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Behavioral Responses to State Income Taxation of High Earners: Evidence from California[†]

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Using administrative data, we analyze the response to Proposition 30, a 2012 measure that increased California marginal tax rates by up to 3 percentage points for high-income households. Relative to baseline departure rates, an additional 0.8 percent of the residential tax base that landed in the top bracket left California in 2013. Using matched out-of-state taxpayers as controls reveals an income elasticity with respect to the marginal net-of-tax rate of 2.5–3.2 for high earners who stayed. These responses eroded 45.2 percent of state windfall tax revenues within the first year and 60.9 percent within 2 years, driven largely by the intensive margin. (*JEL* D91, H24, H31, H71, H73, J61, R23)

The empirical public finance literature has studied the elasticity of taxable income with respect to marginal net-of-tax rates as a measure of the efficiency of an income tax system (Saez, Slemrod, and Giertz 2012). In the leading approach for examining the elasticity of taxable income for the personal income tax (Gruber and Saez 2002; Giertz 2007; Kleven and Schultz 2014), the percent change in taxable income is estimated as a function of the percent change in marginal tax rates and a term designed to capture income effects, alongside a rich set of controls for base-period income. The literature's conclusion based on this methodology has generally been that the compensated elasticity of taxable income with respect to marginal tax rates is in the range of 0.1 to 0.4, while the income effects that would lead to greater labor supply under higher taxes are essentially negligible. These relatively

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modest elasticities have translated into calculations of high optimal marginal tax rates (Saez 2001; Piketty, Saez, and Stantcheva 2014), with perhaps the most widely cited calculation being a top optimal tax rate of 73 percent based on an elasticity of taxable income of 0.25 (Diamond and Saez 2011).

At the same time, a growing literature documents the rise in tax avoidance and evasion by wealthy individuals (Zucman 2014). Agrawal and Foremny (2019) and Kleven et al. (2014) show a tendency of high earners to relocate in response to changes in the top tax rate in Spain and Denmark. In the context of inventors, Moretti and Wilson (2017) and Akcigit, Baslandze, and Stantcheva (2016) investigate the influence of taxation on mobility across state lines within the United States and across international boundaries, respectively. On the other hand, Varner, Young, and Prohofsky (2018) and Young et al. (2016) use administrative tax data in US states and find relatively small migration responses to changes in top income tax rates. Given the large share of income taxes paid in many systems by the top of the income distribution, the elasticity of high earners' taxable income, especially for states within the United States or within other unions with free labor mobility, is an important and still open question.[1]

We study this question using administrative microdata from the California Franchise Tax Board (FTB) on the universe of California taxpayers around the implementation of the major 2012 ballot initiative, Proposition 30. California is the largest US state by GDP, comparable to the economy of the fifth- or sixth-largest country in the world. The Proposition 30 ballot initiative increased marginal income tax rates by 1 percentage point for singles with $250,000–$300,000 in taxable income (married couples with $500,000–$600,000), by 2 percentage points for singles with $300,000–$500,000 in taxable income (married couples with $600,000–$1 million), and by 3 percentage points for singles with over $500,000 in taxable income (married couples with over $1 million). These increases came on top of the 9.3 percent rate that applied to income over $48,942 for singles and $97,884 for married couples, and also in addition to a 1 percent income tax to support mental health expenditures that since 2004 had applied to incomes of over $1 million. The reform therefore brought the top marginal tax rate in California to 13.3 percent for incomes of over $1 million, the highest state-level marginal tax rate in the nation. The reform was voted in November 2012 and applied retroactively to tax year 2012 as well as for future tax years through 2018. California Proposition 55 during the 2016 election year extended these rate increases through 2030.

We first study the extensive margin response to taxation. We document a substantial increase in the outflow of high-earning taxpayers from California in response to Proposition 30. Defining a departure as a taxpayer who went from resident to nonresident filing status,[2] for those earning over $5 million, the rate of departure

[1] The top 1 percent of taxpayers paid approximately 40 percent of California state income taxes in 2011, and 50 percent in 2012 and 2015 after the tax increases studied in this paper.

[2] Since nonresidents of California must file a California return if they have any California-source income, this procedure captures essentially all tax-compliant movers. The out-migration effect is primarily accounted for by taxpayers who remain nonresident filers in the 2014 tax year; we discuss this mode of out-migration at length in Section IVA. On average, the state loses 75–80 percent of the adjusted-gross income tax base of top-bracket out-movers within two years of this mode of migration, with the remaining income continuing to be taxed in 2014 on nonresident tax returns these individual submit.

spiked from 1.5 percent after the 2011 tax year to 2.125 percent after the 2012 tax year, with a similar effect among taxpayers earning $2 million–$5 million in 2012. The increase in departure rate is significant but smaller for taxpayers in the new top brackets earning under $2 million. The fact that the effect increases with income is consistent with the established theory that average tax rates matter for extensive margin individual location decisions.[3] On the whole, relative to the pre-period 2000–2010, the income-weighted rate of departure among top-bracket taxpayers was abnormally higher by 0.8 percent between 2012 and 2013, compared to a baseline of 1.5 percent.[4] Further, we estimate that the treatment on California households' average tax rates relative to the average tax rates they would have faced in zero-income-tax states such as Nevada, Texas, and Florida would have been 23–40 percent higher (depending on their income level and composition) in the absence of the American Taxpayer Relief Act (ATRA), which passed on January 1, 2013. The federal income tax increases in ATRA reduced the incentive to move from high tax states, since the full deductibility of state and local taxes that prevailed at the time for taxpayers not facing the Alternative Minimum Tax (AMT) became more valuable.

We combine these results on the extensive margin behavioral response with conclusions of analysis of the intensive margin response to Proposition 30. Our focus on the California tax reform on this margin is motivated by the need for a credible counterfactual group to assess the average treatment effect of Proposition 30 on the pretax income of California high earners. Much of the empirical public finance literature studies population-level reforms (i.e., federal tax reforms) and thus must use taxpayers of different income levels to impute the potential outcomes of treated groups, with the aid of regression adjustments such as controls or bunching estimators.

We take a different approach: in particular, we use a set of difference-in-differences techniques in which we compare upper-income California resident taxpayers to a sample of nonresident California filers, for which there is relatively rich data given that any substantive California-source income requires the filing of a California tax return even by nonresidents.[5]

Our procedure in particular focuses on the intensive-margin impact of Proposition 30 on those California taxpayers whose income levels in each of the years 2009, 2010, and 2011 would have placed them in the Proposition 30 top bracket if that bracket had been in place at the time. The motivation for using this definition of high earners is the well-known issue in the empirical public finance literature that top incomes are highly mean reverting. In a recent treatment of this topic, Weber (2014) shows that using long lags of income to instrument for pretreatment income increases estimation credibility. Requiring consistently high pre–Proposition 30

[3] The role of average tax rates in individual location decisions is also emphasized in Moretti and Wilson (2017) and Agrawal and Foremny (2019). Analogous intuition on the importance of average tax rates for extensive margin decisions is found in the literature on firm location choices. See, for example, Devereux and Griffith (1998).

[4] Of the 66,936 primary taxpayers whom Proposition 30 placed in the to 12.3 percent bracket in 2012, this implies an income-weighted increase in departures of 535 top-bracket taxpayers, above baseline levels.

[5] Such filers on average have a California adjusted gross income (AGI)–to–federal AGI ratio of between 4.8 percent and 7.5 percent over the course of the 2009–2014 period and, thus, are plausibly not strongly affected by the tax rate increases.

incomes is a simple way to translate this intuition into the definition of a treatment group in our setting. The counterfactual control group of nonresident filers is then defined to be those taxpayers who do not reside in California but file California nonresident returns and who, if California residents, would have filed in the top California Proposition 30–created bracket from 2009 to 2011.

While there is no evidence of substantially different pre-trends between our treatment and control populations, they are imbalanced on covariates. We thus use several techniques to address these imbalances. First, we implement the synthetic difference-in-differences (SDID) approach of Arkhangelsky et al. (2021). Relative to a standard difference-in-differences approach, this technique weights observations in the control sample in order to weaken reliance on parallel trends assumptions holding in totality. More weight is placed on units that on average have similar past trends relative to treated units. Second, primarily to show a more traditional method and illustrate the intuition behind the SDID results, we implement propensity score matching as a preprocessing step, matching only on 2009–2010 covariates and focusing on a propensity score match that selects taxpayers in other high-tax states as control observations. Following the logic in Imbens and Wooldridge (2009), the equality of covariate values in 2011 is a testable implication of the unconfoundedness assumption; we indeed find that this restriction is satisfied. Third, we estimate a dynamic event study regression (Borusyak, Jaravel, and Spiess 2022; de Chaisemartin and D'Haultfœuille, 2020). We use 2011 as the "reference period" (i.e., pre-period). This enables us to leave 2009 and 2010 to estimate "treatment effects" in the pre-period to test for parallel trends. All of these techniques yield very similar estimates.

Our estimates show a substantial intensive margin response to Proposition 30, which appears in 2012 and persists through the last year of our analysis in 2014. The main SDID point estimate differences in log taxable income between treatment and weighted control units average −0.109 log points over the entire 2012–2014 period, and rise from −0.066 log points in 2012 to −0.179 log points in 2014. The appearance of an intensive margin response in 2012 is consistent with the fact that Proposition 30 was retroactive to 2012, was known to have a substantial chance of passage, and in general was a salient issue in California during the bulk of 2012.[6] The alternative approaches with more traditional difference-in-differences methodologies reveal similar or even large estimates in logs. Matched difference-in-difference results on levels with winsorization at the 99.5th percentile also show results of similar magintude. The taxable income effects for the persistent high earners are −$321,000 in 2012, −$360,000 in 2013, and −$436,000 in 2014. Since the baseline taxable income levels of this treatment sample in 2011 were $4.15 million, these results are qualitatively very similar to the main SDID result of −0.109 log points. We prefer the results in logs, and the SDID results to the matched difference-in-differences due to the fact that SDID's weighting scheme ensures that control units are properly weighted to generate parallel trends in the pre-period.

[6] See the discussion of the Proposition 30 institutional setting in Section II.

This intensive margin response is concentrated in noninvestment income, not in capital gains, dividends, and interest income. Similar effects are also estimated in federal AGI, suggesting that most of the behavioral changes leading to this reduced activity are neither state-specific nor related to deductions. That is, they are most likely the result of reduced income generation (labor supply), offshoring of income to other countries, or other forms of tax avoidance.

Applying the main SDID result of a treatment effect of −0.109 log points to a denominator of Proposition 30's 3.63 percent impact on top marginal net-of-tax rates yields an elasticity point estimate of 3.0.[7] This would drop to 2.6 if the relatively small California income of the nonresidents is also assumed to have been treated and to have responded in the same fashion, and if we assume that 18 percent of top-bracket taxpayers face the lower marginal tax rate AMT, as implied by Internal Revenue Service (IRS) data.

An elasticity of 2.6–3.0 is a large estimate, especially relative to the standard public finance literature that generally looks at the elasticity of taxable income across the entire distribution. Other than our focus on high earners, these results should be akin to this literature, since our intensive margin effects are conditional on people staying in California and the traditional literature on federal taxation is in a context where out-migration (moving to another country) is more costly. Our results are also larger than the magnitude of the percent differences in CEO income with respect to cross-country variation marginal net-of-tax rates as reported in Piketty, Saez, and Stantcheva (2014), which are around 2. The differences between our findings and the rest of the literature are very likely due to our focus on very high earners, a population generally of those earning over $1 million. According to FTB statistics, approximately 40 percent of the individual income tax in California is paid by those with taxable income of over $1 million, making this a relevant figure for policymakers. Furthermore, our paper is unique in having a large sample of such millionaire earners in administrative microdata who faced a very substantial tax increase, alongside a control sample that did not.

We note that the fact that leavers of California are likely those who would have even higher elasticities suggests that the intensive margin elasticities we estimate are in fact a lower bound on the intensive margin elasticity in a more closed system, such as at the national level, where barriers to out-migration are larger. In addition, the increasing effects we measure are suggestive of even larger responses two years after the reform than in the initial year.

We do not take a stand on the broad normative implications of our estimates. For example, one possibility is that lower earnings in response to high tax rates reflect a reduction in productive labor supply among high earners. On the other hand, as shown by Piketty, Saez, and Stantcheva (2014), a major driver of top income responses to taxation could be a reduction in rent seeking—for example, a reduction in wage bargaining by CEOs. Furthermore, if we are picking up primarily tax sheltering—and if tax sheltering has no actual cost in terms of resources and instead represents simply a transfer of resources from one set of agents to another

[7] Similar estimates are obtained using the level results that emerge from the matched difference-in-difference technique.

in the economy—then there would be no deadweight loss associated with the tax sheltering (Chetty 2009). Our data, while rich, do not allow sufficient granularity to disentangle such channels.

Using these estimates, we assess their implications for tax revenue in the context of California Proposition 30.[8] We find using a back-of-the-envelope calculation based on our econometric estimates and the mean values of observed taxable income for different filing status that the intensive and extensive margin responses to taxation combined to undo 55.6 percent of the revenue gains from taxation that otherwise would have accrued to California in the absence of behavioral responses over the first 3 years of the reform (2012–2014), with estimates of over 80 percent in the final year. The intensive margin accounts for over 90 percent of this effect, while the extensive margin comprises the rest of the total response.

