Millionaire Migration and the Taxation of the Elite: Evidence from Administrative Data

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Abstract:

A growing number of U.S. states have adopted “millionaire taxes” on top income earners. This increases the progressivity of state tax systems, but raises concerns about tax flight: elites migrating from higher-tax to lower-tax states, draining state revenues and undermining redistributive social policies. Are top income earners “transitory millionaires” searching for lower-tax places to live? Or are they “embedded elites” that are reluctant to migrate away from places where they have been highly successful? This question is central to understanding the social consequences of progressive taxation. We draw on administrative tax returns for all million-dollar income earners in the United States over 13 years, tracking the state from which millionaires file their taxes. The data set contains 43 million tax records and provides census-scale panel data on top income earners. We advance two core analyses: (1) state-to-state migration of millionaires over the long-term, and (2) a sharply-focused discontinuity analysis of millionaire population along the borders of states. We find limited evidence of millionaire tax flight across states in the U.S.

1. Introduction

Rising income inequality is one of the deepest challenges facing American society in the 21st century (Keister 2014; McCall and Percheski 2010; Piketty 2014; Volscho and Kelly 2012). Yet there have been few clear policy responses to growing inequality. Indeed, over the last three decades, federal tax policy has shifted away from the taxation of the elite, reducing tax rates on top incomes, capital gains, and multi-million dollar inheritances – a process to "untax the one percent" (Martin 2013; Piketty and Saez 2007). Increasingly, state governments have been tempted to fill this void with 'millionaire taxes' on top incomes (Young and Varner 2011). In essence, states have been "going where the money is" to find new revenues at the very top of the income distribution (Fairfield 2013:42; Volscho and Kelly 2012; Piketty and Saez 2007).

Taxation, as Morgan and Prasad emphasize, "is one of the central social obligations of the modern world" (2009: 1350). However, the size of this tax obligation varies over time and place, and is subject to political negotiation and unintended consequences such as tax migration. This may be particularly true for the highest income earners, who have marketable skills and deep pockets to invest in relocation. In a federal system with free migration, can different states sustain significantly different policies of elite taxation? Understanding how the demography of the elite responds to progressive taxation is central to the sociology and political economy of taxation.

In a globalizing world, many countries and regions are concerned about capital flight and the migration of top taxpayers. The United States provides an ideal empirical testing ground: a 'world' comprised of 51 small open economies with free migration between them (cf, Fligstein and Mara-Drita 1996). Millionaire migration across U.S. states sheds light on how, with the

ongoing advancement of globalization, top international tax rates may affect the geographic distribution of the world's elites.

Millionaire taxes provide revenue to support public services and serve to moderate the growing inequality in market incomes. However, millionaire migration – the flight of the largest taxpayers – can drain state revenues and undermine state-level redistributive social policies (Mirrlees 1982; Feldstein and Wrobel 1998). The potentially out-sized impact of millionaire migration on state tax revenues may be one mechanism by which elites exert disproportionate influence over state policy (Khan 2012; Page, Bartels, and Seawright 2013; Dobbin, Simmons and Garret 2007; Martin 2010). Indeed, the threat of millionaire migration is powerful leverage in an "exit versus voice" political negotiation over top tax rates (Carruthers and Lamoreaux 2013; Hirschman 1970).

We contrast two core perspectives on millionaire migration. The "transitory millionaire" hypothesis presents top income earners as highly mobile actors searching for lower-tax places to live. The "elite embeddedness" hypothesis, in contrast, suggests that most top income earners have strong social and economic ties to place, making it difficult to move away from places where one has achieved exceptional success. These two perspectives offer very different views on the likelihood of tax-induced migration, and thus on the social consequences of progressive taxation.

We develop a new framework and critical data set for demographic analysis of the elite, and apply it to understanding elite response to tax policy. Elites are difficult to study using conventional data sources (in part, due to top-coding of incomes). However, they must file their taxes – providing census-scale, panel data on how much they earn and where they live (cf.

Piketty and Saez 2003; Chetty et al. 2014). This study draws on IRS "internal-use only" data on the tax returns filed by all million-dollar income earners in all U.S. states between 1999 and 2011. The panel nature of the data allows us to track the state and county from which millionaires file their taxes.

We find that millionaire migration is indeed responsive to top income tax rates. However, the magnitude of the migration response is small, and has little effect on the millionaire tax base. The implied "revenue-maximizing" tax rates on top incomes are much higher than current state policies – 68 percent on income above $1 million (Diamond and Saez 2011). Moreover, evidence for tax flight rests entirely on high migration rates into Florida, and not to any other low-tax state. Moreover, when we focus on the border regions of states, we do not find compelling evidence that millionaires cluster on the lower-tax side of state borders.

2. The Challenges of Elite Taxation

Americans generally support the principle of reducing inequality, but remain ambivalent over how to do it (McCall 2012; Page, Bartels, and Seawright 2013). There are intense debates over how to fund programs that reduce inequality and support economic opportunity (Morgan and Prasad 2009; Martin 2008; Kenworthy 2014; Newman and O'Brien 2011; Prasad 2014). From a political economy perspective, flat taxes on sales and consumption may be more politically viable and help to sustain elite support for social safety net policies. European counties, for example, tend to rely heavily on flat taxes to finance broad welfare states (Prasad 2014; Morgan and Prasad 2009). In contrast, progressive income taxes may be more politically polarizing, but offer the potential of greater redistribution of income and economic opportunity across socio-economic classes (Martin and Prasad 2014; Fairfield 2013).

A central question in these debates is whether some regions can have systems of elite taxation when others do not. In an open economic system with free migration, states will face pressure to reduce the tax burden on highly mobile residents, and increase the tax burden on the less mobile (Slemrod 2010). Indeed, Feldstein and Wrobel (1998) argue that progressive income taxes at the state-level are quickly self-defeating. In principle, raising taxes on the wealthy and providing transfers and services to the poor directly reduces inequality in a state. However, in a context of free migration, states will see an out-migration of top income earners (fleeing taxes) and an in-migration of the poor (seeking services). For the state's labor market, this means a shortage of high-skill workers and an oversupply of low-skill workers. In response, the market bids up wages for high-skill workers, and bids down wages for low-skill workers. Inequality in the state returns to its initial, equilibrium level.

Tax flight is closely related to questions of how economic globalization creates pressures for an international "race to the bottom" in social welfare states (Brady, Beckfield and Seeleib-Kaiser 2005; Brady, Beckfield and Zhao 2007; Beckfield 2013). Over the 20th century, distinct varieties of capitalism and social welfare states have coexisted among developed countries (Hicks and Kenworthy 2003; Esping-Andersen 1990). At least in Europe, this variety has narrowed over the last two decades. "E.U. citizens in various countries are living in an increasingly similar welfare regime" – primarily one that offers fewer social protections than in the past (Beckfield 2013:99). This convergence suggests that greater economic integration and market openness limits the range of viable socio-economic policies.

The Transitory Millionaire Hypothesis

The view that millionaires are highly mobile has gained much political traction in recent years, and has become a central argument in debates over millionaire taxes. In California, the Senate

Republican leader asserted, “There's nothing more portable than a millionaire and his money” (quoted in Yamamura 2011). Before Oregon voters approved a new millionaire tax, Nike chairman Phil Knight predicted the tax would set off a “death spiral” in which “thousands of our most successful residents will leave the state” (Knight 2010). In Washington State, a millionaire tax referendum was defeated after opposition from the state’s top companies: Microsoft warned that the tax would “make it harder to attract talent” while Boeing stated the tax would “erode Washington state's competitiveness” (Garber 2010). New Jersey Governor Chris Christie simply declared “Ladies and gentlemen, if you tax them, they will leave” (Office of the Governor 2010).[1]

In some areas, compelling evidence shows that tax and regulatory discontinuities at the borders of states lead to migration-like reactions, including changes in the location of sales, manufacturing, and corporate domicile. Sales and excise taxes, for example, frequently lead to cross-border shopping (Goolsbee, Lovenheim, and Slemrod 2010; Merriman 2010). In online shopping, the effects of sales taxes appear quite strong. Analysis of eBay.com transactions show that online shoppers avoid buying from retailers located in states with high sales taxes, indicating that such taxes “play a significant role in shaping the geography... of online retail trade” (Einav et al. 2014:1). Similarly, corporations tend to incorporate or “domicile” in states with minimal regulatory restrictions or tax burdens. An overwhelming number of large American firms are incorporated in Delaware, even when their operations and physical headquarters are located elsewhere (Carruthers and Lamoreaux 2013; see also Homes 1998). Internationally, corporate ‘inversion’ strategies allow U.S. companies to shift their legal address to a foreign country with

[1] Similar arguments are common in Europe. Debate was especially heated in 2013, after the French actor Gerard Depardieu renounced his citizenship and moved to Russia to avoid the high French tax burden. Russia’s Deputy Prime Minister Dmitry Rogozin, commenting on his country’s flat 13 percent income tax, remarked “The West has an especially poor knowledge of our tax system. When they learn about it, we expect a mass migration of wealthy Europeans to Russia” (Quoted in Erb 2014).

preferred regulatory and tax structures (Marples and Gravelle 2014; Marian 2015). Individuals with high incomes may deploy similarly sophisticated strategies to arbitrage state borders and locate in lower-tax states.

The Elite Embeddedness Hypothesis

There is, however, room for skepticism about the ready mobility of the elite. In principle, top-income earners are mobile in the sense that they have fewer financial constraints on where they choose to live. In practice, their actual migration patterns may or may not be particularly high or sensitive to tax rates. We note two core factors that may embed elites in their regions and states: lifecycle constraints and place-specific social capital.

