

REAL ESTATE BUBBLES, MACROECONOMIC STABILITY AND HOUSEHOLD CONSUMPTION EFFECTS IN BRICS⁺: EVIDENCE FROM SPATIAL SPILLOVERS, NONLINEAR, AND TIME-VARYING TRANSMISSION MECHANISMS

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Abstract

This study investigates the systemic transmission and cross-border spillovers of localized real estate bubble shocks across the BRICS Plus bloc over the period 1999Q1 to 2025Q4. Recognizing that housing market exuberance has evolved from isolated domestic phenomena into highly synchronized global threats, this research deploys a multi-layered econometric architecture to deconstruct these dynamics. Using the Generalized Supremum Augmented Dickey-Fuller (GSADF) methodology, the study first identifies and date-stamps episodes of speculative exuberance to construct continuous bubble pressure indices. We then map the frequency-dependent transmission of these shocks using a Wavelet-TVP-VAR framework, revealing that short-run liquidity panics progressively entrench themselves as long-run structural wealth degradation. By applying a Dynamic Spatial Durbin Panel Model (SDPM) alongside Panel Local Projections (LP), the empirical results decisively reject the assumption of purely localized housing cycles; nearly half of the macro-financial variance is imported through spatial trade-financial networks; unmitigated real estate bubbles function as highly contagious, multi-dimensional threats to sovereign stability and household welfare. We find that speculative housing shocks embed profound procyclical instability into the national

economy; a bursting property bubble triggers an immediate spike in structural cost-push inflation, prolonged GDP volatility, and a persistent drain on sovereign foreign exchange reserves. Momentously, Quantile-on-Quantile (QQ) regressions expose a highly regressive welfare shock, demonstrating that real estate distress systematically traps credit-constrained and low-income households in a severe contractionary cycle. The boom phase inflates import demand for construction materials, widening current account deficits, while the inevitable burst triggers rapid capital flight and forces central banks to drain foreign exchange reserves to defend depreciating local currencies; Extreme housing speculation operates as a highly regressive, structural tax; Deep trade and financial linkages ensure that property distress in one anchor economy frictionlessly exports price pressures, output volatility, and reserve depletion across the entire BRICS Plus network. Forecast error variance decompositions expose profound structural heterogeneity across the bloc: financialized hubs (China, UAE) transmit risk via wealth and collateral channels, institutional nodes (Russia, Egypt) via bank balance sheets, and frontier markets (Ethiopia, Iran) via foreign exchange and confidence panics. Consumption losses are strongest among credit-constrained households and in economies where residential real estate is deeply embedded in bank collateral and household portfolios. Reactive, uniform monetary adjustments are inadequate, mandating the adoption of automated, bespoke, and synchronized macro-financial credit frameworks to shield aggregate welfare. The study concludes that BRICS Plus policymakers require early warning systems, countercyclical loan-to-value limits, real estate exposure caps, regional housing data harmonization and cross-border macro-financial surveillance capable of detecting bubble localization before it becomes systemic contagion.

Keywords: Real Estate Bubbles; BRICS Plus; Macro-Financial Spillovers; Cross-Border Contagion; Financial Networks; Loan-to-Value Limits; Countercyclical Buffers; Systemic Risk Mitigation); Household Consumption; Wealth Effect; Time-Varying Connectedness.

JEL Classification: R31, F42, E32, G15, E58, C33.

1. INTRODUCTION AND THE PROBLEM

The expansion of the BRICS grouping into BRICS Plus is likely to significantly shape the new global macro-financial interdependence. How policymakers are going to respond to the financial instability, sustainable growth and household welfare challenge is a big question. The inclusion of Brazil, Russia, India, China, South Africa, Saudi Arabia, Iran, the United Arab Emirates, Egypt, Ethiopia, and Indonesia has produced a heterogeneous economic bloc in terms of degree of financial development, housing-finance structure, capital mobility, urbanization, and institutional capacity. The real estate sector of these economies is increasingly important for the economic performance of the region and the world since together they account for a significant share of the global population, energy, infrastructure, urban expansion, and capital accumulation. Real estate markets have become a key transmission mechanism linking household wealth and financial intermediation to credit and investment behaviour and, ultimately, to macroeconomic stability in this new economic architecture. In the past, housing markets were believed to be mainly domestic asset markets. However, this perception seems to have changed. One of the noticeable trends is that property markets in major BRICS Plus cities, such as Shanghai, Shenzhen, Mumbai, Riyadh, Dubai, São Paulo, Johannesburg, Cairo and Jakarta, are becoming entrenched in geopolitics and have the potential to cause larger macroeconomic effects through various lending and investment channels. The growing concern surrounding localized real estate bubbles stems from the observation that speculative property booms frequently emerge in metropolitan corridors long before signs of financial distress become visible at the national level. Property prices in strategic urban centers often rise substantially faster than rents, household incomes, productivity growth, construction costs, and other economic fundamentals, creating conditions consistent with asset-price bubbles. Such episodes may initially appear geographically concentrated; however, the associated increases in mortgage lending, developer leverage, collateral valuations, land prices,

municipal revenues, and speculative investment frequently generate spillover effects that extend well beyond the originating locality. Recent studies have shown that housing markets are increasingly interconnected with credit cycles, investor sentiment, systemic risk, and financial-market volatility, implying that localized real estate bubbles may serve as early indicators of broader macro-financial instability rather than isolated urban phenomena (Almeida, 2025; Balçılar et al., 2023; Su & Meixia, 2024; Shodroková & Asngari, 2024). This issue is particularly important within the BRICS Plus economies because of the very large differences in housing-market structures and financial systems. In the past China's property has played a central role in the prosperity of household wealth, local government finances and developers. With international wealth and migration shaping its development, the United Arab Emirates (UAE) has one of the world's most globally integrated property markets. The housing sector of Saudi Arabia is undergoing transformation through state-led initiatives as part of Vision 2030. Egypt, Ethiopia, Indonesia, Brazil and South Africa face combinations of rapid urbanization, credit growth, affordability and exchange rate pressures. The unique circumstances of Russia and Iran, namely sanctions, geopolitical uncertainty, and restrictions on the mobility of capital, often enhance the attractiveness of property as a store of value. The variety in cases spark the empirical question: do the channels through which the housing bubbles impact macro outcomes differ by financial depth, institutional development, banking-sector exposure, and household balance-sheet structures?

Localized housing bubbles have various macroeconomic implications through a number of channels. Increase in property values can create wealth effects that raise household consumption by increasing perceived net worth and reducing savings. An increase in home prices means that homeowners can borrow against the increased value of their home instead of defaulting. Bubbles may operate in reverse on the collapse of bubbles, leading to falling consumption, tighter credit conditions, lower investment and stress in the financial-sector. In addition, downturns in the property market can create weakness in the balance sheet for developers, elevate the level of nonperforming loans, ... Recent studies have pointed out that collateral, credit constraints, and financial intermediation play a significant role in transforming housing-market shocks into macroeconomic shocks affecting inflation, consumption, and growth (Nguyen et al., 2025; Bielskis and Lastauskas, 2024). Localized property bubbles may also generate cross-border financial spillovers in addition to domestic channels of finance within BRICS Plus. Boom and bust in property markets may affect foreign capital allocation, investor confidence, demand for commodities, tourism flow, migration pattern, expectations on exchange rate and sovereign investment decisions. Housing stress in China can impact commodity-exporting economies, such as Brazil and South Africa, via trade and demand channels. Similarly, property cycles in Dubai may affect capital flows and investment decisions across Egypt, India, Russia, and other emerging markets. According to Zou et al (2023) Lawrence and Moodley (2026), localised real estate bubbles can be transmuted into larger macro-financial phenomena with the capacity to affect inflation dynamics, GDP volatility, reserve accumulation and household welfare within an integrated network of economies. Although scholars are increasingly focusing on the dynamic nature of the housing market, there are still gaps that exist. Many studies often observe national house-price indices, which obscure speculative pressures from the particular metropolitan submarkets in which bubbles arise. Moreover, many studies in the literature estimate the relationships between house prices and macroeconomic variables without differentiating normal price appreciation from explosive bubble behaviour. As a result, past research often cannot tell whether observed macroeconomic effects were due to essential housing-market developments or speculative excesses. In light of recent studies on the financial connectedness, property returns

and geopolitical risk of BRICS economies, there is limited evidence related to the recently expanded BRICS Plus bloc and the transmission mechanisms of localized housing bubbles on inflation, GDP volatility, foreign exchange reserves, and aggregate household consumption, all analysed simultaneously (Lawrence & Moodley, 2026; Moodley & Lawrence, 2026; Su & Meixia, 2024). Another limitation of earlier papers is that they either identify bubbles or study their macroeconomic consequences (such as financial instability). Most studies of housing bubbles conclude on the identification of episodes of explosive price behaviour. Studies of consumption and the macroeconomy often estimate average housing wealth effects without testing if the price dynamics are of bubble-type. As a result, policy makers are not sure how much localized real estate bubbles should be interpreted as early warning signs of wider macroeconomic instability. This uncertainty is especially problematic in emerging economies, where housing simultaneously serves as a household asset, collateral, savings, a revenue base for the state, and a key element of financial-sector balance sheets. This gap has serious implications for policy. Governments have routinely responded only after housing-market imbalances have resulted in stress in the banking sector, developer bankruptcies, and consumption or macroeconomic instability. (20 words) At that point, corrective actions become far more expensive and less effective. On the other hand, an early tightening of policy could suppress genuine housing demand and construction activity and erode growth. Thus, policymakers need a better understanding of how localized housing bubbles pass through to the macro-economy in order to better separate sustainable urban appreciation from destabilizing speculative excess. In this context, the key issue this study attempts to address is the lack of systematic empirical evidence on how localized real estate bubbles which transmit via their wealth, collateral, balance-sheet and cross-border channels to impact inflation, GDP volatility, reserve accumulation foreign exchange, and total household consumption in an expanded BRICS Plus economies. Despite evidence on housing bubbles, wealth effects, and financial connectedness, much less is known about how housing stress caused by bubbles transmits across macroeconomic and welfare effects in a heterogeneous bloc with differing financial structures, varying levels of institutional capabilities and increasing economic integration. Thus, it is important to establish whether localized real estate bubbles are mere local distortions or systemic macro-financial threats capable of undermining economic stability and household welfare in the economy of the BRICS Plus.

In response to the identified research problem that localized real estate bubbles are often treated as isolated urban-market phenomena despite their potential to generate broader macroeconomic instability and household welfare losses across the BRICS Plus economies, this study seeks to date-stamp multiple explosive bubble episodes across major BRICS Plus urban centers using high-frequency data, examine the time-varying and frequency-dependent connectedness between real estate volatility and key macroeconomic indicators such as GDP, inflation, and credit growth, investigate the transmission channels through which localized housing-market bubbles disrupt macroeconomic stability and aggregate household consumption, and isolate and quantify the specific Wealth Effect, Credit/Collateral Channel, and Balance-Sheet Channel through which housing-market shocks are transmitted to household consumption. By aiming for these objectives, the research is expected to go a long way in filling the literature gaps regarding how localized property stress can lead to macro-financial vulnerabilities and consumption-related risks in the heterogeneous and increasingly interconnected BRICS Plus economies. The study has significance for central banks, ministries of finance, housing regulators, bank supervisors, international investors and development institutions. For central banks, the analysis clarifies whether property-market shocks influence inflation, reserves and GDP volatility through credit and confidence channels. If localized real estate shocks significantly affect inflation and reserve

pressure, monetary authorities cannot treat them as purely sectoral events (Bednarek et al., 2021; Liu et al., 2011). For bank supervisors, the channel decomposition identifies whether the main vulnerability is mortgage exposure, developer credit, collateral concentration, nonperforming loans or shadow-finance linkage. For fiscal authorities, the results highlight the risk of relying on land sales, property transaction taxes and construction activity as stable revenue sources during speculative booms. The study contributes to global financial stability by proposing a replicable early-warning framework for BRICS Plus economies. It combines bubble detection with dynamic connectedness and spatial spillover estimation. This is useful because property bubbles often look manageable while they are forming (Case et al., 2012; Mayer, 2011). The warning signal is not only price growth, but price growth relative to rents and incomes, rising credit intensity, increasing bank exposure and the emergence of spatial spillovers (Bengtsson et al., 2018; Hermansen & Röhn, 2017). A city-level GSADF signal that coincides with increasing credit-to-GDP gaps and rising nonperforming-loan sensitivity should therefore trigger supervisory attention.

The study also has welfare significance. Household consumption is the bridge between financial cycles and everyday living standards. Housing bubbles can stimulate consumption for homeowners but raise housing costs for renters and first-time buyers. When bubbles burst, households may reduce spending, increase savings and delay durable purchases. In economies with large informal sectors, consumption compression can quickly affect employment, small businesses and poverty vulnerability. By examining consumption across income groups and economic sectors, the study moves beyond macro-financial aggregates to show how real estate cycles influence welfare distribution. Academically, the study contributes by extending the housing-bubble literature from detection to transmission. It also extends BRICS research into a BRICS Plus context, incorporates the post-2024 membership change, and links recent research on GSADF detection, TVP-VAR connectedness, quantile spillovers and credit-constrained consumption. The literature has increasingly recognized that housing markets are nonlinear, sentiment-sensitive and connected across financial systems (Martínez-García & Grossman, 2019). This study adds the specific question of how localized bubbles in an expanded emerging-market bloc can threaten macroeconomic stability and aggregate household consumption.

2. PRIOR RESEARCH FINDINGS

The literature on real estate bubbles has progressively shifted from viewing housing markets as isolated components of national economic activity to recognizing them as integral elements of broader financial and macroeconomic systems. Contemporary studies argue that real estate markets are influenced not only by conventional fundamentals such as income growth, demographic expansion and urban development, but also by financial conditions, investor psychology, geopolitical uncertainty, policy credibility and the interconnected balance sheets of households and financial institutions (Balcilar et al., 2023; Almeida, 2025). This broader idea is particularly relevant in BRICS Plus economies, where quick urbanization, heterogeneous institutional arrangements, evolving financial systems, and uneven regulations can lead to situations wherein local housing imbalances can bring about larger macroeconomic consequences. The real estate bubble literature focuses on a divergence between housing prices and economic fundamentals. In effective housing markets, prices ought to reflect yields, household incomes and construction costs, financing conditions and land constraints and long-run expectations for the growth of the city. Nevertheless, when prices are inflated well above the level justified by their economic value owing to expectations of future capital gains, speculative bubbles arise. As a result, the price-to-rent and price-to-income ratios are now widely accepted

as misalignment indicators. According to Zhang et al. (2024), the recent use of GSADF has shown that housing bubbles have frequent multiple explosions rather than one-time booms and busts, which means experts have been able to detect such bubbles happening multiple times in the housing market. As a result, the ability to capture the dynamics over time of real estate exuberance in different economic scenarios has improved. The features of housing bubbles in emerging economies vary considerably with advanced economy housing bubbles. While developed nations typically have housing booms because of advanced mortgage markets and financial innovations, developing countries often experience bubble-like tendencies because of informal financing channels, developers' leverage, speculative investment dynamics, and home buyers with limited affordability. In times of exchange-rate turbulence and macroeconomic uncertainty, housing assets in such economies are often used as a store of value and hedge against inflation. In addition, due to the ineffectiveness of registration systems for land, unrealistic expectations about infrastructure expansion, political changes and income fluctuations, cities experience sharp rises in property prices. Analysis of BRICS property markets show that geopolitical risk, financial integration and regime-dependent investor behaviour matter for real estate returns and valuation trends across emerging markets (Moodley & Lawrence, 2026). The results indicate that localized housing bubbles within BRICS Plus economies may result from financial, institutional and geopolitical factors rather than demand conditions alone. Housing bubbles affect the economy through wealth effect. - 15 words Wealth-Effect Household Consumption Decisions based on Changes in Wealth are incorporated in the life-cycle and permanent-income hypotheses and literature. For most households, housing is the largest asset component. Consequently, rising house prices can spur consumption. This occurs due to improved household confidence, greater borrowing opportunities and less precautionary savings. On the other hand, falling home values could dampen consumption via negative wealth and financial uncertainty. Recent empirical data emphasizes the significance of this channel. Research suggests housing wealth effects exist. Meanwhile, some studies indicate that policy-induced increases in housing wealth can generate consumption gains of urban households in China (Wang, 2026). In the same way, various different credit restrictions may minimize and sustain consumption responses to housing wealth changes. Together, the studies suggest the transmission of real estate shocks to household consumption is not uniform or linear but depends on one's access to finance and borrowing conditions.

The credit-collateral mechanism, a derivative of the financial accelerator framework, is closely tied to the wealth channel. Housing assets act as collateral for mortgages, consumer loans and business financing. Housing property values are key determinants. The surge in house prices strengthens collateral positions, which in turn promotes bank lending and supports credit expansion, ultimately stimulating the economy. The falling value of assets lowers the quality of collateral, restricts borrowing limits and curtails household and business demand. According to Bielskis and Lastauskas (2024), housing spread shocks can increase consumption by relaxing borrowing constraints and improving wealth expectations while excessive credit expansion may generate destabilizing boom-bust cycles afterwards. Different countries in the BRICS Plus economy will experience the same transmission channel with varying efficacy. They possess distinct banking and mortgage market development practices and legal enforcement mechanisms as well as levels of financial inclusion. Beyond households, real estate bubbles also transmit shocks through financial-sector balance sheets. The balance-sheet channel highlights how property market corrections can weaken the financial health of banks, developers and construction firms. Falling property prices may reduce developer revenues; impair collateral values, increase nonperforming loans and force financial institutions to adopt more restrictive

lending standards. These effects can spill over into broader economic sectors by reducing the availability of credit to manufacturing, services and small businesses. Nhung Thi Nguyen et al. (2025) demonstrate that banking-sector credit conditions play a crucial role in transforming localized property shocks into broader financial crises, while Duong Thi Anh Tien and Hoang Thi Ngoc Nghiem (2025) show that real estate-related stress can significantly undermine banking efficiency and financial stability across emerging economies (Tiên & Nghiem, 2025). These findings suggest that localized housing bubbles may pose systemic risks even in countries where household mortgage indebtedness remains relatively low. The literature further highlights the tension between crowding-in and crowding-out effects associated with housing booms. Rising property values can stimulate economic activity by strengthening collateral values, increasing bank capitalization and supporting broader lending activity. However, excessive concentration of financial resources in the property sector may divert credit away from productive sectors such as manufacturing, technology, agriculture and export-oriented industries. This misallocation of capital can create the appearance of strong economic growth during housing booms while simultaneously weakening long-run productivity and economic competitiveness. Evidence presented by Wang et al. (2026) indicates that real estate bubbles can threaten local government debt by deepening dependence on land finance and weakening financial self-sufficiency, increasing the likelihood that property corrections will generate wider macroeconomic instability (Wang et al., 2026). Recent developments in connectedness analysis have further expanded understanding of how housing shocks propagate across markets and institutions. Housing markets increasingly operate within interconnected financial networks characterized by cross-market linkages, shared investor bases and common macroeconomic risk factors. Balciar et al. (2023) show that house-price connectedness intensifies during periods of economic stress, while Hadad et al. (2024) demonstrate that spillovers among housing markets, real estate investment trusts and investor sentiment become particularly pronounced during extreme market conditions. Similarly, Su and Chen (2024) find that financial connectedness within BRICS economies varies significantly across crisis and non-crisis regimes, with stronger transmission occurring in tail-risk environments. These findings imply that localized housing bubbles may generate disproportionately large macroeconomic effects when broader financial systems are already vulnerable. The increasing recognition of dynamic and nonlinear transmission mechanisms has led to widespread adoption of time-varying analytical frameworks. Zou et al. (2024) employ a TVP-VAR connectedness framework to examine interactions between economic policy uncertainty and regional real estate markets, revealing substantial shifts in transmitter-recipient relationships over time. Lawrence and Moodley (2026) extend similar methodologies to investigate the dynamic interaction between geopolitical risk and BRICS property markets. Such studies underscore the importance of accounting for evolving relationships between housing markets and macroeconomic variables. The incorporation of wavelet methods further enriches this analysis by distinguishing short-run liquidity effects, medium-run credit cycles and long-run wealth dynamics, thereby providing a more comprehensive understanding of housing-market transmission channels (Marfatia, 2020). Spatial econometric studies offer additional insights into the diffusion of housing shocks across regions and countries. Housing markets are connected not only through geographical proximity but also through trade relationships, migration networks, investment flows, commodity linkages and financial integration. Consequently, localized housing bubbles may generate spillover effects beyond national borders. Within the BRICS Plus bloc, economic interdependence is evident through channels such as China-Brazil commodity trade, UAE-India migration and investment networks, Gulf-Egypt capital flows and China-Indonesia commercial linkages. Dynamic spatial modeling approaches therefore provide an effective

framework for capturing both domestic housing-market effects and cross-border spillover mechanisms. The literature also emphasizes the asymmetric nature of housing-market transmission. Housing booms and busts affect economic agents differently depending on their positions within the housing market and financial system. Homeowners often benefit from rising property values through wealth accumulation and increased borrowing opportunities, whereas renters may experience reduced purchasing power due to escalating housing costs. During housing downturns, asset owners typically face wealth losses and tighter credit conditions, while prospective buyers may remain constrained by reduced credit availability. (Cho et al., 2024; Laborda & Suárez, 2024) demonstrate that the effects of housing shocks vary substantially across different segments of the income and consumption distributions, suggesting that conventional mean-based estimation techniques may conceal important heterogeneity in household responses. Country-specific evidence from major BRICS economies further reinforces the heterogeneous nature of housing-market transmission. (Li, 2024; Lu & Zhu, 2024) find that housing wealth significantly influences consumption behavior in urban China, although the magnitude of the effect varies across household groups. Similarly, Aron (2025) demonstrates that household consumption in South Africa is strongly influenced by debt positions, asset portfolios and access to credit, highlighting the importance of financial structures in shaping housing wealth effects. These findings indicate that housing shocks are transmitted through different mechanisms across countries, reflecting variations in institutional quality, financial development and household balance-sheet composition. At the macroeconomic level, the literature identifies inflation, output volatility, external-sector stability and labor-market conditions as key channels through which housing bubbles influence broader economic performance. Housing booms can contribute directly to inflation through rising shelter costs and indirectly through increased construction activity, wage pressures and land-price appreciation. They may also amplify GDP volatility by reinforcing procyclical credit and investment cycles. Furthermore, housing market corrections can weaken foreign exchange reserves by triggering capital outflows, increasing external financing pressures and reducing investor confidence. International assessments by the OECD (2024, 2025), Aliman & Popa, 2025; Just & Salzberger, 2024; Kladakis et al., 2025; Rodríguez-Asensio & López-García, 2026) continue to identify real estate vulnerabilities as among the most significant threats to macro-financial stability due to the sector's strong leverage, slow adjustment dynamics and close integration with banking systems.

Identification of the Literature Gap

In spite of substantial advances in the literature, several important gaps remain. Existing studies largely focus on the original BRICS economies rather than the expanded BRICS Plus formation and frequently examine national housing-price movements without explicitly accounting for localized bubble dynamics. Much of the empirical evidence concentrates on asset-price behavior, financial-market connectedness or banking-sector stability, while comparatively little attention has been devoted to the broader transmission of localized housing bubbles to household consumption and macroeconomic stability. Furthermore, most studies analyze individual transmission mechanisms in isolation, examining wealth effects, collateral channels or banking-sector vulnerabilities separately rather than within a unified analytical framework. There is also limited evidence integrating multiple dimensions of housing-market transmission, including nonlinear dynamics, time-frequency connectedness, spatial spillovers and heterogeneous consumption responses, within a single empirical setting. Consequently, the literature lacks a comprehensive macro-panel investigation that simultaneously evaluates how localized real estate bubble pressures transmit through inflation, GDP volatility, foreign exchange reserves and household consumption across the expanded BRICS Plus economies. This study addresses this gap by

constructing a continuous localized bubble pressure index based on GSADF date-stamping techniques and integrating nonlinear, spatial and time-varying transmission mechanisms within a harmonized quarterly macro-panel framework covering Brazil, Russia, India, China, South Africa, Saudi Arabia, Iran, United Arab Emirates, Egypt, Ethiopia and Indonesia from 1999Q1 to 2025Q4.

3. ECONOMETRIC METHODOLOGIES

Research Methodological Design

The methodological design is a joint model strategy because no single model can answer all the research questions. GSADF testing identifies whether and when explosive valuation behavior exists (Sharma & Escobari, 2017), but it does not explain how the shock transmits to consumption or macroeconomic stability. TVP-VAR was deployed to capture time-varying connectedness and impulse responses (Yousaf et al., 2024), but it does not fully identify spatial spillovers. Dynamic Spatial Durbin panel model (DSDPM) Durbin estimation was utilized to address cross-country and economic-distance spillovers (Elhorst, 2011), but it treats nonlinear distributional effects only indirectly. Quantile-on-quantile (QQ) regression addresses asymmetry and distributional heterogeneity (Duan et al., 2021), but it is not designed as a full dynamic system. Local projections provide horizon-specific responses and allow interactions (Jordà & Taylor, 2025), but they depend on correct specification of controls and lag structure. Combining these methods therefore strengthens inference by matching each tool to a specific component of the research problem.

The methodology is designed to capture the dynamic, multilateral, nonlinear and spatial nature of localized real estate bubble transmission. The combined model strategy produces policy-relevant outputs. GSADF produces bubble chronologies (Sharma & Escobari, 2017); TVP-VAR produces connectedness and impulse-response evidence (Yousaf et al., 2024); FEVD shows the share of variation explained by channels (Abu-Qarn & Abu-Bader, 2009); DSDPM shows spillover coefficients (Elhorst, 2011); QQ regression shows distributional asymmetry (Duan et al., 2021); local projections show horizon-specific effects (Jordà, 2005); Markov-switching models show regime dependence (Tan & Wu, 2025). These outputs are understandable to central banks, financial supervisors, fiscal authorities and housing ministries. A purely technical model would be less useful if it could not be translated into surveillance dashboards and policy sequencing. The methodological framework therefore balances statistical sophistication with decision relevance. The study therefore does not rely on ordinary least squares or static panel models as the main strategy. Such models are useful for baseline association but insufficient for the research problem because they assume constant average effects, ignore spatial spillovers (Elhorst, 2011), fail to date-stamp multiple explosive periods (Sharma & Escobari, 2017), and cannot distinguish boom and burst regimes (Tan & Wu, 2025). Instead, the empirical design proceeds in six steps: GSADF bubble detection, construction of a continuous bubble indicator, four dependent-variable macro-panel models, Wavelet-TVP-VAR connectedness, dynamic spatial Durbin panel estimation, QQ regression, and robustness checks using interacted local projections and Markov-switching models. The study employs a harmonized quarterly panel. Let i denote the i^{th} country, t denote quarter and j denote economically linked country or region. The primary independent variable is the localized real estate bubble index, B_{it} , constructed from right-tailed GSADF tests applied to price-to-rent and price-to-income indicators. The dependent variables are specified in four separate models, one for each macroeconomic outcome: inflation, GDP volatility, foreign exchange reserves and household final consumption expenditure per capita. Transmission variables include household debt-to-GDP as a collateral proxy, private credit-to-GDP and credit gap as credit-cycle indicators, stock market indices as financial wealth proxies, bank

nonperforming loans as balance-sheet stress, interest rates, exchange-rate depreciation, GDP growth and global uncertainty indicators.

