Research Article

Are We in a Housing Bubble? Empirical Evidence From Portugal

Antonio M. Cunha[1]

1. CEOS.PP - ISCAP, Universidade do Porto, Portugal

This paper investigates whether housing price bubbles emerged in Portugal's two major metropolitan areas — Lisbon and Porto — and whether price pressures in central municipalities have spilled over into neighboring municipalities.

We employ a quantitative approach based on the present value model, testing three hypotheses regarding affordability, speculative behavior, and spatial contagion. Affordability was analyzed using the housing affordability index (price-to-income ratio). Housing bubbles were identified if rental yields fell below mortgage interest rates (measured with T-tests). The spillover effects were identified using the Granger causality test.

The results show a substantial decline in affordability in both metropolitan areas. Lisbon reached an affordability index of 24.5 years of net income to purchase a standard dwelling (up from 13.8 in 2017). Porto also sees a significant rise to 19.1 years. While no widespread housing bubble was detected, localized speculative signs appeared in Lisbon and Oeiras, where housing yields temporarily fell below mortgage rates. Both metropolitan areas have widespread spillover effects, especially in Porto's neighboring municipalities, showing that the affordability constraints depart from the central municipality but affect neighboring municipalities.

Policymakers can benefit from these conclusions to address the housing affordability problem with metropolitan-level policies instead of national-level or municipal-level policies, as they are being addressed today.

Correspondence: papers@team.qeios.com — Qeios will forward to the authors

 doi.org/10.32388/MRK5BU

1. Introduction

The persistent rise in housing prices across Europe's urban centers over the last decade has reignited concerns over affordability, spatial inequality, and speculative market dynamics. In Portugal, these dynamics have been particularly evident in the metropolitan areas of Lisbon and Porto, where double-digit growth in property values has outpaced wage increases and strained access to housing for middle-income households. Furthermore, housing affordability has emerged as a central policy issue, with rising price-to-income ratios pushing an increasing share of the population out of the formal housing market.

While housing price inflation can reflect improved fundamentals, such as rising incomes, demographic growth, or urban revitalization, it may also indicate the formation of price bubbles, particularly when housing yields decline, and purchase decisions become detached from rental value or income potential. In this context, affordability metrics and yield indicators are early warning signals of unsustainable market trajectories. Housing bubbles may emerge in such contexts, potentially leading to abrupt corrections and financial instability. Moreover, housing stress in core urban areas may not be confined locally: it can generate spillover effects, whereby neighboring municipalities are impacted by demand displacement and rising price pressures, a phenomenon still underexplored in the Portuguese context.

This study seeks to address two central research questions:

1. Did housing bubbles emerge in Lisbon and Porto between 2011 and 2022?
2. To what extent did central city price dynamics spill over into neighboring municipalities?

To answer these questions, we develop a quantitative framework based on the present value model of asset pricing and test four specific hypotheses related to affordability, price divergence, and spatial contagion. Our approach combines housing affordability indicators with T-tests and Granger causality analysis. The empirical analysis draws on quarterly data from Statistics Portugal (INE) and the European Central Bank (ECB).

This paper contributes to a growing literature on urban housing dynamics in Southern Europe by examining market fundamentals and spatial price transmission mechanisms. It applies these tools to Portugal's two largest metropolitan areas, using a dataset covering 2011 to 2022. The findings aim to support more informed policymaking on housing regulation, regional planning, and financial stability.

The structure of the paper is as follows: Section 2 reviews the relevant literature; Section 3 presents the methodology and data; Section 4 discusses the results; and Section 5 concludes.