First, millionaires are not typically at a lifecycle stage where migration is common (Geist and McManus 2008). The top one percent are primarily the "working rich" who derive most of their income from wages and salaries (Piketty and Saez 2003). Compared to the general population, top-earners are more likely to be married, to be in a dual-career household (Alm and Wallace 2000; Schwartz 2013), to have school-aged children, to own rather than rent their home, and to own a business – all factors that discourage migration (Geist and McManus 2008; Young and Varner 2011; Hernadez-Murillo et al. 2011; Molloy, Smith and Wozniak 2011; Kiester 2014:356-7). College-educated workers are more mobile than those with less education (Hernández-Murillo et al. 2011; Wozniak 2010). However, migration tends to occur early after graduation, when their incomes are low, rather than at the advanced career stage when income is highest. And millionaires are unlikely to be unemployed and searching for work – a key factor that encourages migration. Thus, elite income earners tend to have many social attributes that deter migration, and fewer attributes that encourage migration.

Second, the socio-economics of location points to tangible limits on the easy migration of elite income-earners. Tax-induced migration models typically assume that income is exogenous to location, and does not depend on social or economic ties to place (Simula and Tannoy 2011; Mirrlees 1982). However, most millionaires are at their peak years of earnings, and are drawing on long personal investments in a career or business line from which they cannot easily migrate away (Saez 2013; Varner and Young 2012). Income-earning capacity derives not just from individual talent and human capital (which is movable) but also from *placed-based social capital* – social and business connections to colleagues, collaborators, funders, and co-founders.

Entrepreneurs, for example, tend to cluster and thrive in their "home" markets where they have deep roots, social ties, and accumulated local market knowledge (Dahl and Sorenson 2012; Sorenson and Audia 2000; Michelacci and Silva 2007). Co-founders and other allies are often critical to a successful entrepreneurial enterprise (Ruef, Aldrich and Carter 2003). When economic success is a joint product – rather than a purely individual accomplishment – there is a difficult network coordination problem for migration: one's own willingness to migrate for tax purposes must align with that of co-founders, collaborators, and perhaps even clients. Migrating away from these social connections is costly. "Unlike human capital, which entrepreneurs carry with them wherever they go, social capital depreciates as one transports it from the regions in which it had been developed" (Dahl and Sorenson 2012:1061).

Those who achieve top incomes, in this view, are deeply embedded insiders who yield remarkable returns in part because of their social placement in a localized economic world. Achieving top-level income status makes players more, rather than less, bound to the regional economy.

The embeddedness of earning potential means that those making $1 million a year in Silicon Valley or Manhattan often cannot leave those regions without a (potentially large) drop in income (Saxenian 1994; Powell et al. 2002; Baldwin and Krugman 2002). Elites become enmeshed in the regions where they make their fortunes, and are increasingly tied to those regions for their best financial opportunities.

Existing Evidence on Millionaire Migration and Tax Flight

Are top income-earners "transitory millionaires" searching for lower-tax places to live? Or are they "embedded elites" that are reluctant to migrate away from places where they have been highly successful? The evidence on elite mobility and tax flight among millionaires is so far limited and equivocal.

Among the world's top physicists, only about 50 percent live in their country of birth, indicating high mobility among top academics and a problem of "brain drain" facing many small countries (Hunter, Oswald, and Charlton 2009; Zucker and Darby 2007). Yet, academia appears to be an unusually mobile profession. Among the world's billionaires, some 87 percent live in their country of birth (Sanandaji 2013). Moreover, the few billionaire migrants were more likely to move to large market economies such as the United States, than to tax havens like Monaco (ibid).

In Europe, economists Kleven, Landais, and Saez (2013) study the migration of elite European soccer players, finding clear evidence of migration of players towards teams in lower-tax countries. After restrictions on foreign players were lifted in 1996, top players migrated from teams in high-tax states (such as France and Sweden) to teams in low-tax states (England or the Netherlands). Teams in low-tax countries were "better able to attract good foreign players and

keep good domestic players at home" (1905). They note, however, that European soccer players are a "particularly mobile segment of the labor market," suggesting that their results represent an "upper bound on the migration response" (1923).

In the United States, there have been two studies of "natural experiments" in taxing millionaires in New Jersey and California (Young and Varner 2011; Varner and Young 2012). These studies use micro-data from state income tax records to measure millionaire migration before and after changes in the top tax rate. They find that increases in the top tax rate had little effect on millionaire migration, raised substantial revenues (on the order of $1 billion annually in both states), and modestly reduced income inequality. A skeptical replication (Cohen, Lai and Steindel 2014) found similar migration effects in New Jersey, leaving simply the question of whether that state's millionaire tax migration is either "small, or very small" (Young and Varner 2014).

The Current Study

Previous studies have been limited either by using narrow segments of the millionaire population (elite European soccer players) or narrow geographic regions (New Jersey and California). Our study provides an ideal combination of the broad-geography, multi-state lens of Kleven, Landais, and Saez (2013), and the scaled-up administrative data of Young and Varner (2011). This offers new analyses that give a comprehensive understanding of how top tax rates affect millionaire demography. First, we focus on millionaire migration in response to progressive state income taxes. Is there a pattern of millionaires moving from high-tax to low-tax states? How different are the migration patterns of millionaires from those of the general population?

Second, we analyze millionaire population along the borders of states. Do millionaires tend to cluster on the low-tax side of state borders? This provides a sharply-focused regression discontinuity analysis of border-county regions, examining small geographic zones where tax responsiveness should be most visible (Keele and Titiunik 2014).

From these analyses, we calculate the overall costs and benefits of elite taxation for revenues in each state, which broadly implies the level of "optimal" income tax rates in the presence of state-to-state millionaire migration. Building on the tradition of fiscal sociology (Martin and Prasad 2014), this study offers an important look into the social consequences of progressive taxation.

3. Data

Our data draws on all American federal income tax filers with reported earnings of $1 million or more in any year between 1999 and 2011. The data provides 43 million tax records, representing 13 years of panel data on 3.7 million unique tax filers, yielding census-scale evidence on the top income-earners in America. We obtain annual income as reported on 1040 tax returns, and adjust incomes for inflation to be in constant 2005 dollars. Tax filers who ever report annual income of at least $1 million are pulled into our dataset and we track their income and residency for the full 13 years regardless of annual income in any other year. On average, we have 12.5 years of tax returns for each tax filer. The unit of analysis is tax records, which often includes married couples filing jointly. For simplicity, we refer to millionaire tax returns as "millionaires". While the term "millionaire" often connotes accumulated wealth, our focus is on top annual incomes – those who earn in one year what few families ever accumulate in wealth (Keister 2014).

As a point of reference, we also draw a one percent sample of the total population of tax filers at all income levels. This gives us roughly 24 million tax records from 2.6 million unique filers.

This allows us to ask, are the rich different? Do they have higher migration rates than the general population? Is elite migration more sensitive to income tax rates?

State residency in each year comes from the home address reported on the 1040 form. Migration is identified by changes in the state from which households file their federal taxes. For example, suppose an individual files their taxes from New York in 2005, and then files from Florida in 2006. We deem such individuals to have migrated in 2005, and they are simultaneously an out-migrant from New York, and an in-migrant to Florida. We identify such individuals as *millionaire* migrants if they earned $1 million or more in the year of migration. From this, we construct a state-to-state matrix of millionaire migration, which shows migration flows between each possible pairing of states (such as New York to Florida, New York to Nebraska, etc).

State income tax rates are drawn from the NBER's Taxsim program (Feenberg and Coutts 1993), estimating the combined federal and state effective income tax rate for couples earning $1.7 million in labor income (the median income of millionaires in our data), taking into account the cross deductibility of federal and state taxes (Stark 2003).[2] We also use state-level data on a range of characteristics relevant to residential desirability. These include the sales and property tax rates, which are the core revenue sources for states with low income taxes. Economic conditions are captured with state per capita income and the unemployment rate. The natural amenities of states are measured in a six-item index including low summer humidity, high winter sunshine, low seasonal differences in temperature, high coastal access, and high topographical / landscape variability (McGranahan 1999). Finally, we include the price of residential land in each state (Davis and Heathcote 2007). This measure subtracts out the "structure cost" of home

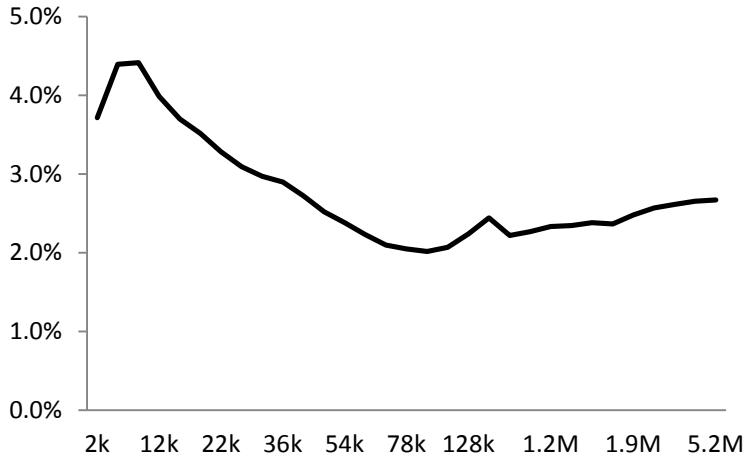
[2] We also examine the tax rates of those earning 50 percent and 100 percent of their income through capital earnings, to measure state-level tax advantages for capital. We do not find clear effects for capital tax rate differences, and do not report these models.

prices, focusing on the intuition that land prices reflect the market value of a home's location (ibid:2595). These variables aim to capture factors that influence migration and may be correlated with the adoption of elite income tax rates. Appendix A lists our variables, descriptive statistics, and sources.

3.1 Basic Facts

In any given year, roughly 500,000 households file tax returns reporting $1 million or more (constant 2005 dollars). From this population, only about 12,000 millionaires change their state in a given year. The annual millionaire migration rate is 2.4 percent, which is lower than the migration rate of the general population (2.9 percent). Figure 1 shows the income-migration curve over the whole distribution of income, as income rises from nearly zero to millions per year. Migration is highest among those with low income – at around the 10^{th} percentile or $8,500. Migration declines thereafter, with the lowest rate occurring at around $85,000 (the 80^{th} percentile). Above this point, migration rates begin to rise with income, but only gradually. The migration rate of those making $5 million or more is still only 2.7 percent. Millionaires are not much more mobile than the middle class, who in turn show less mobility than the poor. Mobility, overall, does not seem to be a luxury good. If anything, residential stability seems to be purchased by those with higher incomes.

