Paraísos Fiscales, Wealth Taxation, and Mobility*

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Abstract

This paper analyzes the effect of decentralized wealth taxation on mobility and the consequences for tax revenue and wealth inequality. Using linked administrative data, we exploit the decentralization of the Spanish wealth tax — after which all regions except Madrid levied positive tax rates. By five years after the reform, the stock of wealthy individuals in Madrid increases by 9%, while smaller tax differentials between other regions do not matter. A theoretical model of evasion and migration rationalizes evasion as the dominant mechanism. Although the tax haven reduces the effectiveness of raising revenue and exacerbates regional wealth inequalities, our results imply that decentralized wealth taxation is feasible in the short-run. Counterfactual exercises show that federal interventions, such as minimum tax rates, can improve the effectiveness of decentralized wealth taxation.

Keywords: Fiscal Decentralization, Fiscal Federalism, Wealth Taxes, Mobility, Inequality, Tax Havens, Evasion; **JEL**: E21, H24, H31, H73, J61, R23

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Rising shares of capital income and the associated increases in inequality observed in many countries have spurred new interest in the taxation of wealth as a revenue source to fund public programs and reduce wealth disparities. Many policy discussions focus on whether wealth taxes are enforceable and if so at which level of government, as taxpayers might respond to wealth taxes by sheltering their assets in tax havens (Alstadsæter et al., 2019) or by moving to regions that do not levy a wealth tax. The risk of tax-induced mobility was indeed a motivating factor in Piketty (2014)'s call for a *global* wealth tax. A central tenant in public finance concerns the "tenable range" of local government redistributive policies, where the classic wisdom is that competition among governments and the resulting mobility undermines progressive redistribution, and for this reason, redistribution is intrinsically a "national policy" (Stigler, 1957; Musgrave, 1959). However, the passage of an international, supranational (e.g., European Union) or even a national wealth tax in heterogeneous federations is politically difficult. This might explain why some countries have decentralized state-level wealth taxes (e.g., Spain, Switzerland), or recently proposed decentralized wealth taxes (e.g., California and New York), and why EU member states are unable to come up with a joint proposal for wealth taxation.

Despite the importance of wealth taxes in recent policy and academic debates, important questions remain unanswered. How large are the mobility responses to wealth taxation and what is the role of tax havens? Are these mobility responses large enough to threaten the "tenable range" of local wealth taxation? How do these responses shape revenues and wealth inequality dynamics at the subnational level?

We break new ground on these issues by using variation in wealth tax rates across sub-national regions (*Comunidades Autónomas*) within Spain. Prior to 2008, Spain had a mostly uniform wealth tax, which was briefly suppressed. It is only after its reintroduction in 2011 that regions started to substantially exercise their autonomy to change wealth tax schedules under this residence-based tax system. Madrid plays a special role in this setting as an internal *paraíso fiscal* with a zero effective tax rate on wealth and filing requirements only for the ultra-wealthy, which facilitates secrecy.

Several features make this setting such that decentralized redistribution is unlikely to be tenable. First, a tax on wealth provides strong incentives to move because the tax is paid every year. Second, Spanish regions are economically integrated and high wealth individuals are likely to own homes in multiple regions, facilitating mobility. Third, an individual's residence for tax purposes can change either because of real migration or a fraudulent declaration of one's primary residence; the latter might occur with the taxpayer simply misreporting the number of days spent in her second home. Finally, and most critically, the presence of an internal tax haven creates large tax differentials. Much like Florida's zero-rated income tax dominates the tax-induced mobility landscape, so too does Madrid's status as a "fiscal paradise."[1] Although characteristics of our institutional setting, these features are common within other federations and within federalist-like supranational institutions.

We assemble administrative wealth tax records for a longitudinal sample prior to the suppression of the wealth tax (2005-2007) and merge them to administrative personal income tax records before and after decentralization (2005-2015). The individual personal income tax records contain information on fiscal residence—which is unique to all personal taxes—making it possible to follow the location of high-wealth individuals before and after decentralization.

First, we aggregate the individual data to the region-year-wealth level and compare the population of wealth tax filers in Madrid to that in other regions. We find a 9% increase in the relative population in Madrid by five years after decentralization. Given that Madrid represents only 20% of high-wealth individuals, this implies that the population of other regions only falls by 2%. A threat to identification would come from a shock that makes Madrid relatively more attractive compared to other regions. To address this, we exploit information on high capital income individuals not subject to the wealth tax. Any shock threatening our results must thus only affect wealth tax filers, but not high capital income non-filers. We document non-filers do not view Madrid any more attractive after the reform and migration effects follow tax changes and do not predate them. Moreover, most wealth tax filers are rentiers or have limited labor income, so that regional differences on labor income taxes are irrelevant. Over the five-year period following decentralization, the mobility elasticity with respect to the net-of-tax rate on *wealth* is 7.5, which translates to an elasticity with respect to a capital *income* tax of 0.33. This elasticity is in the range of the income-tax mobility literature (Kleven et al., 2020) and the elasticity of taxable income (Saez et al., 2012), suggesting mobility inefficiencies are similarly small.

Second, we exploit an orthogonal source of variation relying on the progressivity of

[1] Hines and Rice (1994) define tax havens as jurisdictions that have low tax rates or loopholes on particular assets. Madrid is unlike much of the stereotypical tax competition and tax havens literature (Hines, 2010; Dharmapala and Hines, 2009), where low-tax jurisdictions are small.

the wealth tax in the context of an individual location choice model. This specification allows for region-by-year fixed effects, which control for shocks that may influence preferences for a particular region in a particular year. In line with the aggregate analysis, we find that only the tax rate of Madrid matters for relocation choices. This model also allows us to analyze heterogeneous effects across individuals. We document larger effects at the top of the wealth distribution.

To shed light on the mechanisms behind the mobility responses, we build a theoretical model in which taxpayers have the choice over migrating or evading. In a standard mobility model without evasion, even a small tax differential will attract some individuals at the margin. However, if audit probabilities are sufficiently small—as we verify empirically—an individual who finds it advantageous to evade will *never* find it optimal to falsely declare a region *other* than the tax haven. Given our empirical analysis shows that almost all fiscal residence changes involve Madrid, the theoretical model indicates our results are likely driven by evasion rather than real responses.

We then use our estimates to study the effect of eliminating tax-induced mobility on wealth and income tax revenues by means of counterfactual simulations. We find that Spain foregoes on average 5% of total wealth tax revenue due to tax-induced mobility, with substantial differences across regions. We also document important differences in foregone income tax revenue across regions, but little income tax revenue is foregone at the national level.

Federal systems have a variety of tools to mitigate these mobility effects. An unresolved theoretical debate is whether tax harmonization or minimum tax rates are Pareto improving (Kanbur and Keen, 1993) from the revenue standpoint. We simulate the evolution of revenue under a harmonized wealth tax system or a system with minimum tax rates. Harmonizing leads to large revenue gains, mainly due to the added tax revenue from taxing the base in Madrid. However, we show that this is not a revenue improvement for all regions unless harmonization is to a rate that is very close to the maximum decentralized rate, which might be politically difficult to implement. In contrast, a minimum tax rate increases revenue in *all* regions and it could be politically more feasible, as it allows for some diversity in taxes.

Finally, we study the interplay between the observed mobility responses and regional wealth inequality dynamics at the subnational level.[2] To do this, we build

[2]For the literature on wealth inequality and taxation, see Kopczuk and Saez (2004) Piketty and Saez (2014), Piketty and Zucman (2014), Kopczuk (2015), Jones (2015), Saez and Zucman (2016),

new top national and regional wealth distribution series. The main novelty is that we decompose the wealth shares at the *subnational* level: this is the first attempt to construct harmonized top wealth shares across sub-national regions. Most prior studies of spatial inequality focus on income inequality, economic opportunity or poverty and emphasize the importance of analyzing spatial variation to determine optimal policy responses (Chetty and Hendren, 2018a; Chetty and Hendren, 2018b). Our new regional wealth distribution series show the existence of significant differences in both the level and trend in wealth concentration across regions.

We take advantage of the regional wealth series to simulate the counterfactual spatial dynamics of wealth inequality absent tax-induced mobility. Between 2010 and 2015, the top 1% wealth share growth rate in Madrid (16%) was almost double the growth rate absent tax-induced mobility (8.7%). This finding contrasts with the decline in the top 1% wealth share in the rest of Spain after decentralization. Overall, Madrid's zero-tax rate has exacerbated regional wealth inequalities. Even though much of the mobility is due to tax evasion, increases in regional wealth inequality are relevant as wealth concentration is highly correlated with political influence (Gilens and Page, 2014)—the fiscal residence is where one votes and thus lobbies politicians.

Whether the moves are real or fraudulent is also irrelevant from the revenue standpoint, as both fraud and real moves equally reduce revenue. Fraudulent mobility is also unlikely to have large economic effects. Thus, contrary to studies documenting economic misallocation (Fajgelbaum et al., 2018), our analysis indicates that economic externalities on the receiving or sending region are likely small. Moreover, because most movers are older individuals and taxation follows the residence and not the source principle, even real moves do not necessarily result in the wealthy contributing to the labor force or relocating business or property.

Taken together, our results challenge the conventional wisdom from Musgrave (1959) and Stigler (1957) regarding the assignment of redistributive policy to the central government. Progressive redistribution in the form of subnational wealth taxes is tenable at raising revenue in the short-run, as the elasticity estimates are such that regions are well to the left of the Laffer curve peak.[3] Although the effect on Madrid's tax base is large, the effect on any one other region is small. Nonetheless, the

Smith et al. (2019b), Saez and Zucman (2019a), and Kopczuk (2019). Alvaredo and Saez (2009) and Bonhomme and Hospido (2017) document inequality in Spain.

[3]For recent work on the Laffer curve, see Miravete et al. (2018) and Saez and Zucman (2019a).

rise in wealth concentration might lead to increased political influence in the capital city, which raises concerns about the viability of decentralization in the long-run.

This paper contributes to three main strands of the literature. First, our work relates to the literatures studying the effects of fiscal decentralization on economic growth (Hatfield and Kosec, 2013; Hatfield, 2015) and the effect of decentralized taxes on spatial misallocation.[4] As noted in Agrawal et al. (2021), state and local tax policy provides interesting applications of many classic problems in economics (externalities, imperfect competition, imperfect information, and equity). In our setting, the taxing decisions of Madrid impose a fiscal externality on residents of other regions, which we precisely estimate. Moreover, subnational governments differ in their preferences for redistribution and our study sheds light on whether wealth taxes can be decentralized.

Second, the empirical literature studying behavioral responses to wealth taxation (Scheuer and Slemrod, 2021) has focused on the estimation of taxable wealth elasticities,[5] and has barely studied tax-induced taxpayers' mobility (Kleven et al., 2020). One exception is Brülhart et al. (2016), which shows that behavioral responses in Switzerland can mostly be attributed to changes in wealth holdings rather than mobility across localities. However, all Swiss cantons (must) levy a positive wealth tax, so that the tax differences are less salient, and some assets are taxed under the source principle, which creates much smaller incentives to relocate. Thus, our paper is the first to study mobility responses to adopting or not adopting a wealth tax, which is critical for understanding the suitability of decentralized wealth taxation.

Finally, our work relates to the literature on the effect of taxes on mobility.[6] Studies on wealth-tax induced mobility are, however, scant and there is no evidence about how these responses shape tax revenues and inequality across receiving and sending regions. We focus on tax competition from zero-tax regions in a setting commonly believed to be the least tenable for decentralized taxation. Furthermore, the prior literature has assumed that observed moves are real. Our results reveal that taxpayers may falsely manipulate time in a given state or country for tax purposes.

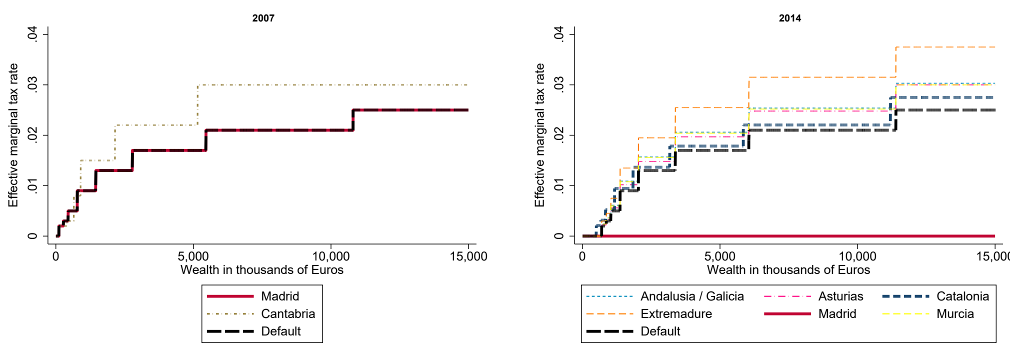
[4]Studies on spatial misallocation and local taxes include Fajgelbaum et al. (2018); Suárez Serrato and Zidar (2016); Fuest et al. (2018); Eugster and Parchet (2019); Giroud and Rauh (2019).

[5]With respect to the elasticity of taxable wealth, see Jakobsen et al. (2020), Zoutman (2016), Seim (2017), Londoño-Vélez and Ávila-Mahecha (2020), and Durán-Cabré et al. (2019).

[6]At the margin, taxes appear to be a factor in the location choices of top earners (Agrawal and Foremny, 2019, Akcigit et al., 2016, Kleven et al., 2013, Kleven et al., 2014, Schmidheiny and Slotwinski, 2018, Moretti and Wilson, 2017, Young et al., 2016).

1 Institutional Details

The Spanish wealth tax was introduced in 1978 (Law 50/1977), but it was briefly suppressed between 2008 and 2010. All regions are subject to this tax except for Basque Country and Navarre, which due to their special status are autonomous to design most taxes, including the wealth tax. The tax schedule is progressive and it is applied to the sum of all individual wealth components net of debts. Over the period 2002-2007, the filing threshold was 108,182.18 Euro (approximately 2.7% of the total adult population in 2007). Since 2011, the threshold was increased and it is only levied if net taxable wealth (i.e., taxable assets - liabilities) is above 700,000 Euro (approximately the top 0.5% of the 2015 total adult population). Given the tax is on individual, and not joint wealth, joint assets are split among spouses.[7]



(a) 2007 (centralized)

(b) 2014

FIGURE 1: Marginal Tax Rates across Regions

Notes: This figure depicts marginal tax rates and brackets across Spanish regions in 2007 and 2014. We show the variation in 2014, as it is the year with the most common variation in tax rates in our post period. The figures have been constructed after digitizing the regional tax books (*Libros de tributación autónomica*) published by the Spanish Ministry of Finance. We also show the central (default) schedule that would go into effect if regions passed no legal modifications. Other years are similar to 2014, with minor differences. Important for our analysis, Basque Country and Navarre also have a wealth tax which is similar to the default tax schedule, as shown on Figure A1.

Since 1997, the rights to modify the amount exempted and the tax rates were ceded to the regions, under the condition of keeping the national statutory minimum bracket and minimum marginal tax rates (default schedule). In 2002, the regions were given the right to change or include deductions in the wealth tax and the condition of

[7] The only relevant component of wealth that is fully excluded in wealth tax records are pension funds, which account for less than 1% of total net wealth for the top 0.5% wealth holders in Spain (Martínez-Toledano, 2020). For further details, including exempted assets and valuation, see Appendix A.1.

requiring a minimum bracket and marginal tax rates was suppressed. All regions kept the national wealth tax schedule (i.e., 0.2-2.5%) during the 1990's and early 2000's. In the mid-2000's a few small changes were implemented by some regions. Thus, it is only after its reintroduction in 2011 when significant differences in the wealth tax emerge. For instance, Madrid decided to keep the wealth tax suppressed after 2011, contrary to Andalusia and later regions such as Catalonia and Extremadure who have raised the marginal tax rates above the default schedule. The first panel of Figure 1 shows the marginal tax rates under the centralized wealth tax and the second panel shows the variation in 2014, the year with the most common variation.

The reintroduction of the wealth tax was authorized in September 2011 and initially came with uncertainty over when or if it would actually be implemented by regional governments. The authorization was sunset to apply retroactively for 2011 and the following year. To have a different tax schedule than the national default, regions must actively pass a law. Immediately after the central government's decision, the regional government in Madrid announced the suppression of the wealth tax and applied a 100% tax credit. However, many other regions did not formulate their wealth tax schedules immediately, but did so by two years later. In September 2012, the central government announced the extension of the wealth and this procedure continues annually (Durán-Cabré et al., 2019).

Madrid's deviation is similar to many international tax havens: it sets a lower tax rate on particular assets (wealth), is characterized by a lack of (full) cooperation on enforcement, and facilitates information secrecy, as only individuals with gross wealth above 2,000,000 Euro are obliged to file a wealth declaration. However, it is different from most tax havens, which are traditionally small and not an economic center like Madrid is to Spain. There are several potential explanations why Madrid does this and why the rest of regions tolerate it. First, Madrid might have the fiscal capacity to do this and brands itself as a tax-friendly (pro-growth) region. Second, Madrid's higher concentration of wealth and income could be attributed to more political influence (Saez and Zucman, 2019b) lobbying for lower tax rates. Finally, any intervention by the central government comes with large political cost, but with little benefit, given all tax revenue accrues to the regions.

For this study, it is important to know the definition of fiscal residence and to understand how taxpayers can change their fiscal residence by "*moving*". The fiscal residence is the property that constitutes the primary residence of the taxpayer and it is the same for all personal taxes, including the personal income tax. For a property to be a primary residence, the wealth taxpayer needs to have lived there continuously over at least three years. An exception applies in case of death of a family member, marriage, divorce, first job, job transfer or any other analogous circumstance (Law 40/1998, Law 35/2006). Updating the fiscal residence for tax purposes can be directly done on the tax form. Despite the legal regulations preventing the immediate change of fiscal residence, taxpayers find it easy to change their fiscal residence either by pretending they live in a rented property, in their secondary residence (86% of wealth taxpayers had at least one secondary residence in 2010), or in the residence of a relative. Auditing falls to both the central and regional authorities. However, enforcement in a multi-tier setting creates coordination problems, and verifying the primary address comes with administrative costs to the tax authorities.

The decentralization of the wealth tax should be considered in the context of fiscal decentralization in Spain. The central government also passed provisions allowing regions to set the tax brackets and tax rates on their half of the personal income tax on *labor*, which created incentives for high (labor) income individuals to move. Spain operates a dual income tax system, under which capital income is taxed at a common schedule. Thus, for high-wealth individuals who obtain a substantial fraction of their income from the return to capital, decentralization of the labor income tax provided little additional incentive to move. Figure A2 shows that approximately 75% of individuals that would be subject to the wealth tax in 2010 have labor income below 90,000 Euro. As shown in Agrawal and Foremny (2019), the incentives to move due to the labor income tax are negligible for incomes below 90,000 Euro in our period of study. In the individual analysis, we perform robustness checks and show that results are not affected by personal income tax differences.

Inheritance taxes have been decentralized since 1997, but regions did not exercise this right until the mid-2000s. In particular, Madrid adopted a tax credit of 99% on close relatives starting already in 2007, such that there is no additional incentive created by this tax starting in 2011. Moreover, the place of residence for this tax is defined based on the location of the deceased over the last five years before death. Given this long duration of proof, and the fact that we focus on five years following decentralization, we expect little of the mobility we identify to be a result of this tax.[8]

[8]See Appendix A.1 for a more detailed discussion about the taxation of capital in Spain.

2 Data

We combine two administrative data sets from the Spanish Institute of Fiscal Studies and the State Agency of Fiscal Administration. The first data set (*Panel de Declarantes del Impuesto sobre la Renta de las Personas Físicas 1999-2015*) consists of a 4% longitudinal sample of individual personal income tax returns, that contains all items reported on the annual personal income tax declaration. This includes the amount and source of income, personal characteristics (e.g., age and gender), and, critically, the fiscal residence of the tax filer. The micro-files are drawn from 15 of the 17 autonomous communities of Spain, in addition to the two autonomous cities, Ceuta and Melilla. We do not observe tax data for the two autonomous regions of Basque Country and Navarre, as their fiscal regime works independent from the regions of the Common Fiscal Regime. Nonetheless, as we have seen in the previous section, both charge a positive wealth tax with a very similar tax schedule to the regions other than Madrid, so that we do not expect this to bias our results.

