Pensioners Without Borders

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Abstract

This paper examines the threat of tax competition and international migration in aging economies, where retirees represent a growing share of the tax base. In 2013, Portugal introduced a full tax exemption on foreign-source pensions for relocating retirees. Contrary to the traditional view that seniors "age in place," flows of foreign EU pensioners to Portugal rose by a factor of 30 after the reform, and stocks by more than 3, with effects concentrated among wealthy, educated pensioners from high-tax countries. The implied migration elasticity of the foreign-pensioner stock is large (2–3) and rises over time. Retirement migration persists after temporary incentives expire, as delayed origin-country retaliation (source-based taxation) only partially offsets outflows. Peer effects and spatial clustering evidence social multipliers and generate housing and healthcare congestion in host regions. In our calibrated optimal tax model, large migration elasticities justify preferential rates on foreign pensions, but regressive windfall gains for domestic homeowners and the geographic concentration of congestion externalities make full exemptions unlikely to be optimal.

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1 Introduction

The world is aging at an unprecedented rate. One in five OECD citizens is currently over 65 years old, a share expected to rise to 30% in the coming decades. As a result, tax collection in advanced economies increasingly relies on retirees: for example, taxpayers over 65 accounted for 23% of federal revenue in 2022 in the US, up from 16% in 2010. Nevertheless, because their pensions are predetermined and they can no longer adjust labor supply, pensioners are generally overlooked in studies of the real effects of income taxation.

However, their lack of attachment to local labor markets implies that they retain the option to relocate to lower-tax jurisdictions. As a result, the growing senior tax base has spurred a new form of tax competition for mobile retirees. As shown in Figure 1, today, around 70 countries – many of them small, high-amenity, lower-income nations in Central America, Southern Europe, and Southeast Asia, located in the geographic "backyard" of large, aging, wealthier economies like Japan, the US, and Northern Europe – have implemented dedicated visas and tax schemes designed to attract foreign pensioners – without incurring the potential labor market consequences of working-age migration. Even within countries, tax incentives for seniors have proliferated: all 41 US states with an income tax fully or partly exempt Social Security income, and 27 of them offer an additional exemption for private pensions in 2023, up from only 21 in 1990 (ITEP, 2023).

Existing research provides limited evidence on retiree migration. First, most studies of migration responses to economic conditions examine wage shocks affecting only labor force participants.[1] Second, the apparent decline of mobility over the life cycle (Molloy, Smith, and Wozniak, 2011) suggests that post-retirement migration may pose only a limited threat to local tax bases. And third, although scarce, existing US evidence finds no effects of variation in state-level taxes on elderly migration (Conway and Rork, 2012).

We shed new light on this question by studying one of the earliest and largest tax breaks for migrating pensioners. Our laboratory is the European Union, the world's largest free movement area and its fastest-aging advanced economy. We exploit the implementation of – and foreign countries' response to – the most generous pensioner-specific tax break in the world: Portugal's Non-Habitual Resident (*NHR*) regime, a full tax exemption of pen-

[1] See Table 2 for a summary.

sions drawn from abroad. Contrary to the traditional view that seniors largely age in place, we document large and dynamically increasing international migration responses among foreign retirees, concentrated at the top of the pension and wealth distribution in high-tax origin countries. In contrast to the predictions of standard spatial models, retirees exhibit asymmetric migration responses to tax increases and decreases, and tax-induced migration displays strong spatial clustering in destination countries. These patterns have two key implications. First, retiree migration persists well beyond the policy horizon, and retaliation through source-based taxation of pensions only partially offsets earlier out-migration. Second, the NHR led to the emergence of concentrated "communities" of foreign retirees in high-amenity local enclaves, increasing demand for healthcare services, raising housing prices, and generating sizable fiscal externalities through permanent shifts in retirees' real location choices. Our findings can be rationalized by a model of retirement migration with endogenous agglomeration, habit formation and congestion forces. These mechanisms amplify pensioners' migration responses to taxes, affect the optimal tax rate on foreign pensions, and limit the effectiveness of unilateral responses to tax competition over retirees.

We start with a location choice framework describing migration patterns across age groups. Unlike working-age individuals, retirees are indifferent to local wages in the destination, but care about the taxation of their pensions. Consistent with theory and within-country evidence (Badilla, Faber, Levy, and Munoz, 2024), mobile pensioners in the EU migrate in the opposite direction of workers: away from high-income countries, towards lower-tax, high-amenity destinations. Using data on the universe of residents from one origin country (Finland), we show that emigration exhibits a sharp uptick around the exact timing of retirement, especially for childless pensioners; and that cross-border relocation is more common among educated, high-income, and high-wealth pensioners.

We then turn to a natural experiment to estimate the causal effect of taxes on international retirement migration. The Non-Habitual Resident regime (*"Residentes Não Habituais"*; henceforth, NHR) was introduced in 2009 to attract "high value-added" migrants through a preferential tax rate on Portuguese-source earnings in a few specialized professions and a full exemption (for a duration of 10 years) of most foreign-source income.

The 2013 State budget law explicitly clarified that the exemption covered foreign pensions. A 2020 amendment raised tax rates to 10 percent for newly incoming pensioners, before the NHR was fully repealed for newcomers in 2024. These reforms resulted in quasi-experimental variation in the tax treatment of successive cohorts of foreign pensioners.

Using a difference-in-differences strategy contrasting moves to Portugal and comparable unaffected countries, we find that international relocation of retirement-age individuals to Portugal increased substantially following the implementation of the NHR. Overall, *flows* of foreign EU pensioners to Portugal rose by a factor of close to 30, and *stocks* by more than 3, with the largest effects arising for migrants from high-tax origin countries and those with longer expected retirement duration. Individual migration registry and income tax panel data allow us to examine selection into tax-induced migration among seniors. Pensioners with high career wages, high capital income, and pensions in the very top tail of the income distribution are all more likely to relocate to Portugal after the tax break.

Estimated international migration elasticities to the net-of-tax rate hover around 2 in the short-run, and above 3 in the medium-run. The effects reflect an overall increase in emigration, rather than merely substitution across destinations. Elasticities are robust to alternative control destinations and estimation strategies, including synthetic control methods; quantitatively consistent with cross-sectional patterns of pensioner mobility; and significantly larger than those found in research studying working-age movers, which cluster slightly below 1. Under our reduced-form estimates, we cannot reject that all pensioners benefiting from the NHR scheme were "marginal" movers induced to relocate to Portugal by the regime. In less than a decade, tax-driven migration increased Portugal's retiree population by 1%, and its retirement income tax base by 5%. These effects are an order of magnitude larger than the tax-triggered migration responses of highly paid working-age migrants (Kleven, Landais, and Saez, 2013; Bassetto and Ippedico, 2023) or wealthy entrepreneurs (Jakobsen et al., 2025), highlighting the large fiscal consequences of population aging when countries compete on the taxation of pensions.

In standard spatial models, migration responses to tax incentives are symmetric: location choices revert following the repeal of a tax benefit. To test this prediction, we exploit

a novel source of bilateral variation: policy responses to tax competition. Finland (in 2018) and Sweden (in 2022) repealed tax treaties with Portugal, reallocating taxing rights to the source country, thus denying the benefit of the NHR to Swedish and Finnish pensioners, including those already in Portugal.[2] After the unilateral enforcement of source-based taxation, the number of Finnish pensioners in Portugal immediately started to decrease, relative to unaffected *origins*. However, our results point to substantial hysteresis and asymmetry in location choices. Unlike short-lived workers' migration responses to tax incentives, which tend to reverse once the incentives expire (Kleven et al., 2014), half of the Finnish pensioners who had migrated to Portugal for tax reasons remained in the country long after losing eligibility to the NHR. Moreover, we find that the longer retirees from a country were exposed to the NHR, the stronger the "lock-in" effect following its repeal.

In our model, this departure from standard predictions arises from agglomeration forces, which increase local amenities as retiree inflows grow, and habit formation, which raises relocation costs over time. Both mechanisms are likely to matter more for non-labor-force participants. As a result, repealing generous tax breaks can only revert part of the migration response, leading to a permanently larger tax base in the destination country.

In the final part of the paper, we assess the downstream economic and fiscal impact of age-targeted tax incentives, leveraging retirees' distinctive propensity to cluster in space, and derive the implications of our results for the optimal taxation of foreign pensions.

We first show that the spatial clustering of mobile retirees is significantly more pronounced than for working-age immigrants, and rose sharply in response to the reform. The introduction of the NHR caused the emergence of clustered "retiree communities." Using granular data across 3,092 Portuguese civil parishes, we document a dramatic rise in the spatial concentration of foreign pensioners within Portugal as a result of the tax-induced moves. Two thirds of the aggregate NHR-motivated inflow were directed to the top quartile of locations, confirming that internationally mobile retirees targeted areas with suitable age-specific amenities and an established community of foreign pensioners: this

[2]The legitimacy of source-based taxation of pensions is a controversial topic in the United States too, where the *State Taxation of Pension Income Act* of 1995 preempted states from taxing the retirement income of their non-residents, partly in response to lobbying efforts by William C. Hoffman's *Retirees to Eliminate State Income Source Tax* (*RESIST*) organization.

pattern is consistent with age-specific agglomeration forces. Areas with the largest pensioner inflows are characterized by amenities that are likely complements of leisure time, such as golf courses or beaches.

We then show that locally concentrated inflows affected housing markets in newly formed enclaves. Due to their geographic concentration, high average wealth, and stronger propensity to be homeowners, foreign retirees exert a distinct influence on housing demand. Municipalities exposed to tax-motivated migrant retirees experienced greater subsequent increases in home prices, housing transactions, and real estate-related employment after 2012. Property markets recovered faster from the crisis in Portugal as a whole after the NHR implementation, notably in areas more exposed to the tax-motivated inflows.

We also find significant congestion externalities of retiree migration. Tax-induced pensioner moves are associated with a proportional increase in the consumption of healthcare in Portugal, potentially offsetting some of the fiscal cost at home but congesting the provision of public goods abroad. Using administrative data on healthcare costs and mortality among foreign retirees, we find that a 1% increase in the number of tax-motivated foreign retirees residing in Portugal leads to a 0.5% increase in the deaths handled by the Portuguese healthcare system, and a 1% increase in total healthcare costs incurred.

Our results are consistent with a model of location choice featuring endogenous agglomeration, congestion, and moving costs, which we use to derive the welfare implications of taxing foreign pensions. These forces amplify migration responses over time and produce spatial clustering in destination countries. From a welfare perspective, they can make low tax rates on foreign pensions unilaterally beneficial, because highly elastic foreign pensioners remain "locked in" when tax advantages expire. Even abstracting from fiscal effects, foreign pensioners raise the value of locally owned housing and congest amenities. Depending on the spatial distribution of migration responses, our augmented optimal tax formula shows that targeted incentives may be justified. Empirically, the pronounced spatial clustering of tax-motivated foreign pensioners implies substantial undesirable redistribution from net buyers to owners through higher housing prices, as well as congestion in local healthcare services, both of which justify calibrated optimal tax rates above the revenue-maximizing level, although still below those applicable to domestic residents.

Contribution Our main contribution is to quantify how sensitive retirees' location choices are to financial incentives. Income taxes affect where retirees choose to live, constraining governments' ability to raise revenue from this growing segment of the tax base. Beyond informing the design of targeted tax schemes, our estimates can also be used to parameterize the *total* population response to local shocks in quantitative spatial models. Migration elasticities are central to these models (such as Diamond, 2016), but their typical estimation via labor demand shocks omits retired individuals by design, though they represent nearly one-third of the population. In other contexts, Imbert et al. (2023) also note that mobility elasticities are affected by demographics and family structure. While recent work (Badilla et al., 2024; Komissarova, 2022) investigates within-country retiree migration, they focus on its *consequences* for local economic development, rather than its causal determinants.

Existing studies of retirees' response to income taxes focus almost exclusively on the role of tax incentives for the late-career retirement margin (Coile and Gruber, 2007; Manoli and Weber, 2016; Gelber et al., 2021). We show that international migration represents a substantial adjustment margin for pensioners, and that these responses matter quantitatively: in our setting, the "accounting-based" foregone revenue from tax breaks granted to foreign retirees accounts for nearly 50% of all tax expenditures in Portugal. Our results contrast starkly with Conway and Rork (2012), who found limited effects of State taxes on within-US elderly migration using a panel regression in Census data.[3] We find that pensioners are, in fact, as responsive to tax rates as the most mobile segments of the labor market, such as professional athletes (Kleven, Landais, and Saez, 2013) or innovators (Akcigit, Baslandze, and Stantcheva, 2016), with larger fiscal consequences and real implications for destination locations. The effects we document at the top tail of the pension distribution imply that even small, granular migration flows can have substantial fiscal externalities in both origin and destination countries. Methodologically, our setting allows us to address some empir-

[3]See Conway and Rork (2012): "*results are overwhelming in their failure to reveal any consistent effect of state income tax breaks on elderly interstate migration*". A smaller literature has studied the response of housing mobility to age-dependent *real estate* taxation. Shan (2010) shows that State-level property tax relief for seniors discourages their residential mobility. Cunningham and Engelhardt (2008) show a positive resale response of older homeowners to preferential capital gains tax on their primary residence. Unlike these papers, we are concerned with income taxation (rather than real estate taxes, which mostly constrain illiquid households (Wong, 2024)); and we study consequential international mobility decisions (rather than short-distance domestic residential moves).

ical challenges faced by existing work on taxation and migration, summarized in Kleven et al. (2020). For labor force participants, location choices are jointly determined by tax *and* wage considerations.[4] Even sharp, exogenous tax policy shocks can correlate with changes in pre-tax wages, due to general equilibrium pass-through, complicating identification; but pensioners are out of the labor force and likely insensitive to wage changes. Besides, international relocation is unlikely to be merely a "paper change" in reported residence, a concern for quantifying within-country real migration responses.

This paper also contributes to a literature showing persistent real effects from one-time shocks. We document a hysteresis of relocation choices, reminiscent of other permanent effects of temporary changes, such as recessionary (Yagan, 2019) or expansionary (Carrington, 1996; Margo, 1998) local shocks. High-powered temporary migration incentives can generate long-term fiscal and economic consequences. Moreover, unilateral policy responses, like source-based taxation, are imperfect countermeasures, particularly when implemented long after the initial treatment.[5]

Finally, understanding the full impact of tax-driven migration on local economies carries important implications for tax policy design. A nascent literature in public finance explores the theoretical implications of migration externalities for optimal tax rates (Kleven, 2025; Guerreiro et al., 2025). Empirically, however, these downstream effects are hard to measure and isolate, as tax changes simultaneously impact both migration decisions and broader economic outcomes (Jakobsen et al., 2025).[6] By leveraging a sharp tax reform that exclusively targeted foreign retirees, we can identify both the direct migration response to taxation *and* some of the broader economic spillovers it generates, helping calibrate the key relevant parameters for optimal tax rates on externality-generating migrants.[7]

[4]Limited attention has been devoted to the mobility of those *not* in the labor force. One exception is Agersnap, Jensen, and Kleven (2020), who show that low-income immigrants to Nordic countries respond to in-cash welfare benefit variation. There is also a small literature on migration responses to wealth taxes which considers both workers and non-workers, but it focuses on the very wealthy, such as U.S. estate taxpayers (Bakija and Slemrod, 2004) or the top 2% of the wealth distribution in Denmark (Jakobsen et al., 2025).

[5]Our findings also have implications for the debate on source- versus destination-based taxation in public finance (Agrawal, Poterba, and Zidar, 2024), heretofore focused on corporate taxes (Auerbach et al., 2017), sales taxes (Agrawal and Mardan, 2019), and capital or property taxation (Wilson and Wildasin, 2004).

[6]For instance, taxation affects simultaneously the migration of inventors (Akcigit, Baslandze, and Stantcheva, 2016; Moretti and Wilson, 2017) and innovation decisions (Akcigit et al., 2021).

[7]While targeted tax schemes for foreign workers can neatly identify working-age migration elasticities (Kleven et al., 2014; Bassetto and Ippedico, 2023), they are less well suited to studying downstream effects:

2 Institutional Context and Data

2.1 International Migration of Retirees in Europe

The European Union (EU) provides an ideal laboratory to study elderly migration decisions. First, there are no formal barriers to international migration between EU countries. Since 1957, the legal principle of free movement of people applies to all EU citizens, whatever their age, employment status, or country of residence. Second, the EU population is aging rapidly: more than 20% of the population was over 65 in 2023, a share expected to increase to 30% by 2070. Third, health insurance transfer considerations, a key concern for older migrants, are mostly irrelevant. EU pensioners living in different member states are entitled to publicly provided healthcare through reciprocal agreements between EU countries, making costs recoverable from the origin government through aggregate compensating transfers each year.[8] Finally, most EU countries either share a currency or peg theirs to the euro – so that pensions are effectively fixed in nominal terms upon migration.

At the same time, there remains substantial variation in taxes, amenities, and consumer prices across EU countries. Under free movement of people, such dispersion helps identify the drivers of international location choices for pensioners and their overall migration elasticity. More than 2.2 million EU citizens aged 55 or more live in an EU country other than their country of citizenship. While the figure may underestimate total international retirement migration, it constitutes a fast-growing share of within-EU migration.[9] As a result, international retirement migration is a central coordination problem in the European Union, as illustrated by the thorny debates surrounding the cross-border transferability of pension rights during the Brexit negotiations (McCarthy, 2018). While pensions and healthcare are funded at the country level, EU regulations guarantee the portability of recipients' rights, allowing pensioners to keep receiving pensions if they live abroad, and to consume

either the responses are small and short-lived, and the lack of geographic clustering makes it difficult to trace broader economic impacts. By contrast, the NHR reform in Portugal generated large, persistent, and spatially concentrated inflows of foreign retirees.

[8] Foreign pensioners still retain the option to consume health care back in their country of origin.

[9] Return migration towards one's own country of citizenship is not counted by construction and country-specific sources imply that a substantial number of European workers, notably from France and the UK, retire outside the EU.

publicly provided healthcare in any EU country in which they reside.[10]

2.2 The Portuguese Non-Habitual Resident Regime

The NHR was introduced in late 2009 to encourage foreigners, including high-net-worth individuals, to establish tax residence in the country. To be eligible, individuals must not have been tax residents in Portugal in the five years preceding their application. The process typically requires that one spends more than 183 days in Portugal each year. Applicants were not required to purchase property in Portugal, but must demonstrate their intention to occupy a permanent place of permanent residence there.[11] "Non-habitual residents" enjoyed a 10-year tax exemption on foreign-source income. Portuguese-source earnings could be subject to a reduced flat tax rate of 20% for a pre-specified list of highly-skilled occupations. Individuals covered by the NHR still paid regular VAT and property taxes. There is no wealth or inheritance taxation in Portugal, on both foreign and domestic tax residents.

The 2013 State budget law clarified legislative language and affirmed that pensioners were eligible for the exemption of their pension income since it was deemed "foreign-sourced".[12] Foreign pensioners migrating to Portugal from fiscal year 2013 onwards were thus granted a 0% income tax rate on their foreign pensions for a duration of 10 years. The unprecedented generosity of the full pension exemption led accounting firm PricewaterhouseCoopers to label it "*Europe's best-kept secret*" in 2016.[13] This coincided with rising interest among EU residents, as reflected, for example, in increased internet search volume for "retiring in Portugal" after 2012 (Appendix Figure B.2). In 2021, the full exemption was replaced by a 10% flat income tax rate, due in part to its mounting fiscal cost but also to

[10]When retirees move abroad, the country of origin is obligated to compensate the country of destination for any healthcare expenses incurred while living there, with costs evaluated at local prices in the destination country, through the issuance of individual *PD S1* forms.

[11]In parallel, Portugal introduced a "golden visa" program in 2012 providing a path to residency (with no tax incentives) to those purchasing real estate in excess of EUR 500,000 (Santos and Strohmaier, 2024). In our empirical application, we focus on the response of EU pensioner migration to the NHR, since EU citizens do not need a visa to establish residence in Portugal and are thus unaffected by the golden visa policy.

[12]Formally, the State budget law 66-B/2012, in its articles 81-5-a and 81-5-b, clarified that the exemption for pensions (category H income) applied as long as a bilateral tax treaty between Portugal and the origin country adjudicated taxing rights over the income and *either* the income had been taxed abroad *or* it was not considered to have been obtained on the Portuguese territory - see e.g. RFF Lawyers, *Personal Income Tax Exemption for Foreign Pensioners*, November 2012.

[13]See PwC, *Europe's best kept secret*, accessed August 2024.

backlash from Portugal's EU partners, who deemed the NHR regime uncooperative. The scheme was fully repealed for incoming pensioners after January 2024.

The tax provisions of the NHR apply only to retirees receiving a pension from a country with which Portugal has established a Double Taxation Agreement (DTA). Most DTAs imply no source-based taxation of the pension income earned by non-residents, as long as it is or could be subject to taxation abroad.[14] Finland and Sweden both engaged in a renegotiation of their DTAs with Portugal, eventually ending them unilaterally, to protest the zero tax rate granted to foreign pensioners. Finland repealed its bilateral tax treaty with Portugal in 2018, while Sweden ceased its own agreement in 2022.

2.3 Data on International Retirement Migration

We measure the *stock* of European residents by age, country of citizenship, and current country of residence in each EU country from 2009 to 2023, using data from Eurostat as well as national population registers and Censuses from several European countries.[15] We use this source to track the evolution of the number of foreign citizens residing in each European country for each age group. We also collect information on migration *flows* by age, to focus more directly on the high-frequency international movement of individuals in response to tax shocks. Throughout, we define pensioners as those aged 55 and above.[16]

We merge our migration data with measures of income tax rates applicable to pensioners and workers in each destination and origin, drawn from OECD databases.[17] Since migration decisions are driven by the total average (rather than marginal) tax liabilities, we estimate elasticities with respect to (one minus) the average tax rate (ATR) calculated

[14] Some countries make exceptions for pensions arising from past public employment in the origin country, and those for which a tax deduction on private contributions was received. For instance, the pensions of French or UK citizens paid by the French or UK public system as a consequence of their career as civil servants are – almost always – taxable in France or the UK, even if recipients live abroad.

[15] Appendix G provides detailed information on the data construction.

[16] We vary this age threshold to 65 in some robustness checks. Alternatively, we also use a definition based on whether individuals already draw a pension, when using data from a specific high-income origin country (Finland) where this information is available. We focus on pensioners from the European Union who are unaffected by changes in the golden visa program since they can reside visa-free in Portugal. We exclude UK pensioners, as they were impacted by Brexit and became eligible for the golden visa program in later years.

[17] Taxes are computed using OECD statutory personal income tax schedules (central and sub-central; sub-central schedules for Belgium, Denmark, Finland, Italy, and Sweden). We exclude credits and allowances, surtaxes, and social security contributions, and assume single taxpayers.

at different levels of retirees' overall income to account for tax progressivity. In addition, we leverage granular local data from Portugal's national statistical institute *INE* on the distribution of migrants by age group, wages, and available amenities across multiple census waves for about 3100 civil parishes (*freguesias*) and 308 districts (*municipios*).[18]

Finally, for the entire population of one high-income origin country (Finland), we combine an exhaustive registry of migration events with administrative income tax longitudinal data including education, lifetime earnings, capital income, pensioner status, and past firm and establishment IDs. This allows us to study selection into retirement migration, heterogeneous responses to foreign tax breaks, and peer effects among movers. Population-wide microdata on the entire Finnish population also enables us to study the response of emigration and return migration to the particular quasi-experiment that muted the benefit of the NHR solely for Finnish pensioners after 2018 (see Section 3).

We can use the Finnish administrative data to document patterns of self-selection of retirees into international migration. Appendix A.1 shows that older individuals tend to relocate immediately after exiting the labor force, as documented by Badilla et al. (2024) for within-country migration, with a stronger propensity for unmarried and childless individuals. Compared to stayers, internationally mobile pensioners are also significantly positively selected in terms of education and career labor income, and exhibit higher variance and higher mean of capital income. These patterns matter for the broader implications of international retirement migration. As aging populations increase the number of retirees, the sharp spike in mobility at the time of retirement, especially among wealthier and more educated individuals, implies that tax differentials across countries can reallocate an increasingly large and fiscally significant segment of the population.

3 Conceptual Framework and Empirical Strategy

This section introduces a conceptual framework of age-specific migration across countries that guides our empirical analysis. The full model is presented in Appendix F. Here, we highlight the key predictions for retirees' location choices and their response to tax incen-

[18]Civil parishes, or *freguesias*, are the smallest administrative division in Portugal, with an average population of less than 3,500 and a median close to 1,000. They are defined as of the 2013 NUTS classification.

tives. These predictions motivate our main estimating equation for the causal impact of age-specific tax breaks, identify sources of endogeneity, and guide the interpretation and welfare implications of our estimates in the presence of social multipliers and local congestion or agglomeration.

3.1 Model predictions

The key distinguishing feature of pensioners is that, unlike a standard working-age mover, their gross income is determined in their origin country rather than in the destination. Pensioners receive a pension P_{it} set by the rules of the origin country and only face residence-based taxation through τ^P_{ijt}. As a result, their location choice does not depend on destination labor market conditions such as wages. In this sense, retirees resemble remote workers or "digital nomads," whose income is largely independent of the location where they reside (Brueckner, Kahn, and Lin, 2023; Delventhal and Parkhomenko, 2024). Retirees also allocate all of their time to leisure, making them more sensitive to local amenities than working-age individuals. By contrast, workers' location choices depend directly on destination wages w_{jt} and labor income taxes τ^W_{jt}.

Age-specific location patternd These differences imply distinct cross-sectional location patterns across age groups. The relative probability that a pensioner from origin i chooses destination j rather than staying at home, π^P_{ijt}/π^P_{iit}, compared with the analogous ratio for workers π^W_{ijt}/π^W_{iit}, increases with the relative net-of-tax rate on pensions $\frac{1-\tau^P_{ijt}}{1-\tau^P_{iit}}$ and with relative amenities $\frac{A_{jt}}{A_{it}}$. By contrast, it decreases with destination wages w_{jt} and with the net-of-tax rate on labor income $(1-\tau^W_{jt})$:

$$\frac{\pi^P_{ijt}/\pi^P_{iit}}{\pi^W_{ijt}/\pi^W_{iit}} = \left(\frac{1-\tau^P_{ijt}}{1-\tau^P_{iit}}\right)^{\sigma_P} \times \frac{(A_{jt})^{\sigma_P-(1-\tilde{l}^W_{jt})\sigma_W}}{(A_{it})^{\sigma_P-(1-\tilde{l}^W_{it})\sigma_W}} \times \left(\frac{w_{jt}}{w_{it}}\right)^{-\sigma_W} \times \left(\frac{1-\tau^W_{jt}}{1-\tau^W_{it}}\right)^{-\sigma_W} \times \alpha_{ijt} \quad (1)$$

In this expression, σ_P and σ_W denote the inverse dispersion parameters of the Frechet preference shocks for pensioners and workers. The term α_{ijt} captures origin–destination factors common to both groups, such as price differences across locations.

We test the cross-sectional predictions of the model (Equation 1), using age-specific migration stocks across all EU countries. In Figure 2, we show cross-country evidence on the relationship between the bilateral old-young odds-ratio and pensioners' net-of-tax rate ratio (Panel A), the workers' net-of-tax rate ratio (panel B) and the average wages ratio (Panel C), in 2022, for all available origin-destination pairs. Each panel shows the best linear fit using an unweighted univariate regression, and reports the corresponding elasticities and standard errors by regressing the log y-axis outcome on the log x-axis variable.

While the cross-sectional regularities do not have a causal interpretation, it is striking that predictions from the model are verified in the data by three tight, approximately linear, and statistically significant negative or positive relationships. Consistent with Equation 13 in Appendix F, relative stocks of pensioners compared to working-age migrants are increasing in the net-of-tax rate for pensioners (Panel A), with a large implied elasticity (point estimate above 2). On the other hand, the old-young odds-ratio is decreasing in the workers' net-of-tax rate ratio (Panel B) and worker earnings (Panel C), consistent with the predicted indifference of pensioners to working-age net earnings.[19]

These cross-sectional patterns also hold true within destination countries. While there is no within-country variation in tax rates, Appendix Figure B.1 shows that there is a tight, linear, negative relationship between the share of seniors among recently arrived immigrants to Portugal and average local earnings in a civil parish, again consistent with mobile pensioners being more indifferent to local labor market strength than working-age migrants.

Migration response to pension taxation The model also implies that the log number of pensioners from i choosing destination j at time t can be expressed as a function of the net-of-tax rate applicable to pensions received from i in destination j, $(1 - \tau^P_{ijt})$, scaled by σ_P, the structural migration elasticity for retirees. Intuitively, locations offering higher net-of-tax pension income attract a larger share of retirees, with the strength of the response governed by σ_P. After absorbing origin-year and origin-destination invariant components into fixed effects, the model delivers the following estimating equation:

[19]Panel (D) also shows that the old-young odds ratio is decreasing in bilateral distance. This finding is consistent with moving costs increasing in distance at the same rate for both workers and pensioners, and pensioners' migration elasticity being larger than working-age movers.

$$\log(N_{ijt}^P) = \sigma_P \log(1 - \tau_{ijt}^P) + \kappa_{it} + \alpha_{ij} + \epsilon_{ijt} \tag{2}$$

The term κ_{it} captures origin-year factors affecting the supply of migrants from country i (such as cohort size or macroeconomic conditions), while α_{ij} captures time-invariant bilateral migration frictions between i and j, including distance or migration networks. The residual ϵ_{ijt} captures time-varying non-tax determinants of migration. To identify our parameter of interest σ_P in (2),[20] we exploit two sources of plausibly exogenous variation in pension taxation generated by institutional features of the European tax system: destination-specific policy changes and origin-specific tax treaty variation.

3.2 Model-consistent sources of variation

Destination-Specific Variation in Taxes The introduction of the NHR regime generates a first source of variation in τ_{ijt}^P across *destinations*. Starting in 2013, the tax rate applicable in Portugal to foreign pension income effectively dropped to zero for pensioners relocating there, while remaining unchanged in other European destinations. Our baseline strategy compares the migration of EU retirees to Portugal relative to unaffected destinations before and after the NHR sharply reduced the tax rate on foreign pensions. Identification relies on the assumption that the NHR reform is orthogonal to other time-varying determinants of migration captured by ϵ_{ijt}, such that flows of retirees to Portugal and to other destinations would have followed parallel trends absent the policy.

Several pieces of evidence support this assumption. First, migration flows to Portugal and control destinations display similar pre-2013 trends, and partially converge again after the scale-back of the regime in 2020. Second, we compare flows of pensioners and working-age migrants to Portugal: both groups would respond to changes in amenities or living costs, but only retirees are affected by pension-specific tax incentives. Third, our main counterfactual, Spain, is Portugal's only neighbor, with comparable amenities (year-long warm climate; large array of coastal areas; comparable touristic appeal). Time-varying, non-tax pull factors follow similar trends in Portugal and Spain, given high trade

[20] Appendix F also shows that this regression recovers a transformation $\frac{\sigma_P}{1-\eta}$ of the structural elasticity when endogenous moving costs amplify long-run migration responses.

integration and similar industrial structure: for example, Spain was hit similarly by the euro area crisis after 2009. Fourth, we include time-varying amenities (number of heating-degree-days, cooling-degree-days, health impact of air pollution) that could independently affect retiree migration. Finally, in robustness exercises yielding qualitatively and quantitatively close estimates, we replace Spain by all EU destinations, or by a composite "synthetic control" (Abadie, Diamond, and Hainmueller, 2010) of countries matching Portugal's past migration trends constructed from a pool of EU states.[21]

Origin-Specific Variation Within a Destination-Year A second source of variation arises from changes in bilateral tax treaties that introduce origin-specific taxation of foreign pensions. In particular, Finland renegotiated its tax treaty with Portugal in 2016 and repealed the agreement on June 14, 2018. The repeal denied the benefit of the NHR to Finnish retirees (including those already residing in Portugal at the time) since their pensions were subsequently taxed at source. We thus contrast pensioner flows to Portugal from Finland relative to similar origins, before and after the repeal. Such policy responses to tax competition are of interest in themselves, but also introduce dyadic variation in tax rates by origin ($\tau_{ijt} \neq \tau_{i'jt}$) within a destination-year, without resorting to unaffected destination countries as controls. This allows for destination-year fixed effects in equation 2, muting concerns about common time-varying pull shocks $\tilde{\epsilon}_{jt}$ for pensioners of all origins. The identification assumption is that Finnish retirees in Portugal would have followed parallel trends to pensioners from similar origins absent the tax treaty repeal.

3.3 Extensions: social multipliers, agglomeration, and price effects

The model-driven estimation strategy also helps clarify when our difference-in-differences regression recovers transformations of the structural parameter σ_p. Two cases of particular interest arise when migration costs depend on the presence of other foreign retirees; and when local, age-specific amenities or prices respond to the inflow of pensioners in a des-

[21] These alternative approaches also enable us to address the SUTVA violation concern that migration flows of foreigners to Spain could have been affected by the NHR scheme if Spain and Portugal are deemed particularly close substitutes by internationally mobile pensioners.

tination.[22] In these cases, the reduced-form elasticity estimated in equation 2 captures an amplified response relative to the structural migration elasticity. In Appendix F.3, we show that allowing for these forces predict the amplification of migration responses over time, the asymmetric hysteresis between the introduction and repeal of tax incentives, and the emergence of local retiree enclaves.

4 Migration Effects of Taxes on Pensioners

In this section, we study the causal effect of the NHR reform on international retirement migration within the EU. We begin with graphical evidence, then estimate retirees' international migration elasticity, and finally examine heterogeneity by country of origin and pensioner characteristics.

4.1 Reduced-form Graphical Evidence

Aggregate time series on flows Figure 3 describes the flow of foreign retirees originating from the EU and arriving in Portugal between 2008 and 2023. Inflows of pensioners were fairly stable in the pre-reform period from 2008 to 2012, but exhibited a sharp increase following the introduction of the NHR, indicated by the first solid vertical line. By 2019, EU pensioner arrivals had been multiplied by a factor of 30 compared to their pre-reform level. The flow displays a substantial decrease (without fully reverting back to its pre-reform level) after the 10% tax rate on foreign pensions was enforced in 2020. We observe signs of anticipatory spikes in migration ahead of NHR scale-backs in both 2019 and 2023, suggesting that forward-looking migration decisions of retirees also responded intertemporally to expected tax reforms. Rather than reflecting a general change in migration patterns to Portugal, arrivals of old-age migrants rose by an order of magnitude more than younger, working-age Europeans. Both series followed precisely parallel trends prior to 2013, but diverged immediately afterwards, partially converging again only after the

[22] Section 5 documents the role of the presence of other retirees for relocation decisions. Such forces could arise due to age-based homophily (Ward, LaGory, and Sherman, 1985) or through the endogenous provision of age-specific amenities (Komissarova, 2022). Section 6 highlights the spatial clustering of pensioner migration, and provides direct evidence of their effects on local prices.

2020 scale-down.[23]

Stocks in Portugal and control destinations Sharp changes in migration *flows* do not necessarily translate into corresponding increases in *stocks* if they simply reflect higher churn. Moreover, while the dramatic post-2013 break in Figure 3 is suggestive of tax-induced retiree migration, it could presumably have occurred even absent the NHR if barriers to pensioner mobility decreased everywhere in the EU, or due to coinciding demographic waves of newly retired pensioners in origin countries.[24] To transparently neutralize such aggregate trends, we plot in Figure 4 the normalized *stock* of foreign retirees in Portugal and in Spain, a comparable destination where taxes on foreign pensioners did not change.