Figure 1. Migration Rates by Income Level, 2000-2011



Source: U.S. Department of the Treasury, IRS Micro Data. One percent sample of all tax filers, and 100 percent sample of those making $1 million or more.

Do states with higher top income tax rates have more out-migration and less in-migration of millionaires? Figure 2 provides a very simple look at the data, showing net-migration (in-migration minus out-migration) per 1,000 millionaires by state over 12 years. There is little evident relationship between top tax rates and millionaire migration: higher-tax states do not tend to have lower rates of net in-migration. The correlation is negative, but very small in magnitude (-0.06).

Figure 2: Millionaire Migration and State Tax Rates on Top Incomes, 2000 - 2011

Source: U.S. Department of the Treasury, IRS microdata. Annual data points are represented with the state abbreviations.

These two simple descriptive findings do not bode well for the transitory millionaire hypothesis. Millionaires are not especially mobile, as their migration rates are similar to those of the middle class. Moreover, states with high tax rates on the elite do not have obvious signs of millionaire out-migration. However, there is much richer evidence contained in the *state-to-state* migration flows, to which we now turn.

4. State-to-State Millionaire Migration Matrix

We analyze millionaire migration flows between all states and the District of Columbia over 12 years.[3] For this analysis, we construct an aggregate 51x50 state-to-state millionaire migration matrix. For each state-year, we observe the number of in-migrants (who filed in a different state in the previous year), the number of out-migrants (who filed in a different state in the next year), and the number of non-migrants. There are longstanding differences in state tax rates. Florida, Texas, and Nevada, for example, have never had an income tax, while New York, New Jersey, and California have long had progressive income taxes. Is there a general pattern of millionaires moving from high-tax to low-tax states? In California, for example, are there net flows into states like Nevada or Texas? Even if the annual migration flows are small, aggregate migration over 12 years should clearly document any pattern of tax-induced migration. Looking at every pair of states, to what extent do differences in tax rates correspond to migration flows? While Young and Varner (2011) and Varner and Young (2012) estimate the short-run effects of tax changes in two key states, this study focuses on the long-run effects of the tax differences between all states over 12 years.

First, we conduct a simple descriptive analysis of the raw migration data, after which we proceed to a formal regression analysis. Figure 3 shows net in-migration flows of millionaires for several key states, plotted against the tax differences between the states. The x-axis shows whether other states have higher or lower taxes on the elite; the y-axis shows whether there is net in-migration from or net out-migration to the other states. If tax flight is occurring, states with higher taxes would show disproportionate flows of millionaires moving to lower tax states. Specifically, the

[3] Similar models have been applied to census data by Herting, Grusky, and Rompaey (1997), to international migration by Beine, Docquier, and Ozden (2011), and to elderly migration in the United States by Conway and Rork (2012). Santos Silva and Tenreyo (2006) provide an excellent discussion of the core model. Note that while our base data set contains 13 years of data, one year is lost as we require two years of information to define migration.

slopes in Figure 3 should be upward sloping: as the tax advantage of moving to a state increases, there should be more net in-migration.

The evidence from Figure 3 is affirmative, but modest. Florida has net in-migration from virtually every other state – shown as negative values on the y-axis. More importantly, migration into Florida is more likely from states that have *higher* tax rates. The greater the tax rate advantage of Florida over another state, the more likely millionaires from that state will migrate to Florida. However, the correlation is low (less than 0.1). Texas (panel 2) has the same low tax rate as Florida but very different migration patterns. Indeed, Texas also sees net out-migration of millionaires to Florida. However, millionaires do tend to move to Texas from higher-tax states, and likewise tend to leave Texas for other low-tax states. New York (panel 3) is a strong contrast to Florida: a high tax state, with net *out*-migration to most states (positive out-migration values on the y-axis). The negative slope indicates that millionaires leaving New York are more likely to choose a state that has a lower tax rate. However, this is due to very high levels of migration to Florida; other states with low tax rates do not disproportionately attract millionaire migration. The last case study, Illinois (panel 4), has millionaire migration patterns that look very similar to New York: out-migration to virtually every state, with greater out-migration to lower tax states. The correlation is -0.29, though it is visually clear that the negative relationship between tax advantage and migration flows is driven by Florida as a powerful outlier.

The final two panels of Figure 3 pool together the entire 51 x 50 migration matrix – all of the state migration flows.[4] In panel 5, using all states, the overall correlation of migration and tax rate difference is -0.24, suggesting a consistently modest relationship. Closer inspection shows

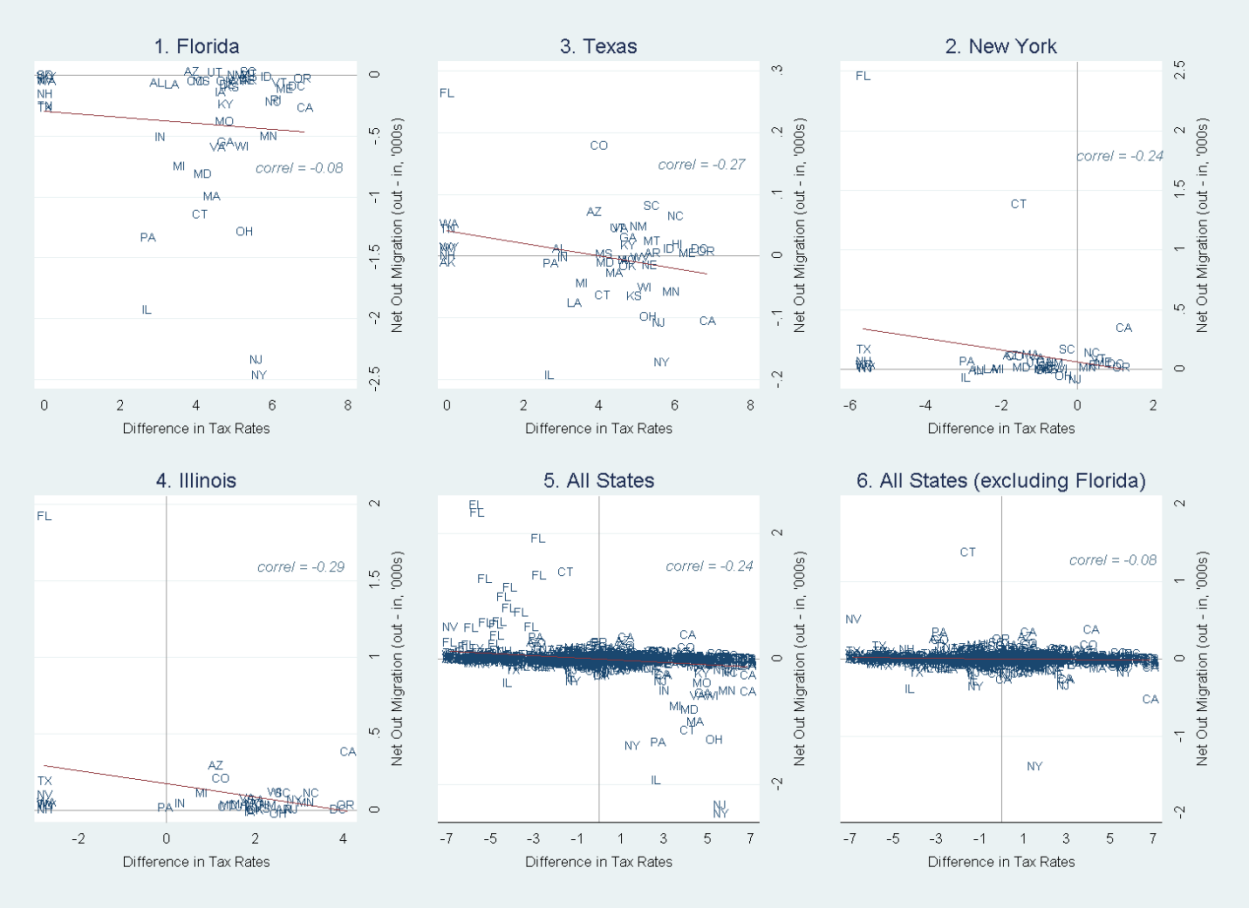
[4] Note that these graphs contain mirror images along the diagonal (eg, flip along the y axis, and then along the x axis to get a perfect overlap). Each observation is repeated as a positive and a negative value. This does not affect the estimated slope / correlation. It would affect the standard errors if we were drawing statistical inferences from these graphs.

that the bottom left quadrant is largely every state's net-migration into Florida, while the upper right quadrant mostly reproduces the graph of Florida's net (in) migration. This is further illustrated in the final panel 6, excluding the Florida observations, which leaves a flat relationship between taxes and migration, and a correlation of -0.08. Migration to Florida appears to be the core pathway for tax-induced migration.

To supplement the descriptive analysis in Figure 3, we provide an online tool for mapping the state-to-state millionaire migration flows, which allows readers to visually inspect the net migration patterns for any state of interest.[5] The Online Appendix 1 shows the comparable figure 3 graphs for all 50 states and the District of Columbia.

[5] This online tool is currently password-protected until fully approved for release. The password is "swordfish".

Figure 3. State-to-State Millionaire Migration, by State, 1999-2011



Source: U.S. Department of the Treasury, IRS microdata, and NBER's TAXSIM program.

4.1 Gravity Model of Migration

To formally analyze these data, we draw on a gravity model (Herting, Grusky, and Rompaey 1997; Conway and Rork 2012; Santos Silva and Tenreyo 2006). The number of millionaire migrants (Mig_{ij}) from state *i* (origin) to state *j* (destination) is a function of the size of the base millionaire populations in each state (Pop_i , Pop_j), the distance between the states ($Distance_{ij}$), and a variable indicating if the states $\{i\ ,j\}$ have a shared border ($Contiguity_{ij}$). These are the core elements that define the basic laws of gravity for interstate migration (e.g.,

Santos Silva and Tenreyro 2006). To this core model we add the difference in top income tax rates between each state pair ($Tax\_Difference_{ij}$). Finally, we specify this as a log-linear model, taking logs of the right-hand side count variables, and estimating with Poisson:

$$Mig_{ij} = \exp(\alpha + \beta_1 \log Pop_i + \beta_2 \log Pop_j + \beta_3 \log Distance_{ij} + \beta_4 Contiguity_{ij} + \beta_5 Tax\_Difference_{ij}) + \varepsilon_{ij} \quad (1)$$

The coefficients from the log-linear model give the semi-elasticity of migration counts with respect to the tax rate – the percent change in migration flows for each percentage point difference in the tax rates.