The second data set (*Panel de Declarantes del Impuesto sobre el Patrimonio, 2002-2007*) is a longitudinal sample of individual wealth tax returns, which contains detailed information about wealth taxpayers' assets and liabilities. These data are available for individuals included in the income tax panel who were subject to the wealth tax between 2002-2007. No centralized data are available after the wealth tax was suppressed. As the legal definition of fiscal residence for wealth and income taxes is the same, we rely on the income tax returns which are available up to 2015.

We have also been granted access to the universe of wealth tax records for Catalonia following decentralization. We use this additional data for robustness checks on the wealth extrapolation method and the tax simulator. Even if we had wealth tax information for all regions, these data would not be sufficient, as national law only requires some residents in zero tax regions (i.e., Madrid) to file a tax return.

The income tax dataset is stratified by region, income level and main source of income, and it oversamples the top of the distribution. Given this stratification, the data are meant to be representative of the personal income tax distribution. We reweight the data to be representative of the *total population* of both wealth taxpayers and personal income taxpayers across regions. To do this, we assume that the sampling probability for wealth tax filers is constant within a region and a year. As we will show, results are robust to not reweighting.

The main variable we use is the fiscal residence, which we directly observe in the annual tax records. However, we need to estimate wealth for the years for which wealth tax records are not available (2008-2015) to define treatment status in some of our specifications and to conduct the counterfactuals. We do so by computing annual rates of return for each asset category as the ratio of the flow to the stock using national accounts. Using these returns, we then extrapolate individual wealth from 2008 onward using reported individual wealth in 2007 as an anchor. All details and robustness checks about our extrapolation method are in Appendix A.2.

Our analysis also requires knowing the tax liabilities an individual pays in their region of residence and all possible counterfactual regions of residence. As there exists no publicly available wealth tax simulation model for Spain, we have constructed our own tax simulator. For details regarding the tax simulator see Appendix A.3.

2.1 Treatment and Comparison Groups

In this section, we define the treated and comparison individuals that we will use in the subsequent analyses. As the treatment status must be defined using data prior to the wealth tax reintroduction, we face a trade-off between using the raw 2007 administrative data or the 2010 extrapolated data.

In our baseline approach, we define treatment based on individuals that are reasonably believed to be paying wealth taxes under the main 700,000 Euro filing threshold. We classify an individual as being in the treatment group if their taxable wealth in 2010 is estimated to be above 700,000 Euro. We refer to this group as the **"2010 wealthy."** The advantage of this approach is that the treatment is based on the immediate year prior to decentralization, but with the limitation of using extrapolated wealth data.[9] The results are nearly identical if we use observed 2007 wealth (**"2007 wealthy"**) to define treatment, as only 5% of individuals are classified differently.

For the comparison group, our preferred specification includes anyone who reports large dividends on their personal income tax form at least once during the wealth tax suppression period, but did not file wealth taxes in 2007. In 2007, Spain introduced

[9] If wealth taxpayers illegally hide a substantial share of their taxable wealth under the centralized regime, we would not observe this wealth in tax records and could mismeasure their "true" treatment status. Nonetheless, given that there is third party information reporting on nearly 90% of total taxable wealth (i.e. commercial and residential properties, land, and financial assets deposited in domestic banks), misreporting should only have a minimal effect on treatment status.

an exemption of up to 1,500 Euro on dividends, so that this group only includes individuals that have more than 1,500 Euro of dividend income. We refer to this group as **"High dividend non-filers."**[10] This is our preferred group because they have a significant amount of capital income, but not enough taxable assets to move for expected wealth tax increases. Alternatively, we use personal income tax filers that were not wealth tax filers in 2007 as a comparison group (**"2007 non-filers"**).

3 Empirical Analysis

3.1 Descriptive Evidence

As visual evidence, we construct heat maps showing the migration flows of the "2010 wealthy" between regions. Figure 2(a) shows the net migration patters of wealth tax filers to a given destination from a given origin region after the reform. To read the heat map, pick a destination row. If the cell is dark red, then net migration (in-flow from the "origin" region minus out-flow to the "origin" region) is stronger towards that "destination" region. If the cell is blue, the opposite is true. Figure 2(b) shows the change in net migration as the difference of annual net migration in the pre- and post-reform period. We construct this figure by calculating the annual average migration flows separately for the years prior to and after decentralization. We then difference this data such that dark red cells see large increases in net migration following the decentralization of the wealth tax, while blue pairs see net declines to that destination. Madrid is the strongest net recipient of wealth tax filers and its annual migration patterns increase dramatically relative to the period without a wealth tax. Almost every other region is losing high-wealth taxpayers to Madrid.[11]

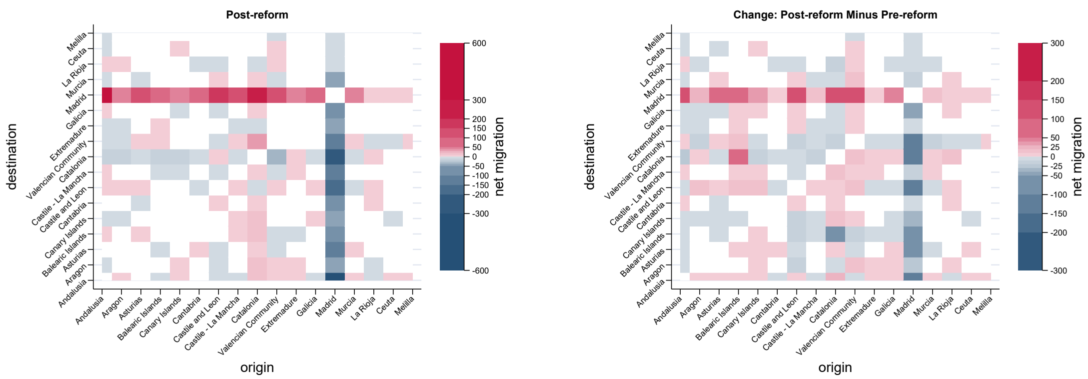
3.2 Aggregate Analysis

3.2.1 Identification Strategy

To study the effect of Madrid's status as a tax haven on mobility, we build tabulations from the tax micro files. We focus on the stock of wealthy *taxpayers* rather

[10] While it is unlikely anyone in this group could become a filer in subsequent years as the threshold was significantly raised, individuals might, for instance, receive a large bequest.

[11] More descriptive evidence and summary statistics can be found on Appendix A.4.



(a) Post-Reform

(b) Change: Post-reform Minus Pre-reform

FIGURE 2: Net Flows Between All Region Pairs

Notes: This figure depicts net mobility patterns. Panel (a) shows the (annual average) net flow of wealth tax filers to a destination region following the wealth tax decentralization (2011-2015). Panel (b) shows the change in the (annual average) net flow of wealth tax filers to a destination region in the five years following decentralization relative to the (annual average) net migration of wealth tax filers in the years prior to decentralization (2005-2010). Values in red indicate a net in-migration from the origin region while blue indicate a net out-migration to the origin region. Folding the graph along the 45 degree line yields the same values in absolute value, but with opposite signs.

than wealth, as we directly observe their fiscal residence across time. We rerun the analysis using the stock of wealth as a robustness check. In our preferred specification, we aggregate the counts focusing on individuals that appear in the personal income tax data for all years from 2008 to 2015. We also present trends for a longer balanced sample covering the period 2005-2015 to show that results are not affected by the onset of the 2008 financial crisis. We prefer the shorter sample because it is more representative of the population of wealth tax filers.[12] We total the number of individuals and the amount of wealth by region, year and treatment-comparison group by tracking the fiscal residence.

We rely on an event-study design to carry out the analysis. Let r index the region, t index time and M_r be an indicator equal to one for the region of Madrid, which sets no wealth tax rate, and zero for all other regions. In this way, we compare the relative evolution of the number of wealthy individuals, N_{rt}, in Madrid relative to all

[12]We do not use an unbalanced sample because when taxpayers are added to the panel, they are meant to be representative of the region-income distribution and not of the region-wealth distribution, so that the sample is less representative of wealth tax filers (e.g., younger, lower wealth).

regions other than Madrid before and after decentralization. We estimate:

$$\ln N_{rt} = M_r \cdot \left[\sum_{y=-5}^{-2} \theta_y \cdot \mathbf{1}(y = t - 2011) + \sum_{y=0}^{4} \beta_y \cdot \mathbf{1}(y = t - 2011) \right] + X_{rt}\alpha + \zeta_r + \zeta_t + \nu_{rt}, \tag{1}$$

where $\mathbf{1}(y = t - 2011)$ are indicators for each event year y and the year prior to the reform is omitted. θ_y corresponds to the evolution of the number of wealthy individuals in Madrid *relative* to other regions in the years prior to 2010, while β_y represents the evolution following the reform. The vector $X_{r,t}$ contains controls such as public spending on various programs, regional demographics, amenity, economic, and other tax controls, while ζ_r and ζ_t are region and year fixed effects.[13] The other tax controls include the mean average tax rate on labor income, which is calculated by simulating tax rates using observed personal labor income.

As supporting evidence of our identifying assumptions, θ_y should be close to zero. A positive treatment effect for Madrid would indicate $\beta_y > 0$ for wealth tax filers and given our focus on the stock, should increase gradually. As in Akcigit et al. (2016), we assume that there is a sufficiently large number of regions, such that the tax rate of any region has a negligible impact on the number of wealthy in other regions. If Madrid's gain is the loss of others, we overestimate the true elasticity of the stock in Madrid. However, it is possible to derive a bias correction. If movers to Madrid are proportionally distributed across Spanish regions based on population, then because Madrid represents approximately 20% of wealth tax filers, the bias is $(1/5)\beta_y$. If instead, the flow to Madrid comes from one region of a similar size, then because the regression contains 16 comparison regions of which only one is affected by spillovers, the bias in the true effect is $(1/16)\beta_y$. Nonetheless, the fact that our estimate may be an upper bound makes it possible to evaluate whether decentralized redistribution is possible in a scenario with the largest possible elasticity.

The most relevant threat to identification would come from a shock that makes Madrid relatively more attractive compared to other regions. We thus add an additional layer of differencing via the comparison group in each region year in a triple interaction design. Let $f = T, C$ index the treatment and comparison groups defined

[13] These covariates include unemployment, GDP per capita, long term unemployment, R&D spending, poverty, high school/tertiary education, gender, median age, fraction of elderly, fertility/mortality rate, heating/cooling degree days, and public spending on certain government services.

in section 2.1, respectively. We can then define an indicator variable W_f that equals one for the treatment group and zero for the comparison group. We estimate:

$$\ln N_{rft} = W_f \cdot M_r \cdot \left[\sum_{y=-5}^{-2} \theta_y \cdot \mathbf{1}(y = t - 2011) + \sum_{y=0}^{4} \beta_y \cdot \mathbf{1}(y = t - 2011) \right] + X_{rt}\alpha + \zeta_f + \zeta_r + \zeta_t + \nu_{rft}, \quad (2)$$

where X_{rft} now includes all interactions of W_f, M_r, and year dummies and ζ_f are treatment group fixed effects. This added difference removes any common changes that also affect the comparison group, such as other state policies, economic conditions, or amenities that may have made Madrid a more attractive place for high wealth individuals. We cluster the standard errors at the regional level to allow for an arbitrary correlation within region over time. Spain has only seventeen regions (clusters), so that the variance matrix estimate will be downward-biased. We follow Cameron and Miller (2015) and implement the percentile-t wild cluster bootstrap, imposing the null, in order to present accurate p-values.

Given that migration to Madrid is critical due to its zero tax status, the prior approach using Madrid as a treatment indicator is justified. However, other tax differentials between regions may matter. We thus model the tax differential between each region. To obtain an elasticity of the stock, we estimate

$$\ln(N_{rt}) = \epsilon \cdot \ln(1 - \tau_{rt}) + \zeta_r + \zeta_t + X_{rt}\alpha + \nu_{rt}, \quad (3)$$

where N_{rt} is the number wealth tax filers (or amount of wealth) in region r in year t, $1 - \tau_{rt}$ is the wealth weighted net-of-average-tax rate, and all other variables remain the same. Because the net-of-tax rate is close to 1, the coefficient ϵ can be interpreted as a classical elasticity or alternatively, ϵ is (approximately) the semi-elasticity corresponding to a one percentage point change in the net-of-tax rate. In addition, we can augment the design to include region-time data for both the treatment and comparison group. To do so, we add all appropriate interactions with the treatment indicator W_f and estimate the coefficient on $W_f \cdot \ln(1 - \tau_{rtf})$.

As moving is an extensive margin response, the decision to move is based off the average tax rate (ATR). We first simulate the ATR for every wealth tax filer in every region and year, using their time-varying wealth and our tax calculator. We then construct the mean ATR as a weighted average across all individuals. We weight by the amount of 2007 (observed) wealth, following Smith et al. (2019a). The use of a wealth weighted average tax rate is justified because individuals with higher wealth and hence, higher tax liabilities, respond more strongly to the tax, as we will show in the individual empirical analysis. Thus, this metric corresponds to the mean rate applied to the average Euro of wealth. As we will show, using a raw average across individuals lowers the ATR, which increases the elasticity.[14] Nonetheless, with this ATR we also obtain an estimate consistent with the income-tax mobility literature.

To address measurement error and possible endogeneity resulting from taxable wealth changing over time, we instrument for $\ln(1 - \tau_{rt})$. We use the mechanical net of average tax rate $\ln(\overline{1 - \tau_{rt}})$, that is, the simulated rate holding wealth constant at its *2007 (observed) level*. This latter tax rate uses only statutory variation in the ATR. Because wealth is observed to us in 2007, there is no measurement error in 2007 wealth that may be correlated with time-varying tax rates using extrapolated wealth.[15] Alternatively, we instrument with the binary $Madrid \times Post$ variable. The use of these two instruments provides local average treatment effects (LATE) for two different sub-populations, giving us some intuition of which regions drive the effects. In the case of $Madrid \times Post$, the instrument only induces a change in the tax of Madrid relative to other regions. In this way, we think of the LATE interpretation as identifying the effect of Madrid's non-adoption of a wealth tax. When we use the simulated $\overline{1 - \tau_{rt}}$ instrument, a change in the instrument induces a change in the tax rates of all regions and, thus, the elasticity is with respect to all differentials.

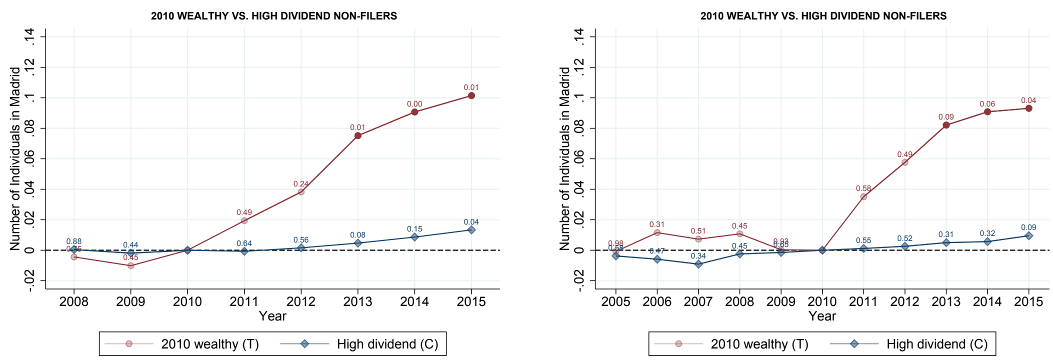
3.2.2 Results

Figure 3 shows θ_y and β_y from estimation of (1). We present separately estimated coefficients for the treatment and comparison groups, so that the reader can observe the trends in both. All panels use our preferred comparison group, "High dividend", but we have verified that the results look almost identical when using the "2007 non-filers" comparison group. The left and right panels present results using the balanced

[14] As shown in Moretti and Wilson (2017), using an ATR at the 95th percentile versus the 99.9th percentile results in an elasticity that is almost twice as large in some specifications.

[15] Although one may ideally want to fix wealth in 2010, then potential measurement error affecting time-varying taxes based on extrapolated wealth and the instrument could be correlated. Holding fixed wealth at its realized value avoids this problem.

2008-2015 and 2005-2015 samples.



(a) Short panel

(b) Long panel

FIGURE 3: Event Study of the Number of Individuals in Madrid, 2010 Wealthy

Notes: This figure shows the coefficients from (1), estimated separately when balancing the sample over different time periods. In panel (a), individuals must appear in the data for every year from 2008 to 2015. In panel (b), individuals must appear in the data for every year between 2005 and 2015. The series in red (circles) shows results for the specification where N_{rt} is the number of the "2010 wealthy" treatment group while the series in blue (diamonds) shows the results where N_{rt} is the number of the "High dividend" comparison group. We cluster standard errors at the regional level. Because we have a small number of clusters, we implement the percentile-t wild cluster bootstrap, imposing the null hypothesis, and report p-values above the series on the graphs. Statistically significant coefficients are in dark colors and the numbers on the graph are the p-values.

For the "2010 wealthy," the number of filers located in Madrid steadily increases following decentralization. The relative stock of wealthy individuals becomes statistically different three years after decentralization. By five years after the reform, Madrid's relative stock of wealthy individuals increases by approximately 9%. Although the relative stock of wealthy individuals in Madrid increases in the two years after the reform, these result are not statistically significant for two main reasons. First, although migration *flows* may jump on impact, the *stock* is a slower moving variable. Second, the first two years of decentralization were characterized by a large amount of uncertainty and a retroactive application of the tax, which may have hindered any type of tax reoptimization. In subsequent analysis, we focus on the shorter balanced sample, which is more representative of the wealthy population.

In support of the main identifying assumption, we find no significant pretrends in the relative attractiveness of Madrid to other regions. Critically, θ_y being close to zero shows that mobility effects follow tax changes and do not predate them.

Although the comparison group shows a minor upward trend following the reform, this increase is statistically insignificant and will only result in slightly smaller estimates using (2). Moreover, this suggests that it is unlikely there are unobservable factors making Madrid a relatively more attractive region to wealth tax filers. Table 1 (Panel I) presents a simple design that uses $W_f \times M_r \times Post$ rather than the generalized (dynamic) design above. This simpler specification identifies an average effect across all post-reform periods, which given the dynamic effects noted above, will understate the cumulative effect. For this reason, in Panel II, we also present the cumulative effect given by the coefficient on the interaction with the Madrid-filer dummies and the year dummy for 2015 from the estimation of (2). Consistent with the event study figures above, estimating (2) using the "High dividend" or the "2007 non-filers" comparison groups only lowers the effects relative to (1) by a small amount. Adding controls, including treatment/comparison group-specific means of regional personal income average tax rates, only lowers the coefficients slightly.

EVIDENCE FROM MODEL WITH TREATMENT AND COMPARISON GROUP

	Comparison: High Dividends				Comparison: All Non-filers			
	Panel I: Average Effect							
	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)	(1h)
Madrid x Post x W_f	0.090	0.074	0.060	0.052	0.095	0.079	0.061	0.053
Uncorrected SEs	(0.008)	(0.008)	(0.012)	(0.011)	(0.008)	(0.008)	(0.012)	(0.012)
Bootstrap p-values	0.114	0.000***	0.000***	0.000***	0.078*	0.000***	0.000***	0.002***
	Panel II: Cumulative Effect							
	(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	(2g)	(2h)
Madrid x 2015 x W_f	0.119	0.104	0.100	0.085	0.126	0.071	0.105	0.093
Uncorrected SEs	(0.008)	(0.011)	(0.009)	(0.011)	(0.008)	(0.007)	(0.009)	(0.013)
Bootstrap p-values	0.068*	0.002***	0.000***	0.000***	0.034**	0.004***	0.004***	0.000***
# obs	272	272	272	272	272	272	272	272
Spending Controls	no	yes	yes	yes	no	yes	yes	yes
Economic Controls	no	no	yes	yes	no	no	yes	yes
Amenity Controls	no	no	yes	yes	no	no	yes	yes
Demographic Controls	no	no	yes	yes	no	no	yes	yes
Income Tax Controls	no	no	no	yes	no	no	no	yes

TABLE 1: Effect of Madrid's Tax Haven Status: Aggregate Analysis

Notes: Panel I presents coefficients from a simplified version of (2) that only uses Madrid × post × filer rather than the event study specification. Panel II shows the coefficient on the final Madrid × filer × event year dummy from regression (2). In all specifications, N_{rt} is the number of wealth tax filers based on the "2010 wealthy" treatment group. The four three columns use the "High dividend" as the comparison group, while the last four columns use "2007 non-filers" as the comparison group. We cluster standard errors at the regional level. Because the number of clusters is small, we implement the percentile-t wild cluster bootstrap, imposing the null hypothesis, and report p-values, *** p<0.01, ** p<0.05, * p<0.1.