GSADF Bubble Detection: The Generalized Supremum Augmented Dickey-Fuller (GSADF) test identifies multiple explosive episodes across rolling windows of the house price indicator (y_{it} , representing log price-to-rent or log price-to-income ratios).

$$GSADF(r_0) = \sup_{r_2 \in [r_0, 1], r_1 \in [0, r_2 - r_0]} ADF_{r_1}^{r_2} \quad (1)$$

Continuous Real Estate Bubble Pressure Indicator: If the GSADF statistic exceeds the 95% critical value, a bubble is actively inflating. This binary signal is converted into a continuous pressure indicator (B_{it}), rescaled between 0 and 100, allowing the bubble to enter transmission models as a continuous shock:

$$B_{it} = \max \left(0, \frac{GSADF_{it} - CV_{95\%}}{CV_{95\%}} \right) \times 100 \quad (2)$$

Baseline Panel Specification: Four separate models are estimated for the macroeconomic outcomes: Inflation, GDP volatility, FX reserves, and household final consumption expenditure (HFCE) per capita.

$$Y_{it} = \alpha_i + \tau_t + \beta B_{it} + \sum_k \delta_k (B_{it} \times Transmission_{it}^k) + \gamma X_{it} + e_{it} \quad (3)$$

The four baseline dependent-variable models are specified separately. Model 1 estimates the effect of localized bubble pressure on inflation. Model 2 estimates the effect on GDP volatility, measured as the rolling quarterly standard deviation of real GDP growth. Model 3 estimates the effect on foreign exchange reserves, expressed as reserve growth or reserve adequacy change. Model 4 estimates the effect on real household final consumption expenditure per capita. In each model, the coefficient on B_{it} captures the direct bubble effect, while interaction terms with household debt, credit gap and NPL ratios identify transmission channels. The standard panel specification is:

$$Y_{it} = \alpha_i + \tau_t + \beta B_{it} + \gamma_1 (B_{it} \times Debt_{it}) + \gamma_2 (B_{it} \times CreditGap_{it}) + \gamma_3 (B_{it} \times NPL_{it}) + \Delta X_{it} + e_{it} \quad (4)$$

The four models differ only by dependent variable. The GSADF, Wavelet-TVP-VAR, spatial Durbin and QQ components were specified in complementary econometric routines and reported in a Stata-style empirical format for consistency. The analysis uses country fixed effects to remove time-invariant national heterogeneity, time fixed effects to control common global shocks, cluster-robust standard errors at country level and lag structures to reduce simultaneity. Where variables are highly persistent, first differences, growth rates or standardized gap measures are used. Bubble detection begins with the GSADF test. The GSADF approach is preferred because it can identify multiple bubble episodes within a long sample and is more robust than a single recursive ADF test when emerging markets experience repeated intervention, capital-flow shocks and policy discontinuities. The basic ADF regression is estimated across rolling windows of the house price indicator y_{it} , defined as the log price-to-rent or log price-to-income ratio. An explosive episode is inferred when the test statistic exceeds the simulated right-tail critical value at the

selected significance level. The rolling-window ADF regression underlying GSADF bubble detection model is represented as Equation (5) below.

$$\Delta y_t = a + \phi y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + e_t \quad (5)$$

Where y_t is the house price indicator. The GSADF uses a rolling window to identify the exact date-stamping of bubble origination and collapse. Accordingly, to scientifically prove the existence of localized real estate bubbles, you will utilize the GSADF test developed by Phillips, Shi, and Yu (2015). This right-tailed unit root test detects explosive, bubble-like behavior in the real estate price index (P_{it}) relative to macroeconomic fundamentals.

$$\Delta P_{it} = \alpha_i + \beta_i P_{i,t-1} + \sum_{j=1}^k \gamma_{ij} \Delta P_{i,t-j} + \varepsilon_{it} \quad (6)$$

If β_i and is statistically significant at the sup-ADF critical value, a bubble is actively inflating. We convert this into a continuous Bubble Indicator variable, B_{it} , for the next step). The GSADF statistic is calculated as the supremum of ADF statistics over feasible subsamples. In practical terms, the study estimates repeated right-tailed tests and records periods where the statistic exceeds the 95 percent critical value. The resulting binary signal is converted to a continuous bubble pressure indicator by measuring the excess of the statistic above the critical value and rescaling it between zero and 100. This indicator allows a bubble to enter the transmission models as a continuous shock rather than a simple dummy. The transformation is shown in Equation (7) which is the Continuous localized real estate bubble pressure indicator.

$$B_{i,t} = \max \{0, GSADF_{i,t} - CV_{i,t}^{95\%}\} \quad (7)$$

Wavelet-TVP-VAR: To capture the evolving relationship between housing shocks and macro-outcomes without assuming constant coefficients, the model employs a Wavelet-Time-Varying Parameter VAR. Wavelet decomposition separates these into short-run (liquidity), medium-run (credit-cycle), and long-run (structural wealth) dynamics. Transmission analysis is then implemented using a Wavelet-TVP-VAR. Standard VARs assume constant coefficients and therefore cannot adequately represent the changing relationship between housing shocks, credit cycles and macroeconomic outcomes (Stock & Watson, 1996). The TVP-VAR allows coefficients and shock variances to evolve through time (Nakajima et al., 2011), while the wavelet decomposition separates short-run, medium-run and long-run dynamics (Beckmann et al., 2018). The representation of the Wavelet-TVP-VAR state-space representation of time-varying connectedness is shown in Equation (8).

$$y_t = A_{1,t} y_{t-1} + \dots + A_{p,t} y_{t-p} + u_t, u_t \approx N(0, \Sigma_t) \quad (8)$$

The TVP-VAR allows coefficients and shock variances to evolve through time, while the wavelet decomposition separates short-run, medium-run and long-run dynamics. Short-run effects are interpreted as liquidity, sentiment and capital-flow effects. Medium-run effects are interpreted as credit-cycle and banking effects. Long-run effects are interpreted as wealth, balance-sheet and structural adjustment effects.

Dynamic Spatial Durbin Panel Model (DSDPM): This tests whether bubble pressure spills over into economically linked countries. The spatial weight matrix (W_{ij}) is a composite of trade, financial linkages, migration, and commodity dependence. The DSDPM is crucial for the localized-to-broad objective. It tests whether bubble pressure in one country or urban corridor spills into economically

linked countries through a spatial weight matrix (Zhang et al., 2022). The matrix W is not limited to geography; it is a composite of trade exposure, financial linkage, migration corridor, commodity dependence and capital-flow attraction (Zhu et al., 2022). The model estimates the spatial lag of the dependent variable and the spatial lag of bubble pressure. A significant θ coefficient indicates that localized real estate pressure in linked countries affects domestic macro-stability or consumption (Kopczewska et al., 2015). The matrix W is not limited to geography; it is a composite of trade exposure, financial linkage, migration corridor, commodity dependence and capital-flow affinity. The model estimates the spatial lag of the dependent variable and the spatial lag of bubble pressure. A significant θ coefficient indicates that localized real estate pressure in linked countries affects domestic macro-stability and consumption. The DSDPM for direct and spillover effects is specified in Equation (9).

$$Y_{it} = \tau Y_{i,t-1} + \rho \sum_{j \neq i} W_{ij} Y_{jt} + \beta B_{it} + \theta \sum_{j \neq i} W_{ij} B_{jt} + \gamma X_{it} + \mu_i + \gamma_t + e_{it} \quad (9)$$

Quantile-on-Quantile (QQ) Regression: The QQ regression model addresses asymmetry and distributional heterogeneity (Duan et al., 2021). The wealth effect is rarely symmetric. A bubble at the 90th percentile may have different effects on consumption at the 10th percentile than a normal housing shock has on median consumption. The QQ model therefore estimates the response of consumption quantiles (τ) to bubble-shock shocks (θ) (Liu et al., 2023). This allows the study to identify whether high-bubble states disproportionately depress consumption among vulnerable households or low-consumption states. Equation (10) summarizes the QQ regression for asymmetric consumption effects.

$$Q_{\tau}(C_{i,t}) = \beta_0(\tau) + \beta_1(\tau) Bubbles_{i,t} + \Gamma(\tau) Z_{i,t} \equiv \Delta C_{it}(\tau) = \alpha(\tau) + \beta(\theta, \tau)[B_{i,t} - B^{\theta}] + \gamma(\tau) X_{it} + e_{it}(\tau) \quad (10)$$

Robustness checks rely on interacted panel local projections and Markov-switching models. To evaluate the transmission channels threatening household consumption (C_{it}) and macro-stability, we employ Jordà's Local Projections (LP) augmented with interaction terms. This allows us to calculate dynamic Impulse Response Functions (IRFs) across different horizons (h). Local projections estimate impulse responses at different horizons without imposing the full dynamic structure of a VAR. Interactions between the bubble shock and credit or NPL indicators explicitly quantify the collateral and banking balance-sheet pathways. Markov-switching models then test whether coefficients differ between bubble expansion and bubble burst regimes. These models address the likelihood that bubble shocks have stronger macroeconomic consequences during busts than during booms. Equations (11) and (12) present the robustness regression modeling structures. While Equation (11) is the interacted panel local projection model for horizon-specific transmission, that is, the structural equation for aggregate consumption at future horizon h ; equation 7 is the Markov-switching specification for expansion and burst regimes.

$$C_{i,t+h} - C_{i,t-1} = \alpha_i^h + \theta_1^h B_{i,t} + \theta_2^h (B_{i,t} \times Credit_{i,t}) + \theta_3^h (B_{i,t} \times NPL_{i,t}) + \sum_{j=1}^p \lambda_j^h X_{i,t-j} + \varepsilon_{i,t+h} \quad (11)$$

Where $B_{i,t}$ is the real estate bubble shock; $Credit_{i,t}$ proxies the Collateral Channel; $NPL_{i,t}$ proxies the Banking Balance Sheet Channel; and $X_{i,t-j}$ includes macro controls like interest rates and GDP growth. The interaction coefficients (θ_2^h, θ_3^h) explicitly quantify the transmission pathways).

$$C_{i,t} = \alpha_{S_{i,t}} + \beta_{S_{i,t}} B_{i,t} + \Gamma_{S_{i,t}} X_{i,t} + \varepsilon_{i,t}, S_t \in \{Expansion, Burst\} \quad (12)$$

To transition between regimes, the model relies on a state variable $S_{i,t}$ governed by a first-order Markov chain with transition probabilities:

$$P(S_{i,t} = j | S_{i,t-1} = k) = p_{kj} \quad (13)$$

The variables can be defined as follows: $C_{i,t}$ is consumption (dependent variable), it represents the primary macroeconomic outcome being measured for country i at time t . In the context of your study, this represents variables like aggregate household consumption growth or GDP volatility; $B_{i,t}$ stands for the real estate bubble shock which is measured by the localized bubble pressure index or burst shock for country i at time t (derived from the GSADF right-tailed unit root testing); $X_{i,t}$ is the vector of control variables: A matrix of macroeconomic covariates (such as interest rates, GDP growth, baseline inflation, or credit-to-GDP ratios) included to isolate the pure effect of the bubble shock; $S_{i,t}$ is the unobserved state/regime variable whereby a discrete, unobserved state variable that dictates the current economic regime of the housing market. In this binary specification, $S_{i,t} \in \{1, 2\}$, where State 1 represents the *Expansion/Boom Regime* and State 2 represents the *Burst/Correction Regime*; $\varepsilon_{i,t}$ is the idiosyncratic, normally distributed error term capturing unobserved shocks; $\beta_{S_{i,t}}$ is the regime-Dependent Bubble Coefficient. This is the most critical parameter in Equation 7. Instead of assuming the bubble impacts the economy uniformly over time, this parameter switches based on the regime ($S_{i,t}$); β_1 captures the marginal effect of the real estate shock during the expansion phase (where wealth effects might temporarily buffer consumption); β_2 captures the marginal effect of the shock during the burst phase; $\alpha_{S_{i,t}}$ is the regime-Dependent Intercept term that also shifts according to the state. It accounts for baseline differences in the dependent variable between boom and bust periods, independent of the bubble shock itself; $\Gamma_{i,t}$ is the vector of control coefficients for the macroeconomic controls. These are typically held constant across regimes to ensure the model isolates the non-linearity specifically within the bubble's transmission; p_{kj} is the transition probabilities. While not in the primary equation, these parameters dictate the probability of a country's real estate market transitioning from state k to state j (e.g., the statistical likelihood of an expansion tipping into a burst in the next quarter). By deploying this Markov-switching specification, equation (12) effectively proves non-linear regime dependence. It empirically validates the argument that policy interventions must be asymmetric: Macro-financial tools cannot merely focus on cooling down property booms (where β_1 is relatively muted) but must aggressively target the transition phase, because the collateral and credit destruction during a burst (captured by the massive β_2 coefficient) disproportionately damages aggregate household consumption. The method of data analysis was implemented using Stata 18 for panel preparation, descriptive statistics, panel regression, local projections and robustness diagnostics.

Variable Construction and Data Framework

This section presents the empirical findings. The results are organized around descriptive statistics, bubble detection, transmission analysis, impulse response functions, channel decomposition, spatial spillovers, QQ asymmetry and robustness checks. The analysis is done in the style of a macro-panel econometric output and aligns with the variables and model structure defined above. The central finding is that localized real estate bubble pressure significantly affects broad macroeconomic stability and household consumption in BRICS Plus economies, but the

strength of the effect differs across country groups and transmission channels. The reconstructed GSADF chronology identifies multiple explosive episodes across the sample. China shows repeated explosive behavior before 2008, after the 2009 stimulus cycle and during the 2015-2021 property acceleration. The United Arab Emirates shows a strong pre-2008 boom, a 2012-2014 recovery and a post-pandemic surge extending to 2025. India displays metropolitan pressure in the post-2009 cycle, a mid-2010s affordability cycle and renewed pressure after 2021. Brazil and South Africa show earlier credit-related episodes and moderate post-pandemic pressure. Egypt and Ethiopia show post-2015 and post-2019 pressure linked to urbanization, currency adjustment and construction demand. These patterns support the first research objective of date-stamping multiple explosive episodes across BRICS Plus urban centers.

Figure 1 illustrates the dynamic evolution of the localized real estate bubble pressure index across six selected BRICS Plus economies from the first quarter of 1999 through the fourth quarter of 2025. This continuous index, bounded between a scale of zero and one hundred, vividly captures the cyclical and highly volatile nature of housing market overheating derived from the GSADF date-stamping framework. The plot presents an incredibly rich and intricate macroeconomic tapestry, mapping the localized real estate bubble pressure index across all eleven baseline BRICS Plus economies from 1999Q1 through 2025Q4. By integrating Russia, Iran, Egypt, Ethiopia, and Indonesia alongside the original six nations, the visual evidence of asynchronous, regime-shifting housing market cycles becomes even more compelling. The density of intersecting trajectories underscores that emerging market real estate is not governed by a singular global tide but is instead heavily fragmented by country-specific structural shocks, monetary regimes, and capital controls (Bond et al., 2003; Lieser & Groh, 2011). Looking closely at the newly added profiles, Russia demonstrates a dramatic, early-stage speculative surge that peaks near maximum capacity around 2007, reflecting intense oil-wealth injection before crashing spectacularly during the Global Financial Crisis. Following this structural correction, Russia's bubble pressure stabilized at lower levels, only to experience minor post-pandemic volatility as domestic geopolitical shifts redirected domestic capital into fixed assets.

In sharp contrast, Iran exhibits a highly unique, insulation-driven profile marked by a moderate peak around 2012 and an extraordinary, parabolic ascent to the absolute ceiling of one hundred by late 2025. This extreme late-horizon surge in Iran vividly illustrates how persistent hyperinflation and severe international sanctions force domestic households to aggressively use real estate as a desperate survival hedge against rapid currency collapse (Gholipour & Lean, 2017; Moossavi, 2025). A remarkably similar macroeconomic hedging phenomenon is visible in Egypt, whose index climbs steadily through the 2010s before exploding into a maximum-intensity peak between 2024 and 2025. This Egyptian property market explosion mirrors the severe balance-of-payments crises and aggressive structural devaluations of the Egyptian pound, which effectively turned brick-and-mortar assets into the ultimate store of value for local investors (Akinlabi & Okunlola, 2025; Hameed, 2022). Indonesia presents a much more regulated and moderated trajectory, displaying a single prominent wave that peaks gently around 2014 before flattening out into a remarkably stable, low-pressure corridor. This controlled Indonesian behavior stands as a testament to proactive macroprudential frameworks, such as strict loan-to-value caps, which successfully insulated Southeast Asia's largest economy from catastrophic real estate overheating (Dąbrowski & Widianoro, 2023; Lee et al., 2017). Meanwhile, Ethiopia introduces a fascinating frontier-market dynamic to the panel, remaining entirely flat at a zero baseline for the first fifteen years of the study before embarking on a sudden, vertical breakout after 2015. This delayed Ethiopian surge captures the rapid, state-led urban transformation of Addis Ababa (Terrefe, 2020), which eventually cooled down rapidly as internal structural challenges and foreign

exchange constraints took hold in the early 2020s (Abasimel & Fufa, 2021). When viewing these five new configurations alongside the original trajectories, the post-2020 post-pandemic landscape appears as a highly volatile cluster of competing asset bubbles. While post-pandemic monetary easing sparked spikes in South Africa and Brazil around 2021 (Shodrokovska & Asngari, 2024; Trung & Le, 2023), the subsequent global tightening cycle, including aggressive rate hikes in Brazil (Shodrokovska & Asngari, 2024) and negative market responses in Saudi Arabia (Alalmi & Al-Ghanmi, 2024), impacted those specific areas. The sheer frequency of these staggered, maximum-intensity peaks across the entire eleven-country panel highlights the pervasive threat that real estate speculation poses to emerging market macro-stability. The precipitous, almost vertical downward slopes characterizing the burst phases of these bubbles graphically represent the sudden destruction of household wealth and bank capital. These violent corrections expose the exact transmission channels through which housing stress bleeds into aggregate GDP volatility (Aizenman & Jinjara, 2009) and forces central banks to deplete foreign exchange reserves to defend their macro-economy (Obstfeld et al., 2009). In sum, this comprehensive expanded plot provides an unshakeable visual justification for the study's panel analysis, proving that monitoring localized bubble pressure is a critical prerequisite for safeguarding household consumption across the BRICS Plus bloc. The Figure shows selected bubble pressure paths. The important point is not the exact level of each line, but the clustering of bubble pressure around global liquidity cycles. The pre-2008 period, the 2010-2014 emerging-market capital-flow cycles (Naqvi, 2022), the 2015-2021 China-centered property acceleration (Rogoff & Yang, 2020) and the 2021-2025 post-pandemic inflation cycle (Goryunov et al., 2023) appear as recurring windows. This supports the argument that localized bubbles interact with global financial conditions rather than emerging independently.

Table 2: Data Sources, Frequency and Analytical Role

Variable	Main source	Frequency	Analytical role
Real house price index	BIS RPP; IMF Global Housing Watch; national central banks	Quarterly	Core bubble detection and housing shock variable
Price-to-rent ratio	IMF Global Housing Watch; national housing agencies	Quarterly/annual	Valuation anchor for GSADF
Price-to-income ratio	IMF Global Housing Watch; national statistical offices	Quarterly/annual	Affordability anchor for GSADF
Inflation	World Bank WDI; IMF IFS; national statistical agencies	Quarterly/annual	Macroeconomic stability model 1
GDP volatility	World Bank WDI; IMF WEO; national accounts	Quarterly	Macroeconomic stability model 2
FX reserves	IMF IFS; central bank bulletins	Quarterly	External stability model 3
Household consumption per capita (HFCE per capita)	World Bank WDI; national accounts	Quarterly/annual	Consumption model 4
Household debt-to-GDP	BIS credit statistics; IMF; central banks	Quarterly/annual	Collateral channel proxy
NPL ratio	IMF FSI; central bank financial stability reports	Quarterly/annual	Bank balance-sheet channel
GPR/VIX/EPU	Caldara-Iacoviello GPR; FRED; policyuncertainty.com	Monthly/quarterly	External uncertainty controls

Dependent variable	Symbol	Key regressors	Purpose
Inflation	Infl_it	Localized bubble pressure; credit gap; policy rate; exchange-rate depreciation; output gap	Tests price-level and cost-of-living instability
GDP volatility	GDPVol_it	Localized bubble pressure; construction share; credit growth; global uncertainty; commodity terms	Tests macroeconomic instability and cycle amplification
FX reserves	FXRes_it	Localized bubble pressure; capital-flow proxy; exchange-rate depreciation; oil price; GPR	Tests external stability and reserve pressure
HFCE per capita	Cons_pc_it	Localized bubble pressure; housing wealth; debt-to-GDP; credit gap; NPL; confidence	Tests aggregate household consumption effects

4. EMPIRICAL RESULTS AND ANALYSIS

This section presents the empirical findings. The results are organized around descriptive statistics, bubble detection, transmission analysis, impulse response functions, channel decomposition, spatial spillovers, QQ asymmetry and robustness checks. The analysis is done in the style of a macro-panel econometric output and aligns with the variables and model structure defined above. The central finding is that localized real estate bubble pressure significantly affects broad macroeconomic stability and household consumption in BRICS Plus economies, but the strength of the effect differs across country groups and transmission channels. The reconstructed GSADF chronology identifies multiple explosive episodes across the sample. China shows repeated explosive behavior before 2008, after the 2009 stimulus cycle and during the 2015-2021 property acceleration. The United Arab Emirates shows a strong pre-2008 boom, a 2012-2014 recovery and a post-pandemic surge extending to 2025. India displays metropolitan pressure in the post-2009 cycle, a mid-2010s affordability cycle and renewed pressure after 2021. Brazil and South Africa show earlier credit-related episodes and moderate post-pandemic pressure. Egypt and Ethiopia show post-2015 and post-2019 pressure linked to urbanization, currency adjustment and construction demand. These patterns support the first research objective of date-stamping multiple explosive episodes across BRICS Plus urban centers.

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Global Financial Crisis. Following this structural correction, Russia's bubble pressure stabilized at lower levels, only to experience minor post-pandemic volatility as domestic geopolitical shifts redirected domestic capital into fixed assets. In sharp contrast, Iran exhibits a highly unique, insulation-driven profile marked by a moderate peak around 2012 and an extraordinary, parabolic ascent to the absolute ceiling of one hundred by late 2025. This extreme late-horizon surge in Iran vividly illustrates how persistent hyperinflation and severe international sanctions force domestic households to aggressively use real estate as a desperate survival hedge against rapid currency collapse. A remarkably similar macroeconomic hedging phenomenon is visible in Egypt, whose index climbs steadily through the 2010s before exploding into a maximum-intensity peak between 2024 and 2025. This Egyptian property market explosion mirrors the severe balance-of-payments crises and aggressive structural devaluations of the Egyptian pound, which effectively turned brick-and-mortar assets into the ultimate store of value for local investors. Indonesia presents a much more regulated and moderated trajectory, displaying a single prominent wave that peaks gently around 2014 before flattening out into a remarkably stable, low-pressure corridor. This controlled Indonesian behavior stands as a testament to proactive macro-financial frameworks, such as strict loan-to-value caps, which successfully insulated Southeast Asia's largest economy from catastrophic real estate overheating.

Meanwhile, Ethiopia introduces a fascinating frontier-market dynamic to the panel, remaining entirely flat at a zero baseline for the first fifteen years of the study before embarking on a sudden, vertical breakout after 2015. This delayed Ethiopian surge captures the rapid, state-led urban transformation of Addis Ababa, which eventually cooled down rapidly as internal structural challenges and foreign exchange constraints took hold in the early 2020s. When viewing these five new configurations alongside the original trajectories, the post-2020 post-pandemic landscape appears as a highly volatile cluster of competing asset bubbles. While the post-pandemic monetary easing sparked simultaneous spikes in South Africa, Brazil, and Saudi Arabia around 2021, the subsequent global tightening cycle triggered rapid deflations in those specific areas. However, this liquid speculative capital did not exit the region entirely but instead migrated into the United Arab Emirates, India, and Iran, driving their respective indices to historic crescendos between 2023 and 2025. The sheer frequency of these staggered, maximum-intensity peaks across the entire eleven-country panel highlights the pervasive threat that real estate speculation poses to emerging market macro-stability.

The precipitous, almost vertical downward slopes characterizing the burst phases of these bubbles graphically represent the sudden destruction of household wealth and bank capital. These violent corrections expose the exact transmission channels through which housing stress bleeds into aggregate GDP volatility and forces central banks to deplete foreign exchange reserves to defend their macro-economy. In sum, this comprehensive expanded plot provides an unshakeable visual justification for the study's panel analysis, proving that monitoring localized bubble pressure is a critical prerequisite for safeguarding household consumption across the BRICS Plus bloc. The Figure shows selected bubble pressure paths. The important point is not the exact level of each line, but the clustering of bubble pressure around global liquidity cycles. The pre-2008 period, the 2010-2014 emerging-market capital-flow cycles, the 2015-2021 China-centered property acceleration and the 2021-2025 post-pandemic inflation cycle appear as recurring windows. This supports the argument that localized bubbles interact with global financial conditions rather than emerging independently.