Finally, we also consider what these elasticity estimates imply about the likely effects of the federal Tax Cuts and Jobs Act (TCJA) reform. The imposition of the federal cap on state and local tax (SALT) deduction increased incentives to leave California for zero-tax states by over two times the force of Proposition 30. Furthermore, the very large impact of the SALT cap combined with a relatively small cut in the top federal marginal tax rate raises questions about the extent to which the TCJA was even federal-revenue positive for high-income California residents, given the behavioral elasticities that we estimate.

This paper proceeds as follows. In Section I, we review related literature. In Section II, we discuss the institutional setting, specifically California Proposition 30 and the federal tax changes that occurred at the same time. In Section III, we describe the data. In Section IV, we describe the empirical methodology. Sections V and VI present the extensive and intensive margin results, respectively. Section VII describes the policy implications of our extensive and intensive margin results. Section VIII concludes.

I. Related Literature

A. *Extensive Margin*

As Kleven et al. (2020) discuss in a recent survey, both lack of access to administrative data and identification challenges have to some extent constrained this literature. Literature on the behavioral response to taxation has aimed to analyze the response to taxable income as a whole (Feldstein 1999) under the notion that this is a sufficient statistic for the efficiency of the tax system. The availability of administrative microdata, however, allows for the separation of the behavioral response into intensive and extensive margins, so that the behavioral impact of taxation on stayers can be separated from the impact on the decision to move out of a state or region.

[8] Our calculations bear on revenue implications with regard to the behavior of high-income taxpayers in the sense of taxpayers who file in the top Proposition 30 tax bracket in three consecutive years; the intensive margin analysis focuses on this group, and our extensive margin results are driven by these persistently high-earning taxpayers.

Within the tax-induced mobility literature, several studies examine the issue in an international context. Using administrative Spanish data, Agrawal and Foremny (2019) find that, conditional on a decision to move, a 1 percent increase in the net-of-tax rate for a region relative to others increases the probability of moving to that region by 1.7 percentage points. Kleven et al. (2014) document an increased tendency of high-earning foreigners to relocate to Denmark when a preferential top rate is introduced for all workers who have lived outside Denmark for at least three years, with estimates implying an elasticity of between 1.5 and 2; although Danish expatriates are afforded this same relocation tax incentive, the authors find small elasticities for such workers. Focusing on specialized groups, Kleven, Landais, and Saez (2013) find an elasticity of foreign European football players with respect to the net-of-tax rate of around 1, with domestic players significantly less sensitive to tax rates in the decision to leave their own country. Similarly, Akcigit, Baslandze, and Stantcheva (2016) study the international mobility of inventors and also find an elasticity of around 1 for foreign superstar inventors but a negligible elasticity for domestic superstar inventors.

As discussed by Kleven et al. (2020), an emerging theme in the microeconometric literature on the migration response to taxation is that treatment effects are strikingly heterogeneous and may depend on factors such as the size of the tax base, local amenities, and agglomeration effects. The above studies thus may not be informative for migration dynamics within the United States. Several studies that have considered mobility across the US states have resembled Kleven, Landais, and Saez (2013) and Akcigit, Baslandze, and Stantcheva (2016) in that they are focused on specialized groups. For example, Moretti and Wilson (2017) consider evidence from star scientists moving in response to taxation across state borders and find an elasticity with respect to the personal income tax of 1.8 and to the corporate income tax of 1.9. Coomes and Hoyt (2008) examine the propensity of in-movers to a metropolitan area to choose the part of that metropolitan area that is located in a lower-tax state. Work by Feldstein and Wrobel (1998) and Leigh (2008) examines the question of the incidence of state income taxation and, in particular, the mechanism whereby extensive margin movement could affect the net-of-tax wage, thus considering the somewhat separate question of whether extensive margin movement reduces the ability of state tax policy to redistribute income.

More general work on the extensive margin response to tax rates in the US context includes work on millionaire migration such as Young et al. (2016), who use IRS data and argue that millionaire migration is a phenomenon of limited economic significance. Young and Varner (2011) consider microdata from New Jersey around the imposition of a millionaire tax and find muted effects. Most recently, and closest to the part of our study that considers the extensive margin, Varner, Young, and Prohofsky (2018) provide an empirical investigation of high-earner migration in the wake of tax increases using the same dataset as in our work. They find negligible effects of high-earner taxes on the margins of both inward or outward migration. We detect small but significant downward effects of Proposition 30 on in-migration and much more substantial upward effects on out-migration, for reasons explained in Section II.

B. *Intensive Margin*

Much has been written about the intensive margin response of taxable income to marginal net-of-tax rates. The classic study by Feldstein (1995) was the first to use panel data methods in this context, analyzing the Tax Reform Act of 1986 and finding elasticities from 1 to over 3 across specifications. Gruber and Saez (2002) use panel data methods in the context of the NBER Continuous Work History File from 1979 to 1990. This analysis yields a main estimate of 0.4. In an important recent study, Kleven and Schultz (2014) find elasticities in the 0.2–0.3 range in Danish data. The datasets used in these papers give rise to the question of whether the studies reflect the responses of high earners as well as earners in the middle of the distribution. For example, the data used by Gruber and Saez (2002) contain only 13 observations of taxable income over $1 million. In Kleven and Schultz (2014), the average taxpayer in this sample earns approximately 250,000 kr. (2013 values) annually, which is $44,642 in 2013 dollars. As of 2018, the cutoff for the top bracket in Denmark is 542,282 kr., which is $81,537 in 2019 dollars.

Studies of high earners have been more challenging given the need for strong assumptions when working with aggregate data or with administrative data paired with appropriate empirical designs. Saez, Slemrod, and Giertz (2012) employ public-use data and aggregate methods to find elasticities for taxable income for the top 1 percent of US earners with respect to the top marginal rate of between 0.58 and 1.71 between 1960 and 2006, depending on assumptions on time trends in the top 1 percent share of income. Using microdata from IRS Statistics of Income containing a substantial share of top earners, the paper analyzes the 1993 US top rate increase from 31 percent to 36 or 39.6 percent and finds an elasticity of taxable income with respect to the marginal net-of-tax rate of 0.5–0.6 using panel data methods. Chetty (2012) provides bounds on elasticity of taxable income estimates and shows that plausible ranges for true elasticities could vary when modest adjustment costs are taken into account. It stands to reason that responses to state tax changes would be larger than for federal taxes, since there are more margins through which to respond.

Piketty, Saez, and Stantcheva (2014) present a theoretical framework in which high top marginal rates reduce income by muting the returns to nonproductive bargaining efforts. Using microdata on CEO compensation, they find that the returns to US CEOs from luck are stronger when top rates are low rather than high. Using a sample of international CEOs, they report elasticities of CEO pay with respect to top marginal rates of between 1.9 and 2 even after controlling for firm performance and CEO characteristics.

A recent literature has analyzed the impact of federal tax reforms from 2012 to 2013. Saez (2017) analyzes the intensive margin impact of the 2013 ATRA reform using aggregate data, finding a substantial time shifting of income from 2013 into 2012 in response to the policy shift. Kawano, Weber, and Whitten (2016) use federal tax return microdata, restricting the sample to taxpayers earning from $350,000 to $650,000, comparing taxpayers whose pre-ATRA incomes placed them just above and below the 2013 federal top rate hikes. They find mostly negligible intensive margin effects, although such techniques do not allow for estimates that are relevant much above these local cutoffs.

II. Institutional Setting

A. *California Proposition 30*

In 2012 California Governor Jerry Brown advocated and campaigned for the passage of Proposition 30, the "Schools and Local Public Safety Protection Act." This effort was based on a desire to preserve statewide education funding by instituting new tax increases on California's wealthiest taxpayers. The proposition also sought to establish the Education Protection Account within the state's general fund, an account that would collect any new tax revenues that were derived from the newly passed ballot measure for the purposes of education spending.

In total, the Department of Finance believed that the new tax rates would result in an overall increase in tax revenues of $6 billion annually between the tax years 2012–2013 and 2016–2017, with smaller amounts in 2011–2012, 2017–2018, and 2018–2019 as taxes are phased in and out. Initially, in tax years 2011–2012 and 2012–2013, combined tax revenues were estimated to total $8.5 billion. With this increase in tax revenue, there would be an additional $2.9 billion required by existing law for the minimum funding of schools and community colleges. The remaining $5.6 billion in the general fund would be appropriated for the purpose of closing the budget gap.[9] The California Legislative Analyst's Office (LAO) mentioned the potential for a behavioral response in response to the newly instituted tax rates; however, the LAO never explicitly mentioned the degree to which (if at all) the possibility of a behavioral response factored into their projections.[10]

After the passage of Proposition 30, California's upper-income taxpayers saw three newly established personal income tax rates. The new tax brackets were the following:

- a 10.3 percent tax bracket for single filers' taxable income between $250,001 and $300,000 and joint filers' taxable income between $500,001 and $600,000,
- an 11.3 percent tax bracket for single filers' taxable income between $300,001 and $500,000 and joint filers' taxable income between $600,001 and $1 million, and
- a 12.3 percent tax bracket for single filers' taxable income above $500,000 and joint filers' taxable income above $1 million.

These tax rates came in addition to a 1 percent income tax to support mental health expenditures that since 2004 had applied to incomes of over $1 million, bringing the top tax rate for filers with incomes over $1 million to 13.3 percent.[11] These

[9] "What Would Proposition 30 Mean for California?" (1–2); see https://calbudgetcenter.org/wp-content/uploads/120911_Proposition_30_BB.pdf.

[10] "Proposition 30 Temporary Taxes to Fund Education. Guaranteed Local Public Safety Funding. Initiative Constitutional Amendment." See https://lao.ca.gov/ballot/2012/30_11_2012.aspx.

[11] Including the mental health millionaire tax, singles would pay 12.3 percent on incomes between $500,001 and $1 million, up from 9.3 percent, and 13.3 percent on incomes about $1 million, up from 10.3 percent. Married couples would pay 11.3 percent on incomes between $600,001 and $1 million, up from 9.3 percent, and 13.3 percent on incomes about $1 million, up from 10.3 percent.

tax rates would initially be in effect for seven years (from tax year 2012 through tax year 2018). Voters ultimately extended these rates through tax year 2030 when they passed Proposition 55 in November 2016. In addition to the increase in individual tax rates, there would also be an accompanying 0.25 percent increase in the state's sales tax rate, resulting in a sales tax rate of 7.5 percent (up from 7.25 percent), not including local sales tax rates, which were subject to potential increases upon the discretion of local governments. When factoring in the state and local sales tax rates in tandem, the average combined sales tax rate statewide was just above 8 percent.[12]

Ultimately, the wealthiest 1 percent of California taxpayers—individuals making incomes of more than $533,000—were expected to provide approximately 78.8 percent of the revenues raised by Proposition 30's tax increases, while California's top 5 percent of taxpayers—individuals making incomes of more than $206,000—would contribute 81.2 percent of the revenues raised. The tax rate would amount to a 1.1 percent increase in income taxes for the top 1 percent of California taxpayers and an increase in 0.05 percent for the top 5 percent of California taxpayers.[13]

B. *Implications of Resident and Nonresident Status*

California's FTB designates three classes of taxpayers for residency purposes: residents, nonresidents, and part-year residents. Nonresidents and part-year residents fill out the same tax form. Residents are individuals that are "present in California for other than a temporary or transitory purpose" or are "domiciled in California, but outside California for a temporary or transitory purpose."

The FTB imposes certain guidelines for establishing residency. A resident is any individual who is present in California for a purpose other than a temporary or transitory one or who is domiciled in California. Determining domicile is an important part of the residency determination and holds that if an individual establishes themselves and their family in California with the intention of making it their "true, fixed, permanent home and principal establishment," then they are a resident. Merely having a second home in the state of California thus does not mean an individual is considered a resident for California tax purposes, though such an individual must pay local property taxes. A part-year resident is any individual who is a California resident for part of a year and a nonresident for part of the year.

Establishing a departure from California requires significant cutting of ties. The FTB states that it will consider a range of factors including the amount of time spent in the state versus outside, but also the location of a principal residence, the state that issued the driver's license, the state where vehicles are registered, and the location of social ties including places of worship, professional associations, and location of spouse and children. The FTB is clear that spending more than nine months of a given tax year in the state makes a taxpayer a resident. Spending less than six months may help a taxpayer make a case that they are not a resident of California but is not sufficient given the other aforementioned factors.

[12] Ibid (1).
[13] Ibid (2).

California residents are taxed on all income, including from sources outside the state. For example, a California resident who earns labor income from the state, labor income in another state, and interest or dividends, or gains from the sale of stocks or bonds of corporations located outside the state, would be liable to pay tax to the state of California on the total amount.

Nonresidents with any income from California sources in the form of money, goods, property, and services that are not exempt from tax are required to file a California tax return if that income was higher than a specific amount, ranging from $14,797 to $59,234, depending on an individual's age, marital status, and number of dependents. They are then taxed only on the portion of their income that derives from California sources.

Dividends and interest, however, are considered sourced in the location of residency. A nonresident earning dividends from a California-based corporation or interest from a bank account in California would not be subject to California income taxes on those amounts. Additionally, any gains from stock or bond sales are considered sourced from the place of residency at time of sale. A nonresident who sells stocks at a profit will not be taxed in California on the proceeds.