Table 2 presents the elasticity estimates for the number of filers. Model (a) is estimated using OLS, while models (b) and (c) present IV estimates using the simulated net-of-tax rate and the $Madrid \times Post$ interaction, respectively. All models have the full set of controls. Panel I shows results without the additional layer of differencing and Panel II the results including the additional layer. Focusing on Panel II, the first instrument yields an elasticity of 5.1. In other words, a one percent increase in the net-of-tax rate, which corresponds to an (approximately) 1 percentage point decline in the average tax rate, increases the number of filers in the region by 5.1%. When using the $Madrid \times Post$ instrument, the elasticity increases to 7.5. Consistent with LATE intuition, this specification identifies tax-induced mobility using only the relative differential with Madrid and not the smaller ATR differences between other regions. The increase in the coefficient from the binary instrument suggests Madrid is critical. When dropping Madrid (model d) and exploiting only smaller tax differentials, the elasticity decreases substantially and is insignificant. Madrid's zero tax rate plays a special role and other tax differentials barely matter.

In Appendix A.5, we conduct various robustness checks in addition to those already presented in Table 1. First, given we define our treatment group based on extrapolated wealth, we show results are robust to using observed (2007) wealth to define the threshold for the treatment group (only 5% of individuals are classified differently across the two samples). Second, given a policymaker may care about the amount of wealth shifting to Madrid, we verify that our elasticities are robust to using the amount of wealth, rather than the number of filers. To do this, we redefine N_{rt} as taxable wealth, holding wealth fixed in its level, but allowing total wealth in region r and year t to change regions based on the fiscal residences of taxpayers. The elasticities are similar to the ones based on the stock of taxpayers. Third, we show that the elasticities are not sensitive to reweighting the dataset to be representative of wealth tax filers. To do this, we simply use the sample weights provided in the personal income tax data to calculate aggregates. The similarity of results suggests that our assumptions for reweighting are innocuous. Finally, we document that, as expected, the elasticities are larger when using the mean tax rate across individuals rather than wealth. The mean ATR across individuals is 1/3 that of the wealth weighted ATR. Given our elasticities can be interpreted as semi-elasticities, the coefficients triple.

3.2.3 Comparison to Income Tax Elasticities

Wealth taxes are applied to the *stock* of wealth, while capital income taxes are applied to the *flow* generated by the stock. We convert our estimates to an equivalent

ELASTICITIES OF THE STOCK OF FILERS WITH RESPECT TO THE NET-OF-TAX RATE

	Number of Wealthy Filers			
	All			w/o Mad.
	Panel I: Panel Data with Only Filers			
	(1a)	(1b)	(1c)	(1d)
$\ln(1 - atr_{rt})$	4.027	3.865	5.749	1.993
Uncorrected SEs	(0.794)	(0.774)	(1.347)	(0.590)
Bootstrap p-values	0.008***	0.008***	0.024**	0.126
# obs	136	136	136	128
F-stat	-	>1000	51	>1000
	Panel II: Panel Data with Filers and Non-filers			
	(2a)	(2b)	(2c)	(2d)
$W_f \times \ln(1 - atr_{rtf})$	5.364	5.119	7.526	2.236
Uncorrected SEs	(1.103)	(1.065)	(1.032)	(0.979)
Bootstrap p-values	0.004***	0.004***	0.000***	0.080*
# obs	272	272	272	256
F-Stat	-	>1000	65	>1000
Controls	yes	yes	yes	yes
OLS	yes	no	no	no
Simulated IV w/ Fixed Wealth	no	yes	no	yes
Madrid x Post IV	no	no	yes	no

TABLE 2: Elasticities of the Stocks with Respect to the Net-of-Tax Rate

Notes: Panel I shows the coefficients from the estimation of (3). Panel II shows the coefficients when this equation is augmented to include data on the comparison group. For the number of filers, the comparison group is the "High dividend". For all columns in the first panel, N_{rt} is the number of "2010 wealthy" filers, while in the second panel N_{rtf} is the number of "2010 wealthy" filers and comparison group non-filers. Column (d) drops Madrid from the regression to test whether smaller tax differentials between regions matter. We cluster standard errors at the regional level. Because the number of clusters is small, we implement the percentile-t wild cluster bootstrap, imposing the null hypothesis, and report p-values, *** p<0.01, ** p<0.05, * p<0.1.

capital income tax to allow for comparison with the larger literature on income tax elasticities. Following Brülhart et al. (2016) and Kopczuk (2019), suppose that an individual with wealth W and a rate of return R in a given year can either be taxed next year on the accumulated stock $(1 + R) \cdot W$ or on the return, $R \cdot W$. Then, a wealth tax rate τ will raise an equivalent amount of revenues as a capital income tax rate of T, where the relationship is given by:

$$T = \frac{(1 + R) \cdot \tau}{R}. \tag{4}$$

We can then convert our wealth tax elasticity, $\epsilon_{1-\tau}$, with respect to the wealth

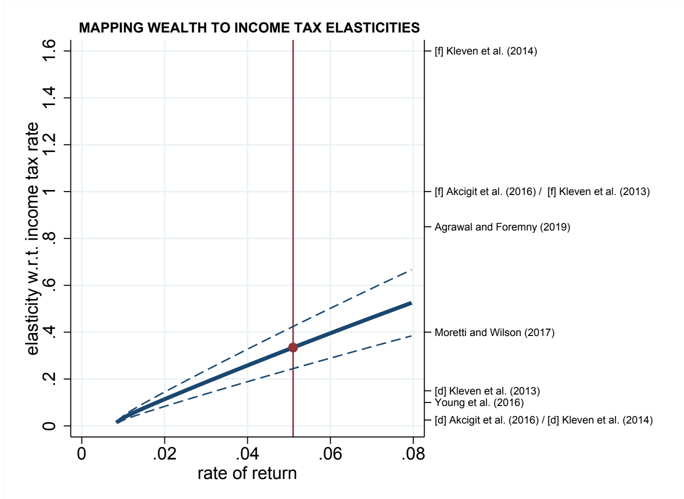


FIGURE 4: Mapping of Wealth to Income Tax Elasticity

Notes: This figure translates the elasticity with respect to the net-of-tax rate on wealth to an elasticity with respect to the net-of-tax rate for capital income as a function of various rates of returns. To construct this, we use our empirical estimates from Table 2 column (2c). The vertical line gives the average annual rate of return for the top 1% wealth group in Spain in the post-reform period (5%). The rate of return has been taken from the distribution of flow rates of return provided by Martínez-Toledano (2020) for Spain. Elasticities are translated using (5) and using the wealth weighted average tax rate across all regions in the post-reform period (0.97%). When income-tax papers report separate elasticities for foreign and domestic individuals separately, we denote that with [f] and [d], respectively. When studies estimate short-run and long-run responses, we report the time horizon most comparable to ours.

weighed net-of-tax rate, $1 - \tau \approx 0.83$, using

$$\epsilon_{1-T} = \epsilon_{1-\tau} \cdot \frac{d\ln(1-\tau)}{d\ln(1-T)}, \tag{5}$$

where ϵ_{1-T} is the elasticity with respect to the capital income net-of-tax rate in (4).

Figure 4 indicates that the magnitude is remarkably similar to the literature on the mobility of top income earners. Using the average rate of return for the top 1% wealth group, we estimate an income tax elasticity of approximately 0.33.[16] When excluding Madrid to rely on only smaller tax differentials between states, this elasticity falls to 0.09. Critically, our estimates represent short-term to medium-term responses. Our elasticity is lower than Brülhart et al. (2016) who find a converted capital income-tax elasticity of 1.05 across municipalities, given the elasticity should rise as jurisdictions become smaller. We compare, when available, our estimates to estimates for the same time horizons of income tax studies in the figure.[17]

[16]When using an unweighted ATR, as in Table A5, the elasticity converts to an estimate that is still less than unity (within the range of the prior literature).

[17]One exception is Young et al. (2016) who estimate a long-term response. The elasticity reported

3.3 Individual Choice Model

3.3.1 Identification Strategy

We complement the aggregate results with an analysis at the individual level by means of a location choice model. This allows us to control for individual-specific factors that may influence the probability of moving to – or residing in – a region, to account for region by year fixed effects, and analyze potential heterogeneous effects across groups of. Furthermore, unlike the aggregate analysis, we do not need to balance our sample, which allows us to see if results are sensitive to doing so.

A "move" or "stay" (we refer to these as a *case*) is an individual time-specific event. If an individual moves more than once, each move represents a case. We will focus on two samples: the full and the movers sample. The full sample is the same we use in the aggregate analysis and includes both movers and stayers. The movers sample includes all individuals that relocated across regions between period t and $t-1$.

For an individual i in year t and alternative region j, the dependent variable d_{itj} is equal to one for the chosen fiscal residence region and zero otherwise. In other words, it equals one for the destination region if the person moved or for the region of residence if the person stays. Our main-specification exploits within region variation in the net-of-average-tax rate, $1-\tau_{itj}$, which we simulate using person-specific wealth in every year t for each taxpayer i and all alternative regions j. We estimate:

$$d_{itj} = \beta \ln(1 - \tau_{itj}) + \omega_{it} + \rho_{tj} + \zeta_j \mathbf{z}_{it} + X_{tj}\alpha + \varepsilon_{itj}. \qquad (6)$$

We also instrument following the aggregate analysis by using the net-of-tax rate based on an individual's 2007 pre-reform tax base as an instrument.

For notation, $\zeta_j \mathbf{z}_{it}$ correspond to interactions of region dummies with characteristics of the taxpayer (i.e., gender, age, age squared, gender by age, and labor income), which make it possible to estimate a region-specific individual return for each of these covariates and to flexibly allow for wealth accumulation to differ across regions be-

for Moretti and Wilson (2017) is a short-run elasticity; however, these authors also estimate the effect of a permanent one percent increase in the net-of-tax rate between year t and $t+5$ would lead to a 6.0 percent increase in the stock of scientists by the end of year $t+10$. Under strong assumptions, Kleven et al. (2013) report long-run elasticities that are only slightly larger than those in the figure. Akcigit et al. (2016) show that domestic [foreign] inventors long-term mobility is slightly less [more] sensitive to tax rates.

tween men and women, age, and other sources of income. Second, X_{tj} are the same controls used in the aggregate analysis at the region-year level. Third, ω_{it} are case fixed effects, which force identification of our parameter of interest based on within-case variation across alternative regions for a specific taxpayer in a given year.

Finally, this specification comes with an added advantage: because the tax system is progressive, we have variation in tax rates across individuals within a region-year. Thus, we include region by year fixed effects ρ_{tj}, which account for other contemporaneous policy choices that a region may make and for any unobserved time-varying economic shocks or amenities that influence the relative attractiveness of a given region. However, their inclusion comes with a cost. If Madrid's status as a tax haven plays a special role, then some of this effect will be absorbed in the region-year fixed effects and may result in an underestimation of the true effect. For this reason, we also present results excluding region-year fixed effects.

We complement these results with a specification that embeds a location choice model in a difference-in-differences model that allows us to compare the results with the ones of the aggregate analysis. In particular, we interact the set of alternative-fixed effects ι_j for each potential location with a $Post_t$ variable indicating time after decentralization. This alternative specification estimates the region's evolution relative to any other omitted alternative $\hat{j}$, and unlike the aggregate analysis, allows us to estimate *pairwise* mobility. The specification allows for alternative fixed effects ι_j, that control for all time-constant characteristics of a specific region. We estimate:

$$d_{itj} = \beta_j \left[\iota_{j \neq \hat{j}} \times Post_t \right] + \omega_{it} + \iota_j + \zeta_j \mathbf{z}_{it} + X_{tj}\alpha + \varepsilon_{itj}. \tag{7}$$

Coefficients β_j for $j = Madrid$ capture the difference in the probability of choosing Madrid after the reform relative to a baseline region. Effects can be identified for pairs of regions j by $\hat{j}$. In a simpler form, we estimate the model by reducing the term in brackets to $M_j \times Post_t$, where M_j is an indicator equal to one for Madrid and zero for the other regions. Note that this model can easily be extended to an event study by replacing the $Post_t$ indicator with event dummies for each year.

We use a linear probability model to estimate (7).[18] This is based on our desire to include many binary covariates for which logit models are ill-suited, along with

[18]The specification of (7) is the linear equivalent to an alternative-specific conditional logit.

our desire to instrument for the tax rate. Although the probability of any one region is not bounded in the linear model, the ω_{it} forces the predicted probabilities over all regions to sum up to one for each individual in a given year.[19] Thus, an increase in the probability of one region must decrease the probability of choosing other regions.

We cluster standard errors at the origin-bracket and alternative-bracket level following Akcigit et al. (2016) and Moretti and Wilson (2017), which cluster at the origin/destination-ability level. Tax brackets form analogous partitions to ability.

3.3.2 Results

Table 3 presents the results of the estimation of (6) for the full sample using OLS and the simulated mechanical tax rate $\overline{1 - atr_{itj}}$ as an instrument (Panels I and II). We perform the same estimations for the sample of movers (Panels III and IV).

Column (a) includes alternative fixed effects only, while column (b) includes a full set of individual, alternative-region, and income tax controls. Given variation of average tax rates within regions across the wealth distribution, we can additionally include a dummy variable for each alternative j in each year t. Column (c) presents results with alternative region-year fixed effects, forcing thus identification from the variation of relative differences of average tax rates within region-year pairs. This specification is useful to address concerns about time varying region specific shocks or changes in amenities, as well as any other fiscal instrument which might change in a single region and affects all taxpayers in that same region. Column (d) adds individual controls. Column (e) to (g) present robustness checks discussed below. Column (h) drops individuals selecting Madrid.

For the full sample using OLS, a one-percent increase in the net-of-average-tax-rate increases the probability of residing Madrid by 8.2 percentage points. Both OLS and IV estimates are similar, suggesting that most identifying variation comes from statutory tax rate variation.[20] For movers, a one-percent increase in the net-

[19] The fact that the linear probability is not bounded between 0 and 1 is not a problem given we care about the partial effect of taxes on the dependent variable, and not the fitted probability per se. The advantage of a nonlinear framework is the ability to relax the IIA assumption. Given most mobility is driven by Madrid, the odds of choosing Madrid over Catalonia, for example, are unlikely to differ when the alternatives include or exclude different regions. In a theoretical model below, we show this is true or any bias is likely minimal, so that the linear probability approach is suitable and comes with many advantages for our setting.

[20] Table A7 shows results are robust to the use of the simulated tax rate based on the "2010 wealthy" treatment sample and the $Madrid \times Post$ interaction as an instrument. IV estimates using

INDIVIDUAL CHOICE MODEL (TAX RATE DIFFERENTIAL)

	Baseline				Robustness			w/o Mad.
	Panel I - FULL SAMPLE (OLS)							
	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)	(1h)
$\ln(1-\tau_{i,t,j})$	6.654***	6.946***	8.046***	8.172***	8.055**	8.150**	8.771***	0.987
	(0.895)	(2.482)	(1.271)	(3.115)	(3.511)	(3.181)	(2.814)	(0.788)
	Panel II - FULL SAMPLE (IV)							
	(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	(2g)	(2h)
$\ln(1-\tau_{i,t,j})$	6.355***	6.621***	7.650***	7.779***	7.637***	7.749***	8.391***	0.953*
	(0.976)	(1.092)	(1.349)	(1.401)	(1.256)	(1.319)	(1.445)	(0.555)
mean ATR (std.)	0.247 (.375)				0.250 (.376)	0.257 (.380)	0.228 (.360)	0.319 (.397)
# obs	5,136,040				4,083,740	4,910,603	3,664,282	3,935,534
	Panel III - MOVERS (OLS)							
	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)	(3g)	(3h)
$\ln(1-\tau_{i,t,j})$	11.844***	10.047***	5.915***	5.831*	4.391	5.330*	7.179**	0.273
	(2.988)	(2.877)	(2.238)	(3.047)	(2.761)	(2.890)	(3.261)	(2.074)
	Panel IV - MOVERS (IV)							
	(4a)	(4b)	(4c)	(4d)	(4e)	(4f)	(4g)	(4h)
$\ln(1-\tau_{i,t,j})$	12.377***	10.655***	6.664***	6.589***	5.247**	6.124***	7.796***	0.541
	(3.110)	(2.686)	(2.284)	(2.330)	(2.330)	(2.229)	(2.643)	(1.712)
mean ATR (std)	0.453 (.491)				0.471 (.501)	0.471 (.494)	0.449 (.511)	0.303 (.412)
# obs	38,675				30,192	37,111	26,265	15,606
alternative FE	yes	yes	no	no	no	no	no	no
alternative-year FE	no	no	yes	yes	yes	yes	yes	yes
individual controls	no	yes	no	yes	yes	yes	yes	yes
alternative region controls	no	yes	no	no	no	no	no	no
PIT differential (ATR)	no	yes	yes	yes	yes	yes	yes	yes

TABLE 3: Individual Choice Model

Notes: This table presents the results from the individual choice model given by (6) for the 2010 wealthy. Panel I and II focus on the full sample of movers and stayers, while Panel III and IV use only movers. All models include a full set of case fixed effects and other controls as indicated in the table. Individual controls include age, age squared, gender, gender by age, and labor income and allow for a separate coefficient for each alternative j. Regional controls vary across j and time and are the same as in the aggregate analysis. Panel I and III are estimated using OLS. IV estimates (Panel II and IV) use simulated tax rates computed using the 2007 constant tax base as an instrument. The reported mean ATR is the average across individuals during the treatment period measured at the region of origin or residence. Columns (e) estimates the same model as in columns (d), using the balanced sample; column (f) applies the "2007 wealthy" treatment; column (g) excludes wealth tax filers with income subject to the labor income schedule above 90,000 Euros; and (h) excludes stayers in or moves to Madrid. Standard errors clustered at the origin-tax-bracket and alternative-tax-bracket level, *** p<0.01, ** p<0.05, * p<0.1

of-average-tax-rate increases the probability of declaring Madrid by 6.5 percentage points. While point estimates are not substantially different to the full sample, the average net-of-average tax rate in the full sample is only 0.24% and almost twice as large for the sample of movers. This suggests that individuals in higher tax brackets have a higher probability of being a mover.

The use of individual data allows us to perform additional robustness checks. In

the binary instrument increase for the sample of movers consistent with the complier intuition discussed in the aggregate analysis.

particular, column (e) of Table 3 shows the estimates of the model using a balanced sample of filers. The results for the unbalanced (d) and balanced (e) sample are nearly identical, which suggests that non-random attrition, perhaps due to death, non-filing, or out-of-country migration, does not threaten our results. Column (f) shows the estimation using the "2007 wealthy" treatment sample derives very similar results, suggesting that the estimations using the '2010 wealthy" treatment sample are not driven my measurement error due to extrapolation. Finally, column (g) shows dropping high income tax payers with labor income above 90,000 Euro facing large decentralized income tax differentials does not matter, thus providing additional evidence that results are not driven by changes in personal income taxes.[21]

To show the special role of Madrid, column (h) drops movers to—and stayers in—Madrid such that the effects are identified based on smaller tax differentials between regions other than Madrid. The coefficient is approximately one-eighth the size of the prior results for the full sample and falls more for the movers, suggesting that the differential relative to Madrid's zero tax rate is critical for the mobility effect.

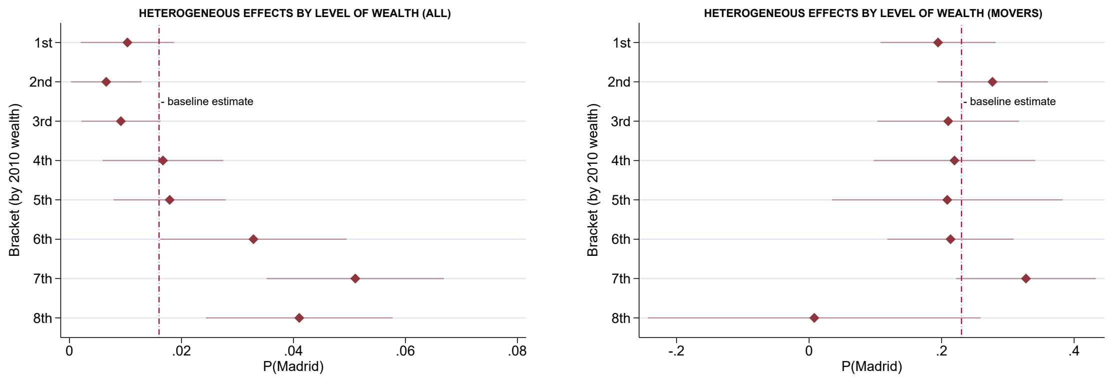
The size of regional tax differentials changes across sub-samples making semi-elasticites hard to compare. We thus estimate the simplified form of (7), which uses the $Madrid \times Post$ indicator. The estimated baseline effect under this specification (Table A6) is 0.016 for the full sample. Given the baseline probability of residing in Madrid in the pre-reform period was 22.3%, our model suggests that following decentralization, this is approximately a 6.7% increase in the share of wealthy individuals in Madrid (compare to Panel I of Table 1). As expected, the magnitude of the coefficient conditional on moving increases substantially compared to the full sample.