Before addressing potential confounders, three lessons emerge from the raw data. First, the (normalized) stock of foreign retirees in Spain (our control) follows the treatment series (in Portugal) extremely closely in the 2008–2012 period, supporting the (untestable) parallel trends assumption that Spain provides a credible counterfactual for Portugal. Second, after the scheme was implemented, the stock of foreign pensioners in Portugal rises dramatically, whereas the stock of migrant retirees in Spain exhibits no such break in trend. By 2017, while the number of foreign pensioners in Spain was almost identical to 2013 levels, the treatment series had more than doubled. Third, effects take time to materialize, with the stock of foreign retirees in Portugal reaching a threefold increase in 2020 (relative to the control group's trend) before plateauing after the introduction of the 10% tax rate.

To formally quantify the sharp increase in the age-specific mobility of EU pensioners to Portugal, we estimate the difference-in-differences specification implied by (2):

$$\log(N_{jt}^{P}) = a + \beta \times \mathbb{1} \cdot (t \geq 2013) \times \mathbb{1} \cdot (j = \text{Portugal}) + \gamma_t + \gamma_j + u_{jt} \tag{3}$$

Where N_{jt}^{P} denotes the number of foreign EU pensioners residing in destination country

[23] As an additional piece of descriptive evidence, Figure B.2 shows Google search trends in France for "retire in Portugal" versus other destinations. Interest in retiring in Portugal sharply increases after the NHR reform and dwindles in 2020 following the 10% tax on foreign pensions.

[24] As explained in Section 3, the NHR also provided younger workers with a partial tax benefit of a flat 20% rate if they belonged to high-value-added specialty occupations, making this group potentially partly treated. Therefore, while the stark divergence in the flows of EU retirees and EU working-age migrants to Portugal after 2012 displayed in Figure 3 strongly supports our overall causal claims, the age-group comparison is not our baseline estimation strategy, since the control group could be partly treated by the NHR starting in 2009.

j at time t, γ_t and γ_j capture year and country fixed effects, respectively. When estimating equation (3) on the sample $j \in \{\text{Spain}, \text{Portugal}\}$, the reduced-form coefficient β captures the proportional increase in the number of foreign pensioners in Portugal after the reform, compared to Spain, and relative to the pre-reform period. Our estimate, reported in Figure 4, indicates a 60% relative increase in the number of foreign retirees living in Portugal caused by the introduction of the NHR scheme. As we will discuss later, this average treatment effect in the post-policy period masks substantial dynamics, with medium-run estimates yielding a more than twofold increase caused by the regime.

While Spain's close geographic and economic proximity makes it a natural and transparent counterfactual, we also probe the robustness of our findings to the use of a distinct estimation strategy. We show in Appendix C that our results are quantitatively similar when using a synthetic control approach and varying either the set of matching variables or the donor pool of countries.[25] We also assess whether the observed migration responses reflect substitution across destinations rather than genuine changes in out-migration behavior, using granular data on Finnish emigration flows. Figure B.6 shows that tax reforms in Portugal are followed by an absolute increase (respectively, decrease) in out-migration to Portugal when tax rates decrease (respectively, increase), with no simultaneous change in out-migration to other Mediterranean countries.

4.2 Estimates of the International Migration Elasticity for Pensioners

We estimate the migration elasticity with respect to the net-of-tax rate implied by the graphical evidence presented in Figure 4. Since location choices are driven by average tax rates, we compute predicted average tax rates in all countries for pensioners at various levels of total income, to take into account progressivity. To leverage exogenous changes in tax rates from the NHR, we instrument the log net-of-tax rate with the reform interaction $\mathbb{1} \cdot (t \geq 2013) \times \mathbb{1}(j = \text{Portugal})$, and estimate:

$$\log(N_{jt}^P) = \sigma_P \log(1 - \tau_{jt}^P) + \gamma_t + \gamma_j + u_{jt} \tag{4}$$

[25] In particular, our results are robust to excluding Spain from the donor pool of control countries.

Our baseline estimates are summarized in Table 1. The top panel uses Spain as a control group; while the bottom panel uses all EU countries as controls. We estimate elasticities for pensioners at both the median (column 1) and average (column 2) pension levels among NHR beneficiaries, based on administrative data from the Portuguese tax authorities. In the first two columns, we report the 2SLS estimates of σ_P from Equation (4). In the third column, we report the reduced-form effect of the reform, β, estimated from Equation (3).[26]

Migration elasticities are large and precisely estimated, between 1.8 and 2.2 in our preferred specification A1 (corresponding to Figure 4) and up to 3 in some control groups and subsample definitions. Elasticities estimated at alternative levels of income are similar, due to relatively limited tax progressivity in Portugal at these levels of earnings (Appendix Table B.6). The elasticity σ_P estimated from quasi-experimental changes in the net-of-tax rate is of similar magnitude to the cross-sectional correlation shown in Figure 2. We find large elasticities for all groups; but older pensioners appear more responsive to tax rates. When estimating σ_P for different time horizons, the results show elasticities close to 4 in the medium-run (e.g., 5 to 9 years after the reform). In comparison, Kleven et al. (2014) find migration elasticities of 1.5 for a tax break targeted at top executives in Denmark.

Using our estimated elasticities, simulating the counterfactual stock of foreign retirees in Portugal absent the NHR implies an overall causal increase of 20,000 to 25,000 European retirees moving to Portugal due to the scheme during the period. Since this interval contains the estimate (from government reports[27]) of the number of pensioners benefiting from the NHR as of 2021 [23,600], we cannot reject that all pensioners using the NHR regime were marginal movers who relocated to Portugal due to the tax break.[28] In less than a decade, the cumulative causal inflow represents 1% of the total retiree population. Their pension income sums up to EUR 1.3 billion in 2021, or 5% of total taxable pensions in Portugal.[29] The "accounting-based" fiscal expenditure (comparing the tax liability of all

[26]The first-stage estimates are summarized in Table B.11 and confirm that the reform led to a large increase in the log net-of-tax rates for pensioners. Table B.12 reports the total and average tax savings from the NHR for Finnish retirees in Portugal, based on micro-level tax data. In 2014, the scheme yielded an average annual tax benefit of 28,000 euros per beneficiary.

[27]Costa, P.R. and Lopes A., *Despesa Fiscal: Programa Regressar e Residentes Nao Habituais*.

[28]While one might be concerned that mobile retirees only temporarily relocate to Portugal, in Section 6 we use French death records to show that a substantial share of tax-motivated mobile pensioners indeed remain in Portugal up to the time of their death.

[29]The denominator (EUR 28 billion) is based on "Category H" income declared in *Estatisticas do IRS, Declara-*

taxpayers with the NHR to their counterfactual liability with the same reported income, had they not claimed it) represents more than half of all tax expenditures in the country, for a yearly value of 0.6% of GDP in 2021 (see Appendix Figure B.5). By that point, the NHR had become the largest personal income tax loophole in the national budget, emphasizing the significant fiscal implications of the migration responses documented in Table 1.

To better contextualize these aggregate effects, we compare our results to the fiscal consequences of international migration responses of working-age migrants documented in leading studies, reported in Panel A of Table 2. Our estimates are more than an order of magnitude larger than the effects associated with migration responses of highly paid working-age migrants (Kleven, Landais, and Saez, 2013; Kleven et al., 2014; Bassetto and Ippedico, 2023), or with the migration responses of wealthy individuals to progressive wealth taxation (Jakobsen et al., 2025).[30] While migration responses of entrepreneurs or highly paid executives are often at the center of policy debates, our results suggest that fiscal competition for pensioners can have much larger implications for tax revenues. As we discuss in Section 6, these estimates represent lower bounds on the overall fiscal impact of the NHR: pensioners also contribute through other tax payments and may affect domestic prices in non-tradable sectors.

4.3 Heterogeneous migration responses

Country-level heterogeneity We first explore heterogeneity in the migration responses to the tax break by *origin country*. We split the average effect in Figure 4 across several large origin countries in Figure B.4. While we observe positive migration responses for all origins, the effects are noticeably larger for some countries (France, Belgium) than others (Netherlands, Germany). We also note that the dynamics vary across origins: while migration responses are immediately large in the year that follows the introduction for French retirees, they take more time to materialize for German pensioners.

To formally test which origin country characteristics predicted a larger migration re-

coes Modelo 3 (2021). The numerator is a lower bound on the fiscal impact of the scheme, since it only includes pension income. Many NHR-induced moving pensioners have additional sources of income, notably dividends and capital gains, which we cannot directly allocate to them from aggregated data.

[30] Jakobsen et al. (2025) estimate that the repeal of the Swedish wealth tax increased domestic value added by about 0.05% through migration responses.

sponse to the non-habitual resident regime, we re-estimate Equation (3) by disaggregating stocks at the origin-destination-year level:

$$\log(N^P_{i,j,t}) = \alpha_{it} + \gamma_{ij} + \beta \cdot \mathbb{1}\{j = Portugal\} \times \mathbb{1}\{t \geq 2013\} + \zeta \cdot \mathbb{1}\{j = Portugal\} \times \mathbb{1}\{t \geq 2013\} \times Z_i + u_{ijt} \quad (5)$$

In this specification, α_{it} are origin-year fixed effects; γ_{ij} are origin-destination fixed effects; and Z_i is one of the potential drivers of migration responses at origin (average tax rates of pensioners, net pension replacement rate, and life expectancy after exiting the labor force). Other terms are absorbed by the fixed effects. The coefficient ζ summarizes the role of conditions at origin for the heterogeneous response of tax-induced migration to Portugal relative to Spain. Standard errors of the regression are heteroskedasticity-robust and two-way clustered at the destination-year (30) and origin (12) levels.

We report our estimates of β from Equation (5) using weighted (Table B.7) and unweighted (Table B.8) fixed effects OLS regressions. The introduction of the NHR regime for pensioners had stronger effects on migration flows originating from high-tax origin countries. We also find larger tax-induced migration responses for origins with longer expected retirement duration, consistent with the benefits of mobility to low-tax destinations accruing for a longer time period. The heterogeneous vulnerability of origin countries to aggressive tax competition for pensioners may imply distinct incentives to implement policy responses to tax competition, which we study in Section 5.

Individual-level heterogeneity Matching the migration registry to longitudinal information on Finnish pensioners, we can characterize heterogeneous senior migration responses depending on *individual-level* past career earnings, wealth, and other demographics.

To align with our difference-in-differences design, we compare the evolution of average demographic characteristics for the stock of Finnish pensioners living in Portugal and in Spain, before and after the introduction of the NHR.[31] Figure 5 shows that on average,

[31]Given the low baseline numbers, changes in average characteristics of the stock are nearly equivalent to changes in characteristics of newly incoming migrants. We report the level and changes in characteristics, before and after the NHR, in Table B.5.

Finnish retirees in Portugal and in Spain exhibited similar levels and trends in characteristics in the years leading to the implementation of the scheme, for the probability of belonging to the top decile of incomes during their career, to receive capital income, to be highly educated, or to be married. After the start of the NHR, however, the stock of Finnish pensioners in Portugal exhibited a dramatic shift in composition. Portuguese-bound movers induced by the NHR scheme tend to be substantially richer than their unaffected counterparts in Spain, with a sharp rise in the share of top earners, the proportion of capital income recipients, and the share of highly educated individuals. Figure B.7 formally summarizes heterogeneous responses across groups, running our main specification Equation 3 in various sub-samples in the Finnish data. The results suggest that a substantial share of the aggregate effect of the NHR policy on Finnish emigration to Portugal was driven by the specific response of pensioners with top career incomes and wealth.[32]

We then show how the average pensions of Finnish citizens living in Spain and Portugal evolve in panel (e) of Figure 5. Pensions received by Finnish retirees in both countries were very similar prior to 2013, around EUR 2,500 per month. After the implementation of the NHR, the average pension paid to pensioners who migrated to Portugal increased to EUR 5,500 per month–nearly four times the average Portuguese wage at the time– while it remained stable and close to its pre-policy level in Spain. Panel (f) of Figure 5 focuses on the right tail of the pension distribution by plotting the average annual pensions for the top 10% of the distribution in these two countries. Prior to the NHR reform, the top decile of pensions in Spain and Portugal followed a similar pattern. However, immediately around the implementation of the NHR reform, there is a significant and sharp increase for the top decile of pensioners in Portugal, suggesting that the reform specifically attracted retirees from the very top of the pension distribution.[33] Overall, the compositional shift implies that the fiscal cost for origins is larger than a naive prediction based on the pre-reform characteristics of the average mobile pensioner. Marginal tax-motivated movers belong to the top tail of the pension distribution, and disproportionately contribute to fiscal revenue lost in origin countries.

[32]We proxy wealth levels using observed business and capital income in the administrative tax data.

[33]The sharp rise to such high levels is possible because the Finnish pension system does not have a pension ceiling, so there is no upper limit on the pensionable wage or the pension amount.

Summarizing We find large migration responses to Portugal's zero tax rate on foreign pensions, driven in particular by high-income, educated retirees from high-tax countries. These responses have important fiscal and welfare implications that depend on their persistence and broader downstream effects, which we explore in Sections 5 and 6, respectively.

5 Persistence and Asymmetry in Migration Responses

We next demonstrate asymmetric responses of pensioner migration to the introduction and repeal of tax incentives. This pattern implies persistent effects of temporary policy changes, and potentially mutes the efficacy of policy responses to tax competition.

5.1 Counteracting Effects of the Source-Based Taxation of Pensions

To study the effect of losing the NHR benefit, we exploit policy retaliation events affecting the net-of-tax pension in Portugal only for retirees from some origins. Finland's government issued regular complaints against the NHR and Portugal's perceived beggar-thy-neighbor tax competition. In 2016, Portugal and Finland signed a new DTA (replacing the one signed in 1970) allowing Finland to tax its retired citizens in Portugal. As the document was never ratified by the Portuguese Parliament, in June 2018, the Finnish government unilaterally enforced the source-based taxation of pensioners starting in fiscal year 2019.

Panel A of Figure 6 plots the stock of Finnish migrants living in Portugal and Spain, and graphically displays three main lessons from the policy response to tax competition for retirees. First, consistent with our findings for all countries in Section 4, the number of Finnish pensioners in Portugal was multiplied by almost 4 after the introduction of the NHR tax break, relative to their share in Spain. Second, the rate of growth in the *stock* of Finnish seniors in Portugal stalled after 2016, as uncertainty arose from the negotiations for a new bilateral tax agreement. Third, when the Finnish government unilaterally enforced the source-based taxation of its pensioners after 2019, the number of Finnish pensioners in Portugal immediately started to decrease. Meanwhile, throughout the period the number of Finnish pensioners in Spain remained stable and close to its pre-2013 level.

Source-based pension taxation in origin countries also constrains the *initial* migration

responses to tax incentives. To generalize our finding, we manually classify origin countries – excluding the specific cases of Finland and Sweden – into two groups based on their pre-NHR bilateral tax treaties with Portugal: those that never apply any source-based taxation on pensions ("lax" countries) and those retaining some degree of source taxation ("strict" countries, which often retain taxation rights on e.g. pensions arising from initially tax-deductible contributions). Appendix Figure B.8 shows that the design of bilateral tax agreements strongly influences the migration response of pensioners, which is significantly larger for "lax" origin countries.[34]

Figures 6 and B.8 mean that source-based taxation mitigates the migration responses to tax breaks. This provides *prima facie* evidence that policy responses to tax competition curb some of the international retirement migration responses. While not a well-suited policy lever to respond to tax competition for workers, who are generally taxed in destination countries under the *lex laboris* principle, it is peculiarly appropriate to curtail tax-motivated outflows of pensioners. Besides, unlike in our baseline strategy, contemporaneous amenity "pull" factors occurring in Portugal no longer represent a confounding threat, as we exploit bilateral *origin-destination-year* variation arising from the tax treaty repeal – effectively a triple-differences strategy. For example, changes in amenities in Portugal might have played a role in the rise of pensioner inflows from all countries after 2013, but should not have differentially affected flows from "lax" or "strict" countries. It therefore confirms that our baseline effects are not driven by such contemporaneous unrelated shocks.

5.2 Hysteresis in migration responses

While the stock of Finnish pensioners in Portugal decreased in response to the source-based pension taxation in Finland in 2018, Figure 6 also shows that it does not fully revert back to its pre-2013 level, and remains permanently above the pre-NHR trend. Having peaked at five times its pre-NHR level at the end of 2018, the stock of Finnish pensioners in Portugal remains at around three times the pre-reform level and the stock in Spain, even long after

[34]This also implies that the baseline pooled estimates presented in Table 1 may be interpreted as lower bounds, since the NHR zero tax rate might only apply to a fraction of foreign pensioners from strict origin countries, leading us to over-estimate the ATR variation induced by the reform and under-estimate the elasticity.

the introduction of source-based taxes for Finnish residents in Portugal.

This persistence is not specific to Finland. Indeed, Figure 3 shows that, while the increase in the tax rate on foreign pensions from 0 to 10 percent after 2020 led to a drop in the flow of foreign pensioners moving to Portugal, it remained substantially higher than pre-policy trends even three years into the less generous regime. The stock of foreign pensioners living in Portugal stalled after 2020, but did not decrease or revert back to its counterfactual path (Figure 4). Persistence beyond the policy horizon holds in spite of the fact that, as we demonstrate below in Section 6, living costs rose *faster* in Portugal than in other European countries over the period.

Decomposition of persistence To gain insight into the drivers of persistence, we avail ourselves of individual longitudinal data on Finnish residents. We decompose the asymmetric rise and fall in the stock of Finnish pensioners in Portugal. We plot annual net pensioner outflows (from Finland to Portugal) i.e. out-migration minus in-migration (mostly return flows) in the bottom panel of Figure 6. While return pensioner migration increases substantially after the repeal, cumulative net inflows after 2019 represent only slightly more than half of the initial outflow. About 50 percent of Finnish retirees initially drawn to Portugal by the tax cut remain there even after its repeal. The asymmetric effects are also visible when examining the composition of Finnish retirees in Portugal. For instance, as demonstrated in Figure 5, even after 2019, the average pension of Finnish retirees in Portugal (relative to Spain) remains much larger than pre-reform, consistent with wealthier migrants remaining even beyond the end of the policy treatment.

Next, we formally test whether migration elasticities differ between the introduction and the repeal of the tax scheme. Our results are reported in Figure 6, Panel A and in Table B.9. Panel A presents σ_P estimates from Equation 4 for the 2009-2018 introduction window, using Spain as the control destination; Panel B reports the corresponding σ_P estimates for the 2016-2024 repeal window, also with Spain as the control. We retain the same post-policy horizon (+5 years) to make measurements directly comparable. Consistent with graphical evidence, retiree migration responds more strongly to tax decreases than to later increases. Over the same horizon, the elasticity with respect to the net-of-tax rate is around

5 at introduction (e.g. a tax decrease) versus 1 at repeal (e.g. a tax increase).

5.3 Length of exposure and hysteresis

In standard location choice models, the unilateral policy response of an origin country would lead to a full reversal of migration patterns, by muting the direct effect of tax breaks. By contrast, in the presence of endogenous amenities or moving costs, the policy response does not counteract the cumulative improvement in the value of staying in Portugal stemming from EU-wide inflows of pensioners. These dynamics generate a "lock-in" effect, whereby location choices persist even after the original tax incentive is removed.

To better characterize this potential path dependence in migration choices, we compare the moves of Finnish and Swedish pensioners to Portugal over the period. Sweden, a neighboring country of Finland with comparable domestic amenities, has similarly high tax rates and a generous pension system. Both countries ended up suspending their tax treaty with Portugal as retaliation for the NHR, but did so in different years. Our identification assumption is that Finnish and Swedish retirees should be similarly affected by any changes in time-varying amenities in Portugal. This allows us to use Finnish retirees as a credible counterfactual for how the stock of Swedish retirees in Portugal would have evolved, had Sweden repealed its tax treaty in 2019 rather than in 2022.

Figure 7 shows that the number of Swedish and Finnish retirees in Portugal followed the exact same trends before 2016, both before 2012 and during the period 2013-2016 when the NHR was available for both origins. Thus the migration response to the introduction of the NHR had comparable magnitude and dynamics for pensioners from Finland and Sweden. As soon as Finland suspended its tax treaty with Portugal in 2016, the two series diverged, and the gap increased after Finnish citizens permanently lost eligibility to the regime in 2019. When *Sweden* later suspended its own tax treaty with Portugal (starting 2022), the stock of Swedish pensioners in Portugal started plateauing too.[35] However, consistent with the hysteresis hypothesis, it did so after reaching a substantially higher level (about 8.5 times its pre-2012 value). The longer duration of tax-cut exposure for Sweden

[35]We document the short-run response of flows to the delayed introduction of source-based taxation for Swedish retirees in Portugal in Appendix D. The number of Swedish and Finnish retirees to Spain, on the other hand, evolved similarly throughout the period.

led to larger cumulative inflows, and thus to a *permanently higher stock* of Swedish retirees living in Portugal, even after Sweden adopted source-based pension taxation.

Long-term migration *elasticities* vary across origin countries depending on the length of exposure to the NHR, as showed by the country-specific elasticities reported in Figure 6, Panel B. Longer availability is associated with stronger cumulative responses to the introduction of foreign tax incentives (e.g. an elasticity of 8 for Sweden versus 5 for Finland), and with weaker reversal effects from their later repeal (e.g. an elasticity of 0.7 for Finland at a two-year horizon versus 0.4 for Sweden). Overall, the asymmetric response of retiree migration to foreign tax decreases and increases means that even temporary targeted incentives generate long-term fiscal consequences, especially if policy retaliation in origin regions is implemented long after the initial shock.

5.4 Social multipliers in retiree migration

The asymmetric migration responses to tax increases and decreases are surprising and inconsistent with standard location choice models. We hypothesize that they reflect the presence of agglomeration forces, making moving costs endogenous to the presence of other pensioners. Retirees may place high value on proximity to peers after relocating abroad due to limited local ties. We find direct evidence for such social multipliers in our data.

We use Finnish administrative data to determine whether individuals' decisions to retire abroad are influenced by their social networks. We first identify all individuals who relocated abroad between 1991–2012 ("the movers").[36] Combining this with comprehensive individual data on lifetime work experiences, we identify individuals who were employed at the same establishment as any of the movers in a given year during the period. If an individual worked at some point in their career with an individual who moved abroad before 2012, they are considered exposed to peer migration.

We next restrict our interest to those who are over 55 and who remained in Finland up to 2012. For them, we measure their exposure in two ways: we know (i) whether they

[36]We include not only individuals over 55 from our estimation sample, but also younger individuals to broaden our definition of peers and increase power, recognizing that peers of all ages can influence the decision to move. We focus on the ten most popular destination countries for senior Finns: Sweden, Denmark, Spain, Portugal, Estonia, France, Germany, Norway, the United Kingdom and the United States.

ever worked during the period 1991-2012 with individuals who moved abroad during the period 1991-2012 (ii) which country (if any) $j \in S$ their co-workers moved to. Our analysis and results are summarized in Appendix E. We find that individuals previously exposed to peers who migrated to a specific country are significantly more likely to retire there. In contrast, the impact of past exposure to peers who retired in other destination countries is smaller, with effects centered around and generally not statistically distinct from zero.

After documenting that social networks influence not only the decision to retire abroad but also the choice of *where* to retire, we turn to peer effects in tax-driven migration. We begin with the same estimation sample, focusing on individuals aged 55 and older who remained in Finland until 2012. We split this sample between those who ever had co-workers, during the period 1991-2012, who moved to Portugal *before* 2012; and those who were never exposed to co-workers moving to Portugal before 2012. We then plot, for each of those groups, their likelihood of moving to Portugal *after* 2012. Consistent with our peer effects hypothesis, Figure E.2 shows that migration responses to the NHR were larger for individuals with past exposure to peers who moved to Portugal before 2012.

Our findings provide suggestive evidence that social networks in origin countries affect the decision to retire and to stay in a given country. Such peer effects can rationalize persistence in the migration decision of retirees, as the amenity value of residing in Portugal or the costs of leaving it endogenously rise with the size of the local retiree community, even beyond the duration of the scheme. They also explain why pensioners disproportionately cluster in space when they relocate upon retirement, as we document in the next section.

6 Downstream Effects of Tax-Driven Retirement Migration

The NHR triggered long-lasting migration responses, permanently increasing the stock of foreign retirees in Portugal. We now show that, due to their persistence and increased spatial concentration, these large flows have real, long-term consequences for destination regions. The downstream fiscal, pecuniary, and congestion externalities of retirees' migration responses also have welfare implications for domestic policies and international tax coordination.

6.1 The Local Effects of Retiree Migration

Emergence of spatially concentrated retiree enclaves We first provide evidence that the introduction of the NHR led to the emergence of highly spatially clustered enclaves of foreign retirees. First, we document that pensioner location choices exhibit substantial cross-sectional spatial concentration, relative to working-age movers. Panels (A) and (B) of Figure B.10 display the unweighted distributions of pensioner and prime-age shares among recent immigrants in 2021 across 3,092 Portuguese civil parishes (*freguesias*). The right skew (relative to the mean share, depicted by a vertical dashed line) indicates substantial spatial clustering of retiree migration. Out of more than 3,000, almost no *freguesia* has more than half of its recent cross-border movers in the 25-40 age group; but more than a quarter are retiree "enclaves" where the pensioner share of recent migrants exceeds 50 percent.[37]

Second, far from being uniform across space, the bulk of the NHR-induced *increase* in EU pensioners living in Portugal occurred in a small subset of locations with a large initial community of foreign EU pensioners. Under standard regression-to-the-mean forces, *freguesias* with high initial exposure to EU pensioners in 2011 would be expected to experience *smaller* subsequent increases in the foreign pensioner share. From 2011 to 2021,[38] the exact reverse occurs. *Freguesias* with a high 2011 share of foreign pensioners witness a larger increase in their foreign pensioner population share, in a nonlinear fashion, as evidenced in Panel (A) of Figure 8. This "great divergence" is suggestive of age-specific agglomeration effects (Diamond, 2016). By contrast, we observe regression to the mean when relating the 2011-2021 change in the *young* (20-40) EU migrant share and the initial young migrant share (Panel (B)). Locations within Portugal attracting the largest inflows of tax-motivated retirees through endogenous agglomeration are thus mostly attractive to migrants in a specific age class. Quantitatively, Panel (C) of Figure 8 shows that 88% (population-weighted: 83%) of the nationwide increase in European pensioners (EU, plus Switzerland and UK) occurred in locations in the top half of initial EU pensioner share,

[37] The dissimilarity index summarizing the relative concentration of immigrants aged 55 or more (relative to all immigrants) across *freguesias* in Portugal is 0.29, while the corresponding measure for prime-age movers (25-40) is 0.16.

[38] 2011 and 2021 are the closest pre- and post-NHR years that correspond to decennial census surveys for which we have detailed local-level population counts.

and 67.5% (population-weighted: 71.5%) in the top quartile.[39] In line with the model in Appendix F, Figure 9 shows that areas with the largest NHR-period pensioner inflows are characterized by amenities that are likely complements to leisure time – such as golf courses or beaches. This non-uniform increase across space shows that internationally mobile pensioners target locations with suitable age-specific amenities and an established community of foreign pensioners, a key agglomeration force specific to this population.

Rising demand pressure in affected housing markets The rising spatial clustering and long-term persistence of pensioner migration induce concentrated increases in demand for living in specific destination locations. We thus study the implications of mobile pensioners' housing demand. From 2019 to 2024, residential housing purchases by non-residents represented close to 11 percent of the total value of purchases in Portugal, with EU buyers representing close to half of the total.[40] We find that, while traditional working-age immigrants have lower home ownership rates than local residents, foreign pensioners, on the other hand, are *more* likely to be homeowners. As shown in Figure 10, Panel A, according to the EU Statistics on Income and Living Conditions (SILC) survey, while only half of EU citizens aged 18 to 64 in Portugal were homeowners in 2024, far below the local homeownership rate of 75%, more than 80 percent of EU migrants aged 65 or more owned their home, a proportion similar to Portuguese citizens of the same age class.[41]

In view of this high homeownership rate, we examine the effects of foreign retirees' tax-induced migration on real estate prices following the introduction of the NHR using two alternative approaches. We first compare home prices in Portugal to untreated destinations. As shown in Panel B of Figure 10, aggregate housing prices in Portugal started to rise sharply around the time the NHR was introduced, increasing by a factor of more than two between the introduction and the end of the regime. The sharp break in trend around 2013

[39] As a result, the senior migration share not only increases on average after the NHR reform, but exhibits substantially more dispersion, indicating a large increase in the spatial concentration of pensioner migrants due to the emergence of retiree enclaves. Appendix Figure B.9 compares the distribution of the shares of pensioners among migrants across *freguesias* in 2011 and 2021. Over the period, the standard deviation of the share of pensioners among all migrants rose by 19%; and the difference in this share between the 90th and 10th percentile of *freguesias* rose by 67%.

[40] This number does not comprise purchases by those who already moved their tax residence to Portugal.

[41] As shown in Figure 5, internationally mobile retirees who relocate for tax reasons to Portugal are positively selected on both earnings and capital income, potentially accounting for high homeownership.

is specific to Portugal. Between 2010 and 2024, home prices in Portugal increased by 140%, compared to roughly 40% in the control group.[42] This provides suggestive evidence that tax incentives targeted at foreigners can have real economic effects– particularly when they induce large, permanent migration responses.[43]

To better isolate the causal impact of foreign retirees on housing markets, we next exploit their rising geographic concentration following the reform. In Panel C, we document the relationship between the *local* increase in the share of foreign EU pensioners and the change in median traded real estate values. The binned scatter plot displays a positive and statistically significant relationship. Municipalities with larger inflows of foreign EU pensioners after the introduction of the scheme experienced significantly greater increases in home prices since 2012. Table 3 confirms that the positive correlation holds across different samples and specifications.[44] Moreover, we show that exposure to pensioner inflows after the reform was associated with faster growth in the share of employment in the real estate industry (Panel D of Figure 10), as well as in overall housing trading volumes (Appendix Figure B.13). These stimulative effects corroborate the findings of direct effects of tax incentives on housing market activity (Berger, Turner, and Zwick, 2020), but operate *indirectly* here via the tax-induced migration of wealthy pensioners.

Overall, using both aggregate and local empirical designs, we find that the spatial clustering of tax-motivated foreign retirees in a few selected enclaves had stimulative downstream effects on property market activity and real estate prices in Portugal. These findings align with concerns raised by policymakers about the impact of wealthier foreign migrants on housing affordability, which ultimately played a key role in the government's decision to scale back the NHR regime. They also imply that, over the period, Portugal's appeal as a destination was partly counteracted by rising costs, alleviating any concerns that the persistence we document in Section 5 would be due to Portugal exhibiting *lower* growth in its cost of living relative to origin countries.

[42] Prices in all EU countries recovered from the euro area crisis after 2011. We build the control group as a weighted average of EU countries following Abadie, Diamond, and Hainmueller (2010). We find similar results when the synthetic control is matched on pre-reform home price dynamics in Figure B.11.

[43] Over the same period, the golden visa regime might also have contributed to rising *aggregate* home prices; see Santos and Strohmaier (2024).

[44] Appendix Figure B.12 shows trends in real estate values for top destinations for foreign retirees.

6.2 Congestion externalities

Pensioners have substantially higher than average health costs (Morgan and Mueller, 2023), accounting for 40 to 60 percent of overall healthcare spending in the EU. A direct potential implication of permanently attracting retirees is therefore increased demand for healthcare services in the destination region. We test for this channel using additional data on mortality and healthcare consumption by foreign retirees in Portugal.

We start by investigating the effects of tax-driven migration to Portugal on the probability that foreign retirees die there, using administrative death registries for French citizens that record the location of death, even when it occurs abroad. Figure 11 plots the migration response to the NHR scheme by French citizens (Panel A), and the corresponding evolution in the number of French pensioners dying in Portugal (Panel B). Following the introduction of the tax break, the number of French retirees residing in Portugal increased eightfold. Over the same period, the number of deaths recorded among French pensioners in Portugal rose by a factor of four. This provides direct evidence that the tax break triggered real relocation rather than "paper" migration responses. Because healthcare expenditures are heavily concentrated in the final years of life, the arrival and aging of foreign retirees could put growing pressure on the destination country's healthcare system.[45] Our estimates imply that a 1% increase in the number of foreign retirees residing in Portugal for tax reasons leads to a 0.5% increase in the number of foreigners' deaths handled by the Portuguese healthcare system. This less-than-unitary elasticity is consistent with the fact that mobile pensioners tend to be younger than the average retiree.[46] Over time, as the newly relocated population ages, the associated healthcare burden for Portuguese infrastructure is likely to increase further. To assess dynamics more directly, we turn to longitudinal microdata from Finland, which track mortality at home and abroad. Among Finns who moved to Portugal after the NHR was introduced, 7% had died by 2024. Of those, half died in Portugal, while the other half returned to Finland before death. Return migration toward the end of life suggests that origin countries might continue to bear some fiscal costs.

We can also examine the broader implications of the surge in foreign retirees triggered

[45] See Howdon and Rice, 2018 for evidence of the concentration of healthcare spending near death.

[46] For instance, administrative Finnish data indicate that internationally mobile pensioners are on average 6 years younger than all pensioners in Finland; see Appendix G.1.

by the NHR scheme on healthcare consumption in Portugal, using administrative data on all healthcare costs billed for retirees abroad, provided by the Finnish government.[47] In the bottom panel of Figure 11, Panel C shows the migration response of Finnish citizens to the NHR scheme, while Panel D displays the corresponding evolution in (normalized) healthcare expenditures for Finnish retirees in Portugal. By 2019, both the stock of Finnish pensioners and the amount of healthcare expenditure on pension-age citizens billed back to Finland by Portugal had increased by a factor of 5. We thus estimate that a 1% increase in the number of foreign retirees residing in Portugal for tax reasons results in a 1% increase in healthcare costs borne by the Portuguese system for this population. Again, this result points to real implications of retirees' relocation for the congestion of healthcare infrastructure in the destination country, potentially offsetting part of the fiscal cost of emigration at home but congesting the provision of public goods abroad.

7 Discussion of Results and Welfare Implications

Summary of key behavioral responses. Our analysis highlights several key mechanisms that can inform a model of cross-border location decisions upon retirement, and the policy trade-offs related to the taxation of pensions:

1. Retirees migrate to high-amenity, low-tax locations around the time of their withdrawal from the labor force.

2. Migration elasticities to the net-of-tax rate for seniors are larger than for working-age migrants, and increase at longer horizons.

3. Retiree migration responds asymmetrically to decreases and increases in foreign tax rates, with larger responses to tax reductions than to tax hikes.

4. Retirees who have already relocated, and those with longer exposure to the preferential regime, exhibit attenuated responses to its repeal, while new inflows fully revert.

[47] As explained in Section 2, under EU coordination rules, Portugal is entitled to bill Finland for the healthcare costs of Finnish citizens residing in Portugal.

5. Relocation decisions are influenced by peers in the origin country, for both tax-induced and non-tax-motivated moves.

6. Retirees cluster geographically more than working-age migrants, and tax incentives *increase* the geographic concentration of retirees within a destination country.

7. Tax-induced retiree inflows raise local housing prices and exert congestion pressure on local healthcare services.

Findings 1 and 2 reveal that despite their lesser overall mobility, retirees are particularly responsive to tax breaks, pointing to mechanisms specific to retirement-age tax-motivated relocation. The third and fourth findings suggest path dependence in the effects of mobility incentives, diverging from the symmetric response in standard location choice models. Findings 5 and 6 also depart from the standard prediction (of a uniform increase in the share of foreign pensioners across space) by documenting spatial clustering governed by social multipliers. The model in Appendix F rationalizes these findings by endogenizing age-specific migration costs. Relocation costs that vary with the size of local pensioner communities contribute to the spatial clustering of seniors, and to the incomplete reversal of the stock of retirees abroad despite the stoppage of inflows.[48]

Overall, endogenous migration costs and age-specific social multipliers generate: (i) large migration responses to targeted tax breaks; (ii) persistent effects that extend beyond the policy horizon; and (iii) strong spatial concentration, and downstream pecuniary and non-pecuniary externalities, in destination countries. These behavioral features have implications for the design of tax and migration policy.