4.2 Results

Table 1 shows our regression results. Model 1 reports the coefficients from the core gravity variables and the top tax rate. The populations of the origin and destination states show nearly-unit elasticities: 1 percent higher population leads to .94 percent higher migration flows. As the distance between states grows, migration flows are less frequent, so that a 1 percent increase in distance reduces migration flows by .26 percent. Contiguity has a very strong effect, as states with shared borders have especially high millionaire migration volumes between them.[6] Finally, the top tax rate has a clear and strongly significant impact on millionaire flows, with a semi-elasticity of -0.07. Migration tends to flow from high-tax to low-tax states, and migrations flows are larger when the tax advantage is larger.

Model 2 incorporates a basic set of state-level controls, addressing winter climate, alternative tax instruments (sales and property tax rates), the economic strength of the states, and the price of

[6] Note that in log-linear models, the coefficients of dummy variables need to be exponentiated for interpretation (Giles 2011). In model 1, contiguity raises migration flows by 91 percent = 100 × [exp(0.65) – 1]. In model 3, this effect is 130 percent.

residential land. These variables have little impact on our coefficient of interest: the effect of the top tax rate is barely changed (-0.08), and is still strongly significant. Sales tax rates have a smaller but still significant negative effect on millionaire migration, even though these taxes are generally regressive and draw less revenue from higher incomes. Millionaires are attracted to states with warmer winter temperatures. Most importantly, millionaires move to states with high residential land prices.[7] This is an important result, as it shows that millionaires are not purely focused on finding low-cost places to live, but rather are attracted to expensive locations.

Model 3 adds the natural amenities scale, which is limited to the contiguous United States and moderately reduces the sample size. This variable has a strong positive correlation with land prices (correl = 0.6), and when both variables are included natural amenities has no additional explanatory power. Without land prices in the model, natural amenities are strongly significant, and as we will see in later specifications, statistical significance is sometimes shifted from land prices to amenities. The key point to note is that our core tax estimate is little influenced by these rich measures of locational attractiveness and regional market demand for housing.

Model 4 applies the same model to our one percent sample of the total population of tax filers, at all income levels. Are the rich different? For the gravity variables, the estimates for the whole population are strikingly similar to the millionaire population. The origin and destination populations have similar, though slightly smaller, elasticities. The distance elasticity is the same for millionaires as the general population, though the contiguity effect is somewhat smaller for millionaires. But the most striking difference is that for the general population, there is no

[7] We find that structure cost (the price of building materials and construction labor) has no effect on migration.

significant tax migration effect.[8] Millionaires are more sensitive to income tax rates than are the general population.

4.3 Interpretation and Optimal Tax Rates

Research often focuses excessively on the statistical significance of a result, with insufficient attention on understanding the magnitude of the findings. It is important to illustrate, not simply whether taxes matter at all, but specifically *how much* they matter.

Our core estimate is that a one point increase in the tax rate leads to a 7 to 8 percent drop in migration flows. However, the practical effect of interest is how this translates into the share of the millionaire population lost to migration. Because migration rates are low, changes in migration flows have a very muted impact on the population. The millionaire population change caused by top tax rates can be used to calculate an "optimal" (revenue-maximizing) tax rate (Kleven et al 2012).

To clarify this magnitude, we calculate millionaire population loss for each state on an annualized basis (reported in appendix B), using the parameter estimates from model 2. For each state, we calculate how many millionaires would be lost if the state raised its tax rate on millionaires by one percentage point (with tax rates constant in all other states).[9] For the average state, a one-point tax increase leads to a loss of 23 millionaire households per year. This loss stems from 11 additional out-migrations, and 12 fewer in-migrations. Since the average state has an annual millionaire population of over 9,000, this is clearly a small effect size (0.2 percent of

[8] Note that in model 3, we use the income tax rate at the median income level (roughly $53,000). As a placebo test, we also estimate the model using the tax rates that apply to millionaires, and likewise find a non-significant result.
[9] We estimate this by predicting migration flows for each state using actual tax rates, and then predicting migration flows after increasing the tax rate in one state by one percentage point. We calculate this for each state, one at a time. Of course, if all states increased their tax rates at the same time, this would leave the tax differences unchanged and have no expected impact on migration.

the millionaire population). The expected loss in income tax revenues from migrating millionaires is $4.6 million for the average state. However, the non-migrating millionaires that remain in the state pay an additional one percent of their total income in tax revenue, yielding a gain in revenues of $325 million. This is an upper-bound estimate of revenue gains (Saez, Slemrod, and Giertz 2012), but suggests a very high revenue yield from state millionaire taxes.

From the perspective of revenue maximization, the optimal top state tax rate τ^* is a function of (1) the portion of total income held by millionaires, a , (2) the elasticity of taxable income, e , and (3) the millionaire migration elasticity, η. The formula for optimal tax rates on top incomes, taking into account both migration and income effects, is given as follows (Piketty and Saez 2013:429):

$$Optimal\ rate: \quad \tau^* = \frac{1}{1 + a \cdot e + \eta} \qquad (2)$$

Roughly speaking, when the tax rate increases, top incomes (reflected in the parameter a) may react adversely with lower reported earnings (given by e), or may move to a lower tax jurisdiction (given by η). We discuss optimal tax rate models, and the scaling of our regression coefficient into the quantity η, in more detail in Appendix C. We do not estimate a and e in this paper, but draw on credible estimates from existing literature ($a = 1.5$, e =0.25) (Saez, Slemrod, and Giertz 2012). With our migration population elasticity estimate ($\eta = 0.1$), the optimal tax rate on top incomes is 68 percent. This is much higher than the current combined federal and state top tax rate in any state. To rationalize current tax rates, the migration elasticity would need to be 10 to 15 times greater than what we actually observe.

Finally, to clarify the implications of our results for understanding elite behavior, we ask how much millionaire migration in America is due to the fact that states have different top tax rates.

Would there be much less cross-state migration of elites if all states had the same tax rate? We use the parameter estimates from model 2 to conduct a counterfactual analysis. At existing tax rates, our model predicts 11,250 migrations per year. When we set the top tax rates to be equal in all states, the model predicts 11,000 migrations – roughly 2.2 percent fewer. Only a small fraction of elite migrations appear to have a state income tax motivation.

4.4 The Florida Effect

Descriptive analysis suggested that evidence for tax migration is largely driven by Florida as an attractive destination for American millionaires. Are elites more able to exploit geographic tax opportunities, or are they just more likely to move to Florida? Table 2 examines the extent to which our regression results are contingent on Florida migration. Model 5 excludes Florida migration flows. Outside of Florida, differences in tax rates between states have no effect on elite migration. Other low tax states, such as Texas, Tennessee, or New Hampshire, do not draw away millionaires from the high tax states.

The uniqueness of the Florida effect is a very robust finding. In supplemental models (reported in Appendix D), we test the effect of excluding each state from the analysis one at a time. In essence, this is a Cook's-D examination of influential observations (in this case, sets of observations associated with each state) (Cook 1977; Andersen 2008). When we exclude any other state but Florida, we yield estimates of the tax effect ranging from -.05 to -.07, all of which are statistically significant (the smallest t-statistic is 2.96). In short, the main results depend fundamentally on Florida: when Florida is excluded, there is no evidence of tax migration; when any other state is excluded, our core finding of tax migration is supported.

Model 6 looks only at Florida migration flows (N = 100), showing a strong tax rate effect: states with higher millionaire taxes are more likely to see out-migration to Florida. However, when other state-level controls are in the model (model 7), the explanatory power of the tax rate is sharply diminished. Natural amenities have a significant effect on Florida migration, but income tax rates do not. This leaves it ambiguous at best whether Florida is attractive to millionaires for its tax advantages or its natural geography. It is hard to tell how much – if any – of the tax migration observed in Table 1 is truly tax-induced or simply collinear with Florida's unique amenities.

5. Millionaire Population along the Borders of States

State-to-state millionaire migration flows give positive but limited evidence of tax-migration among top income-earners in America. We triangulate on these findings with a sharply-focused discontinuity analysis: millionaire populations along the borders of states. Among contiguous counties separated by a state border, do millionaires tend to cluster on the lower-tax side of the border?

