Quantitative Finance and Economics

QFE, 10(4): 649–664.
DOI: 10.3934/QFE.2026025
Received: 09 February 2026
Revised: 10 February 2026
Accepted: 15 May 2026
Published: 23 October 2026

https://www.aimspress.com/journal/QFE

Research Article

Does financial fragility drive the housing bubble? Evidence from selected ASEAN countries

Suryati[1], Jaka Sriyana[2,*], Akhsyim Afandi[2] and Abdul Hakim[2]

[1] Faculty of Islamic Economics and Business, Universitas Islam Negeri Raden Mas Said Surakarta, Surakarta, 57168, Indonesia
[2] Department of Economics, Islamic University of Indonesia, Yogyakarta, 55283, Indonesia

* **Correspondence:** Email: jakasriyana@uii.ac.id; Tel: +6-227-488-1546.

Abstract: This study examined the impact of financial fragility on housing bubbles in selected ASEAN countries using the panel autoregressive distributed lag (PARDL) model and Granger causality based on quarterly data from 2010 to 2024. The findings revealed that financial system fragility influences the development of the housing bubble ratio through interest rate stimulus, stock market volatility, and bond market fluctuations. Moreover, the performance of the monetary sector has a significant positive effect on the housing bubble ratio in the short term. The causality test indicates that Singapore's housing bubble ratio significantly affects Indonesia's housing bubble ratio. Additionally, Indonesia's housing bubble increases Thailand's housing bubble ratio. Surprisingly, Thailand's housing bubble also spread to three ASEAN-5 countries, including Singapore, Malaysia, and the Philippines.

Keywords: housing bubble; financial fragility; interest rate; exchange rate; stock and bond market; money supply

JEL Codes: E3, E6, G5

1. Introduction

The global market can experience an economic bubble when asset prices rise above their intrinsic value (Sherman et al., 2018). Housing is of asset whose prices can meet these criteria, a phenomenon

known as a housing bubble (Ahmed et al., 2021; Asal, 2019; Bago et al., 2021). A housing bubble occurs when house prices grow beyond the appropriate limits of fundamental value (Laurent et al., 2020). This price growth is not accompanied by the adoption of more sophisticated financial innovations to support it.

Changes in consumer behavior can drive housing price bubbles. This considers the dual nature of housing as both a consumer good and an investment (Yang et al., 2018). Consumers currently purchase housing not only as a primary residence but also as an investment. Others have speculative motives, namely the hope of future increases in asset prices. Housing bubbles can precipitate financial and economic crises when they burst (Sherman et al., 2018). When the bubble bursts, property values drop significantly. This causes losses for owners and harms the economy. Housing bubbles have occurred multiple times in various countries and have triggered financial and economic crises. In the early 1990s, Japan experienced economic stagnation due to an unstable financial system, which triggered a bubble economy (Yoshino & Taghizadeh, 2015).

The United States' subprime mortgage crisis spread rapidly worldwide, including to the ASEAN region. ASEAN experienced a global financial crisis due to the contagion of the subprime mortgage crisis. The global financial crisis affected the movement of the capital market index. The average return of ASEAN-5 markets tends to be lower than that of other Asian markets due to the impact of global economic issues (Duwith & Aloo, 2023). The global financial crisis in ASEAN-5 showed that Malaysian and Thai markets experienced a significant decline in the stock index throughout the observation period (Yulianti et al., 2024). Additionally, studies of the ASEAN-5 markets during the global financial crisis found that the Malaysian and Thai markets experienced significant declines in their indices over the observation period. The phenomenon of the housing bubble, which contributed to the economic crisis, served as a crucial lesson for countries worldwide to closely monitor housing price movements.

The trend of rising housing prices in Malaysia suggests that housing price changes are driven by real GDP, monetary liquidity, and exchange rates. (Kok et al., 2018). The upward trend in housing prices in Malaysia suggests that real GDP, monetary liquidity, and currency exchange rates influence these changes. Monetary liquidity has a notable impact on house price fluctuations. This suggests that mortgage loans can influence housing demand and, consequently, affect house prices. Using the Markov-switching method to predict the housing bubble in Malaysia helped determine the level of house price volatility (Hamid et al., 2022).

In another case, macro variables and Singapore's financial system contributed to changes in the housing price index. Gross domestic product, interest rates, inflation rates, and unemployment rates contributed to the increase in the house price index in Singapore between 1979 and 2019 (Azlan & Lee, 2022). Based on the house price index for the period 1995–2014, Singapore was declared to have experienced a housing bubble, as measured by the deviation from the equilibrium home price distribution (Tay et al., 2016). Positive deviation provides a clear, quantitative definition of a housing bubble. Before determining the deviation, the house price index must be adjusted for inflation using the consumer price index.

The trend of housing prices across the five ASEAN-5 countries necessitates close monitoring to prevent the housing bubble from bursting. The analysis of housing bubbles and the causes of price increases cannot be separated from the financial system's contribution (Kok et al., 2018; Azlan & Lee, 2022; Tay et al., 2016; Glindro & Delloro, 2010). For example, interest rates, credit policies, monetary

liquidity, and exchange rates influence house prices. This provides a strong empirical basis for the assertion that financial system fragility has contributed to housing bubbles in ASEAN-5 countries.