Should governments grant low tax rates to foreign retirees? A government chooses a unique tax rate τ_P on foreign retirees, maximizing only the welfare of local residents (tenants with measure one, and landlords with a welfare weight α). It takes into account mul-

[48]This mechanism, akin to "habit formation" documented in other contexts, could also explain the inertia of incumbent mobility when facing local labor market shocks in Monras (2018).

tiple forces, described in equation 6 derived in Appendix F.

$$
\begin{aligned}
-\frac{dW}{d\tau_P} = &-N\bar{P} + N\bar{P}\left(\frac{\tau_P}{1-\tau_P}\epsilon^{\text{micro},1-\tau_P} + \frac{\tau_P}{1-\tau_P}\epsilon^{\text{agglo},N}\epsilon^{\text{macro},1-\tau_P}\right) \\
&+ \frac{\epsilon^{\text{macro},1-\tau_P}}{1-\tau_P}\left(\alpha\sum_j \eta^{r,j}\theta_j r_j H_j^F - (1-\alpha)\sum_j \eta^{r,j}\theta_j r_j \pi_j h_j\right) \\
&+ \frac{\epsilon^{\text{macro},1-\tau_P}}{1-\tau_P}\sum_j \pi_j V_{N,j}^T \times N_j\theta_j
\end{aligned} \tag{6}
$$

The first line summarizes revenue effects. The first term is the mechanical impact of lowering tax rates, which depends on the infra-marginal tax base (number of pensioners N times average pension $\bar{P}$). The second term reflects behavioral migration responses to tax breaks $\epsilon^{\text{micro},1-\tau_P}$.[49] This force is accentuated in the presence of agglomeration (the third term, governed by $\epsilon^{\text{agglo},N}$), making "macro elasticities" $\epsilon^{\text{macro},1-\tau_P} = \frac{\epsilon^{\text{micro},1-\tau_P}}{1-\epsilon^{\text{agglo},N}}$ larger than individual responses (Kleven, 2025). Analogous to "big push" industrial policies, a "*big pull*" aggressive but temporary tax break can be justified in the presence of such social multipliers among migrants.[50]

If tax-induced inflows of retirees (magnified by agglomeration) are spatially concentrated, they can affect local non-tradable prices. This creates windfall gains for owners (valued at α) in proportion to *foreign* housing expenditure $r_j H_j^F$ (first term on the second line). It also redistributes from local renters to owners in proportion to *domestic* housing expenditure $r_j \pi_j h_j$, a regressive transfer if landlord welfare is valued less than tenants ($\alpha < 1$, second term). These effects are larger when the local concentration of the migration *response* θ_j (the "local-to-national" inflow elasticity) is positively correlated with inverse local housing supply elasticities $\eta^{r,j}$. Finally (third line), pensioner inflows exert direct amenity effects on locals: the strength of this force ($V_{N,j}^T$) depends on the geographic overlap between pensioners' migration *response* $\theta_j N_j$ and the *initial* distribution of local residents π_j. Empirically, our large estimated effect on home prices may generate redistributive tensions, and we document potential crowding of public services such as healthcare; but the spa-

[49] The trade-off between behavioral and mechanical effects depends on whether it is legally and politically feasible to set separate tax rates for foreign and domestic pensioners; see Kleven, Landais, and Saez (2013). If so, any non-zero migration elasticity justifies a lower rate for foreigners.

[50] The fiscal externality would be larger if persistent migration beyond the policy horizon, or other non-income based local taxes paid by foreign pensioners, imply extra revenue from marginal pensioner inflows.

tial concentration of foreign pensioners in lower density locations may limit the extent of crowding out on local amenities.

Formula 7 defines the optimal preferential tax rate τ_P^* on foreign non-workers:[51]

$$\begin{aligned}\tau_P^* = \frac{1}{1+\epsilon^{\text{macro},1-\tau_P}}\Bigg[1 \\ + \frac{\epsilon^{\text{macro},1-\tau_P}}{N\bar{P}}\left((1-\alpha)\sum_j \eta^{r,j}\theta_j r_j \pi_j h_j - \alpha \sum_j \eta^{r,j}\theta_j r_j H_j^F\right) \\ - \frac{\epsilon^{\text{macro},1-\tau_P}}{N\bar{P}}\left(\sum_j \pi_j V_{N,j}^T \times N_j \theta_j\right)\Bigg]\end{aligned} \tag{7}$$

While we consider an uncoordinated, revenue-maximizing policy for a single destination country, agglomeration forces must still be taken into account by using the "macro" migration elasticity. Moreover, not only does the aggregate tax-responsiveness of flows matter according to the inverse-(macro) elasticity rule, but the spatial concentration of migration responses θ_j is also essential to gauge the extra welfare consequences of downstream effects on rents and amenities.

We calibrate equation 7 to reflect heterogeneity in the concentration of pensioner inflows θ_j. We sort the 308 Portuguese districts into two equally-populated groups by the normalized percentage increase in the foreign pensioners over 2011-21 ($\hat{\theta_j} = \frac{\Delta_{2011-21}\ln(N_j)}{\Delta_{2011-21}\ln(\sum_k N_k)}$). We use our preferred estimate of the medium-term macro-elasticity $\epsilon^{\text{macro},1-\tau_P} = 3.1$ from table 1; the number of foreign EU pensioners $N = 22000$ as of 2011, and the mean pension $\bar{P} = 60,000$ for NHR residents from table 1. For each group, annualized *domestic* housing expenditure $r_j \pi_j h_j$ is the mean value of traded real estate times the number of households (using a 6% annual user cost factor from the euro area average in Battistini and Gareis (2024)). Foreign housing consumption H_j^F is scaled using local prices so that foreign households in Portugal spend on average 25% of their income on housing (Redding and Rossi-Hansberg, 2017). We calibrate $\eta^{r,j}$ as the estimated effect of foreign pensioner inflows on local home values in table 3, separately for above and below-median θ_j locations. While we focus on the pecuniary externality given our large estimated house price effects

[51] It shares features of the optimal place-based transfer found in Fajgelbaum and Gaubert (2020), the optimal response to foreign population inflows in Guerreiro et al. (2025) (Propositions 6 and 7), and the optimal tax rate with externalities of Kleven (2025) (Proposition 5).

and its role as justification for ending the NHR policy, for robustness, we also allow for negative congestion effects of foreign resident inflows (with a congestion semi-elasticity of 0.3 reflecting the share of public goods in consumption, given our finding of a one-for-one increase in local healthcare consumption with foreign inflows).

Figure 12 plots the sensitivity of the calibrated optimal tax rate to α, the welfare weight on owners of the housing stock. We highlight with a vertical dashed line the case $\alpha = 0.7$ (corresponding to the 70% home-ownership rate in Portugal, i.e. when landlord welfare is valued at 0 but within-homeowners price effects are neutralized). Despite the large long-run migration elasticity, the NHR zero tax rates are unlikely to be optimal. The potential for surplus extraction through increased prices for foreign housing consumption is inherently limited by the small size of the foreign resident community, even at the highest valuation of housing owners $\alpha = 1$. By contrast, the regressive pecuniary externality affects the entire housing expenditure by domestic tenants;[52] at lower values of α, it can raise the optimal tax rate on foreign pensioners significantly above the Laffer rate.

8 Conclusion

Pensioners offer attractive features for empirically studying tax-induced migration. Their pre-tax income consists of a nominally fixed benefit determined in their home country; in most cases it remains unaffected by their location decision. This makes them mostly indifferent to labor market considerations in the destination region, muting a key endogeneity concern when examining the relationship between taxation and relocation.

Their mobility response also has distinct policy implications for origin countries, compared to working-age movers. While retaining domestic workers requires untargeted, costly changes in tax rates, in publicly controlled pay-as-you-go pension schemes, governments have the ability to modulate the level of pensions at source, or even to condition their payment or tax treatment on pensioners' residence choices. As a consequence, the portability of pension rights – a major stumbling point during the UK-EU Brexit negotia-

[52] As in Kleven (2025), "*a small part of the economy [...] generating externalities on a large part of the economy*" has potentially substantial effects on optimal tax rates.

tions – is crucial for cross-country coordination.[53]

Moreover, endogenous agglomeration forces behind the amplified and persistent response to targeted tax breaks have broader implications for international tax competition. Similar forces could operate, for example, in the global competition for firms. If low rates or loose regulatory scrutiny initially attract a sufficient mass of firms to a location, business services (like law practices and banks) can endogenously agglomerate there, making it an attractive place to establish firm headquarters – even after the end of the initial pull factor, be it bank secrecy or tax haven status.

Finally, foreign pensioners do not participate in the labor market, but consume non-tradables locally with incomes drawn from abroad. If high-income pensioners are particularly responsive to international tax differentials, targeted tax exemptions constitute a form of industrial policy for destination regions, and a potent instrument to foster economic development in the localities where migrating pensioners cluster. Such concentrated local effects, explored in Badilla et al. (2024), are a fruitful area for future research.

References

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller (2010). "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program". *Journal of the American statistical Association* 105.490, pp. 493–505.

Agersnap, Ole, Amalie Jensen, and Henrik Kleven (2020). "The welfare magnet hypothesis: Evidence from an immigrant welfare scheme in Denmark". *American Economic Review: Insights* 2.4, pp. 527–542.

Agrawal, David R and Dirk Foremny (2018). "Relocation of the Rich: Migration in Response to Top Tax Rate Changes from Spanish Reforms". *Review of Economics and Statistics*.

Agrawal, David R and Mohammed Mardan (2019). "Will destination-based taxes be fully exploited when available? An application to the US commodity tax system". *Journal of Public Economics* 169, pp. 128–143.

Agrawal, David R, James M Poterba, and Owen M Zidar (2024). *Policy Responses to Tax Competition*. Tech. rep. National Bureau of Economic Research.

Akcigit, Ufuk, Salomé Baslandze, and Stefanie Stantcheva (2016). "Taxation and the international mobility of inventors". *American Economic Review* 106.10, pp. 2930–2981.

Akcigit, Ufuk et al. (June 2021). "Taxation and Innovation in the Twentieth Century*". *The Quarterly Journal of Economics* 137.1, pp. 329–385.

Auerbach, Alan J et al. (2017). "Destination-based cash flow taxation". *Oxford University Centre for Business Taxation* WP 17/01.

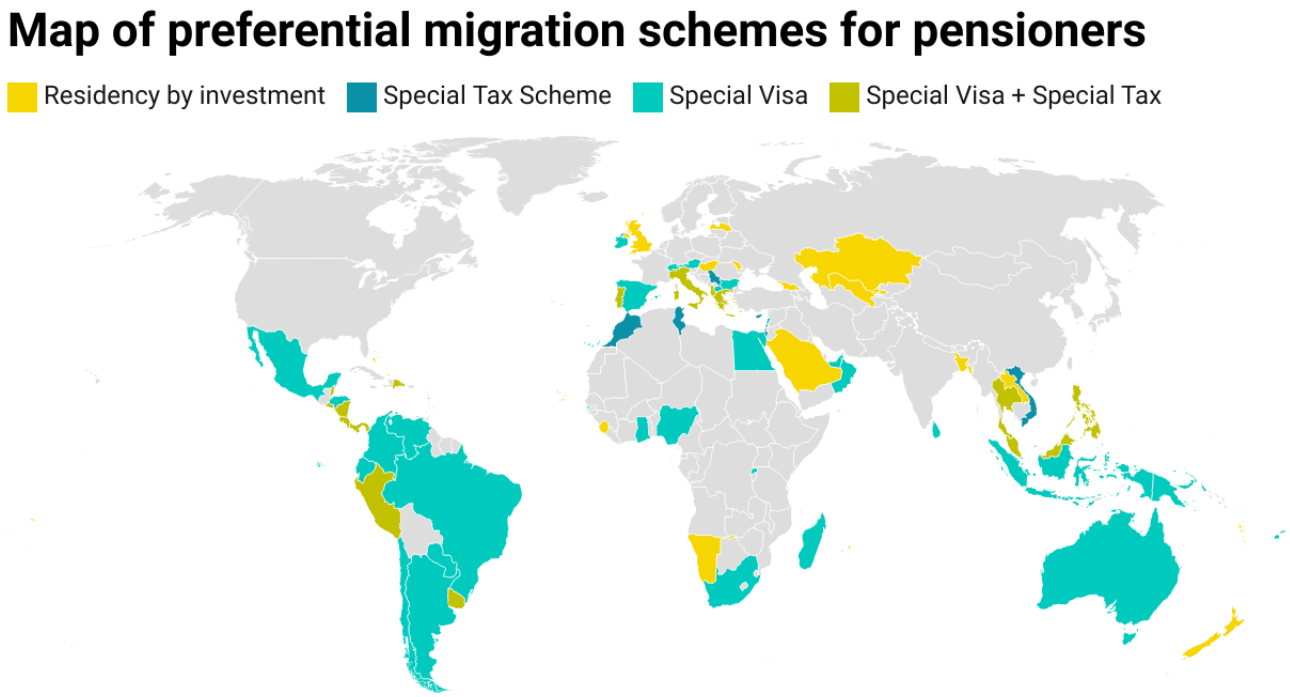
[53] One extreme example of retaining such control in the source country is the practice of "frozen" State pensions paid by the United Kingdom to pensioners living abroad in most of the Commonwealth. Only UK pensioners living in the European Economic Area and a few countries with a reciprocity agreement benefit from the yearly inflation adjustment applicable to domestic pensioners in the UK.

Badilla, Marco et al. (2024). *Senior Migration, Local Economic Development and Spatial Inequality*. Tech. rep.
Bakija, Jon M and Joel Slemrod (2004). *Do the rich flee from high state taxes? Evidence from federal estate tax returns*.
Bassetto, Jacopo and Giuseppe Ippedico (2023). "Can tax incentives bring brains back? Returnees tax schemes and high-skilled migration in Italy".
Battistini, Niccolò and Johannes Gareis (2024). "Housing investment and the user cost of housing in the euro area". *Economic Bulletin Boxes* 3.
Berger, David, Nicholas Turner, and Eric Zwick (2020). "Stimulating housing markets". *The Journal of Finance* 75.1, pp. 277–321.
Brueckner, Jan K, Matthew E Kahn, and Gary C Lin (2023). "A new spatial hedonic equilibrium in the emerging work-from-home economy?" *American Economic Journal: Applied Economics* 15.2, pp. 285–319.
Caliendo, Lorenzo, Maximiliano Dvorkin, and Fernando Parro (2019). "Trade and Labor Market Dynamics: General Equilibrium Analysis of the China Trade Shock". *Econometrica* 87.3, pp. 741–835. DOI: https://doi.org/10.3982/ECTA13758.
Carrington, William J (1996). "The Alaskan labor market during the pipeline era". *Journal of Political Economy* 104.1, pp. 186–218.
Coile, Courtney and Jonathan Gruber (2007). "Future social security entitlements and the retirement decision". *The Review of Economics and Statistics* 89.2, pp. 234–246.
Conway, Karen Smith and Jonathan C Rork (2012). "No country for old men (or women) – Do state tax policies drive away the elderly?" *National Tax Journal* 65.2, pp. 313–356.
Cunningham, Christopher R and Gary V Engelhardt (2008). "Housing capital-gains taxation and homeowner mobility: evidence from the Taxpayer Relief Act of 1997". *Journal of urban Economics* 63.3, pp. 803–815.
Delventhal, Matt and Andrii Parkhomenko (2024). "Spatial implications of telecommuting". *Available at SSRN 3746555*.
Diamond, Rebecca (2016). "The determinants and welfare implications of US workers' diverging location choices by skill: 1980–2000". *American Economic Review* 106.3, pp. 479–524.
Fajgelbaum, Pablo D and Cecile Gaubert (2020). "Optimal spatial policies, geography, and sorting". *The Quarterly Journal of Economics* 135.2, pp. 959–1036.
Gelber, Alexander M et al. (2021). "Using nonlinear budget sets to estimate extensive margin responses: Method and evidence from the earnings test". *American Economic Journal: Applied Economics* 13.4, pp. 150–193.
Glaeser, Edward L, Bruce I Sacerdote, and Jose A Scheinkman (2003). "The social multiplier". *Journal of the European Economic Association* 1.2-3, pp. 345–353.
Guerreiro, Joao et al. (2025). *Foreign Residents and the Future of Global Cities*. Tech. rep. Working Paper.
Howdon, Daniel and Nigel Rice (2018). "Health care expenditures, age, proximity to death and morbidity: Implications for an ageing population". *Journal of health economics* 57, pp. 60–74.
Imbert, Clément et al. (2023). "Floating population: migration with (out) family and the spatial distribution of economic activity". Federal Reserve Bank of San Francisco.
ITEP (Mar. 2023). *State Income Tax Subsidies for Seniors*. March 2023. Institute on Taxation and Economic Policy.
Jakobsen, Katrine et al. (2025). *Taxing top wealth: Migration responses and their aggregate economic implications*. Tech. rep. Working Paper.
Kauppinen, Ilpo and Panu Poutvaara (2023). "Decomposing Migrant Self-Selection: Education, Occupation, and Unobserved Abilities".
Kleven, Henrik (2025). *Externalities and the Taxation of Top Earners*. Tech. rep. National Bureau of Economic Research.
Kleven, Henrik et al. (2020). "Taxation and migration: Evidence and policy implications". *Journal of Economic Perspectives* 34.2, pp. 119–142.

Kleven, Henrik Jacobsen, Camille Landais, and Emmanuel Saez (2013). "Taxation and international migration of superstars: Evidence from the European football market". *American Economic Review* 103.5, pp. 1892–1924.
Kleven, Henrik Jacobsen et al. (2014). "Migration and wage effects of taxing top earners: Evidence from the foreigners' tax scheme in Denmark". *The Quarterly Journal of Economics* 129.1, pp. 333–378.
Komissarova, Kristina (2022). *Location choices over the life cycle: The role of relocation for retirement*. Tech. rep. mimeo.
Manoli, Day and Andrea Weber (2016). "Nonparametric evidence on the effects of financial incentives on retirement decisions". *American Economic Journal: Economic Policy* 8.4, pp. 160–182.
Margo, Robert A (1998). "Wages and labor markets before the Civil War". *The American Economic Review* 88.2, pp. 51–56.
McCarthy, Helen (2018). "The End of the Retirement Dream? British Pensioners in the European Union after Brexit". *Migration Policy Institute Europe Brief* 10.
Molloy, Raven, Christopher L Smith, and Abigail Wozniak (2011). "Internal migration in the United States". *Journal of Economic perspectives* 25.3, pp. 173–196.
Monras, Joan (2018). "Economic shocks and internal migration".
— (2021). "Local Adjustment to Immigrant-Driven Labor Supply Shocks". *Journal of Human Capital* 15.1, pp. 204–235. DOI: 10.1086/713148.
Monte, Ferdinando, Stephen J. Redding, and Esteban Rossi-Hansberg (2018). "Commuting, Migration, and Local Employment Elasticities". *American Economic Review* 108.12, 3855â90. DOI: 10.1257/aer.20151507. URL: https://www.aeaweb.org/articles?id=10.1257/aer.20151507.
Moretti, Enrico and Daniel J Wilson (2017). "The effect of state taxes on the geographical location of top earners: Evidence from star scientists". *American Economic Review* 107.7, pp. 1858–1903.
Morgan, David and Michael Mueller (2023). *Understanding international measures of health spending: Age-adjusting expenditure on health*. Tech. rep. 162. OECD Health Working Paper.
Morten, Melanie and Jaqueline Oliveira (2024). "The Effects of Roads on Trade and Migration: Evidence from a Planned Capital City". *American Economic Journal: Applied Economics* 16.2, 389â421. DOI: 10.1257/app.20180487. URL: https://www.aeaweb.org/articles?id=10.1257/app.20180487.
Rauh, Joshua and Ryan Shyu (2024). "Behavioral responses to state income taxation of high earners: evidence from California". *American Economic Journal: Economic Policy* 16.1, pp. 34–86.
Redding, Stephen J and Esteban Rossi-Hansberg (2017). "Quantitative spatial economics". *Annual Review of Economics* 9, pp. 21–58.
Santos, João Pereira dos and Kristina Strohmaier (2024). *All That Glitters? Golden Visas and Real Estate*. Tech. rep. IZA Discussion Papers.
Shan, Hui (2010). "Property taxes and elderly mobility". *Journal of Urban Economics* 67.2, pp. 194–205.
Ward, Russell A, Mark LaGory, and Susan R Sherman (1985). "Neighborhood and network age concentration: Does age homogeneity matter for older people?" *Social Psychology Quarterly*, pp. 138–149.
Wilson, John Douglas and David E Wildasin (2004). "Capital tax competition: bane or boon". *Journal of Public Economics* 88.6, pp. 1065–1091.
Wong, Francis (2024). *Taxing Homeowners Who Won't Borrow*. Tech. rep. CESifo Working Paper.
Yagan, Danny (2019). "Employment hysteresis from the great recession". *Journal of Political Economy* 127.5, pp. 2505–2558.

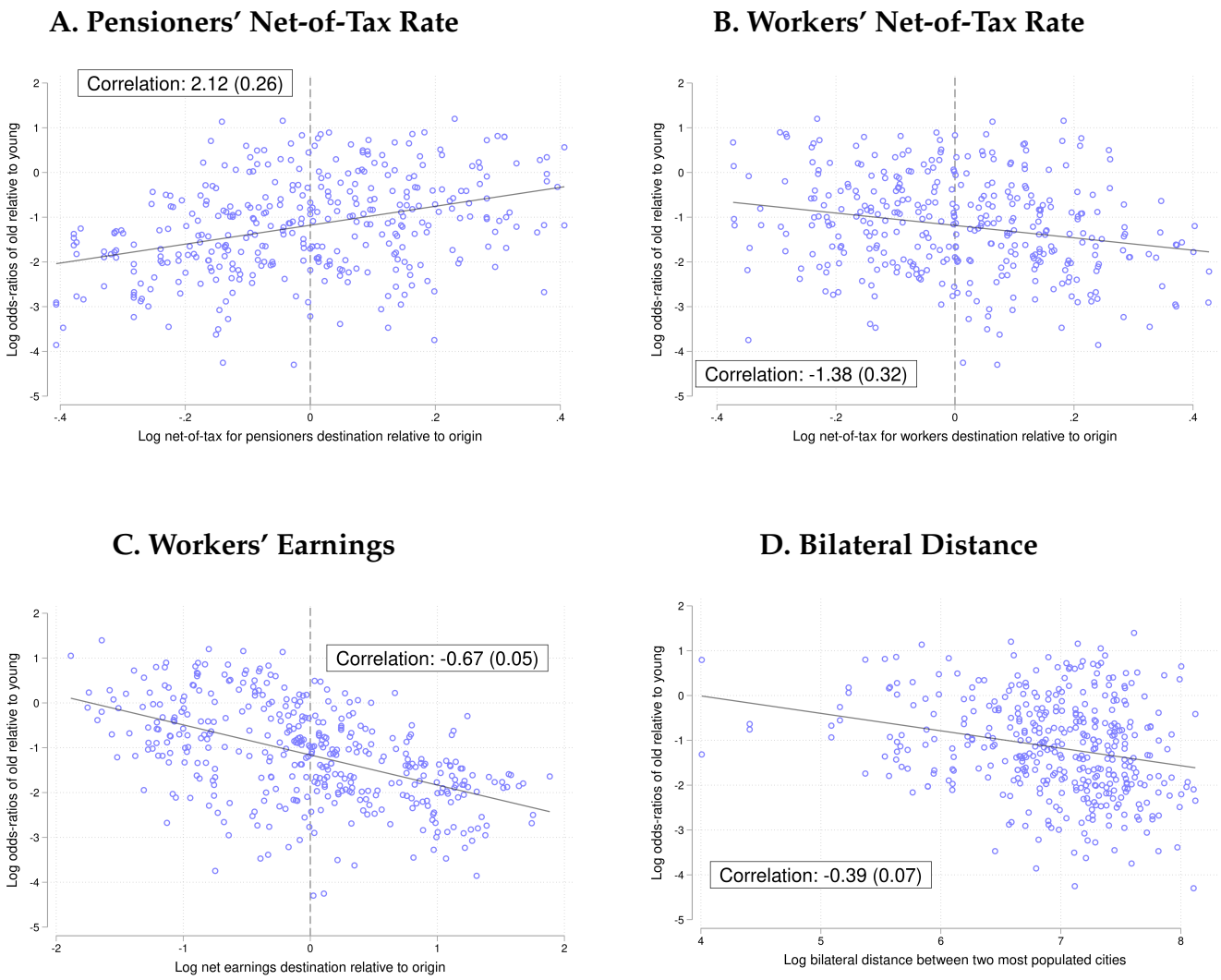
Main figures

Figure 1: Map of Preferential Migration Schemes for Pensioners



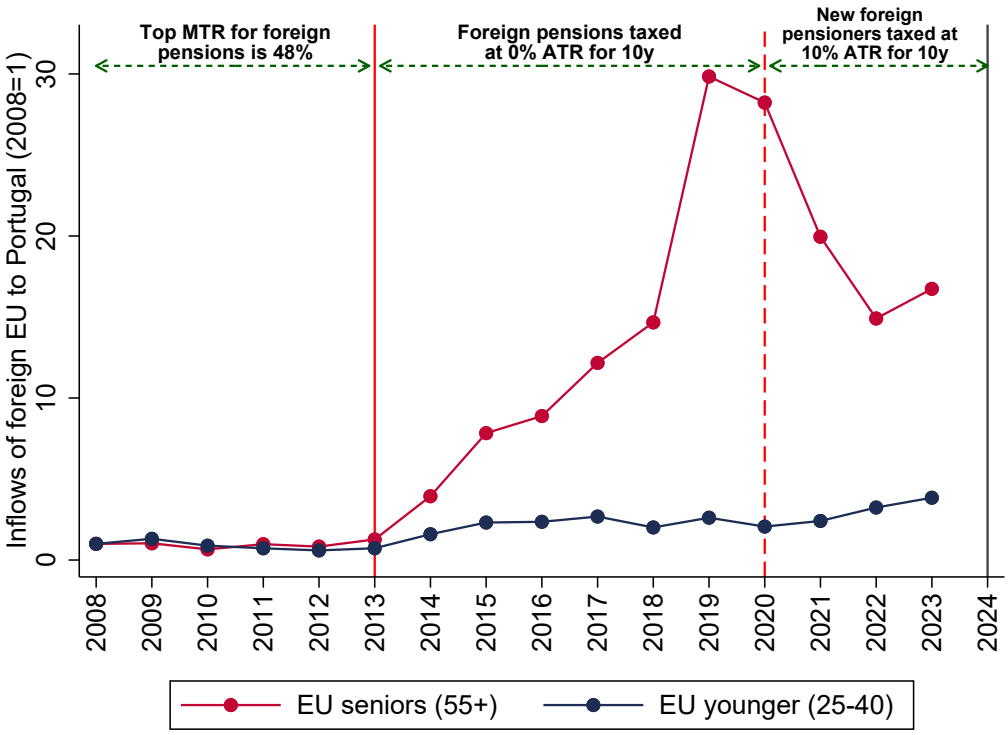
Notes: This figure records the existence of preferential migration schemes targeted at foreign pensioners as of 2025. The schemes are classified into special tax schemes targeted specifically to retirees, special visas conditioned on retirement status, or the availability of a residency by investment option.

Figure 2: **Correlates of Migration Flows of Pensioners vs Workers in the EU**



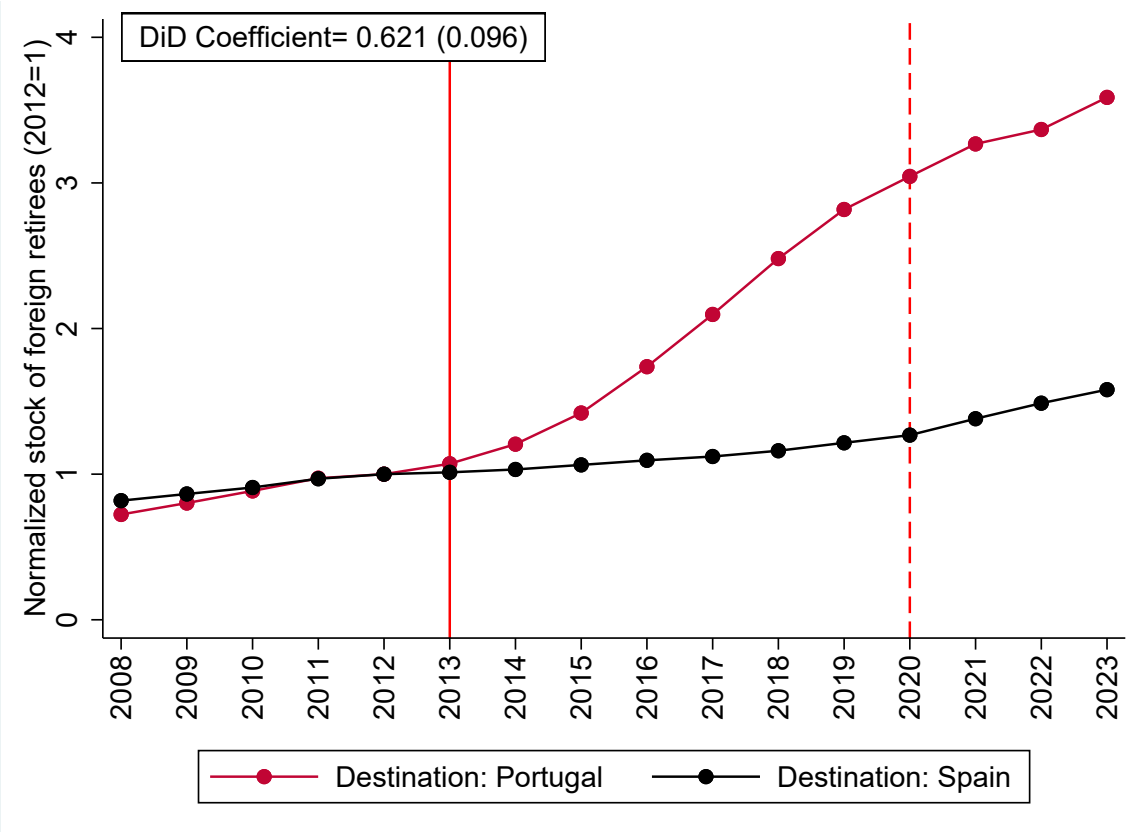
Notes: This figure shows the cross-country relationship between (log) old-young odds-ratio (defined in Equation 1) and log) pensioners' net-of-tax rates ratio (Panel A), the (log) workers' net-of-tax rates ratio (Panel B), the (log) average wages ratio (Panel C), and the log bilateral distance (Panel D). We focus on all destination-origin pairs in our EU-wide dataset for the year 2022. In each Panel, we show the best linear fit using an unweighted, univariate regression. The coefficients and standard errors reported in the figures are obtained by regressing the y-axis outcome on the x-axis outcome. Data are obtained from Eurostat, national censuses, the OECD Taxing Wages and Pensions at a Glance databases, and the CEPII international trade database.

Figure 3: **Migration Flow Responses to the Portuguese Tax Break for Retirees**



Notes: Panel A displays aggregate trends in raw international migration flows to Portugal from all EU origin seniors (aged 55 or more) and younger (25-40) from 2008 to 2023. The first vertical solid line marks the introduction of the NHR scheme in 2013, and the second dashed line indicates the curtailment of the regime after 2020. The vertical gray solid line marks the abolition of the NHR in January 2024. Data are obtained from the *Estimativas anuais de imigração* (Annual Migration Statistics) published by INE (Portugal's national Statistical Institute).

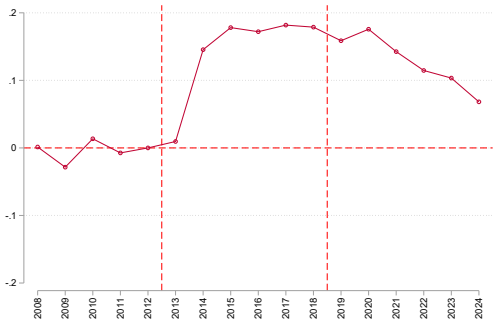
Figure 4: **Effect of the Tax Cut on Stock of Foreign Retirees in Portugal**



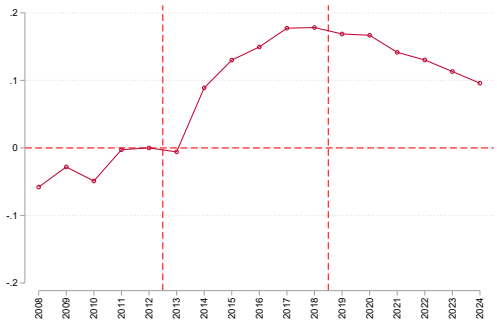
Notes: This figure shows the stock of foreign EU retirees in Portugal (treated, red series) and Spain (control, blue series), before and after a reform (vertical red dotted line) reduced the income tax rate to 0% for foreign retirees moving to Portugal. All series are normalized to one in the pre-reform year (2012). The difference-in-differences coefficients from Equation 3 are displayed, along with the estimate of the standard error. Data are obtained from Eurostat, the European statistical office (population by age group and citizenship as of January 1 of each year), and are complemented when missing with data from national Censuses.

