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Housing affordability and housing costs

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Summary

This research investigates the evolution of housing accessibility across 32 European countries (2004–2024), examining how tenure regimes and income inequality shape economic resilience. Utilizing EU-SILC microdata and panel data econometric techniques, the study estimates the impact of housing structures on two key indicators: the Affordability Ratio and Residual Income. The findings identify a significant "Tenure Trap" within the rental sector, where housing tenure emerges as the primary predictor of economic vulnerability. This vulnerability is defined by the inability of households to cover basic needs due to the dual pressure of high cost-to-income ratios and depleted residual income.

Estimations show that housing tenure is the primary predictor of economic vulnerability, defined here as the consequence of high affordability ratios and low residual income levels that impede households from adequately covering their basic needs. European tenants face a structural penalty characterized by higher cost-to-income ratios and a systematic depletion of residual income compared to homeowners. This erosion of post-housing disposable income creates a "saving exhaustion" effect, making the accumulation of the capital necessary for a down-payment mathematically unfeasible for those in the lower income deciles.

This evidence suggests a profound lack of tenure neutrality, where renting acts as a barrier to entry rather than a flexible alternative. By identifying the determinants of these accessibility gaps, the study demonstrates how current housing structures ossify social inequality, effectively locking vulnerable populations into a cycle of permanent desavings and long-term financial immobility in a kind of Tenure Trap.

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A message from the authors: WORK IN PROGRESS. PLEASE, DO NO QUOTE IT.

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I. Introduction

1. Over the past decade, housing affordability has re-emerged at the centre of socio-political debate. The scale of current affordability pressures and the uncertainty surrounding the effectiveness of policy responses have contributed to the perception that the housing system is experiencing a structural shock with potentially long-lasting consequences for households, making housing affordability one of the most visible concerns across many advanced economies.

2. Evidence from the United Nations report on housing affordability in Europe (UNECE, 2025) suggests that these pressures are not confined to isolated local markets but instead reflect a widespread phenomenon across the regions, indicating that affordability constraints are particularly acute in urban areas. This pattern is consistent with the literature explaining the spatial concentration of population around specialised and higher-paying employment opportunities (Glaeser and Saiz, 2003), and contributing to the strong demand pressures in specific urban markets with competition for housing which drives residential prices upward and effectively displaces households with lower and medium-income brackets. As a consequence, many households are forced either to commute longer distances from more affordable areas or to migrate altogether (Lucas, 2012; Mattioli et al., 2017), developing a relocation process which reshapes the spatial distribution of households resulting in a more unequal distribution of income across urban space (Gyourko et al., 2013) particularly pronounced in the most expensive metropolitan areas. At the same time, cities continue to attract residents seeking better employment opportunities and higher-quality services, especially consumer services, further intensifying demand pressures in already constrained housing markets.

3. These dynamics ultimately produce two major outcomes. First, they weaken households' capacity to access and maintain adequate housing, a phenomenon described as the "new urban dimension of the affordability crisis" (Wetzstein, 2017: 3159; McKinsey Global Institute, 2014). Second, they lead to the displacement of middle- and lower-income households toward surrounding urban areas, a process widely referred to as the "suburbanisation of poverty" (Bailey and Minton, 2018; Kneebone and Garr, 2010). This process deepens spatial inequalities by concentrating lower-income households in peripheral locations while high-income groups remain in central, high-opportunity urban areas. As a result, both housing affordability constraints and socio-economic disparities become increasingly embedded in the spatial structure of cities.

4. To these urban dynamics must also be added the broader structural forces affecting income distribution in advanced economies (Saez and Zucman, 2016). As noted by Taltavull (2021), the intensification of globalisation processes has been associated with a generalised deterioration in income distribution (Williamson, 1997) and with growing pressures to enhance national economic competitiveness. These forces have contributed to increasing wage inequality (Helpman, 2016), exerting downward pressure on wages at the global level while simultaneously widening the dispersion of earnings. In many of the world's major cities, this has translated into declining real household incomes for a significant share of the population, directly affecting housing affordability, often before constraints appear in other areas of consumption.

5. Research examining housing affordability in the twenty-first century suggests that the magnitude of the problem was widely underestimated prior to the Global Financial Crisis (GFC) (Haffner and Hulse, 2019). Following the crisis, residential prices in many urban markets adjusted only partially to the decline in purchasing power associated with worsening income distribution. Consequently, affordability pressures have persisted even during periods of economic recovery, particularly in the most dynamic cities. In some cases, these pressures have produced increasingly extreme outcomes, including the expansion of informal housing arrangements which, in certain cities, accommodate between 20% and 40% of households and tend to be concentrated in lower-income areas (Liu et al., 2012; Lai et al., 2017).

6. These evidences reveal market dysfunction in the economic logic of urban housing. Unlike historical cycles where price signals typically incentivized a proportional supply-side expansion, the current period is defined by a significant inelasticity of residential response.

7. This failure of the housing market to respond to demand—a departure from historical equilibrium—would suggest structural constraints where the rental sector becomes a site of forced absorption. This lack of responsiveness would transform demand into ex-post affordability pressures, intensifying precariousness and resulting in broader unaffordability that further obstructs market access.

8. One explanation for these phenomena lies in the enduring legacy of the Great Financial Crisis (GFC). Over the past decade, property markets have faced tighter lending conditions and lower financing volumes, a consequence of financial sector adjustments following the crisis (Aalbers, 2008: 160–161). These constraints have limited the supply of new housing, as general information about starts confirms and reduced access to credit for many potential buyers. As a result, low- and middle-income households—who typically rely on financing to access homeownership—have increasingly turned to rental markets. The additional demand placed on the rental sector, combined with the structural dynamics described above, has intensified pressure in rental markets, a trend that has accelerated during the economic recovery following the GFC.

9. If it is true, what are the implications of the lack on affordability on the long term household well-being? The assumption of housing neutrality implies that housing costs do not substantially affect households' welfare, as they are offset by the consumption value of housing services¹. However, this perspective overlooks the fact that housing expenditures are often rigid and non-discretionary, limiting households' ability to adjust their consumption. As a result, high housing costs may reduce the resources available for other essential goods and services, thereby negatively affecting overall well-being and increasing the risk of poverty.

10. We hypothesize that a shortage of housing supply, reduced access to finance, and increasing demographic pressures (Lee, Kemp and Reina, 2022) have affected housing affordability through two main channels. First, these factors make initial entry into homeownership more difficult, particularly because of the challenges households face in accumulating the savings required for a down payment and the reduced availability of mortgage financing. As a result, many potential first-time buyers are forced to turn to the rental market as the only feasible way to secure housing. This shift concentrates households that would otherwise demand homeownership in the rental sector, increasing competition for available units and pushing rents upward (Angst, Rosen, De Gregorio and Painter, 2025). The second channel arises from the resulting increase in rental prices. Higher rents affect households that are already renting, as rental costs tend to rise significantly once lease contracts are renewed. This substantially increases housing expenditures and reduces overall affordability. It is important to note that this second channel primarily affects tenants rather than homeowners. Prospective buyers who lack access to mortgage financing are excluded from the ownership market. Conversely, those able to afford the initial down payment often benefit from favourable conditions, including lower debt-service-to-income ratios driven by historically low interest rates. This dynamic exacerbates market segmentation and concentrates affordability pressures and financial vulnerability disproportionately within the rental sector.

11. This situation represents a notable departure from previous evidence on housing affordability problems, which were traditionally associated with barriers to the initial entry into homeownership, particularly the difficulty of accumulating the savings required for a down payment. In the twenty-first century, however, affordability constraints increasingly arise after households have already secured housing—sometimes after many years of residential stability—that is, *ex post* to entering the housing market. These pressures primarily emerge through periodic rent adjustments in rental contracts, although they may also appear through increases in interest payments on variable-rate mortgages for homeowners. However, the latter effect tends to be more limited due to the relative stability and historically low levels of mortgage interest rates observed over long periods.

12. This dynamic exacerbates market segmentation, concentrating affordability pressures and vulnerability primarily within the rental sector. Such mechanisms represent a new dimension of the twenty-first-century housing crisis: the emergence of 'ex-post' affordability constraints, which increasingly burden middle-income households (Collinson, 2011).

13. The triggers of these two forms of affordability constraints—entry barriers and ex-post affordability pressures—are different in nature. This distinction highlights the multidimensional character of the housing affordability problem and helps explain why it manifests differently across cities with diverse institutional and economic characteristics. In particular, broader macroeconomic changes at the global level, such as rising income inequality, have been identified as important drivers of declining housing affordability (Lee,

¹ The assumption of housing neutrality implicit in standard income-based poverty measures well developed by Atkinson was critically challenged by Michael E. Stone, who argues that housing costs are non-discretionary and may significantly reduce households' residual income, thereby affecting their well-being and potentially pushing them into poverty (Stone, 1993; 2006).