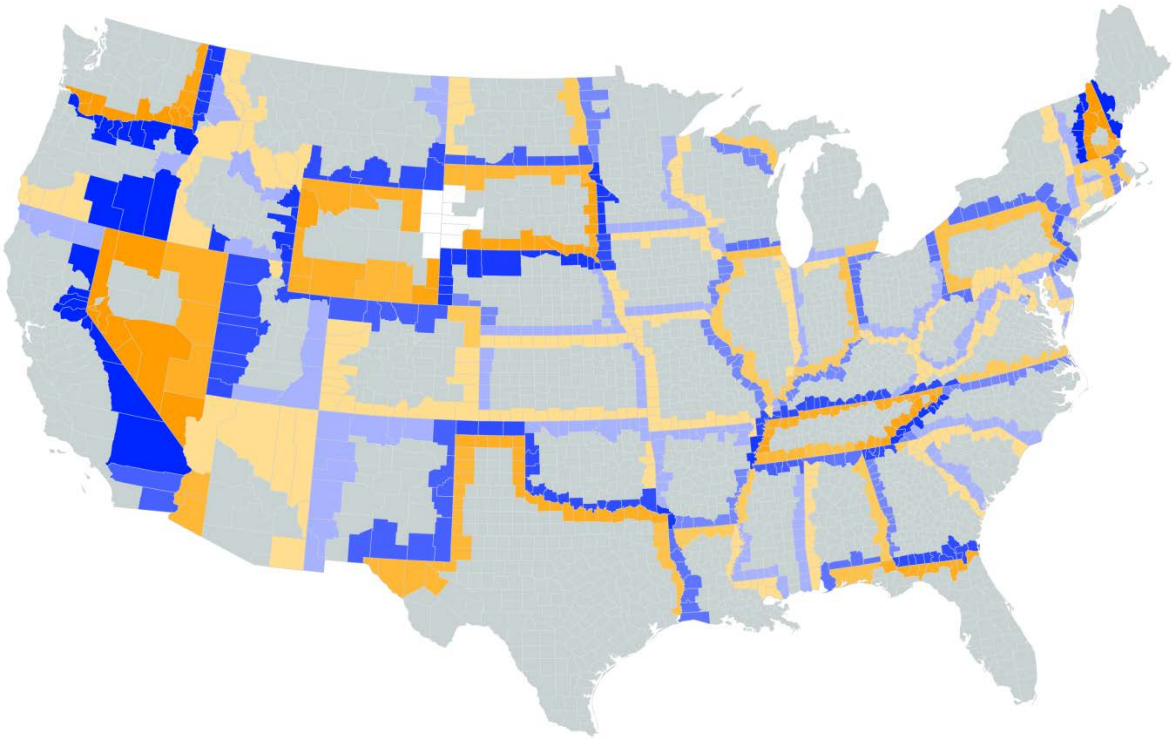
Border regions provide a compelling laboratory for studying the effect of taxes on millionaire populations. This is a regression discontinuity design in which "a geographic or administrative boundary splits units into treated and control areas… in an as-if random fashion" (Keele and Titiunik 2014:2). There are sharp geographic discontinuities in top tax rates, but few barriers to crossing the border, and the geographic, cultural, and economic differences between states are minimized. Border regions usually span plausible commuting distances, so that family, social, and business ties can be maintained (Dahl and Sorenson 2010).

Counties along the border of Washington and Oregon (figure 5) illustrate the analytic strategy. Oregon has long had one of the most progressive income tax regimes in the U.S., with an effective top tax rate of 7.3 percent. Washington State, in contrast, has never had a state income tax (Pearson 2014). The distance between the major cities of these two states (Portland and Seattle) is large: they are roughly 170 miles apart, which imposes potentially significant migration costs, especially in the form of separation from family, friends, colleagues and business partners. However, moving from one side of the Oregon–Washington border to the other is a small life change, similar to changing neighborhoods within a city. The distance between the centers of Portland (OR) and Vancouver (WA) is only 9 miles. Indeed, any point along the border seems readily commutable, substantively similar, and arbitrarily separated by a state border. This is an area in which tax flight should be most clearly visible, and where we can obtain upper-bound estimates of millionaire tax responsiveness.

Figure 5. Border Counties of Washington and Oregon.

Figure 6 maps the counties in the border analysis. There are 1,134 counties adjacent to interstate borders, containing 32 percent of the U.S. population and 35 percent of all millionaires in our data set. Blue counties in Figure 5 are on the high-tax side of the state border, and orange counties are on the low-tax side. Darker shading indicates larger cross-border tax differences. The mean cross-border tax difference is 2.3 percentage points, with the sharpest differences greater than 7 points. Among the largest differences are Oregon–Washington (7.3), Vermont–New Hampshire (6.7), and North Carolina–Tennessee (6.3). Thus, we frequently see large tax differences at state borders.

Figure 6. Border Counties and Tax Differences in the United States.



Note: The high tax side of the border is in blue, while the low-tax side is in orange. Larger tax discontinuities are indicated with brighter coloring.

The border county analysis can be understood as a matching algorithm, matching a treatment county (with higher taxes) to one or more control counties on the opposite side of the state border (Keele and Titiunik 2014). A key question then is the covariate balance between the treatment and control cases (Ho, Imai, King and Stuart 2007). Are the county pairs well-matched and comparable-on-observables? If the matching algorithm is successful, border-county pairs will be effectively identical on all explanatory factors except the income tax rate, creating "as if" random assignment to the treatment and control conditions. A similar quasi-experimental strategy has been used to study the effect of state minimum wage rates on employment (Dube,

Lester, and Reich 2010), and of anti-union "right-to-work" laws on both manufacturing employment (Holmes 1998) and on the location of Walmart stores (Rao, Yue, and Ingram 2011).

5.1 Spatial Discontinuity Model of Population

Our formal models of millionaire population first considers the basic state-level relationship between millionaire population and top tax rates. The outcome variable is log millionaire population in state *i* in year *t* ($\log M_{it}$), which we expect to vary with a state's overall population ($\log pop_{it}$), and potentially with its effective tax rate (tax_{it}). We also include year fixed effects (λ_t).

$$\log M_{it} = \alpha + \beta_1 tax_{it} + \beta_2 \log pop_{it} + \lambda_t + \varepsilon_{it} \quad (2)$$

Next, we move to the matched sample of contiguous county-pairs. All border counties match to at least 1 cross-border county, and on average they pair with 2.1 cross-border counties. This yields 2,344 county pairs, and with 16 years in our millionaire population data set, this gives a sample of 37,504 county-pair-years.[10] In this model, we estimate the effect of the top tax rate on millionaire population *within* county pair-years. Model 2 defines a unique pair-year term for each county pair in each year (τ_{pt}), and the model is identified solely on the remaining cross-border variation in a given year. In other words, within each county pair, and in a given year, does millionaire population cluster on the low-tax side?

$$\log M_{cpt} = \alpha + \beta_1 tax_{ct} + \beta_2 \log pop_{ct} + \lambda_t + \tau_{pt} + \varepsilon_{cpt} \quad (3)$$

Again, this model can be considered a matching algorithm with the treatment effect estimated by OLS (Ho, Imai, King and Stuart 2007; Keele and Titiunik 2014). As such, we consider the

[10] We do not include county pairs that are contiguous at a single point (i.e. "corner" borders) (Dube et al. 2010).

covariate balance across county pairs for a basic set of county characteristics including natural amenities and the county unemployment rate. Balance statistics show that the high-tax county sides are indeed well-matched, with a striking difference in the top tax rate, but otherwise equivalent in their labor market and natural amenities (reported in Online Appendix 2). The contiguous border county framework appears to provide strong quasi-experimental matching of treatment and control cases.

Next, we focus on changes in the tax rates over time, within county pairs. For example, if a state raises the top tax rate, while its neighboring states do not, the tax difference at the border increases. We isolate these changes in the tax rates by adding fixed county effects (θ_c) to the model. Within county pairs, what happens when the top tax rate changes in one of the counties?

$$\log M_{cpt} = \alpha + \beta_1 tax_{ct} + \beta_2 \log pop_{ct} + \lambda_t + \tau_{pt} + \theta_c + \varepsilon_{cpt} \quad (4)$$

This may be considered to show the short-run or immediate effects of tax changes, while the cross-sectional estimates (equation 3) show the long-run effect of established tax differences (Baltagi and Griffen 1984). Of course, the fixed effects model of equation 4 also controls for time-invariant unobserved variables, and is therefore more robust to problems of unobserved heterogeneity (Allison 2009). We estimate these models using OLS, with standard errors clustered by both state and border segment (Dube et al. 2010). Statistical routines that allow for multidimensional clustering of standard errors are not implemented for Poisson regression.[11]

5.2 Results

[11] When we run these models using Poisson, we achieve the same coefficients, but standard errors that are biased by an order of magnitude. Thus, these parameter estimates appear to be robust to the estimator employed.

Table 3 shows regression results for the millionaire population models. Model 8 reports the state level model, which gives the average effect of state income tax on millionaire population throughout the U.S. The cross-state difference in tax rates is negative (consistent with the transitory millionaire hypothesis), but is not statistically significant, with an estimate scarcely larger than its standard error.

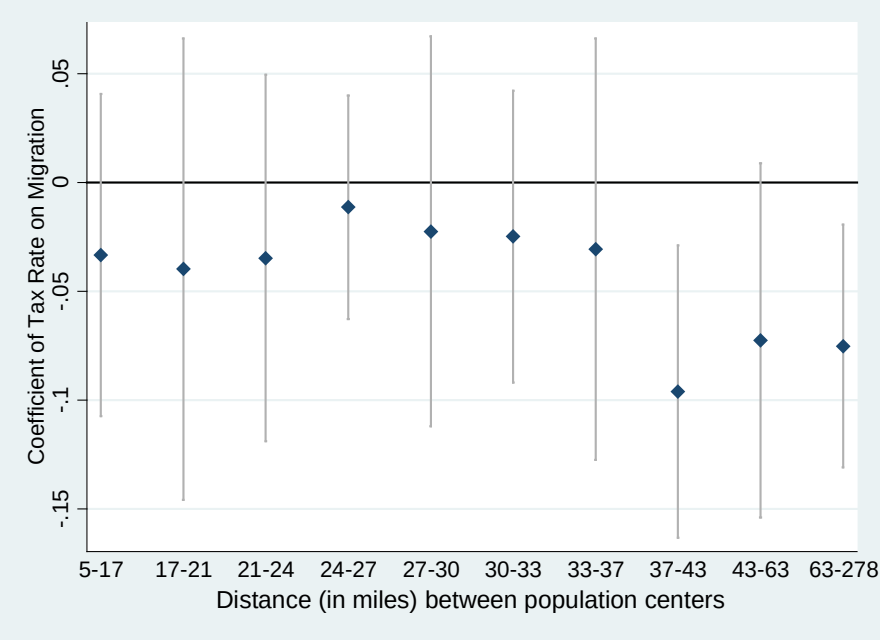
Models 9 and 10 make specific cross-border comparisons between contiguous counties. Do higher tax rates reduce millionaire population when we compare sharply focused regions that seem otherwise equivalent? Model 9 shows supportive evidence of clustering on the low-tax side. Among border county pairs, the county on the high-tax has a significantly lower millionaire population.

