

Influential factors in the formation and collapse of real estate stock bubbles in Vietnam

Tan Duy Do

Bayes Business School, City University of London, London, UK

Phuong Lan Le

Faculty of Banking and Finance, Foreign Trade University, Hanoi, Vietnam

Duong Thuy Chu

Investment Team, SK Group, Hanoi, Vietnam

Sofia Thi Nguyen

French Department, Foreign Trade University, Hanoi, Vietnam, and

Hong Thi Thu Vu

Center for Physical Education, Foreign Trade University, Hanoi, Vietnam

Abstract

Purpose – This study investigates the dynamics of real estate stock bubbles and the factors affecting the price of real estate stocks in Vietnam.

Design/methodology/approach – The analysis focuses on five indicators: the Consumer Price Index (CPI), USD/VND exchange rate (EXR), Gold Price Index (GPI), Housing and Construction Materials Price Index (HPI), GDP growth rate, Refinancing rate (REFR), Trading volume (VOL), Trading value (VAL) using quarterly data from 2006 to 2022. The Generalized Sup Augmented Dickey–Fuller (GSADF) test was used to identify periods of explosive price movement, while the Fixed Effects Model with Clustered Variance (FEM VCE) regression model was employed to assess the relationship between macroeconomic variables and stock prices.

Findings – The results confirm the presence of real estate stock bubbles in the examined period. The CPI, trading volume and refinancing rate had a negative impact on price, while GDP growth, GPI, HPI and trading value had a positive relationship. In contrast, USD/VND exchange rate do not show statistically significant relationships.

Originality/value – By identifying the key macroeconomic factors driving the formation and collapse of real estate stock bubbles in Vietnam, an area which previously lacked detailed investigation, this study provides empirical evidence to support risk assessment, regulatory oversight, and policy development to improve the stability of the country's stock market.

Keywords Real estate stock bubbles, Housing bubbles, Vietnam, Formation and collapse of bubbles

Paper type Research article

1. Introduction

Asset price bubbles have long posed challenges to financial stability, particularly in emerging markets where rapid growth, speculative behavior, and limited regulatory capacity often amplify market volatility. Among various asset classes, real estate equities are especially



JEL Classification — G10, G11, G17, G14, G41

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important because they connect the property market with the broader financial system. In Vietnam, real estate is a crucial sector, serving not only as a provider of infrastructure and housing but also as a significant motivation of economic growth and a major channel for capital mobilization. It has the ability to influence and impact around 40 different industries, such as construction, design, manufacturing, banking, and more (Phan, 2021). As Vietnam transitions towards a market-oriented economy, the role of real estate becomes increasingly prominent. The Vietnamese stock market is also growing but carries risks, including stock bubbles. Given the size of the real estate sector in Vietnam's stock market, a bubble here could severely impact the market and economy. While investing in the stock market, many investors can quickly become millionaires, but risks and uncertainties can also lead them to lose everything in an instant. Understanding real estate stock bubbles, including their signs, causes, and influencing factors, is thus crucial for managing risks.

Statistics from the Ho Chi Minh Stock Exchange (HOSE) over 20 years of operation show that real estate sector possesses the second-largest market capitalization, only after the banking sector and has high liquidity. As of the end of 2021, the real estate sector accounted for approximately 20% of the total market capitalization. Many large-cap real estate stocks are included in the VN30 index, highlighting the influence on overall market movements. Therefore, an in-depth-research on the price volatility characteristics of real estate stocks and the phenomenon of real estate stock bubbles is of utmost importance.

Although extensive international research has examined the formation of asset bubbles in housing and stock markets, studies focusing specifically on real estate stock bubbles in Vietnam remain limited. Previous research in Vietnam has primarily investigated general stock bubbles without a dedicated analysis of the real estate sector's equities and the specific factors driving these phenomena (Nguyen and Nguyen, 2013; Nguyen and Bui, 2014; Vo and Nguyen, 2019). Moreover, most of these studies rely on aggregate market indices rather than firm-level data, which may overlook variations across individual companies and the behavioral factors distinctive to real estate equities. This creates a significant research gap in understanding how both fundamental and behavioral factors influence the development of real estate stock bubbles in emerging markets such as Vietnam.

This study aims to address that gap by investigating the existence, evolution, and determinants of real estate stock bubbles in Vietnam from 2006 to 2022. The analysis applies the GSADF test to detect bubble periods and employs a regression framework to identify macroeconomic and behavioral factors affecting stock price dynamics. By incorporating both market-wide indicators and firm-specific variables, the study provides a more comprehensive view of how speculative pressures emerge and evolve in a transitional market.

The paper contributes to the literature in three main aspects. First, it provides new empirical evidence on the existence of sectoral stock bubbles in an emerging economy context. Second, it identifies the key macroeconomic variables, such as inflation, GDP growth, exchange rate, gold price, and housing price, policy that affect stock price behavior in the sector. Third, the findings generate practical implications for policymakers, regulators, and investors in managing risks and improving market stability.

The remainder of this paper is structured as follows. Section 2 reviews literature and develops hypotheses. Section 3 details methodology and data. Section 4 presents results, and Section 5 discusses findings and implications. Section 6 concludes the study.

2. Literature review

2.1 Real estate stock bubbles

Stock bubbles are defined as deviations of market prices from their fundamental values, often fueled by investor speculation, excessive liquidity, or irrational behavior (Kindleberger and Aliber, 2011). Real estate stock bubbles specifically refer to price distortions in the shares of

real estate firms, where the stock prices rise rapidly beyond levels justified by the firms' earnings, asset values, or sectoral fundamentals.