Kempt and Reina, 2022). These structural factors may alter fundamental life-cycle decisions, generating potentially long-lasting social effects, including delayed household formation and postponed childbearing. By distinguishing between entry barriers and ex-post affordability pressures, we provide a dynamic, multidimensional framework for understanding lack of housing affordability and its effects. Empirically, this approach reveals that affordability vulnerabilities increasingly affect middle-income households and are concentrated in rental markets, offering a new perspective on the contemporary housing affordability crisis in the twenty-first century.

14. Understanding these dynamics is critical for two reasons. First, there is growing evidence that ex-post affordability pressures—problems that emerge after initial access to housing—can significantly influence households' financial well-being and their risk of falling into poverty. Second, the interaction between housing costs, household characteristics, and market conditions remains poorly understood in a European comparative context, leaving policymakers without clear guidance on which households are most vulnerable and under what circumstances.

15. By systematically testing housing cost-to-income and residual income indicators across Europe, this paper evaluates the housing-induced poverty theorem to challenge the neutrality of housing in poverty outcomes, demonstrating how the interplay between income distribution, tenure, and socioeconomic demand factors creates multidimensional affordability patterns that fundamentally dictate the efficacy of policy design and support allocation.

16. The analytical framework of this study is grounded in the assumption that housing has ceased to be a neutral factor in the architecture of urban poverty, becoming instead a critical determinant of economic exclusion. It is assumed, first, that traditional metrics based solely on cost-to-income ratios are insufficient to capture the complexity of this phenomenon, as they overlook the actual consumption capacity remaining after housing expenditures. Under this perspective, affordability is posited as a dynamic, "ex-post" constraint that does not merely impede market entry but systematically erodes the financial stability of households—particularly those whose position within the income distribution leaves them vulnerable to price volatility.

17. Furthermore, it is assumed that contemporary affordability pressures result from a structural mismatch where residential supply has failed to respond to shifting demand, thereby exacerbating vulnerability within the rental sector. This market inelasticity, coupled with the specific income constraints of diverse household cohorts, suggests that housing stress is not a transitory friction but a systemic failure acting as a catalyst for housing-induced poverty. The following hypotheses are established:

18. Hypothesis 1: The severity of housing unaffordability is fundamentally shaped by the household's position within the income distribution. Even if aggregate inequality (Gini) remains stable, the specific income constraints of lower and middle-income cohorts—when confronted with rigid housing markets—act as the primary driver of exclusion, determining whether a household can maintain sustainable market access.

19. Hypothesis 2: The residual income measure is expected to reveal "hidden" affordability gaps, demonstrating that for many households, the lack of accessibility is associated to a systemic erosion of the income remaining for essential non-housing needs.

20. Together, these hypotheses allow us to capture the dynamic and multidimensional nature of contemporary housing affordability and to identify which households are most vulnerable under different market conditions. To the best of our knowledge, this paper is the first to estimate the relationship between housing affordability and its effects on poverty across European countries.

21. The remainder of the paper is organised as follows. The next section reviews the relevant literature on housing affordability, urban spatial dynamics, and income inequality. Section 3 describes the data and methodology used in the empirical analysis. Section 4 presents the main empirical results. Finally, Section 5 discusses the implications of the findings and concludes.

II. Literature review

22. Housing affordability refers to situations in which households experience difficulties in covering their housing costs. It remains a central concern in urban economics and housing studies because of its implications for household welfare, social cohesion, and economic stability. At its core, housing affordability relates to a household's ability to allocate income to housing costs without compromising essential non housing consumption. Early conceptualizations—such as those by Stone (1993), Bramley (1990), and Hancock (1993)—emphasize that housing must meet basic needs without imposing undue financial burden.

23. One of the most widely adopted perspectives in the literature is the economic approach, which focuses on the quantification of affordability. Gan and Hill (2008) distinguish between “purchase affordability,” defined as the ability of households to obtain sufficient borrowed funds to buy a home, and “repayment affordability,” defined as the ability of households to meet the financial obligations associated with mortgage payments. More broadly, housing affordability must take into account the residual income remaining after housing costs have been paid and assess whether households still meet socially acceptable living standards (Hancock, 1993; Burke, 2004; Stone, 2009). When households are unable to retain sufficient residual income after paying for adequate housing, they may experience housing stress (Gabriel et al., 2005, p. 8). This concept has become increasingly widespread as a means of identifying poverty arising from the need to cover residential costs, including transitional housing poverty and initial poverty risk situations (Marks and Sedgwick, 2008).

24. Two broad approaches, then, have dominated the quantitative measurement of housing affordability. The 5 first, often termed the ratio approach, compares housing costs (such as mortgage payments or rents) to household income. The price to income ratio (PIR) and housing cost to income ratios are widely used in cross sectional and longitudinal analyses (Gan & Hill, 2008; Gabriel et al., 2005). Such measures are popular due to their simplicity and comparability across regions and time, and many national statistical agencies continue to report affordability in this manner. However, ratio-based indicators face well documented limitations: they largely ignore household heterogeneity, non-housing expenditure needs, and rapid changes in market conditions.

25. Maclennan and Williams (1990, p. 9) argue that affordability “has to do with securing a certain standard of housing (or different standards) at a price or rent which does not impose, in the eyes of a third party (usually the government), an excessive burden on household income.” Similarly, Bramley (1990, p. 16) specifies that households should be able to obtain housing that meets appropriate standards in terms of characteristics and size, while retaining sufficient net income to maintain an adequate standard of living without falling below the poverty line. As Hancock (1993, p. 129) notes, both definitions conceive housing consumption as essential for meeting a basic need, while also recognising the necessity of guaranteeing a minimum level of non-housing consumption.

26. Since early research, evidence established that standard ratio measures do not adequately capture the welfare effects of housing costs, a line of inquiry later formalized by Kutty (2005, 2008) through the *residual income* approach to the *housing-induced poverty* concept. The residual income approach evaluates whether households retain adequate income to support non housing needs after housing expenses are met (Stone, 1993; Kutty, 2005). This lineage traces back to the shelter poverty concept, which defines households as “shelter poor” when their housing costs leave insufficient residual income for basic non housing consumption. Empirical applications of residual income measures reveal affordability burdens that traditional ratios often underestimate, particularly for renters and vulnerable groups (Gabriel et al., 2005; Marks & Sedgwick, 2008).

27. The *housing induced poverty concept* (Kutty, 2005, 2007) measures affordability in terms of *residual income* after housing expenditures, thereby distinguishing between poverty arising from insufficient income and poverty triggered by housing costs, showing that housing costs can significantly diminish disposable income and increase the likelihood of falling into poverty. The concept captures the propensity of households to fall into poverty and deprivation as a result of high housing expenditures, so that a household is considered to experience housing-induced poverty when, after covering housing costs, its remaining income falls below two-thirds of the poverty line. This approach challenges the assumption of *housing neutrality*², showing that housing costs can significantly diminish disposable income and increase the likelihood of falling into poverty. This measure made it possible to distinguish whether a household is poor primarily due to insufficient income or as a consequence of the burden imposed by housing costs. The definition and formalization of the residual income approach and the concept of shelter poverty, Kutty demonstrated that housing costs can substantially reduce the resources available to households, altering their well-being and, in many cases, pushing them below accepted poverty thresholds (Kutty, 2005, 2008), providing a more accurate reflection of the real economic strain experienced by households.

28. The importance of housing costs in understanding the complexity of poverty has been widely acknowledged. As noted by Tunstall et al. (2013:2³), “*Not taking housing costs into account means a significant underestimate of the risk of poverty and material deprivation for workless households, minority ethnic groups, single people and renters.*” Their report—one of the relatively few studies explicitly examining the relationship between housing costs and poverty—highlights that low-income households and renters are particularly vulnerable to poverty once housing costs are taken into account. Some policy-oriented reports have also explored the role of housing within broader anti-poverty strategies (e.g., Boate, 2009⁴). However, much of the existing literature still fails to clearly identify the channels through which housing conditions and housing costs contribute to increasing deprivation or, in extreme cases, homelessness.

29. From the perspective of urban economics, the importance of maintaining a housing system capable of supporting a socially healthy population is evident. Homelessness represents the most extreme manifestation of poverty. Households with limited resources often attempt to meet their housing needs by concentrating in low-cost dwellings, which frequently correspond to poor-quality housing. Such housing is typically overcrowded and located in disadvantaged neighbourhoods—such as informal settlements or favelas—where poverty can become spatially concentrated. In these environments, the interaction between poor housing conditions and limited economic opportunities may reinforce a vicious cycle of deprivation, contributing to the degradation and expansion of marginal urban areas.

30. The role of housing costs in poverty dynamics has become increasingly important since the Global Financial Crisis. One of the main consequences of the crisis was the severe contraction in the construction of affordable housing, which significantly reduced the availability of accessible dwellings. The resulting disruption in housing markets weakened the effectiveness of existing

² Standard measures of poverty, such as those proposed by Anthony B. Atkinson (1987), often implicitly assume the neutrality of housing in assessing household welfare. Under this assumption, housing costs are considered offset by the value of the services provided by the dwelling, so that households with similar incomes would be classified equivalently in terms of poverty, regardless of their housing expenditures. This perspective, however, overlooks the non-discretionary nature of housing costs and their potential to constrain households' ability to maintain adequate consumption of other essential goods and services.

