Living off Assets? European Household Incomes in the 'Asset Economy'

0. ABSTRACT

This study examines the prevalence and evolution of "petit-rentier" households in Europe, defined as those shifting from primary wage-based income towards income derived from the ownership of assets. Utilizing data from the Household Finance and Consumption Survey (HFCS) for the EU-27 between 2011 and 2021, we investigate factors driving the emergence of these households and their distinct characteristics across countries. We employ a novel methodological approach, combining feature importance analysis from machine learning (ML) with traditional logistic multilevel modelling. Contrary to expectations, our findings reveal a modest but statistically significant decline in the prevalence of "petit-rentier" households across the EU. We identify a strong association between real estate ownership, social class, and households deriving substantial income from capital sources, a finding of particular relevance given rising property prices and rental incomes in the EU. Notably, the inclusion of private pension income among capital sources increases not only the importance of age cohorts but regional variability as well, reflecting the influence of diverse national public pension systems across the EU.

KEYWORDS: *Petit-Rentier Households, Capital Income, Logistic Multilevel Modelling, Gradient Tree Boosting*

1. INTRODUCTION

Prominent scholars have argued that the broadening participation in asset-ownership has profoundly transformed the sociological makeup of contemporary western societies. In his best-selling book on *Capital in the 21st Century*, Piketty (2014, p. 240) argued that one of the most important developments in the past century had been the emergence of a "patrimonial middle class" which had ushered in a "society of petit rentiers". Adkins, Cooper and Koning's influential investigations into the "asset economy" (Adkins, Cooper, and Konings 2021; 2021; 2022) go so far as to suggest that the ownership of assets has now become more significant than employment relations in determining class structures and living conditions. A substantial literature, particularly in the interdisciplinary field of housing studies (Ansell, 2014; Arundel, 2017; Lennartz & Ronald, 2017), has also examined the role of "asset-based welfare" as an increasingly important substitute to public welfare provision. The focus of these investigations has been on the "wealth effects" and capital gains achieved from asset appreciation. Fewer research, however, has centred on discerning the extent to which households have managed to generate a significant income stream from the ownership of assets. This aspect is crucial considering its implications for household's day-to-day livelihoods and their position in broader social structures and processes. Our paper seeks to bring further light to this question.

The few studies which have focused more closely on asset-based income have underscored the "failures of asset-based welfare" (Montgomerie & Büdenbender, 2014) and argued that most of the population have not "escaped the tyranny of earned income" (Froud et al., 2010). Goldstein & Tian (2020) show that, in the 21st century, most western countries have seen a decline in the already minority share of households accruing more than 10% or 20% of income from private assets. The latter

study is also the first to extend its empirical basis beyond a few number of cases. It investigates the factors behind the varying proportions of households who are considered petit-rentiers across 29 countries, including several European Union (EU) member states. Their analysis, however, faced limitations due to the heterogeneous nature of data from the Luxembourg Income Study (LIS), which relies on independent surveys of varying designs and frequencies. These constraints hindered a comprehensive micro-level analysis, leading them to concentrate on factors influencing cross-national proportions of petit rentiers.

Our study utilizes the more uniform data from the Household Finance and Consumption Survey (HFCS), which encompasses up to 23 EU countries through 4 waves spanning roughly a decade (2010-2021). We go beyond the mere cross-country analysis focusing on household-level determinants that contribute to the emergence of petit-rentier households through the examination of a set of socioeconomic variables that may affect the likelihood of reporting a significant portion of income from asset ownership. Following Goldstein and Tian (2020), we use a binary proxy as our main dependent variable to operationalize the concept of petit-rentiers. Our use of the term *rentier* here is a shorthand for income in the form of rent, interest, dividends, profits, royalties or any other legal category of revenue which derives from the remuneration for the ownership of an asset. That is, in other terms, Capital Income (CI). A household is assigned a value of 1 if its income from asset ownership exceeds a certain threshold (either 10% or 20%) and 0 otherwise.

This study operates on two distinct levels. Initially, at the macro level, we provide a descriptive analysis of petit-rentiers, detailing the composition and generation of CI across EU countries. Subsequently, at the micro level, we employ advanced statistical techniques to explore the impact of a set of key socioeconomic variables on households identified as petit-rentiers. We begin with a feature importance analysis using gradient-boosting techniques to identify core factors. Following this, we estimate a multilevel model using the same dataset. This model accounts for variations across waves and countries and includes other variables as fixed effects. This approach enables us to assess their relative importance and directionality in a more conventional regression framework. Thus, this work synthesizes both broad national trends in "petit-rentier" emergence and its determinants at the household level.

The rest of this paper is organized as follows: The next section theoretically contextualizes the dynamics underpinning the social distribution of asset ownership and income and revisits recent debates on the subject. The third section describes our methodology, data sources, and variables. The fourth section presents our empirical analysis and includes a statistical overview of asset-based income at the national level across EU countries followed by the analysis of household-level factors influencing being a petit-rentier, combining feature importance analysis and the estimation of an EU-scale multilevel logistic model. The final section discusses our main findings and their contribution to the literature.

2. AGE, CLASS AND DISTRIBUTION OF ASSET-BASED INCOME

Adkins, Cooper and Koning's (2020) trace the emergence of the "asset economy" to the neoliberal policies that sought to reverse the context of wage and consumer price inflation and asset price stagnation in the late 1970s. Alongside inflation-averse monetary policy, wage repression and public welfare retrenchment, governments encouraged the working population to jump on the bandwagon of asset inflation to compensate for their losses on labour income (ibid). The middle classes who had

managed to get their hands on some "crumbs" from the relative deconcentration of wealth since the world wars where better positioned to do so (Piketty, 2014, p. 261). Privatizations of public assets, such as through the "right-to-buy" public housing (Hodkinson, 2012) and public offerings of state-owned company shares to retail investors (Edwards, 2022; Heinemann, 2021), provided additional opportunities. The promotion of personal and occupational pension plans also enabled the expansion of "indirect" forms of ownership (Waine, 1992) and the formation of a "labour's capital" (Liu & Goldstein, 2022). Such indirect forms of ownership where also fostered through financial products offered by the growing financial services industry, in the form of mutual funds and saving plans (Edwards, 2022; Fligstein & Goldstein, 2015). It was the expansion of mortgage credit, however, that provided the means for mass investment in the most expensive and important asset for households: housing. Homeownership rates increased widely from the 1980s, until the 2008 mortgage crash truncated this trajectory in those countries hardest hit by the crisis (Aalbers et al., 2020; Arundel & Ronald, 2020; Byrne, 2020; Smith et al., 2022).

The 2008 mortgage crash and financial crisis revealed the main limits and contradictions of this strategy for achieving asset ownership. On the one hand, mortgage credit can only compensate so far for losses in labour income. On the other, the expansion of mortgage credit simultaneously drives house price inflation, making homeownership increasingly unaffordable (Kohl, 2018; Ryan-Collins et al., 2017; Smith et al., 2022). Thus, while part of the population becomes excluded from homeownership, those who are granted mortgages face rising debt burdens. Where taken furthest, this contradictory dynamic catalysed widespread crisis (Aalbers et al., 2020). In addition to those expelled from homeownership due to a wave of foreclosures in the wake of the crisis, a "generation rent" formed in the following years from those excluded from mortgage credit (Byrne, 2020; Vidal et al., 2024; Waldron, 2021). Crisis also shook the optimism and savings of retail investors, although this effect was tempered by how households have become socialized into speculative logics through their participation in financial markets (Goldstein & Knight, 2023; Heinemann, 2021). As per funded pension plans, financial instability triggered a re-assessment of their role as a complementary, rather than superior, source of old-age income (Ebbinghaus & Wiß, 2011; Hassel et al., 2019).

Whereas becoming asset owners has proved elusive for many, transforming asset-ownership into a significant income stream is a step further out of reach. Mortgage free owners-occupiers do technically enjoy an "imputed rent" equivalent to the rent they would otherwise pay for a housing unit equivalent to the one they own. In addition, equity release schemes, such as reverse mortgages and home reversion plans, allow one to tap into housing equity while remaining in the dwelling, yet have experienced very limited take up (Hoekstra & Dol, 2021). Selling and downsizing is another option, but fully realizing capital gains from a sale is only within the reach of multiple property owners. The transformation of "under-used" domestic spaces, such as spare bedrooms, into rent-bearing assets, which has been bolstered by short-term rental platforms, does provide additional opportunities for extracting rent from one's home. This comes at the expense of privacy, however, and represents a minority share of the short-term rental market (Cocola-Gant et al., 2021). Regardless, as Froud et al. (2002, 2010) argue, only accumulating a large stock of assets can deliver substantial income. This is not only because the magnitude of the returns is dependent on the size of the investment, but also because larger asset portfolios tend to generate disproportionally higher returns. Large portfolios are more diversified and include higher-risk/higher-return asset classes, as well as afford more professional and informed asset management (Fagereng et al., 2020; Piketty, 2014, pp.

421–454). Wealthier households also benefit from ongoing socio-spatial inequalities, as they tend to own better located real estate assets (Montgomerie & Büdenbender, 2014; Wind & Hedman, 2018).