Figure 5: **Selection of Retirees into Tax-Induced Migration**

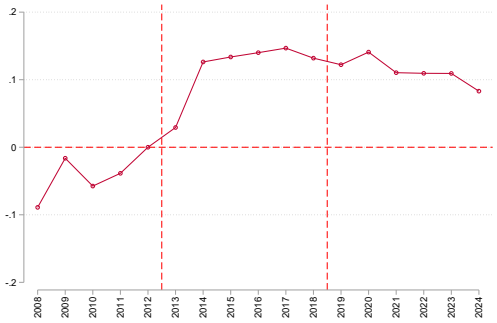
(a) **Share with earnings in top decile**



(b) **Share with any capital income**

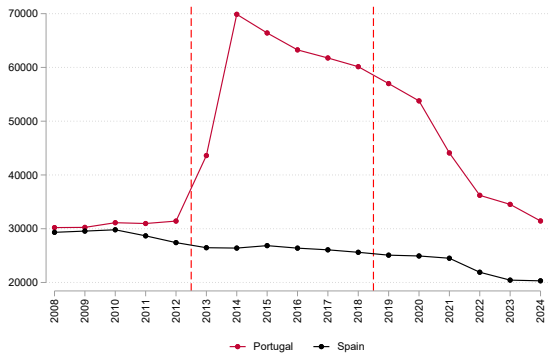


(c) **Share with higher education**

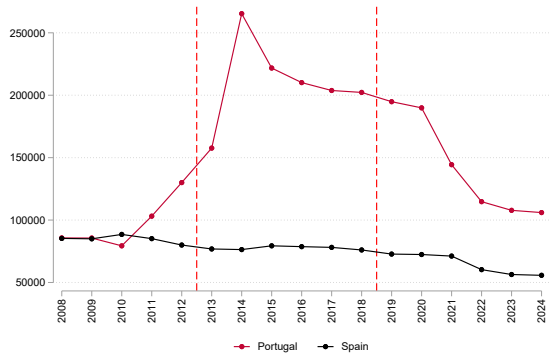


(d) **Share married**

(e) **Average pensions**

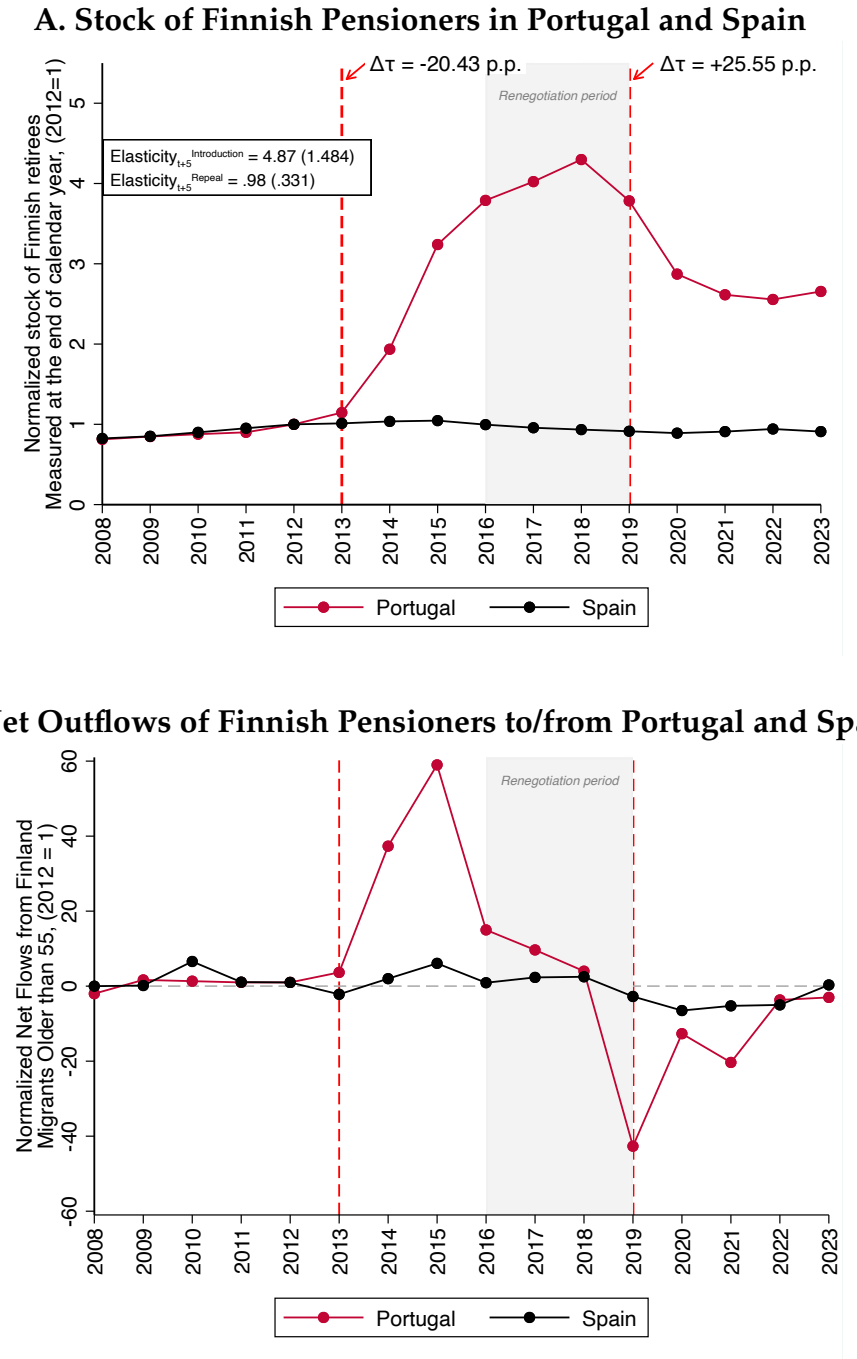


(f) **Top 10% of pensions**



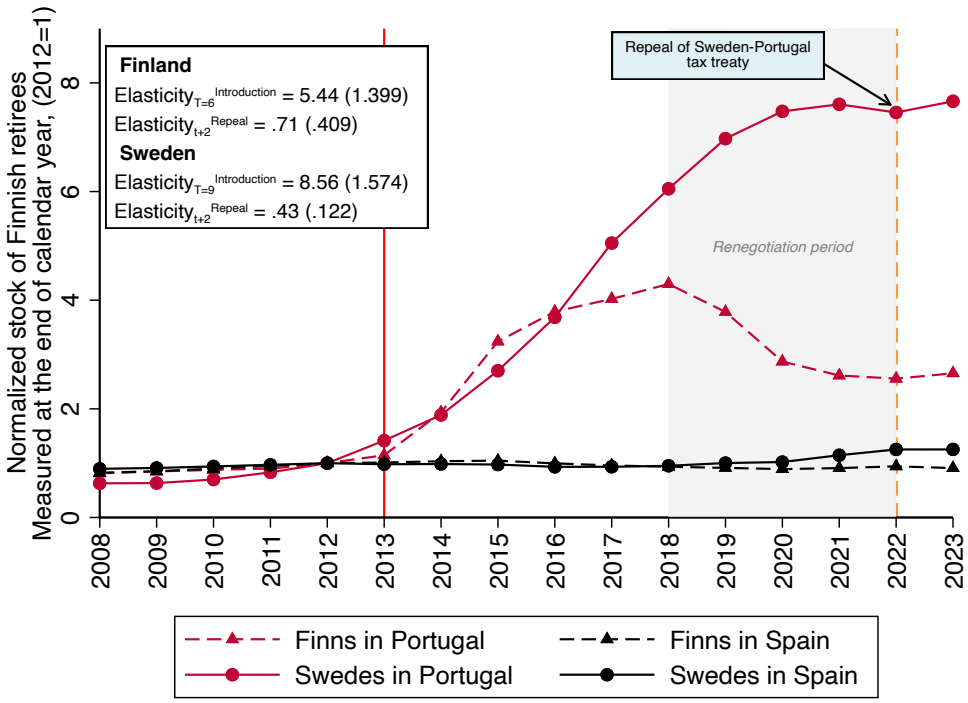
Notes: This figure displays the difference in average characteristics in the stock of Finnish pensioners living in Portugal (treatment group) and Spain (control group), focusing on different demographic features. It highlights changes before and after the NHR reform reduced the income tax rate to 0% for foreign retirees (first vertical red dotted line), and after the repeal of the Finland–Portugal tax treaty (second vertical line). Panel (a)-(d) focus on average characteristics, computed by matching the Finnish population-wide migration register data (starting in 1991) to administrative income tax data, and taking the difference between the stock of Finns in Portugal versus Spain. The difference is normalized to zero in the pre-reform year (2012). Panel (e)-(f) show the average annual pension (in euros) received by Finnish retirees located in Portugal versus Spain, for the full sample and the top 10% in each year.

Figure 6: **Asymmetric Effects of Cutting the Tax Advantage for Retirees from Finland**



Notes: This figure displays migration trends of Finnish pensioners to Spain and Portugal using administrative data from Statistics Finland, restricted to individuals aged 55 and above. Panel A shows the stock of foreign Finnish retirees in Portugal (treated, red series) and in Spain (control, black series). Panel B shows the net outflows of pensioners from Finland to Portugal (red series) and Spain (black series): a positive net outflow means that more seniors left Finland to a given country than moved from that specific country to Finland. The two dotted red lines depict the introduction and later repeal of the full tax exemption of foreign pensioners for Finns in Portugal. All series are normalized to one in 2012.

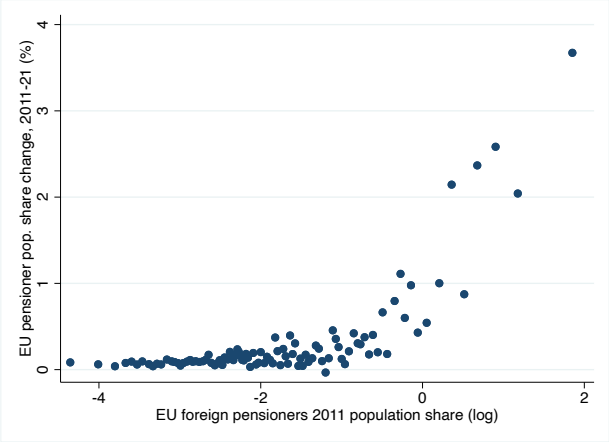
Figure 7: **Stronger Hysteresis After Longer Exposure to NHR**



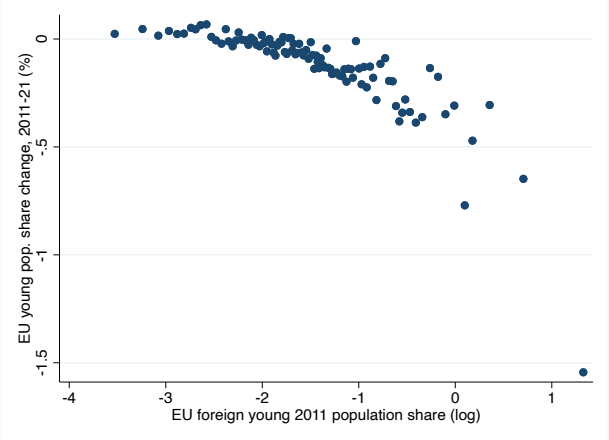
Notes: This figure shows the stocks of retirees from Finland and Sweden in Portugal and Spain over the period. All series are normalized to one in 2012. The red vertical line depicts the introduction of the full tax exemption of foreign pensions in Portugal, which applied to retirees from Finland and Sweden. The vertical dashed orange line depicts the repeal of the generous tax exemption for pensioners from Sweden. Migration elasticities at introduction and repeal of the scheme are computed for each origin– Finland (exposed 6 years) and Sweden (exposed for 9 years)– and are reported in the graph.

Figure 8: **Migration Responses to Taxes Exhibit Agglomeration in Destination**

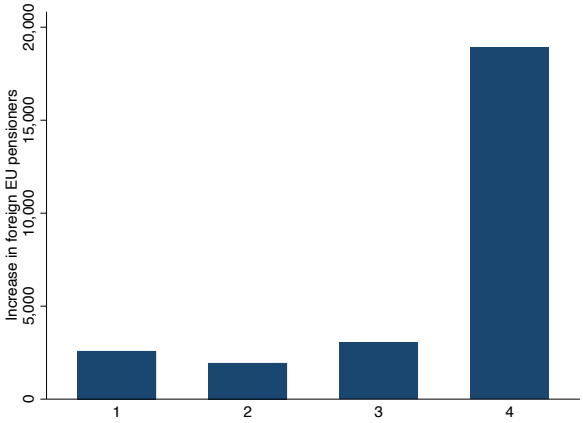
A. Diverging Share of Foreign Pensioners After the Reform



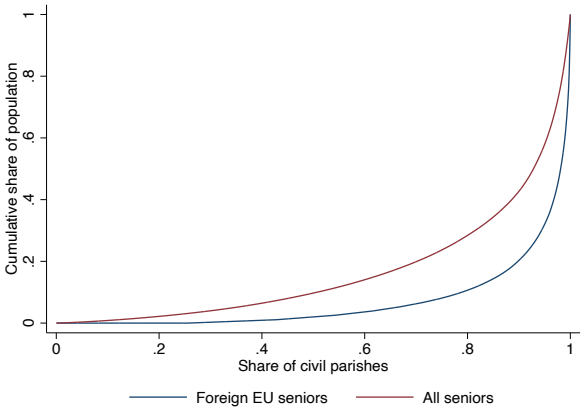
B. Regression to the Mean for Younger Migrants



C. Spatial Concentration of Tax-Induced Pensioners Inflows

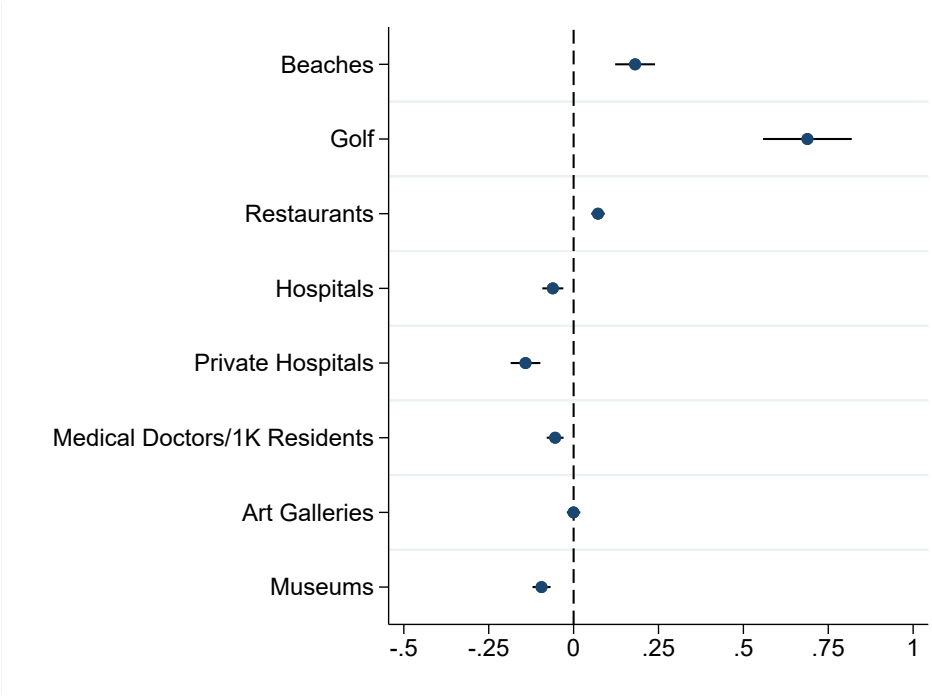


D. Concentration of foreign seniors relative to domestic seniors



Note: This figure shows evidence of age-specific agglomeration forces in migration responses to the tax break. Panel (A) shows that parishes with a high initial population share of European seniors (55+) also experience a larger increase in the share of senior European migrants from 2011 to 2021. Panel (B) shows that parishes with a high initial share of *young* (20-40) European migrants experience a *decrease* in that share over the subsequent period, consistent with regression to the mean. Panel (C) decomposes the overall increase in the total number of European pensioners in Portugal across four equally-populated quartiles of parishes, ranked by their initial share of EU pensioners in the population. Panel (D) demonstrates that foreign European pensioners in Portugal in 2021 are uniquely concentrated across parishes, relative to domestic seniors, by comparing their relative cumulative distribution functions across *freguesias*. Data are taken from the 2021 and 2011 decennial censuses of Portugal.

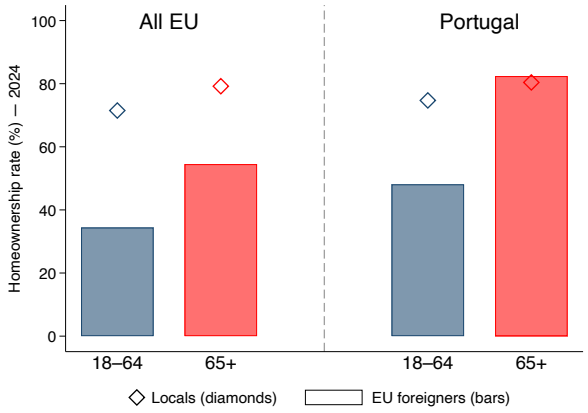
Figure 9: **Inflows of Foreign EU Seniors and Local Amenities**



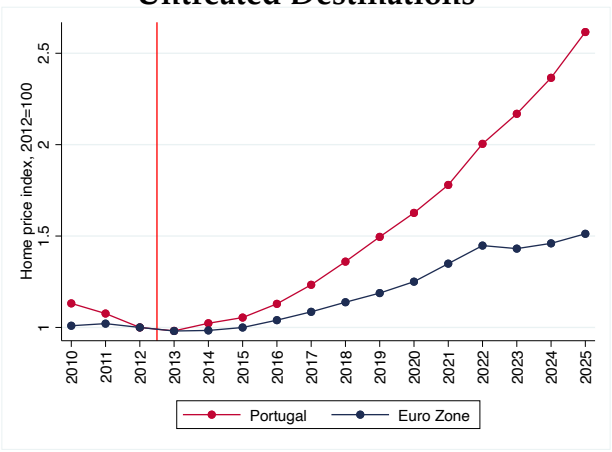
Notes: This figure plots the coefficient and 95% confidence interval from separate regressions of the change in the share of foreign EU pensioners in a Portuguese *municipio* on the log number of each local amenity. Standard errors are robust. We measure the change in the local population of EU seniors between 2011 and 2021 using decennial censuses. Data on each amenity except golf courses are collected from the Portuguese national statistical institute (INE). Data on golf courses is collected from Conselho Nacional da Indústria do Golfe and Portugal Golf Experience.

Figure 10: **Implications of Tax-Induced Migration of Retirees for Housing Prices**

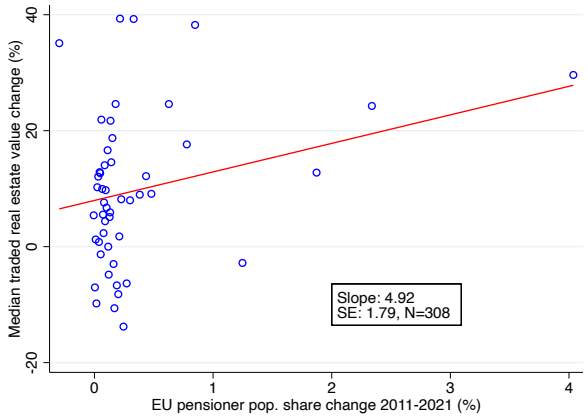
A. Propensity to Buy Housing of Foreign Pensioners in Portugal



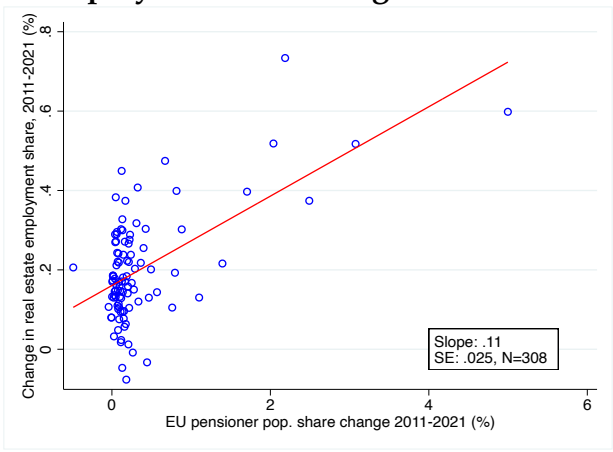
B. Housing Prices in Portugal and Untreated Destinations



C. Local Increase in Housing Prices and Foreign Pensioners

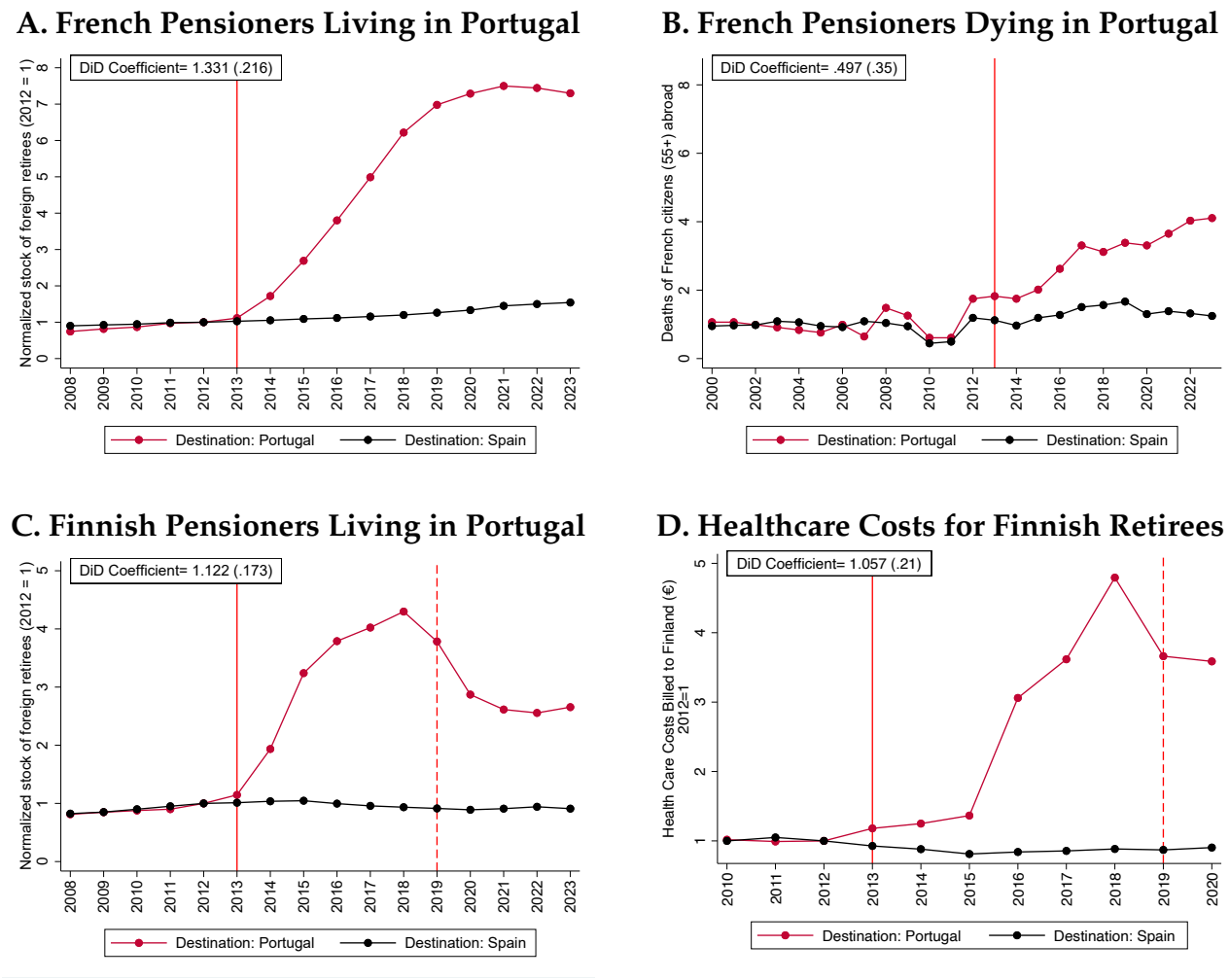


D. Local Increase in Real Estate Employment and Foreign Pensioners



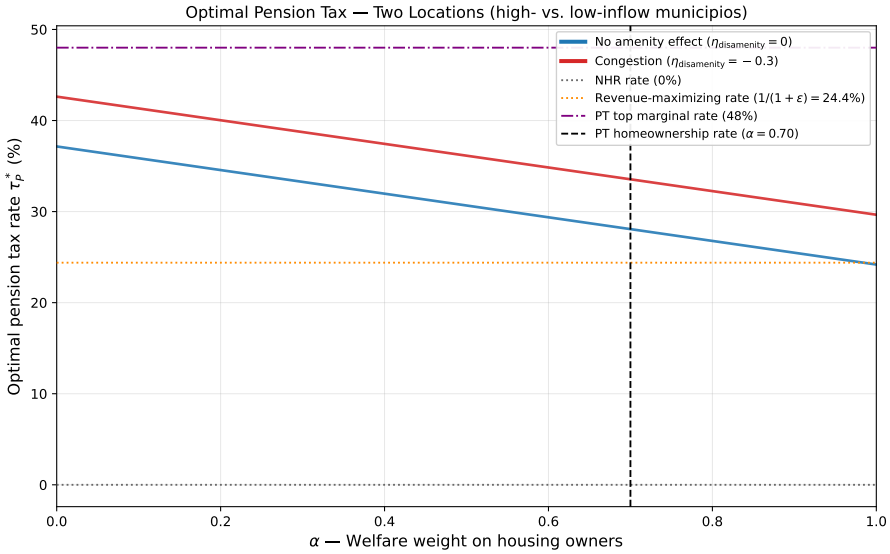
Note: Panel (A) displays the relative homeownership rates (from the EU Statistics on Income and Living Conditions) of locals and EU foreigners, for the 18–64 and 65 and over age groups, for the entire EU and for Portugal, in 2024. Panel (B) shows the relative evolution of aggregate home prices in Portugal and a synthetic control constructed from a weighted average among a donor pool of other OECD countries, with weights chosen to maximize the pre-NHR fit in home price indices. Panel (C) shows the correlation between the increase in the total population share of foreign EU pensioners in a Portuguese *municipio* (x-axis) and the change in the median traded real estate value in a *municipio* (y-axis). We measure the change in the local population of EU seniors between 2011 and 2021 using decennial censuses. We measure the change in local housing prices using the average in the pre- (2000-2012) and post- (2017-2019) NHR period, using real estate value data from the Portuguese national statistical institute (INE). Panel (D) shows the correlation between the increase in the total population share of foreign EU pensioners in a Portuguese *municipio* (x-axis) and the recovery in real estate-related employment in a *municipio* (y-axis).

Figure 11: **Implications of Tax-Induced Migration of Retirees for Health Consumption**



Note: This figure shows evidence of health consumption abroad following migration responses to the tax break. Panel (A) shows the stock of French pensioners living in Portugal (treated, red series), compared to Spain (control, black series), which remains mostly flat. Panel (B) shows the number of deaths of French citizens (aged 55+) in Portugal (treated, red series) versus in Spain (control, black series). Data are taken from French administrative death records provided by INSEE. Panel (C) shows the stock of foreign Finnish retirees in Portugal (treated, red series) and in Spain (control, black series). Panel (D) compares the healthcare costs billed to Finland from Portugal (treated, red series) and Spain (control, black series) for Finnish pensioners. Data are taken from administrative healthcare data from the Finnish Social Insurance Institution. DiD coefficients are estimated over the same time period, i.e. 2009–2023 for Panel A/B and 2010–2020 for Panel C/D.

Figure 12: **Optimal calibrated tax rates on foreign pensioners**



Notes: This figure plots the optimal calibrated tax rate on foreign pensioners, according to equation 7. We define locations as the above- and below-median percentage increase in foreign EU pensioner population from 2011 to 2021, population-weighted groups of Portuguese districts (*municipios*. The calibrated parameters, described in section 7, correspond to our estimated long-term macro-elasticity of migration, the causal effect of foreign pensioner inflows on home prices in each group, the pre-NHR size of the foreign pensioner tax base. We vary α, the welfare weight on owners of the domestic housing stock, and highlight $\alpha = 0.7$ (corresponding to the domestic home-ownership rate) with a vertical dashed line. The blue line correspond to the baseline case, while the red line denotes the case with negative congestion amenity from foreign inflows on public goods consumption. The yellow horizontal line denotes the Laffer rate, and the red dashed horizontal line denotes the top domestic marginal tax rate in Portugal.

Main tables

Table 1: **Migration Elasticity Estimates**

	IV		TWFE
	Pension=EUR 35,000 Log(1-ATR)	Pension=EUR 60,000 Log(1-ATR)	Treat × Post
A. Only Spain as the control			
Average (N=30)			
A1. Retirees 55+	2.224***	1.869***	0.621***
	(0.395)	(0.333)	(0.096)
A2. Retirees 65+	2.803***	2.356***	0.783***
	(0.482)	(0.406)	(0.115)
Medium-term (N=20)			
A3. Retirees 55+	3.111***	2.621***	0.853***
	(0.227)	(0.189)	(0.025)
A4. Retirees 65+	3.856***	3.250***	1.058***
	(0.288)	(0.239)	(0.030)
Short-term (N=18)			
A5. Retirees 55+	1.200**	1.005**	0.342**
	(0.407)	(0.343)	(0.106)
A6. Retirees 65+	1.586**	1.329**	0.452**
	(0.510)	(0.430)	(0.131)
B. Other EU countries as the control			
Average (N=280)			
B1. Retirees 55+	1.450***	1.237***	0.433***
	(0.365)	(0.313)	(0.105)
B2. Retirees 65+	2.043***	1.745***	0.610***
	(0.415)	(0.357)	(0.118)
Medium-term (N=186)			
B3. Retirees 55+	2.274***	1.945***	0.665***
	(0.241)	(0.211)	(0.064)
B4. Retirees 65+	3.005***	2.573***	0.880***
	(0.260)	(0.230)	(0.064)
Short-term (N=157)			
B5. Retirees 55+	0.532	0.453	0.162*
	(0.325)	(0.278)	(0.098)
B6. Retirees 65+	0.975**	0.830**	0.297**
	(0.386)	(0.329)	(0.115)

Robust standard errors in parentheses

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

Notes: The table displays elasticity estimates based on the 2SLS specification (4) in Column (1)–(2) and the β estimated from the corresponding reduced-form specification (3) in Column (3). The outcome variable is $\log(N_{jt}^{P})$, the log number of foreign EU pensioners residing in a destination j in year t. The medium-term (short-term) elasticity refers to a specification that includes years 2018–2023 (2013–2017) as the post-reform period. Panel A displays estimates where the control group is only Spain; while Panel B uses all other EU countries as controls. We compute average tax rates (ATR) for pensioners using information on country-specific tax schedules from the OECD for pensioners earning EUR 35,000 per year (median pension for NHR recipients, Columns (1)) and EUR 60,000 per year (average pension for NHR recipients, Column (2)).

Table 2: **Summary of Empirical Literature on Migration Responses**

Panel A: Migration Across Countries

Citation	Preferred Migration Elasticity	Includes Pensioners	Population	Identification	Y Var	X Var	Migration Effect		
							% Tot. Pop.	% Tax Base	% GDP
This Paper	**2-3**	**Y**	**Foreign pensioners in Portugal**	**IV, Diff-in-diff using introduction of NHR regime in Portugal**	**Stock of foreign EU pensioners**	**Net-of-tax rate (instrumented by reform interaction)**	**0.249**	**1.847**	**0.588**
Agersnap, Jensen, and Kleven (2020)	1.3	Y	Low-income non-EU immigrants (ages 30 or older) in Denmark	Diff-in-diff, using a 2002 welfare scheme that reduced benefits for immigrants in Denmark	Immigration net flow	Welfare benefits (in U.S. dollars)	0.086	0.048	0.025
Bassetto and Ippedico (2023)	0.91	N	High-skilled expatriates from Italy	Triple diff-in-diff, reduced-form, exploiting 2010 Controesodo policy in Italy	Return migration flows	Average net-of-tax rate	0.002	0.007	0.003
Kleven, Landais, and Saez (2013)	Foreign ≈ 1 Domestic ≈ 0.15	N	First-league football players in Europe	Reduced-form, exploiting variation in tax policy/rates across countries and labor market regulation (Bosman ruling)	Number of foreign/domestic players in country	Net-of-tax rate	0.000	0.002	0.001
Kleven et al. (2014)	1.5-2	N	Immigrants in the top 1% in Denmark	Diff-in-diff, IV using variation in preferential tax scheme for high-earning foreigners	Number of foreign individuals	Net-of-tax rate (instrumented by reform interaction)	0.024	0.192	0.100

Panel B: Migration Within Country

Citation	Preferred Migration Elasticity	Includes Pensioners	Population	Identification	Y Var	X Var
Agrawal and Foremny (2018)	0.85	N	Top 1% of Spanish population	Two-region (stock) model, Reduced form	Log of the stock ratio (# individuals in top 1 % in destination over origin)	Log of net tax-rate differential in destination relative to origin
Caliendo, Dvorkin, and Parro (2019)	0.2	N	U.S. households for people between 25 and 65 years old	Reduced-form, IV using lagged wages and migration flows	Migration flows by market	Lagged wages
Conway and Rork (2012)	N/A	Y	Elderly in the U.S. (top vs. bottom income quartile)	Panel gravity model and flow-fixed effect model		

Cunningham and Engelhardt (2008)	Increase in mobility rate: 1-1.4 percentage points	N	Homeowners just above and below 55 (52-58) in the U.S.	Reduced-form, Diff-in-diff using change in mobility before and after the Taxpayer Relief Act of 1997	Probability of individual moving	Interaction between if homeowner is under 55 and was affected by the tax reform
Diamond (2016)	College = 2.12 Non-College = 4.03	N	College & non-college workers in the U.S.	Wages instrumented by Bartik labor demand shocks and their interaction with land-use regulation and availability	Utility value of a city	Wages
Komissarova (2022)	0.92[54]	Y	Individuals in the U.S. ages 57-77	Cross-sectional variation in distance between locations	Retirement flows	Distance (in miles) between commuting zones
Monras (2021)	1.6	N	Low-skilled workers in Miami	Bartik shift-share instrument for inflow of Cubans using the initial share of Cubans to Natives	Number of low-skilled workers leaving Miami	Change in low-skilled wages
Monte, Redding, and Rossi-Hansberg (2018)	3.3	N	Working Commuters in the U.S.	IV instrumenting wages with productivity, Reduced-form diff-in-diff	Bilateral commuting flows	Wages (instrumented by productivity)
Moretti and Wilson (2017)	1.8	N	Top 5% of inventors in the USA	Reduced-form	Flow of scientists moving between states	Net-of-tax rate
Morten and Oliveira (2024)	4.5	N	Male workers ages 25-65 in Brazil	Natural experiment, wages instrumented by Bartik shocks in wage growth	Bilateral migration flows between meso-regions	Change in wages (instrumented using Bartik shock for wage growth by industry)
Rauh and Shyu (2024)	Earning: \$2-5 mil. = 4.01 $\geq$ \$5 mil. = 4.61	Y	High-earning taxpayers in California	Synthetic and matched diff-in-diff	Migration from California to zero-tax state	Average tax rate
Shan (2010)	0.73[55]	Y	Homeowners in the U.S. over the age of 50	Simulated IV using simulated property tax relief benefits as instrument for property taxes	Two-year mobility rate	Property taxes

Notes: This table summarizes existing empirical evidence of migration responses to various shocks in determinants of location decisions. Panel A focuses on studies of cross-country migration, while Panel B focuses on within-country migration. The last three columns of Panel A summarizes the effects of migration responses in percentage of the destination country total population, personal income tax base, and total GDP.

[54]Reports the absolute value. Elasticity is negative, since calculated with respect to distance.

[55]Point estimate of \$100 annual property tax increase on two-year mobility rate

Table 3: **Local EU pensioner pop. share change and changes in real estate values**

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
EU pensioner pop. change 2011-21 vs 2011 pop (p.p.)	5.045***	7.475***	7.595***	5.835***	8.049***	8.143***
	(1.540)	(2.276)	(2.304)	(1.317)	(2.515)	(2.576)
Observations	308	308	308	152	152	152
R-squared	0.015	0.028	0.026	0.033	0.080	0.076
Weighted	No	Pop 2021	Pop 2011	No	Pop 2021	Pop 2011
Sample	All	All	All	Above median θ	Above median θ	Above median θ

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This Table shows the correlation between local changes in the foreign EU population share (in percentage points) and the local changes in real estate median values (in percentage points). Both changes are computed between the pre- and post-reform periods (averaging over multiple pre- and post-policy years for home prices) for each of the 308 *municipios* in Portugal. Robust standard errors are shown in parentheses. The last three columns show estimated effects in the sub-sample of municipalities with above-median percentage change in the number of foreign EU pensioners over the period, consistent with the heterogeneity relevant for equation 7.

Appendices

A Additional facts on International Retirement Migration

A.1 Self-selection into international migration for retirees

We use exhaustive, detailed administrative data on Finnish residents to describe the population of retirees who move abroad. Table A.4 compares the characteristics of Finnish pensioners who migrate internationally upon retirement (migrants) with those who remain in Finland (stayers). It reveals significant disparities in demographic and economic attributes.

Table A.4 first shows that migrants and stayers differ in their demographics. Mobile seniors are more likely to be male and less likely to have children, suggesting that the weakness of local ties may play a role in the decision to emigrate upon retirement. The second insight is that internationally mobile pensioners have higher income levels, with greater capital and business income compared to pensioners who remain in Finland. For example, their average labor income in the years leading up to retirement is 20% higher than that of stayers. In addition, they are more likely to have belonged to the top 10 income earners before retirement. Migrants are also more likely to be highly educated.

Overall, Table A.4 shows that international migration decisions at retirement are more prevalent among high-income earners. This kind of positive self-selection pattern is in line with the literature that focuses on the migration decisions of the working-age population (see Kauppinen and Poutvaara (2023) for results on Finland). This pattern may be due to the significant fixed costs of relocating abroad or because high-income earners have different preferences.