2. Literature Review

2.1. Determinants of Housing Price Growth

Both demand-side and supply-side factors influence housing prices. Regarding demand, Égert and Mihaljek[1] highlight that income growth and interest rate reductions are key determinants of house price increases in OECD countries. Duca et al.[2] further reinforce the importance of monetary accommodation in promoting house price inflation through cheaper credit. On the supply side, Paciorek[3] finds that the housing supply is significantly less elastic in coastal metropolitan areas, where geographic and regulatory constraints reduce the capacity to respond to rising demand. This creates greater price volatility in high-demand locations. In the Portuguese context, Cunha and Lobão[4] demonstrate that Lisbon has considerably lower supply elasticity than Porto. Cunha and Lobão[5] extend this finding to other Iberian metropolitan areas, confirming that coastal municipalities —driven by tourism, foreign demand, and land scarcity—experience more persistent upward price trends. Conversely, interior municipalities exhibit greater supply flexibility, which moderates price dynamics. Glaeser et al.[6] also found that locations with lower elasticities to higher house price increases.

2.2. Housing Affordability and Bubble Indicators

Affordability is typically assessed using the price-to-income ratio, reflecting the years of income required to purchase a home[7]. Several authors suggest that housing price bubbles arise when asset prices deviate from fundamental values, driven by speculative behavior rather than economic fundamentals[8][9]. Key indicators of overvaluation include a rising price-to-income ratio and falling rental yields (annual rent divided by house price). In housing markets, bubbles can be fueled by excess liquidity, measured by monetary growth and low interest rates[10]. Stiglitz[8] defines a bubble as any price trajectory sustained not by fundamentals but by the belief that others will continue to pay more. Case and Shiller[9] modeled this phenomenon, arguing that falling yields suggest prices are driven by speculative expectations rather than rental market fundamentals. A sharp increase in the price-to-income ratio or a decline in yield indicates potential overheating. One frequently used market signal is comparing housing yield and the mortgage interest rate. If the yield falls below the borrowing cost, investors face negative leverage, meaning they accept a cash flow loss in the expectation of capital gains. This behavior is often interpreted as speculative and potentially unsustainable[11]. At the macro level, liquidity and credit

growth are also relevant. Alessi and Detken[12] propose that rapid expansions in credit and broad money are early warning indicators of housing bubbles. In Portugal, this was observed particularly after 2015, when interest rates reached historical lows and credit flows to households accelerated[13].

2.3. Spillover Effects and Regional Contagion

The spatial propagation of price dynamics is increasingly recognized as a crucial feature of real estate markets. Known as the spillover effect, this mechanism occurs when price pressures in core urban areas drive demand into neighboring municipalities, where housing is more affordable or available. This effect may be amplified by infrastructure developments, such as improved public transport or road networks[14]. Duca[15] and Paciorek[3] provide international evidence that metropolitan regions show intense and persistent spatial contagion, especially under supply constraints. In Portugal and Spain, Cunha and Lobão[5] confirm the existence of spillovers from central metropolitan to peripheral metropolitan areas. This transmission is more intense in locations with low supply elasticity, confirming the interaction between regional market structures and spatial price diffusion. Price surges in city centers may increase demand in nearby municipalities, resulting in spatial contagion[16].

2.4. Synthesis and Research Gap

The reviewed literature links demand drivers, supply constraints, price overvaluation, and spatial contagion. However, few empirical studies analyze these dimensions jointly, particularly in Southern European housing markets. Most research isolates affordability, bubble formation, or spillover dynamics without capturing their interdependence. We aim to fill this gap by combining affordability metrics, bubble detection indicators, and causal spillover testing in a single framework.

3. Methodology

We employ a quantitative methodology to assess whether housing price bubbles emerged between 2011 and 2022 in the Lisbon and Porto Metropolitan Areas (LMA and PMA) and investigate spatial spillover effects from central municipalities to neighboring municipalities.

3.1. Analytical Framework and Hypotheses

Our analytical model, derived from the literature review, is grounded in the present value model of asset pricing, which assumes that housing prices reflect the discounted value of future cash flow (rents). Based

on this framework, we test three hypotheses:

- H1: Housing affordability decreased significantly between 2011 and 2022.
- H2: There is a housing bubble in Lisbon and Porto.
- H3: Price dynamics in central municipalities spill over to neighboring municipalities.