California residents who own businesses may be capable of shifting their activities to other states, but because of California's single sales apportionment rules, doing so will generally require shifting sales to other states. The exceptions to this rule are for certain business activities (called qualified business activities, or QBAs), which specifically refer to agricultural business activity, extractive business activity, or a banking or savings/loan or financial business activity. We contend that these are unlikely to be important for pass-through business income that appears directly on individual income tax returns. In all other cases, even for sole proprietorships, the amount of business profit that is taxed in the state is solely a function of what percentage of the business sales happen in California.

These rules have several important implications for our study. First, the methods for shifting income out of California and remaining a resident are relatively limited, given that California taxes all income of residents regardless of the source. Second, the transition associated with leaving California should be expected to occur with at least a year as a partial resident. Third, taxpayers who remain residents have limited ability to shift income to other states unless they are business owners actively shifting sales to other states.

These differences inform the definitions of several key variables in our dataset. Federal AGI encompasses all AGI that appears on the federal tax return. California AGI reflects all income for California residents and only California-source income for nonresidents, and also has some minor definition differences to federal AGI. The variable we refer to as Taxable Income reflects total taxable income, whether sourced in California or not, under California rules. That is, for residents, Taxable Income is the taxable income as entered on the California individual tax return 540, which reflects all sources of income except possibly business income from sales to other states; for nonresidents, Taxable Income is what California taxable income would be if the individual were a resident in California, and therefore similarly reflects essentially all sources of income. It is important to note that while California-source income is knowable from the data for nonresidents, for residents we do not

know California-source income, since residents are taxed on all income, not only California-source income, and there is no way to break down income for residents by source. To the extent there are differences in results between the taxable income and federal AGI specifications, these could reflect the additional use of deductions to further reduce taxable income, or they could reflect some income shifting by California residents with pass-through businesses by shifting sales to other states. We note that our data would not capture the possibility that pass-through business owners might incorporate their businesses, thus shifting income to the corporate tax base, although aggregate data from FTB show no unusual growth in the number of corporation income returns around the implementation of Prop 30.

C. *2012–2013 Federal Tax Changes*

Simultaneous to the changes to state-level taxes were notable changes to the federal tax system with the passing of the ATRA of 2012. While much of the bill extended provisions from tax bills of the past, there were nuanced yet significant changes that meaningfully impacted the wealthiest American taxpayers in particular. In this section we review these changes. To the extent that federal changes affect federal MTR, it will affect the relative tax costs of being in one state versus another.[14]

Tax Rates and Brackets.—In 2001, President George W. Bush signed into law the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA). One of the main provisions of the law was to phase in tax cuts over the course of five years that would stabilize and become permanent. The rates of 28 percent, 31 percent, 36 percent, and 39.6 percent would eventually be reduced to 25 percent, 28 percent, 33 percent, and 35 percent, respectively, in 2006. While the original bill included provisions that would end the tax cuts in 2011,[15] perhaps creating expectations that federal tax rates would rise, EGTRRA was ultimately extended for a further two years by the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010.[16]

With the passing of ATRA in 2012, the first three tax rates (25 percent, 38 percent, and 33 percent) were permanently extended. Additionally, this remained true for the top bracket of 35 percent, but only for individuals making less than $400,000, heads of households making less than $425,000, and couples making less than $450,000. If taxable income exceeded those income levels, the rate would rise to the original pre-EGTRRA level of 39.6 percent.[17] Furthermore, all of the taxable income thresholds for these tax rates would be indexed for inflation after 2013.

[14] Regarding the intensive margin, our empirical setting compares the evolution of income for California residents versus propensity-score-matched nonresidents. A key identifying assumption is that the federal tax changes did not differentially affect California residents versus nonresident control observations.

[15] "Economic Growth and Tax Relief Reconciliation Act of 2001" (5); see https://www.govinfo.gov/content/pkg/BILLS-107hr1836enr/pdf/BILLS-107hr1836enr.pdf.

[16] "Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010," Title II; see https://www.congress.gov/bill/111th-congress/house-bill/4853.

[17] "Tax Provisions in the American Taxpayer Relief Act of 2012 (ATRA)" (5); see https://tpc.io/2sQvOzE.

ATRA also implemented an additional Medicare tax on employees of 0.9 percentage points on incomes over $200,000 for single taxpayers and incomes over $250,000 for married couples. This is in addition to the Medicare portion of the FICA tax, which is 1.45 percent for employers and 1.45 percent for employees. The total Medicare tax rate therefore became 3.8 percent, of which 2.35 percent is statutorily paid by the employee. A self-employed individual would pay the entire 3.8 percent.

Capital Gains, *Qualified Dividends*, *and Alternative Minimum Tax Provisions*.— In 2003, Congress continued to make substantive changes to the US tax system by passing the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). As a consequence of the bill, realized capital gains received by individual shareholders saw decreases in tax rates to which they were subject. More specifically, realized capital gains that were initially subject to a tax rate of 10 percent (in brackets where the ordinary income tax was higher than 15 percent) and 20 percent (in brackets where the ordinary income tax was higher than 15 percent) were lowered to 5 percent and 15 percent, respectively, through 2007 and to 0 and 15 percent, respectively, in 2008.[18]

ATRA, acting in the same fashion as the bill had done with respect to tax rates, permitted the original decreases in the capital gains tax rates to remain permanent. However, this would not be the case for those taxpayers who fell into the reestablished 39.6 percent tax bracket. For those taxpayers, the tax rate on capital gains reverted to its original, pre-ATRA value of 20 percent.[19]

The JGTRRA of 2003 also established new tax rates for qualified dividends. These rates followed the same 5 percent and 15 percent structure as the capital gains tax rates. However, with the passage of ATRA, the rates were slightly altered to continue to mirror the new capital gains tax rate structure (0 percent, 15 percent and 20 percent).[20]

ATRA also provided relief to middle-income earners by raising the AMT exemption limit from $45,000 for married couples ($33,750 for singles) and certain personal credits to $78,750 for married couples ($50,600 for singles). For 2013 and onward, the AMT exemption would be indexed for inflation. However, these changes did not extend to higher-income earners. Under ATRA rules, the AMT imposed a 26 percent tax on taxable income for AMT purposes up to $175,000. Any amount greater than $175,000 would be subject to a 28 percent rate.[21]

D. *Interaction between State and Federal Taxes*

Determining whether confluences of legislative action on state and federal levels would have mitigating or accelerating effects on migration requires understanding the

[18] "Bush Administration Tax Policy: Introduction and Background" (1292); see https://www.brookings.edu/wp-content/uploads/2016/06/20040913galeorszag.pdf.

[19] "Tax Provisions in the American Taxpayer Relief Act of 2012 (ATRA)" (5); see https://www.taxpolicycenter.org/publications/tax-provisions-american-taxpayer-relief-act-2012-atra.

[20] Ibid.

[21] Ibid (6).

ways in which these legislative provisions interact with one another. As far as ATRA and Proposition 30 are concerned, the newly established tax rates and their interaction with the newly instituted "Pease provision" are perhaps the most important element.

As discussed in depth by Saez (2017), ATRA introduced significant changes with respect to itemized deductions. Through the new provision, the Pease limitation, itemized deductions were reduced by 3 percent of an individual's AGI when that income exceeded more than $300,000 for couples ($250,000 for singles and $275,000 for head of household filers) for up to 80 percent of the itemized deduction. The addition of this provision ostensibly increased the marginal tax rate of high-income earners by 1.2 percent $(3\% \times 39.6\% = 1.2\%)$. However, when factoring in the new state tax increase on the top marginal tax rate, an individual's marginal net tax rate is effectively lower as a result. Consider, for example, an individual in the top tax bracket at both the state and federal level living in California in 2013. This individual's marginal tax rate on the federal level would be 39.6 percent, while on the state level the state rate would be 13.3 percent and the taxpayer share of the health-care marginal rate is 2.35 percent. The effective federal marginal rate is $39.6 \times (1 - 0.133 + 0.03) = 35.52$, where 3 percent is added back due to the Pease provision's limits on itemized deductions.[22] Under a no–Proposition 30 counterfactual, the effective federal marginal rate is $39.6 \times (1 - 0.103 + 0.03) = 36.71$. Thus, under Proposition 30 the marginal net-of-tax rate is $100 - 35.52 - 13.3 - 2.35 = 48.83$, whereas without Proposition 30 it would be $100 - 36.71 - 10.3 - 2.35 = 50.64$.

As of 2013, IRS Statistics of Income data show that 18.0 percent of taxpayers faced the federal AMT. For these taxpayers the effective federal marginal tax rate is 28.0 percent, and neither the Pease provision nor the deductibility of state and local taxes apply. For these taxpayers, the marginal net-of-tax rate under Proposition 30 is $100 - 28.0 - 13.3 - 2.35 = 56.35$, whereas without Proposition 30 it would be $100 - 28 - 10.3 - 2.35 = 59.35$.

E. *Polling Data and Proposition 30*

Starting at the time of the March 2012 request for the ballot title for Proposition 30, there was a lively public debate surrounding the measure. On March 14, Greenberg Quinlan Rosner conducted a poll in which California residents supported the measure by a 64 percent to 33 percent margin. While this margin would wane to some extent in the coming months, support for the proposition prevailed in every poll save for one.[23] Additionally, the measure mobilized statewide fundraising efforts, with donations relating to Proposition 30 totaling $120.5 million.[24]

[22] Note that the Pease provision was repealed by the TCJA of 2017, effective for the 2018 tax year.

[23] A SurveyUSA poll in October of 2012 had 29 percent of its respondents identify themselves as "Undecided," 15 points higher than in any other polls conducted concerning Proposition 30. For a review of all polling in the lead up to the vote, see https://ballotpedia.org/California_Proposition_30,_Sales_and_Income_Tax_Increase_(2012).

[24] Ibid. Fifty-five percent of these funds were donated in favor of passage, while 45 percent were donated in opposition. While anti–Proposition 30 donations generally represented the interests of high earners, donations in favor of the measure derived from a broad coalition representing decidedly less moneyed interests.

Overall, Proposition 30 was a first-order issue in both popular and political circles in California during much of 2012. It was clear early on in 2012 that the proposition had a substantial chance of passage, leading some interests representing high-earning California residents to take political action against it. In general, this suggests that even as of early 2012, many in California may have been adjusting their behavior in anticipation of the passage of Proposition 30.

III. Data

This paper uses administrative data from the California FTB. The data file contains the universe of California tax returns from 2000 to 2015, although income items are only complete for 2000–2014.[25] These tax returns include the filings of California residents, nonresidents, and partial-year residents. Nonresidents and partial-year residents are coded identically in the data and thus from this point forward will be referred to interchangeably.

From these returns, we have population-level coverage of certain variables measured from the California Form 540. Variables for which we have full coverage include Taxable Income and California AGI, Federal AGI, Capital Gains (we observe the sum of long-term and short-term capital gains), Interest, and Dividends.[26] Online Appendix B shows the components of "Total Income," which is then adjusted to AGI through subtractions. AGI then becomes taxable income by removing deductions. State and federal quantities differ due to state and federal specific adjustments. For example, state and local taxes could at the time still be itemized in deductions from federal AGI.

Income variables in the data are measured at the household level, or more precisely the level of the primary taxpayer in a household. Three filing statuses account for the near-universe of filings: single, married joint filers,[27] and head of household.[28] In the case of married joint filers, spousal incomes are aggregated together so that it is not possible to attribute income to one spouse or another. The FTB designates one spouse the "primary taxpayer" and the other a "redundant spouse," and the data include identical records for each party reflecting household quantities. All of our analysis is conducted at the level of a primary taxpayer—that is, a household. However, when appropriate, we use the comprehensive panel nature of the data; for instance, when constructing out-migration variables, a taxpayer who today is a primary taxpayer and tomorrow is a redundant spouse is not defined as an out-migration event. We observe taxpayer-level demographic information on marital status and dependents, and for years 2010 and after, we observe taxpayer age.

[25] The file we received also contained some data from 2016 filings, but we determined that the filings were still incomplete for that tax year (California Franchise Tax Board 2017, 2018a, 2018b, 2019a, 2019b, 2020a, 2020b, 2021a).

[26] Data for Interest and Dividends are missing for 2009, and Capital Gains data are missing for 2015.

[27] In nearly all cases, it is suboptimal to file separately when part of a married couple.

[28] "Head of household" is for unmarried taxpayers who manage the upkeep of a home for a qualified set of individuals.

Table 1—Summary Statistics

	Mean	SD	p1	p10	p50	p90	p99
Wage	50,356	67,127	0	0	29,985	122,424	345,427
Federal AGI	77,373	124,526	−4,266	10,129	44,070	157,387	676,565
California AGI	67,692	95,290	−5,290	8,212	40,198	145,393	520,396
Taxable Income	61,730	115,476	0	2,277	31,639	127,807	625,057
Deductions	14,237	16,021	4,042	4,043	8,087	32,849	84,777
Dependents	0.807	1.140	0	0	0	2	4
Married	0.407	0.491	0	0	0	1	1
Nonresident	0.051	0.220	0	0	0	0	1
Cal AGI/Fed AGI Ratio	0.933	0.207	0	0.782	1	1	1.19
Observations	241,490,744						

Notes: The table shows summary statistics for all observations pooled over the time period 2000–2015. The level of observation is the household, as reflected in the primary taxpayer observation, which aggregates spousal income. California AGI differs from Federal AGI in two ways: (i) it includes only California-source income, and (ii) California and Federal law differ slightly in their definitions of AGI.