A.2 International migration around retirement

We also study the link between retirement and international migration events in Figure A.14. In Panel A, we start by plotting for a given cohort of all the residents we observe in Finland in a given year, the age at which they retire (left figure) and their probability of moving abroad (right figure). A very large fraction of Finnish residents retire when they reach the age of 63.[56]

[56]There was a pension reform in Finland in 2005 which set the legal retirement age between 63–68. If an individual retires before age 63, their pension is reduced, while retiring after age 68 results in an increased

Table A.4: **Descriptive Statistics: Internationally Mobile Pensioners**

	(1) All pensioners	(2) Staying pensioners	(3) Migrating pensioners
Age	68.89	68.89	63.85
	(9.800)	(9.800)	(7.310)
Male	0.46	0.46	0.54
	(0.498)	(0.498)	(0.499)
Married	0.55	0.55	0.47
	(0.497)	(0.497)	(0.499)
Has children	0.83	0.83	0.56
	(0.374)	(0.374)	(0.496)
Higher education	0.27	0.27	0.32
	(0.445)	(0.445)	(0.465)
Pension	22991.70	22992.21	21518.66
	(15086.1)	(15079.3)	(28739.0)
Above median pension	0.51	0.51	0.37
	(0.500)	(0.500)	(0.482)
Had capital income 5 years before retirement	0.43	0.43	0.37
	(0.495)	(0.495)	(0.482)
Top 10 income decile before retirement	0.10	0.10	0.11
	(0.294)	(0.294)	(0.315)
Earnings (5 year mean before retirement)	35349.98	35345.67	42382.67
	(24421.2)	(24409.8)	(38265.7)
Capital income (5 year mean before retirement)	6988.88	6981.11	21059.94
	(67128.3)	(66890.6)	(248891.9)
Observations	28566511	28548062	18449
Unique observations	2772299	2770155	17723

mean coefficients; sd in parentheses

Notes: This table provides descriptive statistics on pensioners in Finland for the whole data period 2008–2022. Column (1) includes all pensioners, while Columns (2) and (3) distinguish between those who stayed and those who migrated, respectively. The data are taken from comprehensive administrative records provided by Statistics Finland. The number of observations reflects the total count of individuals in the dataset, with each person counted for every year they appear. Unique observations represent the number of distinct individuals.

At the same time, we observe much larger international migration rates for individuals aged 63–65, compared to individuals just before their retirement age and after the most common retirement ages. To show this, we estimate Equation (8) for the cohort of individuals born in 1951:

$$Y_{it} = \sum_{t \neq 61} \beta_t Age_{it} + \epsilon_{it}, \tag{8}$$

where Y_{it} is equal to one for people who migrated at age t and zero for people who decided to stay in Finland, Age_{it} is a dummy variable for the age of the individual and ϵ_{it}

pension.

is the error term. Subfigure B (right) presents the estimated mean probabilities, β_t, of this cohort moving abroad, relative to age 61 (calendar year 2012).

This suggests a tight connection between leaving the domestic labor force and moving abroad, already noted by Badilla et al. (2024) in the context of within-country migration.

Figure A.13: International Migration by Cohort

Notes: This figure describes retirement and international migration behavior for individuals born in 1951 and residing in Finland in 2005. Panel A (left) displays the distribution of their age of effective retirement. In Panel B, we plot the estimated β's from Equation (8) in the main text. The confidence intervals are presented at the 95% confidence level, and are based on robust standard errors.

We can use the longitudinal nature of our dataset to better explore this connection, now by linking individual-specific retirement events to individual-specific migration events. We run a simple event-study model to see if individuals are more likely to leave Finland when they approach their own retirement event. Specifically, we estimate:

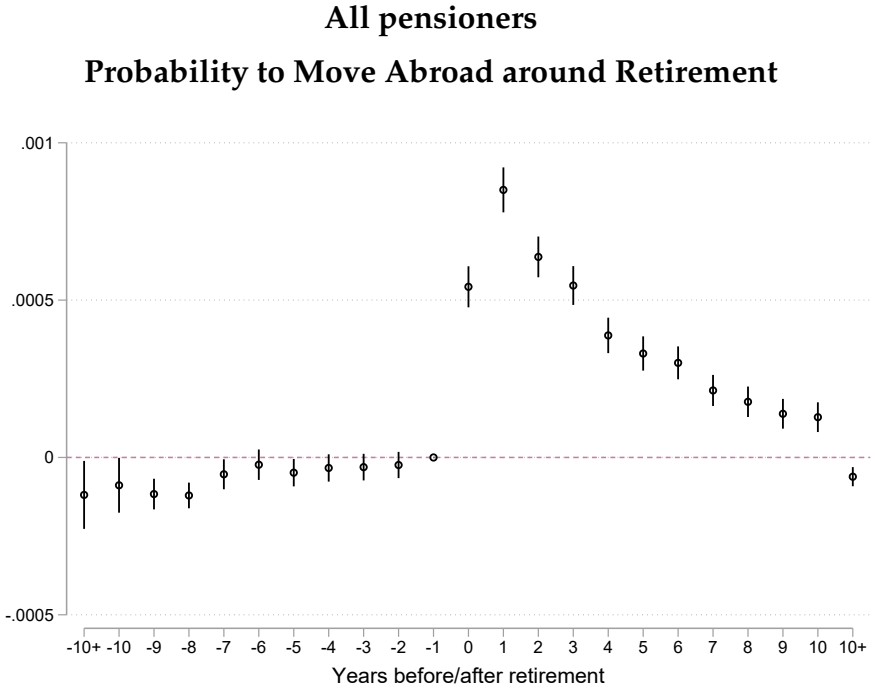
$$Y_{it} = \sum_{j \neq -1} \beta_j X_j + \epsilon_{it}, \tag{9}$$

where Y_{it} is one for people who migrate in calendar year t and zero for people who decide to stay in Finland. X_j are relative time-to-retirement indicators which are set to 1 if

period t is j periods from the start of retirement, i.e. $X_j = \mathbb{1}\{j = t - t_i^*\}$ where t_i^* denotes the year of retirement of individual i. ϵ_{it} is the error term.

We plot the series of coefficients β_j in Panel B, that capture individuals' propensity to move abroad at time j relative to one year prior to the year of retirement. The figure supports the descriptive finding in Panel A. Older citizens exhibit a large uptick in international migration rates immediately around their retirement, which fades as time relative to retirement age increases. This confirms that retirement and international migration are closely coordinated decisions. Figure A.14 generalizes this finding for all cohorts of retirees in our administrative dataset.

Figure A.14: **International Migration Around Retirement**

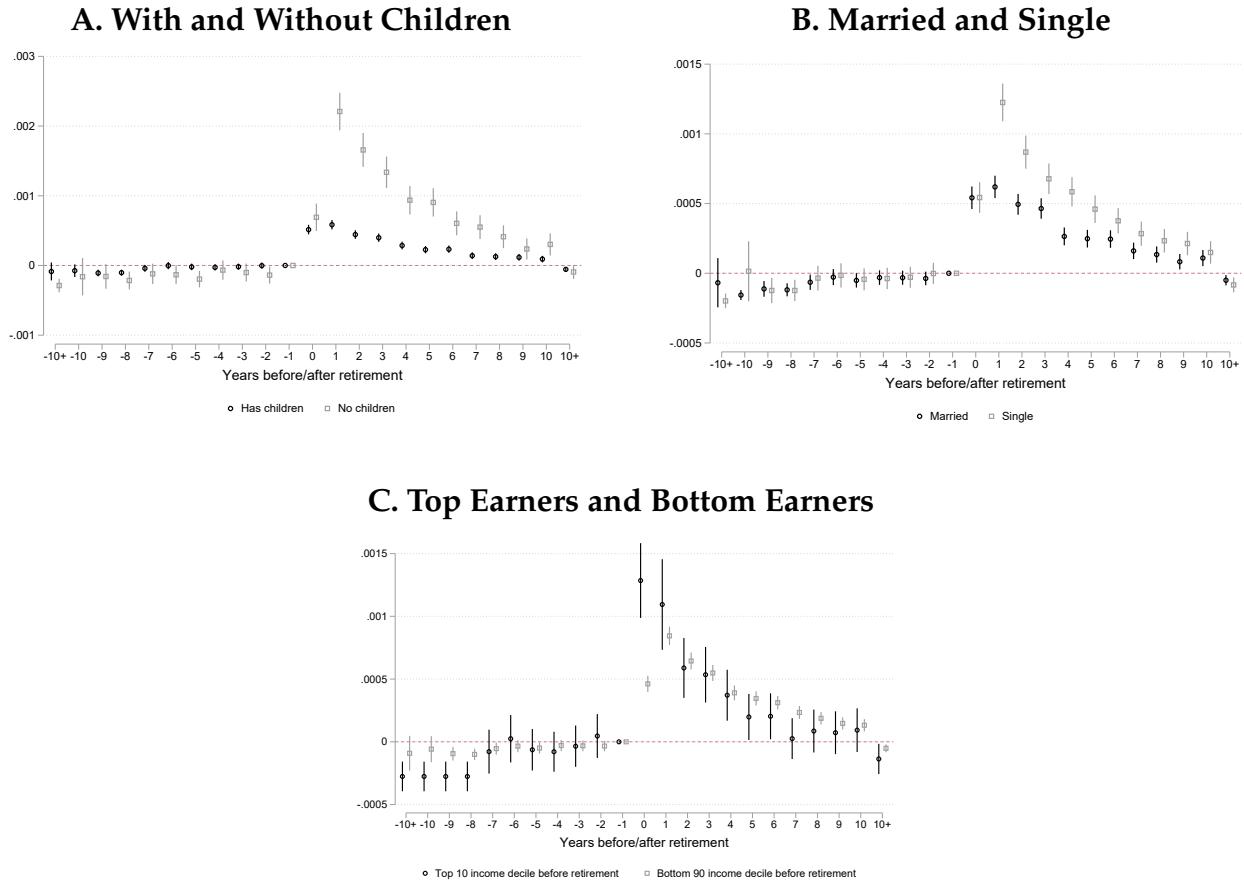


Notes: This figure shows the estimated probability of moving abroad around retirement age (Equation 9). The data includes individuals aged 55 and over with known retirement ages who resided in Finland at some point between 2008 and 2022. The confidence intervals are presented at the 95% confidence level, and are based on robust standard errors. The data are taken from comprehensive administrative records provided by Statistics Finland.

We also estimate Equation (9) for various subgroups. Specifically, we run this regression separately for married individuals, single individuals, those with and without children, and individuals in the top 10% of earners prior to retirement versus those in the bottom

90%. Figure A.15 illustrates that the probability of migration around retirement is higher for individuals with fewer ties to their home country, such as single individuals and those without children. Additionally, wealthier individuals are more likely to migrate around retirement.

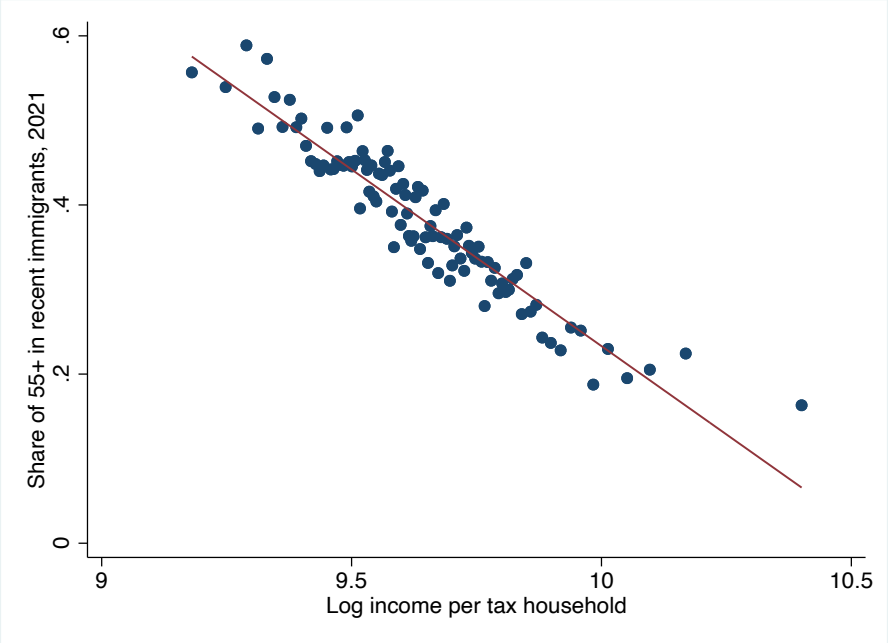
Figure A.15: **International Migration Around Retirement: Heterogeneity**



Notes: This figure shows the estimated probability of moving abroad around retirement age (Equation 9) across different demographic groups. Panel A compares individuals with and without children, Panel B contrasts married and single individuals, and Panel C focuses on pensioners in the top 10% of income earners versus the bottom 90%. The sample includes individuals aged 55+ with known retirement ages who resided in Finland at some point between 2008 and 2022. 95% confidence intervals are shown, based on robust standard errors. Data are from Statistics Finland.

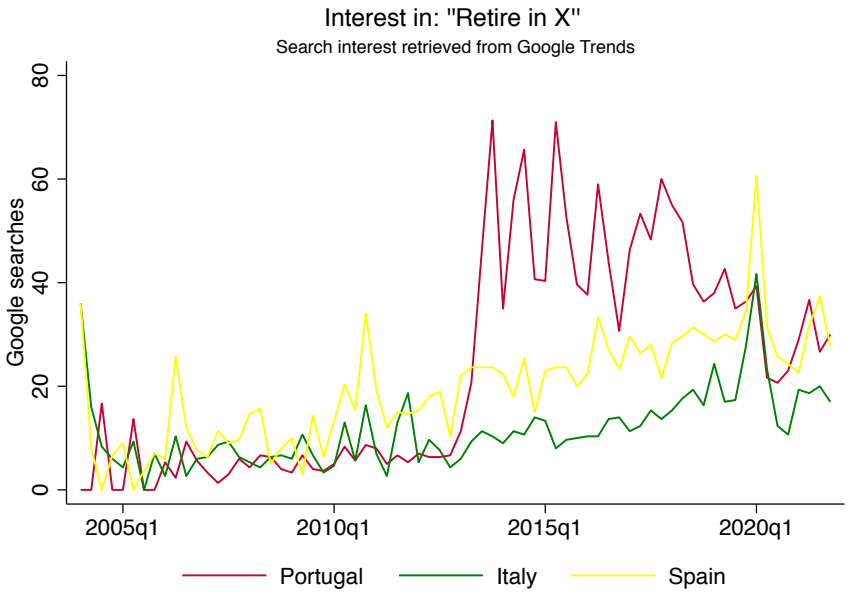
B Additional Figures and Tables

Figure B.1: **Within-country directed migration of pensioners**



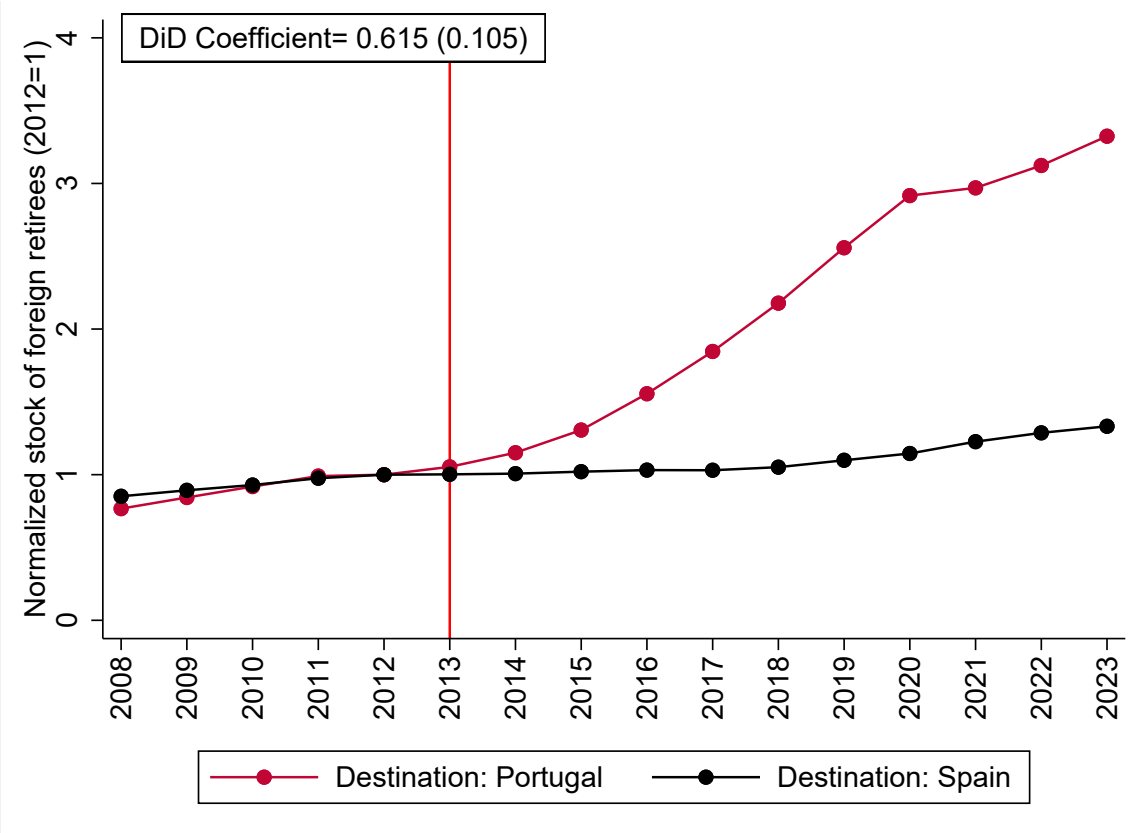
Note: This figure plots the share of movers aged 55 or more among all migrants arrived within the last 10 years in a Portuguese parish (*freguesia*), on the y-axis, against the average income per taxable household in the locality, across 3092 parishes as of January 2021, using Portuguese Census data. The figure is a binned scatter plot of unweighted percentiles.

Figure B.2: **Salience of the option to retire in Portugal**



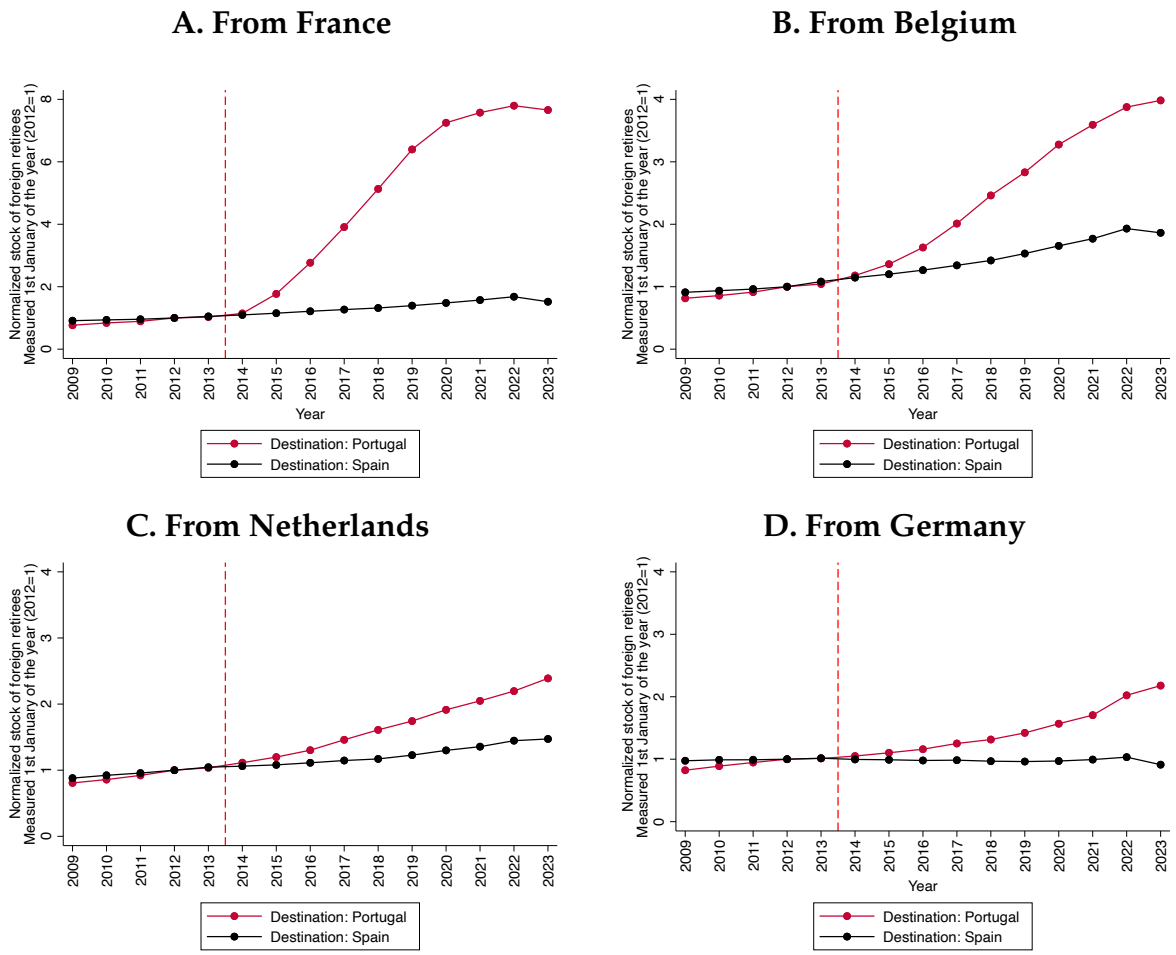
Note: This figure plots the (normalized) volume of Google searches in France for the search patterns "retire in X" for various destination countries X (Portugal, Italy, Spain), obtained from Google Trends and normalized to 100 at the maximum value over the period.

Figure B.3: **Effect of the Tax Cut on Stock of Foreign Retirees in Portugal: Including British Retirees**



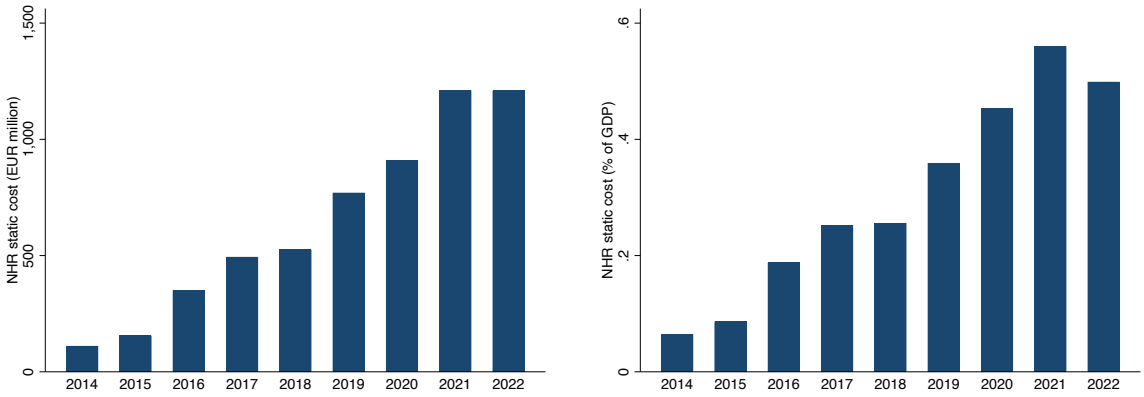
Notes: This figure repeats our baseline results including British retirees in the measure of the stock of EU foreigners. The UK left the EU in 2016. British citizens retiring in EU countries faced some uncertainties regarding the portability of their pensions and healthcare rights during the period 2016–2020.

Figure B.4: **International Migration Responses for Main Origin Countries**



Notes: This figure shows the stock of foreign retirees in Portugal (treated, red series) and Spain (control, blue series), before and after a reform (vertical red dotted line) reduced the income tax rate to 0%, for foreign retirees moving to Portugal, for four of the main origin countries. All series are normalized to one in the pre-reform year (2012). Data are obtained from Eurostat, the European statistical office (population by age group and citizenship as of January 1 of each year)

Figure B.5: **Static Accounting-Based Fiscal Expenditure of the NHR Regime**

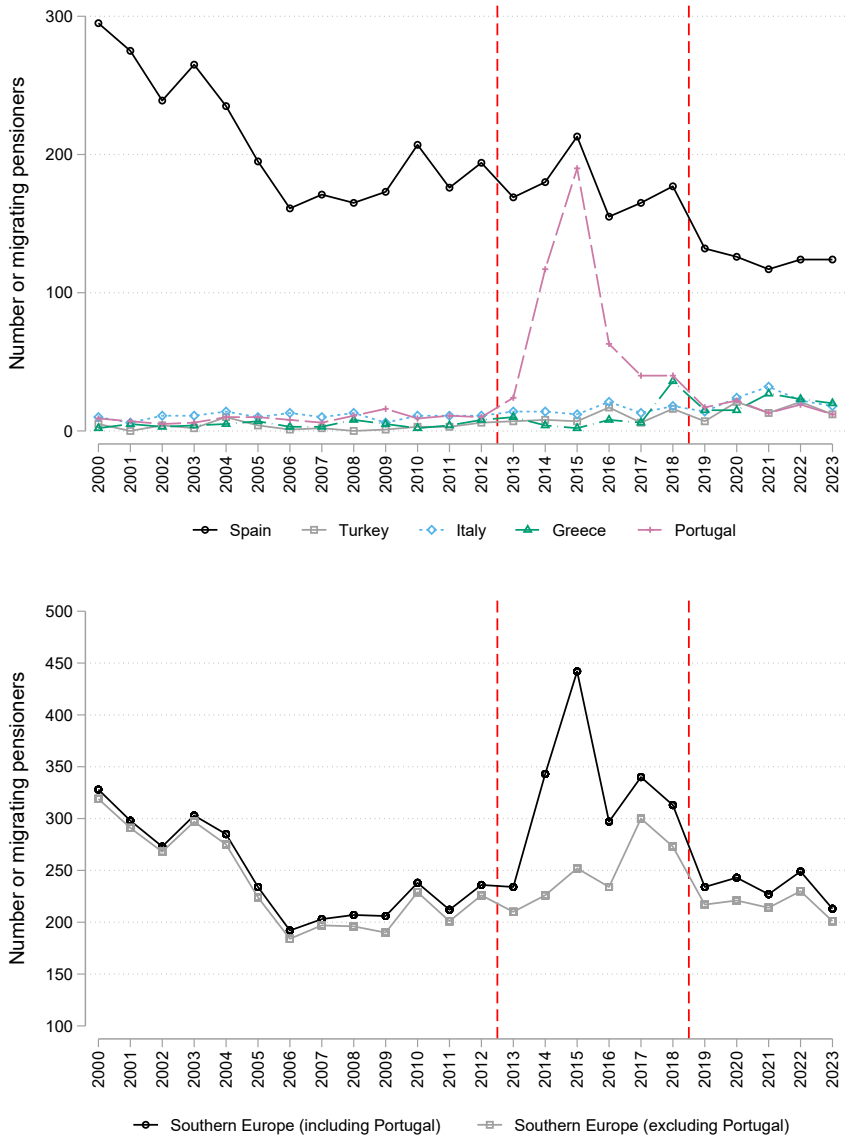


(a) EUR million

(b) % of GDP

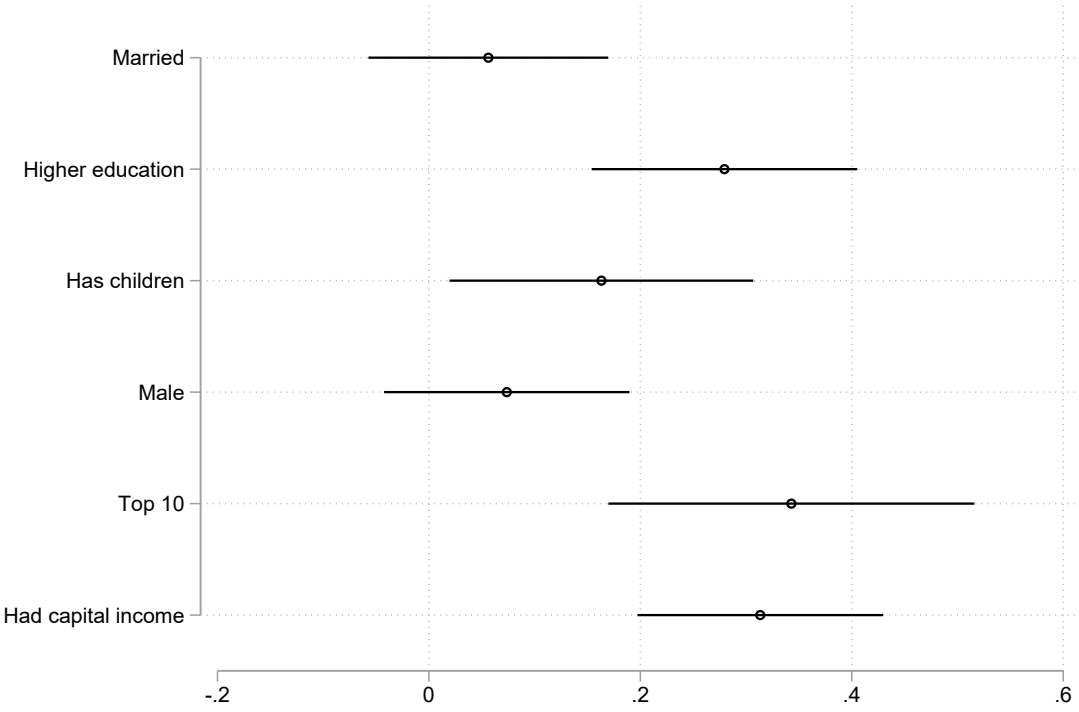
Note: This figure plots estimates of the static accounting-based fiscal expenditure due to the NHR regime (including both the zero rate on pensioners and foreign capital income, and the reduced rate on high-value added domestic labor earnings for impatriates). The estimate is a "mechanical" measure, based on computing a counterfactual tax liability for NHR-claiming taxpayers, assuming they had stated the same amount of income but had not claimed the special tax regime. The data is from *Autoridade Tributaria e Aduaneira, Estatisticas do IRS, Declaracoes Modelo 3.*

Figure B.6: **Out-Migration Flows from Finland to other Southern EU Countries**



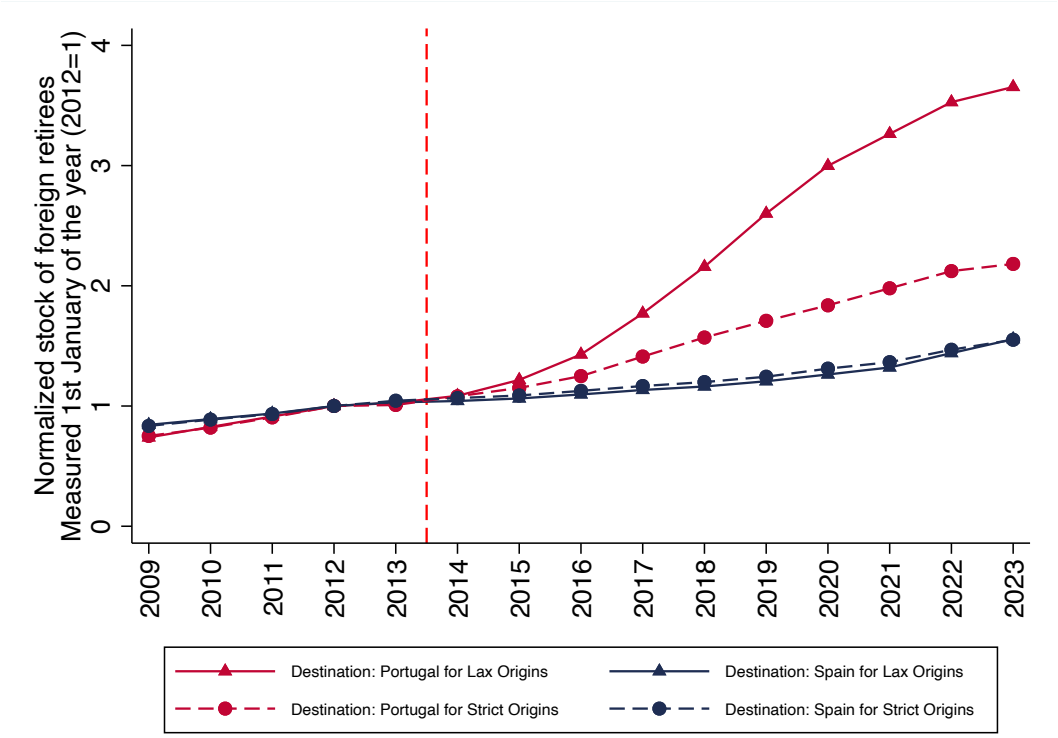
Notes: This figure plots the annual number of Finnish pensioners moving to Southern European countries between 2000 and 2023. The figures are based on administrative records from Statistics Finland, restricted to individuals aged 55 and above. The top panel shows migration flows to specific destinations: Spain, Turkey, Italy, Greece, and Portugal. The bottom panel compares the total number of migrants moving to Southern Europe (including Portugal) against the total number excluding Portugal. The Southern Europe category consists of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, Romania, Serbia, Slovenia, Spain, and Turkey. The vertical dashed lines highlight the period when the Portuguese Non-Habitual Resident (NHR) tax scheme applied to Finnish pensioners, starting in 2013 and ending in 2019.

Figure B.7: **Heterogeneity in Pensioners Migration Responses to Taxes**



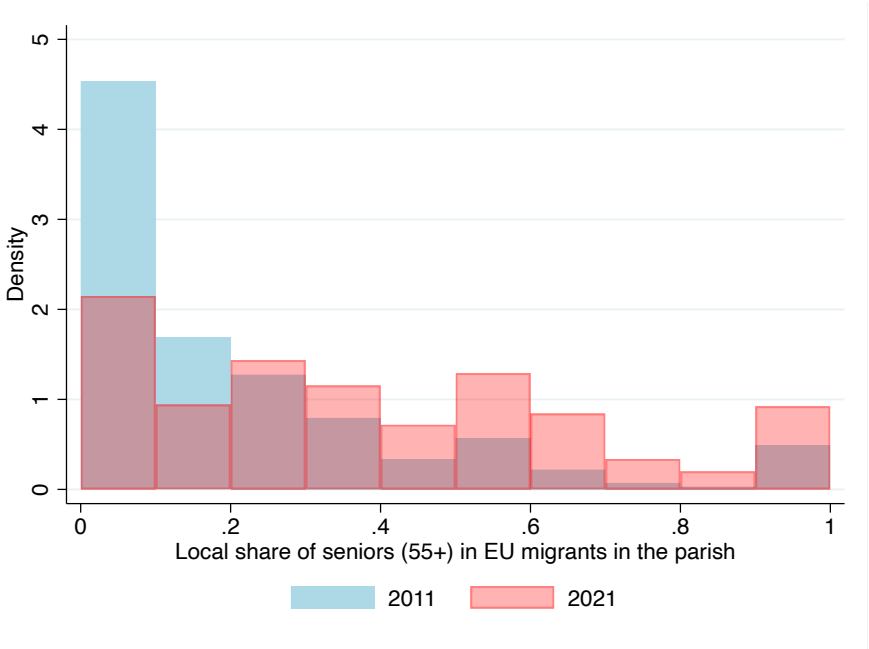
Notes: This figure shows heterogeneous migration responses by Finnish pensioners to the Portuguese tax break. We compare Finnish pensioners moving to Portugal (treated) versus Spain (control), before and after the introduction of the NHR regime in Portugal (defined as post-2013). To perform this estimation, we construct an expanded dataset containing one observation per potential destination (Portugal and Spain) for each individual. We estimate a linear probability model where the dependent variable is a binary indicator equal to 1 if the potential destination matches the individual's actual destination choice, and 0 otherwise. Each plotted coefficient corresponds to the triple interaction term $\mathbb{I}(\text{Portugal}) \times \mathbb{I}(\text{Post-2013}) \times$Characteristic, capturing the differential response to the reform associated with each characteristic relative to the baseline. All interactions are estimated simultaneously in the same regression. The regression controls for destination and year fixed effects. Horizontal lines represent 95% confidence intervals based on standard errors clustered at the individual level. Data are obtained from Statistics Finland. The data include all individuals aged 55 and above who migrated to Portugal or Spain between the years 2008–2018.