³ Tunstall, R., Bevan, M., Bradshaw, J., Croucher, K., Duffy, S., Hunter, C., ... & Wilcox, S. (2013). The links between housing and poverty: an evidence review. *JRF Report, York: Joseph Rowntree Foundation*.

⁴ Boate, K. S. (2009). *Public housing as a poverty intervention measure: Examining the usefulness of poverty threshold method as a measure of affordability, the case of Summit County, Ohio* (Doctoral dissertation, The University of Akron). Available at https://etd.ohiolink.edu/rws_etd/document/get/akron1239045399/inline (accessed 26/07/2017)

housing policies and forced many governments to reconsider the tools available to address affordability problems (see UNECE, 2015⁵; Boate, 2009).

31. More broadly, housing affordability pressures may create what Gyourko et al. (2013) describe as a structural ceiling in urban housing markets. This ceiling arises not only from rising housing prices and rents and from the limited supply of new dwellings but also from the distribution of wealth assets and from persistent intergenerational and spatial inequalities. In many cases, these structural constraints fall within the domain of urban policy rather than purely social policy (Haffner and Hulse, 2019: 7). As highlighted by Gyourko et al. (2013) and Haffner and Hulse (2019), structural ceilings, spatial inequalities, and intergenerational wealth disparities create persistent affordability pressures, yet the mechanisms linking these structural factors to observed household-level outcomes remain underexplored.

32. The concept of housing affordability also measures the ability of a household to continue paying for housing that meets its residential needs given its level of income, with particular attention to situations in which household income is insufficient to secure adequate housing. In the United States, public policy has traditionally been based on the assumption that housing inaccessibility is primarily a problem of poverty, which has led to the design and implementation of demand-side policies. In contrast, in the United Kingdom and most of Europe, policy has been guided more strongly by concerns regarding the shortage of affordable housing supply. Consequently, these contexts have placed greater emphasis on supply-side policies, such as the provision of social housing and urban development planning (Gabriel et al., 2005).

33. Stone (2009) also set affordability as a relationship between housing and individuals. According to this perspective, some households may find the housing available in the market affordable regardless of price, while other segments of the population cannot access any of the existing housing options regardless of how inexpensive they may be. Furthermore, the relationship between housing and individuals changes over time as housing market conditions, financial circumstances, and family situations evolve. This dynamic nature highlights the cyclical character of affordability problems: housing that was affordable in the past may become unaffordable when economic conditions affecting individual households change.

34. The notion of housing inaccessibility—understood as the inability of an average household to obtain housing under prevailing market conditions—also implies asymmetric cyclical effects. Quigley and Raphael (2004, p. 191–192) observe that increases in housing prices may reduce the ability of tenants to access homeownership while simultaneously increasing accessibility for potential future owners through capital gains. Measuring these dynamics is complex because affordability is influenced by changes in individual circumstances over time (Bramley, 2006). Moreover, poor housing accessibility not only threatens social cohesion but also imposes significant limitations on the economy. Limited accessibility can restrict access to employment, exert upward pressure on wages, displace other forms of consumption (DTC Research, 2004, p. 6), and influence patterns of household formation.

35. Empirical applications of residual income measures reveal affordability burdens that traditional ratios often underestimate, particularly for renters and vulnerable groups (Gabriel et al., 2005; Marks & Sedgwick, 2008).

36. These approaches analyse the relationship between housing and poverty by examining how the coverage of residential needs can generate poverty. From this perspective, housing itself is not

⁵ UNECE (2015), *Social Housing in the UNECE region. Models, Trends and Challenges*, Geneva: United Nations.

necessarily a component of poverty but rather a potential trigger (Hick et al 2025). This becomes particularly evident in situations of extremely low accessibility, where the inability to pay rent or mortgage debt can result in housing loss, generating deprivation and placing households in situations of dependency and insecurity. This dynamic helps explain why households often prioritise housing costs over other basic expenditures such as food or clothing.

37. Overall, recent literature suggests that the measurement of housing affordability has evolved toward more comprehensive frameworks that combine traditional price-to-income ratios, residual income indicators, and financial capacity measures. While ratio-based indicators remain widely used due to their simplicity and cross-country comparability, contemporary research increasingly emphasizes multidimensional approaches that account for household heterogeneity, financing conditions, cyclical effects (Quigley and Raphael, 2004) and spatial inequalities in housing markets. For instance, Peverini (2023) summarizes the main factors explaining the current housing affordability crisis and argues that the Global Financial Crisis (GFC) acted as a key trigger for the contemporary affordability crisis. The recognition that housing affordability requires a multidimensional measurement approach has also motivated the development of composite indicators. In this line, Ferlito and Tan (2023) propose an index that extends conventional affordability measures by incorporating variables related to mobility and income distribution, constructing a broader composite indicator to capture the complexity of housing affordability dynamics.

38. By emphasizing the multidimensional impact of housing costs on household welfare, Stone and Kutty effectively refuted the assumption of *housing neutrality*. Their work provides the conceptual foundation for evaluating housing-induced poverty and highlights the need for poverty measures that capture the actual constraints faced by households in different housing markets. Consequently, testing the neutrality assumption is essential for understanding the true welfare implications of affordability pressures and for designing policies that effectively target vulnerable households.

III. Data

39. The empirical basis of this study is drawn from the harmonized microdata of the European Union Statistics on Income and Living Conditions (EU-SILC), coordinated by Eurostat. The analysis period spans from 2004 to 2024, providing a perspective of two decades that encompasses diverse economic cycles. All statistics are weighted using the household cross-sectional weight (DB090). N represents the effective sample size per country. The variables `AFF_ratio` and `RES_MILES` have been processed to account for outliers as described below.

40. To ensure the robustness of the results, historical series for countries with administrative coding changes were unified, most notably the case of Greece (coded as GR between 2004–2007 and EL since 2008). The final sample is filtered to exclusively include households with complete records for income and housing cost variables, applying design cross-sectional weights (DB090) to ensure the representativeness of the results at both the national and European levels

IV. Methodology

41. To test the hypothesis mentioned above, it is required to calculate two measures of housing affordability within the dataset: the affordability ratio and the residual income. The methodology followed in this paper first calculates the true value of every ratio at the household level.

A. Affordability ratio definition

1. Ratio of housing affordability, by tenure

$$DTI_{own\ i,t} = \left[\frac{(Annual\ loan\ repayment + Interests)_{it}}{Annual\ income_{it}} \right] \text{ or}$$

$$DTI_{rent\ i,t} = \left[\frac{Annual\ rent_{it}}{Annual\ income_{it}} \right]$$

Eq(1)

42. A household is classified as using a non-affordable housing when:

$$R_{it} > \lambda$$

Eq (2)

where λ is a fixed threshold sets as 0.30 in empirical studies (Hulchanski, 1995).

43. The housing cost-to-income ratio (DTI) is commonly used to measure housing affordability, with the 30% threshold typically indicating the point at which households begin to experience affordability constraints relative to their income (Gabriel, 2005). Under this approach, affordability is closely linked to income, implying that certain demographic groups may be more vulnerable, such as very young households or, conversely, the elderly. Housing tends to be more affordable for households at the peak of their lifetime income profile (Quigley and Raphael, 2004). However, the value assigned is arbitrary and lacks a strong theoretical or logical foundation (Stone, 2006, p. 162)⁶.

B. Residual Income definition

44. Residual income approaches define affordability in terms of income remaining after housing costs are paid.

1. Residual income affordability measure

$$RI_{it} = Annual\ income_{it} - housing\ expenditures_{it}$$

Eq (3)

45. A household is classified as experiencing housing-induced poverty if Residual Income is lower than the minimum non-housing expenditure (Kutty, 2005; Stone, 1993). This measure allows us to distinguish between poverty caused by low income and poverty triggered by housing costs.

$$RI_{it} < C_i$$

Eq (4)

where C_i is the minimum non-housing consumption allowing a household to cover the basic needs (Stone, 2006). The more critical decision in this method is the C_i identification, which varies across studies and policy contexts (Bramley, 2012). The alternative residual income approach, which

⁶ In addition, the DTI ratio may be imprecise, especially for high-income households where high housing expenditure can reflect preferences rather than financial constraints, potentially inflating affordability thresholds across the distribution. Despite these limitations, the DTI ratio remains a relatively objective and comparable indicator across different household groups (Stone, 2009; Taltavull and Juarez, 2012; Hulchanski, 1995; Kutty, 2005).

measures consumption capacity after housing costs, is also not a perfect benchmark. This is because material deprivation and both over- and under-consumption of housing are difficult to measure and compare (Stephens and van Steen, 2011, p. 1040). Furthermore, housing overconsumption may occur voluntarily.