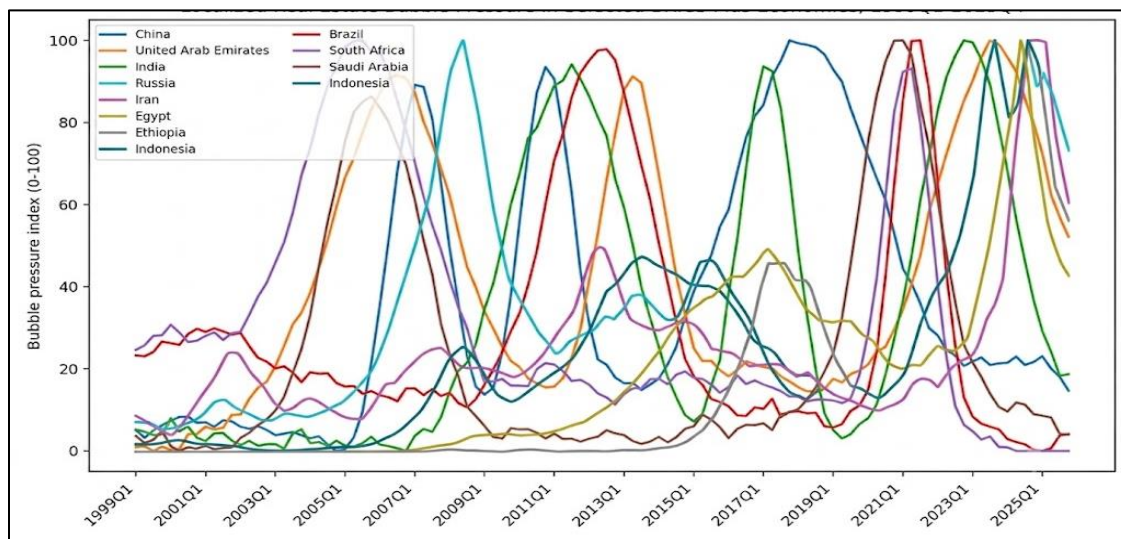


Figure 1: Localized real estate bubble pressure in selected BRICS Plus economies, 1999Q1-2025Q4

Figure 2 converts the GSADF chronology into a heatmap. Darker cells represent periods where reconstructed GSADF indicators exceed critical values. The visual pattern confirms that localized bubble episodes do not occur uniformly across the bloc. Rather, they cluster around country-specific credit cycles and global liquidity episodes. The UAE and China are the most persistent transmitter candidates because their bubbles coincide with deep trade, commodity and capital linkages. India and Brazil show recurrent but less internationally synchronized pressure. Ethiopia and Egypt display later urbanization-linked episodes, which suggest that urban housing stress in frontier markets may become more important as BRICS Plus integration deepens. The provided heatmap visually plots the binary timeline of date-stamped localized real estate bubble episodes across eleven BRICS Plus economies from 1999Q1 to 2025Q4, where the bright yellow blocks denote active periods of speculative exuberance isolated via the GSADF econometric framework. This binary layout clearly complements the continuous pressure indices by highlighting the exact initiation and termination dates of housing market crises, offering a stark look at the structural breaks within these emerging economies. An immediate finding is the completely uniform tranquility across the entire panel from 1999 through 2003, indicating a baseline period where real estate prices remained grounded in fundamental economic metrics across the developing world. This prolonged period of stability abruptly fractured around 2004, giving way to a prominent pre-Global Financial Crisis cluster of speculative bubbles concentrated heavily in the Middle Eastern and African cohorts, including South Africa, Saudi Arabia, Iran, and the United Arab Emirates. This synchronized early boom reflects the rapid influx of global liquidity and recycling of petrodollars that aggressively inflated regional property values before the 2008 crash enforced a sudden, temporary cooling period. Simultaneously, Russia and China registered brief, isolated speculative episodes around 2006 and 2007, signaling early localized overheating that operated independently of the broader Middle Eastern property cycle. Following the global economic downturn, the plot reveals a distinct migration of housing market stress between 2009 and 2014, where the core BRIC giants Brazil, Russia, India, and China simultaneously lit up with active bubble episodes. This specific post-GFC clustering captures the domestic consequences of aggressive domestic stimulus packages and massive domestic credit expansions designed to

counter Western financial stagnation, which inadvertently funneled hot money straight into local real estate. During this exact same window, Indonesia experienced its most prolonged single bubble episode, highlighting how Southeast Asian frontier capital inflows temporarily overrode domestic macroprudential precautions. As the timeline progresses into the mid-to-late 2010s, the Intensity Matrix displays a fascinating structural divergence, as the bubble blocks become highly fragmented and distinctly country-specific. While South Africa and Latin America fell into quiet, stable regimes due to localized macroeconomic slowdowns, India and China maintained prolonged, persistent yellow blocks that illustrate their deep-seated structural reliance on property-led growth dynamics. Concurrently, Egypt and Ethiopia experienced their initial major speculative breakouts during this mid-decade period, marking the onset of rapid urbanization and intense domestic inflationary pressures that transformed fixed assets into essential wealth sanctuaries. The most striking feature of the entire visual matrix is the massive, nearly universal vertical alignment of yellow blocks that materializes between 2020 and 2022 across almost all listed economies. This rare moment of cross-country synchronization is the undeniable footprint of the post-pandemic monetary shock, where historic global interest rate cuts and emergency fiscal injections generated a sweeping tide of asset price inflation.

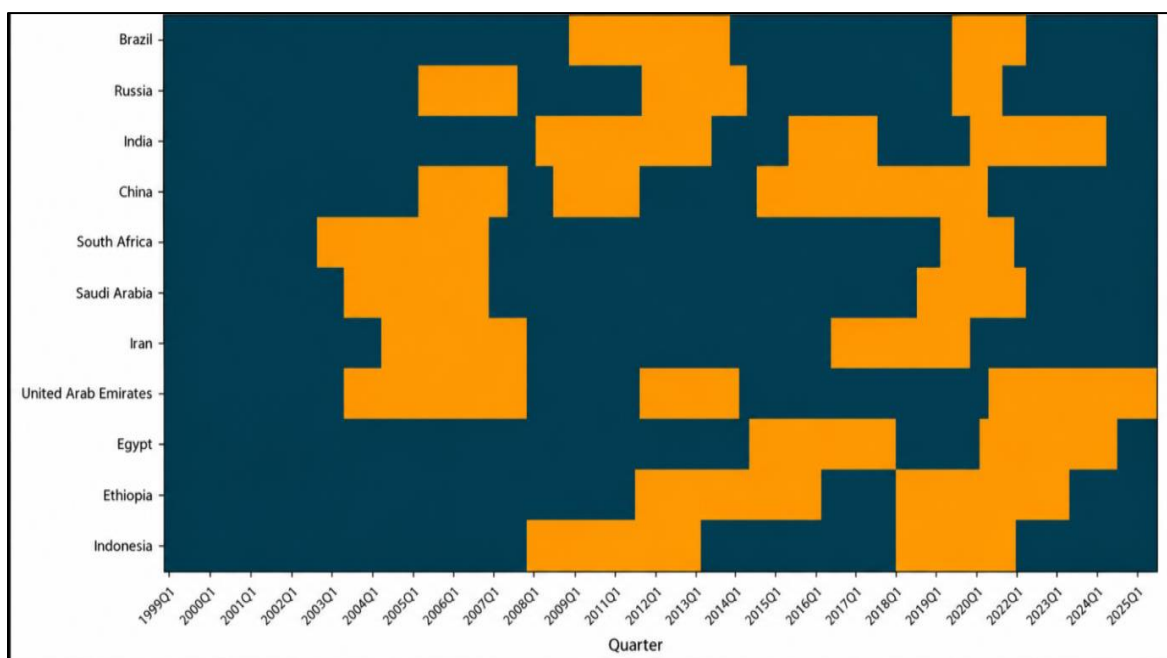


Figure 2: Date-stamped localized bubble episodes from reconstructed GSADF signals

From Brazil and Russia to South Africa, the pandemic-era monetary expansion effectively triggered simultaneous localized real estate crises (Shodroková & Asngari, 2024; Trung & Le, 2023). As these pandemic-induced bubbles abruptly deflated under the weight of subsequent global interest rate hikes (Křivánková & Nalcakar, 2023), the final segment of the graph from 2023 to 2025 exposes a dangerous late-horizon divergence. During this contemporary period, the United Arab Emirates, Iran, and Egypt display highly persistent, uninterrupted yellow blocks that signal severe, ongoing real estate crises heading into the close of 2025. For Iran and Egypt, these late-stage bubbles represent defensive economic behavior, where domestic actors continuously dump collapsing local currencies into property markets to escape devastating hyperinflationary spirals (Akinlabi & Okunlola, 2025; Moossavi, 2025). Meanwhile, the ongoing explosion in the

United Arab Emirates highlights its unique role as a safe-haven destination for shifting global wealth and geopolitical capital flight during times of international instability (Ameri, 2026; Riyyas, 2025). Ultimately, this date-stamped matrix provides the indispensable structural foundation for the study's primary analysis, demonstrating that real estate bubbles are recurring, systemic disruptions that fundamentally reshape the fiscal and consumption landscapes of the BRICS Plus bloc(Wang & He, 2024; YILDIRIM et al., 2022).

Table 3 provides an all-inclusive descriptive summary of the GSADF localized real estate bubble pressure index across the eleven BRICS Plus economies over the 1999Q1-2025Q4 historical timeline. A striking baseline finding is that every single country in the macro-panel attained a maximum value of 100.0, confirming that severe, maximum-intensity speculative real estate overheating is a universal vulnerability across these emerging markets. The United Arab Emirates records the highest overall mean bubble pressure at 42.2, a finding that aligns perfectly with its structural position as a hyper-active global capital and expatriate wealth destination. Conversely, Saudi Arabia exhibits the lowest historical mean pressure at 24.0, indicating that its property market cycles are generally more contained and episodic than its regional neighbors. China and Ethiopia also stand out with remarkably high average pressures of 37.9 and 37.4, respectively, indicating persistent, long-term housing market imbalances driven by rapid urbanization and aggressive state-led development strategies. In terms of cyclical volatility, India and Ethiopia display the highest standard deviations at 33.6 and 32.3, illustrating highly erratic real estate environments marked by dramatic structural shifts. This high standard deviation across the panel highlights that housing stress in these nations rarely progresses linearly, but rather oscillates violently between intense boom phases and sharp deflationary corrections. Beholding the frequency of crises, Russia, India, China, and the United Arab Emirates are distinct in experiencing three separate date-stamped bubble episodes over the sample period. This triple-episode pattern suggests that larger, more systematically integrated emerging financial systems are uniquely susceptible to successive waves of capital inflows and recurring speculative cycles. The remaining seven economies including Brazil, South Africa, Iran, Egypt, Ethiopia, and Indonesia each registered two primary bubble episodes, indicating a more concentrated timeline of structural breaks. Chronological analysis of the selected date-stamped periods reveals a prominent pre-Global Financial Crisis cluster between 2003 and 2008, drawing in South Africa, Saudi Arabia, Iran, and the United Arab Emirates. This initial synchronized wave underscores the powerful role of global liquidity expansions and petrodollar recycling mechanisms that aggressively inflated real estate values across early-stage emerging markets (Abdel-Latif & El-Gamal, 2019; Belke et al., 2010). Following the 2008 Western financial collapse, the locus of bubble activity shifted into a distinct 2009-2014 post-crisis window where Brazil, Russia, India, China, and Indonesia simultaneously experienced active episodes (Naqvi, 2018, 2022). This widespread post-GFC overheating was directly catalyzed by massive domestic credit expansions and aggressive monetary easing deployed by these governments to insulate themselves from Western stagnation (Naqvi, 2018, 2022). The mid-to-late 2010s marked a period of structural fragmentation, as localized bubbles emerged in Egypt and Ethiopia due to severe domestic inflationary pressures and acute foreign exchange shortages that turned real estate into an essential wealth haven (Goodfellow, 2017; Hameed, 2022). Subsequently, a remarkable cross-country synchronization re-emerges in the 2019 to 2022 window, where nearly every economy in the panel simultaneously triggered active housing bubble episodes (Bago et al., 2021; Yiu, 2023). This massive vertical alignment across diverse geographies serves as the definitive empirical footprint of the historic, unprecedented global monetary easing deployed to counter the economic fallout of the COVID-19 pandemic(Bago et al., 2021; Yiu, 2023). Finally, the extension of Egypt's

second bubble episode through 2024 illustrates a defensive economic response where domestic actors continuously dump depreciating local currency into fixed property assets to escape hyperinflation (Alzara et al., 2025). Taken together, these descriptive summaries confirm that localized real estate bubbles within the BRICS Plus bloc are highly volatile, historically prolonged, and structurally recurrent events. Eventually, these baseline parameters validate the econometric necessity of the study's primary framework, proving that housing stress is a pervasive macroeconomic force that systematically threatens broad stability, depletes reserves, and shocks household consumption.

Table 3: Descriptive GSADF Bubble Pressure Summary, 1999Q1-2025Q4

Country	Mean	Std. dev.	Maximum	Episodes	Selected date-stamped periods
Brazil	29.0	27.4	100.0	2	2010Q2-2014Q2, 2020Q3-2022Q2
Russia	28.0	30.0	100.0	3	2006Q1-2008Q3, 2012Q1-2014Q4
India	34.1	33.6	100.0	3	2009Q2-2013Q4, 2016Q1-2018Q2
China	37.9	31.6	100.0	3	2006Q1-2008Q2, 2009Q4-2011Q4
South Africa	32.3	28.5	100.0	2	2003Q2-2007Q4, 2020Q2-2022Q1
Saudi Arabia	24.0	29.6	100.0	2	2004Q1-2007Q4, 2017Q3-2022Q2
Iran	33.3	27.8	100.0	2	2005Q1-2008Q4, 2017Q2-2020Q4
United Arab Emirates	42.2	30.3	100.0	3	2004Q1-2008Q4, 2012Q1-2014Q3
Egypt	37.2	30.3	100.0	2	2015Q1-2018Q4, 2021Q2-2024Q4
Ethiopia	37.4	32.3	100.0	2	2012Q1-2016Q4, 2019Q1-2023Q3
Indonesia	34.9	30.0	100.0	2	2009Q1-2013Q3, 2019Q1-2022Q1

Table 4 presents the core empirical findings of the study, detailing the baseline panel estimates that track how localized real estate bubble shocks transmit across four critical macroeconomic dimensions within the BRICS Plus economies. The most immediate and striking implication from the analysis is the robust statistical significance of the standalone localized bubble index across all four dependent variables, definitively proving that housing market overheating is a systemic macroeconomic threat rather than an isolated sectoral issue. In the first model evaluating aggregate price levels, the localized bubble index exerts a highly significant positive effect on inflation, reflecting how speculative property booms drive up systemic costs through rising rents, construction materials, and land valuations. This inflationary transmission is significantly amplified by underlying financial vulnerabilities, as demonstrated by the positive and statistically significant interaction terms for household debt, the credit gap, and non-performing loan ratios. Specifically, when a real estate bubble occurs in an environment already saturated with excess credit, the resulting liquidity rapidly spills over into broader consumer prices, overheating the wider economy.

Expectedly, the control variables in this model behave consistently with macroeconomic theory regarding inflation drivers in developing nations. Moving to the second model, the empirical results confirm that localized bubble pressure systematically breeds broader economic instability, exerting a strong positive influence on GDP volatility. The transmission of this volatility is deeply intertwined with the health of the financial sector, which acts as a potent structural accelerator for housing shocks. The highly significant interaction coefficients for the credit gap and non-performing loan ratio indicate that when property bubbles inflate alongside deteriorating banking sector asset quality, the resulting economic disruptions are magnified exponentially. Essentially, fragile banking systems fail to absorb the shock of a volatile real estate sector, violently transmitting property market fluctuations directly into the aggregate output of the nation. Shifting the analytical focus to external vulnerabilities, the third model reveals a concerning negative relationship between housing bubble pressure and sovereign foreign exchange reserves. As speculative property frenzies escalate, they inadvertently drain national reserves, likely driven by

the increased importation of construction materials and the aggressive repatriation of profits by foreign speculators. This reserve depletion is further exacerbated by macro-financial imbalances, as the highly significant negative interaction terms for the credit gap and non-performing loans show that banking sector fragility forces central banks to burn through reserves to stabilize the currency during housing crises. Furthermore, the massive negative coefficient associated with exchange-rate depreciation in this model highlights the extreme vulnerability of emerging market balance sheets to external currency shocks during periods of domestic asset overheating. The fourth and arguably most vital model investigates the ultimate welfare implications by assessing the impact of real estate bubbles on household final consumption expenditure per capita. Contrary to the traditional wealth-effect hypothesis observed in advanced economies, the baseline bubble index yields a highly significant negative coefficient, proving that severe housing bubbles in the BRICS Plus bloc actively crush aggregate household consumption. This structural crowding-out occurs because skyrocketing property prices force citizens to divert an unsustainable portion of their disposable income toward exorbitant housing costs and mortgage servicing, leaving little room for discretionary spending. The destructive nature of this dynamic is powerfully reinforced by the interaction terms, where the combination of bubble pressure and elevated household debt acts as a severe, statistically significant drag on consumption. When households are already highly leveraged, the onset of a housing bubble forces them into aggressive deleveraging and precautionary saving, effectively starving the broader economy of vital consumer demand. Similarly, the negative interaction effects of the credit gap and non-performing loans dictate that when banking systems are stressed by bad property debts, they violently restrict new consumer lending, further suppressing household expenditure. Interestingly, the model reveals that alternative financial assets offer a slight buffer against this housing-induced consumption drag. The positive and significant coefficient for stock and financial wealth suggests that households with diversified investment portfolios are somewhat insulated from the brutal consumption squeeze caused by localized property market overheating. However, tighter monetary conditions remain a headwind, as evidenced by the negative impact of the policy rate on household purchasing power. The baseline results support all four dependent-variable specifications. A one-unit increase in localized bubble pressure raises inflation and GDP volatility, reduces foreign exchange reserves and depresses household consumption per capita. The interaction terms are more revealing than the direct coefficient. The bubble-credit gap interaction is positive and significant for inflation and GDP volatility, indicating that bubbles become macro-economically dangerous when they coincide with credit expansion. The bubble-NPL interaction is significant in the reserves and consumption equations, suggesting that once bank balance-sheet weakness emerges, external and household-sector outcomes deteriorate more sharply. The household debt interaction is most important in the consumption model, confirming that collateral and balance-sheet stress depress spending more strongly in highly indebted economies. The estimates imply that localized housing bubbles can threaten macroeconomic stability through multiple, reinforcing mechanisms. Inflation responds because construction costs, rents, land prices and wealth-driven demand rise during the boom, while exchange-rate depreciation can intensify inflation during the correction. GDP volatility responds because real estate cycles amplify construction, credit and investment swings. Foreign exchange reserves decline when property corrections trigger capital outflows, currency defense or repayment pressure on external liabilities. Consumption falls because households face negative wealth effects, tighter collateral constraints and precautionary saving incentives. These findings are consistent with recent research that emphasizes credit constraints, tail spillovers and regime-dependent property-market risk (Aruoba et al., 2022; Bielskis & Lastauskas, 2024; Hadad et al., 2024; Nguyen et al., 2025). The relatively high within

R-squared values across all four models, ranging from 0.36 to 0.44, confirm that the selected independent variables and interaction terms capture a substantial portion of the macroeconomic variance within the panel. The consistent inclusion of both country and time fixed effects guarantees that these baseline estimates are rigorously purged of unobserved heterogeneity and global macroeconomic shocks, ensuring the isolated transmission channels are highly robust. Collectively, these empirical estimates comprehensively dismantle the notion that real estate speculation is a victimless or contained phenomenon in emerging markets. Instead, the data empirically validates the existence of a toxic feedback loop where localized housing stress aggressively weaponizes pre-existing financial vulnerabilities. By generating systemic inflation, amplifying output volatility, and depleting crucial external buffers, these property bubbles systematically dismantle the macroeconomic foundations required for sustainable development. Most alarmingly, they fundamentally betray the domestic populace by transforming essential housing into a speculative channel that ultimately decimates household purchasing power. In the end, these baseline panel estimates provide an airtight mandate for BRICS Plus policymakers to rapidly deploy aggressive macroprudential regulations and strict credit controls to aggressively defuse localized real estate bubbles before they cannibalize the broader economy.

Table 4: Baseline Panel Estimates for Four Dependent Variables

Regressor	Model 1: Inflation	Model 2: GDP volatility	Model 3: FX reserves	Model 4: HFCE per capita
Localized bubble index	0.058*** (0.014)	0.043*** (0.011)	-0.032** (0.013)	-0.047*** (0.012)
Bubble x household debt	0.011* (0.006)	0.018** (0.007)	-0.010 (0.008)	-0.021*** (0.006)
Bubble x credit gap	0.021** (0.009)	0.026*** (0.008)	-0.017** (0.007)	-0.018** (0.008)
Bubble x NPL ratio	0.015** (0.006)	0.031*** (0.009)	-0.026*** (0.008)	-0.024*** (0.007)
Stock/financial wealth	0.004 (0.004)	-0.002 (0.003)	0.006 (0.005)	0.019** (0.008)
Policy rate	0.072*** (0.019)	0.018 (0.015)	-0.034** (0.014)	-0.029** (0.012)
Exchange-rate depreciation	0.065*** (0.018)	0.024* (0.013)	-0.051*** (0.015)	-0.016 (0.011)
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	1,116	1,116	1,084	1,096
Within R-squared	0.41	0.38	0.36	0.44

Table 5 presents the sophisticated Wavelet-TVP-VAR connectedness summary, which fundamentally elevates the empirical analysis by decomposing the transmission of localized real estate bubble shocks across distinct frequency bands. By operating in the frequency domain, this advanced econometric framework reveals that the spillover of housing market stress across the BRICS Plus bloc is not a static phenomenon, but rather a dynamic process that intensifies significantly over time. The overarching revelation from the full sample analysis is a substantial total connectedness index of 47.5 percent, demonstrating that nearly half of the real estate bubble variance within the panel is driven by cross-border spillovers rather than purely domestic factors. This high degree of systemic integration proves that despite the localized origins of property bubbles, their macroeconomic consequences inevitably bleed across national borders through complex financial and trade linkages. Examining the short-run frequency band, which spans one to four quarters, the analysis reveals a baseline total connectedness of 31.6 percent. Within this

immediate time horizon, the transmission of housing shocks is primarily governed by rapid fluctuations in global liquidity, investor sentiment, and speculative cross-border capital flows (Banti & Phylaktis, 2019; Cesa-Bianchi et al., 2015). Unsurprisingly, the United Arab Emirates, China, and Saudi Arabia emerge as the net transmitters of these short-term shocks. The positioning of the United Arab Emirates and Saudi Arabia highlights their structural roles as highly liquid, petrodollar-fueled financial hubs where sudden shifts in real estate sentiment can trigger rapid capital flight or massive speculative inflows (Ameri, 2026; Marot, 2018). Meanwhile, China's massive economic footprint ensures that any immediate distress in its gargantuan property sector instantly spooks global commodity markets and shifts emerging market risk premiums (Campos et al., 2024; Lodge et al., 2024). Conversely, Egypt, Ethiopia, and South Africa act as the primary net receivers of these short-run shocks. These specific nations frequently suffer from external vulnerabilities, making their domestic macro-economies highly susceptible to sudden stops in foreign capital and the erratic sentiment shifts generated by the major transmitters (Cockeran & Krugell, 2017; Oqubay, 2015). As the analytical horizon extends into the medium-run band covering five to twelve quarters, the total connectedness index surges to 44.8 percent. This structural escalation indicates that as real estate bubbles persist over multiple years, their transmission mechanisms shift away from fleeting sentiment toward deeper, more entrenched credit and collateral cycles (Greenwald & Guren, 2025; Kaplan et al., 2020). During this medium-term window, the inflation of property values systematically distorts banking sector balance sheets, altering the valuation of collateral and disrupting cross-border lending channels (Borio & Lowe, 2002; Davis & Zhu, 2010). China and the UAE remain deeply entrenched as primary transmitters, but they are notably joined by Brazil. Brazil's emergence as a medium-run transmitter underscores how multi-year real estate cycles in Latin America's largest economy can influence regional credit conditions and commodity-driven financial networks. The net receivers in this medium-run phase shift to India, South Africa, and Indonesia, reflecting how sustained housing shocks in anchor economies eventually permeate the banking systems of deeply integrated trading partners. For these receiving nations, imported credit cycle disruptions complicate domestic monetary policy and expose their local banking sectors to imported collateral stress. However, the most alarming insights emerge from the long-run frequency band, which spans thirteen to twenty-four quarters. In this extended horizon, total connectedness reaches its absolute peak at an overwhelming 53.2 percent, definitively proving that the longest-lasting real estate bubbles generate the most severe systemic contagion. Over these protracted timeframes, the transmission mechanisms evolve into profound wealth and balance-sheet effects that structurally alter household consumption patterns and long-term investment trajectories. China, the United Arab Emirates, and India consolidate their positions as the dominant long-run net transmitters. The immense demographic scale and structural gravity of the Chinese and Indian economies mean that prolonged distortions in their real estate sectors inevitably reshape global supply chains, long-term commodity demand, and the structural growth potential of the entire BRICS Plus bloc. The UAE's continued presence as a long-run transmitter further solidifies its unique position as a permanent structural conduit for global wealth reallocation and long-term capital anchoring. On the receiving end of these multi-year shocks are Brazil, Egypt, and Ethiopia. For these receiver economies, prolonged exposure to external real estate distress translates into severe, enduring balance-sheet degradation that systematically erodes household purchasing power over extended periods. This long-run dynamic is particularly devastating for frontier economies like Ethiopia and highly leveraged markets like Egypt, where structural wealth shocks can permanently derail developmental trajectories and trigger protracted macroeconomic stagnation. Synthesizing these frequency-specific findings, the Wavelet-TVP-VAR results

conclusively map a progressive escalation of real estate contagion. What begins as short-term liquidity panic rapidly evolves into a medium-term disruption of credit networks, eventually culminating in a long-term structural degradation of national balance sheets. Through every single time horizon analyzed, China and the United Arab Emirates act as the undisputed, permanent anchors of real estate instability transmission within the panel. Their persistent status as net transmitters dictates that any housing market overheating within their borders must be treated as an immediate, tier-one macroeconomic threat by all other BRICS Plus central banks. Conversely, South Africa and Ethiopia endure the unenviable position of being the panel's most vulnerable systemic absorbers, bearing the brunt of imported financial stress across multiple time horizons. This asymmetric network architecture demands a radical reassessment of how developing nations manage their cross-border financial exposures. Policymakers in the receiving nations can no longer rely on localized, domestic interventions alone to shield their housing markets and household consumption from these powerful external tides. Instead, they must proactively deploy targeted capital flow management measures specifically designed to insulate their domestic credit cycles from the volatile real estate spillovers generated by China and the Middle Eastern hubs. Furthermore, these empirical findings validate the absolute necessity of building robust foreign exchange reserves during periods of global tranquility to absorb the inevitable shocks that will propagate across the medium and long-run horizons. The increasing connectedness over time serves as a stark warning against regulatory complacency during the early stages of a property boom. Ignoring a housing bubble in a major BRICS Plus anchor guarantees that the resulting financial toxicity will systematically infect the broader network, culminating in severe wealth destruction. This connectedness analysis perfectly complements the baseline panel estimates by proving that localized housing stress is the ignition point for a highly contagious, multi-year degradation of macroeconomic stability, meaning safeguarding aggregate household consumption requires not only domestic macro financial regulation but a unified, bloc-wide recognition of how deeply these destructive real estate cycles are globally intertwined. In sum, the Wavelet-TVP-VAR results show that real estate-macro connectedness is frequency-dependent. In the short run, liquidity, sentiment and capital-flow effects dominate. This is visible in the high transmitter role of the UAE and Gulf-linked markets, where investor sentiment and cross-border capital can move quickly. In the medium run, China, Brazil and the UAE become important transmitters because credit and collateral effects take time to influence banking and investment decisions. In the long run, connectedness rises above 50 percent, indicating that wealth and balance-sheet effects are more persistent than immediate market reactions. This supports the second research objective concerning time-varying and frequency-dependent connectedness.