3.3.3 Heterogeneity

The individual analysis makes it possible to study heterogeneity. We interact the $Madrid \times Post$ dummy with group-specific indicators to analyze how effects vary along the wealth distribution. Figure 5 shows results by the individual's top bracket of the tax schedule, as well as the baseline estimates (vertical dashed lines). For the full sample, we find substantial variation with the largest effects in higher brackets, but little variation across movers. This confirms that the overall effect is driven by

[21] Small income tax differentials below 90,000 Euro may matter. We rerun the estimations excluding individuals who are above 100,000, 90,000, 80,000, . . . ,10,000 Euro in the labor tax schedule. None of the coefficients we obtain — between [8.39 9.37] — is different from our baseline estimate.

more wealthy individuals moving to and staying in Madrid. The lack of heterogeneity among movers can be explained by the fact that high wealth individuals are relatively homogeneous in their tax avoidance preferences.



(a) Full sample

(b) Movers

FIGURE 5: Heterogeneous Effects by Wealth Tax Bracket

Notes: This figure shows the marginal effects from the simplified version of (7) appropriately interacted with an indicator variable for the respective wealth tax bracket. Estimates based on the full sample are shown in panel (a) and for movers in panel (b). The treatment is the 2010 wealth. All other specifications remain unchanged. We show 95% confidence intervals around point estimates, with standard errors are clustered at the origin-bracket and alternative-bracket level. Dashed lines indicate the effect at baseline.

We also construct categories based on pre-treatment characteristics to analyze responses by age, gender, and their financial situation. We differentiate between individuals that file non-incorporated business income, dividend income, effective rental income, and imputed rents from secondary properties. We interact these indicators with the $Madrid \times Post$ term and we do not find heterogeneous effects. Results suggest that age and gender do not matter for the magnitude of coefficients.[22] With respect to life-cycle effects, the lack of timing moves before/after retirement suggests a lack of forward-looking (forecasting) behavior by households. Furthermore, we provide estimates based on the composition of asset portfolios. Again, no significant difference emerges between dividend and business holders. Movers with real estate are slightly more responsive. Nonetheless, wealth taxpayers are very homogeneous in terms of housing, as 88% of our sample reports having at least a property.

[22]The fact that the effect does not increase in age (the point estimate for individuals above 80 is even lower compared to younger individuals) reassures us that moves are not motivated by other tax instruments, such as inheritance taxes, although as noted previously the inheritance tax provides no additional incentive to move starting in 2011. Only 9% of movers are 80 or older in this sample.

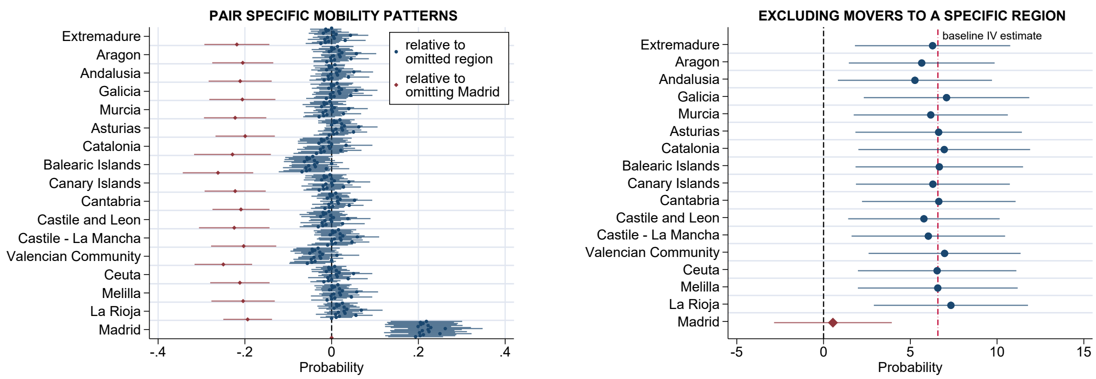
To relate these results to the aggregate analysis, the cumulative effect in 2015 serves as a comparison. Therefore, Figure A8 shows the annual estimates from (7), interacting the event year dummies with the Madrid dummy. The event study based on individual data demonstrates a clear trend break, as in the aggregate analysis. The cumulative effect of the reform is obtained from the full sample, which represents a 0.023 percentage point change in the probability of choosing Madrid. Given the baseline probability of selecting Madrid, the probability rises to 24.6% five years after decentralization. This represents a 10% change in the stock of filers (as opposed to 6.7% of $Madrid \times Post$), comparable to the prior aggregate analysis.

3.3.4 Additional Evidence on the Special Role of Madrid

Tables 2 and 3 already provide some initial evidence that most of the mobility is due to the tax differential with one region: Madrid. However, there also exist smaller tax differentials between other regions that may potentially lead to wealth tax filers changing their fiscal residence from one region to another. To trace out pairwise effects, we estimate (7) seventeen times, omitting a different region each time. This flexible specification allows us to plot similar graphs of the mobility responses for all region pairs to a baseline region. As an example of one of these seventeen estimations, if we omit Castile-La Mancha, only the region of Madrid shows a significant pattern, while all other regions show no pairwise effect. This confirms that all mobility responses are indeed driven by moves between Castile-La Mancha and Madrid, but not others.

We repeat this exercise for every region to show that the null results for non-Madrid regions generalize to every possible omitted region, and thus all region pairs. Figure 6(a) shows the aggregated post-reform effect for the sample of movers (the population relevant for the theory discussed subsequently). The mobility response appears only in pairs involving Madrid. All regions see a decline in the probability of moving there relative to Madrid (red diamonds). Only pairs involving Madrid as a destination see an increase in the probability of moving (blue circles). Almost all other pairs not involving Madrid show insignificant effects.

A concern is that even if all other region pairs have small effects, the difference in taxes between Madrid and the other places is so large that the effect scaled by the tax change is actually homogeneous. To address this, we re-estimate (6) excluding movers to single destination region at a time (Figure 6(b)). Critically, when we



(a) All Region Pairs

(b) Elasticities Excluding a Specific Region

FIGURE 6: The Effect of Tax Differentials Between Region Pairs

Notes: These figures depict the effect of tax differentials between specific region pairs using the sample of movers. Panel (a) shows estimates from a modified version of equation (7). We estimate that equation including a dummy for each region interacted with an indicator for the post-period. We estimate this equation once for each region (17 times), omitting a different region as the base region. The resulting coefficients indicate the probability of choosing the region on the vertical axis as destination relative to each possible alternative (omitted region). Hence, each region pair appears twice. The coefficients for Madrid as the omitted region are plotted in red. Regions are ordered by their 2015 top-tax differential. Panel (b) estimates equation (6), but excludes movers to one destination region at a time. The dashed red line indicates the baseline IV point estimate. The treatment group is the "2010 wealthy." Standard errors are clustered at the origin-bracket and alternative-bracket level with 95% confidence intervals.

exclude movers to Madrid (red diamond), as we previously did in Tables 2 and 3, the effect becomes zero. However, this is not the case when we drop movers to any region other than Madrid. Furthermore, none of those estimates is statistically different from the baseline estimate, as indicated by the red dashed line.

Overall, these exercises reveal that inter-jurisdictional wealth tax differentials, when small, appear not to matter in the location choice decisions. However, the fiscal residency is intensely affected by the presence of a tax haven that facilitates dramatic tax evasion. These results are critical for the subsequent theoretical model.

4 Evasion vs. Migration: Theory

The mobility we see in the data may be tax avoidance (real migration) or tax evasion (fraudulent changes in fiscal residence).[23] Although it is not possible to

[23] An example of real migration could be if a taxpayer living in any other region but Madrid would buy an apartment in Madrid (or already have a second home) and move there to avoid the wealth tax. An example of evasion could be if instead this same person would buy the apartment (or would already have a secondary residence) and pretend that she lives there but stay in the original

causally disentangle whether these responses are real or not, the fact that Madrid is driving the results is quite revealing in terms of the underlying model of mobility that can be used to rationalize our findings. The basic intuition is that in a standard mobility model, even a small decrease from a positive tax rate will attract some marginal individuals. That is not the case in our results: taxpayers appear to be aiming for the lowest possible tax rate. Hence, this evidence alone suggests that our findings reflect reporting/shifting responses and not real migration. We formalize this in a simple model and provide additional empirical evidence using regional variation in audit rates supporting the evasion channel.

4.1 A Model of Migration and Evasion

Individual i endowed with wealth W^i lives two periods: prior to decentralization ($t = 1$) and after decentralization ($t = 2$). Prior to decentralization, the individual chooses to reside in, without loss of generality, region h. After decentralization, the individual makes a new choice. Let j index the regions of Spain: $j = h$ is the home region, $j = m$ is Madrid, and $j = 1, ..., J$ are the alternatives other than Madrid. Taxpayers decide on both where to live and where to declare as the fiscal residence.

Consistent with the data, we assume this high-wealth individual is a *rentier* and consumes only her capital income. Given a global market for capital and thus a world rate of return, R_t, this implies pre-tax consumption $c_t^i = R_t W^i$. As noted previously, an annual wealth tax τ_{jt}^i is equivalent to a capital income tax T_{jt}^i given by (4). Thus, we use this tax to solve the model. Absent moving costs, the utility from individual i choosing region j in time t is given by $u(c_t^i(1 - T_{jt}^i), z_{jt}^i) = c_t^i(1 - T_{jt}^i) + g(z_{jt}^i)$, where z_{jt}^i are amenities (e.g., public services, activities that improve quality of life) in the region of residence that may be person-specific. The function g satisfies $g' > 0$, $g'' < 0$ and we use for simplicity a quasi-linear utility function.[24]

We start from the standard model of tax evasion (Allingham and Sandmo, 1972) and a traditional model of migration (Akcigit et al., 2016) and alter them as follows. First, we modify the standard tax evasion model—which traditionally involves the

region. This latter effect could occur by simply falsely misreporting the number of days spent in the primary/secondary residence.

[24] We assume quasi-linear utility, which implies that the taxpayer is risk neutral and moving costs do not incur income effects. A perturbation making the taxpayer risk averse will not change results. Results will hold if the coefficient of risk aversion is sufficiently small. .

taxpayer selecting the amount of income to hide from the authority—to allow for the taxpayer to make a discrete all-or-nothing decision. In making this decision, the taxpayer must choose among multiple taxing jurisdictions when deciding where to shelter her wealth. Second, we combine the standard mobility and evasion models, such that the taxpayer has the choice over evading versus migrating, along with which region to evade or migrate. In other words, the taxpayer can shelter (via evasion) all of her income in a lower-tax region at some expected cost but maintain the amenities of her home region, or can migrate (via a real move) to the region at some cost that also results in giving up the home region amenities. In order to build intuition, we first consider the cases with only real migration or only evasion.

4.1.1 Migration Only

First, consider the standard model of migration where an individual can only move. Region j will be chosen after decentralization from the set $j' = \{m, h, 1, ..J\}$ if

$$u(c_t^i(1 - T_{jt}^i) - \phi_{hjt}^i c_t^i, z_{jt}^i) = \arg\max_{j'} \left\{ u(c_t^i(1 - T_{j't}^i) - \phi_{hj't}^i c_t^i, z_{j't}^i) \right\}, \qquad (8)$$

where moving costs are given by $\phi_{hjt}^i c_t^i$ with $\phi_{hjt} < 1$ and $\phi_{hht}^i = 0$.[25] The model shows that the probability that an individual located in a given region depends on the full vector of taxes in all regions. Thus, a marginal decrease in the tax rate of any one region, for example region J, will induce added migration to that region for individuals if $u(c_t^i(1 - T_{ht}^i), z_{ht}^i) - u(c_t^i(1 - T_{Jt}^i) - \phi_{hJt}^i c_t^i, z_{Jt}^i)$ was small prior to the tax decrease and region J was the next best alternative. Hence, because the migration decision depends on the tax differential, the amenities, and the moving costs to the destination region, the model predicts that not all migration is to Madrid. Due to amenities, this result would hold even if moving costs are not pair specific.

4.1.2 Evasion Only

Next, we modify the Allingham and Sandmo (1972) and Yitzhaki (1974) model of tax evasion such that the taxpayer makes-an-all or nothing decision to shelter their

[25] The moving cost (and the idiosyncratic evasion cost introduced later) are modeled as a share of the pre-tax capital income flow. Given they are person-specific, they can also be written in dollars, but the percent formulation facilitates comparison to standard tax evasion models.

wealth and must select which region to shelter it. In our model, an individual chooses a region j to declare taxes, so T_{jt} depends on the region of choice. However, with evasion, the individual can stay living in the home region h and so local amenities are given by the home region, z^i_{ht}. Moreover, tax evasion is risky and the individual faces a probability of being caught of $p^i \in [0,1]$ and a fine f^i. As in Dharmapala (2016), the individual incurs idiosyncratic costs of evasion, $\kappa^i_t c^i_t$, $\kappa^i_t < 1$, because individuals have internalized norms of tax compliance to varying degrees. Thus, the utility of declaring one's home region is $c^i_t(1 - T^i_{ht}) + g(z^i_{ht})$ and the utility declaring any other region $j \neq h$ is $(1-p^i)c^i_t(1-T^i_{jt}) + p^i\left[c^i_t(1-T^i_{ht}) - f^i(T^i_{ht} - T^i_{jt})c^i_t\right] - \kappa^i_t c^i_t + g(z^i_{h^i t})$, where if an individual is caught, they must pay all taxes due and a fine that is proportional to the amount of income evaded. After carrying all derivations (see Appendix A.6), we find that evading in Madrid is preferred to truthfully reporting the home region if

$$\frac{T^i_{ht}(1-p^i-p^i f^i)}{1-p^i} > \kappa^i_t. \tag{9}$$

If the idiosyncratic costs are zero, as in the standard evasion model, this expression is always true if $p^i < 1/(1+f^i)$ and implies Madrid is preferable if the audit probability is sufficiently small. Under Spanish law, the fine is 100% of taxes evaded for most individuals in our sample, but higher at the top, which implies $p^i < 0.50$.[26]

If p^i is sufficiently small, unlike the migration model, then Madrid will always be chosen for tax evasion. The intuition can easily be seen in the limiting case where $p^i \to 0$. As the audit probability approaches zero, the form of the fine is irrelevant, and the individual will simply evade in the region that affords them the largest benefit from tax savings. In our model, κ is not region-specific, which implies the number of havens is irrelevant. This assumption could be relaxed, in which case the person would always evade via the region that minimizes taxes and evasion costs.

[26] By 305 Codigo Penal and 192 Ley General Tributaria (LGT), the fine in Spain is a percent of taxes hidden as in Yitzhaki (1974). The Allingham and Sandmo (1972) penalty function would lead to starker results.

4.1.3 Evasion and Migration

Finally, consider the realistic scenario in which the taxpayer has the choice over migrating or evading. Evading in Madrid will be preferable to moving to Madrid if

$$-T^i_{ht}p^ic^i_t - p^if^iT^i_{ht}c^i_t > g(z^i_{mt}) - g(z^i_{ht}) + \kappa^i_tc^i_t - \phi^i_{hmt}c^i_t. \tag{10}$$

If $p^i \rightarrow 0$, only differences in the value of amenities and evasion/moving costs matter.[27]

By revealed preference, in the pre-decentralization period, the home region was chosen over Madrid, which means that $g(z^i_{mt}) - g(z^i_{ht}) - \phi^i_{hmt}c^i_t < 0$ for $t = 1$. Consider the case where $\kappa^i_t = 0$. If amenities and moving costs are time invariant (approximately similar) in both periods, the right side of (10) is negative and evading via Madrid is always optimal as $p^i \rightarrow 0$. Moreover, if the valuation of amenities in both regions is the same, but changing over time, this term is also negative and evading is the better option if κ^i_t is sufficiently small. More generally, the sufficient condition for evasion via Madrid to dominate moving is that the audit probability and idiosyncratic evasion costs are sufficiently small. If this condition does not hold, no evasion will occur and individuals may move to Madrid or any other region.

Proposition 1. *If the probability of detection and idiosyncratic evasion costs are sufficiently low, all fraudulent changes of fiscal residence will be to the tax haven and any increase in the stock of taxpayers in non-havens must be due to real moves.*

The proposition sheds light on our empirical results. Given in Figures 6(a) and 6(b) we find the stock of taxpayers only increases in Madrid and not in other regions with (positive) low tax rates, taxpayer migration is likely limited. Our theoretical model suggests such a *corner* solution is consistent with a reporting/shifting response, rather than a real relocation. As audit probabilities and costs of evasion are person-specific, however, both tax evasion and real moves may exist simultaneously. Nonetheless, given the very small audit probabilities we find in the next section, evasion is likely the dominant mechanism.

[27] It is also possible that an individual moves from their home region to a region other than Madrid, but simultaneously falsely declares Madrid. If the person simultaneously evades, then taxes between the home region and new residential region are irrelevant for the real move and so a real move would only arise if amenities change dramatically over time. If they change dramatically, it would simply mean a minor modification to the necessary audit probability threshold.

4.2 Supporting Evidence from Audit Rates

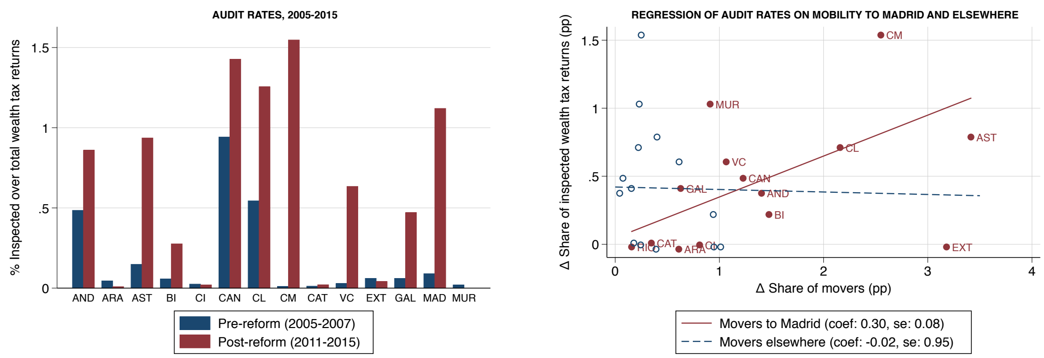
Standard tax evasion models assume that the aggregate audit rate, p, increase with evasion, e, so that $p'(e) > 0$ (Slemrod, 2019; Kleven et al., 2011). If evasion is due to moves to Madrid and not to other regions, we should expect audit rates to increase with the number of movers to Madrid, m, but not with the number of movers to other regions, n, so that the analogous assumption is $p'(m) > 0$ and $p'(n) = 0$.[28]

To test the standard assumption that the aggregate audit rate increases with evasion and shed further light on the mechanisms of mobility, we digitize tabulations on wealth audit records for each region in Spain from 2005-2015 published by the General Inspection Department of the Spanish Ministry of Finance. An audit can be conducted due to the misreporting of fiscal residence or any other misreporting activity. These statistics are thus an upper-bound of the audit rate for fiscal residence.

Figure 7(a) shows the average annual audit rates by region before and after the decentralization of the wealth tax. We define the audit rate as the number audited returns divided by the total number of wealth tax returns filed. Prior to decentralization, despite the regions administering and receiving wealth tax revenue, there was little regional variation in audit rates and they were less than 0.1% for nearly all regions. However, after decentralization audit rates increased in most regions but not uniformly, ranging from 0.01% in Aragon to 1.5% in Castile-La Mancha.