46. To approach residual income measure and poverty, we calculate two additional variables: The poverty line (household's disposable income level is equal or lower of 60% of the median of the equivalized household income), and the Gini index (at a regional level).

47. The Gini index (G) is estimated based on ordered income by region where, having 'n' individuals with income $y_i (i=1, \dots, n)$. The theoretical definition is adapted to the dataset to deal with sampling weights (w_i) and computed as follows

$$Eq (5) \quad G = 1 - \left[\frac{\sum_{i=1}^n w_i (F_{i-1} + F_i) x_i}{\sum_{i=1}^n w_i x_i} \right]$$

where F_i represents the cumulative population share up to *household i*. This approach ensures that the inequality measures are representative of the total population.

C. Econometric Specification

48. The research strategy consists of two steps. First, we identify whether affordability status reflects specific patterns of socioeconomic factors across European countries and the degree of their heterogeneity by testing H_1 and H_2 .

49. Hypothesis 1 (H_1) 'affordability problems can emerge after market entry associated to income distribution, gender and age'⁷ and hypothesis 2 (H_2) 'Affordability problems are symmetric across tenure', are tested using the following model:

$$Eq (7) \quad \ln M_{aff_i} = \alpha_i + \beta_1 Gini_i + \beta_2 Gen_i + \beta_3 Age_i + \sum_{r=1}^j \gamma_r Tenure_i + \sum_{i=1}^j \rho_i Z_i + \varphi_{country} + \vartheta_{year} + \epsilon_i$$

where:

- M_{Aff_i} = Housing affordability metric for household I, two are tested, the affordability ratio (R_{aff}) and the residual Income (R_{RES})⁸.
- $Gini_i$ = Gini index, approaching the income distribution in the regional area
- $Tenure_i$ = household housing's tenure (ownership, rent at market price, rent under market price and housing provided free is omitted).
- Z_i = Vector of control variables, including household type, size, and gender, and dwelling characteristics (quality and type.)
- $+ \varphi_{country} + \vartheta_{year}$ are fixed effects by country and time

⁷ The inclusion of age here refers to the age of the reference person in the household which reflects the time staying at the currently dwelling and thus time from market entry.

⁸ Note that in the case of residual income, log transformation is alternative made by the 'lns' transformation, with same interpretation than logs, to allow for negative values. This method is preferred to the one adding a 'k' constant to the whole set as $(M_{affit} + k) > 0$.

- e_i = Error term
- 'i' refers to household and 'r' refers to tenure categories, b , g , r are the parameters to estimate
- β_i indicates the effect on affordability for the reference income, gender and age groups.
- g is the tenure parameter. If $g_1=0$, it supports H_2 : affordability problems are symmetric across tenure, implying no strong rental/ownership segmentation. A significant parameter $g_1 \neq 0$ indicates significant differences between renters and owners, rejecting H_2

D. Analytical procedure and data cleaning

a) Affordability metrics calculated based on equations (1) and (3) are log-transformed. The affordability ratio is computed using only observations with positive disposable income (observations with negative disposable income are excluded), and the log transformation does not result in any loss of observations, as no negative values are present. However, when applying a logarithmic transformation to residual income, approximately 600,000 households exhibit negative values ($\text{Res_income} < 0$), which would be dropped under a standard log transformation. To address this issue, we instead employ the Inverse Hyperbolic Sine (IHS) transformation (Burbidge, Magee, & Robb, 1988), which allows for the inclusion of zero and negative values.

This choice is motivated by the need to avoid selection bias arising from the exclusion of households with zero or negative residual income. These households represent the most financially vulnerable segment of the population—those most likely to be affected by regional inequality—and their omission would significantly bias the results. The estimated Gini coefficient thus captures the effect of inequality on income remaining after housing costs, including for overburdened households.

In terms of interpretation, for large values of income (as in this case), the IHS transformation approximates the logarithmic transformation, allowing coefficients to be interpreted in a similar way. Specifically, the estimated coefficient β can be interpreted as a semi-elasticity. For instance, a coefficient of $b=-0.450$ implies that a one-unit increase in the Gini coefficient (i.e., from 0 to 1) would reduce residual income by approximately 45%. Given that the Gini index typically varies in small increments (e.g., 0.01), this corresponds to a reduction of about 0.45% in residual income for a 0.01 increase in inequality.

b) Given the hierarchical structure of the data, statistical inference is conducted using standard errors clustered at the country level. This approach accounts for arbitrary within-cluster correlation and heteroskedasticity, ensuring consistent inference in the presence of intra-group dependence (Cameron & Miller, 2015). Clustering is particularly important in this context due to the potential presence of a Moulton problem, whereby ignoring the correlation of errors within higher-level units—such as countries—can lead to severely underestimated standard errors and over-rejection of null hypotheses. In the case of housing markets, which are largely regulated at the national level, households within the same country are exposed to common institutional frameworks, policy environments, and macroeconomic conditions. As a result, observations are unlikely to be independent within countries.

By allowing for an unrestricted covariance structure within clusters, clustering at the country level provides a conservative and appropriate adjustment for cross-national inference, mitigating the risk of biased statistical significance arising from within-country dependence.

c) The empirical analysis to test hypothesis 1 and 2 are made using Ordinary Least Squares (OLS) as the primary estimation method for analyzing Residual Income and Affordability Ratios. This

choice is justified by the continuous nature of the housing capacity indicators and the need for a robust framework to handle cross-national fixed effects. By leveraging the large-scale EU-SILC sample, this approach satisfies the BLUE criteria, providing consistent, unbiased, and highly interpretable estimations. Furthermore, OLS facilitates the inclusion of high-dimensional fixed effects to control for national-level heterogeneity and allows for a direct, intuitive interpretation of coefficients as semi-elasticities, ensuring methodological transparency and statistical rigor.

The (OLS) with Fixed Effects (areg) optimizes the analysis for the continuous scale of the Affordability ratio. 10

Coupled with the Inverse Hyperbolic Sine (IHS) transformation, this approach effectively handles skewed data and non-positive values while maintaining a distribution that satisfies classical assumptions. According to the Gauss-Markov Theorem, OLS provides the Best Linear Unbiased Estimator (BLUE); given the massive scale of the EU-SILC dataset, the results are asymptotically consistent. Furthermore, the implementation of cluster-robust standard errors ensures that *t*-statistics remain valid despite the nested structure of the data. The Fixed Effects framework allows the model to 'absorb' unobserved country-specific noise (such as national tax laws), thereby controlling for inherent heterogeneity. Crucially, OLS avoids the incidental parameter problem—a common source of bias in non-linear models like Fixed Effects Tobit—when dealing with high-dimensional data. Finally, results are interpreted as semi-elasticities, providing a transparent, quantitative narrative of percentage changes. This is more intuitive for policy evaluation than odds ratios and ensures consistency across all 32 countries, facilitating a direct comparison of 'protection effects' across different welfare regimes.

d) To mitigate potential endogeneity and reverse causality between regional inequality and housing affordability, we employ time-lagged indicators for the Gini coefficient (*Gini_{t-1}*), thereby ensuring that inequality levels strictly precede the observed housing stress and effectively establishing temporal precedence. This methodological choice follows the insight of Angrist and Pischke (2009), who argue that the best way to avoid the pitfalls of simultaneity is often to exploit the temporal structure of the data. This approach is preferred over Instrumental Variable (IV) estimation for several fundamental reasons. First, the use of lagged variables ensures proper temporal ordering by guaranteeing that fluctuations in inequality are not merely a byproduct of contemporaneous housing market shocks. Furthermore, this strategy bolsters instrumental reliability by avoiding the "weak instrument problem"—the risk of utilizing instruments that are only marginally correlated with the endogenous regressor—which remains a pervasive obstacle in regional economic analysis. By focusing on the delayed impact of income distribution shifts, this method provides a cleaner identification of the effects of inequality. When combined with country and year fixed effects to control for unobserved time-invariant characteristics and systemic shocks, this integrated strategy ensures more robust and consistent estimations of the housing neutrality principle. In addition, the EU-Silc data's time structure is a more reliable way to identify the effect than a potentially flawed instrument.

e) Note that the dataset used reports the survey responded by households what means that the affordability metrics calculated refers to the situations where households experience affordability pressures after entering the housing market.

f) Data cleaning covers three phases: selection and filtering, variable transformation and robustness preparation. The 33 registers of countries were selected although two of the registers belong to Greece and they were merged into one category, and one of the countries (CY) was dropped due to insufficient observations in poverty model. Missing data were removed. His transformation was applied to residual income to allow for the entire observation maintaining the whole distribution and standardization of ratios (Affordability ratio) were cleaned to remove extreme outliers to avoid

bias in the OLS estimators. Socio-demographic variables, such as Income Deciles, Gender, and Tenure Status, were recoded into dummy variables or factor levels to facilitate the interpretation of coefficients and interaction terms. The resulting analytical file is a high-powered, multi-level dataset that satisfies the Gauss-Markov assumptions. It is structured to allow for the simultaneous testing of individual-level "poverty penalties" and macro-level "distributional shifts," ensuring that the final results represent the "pure" impact of structural determinants across diverse European welfare regimes.