However, the overall estimate depends in part on border county pairs whose population centers are widely dispersed. Some counties are very large and do not form strong test cases. For example, San Bernardino County (California) shares a border with Clarke County, Nevada – home to Las Vegas – but the distance between their population centers is 184 miles, and between them lies the Mojave Desert. In model 10 we limit the analysis to border counties that span plausible commuting zones, where the population centers of the county pairs are no more than 40 miles apart. This retains 75 percent of the counties, and over 90 percent of the millionaire population, while eliminating county pairs that do not represent small, commutable geographic areas.[12] Here, the tax effect on millionaire population is smaller, and is not statistically significant.

[12] The average commuting distance in the United States is 19 miles (Rapino and Fields 2013).

In Figure 7, we show in more detail how the effect of top taxes varies by the distance between county population centers, running the border-county analysis (model 9) on each decile of distance. Contrary to intuition, Figure 7 indicates a stronger tax effect on millionaire population in border regions that span larger distances. The top decile includes county pairs whose centers range from 63 up to 278 miles apart. The tax effects are consistently negative. However, in the narrower geographic areas that motivate this analysis, the tax effects are clearly smaller, and as shown in model 10, do not achieve statistical significance even when pooled together.

Figure 7. Interaction Analysis: The Effect of Tax Rate on Migration, by Distance.



To further clarify this, we look more specifically at cities that straddle state borders (Coomes and Hoyt 2008). Metropolitan statistical areas (MSAs) are designed to capture distinct labor markets – they are areas of high economic integration based on commuting patterns. There are currently 381 MSAs in the United States, and 50 of these span at least one state border. These multi-state cities provide an alternative way to focus on small commutable zones.[13] Model 11 applies the same basic regression model to counties on different sides of a multi-state city. This continues the pattern of weak evidence of clustering on the low-tax side of the border: the coefficient is negative, but not statistically significant.

Finally, models 12 and 13 implement the border-county and multi-state-city analyses focusing purely on changes in the top tax rates. For example, in 2004, New Jersey raised its top tax rate, but Delaware, Pennsylvania and New York did not, leading to a change in the tax difference at

[13] This captures a different set of treatment and control counties for two reasons. First, it excludes border counties that are not part of an MSA. Second, it adds counties that, while not exactly contiguous with a state border, are nonetheless part of an integrated border region.

the border. By incorporating county fixed effects into these models, we isolate changes over time in the tax rates.

Among commutable border counties (model 12), there is no short-run evidence of changes in millionaire population due to changes in millionaire tax rates. When looking at changes in the tax difference between border counties (ie, due to changes in the tax rate in one of the states), the estimate is very close to zero and negligibly wrong-signed. Among the multi-state cities (model 13), we likewise find a non-significant and wrong-signed estimate.

Border regions that create spatial discontinuities in top tax rates offer a quasi-experimental identification strategy, providing a compelling upper-bound estimate. The border county pair models generate several key findings with respect to taxes and millionaire population. On the one hand, low-tax border counties do have more millionaires than their higher-tax neighbors, all else equal. However, the effect is, counter-intuitively, driven by border regions of large geographic size where population centers are far apart. In more geographically narrow, commutable zones – as well as in multi-state cities – the effect is smaller and not statistically significant. Moreover, in the short-run, fixed effects models, we see no population response to tax changes at the border.

6. Conclusion: Elite Demography and the Social Consequences of Progressive Taxation

Taxes on elite income earners provide a way to moderate the sharp growth in inequality seen over the last several decades, particularly the growing share of income held by the top one percent. However, in contemporary policy debates, the threat of millionaire migration from higher tax regions is often presented as a key constraint on redistributive social and fiscal policy.

For this reason, the mobility of the elite is a salient concern for policy-makers not only in U.S. states, but for governments in many countries.

There are two core frameworks for understanding elite mobility. In the "transitory millionaires" hypothesis, top earners are residentially mobile and sharply attuned to locational tax advantages. Redistributive policy initiatives are quickly defeated by the out-migration of the rich, to the detriment of states with progressive taxation. In contrast, the "embedded elites" perspective emphasizes social and network costs of migration that limit the attractiveness of moving purely for tax reasons, and that ground millionaires in the regions where they become successful. In this view, progressive taxation is simply part of the regional cost of living for an elite that is not especially concerned with locational costs.

The most striking finding of this research is how little elites seem willing to move to exploit tax advantages across state lines in America. Our results show that some millionaire tax flight is occurring, but only at the margins of statistical and sociological significance. First, millionaires are not unusually mobile compared to the general population, as both have annual migration rates of around three to four percent. Among millionaires, there is indeed an observable pattern of migration from high-income tax to low-income tax states that we do not see for the general population. However, the migration flows are small and have little impact on the millionaire population tax base. Our core migration estimate translates into millionaire population elasticity roughly 0.2, which in turn implies optimal tax rates much higher than currently exist in any state. Millionaire taxes are highly effective at raising revenue for states. If a state raised income taxes on the elite by one percentage point, we expect 0.2 percent of millionaires to migrate away, while the remaining 99.8 percent of millionaires would contribute significantly more revenue to state budgets. Further, we show that only 2.2 percent of migration flows among the elite appear

to be motivated by tax advantages – the great majority of millionaire relocations are unrelated to state income taxes and do not confer tax benefits. Finally, this modest degree of tax-induced elite migration is due entirely to Florida's status as a millionaire destination; excluding Florida from the analysis leaves no evidence of tax-induced migration. This leaves the question of whether Florida is better understood as a tax haven or a luxury resort.

We supplement these results by looking at millionaire population along the borders of states. In general, states with more progressive income taxes do not have lower millionaire populations. However, counties on the high-tax side of a state border do tend to have smaller millionaire populations than their lower-tax neighbors. Yet among the most compelling border regions and multi-state cities that represent small commutable zones, the millionaire difference at the border is small and not statistically significant.

Overall, our results show that millionaire tax flight may indeed occur, but at a scale too small to markedly constrain state tax policy in the United States. For states seeking purely to maximize revenue, millionaire tax rates would be much higher, as the migration cost is small relative to the revenues generated.

Consistent with the elite embeddedness thesis, these results ultimately imply high social and economic costs of migration, even for the rich (Dahl and Sorenson 2010). Future research could explore this further by studying how elite income or wellbeing is affected by cross-state moves. Indeed, the tacit assumption of the transitory millionaire hypothesis is that income and wellbeing are exogenous to geographic location. Under this assumption, the primary constraints on migration are simply the "moving truck" costs. However, Geist and McManus (2008) show that in the wake of geographic mobility there is greater instability in income, employment, and family

status. Moreover, for high income earners specifically, there is a strong risk of income decline in the year following migration Geist and McManus (2008:page). Most millionaires are the "working rich," and their incomes likely derive in part from place-based social capital in highly networked industries. More research is needed on the opportunity costs of migration.

Additional research could focus on identifying conditions under which tax-induced migration is most likely, particularly among different occupations. Professional athletes appear to be much more mobile than the general population (Kleven, Landais, and Saez 2013), as do academics (Zucker and Darby 2007). In contrast, and somewhat counter-intuitively, business owners and entrepreneurs appear less mobile than the general population (Dahl and Sorenson 2012; Michelacci and Silva 2007). Exploring these contrasts in mobility will develop greater insight into why the transitory millionaire hypothesis finds such little empirical support.

One solution to the threat of elite mobility is greater coordination and harmonization of tax policies (Genshel and Scwharz 2011). The hallmark of such coordination is the proposed global tax on wealth, as advocated by Piketty (2014). A global tax ameliorates the problem of capital flight by setting a world-wide minimum tax rate on the wealthy, narrowing the window for tax-migration. More modestly, tax coordination may come in the form of penalizing "tax haven" localities, clamping down on offshore bank accounts, and restricting other opportunities to evade local tax obligations. However, in the United States, political polarization and a growing policy divide between red and blue states suggests that tax cooperation and harmonization is increasingly unlikely. Our findings show that states have viable policy choices that can contribute to reducing inequality, without waiting for federal policy solutions.

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Table 1. Log-Linear Regressions for Millionaire Migration

	Model 1 Millionaires	Model 2 Millionaires	Model 3 Millionaires	Model 4 All Population
log pop. origin	0.93***	0.95***	0.95***	0.89***
	(0.03)	(0.04)	(0.04)	(0.04)
log pop. destination	0.93***	0.91***	0.92***	0.83***
	(0.04)	(0.04)	(0.04)	(0.03)
log distance	-0.25***	-0.26***	-0.26***	-0.30***
	(0.04)	(0.04)	(0.04)	(0.03)
Contiguity	0.76***	0.82***	0.81***	1.08***
	(0.12)	(0.11)	(0.11)	(0.07)
Income tax rate	-0.07***	-0.08***	-0.08***	0.01
	(0.02)	(0.02)	(0.02)	(0.02)
Winter temp / 10		0.09*	0.09*	0.05
		(0.04)	(0.04)	(0.03)
Sales tax		-0.05*	-0.05**	-0.01
		(0.02)	(0.02)	(0.01)
Property tax		-0.05	-0.05	0.04
		(0.08)	(0.08)	(0.05)
Unemployment rate		-0.01	-0.00	-0.02
		(0.04)	(0.04)	(0.03)
Average income		-0.03**	-0.03**	-0.01
		(0.01)	(0.01)	(0.01)
Residential Land Value		0.19***	0.20***	0.03
		(0.04)	(0.06)	(0.04)
Natural Amenities Scale			-0.00	-0.00
			(0.02)	(0.01)
Constant	-0.55***	-0.64***	-0.66***	-1.10***
	(0.14)	(0.13)	(0.13)	(0.18)
N	2550	2550	2352	2352
pseudo R-sq	0.734	0.771	0.770	0.793

* p<0.05 ** p<0.01 *** p<0.001. Robust standard errors in parentheses. The outcome variables represents counts of millionaire (or all population) migration flows between each state-pair, summed over 2000-2011. Model 4 uses a one percent sample of the total population, rather than just millionaires, and the income tax rate at the median. Source: Office of Tax Analysis micro data.