3.2. Measurement and Methods

- H1: Housing Affordability Index.

This indicator measures how many years of income are needed to purchase a 100 m^2 dwelling, assuming 14 salary payments per year:

$$\mathbf{Affordability\ Index}_{i,t} = \mathbf{House\ Price}_{i,t} / \mathbf{Annual\ Salaries}_{i,t} \quad (1)$$

Higher values indicate lower affordability. We measure the evolution of the affordability index over time and across municipalities.

- H2: Bubble Detection Rule.

A speculative condition is assumed if:

$$\mathbf{Yield}_{i,t} < \mathbf{Mortgage\ Rate}_{i,t} \quad (2)$$

Where the yield expresses the expected return on investment in housing as a rental asset and is calculated as:

$$\mathbf{Yield}_{i,t} = \mathbf{Annual\ Rent}_{i,t} / \mathbf{House\ Price}_{i,t} \quad (3)$$

Where *i* is the city and *t* the quarter.

Suppose the rental yield (expected return) is lower than the mortgage (cost of capital). In that case, the rental return does not cover financing costs, suggesting that investment decisions rely solely on capital appreciation expectations. We apply T-tests for unequal variances comparing housing yields and average mortgage rates. A statistically significant yield lower than the mortgage rate suggests a bubble condition.

- H3: Spillover effect.

The analysis checks whether central city price movements preceded (and predict) those in peripheral municipalities:

$$\mathbf{House\ Price\ Neighboring}_t = \mathbf{House\ Price\ Central}_{t-k} + \varepsilon_t \quad (4)$$

Where *k* is the optimal lag selected via the Akaike Information Criterion (AIC) for each pair of data series.

The data series are transformed through first differencing to become stationary. We conduct pairwise Granger causality tests using quarterly house price series. A statistically significant test will reject the hypothesis of no spillover effect if the p-value is not statistically significant.

3.3. Case Selection and Data Sources

We focus on eight municipalities with high population density and economic significance: Lisbon, Amadora, Almada, and Oeiras in the LMA; Porto, Vila Nova de Gaia, Matosinhos, and Maia in the PMA. The selection reflects areas with the strongest urban and suburban interaction within each metropolitan region (these are the adjacent municipalities to the metropolitan center with the most significant commuting populations). The dataset comprises quarterly data from Statistics Portugal (INE) and the European Central Bank (ECB), covering Q1 2011 to Q4 2022. The following variables were collected: Median housing sale prices (€/m^2), Median rental values (€/m^2/year), Average salaries (€/month), Mortgage interest rates (%).

4. Results and Discussion

This section presents empirical analysis results for the four tested hypotheses. The findings are structured by hypothesis and interpreted considering the theoretical framework and existing literature.

- H1 – Housing Affordability: The results of equation 1 are in Table 1 below.

Municipality	2017	2022	Δ (2017/22)	CAGR (%)
Lisbon	13.8	24.5	+10.7	12.2%
Oeiras	12.6	21.4	+8.8	11.2%
Almada	10.1	16.3	+6.2	10.1%
Amadora	9.8	15.1	+5.3	9.2%
Porto	11.9	19.1	+7.2	10.3%
Gaia	9.6	15.3	+5.7	9.8%
Matosinhos	10.7	17.9	+7.2	10.9%
Maia	8.3	13.2	+4.9	9.7%

Table 1. Housing Affordability Index (H1)

Notes: CAGR = Compound Annual Growth Rate.

The Housing Affordability Index rose substantially over the period. Lisbon index increased from 13.8 years of net income in 2017 to 24.5 years by 2022, and from 11.9 to 19.1 years in Porto. All municipalities under study exhibit a similar upward trend, with variations in intensity. This trend confirms H1, illustrating a sharp erosion in affordability. The gap between central and peripheral municipalities increased (except for Porto to Matosinhos), indicating that housing affordability constraints start from the metropolitan center municipality, but spread to neighboring municipalities. This aligns with the argument of affordability contagion and supports the relevance of spatial monitoring[3][16]. It also confirms that the municipalities with lower supply elasticity, Lisbon and Porto[5], are more prone to higher house price increases and affordability constraints.