Following Semyonov and Lewin-Epstein (2013), household wealth is otherwise accumulated through two major mechanisms: labour market income and inter-generational transfers. European countries have experienced growing income inequality since the 1980s and Albertini et al. (2020) identify a "fanning out" over time of the earning hierarchy, that is, an increase in the gap between higher earners and the rest of the population. Their higher earner category includes large employers as well as individuals in higher-grade professional, administrative, and managerial occupations, also known as the "working rich" who have emerged from contemporary corporate structures (Dumenil & Lévy, 2004; Erturk et al., 2007). Particularly, as Godechot (2016) notes, in the financial sector, amongst those well-positioned to appropriate rents created in financial markets. As per inter-generational transfers, wealth inequality is more concentrated than income inequality, and this disequilibrium is passed on mainly through inheritance and gifts. The annual flow of inheritances and gifts has accelerated since the 1980s, as burgeoning asset appreciation and returns is handed down an inverting population pyramid (Piketty, 2014).

The availability of credit, and particularly mortgage credit, has also facilitated debt-based entrepreneurial investments and "proactive" asset-based welfare strategies (Ronald et al., 2017; Wind et al., 2020). Buy-to-let real estate investments have spurred the growth of private landlordism, particularly in the wake of the 2008 crisis, as those who had accumulated wealth in previous cycles and weathered the storm, leveraged their patrimony to acquire additional properties at discounted rates and introduce them into the expanding private rental market (Boertien & López-Gay, 2023; Ronald & Kadi, 2018; Soaita et al., 2017). Debt-based investment strategies, however, are conditioned by and amplify existing inequalities, as wealthier households can both borrow more and at a lower cost (Fligstein & Goldstein, 2015).

Altogether, as Goldstein and Tian (2020) suggest, there are both concentration effects and diffusion effects at work in contemporary financial capitalism. Their findings suggest that "the concentration effect tends to predominate over the diffusion effect when it comes to the social distribution of asset-based income accrual in most countries" (*ibid*, 24). In a similar vein, Authors (forthcoming) argue that the processes that enable the acquisition of assets; privatisation, financialization and digitalisation, and the concrete mechanisms underpinning them, set in motion contravening tendencies and are ultimately limited by wage income. These processes, in turn, contribute to eroding the wage base, further limiting asset acquisition opportunities and, thus, their income-generating potential.

Whereas the concept of petit-rentiers stimulates inquiries into the social distribution of asset ownership and income, the terms "generation rent" and "generation landlord" (Ronald & Kadi, 2018), which have also become commonplace in the academic literature and public discourse, evoke an important generational dimension to be considered, particularly in relation to housing. This divide has been popularly portrayed as 'boomer' home-owners and landlords versus 'millennial' renters. The former reaped the opportunity to access housing property in much more favourable macroeconomic circumstances, whereas the latter have been priced out due to asset inflation (Shaw, 2018; Sternberg, 2019). Older people are also generally further down their career path and have had more time to accumulate personal savings to be invested. Yet, there is also a fundamental class dimension to this divide that is increasingly being underscored in the academic literature. Income differences and intergenerational wealth transfers explain much of today's differing homeownership trajectories

(Christophers, 2018; Forrest & Hirayama, 2018; Ronald, 2018). Christophers (2018) argues that intergenerational differences are in fact best understood as an 'epiphenomenal manifestation' of class-based inequalities. Whilst it is broadly acknowledged is that there is both an age and class bias in contemporary property structures, there are varying emphases and interpretations of their relative importance and underlying causal mechanisms.

3. METHODOLOGY

3.1 Operational Definition of CI and Petit-Rentier

CI encompasses income derived from the ownership of assets and applies to both corporations and households. For the latter, it is categorized into three primary segments: real income (primarily rent from real estate), financial income (comprising core financial earnings like interest, dividends, and business profits), and capital gains from asset appreciation. Notably, financial income also includes deferred earnings from retirement funds, excluding public provisions, and is categorized as "Private Pensions" (PrP).

Challenges in researching CI include its opaque nature and the inconsistency in data reliability and definition across different sources. The microdata provided by the HFCS is used exclusively in this paper as it ensures consistency across the studied EU countries, though it necessitates omitting data on capital gains[1] and more fine-grained financial income breakdowns due to their unavailability in the required detail. The concept of a "petit-rentier" household—households for whom CI constitutes a significant portion of total annual income—is operationalized following the methodology of Goldstein and Tian (2020). Petit-rentier households are identified as those whose CI exceeds a certain threshold (usually 10% or 20%) of their total annual income.[2]

3.2 Data: Source Description

Our research employs microdata from the HFCS, which aggregates multiple national surveys coordinated by the European Central Bank (ECB). This survey covers information from 23 EU countries—including 19 in the Euro Area plus Czech Republic, Croatia, Hungary, and Poland—with an average sample size exceeding 83,000 households per wave. Among these, only 15 countries have consistently participated in all four waves of the survey from 2010 to 2021. For cross-national analysis, the sample is limited to these 15 countries to maintain a balanced panel. However, for the household-level analysis, which employs gradient-boosting algorithms and multilevel models (which are less sensitive to unbalanced data), we include all countries for each wave. This approach maximizes the

[1] The HFCS does not provide information on capital gains for France and Poland, two of the largest populations among EU countries. Additionally, the reporting of capital gains is computed like a residual as income not computable to conventional sources, an excessively broad categorization. Therefore, to maintain methodological consistency and to ensure the inclusion of all major EU economies in our analysis, we have excluded capital gains from our definition of capital income throughout this study. Furthermore, capital gains represent irregular, non-recurring income flows unlike the other forms of CI and its relative share is by far the smallest among them. Using HFCS data, capital gains accounted for 13.5% of total household CI for the whole EU sample in 2021, 3.3% down from 2010.

[2] These necessarily discretionary choices also facilitate comparison with Goldstein and Tian (2020), one of the few cross-country empirical studies on CI and rentier households prior to this research.

inclusion of all available microdata from the HFCS for this study. We also considered individual survey weights to calculate consistent population statistics and for the estimation of multilevel models.[3]

Regarding categorical variables, we employed a systematic approach to social class categorization based on the household reference person as defined by the United Nations Canberra Group guidelines. We established a four-tier classification system based on labour market position: workers (individuals engaged in wage labour under employment contracts), self-employed (individuals who work independently without employing others), employers (individuals who own businesses and employ others), and inactive (a residual category for individuals not classified in the above groups).

To enhance structural consistency in our classification scheme, we implemented several methodological adjustments. Rather than creating a separate category for retirees, we classified them according to their most recent principal labour market status prior to retirement, maintaining conceptual continuity in social class identification. We refined the employer category by reclassifying nominal employers without hired personnel as self-employed, ensuring the employer classification accurately reflects the structural position of employing others. The "inactive" classification serves as a residual category for household reference persons whose labour market status did not align with our three primary social class positions. This classification framework allows for a more nuanced analysis of socioeconomic stratification based on structural positions in labour relations rather than transitory status. Throughout the empirical section of this work, we focus exclusively on shares and proportions; consequently, all monetary variables have been analysed using their reported nominal euro values without further adjustment or transformation.

3.3 MODELLING STRATEGY: the macro and micro scales of petit-rentier identification

Our primary objective, both at macro and micro levels, is to identify patterns in the proportion of households reporting a significant share of CI among their total annual income. The empirical analysis begins with a country-level overview of descriptive statistics on CI and its main components. Subsequently, a fixed effects panel model is estimated to identify EU-scale temporal trends in the proportion of households reporting significant CI, as represented by the equation:

$$\overline{y}_{ti} = \alpha_i + \beta\omega_t + \epsilon_{ti} \quad (1)$$

Where $\overline{y}_{it}$ represents the national share of CI for country i and wave t, α_i is a country-level fixed effect and ω_t denotes the survey wave, incorporated as a linear time trend.

At the micro level, our analysis descends from national to household perspectives to identify key factors contributing to significant CI reporting by households. We propose a novel two-stage process that improves upon traditional multilevel model estimations. Initially, a gradient tree boosting model is utilized for feature importance analysis. This analysis informs for feature selection and complements the subsequent estimation of a logistic multilevel model constructed using those same features as covariates.

Our microdata is composed of country-level household surveys from multiple waves, which necessitates a robust hierarchical structure for accurate analysis. To establish this structure, we need

[3] All the estimations were performed in R. The necessary code to replicate our results is publicly available on (authors´ GitHub repository). The necessary microdata for replication is protected and should be requested through the following access form:
https://www.ecb.europa.eu/home/pdf/research/hfcn/access_form_leadresearchersurname_researchersurname.pdf

to manage random intercepts associated with countries and waves. Crucially, we must also introduce a third level to account for country-wave interactions, a factor often neglected in standard specifications (Schmidt-Catran & Fairbrother, 2016). By doing so, we can construct a four-level logistic model with crossed effects. As outlined by Schmidt-Catran et al. (2019) such model can be consistently formulated as follows:

$$g(y_{jti}) = \beta_0 + \sum_{k=1}^{K}(\beta_k\, x_{kjti}) + \sum_{t=1}^{T}(\delta_t \omega_t) + u_{jt} + v_j \quad (2)$$

Where y_{jti} is a dummy variable that takes the value of 1 if the household reports that more than 10% of their annual income comes from CI sources. In this model i stands for the i-th household, j for the j-th country and t for the corresponding wave. The model includes K covariates included as fixed effects. The three levels of data characteristic of the HFCS are considered: the wave is included as a dummy in the fixed part, and random intercepts v_j and u_{jt} account for the country and the country-wave interaction variance respectively.