We analyze whether the non-uniform change in audit rates is related to evasion via declaration of a fraudulent residences by regressing the pre/post-reform change in audit rates on the change in the share of movers to Madrid and, separately, the change in the share of movers to all other regions. Figure 7(b) reveals that audit rates increase more in regions with a larger increase in the share of movers to Madrid after decentralization. In contrast, changes in audit rates are not correlated with a larger share of movers to other regions after decentralization. Hence, these results provide evidence that the tax authority believes that most fiscal residence evasion is conducted via the zero-tax region of Madrid and not other regions. In line with our theoretical model, these results combined with our prior empirical analyses suggest that tax evasion is the dominant mechanism for residential changes.

[28]The decision to move is an all or nothing decision. Thus, the standard assumption of $p'(e) > 0$ requires that the audit probability conditional on declaring Madrid is greater than the audit probability of declaring the home region, but the audit probability conditional on declaring any other region is equal to the audit probability of declaring the home region.



(a) Wealth Tax Audit Rates, 2005-2015

(b) Audit Rates and Mobility

FIGURE 7: Audit Rates and Evasion

Notes: These figures depict the relationship between audit rates and mobility to Madrid and elsewhere. To calculate audit rates, we have digitized statistics on wealth tax audit records for all regions in Spain over the period 2005-2015 published by the General Inspection Department within the Spanish Ministry of Finance. Panel (a) shows the audit rates across regions in Spain before and after decentralization. Panel (b) presents the results from regressing the change in audit rates shown in the prior panel on the change in the share of movers to Madrid (solid red) or the change in the share of movers to other regions (dashed blue). Regression results weight by regional population.

5 Implications for Tax Revenue

What are the implications of our results for the revenue maximizing wealth tax rate and for regional wealth and personal income tax revenues? This section sheds light on whether a tax haven undermines decentralized wealth taxes. This is a partial equilibrium analysis that abstracts from any other behavioral responses; spillovers due to the presence of top wealth holders; any other fiscal externalities other than the wealth and personal income tax; and from tax competition. Capital reallocation and talent/innovation due to labor market reallocation are two economic spillovers that could potentially overturn this result. Reallocating mobile capital facing a world rate of return is not likely, except for investments in real estate. Moreover, given that our theoretical results can be better rationalized with evasion—as discussed in Section 4—the spatial allocation of capital and labor are unlikely to change due to the decentralized schedule. Hence, we expect the partial equilibrium analysis to be close to the general equilibrium analysis.

5.1 Revenue Maximizing Tax Rate

The conventional wisdom says that mobility threatens local capital taxation. Our elasticities suggest that subnational governments are well to the left of the peak of the Laffer curve for wealth taxes. To see this, let B_r denote the wealth tax base, which is a function of the tax rate. Totally differentiating tax revenue implies:

$$\frac{d\left(\tau_r B_r\right)}{d\tau_r} \propto 1 - \frac{\tau_r}{1-\tau_r}\epsilon_{1-\tau_r}. \tag{11}$$

Using the wealth weighted average tax rate of 0.83%, this implies that if mobility was the only behavioral response, tax revenue would increase as long as the mobility elasticity is less than 119. Given that our elasticities in Table 2 are substantially smaller, we conclude that if governments are Leviathan, a local capital tax rate greater than zero is the optimal decentralized Nash equilibrium strategy — even in the presence of tax havens. Local redistributive policy is thus tenable.

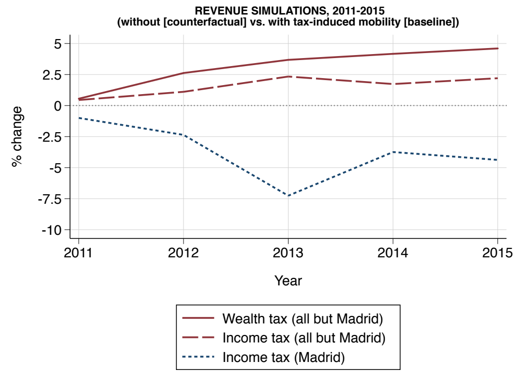
5.2 Revenue Simulations

The documented mobility responses after the decentralization of the wealth tax might have important consequences for tax revenue (Saez and Zucman, 2019a). We study the effect of eliminating tax-induced mobility on wealth and income tax revenues by means of counterfactual simulations.[29] To identify the population of tax-induced movers, we use the annual coefficients from estimating (2). We apportion the increase in Madrid using the annual shares of net migration that each region contributes to Madrid relative to the pre-reform period and then draw taxpayers randomly from the set of movers involving Madrid.[30]

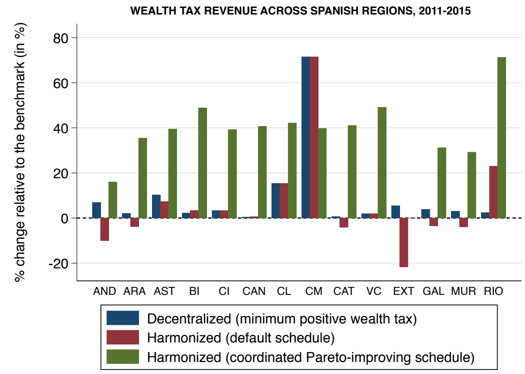
Panel (a) of Figure 8 shows the percent change of wealth (solid) and income (dashed) tax revenue from eliminating tax-induced mobility to Madrid relative to the observed baseline with tax-induced mobility. Conditional on implementing a decentralized system, Spain foregoes approximately 5% of total wealth tax revenue in 2015 due to tax-induced mobility; this arises as the tax base shifts to the zero-tax region of Madrid. The revenue losses rise over time, consistent with the stock of movers to Madrid increasing between 2011-2015. However, the revenue effects are heterogeneous across regions. Whereas Castile-La Mancha, Castile and León, and

[29] We focus on the personal income tax, because it is the most important tax in terms of regional revenue (39% of total regional direct and indirect tax revenue). Spain also has a property tax that it is collected by local governments, however, housing only accounts on average for 15% of total net wealth for the top 1% in Spain over the period 2011-2015 (Martínez-Toledano, 2020), so that we do not expect this tax to overturn our results.

[30] See Appendix A.7 for a detailed explanation of the methodology used to carry the simulations.



(a) Non Tax-induced vs. Tax-induced Mobility



(b) Alternative Scenarios

FIGURE 8: Revenue Simulations, 2011-2015

Notes: Panel (a) depicts for all regions excluding Madrid, the percent change of wealth tax revenue (solid red line) and income tax revenue (long dashed red line). Moreover, the figure also shows, for the region of Madrid, the percentage change of income (short dashed blue line) tax revenue between the same counterfactual and baseline scenario. The change is the difference in revenue between the decentralized scenario absent tax-induced mobility to Madrid relative to the baseline decentralized scenario with tax-induced mobility to Madrid over the period 2011-2015. We then convert this to a percent by dividing by the baseline revenue. Panel (b) depicts the percent change of wealth tax revenue absent tax-induced mobility to Madrid relative to the baseline decentralized scenario with tax-induced mobility to Madrid over the period 2011-2015 under three different counterfactual scenarios. The three different counterfactual scenarios are: a decentralized scenario with a minimum tax rate at the default schedule, a harmonized scenario where all regions adopt the default schedule and a harmonized scenario that results from a Pareto-improvement for all regions on the basis of tax revenue. The regions of Ceuta and Melilla are excluded from the figure as they are very small. Appendix A.7 explains in detail the methodology used to carry the counterfactual revenue simulations.

Asturias lose on average more than 10% of their revenue due to tax-induced mobility, Catalonia and Cantabria lose on average less than 1% of revenue (see Figure A10). The two Castiles are within a short distance to Madrid, suggesting that proximity may be important at lowering the cost of tax evasion, perhaps due to a higher ownership of a second residence in Madrid that one can use for evasion.

Unlike the wealth tax, Madrid levies a positive personal income tax, so that national income tax revenues barely change due to mobility. Nonetheless, there are heterogeneous fiscal externalities from tax-induced mobility on the other regions. The correlation between foregone wealth and income tax revenue is higher in regions with low tax-induced mobility, meaning that many of the movers in the regions with the largest wealth tax revenue effects are *rentiers* with little taxable income (Figure A10). Madrid foregoes on average 4% of income tax revenue from closing down mobility (Figure 8, Panel (a)).

We also provide evidence on whether a harmonized tax rates improve revenue for all regions and how close that tax rate needs be to the minimum or maximum tax rate. Keen (1987) and Keen (1989) show that harmonizing to a weighted average of existing tax rates can be Pareto improving. However, Kanbur and Keen (1993) prove, using the simple case of tax revenue maximization, that the opposite may be true: harmonization may harm *all* jurisdictions' tax revenue if the harmonized rate is low. This stands in contrast to the consensus in the literature that introducing minimum tax rates – eliminating tax havens – is Pareto improving for all jurisdictions (Kanbur and Keen, 1993). Despite the theoretical ambiguity of whether harmonization is good or bad, no direct empirical evidence exists on whether harmonization is Pareto improving, and if so, what tax rate is necessary to achieve this.

To study how tax coordination might shape wealth tax revenue, we compare the baseline wealth tax revenue across Spanish regions to the simulated wealth tax revenue under different scenarios which effectively eliminate tax-induced mobility: a scenario with a minimum tax rate and a harmonized scenario in which we apply the default (centralized) wealth tax schedule to all regions.[31] Finally, we gradually increase the harmonized tax schedule until we find a coordinated tax system that makes all regions better-off in terms of wealth tax revenue relative to the baseline.

Panel (b) of Figure 8 depicts the percent change of wealth tax revenue between each of the three counterfactual scenarios and the observed baseline over the period 2011-2015. We confirm the result of the theoretical literature that setting a minimum positive tax rate is Pareto improving with respect to revenues. However, harmonizing the wealth tax schedule by applying the national default to all regions is not Pareto-improving, as some regions that have higher decentralized wealth tax schedules (i.e., Andalusia, Catalonia, Extremadure, Galicia, Murcia) lose revenue. The minimum coordinated wealth tax schedule that is Pareto-improving is one in which the wealth tax schedule is 48% higher than the default in 2012-2015 (see Figure A11). The maximum wealth tax schedule in 2012-2015 is the one of Extremadure (i.e, 50% higher than the default).[32]

The centralized schedule that increases tax revenues in all regions must thus place an extreme amount of weight on the highest tax jurisdiction's rate – a political conundrum that makes decentralization the prevailing strategy. This is a striking result

[31] In the scenario with a minimum tax rate, we keep the baseline wealth tax schedule in each region unchanged except for the zero-tax regions, to which we assign the default schedule.

[32] We never allow the harmonized schedule to be greater than or equal to the maximum tax rate, so this schedule is different in 2011 as the maximum tax rate was lower.

that contains a spirit of the intuition from Kanbur and Keen (1993): lowering the tax rate of high-tax jurisdictions lowers tax revenues if the harmonized rate is too far away from the equilibrium rate. From a tax revenue perspective, we show that a Pareto-improving reform exists, but it requires all jurisdictions other than the highest to raise their tax rates. Thus, minimum tax rates dominate.

6 Implications for Wealth Inequality

Finally, we analyze how Spain's decentralized system affects regional wealth inequalities. Understanding the interplay between wealth taxes and inequality dynamics is relevant from a policy standpoint, as wealth taxes may be introduced as a means of raising tax revenue to fund public services, but also to limit the growth of inequality and political concentration. Even if mobility is due to tax evasion and no real relocation of wealth, increases in wealth inequality are highly correlated with political influence, as economic elites shape policies (Gilens and Page, 2014).

To analyze whether Spain's decentralization contributed to increasing regional wealth inequalities, we build new top national and regional wealth distribution series using the personal income and wealth tax panel. We calculate the national shares of wealth by dividing the wealth amounts accruing to each fractile from wealth tax records by an estimate of total net personal wealth. We thus ensure consistency with national accounts aggregates. The series are comparable to Saez and Zucman (2016) for the U.S. and Garbinti et al. (2019) for France.[33] The wealth tax has high exemption levels and less than the 5% of adults filed wealth tax returns before 2007. Thus, we limit our analysis of wealth concentration to the top 1 percent. Taxable wealth from 2008-2015 is based on the extrapolation method from Appendix A.2.[34]

The new series show an increase in wealth concentration since 2007 and are similar to Martínez-Toledano (2020)'s wealth distribution series using the mixed capitalization-survey method (Figure A12). Our top wealth shares are slightly lower in level, most likely because we do not account for pension funds (more prevalent at the top of the wealth distribution), as they are exempted from the wealth tax. We are not the first to construct national wealth shares with Spanish wealth tax records.

[33] Net personal wealth is the sum of financial assets (e.g., deposits, debt assets, stocks, etc.) and non-financial assets (e.g., real estate, business assets, collectibles, consumer durables) minus liabilities.
[34] Appendix A.8 explains in detail the methodology used to construct all wealth distribution series.

Alvaredo and Saez (2009) already built distribution series with wealth tax tabulations over the period 1982-2005. Our estimated series are broadly similar, but we extend them until 2015.[35] Overall, the consistency of our series with existing methods and sources suggests that the extrapolation method we use accurately captures the recent evolution of wealth concentration in Spain.

We then proceed with a novel decomposition of the wealth shares at the regional level. Tax-induced migration might exacerbate spatial disparities in wealth concentration levels. The regional decomposition of wealth inequalities is a step forward in the analysis of economic inequalities, as most regional studies have focus on income inequality, equality of opportunity or poverty and not on wealth. The Spanish setting is ideal for regional wealth inequality analysis, as the wealth tax panel we use includes the region of residence.[36] Appendix A.8 describes in detail he methods used to construct these subnational measures of wealth inequality, which could be applied to other countries. Figure 9 depicts the evolution of top 1% regional wealth shares

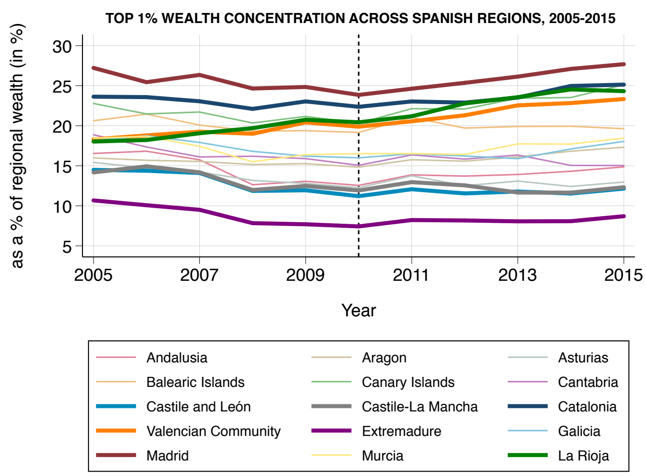


FIGURE 9: Top 1% Wealth Concentration Across Spanish Regions, 2005-2015

Notes: This figure depicts top 1% wealth shares across Spanish regions, 2005-2015. Our series are consistent with national accounts and 2008-2015 taxable wealth is based on our extrapolation method. Wealth groups are defined relative to the total number of adults in each region (aged 20 and above from the Spanish Census). The regions of Ceuta and Melilla are excluded from the figure as they are very small and hence, they count on a very small sample of wealth taxpayers. See Appendix A.8 for a detailed explanation of the construction of the wealth distribution series.

in Spain from 2005-2015. There exist significant differences in both levels and trends

[35]The differences mainly come from our refined wealth denominator including the new non-financial series from Artola Blanco et al. (2020) and the additional adjustment of reported real assets.

[36]We use as regional wealth denominators, the decomposed national wealth total of Martínez-Toledano (2020), that also relies on tax records including the region of residence.

in wealth concentration across regions. Madrid has the highest wealth concentration throughout the whole period followed by Catalonia, Valencian Community and La Rioja. Extremadure is the region with the lowest wealth concentration, followed by the two Castiles and Asturias. The differences in regional wealth disparities at the top have increased since the onset of the financial crisis, as wealth concentration has increased in regions with, a priori, high levels of wealth concentration and decreased or stagnated in regions with low levels of wealth concentration. These patterns are consistent with known facts that income inequality is higher in urbanized areas and that spatial concentration of inequality has risen since the financial crisis.

We then use the new regional wealth distribution series to run counterfactual simulations and analyze how tax-induced mobility shapes subnational wealth inequality. To do this, we simulate the evolution of top 1% regional wealth shares absent tax-induced mobility following the same procedure as for the revenue analysis. We update annually – for all tax-induced movers – their region of residence and the wealth and personal income tax liabilities payed. As in the revenue analysis, the fact that this is also a partial equilibrium analysis does not constitute an important limitation given that financial assets form the lion's share of the total return of wealth taxpayers and this is largely set at the global level. Housing prices could be altered if movers to Madrid would acquire new properties in the region. However, we have shown that this is not likely to be the case as the mobility responses seem to be fraudulent.

Figure 10 compares the evolution of top 1% wealth concentration in Madrid versus the rest of Spain under the baseline scenario with mobility and the counterfactual absent tax-induced mobility. The movement of wealthy taxpayers to Madrid has led to a rise in wealth concentration in the region and a drop in wealth concentration in other regions. Between 2010 and 2015 the growth of the top 1% wealth share in Madrid (16%) was almost double the growth under our counterfactual without mobility (8.7%). Differences between the benchmark and the counterfactual series only appear in 2012. As shown previously, mobility in 2011 was low. The figure indicates that the gap between both scenarios is larger for Madrid than for the rest of Spain, as wealth grew faster in Madrid than in the rest of Spain from 2010-2015.[37]

Overall, our findings show that tax-induced mobility contributes to the concen-

[37] Figure A13 compares the evolution of top 1% wealth shares and its counterfactuals for all individual Spanish regions. In line with the revenue analysis, most of the drop in wealth concentration comes from the two Castiles, Asturias and Andalusia.

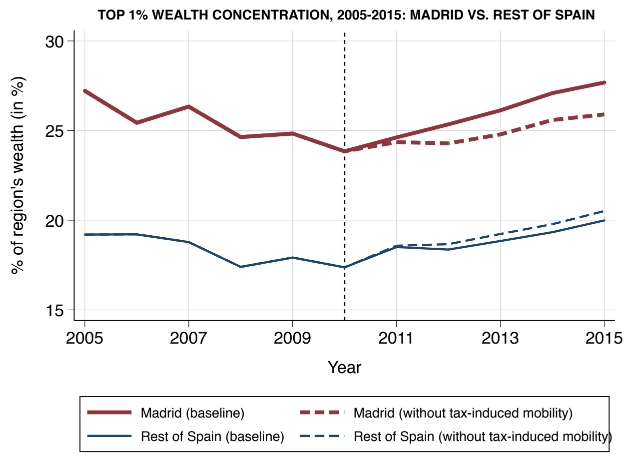


FIGURE 10: Top 1% Wealth Concentration, 2005-2015: Madrid vs. Rest of Spain

Notes: This figure compares the evolution of top 1% wealth concentration in Madrid versus the rest of the regions in Spain under the baseline scenario with tax-induced mobility (solid) and the counterfactual scenario absent tax-induced mobility (dashed). Appendix A.7 explains in detail the methodology used to select the sample of tax-induced movers and Appendix A.8 describes the methodology used to construct the baseline and counterfactual wealth shares.

tration of wealth within tax havens and potentially to increased political influence through lobbying, as Madrid is also the capital of Spain.

7 Conclusion

This paper estimates mobility responses to wealth taxes and their resulting effect on wealth and income tax revenues and wealth inequality. Internal tax havens, such as Madrid, allow the wealthy to reduce taxes paid even without offshoring wealth, but we show that the elasticities are comparable to mobility responses in other settings. Our findings thus reveal that even in the presence of mobility responses to *paraísos fiscales*, decentralized implementation of wealth taxes is possible from the revenue standpoint in the short run. However, the potential increase in political influence, resulting from the rise in wealth concentration in the zero-tax region, raises concerns about the viability of decentralized wealth taxes in the long-run.

Even though we focus on a domestic tax haven, we believe our results also have implications for wealth taxation at the international level. Internationally, one might argue that only real moves matter, however, several pop stars or athletes have been accused or convicted of fraudulently declaring the country of their fiscal residence (e.g., Shakira, Boris Becker). If this is more difficult internationally, our results represent an upper bound to the international elasticity.