Table 2. Millionaire Migration and Florida

	Model 5 Excluding Florida	Model 6 Florida only	Model 7 Florida only
log pop. origin	0.97***	0.83***	0.82***
	(0.04)	(0.07)	(0.05)
log pop. destination	0.79***	0.88***	0.83***
	(0.04)	(0.06)	(0.08)
log distance	-0.27***	-0.95***	-0.88***
	(0.04)	(0.21)	(0.12)
Contiguity	1.06***	-0.45	-0.27
	(0.09)	(0.23)	(0.17)
Income tax rate	-0.03	-0.09***	-0.02
	(0.02)	(0.02)	(0.02)
Winter temp / 10	-0.01		0.08
	(0.03)		(0.05)
Sales tax	-0.04		0.05
	(0.02)		(0.03)
Property tax	-0.00		0.19
	(0.06)		(0.20)
Unemployment rate	0.02		0.00
	(0.03)		(0.06)
Average income	-0.01		0.02
	(0.01)		(0.02)
Residential Land Value	0.05		-0.13
	(0.05)		(0.15)
Natural Amenities Scale	0.05**		0.09*
	(0.02)		(0.04)
Constant	-0.61***	0.87**	1.00***
	(0.13)	(0.29)	(0.28)
N	1919	100	96
pseudo R-sq	0.794	0.819	0.885

* p<0.05 ** p<0.01 *** p<0.001. Robust standard errors in parentheses. The outcome variables represents counts of millionaire migration flows between each state-pair, summed over 2000-2011.
Source: Office of Tax Analysis micro data.

Table 3. Log-Linear OLS Models for Millionaire Population

	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
	States	Border Counties	Border Counties: 40 miles or less	Multi-state MSAs	FE: Border Counties: 40 miles or less	FE: Multi-state MSAs
Log population	1.091***	1.217***	1.308***	1.332***	1.113***	0.735***
	(0.046)	(0.059)	(0.038)	(0.042)	(0.185)	(0.126)
Tax rate	-0.022	-0.052**	-0.034	-0.042	0.004	0.011
	(0.017)	(0.019)	(0.019)	(0.025)	(0.033)	(0.028)
Year dummies	Yes	No	No	No	No	No
County-pair (or MSA) *x* year dummies	No	Yes	Yes	Yes	Yes	Yes
County fixed effects	No	No	No	No	Yes	Yes
N	816	37,504	28,224	5,616	28,224	5,616
adj. R-sq	0.914	0.847	0.865	0.797	0.164	0.015

Notes : * p<0.05 ** p<0.01 *** p<0.001. Standard errors in parentheses are clustered by state in Models 8, 11, and 13, by state and interstate border in Models 9, 10, and 12.

Sources : U.S. Department of the Treasury, IRS microdata, 1996-2011; U.S. Census Bureau, Intercensal Population Estimates, 1996-2011.

Appendix A. Variables, Descriptive Statistics, and Data Sources

Table A1. Descriptive Statistics and Data Sources, 1999-2011 (N = 2550)

	Mean	Std. Dev.	Min	Max	Source
State-to-State Relational (Matrix) Variables					
Millionaire migration counts	53	195	0	3,637	IRS - CDW
All migration counts	15,246	30,903	73	412,124	IRS - public
Distance	1,221	912	20	5,112	U.S. Census; Nichols (2003)
Contiguity	0.1	0.3	0.0	1.0	Merryman (2005)
State Attributes					
Millionaire population	109,966	167,090	5,923	877,643	IRS - CDW
All population	26,368,500	28,831,860	2,422,762	153,760,800	IRS - public
Income tax rate @ $1.7 million	38.6	2.1	34.6	41.4	TAXSIM
Income tax rate @ $53,000	12.1	1.8	9.0	15.5	TAXSIM
Winter temperature	32.3	12.2	2.6	67.4	NOAA Climatic Data
Sales tax rate	4.8	1.9	0.0	7.0	Tax Foundation
Property tax rate	1.0	0.4	0.2	1.8	Tax Foundation
Unemployment Rate	5.6	1.0	3.4	7.6	Bureau of Labor Statistics
Average Income	34,731	5,712	26,553	56,659	Bureau of Economic Analysis
Aggregate natural amenities scale	0.5	2.1	-2.9	6.7	USDA (McGranahan 1999)
January sun (days)	15	3	6	25	USDA (McGranahan 1999)
Summer humidity	55.0	16.0	17.5	75.2	USDA (McGranahan 1999)
Topographical variation	9.8	4.9	1.5	18.8	USDA (McGranahan 1999)
Water / coastal access	6.7	7.7	0.2	33.4	USDA (McGranahan 1999)
Temperature difference (Summer - Winter)	43.0	7.8	23.4	62.1	USDA (McGranahan 1999)

Appendix B: Migration and Revenue Estimates of a 1% Millionaire Tax

This appendix provides estimates of the migration and income-tax revenue consequences of a 1% millionaire tax in each state. The tax change we model is a tax equal to one percent of annual income on those earning $1 million or more in annual income. Based on the parameter estimates in model 2 (Table 1), we estimate the consequences of such a tax increase in the following way:

1. Predict in- and out-migrations for each state using *actual* tax rates (over the period 2000-2011).
2. Predict *counterfactual* migrations after raising the tax rate in each state – one state at a time – by one percentage point.
3. The loss of millionaire households due to the tax is estimated by the comparison between the predicted migrations under the *actual* tax rate and the *counterfactual* tax rate; this includes both extra out-migration due to the tax increase, and lower in-migration due to the tax.
4. The revenue cost is calculated as how much revenues migrants *would have paid* in income tax if they had *not* moved to a different state. For each state, this is computed from (1) the number of millionaire households lost; (2) the average income of millionaires in each state, and (3) the state tax rate. Specifically for state *i*:
   $Revenue\ loss = (migration\ loss_i) * (average\ income\ of\ millionaires_i) * (effective\ tax\ rate\ on\ millionaires_i)$.
5. Finally, the revenue gain from raising the tax rate is estimated simply by the number of millionaires who remain in the state. Each non-migrating millionaire contributes an extra

one-percent of their annual income in tax revenues. The aggregate of this is the overall revenue gain.

It is possible that out-migrating millionaires create "vacancy chains" that lead to promotions among the middle class into the millionaire bracket. If so, the revenue losses from millionaire migration are over-estimated. In contrast, there may be spillover effects of out-migration – the loss of elite talent reduces the income of others. If so, the revenue losses are under-estimated. Both scenarios seem plausible.

The estimates of revenue gains are upper-bound calculations. They do not take into account efforts by non-migrating millionaires to reduce or conceal their taxable income in response to the higher tax rate (Saez, Slemrod, and Giertz 2012).

Table B1 shows the estimated effects of a 1 point millionaire tax on in-migrations, out-migrations, and revenues for each state. Numbers are reported on an annual basis.

Table B1: Annual Migration and Revenue Estimates by State: Effect of a One Percentage Point Tax Increase

	Millionaire Pop.	Extra Outmigrations	Fewer Inmigrations	Total Migration Loss	Revenue Loss ($millions)	Revenue Gain ($millions)
Alaska	695	-1	-1	-2	-2.3	129.2
Alabama	4,015	-5	-12	-17	-2.5	72.4
Arkansas	1,712	-3	-4	-7	-4.7	209.0
Alabama	4,015	-5	-12	-17	-2.5	72.4
Arizona	6,819	-9	-19	-27	-22.8	2,741.0
California	73,137	-27	-32	-59	-4.2	247.5
Colorado	7,933	-9	-15	-24	-10.2	530.0
District of Columbia	2,033	-4	-2	-6	-1.1	31.5
Connecticut	15,337	-28	-22	-50	-1.8	65.9
Delaware	1,181	-1	-5	-6	-3.2	1,314.9
Florida	34,353	-18	-67	-85	-10.6	390.2
Georgia	11,261	-16	-28	-44	-1.2	42.7
Iowa	2,113	-6	-3	-9	-1.9	64.8
Idaho	1,276	-2	-2	-4	-7.6	737.3
Illinois	24,916	-38	-27	-64	-3.8	212.4
Hawaii	1,081	-1	-3	-3	-1.7	58.6
Indiana	5,173	-11	-10	-21	-2.9	106.2
Kansas	2,969	-7	-4	-11	-2.3	73.4
Kentucky	2,870	-7	-6	-13	-1.8	116.7
Maryland	9,928	-16	-20	-37	-1.7	49.0
Massachusetts	17,411	-32	-28	-61	-6.4	291.7
Louisiana	4,347	-5	-8	-14	-14.6	656.1
Maine	951	-2	-2	-3	-6.6	428.2
Michigan	9,321	-17	-11	-28	-5.9	228.6
Missouri	5,859	-12	-11	-23	-1.0	48.9
Minnesota	7,579	-17	-6	-22	-4.7	173.3
Mississippi	1,756	-3	-3	-6	-0.8	29.1
North Dakota	494	-1	-1	-1	-2.6	86.7
New Mexico	1,249	-2	-3	-5	-0.8	224.5
Nebraska	1,751	-5	-2	-7	-0.2	67.0
New Hampshire	1,900	-2	-5	-7	-17.1	736.4
New Jersey	23,868	-39	-27	-67	-1.1	34.2
Nevada	4,780	-6	-11	-17	-21.6	2,071.9
Montana	737	-1	-2	-3	-8.7	265.9
North Carolina	8,642	-15	-17	-32	-0.2	12.3
New York	55,129	-42	-27	-69	-10.7	358.5
Ohio	10,088	-25	-14	-39	-3.5	132.2
Oklahoma	3,425	-7	-6	-13	-3.1	112.0
Oregon	3,557	-4	-6	-10	-7.2	538.6
Pennsylvania	15,752	-25	-29	-53	-1.6	39.8
Rhode Island	1,276	-3	-2	-6	-3.7	124.7
South Carolina	3,577	-6	-8	-13	-0.1	27.4
South Dakota	822	-1	-2	-3	-0.7	216.7
Tennessee	6,283	-8	-12	-21	-1.4	1,191.6
Texas	35,418	-19	-24	-42	-2.3	102.0
Virginia	11,089	-15	-21	-36	-1.0	22.3
Utah	2,598	-3	-6	-9	-8.7	406.0
Vermont	587	-2	-1	-3	-0.8	433.5
Wisconsin	6,072	-14	-8	-23	-0.9	28.0
Washington	10,425	-6	-13	-19	-5.5	190.2
West Virginia	784	-2	-2	-3	-0.2	47.4
Average	9222	-11	-12	-23	-4.6	325.3

Appendix C. Optimal Tax Rates

This appendix explains how to convert out migration estimates into revenue-maximizing tax rates on incomes above $1 million for U.S. states.