Overall, this combined approach offers a thorough understanding of the dynamics within the "petit-rentier" class across the EU from 2011 to 2021. The macro-level analysis identifies broader trends and cross-national variations across the EU, effectively controlling for national differences. Meanwhile, the micro-level analysis delves into the specific factors within households that influence their likelihood of reporting a significant proportion of CI in their annual earnings.

4. EMPIRICAL SECTION: HFCS evidence on CI

4.1 STATISTICAL OVERVIEW: main components, participation rates and mean values

To elucidate the key characteristics of CI, we collated essential statistics from the first (2011) and last (2021) waves of the HFCS for 15 EU countries where data was available for both periods. Our descriptive analysis encompasses three dimensions: firstly, participation rates in different forms of CI; secondly, their associated mean values; and thirdly, the structure of CI delineated by the weighted share of its components.

INSERT TABLE 1

Starting from the right, table 1 shows obtained population statistics reporting participation rates. For overall CI participation (any form), countries like Italy and France exhibited high and relatively stable rates (83-91% for Italy and 91-86% for France). In contrast, nations such as Slovenia and Luxembourg displayed significant decreases (from 42 to 7% for Slovenia and from 50% to 27% for Luxembourg). Notably, in the case of rental and PrP income, approximately two-thirds of the countries reported increased participation rates. Conversely, a similar proportion of countries (11/15) experienced declining participation rates for financial income between 2011 and 2021.

The mean values of these capital forms, adjusted to 2011 constant prices, present a complex scenario. Financial income exhibited an increase in a few countries like Finland while a majority reflected an erosion of mean values for financial rents, especially deep in cases such as Austria. The mean value of rental income rose remarkably in countries like Belgium, Italy, and Spain while the mean values of private pensions notably increased in countries like Finland and the Netherlands. Overall, a majority (12/15) of the countries reported increased mean rental income values, while approximately the same

majority (11/15) indicated declines in mean financial income values. Mean values for PrP income showed a roughly equal number of countries reporting increases and decreases.

Concerning shares, rental income reported a generalized increase in its relative weight across 12 countries, while only 4 countries reported an increase for financial income and 7 for PrP income. Both the largest increase (+30%, Belgium) and the smallest decline were observed in rental income, whereas the smallest maximum growth and largest decrease were reported in financial income. Collectively, this compositional shift suggests a movement towards rental income at the expense of financial income, with PrP income occupying an intermediate position. This trend seems to reflect two predominant characteristics of EU economies over the past decade: burgeoning housing prices amidst negligible inflation and exceptionally low interest rates, which have weakened returns on interest-bearing financial assets. These trends underscore the diversity of strategies and preferences for CI across different EU countries. Including or excluding private pensions significantly changes the perception of the CI structure, highlighting the importance of considering various income components for a comprehensive analysis.

4.2 Characterizing "petit-rentier" households

In the past decade, the landscape of CI distribution within the EU has witnessed notable shifts, as evidenced by the overview depicted above. However, relying only on mean values or participation rates for highly unequally distributed sources of income is not a reliable way of identifying "petit-rentiers", whose class position is built on being able to obtain a significant amount of non-waged income. For this purpose, following Goldstein & Tian (2020), we constructed a binary proxy to grasp the prevalence and evolution of petit-rentiers among EU countries during the last decade. This analysis focuses on the proportion of households surpassing specific CI levels, which represent the share of total annual household income derived from capital sources. For consistency with the referred work, we rely fundamentally in the 10% threshold as our main proxy for our modelling strategy. Nonetheless, we provide a first approximation including both 10% and 20% marks for comparative purposes.

INSERT CHARTS 1 & 2 HERE

An initial examination indicates that, from 2011 to 2021, there has been a general trend towards a decline in the proportion of the general population exceeding both 0.1 and 0.2 CI shares of total income. This trend is particularly noticeable in countries like Austria, where the percentage surpassing the 0.1 CI threshold diminished from 6.9% to 4.6%, and in France, where it decreased from 20.3% to 15.7%. Overall, only five countries reported a slight improvement. A similar pattern is observed at the 0.2 CI level, with a decrease in the proportion of populations exceeding this threshold in most countries (9 out of 15). This downward trend is also evident in the average share of CI, with 11 countries reporting lower values in 2021.

INSERT CHART 3 HERE

To offer a more detailed perspective on petit-rentierism, it is crucial to consider households with CIs that fall below our established minimum thresholds. Chart 3 provides the empirical cumulative density distributions (ECDF) of CI across different countries, as well as their GINI indices at both the start and end of the study period. The GINI index, a measure of income distribution disparity, indicates greater inequality with values nearing 1. Analysis reveals that, among the 15 countries studied, 10 saw an increase in CI inequality. Notable increases were observed in Slovenia, Malta, and the Netherlands,

where the GINI indices rose by over 2 percentage points, indicating a widening disparity. Conversely, Luxembourg, Finland, Italy, and Slovakia experienced reductions in inequality, with Luxembourg showing a significant decrease of more than 1 point in its GINI coefficient. In contrast, France, which is central to Piketty´s (2014) hypothesis on the emergence of a “petit-rentier” society, displayed only a marginal rise in its GINI index from 0.93 to 0.94, which kept France as the country were this kind of income was more widely distributed. This suggests that the "democratization of CI" in France is likely an exception rather than indicative of a wider cross-national trend.

Table 2 presents an overview of the dynamics of households´ CI across EU member states at the first (2011) and last (2021) waves for our broadest definition of CI including PrP. The table is segmented into three main categories: a summarization of national participation rates of households exceeding selected thresholds, and the breakdown of CI into major components (rental income, financial income, and private pension payments) for households above the 10% (centre) and 20% (right) tiers of CI.

INSERT TABLE 2 HERE

Notably, participation shares for the standard 10% CI tier revealed a downward trend in 10 countries, while increasing the threshold to 20% showed a somewhat softer decline in just 9 countries, one less than the lower tier. This indicates a process of concentration of CI. Rental income increased its share among CI components, where out of 15, 10 and 11 countries reported a growth at the 10% and 20% thresholds respectively. Often, at the expense of PrP and particularly financial income relative weights. Financial income, despite its larger share among petit-rentier households, experienced erosion in 11 countries from 2011.

By 2021, rental income became the dominant CI component in 10 out of 15 countries, marking a 66% increase from 2011, when it only was dominant for 6. Regarding countries where rental income is still not predominant, Finland, Malta, and France are predominantly influenced by financial income, whereas the Netherlands and Finland see a higher dominance of PrP. These trends suggest a shifting landscape in income sources within these economies, with rental income becoming increasingly significant over the decade for petit-rentier households in 2/3 of our sampled EU countries.

A more formal yet accessible framework for examining temporal trends in above-CI shares among the total population or specific subgroup clusters is to integrate aggregate national CI shares into a fixed effects panel model, where time serves as the only covariate. Table 3 presents the results of estimating this model across various CI thresholds (5%, 10%, 20% and mean national share). It also details the outcomes of estimating those models for two control groups: households in the top quintile of wealth and income. The upper section of table 3 reports the results for the total population. On the left-hand side, excluding pensions, the findings indicate a small negative effect for the time trend coefficient across all models, with more pronounced declines for less restrictive tiers. All models, except for the 20% tier, reported values significant at least at the 5% level. Regarding explanatory power, all models reported relatively modest R-squared values, with the 5% tier showing a value above 0.2.

INSERT TABLE 3 HERE

On the right-hand side, which includes a measure of CI incorporating PrP income, the results were similar but showed lower levels of significance, smaller effects (coefficients closer to zero), and reduced explanatory power across the four models. The middle and lower sections of the table, focusing on households in the top quintiles of wealth and income, displayed less conclusive evidence.

These models exhibited a mix of positive and negative coefficients, but none were significant in all cases, and they had minimal R-squared values. This evidence suggests two contrasting narratives: a significant negative trend for total households with earnings above the CI threshold, and an absence of such a trend among top income and wealth quintiles, where no clear alternative trend can be identified.

4.3 Household-level CI determinants (I): Gradient Boost Feature Importance Analysis

Having delineated the principal cross-national characteristics of CI across EU countries, our focus now shifts to exploring the household-level determinants of reporting a proportion of CI above a reference 10% threshold. As previously indicated, this section leverages the synergies of two distinct analytical procedures. We initiate our analysis with a ML approach using gradient-boosting to ascertain the relative importance of various features in explaining "petit-rentier" households. This method offers a significant advantage over traditional regression analyses, as it permits a less constrained examination of feature importance, encompassing control levels such as waves and countries. While the primary drawback of this approach is the inability to obtain coefficients that quantify the magnitude and direction of feature effects, this limitation is adequately addressed by the subsequent introduction of a more conventional logistic multilevel model.