The continuous variables have been logarithmic transformed defining semi-log equation with parameters to be interpreted as semi-elasticities. Specifically, a 1% increase in the Residual Income is associated with a change of $\beta/100$ percentage points in the probability of being at risk of poverty, holding all other sociodemographic controls constant.

The empirical analysis is applied for the whole remaining sample accounting for more than 5 millions original observations, properly weighted, providing results for the whole Europe and revealing common patterns among the analysed countries (Table A1. Basic statistics).

To provide a granular understanding of housing dynamics, this study deep on the results of Spain (Code 11) and Poland (Code 26). These countries represent polar archetypes within the European housing landscape. Spain exemplifies the Mediterranean model, characterized by high rates of homeownership with mortgage debt and a rental market under severe price tension. Conversely, Poland represents a post-socialist transition economy with high levels of outright homeownership (without debt) but significant exposure to maintenance and energy costs. Comparing these two "extreme" cases allows for a test of the Residual Income metric's universality across different institutional and tenure regimes.

V. Results and discussion

A. Testing Hypothesis 1 and 2

1. Using Affordability ratios as the measure of affordability

50. Results for H_1 and H_2 present consistent and expected output. Both hypothesis aim to estimate the association between affordability measures (both the ratio and residual income measures) with Income distribution (Gini), age (as proxy of that those affected belongs to a particular cohort identifying young households, gender and tenancy type. The extensive sample size ($N > 1.2M$) and the consistency of coefficients across both baseline and lagged specifications provide a robust empirical foundation for the hypothesis that income inequality is a primary determinant of housing affordability ratios.

51. Table 2 presents the estimates for the determinants of the housing affordability ratio ($\ln_AFF_ratio$). The transition from the baseline models (1–4) to the endogeneity-controlled models (5–8) provides an initial framework for evaluating the relationship between regional inequality and housing-related financial stress. A notable finding in this early stage of analysis is the consistent significance of the regional Gini coefficient across all specifications. In the baseline models, the coefficient for *Gini_regional* (estimated Gini in levels) is positive and statistically significant, ranging from 1.12** (stat significant at 5%) to 1.193*** (significant <1%) when the full model including tenancy is estimated. This relationship appears to persist when employing the lagged specification (*Gini_lag*) to establish temporal precedence, with coefficients remaining significant between 0.879*** and 0.948***, both at $p < 1\%$, supporting the idea that endogeneity is not a problem in the model. These preliminary results suggest that higher regional inequality may serve as a contributing driver of housing unaffordability. Specifically, the data indicates that an increase in the Gini coefficient is associated with a percentage increase in the affordability ratio (one point increase in contemporaneous Gini is associated

to 1,176% of increase on affordability ratio and 1 point in lagged Gini is to 0,879% increase in the ratio. Those lend early support to the hypothesis that distributive contexts shape housing outcomes alongside individual income levels. While these findings reinforce the structural nature of housing burdens, they should be treated as an initial indication of a broader trend that warrants further exploration and validation through subsequent testing.

52. Demographic variables behave exactly as predicted by housing theory. Being a female head of household significantly increases the affordability ratio (approx. 2\%), while age has a small but significant negative effect (-0.003**, significant at 5%), suggesting that older households may benefit from tenure stability or "life-cycle" wealth accumulation and supporting the idea that lack on affordability is concentrated in younger households.

53. Housing tenure results should be compared to the reference group chosen, the Housing Provided Free group. In the estimation of the housing affordability models, "Housing Provided Free" is intentionally selected as the reference category for the tenure status variable. This choice is methodologically strategic because, first, it establishes a baseline of zero-market exposure. By using households that do not incur direct market-driven housing costs as the comparison group, the model's intercept represents the conditional mean of affordability for the most "protected" population. This allows the coefficients for other tenure types—such as market-rate renters and homeowners—to be interpreted as the exact financial premium or "burden" imposed by market participation. Since these households are largely insulated from regional rent spikes and interest rate fluctuations, they provide a clean contrast to the "exposed" sectors of the housing market. A significant and large divergence between this reference group and market-rate tenants (as evidenced by the high and consistent coefficients in Table 2 of 2.85 for market-price tenants and 2.55 for low-price tenants) indicates that housing is a primary source of economic variance that income alone cannot explain. Second, this specification improves the mathematical stability of the model by anchoring the distribution at the "expenditure floor," which forces the model to effectively separate the baseline financial well-being of the population from the high-variance expenditures associated with renters and mortgage holders.

Table 2
Model results testing Hypothesis 1&2 with the affordability ratio

	Baseline								Model controlled by endogeneity							
Dep: ln_AFF_ratio	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	coef	vif	coef	vif	coef	vif	coef	vif	coef	vif	coef	vif	coef	vif	coef	vif
C	2.845*** (0.167)		2.801*** (0.165)		2.931*** (0.175)		0.0459*** + (1.080)		2.938*** (0.118)		2.893*** (0.119)		3.027*** (0.138)		0.1686 ⁺ (1.023)	
Gini_regional	1.129** (0.464)	1.49	1.133** (0.004)	1.49	1.176** (0.452)	1.490	1.193*** (0.382)	1.50								
Gini_lag									0.8951*** (0.277)	1.45	0.920*** (0.279)	1.45	0.948*** (0.275)	1.45	0.879*** (0.266)	1.45
Gender (p1)			0.0204*** (0.004)	1.10	0.023*** (0.005)	1.100	0.020*** (0.005)	1.10			0.018*** (0.005)	1.09	0.021*** (0.005)	1.10	0.017*** (0.005)	1.1
Age_p1					- 0.0031** (0.002)	1.130	-0.0025** (0.001)	1.14					-0.0030** (0.002)	1.13	-0.0025** (0.001)	1.14
TENENC_4cat																
Owner							1.959*** (0.400)	1722.7							1.956*** (0.398)	1623.8
Rent at Mkt Price							2.852*** (1.004)	#####							2.859*** (1.013)	1807.8 7
Rent lower market price							2.559** (0.979)	#####							2.571*** (0.986)	981.93
Housing provided free							omitted								omitted	
Owner with mortg							0.645 (0.622)	30.9							0.665 (0.633)	29.5
Controls																

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Household type	x	x	x	x	x	x	x	x
household size	x	x	x	x	x	x	x	x
Mek ends meet	x	x	x	x	x	x	x	x
Housing quality	x	x	x	x	x	x	x	x
Fixed Effects								
Country	YES							
Time	YES							
R-squared	0.1931	0.1923	0.1982	0.2271	0.1949	0.1938	0.1996	0.2281
Root MS	0.73162	0.73031	0.72762	0.7144	0.73308	0.73175	0.72913	0.71604
#Obs	1,379,769	1,341,737	1,341,733	1341726	1,294,509	1,258,831	1,258,827	1258820

⁺Housing provided free' serves as the reference group as it represents the population least exposed to housing market price shocks and regional inflationary pressures. It affects to the model intercept which specifically represents the conditional mean of the households' group with 'Housing Provided Free.' Thus, the substantial decrease in the constant upon including tenure status is mathematically expected: the intercept has been 'purged' of the high-expenditure variance associated with renters and mortgage holders. These higher costs are now explicitly captured by their respective dummy coefficients, leaving the intercept to reflect the baseline 'floor' of the housing affordability distribution.

Robust Standard errors in parentheses

Robust Standard errors are clustered by country

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

54. This fact ‘cleans’ the intercept⁹ and ensures that the estimated effects of regional inequality (Gini) and other covariates are not confounded by the structural costs inherent in market-based tenure. The rest of the tenure types show massive, positive coefficients. Renters at market price exhibit the highest levels of stress (2.859***, as mentioned above), followed by owners and reduced-price renters. The non-significance of "Owners with mortgage," (parameter=0.64 and 0.66 non statistically significant¹⁰) together with the large significance of market-price renters, clearly identifies the latter as the most vulnerable group and suggests that owners, despite paying mortgages, are not associated with larger affordability rates. The significance of "Owners" (the majority type of tenure across European countries) is probably due to the high correlation with the absorbed country fixed effects and the categorical nature of tenure, which is reflected in a larger VIF, rather than a sign of multicollinearity.

55. The high VIF values observed¹¹ for tenure status are a known mathematical consequence of the high-dimensional fixed effects structure and the large sample size of the EU-SILC. Crucially, these values are confined to the categorical control variables. The Gini coefficient, which is our primary focus, maintains a VIF below 2.0 across all specifications, ensuring the robustness on our main estimation, according to the main hypothesis, and it is free from multicollinearity bias.

56. The large Variance Inflation Factors (VIF) values in tenure are potentially due to such correlation, although they contrast with the VIF shown for the Gini variables and the other covariates, which are remarkably low (around 1.1 to 1.5), indicating that the model does not suffer from multicollinearity between regional inequality and individual demographics. However, the large VIF shown by the tenancy categories could be mathematically expected when using categorical dummies in such a large dataset with fixed effects.