Financial system fragility is part of economic instability. The identification of the financial instability hypothesis (FIH) with the term financial fragility can be interpreted as financial system fragility (Pedrosa & Lang, 2021). It has been noted that episodes of systemic banking crises can destabilize the economy (Pesola, 2011). Understanding and anticipating such risks is crucial to ensuring financial stability. Financial system fragility encompasses the banking sector, money market, capital market, and non-bank financial industry (NBFI), and Indonesia examines it in distinct ways. The stability of the Indonesian economic system has been assessed using indicators of banking, money, capital, and the performance of the monetary sector.

Studies on housing bubbles and financial system fragility have limited ability to detect causal relationships between these variables at the individual-country level. A crisis triggered by the bursting of a price bubble in one country could arise from contagion effects of the bursting of a bubble in another, given international financial integration. This research examines the impact of financial fragility on housing bubbles in selected ASEAN countries. Therefore, this study contributes to the literature by testing international financial integration using a contagion-effect test.

2. Literature review

2.1. Bubble

Modern economic crises often follow financial crises, which in turn result from a bursting asset-price bubble. Understanding bubbles is therefore crucial to understanding financial crises and periods of extreme price volatility. A bubble is formally defined as a sustained period of an asset market price significantly exceeding its fundamental value. Understood as the present discounted value of the future cash flows the asset is expected to generate, the fundamental value reflects the price a rational and long-term holder is willing to pay (Jarrow, 2015). Kindleberger's classic notion of bubbles refers to price increases driven by a process of speculative mania that attracts new buyers seeking capital gains, ultimately leading to a self-fulfilling and unsustainable boom (Mauldin, 2013). The increase is typically followed by a reversal of expectations and a sharp price decline, often leading to a financial crisis. Economic theory formalizes the bubble creation into several possible categories, each providing a specific mechanism explaining how and why prices may diverge from fundamental values (Kubicová & Komárek, 2011).

The first category, rational speculative bubble models, incorporates the possibility of explosive price paths within a rational expectations framework (Blanchard & Watson, 1982). Investors, realizing that prices exceed fundamentals, are willing to pay a premium, expecting to sell the assets to an even more optimistic investor in the future. Importantly, the bubbles appear rational rather than merely the result of irrational exuberance. The second perspective, the intrinsic bubble theory (Froot & Obstfeld, 1991) asserts that, although fully explained by underlying fundamentals, specific links between prices and fundamentals may resemble speculative bubbles. For instance, when stock prices respond nonlinearly to changes in dividends, they can persistently deviate from a linear present-value model. This theory implies that a specific asset price increase may appear to be a "bubble" but, in fact, be the result of fundamental economic variables, hence being misidentified as a bubble.

Finally, the limited-arbitrage-based bubble theory criticizes the main argument of the efficient market hypothesis suggested by Fama (1970) that rational traders should rapidly eliminate mispricing. Abreu & Brunnermeier (2002) and Brunnermeier & Oehmke (2012) showed that when rational arbitrageurs face coordination problems, capital constraints, or trade against psychologically biased traders, mispricing can occur and persist. This theory is especially relevant to housing markets characterized by high transaction costs, illiquidity, and heterogeneous participants, which make them more vulnerable to arbitrage imperfections.

2.2. Financial fragility

The theory of financial fragility, especially presented in Hyman Minsky's financial instability hypothesis (FIH), complements the study of economic bubbles at the macro level. Challenging the concept of a self-correcting economy that naturally returns to equilibrium, Minsky (1982) contended that capitalist economies with advanced financial systems are inherently prone to instability, succinctly summarized in his well-known "stability is destabilizing" statement. A prolonged period of economic stability, along with rising asset prices, naturally urges economic agents, including households, firms, and financial institutions, to transition from conservative "hedge" financing to riskier "speculative" and ultimately "Ponzi" financing, in which cash flows are inadequate to service debt without continued asset price increases. This escalation in leverage and risk-taking amplifies systemic financial fragility, setting the stage for a crisis, often dubbed a "Minsky Moment", when a shock triggers a widespread attempt to deleverage and sell assets, collapsing prices (Vercelli, 2011).

Formalizing Minsky's theoretical framework, Bernanke & Gertler (1990) and Greenwald & Stiglitz (1997) incorporated the importance of asymmetric information and balance sheet channels and demonstrated that a decline in borrowers' equity, a key financial fragility indicator, can lead to credit restriction and lower investment, thereby spreading financial shocks across the economy. Assessing this fragility requires aggregate indicators of each sector of the financial system. A widely adopted methodology is the Financial Stress Index (FSI) introduced by Illing & Liu (2006). The FSI incorporates variables that capture stress in key financial sectors. The Federal Reserve Bank of Cleveland has developed a financial stability monitoring tool, utilizing the Cleveland Financial Stress Index (CFSI), to measure financial fragility (Bianco et al., 2013). CFSI helps identify potential systemic risks that can disrupt the banking sector and the broader economy. Many studies have employed interest rate spread in the banking sector, exchange rate volatility, stock market volatility, bond yield volatility, and money supply growth as indicators of financial fragility (Illing & Liu, 2006; Priyono & Bustaman, 2020; Mokoginta & Asfari, 2016).