For this analysis, we employ the widely recognized LightGBM[4] framework to train our supervised decision tree models. Following extensive testing of various formulations, we have selected a set of features for our analysis, categorized along 3 main groups. The first group contains several standard sociodemographic characteristics: gender, sex, age-cohort and household size). The second group is constituted by our hierarchical controls, country and wave. The third and more interesting group is constituted by a set of socioeconomic covariates. This group could be itself divided into two categories as well.

First, we have included a custom definition of class generalizable to the whole population by assigning retired people to the social class which would correspond given their last main labour situation. The second group moves from class positioning towards the importance of ownership in the form of assets of distinct nature. For that purpose, we compute a series of dummy variables which takes the value of 1 in case the household presents this form of asset in their portfolio and 0 otherwise. Considering real assets, we introduce one dummy controlling for homeownership and another for those households which have other real-estate properties distinct from their main residence. For the distinct types of financial assets, we set dummies for: Unlisted-Shares, Bonds, Mutual-Funds, Managed-Accounts and Other-Fin-Assets for any other financial asset not already consider by the previous categories. A final dummy is included controlling for the ownership of PrP schemes. Chart 3 shows the relative feature importance of those factors for the identification of CI households.

In the first model, which focuses solely on real and financial CI, ownership of additional properties besides the primary residence emerges as a dominant factor, accounting for over 40% of the model's influence. Kadi et al., (2020)emphasis on the rise in multiple property ownership for investment purposes, as distinguished from secondary homeownership for household consumption, comes through here. The country identifier is the next most significant determinant, contributing around 30%. Thus, these two covariates alone constitute over 70% of the model's feature importance. Around

[4] For a detailed overview of lightGBM features check its GitHub project: https://github.com/microsoft/LightGBM

another 10% is contributed by ownership of listed shares, while factors like owning other real estate-properties, social class and private pension scheme ownership exert a modest but still noteworthy influence, each surpassing 10%.

INSERT CHART 3 HERE

In the second model, which incorporates an alternative measure of CI including rents from PrP plans, we observe subtle yet significant differences. The country factor supersedes ownership of additional real estate as the predominant feature, reflecting more than 40% of total influence. This seems intuitive, aligning with the relevance of public pension provisions to determine the demand of PrP. Additionally, social class ascends to the second position, exceeding 20%, a plausible outcome considering the varied likelihood of private pension plan subscriptions across social classes. The influence of owning additional real estate drops to just below that of social class, yet it still represents around 20% of the total influence. Age sees an increased importance, surpassing 10%, an expected result given its role as a primary determinant for receiving periodic rents from pension plans. The contribution of owning listed shares remains significant, albeit above 5%, while the remaining variables collectively account for the unexplained remainder, approximately 5%.

Regarding models' predictive performance, both reported relatively high adjusted accuracies above 0.85% with the model excluding pensions reporting a bit larger value, what is reasonable given the more restrictive definition of CI as it implies a greater number of total 0s which are easier to predict. Nonetheless, neither model relied on those negative cases for their good performance as the sensitivity rate (correctly identified positive cases) also stands above 50% of the cases for both models, although clearly larger (+0.67) if PrP are included among the sources of CI.

4.4 CI global determinants in the EU (II): Multilevel Logistic Model approach

To conclude, this study employs a three-level hierarchical logistic model with crossed random effects to analyse household-level CI patterns across EU countries between 2011 and 2021. This approach explicitly addresses the nested data structure, where households are situated within countries and survey waves. Time is modelled as a fixed effect, while country-level and country-wave interaction effects are treated as random effects to capture unobserved heterogeneity. Building on the preceding feature importance analysis, this final section seeks to quantify both the magnitude and direction of covariate influences more comprehensively. By integrating ML principles with multilevel modelling, we enhance the latter's capacity to analyse key covariates previously identified through gradient tree boosting methods.

In the models, the dependent variable indicates whether a household derives at least 10% of its total income from capital sources, with two alternative definitions employed across the tables. Table 4 shows results for the broader definition that also incorporates PrP payments, while Table 5 presents results for the narrower definition including only financial and real estate rents. For each definition, three model specifications are presented: a reduced version with minimal control variables (Models 1.A and 2.A), full models with all variables included (Models 1.B and 2.B), and full models excluding the COVID-19 affected Wave 4 (Models 1.C and 2.C) to isolate any potential issues regarding its inclusion for estimating the models. When model version is not directly referenced, it should be assumed as the full "B" form.

INSERT TABLES 4 & 5 HERE

A consistent finding across all model specifications is the declining trend in the proportion of households reporting significant CI over time. The negative coefficients for Waves 2 and 3 relative to Wave 1 indicate a gradual decrease in CI significance throughout the study period. This temporal pattern persists even after controlling for a comprehensive set of household characteristics and asset ownership variables, suggesting a structural rather than compositional change in income sources across EU households.

When examining the COVID-19 affected wave (Wave 4), the analysis reveals important nuances. In Table 5 (excluding PrP), the Wave 4 coefficient in Model 2.B (-0.31) is more negative than for previous waves, suggesting an acceleration of the declining trend during the pandemic period. This likely reflects COVID-related disruptions such as rental market interventions and financial market volatility. However, in Table 4 (including PrP), the Wave 4 effect in Model 1.B becomes less pronounced (-0.19) and only marginally significant, indicating that PrP payments remained relatively stable during the pandemic, potentially buffering households against other CI disruptions.

The comparative analysis of Models B (including Wave 4) and C (excluding Wave 4) in both Tables 4 & 5 reveals remarkable stability in most coefficient estimates. This consistency suggests that the fundamental relationships between household characteristics, asset ownership, and CI reporting remain largely consistent despite the pandemic. The relatively modest differences between these models strengthen the case for including Wave 4 in the analysis, as it provides valuable insights into how CI patterns respond to economic shocks while confirming the robustness of the identified relationships. Rather than treating the COVID-19 wave as an anomalous outlier, incorporating it into the analysis allows for a more comprehensive understanding of CI dynamics across varying economic conditions.

Age emerges as the strongest demographic variable reporting a significant effect on CI. A clear age gradient is evident, with older cohorts substantially more likely to report significant CI. In Table 5 (Model 2.B), the oldest age group (70+) shows a coefficient of 0.48, while in Table 4 (Model 1.B), this effect is even stronger with a coefficient of 0.71. The 50-69 age cohort also demonstrates positive associations (0.18 in Table 5 and 0.34 in Table 4, B models), while younger households are less likely to derive significant income from non-labour sources, especially if we include PrP among CI sources. This is confirmed by the significant negative coefficient reported by the 18-29 age-cohort in Model 1.B in Table 4 (-0.07 and -0.19 in Models 1.B and 1.C) which becomes non-significant in Table 5 results excluding PrP. Thus, the partial effects of age-cohorts are relatively larger and more robust in Table 4 which includes PrP. This pattern aligns with life-cycle theories of wealth accumulation, as older individuals have had more time to build asset portfolios that generate CI and, more importantly, are the primary cohort receiving PrP payments.

Education level similarly exhibits a gradient effect on capital income reporting. Tertiary education correlates positively with significant capital income (coefficient of 0.09 in both Tables 4 and 5 B models), while primary education shows a more substantial negative association (-0.36 and -0.19 in Tables 4 and 5 respectively). This educational gradient likely operates through multiple mechanisms, including higher lifetime earnings, greater financial literacy, and potentially intergenerational wealth transfers that facilitate capital accumulation. Nonetheless, the size effect of education in the models is modest. Household size consistently demonstrates a negative relationship with reporting a significant amount of CI. Both models report significant but moderate negative coefficients of -0.14 in Table 4 and -0.16 in Table 5. This finding suggests that larger households face greater constraints in

allocating resources toward capital-generating investments, potentially due to higher consumption needs or the dilution of assets across more household members. Regarding demographic variables, gender effects appear relatively minor in the analysis. The female coefficient is small and positive (0.04) in Table 5 (Models 2.C & 2.B) but becomes non-significant and close to 0 in Table 4 (0.01 and 0.00 in Models B and C respectively). This suggests that gender plays a limited role in determining capital income when accounting for other socioeconomic factors, especially if PrP payments are considered.

Turning to socioeconomic covariates, social class demonstrates strong associations with households reporting petit-rentier status. Employers show the most substantial positive association (coefficients of 0.79/0.94 in Table 4 and 0.87/1.07 in Table 5 B/C models), followed by self-employed individuals (significant only in Table 5 with a coefficient of 0.61) and inactive individuals (coefficients of 0.66 and 0.45 in Tables 4 and 5 full models). These findings reflect the differential access to capital-generating assets across occupational categories, with business owners particularly well-positioned to derive income from capital sources, although all other social classes are associated with a significant advantage compared to being a worker.