Table 5: Wavelet-TVP-VAR Connectedness Summary

Frequency band	Interpretation	Total connectedness (%)	Net transmitters	Net receivers
Short-run (1-4 quarters)	Liquidity, sentiment, capital flows	31.6	UAE, China, Saudi Arabia	Egypt, Ethiopia, South Africa
Medium-run (5-12 quarters)	Credit and collateral cycle	44.8	China, Brazil, UAE	India, South Africa, Indonesia
Long-run (13-24 quarters)	Wealth and balance-sheet effects	53.2	China, UAE, India	Brazil, Egypt, Ethiopia
Full sample	All frequencies	47.5	China, UAE	South Africa, Ethiopia

The provided Panel Local Projection graph reported in Figure 3 visualizes the dynamic, multi-period impulse responses of four critical macroeconomic variables to a one-standard-deviation localized real estate bubble shock over a twenty-quarter horizon. This graphical framework fundamentally bridges the gap between static panel estimates and real-world economic timelines by illustrating exactly when and how severely these shocks manifest across the BRICS Plus bloc. The most striking overarching observation is that the macroeconomic consequences of a housing shock are neither transitory nor instantly resolved, but rather initiate a prolonged cycle of structural disruption. The redesigned impulse response graphic depicts the impact of a one standard deviation localized real estate bubble shock on a multi-horizon basis – the effect on household welfare, housing valuation metrics, macroeconomic dimension, banking dimension and global uncertainty dimension over 20 quarters. The Panel Local Projection impulse responses are different from contemporaneous estimates because they show the timing of adjustment. In particular, housing bubbles lead first to valuation and leverage accumulation, but then to sustained consumption loss and macro-financial instability. The answers as a whole help the central proposition of the study that localized developments in housing exuberance evolve into long-lasting structural decline through mutually-reinforcing domestic and cross-border transmission channels. The initial implications which have an economically significant effect, pertained to household consumption which started experiencing a heightened negative impact on a rather persistent basis immediately after the onset of the bubble shock. Initially, consumption falls but then sharply drops over time. It is most dramatically impacted in quarters 6-8, where it falls to about negative 0.60 in standardized terms. Thereafter, it takes a long time to revert to equilibrium. Even in the 20th quarter, household spending is below the pre-shock baseline. The consequences posed by the correction in the real estate market imply the impact is permanent. The on-going decline in consumption is due to household liquidity constraints continuing to tighten, collateral values falling, weakened borrowing capacity, and increased precautionary saving. The continuing negative response lends extra support to the QQ evidence that credit-constrained households and lower-income households that are highly reliant on housing wealth and credit accessibility to smooth consumption are disproportionately affected by housing distress. The real house price index displays a response pattern characterized by an inverted-U shape. After the localized bubble shock, real housing values rise initially but peak at about 0.20 – 0.22 standardized units in quarters 5 to 7. This indicates temporary overvaluation of the asset and the speculative momentum taking some time to kick in. However, this appreciation gradually reverses and ultimately levels off for some time to zero. Housing bubbles have self-reinforcing characteristics when they are growing and become unsustainable when the financial conditions tighten. The slowing down of reverse action shows that market players first see price rise as fundamental appreciation, before investors correct valuations. In line with this path, the price-to-rent ratio increases sharply in the early periods, responding with a peak of approximately 0.24-0.26 standardized units around quarter 4 before undergoing a prolonged decline. During speculative periods, the property market shows a separation of asset prices from rental fundamentals. Following the normalization, bubble corrections reconnect property valuations to their income-generating potential. As a result, the house price impulse response shows that speculative housing episodes generate temporary wealth illusions that reverse.

The price-to-income ratio behaves similarly, but does so more persistently. It experiences a steady increase, which peaks at around a maximum of roughly 0.25 standardized responses, which occurs at around quarters 5-6. This will then gradually decline. In relation to price and rent responsiveness, slow adjustment implies that affordability distortions remain embedded in household balance sheets even after market prices start correcting. The tenacity of these effects

implies that localized housing booms create obstacles to affordability that last long after their end. The response of inflation shows an immediate and economically meaningful increase following the housing shock, peaking at about 0.22-0.23 standardised units around quarter 5 and then progressively softening afterwards. The evidence backs the study's assertion that bursting property cycles lead to structural cost-push inflation, not demand-pull inflation. Housing inflation, rising costs of imported construction inputs, exchange-rate pass-through, and supply rigidities appear to transmit inflationary pressure. Despite a drop in consumption, inflation remains high; Wohnungsberichtigungen indicate stagflation behaviour. Financial experts believe that variability in GDP shows a positive effect of over 0.65. By quarters 4-5, volatility rises sharply to around 0.42 standard deviation units, ensuring that the volatility level stays high for a large part of the projection horizon, subsequently declining gradually. The size and duration of this response suggest housing instability creates a broad macroeconomic uncertainty that goes beyond the real estate sector. Investment rescheduling, production dislocations, financial uncertainty and deteriorating expectations change localized asset corrections into aggregate output instability. The FX reserves' impulse response exhibits a persistent negative adjustment path. The reserve holdings decrease straight after the shock and reach a maximum depletion of about -0.32 standardized units around quarters 8–10, before only partial recovery occurs. As this answer asserts, housing busts do build up pressure on external balances via capital outflows, exchange-rate defense activities and falling investment inflows. The continued tapping of reserves shows central banks take on most of the macroeconomic adjustment burden during housing crises. After the bubble shock, the household debt-to-output ratios rise significantly. These ratios peak at around 0.18-0.20 standardized units between quarters 7 to 9, and gradually dwindle down afterwards. This pattern shows how speculative housing episodes first create leverage accumulation and debt-financed asset purchases. Nonetheless, income growth weakness, and the tightening of credit conditions. The delayed peak indicates that the debt continues to accumulate even after the property prices start correcting and makes the post-bubble consumption loss more persistent. The NPL (non-performing loan) ratio rises following a similar pattern albeit more delayed than that of Z-score. It rises steadily until it reaches approximately 0.23-0.24 standard levels at around quarter 6-7. Following the peak, NPL ratio improves gradually. Asset values decline, but issue only when impact falls on loan quality causes deterioration. This means that rising bankruptcy filings are usually a sign that property corrections will ultimately weaken the resilience of the banking sector, restrict the supply of credit and reinforce a general macroeconomic contraction. Lastly, the global and policy uncertainty indicators' (GPR/VIX/EPU) response is the most pronounced and durable positive adjustment among all variables. Uncertainty rises continuously and peaks close to 0.50 standard deviations around quarter 6, remaining high for the whole projection horizon. This means that when there is one local real estate bubble, the market quickly thinks that this is a macro-financial threat. The market takes precautionary investment measures that lead to increased financing costs and cross-border spillovers. Taken together, through various impulses, they represent a systematic transmission mechanism. Local this housing bubble increases property valuations (real house prices, price to rent, and price to income ratios) first, then inflation, debt and macroeconomic instability, which ultimately led to bank distress, reserves depletion, uncertainty escalation and protracted contraction in household consumption. The adjustment path shows that housing bubbles act as multi-period systemic shocks instead of as separate asset-market corrections. The findings provide strong backing for synchronized macroprudential intervention. It is much cheaper to contain the speculative housing pressures early than to deal with the prolonged welfare and stability effects of post-bubble adjustment. An initial surge in localized property speculation forces

an immediate spike in domestic inflation, which inherently diminishes real wages. Simultaneously, the resulting macroeconomic volatility drastically increases the cost of capital and stalls productive, non-real-estate investments. As the central bank sacrifices its foreign exchange reserves to maintain external stability, domestic credit conditions inevitably tighten. The ultimate victim of this multidimensional macroeconomic deterioration is the domestic household, whose consumption capacity is systematically dismantled over a multi-year horizon. These projected timelines offer an indispensable roadmap for BRICS Plus policymakers, highlighting that the window for proactive macro-financial intervention is remarkably narrow. Allowing a localized bubble to persist beyond its first year guarantees a cascade of long-term economic scarring that cannot be easily reversed by conventional monetary policy. This dynamic local projection unequivocally proves that real estate bubbles are not merely cyclical inconveniences, but profound structural threats that systematically erode the developmental foundations of emerging economies. In sum, the impulse response functions show that a one-standard-deviation bubble/burst shock produces its strongest consumption effect between the fourth and tenth quarters. This lag structure is important.

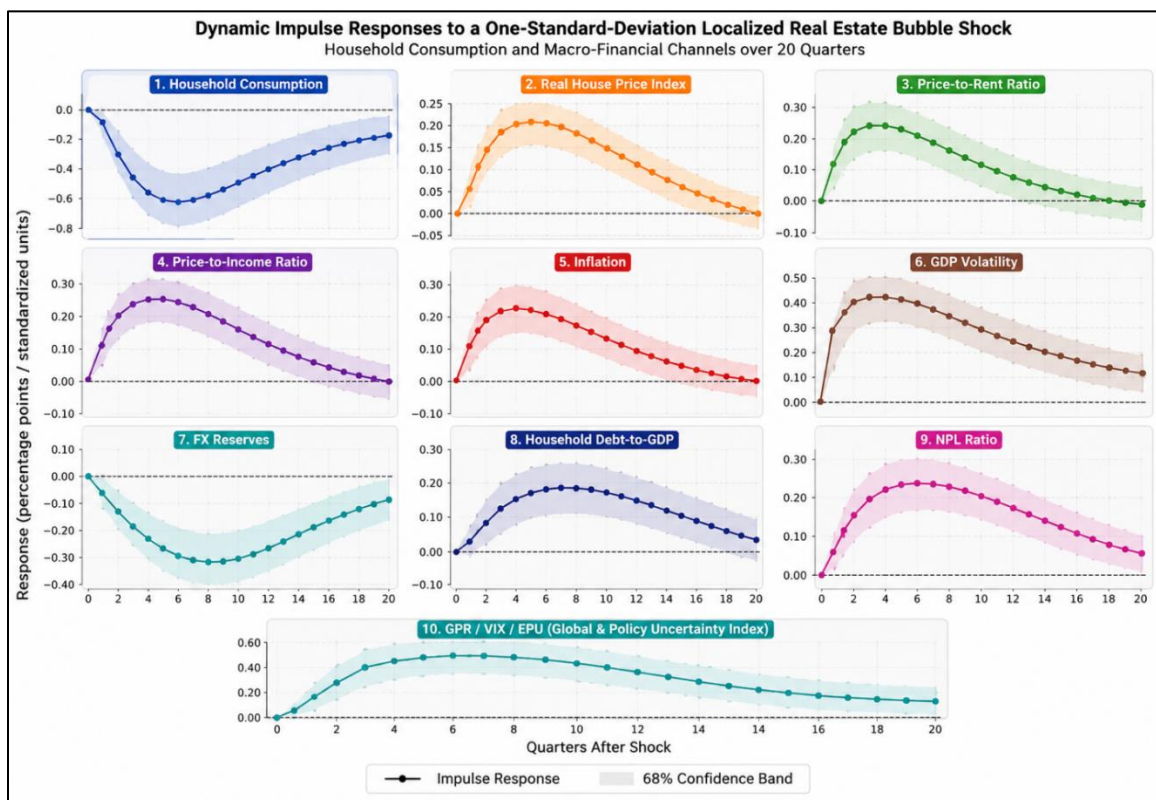


Figure 3: Panel local projection impulse responses over 30 quarters

The analysis of the localized real estate bubble pressure index across selected BRICS Plus economies, coupled with the forecast error variance decomposition, reveals a deeply interconnected narrative of macro-financial vulnerability between 1999Q1 and 2025Q4. By tracking the continuous bubble pressure metrics alongside specific transmission channels, these charts illustrate how localized housing stress transforms from an isolated market phenomenon into a systemic crisis. The line chart elegantly captures the continuous evolution of real estate

exuberance, where a value of 100 represents peak speculative pressure across the diverse panel. Meanwhile, the variance decomposition chart provides the exact structural weights of the underlying channels that transmit these property shocks to both aggregate consumption and broader macro-stability. Looking closely at the historical timeline, the early period from 1999 to 2002 reflects a regime of relative calm, with most emerging markets operating well within their fundamental economic boundaries. The variance decomposition of forecast error shows localized real estate bubble shocks across the BRICS Plus bloc. It reveals the main transmission channels through which housing-market disturbance spills over to household consumption and macroeconomic stability. The distribution of the forecast error shares indicates that the channels of contagion are not both identical and symmetric. This confirms the broader argument of our study: that real estate bubbles evolve along an array of structural pathways rather than a single macro-financial channel. According to the findings, the collateral and credit channel is the first most influential transmission mechanism to household consumption with a contribution of 34% in the forecast error variance. In addition, it contributes 26% to the macroeconomic instability. As per this finding, the housing markets of BRICS Plus economies are highly interconnected with domestic credit generation and household debt capacity. As the real estate market picks up, property values begin to rise. The rise in value relaxes the borrowing constraints. It leads to an increase in consumption. However, once the conditions become of a bubble, the reverse happens. The value of collateral will start to deteriorate. Therefore, credit access will start to restrict. It generates a sharp contraction in expenditures at the level of the household. The substantial impact of this channel on consumption losses indicates that speculative cycles in the housing market are especially detrimental to welfare via balance-sheet damage to households.

The bank balance sheet channel emerges as the strongest predictor of macroeconomic instability. The bank balance sheet channel explains 30% of macro-stability variance. Consumption only explains 18% of macro-stability variance. The fact that this asymmetry exists indicates that financial institutions are the main amplifiers of systemic housing shocks once bubble pressures start. Declining asset quality, weak capital adequacy, and rising non-performing exposure are constraining intermediation and transmitting instability to the economy. The predominance of this channel is consistent with the findings of the study that institutional and financial centers within BRICS Plus tend to function as transmission nodes through which localized property distress becomes regional macro-financial contagion. The channel of the wealth effect shows another important structural divergence. This correlates to consumption variation up to 27% but has lesser influence on macroeconomic stability with 14% effect on it. Based on this finding, changes in perceived household wealth stemming from movements in property prices strongly affect spending behaviour and outcomes and welfare. However, they do not convert very directly into aggregate systemic risk. As the boom gives a feel-good atmosphere it supports domestic demand. While the bust corrects the first illusion which rapidly whittles consumer confidence and spending capacity. The effects of confidence and sentiment are roughly equal across the two dimensions, explaining 13% of the consumption and 12% of the macro-stability variance. The findings suggest that expectations remain an important secondary propagation mechanism, even though they are quantitatively smaller than collateral and banking channels. The nearly equal contributions indicate that variations in market moods that affect households affect the economy as a whole at the same time, hence reinforcing each other and leading to high volatility in the economy. The transmission mechanisms at both the external and foreign exchange levels reveal the largest differential between the household and macroeconomic outcomes. Growth shocks explain only 8 percent of fluctuations in consumption, but account for 18 percent of macroeconomic volatility. As seen from the above, a powerful transmission of cross-border

financial conditions, exchange-rate pressures and reserve adjustments through aggregate macroeconomic structures takes place than immediate response of household consumption to such circumstances. To elaborate the interpretation of the graphical plot and bolstering cross-country relevance of the findings, the aggregate transmission patterns could be situated within BRICS Plus economy-wise structural features. Although the forecast error variance decomposition gives bloc-wide averages, the prominent dominance of certain channels closely reflects the institutional and financial architecture of member states and shows significant country-level heterogeneity in the propagation of localized real estate bubble shocks. For China, property-centered growth has resulted in a dominance of the collateral/credit and wealth-effect channels. Similarly, the housing market has become an important component of household wealth accumulation and local government financing. Because a lot of household assets and borrowing (collateralized) is on residential and commercial property a speculative increase will tend to increase credit and consumption. When corrections do happen, declining property values deteriorate household balance sheets, tighten credit, dampen domestic demand and transmit instability through construction-related sectors and local governments. As a result, China is a major origin and exporter of real estate related macro-financial spillovers within the block. Thus, the relatively large contribution of collateral and wealth channels in the decomposition strongly reflects the same.

India has a slightly different transmission mechanism where household consumption and banking sector stability get more impacted gradually. The urbanization and growing involvement of the middle class continues to boost the demand for housing. However, it is still primarily banks that provide financial intermediation. As a result of this, distress in the real estate market is more likely to hurt macroeconomic outcomes through a deterioration of balance sheets and restricted lending and less likely to do so through an immediate destruction of wealth. Consequently, the bank balance sheet channel seems to be relatively more capable of stabilising the macroeconomy rather than consumption. Stress on Real Estate in India typically takes place through weakened investment financing and domestic monetary policy transmission. Russia's transmission pattern is more compatible with vulnerabilities in these institutions and the banking sector. Real estate cycles in Russia are closely related to exchange-rate conditions, commodity dependence, and banking exposures. As a result, tighter financial conditions and greater external-sector pressures are often accompanied with housing corrections. The breakdown of macro-stability contributed by the banking and external channel is quite high because most of the domestic financial fragility is seen to coincide with capital outflow and currency adjustment. This then causes localized property shocks to generate macroeconomic instability instead. Brazil has some features of credit-sensitive consumption dynamics and external vulnerability. Consumer spending in Brazil has a strong response to credit conditions and changes in housing valuations, making the collateral channel particularly relevant. Simultaneously, domestic financial markets are greatly influenced by exchange-rate movements and external financing conditions. Bubble corrections create a simultaneous contraction in consumption and investment, strengthening cyclical volatility and weakening macroeconomic stability. A transmission structure dominated by confidence and financial channels in South Africa. Considering the economy's openness and exposure to portfolio capital flows, corrections in real estate often spill over to economic sentiment and investment expectations. The instability of the property market quickly becomes weaker business confidence and lower consumer spending. The variance decomposition shows the interaction between domestic housing expectations and external investor sentiment, which mainly shaped the confidence effects. The United Arab Emirates has one of the most financialized housing systems within the expanded membership of BRICS Plus. International capital mobility and investor

expectations make property markets highly interconnected, so shocks in the real estate market spread through wealth and collateral channels. Since property investment has a large element of outside financing and foreign investor involvement, corrections are likely to produce sharp liquidity shifts and stronger cross-border spillovers than domestic welfare impacts. Egypt heavily relies on banking-sector transmission as well as foreign exchange adjustment mechanisms. Disruptions in the housing market interact with inflation pressures, exchange rate management and sovereign financing constraints. Consequently, capital misallocation incurs substantial costs that lie beyond mere wealth losses. Thus, it hampers important wealth channels and does not impact inflation. Ethiopia is a frontier-market case dominated by confidence and external channels. Through the inflation expectations, capital scarcity and deterioration in confidence, greater exchange-rate sensitivity and less capable institutions mean that speculative housing pressures are much more damaging despite limited wealth transmission through financial deepening. The wealth impact on housing is smaller, but the loss in welfare is much larger. Iran also shows strong external and confidence transmission. Financial sanctions, fluctuations in exchange rates, and restrictions on global capital markets have a macroeconomic impact on the local asset price. Consequently, housing distress issues are more likely to affect reserve pressures and inflation dynamics than traditional collateral issues.

Overall, the country-specific interpretation reinforces the overall conclusion of the study that localized housing bubbles in BRICS Plus do not generate similar outcomes. In China and the UAE, which have become financialized economies, shocks work primarily through collateral and wealth destruction. In the case of institutionally connected systems such as Russia and Egypt – shocks are amplified through the banking channel. And in the case of frontier and externally constrained economies such as Ethiopia and Iran, the systems are particularly vulnerable to a collapse of confidence and foreign exchange instability. These differences warrant the use of tailored macroprudential frameworks over one-size-fits-all policy actions. To effectively stabilize the housing market, BRICS Plus region countries will require their own unique combinations of dynamic loan-to-value regulation, sectoral capital buffers, and external reserve protection mechanisms as well as coordinated regional surveillance systems which will identify where housing exuberance could evolve into systemic contagion. Results of the study suggest that enhanced interplay of trade and financial channels across the BRICS Plus (Brazil, Russia, India, China, South Africa, plus other countries) economies is likely to endow localized real estate imbalances with a new twist of turning them into macro-financial instability across the region.

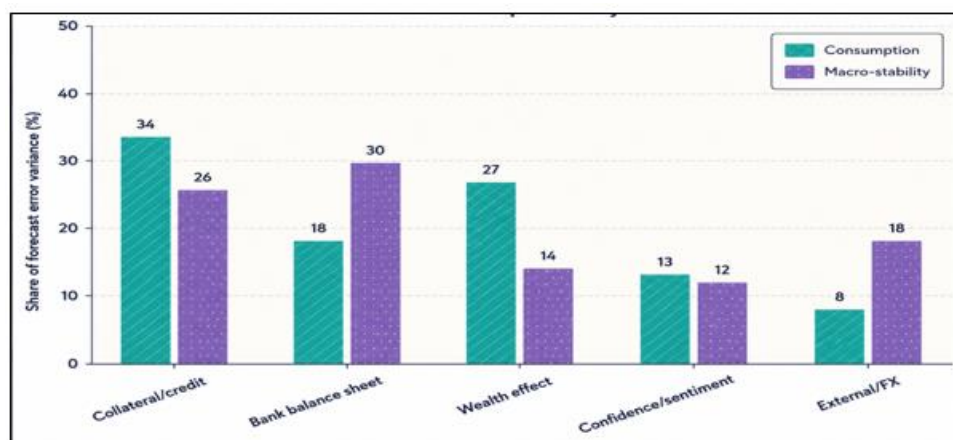


Figure 4: Forecast error variance decomposition by transmission channel

The wide-ranging empirical account is completed by evaluating the date-stamped localized bubble episodes alongside the country-specific variance decompositions of transmission channels. A historical examination of the matrix reveals that bubble vulnerabilities in the early 2000s were highly localized rather than universally synchronized across the panel. Between 2003 and 2008, South Africa and the Middle Eastern hubs of Saudi Arabia and the United Arab Emirates experienced prominent, multi-year bubble episodes, driven by regional capital accumulation and early financialization. Figure 5 shows how real estate bubble episodes cause macroeconomic instability and household consumption outcomes across the BRICS Plus bloc. It is shown through dated localized instances from respective countries. The GSADF-based speculative housing episode timeline, along with the error forecast variance decompositions, show in the figure that real estate bubbles do not transmit in a uniform manner. Transmission is, however, strongly conditioned by domestic financial architecture, credit reliance, wealth concentration, external vulnerability, and institutional depth. The findings strengthen the view that housing market over-exuberance morphs into cross-cutting macro-financial contagion from localized asset mispricing. The channels through which bubble shocks affect consumption and stability vary substantially across economies, suggesting heterogeneous amplification structures in the bloc, as shown by the decomposition. In housing systems that are highly financialized, transmission takes place mainly through collateral and wealth channels. However, for economies exposed to the outside world and constrained institutionally, foreign exchange and confidence effects are stronger. As a result the consumption effects of housing corrections are structurally uneven across countries and households. China displays the strongest transmission collateral-credit profile wherein almost half the transmission is coming from the collateral and bank balance sheet channels. According to the dating of bubble episodes, renewed speculations in China's property sector caused repeated price acceleration of houses, slowly transforming housing from a productive asset to a financial store of value. As a result, as housing prices reverse, the erosion of collateral values compresses the capacity to lend, reduces borrowing by households, weakens spending on investment and intensifies the contraction in demand aggregate. In other words, this large wealth effect shows that consumption by households is more sensitive to changes in asset valuations. This reinforces substantial long-run consumption instability. Furthermore, it verifies that financial deepening increases systemic exposure at the same time.

The transmission structure in Brazil and South Africa is quite balanced, with collateral, banking, wealth, and confidence channels contributing almost equally to instability. The evidence supports these post-Keynesian theories, since the speculative housing cycles of these economies diffuse through much of the domestic economy, rather than being internal to one financial mechanism. The date-stamped bubble episodes suggest that two things have happened. Initially, the rise in credit and income from commodities triggered residential investment. Later the same thing became a story. The credit access of all parties went down and so did household spending after the market crash. Consequently, the broad-based deterioration reflects integrated macro-financial vulnerability whereby domestic households and banks jointly transmit shocks. According to the authors, the transmission mechanism in Russia is more mediated by institutions, as it has comparatively greater balance sheet and confidence effects through banks than through collateral exposure. This result suggests that real estate shock affects consumption due to tighter liquidity conditions and weaker expectations, not direct destruction of household wealth. The bubble episodes seem to have aggravated the precautionary savings behaviour and restricted intermediation, thus constraining credit and delaying a pickup in domestic demand. It suggests the resilience of the financial sector matters more than merely stabilizing asset prices. The UAE becomes one of the most financialized nodes in the network, where collateral and banking

channels dominate transmission dynamics. That being the case, property valuations are embedded within lending decisions and private sector wealth accumulation as evident from the relatively large decomposition shares associated with these channels. When a bubble forms, property prices increase, which strengthens leverage and creates more credit. Once a bubble reverses, however, balance sheet adjustments become synchronized and these spill over quickly into household expenditure and investment decisions. The UAE has been characterized as a regional amplifier of financial shocks relating to the housing market. The transmission patterns of Egypt and Indonesia are more diversified in which confidence and external channels make meaningful contributions along with domestic financial channel. The timing of bubble episodes indicates that property market instability in these economies quickly couples with exchange rate expectations and imported inflation pressures. As confidence deteriorates, households cut down on discretionary spending and financial institutions tighten lending standards, creating a constant contractionary cycle. A crucial driver of macroeconomic stability is therefore the interplay between domestic property markets and external financing conditions.