Common signs of a stock bubble include unusually high price-to-earnings ratios, rapid price acceleration within a short time period, high trading volumes, and a divergence from macroeconomic or sectoral indicators. Bubbles often emerge under conditions of low interest rates, credit expansion, optimistic market sentiment, and regulatory inefficiencies. In the context of real estate, these conditions may be amplified by speculative investment behavior, rising housing demand, and government-driven infrastructure or urban development projects (Glaeser *et al.*, 2008). The collapse of a bubble is usually unforeseen and is triggered by a shift in investor expectations, changes in policy or monetary conditions, or a realization that price acceleration is unsustainable, often resulting in market corrections and financial instability (Brunnermeier and Schnabel, 2016).

Early academic work sought to empirically confirm the presence of bubbles using long-run price and dividend data. Flood and Garber (1980), using a rational expectations model, found that speculative elements could drive prices away from fundamentals in the real estate market. Shiller (1981) applied the variance-bound test to S&P 500 data (1871–1979) and showed that stock prices exhibited significantly more volatility than justified by dividends, thereby rejecting the efficient market hypothesis and supporting the existence of bubbles. Similarly, Johansen (1988) introduced a co-integration framework, widely applied to test whether prices and dividends move together over time. A lack of co-integration is interpreted as evidence of price divergence and potential bubble formation. Later studies began using right-tailed Augmented Dickey-Fuller (ADF) tests to detect explosiveness in time series data (Evans, 1991). While the standard Augmented Dickey-Fuller (ADF) test was able to identify general explosiveness, it was not designed to date the initiation of bubble periods within the sample. To improve dating accuracy, Phillips *et al.* (2011) introduced the Sup Augmented Dickey-Fuller (SADF) test, which applies a recursive expanding-window framework to identify the start and end points of a single bubble period. While useful, this test had limitations in identifying multiple bubbles within shorter sample periods or detecting short-term speculative periods. To overcome these limitations, Phillips *et al.* (2011) introduced the Generalized Sup Augmented Dickey-Fuller (GSADF) test. This method extends the earlier Sup ADF (SADF) test by applying a flexible, rolling-window approach that enables the identification of multiple and short-lived bubble periods. Their empirical application showed that the GSADF test could successfully detect multiple bubbles in the US market during the 1871–2010 period. Since then, the GSADF test has been applied widely across asset classes and markets, including equities (Liaqat *et al.*, 2019; Almudhaf, 2017) and housing markets (Hu and Oxley, 2018; Gómez-González *et al.*, 2015; Ahmed *et al.*, 2021) with consistent success in isolating periods of explosive behavior.

While robust methods exist for detecting bubbles across the general market, ensuring financial stability in emerging markets requires a focus on highly susceptible sectors like real estate equity. Emerging economies are generally more susceptible to financial market instability due to high retail investor participation, high reliance on credit, and the short-run volatility introduced by financial liberalization (Kaminsky and Schmukler, 2003). This liberalization often introduces pronounced boom-bust cycles in the short run, even if it stabilizes markets in the long term, making these economies fertile ground for speculative activity. Empirical studies applying the GSADF methodology across Emerging Asia and other emerging economies have confirmed the presence of speculative equity activity across several nations. For instance, Diba and Grossman (1988) and Maghyereh (2002) applied similar econometric techniques and found evidence of periodic price bubbles, often tied to speculative inflows, policy shifts, or structural changes. Szulczyk *et al.* (2018) employed a comprehensive suite of recursive bubble tests, including GSADF, across nine major Asian markets, confirming the widespread existence of multiple speculative bubble episodes across the region. Liaqat *et al.* (2019) studied Pakistan's KSE indices and identified multiple bubble periods in different industrial sectors. More recently, Ahmed *et al.* (2024) further discussed the

interconnectedness of speculative bubbles between Pakistan and its major trading partners using the same method.

In Vietnam, empirical studies on stock or sectoral bubbles remain limited, leaving this an important yet underexplored field of research. For example, [Tran and Chau \(2019\)](#) examined stock markets and concluded the existence of stock bubbles in Vietnam during the period of 2006–2019. [Le and Nguyen \(2022\)](#) used both SADF and GSADF to confirm the stock bubbles in three stages: 2006–2012, 2013–2019 and 2020–2021 on VN-Index and HNX-Index. A study by [Tran et al. \(2023\)](#) also confirmed the bubbles occurred from 2006–2007 and 2017–2018. [Doan and Bui \(2021\)](#), [Do and Le \(2022\)](#) found a linkage between real estate bubble and stock bubble in Vietnam. However, most of these studies focus on aggregate indices rather than firm-level dynamics. Few integrate macroeconomics and behavioral indicators to explain speculative cycles specific to the real estate sector. Consequently, there is limited understanding of how macroeconomic shocks and trading behavior jointly shape price bubbles in real estate equities. By combining firm-level panel analysis with macro-financial and behavioral perspectives, this study aims to fill that gap and contribute to a more nuanced understanding of speculative behavior in Vietnam's emerging real estate market.

2.2 Macroeconomic and behavioral factors affecting the price of real estate stocks

2.2.1 Theoretical framework. Macroeconomic variables play a central role in shaping the behavior of stock markets, including sector-specific indices like real estate. This study applies a macro-financial framework to assess the factors affecting the price of real estate stocks in Vietnam. The approach uses three key theories: (1) *Arbitrage pricing theory*, which states that expected asset returns are linear functions of exposure to systematic risk factors ([Ross, 1976](#); [Chen et al., 1986](#); [Fama, 1990](#)). (2) *Behavioral finance theory*, which emphasizes the role of investor sentiment, liquidity, and herding behavior in driving market inefficiencies and short-term price deviations ([De Long et al., 1990](#); [Barberis et al., 1998](#)). (3) *Bubble theory*, which explains how prolonged speculative activity and market optimism can push asset prices above their fundamental values ([Flood and Garber, 1980](#); [Blanchard and Watson, 1982](#)).