Asset ownership variables emerge as the strongest predictors of reporting more than 10% of CI. Owning real estate beyond one's primary residence exhibits the largest effect sizes (coefficients of 1.77 in Table 5 and 1.59 in Table 4), highlighting the central role of property investments in generating capital income for European households. Being a homeowner also shows consistent positive associations (0.41 in Table 5 and 0.33 in Table 4), though of smaller magnitude than additional property ownership. Among financial assets, bonds demonstrate the strongest relationship with capital income reporting (coefficients of 0.74 in Table 5 and 0.70 in Table 4), followed by listed shares (0.54/0.56 in both tables B/C models). Participation in private pension schemes also shows substantial positive coefficients (0.58 in Table 5 and 0.53 in Table 4), confirming their role as an important capital income source for many households. The positive associations for mutual funds, managed accounts, and other financial assets further underscore the importance of diversified financial portfolios in generating significant CI, all reporting significant but more modest partial effects between 0.30 and 0.45.

Moving to the random part of the model, the country-level variance reported by full models (0.40 in Table 5 and 0.61 in Table 4) indicates substantial heterogeneity across EU nations, likely reflecting differences in institutional frameworks, tax policies, housing markets, and financial systems. The country-wave interaction variance, while smaller (0.12 in Table 5 and 0.07 in Table 4), suggests that temporal trends vary somewhat across countries, potentially due to differential impacts of macroeconomic developments and policy changes. As expected from a robust set of fixed effects, we identify an important reduction in size for both variances in full models compared to their reduced counterparts. Conversely, removing the COVID-19 wave does not lead to smaller variances, reinforcing the suitability of including Wave 4. Focusing on Table 4, the AIC decreases from 207,234 in Model 1.A to 108,814 in Model 1.B, while in Table 5, the AIC decreases from 149,500 in Model 2.A to 95,300 in Model 2.B. The comparative analysis of model specifications offers valuable insights into the robustness of our findings. The substantial reduction in AIC and BIC values from the reduced models (1.A and 2.A) to the full models (1.B and 2.B) confirms the suitability of household characteristics, social class, and asset ownership as covariates explaining the determinants of a household reporting a significant share of CI in their annual earnings.

These findings collectively illuminate the composition and evolution of what we have called the "petit-rentier" class—households deriving at least 10% of income from capital sources. This group appears to be gradually shrinking over time, as indicated by the negative temporal trend coefficients across both tables. Given the reported fixed effects, the "petit-rentier" class seems predominantly composed of older individuals, those with higher education levels, employers, and households with diversified asset portfolios particularly focused on real estate investments beyond primary residences. The declining trend in households reporting significant CI may reflect broader macroeconomic conditions during the study period, including historically low interest rates that reduced returns on certain financial assets. The potential acceleration of this trend during the COVID-19 pandemic, particularly evident in Table 5 (Model 2.B), suggests that economic shocks may disproportionately affect CI streams, though private pensions appear to provide some buffering effect against such disruptions, as shown in Table 4 (Model 1.B).

The results of our multilevel model estimations could be broadly split into two fields: those derived from comparing "between" different CI definitions and those derived from comparing alternative model specifications "within" a shared CI definition—comparing the same columns of different tables or comparing distinct columns from the same table. On the one hand, there exist certain notable differences depending on the inclusion of PrP (or not) among CI sources. If included, the partial effect of being "70+ years" old is consistently larger, while being "self-employed," on the contrary, drops to approximately half its size when CI does not include PrP payments. Being "18-29 years" only reports a significant negative coefficient when PrP are included. For gender, the mechanism works the other way around: being female only reports a significant (positive) coefficient when PrP are excluded. On the other hand, the consistency of findings across model specifications, particularly the stability of coefficients between models with and without the COVID-19 wave, strengthens confidence in the identified relationships while suggesting that Wave 4 data provide valuable additional insights. The varying impact of the COVID-19 wave across different capital income definitions (Tables 4 and 5) highlights the importance of examining distinct capital income sources separately and understanding their unique responses to economic shocks. These findings enhance our understanding of CI distribution across households and its evolution over the past decade. The results from our estimated multilevel models thus confirm and extend the insights gained from our earlier machine learning feature importance analysis.

5. CONCLUDING REMARKS

Our analysis of CI trends within the EU-27 from 2010 to 2021 provides crucial empirical insights into ongoing sociological debates regarding the changing property and class structures in contemporary European societies. At the cross-national level, we observed divergent patterns: while some countries experienced an expansion in households' CI, a general downward trend prevailed. This finding aligns with Goldstein and Tian's (2020) LIS results from 29 countries. Collectively, these empirical findings challenge the notion of a "society of petit rentiers" (Piketty, 2014) and claims about fundamental changes in class structures brought about by the "asset economy" (Adkins et al., 2021; 2022).

The concentration of income derived from asset ownership was evident not only in the increased Gini coefficients of CI in most countries but also in the declining shares of households reporting CI above specific thresholds (10%, 20%). Notably, this trend was less pronounced, or even absent, among top quintile earners and wealthy households. Additionally, our findings indicate a significant shift in the composition of CI, with a marked increase in rental income becoming the prevalent source of CI in a

majority of EU countries. This suggests an evolving paradigm in the distributional dynamics of capital accumulation.

Further analysis at the household level, accounting for cross-country variations, revealed that class and ownership structure are pivotal factors in the phenomenon of petit rentiers. Primarily, ownership of real estate assets, other than the main residence, emerged as the most significant factor. This finding corroborates the literature on the rise of private landlordism in various European countries following the 2008 global financial crisis (e.g. Boertien & López-Gay, 2023; Ronald & Kadi, 2018; Soaita et al., 2017). In terms of social class, being an employer was identified as the second most influential determinant in predicting a household's likelihood of being petit rentiers. Sociodemographic characteristics generally exerted a minor influence, except in cases where CI included PrP payments. In such instances, age showed a more substantial impact, exhibiting a negative correlation for the 0-29 age group and a positive one for those over 70.

These results challenge the generational focus of much literature on contemporary property structures. Despite older individuals benefiting from more favourable macroeconomic conditions for acquiring assets and being further along their career paths with more time to accumulate personal savings for investment, our results demonstrate that social class remains a more influential factor in accounting for CI. In the debates between age and class regarding the social distribution of asset ownership and income (e.g. Christophers, 2018; Forrest & Hirayama, 2018; Ronald, 2018), our study highlights the persistent relevance of class. Additionally, country-level differences had a more pronounced influence on the likelihood of households being petit-rentiers when PrP payments were considered. As such, the heterogeneous structure and design of pension regimes across European countries has important implications for the proliferation of petit rentierism across the population.

The importance of PrP plans for petit-rentiers extends beyond their role as a private source of income. The model of public pension provision, particularly the generosity of those retirement plans, strongly affects the demand for PrP, as they are to significant extent substitutive goods. Both feature importance analysis and reported multilevel models support this claim, showing increased importance of the national sphere and greater cross-country variability, respectively when PrP were included. Among the main CI sources, only capital gains have not been properly covered in this analysis due to a lack of data availability. This is an important limitation, although capital gains are by far the most volatile and less interpretable component of CI.

In summary, our research uncovers a nuanced landscape of CI dynamics across the EU-27, highlighting the integral role of class and property ownership in shaping economic outcomes. While general trends point to a decline in the share of households reporting significant CI, notable exceptions exist both at the national level, such as in France, and among certain cross-country groups within the EU, particularly the wealthiest households and top income earners. Given the scarcity of literature analysing CI empirically, this study contributes valuable insights into the evolving nature of capital accumulation and distribution within the EU.

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7. TABLES AND CHARTS REFERED THROUGH MAIN TEXT

TABLE 1: CI. Statistical Overview

	PARTICIPATION RATES							
	% CI (any)		% Financial		% Rental		% PrP	
	2011	**2021**	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**
Austria	75%	66%	74%	66%	5%	4%	2%	4%
Belgium	43%	76%	40%	75%	8%	10%	2%	1%
Chypre	32%	17%	25%	11%	13%	8%	1%	2%
Finland	76%	54%	75%	52%	8%	9%	40%	44%
France	91%	86%	91%	86%	14%	14%	2%	1%
Germany	46%	32%	42%	24%	13%	14%	8%	10%
Greece	15%	13%	8%	5%	8%	9%	1%	1%
Italy	83%	91%	82%	91%	5%	7%	1%	1%
Luxembourg	50%	27%	45%	17%	13%	16%	3%	6%
Malta	96%	41%	96%	38%	7%	7%	2%	10%
Netherlands	37%	12%	37%	11%	1%	2%	25%	20%
Portugal	22%	28%	19%	24%	6%	7%	1%	1%
Slovenia	45%	7%	44%	4%	3%	3%	3%	4%
Slovakia	5%	13%	3%	9%	2%	5%	1%	2%
Spain	36%	24%	32%	15%	7%	13%	0%	3%

	MEAN VALUES (constant prices 2011 = 100)					
	Financial		Rental		PrP	
	2011	**2021**	**2011**	**2021**	**2011**	**2021**
Austria	1587	328	842	318	1111	205
Belgium	2062	622	918	1053	395	161
Chypre	2133	1513	1512	786	102	184
Finland	1399	2045	458	562	7460	9790
France	3179	2046	919	1016	37	16
Germany	1085	652	1626	1952	681	856
Greece	258	148	571	490	88	15
Italy	375	382	569	791	196	173
Luxembourg	1221	2650	3229	3847	660	1973
Malta	1006	845	254	476	189	452
Netherlands	1244	380	66	305	5374	4079
Portugal	585	439	364	545	99	185
Slovenia	565	89	65	146	204	168
Slovakia	14	130	43	154	40	59
Spain	733	320	593	993	0	419