2.3. Synthesis and the ASEAN context

The synthesis of these theoretical strands establishes a coherent framework for analyzing housing markets. Following the Minskyan concept that "stability is destabilizing", a period of sustained stability increases confidence and risk-taking, which in turn heightens fragility through leverage and sets the stage for a potential bubble. The theories of rational speculation and limited-arbitrage-based bubbles then explain how this fragility becomes sustained price deviations in a housing market. A suggested testable hypothesis is as follows: measurable indicators of sectoral financial fragility should

have a significant, potentially leading, relationship with housing price inflation. This theoretical nexus can be represented in its general functional form. Let the real housing price level (RHP_t), which serves as the core indicator for potential bubble conditions, be a function of a vector of fundamental determinants F_t (e.g., income, demographics, user cost) and a measure of the prevailing state of financial fragility Ψ_t.

$$RHP_t = f(F_t, \Psi_t) \tag{1}$$

where Ψ_t, the latent state of financial fragility, is not directly observable but is manifested through distress signals across key financial sectors. Following the FSI literature (Illing & Liu, 2006; Hollo et al., 2012), these sectoral manifestations can be proxied by specific, measurable variables: banking-sector stress (interest rate spread), foreign-exchange market volatility, equity market volatility, bond market volatility, and monetary-sector dynamics.

The hypothesis is particularly relevant for the ASEAN context. The 1997 Asian Financial Crisis experience has transformed ASEAN economies into more financially deepened, more integrated into volatile global capital flows, and with strong, non-inflationary growth (ADB, 2021). These developments, while beneficial, also create an environment ripe for the Minskyan buildup of financial imbalances. Specifically, rapid urbanization, the expansion of mortgage markets, and significant cross-border real estate investment have made regional housing markets focal points for speculative capital and uniquely vulnerable to the fragility-bubble cycle (UN, 2018).

3. Methods

The data of the current study cover all ASEAN-5 countries: Indonesia, Malaysia, Singapore, the Philippines, and Thailand. The research covers the period from the first quarter of 2010 to the fourth quarter of 2024. Data come from official publications of the institutions listed in Table 1. The study uses the Residential Property Price Index (RPPI) and the Consumer Price Index (CPI) as the dependent variables. The independent variables include the interest rate spread, exchange rate volatility, stock market volatility, bond yield volatility, and money supply growth. The initial step in identifying a housing bubble index is to compare the Residential Property Price Index (RPPI) with the Consumer Price Index (CPI).

$$Housing\ Bubble\ Index = \frac{House\ Price\ Index}{Consumer\ Price\ Index} \tag{2}$$

Keen (2013) used this method to measure asset bubbles in the USA during the subprime mortgage crisis. To check the accuracy of the results, we compared the RPPI with the composite stock price index. The housing price ratio was calculated using a base of 1, and bubble levels were categorized based on asset bubbles in the USA.

Table 1. Operational variables.

Indicator	Variable	Symbol	Expected sign	Data sources
Housing bubble	Housing bubble index	HBI		https://data.imf.org/ https://www.ceicdata.com/
Banking sector	Interest rate spread	IRS	_	https://data.imf.org/
Foreign exchange market	Exchange rate volatility	ERV	+	https://data.imf.org/
Stock market	Stock market volatility	SMV	+	https://finance.yahoo.com/
Bond market	Bond yield volatility	BYV	_	https://asianbondsonline.adb.org/data-portal/
Monetary sector	Money supply growth	MSG	+	https://data.imf.org/

This study uses the autoregressive distributed lag (ARDL) model to answer how financial fragility affects the potential bubble economy of countries in the ASEAN-5 region. Additionally, the PARDL model is used to analyze the long-term impact and relationship between the two variables. The PARDL is an econometric model that builds of the ARDL. If ARDL is applied to time-series data only, then the PARDL is employed to analyze short- and long-term relationships among variables in panel data, leveraging its flexibility in handling variables with mixed stationarity (I(0) and I(1)) (Pesaran et al., 2001). The VECM panel model in this study is as follows:

$$[\Delta HBI]_{it} = \begin{bmatrix}\alpha_0\\ \alpha_1\\ \alpha_2\\ \alpha_3\\ \alpha_4\\ \alpha_5\end{bmatrix} + \sum_{t-1}^{k} \tau_{it} \begin{bmatrix}\Delta IRS\\ \Delta ERV\\ \Delta SMV\\ \Delta BYV\\ \Delta MSG\end{bmatrix}_{it} + \pi \begin{bmatrix} IRS\\ ERV\\ SMV\\ CBYS\\ MSG\end{bmatrix}_{it-1} + \begin{bmatrix}v_0\\ v_1\\ v_2\\ v_3\\ v_4\\ v_5\end{bmatrix} \quad (3)$$

where $\mathrm{HBI_{it}}$ is the housing bubble index, $\mathrm{IRS_{it}}$ is the interest rate spread, $\mathrm{ERV_{it}}$ is exchange rate volatility, $\mathrm{SMV_{it}}$ is stock market volatility, $\mathrm{CBYS_{it}}$ is bond yield volatility, and $\mathrm{MSG_{it}}$ is money supply growth.

This study also aims to determine whether housing bubble potential across ASEAN countries exhibits contagion effects using the Granger causality test. The relationship of mutual influence in econometrics was proposed by Granger, and is often known as Granger causality (Shojaie & Fox, 2022). A crucial point in conducting a causality test is the length of the lag used. Hsiao addressed the weakness of determining the lag length in Granger causality. The determination of the lag length is based on the final prediction error (FPE) method. As in the lag model, we can use the criteria proposed by Akaike and Schwarz to determine the optimal lag length, as follows:

$$[\Delta HBI]_{it} = \begin{bmatrix}\alpha_0\\ \alpha_1\end{bmatrix} + \sum_{t-1}^{k} \tau_{it} [\Delta HBI]_{it} + \pi [HBI]_{it-1} + \begin{bmatrix}v_0\\ v_1\end{bmatrix} \quad (4)$$

4. Results

The following processed data are used to analyze housing bubbles and financial system vulnerabilities in the ASEAN-5 (Indonesia, Malaysia, Singapore, the Philippines, and Thailand) from the first quarter of 2010 to the fourth quarter of 2022.