All dollar amounts are inflation-adjusted to 2015 dollars using inflation factors from the FTB (see online Appendix Table A1 for these inflation factors). Table 1 contains summary statistics for the full sample, 2000–2015. Lastly, to impute marginal tax rates and taxes paid, we follow the literature in using version 27 of the TAXSIM calculator provided by the NBER. See Feenberg and Coutts (1993) for a description of TAXSIM. We use taxpayer-level TAXSIM computations only in our assessment of the average-tax-rate effects of Proposition 30 to inform the extensive margin analysis.

The TAXSIM calculations were not done using the standard TAXSIM online interface due to contractual limitations on the use of the data. Instead, we obtained the TAXSIM FORTRAN archive directly from the NBER and performed computations locally on the FTB data. These computations at the microdata level are used only in the context of assessing the incentives for California taxpayers to out-migrate driven by either Proposition 30 or the 2018 federal TCJA.

IV. Methodology

A. *Extensive Margin Responses: Migration*

Our ability to detect a larger out-migration effect as compared to the work of Varner, Young, and Prohofsky (2018) owes primarily to our use of a more general definition of out-migration. In the following we will define this measure and demonstrate its validity and quantitative importance for high earners.

Measuring Out-Migration.—To define an out-migration event, Varner, Young, and Prohofsky (2018) identify cases in which a taxpayer in three consecutive years $t, t+1, t+2$ displays the following behavior:

- Year t: files as a California Resident
- Year $t+1$: files as a California nonresident or partial-year resident
- Year $t+2$: does not file

We agree that such behavior patterns constitute migration, and term this phenomenon "full out-migration" occurring in year t. However, this definition may undercount out-migration in the following sense. Some California households may have California-based sources of income that are not easy to immediately relocate. Thus, even if the household for all practical purposes has relocated to another state, it may still file taxes in California due to these income sources. For example, a household may own properties other than its residence from which it derives rental income. Further, it is likely that this scenario is particularly relevant to high-income households. Thus, we consider the additional channel of migration, in which a taxpayer in three consecutive years $t, t+1, t+2$ displays the following behavior:

- Year t: files as a California resident
- Year $t+1$: files as a California nonresident or partial-year resident
- Year $t+2$: files as a California nonresident or partial-year resident

We refer to this sequence of events as "partial out-migration" occurring in year t. While we have provided an intuition for this definition, we proceed to validate this definition in the data, as well as the quantitative relevance of this out-migration margin.

First, we show that such events fit the intuitive definition of migration. Figure 1 plots the cumulative ratio of California AGI[29] to federal AGI among all partial out-migrations of top-bracket taxpayers[30] that occur in years 2000–2009, and separately for partial out-migrations occurring in year 2012. We rely on this ratio to measure the fraction of total taxpayer income derived from California-based sources, because we directly observe both the numerator and denominator in the data (we do not observe state and federal quantities simultaneously for any other component of income, such as taxable income). The figure demonstrates that among partial migration events occurring in 2012, a top-bracket household decreases its California-to-federal AGI by 75–80 percent by 2014. This effect is nearly identical during years 2000–2009. Online Appendix Figure A1 shows that the dynamics of this ratio are driven by a drop in the level of California AGI, whereas federal AGI does not appreciably drop after the partial out-migration.

For in-migration, we construct a parallel set of measures. Online Appendix Figure A2 shows that when taxpayers enter California, their AGI in the state increases by roughly the same magnitude as the leavers' AGI falls.

Secondly, we check whether such events are quantitatively important in the data. Online Appendix Table A2 shows, over the 2000–2009 period, percentage rates of out-migration for various income bins. This tables makes clear that "full out-migration" is the dominant mode of out-migration for taxpayers in the 9.3 percent bracket, but that "partial out-migration" is the primary mode of out-migration observed among high earners.

[29] California AGI differs from federal AGI in two ways: (i) it includes only California-source income, and (ii) California and federal law differ slightly in their definitions of AGI.

[30] "Top-bracket" refers to households that are in the top tax bracket under Proposition 30 policy, based on inflation-adjusted taxable income.

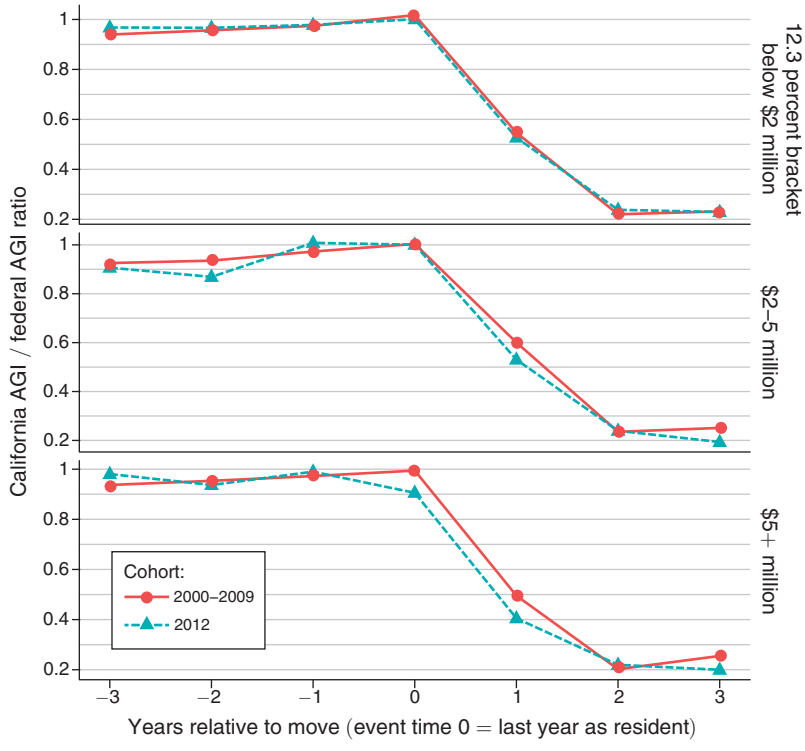

FIGURE 1. HOW MUCH INCOME LEAVES CALIFORNIA WITH NONRESIDENT OUT-MIGRANTS?

Note: The sample is all taxpayers who displayed a Resident–Nonresident–Nonresident transition, where in the "Resident" year the taxpayer was in the top tax bracket according to 2012 tax policy.

Figure 2 shows in a map the destination states of households that move out of California, both prior to Proposition 30 in 2000–2009 and from 2012 to 2013, by percent of California AGI that departed to each of the states. While New York remains as one (presumably) non-tax-motivated destination, a large and increasing share of the out-migration is to the zero-tax states of Nevada, Florida, and Texas.

Out-Migration Regression Specification.—We adopt a time-disaggregated difference-in-differences regression specification to evaluate the impact of Proposition 30 on out-migration. First, we restrict the sample to California-resident tax returns from years 2000 to 2013, which are at the postreform 9.3 percent tax bracket. The 9.3 percent bracket forms the "control" group. We allow for three "treatment" groups: those in the postreform 10.3 percent, 11.3 percent, and 12.3 percent tax brackets. The bracket index b runs through the set $b \in \{9.3\%, 10.3\%, 11.3\%, 12.3\%\}$ in the baseline specification, with alternative specifications including finer cuts of the top income bracket. The dependent variable $\mathbf{1}\{MoveOut\}_{it}$ indicates that taxpayer i engages in full out-migration or partial out-migration beginning in year t, as defined below. We also consider each source

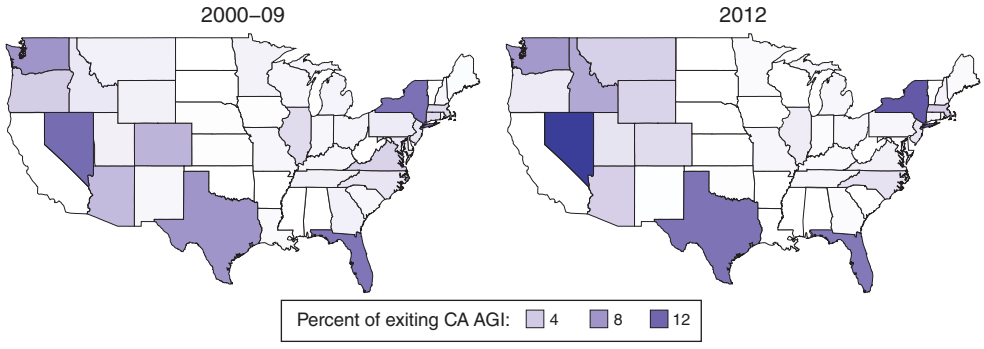

FIGURE 2. MOVER DESTINATIONS

Notes: This figure shows the destinations of top-bracket California out-migrants by the latest year of residence (2014–2015) for both prior to Proposition 30 in 2000–2009 and from 2012 to 2013. California (CA) AGI differs from federal AGI in two ways: (i) it includes only California-source income, and (ii) California and federal law differ slightly in their definitions of AGI.

of out-migration separately. We use years 2000–2010 as the "pre-period," and estimate effects separately for years 2011–2013.

$$(1)\quad \mathbf{1}\{MoveOut\}_{it} = \alpha_t + \alpha_{MaritalStatus} + \mathbf{1}\{t \leq 2010\}_{it} \times \sum_b \beta_{b,Pre}\mathbf{1}\{\text{In Bracket } b \text{ at Year } t\}_{it} + \sum_{x=2011}^{2013} \mathbf{1}\{t = x\}_{it} \times \sum_b \beta_{b,x}\mathbf{1}\{\text{In Bracket } b \text{ at Year } x\}_{it} + \phi'\mathbf{X}_{it} + \varepsilon_{it}.$$

All specifications include year and marital status fixed effects. We run the regressions either with an empty covariate vector $\mathbf{X}_{it}$, or allow this vector to include the log of taxable income along with fixed effects for 100 bins of taxable income. The baseline regression is weighted by taxable income (inflation adjusted so that weights are consistent across years), so that the coefficients are interpreted not as the fraction of taxpayers moving out but as the fraction of taxable base moving out.

Finally, we stop the sample at the outward migration that occurred in 2014 (2013 resident base year), as going forward requires certainty that 2016 data are complete. Tax returns from high earners take longer to process, and this may bias the sample. Practically, this choice does not affect the estimates, because we estimate year-by-year coefficients.

Incentives to Move.—Our methodology aims to estimate the abnormal rate of out-migration in the years surrounding the passage of Proposition 30 in different categories of taxpayers. A naïve interpretation of our results would state that they are driven by a three-point hike in the marginal income tax rate of top-bracket taxpayers or by two- and one-point hikes for lower brackets. Such statements would be misleading in two ways. First, extensive margin decisions respond to changes in

average tax rates (not marginal rates). Secondly and more importantly, even it were the case that these two rates were equal—as may approximately be the case for very high earners—the deductibility of state taxes paid from federal taxable income leads the effective increase in tax rates due to Proposition 30 to be lower than 3 percent.

To illustrate the issue, suppose that marginal rates are equal to average rates and that state rates are 10.3 percent and federal rates are 40 percent. The taxpayer's cumulative tax rate is $10.3\% + \left(1 - 0.103\right) \times 40\% = 46.18\%$. If state rates are raised to 13.3 percent, the taxpayer's cumulative rate is 47.98 percent by the same logic, which amounts to a net tax increase of 1.8 percent.

Complicating matters further, federal tax rates rose between 2012 and 2013, which would further mitigate the change in average tax rates for those 2012 California residents contemplating out-migration. This implies that in the absence of a federal tax increase, any out-migration incentives would in fact have been stronger.

To precisely understand how Proposition 30 altered incentives to move out of California, we undertake the following exercise. We fix taxpayer behavior at 2012 levels. We first use TAXSIM to compute the difference in the average tax rate that each taxpayer i would face if she moved to a state outside California s, relative to California, under 2011 tax policy:[31]

$$\left\{T^{CA}_{2011}\left(z_{i,2012}\right) - T^{S}_{2011}\left(z_{i,2012}\right)\right\}_{\forall i, S \neq CA}. \tag{2}$$

This quantity represents for each taxpayer the pre–Proposition 30 tax gains to moving out of California.[32] Next, we compute this same quantity for 2012 tax policy:

$$\left\{T^{CA}_{2012}\left(z_{i,2012}\right) - T^{S}_{2012}\left(z_{i,2012}\right)\right\}_{\forall i, S \neq CA}. \tag{3}$$

Federal tax policy did not change substantially from 2011 to 2012. On the other hand, TAXSIM's 2012 policy incorporates Proposition 30 due to its retroactive nature. Thus, this quantity can be interpreted as the post–Proposition 30 tax gains to moving out of California, before the 2012–2013 federal tax increase. Finally, we repeat the computation for 2013 tax policy, computing

$$\left\{T^{CA}_{2013}\left(z_{i,2012}\right) - T^{S}_{2013}\left(z_{i,2012}\right)\right\}_{\forall i, S \neq CA}. \tag{4}$$

This quantity represents for each taxpayer the post–Proposition 30, post-2012–2013 federal policy shift gains to moving out of California.

To systematically summarize the results of this exercise, we first disaggregate taxpayers i into groups B based on their 2012 income: those in the 10.3 percent bracket, the 11.3 percent bracket, 12.3 percent bracket earning under \$2 million, \$2 million–\$5 million, and over \$5 million. For each such group, we report first how

[31] To render average tax rates comparable across states, we fix as the denominator 2012 California axable Income. This is not ideal but is advantageous compared to using either raw amounts of taxes paid (which are difficult to interpret), state-by-state taxable income (this quantity cannot be computed in zero-tax states like Texas and Nevada), or a measure of federal taxable income (which will be different under different amounts of state taxes paid).