Taken together, our analysis implies that redistributive policy could be locally determined. Decentralization of wealth taxes has the advantage of allowing regions to tailor their tax to the characteristics of the regional wealth distribution, which our novel regional wealth series document is important. By matching taxation preferences to the wealth distribution, decentralized taxation allows redistributive policies to act as a local public good (Pauly, 1973). Nonetheless, although decentralization has these advantages and is feasible, without appropriate enforcement, sourcing rules, and restrictions on tax competition, a wealth tax will not realize its full potential at raising revenue and reducing wealth concentration in the medium to long-run.

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A Appendix (Online Only)

A.1 A Brief Summary of Taxation in Spain

A.1.1 The wealth tax

The Spanish wealth tax was adopted in 1978 (Law 50/1977) aimed at complementing the personal income tax (Law 44/1977), but with an extraordinary character. As it is common for wealth taxes, it has been since then a progressive annual tax on the sum of all individual wealth components net of debts. The wealth tax was centrally administered and all regions were required to implement this tax, excluding Basque Country and Navarre, which have never been part of the Common Fiscal Regime (*Régimen Fiscal Común*) and manage their taxes independently.

With the new 1991 law (still in place at present), the wealth tax ceased to have the initial transitory and extraordinary characteristics, asset valuation rules were improved, filing become strictly individual and many changes were introduced to the former wealth tax system (Law 19/1991). Collectibles and consumer durables (excluding mainly vehicles, boats, planes, jewelry and antiques) started to be exempted, as well as pension and property rights in the individual's ownership. The first important reform after the new 1991 law was the introduction of the exemption on some business assets and company shares (except from shares in property investment companies) in 1993 (Law 22/1993, RD 2481/1994).

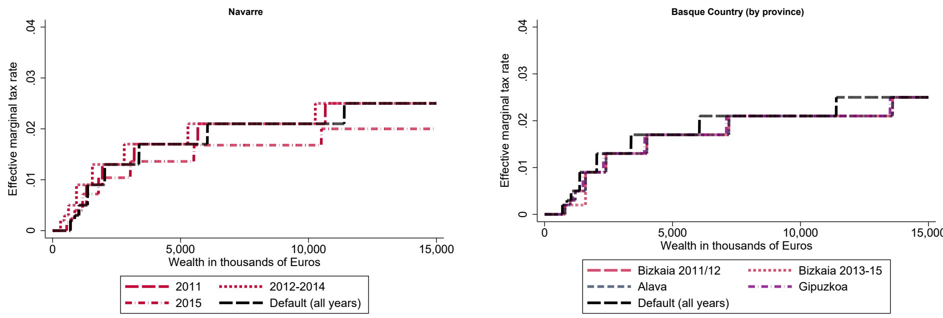
Since 1996 the rights to modify the minimum exempted and the tax rates were ceded to the regions under the condition of keeping the same minimum bracket and marginal tax rate as the national one (Law 14/1996). The first important reform of the wealth tax of the 2000s was the introduction of an exemption in primary residence of 25,000,000 pesetas or 150,253.03 Euro in 2000 (Royal Decree Law 3/2000). For a property to be qualified as the primary residence, the wealth taxpayer needs to have lived continuously there (spending at least 183 days a year) over at least three years or in case not, the taxpayer could benefit from the exemption in case of death, marriage, divorce, first job, job transfer or any other analogous circumstance (Law 40/1998, Law 35/2006). Wealth taxpayers are obliged to report their primary residence and any other urban property using the highest of the following three values: the assessed value, the purchasing value or any other administrative value (e.g., value reported in estate taxes). According to the Spanish Tax Agency of Fiscal Administration, most wealth taxpayers report assessed values as this is the value the Tax Agency has and is directly filled in the tax form without self-reporting.

In 2001, the regions were ceded the right to change or include deductions in the wealth tax and the condition of keeping the same minimum bracket and minimum marginal tax rate as the national one was suppressed (Law 21/2001). Nonetheless, all regions kept the national schedule (0.2-2.5%) during the late 1990's and beginning of the 2000's (only a few regions changed the minimum exemption and Cantabria changed the wealth tax schedule in 2006).

In 2008, the wealth tax was suppressed (Law 4/2008) and reintroduced with a temporary character with the aim of reducing the public deficit for years 2011 and 2012 (Royal Decree Law 13/2011). Even though the central government had approved its reintroduction, regional governments had the legislative power to implement it or not and regional differences in the wealth tax schedule became significant. For instance, Madrid decided to keep the suppression of the wealth tax after 2011, contrary to regions such as Catalonia and Extremadura who have raised the top marginal tax rates (up to 2.75% and 3.75%, respectively) above the national tax rate (2.5%). With the reintroduction some of the main features of the wealth tax system were modified. The exemption on primary residence was raised up to 300,000 Euro, all individuals under personal obligation having gross wealth over 2,000,000 Euro were obliged to file and the new minimum exemption was raised up to 700,000 Euro. With Law 16/2012 the wealth tax was extended until 2013 and with Laws 22/2013, 36/2014, 48/2015, 6/2018 and RD-Law 3/2016, the wealth tax was extended for an indefinite number of years, so that it is still currently in place. Note that after the decentralization, the regions of Basque Country and Navarre kept having a wealth tax similar to the default schedule proposed by the central government (Figure A1).

Both, residents (under personal obligation) and non-residents (under real obligation), are required to file if they have a positive net taxable base. The wealth tax is residence-based and non-residents only have to file the assets held in Spanish territory. Individuals are resident in Spain for tax purposes if they spend more than 183 days in Spain during a calendar year or if they have Spain as their main base or centre for activities or economic interests. It is presumed, unless proven otherwise, that a taxpayer's habitual place of residence is Spain when, on the basis of the foregoing criteria, the spouse (not legally separated) and underage dependent children permanently reside in Spain.

Wealth tax filers are required to annually report end-of-year taxable financial



(a) Navarre (b) Basque Country

FIGURE A1: Marginal Tax Rates in *Foral* Regions

Notes: This figure depicts marginal tax rates and brackets across Navarre and Basque Country, the only two regions which are not part of the common fiscal regime and hence, for which we lack data. The default schedule applied to the rest of regions, as in Figure 1, is shown for reference. If not indicated differently, schedules were valid between 2011-2015. The schedules of the Basque Country vary across provinces as indicated in Panel (b).

assets at market value (e.g. cash, bank deposits, stocks, bonds, financial assets held abroad, etc.), taxable non-financial assets (e.g. real estate, land, consumer durables, non-corporate business assets, non-financial assets held abroad), and taxable debt (e.g. mortgages, inter-personal debts). They are also obliged to report non-taxable business assets and stocks and the full value of their primary residence. Note that both taxable and non-taxable business assets need to be reported at book value.

While income is largely covered by third-party reporting in Spain, there is only partial third-party reporting of wealth, namely dwellings (whenever they have an assessed value) and financial assets and liabilities held in bank accounts (checking accounts, deposits, mortgage debt). All the rest of wealth categories have virtually no third-party reporting. Despite technological improvements in third-party reporting in recent years, enforcement capacity in the case of wealth taxes is still limited, mainly because of no third-party reporting wealth categories and because available resources and tax technology are not enough to systematically cross-check all items reported in the wealth tax return using third-party reported information.

Audits can be made by central or regional tax authorities. The central government makes wealth tax audits whenever the reported information in the personal income tax form does not match with what is reported in the wealth tax form. The central government also shares information with regional authorities for auditing purposes. However, verifying the primary address comes with substantial difficulty to both tax authorities. They tend to make the audits based on utility bills, bank transaction information and other expenses. The incentives to audit are higher for regional than central authorities as all wealth tax revenue goes to the regional authority. Partial self-reporting coupled with imperfect enforcement capacity offers scope for tax evasion and avoidance.

Non-compliance, including fraudulent moves and misreporting of wealth can be penalized according to Spanish fiscal legislation *Ley General Tributaria (LGT)*. The penalty is proportional to the amount evaded and the rate varies between 50 and 150% depending on both the amount evaded and if there was hiding. Only if this amount exceeds 120,000 Euros this is considered to be a crime (Article 305 *Código Penal*). In this case, penalties are a larger multiple of the amount evaded, which has to be determined by a judge.

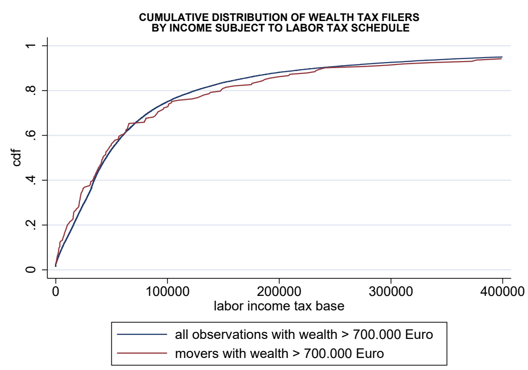


FIGURE A2: Cumulative Distribution of Wealth Tax Filers by Labor Income

Notes: This figure shows the cumulative distribution of taxable labor income for the 2010 wealthy treatment group (i.e., wealthy individuals with taxable wealth above 700,000 Euro in 2010) and for the movers within this treatment group. This figure is constructed by linking the personal income and wealth tax panel.

A.1.2 Other taxes

The decentralization of the wealth tax should be considered in the context of fiscal decentralization in Spain. The central government also passed provisions allowing regions to set the tax brackets and tax rates on their half of the personal income tax on *labor*, which created incentives for high (labor) income individuals to move. Spain operates a dual income tax system, under which capital income is taxed at a common schedule. Thus, for high-wealth individuals who obtain a substantial fraction of their income from the return to capital, decentralization of the labor income tax provided little additional incentive to move. Figure A2 shows that most high wealth individuals have labor income such that income tax differentials across regions are minimal.

Wealth transfer taxes are also decentralized to the regions. Spain operates an inheritance tax (not an estate tax). Inheritance taxes have been decentralized to the regions since 1997, but regions did not exercise this right until the mid-2000s. In particular, Madrid operates a tax credit of 99% on close relatives since 2007, so that there is no additional incentive to relocate to Madrid created by this tax starting in 2011. Moreover, the place of residence for this tax is defined based on the location of the deceased over the last *five* years before death. Given this long duration of proof, and the fact that we focus on five years following decentralization, we expect little of this new mobility to be a result of these taxes. Spain has no other personal taxes at the regional level.

A.2 Wealth Extrapolation Method

A.2.1 Methodology

We estimate wealth for the years for which wealth tax records are not available (2008-2015) by combining national accounts, wealth and personal income tax returns. Following Martínez-Toledano (2020), we map each personal income category from national accounts to a personal wealth category in non-financial and financial accounts. For non-financial accounts we rely on the reconstruction done by Artola Blanco et al. (2020) and for financial accounts on the Bank of Spain balance sheets. We can map urban real estate, business assets, life insurance, deposits, debt assets, shares and debts. Then, we compute the annual rate of return for each asset category as the ratio of the flow to the stock. Using these returns, we then extrapolate individual wealth from 2008 onward using reported individual wealth in 2007 as an anchor.

Asset categories for which the aggregate rate of return is not available in national accounts (e.g., jewelry, antiques, rural real estate, industrial and intellectual property rights) are extrapolated forward using the annual growth rate of the average reported values from official aggregate wealth tax records published by the Spanish Tax Agency over the period 2011-2015. For some assets (e.g., taxable business assets, liabilities), we also use this last procedure, as it better matches the evolution of total reported wealth by region. We refine the extrapolation by adjusting reported urban real estate to account for the exemption on main residence, which was raised in 2011.

A.2.2 Robustness checks

To test for the robustness of our extrapolation method, we first compare extrapolated average regional wealth to the actual reported average wealth published by the Spanish Tax Agency. Figure A3 shows that the extrapolation closely matches regional average wealth in both level and trend. We also compare extrapolated versus actual individual reported wealth levels using Catalonia's administrative wealth tax records after 2011. Figure A4 shows that there exists a strong correlation between our extrapolated and the direct wealth measures in this region around the 700,000 Euro threshold. Overall, this evidence supports the robustness of our wealth extrapolation method to define treatment status in some of our specifications and to carry the revenue and inequality analysis.

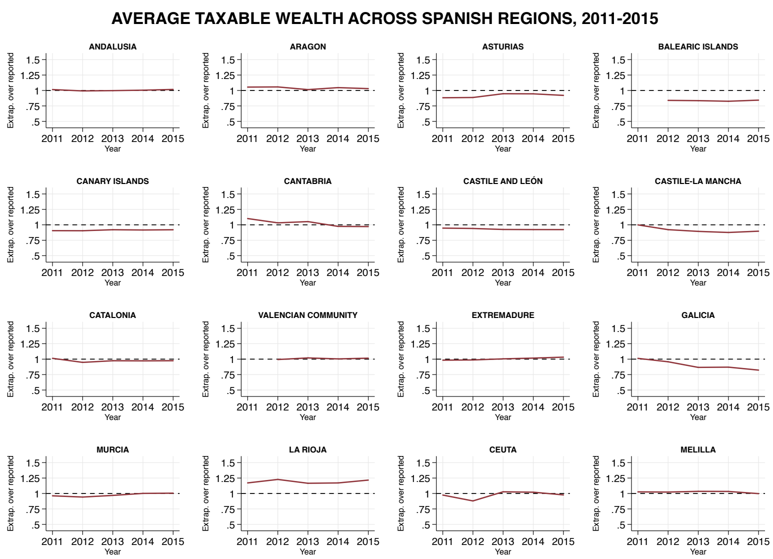


FIGURE A3: Average Taxable Wealth Across Spanish Regions, 2011-2015

Notes: This figure compares extrapolated versus actual reported average wealth across Spanish regions over the period 2011-2015. Reported average wealth figures across regions have been calculated after digitizing the official wealth tax statistics published by the Spanish Tax Agency. Note that the region of Madrid is missing, as it has a 0% wealth tax rate over the whole period 2011-2015.

A.3 Wealth Tax Calculator

This section describes the wealth tax calculator we have built to compute marginal and average tax rates for all individuals in the seventeen Spanish regions from 2005-2007 and 2011-2015, as the wealth tax was suppressed between 2008 and 2010. The

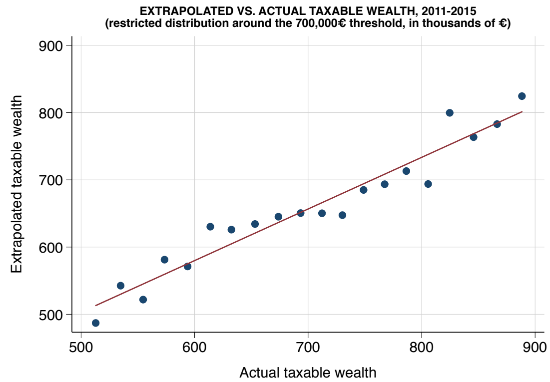


FIGURE A4: Extrapolated vs. Actual Taxable Wealth, 2011-2015 (Using Catalan Wealth Tax Records)

Notes: This figure compares extrapolated versus actual individual reported wealth levels around the 700,000 Euro threshold for Catalonia's wealth taxpayers pooling years 2011-2015. The Catalan wealth tax records have been kindly shared by the Catalan Tax Agency. The comparison is made for the subsample of Catalan wealth taxpayers we are able to match across the two data sources (approximately 40% of our sample).

tax calculator takes into account regional variation in marginal tax rates, tax bracket thresholds and the basic deductions included in the input data table. Information about marginal tax rates, deductions and tax brackets are taken from the annual *Manual Práctico de Renta y Patrimonio* published by the Spanish Ministry of Finance. We use the tax calculator to simulate for each individual the average tax rate in her region of residence and hypothetical tax rates if she lived in any other region. The tax simulator thus provides all counterfactual levels of the wealth tax burden across regions of Spain under both a decentralized and centralized wealth tax system.

A.3.1 Structure of input data

The tax calculator consists of a STATA program file (spatax.ado) which runs over a data-set which contains the input variables needed. The command is

```
taxbase, y() pers_handicap() tb_general() tb_capital() tb_cgains()
   tl_cg() tl_rg() div_nont() sample_type() taxl_wt_lim() taxl_wt()
   tl_saving() id_houshold() out(),
```

where the variables are defined as in Table A1. These input variables allow us to construct an average and marginal tax rate for each person for all years and regions in the data set. The option `out` specifies the prefix which will be added to each variable (see output data). Tax rates and bracket thresholds are not inputs in the data set because they are coded directly into the program which feeds in wealth, income and characteristics for each individual.

Variable	Definition
y	Year identifier (2005-2007, 2011-2015)
pers_handicap	Handicap status: 0 - not handicapped, 1 - handicapped up to 33%, 2 - between 33%-66%, 3 - above 66%
tb_general	PIT labor income tax base
tb_capital	PIT capital income tax base
tb_cgains	Positive capital gains from the selling of assets purchased more than one year in advance (part of the capital income tax base)
tl_cg()	PIT liabilities to central government
tl_rg()	PIT liabilities to regional government
div_nont()	non-taxable dividends in the personal income tax
sample_type()	Type of personal income tax filing: 1 - individual 2 - joint
taxl_wt_lim()	Wealth tax liability cap (60% of the personal income tax base + div_nont + tb_cgains)
taxl_wt()	Wealth tax liability before applying the wealth-income tax liability cap
tl_saving()	Capital income tax liability
id_houshold()	Household identifier

TABLE A1: Input Variables

A.3.2 Output data

The output variables are given by a set of marginal and average tax rates. These variables are labeled *mtr_ out-prefix_ region* & *atr_ out-prefix_ region* where region is the official region identifier according to the National Institute of Statistics and the prefix is added as specified by the out() option.

A.3.3 Robustness Checks

To test the robustness of our simulator, we compare the simulated and direct wealth tax liabilities for the years in which direct individual wealth information is available. Figure A5 shows that in 2007, the last year for which direct wealth tax information is available, the simulated wealth tax liabilities consistently match the direct wealth tax liabilities available in the administrative tax return data. We also use the Catalan wealth tax micro files and compare the direct Catalan wealth tax liabilities with the simulated wealth tax liabilities over the 2011-2015 period. We regress the simulated wealth tax liabilities on the direct wealth tax liabilities pooling all years 2011-2015 and find a coefficient of 0.98 with standard error of 0.01. Overall,

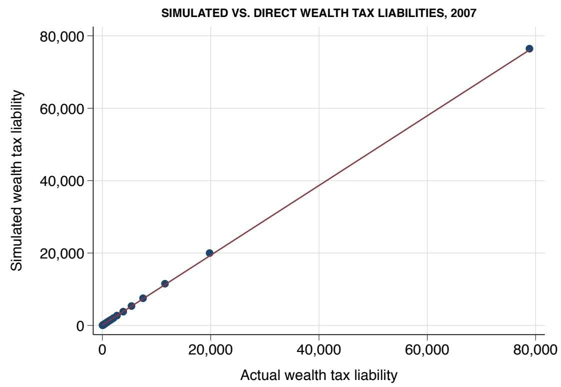


FIGURE A5: Simulated vs. Direct wealth tax liabilities, 2007

Notes: This figure compares simulated versus actual wealth tax liabilities for all wealth taxpayers in 2007, the last year for which we have direct information on wealth. Results are presented in Euro.

this evidence supports not only the robustness of the tax simulator but also that of the extrapolation method.

A.4 Descriptive Evidence

The key result of our paper can be seen in the administrative data (Figure A6). We plot the change in the number of individuals who would be subject to the post-reform wealth tax for Madrid and the average of the other regions. Following decentralization, the number of wealth tax filers reporting Madrid as their fiscal residence increases by over 6,000. The other regions see an average decline of 375 filers.

Table A2 shows the summary statistics for the "2010 wealthy" treatment sample in 2010. Wealthy individuals in Madrid are similar to those in other regions on the basis of demographic characteristics, but Madrid wealth tax filers have higher average wealth and income levels. Movers to Madrid are also similar based on demographics to movers to other regions, but movers to Madrid have higher wealth. Regardless of these level differences, as will be shown, our empirical design does not require the level of wealth to be similar in all regions, but the trend prior to the reform. Moreover, in our preferred specification the mobility response is based on the taxpayer's fiscal residence and not on her wealth, so that the benchmark empirical design requires the trend in the number of movers to be similar in all regions.