Table 2. Data description.

	HBI	IRS	ERV	SMV	BYV	MSG
Mean	1.29	4.36	−0.00	0.00	0.05	0.02
Median	1.33	4.43	0.00	0.01	0.04	0.02
Maximum	1.93	6.53	0.07	0.14	0.27	0.11
Minimum	0.79	−0.89	−0.08	−0.21	0.00	−0.11
Std. Dev.	0.27	1.01	0.02	0.04	0.04	0.037
Skewness	0.26	−1.01	−0.40	−1.06	2.06	−0.37
Kurtosis	2.82	6.75	3.78	6.38	9.26	3.44
Jarque-Bera	3.47	196.99	14.00	172.78	608.83	8.35
Probability	0.17	0.00	0.00	0.00	0.00	0.01
Sum	336.93	1134.80	−0.75	0.86	14.04	5.72
Sum Sq. Dev.	19.79	267.28	0.14	0.56	0.42	0.37
Observations	260	260	260	260	260	260

4.1. Housing bubble detection

A bubble economy appears when the price of an asset exceeds the value of its fundamental assets (Sherman et al., 2018). The calculation of a bubble economy, particularly in the housing sector, is based on comparing or creating a ratio between the house price index and the consumer price index. Based on the movements of the House Price Index and Consumer Price Index shown above, the housing bubble index can be calculated using 2010 as the base year, with a base value of 1. Table 3 shows the maximum housing bubble index ratios for each ASEAN-5 country.

Table 3. Housing bubble index.

Country	Housing bubble index
Malaysia	1.94
Indonesia	1.58
Singapore	1.55
Thailand	1.37
Philippines	1.11

The calculation results indicate that Malaysia has the highest housing bubble ratio among the countries examined. Meanwhile, the Philippines has the lowest housing bubble ratio. The results of the bubble ratio calculation indicate that the five countries, spanning the observation period from the first quarter of 2010 to the fourth quarter of 2022, did not meet the bubble criteria. However, Malaysia had the highest housing bubble ratio, reaching a value of 1.94 in the second quarter of 2020. This value is

very close to the bubble threshold: house prices are said to have reached a bubble if the ratio to the Consumer Price Index exceeds 2. Meanwhile, Thailand and the Philippines have relatively stable housing market conditions. Empirical evidence shows that potential house price bubbles in Malaysia are driven by housing demand, economic growth prospects, and buyer expectations, all of which positively affect housing bubbles. The study found that the current state of the Malaysian housing market, foreign investment, and government policies had no significant influence on the potential for a house price bubble. In Malaysia, housing costs have increased significantly in recent years, especially in metropolitan areas.

4.2. Analysis of the influence of financial fragility on the housing bubble

Table 4 presents the results of the PARDL estimation of the housing bubble index, with lag 3 as the optimal lag. Based on long-term estimates, a long-term relationship appears to exist between financial fragility and housing bubbles. Financial fragility includes several key variables: interest rate spread, exchange rate volatility (EMPI), stock market volatility, bond yield spread, money supply growth, and the housing bubble ratio in ASEAN-5 countries. In the long term, three variables significantly affect the housing bubble ratio: interest rate spread, stock market volatility, and bond yield volatility. The remaining variables, namely exchange rate volatility and money supply growth, have no long-term effect on the housing bubble.

Table 4. Estimation of PARDL.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
	Long-run (pooled) coefficients			
IRS	−0.26	0.08	−3.02	0.00***
ERV	3.32	3.43	0.96	0.33
SMV	3.54	1.83	1.93	0.05*
BYV	−10.53	3.85	−2.72	0.00***
MSG	0.028	1.21	0.02	0.98
C	3.336	0.39	8.38	0.00***
	Short-run (mean-group) coefficients			
COINTEQ	−0.02	0.01	−1.71	0.08*
D(HBI(−1))	−0.01	0.10	−0.11	0.90
D(HBI(−2))	0.07	0.02	2.95	0.00***
D(IRS)	0.06	0.07	0.84	0.39
D(IRS(−1))	0.04	0.04	1.11	0.26
D(IRS(−2))	0.02	0.01	1.37	0.17
D(ERV)	−0.06	0.14	−0.42	0.66
D(ERV(−1))	0.09	0.13	0.67	0.50
D(ERV(−2))	−0.02	0.11	−0.19	0.84
D(SMV)	−0.06	0.06	−0.88	0.37
D(SMV(−1))	−0.17	0.06	−2.60	0.00***
D(SMV(−2))	−0.07	0.04	−1.66	0.097*
D(BYV)	0.23	0.14	1.70	0.09*

Continued on next page

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BYV(−1))	0.06	0.10	0.61	0.53
D(BYV(−2))	0.00	0.08	0.07	0.94
D(MSG)	0.05	0.08	0.66	0.50
D(MSG(−1))	0.00	0.08	0.03	0.97
D(MSG(−2))	0.04	0.02	1.68	0.09*

Note: ***, **, * indicate significance at 0.01, 0.05, and 0.10 levels, respectively.