Figure B.8: **Asymmetric Migration Response to the Introduction of the NHR Regime by Prevalence of Source-Based Taxation of Pensions in the Origin**



Notes: This figure compares the evolution of the (normalized) stocks of foreign EU pensioners in Portugal (in red) and Spain (in black), separately for origin countries with mostly residence-based taxation of pensions in their bilateral tax treaties with Portugal (solid lines with triangle markers), and for those with stricter source-based rules (dashed lines with circle markers). "Lax" origin countries include all those where relevant articles on the taxation of foreign pensions are modeled exclusively after the OECD model convention on avoidance of double taxation (residence-based approach, except for former civil servants); stricter origin countries include those differentiating the source-based taxation of Social security pensions and the residence-based taxation of private pensions (Bulgaria, Luxembourg, Malta), as well as those that maintain a source-based taxation of all pensions arising from contributions that were tax deductible in the origin country (Netherlands, Denmark). We exclude two countries that switched from residence to source-based regimes during the period (Finland and Sweden).

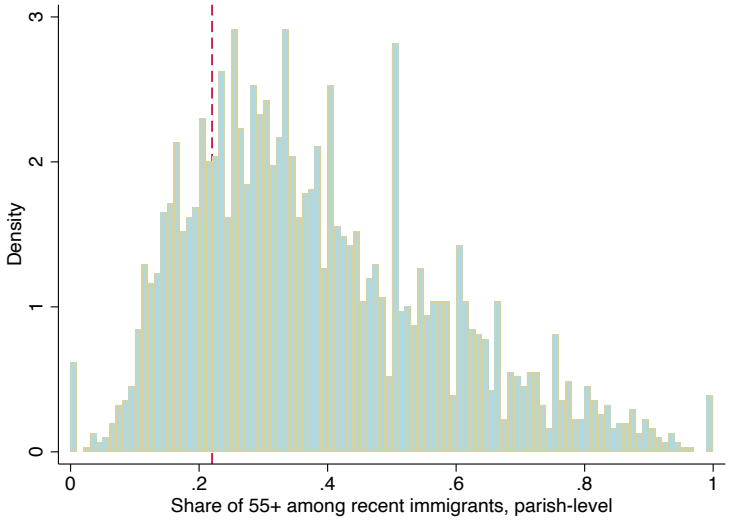
Figure B.9: **Local share of seniors among all EU migrants, 2011 and 2021**



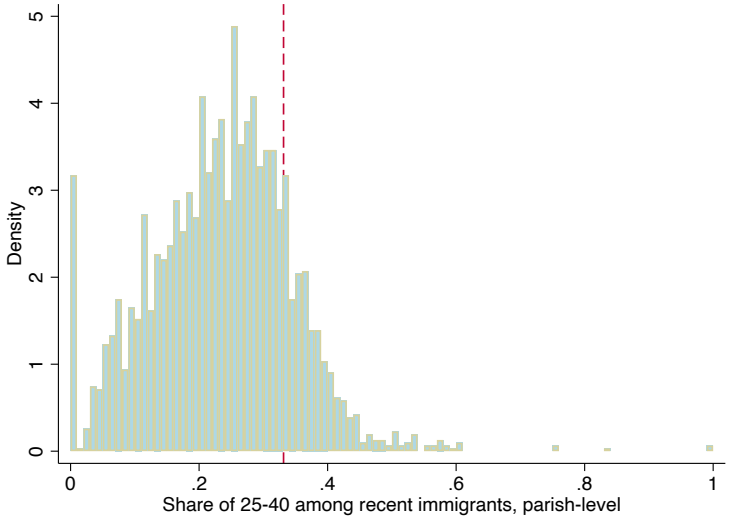
Note: This figure plots the distribution (across 3,092 Portuguese parish parishes or *freguesias*) of the proportion aged 55 or more among all EU migrants in the parish, in 2011 and 2021, using Portuguese decennial Census data.

Figure B.10: **Spatial Concentration of Foreign Migrants by Age within Portugal**

A. Foreign Migrants Aged 55 or more

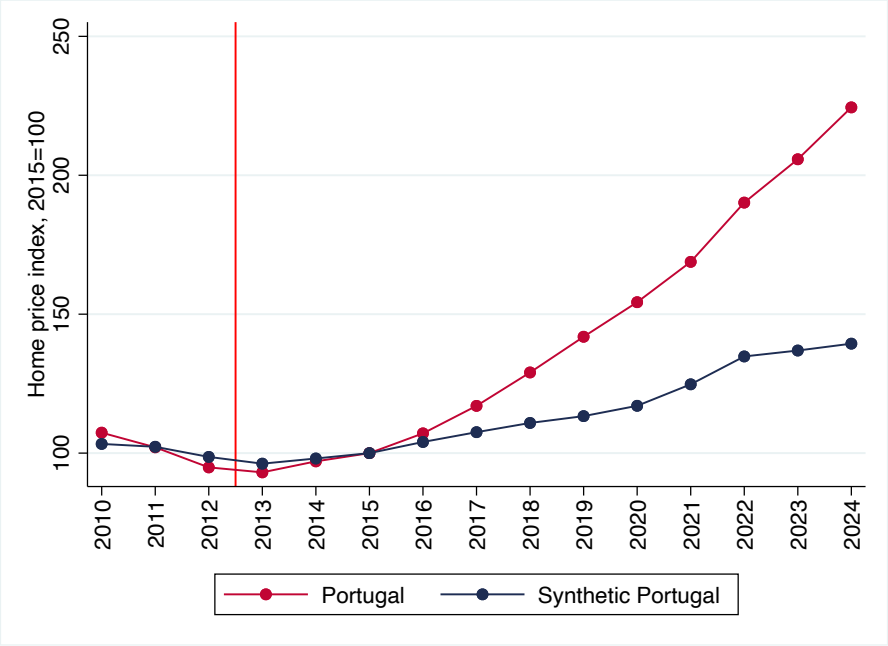


B. Foreign Migrants Aged 25-40



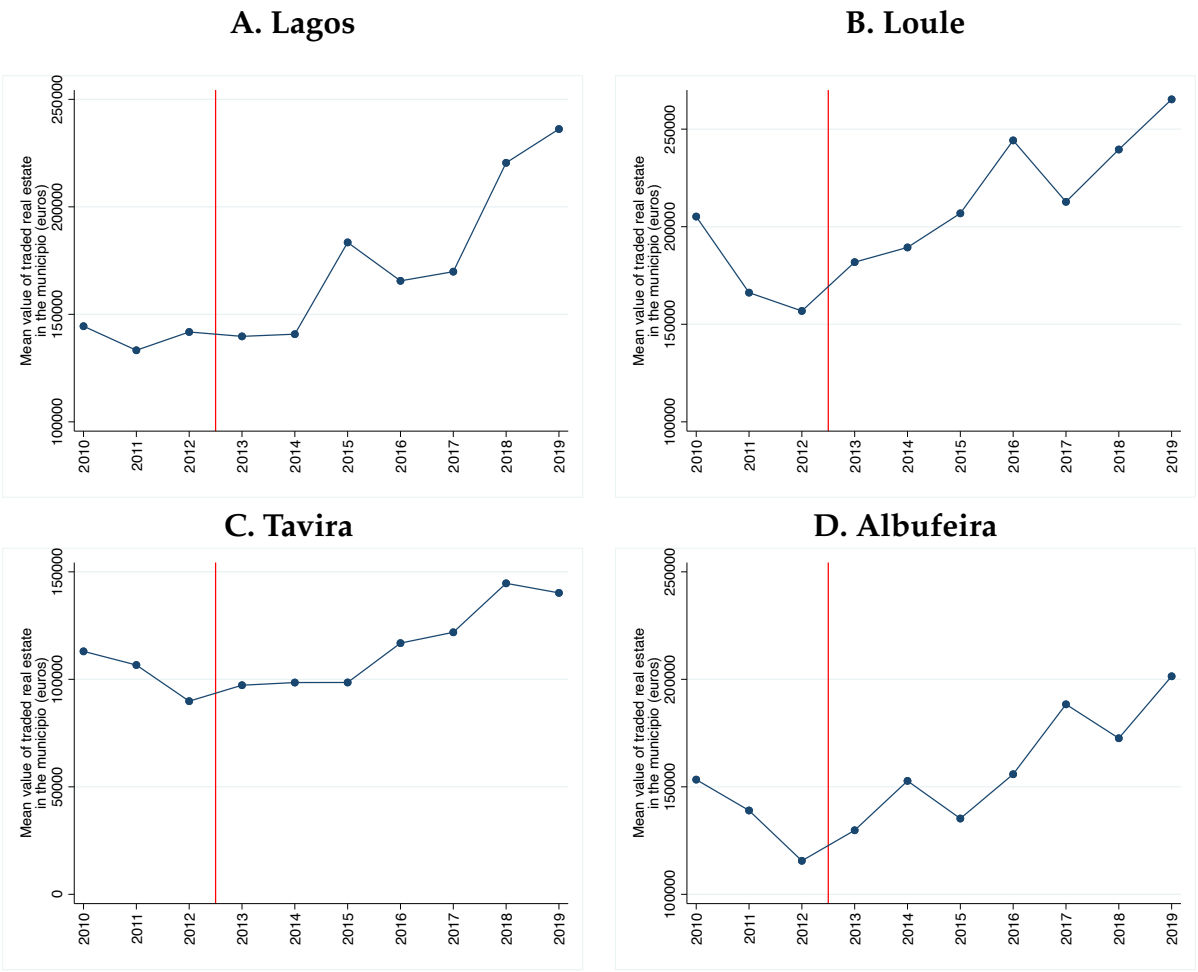
Note: This figure plots the distribution of the shares of a given age group among all migrants who arrived within the last 10 years in a Portuguese parish (*freguesia*), across all parishes as of January 2021. The vertical dashed lines denote the respective national average shares of each age group in total recently arrived migrants. Data are taken from the 2021 decennial census of Portugal.

Figure B.11: **Home Prices Index, Portugal versus Synthetic Portugal**



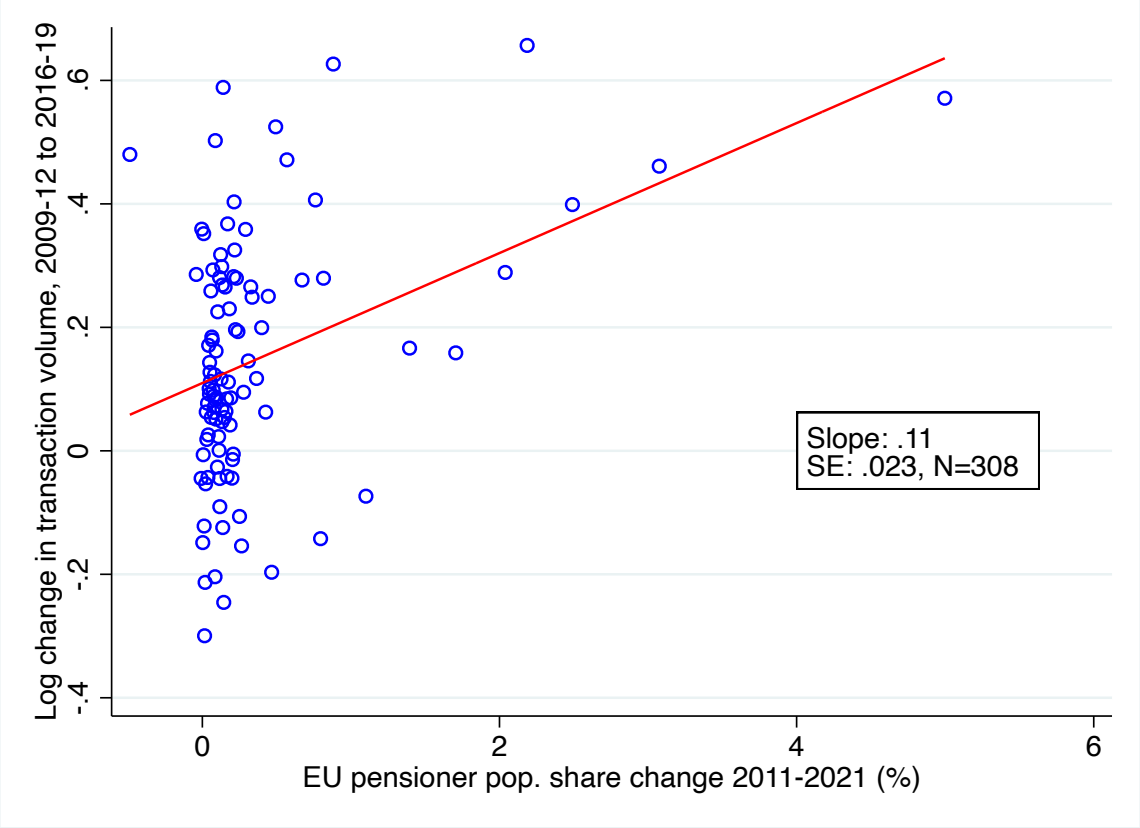
Note: This figure shows the evolution of the quarterly home price index (2015=100) in Portugal versus the average in the euro area.

Figure B.12: **Real Estate Values in Top Destinations (*municipios*) for Foreign Retirees**



Notes: This figure shows the evolution of the average traded real estate value in some of the Portuguese *municipios* that are most attractive to foreign pensioners.

Figure B.13: **Inflows of EU seniors and total transaction volume**



Notes: This figure shows the correlation between the increase in the total population share of foreign EU pensioners in a Portuguese *municipio* (x-axis) and the change in the volume of traded real estate value in a *municipio* (y-axis). We measure the change in the local population of EU seniors between 2011 and 2021 using decennial censuses. We measure the change in average monthly local housing volumes using the average over the crisis (2009-2011) and post-NHR (2017-2019) periods, using real estate transactions data from the Portuguese national statistical institute (INE).

Table B.5: **Descriptive Statistics: Finnish Pensioners in Spain vs Portugal**

	Pre			Post		
	Portugal	Spain	Diff	Portugal	Spain	Diff
Age	64.47	63.57	0.91	65.07	64.71	0.35
	(5.57)	(5.64)		(5.52)	(6.17)	
Male	0.55	0.55	-0.00	0.62	0.53	0.09***
	(0.50)	(0.50)		(0.49)	(0.50)	
Married	0.68	0.56	0.11	0.66	0.51	0.15***
	(0.47)	(0.50)		(0.48)	(0.50)	
Has children	0.90	0.84	0.06	0.91	0.82	0.09***
	(0.30)	(0.37)		(0.28)	(0.38)	
Higher education	0.55	0.36	0.19**	0.69	0.38	0.30***
	(0.50)	(0.48)		(0.46)	(0.49)	
Pension	36458.34	28808.54	7649.80	62719.57	25270.39	37449.18***
	(40551.69)	(31745.32)		(68449.91)	(20193.70)	
Above median pension	0.66	0.63	0.03	0.78	0.52	0.26***
	(0.48)	(0.48)		(0.41)	(0.50)	
Had capital income 5 years before retirement	0.65	0.55	0.10	0.77	0.51	0.26***
	(0.48)	(0.50)		(0.42)	(0.50)	
Top 10 income decile before retirement	0.17	0.15	0.03	0.35	0.13	0.21***
	(0.38)	(0.35)		(0.48)	(0.34)	
Earnings (5 year mean before retirement)	54010.28	41813.33	12196.95	70051.39	37795.63	32255.75***
	(46361.14)	(32601.43)		(50465.72)	(30057.72)	
Capital income (5 year mean before retirement)	13972.78	11720.18	2252.60	25889.12	9732.53	16156.58**
	(23762.09)	(26598.79)		(144887.63)	(39462.33)	

Mean coefficients; standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents descriptive statistics on pensioners from Finland for the period 2008–2018. Columns under "Pre" cover the years before the NHR reform (2008–2012), and columns under "Post" cover the years during the reform period (2013–2018). The data is taken from comprehensive administrative records provided by Statistics Finland. Differences between countries are calculated as Portugal minus Spain.

Table B.6: **Migration Elasticity Estimates: More Income Levels**

	Pension=EUR 15,000 Log(1-ATR)	Pension=EUR 45,000 Log(1-ATR)	Pension=EUR 55,000 Log(1-ATR)
A. Only Spain as the control			
Average (N=30)			
A1. Retirees 55+	3.875***	2.032***	1.903***
	(0.774)	(0.360)	(0.337)
A2. Retirees 65+	4.884***	2.561***	2.398***
	(0.953)	(0.439)	(0.411)
Long-term (N=20)			
A3. Retirees 55+	5.525***	2.842***	2.662***
	(0.570)	(0.206)	(0.192)
A4. Retirees 65+	6.850***	3.524***	3.301***
	(0.723)	(0.260)	(0.243)
Short-term (N=18)			
A5. Retirees 55+	2.046**	1.096**	1.026**
	(0.752)	(0.371)	(0.348)
A6. Retirees 65+	2.705**	1.449**	1.356**
	(0.949)	(0.466)	(0.436)
B. Other EU countries as the control			
Average (N=280)			
B1. Retirees 55+	2.171***	1.343***	1.264***
	(0.544)	(0.340)	(0.320)
B2. Retirees 65+	3.053***	1.892***	1.781***
	(0.613)	(0.387)	(0.365)
Long-term (N=186)			
B3. Retirees 55+	3.360***	2.114***	1.989***
	(0.367)	(0.228)	(0.217)
B4. Retirees 65+	4.425***	2.794***	2.629***
	(0.388)	(0.247)	(0.235)
Short-term (N=157)			
B5. Retirees 55+	0.809	0.491	0.462
	(0.495)	(0.301)	(0.283)
B6. Retirees 65+	1.483**	0.899**	0.847**
	(0.585)	(0.356)	(0.335)

Robust standard errors in parentheses

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

Notes: The table displays elasticity estimates based on Equation (4). The outcome variable is $\log(N_{jt}^{P})$, the log number of foreign EU pensioners residing in a destination j in year t. We define pensioners as people aged 55 or more in a given year. The long-term (short-term) elasticity refers to a specification that includes years 2018–2023 (2013–2017) as the post-reform period. Panel A displays estimates where the control group is only Spain; while Panel B uses all other EU countries as controls. A.1 is the baseline estimate. We compute average tax rates (ATR) for pensioners using information on country-specific tax schedules from the OECD. We simulate ATRs for pensioners earning EUR 15,000 per year (Column (1)), EUR 45,000 per year (Column 2) and EUR 55,000 per year (Column (3)).

Table B.7: **Heterogeneous migration responses (Weighted)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Portugal × Post	0.559***	0.487***	0.481***	0.513***	0.471***	0.570***	0.457***	0.325***
	(0.121)	(0.099)	(0.097)	(0.107)	(0.099)	(0.119)	(0.096)	(0.096)
Portugal × Post × Tax rate workers		-2.508***						-1.784
		(0.142)						(1.645)
Portugal × Post × Tax rate pensioners			1.564***					1.129
			(0.284)					(1.547)
Portugal × Post × Tax rate pensioners (pension=average earnings)				0.747				
				(0.776)				
Portugal × Post × Δ tax rates pensioners-workers					1.127***			
					(0.095)			
Portugal × Post × Net pension replacement rate						0.479		-0.821**
						(0.449)		(0.278)
Portugal × Post × Life expectancy after exiting the labor market							0.080***	0.084*
							(0.023)	(0.039)
R-Square	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.991
Observations	336	336	336	336	336	336	336	336
Clusters	12	12	12	12	12	12	12	12

Robust standard errors in parentheses

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

Table B.8: **Heterogeneous migration responses (Unweighted)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Portugal × Post	0.588***	0.560***	0.528***	0.527***	0.534***	0.601***	0.557***	0.590***
	(0.132)	(0.107)	(0.111)	(0.114)	(0.105)	(0.133)	(0.115)	(0.106)
Portugal × Post × Tax rate workers		-2.302**						-4.426**
		(0.835)						(1.490)
Portugal × Post × Tax rate pensioners			1.458					-2.744*
			(0.817)					(1.445)
Portugal × Post × Tax rate pensioners (pension=average earnings)				1.200*				
				(0.645)				
Portugal × Post × Δ tax rates pensioners-workers					1.021**			
					(0.459)			
Portugal × Post × Net pension replacement rate						0.375		-0.954
						(0.567)		(0.557)
Portugal × Post × Life expectancy after exiting the labor market							0.073***	0.057
							(0.018)	(0.038)
R-Square	0.991	0.992	0.991	0.991	0.991	0.991	0.991	0.992
Observations	336	336	336	336	336	336	336	336
Clusters	12	12	12	12	12	12	12	12

Robust standard errors in parentheses

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

Table B.9: **Migration Elasticity Estimates: Finnish Pensioners**

	Pension = Observed Average Log(1-ATR)
Only Spain as the control	
NHR introduction 2009–2017 (N=18)	
A1. Retirees	4.867**
	(1.484)
NHR repeal 2016–2023 (N=16)	
A2. Retirees	0.978**
	(0.331)
Pooled 2009–2023 (N=30)	
A3. Retirees	1.576
	(1.303)

Robust standard errors in parentheses

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

Notes: Estimates are from 2SLS based on Equation (6) but restricted to only Finnish pensioners. The outcome is $\log N_{jt}$, the log number of *Finnish* pensioners residing in destination j in year t. Pensioners are defined as those aged 55 and above using Eurostat data. Rows report elasticities for the NHR introduction window (2009–2017), the NHR repeal window (2016–2023), and a pooled 2009–2023 specification; the header above each row shows the years and the corresponding sample size N. The single column reports the elasticity with respect to $\log(1 - \text{ATR})$ evaluated at the observed average pension. Spain is the control group throughout; destination and year fixed effects are absorbed, and robust standard errors are reported. Average tax rates (ATR) are computed from country-specific personal income tax schedules (OECD) applied to observed pensions for Finnish pensioners residing in Portugal or Spain. For pensioners residing in Portugal, ATRs correspond to Portuguese rates before the repeal of the bilateral tax treaty and Finnish rates thereafter. Using Finnish administrative pension and migration records, we identify movers to Portugal/Spain (1990–2022) and compute ATRs from observed pensions. Instruments are treatment-by-post indicators for the NHR introduction and the NHR repeal and treatment years for the pooled estimate.

Table B.10: **Migration Elasticity Estimates: Including Amenity Controls**

	IV		TWFE
	Pension=EUR 35,000 Log(1-ATR)	Pension=EUR 60,000 Log(1-ATR)	Treat × Post
A. Only Spain as the control			
Average (N=28)			
A1. Retirees 55+	1.527**	1.288**	0.440**
	(0.555)	(0.472)	(0.152)
A2. Retirees 65+	1.983**	1.673**	0.572**
	(0.667)	(0.566)	(0.182)
Long-term (N=18)			
A3. Retirees 55+	2.309***	1.957***	0.762***
	(0.166)	(0.156)	(0.038)
A4. Retirees 65+	2.853***	2.419***	0.941***
	(0.171)	(0.155)	(0.043)
Short-term (N=18)			
A5. Retirees 55+	1.485*	1.252*	0.428*
	(0.605)	(0.510)	(0.160)
A6. Retirees 65+	1.936*	1.632*	0.558**
	(0.747)	(0.630)	(0.197)
B. Other EU countries as the control			
Average (N=249)			
B1. Retirees 55+	1.275***	1.089***	0.376***
	(0.417)	(0.359)	(0.120)
B2. Retirees 65+	1.899***	1.621***	0.560***
	(0.468)	(0.403)	(0.133)
Long-term (N=160)			
B3. Retirees 55+	2.190***	1.873***	0.631***
	(0.325)	(0.284)	(0.090)
B4. Retirees 65+	2.997***	2.562***	0.863***
	(0.334)	(0.293)	(0.087)
Short-term (N=148)			
B5. Retirees 55+	0.495	0.421	0.147
	(0.355)	(0.303)	(0.103)
B6. Retirees 65+	0.981**	0.834**	0.291**
	(0.412)	(0.352)	(0.118)

Robust standard errors in parentheses

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

Notes: The table displays elasticity estimates based on the 2SLS specification (4) in Column (1)-(2) and the β estimated from the corresponding reduced-form specification (3) in Column (3). The outcome variable is $\log(N_{jt}^{P})$, the log number of foreign EU pensioners residing in a destination j in year t. The long-term (short-term) elasticity refers to a specification that includes years 2018–2023 (2013–2017) as the post-reform period. Panel A displays estimates where the control group is only Spain; while Panel B uses all other EU countries as controls. We compute average tax rates (ATR) for pensioners using information on country-specific tax schedules from the OECD for pensioners earning EUR 35,000 per year (median pension for NHR recipients, Columns (1)) and EUR 60,000 per year (average pension for NHR recipients,Column (2)). Each specification includes the number of heating/cooling days and the number of years of life lost to air pollution as additional controls for amenities.

Table B.11: **Migration Elasticity Estimates: First Stage**

	IV First Stage	
	Pension=EUR 35,000 Log(1-ATR)	Pension=EUR 60,000 Log(1-ATR)
A. Only Spain as the control		
Average (N=30)	0.279***	0.332***
	(0.014)	(0.016)
Long-term (N=20)	0.274***	0.326***
	(0.014)	(0.016)
Short-term (N=18)	0.285***	0.340***
	(0.016)	(0.019)
B. Other EU countries as the control		
Average (N=325)	0.304***	0.359***
	(0.008)	(0.009)
Long-term (N=215)	0.299***	0.353***
	(0.009)	(0.010)
Short-term (N=198)	0.310***	0.365***
	(0.007)	(0.008)

Robust standard errors in parentheses

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

Notes: The table displays the first stage estimates of the elasticity estimates reported in Table 1, based on the 2SLS specification (4). The outcome variable is $\log(1 - \tau_{jt}^{P})$, the log net-of-tax rate of foreign EU pensioners residing in a destination j in year t. This is instrumented by the reform interaction $\mathbb{1} \cdot (t \geq 2013) \times \mathbb{1}(j = \text{Portugal})$ in the 2SLS specification (4). The first stage estimates are positive and highly significant, indicating that the reform interaction is a strong instrument. The long-term (short-term) estimate refers to a specification that includes years 2018–2023 (2013–2017) as the post-reform period. Panel A displays estimates where the control group is only Spain; while Panel B uses all other EU countries as controls. We compute average tax rates (ATR) for pensioners using information on country-specific tax schedules from the OECD for pensioners earning EUR 35,000 per year (median pension for NHR recipients, Columns (1)) and EUR 60,000 per year (average pension for NHR recipients, Column (2)).

Table B.12: **Implied Tax Savings for Finnish Retirees in Portugal**

Year	Foregone Income Taxes	Mean	Median	90th Percentile
2013	359,070.44	23,938.03	19,826.86	.
2014	2,974,691.25	28,063.12	13,294.00	65,291.84
2015	5,520,127.50	22,531.13	11,450.72	53,733.88
2016	5,748,461.50	20,530.22	9,850.78	50,490.19
2017	5,827,253.50	19,686.67	9,603.51	49,974.60
2018	5,765,620.50	19,028.45	9,096.49	49,620.01

Notes: This table presents the estimated aggregate and distributional loss in tax revenue resulting from the migration of Finnish pensioners to Portugal. The sample is constructed from Statistics Finland administrative records, restricted to all pensioners who moved to Portugal between 2013 and 2018 and for whom pension income is observed. Lost income taxes represent the hypothetical tax revenue Finland would have collected had these individuals remained tax residents in Finland. These values are derived by applying average tax rates (ATR) to observed pension income, where tax rates are simulated using the SISU static microsimulation model based on monthly pension levels and the year of emigration. The first column reports the total lost taxes for each cohort year. The remaining columns display the mean, median, and 90th percentile of lost taxes per individual migrant in that year. The 90th percentile for 2013 is suppressed due to an insufficient number of observations.

C Synthetic Control Estimates

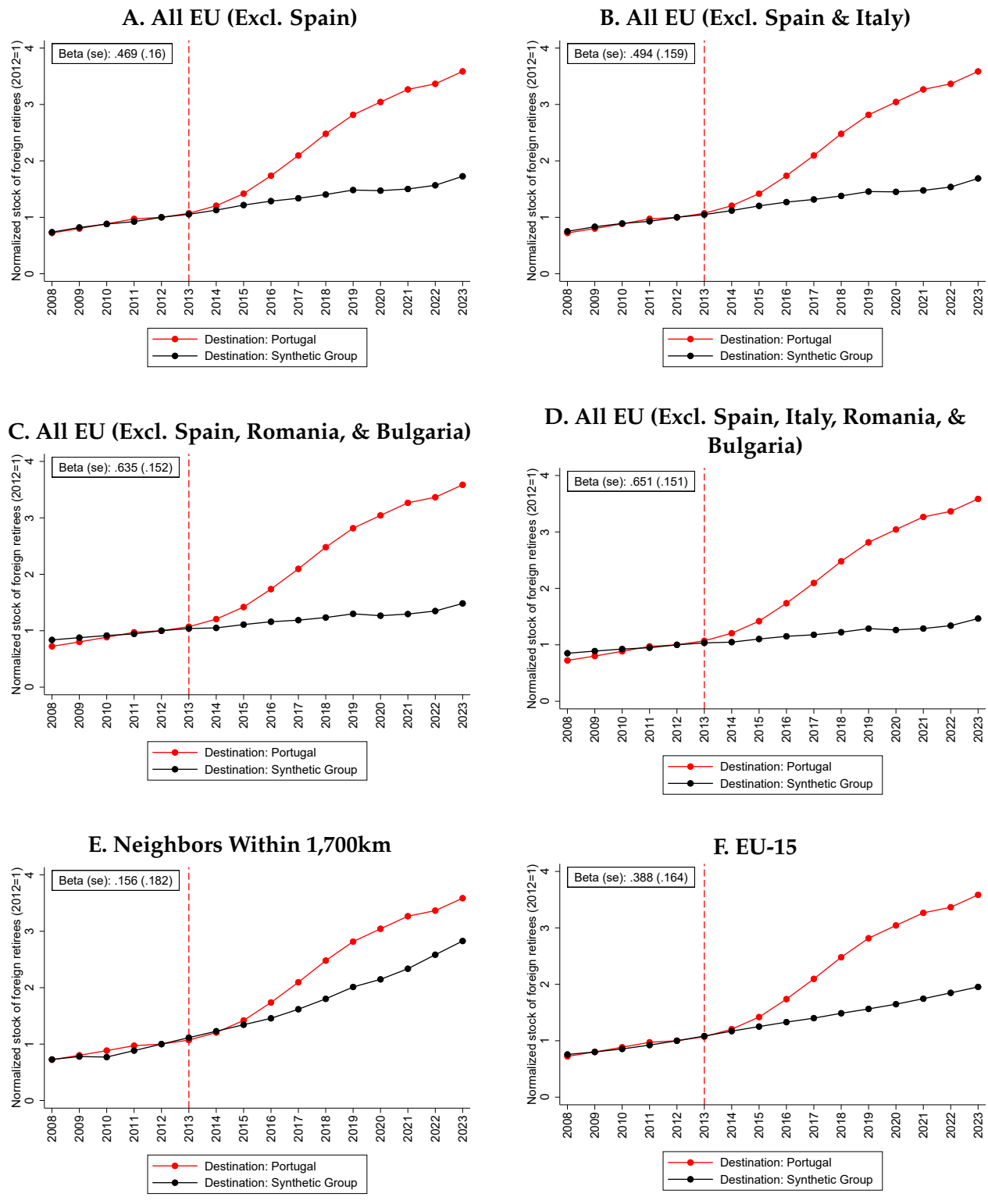
While Spain's close geographic and economic proximity makes it a natural counterfactual, we also probe the robustness of our findings to the use of a distinct estimation strategy.

We employ an alternative, data-driven pick for the counterfactual, through a synthetic control approach. We compare the focus destination to a synthetic Portugal constructed from a weighted pool of donor EU member States. The weights are chosen to minimize the distance between past migration flows to Portugal and to the synthetic control in the pre-reform period 2008-2012.

We report results from a range of alternative specifications used to construct the synthetic control for Portugal. First, we vary the set of matching variables, alternatively using levels or growth rates of retiree inflows, and augmenting the baseline specification with additional covariates such as GDP per capita and housing prices. Second, we vary the donor pool of countries contributing to the synthetic control. In particular, we exclude Spain in some specifications to show that our results are not driven by a direct comparison between Portugal and Spain. We also exclude EU countries that experienced contemporaneous policy changes likely to affect retiree migration. Italy introduced preferential tax regimes for foreign retirees in 2019, while Romania and Bulgaria obtained full access to free mobility within the EU in 2014, potentially affecting retiree migration patterns in the post-NHR period. Figure C.1 supports the baseline quantitative and qualitative result of a large, significant, and persistent increase in the stock of foreign pensioners in Portugal caused by the introduction of the NHR.

The full set of estimates are presented in Table C.1 for the full post-reform period (2013-2023), as well as estimates for medium-term (2018-2023) post-reform period in Table C.2. The magnitude of the effect is stable across alternative choices of matching variables and donor pools. The point estimates are larger when focusing on the later years, consistent with the dynamic pattern of foreign retirees in Portugal documented in the main text.

Figure C.1: **Portugal vs. Synthetic Portugal**



This figure repeats our baseline estimates using the synthetic control method for different donor pools. The weights are chosen to minimize the distance between past migration flows to Portugal and to the synthetic control in the pre-reform period 2008–2012.

Table C.1: **Migration Response to NHR in Portugal vs. Synthetic Portugal**

	(1)	(2)	(3)	(4)	(5)	(6)
Portugal x Post	0.469***	0.325*	0.493***	0.494***	0.099	0.509***
	(0.160)	(0.170)	(0.158)	(0.159)	(0.200)	(0.158)
Matching Variable	Level	Level w/ Cov.	Growth	Level	Level w/ Cov.	Growth
Donor Pool	All EU (excl. ES)	All EU (excl. ES)	All EU (excl. ES)	All EU (excl. ES, IT)	All EU (excl. ES, IT)	All EU (excl. ES, IT)
Observations	32	32	32	32	32	32
	(7)	(8)	(9)	(10)	(11)	(12)
	0.635***	0.662***	0.437**	0.651***	0.695***	0.590***
	(0.152)	(0.154)	(0.162)	(0.151)	(0.155)	(0.160)
Matching Variable	Level	Level w/ Cov.	Growth	Level	Level w/ Cov.	Growth
Donor Pool	All EU (excl. ES, RO, BG)	All EU (excl. ES, RO, BG)	All EU (excl. ES, RO, BG)	All EU (excl. ES, IT, RO, BG)	All EU (excl. ES, IT, RO, BG)	All EU (excl. ES, IT, RO, BG)
Observations	32	32	32	32	32	32
	(13)	(14)	(15)	(16)	(17)	(18)
	0.156	0.163	0.338*	0.388**	0.290	0.320*
	(0.182)	(0.182)	(0.167)	(0.164)	(0.171)	(0.168)
Matching Variable	Level	Level w/ Cov.	Growth	Level	Level w/ Cov.	Growth
Donor Pool	Neighbors	Neighbors	Neighbors	EU 15	EU 15	EU 15
Observations	32	32	32	32	32	32

Robust standard errors in parentheses

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

Notes: This table summarizes the reduced-form coefficients of migration to Portugal *relative to Synthetic Portugal*, similar to Equation 3. Portugal x Post refers to the coefficient on $\mathbb{1} \cdot (t \geq 2013) \times \mathbb{1} \cdot (j = \text{Portugal})$. The estimation period is 2008–2023, inclusive, with 2013 and onward as the post-reform period. There is one observation per treatment status (Portugal vs synthetic Portugal) and year. Standard errors are robust. Synthetic Portugal is constructed using different SCM approaches, varying the matching variables and donor pools. Covariates included in matching variables under "Level w/ Cov." are GDP per capita and housing prices. The "All EU" donor pools do not include Croatia, Cyprus, France, Greece, Malta, and Poland due to lack of data. Columns (7)–(12) additionally exclude Romania and Bulgaria from the "All EU" pool, as they gained full EU free movement rights in 2014. The "Neighbors" donor pool includes EU countries in close geographic proximity to Portugal, within 1,700 km of Lisbon (Spain, France, Italy, Belgium, Luxembourg, Ireland).