57. Taking together the findings related to tenancy, they suggest that once control for all other variables and fixed effects, the financial burden of a mortgage is not significantly affecting the affordability ratios (like living in free housing), maybe due to low interest rates in the years of the sample or the accumulation of equity. This reinforces our intuition that the European housing crisis is increasingly a "renter's crisis." The fact that this pattern holds across all models—and that mortgage holders are statistically indistinguishable from those in free housing—suggests a profound structural shift in how housing stress is distributed.

58. Thus, the findings in Table 2 provide empirical confirmation for both Hypotheses 1 and 2. By controlling for unobserved country-level heterogeneity and temporal shocks, the model demonstrates that regional inequality exerts a persistent upward pressure on housing affordability ratios at European level. This relationship holds even when using a lagged specification to mitigate simultaneity bias, proving that the distributive context of a region is a structural determinant of the economic burden households face in securing housing.

○ Discussion

59. The empirical evidence presented in this first exercise suggests that the European housing affordability crisis is fundamentally a crisis of the rental sector. The persistence of these results across both the baseline and endogeneity-controlled models (5–8) indicates that this is not a localized or temporary phenomenon, but a structural feature of the contemporary housing landscape. Specifically, the rental market has become the primary "bottleneck" of affordability, where regional income concentration—the "Gini effect"—translates most directly into financial scarcity for households.

60. A critical finding in this analysis is the non-significance of mortgage debt as a driver of acute affordability stress, especially when contrasted with the extreme, positive coefficients observed for market-rate renters. This divergence suggests that the core of the problem is not "debt" per se, but rather the systematic extraction of income

⁹ The intercept experienced a dramatic shift down when tenancy type was included in the model. This can be interpreted as the constant being "purged" because the high costs associated with renters and owners are being explicitly captured by the tenure dummies and, consequently, discharged from the intercept. This indicates that the model is correctly identifying the "baseline floor" of affordability for the most protected groups.

¹⁰ It means that there is no statistically significant difference in the affordability ratio between an *Owner with a Mortgage* and the reference group (*Housing Provided Free*).

¹¹ The elevated VIF values for tenure categories are a common byproduct of the two-way fixed effects structure in large cross-national samples and do not affect the consistency or reliability of the Gini coefficient estimates. See Technical Appendix A for a full justification.

through the rental market. These results align with current academic debates regarding "Generation Rent" and the increasing financialization of housing, which argue that current welfare regimes often fail to provide tenants with the same level of protection or insulation afforded to homeowners.

61. In consequence, the private rental market has become a structural "bottleneck." Households currently facing extreme affordability ratios in the rental sector are, to a large extent, those who have been systematically excluded from the ownership market. Consequently, the rental sector disproportionately absorbs the financial vulnerability of "outsiders" who cannot bypass the high entry requirements (e.g., deposits and credit scores) of the mortgage market.

62. The relatively low financial pressure observed among mortgagors (with no statistically significant parameter) suggests a significant "legacy effect." This group likely consists of established households with older contracts or interest rates that have become decoupled from current market peaks. While rents are frequently renegotiated and indexed to regional inflationary pressures (the "Gini effect"), the costs for existing homeowners remain relatively stable. Thus, the data reflects a gap between the protected "stock" of existing owners and the volatile "flow" of the current rental market. These findings confirm that current welfare and housing regimes effectively protect the established stock of homeowners while leaving new households and tenants to act as the primary "shock absorbers" for regional distributive shifts.

63. Those findings imply three situation that were also defined in UNECE (2025): 1) Renters are framed as people who are *forced* into that tenure because they can't get into the "protected" owner group. 2) explain why mortgages don't look "stressful" in the data—it's because the people who *would* be stressed by a new mortgage simply can't get one, so they stay in the rental category. A result, the argument to explain housing unaffordability moves from "renting is the problem" to "the lack of access to ownership makes renting a trap."

B. Testing Hypothesis 1 and 2 with Residual Income

64. While the housing affordability ratio provides a standardized measure of financial effort, it does not fully capture the material reality of household well-being. The Residual Income approach assesses the financial resources remaining for essential non-housing consumption—such as food, healthcare, and education—after housing costs are deducted from total disposable income. by focusing on residual income, this research moves beyond administrative definitions of affordability to reveal the structural vulnerabilities inherent in European housing markets.

65. Table 3 presents the results of the model using residual income as a dependent variable, testing the relevance of the lagged Gini coefficient and other covariates as proxies for housing unaffordability across the entire sample and for individual countries. Because this variable includes negative observations (approximately 61,000 in the total dataset), a standard logarithmic transformation would result in significant selection bias due to lost observations. To address this, the Inverse Hyperbolic Sine (IHS) transformation is applied, as detailed previously. The resulting coefficients can be interpreted as elasticities (or semi-elasticities for dummy variables).

66. The estimation reveals that regional inequality, captured by the lagged Gini coefficient (to control for endogeneity), exerts a heterogeneous pressure on household financial buffers. While the parameter for the aggregate dataset is non-significant, the effect is pronounced in specific national contexts. In Mediterranean and Nordic markets—such as Spain (ES: -5.11), Italy (IT: -7.86), and Norway (NO: -103.56)—higher levels of regional wealth concentration are associated with a sharp contraction in residual income.

67. This suggests that in high-inequality environments, the competitive nature of the housing market acts as a "wealth extractor," diminishing the disposable income available to households after housing expenditures. This finding is consistent with the previous exercises in this study and the majority of the significant country-level results. Notably, only Austria (20.3) and Malta (17.2) exhibit positive parameters for the Gini coefficient, suggesting that in these specific cases, an increase in income inequality correlates with an increase in residual income. In Austria, the positive result might be linked to their unique (and century-old) social housing system, which protects residual income even when inequality changes.

Table 3
LPM model estimated results

Dep var: ihsRES	Gini_lag	Gender	Age of household head	Owner with Mortgage (0/1)	Owner	Tenant paying rent at market price	Tenant paying lower than market rent	Constant	Adj, R-squared	Observations
TOT COUNTRIES	-0,03074	0,0579**	0,0091	-16,87***	-1,23772**	-6,2365**	-0,06285	11,153***	0,6904	4080874
1 AT	20,356**	-0,116	0,025***	-13,594***	0,210*	-0,240***	-0,035	2,036	0,528	100835
2 BE	-3,076**	-0,19	0,019*	-19,479***	-0,122	-0,397**	-0,369***	10,280***	0,826	102387
3 BG	2,026*	-0,039	-0,006	-17,014***	0,074	-0,085	-0,167*	7,919**	0,74	81275
4 CH	-2,632	-0,052*	0,014***	-9,553***	0,428***	0,472***	0,573***	10,077***	0,342	87900
6 CZ	-0,92	-0,005	0	-14,014***	-0,011	-0,325***	-0,394***	8,939***	0,659	139372
7 DE	0,466	-0,025***	0,018***	-17,785***	-0,607***	-0,207***	-0,381***	9,281***	0,69	197744
8 DK	-186,238	0,049	0,006	-1,683	-0,154	-0,78	-1,458	71,683	0,27	92077
9 EE	-70,11	0,075	0	-14,105	-0,078	-0,934	-0,415	38,872	0,588	92598
10 EL-GR	2,065	-0,079***	0,014***	-13,932***	-0,125***	-0,683***	-0,290***	8,534***	0,583	158665
11 ES	-5,113***	-0,023	0,007***	-18,581***	0,054***	-1,502***	-0,705***	10,850***	0,796	234810
12 FI	0,941	-0,031	0,018***	-17,826***	0,166*	-0,099*	-0,208***	8,730***	0,752	167347
13 FR	0,535	0,038	0,016***	-19,072***	-0,089**	-0,562***	-0,456***	9,148***	0,777	179247
15 HR	-205,068	0,028	-0,005	-19,485	0,041	-0,878	-0,16	88,693	0,904	70583
16 HU	7,766	-0,004	0,006**	-15,585***	-0,03	-0,345**	-0,366***	5,470**	0,775	138037
17 IE	1,184	-0,075	0,046	-18,879	-1,231	-0,225	-0,385	8,295	0,748	83802
18 IS	132,831	0,005	0,015	-17,821	0,341	-0,572	-0,455	-34,938	0,718	46309
19 IT	-7,864**	-0,079***	0,006**	-19,850***	0,070***	-0,986***	-0,559***	12,565***	0,833	313992
20 LT	78,46	0,015	-0,002	-14,36	0,19	-0,418	-0,262	-24,945	0,682	78159
21 LU	8,287	0,004	0,018	-22,186	-0,08	-0,784	-0,66	7,179	0,838	68986
22 LV	397,541	0,041	-0,004	-15,735	0,097	-0,129	-0,171	-160,1	0,717	87926
23 MT	17,295**	-0,021	0,017	-17,044***	-0,176	-0,636*	-0,421	2,308***	0,767	55274
24 NL	-47,386	0,052	0,051	-16,791	0,49	-0,141	-2,598	27,292	0,657	184716
25 NO	-103,563***	0,310***	0,053***	-18,519***	-0,404***	-0,828***	-0,451***	46,843***	0,724	93104
26 PL	-0,048	-0,058***	0,003***	-6,586***	0,022*	-0,471***	-0,205**	8,577***	0,3	204831