4.3. Analysis of housing bubble causality effects in ASEAN-5

This study also attempts to determine whether we can predict the value of a country's housing bubble index using past value(s) of another country's housing bubble index. To perform the analysis, we employ the Granger causality test (Granger, 1969). Table 5 provides the results of the Granger causality test, examining the two-way relationship between the ratio of housing bubbles among ASEAN countries (Table 5).

Table 5. Granger causality of housing bubbles in ASEAN-5 countries.

Null hypothesis	Obs	F-Statistic	Prob.
Malaysia Granger cause Indonesia	56	0.45	0.77
Indonesia Granger cause Malaysia		0.80	0.53
Singapore Granger cause Indonesia	56	3.85	0.01***
Indonesia Granger cause Singapore		0.07	0.99
Philippines Granger cause Indonesia	56	1.07	0.38
Indonesia Granger cause Philippines		1.07	0.38
Thailand Granger cause Indonesia	56	0.65	0.63
Indonesia Granger cause Thailand		2.39	0.06*
Singapore Granger cause Malaysia	56	1.41	0.24
Malaysia Granger cause Singapore		1.28	0.29
Philippines Granger cause Malaysia	56	1.49	0.22
Malaysia Granger cause Philippines		0.61	0.66
Thailand Granger cause Malaysia	56	2.03	0.10*
Malaysia Granger cause Thailand		1.18	0.33
Philippines Granger cause Singapore	56	1.22	0.32
Singapore Granger cause Philippines		1.39	0.25
Thailand Granger cause Singapore	56	2.28	0.07*
Singapore Granger cause Thailand		1.19	0.33
Thailand Granger cause Philippines	56	2.42	0.06*
Philippines Granger cause Thailand		1.09	0.37

Note: ***, **, * indicate significance at 0.01, 0.05, and 0.10 levels, respectively.

Source: Authors' analysis.

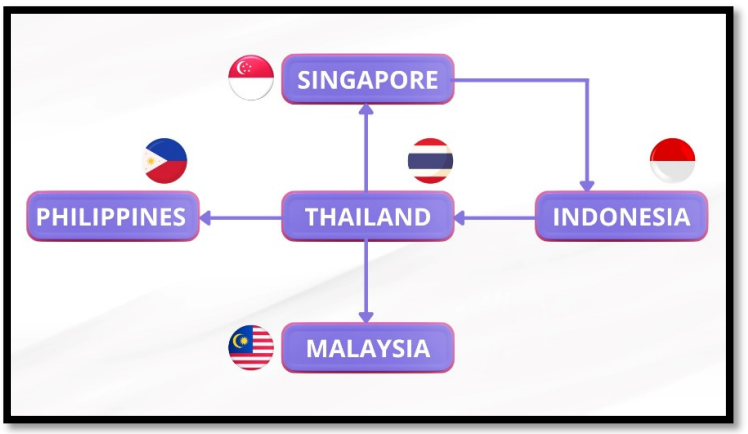


Figure 1. Housing bubble effects among the ASEAN-5 countries.

Figure 1 depicts the Granger Causality pattern of the housing bubble index across the ASEAN-5 countries. First, the Singapore housing bubble index Granger-causes the Indonesian housing bubble index. This is understandable given that Singapore serves as a regional financial hub with substantial cross-border investment flows. The surge in Singapore property prices has prompted investors to seek alternative investments in the surrounding region, particularly Indonesia, which has a larger housing market with relatively lower prices, highlighting the close financial ties between the two countries. Second, the Indonesian housing bubble index Granger-causes the Thai housing bubble index. When Indonesian property prices surge due to speculative pressure, investors tend to diversify their portfolios into Thailand, thereby driving up prices and increasing the risk of a bubble in that country. Third, evidence suggests that the Thailand housing bubble index Granger-causes the housing bubble indices of Singapore, Malaysia, and the Philippines. This pattern resembles the 1997/1998 Asian financial crisis, when the Thai baht sharply depreciated due to a crisis in the property and banking sectors, triggering a domino effect across other ASEAN nations.

5. Discussion

5.1. Banking sector performance

The performance of the banking sector, proxied by the interest rate spread, affects the housing bubble ratio in the long term. A decreasing interest rate spread reflects a decline in credit interest rates. The decrease in the interest rate spread between deposits and loans, also known as the interest rate spread, can play a significant role in the dynamics of the housing market (Hinch et al., 2019). The decrease in the interest rate spread means that financial institutions are trading low deposit interest rates for low loan interest rates. This results in a decrease in the cost at which individuals and investors can obtain financing to purchase a home (Chinloy & Jiang, 2022).

Our results align with a previous study that found interest rate spreads and real stock market growth, along with standard macro variables, were the best predictors of a housing boom (Martínez-García & Grossman, 2020). Smaller spreads make financial institutions feel more confident in providing credit.

Low interest rates can attract individuals and investors to make loans (Gamber & Seliski, 2019). The volume of home-purchase loans can fuel house price growth by increasing the amount of money supply. In addition to boosting aggregate demand for housing, lower borrowing costs will likely push up house prices (Kader et al., 2022). As house prices continue to rise, more buyers enter the market, further inflating the housing price bubble.

5.2. Stock and bond market

The ASEAN-5 stock markets have long-term and short-term effects on the first and second lags on the housing bubble ratio. Exchange rate volatility has a positive and statistically significant long-term relationship with the housing bubble ratio. A positive correlation exists between the stock market and the housing market in major international cities, including Hong Kong, San Francisco, New York, Los Angeles, Vancouver, London, and Tokyo (Alqaralleh et al., 2023).