The basic reduced form model for revenue-maximizing top tax rates is given as follows:

$$Baseline\ optimal\ rate: \quad \tau^* = \frac{1}{1 + a \cdot e} \qquad (1)$$

In this model, the revenue maximizing rate τ^* depends on two parameters (Saez 2001; Saez, Slemrod, and Giertz 2012). First, the shape (thinness) of the top tail of the income distribution is captured by a. As a increases, the portion of income in the top bracket is declining, meaning that less revenue can be generated from the tax.[14] Second, e is the elasticity of taxable income – how much the income reported on tax returns declines when the tax rate is raised.

With estimates of these two parameters, we can calculate the expected revenue-maximizing top tax rates. We do not estimate these parameters in this paper, but can draw on existing research for credible values. For a, Diamond and Saez (2010) show that $a = 1.5$ consistently for income thresholds above $400,000. For the elasticity of taxable income, research typically finds small estimates, with e = 0.25 as a typical result (Saez, Slemrod and Geirtz 2012; Picketty and Saez 2013). These parameters suggest a top marginal tax rate of 73 percent. However, this does not take into account potential migration responses.

To estimate revenue-maximizing top tax rates based on migration responses, Kleven, Landais, and Saez (2013) derive the following model:

[14] a is defined as the ratio of z $/z^*$, where z^* is the top income bracket and z is the average income above the top bracket (ie, the amount of income exposed to the top tax rate). For example, if the top bracket is $z^* = \$1$ million, and households in that bracket on average earn $1.5 million *more* than that threshold, then a = 1.5.

$$Optimal\ rate\ with\ migration\ only\text{:}\quad \tau^{*} = \frac{1}{1+\eta} \qquad (2)$$

In this model, η is the "elasticity of the total number of players [millionaires] in country *n* with respect to 1 – [top tax rate in country *n*]" (Appendix A4). This captures the percent loss of population for a one percent increase in the tax rate. With their overall migration elasticity of about 0.2, they estimate revenue-maximizing top tax rates for European countries of about 81 percent.[15]

Our core estimate captures the semi-elasticity of migration flows. To convert our estimate in to a comparable value for η, we need to rescale our estimate to give an implied population elasticity. This involves converting a percent *migration* change into a percent *population* change, by considering the percent magnitude of our estimate at the mean millionaire population and tax rate.

For the average state, a one-point increase in the tax rate leads to a drop in in-migration of 12 millionaires, and an increase in out-migration of 11 millionaires – a population loss of 23. The average state millionaire population is 9,200, which gives a 0.2 percent loss in millionaire population. The average combined federal and state income tax rate is 38.5 percent. A one-point increase at the mean represents a 2.6 percent increase in the tax rate. Thus, our estimate for η is 0.2 / 2.6 = 0.08, or with rounding simply 0.1.

Entering this into equation (2) gives a revenue-maximizing tax rate of roughly 93 percent. However, this does not take into account the elasticity of taxable income.

[15] Note that migration elasticities are much higher for foreign players, indicating that optimal tax rates would be lower for foreign than domestic players, as some countries currently have (Table A3).

Our final model takes into account both income responses (e) and migration effects (η) from raising top tax rates at the state level. In other words, faced with a state tax increase, elites may make greater efforts reduce their reported taxable income, or they may migrate to a lower tax jurisdiction. Both responses affect the revenue yield from the tax and the losses to the tax base. This combined model is given by Piketty and Saez (2013:429) as

$$Optimal\ rate\ with\ income\ and\ migration\ effects: \quad \tau^* = \frac{1}{1 + a \cdot e + \eta} \qquad (3)$$

Inputting our migration elasticity of 0.1, along with realistic values for a (1.5) and e (0.25) gives an optimal top tax rate of 68 percent.[16] This is a combined federal and state rate, but is much higher than exists in anywhere in the US. For millionaire migration to account for current state tax policies, the migration effects would need to be an order of magnitude larger. It would take a migration elasticity of 1 to make California's top tax rate the revenue-maximizing level, and an elasticity of 1.5 to make Florida's rate revenue-maximizing. These would be migration effects about 10 to 15 times larger than what we actually observe.

Moreover, even with a high-end estimate for the elasticity of taxable income (e = 0.57) (Gruber and Saez 2002), the revenue-maximizing rate for our migration elasticity is still 51 percent (See Table A1).

[16]To be explicit: $1 / (1 + 1.5 \cdot 0.25 + 0.1) = .68$

Table C1: Revenue-Maximizing Top Marginal Tax Rates

	e = 0.1	e = 0.25	e = 0.60
$\eta = 0.00$	0.87	0.73	0.53
$\eta = 0.01$	0.80	**0.68**	0.50
$\eta = 0.20$	0.74	0.63	0.48
$\eta = 0.50$	0.61	0.53	0.42
$\eta = 1.00$	0.47	0.42	0.34
$\eta = 1.50$	0.38	0.35	0.29

Appendix D: State Influence Analysis and the Florida Effect

In this appendix, we report the effect of excluding each state, one at a time. How much do the results depend on the inclusion or exclusion of any one particular state? In Table 2, we showed that the exclusion of Florida eliminated the tax effect. This leads to the question of whether this simply shows estimate instability, or a uniquely strong influence of Florida on millionaire migration. Drawing on the logic of a Cook's D analysis (Cook 1977; Andersen 2008), we estimate model 2 (Table 1) 51 times, dropping each state one at a time.

In Table D1 below, we list each state and show the tax coefficient (as well as standard error and t-statistic) when that state is *excluded*. States are listed in order from smallest to largest coefficient. We also report the difference from the coefficient when all states are in the model (0.064 from model 2), and the t-test for the difference in coefficients.

As noted in the main text, the only state exclusion that changes the substantive results is Florida. Likewise, this is the only exclusion that shows a statistically significant difference in the results.

Table D1. Tax-Migration Coefficient after Excluding Each State

	Coefficient	S.E.	t statistic	Difference from Model 2 estimate	t-test of difference
Florida	0.019	(0.015)	1.26	-0.045*	-1.98
California	0.053	(0.018)	2.96	-0.011	-0.59
New York	0.059	(0.016)	3.67	-0.004	-0.27
Ohio	0.059	(0.017)	3.44	-0.004	-0.25
New Jersey	0.059	(0.017)	3.42	-0.004	-0.25
Georgia	0.060	(0.018)	3.41	-0.003	-0.18
Pennsylvania	0.062	(0.017)	3.55	-0.002	-0.12
Michigan	0.062	(0.017)	3.58	-0.002	-0.11
Virginia	0.062	(0.018)	3.53	-0.002	-0.11
Oklahoma	0.062	(0.017)	3.59	-0.001	-0.09
Nevada	0.062	(0.019)	3.34	-0.001	-0.08
Wyoming	0.063	(0.018)	3.53	-0.001	-0.06
Maryland	0.063	(0.017)	3.58	-0.001	-0.06
Indiana	0.063	(0.017)	3.61	-0.001	-0.05
Missouri	0.063	(0.017)	3.59	-0.001	-0.05
Colorado	0.063	(0.018)	3.45	-0.001	-0.04
Connecticut	0.063	(0.018)	3.54	-0.001	-0.04
Kentucky	0.063	(0.017)	3.64	-0.001	-0.03
Arkansas	0.063	(0.017)	3.63	-0.001	-0.03
Mississippi	0.063	(0.017)	3.65	0.000	-0.03
Kansas	0.063	(0.018)	3.59	0.000	-0.02
West Virginia	0.063	(0.017)	3.66	0.000	-0.01
South Dakota	0.063	(0.017)	3.65	0.000	-0.01
Iowa	0.063	(0.017)	3.63	0.000	-0.01
Oregon	0.063	(0.018)	3.62	0.000	-0.01
Illinois	0.064	(0.018)	3.59	0.000	-0.01
North Dakota	0.064	(0.017)	3.67	0.000	0.00
Louisiana	0.064	(0.017)	3.72	0.000	0.00
Delaware	0.064	(0.017)	3.67	0.000	0.01
Alabama	0.064	(0.017)	3.71	0.000	0.01
Massachusetts	0.064	(0.017)	3.66	0.000	0.01
New Hampshire	0.064	(0.018)	3.62	0.000	0.01
Alaska	0.064	(0.017)	3.67	0.000	0.01
Minnesota	0.064	(0.018)	3.63	0.000	0.02
Rhode Island	0.064	(0.018)	3.66	0.000	0.03
District of Columbia	0.064	(0.017)	3.68	0.001	0.04
New Mexico	0.064	(0.017)	3.69	0.001	0.05
Hawaii	0.064	(0.017)	3.70	0.001	0.05
Nebraska	0.064	(0.018)	3.63	0.001	0.05
Utah	0.064	(0.017)	3.69	0.001	0.05
Montana	0.064	(0.017)	3.71	0.001	0.05
Maine	0.065	(0.017)	3.72	0.001	0.08
Idaho	0.066	(0.017)	3.76	0.002	0.11
North Carolina	0.066	(0.018)	3.71	0.002	0.12
Vermont	0.066	(0.018)	3.77	0.002	0.14
Wisconsin	0.066	(0.018)	3.67	0.002	0.14
South Carolina	0.067	(0.018)	3.79	0.003	0.19
Arizona	0.067	(0.018)	3.72	0.003	0.19
Tennessee	0.070	(0.019)	3.72	0.006	0.32
Texas	0.071	(0.019)	3.83	0.007	0.40
Washington	0.071	(0.019)	3.84	0.008	0.41