[32] We note that this calculation disregards movements out of America, but we will show in the results that this does not represent a sizeable share of Proposition 30–driven out-migration.

Table 2—Increase in Average Tax Rate Difference between California and Other States, 2012–2013

		Prop 30 + Federal Tax Increase		
Income bin	Only Prop 30	Zero-tax states	Non-zero-tax states	Tax cuts
10.3% bracket	0.0022	−0.0077	−0.0029	0.0056
11.3% bracket	0.0061	−0.0009	0.0004	0.0082
12.3% bracket	0.0125	0.0107	0.0082	0.0163
$2–5 million	0.0181	0.0166	0.0118	0.0204
$5+ million	0.0225	0.0187	0.0141	0.0219

Notes: For this table, each taxpayer i is sorted into an income bin B based on their 2012 income. For each such group, the column "Only Prop 30" reports how Proposition 30 altered incentives to leave California, averaged over individuals and destination states. Note that if $T^{S}_{2012}(z_{i,2012}) = T^{S}_{2011}(z_{i,2012})$ (that is, the destination state does not change tax policy between 2011 and 2012), the quantity collapses to $T^{CA}_{2012}(z_{i,2012}) - T^{CA}_{2011}(z_{i,2012})$. Differences between the effective increase in the average tax rate and the increase in the top marginal rate are due to the federal deductibility of state taxes and the discrepancy between average and marginal tax rates. In the remaining columns, we account for how this increase in move-out incentives is altered by the concurrent 2012–2013 increase in federal tax rates, which induce variation in cross-state movement incentives due to the interaction of the federal policy shift with the existing state of tax deductions in non-California states. We report such averages in the "Prop 30 + Federal Tax Increase" columns of the table. To provide a broad picture of this heterogeneity, we split the destination states into three groups in the latter columns: (i) zero-tax states, which have zero state income taxes in 2012 and 2013; (ii) non-zero-tax states, which tax income but do not change tax policy between 2012 and 2013; and (iii) the states of Iowa, Kansas, and Maine separately, because these states enacted tax cuts. See Section IVA for further details.

Proposition 30 altered incentives to leave California, averaged over individuals and destination states:

$$\left[\frac{1}{\sum_{i\in B,S\neq CA} 1}\right] \sum_{i\in B,S\neq CA} \left[T^{CA}_{2012}(z_{i,2012}) - T^{S}_{2012}(z_{i,2012})\right] - \left[T^{CA}_{2011}(z_{i,2012}) - T^{S}_{2011}(z_{i,2012})\right]. \tag{5}$$

We report these averages in Table 2 in the "Only Prop 30" column. Note that if $T^{S}_{2012}(z_{i,2012}) = T^{S}_{2011}(z_{i,2012})$ (that is, the destination state does not change tax policy between 2011 and 2012), the quantity collapses to $T^{CA}_{2012}(z_{i,2012}) - T^{CA}_{2011}(z_{i,2012})$. Thus, we do not disaggregate these averages across destination states, as very few states other than California changed tax policy between 2011 and 2012. These figures show that even for very high earners earning over $5 million in 2015 dollars, the effective increase in average tax rate is closer to 2 percent than to the top marginal rate increase of 3 percent. This is due both to the federal deductibility of state taxes and the discrepancy of average and marginal tax rates.

We then account for how this increase in move-out incentives is altered by the concurrent 2012–2013 increase in federal tax rates, which induce variation in cross-state movement incentives due to the interaction of the federal policy shift

with the existing state of tax deductions in non-California states. That is, we compute disaggregated averages of the form

$$\left[\frac{1}{\sum_{i\in B,S\neq CA} 1}\right] \sum_{i\in B,S\neq CA} \left[T^{CA}_{2012}\left(z_{i,2013}\right) - T^{S}_{2013}\left(z_{i,2012}\right)\right] - \left[T^{CA}_{2011}\left(z_{i,2012}\right) - T^{S}_{2011}\left(z_{i,2012}\right)\right]. \tag{6}$$

We report such averages in the "Prop 30 + Federal Tax Increase" columns of Table 2. To provide a broad picture of this heterogeneity, we split the destination states into three groups in the latter columns of Table 2: (i) zero-tax states, which have zero state income taxes in 2012 and 2013; (ii) non-zero-tax states, which tax income but do not change tax policy between 2012 and 2013; and (iii) Iowa, Kansas and Maine, which are reported separately because these states enacted tax cuts between 2012 and 2013, thus increasing the incentive to move there. Lastly, in the table calculations we omit Minnesota, which raised the top state income tax rate from 7.85 to 9.85.[33] Online Appendix Figure A3 provides a visualization by state of average rate increases for taxpayers in the \$5+ million income bin.

The largest change in marginal gains from out-migration in this calculation is realized by moving to the states that cut taxes. However, outside these cases, we see that empirically the most additional tax savings over and above preexisting gaps are realized by relocating to previously zero-tax states such as Texas and Nevada, as opposed to states that previously had nonzero income taxes. This occurs in the data because of the Pease provision of ATRA, which, as explained above, included a phase-out of itemized deductions.

It is theoretically ambiguous whether out-migration in response to a California tax increase should flow more strongly to states with higher marginal increases in tax savings, such as Kansas, Maine, and Iowa, or whether migration should flow toward the states with all-in highest savings in taxes, which are the zero-tax states. The latter behavior would be rationalized in a model in which taxpayers only value tax savings in location decisions, in which case the salient decision criterion is the minimum average tax rate obtainable by moving to any state within the United States. The former behavior could be rationalized in a model in which taxpayers have very strong idiosyncratic destination preferences; in an extreme case, suppose each taxpayer can only move to one destination state at random (perhaps due to social networks or an employment situation), in which case the decision criterion is the minimum average tax rate obtainable by moving to that one state. In this case, and given random preferences, states such as Kansas should see higher out-migration from California than would a zero-tax state like Texas. We note that while all analysis here is framed in terms of savings in the average tax realized from leaving California, it can be considered equivalently as gains in the net-of-tax rate.[34]

[33] Kansas and Maine cut rates, while Iowa held its rates constant but reduced its definition of taxable base.

[34] Much of the literature on the extensive margin response to taxation uses logs of the net-of-tax rate, instead of levels, as the independent variable of interest (i.e., Kleven et al. 2014; Moretti and Wilson 2017; Agrawal and Foremny 2019). Online Appendix Table A3 shows the analysis in terms of logs of the net-of-tax average rate. Note here that the incorporation of the federal tax increase from 2012 to 2013 in fact can lead to higher increases

B. *Intensive Margin Methodology*

Our focus with regard to the intensive margin impact of taxation is estimating the effect of the California tax reform, attempting to difference out behavioral responses to the federal tax reform. We do this because the federal tax reform affects all US citizens and thus it is difficult to construct a credible counterfactual group. Existing studies largely attempt to use lower-income groups to control for the income trends in top-brackets. In contrast, our approach is to focus on state tax reforms for which we have cross sectional variation for taxpayers of comparable earnings status.

Treatment and Control Groups.—To study the causal effect of the California tax reform (and to difference out income retiming from 2013 into 2012 resulting from the federal tax increase), we use the following empirical strategy. We define the "treatment group" of taxpayers as those who from 2009 to 2011 filed as California residents, and further who for each year earned taxable income which placed them in the range of the top-bracket as newly introduced by California Proposition 30. Finally, we require that each "treated" taxpayer file as a California resident through 2014. The motivation for defining treatment status based on a measure of persistent high-earnings is the well-known issue in the literature on intensive margin responses to taxation that high incomes are strongly mean reverting (see for example Weber 2014). For example, in our setting of California, incomes may mean revert due to startup IPOs or other liquidity events.

To identify the causal response of such taxpayers to California Proposition 30, we need a suitable counterfactual. Our "control group" is defined as those taxpayers who file nonresident returns in California in every year from 2009 to 2014, and whose inflation-adjusted taxable income[35] would place them in the top California bracket as introduced under Proposition 30 for 2009–2011, had Proposition 30 been in effect at that time. Such taxpayers are not subject to California taxes except for their California-source income; Online Appendix Table 16 shows that such filers on average have a California AGI to Federal AGI ratio of between 4.8 percent and 7.5 percent over the course of the 2009–2014 period. On the other hand, California residents are subject to state income taxation on all income regardless of its geographic source.

This setup suggests a difference-in-differences strategy. In contrast to Gruber and Saez (2002), our specifications do not attempt specifically to run regressions of taxable income on marginal tax rates, but rather to estimate the divergence in taxable income that emerges between previously parallel trends of treated versus control groups after the implementation of Proposition 30. In a sense then, Proposition 30 is our instrument. In this setting, remaining legislative endogeneity would have

in the log net-of-tax rate benefits from leaving California. This is because although the levels difference argument from above carries through, differences in logs are approximately percent differences. The large federal tax increase leads all net-of-tax rates to fall, leading to the magnification of any percent difference. Based on these calculations, the average incentive to move is approximately equal for states with nonzero taxes and no tax changes when incorporating the federal tax rise, but it is 38 percent higher for zero-tax states with the federal tax change.

[35] That is, their California taxable income if they were California residents, in which case their entire income base would be subject to California taxation. This quantity is a variable in our dataset.

to derive from taxes being increased at a time when the state expects California incomes to fall relative to non-California incomes, and particularly in such a way as to generate divergences of the weighted non-California incomes that are parallel to California incomes in the pre-period, which we view as unlikely. It is also important to note that this strategy rests on the assumption that intensive margin responses to ATRA that reflected in 2012–2014 income measures are symmetric between treatment and control groups. That is, high-income California and non-California taxpayers at similarly high income levels—with parallel pre-trends established either through SDID or matching to taxpayers in tax-similar states—have similar taxable income elasticities.

Synthetic Difference-in-Differences.—SDID as introduced in Arkhangelsky et al. (2021) is a synthesis of ideas underlying the synthetic controls and difference-in-differences methods for causal program evaluation. The main advantage of the method over standard difference-in-differences is that it reweights control observations to weaken the parallel trends assumption. While we find that broadly parallel trends are observed between the treatment group and various subsamples of the control group that can be selected through propensity score matching techniques, SDID is preferable to these ad hoc techniques in that it retains the logic of ad hoc techniques that aim to make the parallel trends assumption plausible but does not require the use of arbitrary sample restrictions.

Instead, SDID generates unit weights that align preexposure trends in the outcome of unexposed units with those for the exposed units, and it generates time weights so that the average posttreatment outcome for each of the control units differs by a constant from the weighted average of the pretreatment outcomes for the same control units. Estimated weights are then used in a weighted two-way fixed effects difference-in-differences regression intended to recover the average treatment effect on the treated.

Our primary dependent variable of interest is log taxable income. Thus, we use this variable to generate SDID weights. In this procedure, 2006–2011 is the pre-period and 2012–2014 is the post-period, where the treatment begins in 2012. As in the recent synthetic controls literature, SDID uses L2 regularization (also known as "ridge regression") to estimate its entity weights. This procedure introduces dispersion into the weights by shrinking the OLS coefficients (when well defined) uniformly toward zero in a ratio sense. Regularization stabilizes estimated weights by controlling their variance; to see this, note that least squares with L2 regularization is equivalent to adding a constant positive term to the diagonal of the variance-covariance matrix used to calculate the OLS estimator: $\hat{\beta}_{Ridge} = (X'X + cI)^{-1} X'Y$ for $c > 0$. Time weights are estimated using unpenalized least squares.

To ensure that our discretion in algorithm implementation does not affect the empirical results, we use the off-the-shelf implementation in the "synthdid" R package provided by the authors.[36] Relative to the classic synthetic controls setup, SDID does

[36] https://github.com/synth-inference/synthdid.

not force a pretreatment match on levels of the dependent variable, but insists only on matching trends. This alleviates the potential for mean-reversion bias, which can arise in synthetic controls or difference-in-differences with prematching designs that force pretreatment matches on the level of the dependent variable of interest (Weber 2014). Graphical output from the SDID package demonstrates the parallel trends in weighted units.

Our study is also concerned with log federal AGI as well as year-specific coefficients. To maintain a consistent analysis, we carry through the weights from the all-up (e.g., 2006–2011 as pre-period, 2012–2014 as post-period) log taxable income estimation. Given that we carry one set of weights through the analysis, we use the jackknife approach for inference, following the discussion in Arkhangelsky et al. (2021) for a setting with prespecified weights.

We also use SDID to estimate placebo specifications, assuming counterfactually that there were treatments after the year 2007 (making the post-period 2008–2010) or 2008 (making the post-period 2009–2011). Placebo specifications that consider counterfactual treatments in later years would be contaminated by effects of the reform beginning in 2012, and placebo specifications that consider counterfactual treatments in earlier years risk being contaminated by the effects of the 1 percent tax on incomes over $1 million that was implemented for tax years beginning in 2005.

Alternatives to Synthetic Difference-in-Differences.—While we view the cutting-edge SDID as a superior method to those requiring parametric propensity score matching and/or arbitrary sample restrictions to create parallel trends, for robustness we show the results under several older procedures.

The first alternative is difference-in-differences with matching on covariates, or "matched DID." A simple matching procedure that makes advantageous use of the substantial size of both the California high-income tax filing sample and the nonresident filer sample is implemented as a preprocessing step. In this approach, we match propensity scores calculated using a logistic regression on 2009–2010 total AGI, taxable income, and capital gains. However, since the size of the full control group is smaller than that of the treatment group, the propensity score match must be done with replacement. This approach then retains the full "treatment" group while parametrically reweighting the "control" group to achieve better covariate balance. The procedure enables us to recover an average treatment effect on the treated, where the "treated" are persistently high-earning California residents as defined in our particular fashion.