	COMPOSITION (A+B+C)=100%					
	Rental (A)		Financial (B)		PrP (C)	
	2011	**2021**	**2011**	**2021**	**2011**	**2021**
Austria	24%	37%	45%	39%	31%	24%
Belgium	27%	57%	61%	34%	12%	9%
Chypre	40%	32%	57%	61%	3%	7%
Finland	5%	5%	15%	16%	80%	79%
France	22%	33%	77%	66%	1%	1%
Germany	48%	56%	32%	19%	20%	25%
Greece	62%	75%	28%	23%	10%	2%
Italy	50%	59%	33%	28%	17%	13%
Luxembourg	63%	45%	24%	31%	13%	23%
Malta	18%	27%	69%	48%	13%	25%
Netherlands	1%	6%	19%	8%	80%	86%
Portugal	35%	47%	56%	38%	9%	16%
Slovenia	8%	36%	68%	22%	24%	42%
Slovakia	44%	45%	15%	38%	41%	17%
Spain	45%	57%	55%	18%	0%	24%

PrP: Private Pension Plans

CHART 1: Share of total households reporting CI above selected thresholds (pensions ex.)

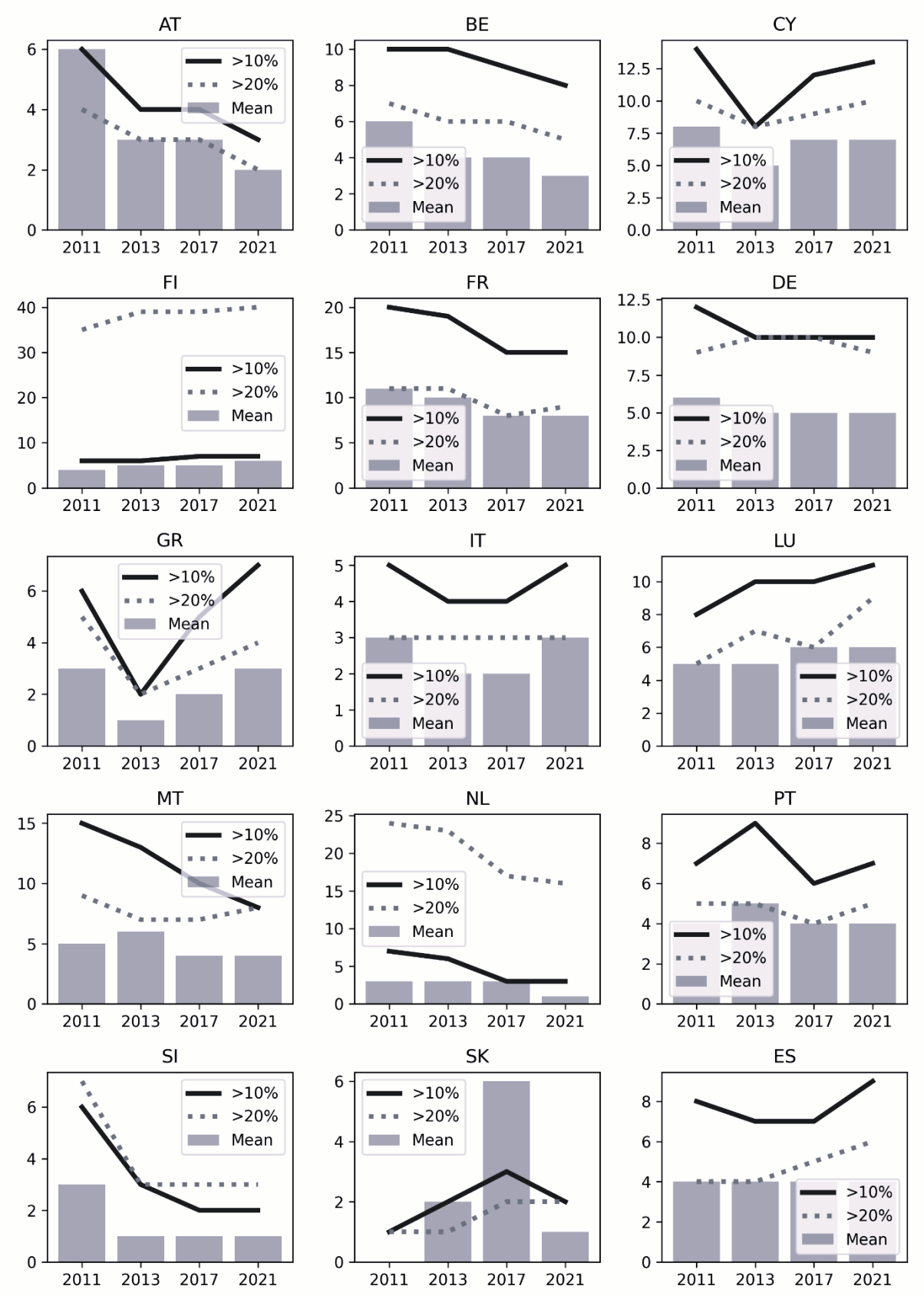


CHART 2: Share of total households reporting CI above selected thresholds

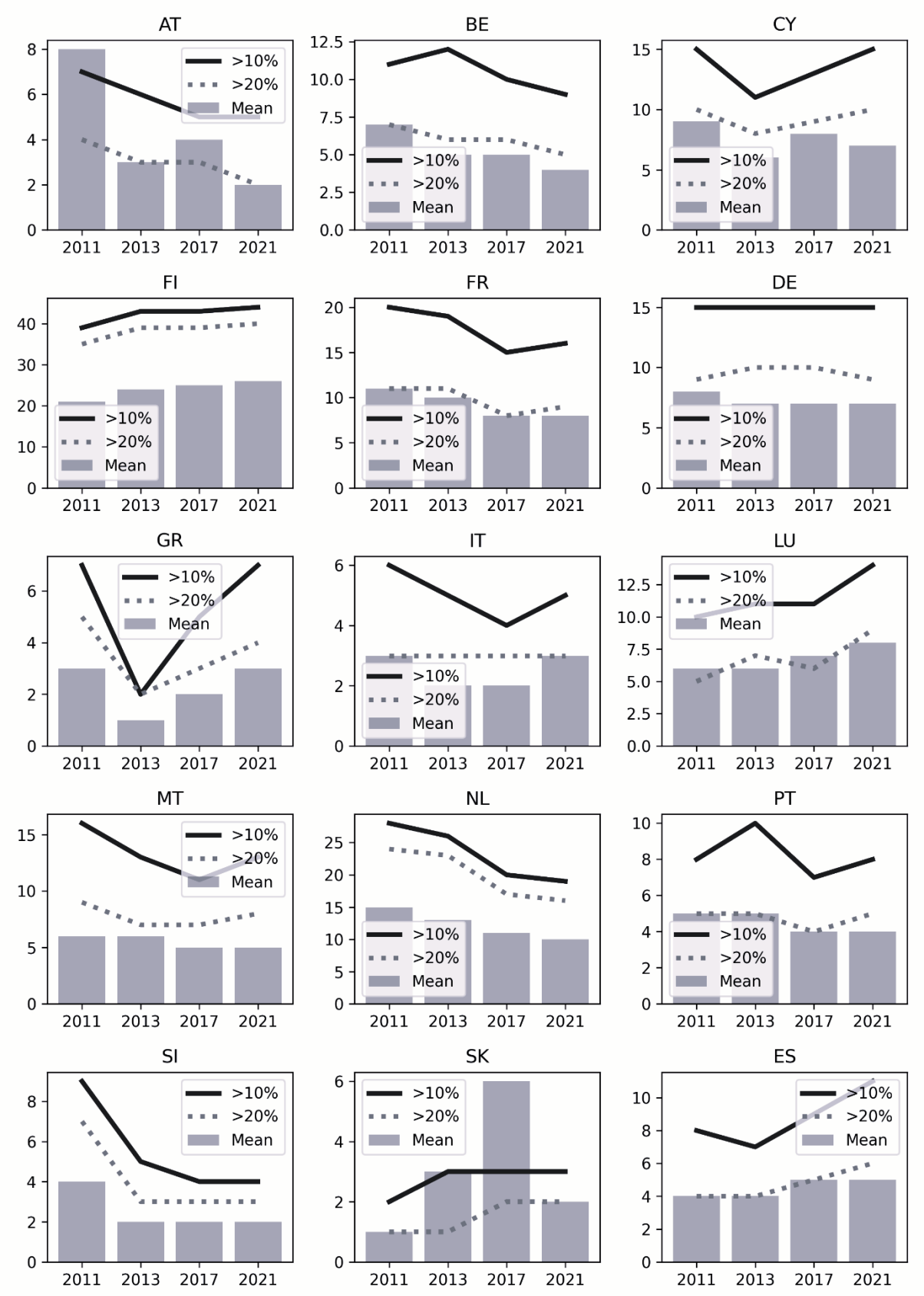


CHART 3: Empirical Cumulative Distribution Function (CDF) of households share of CI