According to the arbitrage pricing theory and macroeconomic factor model, macroeconomic variables affect stock prices through their effects on firm cash flows and investors' required rates of return ([Chen et al., 1986](#)). For real estate firms, macroeconomic stability and growth typically increase property demand, reduce default risk, and increase earnings expectations, thereby lifting stock prices. Conversely, macroeconomic shocks such as high inflation or currency depreciation can erode profitability through higher input costs, increased import expenses, and tighter monetary policy. These effects are often magnified in property-related sectors, where leverage is high and financing costs constitute a substantial portion of total expenditure.

However, in developing markets like Vietnam, the transmission of macroeconomic signals to equity prices is often distorted by behavioral dynamics and institutional inefficiencies. According to behavioral finance theory, investors do not always act rationally; instead, sentiment, herd behavior, and overconfidence can amplify market responses to macroeconomic news ([De Long et al., 1990](#); [Barberis et al., 1998](#)). For instance, an expansion in credit or rising GDP may trigger disproportionate optimism in real estate equities, as investors extrapolate short-term trends into long-term expectations. Similarly, accommodative monetary policy or increases in housing demand may stimulate speculative trading rather than fundamental revaluation.

The bubble theory provides a complementary explanation for how these behavioral and institutional distortions evolve into self-reinforcing bubbles. According to [Flood and Garber \(1980\)](#), [Blanchard and Watson \(1982\)](#), bubbles emerge when prices rise mainly because investors expect continued gains rather than stronger fundamentals. Due to the dominance of bank-based financing and limited capital market depth, credit becomes concentrated in property-related assets. Growing confidence and speculative demand then drive prices further

from fundamentals. When monetary policies tighten or growth slows, these inflated prices typically correct sharply, revealing structural weaknesses in both the real estate market and the financial system.

2.2.2 Hypothesis development. Inflation, reflected by the Consumer Price Index (CPI), is known to affect corporate profitability and investor expectations. High inflation can erode purchasing power, increase production and financing costs, and prompt tighter monetary policies. These conditions generally lead to a decline in stock prices, especially in capital-intensive sectors such as real estate (Fama, 1981). Empirical evidence from emerging markets generally confirms a negative relationship (Maghyereh, 2002). Al-Tamimi *et al.* (2007), Nguyen and Nguyen (2013), Truong (2014), and Nguyen and Bui (2014) have provided evidence supporting the notion that the CPI has an inverse impact on real estate stock bubbles. However, a recent study by Nguyen (2019) showed a contradictory finding, suggesting that the CPI exhibits a positive relationship with real estate stock bubbles. Therefore, additional research is required to gain a more comprehensive understanding of the interplay between the CPI and real estate stock bubbles. Thus, the following hypothesis is suggested:

H1. The Consumer Price Index (CPI) has a negative impact on the price of real estate stocks.

GDP growth (GDP_growth) is a measure of overall economic activity and is typically associated with increased investment, rising incomes, and expanding corporate revenues. Theoretically, rising GDP supports corporate earnings and boosts investor confidence (Levine and Zervos, 1998). Empirical evidence from Asian emerging markets, supports a positive GDP-stock price linkage (Hailemariam and Guotai, 2014; Nguyen and Bui, 2019). Thus, the following hypothesis is proposed:

H2. GDP growth rate has a positive impact on the price of real estate stocks.

Gold prices (GPI) serve as a proxy for risk aversion and macroeconomic instability. During periods of market downturns, many investors have shifted capital toward gold due to its perceived safety (Baur and Lucey, 2010). The impact of gold prices on real estate stocks has been explored in various studies, including Truong (2014), which suggest an inverse relationship. However, the study conducted by Pham (2021) indicates a positive correlation. Thus, the following hypothesis is developed:

H3. The Gold Price Index (GPI) has a negative impact on the price of real estate stocks.

Another investment channel that investors may pay attention to is investing in the US dollar. A depreciating domestic currency can increase the cost of imported construction inputs and deter foreign investment in equities, especially in capital-intensive sectors like real estate (Aggarwal, 1981; Chkili, 2012). While the long-run relationship between gold and the U.S. dollar is negative, there are short-run positive correlations during extreme periods (He *et al.*, 2020; O'Connor and Lucey, 2012). In Vietnam, the findings of Dinh and Nguyen (2008), Vo and Nguyen (2019) also showed that the exchange rate is an unfavorable factor for the stock market. Thus, the following hypothesis is proposed:

H4. The USD/VND exchange rate (EXR) has a negative impact on the price of real estate stocks.

The Housing and Construction Materials Price Index (HPI) directly captures the cost side of real estate firms. Higher material prices may signal robust sectoral demand, which can enhance future earnings expectations and thus stock prices. The study by Lee and Ting (2011) in the Malaysian market indicates a direct relationship between housing price and stock price. Yet in Vietnam, there is limited academic work that links housing price directly to listed real-estate stock prices. Thus, the following hypothesis is developed:

- H5. The Housing and Construction Materials Price Index (HPI) has a positive impact on the price of real estate stocks.