In order to select the most plausible control group, our main specification for matched DID uses only taxpayers filing in 2011 from states with similar state tax rates to California. We define this group of states as Hawaii (11 percent top rate), Oregon (9.9 percent top rate), Minnesota (9.85 percent top rate), Iowa (8.98 percent top rate), New Jersey (8.97 percent top rate), Vermont (8.95 percent top rate), DC (8.95 percent top rate), and New York (8.82 percent top rate). To motivate this approach, suppose that in the initial procedure we match a California taxpayer to a Texas resident filing as a California nonresident with the same pre-period income. If the Texan were transplanted to California, she would presumably earn less given the higher marginal tax rate in California, which contaminates the matching. That

is, we would like to match on pre-period incomes under identical tax regimes. In an ideal setting, we would compare the behavior of individuals that are randomly assigned to various states, to mitigate any bias introduced by the potential correlation between an individual's propensity to migrate and their income. Additionally, other location-specific factors might relate to differences in incomes, such as economies of agglomeration of high-skill and high-wage industries, and a positive relationship between attractive amenities, costs of living, and wages. Using states with high tax rates in the pre-period helps alleviate some of these concerns and yields more conservative estimates that we rely on in our elasticity calculations. We use this matching procedure focusing on the control sample from high-tax states for our main estimates. As an alternative, we also attempt matched DID using the full set of nonresident controls as matching candidates, but this approach is not as successful at generating completely parallel pre-trends.

After matching, we apply a difference-in-differences estimation. As discussed in Imbens and Wooldridge (2009), while the unconfoundedness assumption justifying the matching procedure cannot be directly tested, its plausibility can be assessed through placebo-style tests. In our setting, while 2009–2011 covariates are predetermined from the viewpoint of the tax policy treatment, we only match on 2009–2010 covariates. This allows us to examine outcomes in 2011 as a placebo-style test. If unconfoundedness were true, we would not expect the matched control and treatment groups to display systematic differences in 2011. As such, in our difference-in-differences regression, we take the pre-period as 2009–2010 and estimate "treatment effects" separately for 2011–2014. If unconfoundedness holds, we do not expect to see a positive and statistically significant coefficient for 2011.

The estimating equation is as follows.

$$z_{it} = \alpha_i + \alpha_t + \alpha_{MaritalStatus} + \sum_{x=2011}^{2014} \mathbf{1}\{t = x\}_{it} \times \mathbf{1}\{CaliforniaResident\}_{it} \times \beta_t + \varepsilon_{it}, \tag{7}$$

where z_{it} is taxable income under the California definition, β_{2011} is akin to a placebo test, and β_t for $t \in \{2012, 2013, 2014\}$ are the coefficients of interest.

As a second alternative specification, we also estimate a dynamic event study regression (Borusyak, Jaravel, and Spiess 2022; de Chaisemartin and D'Haultfœuille 2020). We use 2011 as the "reference period" (i.e., pre-period). This enables us to leave 2009 and 2010 to estimate "treatment effects" in the pre-period to test for parallel trends. Specifically the dynamic event study estimation equation is

$$z_{it} = \alpha_i + \alpha_t + \alpha_{MaritalStatus} + \sum_{x \in \{2009,2010,2012,2013,2014\}} \mathbf{1}\{t = x\}_{it} \times \mathbf{1}\{CaliforniaResident\}_{it} \times \beta_t + \varepsilon_{it}. \tag{8}$$

Building on this specification, for specifications where there is remaining concern about parallel trends, we implement the "honest approach to parallel trends" of Rambachan and Roth (2020). We estimate fixed-length confidence intervals under the single-parameter (M) approach. M is the single parameter that determines

the degree of possible nonlinearity of parallel trends, serving as an upper bound to the extent to which differential trends can change within periods. We implement this method using the publicly available HonestDiD R package.

Regression Specification and Income Retiming: Our estimating equation differs from the classical equation in the literature estimating intensive margin responses to tax policy using microdata, which runs the year-on-year log difference in income variables on the left-hand side.[37] We use this specification because it enables a cleaner treatment of federal income retiming than the classic approach.

To see this, consider the following framework. Suppose that observed income in year t for taxpayer i is $z_{it}(W_{it})$, where W_{it} (the treatment) is binary: 0 corresponds to tax policy prior to the reform, while 1 corresponds to the postreform tax policy. That is, we observe $z_{it}(0)$ in the absence of Proposition 30, and $z_{it}(1)$ under Proposition 30. This potential outcomes formalism encapsulates all behavioral responses (including "nonreal" responses such as tax base shifting) except for income retiming responses. For such responses, let $F_i > 0$ denote income shifted from 2013 into 2012 in response to the federal tax reform. Explicitly, in the absence of Proposition 30, the observed sequence of incomes for taxpayer i is

$$\{z_{i,2009}(0), z_{i,2010}(0), z_{i,2011}(0), z_{i,2012}(0), z_{i,2013}(0), z_{i,2014}(0)\}. \tag{9}$$

In reality, we observe the following sequence:

$$\{z_{i,2009}(0), z_{i,2010}(0), z_{i,2011}(0), z_{i,2012}(0) + F_i, z_{i,2013}(1) - F_i, z_{i,2014}(1)\}. \tag{10}$$

Given this setup, any log-difference variables involving 2012 or 2013 are all mismeasured due to front-loading. We note that the year on year difference 2012–2013 double-counts the front-loading quantity, and any longer difference involving 2012 or 13 (such as a 2011–2013 difference) will still be contaminated by the income re-timing.

Front-loading of this type is empirically relevant. For example, Saez (2017) uses aggregate public-use data to infer substantial front-loading from 2013 into 2012 in response to the federal tax reform. We corroborate this in our data.

Working in levels instead of differences allows a year-by-year comparison of income levels and avoids the problems in interpretation created by using log differences in the presence of front-loading. We also note that any 2012 treatment effects we estimate in the context of the California Proposition 30 treatment effect do not have a retiming interpretation, because the California policy was retroactive to 2012. We do not expect a 2011 front-loading response, as Proposition 30 was not widely expected or discussed as of 2011.

[37] See Gruber and Saez (2002) for a classic treatment and Kawano, Weber, and Whitten (2016) in the context of the 2013 federal tax change.

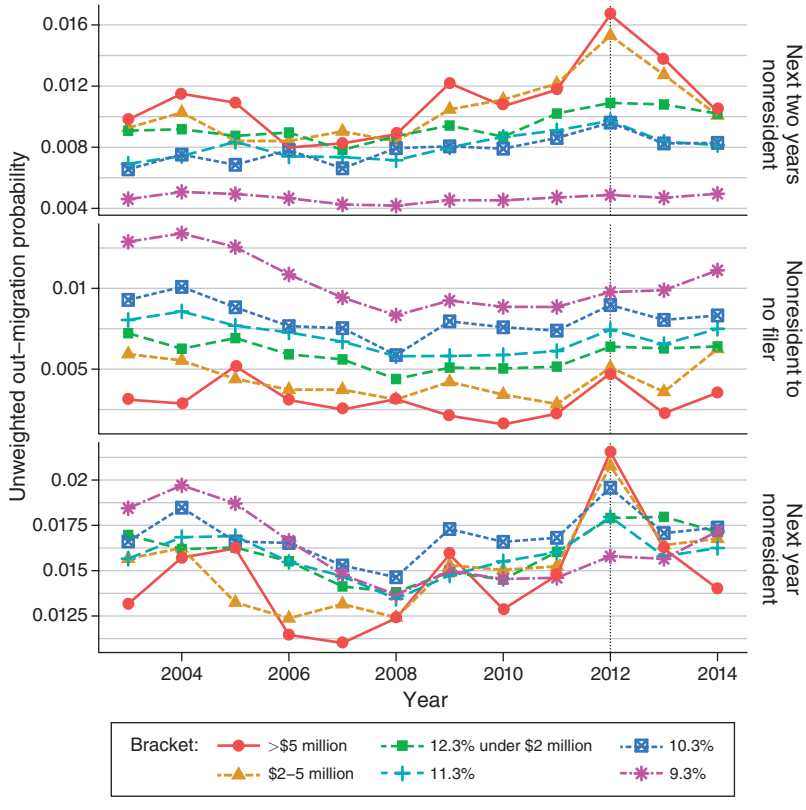

FIGURE 3. OUT-MIGRATION PROBABILITIES

Note: This figure shows the rate of out-migration among current-year residents, disaggregated by taxable income bins.

V. Extensive Margin Response

Figure 3 shows the main graphical results on out-migration, with the years in the *x*-axis representing the base year, and the departure is evidenced in both of the following years, either as a move to nonresident status for both years or as a move to nonresident and then to nonfiler. That is, the value corresponding to the 2012 point on the *x*-axis is the hazard rate based on 2013 and 2014 for taxpayers who were still California residents in 2012.

The top two graphs show taxable-income-weighted out-migration probabilities by year and tax bracket for taxpayers who filed as California residents in year t, disaggregated across the two ways that taxpayers leave the state: (i) resident to nonresident to nonresident and (ii) resident to nonresident to nonfiler. The bottom panel shows the combined effect of both types of departure. In order to examine how the departure rates vary at different points of the income distribution for high earners, we decompose the 12.3 percent bracket into three subgroups: 12.3 percent under $2 million, $2 million–$5 million, and greater than $5 million.[38]

[38] The tax brackets or taxable income bins are assigned based on 2012 rules and income, with income indexed to inflation to lead and lagged years use California FTB inflation factors.

The top graph shows a sharp uptick in taxpayers who earned $5 million or more in 2012 leaving the state after 2012 for multiple years of nonresident tax filings, from a rate of around 1.2 percent in the prior years to over 1.6 percent in the year 2012–2013. Taxpayers earning between $2 million and $5 million display a similarly large effect. Figure 3 corroborates the aggregated statistics from online Appendix Table A2 in demonstrating that this tax structure of departure is substantially more common for this group than moving from resident to nonresident to nonfiler, presumably given the fact that most very high earners have some remaining California-source income and then would have to file a California tax return even as a nonresident for several years after departure. As discussed in Section IVA, this mode of migration leads to an outflow of 75–80 percent of taxable base within 2 years. The middle graph shows an increase in full out-migration as well, although smaller. Overall, the bottom graph shows that when the departure structures are combined, there is a clear increase from a 1.5 percent departure rate after the 2011 tax year to a 2.125 percent departure rate after the 2012 tax year for taxpayers with more than $5 million in taxable income. Similar patterns are seen in the $2 million–$5 million range of broadly comparable magnitude. We note that there is no evidence of pre-trends in the departure rates for the taxpayers in the highest income categories.

Table 3 provides regression estimates of the magnitude of the out-migration effect, showing estimates of the baseline equation (1). The estimates from column 1 show that relative to the 2000–2010 period, we cannot detect statistically or economically significant deviations in the rate of migration in 2011–2012 for the newly introduced top bracket, but from 2012 to 2013, California loses 0.8 percent of the taxable base in this income range. Column 2 demonstrates that the inclusion of log income and fixed effects for 100 income percentiles as income controls does not diminish these results. The remaining columns of the table decompose mover types into those who file the next two years as nonresident versus those who file for one year as a nonresident and then do not file. Most of the effect (0.5 percent of the 0.8 percent) is concentrated in taxpayers moving from resident status into persistent nonresident filing.

Even the 10.3 percent and 11.3 percent brackets show strongly statistically significant responses, though of considerably smaller magnitude than the 12.3 percent bracket. In part, the statistical significance likely reflects the fact that there is a large number of taxpayers in that bracket, even though the marginal tax rate increase was only around 10.8 percent of the baseline level ($= 1\%/9.3\%$). These taxpayers may be expecting income growth that would put them in the new, salient higher brackets in the future.

Table 4 shows unweighted estimates with more granular income bins, showing that the out-migration effect is indeed concentrated in higher-earning taxpayers. This table directly mirrors the graphs in Figure 3. Investigating treatment heterogeneity in online Appendix Table A5, we find some evidence that 2012 treatment effects may be up to twice as large for single households as for married households, perhaps indicative of the greater ease with which a single individual can make a decision to move states. Online Appendix Figures A4 and A5 show heterogeneity by wage share and age, respectively.