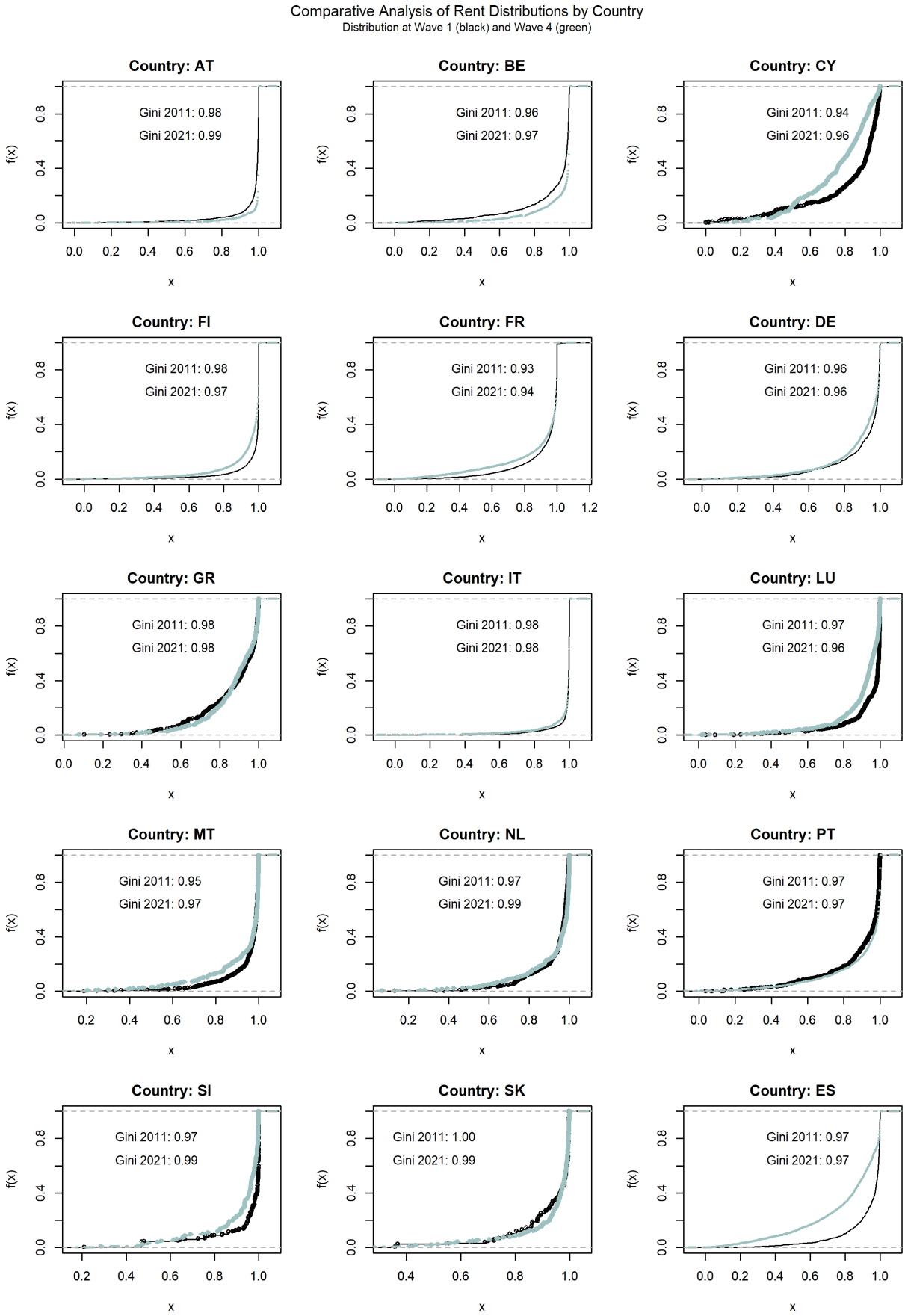


TABLE 2: PETIT RENTIER HOUSEHOLDS (2011-2021): Overview and composition

	Participation rates				*Composition (+10% CI)*						*Composition (+20% CI)*					
	10%		20%		Rental		Financial		PrP		Rental		Financial		PrP	
	2011	**2021**	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**
AT	7%	5%	4%	2%	25%	40%	41%	34%	35%	26%	24%	38%	39%	38%	36%	24%
BE	11%	9%	7%	5%	28%	64%	59%	26%	13%	11%	26%	63%	60%	24%	14%	13%
CY	15%	15%	10%	10%	41%	30%	56%	62%	3%	8%	37%	29%	61%	63%	3%	8%
FI	39%	44%	35%	40%	4%	4%	14%	16%	82%	81%	4%	3%	13%	15%	83%	82%
FR	20%	16%	11%	9%	29%	36%	70%	63%	1%	0%	29%	37%	70%	63%	1%	0%
DE	15%	15%	9%	9%	50%	56%	28%	18%	22%	26%	48%	54%	29%	18%	23%	28%
GR	7%	7%	5%	4%	62%	78%	27%	19%	11%	3%	59%	77%	28%	19%	13%	4%
IT	6%	5%	3%	3%	60%	66%	17%	17%	22%	18%	58%	65%	16%	11%	26%	23%
LU	10%	14%	5%	9%	66%	43%	19%	31%	15%	25%	65%	38%	19%	34%	16%	28%
MT	16%	13%	9%	8%	22%	27%	60%	46%	18%	27%	22%	27%	58%	47%	20%	26%
NL	28%	19%	24%	16%	1%	6%	15%	7%	84%	87%	0%	5%	13%	7%	86%	88%
PT	8%	8%	5%	5%	36%	47%	54%	36%	10%	17%	34%	44%	55%	37%	11%	19%
SI	9%	4%	7%	3%	4%	31%	67%	22%	29%	47%	3%	31%	68%	18%	30%	51%
SK	2%	3%	1%	2%	46%	42%	8%	38%	46%	20%	45%	43%	4%	42%	51%	15%
ES	8%	11%	4%	6%	48%	55%	52%	18%	NA*	27%	44%	49%	56%	19%	NA*	32%

* Value not reported in the corresponding HFCS wave.

TABLE 3: Time-trend fixed-effects Panel Regression on CI national shares

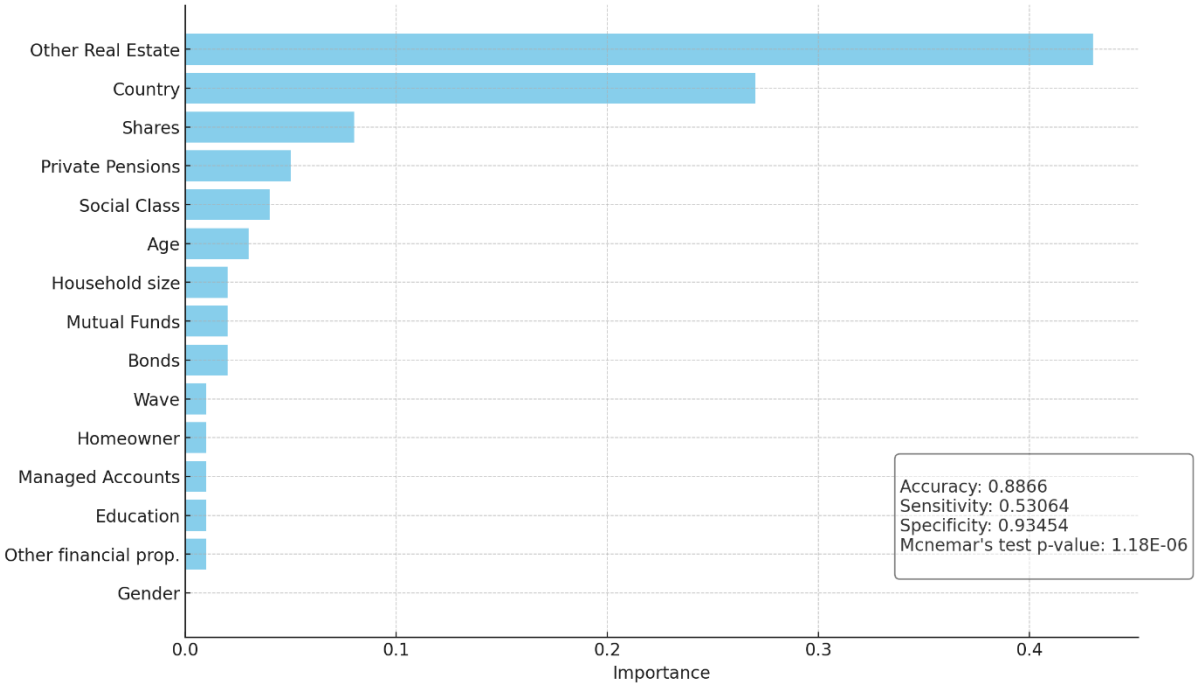
		Panel cross-national regression. Wave as linear time trend							
		Excluding PrP				*Including PrP*			
		Estimate	*t-value*		*R^2*	*Estimate*	*t-value*		*R^2*
TOTAL	5%	-0.009	-3.412	***	0.21	-0.008	-2.630	**	0.14
	10%	-0.005	-2.567	**	0.13	-0.003	-1.562	*	0.05
	20%	-0.002	-1.179		0.13	-0.002	-1.179		0.03
	Mean %	-0.003	-2.210	**	0.10	-0.002	-1.415		0.04
TOP 20 WEALTH	5%	-0.001	-0.101		0.00	0.001	0.082		0.00
	10%	0.001	0.150		0.00	0.002	0.252		0.00
	20%	-0.001	-0.255		0.03	-0.001	-0.175		0.00
	Mean %	0.001	0.076		0.00	0.001	0.076		0.00
TOP 20 INCOME	5%	0.001	0.189		0.00	0.005	0.589		0.01
	10%	-0.001	-0.079		0.00	0.002	0.273		0.00
	20%	-0.002	-0.640		0.03	-0.001	-0.283		0.00
	Mean %	0.000	-0.057		0.00	0.000	-0.057		0.00