The high volatility of the stock market in the long term can reflect ongoing systemic uncertainty (Hamilton, 1996). Investors and households will seek more stable, tangible assets, such as property, which are seen as safer from short-term fluctuations. This behavior can encourage investment to shift from the stock market to the property sector, leading to a gradual increase in house prices and, if not controlled, potentially forming a bubble (Liow, 2006).

The results of the short-term estimation indicate that stock market volatility is negatively and statistically significantly associated with the housing bubble ratio. An increase in stock market volatility will decrease the housing bubble ratio, and vice versa (Liu & Chen, 2016). This condition aligns with the results of a study on US housing from 1991 to 2014, which showed that average housing price returns are typically higher during periods of pessimistic sentiment (Park & Ryu, 2021).

Increased stock market volatility can reduce the ratio of house price bubbles through several interrelated mechanisms. The stock market and the housing market are sometimes seen as alternative investments (Tikkanen, 2018). When the stock market shows higher volatility and risk, investors may shift back to housing. However, if the level of uncertainty remains high, they may avoid both markets, which can lower house prices. Stock market volatility often prompts investors to become more cautious, leading them to shift investments to safer assets, such as bonds, or to hold cash. When funds shift into safer assets, they leave the real estate market, thereby reducing demand and depressing house prices.

The ASEAN-5 bond market, proxied by bond yields, affects house price bubbles in both the long and short term. Our findings illustrate the negative relationship between bond yield volatility and the housing bubble ratio. Unfortunately, a decrease of one point in bond yield volatility will increase the housing bubble ratio by 10 units. Bond yield volatility reflects the variability of interest rates and returns in the bond market. Higher interest rates affect the cost of borrowing, including mortgages for home purchases (Piazzesi & Schneider, 2010). When mortgage interest rates are higher, the cost of subsidizing homes increases, which can reduce housing demand and ultimately depress housing prices. Lower government bond yields can affect the housing bubble ratio. This can happen through several financial mechanisms. When bond yields fall, mortgage interest rates usually also fall (Reilly et al., 2010).

5.3. Monetary sector performance

The performance of the ASEAN-5 monetary sector, as reflected in the growth of the money supply, does not have a significant long-term effect on changes in the housing bubble ratio. However, in the short term, the second lag shows that the growth of the money supply has a positive and significant effect on the housing bubble ratio. Higher money supply growth in the previous quarter can lead to a higher housing bubble ratio in the current quarter. An increase in money supply growth is a consequence of loose monetary policy, characterized by low interest rates. Lower interest rates encourage lending and facilitate access to financing, thereby increasing demand for home purchases (Lee & Park, 2022; Hinch et al., 2019). An increase in money supply growth at a given level can be interpreted as inflationary for assets, including the housing market. More money circulating in the economy can increase demand for property, driving higher prices.

A recent study in the US, examining the investment activities of the baby boomer generation, found that high inflation led to a shift in their portfolios, making housing more attractive than equities (Leombroni et al., 2020). Higher money supply growth can change market players' perceptions of property values. When the market expects housing prices to keep rising because of increased liquidity, property investment is likely to increase, even when prices are already above their intrinsic value.

6. Conclusions

This research examines the impact of financial fragility on the housing bubble in selected ASEAN countries. A country is considered to have reached a bubble if its ratio to the consumer price index exceeds 2.0. Malaysia had the highest housing bubble ratio, reaching 1.94 in the second quarter of 2020, close to the bubble threshold. Meanwhile, Thailand and the Philippines had relatively stable housing market conditions.

Long-run PARDL estimates indicate that bond market conditions, as measured by bond yield volatility, are negatively and significantly associated with the housing bubble ratio. The stock market also exerts a long-term influence on the housing bubble. In the short term, however, the housing bubble ratio is negatively affected by its own lagged value and by volatility in the bond, stock, and foreign exchange markets. Furthermore, the performance of the monetary sector has a significant positive effect on the housing bubble ratio in the short term.

The occurrence of a housing price bubble in one country can have significant effects, including influencing house prices in other countries. The results of the causality test show that Singapore's housing bubble ratio significantly affects Indonesia's housing bubble ratio. Additionally, Indonesia's housing bubble increases Thailand's housing bubble ratio. More surprisingly, Thailand's housing bubble transmitted housing bubble dynamics to three ASEAN-5 countries: Singapore, Malaysia, and the Philippines.

Author contributions

Author 1 was responsible for conceptualizing the methodology, conducting data analysis, and validating the research. In addition, Author 1 made significant contributions to the formal writing of the study. Authors 2 and 3 conducted the critical literature review, strengthened the theoretical analysis,

and contributed to the formal writing to ensure clarity and coherence. The author 4 collaborated to validate the results and ensure the consistency and robustness of the conclusions.

Use of AI tools declaration

The author used OpenAI's ChatGPT (GPT-4) to edit and refine the wording of the Introduction and Literature Review. The author thoroughly reviewed and verified all outputs.

Acknowledgements

This research is supported by the Faculty of Islamic Economics and Business, Universitas Islam Negeri Raden Mas Said Surakarta, Indonesia.

Conflict of interest

The author declares no conflicts of interest in this paper.

Data availability statement

The data are available upon request to the authors.