Table C.2: **Migration Response to NHR in Portugal vs. Synthetic Portugal: Medium-Run (2018-2023) Effects**

	(1)	(2)	(3)	(4)	(5)	(6)
Portugal x Post	0.698***	0.529***	0.724***	0.727***	0.292*	0.743***
	(0.101)	(0.116)	(0.098)	(0.099)	(0.152)	(0.097)
Matching Variable	Level	Level w/ Cov.	Growth	Level	Level w/ Cov.	Growth
Donor Pool	All EU (excl. ES)	All EU (excl. ES)	All EU (excl. ES)	All EU (excl. ES, IT)	All EU (excl. ES, IT)	All EU (excl. ES, IT)
Observations	22	22	22	22	22	22
	(7)	(8)	(9)	(10)	(11)	(12)
	0.893***	0.909***	0.659***	0.910***	0.942***	0.848***
	(0.091)	(0.099)	(0.101)	(0.090)	(0.102)	(0.104)
Matching Variable	Level	Level w/ Cov.	Growth	Level	Level w/ Cov.	Growth
Donor Pool	All EU (excl. ES, RO, BG)	All EU (excl. ES, RO, BG)	All EU (excl. ES, RO, BG)	All EU (excl. ES, IT, RO, BG)	All EU (excl. ES, IT, RO, BG)	All EU (excl. ES, IT, RO, BG)
Observations	22	22	22	22	22	22
	(13)	(14)	(15)	(16)	(17)	(18)
	0.256**	0.262**	0.521***	0.583***	0.443***	0.500***
	(0.120)	(0.120)	(0.108)	(0.104)	(0.111)	(0.108)
Matching Variable	Level	Level w/ Cov.	Growth	Level	Level w/ Cov.	Growth
Donor Pool	Neighbors	Neighbors	Neighbors	EU 15	EU 15	EU 15
Observations	22	22	22	22	22	22

Robust standard errors in parentheses

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

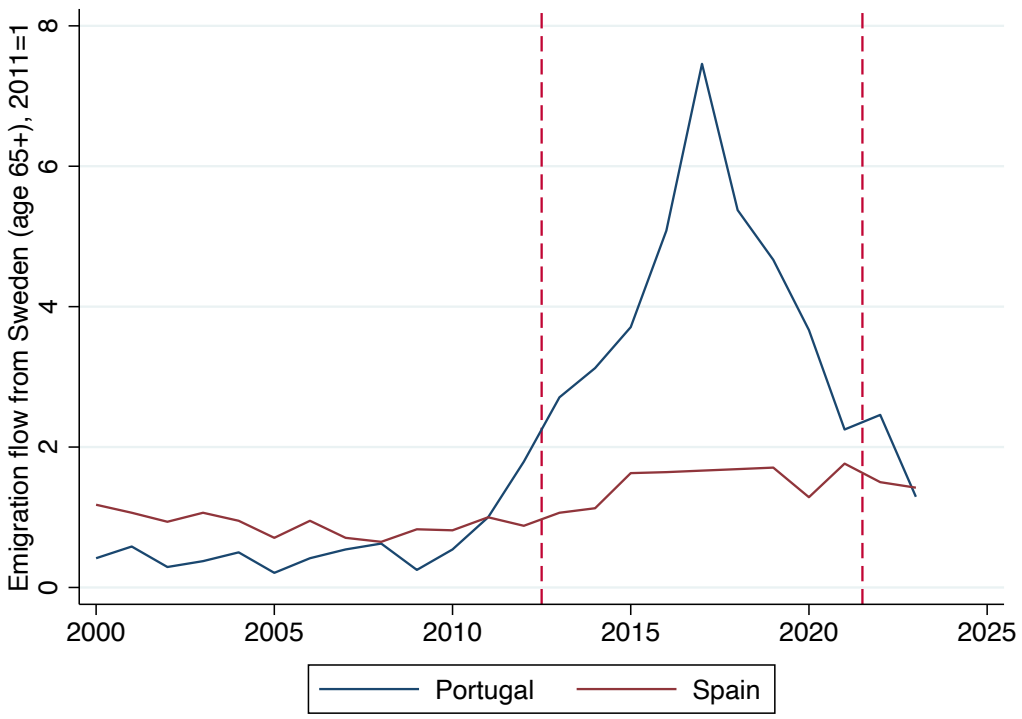
Notes: This table summarizes the reduced-form coefficients of migration to Portugal *relative to Synthetic Portugal*, similar to equation 3. Portugal x Post refers to the coefficient on $\mathbb{1} \cdot (t \geq 2018) \times \mathbb{1} \cdot (j = \text{Portugal})$. The estimation period is 2008–2012 and 2018–2023, inclusive, with 2018 and onward as the post-reform period. There is one observation per treatment status (Portugal vs synthetic Portugal) and year. Standard errors are robust. Synthetic Portugal is constructed using different SCM approaches, varying the matching variables and donor pools. Covariates included in matching variables under "Level w/ Cov." are GDP per capita and housing prices. The "All EU" donor pools do not include Croatia, Cyprus, France, Greece, Malta, and Poland due to lack of data. Columns (7)-(12) additionally exclude Romania and Bulgaria from the "All EU" pool, as they gained full EU free movement rights in 2014. The "Neighbors" donor pool includes EU countries in close geographic proximity to Portugal, within 1,700 km of Lisbon (Spain, France, Italy, Belgium, Luxembourg, Ireland).

D Evidence from Sweden's tax treaty repeal

We provide additional evidence on tax-induced migration by exploiting the Sweden-Portugal bilateral row which ended in Sweden repealing its tax treaty with Portugal starting in 2022. Like Finland in 2016, but with a two-year lag, Sweden started expressing concerns about the NHR and complained about non-cooperative and beggar-thy-neighbor tax policy on Portugal's end in EU institutions. Portugal and Sweden engaged in the renegotiation of their Double Taxation Agreement in 2018, and a protocol was ratified by Sweden in May 2019. However, Portugal failed to ratify the new treaty on its end. After several years of uncertainty, Sweden unilaterally repealed its tax treaty with Portugal starting January 1, 2022.

Similar to the case of Finland (but starting two years later for the renegotiation and three years later for the actual repeal), this event generated bilateral variation in the net-of-tax rate applicable to pensions originating from Sweden and received in Portugal, but not in other destination countries or for other origin countries. We collect data from the Swedish Statistical Bureau (*Statistiska centralbyran*) on emigration flows by broad age group and destination country from 2002 to 2023. We exploit the same identification strategy (comparing emigration flows of senior Swedish residents towards Portugal and comparable destinations, such as Spain) around the 2018-2022 window. Our results demonstrate that uncertainty on the future treatment of foreign-sourced pensions reduced emigration flows to Portugal starting in 2018. Portugal-bound flows of retired citizens from Sweden then fully reverted back to the (normalized) level of alternative destinations after the full repeal of the DTA was enacted in 2022.

Figure D.1: **Migration from Sweden to Portugal**



Notes: This figure shows the international migration flows of retirees to Portugal (treated, red series) and Spain (control, blue series), around the introduction of the NHR (2012), renegotiation of the Sweden-Portugal tax treaty (2018) and eventual repeal (2022). All series are normalized to one in the pre-reform year. Data are obtained from SCB (Sweden's statistical office), series *"Immigrations and emigrations by country of emigration/immigration, region of birth, age and sex. Year 2000–2023"*.

E Peer effects in retirees migration

We investigate the presence of peer effects, and a social multiplier in the decision to relocate abroad. To do this, we leverage individual-level data on migration from Finland, merged with exhaustive longitudinal career data.

Specifically, we use the exhaustive Finnish migration records to identify all individuals who relocated abroad between 1991-2012 ("the movers"). We then combine this information with comprehensive individual data on lifetime work experiences in Finland, which includes encrypted identifiers for firms and establishments. We identify individuals who were employed at the same establishment than any of the movers in a given year during the period 1991-2012. If an individual was at some point in their career exposed to an individual who moved abroad before 2012, they are considered exposed to peer migration due to their professional networks.

We restrict the sample to the individuals who are over 55 and remained in Finland up to the year 2012. For them, we measure their exposure in two ways: we know (i) if they ever worked during the period 1991-2012 with individuals who moved abroad during the period 1991-2012 (ii) which country $j \in S$ their co-workers moved to. We then estimate the following specification, either for the full sample or conditional on retiring abroad:

$$Y_{ijt} = \alpha + \beta_j \cdot \mathbb{1} \cdot (E_{-i,j} = 1) + \sum_{j' \neq j} \beta_{j'} \cdot \mathbb{1} \cdot (E_{-i,j'} = 1) + \gamma \cdot X_{it} + u_{it} \tag{10}$$

Where Y_{ijt} is the probability that individual i moves to $j \in S$ in year t after 2012. The variable $E_{-i,j}$ is equal to one if any of individual i's peers, denoted $-i$, have moved to country j before 2012. We also include a vector of individual-level controls, X_{it}, which consists of sex, marital status, whether the individual has children, higher education attainment, and whether they belonged to the top 10% of the income distribution before retirement, to account for heterogeneous migration choices. We estimate Equation (10) separately for each of the ten destinations j.

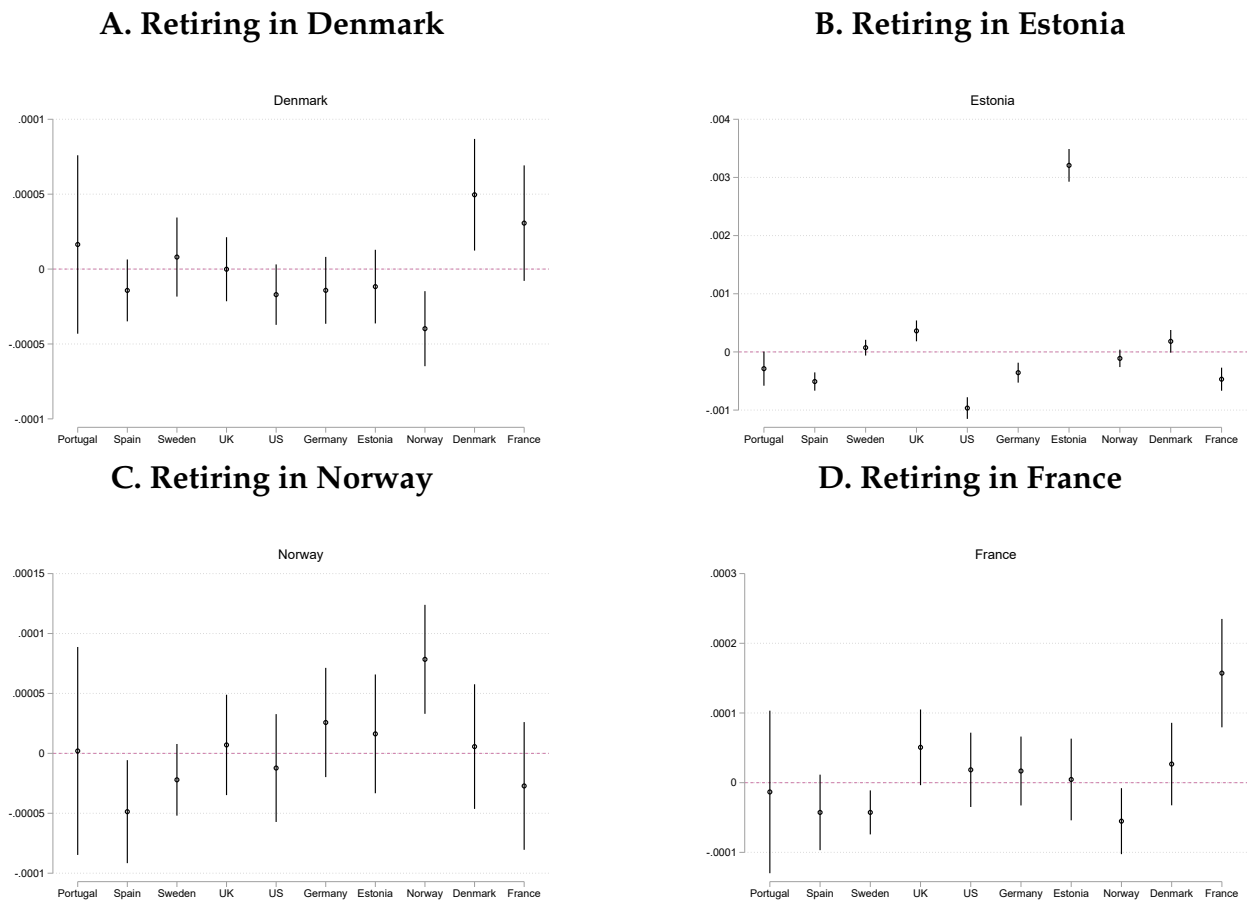
The coefficient β_j captures the effects of having ever worked in an establishment where some co-workers moved to country j before 2012, on the probability that a senior individual retires in country j after 2012. The coefficients $\beta_{j'}$ capture the effects of having

worked with individuals who moved to other destination countries j' before 2012, on the probability to retire in country j after 2012. If peer effects are destination-specific (e.g. the probability to move to Portugal is increased by having people in one's social network who moved to Portugal before), β_j should be larger than $\beta_{j'}$. On the other hand, if an individual probability to retire in a given destination is only affected by knowing other people who retired abroad, but not to that specific destination, β_j and all the $\beta_{j' \neq j}$ should be of similar magnitude. Moreover, detecting any large effect of exposure to peers who moved to j' on an individual's propensity to move to j could also be the sign that our design simply captures self-selection in migration rather than true peer effects. For instance, highly educated individuals are more likely to retire abroad but also more likely to work in similar establishments.

In Figure E.1, we plot the estimated coefficients of interest, β_j, along with the series of $\beta_{j'}$, estimated separately for the main destination countries before 2012: Denmark (Panel A), Estonia (Panel B), Norway (Panel C), and France (Panel D). A consistent pattern emerges across all panels: individuals who were previously exposed to peers who migrated to a specific destination are significantly more likely to retire in that same country. In contrast, the impact of exposure to peers who retired in other destination countries is smaller, with effects centered around and generally not statistically distinct from zero.[57] This helps alleviate concerns that our measure of exposure to peers moving to a particular destination could be highly correlated with other factors also affecting the overall probability to move; for instance if past co-workers exhibit similar education or skill level than the focal individual on average. While self-selection may still partly explain the patterns observed in Figure E.1 –given that individuals are not randomly assigned to past establishments– we consider the likelihood of selection based on destination-specific factors to be less likely.

[57] Appendix Tables E.1 and E.2 show the country-by-country estimates of Equation (10) for, respectively, the full sample of seniors in Finland in 2012, and only those who moved abroad (anywhere) after 2012.

Figure E.1: **Establishment-Level Peers' Past Location Choices and Own Migration**



Notes: This figure shows estimates of β_j and $\beta_{j'}$ from Equation (10), estimated separately for Portugal (panel A), Spain (panel B), Sweden (panel C) and France (panel D) as destination countries. In each panel, the outcome variable is the probability that individuals aged 55 or older retire in that specific destination after 2012. We add controls for sex, marital status, whether the individual has children, higher educational attainment, and whether they belonged to the top 10% of the income distribution before retirement. The coefficients capture how the probability of retiring in Portugal (Panel A), Spain (Panel B), Sweden (Panel C) and France (Panel D) is affected by having worked with peers who moved (before 2012) to each country on the x-axis. Data come from matching the exhaustive migration registry for the post-2013 period to 1991–2012 work history FOLK dataset and peers are defined by co-workers in the same establishment-year pair (see Appendix G.1).

Table E.1: Peer effects in migration: full sample, all destinations

	(1) Portugal	(2) Spain	(3) Sweden	(4) UK	(5) US	(6) Germany	(7) Estonia	(8) Norway	(9) Denmark	(10) France
Estab exposure Portugal=1	0.000169	0.000176	0.0000794	0.000124*	0.000153**	0.0000805	-0.000280*	0.000000763	0.0000160	-0.0000140
	(0.000104)	(0.000138)	(0.000104)	(0.0000639)	(0.0000669)	(0.0000723)	(0.000150)	(0.0000443)	(0.0000304)	(0.0000595)
Estab exposure Spain=1	-0.0000198	0.000268***	-0.000261***	-0.0000287	-0.0000673***	-0.0000242	-0.000491***	-0.0000517**	-0.0000152	-0.0000445
	(0.0000449)	(0.0000675)	(0.0000523)	(0.0000241)	(0.0000259)	(0.0000293)	(0.0000800)	(0.0000219)	(0.0000105)	(0.0000277)
Estab exposure Sweden=1	0.0000689**	0.000102**	0.000141***	-0.0000992***	-0.000133***	-0.0000815***	0.0000785	-0.0000230	0.00000775	-0.0000432***
	(0.0000309)	(0.0000481)	(0.0000526)	(0.0000176)	(0.0000178)	(0.0000214)	(0.0000690)	(0.0000153)	(0.0000135)	(0.0000161)
Estab exposure UK=1	0.0000819*	0.000177**	-0.0000478	0.0000923***	0.0000513*	-0.00000558	0.000351***	0.00000880	0.000000423	0.0000518*
	(0.0000445)	(0.0000713)	(0.0000562)	(0.0000286)	(0.0000289)	(0.0000312)	(0.0000914)	(0.0000213)	(0.0000109)	(0.0000277)
Estab exposure US=1	0.0000659	-0.0000410	-0.0000736	0.000000120	0.000105***	0.0000427	-0.000987***	-0.00000853	-0.0000159	0.0000207
	(0.0000483)	(0.0000691)	(0.0000587)	(0.0000250)	(0.0000298)	(0.0000337)	(0.0000950)	(0.0000230)	(0.0000102)	(0.0000273)
Estab exposure Germany=1	0.0000314	-0.0000756	-0.000205***	-0.0000118	-0.0000481**	0.0000665**	-0.000367***	0.0000275	-0.0000137	0.0000178
	(0.0000454)	(0.0000661)	(0.0000555)	(0.0000232)	(0.0000241)	(0.0000325)	(0.0000874)	(0.0000232)	(0.0000114)	(0.0000252)
Estab exposure Estonia=1	0.000175***	0.000231***	-0.000246***	-0.00000578	-0.0000448	0.0000140	0.00321***	0.0000151	-0.0000121	0.00000387
	(0.0000521)	(0.0000776)	(0.0000562)	(0.0000270)	(0.0000289)	(0.0000340)	(0.000143)	(0.0000253)	(0.0000125)	(0.0000299)
Estab exposure Norway=1	-0.0000880**	-0.0000980*	0.0000698	-0.0000610***	-0.0000544**	-0.0000847***	-0.000114	0.0000790***	-0.0000396***	-0.0000549**
	(0.0000381)	(0.0000584)	(0.0000545)	(0.0000222)	(0.0000231)	(0.0000277)	(0.0000762)	(0.0000232)	(0.0000128)	(0.0000241)
Estab exposure Denmark=1	0.0000735	0.000163**	0.000353***	0.0000210	0.0000137	0.0000336	0.000148	0.0000114	0.0000513***	0.0000301
	(0.0000523)	(0.0000790)	(0.0000655)	(0.0000280)	(0.0000277)	(0.0000329)	(0.0000993)	(0.0000264)	(0.0000190)	(0.0000302)
Estab exposure France=1	0.000194***	0.000172**	0.0000342	0.0000753**	0.0000598*	0.0000837**	-0.000483***	-0.0000248	0.0000314	0.000159***
	(0.0000613)	(0.0000863)	(0.0000682)	(0.0000324)	(0.0000332)	(0.0000412)	(0.000101)	(0.0000271)	(0.0000197)	(0.0000397)
mean	0.00019	0.00052	0.00072	0.00016	0.00021	0.00020	0.00122	0.00009	0.00004	0.00011
r2	0.00026	0.00015	0.00015	0.00008	0.00013	0.00010	0.00311	0.00003	0.00005	0.00008
N	2605535	2605535	2605535	2605535	2605535	2605535	2605535	2605535	2605535	2605535

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.010

Note: This table shows estimates of β_j and $\beta_{j'}$ from Equation (10), estimated separately for the top 10 destination countries of senior Finns. In each panel, the outcome variable is the probability that individuals aged 55 or older retire in that specific destination after 2012. We add controls for sex, marital status, whether the individual has children, higher educational attainment, and whether they belonged to the top 10% of the income distribution before retirement. The coefficients capture how the probability is affected by having worked in the same establishment as peers who moved (before 2012) to each country. The sample includes all Finns still living in Finland in 2012 and aged 55 or older.

Table E.2: Peer effects in migration: mover sample, all destinations

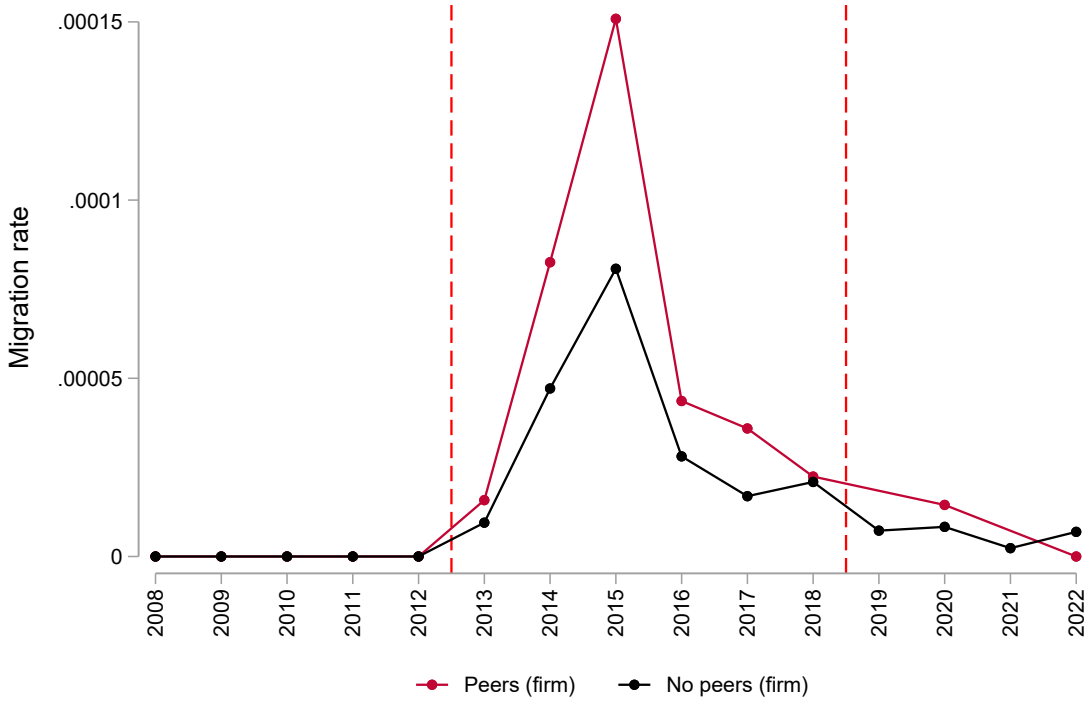
	(1) Portugal	(2) Spain	(3) Sweden	(4) UK	(5) US	(6) Germany	(7) Estonia	(8) Norway	(9) Denmark	(10) France
Estab exposure Portugal=1	0.00691	-0.00238	0.00483	0.0140	0.0172*	0.00416	-0.0595***	-0.00312	0.00165	-0.00926
	(0.0145)	(0.0189)	(0.0149)	(0.00948)	(0.00983)	(0.0107)	(0.0181)	(0.00670)	(0.00454)	(0.00907)
Estab exposure Spain=1	0.00576	0.0786***	-0.0420***	-0.00178	-0.00933	0.00316	-0.0200	-0.00918*	-0.000960	-0.00611
	(0.00988)	(0.0141)	(0.0113)	(0.00556)	(0.00590)	(0.00668)	(0.0142)	(0.00509)	(0.00238)	(0.00630)
Estab exposure Sweden=1	0.0258***	0.0480***	0.0693***	-0.0182***	-0.0226***	-0.01000*	0.0450***	-0.00173	0.00389	-0.00626
	(0.00754)	(0.0114)	(0.0119)	(0.00438)	(0.00450)	(0.00542)	(0.0130)	(0.00397)	(0.00346)	(0.00403)
Estab exposure UK=1	0.00109	0.00274	-0.0397***	0.0162***	0.00714	-0.00931	0.00532	-0.00213	-0.00137	0.00716
	(0.00942)	(0.0145)	(0.0117)	(0.00622)	(0.00640)	(0.00702)	(0.0152)	(0.00475)	(0.00248)	(0.00602)
Estab exposure US=1	0.0231**	0.0101	-0.00912	0.00227	0.0241***	0.0123*	-0.0993***	-0.000108	-0.00307	0.00643
	(0.0101)	(0.0139)	(0.0121)	(0.00555)	(0.00652)	(0.00740)	(0.0156)	(0.00508)	(0.00225)	(0.00592)
Estab exposure Germany=1	0.0104	-0.00782	-0.0383***	0.00201	-0.00622	0.0206***	-0.0136	0.00863	-0.00268	0.00643
	(0.0103)	(0.0144)	(0.0122)	(0.00546)	(0.00573)	(0.00761)	(0.0160)	(0.00553)	(0.00271)	(0.00599)
Estab exposure Estonia=1	0.00384	-0.0217**	-0.0982***	-0.0150***	-0.0214***	-0.0156***	0.286***	-0.00655*	-0.00581***	-0.00915**
	(0.00742)	(0.0107)	(0.00856)	(0.00419)	(0.00454)	(0.00522)	(0.0127)	(0.00387)	(0.00209)	(0.00446)
Estab exposure Norway=1	-0.0118	0.00186	0.0429***	-0.00796	-0.00352	-0.0121*	0.0362***	0.0228***	-0.00869***	-0.00886
	(0.00872)	(0.0128)	(0.0120)	(0.00516)	(0.00553)	(0.00654)	(0.0138)	(0.00560)	(0.00304)	(0.00567)
Estab exposure Denmark=1	-0.00356	-0.0113	0.0258**	-0.000240	-0.00377	-0.00211	-0.0180	-0.00454	0.00878**	0.000702
	(0.00994)	(0.0142)	(0.0118)	(0.00560)	(0.00562)	(0.00656)	(0.0148)	(0.00533)	(0.00374)	(0.00588)
Estab exposure France=1	0.0173	-0.00559	-0.00988	0.0103*	0.00761	0.00848	-0.0966***	-0.00842	0.00527	0.0253***
	(0.0111)	(0.0152)	(0.0125)	(0.00612)	(0.00636)	(0.00784)	(0.0152)	(0.00537)	(0.00385)	(0.00746)
mean	0.03662	0.10102	0.13882	0.03120	0.03996	0.03966	0.23650	0.01686	0.00832	0.02043
r2	0.04935	0.05240	0.04064	0.00342	0.01120	0.00462	0.14304	0.00546	0.00464	0.01107
N	13463	13463	13463	13463	13463	13463	13463	13463	13463	13463

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.010

Note: This table shows estimates of β_j and $\beta_{j'}$ from Equation (10), estimated separately for the top 10 destination countries of senior Finns. In each panel, the outcome variable is the probability that individuals aged 55 or older retire in that specific destination after 2012. We add controls for sex, marital status, whether the individual has children, higher educational attainment, and whether they belonged to the top 10% of the income distribution before retirement. The coefficients capture how the probability is affected by having worked in the same establishment as peers who moved (before 2012) to each country. The sample includes all Finns still living in Finland in 2012 and aged 55 or older who moved abroad (to any destination) after 2012.

Figure E.2: **Migration Responses to Taxes Are Linked to Peer-Effects at Origin**



Notes: This figure shows migration rates, for those exposed (red series) and not exposed (dark series) to co-workers who moved to Portugal between 1991 and 2012. The estimates are based on administrative data from Statistics Finland. We consider all individuals who remained in Finland up to 2012 and are aged 55 or older in 2012. Using firm identifiers, we link individuals to their former colleagues and measure if they worked during the period 1991-2012 at the same firm as those who moved to Portugal between 1991–2012 (exposed group). We then construct the two groups of exposed and not exposed individuals, and plot their migration rate to Portugal between 2013 and 2022. The migration probabilities before 2013 are zero by design, as all individuals who moved before 2012 have been excluded. The first vertical red line indicates the introduction of the 0% tax rate for foreign pensioners in Portugal. The second vertical red line indicates the repeal of the tax regime for Finns in Portugal.

F Model derivations

F.1 Model setup

Countries of origin are indexed by i and destinations by j. Households h from age group $k = \{P, W\}$ (pensioners, workers) have a unit endowment of time, and receive Cobb-Douglas utility from a numeraire tradable good x and a local good y with local price p_j. They enjoy multiplicative local (potentially age-specific) amenities $(A_j^K)^{1-l_j^K}$, which are complementary to leisure time $(1-l)$ spent enjoying them. Households also receive idiosyncratic preference shocks $\xi_{ij}(h)$, distributed Frechet with inverse dispersion parameter σ_k that governs the migration elasticity, due to preference heterogeneity across destinations. Moving from i to j incurs (potentially endogenous) moving costs of $1/\mu_{ij}^k > 1$, with μ_{ii}^k normalized to 1.

Pensioners Pensioners from i living in j spend all their time on leisure, $l_j^P = 0$. Their net income is the product of the gross nominal pension income received (P_{it}), according to pension determination rules in the *origin* country,[58] and one minus the average tax rate (ATR) on pensions, τ_{ijt}^P, which can depend on both origin and destination countries in double taxation agreements.

A pensioner's problem is thus:

$$\max_{x,y,j} U_{ijt}^P(h) = x^{1-\phi_Y} y^{\phi_Y} A_j^P \mu_{ij}$$

subject to the budget constraint:

$$x + p_j y \leq P_i(1-\tau_{ij}^P)$$

This yields the standard (common component of) indirect utility:

$$V_{ij}^P = \frac{P_i(1-\tau_{ij}^P) A_j^P \mu_{ij}}{p_j^{\phi_Y}}$$

[58] Pensioners' gross incomes are determined in their origin country, not their destination location, a key feature that distinguishes them from standard working-age movers, but makes them somewhat similar to remote workers or "digital nomads".

Aggregating over all pensioners from i yields a location choice probability at time t:

$$\pi_{ijt}^{P} = \frac{\left(P_{it}(1-\tau_{ijt}^{P})A_{jt}^{P}\mu_{ij}^{P}p_{j}^{-\phi_Y}\right)^{\sigma_P}}{\sum_k \left(P_{it}(1-\tau_{ikt}^{P})A_{kt}^{P}\mu_{ik}p_{k}^{-\phi_Y}\right)^{\sigma_P}} \tag{11}$$

Workers Conditional on living in i, a working-age household splits their time between work l_j^W and leisure $1 - l_j^W$. Tax rates for workers are set in the destination country, according to the *lex laboris*, τ_j^W. A worker's problem is:

$$\max_{x,y,l,j} U_{ijt}^{W}(h) = x^{1-\phi_Y} y^{\phi_Y} (A_j^W)^{1-l_j^W}$$

subject to the budget constraint:

$$x + p_j y \leq w_j l_j^W (1 - \tau_j^W)$$

This yields optimal labor effort $\tilde{l}_j^W = \min(1, \frac{1}{\ln(A_j^W)})$ and indirect utility:

$$V_{ij}^{W} = \frac{w_j \tilde{l}_j^W (1-\tau_j^W)(A_j^W)^{1-\tilde{l}_j^W}\mu_{ij}}{p_j^{\phi_Y}}$$

For low enough local amenities, workers spend all their time working and are indifferent to local amenities. Aggregating choices across workers from i yields the location choice probability:

$$\pi_{ijt}^{W} = \frac{\left(w_{jt}\tilde{l}_{jt}^W (1-\tau_{jt}^W)(A_j^W)^{1-\tilde{l}_{jt}^W}\mu_{ij}^W p_j^{-\phi_Y}\right)^{\sigma_W}}{\sum_k \left(w_{kt}\tilde{l}_{kt}^W (1-\tau_{kt}^W)(A_k^W)^{1-\tilde{l}_{kt}^W}\mu_{ik}p_k^{-\phi_Y}\right)^{\sigma_W}} \tag{12}$$

F.2 Model predictions

Cross-sectional regularities It is useful to contrast the location patterns of pensioners to those made by working-age individuals. Normalizing choice probabilities by the home-country location in both cases yields an "odds-ratio" – the probability that a pensioner from i locates in j rather than staying home, compared to the same quantity for a working-age individual. Here, we make the additional assumptions that baseline amenities $A_j^W = A_j^P =$

A_j are identical before the operation of leisure time.

$$\frac{\pi^P_{ijt}/\pi^P_{iit}}{\pi^W_{ijt}/\pi^W_{iit}} = \frac{\frac{\left((1-\tau^P_{ijt})A_{jt}\mu^P_{ij}p_j^{-\phi_Y}\right)^{\sigma_P}}{\left((1-\tau^P_{iit})A_{it}p_i^{-\phi_Y}\right)^{\sigma_P}}}{\frac{\left(w_{jt}\tilde{l}^W_{jt}(1-\tau^W_{jt})(A_{jt})^{1-\tilde{l}^W_{jt}}\mu^W_{ij}p_j^{-\phi_Y}\right)^{\sigma_W}}{\left(w_{it}\tilde{l}^W_{it}(1-\tau^W_{it})(A_{it})^{1-\tilde{l}^W_{it}}p_i^{-\phi_Y}\right)^{\sigma_W}}} \tag{13}$$

$$= \left(\frac{1-\tau^P_{ijt}}{1-\tau^P_{iit}}\right)^{\sigma_P} \times \left(\frac{w_{jt}}{w_{it}}\right)^{-\sigma_W} \times \frac{(A_{jt})^{\sigma_P-(1-\tilde{l}^W_{jt})\sigma_W}}{(A_{it})^{\sigma_P-(1-\tilde{l}^W_{it})\sigma_W}} \times \left(\frac{1-\tau^W_{jt}}{1-\tau^W_{it}}\right)^{-\sigma_W} \times \alpha_{ijt} \tag{14}$$

The (log) old-young odds-ratio is linearly increasing (with slope σ_P) in the destination-origin (log) ratio of keep rates for pensioners ($\frac{(1-\tau^P_{ijt})}{(1-\tau^P_{iit})}$), and linearly decreasing in the destination-origin (log) ratio of working-age earnings ($\frac{w_{jt}}{w_{it}}$), and in the destination-origin (log) ratio of keep rates for workers ($\frac{(1-\tau^W_{jt})}{(1-\tau^W_{it})}$).[59] We test these cross-sectional predictions in section 3.