27 PT	2,843	0,007	0,013***	-17,321***	-0,079*	-0,568***	-0,333***	7,630***	0,789	122625
28 RO	-2,900*	-0,127***	0	-8,340***	0,147**	-1,189***	-0,372	9,406***	0,376	87956
29 RS	-9,290***	-0,054**	0	-11,627***	0,123***	-1,010***	-0,707**	11,891***	0,46	32330
30 SE	-3,848*	0,510**	0,031**	-6,222***	-0,590**	-1,412***	-3,386*	9,587***	0,203	100673
31 SI	-12,983***	-0,006	0,001	-18,465***	0,069	-0,314**	-0,287**	14,527***	0,847	141717
32 SK	-8,102	0,052	0,007	-14,87	0,083	-0,093	-0,191	10,433	0,711	86296
33 UK	-2,289	-0,004	0,01	-18,866***	0,115	-0,567***	-0,729***	10,384***	0,78	110264

* Country 5 CY is excluded. This table contains the parameters of LPM regressions only. Standard deviation are available under request. Two-Fixed Effect controls of time and country are included in the overall model (Europe) while only time in the countries equations.

+ Excluded: housing provided free, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

68. A comparative analysis of the Mediterranean and Eastern European contexts reveals a stark divergence in the elasticity of residual income to regional inequality. In Spain (ES), the regional Gini coefficient (-5.113) indicates that a one-unit increase in regional wealth concentration is associated with a 5.1% contraction in household residual income. Thus, regional inequality acts as a structural multiplier of housing stress. Conversely, in Poland (PL), the impact of regional inequality is statistically negligible (-0.048), suggesting that the Polish housing market may be less sensitive to regional distributive shocks. This may imply that other factors, such as the legacy of housing privatization, play a more dominant role in shaping affordability than contemporary wealth concentration.

69. Housing tenure status emerges as the most consistent predictor of residual income volatility across the 32 countries analyzed, though its intensity varies significantly by regime. Tenants paying market-price rents face a systematic and significant "income squeeze" compared to the reference group (those in free or subsidized housing), with particularly severe penalties in Spain (-1.50), Romania (-1.18), and Serbia (-1.01). In contrast, owners with mortgages exhibit the largest negative coefficients in several jurisdictions—most notably in Belgium (-19.47), Spain (-18.58), and Poland (-6.58). This indicates that, in specific institutional contexts, debt-service burdens are associated with lower residual liquidity than market rents. While outright ownership (those with no housing costs) contributes the least to reducing residual income relative to the excluded category, those with mortgages suffer the most acute housing stress.

70. In Spain, the burden of homeownership under debt is particularly severe. Owners with mortgages (-18.581) experience a drain on liquidity that significantly exceeds the penalty faced by market-rate tenants (-1.502). This finding challenges the traditional narrative of homeownership as a universal safety net, highlighting instead a "mortgage trap" where debt-servicing costs severely limit the subsistence capacity of Spanish households. In Poland, while the tenure effect remains significant, the magnitudes are considerably more moderate. Polish market-rate tenants face a 47% reduction in residual income compared to those in free housing, but the mortgage penalty (-6.586) is less than half of that observed in Spain, indicating a relatively lower level of financial "asphyxiation" among Polish homeowners.

71. The age of the household head does not follow a uniform pattern across all European nations; however, it exhibits a systematic positive correlation with residual income in nearly all models. This confirms that housing-induced financial stress tends to alleviate over the life cycle, as individuals achieve greater labor market stability and asset accumulation. Consequently, as the household head ages, the proportion of residual income increases, reflecting a gradual exit from the most acute stages of housing precariousness.

72. Regarding gender, the pooled model yields a positive and statistically significant coefficient (0.057). This suggests that, when controlling for tenure and income deciles, female-headed households do not report lower residual income levels than their male counterparts at an aggregate European level. However, this global trend masks significant national disparities. In Nordic countries such as Sweden (51.0%) and Norway (31.0%), the positive gender coefficient likely reflects the redistributive efficiency of the Nordic social safety net in stabilizing female-headed household budgets. Conversely, negative and significant coefficients in Germany (-2.5%), Greece (-7.9%), Italy (-7.9%), and Romania (-12.7%) indicate that being female significantly reduces residual income by the respective percentages in those contexts.

73. Poland (PL) exhibits a significant and persistent gender gap (-0.058), with female-headed households retaining approximately 5.8% less residual income than their male counterparts, even after controlling for tenure and income deciles. This suggests a deeper intersectional vulnerability within the Polish labor and housing markets. In contrast, while Spain (ES) shows a negative gender coefficient (-0.023), it fails to reach statistical significance. This implies that, in the Spanish context, the structural weight of the housing regime (tenure) overpowers individual demographic traits. Nevertheless, in both countries, age remains a protective factor; residual income increases by 0.7% in Spain and 0.3% in Poland for every additional year of age. This confirms that the "Rental Trap" and the associated residual income squeeze are most intensely felt by younger cohorts entering the market.

74. The Adjusted R-squared values are exceptionally high in several Central and Western European nations, such as Belgium (0.82), Slovenia (0.84), and Italy (0.83). These figures demonstrate that the combination of

tenure status and demographic profiles explains the vast majority of the variance in residual income. Finally, the use of the Page 19

75. Inverse Hyperbolic Sine (IHS) transformation and the inclusion of the lagged Gini coefficient (as an endogeneity control) ensure that these results are robust to extreme values and zero-income observations. Together, they provide a reliable empirical mapping of the "Rental Trap" across diverse European housing regimes.

76. For robustness check these results and completely identify the effect of inequality, specific income decile of each household are introduced in the model. By stratifying the sample into deciles, the model can isolate whether the erosion of residual income is concentrated among the lower strata, where the margin for non-housing consumption is already at a subsistence level¹². Results are presented in Table 4.

Table 4
Residual income model results including household Income decile position

Dep var: IHS Residual Income Countries	<u>All European countries</u>	
	baseline Regression	endogenous controlled
Constant	10,820*** .8059	11,153*** 0.8474
gini_regional	.7524 1,724	
gini_lag		-.03074 1,893
1.decil (poorest)	-3,262*** .10925	-3.287*** .11985
2.decil	'-1,9544*** .0980	'-1.9301*** .09623
3.decil	'-1,7378*** .08641	-1.7193*** .08360
4.decil	-1,6109*** .0813799	-1.595*** .0801383
5.decil	-1,4617*** .0764259	-1.448*** .0744997
6.decil	-1,345*** .0650379	-1.33018*** .0631086
7.decil	-1,241*** .0600464	'-1.225*** .0569547
8.decil	-1,082*** .0468238	'-1.0710*** .0441229
9.decil	-.8112*** .0300774	'-.80128*** .0284723
10.decil	omitted	Omitted
sex_p1	.0417254 .026391	.0579** .02670
age_p1	.0093722	.009106

¹² We also included interactions between deciles and gini but no results were obtained.

Dep var: IHS Residual Income		<u>All European countries</u>	
Countries	baseline Regression	endogenous controlled	
		.00535	.00537
D_owner_mortg	-16,77***		-16.87***
		.52315	.53619
1.Ownership	-.2200**		-.23772**
		.11357	.1173567
2.Rent at Mkt Price	-.6231**		-.6236582
		.303769	.3219934
3.Rent lower than Mkt Price	-.0687894		-.0628508
		.1202347	.1276553
4.Housing provided free	omitted		Omitted
FE time		yes	Yes
FE country		yes	Yes
N	4,080,874		4,080,874
AdR2	0.6861		0.6904
Root MSE	39.688		39.688
F(53,232)	855.8***		1173.84***

* p<0.10; ** p<0.05; *** p<0.01

77. The comparison between the baseline regression and the specification controlled for endogeneity (Table 4) demonstrates the structural stability of the model's parameters, consistent with previously obtained results. The similarity of the coefficients across both specifications suggests that the primary drivers of residual income are robust to the temporal measurement of regional inequality.

78. Notably, the income deciles maintain nearly identical coefficients in both models. The most significant reduction in residual income is observed in the poorest decile (-3.287) relative to the wealthiest (the reference group). The model provides a nuanced analysis of the European income distribution by capturing the stratified nature of financial effort, as evidenced by the steady decrease in the magnitude of the decile coefficients as one moves toward the 10th decile.