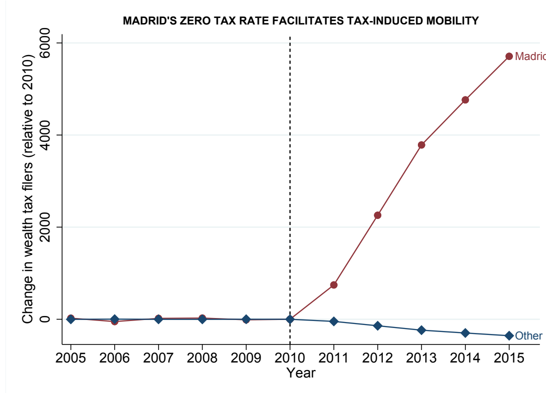


FIGURE A6: Madrid's Zero Tax Rate Facilitates Tax-induced Mobility

Notes: This figure shows the number of wealth tax filers in Madrid and the average number of wealth tax filers among the other sixteen regions of Spain. For this figure, we use the "2010 wealthy." We follow a re-weighted balanced sample of filers. We normalize each series to zero in 2010 and use the pre-decentralization data to remove group-specific trends, such that the figure shows the change in filers that is in excess of any pre-reform trends. The latter adjustment only changes the orientation of the lines and not the trend break.

A.5 Additional Results

This section presents additional robustness checks. For defining treatment, in an alternative approach, we rely on the 2007 records and avoid relying on extrapolated data. We classify an individual as treated by the decentralization if they filed wealth taxes under the centralized regime in 2007 and had taxable wealth of more than 700,000 Euro in 2007. We refer to this group as the **"2007 filers."** Using the administrative wealth tax data to determine who has more than 700,000 Euros in 2007 only classifies 4% of individuals differently than using extrapolated 2010 wealth. Figure A7 shows the results.

Next, in Table A3, we show robustness of the stock of people to the stock of wealth. For regressions using total wealth rather than the total number of filers, we use wealth tax filers that have a level of taxable wealth that is sufficiently below the new 700,000 Euro threshold as a third comparison group. We assign individuals to the comparison group if their 2010 taxable wealth is between 108,182.18 and 300,000 Euro.[38] If some of these individuals may expect their wealth to grow and be subject to the tax, we may underestimate the effect on total wealth. We name this comparison group the **"<300,000"**.

As a final check on the aggregate analysis, we show robustness to various weighting

[38]We do not select individuals close to the threshold since they are also likely to be affected by the reform, which would bias the results as mentioned in Akcigit et al. (2016).

Variables	# obs	Mean	sd	Min	Max
		Panel A: All filers in 2010			
Labor income	375,170	62.24	270.5	0	14,006
Business income	375,170	30.72	190.6	-1,125	21,560
Capital income	375,170	72.49	245.1	-3,193	22,162
Debt	375,170	179.6	1,365	0	203,162
Wealth tax base	375,170	2,355	5,972	700.0	313,634
Age	375,170	64.77	12.05	11	106
Female	375,170	0.441	0.497	0	1
		Panel B: Filers residing outside Madrid			
Labor income	294,463	48.30	204.9	0	14,006
Business income	294,463	28.10	128.8	-1,079	5,535
Capital income	294,463	68.93	186.0	-3,193	8,164
Debt	294,463	158.2	748.8	0	30,799
Wealth tax base	294,463	2,141	5,375	700.0	313,634
Age	294,463	65.16	11.97	11	104
Female	294,463	0.442	0.497	0	1
		Panel C: Filers residing in Madrid			
Labor income	80,707	113.1	428.5	0	12,154
Business income	80,707	40.30	328.9	-1,125	21,560
Capital income	80,707	85.47	391.0	-2,168	22,162
Debt	80,707	257.4	2,570	0	203,162
Wealth tax base	80,707	3,136	7,719	700.1	310,083
Age	80,707	63.37	12.23	17	106
Female	80,707	0.437	0.496	0	1
		Panel D: Filers which moved to any region other than Madrid			
Labor income	1,094	28.07	53.60	0	377.1
Business income	1,094	46.92	160.2	-298.7	886.0
Capital income	1,094	50.81	68.58	-2.774	317.3
Debt	1,094	339.0	1,409	0	10,113
Wealth tax base	1,094	2,203	2,434	704.0	12,654
Age	1,094	63.04	12.66	34	97
Female	1,094	0.376	0.485	0	1
		Panel E: Filers which moved to Madrid			
Labor income	880	37.27	79.13	0	478.8
Business income	880	36.98	104.2	-27.25	577.3
Capital income	880	93.21	176.5	-48.98	955.5
Debt	880	217.3	622.6	0	4,510
Wealth tax base	880	4,080	6,255	705.5	38,252
Age	880	65.22	13.17	36	91
Female	880	0.463	0.499	0	1

TABLE A2: Summary Statistics, 2010 (2010 Wealthy Treatment Sample)

Notes: This table presents summary statistics for our preferred treatment sample (i.e., "2010 wealthy", those who have wealth above 700,000 Euro in 2010) in pre-reform year 2010. Results are very similar for other pre-reform years. Note that all figures are calculated using weights to match the total number of wealth tax filers in every region in 2010. All monetary values are in thousands of Euro.

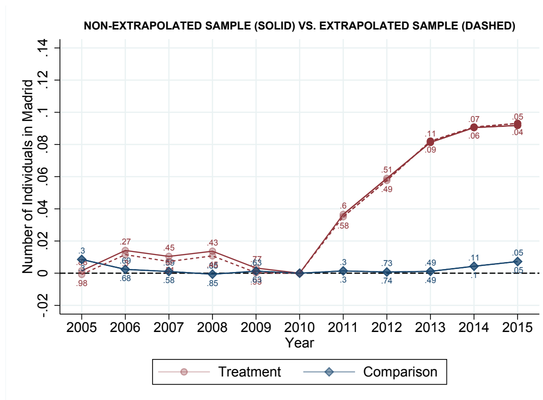


FIGURE A7: Event Study of the Share of Individuals in Madrid Using 2007 Data

Notes: This figure shows the coefficients from (1). The results using the 2010 wealthy treatment/comparison sample from the main text are shown in dashed lines. In the solid lines, we instead define a wealth taxpayer as any person that filed wealth taxes in 2007 and had more than 700,000 Euro of wealth in 2007. Thus, this latter sample does not use extrapolated data to define the treatment group. Note that because we reweight the data, the comparison group changes slightly as well. All other notes from the figure in the main text apply.

	Amount of Wealth			
	All			w/o Mad.
	Panel I: Panel Data with Only Filers			
	(1a)	(1b)	(1c)	(1d)
$\ln(1 - atr_{rt})$	3.107	2.831	4.157	1.445
Uncorrected SEs	(1.104)	(1.113)	(2.170)	(1.145)
Bootstrap p-values	0.048**	0.072*	0.216	0.256
# obs	136	136	136	128
F-stat	-	>1000	51	>1000
	Panel II: Panel Data with Filers and Non-filers			
	(2a)	(2b)	(2c)	(2d)
$W_f \times \ln(1 - atr_{rtf})$	5.626	5.358	7.916	2.086
Uncorrected SEs	(1.335)	(1.291)	(1.019)	(1.391)
Bootstrap p-values	0.022**	0.024**	0.000***	0.182
# obs	272	272	272	256
F-Stat	-	>1000	65	>1000
Controls	yes	yes	yes	yes
OLS	yes	no	no	no
Simulated IV w/ Fixed Wealth	no	yes	no	yes
Madrid x Post IV	no	no	yes	no

TABLE A3: Elasticities of the Stock of Wealth with Respect to the Net-of-Tax Rate

Notes: Panel I shows the coefficients from the estimation of (3). Panel II shows the coefficients when this equation is augmented to include data on the comparison group. For the total wealth specifications, the comparison group is the "$< 300,000$". For all columns, N_{rt} is the amount of wealth. Column (d) drops Madrid from the regression to test whether smaller tax differentials between regions matter. We cluster standard errors at the regional level. Because the number of clusters is small, we implement the percentile-t wild cluster bootstrap, imposing the null hypothesis, and report p-values, *** p<0.01, ** p<0.05, * p<0.1.

	Number of Wealthy Filers			
	All			w/o Mad.
	Panel I: Panel Data with Only Filers			
	(1a)	(1b)	(1c)	(1d)
$\ln(1 - atr_{rt})$	4.378	4.191	6.246	2.089
Uncorrected SEs	(0.798)	(0.777)	(1.457)	(0.427)
Bootstrap p-values	0.000***	0.002***	0.014**	0.102
# obs	136	136	136	128
F-stat	-	>1000	51	>1000
	Panel II: Panel Data with Filers and Non-filers			
	(2a)	(2b)	(2c)	(2d)
$W_f \times \ln(1 - atr_{rtf})$	5.750	5.498	8.180	2.281
Uncorrected SEs	(1.121)	(1.079)	(1.072)	(0.785)
Bootstrap p-values	0.004***	0.004***	0.000***	0.092*
# obs	272	272	272	256
F-Stat	-	>1000	65	>1000
Controls	yes	yes	yes	yes
OLS	yes	no	no	no
Simulated IV w/ Fixed Wealth	no	yes	no	yes
Madrid x Post IV	no	no	yes	no

TABLE A4: Elasticities of the Stocks with Respect to the Net-of-Tax Rate (No Reweighting of Filers)

Notes: Unlike the table in the text, this table does not reweight the data to be representative of wealth tax filers. Everything else remains the same. Panel I shows the coefficients from the estimation of (3). Panel II shows the coefficients when this equation is augmented to include data on the comparison group. For the number of filers, the comparison group is the "High dividend". For all columns in the first panel, N_{rt} is the number of "2010 wealthy" filers, while in the second panel N_{rtf} is the number of "2010 wealthy" filers and comparison group non-filers. Column (d) drops Madrid from the regression to test whether smaller tax differentials between regions matter. We cluster standard errors at the regional level. Because the number of clusters is small, we implement the percentile-t wild cluster bootstrap, imposing the null hypothesis, and report p-values, *** p<0.01, ** p<0.05, * p<0.1.

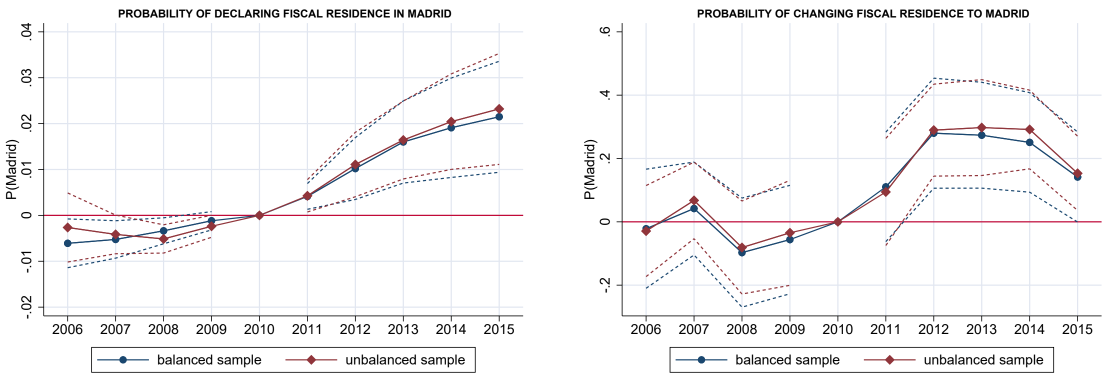
procedures. Table A4 show the results when we do not reweight the income data to be representative of wealth tax filers and Table A5 shows the results when the average tax rate is not weighted by wealth.

Figure A8 shows the choice model in event study format. We then show the results using the binary rather than continuous treatment (Table A6) and for the instruments (Table A7). Finally, Figure A9 shows the lack of heterogeneous effects across individual characteristics.

	Number of Wealthy Filers			
	All			w/o Mad.
	Panel I: Panel Data with Only Filers			
	(1a)	(1b)	(1c)	(1d)
$\ln(1 - atr_{rt})$	10.868	10.435	15.234	5.424
Uncorrected SEs	(1.916)	(1.856)	(3.505)	(1.497)
Bootstrap p-values	0.002***	0.002***	0.018**	0.094*
# obs	136	136	136	128
F-stat	-	>1000	53	>1000
	Panel II: Panel Data with Filers and Non-filers			
	(2a)	(2b)	(2c)	(2d)
$W_f \times \ln(1 - atr_{rtf})$	14.004	13.178	20.169	5.084
Uncorrected SEs	(2.869)	(2.744)	(2.799)	(2.253)
Bootstrap p-values	0.004***	0.006***	0.000***	0.088*
# obs	272	272	272	256
F-Stat	-	>1000	52	>1000
Controls	yes	yes	yes	yes
OLS	yes	no	no	no
Simulated IV w/ Fixed Wealth	no	yes	no	yes
Madrid x Post IV	no	no	yes	no

TABLE A5: Elasticities of the Stocks with Respect to the Net-of-Tax Rate (No Weighting of Taxes)

Notes: Unlike the table in the text, this table uses mean average tax rate across individuals and not the weight weighted average tax rate. Everything else remains the same. Panel I shows the coefficients from the estimation of (3). Panel II shows the coefficients when this equation is augmented to include data on the comparison group. For the number of filers, the comparison group is the "High dividend". For all columns in the first panel, N_{rt} is the number of "2010 wealthy" filers, while in the second panel N_{rtf} is the number of "2010 wealthy" filers and comparison group non-filers. Column (d) drops Madrid from the regression to test whether smaller tax differentials between regions matter. We cluster standard errors at the regional level. Because the number of clusters is small, we implement the percentile-t wild cluster bootstrap, imposing the null hypothesis, and report p-values, *** p<0.01, ** p<0.05, * p<0.1.



(a) Full Sample (Movers and Stayers) (b) Movers

FIGURE A8: Choice Event Study

Notes: These figures show the change in the probability of declaring fiscal residence in (panel a) or changing fiscal residence to (panel b) Madrid relative to all other regions using a simple variant of (7) with event time dummies interacted with a Madrid indicator. Panel (a) use the full sample of movers and stayers while panel (b) only uses movers. The specifications include alternative region and case fixed effects, as well as individual and alternative region controls. We present results for a balanced sample (blue/circle) and an unbalanced sample (red/diamond) that allows for attrition from the sample. The treatment group is the 2010 wealthy. Standard errors are clustered at the origin-bracket and alternative-bracket level. Dashed lines indicate 95% confidence intervals. The models start in 2006 as we need lagged information for the construction of the clusters and the "move" variable.

	Panel I - Full Sample				
	(1a)	(1b)	(1c)	(1d)	(1d)
$\text{Madrid}_j \times Post_t$	0.018***	0.016***	0.016***	0.017***	0.016***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
R^2	0.097	0.097	0.101	0.097	0.101
# obs	5,136,040				
	Panel II - Movers				
	(2a)	(2b)	(2c)	(2d)	(2e)
$\text{Madrid}_j \times Post_t$	0.223***	0.222***	0.217***	0.235***	0.230***
	(0.015)	(0.016)	(0.034)	(0.026)	(0.038)
R^2	0.303	0.303	0.308	0.304	0.309
# obs	38,675				
alternative FE	yes	yes	yes	yes	yes
individual controls	no	no	yes	no	yes
alternative region controls	no	no	no	yes	yes
PIT differential (ATR)	no	yes	no	no	yes

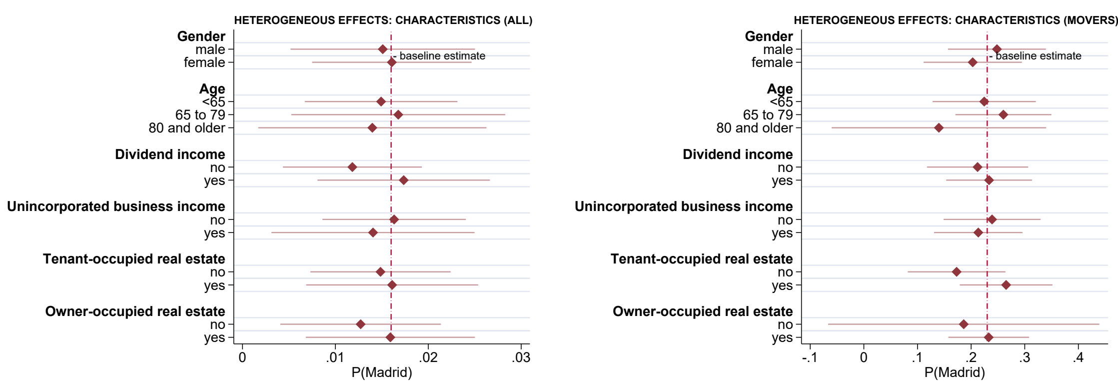
TABLE A6: Individual Choice Model

Notes: This table presents the results from the simplified version of the individual choice model in (7) for the "2010 wealthy". Panel I focuses on the full sample of movers and stayers, while Panel II used only movers. All models include a full set of case fixed effects and the other controls indicated in the table. Individual controls include age, age squared, gender, gender by age, and labor income and allow for a separate coefficient for each alternative j. Regional controls vary across j and over time and correspond to the set of controls in the aggregated analysis. Standard errors clustered at the origin-tax-bracket and alternative-tax-bracket level, *** p<0.01, ** p<0.05, * p<0.1

	Panel I - Full Sample			
	(1a)	(1b)	(1c)	(1d)
$\ln(1-\tau_{i,t,j})$	7.622***	7.767***	4.867***	4.287***
	(1.292)	(1.345)	(0.839)	(0.674)
# obs	5,136,040			
mean ATR (std.)	0.237 (.364)			
	Panel II - Movers			
	(2a)	(2b)	(2c)	(2d)
$\ln(1-\tau_{i,t,j})$	6.581***	6.492***	48.027***	46.553***
	(2.245)	(2.291)	(13.358)	(12.495)
# obs	38,675			
mean ATR (std)	0.446 (.488)			
alternative FE	no	no	yes	yes
alternative-year FE	yes	yes	no	no
individual controls	no	yes	no	yes
alternative region controls	no	no	no	no
PIT differential	yes	yes	yes	yes

TABLE A7: Individual Choice Model - Instruments

Notes: This table presents the results of (6) for different instruments. Model (a) and model (b) fixes the extrapolated tax base in 2010 to simulate the average tax rate instrument over time. Model (c) and model (d) use the Madrid × post dummy as an instrument. Standard errors clustered at the origin-tax-bracket and alternative-tax-bracket level, *** p<0.01, ** p<0.05, * p<0.1



(a) Full sample

(b) Movers

FIGURE A9: Heterogeneous Effects by Characteristics

Notes: This figure shows the marginal effects from the simplified version of (7) appropriately interacted with an indicator variable for the respective category. Each grouping (gender, age, capital income characteristics) is estimated in a separate equation. Estimates based on the full sample are shown in panel (a) and for movers in panel (b). The treatment is the 2010 wealth. All other specifications remain unchanged. We show 95% confidence intervals around point estimates, with standard errors are clustered at the origin-bracket and alternative-bracket level.

A.6 Theory Appendix

A.6.1 Evasion Only

This section shows derivations of the theory of tax evasion. For the case of evasion only, the utility of declaring one's home region as the region of residence is

$$c_t^i(1 - T_{ht}^i) + g(z_{ht}^i). \tag{A1}$$

The expected utility of declaring any other region $j \neq h$ is

$$(1 - p^i)c_t^i(1 - T_{jt}^i) + p^i \left[c_t^i(1 - T_{ht}^i) - f^i(T_{ht}^i - T_{jt}^i)c_t^i\right] - \kappa_t^i c_t^i + g(z_{h^it}^i). \tag{A2}$$

Assume that the tax rate in Madrid, T_{mt}^i, is zero, but is positive in all other regions. Madrid is preferred to the home region if its expected utility is greater than from declaring one's home region. Given that in the presence of evasion, the consumer remains in their home region and consumes the home region amenities, this implies:

$$(1 - p^i)c_t^i + p^i \left[c_t^i(1 - T_{ht}^i) - f^i T_{ht}^i c_t^i\right] - \kappa_t^i c_t^i + g(z_{ht}^i) + > c_t^i(1 - T_{ht}^i) + g(z_{ht}^i) \tag{A3}$$

$$\frac{T_{ht}^i(1 - p^i - p^i f^i)}{1 - p^i} > \kappa_t^i, \tag{A4}$$

which yields the equation in the text. In the standard evasion model, there are no idiosyncratic evasion costs and so this implies that

$$p^i < \frac{1}{1 + f^i}. \tag{A5}$$

Consider a resident of region h. This individual will never choose to declare taxes in a region other than their home region or Madrid. In order to do so, the expected utility of that region must be greater than the home region *and* Madrid. Comparing such a region to Madrid, it is easy to show that the expected utility of Madrid is always greater if (A5) holds:

$$\begin{aligned}(1 - p^i)c_t^i + p^i \left[c_t^i(1 - T_{ht}^i) - f^i T_{ht}^i c_t^i\right] - \kappa_t^i c_t^i + g(z_{ht}^i) \quad &\text{(A6)}\\ > (1 - p^i)c_t^i(1 - T_{jt}^i) + p^i \left[c_t^i(1 - T_{ht}^i) - f^i(T_{ht}^i - T_{jt}^i)c_t^i\right] - \kappa_t^i c_t^i + g(z_{ht}^i)&\\ \frac{1}{1 + f^i} > p^i. \quad &\text{(A7)}\end{aligned}$$

The prior expression is identical to (A5). Thus, if the idiosyncratic costs and audit probability are sufficiently small, the individual will only evade to Madrid, if at all.