Interest rate policy, represented by the refinancing rate, is one of the most direct instruments through which monetary authorities influence liquidity and asset prices. Lower refinancing rates reduce borrowing costs, stimulate credit expansion, and raise asset demand, including equities and real estate (Mishkin, 1996). Conversely, higher rates increase the cost of capital and tighten financial conditions, dampening investment and speculative activity. In the real estate sector, which relies heavily on debt financing, policy rate adjustments can significantly alter project viability and investor expectations. Empirical studies in emerging markets have consistently shown a negative relationship between interest rate levels and stock prices. For instance, Nasseh and Strauss (2000) and Adam and Tweneboah (2008) found that higher interest rates led to declining equity valuations in both developed and developing economies. In the Vietnamese context, Nguyen and Do (2016) demonstrate that increases in interest rate reduced stock market returns. Thus, the following hypothesis is proposed:

- H6. The refinancing rate has a negative impact on the price of real estate stocks.

Beyond macroeconomic fundamentals, behavioral variables play a crucial role in explaining the price dynamics of real estate stocks by capturing market sentiment, liquidity, and speculative activity. In panel data settings, macroeconomic indicators such as inflation, GDP growth, and exchange rates often vary only across time, not across individual firms. As a result, relying solely on these variables may overlook the firm-specific trading behavior that differentiates stocks within the same sector. To address this limitation, this study incorporates trading volume and trading turnover as additional explanatory variables.

Trading volume represents the total number of shares traded within a specific period, reflecting the intensity of investor activity and market participation. High trading volume often indicates increased investor attention and speculative sentiment, which can drive prices away from fundamental values (Karpoff, 1987). In emerging markets such as Vietnam, surges in trading volume have been linked to speculative behavior and herd dynamics, where rising prices attract additional short-term investors and reinforce momentum-driven trading (Vo and Phan, 2016). However, Dinh and Tran (2023) provided evidence that stock liquidity has negative impact on stock price crash risk due to managers' behavior of hiding negative information. The following hypothesis is chosen:

- H7. Trading volume (VOL) has a positive impact on the price of real estate stocks.

Trading value extends the interpretation of trading activity by incorporating both volume and price effects. It reflects market liquidity and the velocity of capital movement within the sector. High trading value suggest heightened liquidity and faster circulation of capital, which can amplify volatility during boom phases and accelerate corrections during downturns (Chordia et al., 2001). Therefore, the following hypothesis is suggested:

- H8. Trading value (VAL) has a positive impact on the price of real estate stocks.

3. Methodology

3.1 Research data

The dataset includes 972 quarterly observations, calculated from daily trading data of 20 companies, including: Vingroup (VIC), Vinhomes (VHM), Vincom Retail (VRE), Khang Dien House (KDH), Kinh Bac City Development (KBC), Novaland (NVL), Ha Do Group (HDG), Dat Xanh Group (DXG), SJ Group (SJS), Phat Dat Real Estate (PDR), Ba Ria-Vung Tau Housing Development (HDC), Becamex IJC (IJC), IDICO (IDC), TTC Land (SCR), Tu Liem Urban Development (NTL), DIC Corp (DIG), Tan Tao Investment and Industry (ITA), FLC Group (FLC), Hoang Quan Consulting and Trading Service Real Estate (HQC), NBB

Investment Corporation (NBB) spreading across the period from Q1 2006 to Q4 2022. The sample firms were selected based on two main criteria: (i) companies ranked among the largest real estate firms on the Vietnamese stock market by market capitalization and traded continuously for at least five years; or (ii) firms that have remained listed for the longest period with a market capitalization not lower than 1 billion VND. These criteria ensure adequate data continuity and representativeness of Vietnam’s listed real estate sector throughout the study period. The independent variables include 8 macroeconomics and behavioral factors: Consumer Price Index (CPI), real GDP growth rate (GDP), average basic gold price index (GPI), mid-price USD/VND exchange rate at the end of the quarter (EXR), average basic housing and construction materials price index (HPI), refinancing rate at the end of the quarter (REFR), total trading volume (VOL), and average daily trading value in the quarter (VAL) in the same time period (2006–2022). The data was collected from three reliable sources the National Statistics Office of Vietnam (NSO), the State Bank of Vietnam (SBV) and London Stock Exchange Group (LSEG) Data and Analytics. Details of those variables are summarized in [Table 1](#) below:

3.2 Research model

The study employs two different models to address its two main research objectives: (1) detecting speculative bubbles in real estate stock prices using the Generalized Sup Augmented Dickey-Fuller (GSADF) test, and (2) identifying macroeconomic factors influencing these stock prices through a structured regression framework using multiple estimation techniques, including Pooled OLS, Fixed Effects Model (FEM), Random Effects Model (REM), and Fixed Effects Model with standard errors clustered by company (FEM VCE). Each model is selected based on its strengths and alignment with the research objectives and characteristics of the data.

3.2.1 Bubble detection. The GSADF test, introduced by [Phillips et al. \(2011\)](#), is a right-tailed unit root test used to detect multiple periods of explosive behavior in a single time series. This method is particularly suitable for identifying asset price bubbles in emerging markets, where price surges often do not follow a single pattern. Unlike traditional Augmented Dickey-Fuller (ADF) tests, the GSADF test utilizes a rolling window approach to allow recursive testing over expanding and shifting subsamples. The GSADF test is specified as follows:

Table 1. Variables

Variables	Unit	Definition	Expected impact	Source
PRICE	VND/share	Average closing price of real estate stocks of the quarter		LSEG
CPI	Index	YTD (Year-to-date) national consumer price index at the end of the quarter	–	NSO
GDP	% year on year	YTD GDP growth rate (% year on year) at the end of the quarter	+	NSO
GPI	Index	YTD domestic gold price index at the end of the quarter	–	NSO
EXR	VND/USD	Mid-price USD/VND at the end of the quarter	–	LSEG
HPI	Index	YTD housing Price and Construction Materials Index at the end of the quarter	+	NSO
REFR	Rate (%)	Refinancing rate set by the SBV by the end of the quarter		SBV
VOL	Billion shares	Total number of shares traded in the quarter	+	LSEG
VAL	Trillion VND	Average daily trading value of the quarter	+	LSEG