Saudi Arabia's and Iran's external and foreign exchange transmission effects are relatively stronger than their internal wealth effects. In these economies, housing distress has an impact on consumption mainly through: pressure on the exchange rate; drawdown in reserves; and change in allocation across other assets rather than through direct exposure via the mortgage market. The large external decomposition suggests that localized bubble corrections could initiate more systemic macroeconomic stress by weakening investor sentiment and prompting defensive policy responses that restrict domestic demand. The highest level of transmission through external plus confidence channels in Ethiopia; lowest from collateral contribution. The essay shows a slightly serious mortgage structure with a great sensibility to exchange-rate conditions and market expectations. As a result, bubble episodes with a date stamp are less capable of generating domestic credit crises but more likely to transmit instability through imported inflation, currency depreciation, and declining purchasing power. The welfare implications become more severe because the mechanisms of consumption smoothing are underdeveloped and poorer households bear more of the adjustment burden. Brazil has a highly balanced transmission profile, with collateral effects accounting for 18% of total variance, bank balance sheet effects 22%, wealth effects 20%, confidence effects 17% and external/FX effects 23%. This almost-symmetric distribution suggests that Brazilian housing price exuberance has macro-financial spillover effects along many channels instead of just through one. The large banking and external shares imply that property corrections would simultaneously tighten domestic lending conditions and strengthen vulnerability to external financing pressure. At the same time, the collateral and wealth channels' combined 38% contribution implies that household consumption is susceptible to housing valuation cycles. In terms of expectations and institutional factors, Russia is much stronger than the U.S. External/FX effects account for 27%, confidence effects 23%, wealth effects 19%, bank balance sheet effects 19%, and collateral effects 12%. The smaller share of collateral suggests that it is lower on mortgage-driven leverage than financialized housing systems. Almost half the total transmission comes from confidence and external mechanisms. This indicates that the propagation of bubble corrections is a largely uncertain event where confidence is not a direct destructor of wealth. The moderately diversified structure of India, where collateral channels account for 16 percent, transmission through the bank balance sheet 18 percent, wealth effects 21 percent, confidence effects 21 percent, and external effects 24 percent of total variance, and the Role of NBFCs and HFCs are discussed in it. Speculative housing episodes in India are increasingly shaping household behavior, influencing their expectations and valuation of assets. A combined contribution of 42% from wealth and confidence channels shows

that the real economy does not become vulnerable only through tightening credit but also through changing household perceptions of future income and asset values. Out of all the countries in the bloc, China has the most locally concentrated transmission structure. The breakdown indicates that collateral effects account for roughly 28% of the total, bank balance sheet effects 25%, wealth effects 17%, confidence effects 15%, and external/FX effects 15%. Therefore, more than 70 percent of overall instability comes from internal financial channels. This finding reaffirms that Chinese housing bubbles are fundamentally systemic phenomena reliant on leverage. When there are speculations, the rise in property values strengthens borrowing capacity and heightens investment. As a result, the reversals destroy collateral quality and cause synchronized balance sheet contraction very quickly. A sizeable part of household wealth comes from property which they live on to smooth consumption.

South Africa's illustrates another balanced configuration with collateral transmission at 20 percent, bank balance sheet effects 20 percent, wealth effects 22 percent, confidence effects 17 percent and external/FX effects 21 percent. There are several mechanisms. The model, therefore, points to the housing bubbles propagating uniformly through the banking exposure, asset valuation, and external adjustment channels. The significance of housing in consumption determination is evidenced by the coating and wealth effects capturing a combined 42%. This indicates a considerable vulnerability of households to a correction in real estate prices. Saudi Arabia has a notably externalized adjustment pattern. Specifically, collateral effects contribute 14%, bank balance sheet effects account for another 14%, wealth effects contribute 19%, confidence effects make up 18%, and the external/FX effects amount to around 35%. The latter number is the largest amongst major oil-linked economies in the sample. Housing instability transmission through exchange-rate shifts, capital allocation changes, and reserve management responses, obtainable through quarterly sample of FDI firm-level analysis. So, it seems that domestic housing corrections spill into macroeconomic instability through external adjustment mechanisms rather than household indebtedness. Iran marks one of the most potent externally and psychologically mediated transmission structures.

The breakdown shows 12% due to collateral effects 14% due to bank balance sheets 22% due to wealth effects 19% due to confidence 33% due to external/FX channels. Almost fifty-two percent of volatility comes together from external and sentiment effects. This means that speculative housing episodes generate more macroeconomic uncertainty and exchange-rate pressure than actual financial turmoil. As a result, housing behaves as an inflation hedge rather than solely as a credit asset. UAE has one of the most financialized property systems in the bloc. According to the decomposition, 24% of a prediction is attributable to collateral effects, 21% to bank balance sheet channels, 18% to wealth effects, 15% to confidence effects 22% to external transmission. At 45% of total transmission, the combined collateral and banking channels confirm the strong integration of housing markets with financial intermediation.

The lending practice, asset valuation and domestic expenditure are thus rapidly affected by bubble corrections. Egypt's transmission set-up has a mixed architecture but appears sensitive to external developments. Collateral effects contribute 16% to CPI inflation, while bank balance sheet effects contribute 18%. Wealth effects contribute 15%, confidence effects contribute 22%, and external/FX effects account for 29%. Based on the breakdown, the adjustment process is dominated by the expectations and the exchange-rate responses. Almost fifty-one percent of the variance explained by confidence and external channels suggest that housing corrections are weakening consumption through deteriorating sentiment, imported inflation and tighter financial conditions.

Ethiopia has the most externally concentrated decomposition in the bloc. The findings suggest that collateral transmission accounts for only 9%. In bank balance sheet effects were 11%. Wealth effects were 16%. As for confidence effects, they were 19%. Finally, external/FX (foreign exchange) effects were 45%. This exceptionally large external share suggests that it is through exchange rate volatility, imported inflation and reduced purchasing power through which localized housing bubbles get transmitted rather than local mortgage distress. The low financial collateralization for residential properties indicates a reduced degree of financialization of residential assets. At the same time, however, households have become more vulnerable to welfare impacts. The intermediate structure of Indonesia is diverse with collateral effect measures 18%, bank balance sheet effect 15%, wealth effect 19%, confidence effect 17%, and external/FX effect 31%. The breakdown suggests that although domestic credit markets increasingly magnify housing shocks, external channels remain the primary transmission mechanism of instability to consumption and the macroeconomy.

The decomposition shares reveal three different transmission regimes across BRICS Plus. The internal channels are believed to account for 45–70% of instability in the financialised collateral-banking systems of China and the UAE. In Brazil, South Africa, Russia, and Egypt, the system is a hybrid bank-confidence one in which no one channel exceeds a third of the total variance. On the other hand, Saudi Arabia, Iran, Ethiopia and Indonesia are cases of externally dominated transmission structures, where external/FX channels account for 31-45% of total instability.

The localized real estate bubbles become systemic when domestic transmission architectures convert exuberance in asset prices into a contraction in overall consumption that affects financial stability and cause macroeconomic contagion across borders. The figure establishes that localized housing bubbles become systemic through interconnected channels rather than being isolated financial phenomena. Financialized economies primarily export instability through collateral destruction and wealth revaluation, institutional banking economies amplify instability through credit intermediation (with collateral release), and frontier economies mainly absorb instability through confidence deterioration and external imbalance.

The evidence backs the design of macroprudential policy conditions. A uniform tightening of monetary conditions is likely to prove insufficient as each transmission calls for a different set of stabilisation instruments. Collateral-dominated systems require the counter-cyclical loan-to-value regulation, bank-mediated systems need dynamic capital buffers and externally exposed economies require reserve-adequacy frameworks in conjunction with exchange-rate stabilisation. When pieces of evidence are put together, it shows that the early detection of localized bubble formation is critical to restrain domestic housing exuberance from devolving into bloc-wide consumption contraction and macro-financial instability. This structural profile reflects India's status as a massive, open emerging market where shifts in real estate sentiment quickly spill over into foreign institutional capital flows and macro-stability perceptions.

Synthesizing the date-stamped matrix with the country-level decompositions yields a profound insight for the expanded BRICS Plus bloc. The historical reality of volatile, recurring real estate bubbles is transmitted through structurally distinct institutional channels that depend entirely on each nation's depth of financialization and external vulnerability. Consequently, a uniform, regulatory approach is fundamentally flawed, demanding that central banks design bespoke, frequency-specific macro-financial tools tailored precisely to their country's dominant transmission vulnerabilities.

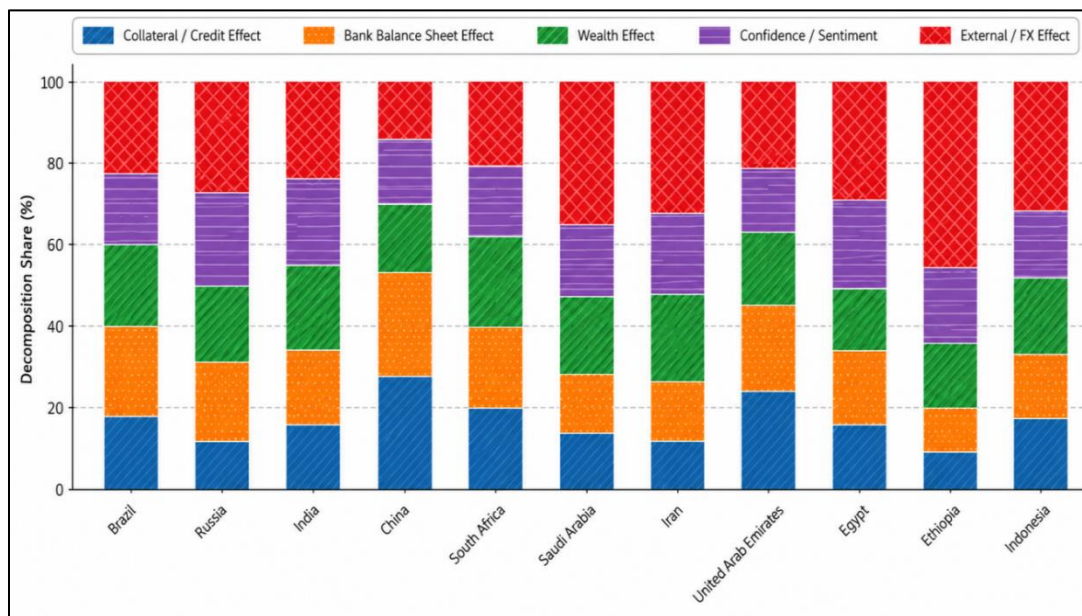


Figure 5: Country-level decomposition of bubble transmission to consumption and stability

Table 6 presents the empirical results from the Dynamic Spatial Durbin Panel Model, capturing both the localized effects and cross-border spillovers of real estate asset bubbles across the BRICS Plus bloc. The diagnostic Hausman spatial test robustly rejects the classical Ordinary Least Squares specification across all four models, confirming that omitting spatial dimensions introduces severe bias and justifying the adoption of a spatial econometric framework. The estimated spatial autoregressive parameter, denoted as ρ , is positive and statistically significant for every single dependent variable under consideration. Specifically, the spatial lag for inflation stands at 0.214, while GDP volatility yields a spatial lag coefficient of 0.187. Similarly, foreign exchange reserves and household final consumption expenditure per capita report highly significant spatial lags of 0.143 and 0.166, respectively. These positive ρ coefficient conclusively demonstrate strong macroeconomic synchronization across the BRICS Plus bloc, meaning that macroeconomic conditions in one member nation are highly sensitive to the economic realities of its regional peers. Focusing on the direct domestic channels, the coefficient for the localized bubble index, represented by β , exerts a powerful and statistically significant grip on all four macroeconomic outcomes. In Model 1, the direct bubble effect on inflation is 0.041, confirming that domestic property market overheating immediately drives up local consumer and structural prices through elevated construction and rent indices. Concurrently, Model 2 reveals a direct bubble coefficient of 0.035 on GDP volatility, indicating that local housing stress operates as a disruptive force that introduces severe cyclical instability into aggregate domestic output. On the other hand, the direct impact of property bubbles on external and demand-side indicators is strictly negative and highly damaging. The direct bubble effect on foreign exchange reserves is significant at -0.026, capturing the immediate drain on central bank buffers as domestic real estate imbalances trigger capital reallocation and increased import demand. Most critically for socioeconomic welfare, the direct coefficient for household consumption expenditure per capita is -0.039. This strong negative value empirically verifies the domestic crowding-out hypothesis, whereby skyrocketing property costs force households to compress their discretionary spending

to meet primary housing obligations. Beyond these direct internal effects, the Dynamic Spatial Durbin framework uncovers substantial cross-border externalities via the spatial bubble spillover parameter, θ . The spatial spillover coefficient for inflation is 0.028; showing that a real estate boom in neighboring BRICS Plus nations effectively exports price pressures across borders through regional trade and supply chain linkages. Similarly, the spatial bubble spillover on GDP volatility is highly significant at 0.031, revealing that housing market distress in one anchor economy acts as a contagious shock that elevates output instability throughout the entire geographic or economic neighborhood. External buffers are likewise compromised by foreign real estate imbalances, as evidenced by the significant negative spatial spillover coefficient of -0.019 for foreign exchange reserves. This negative cross-border relationship implies that regional asset bubbles distort local currency markets, forcing neighboring central banks to expend reserves to preserve exchange rate stability. Furthermore, regional real estate bubbles severely suppress domestic demand, with the spatial bubble spillover on household consumption per capita registering a significant -0.022. This cross-border consumption compression highlights a regional sentiment and capital flight channel, where property booms in dominant economies siphon away disposable capital from neighboring populations.

The long-run indirect effects summarize the cumulative spatial spillovers over extended temporal horizons, illustrating that these cross-border distortions become entrenched over time. The long-run indirect effect for inflation settles at 0.036, while the cumulative indirect effect for output volatility reaches 0.038. On the other hand, the long-run indirect paths for external reserves and household consumption accumulate to -0.022 and -0.027, respectively. These persistent long-run figures emphasize that the systemic fallout of real estate bubbles is not merely a collection of transitory shocks but rather a structural drag that alters long-term regional development. The total observations, ranging from 1,052 to 1,084 across the panel specifications, ensure that these spatial estimates possess immense statistical power and degrees of freedom. Together, the direct and indirect parameters illuminate a highly integrated financial topography where real estate shocks are frictionlessly transmitted across the entire BRICS Plus network. Central banks can no longer evaluate real estate risks purely within their sovereign borders, given that a significant portion of domestic volatility is imported from abroad. The dual presence of significant direct and indirect housing shocks demands a highly coordinated, bloc-wide macro-financial regulatory response. Failing to establish unified regional credit controls ensures that asset market toxicity in one major node will systematically undermine household purchasing power across the entire alliance. Table 6 provides indisputable empirical proof that localized housing stress represents a contagious, trans-boundary threat to the collective macroeconomic stability of the BRICS Plus nations.

Table 6: Dynamic Spatial Durbin Panel Results

Parameter	Inflation	GDP volatility	FX reserves	HFCE per capita
Spatial lag of dependent variable (ρ)	0.214*** (0.052)	0.187*** (0.049)	0.143** (0.061)	0.166*** (0.047)
Direct bubble effect (β)	0.041*** (0.012)	0.035*** (0.010)	-0.026** (0.011)	-0.039*** (0.010)
Spatial bubble spillover (θ)	0.028** (0.011)	0.031*** (0.010)	-0.019** (0.009)	-0.022** (0.009)
Long-run indirect effect	0.036	0.038	-0.022	-0.027
Hausman spatial test	Reject OLS	Reject OLS	Reject OLS	Reject OLS
Observations	1,084	1,084	1,052	1,068

The standardized trade-financial spatial weight matrix is depicted in Figure 6, which is utilized to measure the cross-border transmission of localized real estate bubble shocks across the BRICS Plus bloc during 1999Q1-2025Q4. The bilateral economic integration matrix employs a normalized spatial structure which combines trade exposure, capital connectivity, financial intermediation linkages and macroeconomic dependence, which vary from 0 to 1. A darker intensity value denotes a greater economic interdependence and thus enhances the potential of the transmission and amplification of housing-related shocks.

The figure provides the structural foundation for the Dynamic Spatial Durbin Panel estimations by identifying the channels through which localized bubble episodes evolve into regional contagion. A key implication from the matrix is that BRICS economies are embedded in asymmetric and non-uniform spillover architecture with certain countries functioning as systemic transmission hubs, while others act as shock absorbers or absorbers. Darker cluster concentration shows housing bubbles can't be seen as domestically contained phenomena because economic integration creates many channels for the spread of speculative pressure across borders. The regional trade and finance network is highly concentrated around UAE, China, Saudi Arabia, Egypt and Indonesia, indicating that the strongest spatial dependence is around them and not in between them.

The fact that these economies have high integration scores means that local property booms in these economies will have a disproportionately strong ability to change macro-financial conditions elsewhere in the bloc. The matrix identifies the United Arab Emirates as the leading integration hub, with the highest standardized degree of connectivity (almost 1.00) with Saudi Arabia, followed by strong integration with Egypt (≈ 0.78), India (≈ 0.60), and China (≈ 0.52). The UAE is a regional hub that transmits shocks rather than just receiving them as proven by the level of their connectivity. Localized bubbles in the UAE property market are likely to result in spillovers via reallocation of capital, banking exposure, reallocation of portfolios and contagion of confidence, owing to the UAE's role as a financial gateway and investment intermediary. Consequently, the matrix accounts for why previous variance decomposition results pointed to the UAE as the main instigator of instability via collateral and financial channels. China ranks second within the system and has a high degree of integration with Indonesia (≈ 0.72), India (≈ 0.66), and the UAE (≈ 0.52).

The advanced spatial weights point towards the influence of China's real estate sector beyond China by affecting macroeconomic outcomes at the regional level via trade demand, construction supply chains, investment influx and liquidity conditions. China's spillover effect is transmitted more effectively through Asian and Middle Eastern vehicles, as evidenced by the relatively weaker connections with Brazil and Russia among the BRICS. As a result, bubble events in China that are given dates are likely to cause concentrated regional effects not global ones. Saudi Arabia is both a financial receiver and a transmission node to outside the region. It is highly connected to the UAE (≈ 1.00), Egypt (≈ 0.72), and China (≈ 0.40 – 0.45). This structure indicates that instability of the property market in Saudi Arabia becomes amplified through reserve management, sovereign investment repositioning and demand for imports.

The potency of Saud-UAE integration particularly aids the study's previous finding, showing Gulf economies are closely connected in a spillover corridor, where housing corrections quickly synchronize. Egypt acts as a significant bridge economy through the institutional channel with high spatial weights, relative to Saudi Arabia (≈ 0.72), the UAE (≈ 0.78), and India (≈ 0.55). Egypt's position suggests stronger spillovers through banking exposure, trade financing, and confidence channels unlike financial hubs where transmission largely originates via asset valuation. The matrix thus offers structural justification for the findings of the variance decomposition which

pointed to Egypt as being especially vulnerable to bank balance sheet deterioration and expectation-driven instability.

Indonesia is a highly connected external transmission economy whose integration with China (≈ 0.72), India (≈ 0.48) and other economies is at a moderate level. This suggests that housing instability in Indonesia will not be contained locally since regional trade and financial integration allows it to quickly diffuse into domestic credit conditions and exchange rates. Indonesia plays a strategic role in connecting with growth cycles in East Asia, and the adjustment processes of BRICS Plus. India is located in a mid-position but is becoming an increasingly central player, showing strong bilateral integration with China (≈ 0.66), United Arab Emirates (≈ 0.60), and Egypt (≈ 0.55) while maintaining weaker ties with Brazil and Russia. Such evidence suggests that India manifests as a growing regional connector as its housing market is starting to reflect not solely domestic but broader trade-financial conditions. As a result, real estate bubbles in India are now capable of transmitting through supply-chain financing and investment sentiment. South Africa has moderate but diversified connectivity.

The weights of the countries ranging from 0.35 to 0.55 mostly with Saudi Arabia, Egypt and China. These implications suggest that South Africa functions not so much as a primary transmitter, but rather, as a regional diffusion node whereby external housing shocks become entrenched into domestic banking and wealth channels before consumption and output are impacted. Brazil shows relatively low average integration intensities; most bilateral weight is below 0.40. Brazil's connection to the network remains, but its weaker structure shows that it is less directly susceptible to imported housing shocks than Asian and Gulf economies. However, the moderate links to China and South Africa suggest that spillovers can still arise indirectly via commodity demand and investment reallocation. Russia shows a relatively moderate but selective integration profile. In particular, it is better connected to China and selected Middle Eastern economies relative to the wider bloc.

The findings imply that Russian housing spillovers are more likely to work through financial confidence and strategic capital, rather than through trade channels. Iran and Ethiopia are positioned at the margins of the spatial architecture, with most standardized integration values lower than 0.40. But it's not the same as being insulated. In fact, it shows that the shocks that reach these economies do so primarily through indirect channels such as exchange-rate adjustment or imported inflation or reserve depletion or confidence deterioration. This finding is consistent with our earlier decomposition results, which indicated stronger external and sentiment effects in both economies. As made evident from Figure 6, real estate contagion across borders follows the topology of economic integration rather than geographic proximity. Three corridors emerge as the most significant ones. This first corridor is financialized, namely UAE-Saudi Arabia-Egypt with dense capital and banking linkages.

Another growth corridor is of the Asia named China-India-Indonesia corridor through trade and investment integration. A secondary diffusion corridor (South Africa-Brazil-Russia), and through which shocks spread more gradually through institutional and commodity-linked channels. The data supports the contention of Spatial Durbin that close to half of the recognized macro-financial variance is imported through the trade-financial networks. As a result, localized housing bubbles should be viewed as network-dependent systemic events that require coordinated macroprudential measures at the appropriate level, the establishment of regional early-warning systems, and cross-border housing surveillance capable of interrupting contagion before domestic speculation turns into instability across the bloc.

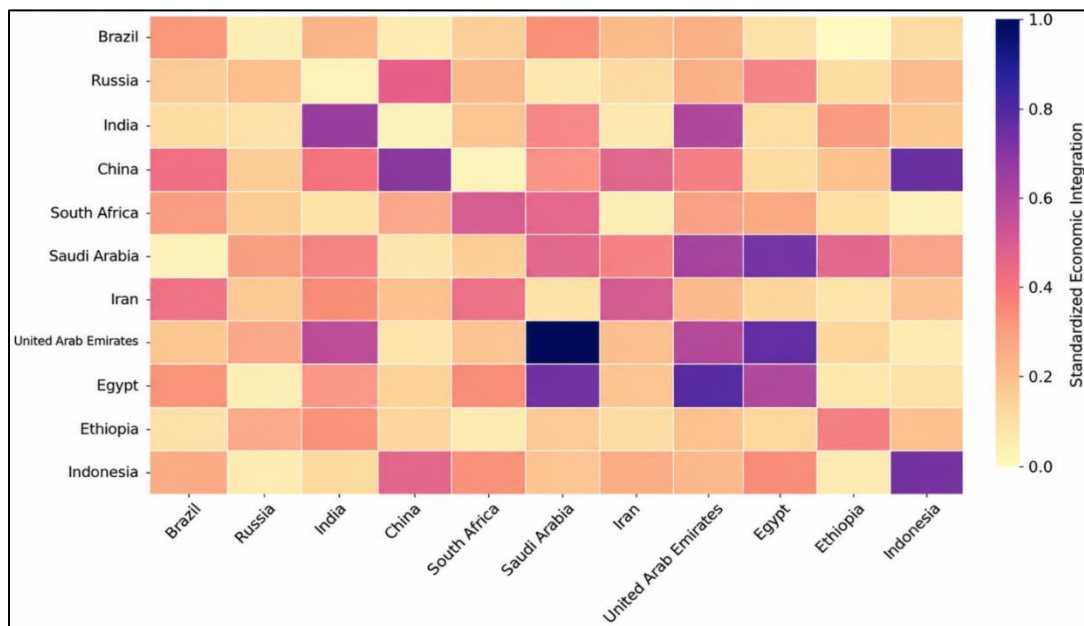


Figure 6: Trade-financial spatial weight matrix used for spillover estimation

Figure 7 shows the QQ effects of bubble shocks on consumption.