- H2 – Evidence of Bubbles: The results of equation 2 are in Table 2 below.

Municipality	Yield (%)	Mortgage (%)	Yield < Mortgage?	Bubble?	
Lisbon	2.48	2.63	✔**	Yes	
Oeiras	2.51	2.63	✔**	Yes	
Almada	2.75	2.63	✘*	No	
Amadora	2.82	2.63	✘*	No	
Porto	2.73	2.63	✘*	No	
Gaia	2.70	2.63	✘*	No	
Matosinhos	2.68	2.63	✘*	No	
Maia	2.66	2.63	✘*	No	

Table 2. Rental Yield vs Mortgage Rate (T-Test Results, Q4 2022) (H2)

*Notes: The Yield < Mortgage columns show a ✔ if the municipality rental yield is lower than the mortgage rate. It also tests the difference in means of both series with the two-tailed unequal variance T-test, where **,* represents statistical significance at the 5% and 10% levels, respectively. Yield (%) is computed with equation 3.*

Yield-to-mortgage rate comparisons reveal a temporary bubble condition in Q4 2022 in Lisbon (2.48%) and Oeiras (2.51%), where yields fell below the average mortgage rate (2.63%). T-tests for these municipalities confirmed statistical significance ($p < 0.05$). In all other municipalities, yields remained above financing costs. Thus, H2 is only partially confirmed. While no systemic or prolonged bubble was detected, temporary mispricing signals emerged in selected markets, possibly reflecting speculative pressures or anticipation of future capital gains. These findings are consistent with Mayer[11], who argued that yield–interest gaps are helpful early indicators of speculative valuation.

- H3 – Spillover Effect: The results of equation 4 are in Table 3 below.

Central Municipality	Neighboring Municipality	F-statistic	Spillover?
Lisbon	Oeiras	6.38***	Yes
Lisbon	Almada	4.72**	Yes
Lisbon	Amadora	5.19***	Yes
Porto	Gaia	7.01***	Yes
Porto	Matosinhos	6.47***	Yes
Porto	Maia	2.04	No

Table 3. Granger Causality Results: Central vs Neighboring (H3)

*Notes: ***, **,* represent statistical significance at the 1% and 5%, and 10% levels, respectively.*

Granger causality tests confirmed that house price dynamics in central municipalities significantly influenced prices in neighboring municipalities. The effect was more significant in the PMA (from Porto to Gaia and Matosinhos) and less significant in the LMA, where geographic barriers such as the Tagus River and the larger dimension of the Lisbon municipality may have slowed the transmission. These results highlight the interplay between housing market fundamentals and spatial dynamics, confirming the findings of Cunha and Lobão[5].

While broad-based bubbles were not detected, the concentration of affordability constraints and speculative dynamics in central municipalities that spillover to neighboring municipalities remains a concern.

5. Conclusion

This study investigated the presence of real estate bubbles and spillover effects in Portugal's two main metropolitan areas between 2011 and 2022. It found increasing housing affordability constraints, particularly in Lisbon, and a strong interdependence between central and peripheral housing markets. Although no continuous and generalized bubbles were observed, signs of overvaluation emerged in 2022, particularly in Lisbon and Oeiras.

The results underscore the differences between metropolitan areas and municipalities regarding affordability and overvaluation. Nevertheless, price dynamics in central municipalities spill over to neighboring municipalities. This suggests that policymakers should design policy measures at the metropolitan area level instead of the national or municipal level to manage affordability and prevent market distortions.

This conclusion is particularly relevant because Portugal does not have metropolitan-level urban planning. Urban planning is conducted at the municipal level, and housing laws are implemented nationally, leaving metropolitan areas in a policy void. Without integrated planning, the spillover effects impact neighboring municipalities randomly and unplanned.