Based on the differences reported in Table 2 between the increases in average tax rates based on Proposition 30 alone versus based on Proposition 30 plus federal

Table 3—Movement Regressions: Taxable Income Weighted

	Mover type					
	Next year NR/partial		Next 2 years NR/partial		Next year NR, then missing	
	(1)	(2)	(3)	(4)	(5)	(6)
10.3% bracket						
1{2011}	0.002	0.002	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0005)	(0.0005)
1{2012}	0.003	0.003	0.002	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0005)	(0.0005)
1{2013}	0.001	0.002	0.001	0.001	0.0004	0.0005
	(0.001)	(0.001)	(0.0005)	(0.0005)	(0.0004)	(0.0004)
11.3% bracket						
1{2011}	0.002	0.002	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.0004)	(0.0004)	(0.0003)	(0.0003)
1{2012}	0.003	0.003	0.002	0.002	0.001	0.001
	(0.001)	(0.001)	(0.0004)	(0.0004)	(0.0003)	(0.0003)
1{2013}	0.001	0.001	0.001	0.001	0.0003	0.0003
	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0003)	(0.0003)
12.3% bracket						
1{2011}	0.002	0.002	0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1{2012}	0.008	0.008	0.007	0.007	0.001	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
1{2013}	0.002	0.002	0.002	0.003	−0.0000	−0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0003)	(0.0003)
Income controls		×		×		×
Observations	44,047,789	44,047,789	44,047,789	44,047,789	44,047,789	44,047,789
R^2	0.001	0.001	0.001	0.001	0.002	0.002
Adjusted R^2	0.001	0.001	0.001	0.001	0.002	0.002

Notes: Regressions include years 2000–2014 but exclude all taxpayers below the 9.3 percent bracket. All specifications contain marital status and year fixed effects. 2000–2010 is the pre-period, and difference-in-differences effects are estimated for years 2011–2014. Standard errors are clustered by taxpayer. Income controls include log income and fixed effects for 100 income percentiles. Regressions are weighted by taxable income.

variation relative to other states, we estimate that the treatment on California households' relative average tax rates would have been 23–40 percent higher without the federal reform. In the absence of the ATRA, and assuming taxpayers understood the actual net change in incentives due to both state and federal variation, this analysis suggests that the hazard rates of departure would have been larger.

A. *Transitory versus Persistent High Earners*

Although secular income trends have been diverging at the top of the income distribution over the past several decades, it is well known that high incomes are strongly mean reverting, and this issue has been the subject of much research—for example, in the literature on the intensive margin response to taxation (see Weber 2014 for a recent discussion). Further, the tax revenue implications of transitorily high earners leaving California are less problematic than the out-migration of persistent high earners. It

Table 4—Movement Regressions: Unweighted, Granular Bins

	Mover type					
	Next year NR/partial		Next 2 years NR/partial		Next year NR, then missing	
	(1)	(2)	(3)	(4)	(5)	(6)
12.3% bracket						
Under 2 million						
1{2011}	0.002	0.002	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0004)
1{2012}	0.003	0.003	0.002	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0004)
1{2013}	0.003	0.003	0.002	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0004)
2–5 million						
1{2011}	0.002	0.002	0.003	0.003	−0.0004	−0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1{2012}	0.006	0.006	0.006	0.006	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1{2013}	0.002	0.002	0.003	0.003	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
5 million+						
1{2011}	0.002	0.002	0.001	0.001	0.0001	0.0001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
1{2012}	0.007	0.007	0.006	0.006	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
1{2013}	0.002	0.002	0.003	0.003	−0.001	−0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Income controls		×		×		×
Observations	44,047,789	44,047,789	44,047,789	44,047,789	44,047,789	44,047,789
R^2	0.001	0.001	0.0003	0.001	0.001	0.001
Adjusted R^2	0.001	0.001	0.0003	0.001	0.001	0.001

Notes: Regressions include years 2000–2014 but also exclude all taxpayers below the 9.3 percent bracket. All specifications contain marital status and year fixed effects. 2000–2010 is the "pre-"period, and difference-in-differences effects are estimated for years 2011–2014. Standard errors are clustered by taxpayer. Income controls include log income and fixed effects for 100 income percentiles.

turns out that out-migration in response to Proposition 30 is driven by persistently high earners.

To see this, in Table 5 we replicate the baseline analysis in Table 3 but add one extra taxpayer group: those whose taxable income places them in the Proposition 30 top bracket not only in year t but also in $t-1$ and $t-2$. We restrict the sample to years 2002 and after to accommodate the definition of this group. The first two columns confirm that the out-migration effect holds when dropping the early years of the table; columns 3 and 4 show that taxpayers persistently filing in the top bracket fully subsume the out-migration effect from 2012 to 2013. Online Appendix Figure A6 shows the year-to-year movements trends for such taxpayers in isolation ("Triple Top" line) along with other income bins. Notably, this series is far more stable than the relatively noisy top-earner migration rates shown in Figure 3, suggesting that noisy year to year migration rates are due to the behavior of transitory high earners.

Table 5—Movement Regressions: Income Weighted, Top-Bracket Persistence

	Next-year nonresident			
	(1)	(2)	(3)	(4)
10.3% bracket				
1{2011}	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
1{2012}	0.003	0.003	0.003	0.003
	(0.001)	(0.001)	(0.001)	(0.001)
1{2013}	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
11.3% bracket				
1{2011}	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
1{2012}	0.003	0.003	0.003	0.003
	(0.001)	(0.001)	(0.001)	(0.001)
1{2013}	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
12.3% bracket				
1{2011}	0.002	0.003	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)
1{2012}	0.008	0.008	0.003	0.003
	(0.003)	(0.002)	(0.002)	(0.002)
1{2013}	0.002	0.003	0.003	0.003
	(0.001)	(0.001)	(0.002)	(0.002)
3-year top bracket				
1{2011}			0.004	0.004
			(0.002)	(0.002)
1{2012}			0.009	0.009
			(0.003)	(0.003)
1{2013}			0.003	0.003
			(0.002)	(0.002)
Income controls		×		×
Observations	38,172,119	38,172,119	38,147,199	38,147,199
R^2	0.001	0.001	0.001	0.001
Adjusted R^2	0.001	0.001	0.001	0.001

Notes: Regressions include years 2003–2014 but exclude all taxpayers below the 9.3 percent bracket. All specifications contain marital status and year fixed effects. 2003–2010 is the pre-period, and difference-in-differences effects are estimated for years 2011–2014. Standard errors are clustered by taxpayer. Income controls include log income and fixed effects for 100 income percentiles. Regressions weighted by taxable income. "3-year top bracket" denotes those taxpayers who in year t, $t-1$, and $t-2$ report top-bracket taxable income.

B. *Mover Origins and Destinations*

Figure 4 disaggregates the out-migration effect across four county-regions in California by total taxable income. California resident locations in year t are measured as of year $t-1$, as if year t is a taxpayer's last year filing as a resident, then by the time of filing taxes, the taxpayer is often already located in a different state. The figure shows that the out-migration effect appears to be primarily driven by the Los Angeles–Long Beach and San Diego metropolitan areas. Online Appendix Table A6 shows accompanying regression estimates confirming this graphical intuition. San Francisco

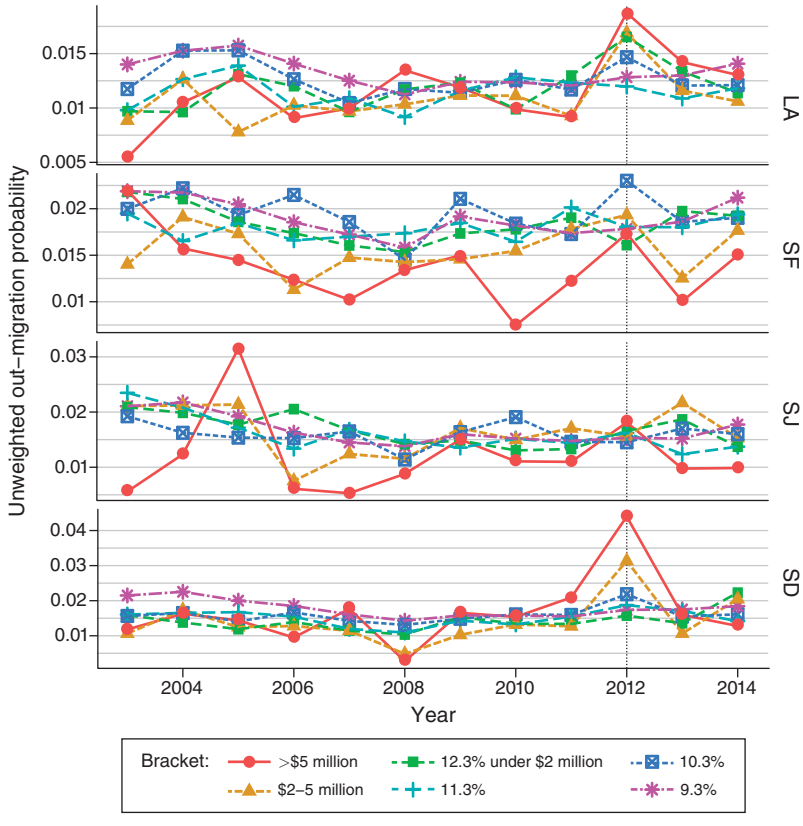

FIGURE 4. OUT-MIGRATION BY COUNTY-REGIONS

Notes: This figure decomposes out-migration across four county-regions in California, by total tax base as of 2010. LA is Los Angeles–Long Beach (Los Angeles County); SF is San Francisco (Marin County, San Francisco County, and San Mateo County); SJ is San Jose (Santa Clara County); SD is San Diego (San Diego County).

and surrounding counties generally have the highest costs of living in the state and, as such, may attract residents whose moving behavior is less elastic to changes in tax policy.

Figure 5 disaggregates the out-migration effect across mover destinations, by state of residence as measured in the year $t + 1$ for taxpayers filing in year t as California residents and moving immediately thereafter. The figure shows that the out-migration effect is strongest in the direction of states with zero state taxes, is small but discernible in the direction of low-tax states, and is not visible in the direction of medium- and high-tax states.[39] This is consistent with the strong salience of

[39] Zero-tax states include Alaska, Florida, Nevada, South Dakota, Texas, Washington, and Wyoming. States are considered "low tax" if the top-bracket individual income tax rate is between 0.01 percent and 5.99 percent (23 states). States are considered "medium tax" if the top-bracket individual income tax rate is between 6 percent and 7.99 percent (10 states). "High-tax" states have individual income tax rates about 8 percent in the top bracket and include Hawaii; Oregon; Michigan; New Jersey; Vermont; Washington, DC; and New York. Iowa, Kansas, and Maine are omitted due to concurrent tax policy changes in these states. State individual income tax rates can be found here: https://taxfoundation.org/state-individual-income-tax-rates/.

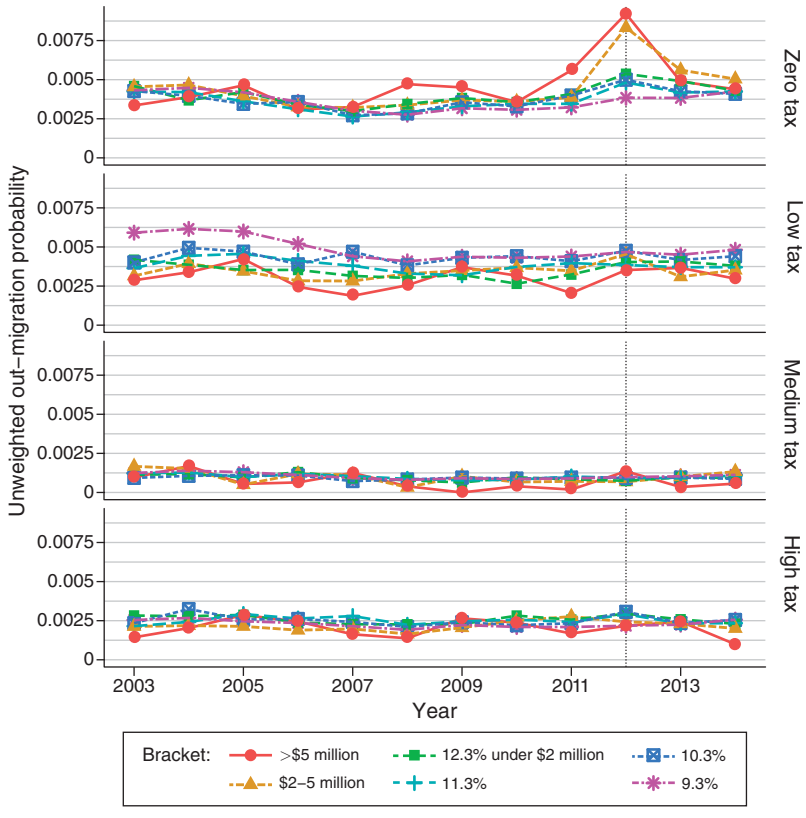

FIGURE 5. OUT-MIGRATION DESTINATIONS

Notes: Mover destinations are measured as of year $t + 1$ for a move beginning in year t for a year t California resident. "Zero" denotes states with a zero state tax, which include Arkansas, Florida, Nevada, South Dakota, Texas, Washington, and Wyoming. "Low tax" denotes states with individual income tax rates between 0.01 percent and 5.99 percent in the top bracket (23 states). "Medium tax" denotes states with individual income tax rates between 6 percent and 7.99 percent in the top bracket (10 states). "High tax" denotes states with individual income tax rates above 8 percent in the top bracket, which include Hawaii; Oregon; Michigan; New Jersey; Vermont; Washington, DC; and New York. Iowa, Kansas, and Maine are omitted due to concurrent tax policy changes in these states. The source of the state income tax rates is the Tax Foundation.[a]

[a]https://taxfoundation.org/state-individual-income-tax-rates/.

tax considerations in relocation decisions. Online Appendix Table A7 contains the accompanying regression estimates, which formalize this finding.