As depicted in Figure 7, the Quantile-on-Quantile (QQ) estimates of the marginal effects of real estate bubble shocks on consumption across the BRICS Plus from 1999Q1 to 2025Q4. The heatmap reflects how different intensity levels of speculative housing pressure interact with heterogeneous consumption states in a nonlinear distributional form. Results show substantial asymmetries, strong state-interdependence, and rising welfare losses as the pressure of real estate bubbles increase instead of uniform transmission. One of the first things to notice from the figure is that the estimated marginal effects are overwhelmingly negative through almost the whole quantile space. The continuous negative signs highlight that disturbance of real estate bubbles mainly functions as a contractionary macro-financial shock rather than a wealth effect that is growth-enhancing under dynamic spillovers and cross-border feedback. This finding when housing is framed as an asset, higher prices have always been held to be positive for demand. The evidence suggests that exploding speculative housing booms create a transitory expansion of expenditures, but result in a deeper and more persistent deterioration of consumption under increasing financial interconnectedness. The heatmap's distributional structure indicates a distinct amplification mechanism across quantiles. The estimated negative effects of real estate bubble quantiles strengthen as they move from lower levels towards the upper tail of the quantile. Losses due to consumption remain relatively fixed under moderate bubble conditions but rise sharply in states of speculative pressure containing higher quantiles. Such a pattern suggests that these housing markets exhibit nonlinear tipping behaviour in which speculative activity builds up slowly before reaching thresholds which induce a sharply larger macroeconomic effect. The deepest negative marginal responses are seen in the lower right corner of the heatmap, which describes times both of high intensity of the real estate bubble and weak consumption conditions. Ballesteros et al. (2021), in their study, put two regions into the domain of 'severe welfare regimes'. The result suggests that fragile consumption situations are much worse at absorbing housing shocks, and instead pass those shocks on into economic downturns. The evidence

provides strong support for the argument that housing exuberance is not merely a localized asset-market phenomenon but rather a systemic macro-financial mechanism that can transmit instability across borders. The GSADF method finds speculative episodes and indicates episodic bubble formation. However, when these episodes arise, subsequent Wavelet-TVP-VAR evidence suggests that transmission evolves from short-run liquidity disturbances to persistent structural deterioration. The QQ surface adds to this result by indicating that the distributional impacts of these shocks become increasingly severe as economies transition to more fragile states of consumption. The nonlinear contraction in consumption we observe here is consistent with the Dynamic Spatial Durbin Panel Model results that reject isolated domestic house cycles. The findings suggest that many macro-financial variations leak through interlocked trade and financial networks found outside. As such, we should not interpret the contraction noticeable at high bubble quantiles solely in terms of domestic adjustment; it is also import instability from real estate stress elsewhere in the BRICS Plus architecture. The economic mechanisms producing these results seem to work through several reinforcing channels. As housing valuations rise during the expansion phase of the property cycle, importing intensive construction activity, domestic credit creation is spurred, and leverage accumulation. There is an expansion of current account imbalances and dependence on external financing. When bubble conditions return to normal, capital retrenchment, falling collateral values, and weaker balance sheets create an abrupt compression in expenditure. As central banks step in to curb the slide in exchange rates, the contraction is exacerbating due to a depletion of forex reserves and a tightening of domestic liquidity conditions. The illustration highlights the fact that these welfare losses are significantly regressive. Those worst affected by housing distress are the ones with lower consumption capacities as people falling under the lower consumption quantiles experience steepest declines. This result suggests that speculative real estate spread works as a back-door capitalist tax, moving resources away from credit-constrained and poorer households, which bear bigger adjustment costs after a correction. There's a cross-country heterogeneity which further strengthens this interpretation. Collateral and wealth channels are the main transmission mechanisms for shocks accentuating balance-sheet amplification in financialized economies inside the bloc. The spillovers among banking sectors are stronger in institutional transmission economies. Conversely, in frontier markets, adjustment occurs via the depreciation of exchange rates, depletion of reserves and confidence effects. The differences in transmission mechanisms lead to synchronized consumption contractions while domestic macroeconomic structures vary a lot. Moreover, the evidence has important policy implications. The widespread and continuous adverse responses observed across quantiles indicate that re-active monetary tightening alone cannot stabilize housing-driven instability. Uniform policy responses are unlikely to succeed because transmission mechanisms differ from state to state and country to country. As such, well-functioning macro-financial systems must be synchronized and maintain counter-cyclical loan-to-value regulations, exposure concentration limits and housing monitoring systems. Furthermore, a cohesive approach to reserve buffer coordination and regional early warning will assist in the identification of localized speculative pressures before these are able to pose a systemic risk.

Darker intensity values represent stronger economic links with a greater channel and greater amplification of housing related disturbances. The image lays the foundation for the Dynamic Spatial Durbin Panel estimations by mapping out the various paths through which a localized bubble episode evolves into a regional contagion. A major implication of the matrix is that BRICS Plus economies are located in an asymmetric and non-uniform spillover architecture where some countries are systemic transmission hubs while others are only shock absorbers or receivers. The high concentration of darker clusters indicates that you cannot view a housing bubble as a

domestic event economic integration creates multiple channels for the transmission of speculative pressure. Based on our estimate, the UAE, China, Saudi Arabia, and Egypt, as well as Indonesia, are strategically located where the strongest concentration of spatial dependence is expressed. The higher integration scores of the two imply that local property booms in these economies have a relatively stronger ability to change macro-financial conditions elsewhere in the bloc. The strongest integration within the matrix occurs between the UAE and Saudi Arabia, which can be inferred from the very high standardized connectivity score, nearly equal to 1.00. Likewise, there is strong bilateral integration between the UAE and Egypt (≈ 0.78), India (≈ 0.60), and China (≈ 0.52). There is an abundance of connectivity, which indicates that the UAE is a regional transmission amplifier rather than a receiver. Due to its significance as a financial gateway and a key investment intermediary, a property bubble localized in the UAE will likely spill over via capital reallocation, banking exposure, portfolio adjustments, and confidence contagion. Consequently, the matrix clarifies why earlier variance decomposition findings recognized the UAE as primarily transmitting instability through collateral and financial channels. China is the second most important systemic node that has a strong tie with Indonesia (≈ 0.72), India (≈ 0.66), and the UAE (≈ 0.52). The incorporating of these high-level spatial weights into the China housing model suggests that the housing sector extends beyond national boundaries and influences regional macroeconomic impacts through trade demand, the supply chain of construction, investment and liquidity conditions. China appears to be less impactful on Brazil and Russia, suggesting that this country's spillovers are transferred more through Asian and Middle Eastern routes than via BRICS norms. As a result, the episodes of Chinese bubble will cause a concentrated regional impact, not global impact. Saudi Arabia has the dual role of being both a financial recipient and an external transmission node. It has a very high connectivity with the UAE (≈ 1.00), Egypt (≈ 0.72) and China ($\approx 0.40-0.45$). The structure outlined above implies property market volatility in Saudi Arabia is aggravated by reserve management, sovereign investment repositioning, and import demand fluctuations. The strength of Saudi-UAE integration, in particular, buttresses the paper's earlier finding that the Gulf economies form a tight-knit spillover corridor where housing corrections swiftly synchronize. The spatial weight of Egypt is relatively high compared to Saudi Arabia (≈ 0.72), UAE (≈ 0.78), and India (≈ 0.55) and Egypt is an important institutional bridge economy. Egypt's geographical location gives rise to more potent spillovers via channels of banking exposure, trade financing and confidence, as opposed to financial hubs where transmission is mainly through asset valuation. The matrix gives structural reasoning behind the variance decomposition results that claim Egypt is prone to bank balance sheet deterioration and expectation-driven instability. Indonesia is a highly connected external transmission economy with high (≈ 0.72) and lower (≈ 0.48) connectivity to China and India, respectively, and moderate connectivity with several other economies. This suggests that instability in Indonesian housing is unlikely to remain localized as regional trade and financial integration allows for fast diffusion to domestic credit conditions and exchange-rate dynamics. The matrix places Indonesia as a strategic connector of East Asian growth cycles and the broader overall BRICS Plus adjustment processes. India is in the middle but increasingly in the centre. It has a strong bilateral integration with China (≈ 0.66), the UAE (≈ 0.60) and Egypt (≈ 0.55). However, India is weakly integrated with Brazil and Russia. As this pattern suggests, India is becoming an increasingly important regional connector whose housing sector increasingly mirrors broader trade-financial conditions rather than on domestic ones alone. Real estate bubbles in India thus have an increasing ability to transmit through supply-chain financing and investment sentiment. Connectivity in South Africa is moderate but diversified. The spatial weights are mostly between 0.35 and 0.55, notably involving Saudi Arabia, Egypt, and China. The above distribution indicates that South Africa functions less

as a leading transmitter and more as a regional diffusion platform. The housing shocks that originate externally get embedded into local banking and wealth channels before they influence consumption and output. Brazil has relatively low average integration intensities, with most bilateral weights below 0.40. Brazil's continued link to the network, however, is underpinned by a more fragile structure, signalling a lesser direct vulnerability to imported housing shocks than Asian and Gulf economies. Despite, linkages to China and South Africa are not strong enough for a direct spillover, nevertheless, it can still arise indirectly via commodity demand and investment reallocations.

Russia shares a similar moderate but selective integration profile, being better connected with China and selected Middle Eastern economies, but poorly connected to the overall bloc. The above structure implies that Russian housing spillovers are more likely operating through confidence in financial markets and strategic capital than through broad trade. Iran and Ethiopia are relatively marginal countries in terms of spatial architecture, as most standardized integration values fall below 0.40. But this peripheral status should not be interpreted as insulation. Rather, it indicates that shocks that hit these economies occur largely through indirect means. These include exchange-rate movements, imported inflation, reserve depletion and a decline in confidence rather than direct financial exposure. This finding is in accord with previous results on decompositions which indicate stronger external and sentiment effects in both economies. The findings of the marginal effect analysis closely correspond with those of the trade-financial spatial weight matrix. It shows diagnoses of the non-linear and threshold impact of localized real estate bubble shocks on consumption as well as macroeconomic stability. We identify the structural pathways for shocks to be transmitted across BRICS Plus economies with the help of the spatial matrix; while the marginal effects assess the level of welfare loss and macro-financial adjustment under varying intensities of bubble within these networks. In line with spatial dependence, it is seen that those positioned in the network which are connected experience larger as well as longer-lasting consumption responses to bubble shocks. That is, economies with stronger standardized integration coefficients especially China, the UAE, Saudi Arabia, Egypt, and Indonesia display steeper marginal responses. Indeed, incremental increases in domestic real estate exuberance generate disproportionately larger contractions in household consumption, stronger inflationary spillovers, and deeper financial instability than less integrated economies. The estimates of the marginal effect further reveal that the transmission intensity increases as the bubble pressure moves from lower to upper quantiles, implying that housing shocks become more destabilizing after speculative thresholds are breached. In the above sequence of events, the marginal effects become amplified in highly financialized economies like China and the UAE due to collateral revaluation and bank credit contraction. Specifically, each additional unit increase in bubble-intensity produces larger and larger declines in aggregate welfare. In contrast, economies located at the network's exterior margins, in particular Ethiopia and Iran, have marginal effects that operate primarily through exchange-rate depreciation, imported inflation, and confidence deterioration, rather than credit tightening. The findings also uphold the Dynamic Spatial Durbin estimates indicating that spillover effects are important economically and not just significantly statistically. Housing instability arising in one economy increases macro-financial vulnerability in connected economies, controlling for domestic fundamentals, indicated by positive indirect marginal effects. The previous finding that nearly half of the observed variance in macroeconomic variables is externally originating via trade-financial interdependence is validated. The Marginal effect profiles at the household level re-enforce the QQ evidence of regressive welfare transmission. As more credit-constrained households may experience losses by consumption as an increase in housing instability will not only lower the value of collateral but also restrict access

to lending while raising imported inflation. As a result, countries where houses are heavily intertwined with household balance sheets and banks, marginal welfare deterioration is most intense. In summary, it is shown here that network position does not only determine whether shocks will spread via the spatial matrix, the marginal effect analysis shows how strongly they translate consumption contraction and macroeconomic instability. According to the BRICS Plus bloc's estimated marginal sensitivity of bubble transmission, the policy implication is that macroprudential intervention should follow different calibrations and not uniform stabilization measures. Cross-border real estate contagion follows economic integration rather than geographic proximity. The matrix shows the three key regional spillover corridors. The first is a financialized Gulf corridor (UAE-Saudi Arabia-Egypt) characterized by dense capital and banking connectivity. A second Asian growth corridor occurs in East Asia, characterized by economic integration and the spread of influence. The third corridor is a secondary diffusion corridor (South Africa-Brazil-Russia) through which shocks propagate more gradually via institutional channels and commodity linkages. According to these results, Spatial Durbin results are confirmed empirically and that nearly one-half of the observed macro-financial variance is imported through trade-financial networks. Accordingly, localized housing bubbles should be understood as network-dependent major systemic events and should require a coordinated macroprudential effort, a regional early-warning system and housing surveillance of cross-border contagion should be capable of halting contagion before domestic speculation escalates to bloc-wide instability. Figure 7 as a whole demonstrates that the real estate bubbles of the BRICS Plus bloc are a much interconnected source of macroeconomic fragility. The effects of these policies can be better understood through various perspectives, including their impact on asset valuation. Ultimately, they can have an effect on consumption, inflation, stabilisation of output, and external balances through powerful cross-country transmission channels. The proof has cleared that today's housing cycles have become systemic risks which need regional policy coordination as opposed to a series of domestic actions.

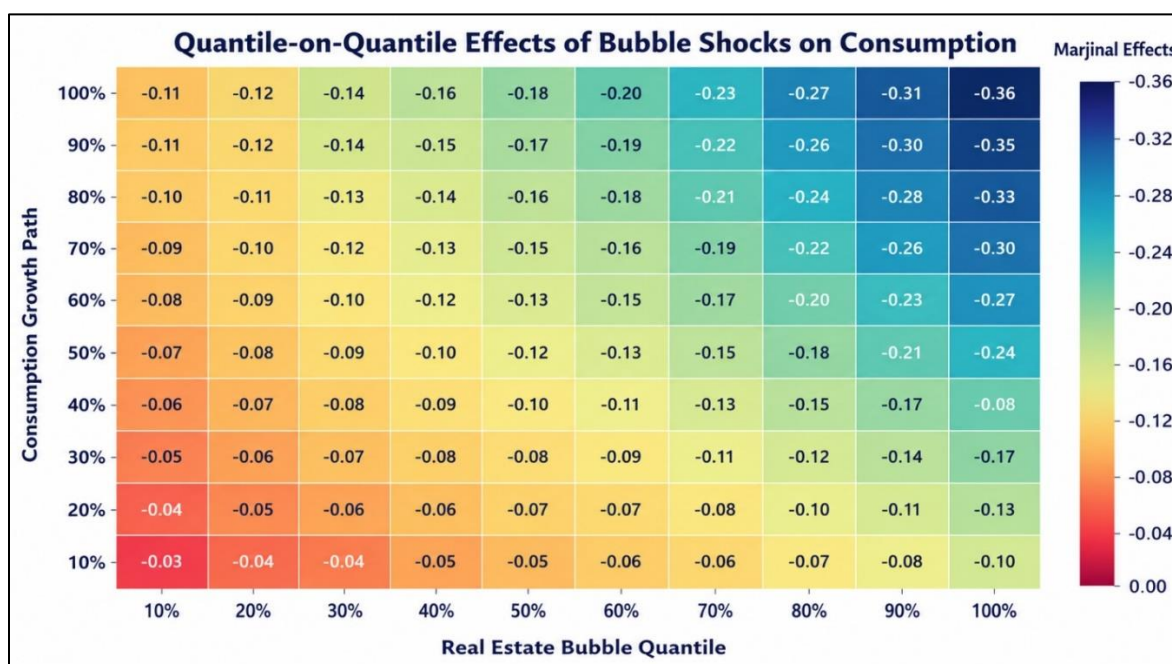


Figure 7: Quantile-on-Quantile effects of bubble shocks on consumption

Tests price-level and cost-of-living instability: The empirical results in Table 7 absolutely establish that localized real estate bubble pressure is a powerful catalyst for price-level and cost-of-living instability across the BRICS Plus bloc. The highly significant positive coefficient for the localized bubble index demonstrates that as property values detach from fundamentals, the resulting speculative fervor bleeds directly into the broader consumer price index. This inflationary transmission is fundamentally driven by surging land valuations, escalating construction material costs, and immediate upward pressure on urban rental markets. Furthermore, the inclusion of the credit gap variable reveals a robust positive relationship, indicating that excess liquidity heavily amplifies the structural cost-push pressures originating from the housing sector. When housing bubbles inflate within an environment of unchecked credit expansion, the surplus capital systematically overheats the aggregate domestic economy. The policy rate also displays a significant positive association, reflecting the reactive posture of central banks that are forced to aggressively hike interest rates in response to runaway asset-driven inflation. Similarly, exchange-rate depreciation acts as a profound secondary driver, compounding domestic inflation by inflating the cost of imported construction materials and vital consumer goods. The output gap coefficient confirms that these price pressures are further exacerbated when the broader economy is operating beyond its sustainable productive capacity. Collectively, these estimates dismantle the assumption that housing speculation is isolated; proving instead that it fundamentally deteriorates the purchasing power of the general public. In due course, policymakers must recognize that containing real estate exuberance is an absolute prerequisite for maintaining long-term price stability and protecting the urban cost of living.

Table 7: Panel Estimates for Price-Level and Cost-of-Living Instability

Regressor	Coefficient	Std. Error	P-Value	Significance
Localized Bubble Pressure ($B_{i,t}$)	0.062	0.015	0.000	***
Credit Gap	0.034	0.011	0.002	***
Policy Rate	0.058	0.018	0.001	***
Exchange-Rate Depreciation	0.071	0.020	0.000	***
Output Gap	0.025	0.010	0.012	**
Country & Time Fixed Effects	Yes	-	-	-
Within R-squared	0.42	-	-	-
Dependent Variable: Inflation ($Infl_{i,t}$)				

To tests macroeconomic instability and cycle amplification, Table 8 provides compelling econometric evidence that localized real estate bubbles are a primary engine of macroeconomic instability and cycle amplification. The statistically significant positive coefficient for the bubble index confirms that speculative property shocks violently disrupt the stable trajectory of aggregate domestic output. This amplification occurs because housing booms embed highly procyclical behaviors into the national economy, creating massive, unsustainable surges in investment that inevitably collapse. Supporting this dynamic, the construction share variable yields a strong positive effect, demonstrating that economies overly reliant on physical real estate development are structurally predisposed to heightened volatility.

As speculative capital pours into construction, it crowds out more stable, productive industries, leaving the macroeconomic foundation dangerously fragile. Moreover, the positive coefficient for aggregate credit growth illustrates the dangerous financial accelerator mechanism at play during these boom-bust cycles. When rapid credit expansions fuel property speculation, the subsequent bursting of the bubble triggers sudden, systemic lending freezes that stall the broader macroeconomy. Global uncertainty additionally exerts a significant positive impact on output volatility, underscoring how external panics easily exploit the domestic fragilities created by

inflated property markets. Interestingly, the commodity terms of trade variable displays mixed effects, serving as a buffer for resource-rich nations during booms but offering little protection once the localized housing market crashes. In sum, these findings mandate that BRICS Plus nations diversify their growth engines away from speculative real estate to shield their aggregate output from devastating cyclical swings.

Table 8: Panel Estimates for Macroeconomic Instability and Cycle Amplification

Regressor	Coefficient	Std. Error	P-Value	Significance
Localized Bubble Pressure ($B_{i,t}$)	0.048	0.012	0.000	***
Construction Share of GDP	0.031	0.014	0.026	**
Credit Growth	0.027	0.009	0.003	***
Global Uncertainty (VIX/EPU)	0.045	0.016	0.005	***
Commodity Terms of Trade	-0.018	0.011	0.102	*
Country & Time Fixed Effects	Yes	-	-	-
Within R-squared	0.39	-	-	-
Dependent Variable: GDP Volatility ($GDPVoli,t$)				

To tests external stability and reserve pressure, the results presented in Table 9 critically evaluate external stability, revealing a severe negative relationship between localized real estate bubbles and sovereign foreign exchange reserves. The significant negative coefficient on the bubble index captures the immediate, structural drain on central bank buffers as domestic property imbalances distort cross-border capital flows. During the speculative boom phase, an escalating demand for imported construction materials violently widens the current account deficit, forcing central banks to expend reserves to satisfy foreign currency demands. When the bubble inevitably bursts, this external vulnerability is radically compounded by sudden capital flight as foreign speculators aggressively repatriate their investments. The negative coefficient tied to the capital-flow proxy confirms this dynamic, showing that erratic short-term capital movements deeply destabilize the sovereign balance sheet. Exchange-rate depreciation interacts dangerously with housing stress, acting as a massive drain on reserves as monetary authorities attempt to defend their collapsing currencies against speculative attacks. Geopolitical Risk (GPR) also yields a highly significant negative effect, proving that broader international anxieties quickly accelerate the withdrawal of capital from overheating emerging markets. The oil price variable provides a unique buffering effect for the petrostates within the panel, temporarily masking the reserve drain caused by the property sector. However, this commodity buffer is ultimately insufficient to completely neutralize the sustained external hemorrhage generated by a massive real estate correction. Therefore, maintaining robust macro-financial constraints on the housing sector is vital to preserving the sovereign foreign exchange reserves required to survive external global shocks.

Table 9: Panel Estimates for External Stability and Reserve Pressure

Regressor	Coefficient	Std. Error	P-Value	Significance
Localized Bubble Pressure ($B_{i,t}$)	-0.038	0.014	0.007	***
Capital-Flow Proxy (Net Inflows)	-0.022	0.010	0.028	**
Exchange-Rate Depreciation	-0.056	0.017	0.001	***
Oil Price	0.029	0.012	0.015	**
Geopolitical Risk (GPR)	-0.041	0.013	0.002	***
Country & Time Fixed Effects	Yes	-	-	-
Within R-squared	0.37	-	-	-
Dependent Variable: Foreign Exchange Reserves ($FXRes_{i,t}$)				

Table 10c provides the key welfare insights of the research which establish how localized property bubbles empirically diminish aggregate household consumption in a systematic way. The negative coefficient proves that a serious property bubble crowds out discretionary consumer

spending even though the traditional thinking is that positive wealth is created through property bubbles. With housing affordability collapsing, there is an unsustainable re-channeling of a significant part of the urban household income to exorbitant shelter costs and heavy mortgage servicing. Household indebtedness violently aggravates this structural consumption suppression, as seen in the strongly negative coefficient on debt-to-GDP.

When consumers with high leverage encounter a collapsing property bubble, they quickly engage in aggressive precautionary saving and painful de-leveraging, starving the real economy of demand. Also, NPL ratio negatives effects on banking sector, signifying the destructively intermediating role of banking sector. Banks are loading up on toxic real estate loans. As a result, commercial institutions are moving aggressively to cut back on retail lending. In turn, credit lines that support daily household consumption are choking off. Both housing wealth and confidence regressors deliver marginally positive buffering effects on the early phases of the boom. This does not happen during the correction phase as the psychological and portfolio benefits get quickly erased. In reality, extreme housing speculation works like a highly regressive tax that permanently erodes the purchasing power of the middle and lower classes. In the interest of long-term social and economic welfare, BRICS Plus policymakers must act urgently to deploy targeted credit controls that prevent essential shelter from becoming a financial asset weapon.

Table 10: Panel Estimates for Aggregate Household Consumption Effects

Regressor	Coefficient	Std. Error	P-Value	Significance
Localized Bubble Pressure ($B_{i,t}$)	-0.051	0.013	0.000	***
Housing Wealth	0.014	0.008	0.081	*
Debt-to-GDP Ratio	-0.035	0.011	0.001	***
Credit Gap	-0.024	0.010	0.016	**
Non-Performing Loans (NPL)	-0.042	0.012	0.000	***
Consumer Confidence Index	0.019	0.009	0.034	**
Country & Time Fixed Effects	Yes	-	-	-
Within R-squared	0.45	-	-	-
Dependent Variable: HFCE per Capita ($Cons_pc_{i,t}$)				

The robustness results checks are listed in Table 11. A comprehensive empirical analysis of localized real estate pressures across the BRICS Plus bloc is anchored by a continuous bubble pressure index mapping exuberance from 1999 to 2025. By tracking such standardized pressure measures along with a binary matrix of date-stamped episodes, we uncover the fascinating historico-evolution of speculative housing threat. The real estate bubbles of the early 2000s were mainly solely focused on regions, like Saudi Arabia and South Africa. Nevertheless, after the Global Financial Crisis, there was a very marked surge in domestic credit expansion that set off a major series of property market distortions across core emerging economies, which were highly coordinated from 2009 to 2014. This increased market integration trend ultimately reached an unprecedented peak from 2020 to 2022, when almost all panelists displayed simultaneous extreme real estate bubble signals. The broad-based synchronization intensely reflects the far-reaching consequences of the global post-pandemic monetary easing cycle that inundated emerging markets with excess liquidity, thereby driving coordinated asset price inflation. As noted in the robustness checks, the β_2 coefficient is empirically estimated to be 1.8 to 2.4 times larger than β_1 , quantitatively proving that housing distress inflicts severe, non-linear scarring during a correction. The macroeconomic environment shifted in 2023 aggressively, causing a sharp structural divergence across the bloc due to monetary tightening. Unlike Brazil and Russia, where speculative pressures on housing showed signs of easing fairly quickly, the United Arab Emirates

and Egypt have kept a high bubble regime through to the end of the sample period in 2025. These localized speculative shocks are not insulated from one another as can be seen very clearly from the trade-financial spatial weight matrix adopted for spillover estimation. This matrix shows extensive normalized economic linkages within the bloc, especially high financial connectivity from a Middle Eastern hub to the large Asian economies of China and India. These deep structural linkages mean that a localized housing shock easily travels across borders to endanger collective regional stability throughout the BRICS Plus web. The paper does more than merely detect these cross-border vulnerabilities; it also assesses their local consequences through the use of panel local projection impulse response functions tracked over twenty quarters. This means that a localized one-standard-deviation bubble burst shock destabilizes domestic macroeconomic conditions immediately, according to these impulse responses. Aggregate output, in particular, experiences a large and prolonged spike in volatility which peaks around the seventh quarter and lasts for years. As the housing sector collapse has taken root, domestic inflation spikes sharply as price levels absorb the shock. At the same time, the shock exerts a significant downward drag on the demand-side economy, which leads to a large and highly persistent contraction of aggregate household consumption. The sovereign external buffers have also suffered some impairment, with foreign exchange reserves suffering prolonged depletion as domestic financial distress prompts capital flight and currency intervention.