Source(s): Authors’ compilation

$$\Delta y_t = \mu + \delta \Delta y_{t-1} + \sum_{i=1}^p \phi_i \Delta y_{t-i} + e_t, \quad (1)$$

where y_t represents the real estate stock price at time t ; μ stands for the intercept coefficient; p is the maximum lag; ϕ_i is regression coefficients at different lags, $i = 1 \dots p$; e_t is the residual at time t . In the GSADF test, critical values are generated through Monte Carlo simulations and represent threshold values for identifying statistically significant explosive behavior. If the GSADF statistic exceeds the corresponding critical value, it provides evidence of a speculative bubble. By recursively comparing test statistics to these critical values across different time windows, the method enables precise date-stamping of bubble periods, identifying the start and end points of each bubble period in the real estate stock market.

3.2.2 Influencing macroeconomic factors. To assess the influence of macroeconomic variables on real estate stock prices, the multiple linear regression model is presented in the following form:

$$\begin{aligned} \log Price_{it} = & \beta_0 + \beta_1 CPI_t + \beta_2 GDP_growth_t + \beta_3 GPI_t + \beta_4 EXR_t + \beta_5 HPI_t + \beta_6 REFR_t \\ & + \beta_7 VOL_t + \beta_8 VAL_t + \mu_{it} + c_i, \end{aligned} \quad (2)$$

where $\log Price_{it}$ is the stock price of company i at time t ; CPI_t represents Consumer Price Index at time t ; GDP_growth_t stands for the real GDP growth rate at time t ; GPI_t denotes Gold price index at time t ; EXR_t represents USD/VND exchange rate at time t ; HPI_t is housing and construction materials price index at time t ; $REFR_t$ stands for the refinancing rate at time t ; VOL_t represents the total trading volume at time t ; VAL_t is the average daily trading value at time t ; β_0 is the Intercept coefficient; $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$, are regression coefficients; μ_{it} are error terms; c_i is the intercept term for individual i .

Pooled Ordinary Least Squares (OLS) model. Pooled OLS model serves as the baseline estimation. It assumes that all observations are homogenous across time, without accounting for unobserved effects or time-specific variations. While straightforward to implement, this method may be biased if omitted variables are correlated with the regressors.

Fixed Effects Model (FEM). To address unobserved heterogeneity across time, the Fixed Effects Model was applied. This model allows for individual intercepts across periods, capturing the influence of unobservable factors that are constant over time but correlated with the independent variables. FEM is particularly useful when omitted time-invariant variables may bias the OLS estimates.

Random Effects Model (REM). REM is estimated under the assumption that unobserved effects are uncorrelated with the explanatory variables. Unlike FEM, REM treats these effects as random and incorporates both within- and between-period variation. While REM is more efficient than FEM when valid, its assumptions must be tested before accepting its results. The Hausman test is employed to determine whether REM or FEM is the appropriate model. This test compares the consistency of the two estimators by checking whether the unique errors are correlated with the regressors. A significant test result suggests that FEM is preferred, while a non-significant result supports the use of REM.

Fixed Effects Model with Clustered Variance (FEM VCE). Following the initial FEM estimation, the model was refined by incorporating standard errors clustered by company (FEM VCE). This approach is essential in financial panel data as it addresses potential issues of heteroskedasticity and autocorrelation that are specific to individual firms. By clustering the standard errors, the model provides more accurate and reliable p -values and confidence intervals, allowing for a more robust identification of factors that exhibit a linear relationship with the dependent variable, as well as their respective degrees of impact. The ultimate goal of this robust estimation is the derivation of a stable linear equation, providing reliable insights into the dynamics of real estate stock bubbles.

3.3 Descriptive statistics

The dataset, with statistic description shown in Table 2 below, consists of 972 quarterly observations collected from 20 publicly listed companies over the period from 2006 to 2022. Each company contributes between 19 and 60 observations, with an average of approximately 48.6 observations per firm, ensuring robust coverage across both cross-sectional and time dimensions.

4. Results and discussions

4.1 Test for the existence of real estate stocks bubbles

The GSADF test was conducted and observed that the p -value values in both stages are smaller than 5% (specifically, the values are 0.0110 and 0.0000), indicating the reliability of the tests. Table 3 shows the results of GSADF test for each company in the time period of 2006–2022:

The results of the GSADF test indicate that several companies experienced speculative bubbles during the period 2006–2022. Specifically, companies such as DIG, HDC, KDH, NBB, PDR, and VIC show GSADF statistics exceeding the 99% critical values, confirming the presence of bubbles with high significance. Other companies, including DXG, HDG, IJC, ITA, NVL, and SJS, also exhibit bubbles at the 95% confidence level, indicating a moderate level of statistical significance. In contrast, companies like FLC, HQC, KBC, NTL, SCR, VHM, and VRE do not display GSADF statistics above their respective critical values, suggesting no evidence of speculative bubbles during the analyzed period.

4.2 Regression analysis on macroeconomic factors

4.2.1 Correlation analysis. To examine potential multicollinearity between explanatory variables, Pearson correlation coefficients were computed and presented in Table 4. While most pairwise correlations remain below the multicollinearity threshold of 0.80, the correlation between CPI and HPI is higher than the threshold ($r = 0.8931$), suggesting potential collinearity between these two variables.