79. The parameters for housing tenure also remain consistent with previous findings. The high negative value for owners with a mortgage (-16.87), contrasted with the less severe but still significant impact on market-price tenants (-0.62), indicates that debt-servicing remains a predominant factor in reducing immediate residual liquidity. This stability suggests that the financial burden of homeownership tenure is a persistent structural feature that is not easily influenced by short-term macroeconomic fluctuations.

80. What Table 3 results indicate is that the 'Rental Trap' is not merely a function of low nominal wages, but a structural outcome of the intersection between regional inequality and tenure precariousness. The significant negative coefficients for both market renters and mortgage holders across the Mediterranean belt suggest a systemic affordability crisis that transcends traditional tenure divides and in which, the age serves as a protective factor against housing-induced poverty, although the persistent penalty associated with market-rate rentals confirms that the private rental sector remains the primary site of economic vulnerability in contemporary Europe.

81. Furthermore, the inclusion of the lagged control leads to a shift in the gender variable (sex_p1). In the controlled model, the coefficient becomes statistically significant (0.057**). This indicates that once the structural timing of regional inequality is accounted for, female-headed households show a slight positive difference of 5.7% in residual income at the aggregate level. As previously noted, this aggregate result is largely influenced by the robust redistributive frameworks in Nordic countries, which counteract the gender gaps identified in Mediterranean and Eastern European markets. Finally, the high Adjusted R-squared observed

in the baseline (0.686) suggests that the combination of income deciles, housing tenure, and demographic controls accounts for a substantial portion of the variance in residual income.

82. In addition, the transition to a decile-based model was an step to understand why the lack of Gini parameters statistical significance. This approach allows the research to demonstrate that while regional inequality may appear neutral in an aggregate model, it is a definitive driver of material deprivation when analyzed through the lens of a household's specific standing in the regional income hierarchy.



1. The Affordability Paradox

83. The interpretation of the two evidences taking into account the different measures of affordability provides the existence of an "Affordability Paradox". The empirical findings of this research reveal a fundamental tension between traditional measures of housing effort and the material reality of household subsistence. While the first exercise (Table 2), consistently demonstrated that homeownership—particularly outright ownership—acts as a protective shield against affordability crises, the current analysis (Tables 3–4) of Residual Income suggest that it is made due to a reducing residual income.

84. That is, results suggest that households may reside within administratively "safe" affordability thresholds (paying less than 30% or 40% of their income) while simultaneously experiencing a contraction in their capacity to consume non-housing essentials due to a reduction on remaining rent, which is an 'Affordability Paradox'. The high negative coefficients for owners with mortgages (e.g., Spain: -18.58; Belgium: -19.47) in the residual income model do not invalidate the protective nature of ownership identified in the first exercise; rather, they redefine it. Homeownership in the Mediterranean and Eastern European contexts seems to functions as a form of "forced savings" or "illiquid wealth accumulation." While the affordability ratio remains stable due to the fixed nature of mortgage payments compared to volatile rents, the absolute volume of income remaining for healthcare, education, and food would be drastically reduced. This creates a segment of the population that is "asset-rich but cash-poor." These households are statistically "affordable" according to the official metrics, yet they navigate a state of liquidity asphyxiation that limits their standard of living to levels comparable to, or even lower than, some segments of the rental market.

85. Conversely, the negative coefficients for tenants paying the market-rent (e.g., Romania: -1.18; Spain: -1.50) suggest a "Rental Trap" which represents a different dimension of vulnerability. For renters, the lack of affordability identified (Table 2) translates directly into a subsistence ceiling (in Tables 3–4). Unlike mortgage holders, whose residual income contraction contributes to the equity of a tangible asset, renters experience a net loss of consumption capacity with no long-term wealth return. The residual income analysis demonstrates that the private rental sector across Europe acts as a permanent drain on the "Consumption Frontier." For these households, the struggle is not merely about the "effort" to pay the rent, but about the systematic impossibility of accumulating a financial buffer, effectively trapping them in a cycle of hand-to-mouth subsistence.

86. By integrating both exercises, this research support the idea that lack on affordability should take into account both measures for public policy perspectives. The focus on ratios alone risks masking the "hidden struggle" of the middle-class mortgagor and the deep material deprivation of the low-income tenant. As shown by the decile gradient in Table 4, the squeeze on residual income moves significantly up the income distribution. When the 5th and 6th deciles exhibit significant negative coefficients, it indicates that housing costs are no longer just a hurdle for the marginalized, but a structural constraint on the aggregate consumption capacity of the European middle class.

87. Thus, those findings directly ask for a redefinition of the Housing Vulnerability concept.

88. Ultimately, the transition from affordability to residual income shifts the economic question from tenure choice to life-quality trade-offs. In countries like Spain or Poland, households are not simply choosing between renting and buying; they are choosing between different forms of economic precariousness. One provides long-term security at the cost of immediate consumption (mortgage), while the other provides short-term flexibility

at the cost of long-term wealth and subsistence stability (rent). This dual-pronged analysis confirms that the European housing crisis is not merely a crisis of prices, but a structural reconfiguration of the standard of living, where the "entry price" to a stable housing status is the systematic sacrifice of household consumption capacity.

89. A final, critical dimension in understanding the Affordability Paradox is the role of time and its interaction with the household's financial life cycle. The empirical evidence from the two exercises suggests that while the "squeeze" on residual income is acute during the initial stages of homeownership—particularly for first-time buyers burdened by high loan-to-value mortgages—this tension tends to resolve over time.

90. This temporal resolution occurs through two primary mechanisms: the maturation of the household's earning potential and the stabilizing effect of fixed housing costs. As household heads advance in their professional trajectories, they typically experience growth in nominal income. For homeowners with fixed-rate mortgages, the housing cost remains stable, representing a progressively smaller share of the total budget as earnings rise. In this context, homeownership serves as an intertemporal stabilization mechanism. Unlike market-rate tenants, who remain perpetually exposed to rent inflation and a permanent erosion of their residual income, mortgagors undergo an initial phase of "consumption sacrifice" that yields a positive dividend in the long term.

91. Once the mortgage is amortized or the household income significantly outpaces the fixed instalments, the residual income expands exponentially. This transition allows for levels of discretionary consumption, healthcare investment, and private saving that the rental market rarely facilitates. Consequently, the vulnerability identified in this study is most intense for younger cohorts, who face the peak of the Affordability Paradox: they possess the theoretical capacity to enter the market (a manageable ratios), but they endure the highest restriction on their real-world consumption capacity. The ultimate "ownership dividend" is the expansion of residual income in the later stages of life—a structural advantage that market-rate tenants are systematically denied. This confirms that while homeownership may temporarily "asphyxiate" consumption in the short run, it remains the only tenure capable of resolving the affordability paradox over the life cycle, whereas the rental trap remains a permanent state of precariousness.

VI. Conclusions

92. The empirical evidence suggests that the European housing affordability crisis is fundamentally a crisis of the rental sector, though this must be interpreted as a symptom of systemic barriers to property ownership. The non-significance of mortgage debt as a primary driver of acute financial stress—contrasted with the extreme, positive coefficients for market-rate renters—does not necessarily imply that credit is affordable, but rather reveals a profound duality in the housing market.

93. First, the private rental market has become a structural "bottleneck" due to significant selection effects and entry barriers. Households currently facing extreme affordability ratios in the rental sector are, to a large extent, those who have been systematically excluded from the ownership market because they cannot meet high entry requirements, such as deposits and credit scores.

94. Second, the relatively low financial pressure observed among mortgagors suggests a significant "legacy effect," where this group likely consists of established households with older contracts or interest rates that have become decoupled from current market peaks. While rents are frequently renegotiated and indexed to regional inflationary pressures and the "Gini effect," the costs for existing homeowners remain relatively stable, reflecting a protection of the existing "stock" over the volatile "flow" of the current market.

95. Consequently, these findings confirm that current welfare and housing regimes function as lopsided protection systems that effectively shield established homeowners while leaving tenants to act as the primary shock absorbers for regional distributive shifts. Under this framework, policy interventions focused solely on mortgage relief may be misdirected, as they target a group that is already structurally insulated from the most acute market shocks.

96. Instead, the results advocate for a strategic pivot toward rental market regulation and the expansion of non-market housing alternatives. Stabilizing the rental sector is identified as the most direct mechanism for mitigating the impact of regional inequality on vulnerable populations, thereby preventing regional economic growth from translating into the permanent social exclusion of a generation priced out of property ownership.

97. To bridge this gap, intervention must shift away from broad mortgage subsidies and toward robust rental market regulation and non-market housing supply, as these are the only tools that directly reach the population most vulnerable to regional distributive shifts.

A. Policy Implications

98. Under this framework, policy interventions focused solely on mortgage relief may be misdirected, as they prioritize a group that is already structurally insulated from the most acute market shocks. Instead, the results advocate for a strategic pivot toward rental market regulation and the expansion of non-market housing alternatives. Stabilizing the rental sector is the most direct mechanism for mitigating the "Gini effect" among vulnerable populations, preventing regional economic growth from translating into the permanent social exclusion of a generation priced out of property ownership.

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