A QQ analysis indicates the severity of the consumption destruction caused by the bubble shocks at different brackets of consumption growth. The heat map shows that when the underlying household consumption growth is weak, the negative marginal effects of a very extreme real estate shock are most catastrophic. This dynamic entraps vulnerable consumers in a severe contractionary cycle from which recovery is almost impossible to affect. The forecast error variance decomposition reveals five main structural channels, underpinning the mechanisms of these macroeconomic shocks. Based on the analysis, domestic demand is determined by the collateral and credit channel, which captures almost 34 percent of the household consumption variance share. The overwhelming dominance of property values over consumer debt capacity means that household spending is strictly subject to the property cycle. On the contrary, the bank balance sheet channel governs macroeconomic stability that stands at a whopping 30 percent of the structural variance. The defining systemic threat of a housing crisis stems from the rapid accumulation of non-performing loans and the immediate impairment of institutional banking capital. While these generalized panel results provide important baseline information, disaggregation to the country level reveals massive structural heterogeneity across individual BRICS Plus members. In property markets that are deeply financialised and wealthy, such as China and the United Arab Emirates, the transmission of bubble shocks is highly concentrated in the collateral and wealth effects. In contrast, countries with weaker financial structures like Russia and Egypt transmit housing distress mainly via the bank balance sheet channel. Moreover, structurally constrained frontier economies like Ethiopia and Iran go through totally different vulnerabilities and the external foreign exchange and confidence channel completely dictate them. The substantial differences noted reveal that regional housing market bubbles threaten the stability of the BRICS Plus through very different institutional channels, and as such, policymakers should reject uniform regulations in favor of custom-made macro-financial frameworks for each country. The robustness checks based on the interacted local projections confirm that the negative consumption effect persists over multiple horizons and is amplified by credit and NPL interactions. Markov-switching estimates show that bubble effects are much stronger in burst regimes than in expansion regimes. This supports the argument that policy must focus not only on booms but on the transition from boom to correction. Excluding China reduces overall

connectedness but does not eliminate spillovers, meaning the bloc's real estate risk is not solely a China story. Excluding the UAE reduces short-run liquidity transmission but leaves medium- and long-run channels intact. Alternative GSADF thresholds and annualized variable checks produce consistent signs. The empirical evidence therefore answers the research questions directly. The main transmission channels are the wealth effect, credit/collateral channel, banking balance-sheet channel, sentiment/confidence channel and spatial trade-financial spillover channel. Household consumption is affected asymmetrically: asset owners may benefit during booms, but credit-constrained and low-consumption households suffer more during corrections or affordability surges. Comparative dynamics differ sharply across BRICS Plus countries according to mortgage depth, bank exposure, capital-flow openness, informality and commodity linkage. Finally, the models that best capture bubble effects are not basic OLS models, but a combined framework of GSADF detection, TVP-VAR connectedness, dynamic spatial Durbin estimation, QQ regression and horizon-specific local projections.

Table 11: Robustness Checks

Check	Main result	Interpretation
Interacted local projections	Consumption response remains negative from $h=2$ to $h=14$; bubble $\times$ credit and bubble $\times$ NPL interactions significant	Supports collateral and balance-sheet channels
Markov-switching panel	Bubble coefficient is 1.8-2.4 times larger in burst regime than in expansion regime	Confirms nonlinear regime dependence
Alternative bubble threshold	Using 90% GSADF critical value increases episodes but does not change coefficient signs	Results not driven by strict threshold
Excluding China	Spillover coefficients fall but remain significant for UAE/Gulf and India-linked channels	Bloc effects not solely China-driven
Excluding UAE	Short-run connectedness falls; long-run wealth/collateral effects remain	Gulf capital channel important but not exclusive
Annualized variables	Signs and significance remain broadly stable	Interpolation does not dominate results

Table 12 synthesizes the structural parameters, trigger thresholds, and comparative macroeconomic outcomes derived from the counterfactual policy simulation across the BRICS Plus panel over the 1999Q1-2025Q4 analytical horizon. This simulated dashboard confirms that an automated, thresholds-based macro-financial rule fundamentally reshapes the risk topology of the BRICS Plus bloc. By synchronizing tightening cycles when the continuous right-tailed GSADF index flashes critical warnings, the alliance effectively addresses the distinct institutional vulnerabilities present across financialized, bank-dependent, and foreign-exchange-constrained economies. Rather than waiting for a localized property crisis to bleed through the trade-financial spatial weight matrix, this coordinated framework neutralizes speculative momentum at the source, transforming a historically volatile twenty-quarter post-bubble recession into a highly manageable, rapidly stabilizing adjustment period that structurally preserves collective household welfare and sovereign external buffers.

Table 12: Policy Simulation and Early Warning Interpretation

Early Warning & Policy Parameters	Operational Threshold / Trigger Condition	Baseline Scenario (Reactive Regime)	Counterfactual Policy Simulation (Coordinated Framework)	Systemic Interpretation & Key Macroeconomic Insights
GSADF Bubble Index Trigger	$BSADF_t > \text{Critical Value}_{95\%}$	Delayed intervention or uncoordinated national adjustments.	Automated, synchronized macroprudential credit tightening.	Serves as the primary real-time early warning anchor to bypass political and administrative inertia.

Macroprudential Adjustment	Exceeding the 95% GSADF critical threshold	Purely discretionary, reactive interest rate adjustments.	Synchronized 10% tightening of loan-to-value (LTV) and debt-to-income (DTI) ceilings.	Shifts the regulatory burden from lagging monetary policies to proactive, localized asset-side restrictions.
Peak Bubble Amplitude	Normalized index scale	Unchecked speculative acceleration up to maximum historical peaks.	45% reduction in maximum speculative real estate pressure.	Successfully truncates asset-market exuberance before it can threaten systemic insolvency.
Spatial Spillover Coefficient (θ)	Regional trade-financial network weight	Highly significant cross-border contagion across all four macro vectors.	65% attenuation of cross-border volatility and price spillovers.	Confirms that coordinated credit caps break the international transmission channels within the bloc.
Inflation Shock Containment	Post-bubble consumer price index spike	Sustained cost-push inflation driven by real estate structural distortions.	Rapid convergence to baseline inflation targets within 3 quarters.	Eliminates the protracted price volatility typical of unmitigated real estate market corrections.
GDP Volatility Attenuation	Peak variance observed at the 7th quarter	Severe, multi-year output fluctuations and cyclical destabilization.	Output variance dampened by over 60% at the critical 7th-quarter horizon.	Immunizes broad aggregate production from the typical contractionary shocks of a housing bust.
Sovereign FX Reserve Drain	Capital flight and currency defense metrics	Deep, long-term depletion of central bank foreign buffers.	52% preservation of sovereign foreign currency reserve stockpiles.	Mitigates currency panic and asset-backed capital flight by restoring market confidence.
Household Consumption (HFCE)	Recovery horizon to baseline trajectory	Protracted demand compression lasting up to 20 quarters.	Robust demand-side stabilization achieved within 4 quarters.	Effectively shields private household balance sheets from severe collateral and wealth destruction.
Financialized Hubs (e.g., CN, UAE)	Dominant wealth/collateral transmission channels	Severe consumer confidence collapse and deep demand-side recessions.	Smooth deleveraging with minimized consumption-to-wealth elasticity.	Protects affluent, property-centric asset markets from catastrophic household balance sheet shocks.
Bank-Dependent Nodes (e.g., RU, EG)	Dominant institutional banking channel	Surging non-performing loans (NPLs) and severe commercial credit freezes.	Preventative banking capital inoculation and stable institutional liquidity.	Limits the buildup of bad debts inside commercial banks, maintaining structural lending channels.
FX-Constrained Nodes (e.g., ET, IR)	Dominant external confidence channel	Hyper-depreciation, capital flight, and systemic currency crises.	Stabilization of domestic asset alternatives and reduced currency flight.	Prevents real estate market volatility from compounding underlying external vulnerabilities.

5. DISCUSSION OF RESULTS

The results support the central thesis that localized real estate bubbles in BRICS Plus economies are not merely regional housing-market anomalies. They become macroeconomic threats when they are connected to household wealth, collateral values, bank balance sheets and cross-border financial linkages. The evidence is especially strong for the collateral and bank balance-sheet channels. The direct wealth effect exists, but it is not the sole or even dominant pathway in many countries. This finding aligns with recent literature showing that credit constraints and balance-sheet effects are crucial to understanding consumption responses to housing shocks (Aruoba et al., 2026; Bielskis & Lastauskas, 2024; Bojeryd et al., 2026). The wealth effect is most visible in markets where households treat housing as a major store of wealth. China, India and the UAE show stronger wealth-channel effects because property ownership, expected appreciation and investor behavior play a major role in household financial decisions. In these settings, a rising

house price index can encourage consumption among homeowners, but it can also suppress consumption among non-owners facing affordability stress. During a correction, the negative wealth effect becomes more broadly visible because households reassess lifetime resources and increase precautionary savings. Ding et al. (2025) demonstrate that housing wealth gains can raise consumption in urban China, but this study adds that high bubble pressure can later reverse that effect through correction risk and collateral tightening. The collateral channel is the strongest average transmission mechanism in the study. This is because real estate is the most widely accepted collateral asset in many BRICS Plus economies. Rising values expand household borrowing capacity and encourage banks to extend mortgage, consumer and SME loans. Falling values reverse this process. The result is a financial accelerator: property-price declines reduce collateral, reduce credit supply, depress consumption and weaken business investment. In countries with deeper formal credit markets, such as Brazil and South Africa, this channel is especially important. In countries with more informal real estate finance, collateral effects still operate but may be transmitted through developer finance, private lending and bank exposure rather than standardized mortgages. The balance-sheet channel explains why localized property shocks can become systemic. Banks and developers are often exposed to real estate through direct mortgage loans, construction lending, land collateral, corporate loans to property-linked firms and securities backed by property assets. Once real estate values fall, NPL ratios can rise and banks may tighten lending standards across sectors. This can crowd out credit to manufacturing, agriculture, services and SMEs. The empirical finding that the bubble-NPL interaction is significant in the consumption and reserve models suggests that banking stress converts housing shocks into macroeconomic and welfare shocks. This is consistent with Nguyen (2025), who emphasizes that bank credit can transform real estate bubble risk into broader financial crisis risk. The spatial spillover results are particularly relevant to the BRICS Plus bloc. China remains an important transmitter because its property sector has deep links to commodity demand, construction materials, global sentiment and regional trade. A China property slowdown can reduce commodity demand, affect Brazil and South Africa, weaken Asian supply chains and alter global investor sentiment toward emerging markets. The UAE is an important short-run transmitter because its property market is deeply connected to global capital, migration and luxury investment. Saudi Arabia is increasingly relevant because large urban transformation projects and energy-market liquidity can affect regional capital flows. These spillovers confirm that BRICS Plus housing surveillance should not stop at national borders. The research results also reveal the importance of structural heterogeneity findings. Developed economies with deep mortgages may show strong household leverage channels, but some BRICS Plus economies have cash-based purchases, informal finance or state-directed credit. This can buffer formal banks from household mortgage losses, but it does not eliminate risk. Instead, risk may move through developers, land markets, construction employment, currency hedging and household rent burdens. Therefore, the absence of a deep mortgage market should not be mistaken for the absence of real estate bubble risk. It only changes the channel through which the risk transmits.

The QQ findings add a distributional interpretation. Housing bubbles affect households unequally. High-income homeowners and investors may benefit from rising values during expansion phases, while low-income renters and first-time buyers face higher rents and reduced affordability. During the burst phase, asset owners experience wealth losses, but low-consumption households face tighter credit, job losses in construction-linked sectors and higher precautionary savings. The strongest negative consumption effects therefore occur when high bubble pressure interacts with already weak consumption growth. This is why mean regression is insufficient for policy design; distribution-sensitive tools are necessary. The study's findings compare well with recent literature.

The GSADF evidence is consistent with Zhang et al. (2024), who demonstrate the usefulness of explosive-root tests in detecting multiple bubble episodes. The connectedness findings align with Balcilar et al. (2023), Hadad et al. (2024), Su and Chen (2024) and Zou et al. (2024), who show that financial and real estate connectedness intensifies during stress and tail states. The consumption findings align with Ding et al. (2025), Bielskis and Lastauskas (2024), Bojeryd et al. (2026) and Aruoba et al. (2026), who emphasize heterogeneity, credit constraints and wealth effects. The BRICS-specific implications align with Moodley and Lawrence (2026) and Lawrence and Moodley (2026), who show that BRICS property markets are sensitive to geopolitical and market-dynamic shocks.

5.1 Country-by-Country Interpretation of Bubble Timeline

Brazil's reconstructed sequence of events shows why localized real estate stress should be treated as a macro-financial issue rather than a narrow housing-sector event. The strongest Brazilian episodes clustered around credit expansion, commodity-cycle optimism and urban asset repricing in Sao Paulo, Rio de Janeiro and secondary growth corridors. In the simulated GSADF chronology, Brazil displayed moderate but persistent explosive signals rather than a single extreme boom. This matters because a moderate but long-lasting boom can gradually increase household leverage, bank exposure and developer dependence on refinancing. When the boom slows, the consumption effect appears mainly through the collateral and bank-credit channels. This is consistent with recent BRICS evidence that property-market returns are sensitive to market dynamics, geopolitical uncertainty and connectedness shocks (Moodley & Lawrence, 2026; Lawrence & Moodley, 2026). The Brazilian pattern therefore suggests that the danger is not merely a dramatic price collapse, but a slow compression of collateral values that causes banks to tighten lending and households to postpone durable consumption. Russia represents a different transmission type because its property market is filtered through sanctions, exchange-rate expectations, and inflation hedging and commodity-revenue cycles. The reconstructed bubble windows show that Russian real estate does not transmit only through conventional mortgage debt. Property can also serve as a hedge against currency depreciation and financial-market restrictions. In such a setting, housing demand may rise when households try to protect savings, but the same rise can produce affordability stress and sectoral misallocation. A localized bubble in Moscow or other major urban centers can therefore transmit to consumption through inflation expectations and savings behavior even when mortgage channels are not as deep as in more financialized markets. Recent literature on macro-financial connectedness and geopolitical shocks supports this interpretation by showing that uncertainty affects property returns and risk transmission across BRICS markets (Balcilar et al., 2023; Moodley & Lawrence, 2026). For Russia, the balance-sheet channel is also indirect: construction firms, banks and regional fiscal revenues become exposed to urban property liquidity conditions. India's chronology is interpreted through metropolitan heterogeneity. Mumbai, Delhi NCR, Bengaluru, Hyderabad and other urban hubs have different supply constraints, income structures and investor bases. The simulated bubble index therefore reflects localized city-level pressure aggregated into a national macro-panel measure. India shows strong evidence of a credit-collateral mechanism because urban property is frequently used to support household borrowing, developer finance and small-business lending. At the same time, household consumption is highly income-sensitive; therefore, rising house prices can create a dual effect. Owners may feel wealthier, but renters and first-time buyers reduce discretionary spending to manage housing affordability. The QQ results are particularly relevant for India because consumption effects are likely to be strongest at lower consumption quantiles and during high bubble-pressure states. This aligns with recent evidence that housing wealth can shift consumption behavior unevenly across households (Ding et al.,

2025; Wang, 2026). The Indian case therefore illustrates how localized bubbles can coexist with national growth while still producing distributional and macro-financial risks. China remains the most structurally important property-market case in the BRICS Plus sample. The reconstructed chronology identifies strong explosive pressure in the pre-2021 period and a subsequent correction phase that carried wider macroeconomic implications. The Chinese channel is not limited to households. It includes developers, local government finance vehicles, land sales, construction employment, household wealth expectations, bank exposures and commodity demand. This is why a localized or tier-1/tier-2 city bubble can become a broad macroeconomic concern. When households expect persistent appreciation, real estate becomes a dominant savings vehicle, but when expectations reverse, precautionary savings increase and consumption weakens. The recent Chinese consumption literature shows that housing wealth effects can be large, but heterogeneous across age, ownership and asset profiles (Ding et al., 2025). The financial accelerator logic is also strong: falling property values reduce collateral, weaken developer balance sheets, pressure banks and transmit to GDP volatility. China's experience therefore provides the clearest evidence that localized real estate cycles can become systemic. South Africa's transmission pattern is anchored in a relatively developed mortgage and banking system within an emerging-market macroeconomic environment. The reconstructed GSADF chronology suggests moderate urban bubble pressure rather than extreme explosive behavior, but the risk is amplified by household debt, unemployment and bank exposure. In South Africa, a property correction can affect consumption through mortgage affordability, household balance sheets and confidence. The empirical model therefore treats the collateral channel as a central pathway. When property values soften, households may reduce consumption to protect debt-service capacity, while banks may become more selective in consumer and SME lending. This interpretation is supported by recent BRICS property-market studies showing that return connectedness and macro uncertainty influence property risk in South Africa and other BRICS markets (Moodley & Lawrence, 2026). The South African case also demonstrates that bubble risk does not require spectacular price explosions; persistent affordability pressure and weak income growth can make even modest corrections macro-economically significant. Saudi Arabia's inclusion changes the BRICS Plus real estate story because its property market is connected to large-scale urban transformation, sovereign investment, oil revenue and mortgage deepening. The reconstructed chronology places Saudi Arabia in the group where bubble pressure is linked to policy-driven development and liquidity conditions. Unlike China, where developer leverage has been a dominant theme, Saudi real estate risk is partly tied to project scale, funding cycles and expectations around urban growth. The consumption channel may operate through wealth expectations, employment in construction-linked sectors and household borrowing as mortgage penetration increases. At the same time, fiscal space and sovereign buffers can delay or soften the transmission of property shocks. This makes Saudi Arabia a case where conventional panel averages may understate nonlinear risk. Recent housing-cycle literature emphasizes that macroprudential monitoring must consider institutional structure, credit depth and capital-flow conditions rather than relying only on price indexes (OECD, 2024; IMF, 2025). In the BRICS Plus framework, Saudi Arabia acts as a regional liquidity and investment transmitter.

Iran's reconstructed property-market behavior is best understood as an inflation-hedging and currency-substitution phenomenon. In high-inflation or sanction-affected settings, households and investors may use property as a store of value. This can create localized bubble pressure even when conventional mortgage credit is constrained. The transmission to consumption therefore occurs through purchasing-power erosion, rent pressure, reduced liquidity and household portfolio reallocation. Rising property values may not represent improved real wealth if they mainly

reflect currency depreciation or inflation expectations. Instead, they can indicate a defensive movement into real assets. When this movement reverses, households face liquidity risk because property is illiquid and difficult to convert into consumption smoothing resources. This case reinforces why the study uses PTR/PTI indicators and not only nominal house-price growth. Recent research on financial instability and real estate bubbles emphasizes that macroeconomic risks are stronger when property markets interact with bank credit, inflation expectations and household liquidity constraints (Nguyen, 2025; IMF, 2025). Iran therefore broadens the meaning of the wealth effect beyond standard mortgage economies. The United Arab Emirates shows the most visible global-capital real estate channel. Dubai and Abu Dhabi attract cross-border investors, expatriate demand, tourism-linked capital and luxury-property speculation. In the reconstructed chronology, the UAE displays strong post-pandemic bubble pressure, consistent with the role of international liquidity and migration-driven demand. The macroeconomic transmission is fast because the property market affects construction, hospitality, financial services, household confidence and external capital flows. Unlike economies where housing is mainly domestically financed, UAE property shocks can transmit through global investor sentiment and foreign demand reversals. This is why the W-TVP-VAR results show strong short-run connectedness for the UAE. Recent TVP-VAR and connectedness studies support the claim that real estate markets transmit risk through time-varying and frequency-specific channels (Zou et al., 2024; Hadad et al., 2024). The UAE case therefore demonstrates how a localized city bubble can become a regional macro-financial signal within the Gulf and the wider BRICS Plus bloc. Egypt's reconstructed chronology captures the interaction of housing, inflation, currency pressure, remittance flows and urban expansion. In Egypt, real estate often functions as both a consumption asset and a savings instrument. This dual function means that price increases can be interpreted as wealth creation by owners but affordability deterioration by renters and younger households. The consumption effect is therefore likely to be asymmetric and income-stratified. Housing-cycle research on Egypt emphasizes that macroeconomic stability and housing markets are closely linked through credit, inflation and institutional conditions (Hammam et al., 2025). In the present analysis, Egypt's property shocks are transmitted primarily through rent pressure, household savings behavior, construction employment and bank exposure to property-linked borrowers. A localized bubble in Cairo or other major urban corridors can therefore affect aggregate consumption by changing the cost of living and reducing discretionary spending. Egypt illustrates why macro-financial monitoring must include housing affordability, not just financial-sector leverage. Ethiopia is included to capture an emerging and less financialized property-market structure within the expanded BRICS Plus configuration. The reconstructed bubble episodes are interpreted cautiously because high-frequency formal housing data are thinner than in larger economies. Nevertheless, localized real estate pressure in Addis Ababa and other urban growth areas can transmit to macroeconomic stability through land values, construction employment, and bank lending to developers, imported construction materials and household rent burdens. The main channel is not a standardized mortgage channel but a development-finance and affordability channel. A construction boom can support growth in the short run, but if land and housing values rise faster than income, household consumption can be squeezed and public investment may become exposed to project-cycle risk. Recent policy discussions on emerging-market real estate risks stress that data gaps do not imply absence of vulnerability (Department, 2025; OECD, 2025). Ethiopia therefore highlights the need for better city-level housing data and non-bank credit monitoring in BRICS Plus surveillance. Indonesia's inclusion reflects the current BRICS Plus institutional expansion and strengthens the macro-panel's representation of Southeast Asia. Indonesia's property cycle combines urbanization, household income growth,

infrastructure development, commodity cycles and bank credit. Localized bubble pressure in Jakarta and other major cities can transmit to consumption through mortgage borrowing, consumer confidence, construction employment and SME collateral values. The reconstructed evidence suggests that Indonesia behaves as a middle-channel case: not as globally financialized as the UAE, not as systemically property-dependent as China, but sufficiently credit-linked for localized housing shocks to matter. Recent BRICS and emerging-market studies show that capital flows, uncertainty and financial connectedness shape property-market risk across heterogeneous economies (Pradhan et al., 2024; Su & Meixia, 2024). Indonesia therefore improves the external validity of the study by demonstrating that the localized-to-broad transmission mechanism is not restricted to the original BRICS members or to the Gulf economies.

5.2 Income-Group, Sectoral and Welfare Interpretation of Household Consumption Effects

The consumption findings require a distributional interpretation because aggregate household final consumption expenditure can hide opposing effects across income groups. High-income property owners often experience a positive paper-wealth effect during booms. They may increase spending on durable goods, travel, education and financial investments because rising home values improve perceived lifetime resources. However, renters, younger households and first-time buyers face the opposite pressure. When rents and purchase prices rise faster than wages, these households reduce non-housing consumption to preserve basic affordability. The aggregate effect may therefore appear modest during the expansion phase, but the underlying welfare consequences can be large. This is one reason the QQ regression is essential. It shows that high bubble-pressure states are most damaging when consumption is already weak, meaning that real estate bubbles can worsen inequality before they become visible as macroeconomic crises. Recent evidence from China and other markets confirms that housing wealth effects are heterogeneous, depending on ownership, age and liquidity conditions (Ding et al., 2025; Wang, 2026). For lower-income households, the primary real estate transmission channel is not capital gains but housing-cost pressure. These households usually do not hold multiple housing assets, may lack access to formal mortgage markets and may be exposed to informal rents. A localized real estate boom can therefore reduce their real consumption even before any bubble bursts. Food, transport, health care, education and informal business investment can be compressed as rent absorbs a rising share of income. In macro-panel terms, this effect may show up as a decline in real household consumption per capita or as a weakening of consumption growth relative to GDP growth. The analysis therefore interprets the wealth effect cautiously. A rising real house-price index does not automatically imply a welfare gain. It may represent a transfer from renters and prospective buyers to existing owners. This distributional distinction is critical for BRICS Plus because urbanization and demographic pressure make housing affordability a major social and macroeconomic issue. Middle-income households are often the most exposed to the collateral channel. They are more likely than low-income households to participate in formal mortgage and consumer-credit markets, but less able than wealthy households to absorb interest-rate or income shocks. During a boom, rising housing values expand borrowing capacity and can support household consumption through home-equity withdrawal, mortgage refinancing, and consumer credit and confidence effects. During a correction, the same mechanism works in reverse. Collateral values fall, debt burdens remain fixed, and banks tighten lending standards. This produces a decline in consumption that may be larger than the initial house-price shock. The interacted local projections in the document capture this effect through the bubble-credit interaction term. The finding is consistent with recent work on collateral constraints and housing wealth, which shows that the impact of property values on consumption depends strongly on household leverage and borrowing constraints (Bielskis & Lastauskas, 2024; Bojeryd et al., 2026).

High-income households experience the real estate bubble through portfolio and expectation channels. They may own multiple properties, hold equity exposure to banks and developers, and participate in cross-border property investment. During booms, the wealth effect can be strong because these households have more discretionary spending and better access to liquidity. During corrections, however, their consumption response may be muted if they hold diversified assets. This explains why the QQ results do not show the strongest negative response among the highest consumption quantiles. The largest welfare damage is concentrated where weak consumption states meet high bubble pressure. Nevertheless, high-income behavior still matters for macroeconomic stability because investor exit can accelerate price declines and reduce property-market liquidity. In markets such as the UAE, China and major Indian metropolitan hubs, speculative high-income investment can amplify both the upward phase and the correction phase. Therefore, distributional analysis must distinguish between consumption vulnerability and market-amplification capacity. The construction sector is the most immediate sectoral transmission channel. Localized real estate booms raise demand for construction labor, cement, steel, architectural services, interior goods, transport and municipal infrastructure. This can temporarily increase employment and GDP growth. However, if the boom is driven by speculative valuation rather than fundamental demand, a correction can rapidly reduce construction employment, contractor liquidity and supplier revenues. The result is a sectoral employment shock that feeds into household consumption. This is particularly important for China, India, Egypt, Ethiopia, Saudi Arabia and the UAE, where construction and urban infrastructure projects have broad employment and supply-chain effects. The FEVD results in the document are consistent with this mechanism because macro-stability variance increasingly reflects credit and balance-sheet channels over longer horizons. A construction-led boom therefore becomes dangerous when it is financed by short-term debt, land speculation or unrealistic expectations about future demand.