References

Abreu D, Brunnermeier MK (2002) Synchronization risk and delayed arbitrage. *J Financ Econ* 66: 341–360. https://doi.org/10.1016/s0304-405x(02)00227-1

Asian Development Bank (ADB) (2021) Asian economic integration report 2021

Ahmed R, Jawaid ST, Khalil S (2021) Bubble detection in housing market: Evidence from a developing country. *SAGE Open* 11: 1–11. https://doi.org/10.1177/21582440211006690

Alqaralleh H, Canepa A, Salah Uddin G (2023) Dynamic relations between housing markets, stock markets, and uncertainty in global cities: A time-frequency approach. *N Am J Econ Financ* 68: 101950. https://doi.org/10.1016/j.najef.2023.101950

Asal M (2019) Is there a bubble in the Swedish housing market? *J Eur Real Estate Re* 12: 32–61. https://doi.org/10.1108/JERER-03-2018-0013

Azlan M I, Lee Y (2022) Determinants of housing prices. *AJRESS* 3: 91–106. https://doi.org/10.55057/ajress.2022.3.4.9

Bago JL, Akakpo K, Rherrad I, et al. (2021) Volatility spillover and international contagion of housing bubbles. *J Risk Financ Manag* 14: 1–14. https://doi.org/10.3390/jrfm14070287

Barlevy G (2007) Economic theory and asset bubbles. *Econ perspect* 3: 44–59. https://ssrn.com/abstract=1012865

Bernanke B, Gertler M (1990) Financial fragility and economic performance. *Q J Econ* 105: 87–114. https://doi.org/10.2307/2937820

Bianco T, Oet MV, Ong SJ (2013) The Cleveland financial stress index. *SSRN* 4: 1–5. https://doi.org/10.2139/ssrn.2244555

Blanchard OJ, Watson MW (1982) Bubbles, rational expectations and financial markets. In *NBER Working Paper Serie*: 899. https://doi.org/10.3386/w0945

Brunnermeier MK, Oehmke M (2012) Bubbles, financial crises, and systemic risk. In *NBER Working Paper Series* 38: 152–158. https://doi.org/10.1080/01932691.2016.1147360

Chinloy P, Jiang C (2022) Spreads and volatility in house returns. *J Risk Financ Manag* 15: 1–16. https://doi.org/10.3390/jrfm15080369

Duwith EM, Aloo S (2023) Market performance and returns comparison in Asia. *RAMP* 1: 1–8. https://doi.org/10.58784/ramp.74

Fama EF (1970) American finance association efficient capital markets : A review of theory and empirical work. *Papers and Proceedings of the Twenty-Eighth Annual Meeting of the American Finance Association New York* 25: 383–417. https://doi.org/https://doi.org/10.2307/2325486

Froot KA, Obstfeld M (1991) Intrinsic bubbles : The case of stock prices. *Am Econ Rev* 81: 1189–1214. https://www.jstor.org/stable/2006913

Gamber E, Seliski J (2019) The effect of government debt on short-term real interest rates: Comment on Findlay. In *Congressional Budget Office*: 37. https://doi.org/10.2307/3867233

Glindro ET, Delloro V (2010) Examining asset price bubbles in the Philippines. *BSP Working Paper Series of National Convention on Statistics (NCS)*. Available from: https://www.bsp.gov.ph/Sites/researchsite/Publications/BSP-Working-PaperSeries/WPS201002.pdf

Granger CWJ (1969) Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* 37: 424–438. https://doi.org/10.2307/1912791

Greenwald B, Stiglitz J (1997) New and old Keynesians. *A Macroeconomics Reader* 7: 23–44. https://doi.org/10.4324/9780203443965.ch22

Hamid N, Razali MN, Azmi FA, et al. (2022) Prospecting housing bubbles in Malaysia. *Real Estate Manag Valuat* 30: 74–88. https://doi.org/10.2478/remav-2022-0030

Hamilton JD (1996) Stock market volatility and the business cycle. *J Appl Econ* 11: 573–593. https://doi.org/10.1002/(SICI)1099-1255(199609)11:5<573::AID-JAE413>3.0.CO;2-T

Hinch M, McCord M, McGreal S (2019) LIBOR and interest rate spread: Sensitivities of the Australian housing market. *Pac Rim Prop Res J* 25: 73–99. https://doi.org/10.1080/14445921.2019.1610594

Hollo D, Kremer M, Lo Duca M (2012) CISS-A composite indicator of systemic stress in the financial system. In *Working Paper Series*: 1426. https://doi.org/10.2139/ssrn.1611717

Illing M, Liu Y (2006) Measuring financial stress in a developed country: An application to Canada. *J Financ Stabil* 2: 243–265. https://doi.org/10.1016/j.jfs.2006.06.002

Jarrow RA (2015) Asset price bubbles. *Annu Rev Financ Econ* 7: 201–218. https://doi.org/10.1146/annurev-financial-030215-035912

Kader SA, Zayed NM, Uddin MS, et al. (2022) Factors affecting demand and supply in the housing market : A study on three major cities in Turkey. *Computation* 10: 1–11. https://doi.org/ 10.3390/computation10110196

Keen S (2013) A bubble so big we can't even see it. *Real-World Econ Rev* 64: 3-10. https://www.paecon.net/PAEReview/issue64/Keen64.pdf

Kok SH, Ismail NW, Lee C (2018) The sources of house price changes in Malaysia. *Int J Hous Mark Anal* 11: 335–355. https://doi.org/10.1108/IJHMA-04-2017-0039

Kubicová I, Komárek L (2011) The classification and identification of asset price bubbles. *Finance Uver-Czech J Econ. Finance* 61: 34–48.