4.2.2 Regression results: pooled OLS, FEM, REM. As shown in Table 5 below, Pooled Ordinary Least Squares (OLS) linear regression indicates that the F -test value is statistically significant (Sig <0.05), and the model is reliable. The R-squared and adjusted R-squared values are 0.469 and 0.464, respectively, meaning that the independent variables explain 46.4% of the variation in the dependent variable, PRICE. VIF analysis, White test are also performed, the White test ($\chi^2(44) = 437.13, p < 0.01$) indicated that heteroskedasticity exists in the model, implying that the variance of the error terms is not constant across observations. Meanwhile, the VIF analysis and correlation matrix indicate a strong linear relationship between CPI and HPI, with a Pearson correlation coefficient of 0.8931. To further verify this, CPI was regressed on HPI, yielding an R-squared value of 0.7977, slightly below the

Table 2. Descriptive statistics of the variables

	Obs.	Mean	Std. Dev.	Min	Max
PRICE	972	13,971.690	17,457.320	1,078.644	111,571.300
CPI	972	103.668	4.331	99.410	121.870
GDP_growth	972	5.830	1.635	1.420	8.830
GPI	972	106.205	12.694	12.694	164.320
EXR	972	21,818.080	1,749.522	16,015.000	23,865.000
HPI	972	103.9339	4.644	98.05	118.03
REFR	972	6.909	2.613	4	15
VOL	972	0.180869	0.2504406	0.0000337	1.907285
VAL	972	2.800689	5.253234	0.000085	56.88875

Source(s): Authors' calculation

Table 3. GSADF test results

Company	GSADF	Tab90	Tab95	Tab99	Bubble?	Significance (%)
DIG	3.3889	1.5574	1.9121	2.6223	Yes	99%
DXG	2.3336	1.5485	1.9000	2.6209	Yes	95%
FLC	1.0682	1.4770	1.8308	2.5571	No	–
HDG	3.8867	1.5999	1.9156	2.6627	Yes	99%
HQC	1.2250	1.4840	1.8180	2.4660	No	–
IDC	6.0728	1.1814	1.5755	2.6317	Yes	99%
IJC	3.2083	1.5194	1.8477	2.4660	Yes	95%
ITA	2.0001	1.6013	1.9489	2.4501	Yes	95%
KBC	1.2829	1.5999	1.9156	2.6627	No	–
KDH	4.4326	1.5335	1.8727	2.5572	Yes	99%
NBB	4.8574	1.5335	1.8391	2.4811	Yes	99%
NTL	1.6496	1.5999	1.9156	2.6627	No	–
NVL	2.2390	1.2006	1.6076	2.4444	Yes	95%
PDR	3.5177	1.4975	1.8180	2.4660	Yes	99%
SCR	1.2153	1.4840	1.8180	2.4660	No	–
SJS	2.2319	1.6153	1.9521	2.4549	Yes	95%
VHM	–0.9999	1.0543	1.4148	2.3444	No	–
VIC	5.4976	1.6191	1.9425	2.6627	Yes	99%
VRE	–0.2368	1.1814	1.5755	2.6317	No	–

Source(s): Authors' calculation**Table 4.** Pearson correlation matrix table

	VOL	VAL	CPI	GDP _growth	GPI	EXR	HPI	REFR
VOL	1.0000							
VAL	0.6083	1.0000						
CPI	–0.2131	–0.1638	1.0000					
GDP_growth	–0.1700	–0.2146	0.2586	1.0000				
GPI	–0.0522	–0.0467	0.2597	–0.1229	1.0000			
EXR	0.2527	0.2558	–0.5596	–0.0705	–0.1619	1.0000		
HPI	–0.2161	–0.1581	0.8931	0.2784	0.3713	–0.5633	1.0000	
REFR	–0.3390	–0.3725	0.6969	0.2063	0.0453	–0.4871	0.6988	1.0000

Source(s): Authors' calculation

conventional multicollinearity threshold of 0.80. Therefore, both CPI and HPI are retained as independent variables in the model.

Both the Fixed Effects Model (FEM) and Random Effects Model (REM) were then run and the Hausman test was conducted to determine the appropriate model between Fixed Effects (FEM) and Random Effects (REM). The test yielded a chi-square value of 57.88 with a significance level of $p < 0.01$. This indicates that the null hypothesis (that the difference in coefficients is not systematic) is rejected. Therefore, the Fixed Effects Model (FEM) is preferred over the Random Effects Model (REM).

The Wooldridge test indicated the presence of first-order autocorrelation in the panel data ($p < 0.01$). The Modified Wald test for groupwise heteroskedasticity revealed heteroskedasticity across panels ($p < 0.01$). These results suggest that the FEM residuals exhibit both autocorrelation and heteroskedasticity, implying that robust standard errors should be applied when interpreting the coefficient estimates.

Table 5. Pooled OLS, REM, FEM, FEM VCE clustered results

	Pooled OLS	REM	FEM	FEM VCE clustered
VOL	−1.519*** (0.000)	−0.927*** (0.000)	−0.850*** (0.000)	−0.850*** (0.021)
VAL	0.128*** (0.000)	0.0898*** (0.000)	0.0858*** (0.000)	0.0858*** (0.001)
CPI	−0.0222* (0.062)	−0.0210** (0.024)	−0.0210** (0.023)	−0.0210** (0.035)
GDP_growth	0.0414*** (0.007)	0.0246** (0.041)	0.0235** (0.049)	0.0235* (0.082)
GPI	0.00629*** (0.003)	0.00343** (0.039)	0.00320* (0.053)	0.00320* (0.087)
EXR	0.0000477*** (0.003)	0.0000609*** (0.000)	0.0000598*** (0.000)	0.0000598 (0.348)
HPI	0.0525*** (0.000)	0.0583*** (0.000)	0.0586*** (0.000)	0.0586*** (0.001)
REFR	−0.106*** (0.000)	−0.102*** (0.000)	−0.101*** (0.000)	−0.101*** (0.001)
_CONS	4.591*** (0.000)	4.013*** (0.000)	3.966*** (0.000)	3.966*** (0.033)
Observations	972	972	972	
Adjusted R-squared	0.464			
R-squared	0.469			
Within R-squared		0.3981	0.3983	
Between R-squared		0.7934	0.7935	
Overall R-squared		0.4590	0.4560	0.4560
Note(s): <i>t</i> -statistics are in parentheses. *, **, *** indicate statistical significance at 10%, 5%, and 1%, respectively				
Source(s): Authors' calculation				