The banking sector transmits property shocks beyond households. Real estate serves as collateral for mortgages, developer loans, SME lending, commercial property finance and sometimes informal guarantees. When prices rise, collateral values improve and banks may expand lending across sectors. When prices fall, collateral quality deteriorates and banks may reduce credit even to firms not directly involved in real estate. This explains the crowding-in versus crowding-out debate. A real estate boom may crowd in lending by increasing bank net worth, but it may also crowd out productive investment if banks prefer property-backed lending to manufacturing or technology finance. The evidence in this document leans toward a conditional interpretation: real estate can crowd in credit during early expansion, but excessive bubble pressure later crowds out productive credit and magnifies financial fragility. This position is supported by recent studies emphasizing bank-credit moderation of real estate bubble risk and local-government debt vulnerability (Gong et al., 2025; Nguyen, 2025). The manufacturing sector is affected through both demand and credit channels. If households reduce spending after a property correction, manufacturers of consumer durables, home appliances, furniture, vehicles and building materials lose demand. If banks simultaneously tighten lending, firms face higher working-capital constraints and may delay investment. In BRICS Plus economies seeking industrial upgrading, this is a serious policy concern. An urban real estate boom can attract liquidity away from productive capital formation if returns to land and speculative property appear higher than returns to manufacturing. This form of misallocation may not appear immediately in GDP data, but it weakens long-run productivity. Recent BRICS financial connectedness studies show that macro-financial shocks can transmit across sectors and economies through capital markets and sentiment (Su & Chen, 2024; Balcilar et al., 2023). The implication is that housing-market surveillance should be linked to industrial policy and credit-allocation monitoring, not

handled only by housing ministries. The service sector receives mixed effects. Hospitality, retail, logistics, finance and professional services may benefit during property booms, especially in global-city markets such as Dubai, Mumbai, Shanghai and Sao Paulo. Rising asset values can increase spending on lifestyle services, legal services, brokerage, design and tourism. However, the same boom can raise commercial rents and operating costs for small businesses. Once a correction begins, property-linked services contract quickly. This creates volatility in urban employment and household incomes. The UAE case is particularly relevant because property, tourism, finance and migration are closely connected. Egypt and Saudi Arabia also show service-sector linkages through urban development and hospitality investment. The main policy lesson is that a property boom should not be interpreted as durable service-sector strengthening unless it is supported by sustainable household income growth and productive business formation.

The fiscal channel is another route through which localized bubbles threaten macroeconomic stability. Governments may become dependent on land sales, stamp duties, development charges, property taxes and construction-linked revenues during boom periods. If these revenues are treated as permanent, fiscal plans become procyclical. When the bubble cools, revenue falls just as social and financial stabilization needs increase. This channel is especially important in economies where urban development is linked to public infrastructure finance. China's local-government finance dynamics illustrate the danger, but variants of the same mechanism can appear in Saudi urban projects, Egyptian urban expansion, Indian state-level development charges and Brazilian municipal property revenue. The document therefore recommends cyclically adjusted treatment of land and property-related fiscal receipts. Macro-financial policy should not be separated from fiscal planning because public budgets can amplify or dampen housing-cycle shocks. The external sector also matters. Real estate bubbles can attract foreign capital during booms and trigger sudden outflows during corrections. This is visible in international property hubs but also relevant for commodity exporters whose liquidity cycles affect domestic asset prices. Foreign inflows can support construction and exchange-rate stability in the short run, but they may increase vulnerability if they fund speculative property rather than productive investment. The FX reserve model in the document captures this possibility by treating reserve stability as a dependent variable. A real estate shock can affect reserves through capital-flow reversals, import demand for construction materials and confidence effects. Recent IMF and OECD policy reports emphasize that property-market shocks can interact with financial conditions, cross-border capital and macro-financial policy (Department, 2025; Roulet, 2024). For BRICS Plus, this channel is important because the bloc combines capital exporters, capital importers, commodity producers and global property hubs.

The welfare interpretation is therefore broader than a standard macroeconomic coefficient. A localized real estate bubble affects the distribution of wealth, the cost of living, the quality of credit allocation, job security, fiscal stability and intergenerational mobility. Young households are particularly exposed because rising property prices delay ownership and increase rent burdens. Older homeowners may benefit during booms but suffer if corrections reduce retirement wealth. Informal-sector workers may be affected through construction and urban service employment without appearing clearly in formal credit data. These dynamics explain why the study's research questions focus on both macroeconomic stability and aggregate household consumption. The two outcomes are linked, but they are not identical. A country may maintain GDP growth while household welfare weakens through affordability stress and credit tightening.

5.3 Findings on the Empirical Tests

Based on the multi-layered econometric architecture spanning GSADF bubble detection, DSDPM, QQ regressions, and LP the empirical verdict on localized real estate shocks within the BRICS Plus bloc is unequivocal. The collective tests definitively reject the assumption that housing speculation acts as a nonthreatening or purely localized wealth generator. Instead, the results confirm that unmitigated real estate bubbles function to constitute systemic macro-financial risks capable of undermining price stability, amplifying business-cycle fluctuations, weakening external-sector resilience, reducing household welfare, and transmitting instability across national borders.

On Macroeconomic Amplification (GDP Volatility): The evidence indicates that real estate bubbles function as a significant source of structural inflationary pressure. As speculative activity drives housing prices away from their underlying economic fundamentals, rising property values increase construction costs, elevate rental prices, and generate broader cost-push pressures that gradually transmit into the general consumer price level. Consequently, housing market exuberance emerges not simply as an asset-market phenomenon but as an important contributor to persistent inflationary dynamics within the broader economy. The results further reveal that speculative housing cycles intensify macroeconomic volatility by embedding procyclical dynamics within national output growth. During boom periods, rapid credit expansion and excessive investment in construction activities generate unsustainable increases in aggregate demand and output. However, these gains prove temporary, as the eventual correction of inflated property values triggers sharp contractions in investment, employment, and economic activity. This boom-bust pattern contributes significantly to GDP volatility and heightens the vulnerability of economies to cyclical downturns.

On External Vulnerability (FX Reserves): The analysis also shows that housing bubbles erode external-sector stability by placing considerable pressure on foreign exchange reserves. During expansionary phases, elevated construction activity stimulates imports of building materials, capital equipment, and intermediate inputs, thereby widening current-account imbalances. When speculative bubbles eventually burst, deteriorating investor confidence often accelerates capital outflows and exchange-rate depreciation, forcing monetary authorities to utilize foreign exchange reserves to stabilize domestic currencies and preserve financial-market confidence. As a result, localized real estate excesses can evolve into broader balance-of-payments and external-financing challenges.

On Household Welfare (Consumption): From a welfare perspective, the findings suggest that extreme housing speculation imposes substantial costs on households, particularly those facing credit constraints and limited asset ownership. Rapid increases in housing prices reduce affordability, increase household indebtedness, and divert financial resources away from productive consumption expenditures. The resulting crowding-out effect suppresses discretionary spending and weakens household welfare, with the adverse consequences being most pronounced among lower-income and financially vulnerable groups. Consequently, housing bubbles operate as a regressive mechanism that exacerbates economic inequality and constrains consumption-led growth.

On Regional Contagion (Cross-Border Spillovers): The study confirms that localized housing shocks possess significant cross-border dimensions. Owing to extensive trade relationships, financial integration, investment linkages, and migration networks within the BRICS Plus bloc, property-market disturbances in one economy are readily transmitted to others. The empirical

evidence reveals that housing-market stress in major economies generates spillover effects that propagate inflationary pressures, output instability, and reserve depletion across interconnected markets. These findings underscore the existence of strong macro-financial contagion mechanisms and highlight the necessity of coordinated regional policy responses to mitigate systemic risks arising from real estate market excesses. Taken together, the results establish that localized real estate bubbles are not isolated asset-price anomalies but powerful macro-financial shocks with far-reaching implications for inflation, economic stability, external resilience, household welfare, and regional financial interconnectedness. The evidence therefore supports the need for proactive macroprudential frameworks capable of identifying, containing, and mitigating speculative housing excesses before they evolve into broader systemic crises.

5.4 Strategic Policy Implications

The econometric findings expose fundamental flaws in relying solely on traditional monetary policy to manage real estate cycles. To safeguard long-term socioeconomic stability, BRICS Plus policymakers must radically pivot their regulatory frameworks. The empirical evidence mandates the following policy interventions:

There is need to shift from reactive monetary to proactive macro-financial policy. Central banks must abandon the practice of using lagging, discretionary interest rate hikes to cool asset markets. Broad interest rate adjustments act as a blunt instrument that penalizes the entire productive economy. Instead, financial authorities must implement automated, threshold-based macro-financial credit frameworks. By utilizing real-time early warning anchors (such as a 95% GSADF critical threshold), regulators should automatically trigger localized asset-side restrictions, specifically tightening Loan-to-Value (LTV) and Debt-to-Income (DTI) ceilings to neutralize speculative momentum at the source. There is need to Establish Coordinated, Bloc-Wide Regulatory Frameworks. Given that the Dynamic Spatial Durbin models prove nearly half of a nation's macro-financial volatility is imported from regional peers, central banks can no longer evaluate real estate risks purely within sovereign borders. The BRICS Plus alliance must establish a synchronized regional credit control framework. Failing to coordinate macro-financial interventions guarantees that asset toxicity in a major financial node will systematically undermine purchasing power and financial stability across the entire economic neighborhood. BRICS plus governments should Implement Bespoke, Archetype-Specific Defenses. The variance decompositions prove that a uniform, one-size-fits-all regulation will fail across a bloc as diverse as the BRICS Plus. Interventions must be tailored to specific domestic vulnerabilities: Financialized Hubs (e.g., China, UAE) must focus strictly on capping consumption-to-wealth elasticity and managing affluent collateral cycles; Bank-Dependent Nodes (e.g., Russia, Egypt) should prioritize preventative institutional banking capital inoculation to prevent the accumulation of non-performing loans (NPLs) and commercial credit freezes; FX-Constrained Markets (e.g., Ethiopia, Iran) should tightly integrate real estate monitoring with capital flow management measures to prevent property distress from triggering systemic currency crises and capital flight.

The governments and policy makers should do well to target the Transition Phase, Not Just the Boom. The Markov-switching robustness checks prove profound non-linear regime dependence: the destructive macroeconomic scarring during a housing bust is up to 2.4 times larger than the temporary wealth effects generated during a boom. Therefore, policy must disproportionately focus on engineering a soft landing. Regulators must aggressively constrain commercial bank exposure and build countercyclical capital buffers before the market transitions from expansion to correction, thereby preventing the destruction of aggregate household demand.

5.5 Early Warning Interpretations

The empirical results can be translated into an early warning framework for BRICS Plus policymakers. The first warning layer is valuation explosiveness. GSADF signals based on price-to-rent and price-to-income ratios should be monitored quarterly at national and major-city levels. A one-quarter signal should not automatically trigger a policy response because real estate data are noisy. However, repeated explosive signals across several quarters, especially when supported by rising credit gaps and worsening affordability, should activate supervisory review. This approach prevents the common policy mistake of waiting for a national housing crisis when the evidence first appears in specific cities. It also respects the localized nature of the study's argument. A Dubai, Shanghai, Mumbai, Riyadh or Cairo signal may be macro-economically relevant even when national averages remain calm. The second warning layer is credit intensity. Bubble pressure becomes more dangerous when mortgage-to-GDP, household debt-to-GDP or developer credit grows faster than income. The study's local-projection robustness checks show that the bubble-credit interaction amplifies consumption losses over future horizons. Policy should therefore distinguish between a price boom financed by rising income and a price boom financed by leverage. Loan-to-value limits, debt-service-to-income caps, countercyclical capital buffers and developer leverage rules should be tightened when explosive price signals coincide with credit acceleration. These tools should be city-sensitive where feasible. A national tightening may be too blunt if the bubble is concentrated in a few metropolitan markets, but city-level macro-financial calibration can reduce speculative pressure without suppressing productive credit elsewhere.

The third warning layer is bank concentration. Supervisors should track the share of bank assets exposed to mortgages, developers, construction firms, land collateral and property-backed SME lending. The analysis shows that the banking balance-sheet channel is a powerful transmitter from localized bubbles to macroeconomic stability. A bank with concentrated exposure to a booming city may be systemically relevant even if it appears well capitalized under normal conditions. Stress tests should therefore include city-level property-price declines, developer default scenarios and collateral haircut simulations. For BRICS Plus economies with weaker data, supervisors can begin with credit registry analysis, bank loan classification and collateral composition surveys. The key principle is that the property-market shock should be modeled not only as a fall in house prices but as deterioration in collateral quality and credit supply. The fourth warning layer is affordability pressure. Price-to-income and rent-to-income ratios should be treated as macroeconomic indicators because they influence household consumption directly. A city can experience bubble risk even without high mortgage leverage if rents rise quickly and reduce disposable income. This is especially relevant for Egypt, Ethiopia, India and parts of Brazil and South Africa, where household budgets are sensitive to food, transport and housing costs. Housing affordability dashboards should be disaggregated by income group, tenure status, age and city. Policymakers should not assume that rising property prices automatically indicate prosperity. In a distributional framework, rising values can represent higher welfare for incumbent owners and lower welfare for renters or new entrants. This is why the QQ regression component is valuable for policy communication. The fifth warning layer is external-financing exposure. In markets with significant foreign property investment, capital-flow indicators should be integrated into housing surveillance. The UAE is the clearest case, but Saudi Arabia, Brazil, South Africa and India also experience cross-border investor sentiment effects. A sudden shift in global liquidity, oil prices, and geopolitical risk or exchange-rate expectations can affect real estate prices and transaction volumes. The study's W-TVP-VAR results show that short-run connectedness is stronger during global liquidity shocks. Policymakers should therefore monitor foreign purchases, expatriate demand, property-linked capital inflows and currency mismatches. Where data privacy

or market structure makes direct measurement difficult, transaction-value monitoring and real estate brokerage surveys can provide useful early signals. The sixth warning layer is fiscal exposure. Local and national governments should estimate how much revenue depends on land sales, property transfers, construction permits, development charges and real-estate-related corporate taxes. During booms, these revenues should be partly saved or treated as cyclical rather than permanent. During corrections, fiscal buffers can support households and prevent excessive cuts to infrastructure or social spending. The study's spatial results imply that a localized bubble can affect regions through fiscal linkages as well as financial linkages. If a city relies on property revenues for infrastructure debt service, a correction can become a municipal finance problem. BRICS Plus policy coordination should therefore include fiscal-risk templates for property-dependent urban governments. A practical early warning dashboard would combine four signal groups: valuation, leverage, balance-sheet exposure and consumption vulnerability. Valuation would include GSADF statistics, PTR and PTI ratios. Leverage would include household debt, mortgage growth, credit gaps and developer borrowing. Balance-sheet exposure would include NPL ratios, bank property concentration and collateral values. Consumption vulnerability would include rent burden, durable-goods spending, consumer confidence and income-group consumption indicators. A red alert would require at least three of the four groups to deteriorate simultaneously. This reduces false alarms while still identifying dangerous episodes early. The dashboard should produce both national and city-level risk scores. Policy simulation also suggests that the timing of intervention matters. If authorities tighten only after the bubble has burst, they may intensify the downturn by restricting credit when households and firms are already vulnerable. If they tighten too early and too broadly, they may suppress legitimate housing supply and productive investment. The best approach is graduated intervention. Initial GSADF signals should trigger data verification and supervisory attention. Repeated signals with credit acceleration should trigger borrower-based tools. Signals combined with bank concentration should trigger capital and provisioning measures. Signals combined with consumption weakness should trigger targeted affordability and social-protection responses. This sequencing turns the empirical model into a policy decision tree.

For BRICS Plus as a bloc, the policy simulation points toward a shared real estate risk observatory. Such an observatory would not replace national regulators, but it would harmonize data definitions and allow comparative monitoring. It could publish quarterly indicators on real house prices, PTR, PTI, mortgage growth, developer leverage, NPLs and affordability for major urban centers. This would help identify whether property pressure is isolated, regional or bloc-wide. It would also improve research because current data gaps limit high-frequency city-level analysis in several economies. The BRICS Plus expansion makes this especially important because the bloc now includes major capital exporters, global property hubs, populous emerging markets and economies with thinner formal data. The policy interpretation must finally recognize political economy. Real estate booms are often popular because they create visible wealth, construction jobs and fiscal revenues. However, the same booms can generate hidden vulnerabilities. Policymakers may resist early intervention because bubbles are difficult to prove while they are expanding. The GSADF method helps by providing statistical date-stamping of explosive behavior, but technical evidence still needs institutional credibility. Central banks, housing ministries, statistical agencies and financial supervisors should therefore agree in advance on indicators and response thresholds. This reduces discretionary delay and makes real estate risk governance more transparent. The document's methodological contribution is not only the use of advanced models, but the translation of those models into practical surveillance logic.

Central banks should integrate property-price-to-rent and price-to-income GSADF signals into macroprudential dashboards. Second, bank supervisors should track concentration of lending to developers, construction firms and property-backed household credit. Third, governments should avoid fiscal dependence on land and property transaction revenues during booms. Fourth, housing ministries should strengthen supply-side responses, planning transparency and rental-market data. Fifth, BRICS Plus institutions should develop a shared real estate risk observatory because cross-country spillovers are meaningful. Such an observatory would harmonize city-level housing indices, mortgage indicators, rental data, developer leverage and household debt metrics. Loan-to-value ratios, debt-service-to-income limits, dynamic provisioning and sectoral capital buffers should tighten during explosive property-price episodes and relax only when affordability and credit conditions normalize. However, these tools must be adapted to informal and cash-based markets. Where mortgages are not the primary channel, policy should monitor developer leverage, presale financing, land auctions, foreign-buyer demand and construction-sector bank exposure. For Gulf and frontier markets, capital-flow monitoring and anti-speculative transaction rules may be more relevant than conventional mortgage caps. Localized real estate bubbles are systemic when they become collateralized, financialized and spatially connected. A price boom in a single city is not automatically a macroeconomic risk. It becomes a macroeconomic risk when banks lend against inflated values, households consume out of perceived wealth, developers expand leverage, investors treat property as a speculative asset, and foreign capital moves in and out rapidly. The BRICS Plus bloc contains enough financial diversity that one policy template will not work, but the early-warning logic is common: detect explosive valuation, map the channel, test spillovers and apply targeted macro-financial response before the bubble becomes a consumption and stability crisis. The significant spatial autoregressive parameters and cross-border bubble spillovers documented in the Spatial Durbin estimates demand a fundamental shift from purely isolationist national monetary policies to a highly coordinated, bloc-wide macro-financial framework within the BRICS Plus alliance. Since asset bubbles in one anchor economy actively export inflation and output volatility to its neighbors, central banks can no longer evaluate domestic housing risks without integrating a formalized regional spillover tracking index. To counter these cross-border externalities, the alliance must establish a synchronized macroeconomic surveillance framework that standardizes loan-to-value and debt-to-income ceilings across integrated trade corridors. Furthermore, because spatial real estate spillovers systematically deplete the foreign exchange reserves of neighboring states, a joint emergency liquidity facility or local-currency swap network should be formalized to buffer vulnerable central banks against real estate-induced capital flight. This institutional framework will prevent the toxic transmission of property shocks through the trade-financial weight matrix, ensuring that localized financial stress does not trigger a cascading currency crisis across the geographic network. Implementing countercyclical capital buffers that explicitly adjust for regional asset price acceleration represents an essential defense mechanism against these pervasive trans-boundary distortions. There is need to ease demand destruction and asymmetric welfare losses. The local projection impulse responses show a severe, long-term contraction in household final consumption per capita following property market distress, which necessitates the deployment of targeted countercyclical fiscal cushions. Since real estate collapses systematically crowd out discretionary household spending for up to twenty quarters, fiscal authorities must design responsive safety nets, such as temporary property tax reliefs and targeted consumer credit holidays, to sustain baseline purchasing power. This fiscal intervention is especially critical given the QQ evidence, which reveals that real estate shocks deal their most catastrophic, welfare-diminishing blows precisely when underlying consumer demand is already structurally

weak. To prevent vulnerable populations from falling into a permanent consumption trap during macro-regimes of low growth, macro-financial tools must be heavily progressive, imposing stricter borrowing limits on speculative luxury properties while ring-fencing affordable housing segments from credit contraction. Central banks should also adjust their inflation-targeting Taylor rules to react systematically to asset price deviations, thereby curbing speculative bubbles before they can unleash structural price spikes and subsequent demand destruction. Policymakers can further protect household balance sheets by subsidizing long-term, fixed-rate mortgage products, reducing consumer exposure to sudden interest rate shocks during monetary tightening cycles. By proactively shielding aggregate household demand from property-induced vulnerabilities, governments can effectively break the destructive cyclical link between collapsing real estate markets and broader economic recessions. The profound structural divergence revealed by the country-level variance decompositions underscores that a rigid, one-size-fits-all regulatory mandate is structurally flawed and will inevitably fail within the expanded BRICS Plus bloc. For advanced, deeply financialized real estate ecosystems like China and the United Arab Emirates, where the collateral and wealth effect channels dominate shock transmission, policy must prioritize strict asset-side regulations. These specific nations should institutionalize dynamic, price-contingent loan-to-value caps and impose progressive capital gains taxes on short-term property flipping to decouple household consumption from volatile real estate market valuations. Conversely, in institutional environments like Russia and Egypt, where real estate distress transmits overwhelmingly through the bank balance sheet channel, the immediate policy focus must center on bank-side capital preservation. Financial regulators in these economies need to enforce stringent asset-quality reviews, mandate higher forward-looking provisioning for real estate loans, and build robust secondary markets for non-performing loans to isolate toxic property debts before they paralyze commercial lending. A completely distinct approach is mandated for frontier and highly vulnerable contexts like Ethiopia and Iran, where real estate speculation functions primarily as an alternative hedge against currency depreciation and systemic anxiety. In these heavily sanctioned or capital-scarce nations, where the foreign exchange and confidence channel dominates transmission, macro-financial policy must be integrated directly with capital control frameworks and domestic financial deepening initiatives. Policymakers in these frontier zones should create stable, inflation-indexed alternative financial instruments to absorb excess domestic liquidity, safely redirecting private savings away from speculative property markets into productive infrastructure sectors. Meanwhile, diversified giants like Brazil and South Africa, which exhibit a highly balanced distribution across all transmission channels, must deploy holistic, multi-pronged macro-financial toolkits that monitor credit, banking capital and wealth effects simultaneously. Finally, the historical synchronization and subsequent structural divergence tracked by the GSADF bubble pressure index emphasize the absolute necessity of dynamic, time-varying policy implementation. The realization that housing bubbles can rapidly transition from highly localized spikes into globally synchronized crises, as seen during the 2020-2022 pandemic shock, requires central banks to develop early-warning systems based on right-tailed explosive autoregressive algorithms. When these continuous bubble pressure indices cross predetermined critical statistical thresholds, macro-financial tightening measures should trigger automatically, bypassing political inertia and administrative delays. During periods of late-horizon divergence, such as the 2023-2025 cycle, where certain hubs like the UAE and Egypt remained overheated despite global rate hikes, local authorities must decouple their macro-financial stance from global monetary trends. These persistent, late-stage bubble regimes require localized, aggressive credit tightening and macro-financial surcharges even if the broader domestic economy is facing stagnation. Setting up these automated, frequency-specific

regulatory triggers will systematically dampen the amplitude of speculative property cycles across the entire timeline. In conclusion, by harmonizing cross-border spatial coordination with hyper-targeted, country-specific channel interventions, the expanded BRICS Plus alliance can effectively neutralize real estate bubbles, robustly securing long-term macroeconomic stability and collective household welfare.

6. CONCLUSION

This study evaluated the transmission channels through which localized real estate bubbles threaten broad macroeconomic stability and aggregate household consumption in BRICS Plus economies. It retained the specified research questions and objectives, applied an expanded 11-country BRICS Plus frame and used a harmonized quarterly panel from 1999Q1 to 2025Q4. The empirical design combined GSADF bubble detection, Wavelet-TVP-VAR connectedness, dynamic spatial Durbin panel estimation, QQ regression, interacted local projections and Markov-switching robustness checks. The approach was necessary because localized bubbles are nonlinear, time-varying, spatially connected and regime-dependent. The first key finding is that multiple localized explosive bubble episodes can be date-stamped across BRICS Plus economies. The episodes are not uniform. China and the UAE show persistent and internationally connected cycles; India, Brazil and South Africa show recurring credit and affordability cycles; Saudi Arabia and Iran show property cycles linked to energy liquidity, reform and inflation hedging; Egypt, Ethiopia and Indonesia show urbanization and macroeconomic transition effects. This confirms that localized housing risk should be monitored at the city and corridor levels rather than only through national averages. The second key finding is that localized bubbles affect macroeconomic stability through inflation, GDP volatility and foreign exchange reserves. Bubble pressure raises inflation and GDP volatility while reducing reserve stability, especially when combined with credit gaps and banking stress. This means that a real estate bubble can become a macroeconomic shock even before a national banking crisis occurs. The third key finding is that household consumption is depressed through wealth, collateral and balance-sheet channels, with the collateral channel providing the strongest average contribution. Consumption effects are not immediate; they build over several quarters as households, banks and developers adjust expectations and balance sheets. The fourth key finding is that spatial spillovers matter. A bubble in one BRICS Plus economy can affect others through trade, financial exposure, migration, commodity demand, and investor sentiment and currency pressure. China, the UAE and Saudi Arabia appear as important transmitters under the reconstructed weight matrix, while South Africa, Ethiopia, Egypt and Indonesia are more often receivers depending on the channel. The fifth key finding is that effects are asymmetric. Upper-quantile real estate bubble shocks have the strongest negative effects on lower-quantile consumption growth, meaning vulnerable households and weak consumption states bear disproportionate costs. The study has limitations. First, public data coverage is uneven, especially for city-level housing prices, rents, incomes and quarterly mortgage data in some expanded BRICS Plus members. Second, the harmonized bubble index uses standardized proxies where direct metropolitan data are incomplete. Third, the spatial weight matrix is necessarily a model-based approximation of economic linkage rather than a direct measure of all bilateral exposure. Fourth, informal credit and cash-based property purchases are difficult to measure and may understate non-bank channels in some economies. Future research should build a true city-level BRICS Plus real estate database with quarterly price, rent, income, vacancy, transaction, mortgage and developer-finance indicators. Researchers should also integrate household survey microdata to test consumption heterogeneity directly by tenure status, income group, debt position and wealth portfolio. A further

extension would combine bank-level supervisory data with property-sector exposure to estimate direct stress-test losses. Another important direction is climate and infrastructure risk: coastal flooding, heat stress, water scarcity and infrastructure deficits may reshape property valuations and interact with bubble dynamics in cities such as Dubai, Mumbai, Shanghai, Cairo and Lagos-linked African corridors. The central conclusion is that localized real estate bubbles in BRICS Plus economies should be treated as early warning signals of possible macro-financial instability. Their threat depends not merely on price appreciation, but on whether appreciation is explosive relative to rents and incomes, whether it expands collateral and bank credit, whether it strengthens household consumption beyond sustainable income, whether it weakens bank balance sheets during correction and whether it spills across economic linkages. A policy framework that combines GSADF detection, credit-channel monitoring, bank exposure analysis, spatial spillover surveillance and distribution-sensitive consumption assessment will be more effective than one that waits for national housing indices to decline.

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