A.6.2 Evasion vs. Migration

Recall from the migration model in the text, Madrid will be the chosen region of residence if it is preferred to the home region:

$$c_t^i + g(z_{mt}^i) - \phi_{hmt}^i c_t^i > c_t^i(1 - T_{ht}^i) + g(z_{ht}^i) \tag{A8}$$

$$\tag{A9}$$

and is preferred to all other regions:

$$c_t^i + g(z_{mt}^i) - \phi_{hmt}^i c_t^i > c_t^i(1 - T_{j't}^i) + g(z_{j't}^i) - \phi_{hj't}^i c_t^i. \tag{A10}$$

In the evasion only model, Madrid is chosen if:

$$(1 - p^i)c_t^i + p^i \left[c_t^i(1 - T_{ht}^i) - f^i c_t^i\right] - \kappa_t^i c_t^i + g(z_{ht}^i) > c_t^i(1 - T_{ht}^i) + g(z_{ht}^i). \tag{A11}$$

Now consider an individual that has the choice of evading or moving to Madrid. When will evasion be chosen? Assuming $p^i < 1/(1 + f^i)$ holds, this requires

$$(1 - p^i)c_t^i + p^i \left[c_t^i(1 - T_{ht}^i) - f^i T_{ht}^i c_t^i\right] - \kappa_t^i c_t^i + g(z_{ht}^i) > c_t^i + g(z_{mt}^i) - \phi_{hmt}^i c_t^i \tag{A12}$$

$$-T_{ht}^i p^i c_t^i - p^i f^i T_{ht}^i c_t^i > g(z_{mt}^i) - g(z_{ht}^i) + (\kappa_t^i - \phi_{hmt}^i)c_t^i.$$

Given region h was selected prior to decentralization in period $t-1$, this implied, that when there were no tax differences:

$$c_{t-1}^i + g(z_{m,t-1}^i) - \phi_{hmt-1}^i c_{t-1}^i < c_{t-1}^i + g(z_{h,t-1}^i). \tag{A13}$$

Then if there are no idiosyncratic evasion costs and both amenities and moving costs are time invariant ($z_{mt}^i \approx z_{m,t-1}^i, z_{ht}^i \approx z_{h,t-1}^i, \phi_{hmt}^i \approx \phi_{hm,t-1}^i$), we have

$$g(z_{mt}^i) - g(z_{ht}^i) - \phi_{hmt}^i < 0. \tag{A14}$$

Then, the right hand side of (A13) continues to be negative if κ_t^i is sufficiently small.

Then from (A13) we can consider two cases:

1. If $p^i \to 0$, only the differences in amenities valuation and the other costs matters: $g(z^i_{mt}) - g(z^i_{ht}) + (\kappa^i_t - \phi^i_{hmt})c^i_t$. If this term is negative [positive], then evading [moving] is the better option. However,the implications of the chosen region in (A14) suggest this term is likely negative, such that evading is almost always optimal if all the previously derived conditions hold. Moreover, note that if the valuation of amenities in both regions is the same, this term is also always negative if $\kappa^i_t < \phi^i_{hmt}$ and evading is always the better option.

2. If the audit probability approaches its upper bound, $p^i \to 1/(f^i + 1)$, then this implies $-T^i_{ht}c^i_t > g(z^i_{mt}) - g(z^i_{ht}) + (\kappa^i_t - \phi^i_{hmt})c^i_t$. If the right had side is very negative, then evasion will still be selected, but otherwise migration is selected.

A.7 Methodology for Revenue Analysis

This section describes the methodology used to analyze how tax-induced mobility responses affect wealth and income tax revenues by means of counterfactual simulations. We then use the counterfactual simulations to make comparisons with respect to the baseline scenario, that is, the observed (realized) revenues. To construct the counterfactuals, we simulate the evolution of wealth and income tax revenue absent tax-induced mobility. Consistent with our empirical analysis, tax-induced migration is defined as mobility to Madrid, as the small tax differentials between other regions have no noticeable effect on the stock of wealthy taxpayers. To identify the number of tax-induced movers, we use the annual coefficients of the relative change in the stock of movers to Madrid from estimation of (2).

We apportion the change in Madrid's stock back to each of the other regions of Spain using the annual shares of net migration that each region contributes to Madrid relative to the pre-reform period. By making the apportionment factors based off the change in net-migration relative to 2010, these factors are consistent with the econometric specification. As we do not know who moved for tax or non-tax reasons, we then draw taxpayers randomly from the set of movers involving Madrid that are subject to the wealth tax (i.e., they have taxable wealth above 700,000€). Given that tax-induced migration involves movement to Madrid and inducing some people who would move from Madrid, to stay, whenever the selected number of movers in each region does not add up to the total net migration share, we draw taxpayers (i.e., subject to the wealth tax) randomly from the set of stayers in Madrid over the 2011-2015 period. We assign them to each region so as to match each region's net migration share to Madrid. Because the distribution of taxpayers in Madrid is more skewed than in the rest of regions, we censor the wealth drawing so as to never pick the richest 1% of stayers. This also helps deal with the fact that we have a stratified sample, rather than the full universe of taxpayers.[39]

As the personal income and wealth tax panel is meant to be representative of the personal income tax distribution, we need to reweight the dataset so that it is also representative of the wealth tax distribution. First, we reweight the sample of wealth taxpayers to match regional totals over the period 2005-2007. We then extrapolate these weights forward by applying region-specific adult-age population growth rates using the Annual Population Series (*Cifras de Población*) published by the Spanish Statistics Institute. Finally, we reweight the subsample of personal income taxpayers that do not file wealth taxes so that after reweighting, the full panel matches the total number of personal income taxpayers in each region and year. In the counterfactual revenue simulations, we fix the regional distribution of wealth tax filers to its pre-reform level (i.e., year 2010) and only allow the weights to change over time through the change in the total number of wealth tax filers. We also use this reweighting procedure in the inequality analysis. As explained in the main text, this is a partial equilibrium analysis.

We simulate four different scenarios eliminating any tax-induced mobility:

1. Decentralization without tax-induced mobility: We keep the baseline wealth and income tax schedule in each region unchanged but close down tax-induced mobility. Note that this is the only scenario for which we also simulate the personal income tax. We do so by keeping fixed the baseline personal income tax liability for both capital and labor income (i.e., we assume there are no differences in the personal labor income tax schedule between Madrid and the rest of regions), so that the only thing that changes is the region of residence.

2. Decentralization with a positive minimum wealth tax: We keep the baseline wealth tax schedule in each region unchanged except for the zero-tax regions (i.e., Balearic Islands and Valencian Community in 2011, Madrid between 2011-2015).

[39] For movers from Castile and León to Madrid we also censor the personal income tax liability for the largest top 1%, as some of the movers in this region are ultra rich individuals and they would not receive so much weight if we had the full universe of taxpayers.

For these regions, we assign the default schedule, which is the lowest positive schedule observed. This scenario could arise if the central government only allowed regions to deviate upward from the default schedule. As all migration we observe in the data is to tax havens, this scenario closes down tax-induced mobility according to the procedure described above.

3. Harmonization with default schedule: We apply the default (centralized) wealth tax schedule to each region, including Madrid. As all regions levy the same tax rate, this closes down tax-induced mobility as discussed above.

4. Harmonization with a Pareto-improving schedule: We find the coordinated harmonized wealth tax schedule over the period 2011-2015 such that all regions are better-off (according to tax revenue) after harmonization than in the observed baseline with decentralization. To do this, we scale the marginal tax rate in each bracket upward by 1% increments (relative to the default schedule). We then conduct a search, which iterates until we find a wealth tax schedule that generates a Pareto improvement in terms of tax revenue for all regions. In each year, we never let the harmonized tax rate rise above the maximum regional tax rate in that year.

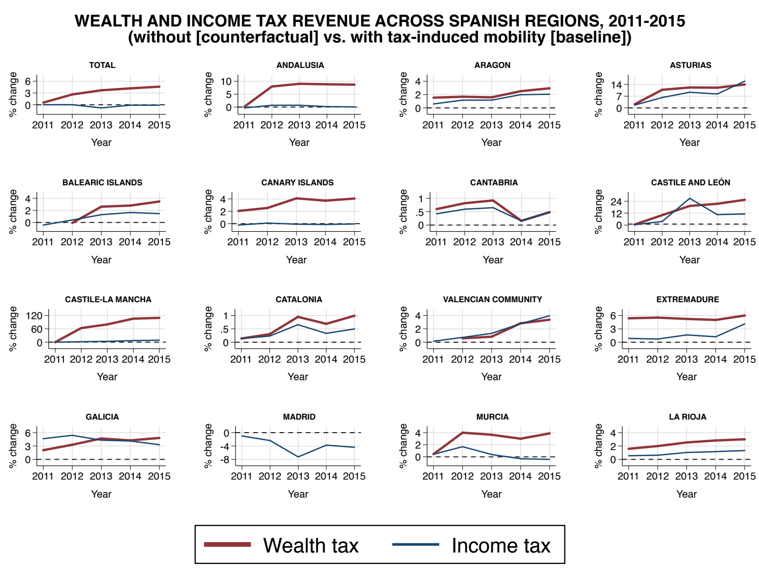
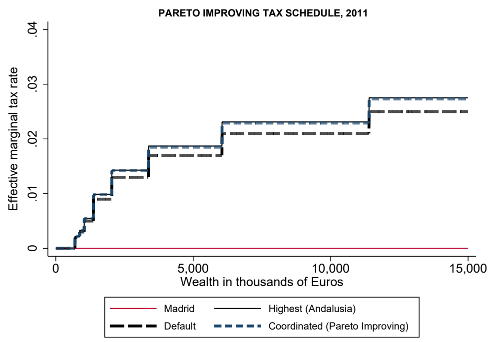
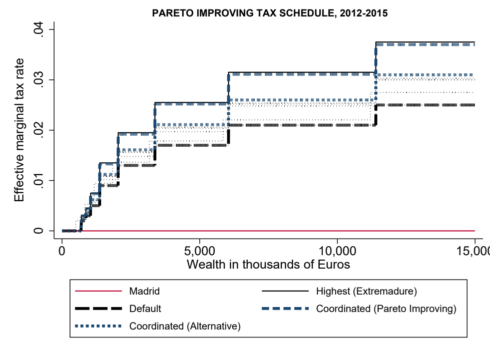


FIGURE A10: Wealth and Income Tax Revenue Across Spanish Regions, 2011-2015

Notes: This figure depicts the percent change of wealth and income tax revenue under the decentralized scenario absent tax-induced mobility to Madrid relative to the baseline decentralized scenario with tax-induced mobility to Madrid across Spanish regions over the period 2011-2015. Note that we exclude the regions of Ceuta and Melilla from the figure, as they count on a very small sample of wealth taxpayers and thus have a very low share of movers.



(a) Pareto-Improving Tax Schedule, 2011



(b) Pareto-Improving Tax Schedule, 2012-2015

FIGURE A11: Baseline vs. Coordinated Wealth Tax Schedules, 2011-2015

Notes: This figure compares the coordinated harmonized wealth tax schedules that are Pareto-improving for all regions to the baseline wealth tax schedules over the period 2011-2015. Panel (a) shows the wealth tax schedule for 2011 and panel (b) for 2012-2015. On panel (b) we also depict a lower alternative coordinated harmonized wealth tax schedule that is Pareto-improving for all regions but Extremadure, which is the region with the highest wealth tax schedule between 2012-2015. This alternative schedule is the same as the depicted coordinated schedule in 2011.

Figure A10 shows region-specific revenue changes in response to closing down tax-induced mobility and figure A11 shows the (revenue) Pareto improving tax schedule.

A.8 Methodology for Inequality Analysis

We now describe the methodology used to construct the national and regional top wealth shares used to analyze how the tax-induced mobility responses shape the wealth distribution. To calculate the national shares of wealth, we divide the wealth amounts accruing to each fractile by an estimate of total personal wealth. Had everyone been required to file a wealth tax return, the wealth denominator is ideally defined as total personal wealth reported on wealth tax returns. As only a fraction of individuals file a wealth tax return, we cannot estimate the denominator using wealth tax statistics. We rely on the non-financial accounts reconstructed by Artola Blanco et al. (2020) and financial accounts from the Bank of Spain. Artola Blanco et al. (2020) reconstruct the series of business assets and urban and rural real estate. For other non-financial assets such as consumer durables (e.g., cars, boats, etc.) and collectibles (e.g., jewelry, antiques, etc.), we rely on the reported totals in the last four waves (2005, 2008, 2011, 2015) of the Spanish Survey of Household Finances (SHF) provided by Bank of Spain. We correct our estimate of total personal wealth assuming that total wealth in the excluded regions of Navarre and Basque Country is proportional to GDP. These two regions combined represent about 6-7% and 8% of Spain in terms of population and gross domestic product, respectively (Martínez-Toledano, 2020). Our wealth distribution series are fully consistent with national accounts aggregates.

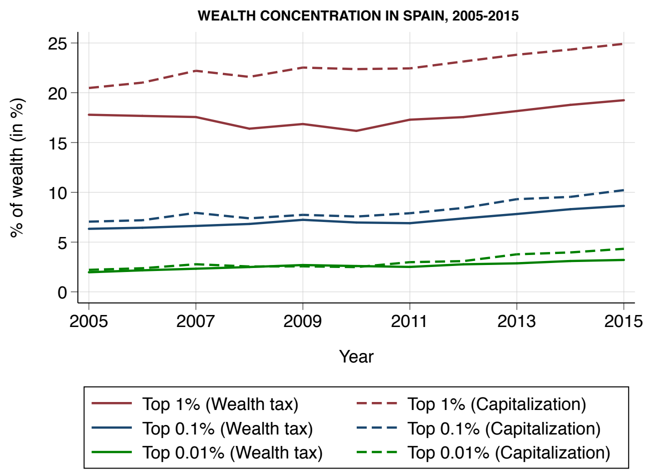


FIGURE A12: Wealth Concentration in Spain, 2005-2015

Notes: This figure compares our top wealth distribution series using wealth tax records (solid lines) with Martínez-Toledano (2020)'s series (dashed lines) using the mixed-survey capitalization method over the period 2005-2015. Our series are consistent with national accounts and have been constructed using as denominator, the non-financial aggregates reconstructed by Artola Blanco et al. (2020) and the financial aggregates as reported by the Bank of Spain. Artola Blanco et al. (2020) only reconstruct urban, rural estate and business assets. Thus, for other non-financial assets such as consumer durables (e.g., cars, boats, etc.) and collectibles (e.g., jewelry, antiques, etc.), we rely on the reported totals in the last four waves (2005, 2008, 2011, 2014) of the Spanish Survey of Household Finances (SHF) elaborated by Bank of Spain. Wealth tax information excludes the regions of Navarre and Basque Country because they do not belong to the Common Fiscal Regime. We follow Alvaredo and Saez (2009) and Martínez-Toledano (2020) and correct our denominator assuming that total wealth in those regions is roughly proportional to GDP. Combined, they represent about 6-7% and 8% of Spanish population and gross domestic product over our period of analysis. For the numerator, we use total reported wealth in tax files and adjust real assets to reflect market prices and actual totals. Real estate wealth is commonly taxed according to its tax-assessed value and market prices are about three times as high as tax-assessed values on average. We correct each individual's annual reported real estate wealth using the ratio of aggregate real estate wealth at market prices elaborated in Artola Blanco et al. (2020) and aggregate tax-assessed real estate wealth reported by the Spanish Cadastre. We finally adjust consumer durables, antiques and business assets that tend to be underestimated, as they are self-reported. We do so by using the reported shares of these assets among the top 1% richest individuals in the SHF. Note that 2008-2015 taxable wealth is based on our extrapolation method. Wealth groups are defined relative to the total number of adults (age 20 and above from the Spanish Census).

The numerator, that is, total reported wealth in tax files, must be adjusted to reflect market prices to be consistent with the denominator.[40] For example, real estate wealth is not taxed according to its market value, but according to its tax-assessed value. We apply as a correction factor to each individual's annual reported real estate

[40]Financial assets are reported at market values, so only real assets need to be adjusted.

wealth. This factor is defined as the ratio of aggregate real estate wealth at market prices estimated in Artola Blanco et al. (2020) divided by aggregate tax-assessed real estate wealth reported by the Spanish Cadastre. Market prices are about three times as high as tax-assessed values on average. Moreover, other real assets such as consumer durables, antiques and business assets tend to be underestimated in wealth tax records, as contrary to most financial assets, they are self-reported. We adjust them using the reported shares of these assets among the top 1% richest individuals in the SHF.[41] Whenever a taxpayer's share out of total taxable assets lies below the average share observed in the survey, we assign the survey share.

Our top wealth shares are defined relative to the total number of adults (age ≥20) from the Spanish Census. The progressive wealth tax has high exemption levels and less than the top 5% of adults filed wealth tax returns prior to 2007 and less than 1% after 2011. Thus, we limit our analysis of wealth concentration to the top 1% of the population and above. Taxable wealth from 2008-2015 is based on the extrapolation method from section A.2. Figure A12 compares our series with Martínez-Toledano (2020)'s series.

To calculate the regional shares of wealth, we construct the numerator for each region by simply decomposing the adjusted total reported taxable wealth by region, as the administrative records include the region of residence. For the denominator, we decompose the national total used in Martínez-Toledano (2020), which also relies on tax records that include the region of residence and cover the full distribution.

We then analyze how tax-induced mobility shapes the wealth distribution using the same simulation method as for the revenue analysis, that is, after determining the number of tax-induced movers for each region, we calculate the counterfactual national and regional wealth shares using each individual's wealth had they not moved. For that, we update – for all tax-induced movers – the region of residence and the wealth and personal income tax liabilities payed. As with the revenue effects, this is also a partial equilibrium analysis. Figure A13 shows the results by region.

[41] Note that these assets are also self-reported in the SHF. However, we expect the reported values to be more accurate as the incentives to underreport are not as evident as when filing taxes.

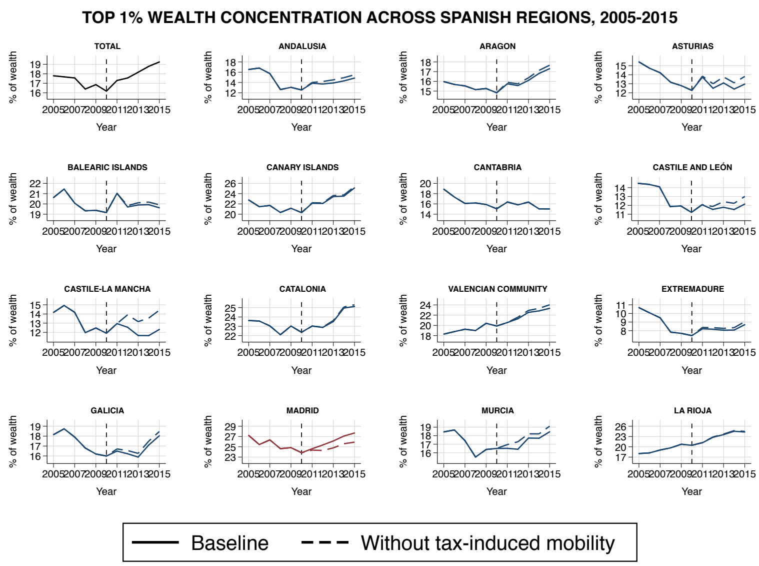


FIGURE A13: Top 1% Wealth Concentration Across Spanish Regions, 2005-2015 (With vs. Without Tax-Induced Mobility)

Notes: This figure compares the evolution of top 1% wealth concentration in Spain and across Spanish regions under the benchmark scenario with mobility and the counterfactual scenario absent tax-induced mobility over the period 2005-2015. The autonomous cities of Ceuta and Melilla are excluded from the figure as they account for a very small fraction of total wealth and have a very small number of movers.