Laurent SB, Brittany W, Version P (2020) Bernanke and Kindleberger on financial crises , 1978–2002. *Oxf Econ Pap* 76: 314–329. https://doi.org/10.1093/oep/gpad010

Lee C, Park J (2022) The time-varying effect of interest rates on housing prices. *Land* 11: 1–16. https://doi.org/10.3390/land11122296

Leombroni M, Piazzesi M, Schneider M, et al. (2020) *Inflation and the price of real assets* (NBER Working Paper 26740). Available from: http://www.nber.org/papers/w26740

Liow KH (2006) Dynamic relationship between stock and property markets. *Appl Financ Econ* 16: 371–376. https://doi.org/10.1080/09603100500390885

Liu HH, Chen SH (2016) Nonlinear relationships and volatility spillovers among house prices, interest rates and stock market prices. *Int J Strateg Prop M* 20: 371–383. https://doi.org/10.3846/1648715X.2016.1191557

Martínez-García E, Grossman V (2020) Explosive dynamics in house prices? An exploration of financial market spillovers in housing markets around the world. In *Globalization Institute Working Paper*: 342. https://doi.org/10.1016/j.jimonfin.2019.102103

Mauldin J (2013) *Bubbles, bubbles everywhere*. Available from: https://obj.portfolioconstructionforum.edu.au/articles_perspectives/Bubbles-bubbles-everywhere.pdf

Minsky HP (1982) The financial-instability hypothesis: Capitalist processes and the behavior of the economy. In *Hyman P Minsky Archive* 282: 13–47. https://digitalcommons.bard.edu/hm_archive/282

Mokoginta IS, Asfari DD (2016) *Fiscal stress index as an early warning system for fiscal crisis in Indonesia*. Available from: https://journal.unpar.ac.id/index.php/Sosial/article/view/1669

Park D, Ryu D (2021). A machine learning-based early warning system for the housing and stock markets. *IEEE Access* 9: 85566–85572. https://doi.org/10.1109/ACCESS.2021.3077962

Pedrosa I, Lang D (2021) To what extent does aggregate leverage determine financial fragility ? New insights from an agent-based stock-flow consistent model. *J Evol Econ* 31: 1221–1275. https://doi.org/10.1007/s00191-021-00745-4

Pesaran MH, Shin Y, Smith RJ (2001) Bounds testing approaches to the analysis of level relationships. *J Appl Econ* 16: 289–326. https://doi.org/10.1002/jae.616

Pesola J (2011) Financial macroeconomic shocks and banks' loan losses: evidence from Europe. In *Bank of Finland Research Discussion Papers*: 15. https://doi.org/10.2139/ssrn.1018637

Piazzesi BM, Schneider M (2010) Interest rate risk in credit markets. *Papers and Proceedings of The One Hundred Twenty Second Annual Meeting of The American Economic Association* 100: 579–584. Available from: https://www.jstor.org/stable/27805062

Priyono AF, Bustaman A (2020) Construction of the Indonesian financial system stability index. *QE Journal* 6: 32–47. https://doi.org/10.24114/qej.v6i1.17535

Reilly FK, Wright DJ, Gentry JA (2010) An analysis of credit risk spreads for high yield bonds. *Rev Quant Finance Account* 35: 179–205. https://doi.org/10.1007/s11156-009-0162-7

Sherman HJ, Meeropol MA, Sherman, PD (2018) Housing bubble and financial crisis. *Principles of Macroeconomics* 46: 170–180. https://doi.org/10.4324/9781351232111-14

Shojaie A, Fox EB (2022) Granger causality : A review and recent advances. *Annu Rev Stat Appl* 9: 289–319. https://doi.org/10.1146/annurev-statistics-040120-010930

Tay DJ, Chou CI, Li SP, et al. (2016) Bubbles are departures from equilibrium housing markets: Evidence from Singapore and Taiwan. *PLoS ONE* 11: 1–13. https://doi.org/10.1371/journal.pone.0166004

Tikkanen J (2018) Stocks and residential real estate as investment options in Finland. Available from: https://www.theseus.fi/handle/10024/147917

United Nations (UN), Department of Economic and Social Affairs (2018) World urbanization prospects: The 2018 revision (ST/ESA/SER.A/420). Available from: https://population.un.org/wup/assets/WUP2018-Report.pdf

Vercelli A (2011) A Perspective on Minsky moments: The core of the financial instability hypothesis in light of the subprime crisis. In *The Levy Economics Institute Working Paper*: 579. https://doi.org/10.2139/ssrn.1486128

Yang Z, Fan Y, Zhao L (2018) A reexamination of housing price and household consumption in China: The dual role of housing consumption and housing investment. *J Real Estate Finance Econ* 56: 472–499. https://doi.org/10.1007/s11146-017-9648-6

Yoshino N, Taghizadeh HF (2015) Japan's lost decade: Lessons for other economies. *SSRN*: 521. https://doi.org/10.2139/ssrn.2593714

Yulianti, Della S, Mokoginta IJ, et al. (2024) ASEAN-5 market performance during the global crisis Stevia. *RAMP* 2: 29–37. https://doi.org/10.58784/ramp.98



AIMS Press

© 2026 the Author(s), licensee AIMS Press. This is an open access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0)