*** significant at .01, ** significant at .05, * significant at .1

Mean %: Mean national CI participation rates

CHART 4: LightGBM gradient boost algorithms. Feature importance analysis

EXCLUDING PENSIONS MODEL (10 % CI)



INCLUDING PENSIONS MODEL (10 % CI)

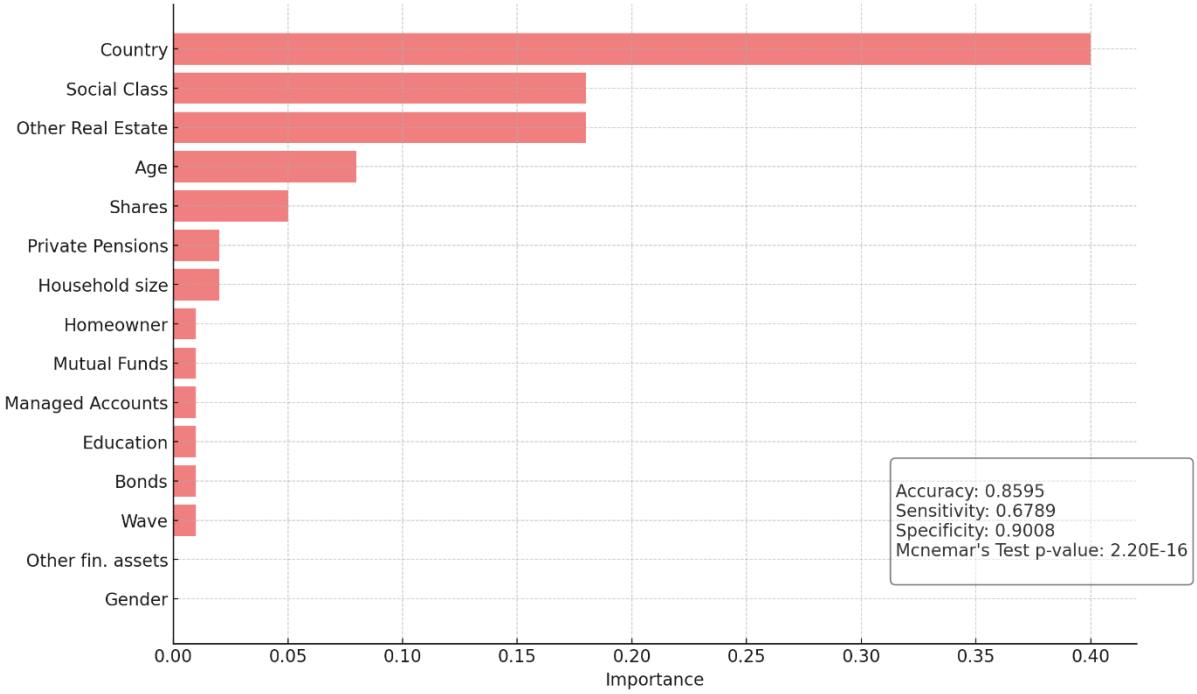


TABLE 4: Multilevel logistic model with crossed effects

Capital Income Threshold 10% Def= Financial rents + Real rents + Private Pensions payments

	MODEL 1. A			MODEL.1. B			MODEL.1.C		
FIXED EFFECTS	coef	t-stat		coef	t-stat		coef	t-stat	
(Intercept)	-2.39	-11.74	***	-3.90	-20.41	***	-3.91	-19.81	***
Household size				-0.14	-17.63	***	-0.14	-15.09	***
Wave (ref: Wave1)									
Wave 2	-0.19	-2.03	**	-0.23	-1.96	**	-0.21	-1.92	*
Wave 3	-0.16	-1.75	*	-0.20	-1.75	*	-0.20	-1.86	*
Wave 4	-0.08	-0.90		-0.19	-1.68	*			
Gender (Ref: male)									
Female				0.01	0.57		0.00	-0.16	
Age Cohort (Ref:30-49)									
Age18-29				-0.07	-1.39	*	-0.19	-2.89	***
age50-69				0.34	13.66	***	0.36	11.89	***
age+70				0.71	21.98	***	0.79	20.16	***
Education (Ref: Secondary)									
Primary				-0.33	-13.51	***	-0.36	-12.86	***
Tertiary				0.11	5.97	***	0.09	4.03	***
Social Class (Ref: Worker)									
Employer				0.79	4.07	***	0.94	3.48	***
Self-Employed				0.39	2.23	**	0.16	0.65	
Inactive				0.67	29.26	***	0.66	23.55	***
Real Assets Portfolio (ref: no)									
Homeowner				0.34	16.30	***	0.33	13.77	***
Other Real-Estate properties				1.58	90.29	***	1.59	77.29	***
Financial Assets Portfolio (ref: no)									
Bonds				0.63	17.60	***	0.70	17.53	***
Mutual Funds				0.36	15.71	***	0.38	13.58	***
Listed Shares				0.54	23.53	***	0.56	20.93	***
Managed Accounts				0.44	11.06	***	0.37	6.90	***
Other Financial Assets				0.31	9.04	***	0.37	8.97	***
Private Pensions Schemes				0.53	27.63	***	0.53	22.86	***
VARIANCE	var	std		var	std		var	std	
country-wave	0.07	0.26		0.09	0.30		0.07	0.27	
country	0.83	0.91		0.55	0.74		0.61	0.78	
AIC	207234			108814			76855		
BIC	207298			109064			77088		
LogLIk	-103611			-54383			-38405		
Deviance	207222			108766			76809		

**** significant at .01, ** significant at .05, * significant at .1*

TABLE 5: Multilevel logistic model with crossed effects

Capital Income Threshold 10% Def= Financial rents + Real rents

	MODEL 2. A			MODEL 2. B			MODEL 2. C		
FIXED EFFECTS	**coef**	**t-stat**		**coef**	**t-stat**		**coef**	**t-stat**	
(Intercept)	-2.73	-16.41	***	-4.08	-23.07	***	-4.08	-22.94	***
Household size				-0.16	-19.15	***	-0.16	-16.48	***
Wave (ref: Wave1)									
Wave 2	-0.23	-2.04	**	-0.26	-1.94	*	-0.25	-1.88	*
Wave 3	-0.21	-1.90	*	-0.24	-1.82	*	-0.26	-1.93	*
Wave 4	-0.22	-1.98	**	-0.31	-2.36	**			
Gender (Ref: male)									
Female				0.04	1.99	**	0.04	1.72	*
Age Cohort (Ref:30-49)									
Age18-29				0.08	1.60		-0.04	-0.64	
age50-69				0.18	7.07	***	0.19	6.29	***
age+70				0.48	13.60	***	0.50	12.14	***
Education (Ref: Secondary)									
Primary				-0.16	-6.26	***	-0.19	-6.23	***
Tertiary				0.11	5.72	***	0.09	3.84	***
Social Class (Ref: Worker)									
Employer				0.87	4.14	***	1.07	3.90	***
Self-Employed				0.74	3.95	***	0.61	2.39	**
Inactive				0.42	15.75	***	0.45	14.36	***
Real Assets Portfolio (ref: no)									
Homeowner				0.41	18.48	***	0.41	15.59	***
Other Real-Estate properties				1.76	95.28	***	1.77	80.56	***
Financial Assets Portfolio (ref: no)									
Bonds				0.67	18.54	***	0.74	17.76	***
Mutual Funds				0.38	15.58	***	0.39	13.29	***
Listed Shares				0.54	22.34	***	0.56	20.32	***
Managed Accounts				0.47	11.27	***	0.42	7.46	***
Other Financial Assets				0.32	8.89	***	0.39	9.19	***
Private Pensions Schemes				0.58	28.89	***	0.58	24.12	***
VARIANCE	**var**	**std**		**var**	**std**		**var**	**std**	
country-wave	0.09	0.31		0.12	0.34		0.11	0.33	
country	0.46	0.68		0.40	0.63		0.40	0.63	
AIC	149544			95295			67673		
BIC	149608			95545			67906		
LogLIk	-74766			-47623			-33814		
Deviance	149532			95247			67627		

**** significant at .01, ** significant at .05, * significant at .1*