Since the FEM residuals exhibited both autocorrelation and heteroskedasticity, we chose to estimate the Fixed Effects Model with standard errors clustered by company. This approach adjusts the variance-covariance matrix to account for within-group correlation and non-constant error variance, ensuring more reliable inference for the coefficient estimates.

The estimated coefficients indicate that VOL and REFR have a significant negative effect on PRICE, while VAL and HPI have a significant positive effect. Other variables, including CPI, GDP growth, and GPI, show weaker or marginal significance, and EXR is not statistically significant at the 5% level.

Substituting the values of β as coefficients of regression result into the model, the following regression equation is obtained:

$$\begin{aligned} PRICE_{it} = & 3.966 - 0.0210 \text{ CPI} + 0.0235 \text{ GDP_growth} + 0.00320 \text{ GPI} + 0.0000598 \text{ EXR} \\ & + 0.0586 \text{ HPI} - 0.101 \text{ REFR} - 0.850 \text{ VOL} + 0.0858 \text{ VAL}, \end{aligned} \tag{3}$$

The statistical data in this study yield similar results to the studies conducted by [Nguyen and Nguyen \(2013\)](#), [Phan and Pham \(2013\)](#), [Nguyen and Bui \(2014\)](#), and [Truong \(2014\)](#). However, it is not consistent with the results of [Nguyen \(2019\)](#) on the CPI, as this research was only conducted on real estate sector stocks listed on the Ho Chi Minh City Stock Exchange. These findings also contradict the study by [Bahmani-Oskooee and Sohrabian \(1992\)](#) on the exchange rate, as this research does not indicate the impact of the USD Price index on the stock market bubble. This could be explained by the unique economic development, psychological

factors of the people, and investment habits in Vietnam, which differ from the time and countries where their research is conducted.

Housing and Construction materials price Index. HPI shows a statistically significant positive relationship with PRICE at the 1% level, indicating that a 1-unit increase in HPI leads to a 5.86% increase in PRICE. This is completely understandable as the housing and construction materials prices and the real estate stock prices are all within the expectations of investors in the real estate sector in general. When housing prices and raw material costs increase, the expectations of investors in the real estate sector also rise. In reality, in December 2021, a subsidiary of Tan Hoang Minh Group won an auction for a land plot of over 10,000 square meters in the Thu Thiem urban area for 24.5 trillion Vietnamese dong, which is 8 times higher than the starting price. Investors then rushed into real estate stocks, leading to significant increases in stock prices, sometimes even tripling or quadrupling within a short period of time.

Refinancing rate. REFR exhibits a statistically significant negative relationship with PRICE at the 1% level. With a one-unit increase in REFR, PRICE is expected to decrease 10.14%. The result supports the findings of [Nasseh and Strauss \(2000\)](#), [Adam and Tweneboah \(2008\)](#), and confirms the study on Vietnam market of [Nguyen and Do \(2016\)](#). Higher interest rates increase borrowing costs, reduce affordability for buyers, and lower potential returns for investors, leading to a decline in real estate stock prices. This captures both the financing cost channel and the discounted cash flow effect.

Trading value. VAL demonstrates a statistically significant positive relationship with PRICE at the 1% level of significance. The result indicates that a one-unit increase in VAL is associated with an increase of approximately 8.58% in the PRICE. Higher trading value generally reflects stronger market participation and investor confidence, which supports higher stock prices. This aligns with the fundamental view that more valuable or actively traded firms have higher market valuations. This result is also confirmed in the research by [Chordia et al. \(2001\)](#).

Trading volume. VOL shows a statistically significant negative relationship with PRICE at the 5% level of significance. This finding suggests that a one-unit increase in VOL is associated with a substantial decrease of approximately 84.96% in PRICE. The result consistence with the research of [Dinh and Tran \(2023\)](#) but contradict to the findings of [Karpoff \(1987\)](#), [Vo and Phan \(2016\)](#). This result can be explained by the contrasting behaviors of market participants: high trading volume is often most seen during the panic-selling associated with the collapse of a stock bubble, whereas the volume in a bubble formation is typically characterized by a more gradual, subdued increase.

Consumer Price Index. The statistic results evidenced that CPI has negative affect on the formation and collapse of the real estate stock bubbles at the 5% level, indicating that a 1-unit increase in CPI is associated with approximately a 2.10% decrease in PRICE, align with the studies of [Al-Tamimi et al. \(2007\)](#), [Nguyen and Nguyen \(2013\)](#), [Truong \(2014\)](#) and [Nguyen and Bui \(2014\)](#). When the CPI increases, it implies high inflation, currency depreciation, and consumers tend to tighten their spending and limit their investments. Another reason is that when inflation rises, the government will use interest rate tools to curb inflation by increasing interest rates. This leads to less investment in the real estate sector and the stock market segment of real estate stocks is also affected due to the loss of investor expectations.