Effect of pensioner-specific tax breaks Scaling equation 11 by the number of pensioners originating from i at the beginning of period t, $\bar{N}^P_{it}$, yields:

$$\begin{aligned}
\log(N^P_{ijt}) &= \log(\bar{N}^P_{it}\pi^P_{ijt}) \\
&= \sigma_P \log(1-\tau^P_{ijt}) \\
&+ \log(\bar{N}^P_{it}) - \log(\sum_k [(1-\tau^P_{ikt})A^P_{kt}p_k^{-\phi_Y}]^{\sigma_P}) + \sigma_P \log(\mu^P_{ijt}) \\
&+ \sigma_P \log(A^P_{jt}) - \phi_Y \sigma_P \log(p_{jt})
\end{aligned}$$

Absorbing origin-time and origin-destination invariant terms in fixed effects yields our main estimating equation from section 3:

$$\log(N^P_{ijt}) = \sigma_P \log(1-\tau^P_{ijt}) + \kappa_{it} + \alpha_{ij} + \epsilon_{ijt} \tag{15}$$

Equation 15 corresponds to a regression equation with origin-year and origin-destination pairwise fixed effects. Exogenous shocks to the tax rate for pensioners from i in j identify σ_P, the pensioner migration elasticity, under the condition that the structural error term ($\epsilon_{ijt} = \sigma_P \log(A^P_{jt}) - \phi_Y \sigma_P \log(p_{jt}) + \sigma_P \log \mu^P_{ijt}$) is orthogonal to the shocks.

[59] Under some additional regularity assumptions, the ratio is also increasing in the destination-origin amenity ratio: a positive labor supply makes workers relatively less sensitive to amenities than pensioners. In particular, if $\sigma_W \geq \sigma_P$, then the optimal labor supply equation $\tilde{l}^W_j = \min(1, \frac{1}{\ln(A_j)})$ implies that the log odds-ratio is increasing in the amenity ratio for $A_j > A_i$.

F.3 Allowing for agglomeration effects

The model-driven estimation strategy also helps to clarify under what conditions our difference-in-differences regression could recover transformations of the structural parameter σ_P.

Endogenous moving costs One case of particular interest is when local, age-specific inverse moving costs endogenously depend on the fraction of pensioners from an origin who chose a given destination. We model such a case as:

$$\mu_{ijt} = \tilde{\mu}_{ij} \times (\frac{N^P_{ijt}}{N^P_{it}})^{\eta}$$

This allows moving costs to decrease iso-elastically with the presence of other pensioners from the same origin in the destination. In this case, re-writing equation 15 yields:

$$\log(N^P_{ijt}) = \sigma_P \log(1 - \tau^P_{ijt}) + \kappa_{it} + \alpha_{ij} + \sigma_P \eta \log(\frac{N^P_{ijt}}{N^P_{iit}}) + \sigma_P \log(\tilde{A}^P_{jt})$$

Under these conditions, the reduced-form estimating equation implies that the response of migration to destination-level tax shocks is amplified by a factor $\frac{1}{1-\sigma_P\eta}$

$$\log(N^P_{ijt}) = \frac{\sigma_P}{1 - \sigma_P\eta} \log(1 - \tau^P_{ijt}) + \tilde{\kappa}_{it} + \tilde{\alpha}_{ij} + \tilde{\epsilon}_{ijt} \tag{16}$$

where $\tilde{\kappa}$, $\tilde{\alpha}$ and $\tilde{\epsilon}$ are appropriately scaled fixed effects and residuals. An exogenous tax cut in j attracts pensioners (with elasticity σ_P), yielding a decrease in endogenous moving costs for others (at rate η), attracting more pensioners. This circular "social multiplier" (Glaeser, Sacerdote, and Scheinkman, 2003) amplifies the baseline effect of the tax cut by a factor $\frac{1}{1-\sigma_P\eta}$. Empirically, such an amplification effect implies larger tax elasticities of migration in the long-run than in the short-run, as shown in section 4. It also predicts a larger response of pensioners whose close networks also locate in the tax-break destination, as we evidence in section 5; and persistence in the effects of a policy beyond the treatment, since endogenous moving costs make *leaving* the tax-break location (now defined as the new "origin") more costly once social networks have been established there.[60]

[60] Section 6 documents empirically the spatial clustering of pensioner migration, and provides direct evidence of the role of agglomeration effects in retiree mobility.

F.4 Simulation

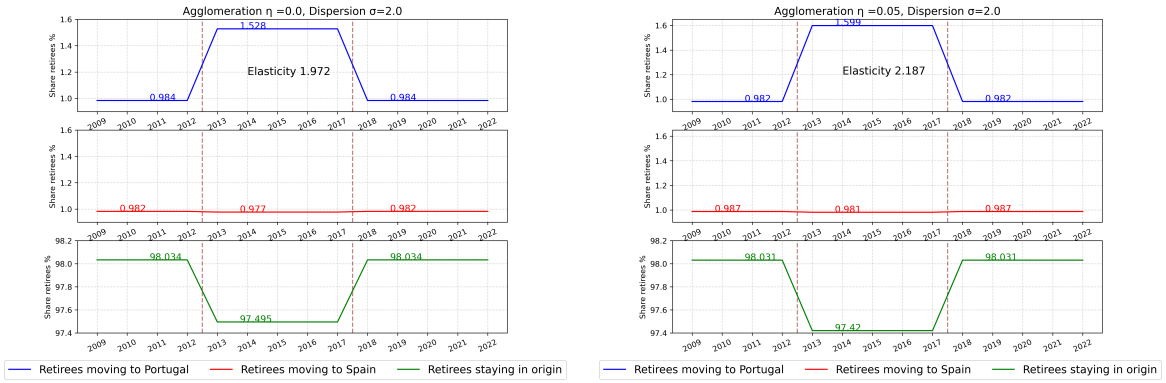
Endogenous agglomeration can also account for asymmetries between the effects of the broad-based introduction of the scheme, and the origin-specific repeal of the preferential tax rate for pensioners from Finland. The introduction of the NHR in Portugal, for pensioners from all origins, triggers Finnish migration to Portugal through both the direct effect on net pensions, and the indirect "agglomeration multiplier" effect: an overall increase in the amenity value of Portugal as a result of rising pensioner inflows from all over the EU. The origin-specific repeal reduces Finnish pensioner flows to Portugal through the direct effect, but endogenous amenities in Portugal remain higher than in the pre-policy period, since foreign stocks from other countries remain at a permanently higher level. Therefore, the introduction of the Portuguese tax break has larger effects than its origin-specific repeal on pensioner stocks coming from Finland and living in Portugal. As shown in simulations of the model below, such asymmetry and hysteresis in the effects of a temporary drop in the tax rate are predicted to be larger for "small" origin countries representing a lesser share of overall stocks of foreign pensioners in the destination.

To gain quantitative insights into the role of agglomeration for amplification and hysteresis, we simulate our location choice model with two origin countries (one large, "France", with 5,000,000 retirees, and one small, "Finland", with 500,000). Pensioners from each origin maximize utility by picking a location between three options: staying home, moving to Spain, and moving to Portugal. Consistent with large moving costs, we calibrate initial amenities in Spain and Portugal relative to the home country so that only a small share ($\pi_P \simeq 0.01$) of pensioners elect to retire in Portugal at baseline, and pick initial tax rates of 20% in all destinations. Pensioners are subject to idiosyncratic preference shocks distributed Frechet, with an inverse dispersion equal to σ, and a country-specific location parameter that is allowed to depend on the endogenous number of pensioners locating there.

We display simulations of counter-factual experiments in the model in figure F.1. We average the estimated elasticities and responses across 50 simulations for robustness. A temporary drop in the tax rate applicable to pensions in Portugal for pensioners from all origin countries yields an increase in the share of pensioners relocating there, with an aver-

age numerical estimated elasticity with respect to the net-of-tax rate $\frac{\Delta \log(N)}{\Delta \log(1-\tau_P)}$ very close to $\sigma(1-\pi_P) \simeq 2 \times (1-0.01) = 1.98$. We next introduce agglomeration forces in the simulated model, making destination-specific amenities depend on the number of foreign pensioners from all origins locating in Portugal, with elasticity $\eta = 0.05$. As in the analytical formulas in section 3, this increases the estimated numerical elasticity by a factor of $\frac{1}{1-\eta\sigma} \simeq 110\%$.

Figure F.1: **Amplification through agglomeration**



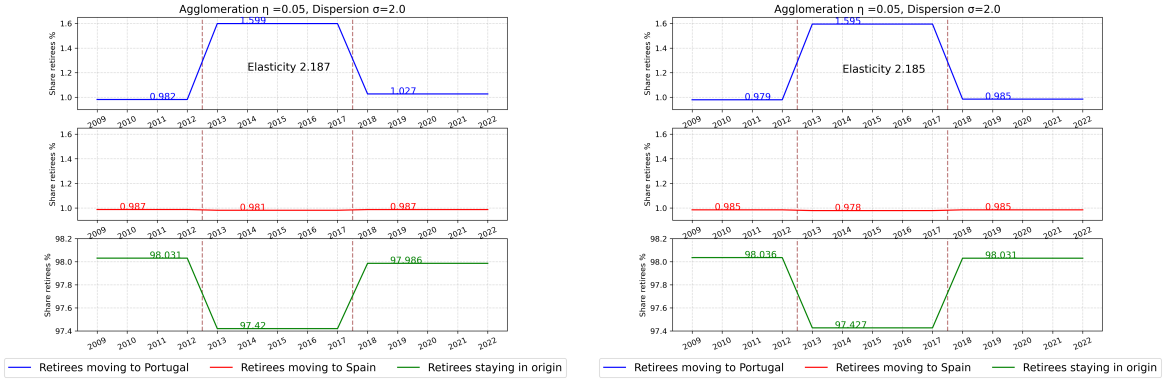
(a) Response with exogenous amenities (b) Response with endogenous amenities

Notes: The figure displays simulated responses of location choices in a calibrated version of our model with $\sigma = 2$. We simulate a reduction in the tax rate applicable to foreign pensions for all origin countries in Portugal after 2012, and a repeal of the preferential tax rate in 2018 for all origin countries. Panel A (resp. Panel B) displays the impact of both reforms when amenities are exogenous (endogenous with $\eta = 0.05$).

We then show that responses to origin-specific repeals display heterogeneous hysteresis, depending on the size of the origin country. In figure F.2, we simulate the repeal of the preferential tax rate after 2018, for either only the small origin country or only the large one – for example due to the application of source-based taxation for pensions received by Finland (or French) pensioners moving to Portugal. When applied only to the small country ("Finland"), this removal results in an incomplete reversal of the migration response – the level of migration remains more than five percent higher than at baseline even after the repeal. Permanently higher pensioner inflows from the other, larger origin country keep endogenous amenities in Portugal at a higher level from the point of view of Finnish pensioners, even after the end of the regime, leading to hysteresis. On the other hand, removing the favorable tax regime for only the large country ("France") yields an almost exact full reversal of the migration response of French pensioners: the level of post-reversal

migration to Portugal is only 0.6% larger than at baseline. Finnish pensioners in Portugal are few enough to have a limited impact on the endogenous amenity there through agglomeration. Thus, the observed hysteresis effects documented in the paper is more likely to appear for small than for large destinations.

Figure F.2: **Heterogeneous hysteresis**



(a) Repeal in small origin country

(b) Repeal in large origin country

Notes: The figure displays simulated responses of location choices in a calibrated version of our model with $\sigma = 2, \eta = 0.05$. We simulate a reduction in the tax rate applicable to foreign pensions for all origin countries in Portugal after 2012, and an origin-specific repeal of the preferential tax rate in 2018. Panel A (resp. Panel B) displays the impact of both reforms when the origin-specific repeal applies in only the small (resp. only the large) country after 2018.

F.5 Welfare effects of changing tax rates

We derive the optimal unilateral tax rate from the perspective of a small host country, comprised of J sub-locations indexed by j. We define $N_k = \phi_k(\tau_P, N)$ as the function relating the number of pensioners from k locating in the country to the tax rate τ_P, and to the total number N of foreign pensioners ($N = \sum_k N_k$) via agglomeration forces. We define $N_{k,j}$ as the number of foreign pensioners from k choosing location j within the host country, so that $\sum_j N_{kj} = N_k$.

Let the "local-to-aggregate" elasticity for origin k and location j represent the local response to an aggregate inflow of foreign pensioners from k:

$$\theta_{kj} = \frac{dN_{kj}}{dN_k} \frac{N_k}{N_{kj}}$$

We define the (partial) elasticities of the location choice function to the net-of-tax rate and

to the total number of foreign pensioners:

$$\epsilon_k^{\text{micro},1-\tau_P} = -\frac{\partial \phi_k}{\partial \tau_P}\frac{1-\tau_P}{N_k}$$

$$\epsilon_k^{\text{agglo},N} = \frac{\partial \phi_k}{\partial N}\frac{N}{N_k}$$

We then note that the total response is:

$$\frac{dN_k}{d\tau_P} = \frac{\partial \phi_k}{\partial \tau_P} + \frac{\partial \phi_k}{\partial N}\frac{dN}{d\tau_P}$$

so that:

$$\frac{dN_k}{d\tau_P} = -\epsilon_k^{\text{micro},1-\tau_P}\frac{N_k}{1-\tau_P} + \epsilon_k^{\text{agglo},N}\frac{N_k}{N}\frac{dN}{d\tau_P}$$

Summing up and re-arranging yields:

$$\sum_k \frac{dN_k}{d\tau_P} = \frac{dN}{d\tau_P} = -\frac{1}{1-\tau_P}\sum_k \epsilon_k^{\text{micro},1-\tau_P} N_k + \frac{dN}{d\tau_P}\frac{1}{N}\sum_k \epsilon_k^{\text{agglo},N} N_k$$

Under the extra-assumption that the net-of-tax-rate and agglomeration elasticities do not vary by origin country k, we obtain the macro-elasticity of the foreign number of pensioners to the net-of-tax rate, inclusive of agglomeration forces:

$$\epsilon^{\text{macro},1-\tau_P} = -\frac{dN}{d\tau_P}\frac{1-\tau_P}{N} = \frac{\epsilon^{\text{micro},1-\tau_P}}{1-\epsilon^{\text{agglo},N}}$$

and

$$-\frac{dN_k}{d\tau_P}\frac{1-\tau_P}{N_k} = \epsilon^{\text{micro},1-\tau_P} + \epsilon^{\text{agglo},N}\epsilon^{\text{macro},1-\tau_P} = \epsilon^{\text{macro},1-\tau_P}$$

The host country maximizes the weighted sum of the welfare of a measure 1 of domestic tenants and of domestic landlords, with a weight α on the latter. Its instruments are a uniform tax rate τ_P on foreign pensioners, and a transfer T to domestic tenants. Tenants live in each location j in proportion π_j, consuming housing h_j, and can be directly affected by the number of foreign pensioners in that location $N_j = \sum_k N_{kj}$ through positive or negative externalities. In each location, housing market clearing requires that total housing (owned by landlords) H_j equals the sum of consumption by domestic renters $\pi_j h_j$ and foreign pensioners H_j^F.

Formally:

$$\max_{\tau_P,T} W = \sum_j \pi_j V^T(h_j, y + T - r_j h_j, N_j) + \alpha V^L(\sum_j H_j r_j)$$

subject to

$$\sum_k N_k P_k \tau_P = T$$

Substituting the government's budget constraint into the objective, we find the first-order condition with respect to τ_P:

$$\frac{dW}{d\tau_P} = \sum_j \pi_j V_c^T \times (\sum_k N_k P_k + \sum_k \frac{dN_k}{d\tau_P} P_k \tau_P - h_j \frac{dr_j}{dN_j} \sum_k \frac{dN_{kj}}{d\tau_P})$$

$$+ \sum_j \pi_j V_{N,j}^T \times \sum_k \frac{dN_{kj}}{d\tau_P} + \alpha V_C^L \times \sum_j H_j \frac{dr_j}{dN_j} \sum_k \frac{dN_{kj}}{d\tau_P}$$

We make the following additional assumption for simplicity

- quasi-linear utility for tenants and landlords ($V_c^T = V_c^L = 1$)
- constant local-to-aggregate elasticities across origins ($\theta_{kj} = \theta_j$)

Defining the average foreign pension as $\bar{P}$ and the elasticity of local rents to the local number of foreign pensioners $\eta^{r,j} = \frac{dr_j}{dN_j}\frac{N_j}{r_j}$, using the housing market clearing condition, and re-arranging yields:

$$\frac{dW}{d\tau_P} = N\bar{P}(1 - \frac{\tau_P}{1-\tau_P}(\epsilon^{\text{micro},1-\tau_P} + \epsilon^{\text{agglo},N}\epsilon^{\text{macro},1-\tau_P}))$$

$$+ \frac{\epsilon^{\text{macro},1-\tau_P}}{1-\tau_P}((1-\alpha)\sum_j \eta^{r,j}\theta_j r_j \pi_j h_j - \alpha \sum_j \eta^{r,j}\theta_j r_j H_j^F)$$

$$- \frac{\epsilon^{\text{macro},1-\tau_P}}{1-\tau_P} \sum_j \pi_j V_{N,j}^T \times N_j \theta_j$$

and setting the FOC to 0, the optimal unilateral tax rate is then:

$$\tau_P^* = \frac{1}{1+\epsilon^{\text{macro},1-\tau_P}}\left[1 + \frac{\epsilon^{\text{macro},1-\tau_P}}{N\bar{P}}\left((1-\alpha)\sum_j \eta^{r,j}\theta_j r_j \pi_j h_j \quad -\alpha \sum_j \eta^{r,j}\theta_j r_j H_j^F \right.\right.$$
$$\left.\left. - \sum_j \pi_j V_{N,j}^T \times N_j \theta_j\right)\right] \tag{17}$$

G Data appendix

G.1 Description of Finnish administrative data

The Finnish administrative data are provided by Statistics Finland and contain information on all individuals permanently residing in Finland. Our analysis uses these individual-level, full-population administrative records for the years 1990 to 2024. The main data source is the longitudinal modules on personal data (FOLK), which provide extensive socio-economic information, including age, sex, educational level, firm and establishment IDs, main activity, all taxable income (such as pensions, business income, and capital income), and the start date of pension benefits. All information is recorded at the end of the year.

The data are then merged with the migration register using encrypted individual social security numbers. Since we do not observe individuals in the data after they emigrate, we must link the data to the year before their emigration. This means that all demographic information is recorded one year prior to the move. To accurately reflect the age at the time of migration, the age variable is adjusted by adding one year. The migration data provide details on the date of migration (including both emigration and immigration) and the countries of destination or return. The migration records capture only registered migration events. However, the incentive to register is substantial; spending more than six months abroad exempts individuals from Finnish taxes, which are typically higher than those in the destination country, and recording one's return is necessary to qualify for transfers. As before, we define pensioners as individuals older than 55 years. Although we can identify actual pensioners, it is possible that some wealthy individuals near retirement age may choose to retire early by relocating from Finland to Portugal, where their capital income is not taxable. Therefore, focusing only on pensioners may not capture all tax-related migration events. Our results are similar when focusing only on individuals receiving a pension.

Tables G.1 and G.2 provide descriptions of the main variables used in the analysis carried out using Finnish administrative data. Variables such as earnings, capital income, and income decile are calculated based on values before retirement. Since these variables often decline as the official retirement date approaches, we use a 5-year average before retirement. For individuals older than 55 years but not officially retired, we calculate a 5-year

average before migration.

Constructing flow of migrants. The flow of migrants is derived from the Finnish administrative micro-data described above. We aggregate the micro-data by destination country and migration year. In addition to calculating the overall flow of migrants to each country, we also compute the flows for various demographic groups, including married and single individuals, those with and without children, those with capital income, and those who were in the top 10% or bottom 90% of earners before retirement. We also aggregate the flow of return migrants in a similar way.

Constructing stocks of migrants. The stocks are calculated based on migration records from 1991 to 2024 merged with FOLK personal data. Although aggregate data sources could provide the total number of Finns residing in Portugal before this period, we would lack detailed information about their characteristics. Therefore, we construct the stock using the available micro-data. The starting point is the flow of migrants described above. Each year, we add individuals moving to Spain or Portugal to the dataset and keep them in the migrant stock until they either return to Finland or die. This tracking is possible because Finnish administrative registers record the year of death even for individuals residing abroad. Consistent with our flow data analysis, we use FOLK personal data, to track the demographics of all individuals. This allows us to calculate the cumulative numbers of, for example, married and single individuals. The shares of different groups are then determined by dividing the number of each group by the total stock. We also track how income variables like earnings, pensions, capital income, and business income change within the stock by adding the income of newcomers, subtracting the income of return migrants, and relating these numbers to the total stock. In addition, in this analysis, we limit the movers to those who have the same destination and return country (or a missing return country if they did not return). This ensures the accurate calculation of shares as individuals who initially migrated to Spain but later migrated to Portugal would otherwise inappropriately reduce the Portuguese stock, despite not being part of it initially.

Table G.1: Data Appendix: Variable Descriptions (Part 1)

Variable Name	*Description*
Age	Age of the individual at the time of migration to another country.
Male	Reported sex of the individual (1 = Male, 0 = Female).
Married	An individual is classified as married if they are married (including same-sex marriages, which were previously referred to as "registered partnerships" before 2017). They are classified as not married if they are divorced, widowed, or single. (1 = Married, 0 = Not Married). For movers, this classification is based on information available one year before the move, at the end of that year.
Has children	Calculated based on a variable that records the number of children. (1 = Has >=1 Child, 0 = No Children or missing information). For movers, this classification is based on information available one year before the move, at the end of that year.
Higher education	An individual is classified as highly educated if they hold a higher education degree, either from a university of applied sciences or a university. A higher education degree is defined as a bachelor's degree or higher, based on the individual's highest obtained degree. If information is missing, it is classified as no higher education (1 = Higher Education, 0 = No Higher Education). For movers, this classification is based on information available one year before their move, at the end of that year.
Migrant	An individual is classified as a migrant if they relocate from Finland (1 = Migrant, 0 = Non-Migrant). Individuals may experience multiple migration events.
Pension	Information on pension income is sourced from tax records. This information is only available for individuals who have officially retired, and is therefore missing for individuals who move close to retirement age but have not yet retired. If these individuals retire officially while abroad, we do not have information on their current pension as the FOLK data only has individuals residing in Finland. For movers, this information is based on information available one year before the move, at the end of that year. Pensions are adjusted to 2023 values. The reported mean values do not include zeros or missing values.

Table G.2: Data Appendix: Variable Descriptions (Part 2)

Variable Name	*Description*
Above median pension	This variable is constructed by calculating the annual pension decile each individual falls into (excluding zeros and missing values). It is coded as 1 for those in the 5th decile or above (Above Median) and 0 for those in deciles below the 5th (Below Median). For movers, this classification is based on information available one year before the move, at the end of that year.
Earnings	Average taxable earnings five years before retirement. For individuals older than 55 years but not officially retired, this variable is a five-year average before moving. Earnings are adjusted to 2023 values. The reported mean values exclude zeros or missing values.
Capital income	Average capital income five years before retirement. For individuals older than 55 years but not officially retired, this variable is a five-year average before moving. Capital income is adjusted to 2023 values. The reported mean values exclude zeros or missing values.
Had capital income	If the five-year average for capital income is greater than zero and nonmissing, this value is 1 and 0 otherwise.
Had business income	If the five-year average for business income is greater than zero and nonmissing, this value is 1 and 0 otherwise.
Top 10 income decile	If an individual belonged to the top 10 income decile at some point five years before retirement, this value is 1 and zero otherwise.

G.2 Eurostat

We measure the *stock* of European residents by age, country of citizenship, and current country of residence in each EU country from 2009 to 2022, using data from Eurostat as well as national population registers and Censuses from several European countries. In this data appendix, we describe in detail the data sources as well as the adjustments we made to the raw data for our analyses.

EU aggregate migration data by destination-year This data set combines three series in the Eurostat database that count the number of EU citizens in each country of destination, excluding citizens of the destination country: (1) EU27 countries (2007-2013) except reporting country, (2) EU28 countries (2013-2020) except reporting country, and (3) EU27 countries (from 2020) except reporting country.

Within each group of tables, we procure data for 5-year age bins ranging from 20-24 years to 80-84 years and 85+ years. We define the retirees to be migrants aged 55 years or more (65 years or more in several robustness checks). We define working age migrants to be between 20 and 39 years of age. We then combine the three groups of tables together to obtain a time series spanning 2009-2022 for the retired and working-age migrants. This combined data set contains data for the following 22 EU countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and United Kingdom.

Destination-origin migration data. For certain analyses, we use destination-origin-level data instead of the EU aggregate. This data is also obtained from the Eurostat database for 5-year age bins. We similarly define retirees to be migrants aged 55 years or more (or 65 years or more), and working age migrants to be between 20 and 39 years of age. This data set contains the following EU 22 countries as destinations: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden. Migrants to these destinations come from 28 EU countries: Aus-

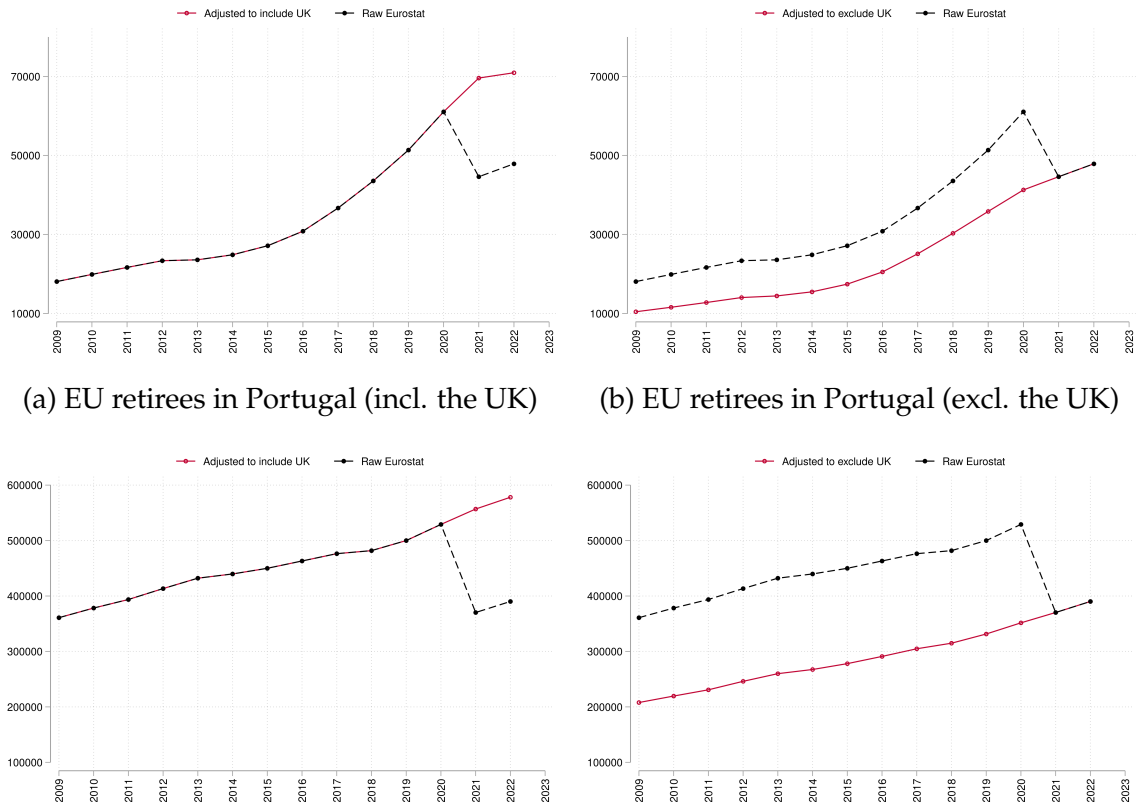
tria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom. Data for France as a destination is largely missing from this data. Therefore, we supplement this data with the French census data, which provides with us the numbers of retired and working-age migrants from Belgium, Germany, Italy, Netherlands, Poland, Portugal, Romania, Spain, and United Kingdom. Since data for the UK as a destination is missing, to normalize odds-ratios for the UK we obtain the number of UK citizens living in the UK by age group from Eurostat.

Data interpolation. In the EU aggregate migration and destination-origin migration data from Eurostat, there are years when data on the number of retirees or working age migrants are missing. We impute these missing data using interpolation. However, we limit this imputation to cases where both data for the previous and succeeding years are available, in which cases the imputed value is the arithmetic mean of the previous and succeeding years' values. For the EU aggregate migration data, we impute data for the following destination-year combinations: France-2014, Luxembourg-2011, Norway-2015, Norway-2020, Poland-2009, and Romania-2022. For the destination-origin migration data, we impute data for the following destination-year combinations: Austria-2011, Estonia-2021, Netherlands-2011, Germany-2011, and Romania-2012. For each destination-year combination, imputation is carried out for all origins.

Adjustments to include or exclude the UK. The EU aggregate migration data from the Eurostat database includes the United Kingdom up until 2020 and excludes the United Kingdom beginning 2021. To obtain two time series that consistently include or exclude the United Kingdom, we combine the EU aggregate migration data and the destination-origin-level migration between the UK and other destination countries. Specifically, for the series with the United Kingdom, we take the sum of the EU aggregate migration count and the count of migrants from the UK for two years 2021 and 2022. For the series without the United Kingdom, we subtract the count for migrants from the UK from the total EU-

wide count for years on or before 2020. In our baseline analyses, we use the time series that excludes the United Kingdom. Figure G.1 demonstrates these adjustments to the EU aggregate migration counts for Portugal and Spain.

Figure G.1: Illustration of adjustments to raw *eurostat* EU aggregate stocks data



(a) EU retirees in Portugal (incl. the UK)

(b) EU retirees in Portugal (excl. the UK)

(c) EU retirees in Spain (incl. the UK)

(d) EU retirees in Spain (excl. the UK)

Note: This figure plots the illustrations of the adjustments to the raw Eurostat migration data for two destinations Portugal and Spain.

G.3 Additional sources

OECD Central government personal income tax rates and thresholds data The Eurostat international migration of retirees data are then merged with measures of income tax rates applicable to pensioners and workers in each destination and origin country, drawn from the Central government personal income tax rates and thresholds database. Since migration decisions are driven by the total average (rather than marginal) tax liabilities, we estimate elasticities with respect to (one minus) the average tax rate (ATR) at different levels of

overall income of retirees to account for tax progressivity, which will be discussed in detail below.

Estimation of average tax rates. We estimate the average income tax rates for each country from 2009 through 2022 for an income profile I. In the OECD data, every country has a certain number of income brackets k with associated upper thresholds t_k and marginal tax rates r_k. Within every income bracket k, the tax liability L_k is computed as follows

$$L_k = \begin{cases} (I - t_{k-1})r_k & \text{if } t_{k-1} < I < t_k \\ (t_k - t_{k-1})r_k & \text{if } I \geq t_k \\ 0 & \text{otherwise} \end{cases}$$

where $k \geq 1$ and $t_0 = 0$. The total tax liability of income profile I is the sum of tax liabilities across income brackets k, and the average income tax rate applicable for income profile I is the ratio of the total tax liability in a year and income I. We perform this estimation on two income profiles EUR 24,000 and EUR 35,000 in our baseline analyses. The estimated average personal income taxes range from 0% to 34.8% for the first income profile and from 0% to 38.1% for the second.

Adjustments to Germany's non-linear marginal tax schedule. Unlike other countries in the OECD income tax rates and thresholds data set during the 2009-2022 period, Germany has *progressive* marginal tax rates[61] within a bracket (as opposed to *fixed* marginal tax rates in other countries) for the second and third brackets. Within these income brackets, the marginal tax rates vary linearly with income. Using this linear relationship and known lower and upper marginal tax rates of these brackets (14 and 24% for the second level and 24 and 42% for the third), we can estimate marginal tax rates within these brackets for an income profile I.

OECD Pensions at a glance data We rely on the OECD *Pensions at a glance* average tax rates applicable to retirees and workers in 2022. This database covers OECD countries

[61]For details, see https://www.lohn-info.de/einkommensteuertarif_2021.html and https://www.lohn-info.de/einkommensteuertarif_2017.html for years 2021 and 2017.

and hence most of the EU countries (and the United Kingdom) in our analysis, except for Bulgaria, Croatia, Cyprus, Malta, and Romania. Average tax rates for workers and pensioners are use to compute (log) ratio of keep rates (1-ATR) between the destination and the origin for pensioners and workers.

Eurostat average income data Another data source used in the validation of the cross-sectional predictions is the Eurostat net earnings series. It provides information on gross and net earnings as well as taxes and social security contributions by year and EU country.

CEPII Bilateral distance data We use the distance between capital cities from the CEPII bilateral distance dataset.

H Literature Review Computations

To calculate the migration effect statistics for each paper in Table 2, Panel A, we approximate the number of people who moved as a result of each policy (ΔN) using data and figures reported in the papers. To get the migration effect, we scale this change by the total population in column 8. For the last two columns, we compute $\Delta N \times Wage$ and scale by the personal income tax base and gross domestic product (nominal GDP). Total population, tax base, and GDP correspond to the final year of each reported time period. For values that require currency conversion, we use the exchange rate for that final year.

This Paper

To calculate the change in the number of foreign EU pensioners following the NHR regime in Portugal, we use data from Eurostat. Using Figure 4 and values from the synthetic control analysis (Appendix C), the change in number of foreign EU pensioners is approximately 26,512 in 2023. For income, we use the average pension income, 60,000 euros. Data on total population, income tax base, and GDP are downloaded from Portugal's national statistical institute, INE, using the following series:

- Resident population (Long series, start 1991 - No.) by Place of residence (NUTS - 2024), Sex and Age; Annual
- Taxable income (€) by Geographic localization (NUTS - 2024); Annual
- Gross domestic product (B.1*g) at current prices (Base 2021 - €) by Geographic localization (NUTS - 2024); Annual

Agersnap, Jensen, and Kleven (2020)

Agersnap, Jensen, and Kleven (2020) study the effect of a welfare scheme in Denmark in 2002 that reduced benefits for immigrants coming from outside the EU. They report the scheme reduced the flow of immigrants by 5,000 per year. Using Appendix Figure A.II we approximate the average monthly cash welfare benefits across household types in 2018 to be $\approx$ 1,245 euros. Because they also report welfare benefits are the primary source of income in the years following arrival for refugees, we set the wage equal to the total annual benefits. Population data is from the World Bank, data on GDP from Eurostat, and tax base

is from Danmarks Statistik (PSKAT2 table).

Bassetto and Ippedico (2023)

Bassetto and Ippedico (2023) exploit a 2010 tax break for high-skilled expatriates to study its effect on return migration to Italy. They report that a "quarter of eligible returnees post-2010 would not have returned absent the tax scheme" (p. 2). Using Figure 3a, the average post-2010 number of eligible returnees they report is $N = 4000$, implying the tax scheme induced an additional ≈ 1000 returnees. For wage, we use the baseline parameter for annual earnings for a representative returnee reported in Table A.11, equal to 57,600 euros. Data on Italy's population and GDP in 2018 are downloaded from Eurostat. Data on Italy's tax base is from the Ministero dell'Economia e delle Finanze Open Data IRPEF series.

Kleven, Landais, and Saez (2013)

Kleven, Landais, and Saez (2013) study the tax-induced migration of football players in Europe. We focus on the Beckham Law case, a special scheme for foreign workers that moved to Spain after 2003. To get the change in number of foreign football players post-Beckham law, we apply their synthetic control method used in Figure 2, but replace the y-variable from the share of foreign players to the number of players using the raw data. Comparing the synthetic control to the actual data corresponds to a change of 25 foreign players post-Beckham law by 2008. Wage is set to 398,175 euros, the average earnings for football players in Spain reported in Table A1. Population data is from the World Bank, data on GDP from Eurostat, and the tax base data are from Spain's Agencia Tributaria.

Kleven et al. (2014)

Kleven et al. (2014) study a preferential tax scheme for foreign high-earners in Denmark in 1991. The change in number of foreigners with earnings above the scheme threshold is estimated as $\approx 1,300$ by 2005, using Figure III, Panel A. Table I lists average earnings for scheme employees as 163,500 euros. Population data is from the World Bank, data on GDP from Eurostat, and tax base is from Danmarks Statistik (PSKAT2 table).