Future research could expand the geographical scope and analyze post-2022 developments, including the impact of falling interest rates.

Notes

International Conference on Organisational and Management Studies.

References

1. ^Égert B, Mihaljek D (2007). "Determinants of House Prices in Central and Eastern Europe." Comp Econ Stud. **49**(3):367–388. doi:10.1057/palgrave.ces.8100221.
2. ^Duca JV, Muellbauer J, Murphy A (2021). "What Drives House Price Cycles? International Experience and Policy Issues." J Econ Lit. **59**(3):773–864. doi:10.1257/jel.20201325.
3. a, b, cPaciorek A (2013). "Supply Constraints and Housing Market Dynamics." J Urban Econ. **77**:11–26. doi:10.1016/j.jue.2013.04.001.
4. ^Cunha AM, Lobão J (2021). "The Determinants of Real Estate Prices in a European Context: A Four-Level Analysis." J Eur Real Estate Res. **14**(3):331–348. doi:10.1108/JERER-10-2020-0053.
5. a, b, c, dCunha AM, Lobão J (2022). "House Price Dynamics in Iberian Metropolitan Statistical Areas: Slope Heterogeneity, Cross-Sectional Dependence and Elasticities." J Eur Real Estate Res. **15**(3):444–462. doi:10.1108/JERER-02-2022-0005.
6. ^Glaeser EL, Gyourko J, Saiz A (2008). "Housing Supply and Housing Bubbles." J Urban Econ. **64**(2):198–217. doi:10.1016/j.jue.2008.07.007.

7. ^Galster G, Lee KO (2021). "Housing Affordability: A Framing, Synthesis of Research and Policy, and Future Directions." Int J Urban Sci. **25**(sup1):7–58. doi:10.1080/12265934.2020.1713864.
8. a, bStiglitz JE (1990). "Symposium on Bubbles." J Econ Perspect. **4**(2):13–18. doi:10.1257/jep.4.2.13.
9. a, bCase KE, Shiller RJ (2003). "Is There a Bubble in the Housing Market?" Brookings Pap Econ Act. **2003**(2): 299–362. doi:10.1353/eca.2004.0004.
10. ^Ehrenbergerova D, Bajzik J, Havranek T (2023). "When Does Monetary Policy Sway House Prices? A Meta-Analysis." IMF Econ Rev. **71**(2):538–573. doi:10.1057/s41308-022-00185-5.
11. a, bMayer C (2011). "Housing Bubbles: A Survey." Annu Rev Econ. **3**(1):559–577. doi:10.1146/annurev.economics.012809.103822.
12. ^Alessi L, Detken C (2011). "Quasi Real Time Early Warning Indicators for Costly Asset Price Boom/Bust Cycles: A Role for Global Liquidity." Eur J Polit Econ. **27**(3):520–533. doi:10.1016/j.ejpoleco.2011.01.003.
13. ^Fanico MDCL (2009). Mercado imobiliário português: performance, ciclos e tendências [Portuguese Real Estate Market: Performance, Cycles and Trends]. ISCTE - Instituto Universitário de Lisboa (Portugal).
14. ^Januário JF, Costa Á, Cruz CO, Sarmento JM, e Sousa VF (2021). "Transport Infrastructure, Accessibility, and Spillover Effects: An Empirical Analysis of the Portuguese Real Estate Market from 2000 to 2018." Res Transp Econ. **90**:101130. doi:10.1016/j.retrec.2021.101130.
15. ^Duca JV (2020). "Making Sense of Increased Synchronization in Global House Prices." J Eur Real Estate Res. **13**(1):5–16. doi:10.1108/JERER-11-2019-0044.
16. a, bOoi JT, Le TT (2013). "The Spillover Effects of Infill Developments on Local Housing Prices." Reg Sci Urban Econ. **43**(6):850–861. doi:10.1016/j.regsciurbeco.2013.08.002.

Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.