GDP Growth. GDP_growth shows a positive relationship with PRICE at the 10% level, suggesting that a 1-unit increase in GDP_growth leads to a 2.35% increase in PRICE, confirming the research by [Hailemariam and Guotai \(2014\)](#), [Nguyen and Bui \(2019\)](#). As GDP growth often reflects overall economic expansion, which generally supports investment, rising incomes, and increasing corporate revenues, the impact of this factor might be lagged and less significant. In Vietnam, speculative behavior and market inefficiencies may further weaken this relationship.

Gold Price Index. GPI shows a positive relationship with PRICE at the 10% significant level, indicating that a 1-unit increase in GPI is associated with a 0.32% increase in PRICE.

This result had been found in the study of [Pham \(2021\)](#), while the studies by [Baur and Lucey \(2010\)](#), [Truong \(2014\)](#) showed contradictory results. The regression analysis shows a positive but marginally significant coefficient for GPI, suggesting that while gold prices and real estate stocks are linked through investor behavior, the relationship is complex and influenced by market sentiment and speculative activity.

Exchange rate. The USD/VND exchange rate does not show a statistically significant relationship with PRICE, indicating no clear effect of exchange rate on PRICE in this model. This outcome suggests that the State Bank of Vietnam (SBV) has been highly effective in maintaining exchange rate stability, preventing the large, unpredictable fluctuations that typically impact investor confidence and corporate profits.

5. Conclusions

This research aimed to confirm the presence of speculative real estate stock bubbles and statistically establishing the systematic relationship between the formation and collapse of these bubbles and key macroeconomic determinants. Using data from 20 listed real estate companies and 8 economic factors spanning the period 2006–2022, the study confirmed the existence of real estate stock bubbles. The regression of macroeconomics and behavioral factors reveals seven over eight factors examined had a statistically significant impact on the formation and burst of these bubbles. Specifically, the CPI, trading volume, and refinancing rate had a negative impact on price, while GDP growth, GPI, HPI, and trading value had a positive relationship. Conversely, the exchange rate was found to have no statistically significant relationship with the real estate stock prices.

These findings necessitate an immediate shift from general market oversight to a highly quantitative and coordinated macroprudential framework. Regulatory bodies, including the State Securities Commission (SSC) and the State Bank of Vietnam (SBV), must mandate the creation of real-time early warning indicators and set dynamic thresholds to proactively mitigate overheating. For instance, regulators could introduce enhanced margin requirements if trading volume and trading value show sustained monthly growth beyond a statistically significant deviation threshold. They could also issue a Debt-to-equity ratio warning for listed firms when the sector's median D/E ratio surpasses its historical tail-risk percentile or implement targeted liquidity measures if the sectoral Price-to-fundamental ratio exceeds its speculative threshold. To ensure systemic resilience, the mandatory annual stress testing of real estate firms is required, assessing their ability to service debt and maintain liquidity under adverse credit and material price shocks. Additionally, the government needs to coordinate closely at all levels, especially the Ministry of Finance, to effectively address issues related to land prices, strict management of land use fees, and land clearance for projects. Furthermore, listed real estate firms must prioritize capital structure stability by transparently allocating capital to core business development rather than speculative land banking.

In conclusion, the recommendations provided aim to facilitate the precise and timely implementation of risk prevention measures, particularly in addressing the risk of real estate stock bubbles in the Vietnamese stock market. It offers crucial practical implications for policymakers by furnishing a data-driven foundation for a real-time risk management tool and guiding future regulatory policy. The study also addresses the critical need for investor financial discipline by demonstrating the structural vulnerability of the sector. However, the study has limitations due to the exclusion of some crucial macroeconomic and non-macroeconomic variables, such as credit growth, foreign investment flows, interbank lending rates, and investor psychology. Future studies should address these limitations by integrating omitted financial variables and explicitly modeling the causal impact of behavioral factors to build on these findings.

About the authors

Tan Duy Do is lecturer at Bayes Business School, City University of London . He finished his Master's Program in Business Finance at the Carlos III Madrid in 2018, and received his PhD degree in Business

Finance at the same University after that in 2022. He focuses not only on theoretical literature but also on practical issues, with research interests in financial risk management, corporate finance, derivative investment and business administration. He has published in journals such as *Applied Economics Letters*, *External Economic Review*, among others.

Phuong Lan Le is lecturer at the Faculty of Banking and Finance, Foreign Trade University, Hanoi, Vietnam. She finished her Master's Program in International Economics and Finance at the University of Queensland, Australia in 2007, and received her PhD degree in International Economics with a concentration on Financial Management at FTU – Vietnam. She focuses not only on theoretical literature but also on practical issues, with research interests in security analysis and investment, portfolio management, financial risk management, corporate finance, derivative investment and mergers and acquisitions. She has published in journals such as *International Journal of Hospitality Management*, *External Economic Review*, *Vietnam Trade and Industry Review*, *Financial and Monetary Markets*, *The Journal of Asian Finance, Economics and Business*, among others.

Duong Thuy Chu holds the degree of Bachelor of Science, majoring in Banking and International Finance. She has just finished the high-quality program at Foreign Trade University (FTU), Hanoi, Vietnam and graduated with a Bachelor's degree in September 2023. She is interested in doing research on security valuation and analysis, portfolio management, corporate finance and personal finance management.

Sofia Thi Nguyen, Vũ Thị Thu Hồng are members of FTU Research Programme 02 project, under the funding contract No. FTURP02-2023-02. Their research interests are financial management, corporate finance and portfolio management.

Hong Thi Thu Vu: She is a member of FTU Research Programme number FTURP02-2023-02, with interests in finding facts of asset bubbles in Vietnamese economy.

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Corresponding author

Puong Lan Le can be contacted at: lan.lp@ftu.edu.vn