C. *In-Migration*

Online Appendix Figure A7 shows the in-migration share of the specific income brackets from 9.3 percent to 11.3 percent and then for the three sub-brackets of the 12.3 percent bracket. Overall, the higher the income bracket the smaller the share of a given tax bracket category that is accounted for by inward migration. We examine in-migration both on its own and as an offset to the out-migration analysis. Looking at in-migration in isolation, Online Appendix Figure A7 suggests a small downward

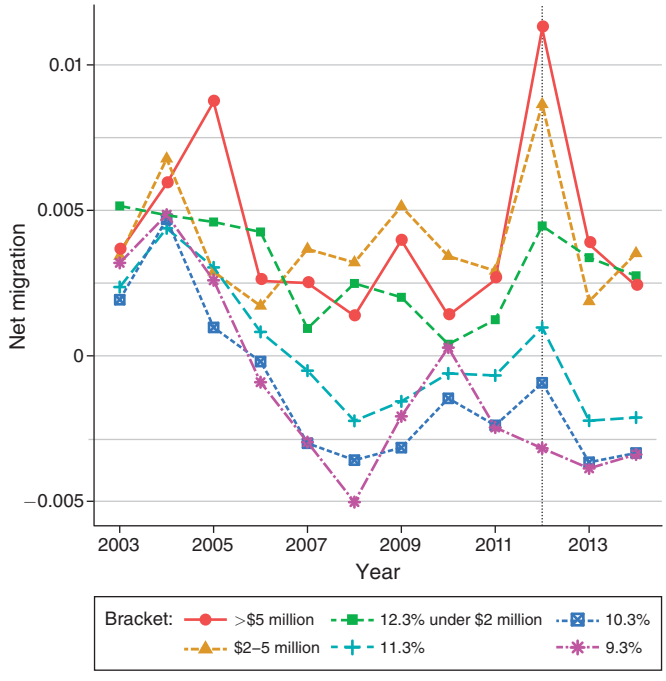

FIGURE 6. NET MIGRATION OF TAXPAYERS

Note: This figure shows the rate of out-migration among current-year residents who are in the top bracket in not only the current year but also the past two years.

effect on in-migration after the salient tax increases of 2012 but not a strong effect across other brackets. Combining this effect with out-migration in Figure 6 slightly magnifies the effects in the above section. We continue to use gross out-migration as our central extensive margin measure and conclude that at the very least, in-migration does not offset any of these effects and may in fact reinforce them.

D. *Elasticity Calculations*

As highlighted by Kleven et al. (2020), the elasticity of mobility with respect to tax policy may vary substantially depending on the specific context. However, for completeness, we present here a calculation of the elasticity of out-migration to zero-tax states with respect to the difference in average tax rates between such states and California.

Focusing only on moves to zero-tax states, online Appendix Table A7 shows that the treatment effects are 0.4 percent for the 2–5 million bin and 0.5 percent for the 5+ million bin. Online Appendix Table A8 reports that the baseline rates of migration from California to these zero-tax states are 0.394 percent and 0.428 percent, respectively. These figures supply the necessary ingredients for the numerator of the elasticity. To evaluate the denominator, the disparity in average tax rate from California to the zero-tax states was 6.56 percent in 2011 and 8.22 percent in 2013

for taxpayers earning $2 million–$5 million in 2012, and similarly 6.78 percent in 2011 and 8.65 percent in 2013 for those earning over $5 million (see Section IVA for a discussion of how these figures are computed).

For taxpayers earning $2 million–$5 million, the elasticity is

$$\frac{\frac{0.4}{0.394}}{\frac{8.22}{6.56} - 1} = 4.01. \tag{11}$$

For taxpayers earning over $5 million, the elasticity is

$$\frac{\frac{0.5}{0.428}}{\frac{8.22}{6.56} - 1} = 4.61. \tag{12}$$

log Net-of-Tax Rate.—Using the log specification of Moretti and Wilson (2017) along with the log net-of-tax rate differences computed in online Appendix Table A3, we compute the elasticity of migration with respect to the log net-of-tax rate as for the $2 million–$5 million bracket:

$$\frac{\log\left(\frac{0.004 + 0.00394}{1 - (0.004 + 0.00394)}\right) - \log\left(\frac{0.00394}{1 - 0.00394}\right)}{0.0450} = 15.66, \tag{13}$$

where 0.0450 is the increase in the average tax rate difference between California and the zero-tax states for those earning $2 million–$5 million. For the $5+ million category,

$$\frac{\log\left(\frac{0.005 + 0.00428}{1 - (0.005 + 0.00428)}\right) - \log\left(\frac{0.00428}{1 - 0.00428}\right)}{0.0504} = 15.45, \tag{14}$$

where 0.0504 is the increase in the average tax rate difference between California and the zero-tax states for those earning $2 million–$5 million.

These magnitudes are far higher than those documented in Moretti and Wilson (2017), which are around 2. However, we again emphasize that our elasticity calculations should be interpreted with substantial caution; they are likely to overstate magnitudes relative to other papers because the out-migration effect we find is a one-time movement; out-migration in our context reverts to pre–Proposition 30 levels after 2012–2013, while, for example, Moretti and Wilson's (2017) analysis finds a hazard rate of migration that increases with time.

VI. Intensive Margin Response

A. *Covariate Balance after Matching*

We first examine the extent of covariate balance in the raw data on high earners. Table 6 shows summary statistics for covariate balance in the year 2011 across the treatment group (that is, taxpayers filing as California residents from 2009 to 2014 who file in the top Proposition 30 bracket in 2009–2011) and raw control group

Table 6—Summary Statistics: Resident versus Nonresident Repeated High Earners

Statistic	Observations	Mean	SD	Pctl(25)	Median	Pctl(75)
Resident						
Federal AGI	21,033	4.24	12.82	1.31	1.98	3.64
Taxable income	21,033	4.15	11.56	1.29	1.96	3.61
Capital gains	21,033	0.91	8.83	−0.003	0.00	0.06
Married	21,033	0.67	0.47	0	1	1
Single	21,033	0.30	0.46	0	0	1
Age	21,033	54.90	13.97	47	54	63
Nonresident						
Federal AGI	13,419	7.89	27.01	1.50	2.57	5.51
Taxable income	13,419	7.54	24.23	1.52	2.50	5.19
Capital gains	13,419	2.15	18.22	−0.003	0	0.2
Married	13,419	0.73	0.44	0	1	1
Single	13,419	0.24	0.43	0	0	0
Age	13,419	54.26	13.36	47	54	62

Notes: The "Resident" sample consists of taxpayers who from 2009 to 2011 filed as California residents and, further, who for each year earned taxable income that placed them in the range of the top bracket as would be newly introduced by Proposition 30 in 2012. The "Nonresident" sample consists of the analogous group of nonresident taxpayers: those who filed each year in California and whose income would place them in the range of the top bracket as would be newly introduced by Proposition 30 in 2012. Taxable Income for California residents is their California taxable income. Taxable income for California residents is the taxable income as reported on their tax return, which is generally worldwide income. Taxable income for nonresidents is the taxable income of the taxpayer if they had been a California resident and their full income had been subject to California state taxation, and therefore has a directly comparable definition.

(taxpayers filing as California nonresidents from 2009 to 2014 who would file in the top Proposition 30 bracket in 2009–2011 if all their income were California sourced). Online Appendix Figure A8 shows the raw plots of this difference-in-differences for levels and logs of taxable income and AGI. As is evident in this figure, and from the tabulation in Table 6, nonresident filers in the control group display substantially higher earnings than do residents. Thus, covariate balance is a serious concern.

Table 9 shows summary statistics for covariate balance in the year 2011 across the two matched samples—first, using the full control set as matching candidates and, second, using only control observations filing from states with similar tax rates to California. We note that the matching procedure uses only the average levels of taxable income, AGI, and capital gains across 2009–2010 to estimate the propensity score, so that 2011 balance is not baked into the procedure. Matching achieves reasonable balance across the 2011 income variables and, further, also in demographics, especially using the matching that draws only on taxpayers in similar-tax states.

B. *Synthetic Difference-in-Differences Estimates*

Table 7 and Figure 7 show SDID estimates for log taxable income and log federal AGI. The treatment group is units in the top tax brackets in 2009–2011. The figure shows pretreatment and posttreatment trends in taxable income and federal AGI over time for California taxpayers (treated) as well as the weighted average of control units (synthetic control). The arrows indicate the estimated effects. The increase in the top-bracket rate paid by individuals in this category from 10.3 percent to 13.3 percent resulted in a change in log taxable income of −0.109 and a change in

TABLE 7—SYNTHETIC DIFFERENCE-IN-DIFFERENCES

	Dependent variable	
	log taxable income (1)	log federal AGI (2)
All post	−0.109 ($t = -5.27$)	−0.082 ($t = -4.26$)
2012	−0.066 ($t = -3.00$)	−0.058 ($t = -2.91$)
2013	−0.081 ($t = -2.81$)	−0.068 ($t = -2.56$)
2014	−0.179 ($t = -5.71$)	−0.121 ($t = -4.31$)

Notes: This table shows the results of SDID estimates using the estimation techniques of Arkhangelsky et al. (2021). The log taxable income variable is used to generate SDID weights. In this procedure, 2006–2011 is the pre-period and 2012–2014 is the post-period, where the treatment begins in 2012. SDID uses L2 regularization to estimate entity weights. The results are generated using the "synthdid" *R* package provided by Arkhangelsky et al. (2021). To maintain a consistent analysis, weights from the all-up log taxable income estimation are carried over to log federal AGI estimation. Given the carryover of one set of weights through the analysis, we use the jackknife approach for inference, following the discussion in Arkhangelsky et al. (2021) for a setting with prespecified weights.

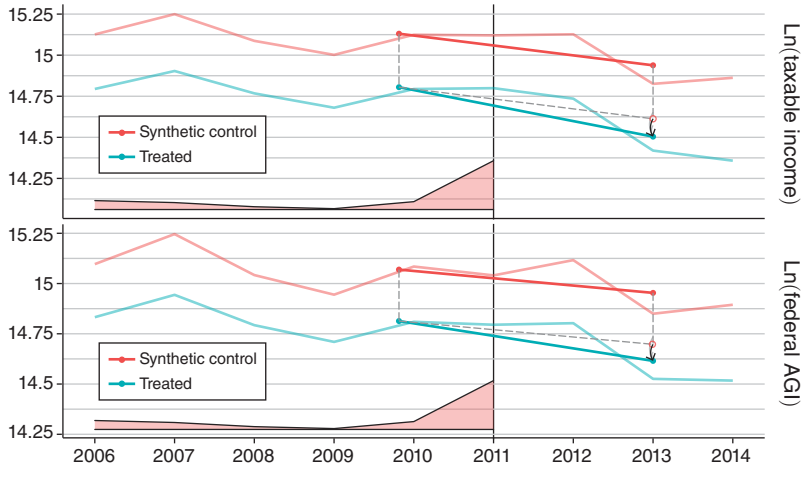

FIGURE 7. SDID MAIN GRAPH

Notes: This figure graphically shows the results of the SDID estimation, whose coefficients are shown in Table 7. The figure shows pretreatment and posttreatment trends in taxable income and federal AGI over time for California taxpayers (treated) as well as the weighted average of control units (synthetic control). The arrows indicate the estimated effects. The results are generated using the "synthdid" R package provided by Arkhangelsky et al. (2021).

log federal AGI of −0.082. This reflects in each case a disparity between treatment and control groups that begins in 2012 and increases in each of the following years 2013 and 2014. By 2014 the estimated effects are −0.179 for log taxable income and −0.121 for log federal AGI. The appearance of an intensive margin response in 2012 is consistent with the fact that Proposition 30 was retroactive to 2012 and, as discussed

Table 8—Placebos

	Matching years	
	2003–2008	2002–2007
log taxable income		
All post	−0.019	0.010
	($t = -0.57$)	($t = 0.21$)
2008		0.246
		($t = 4.40$)
2009	0.059	−0.073
	($t = 1.38$)	($t = -1.19$)
2010	−0.042	−0.144
	($t = -1.00$)	($t = -2.55$)
2011	−0.075	
	($t = -1.71$)	
log federal AGI		
All post	−0.054	0.005
	($t = -1.77$)	($t = 0.12$)
2008		0.111
		($t = 2.42$)
2009	−0.006	−0.007
	($t = -0.15$)	($t = -0.13$)
2010	−0.093	−0.090
	($t = -2.61$)	($t = -1.84$)
2011	−0.063	
	($t = -1.56$)	

Notes: This table shows the results of placebo SDID estimates using the estimation techniques of Arkhangelsky et al. (2021). The log taxable income variable is used to generate SDID weights. In the left column, 2003–2008 is the pre-period and 2009–2011 is the post-period, where the placebo treatment period begins in 2009. In the right column, 2002–2007 is the pre-period and 2008–2010 is the post-period, where the placebo treatment period begins in 2008. All estimation procedures are the same as in Table 7 and use the "synthdid" *R* package provided by Arkhangelsky et al. (2021).

in Section II, was known to have a substantial chance of passage and in general was a salient issue in policy circles during the bulk of 2012.

In Table 8 and Figure 8, we conduct a placebo analysis. Here we counterfactually suppose that the treatment was in years 2009 (left column) and 2008 (right column), respectively. We find no statistically significant negative effects on taxable income, with coefficient point estimates generally highly unstable after treatment. Placebo specifications that consider counterfactual treatments in later years would be contaminated by effects of the reform beginning in 2012, and placebo specifications that consider counterfactual treatments in earlier years risk being contaminated by the effects of the 1 percent tax on incomes over $1 million that was implemented for tax years beginning in 2005.

C. *Difference-in-Difference with Matching*

An alternative specification to SDID is to use matching procedures in an attempt to balance treatment and control groups on observable characteristics. An example of such an approach is the standard propensity score matching technique, which has

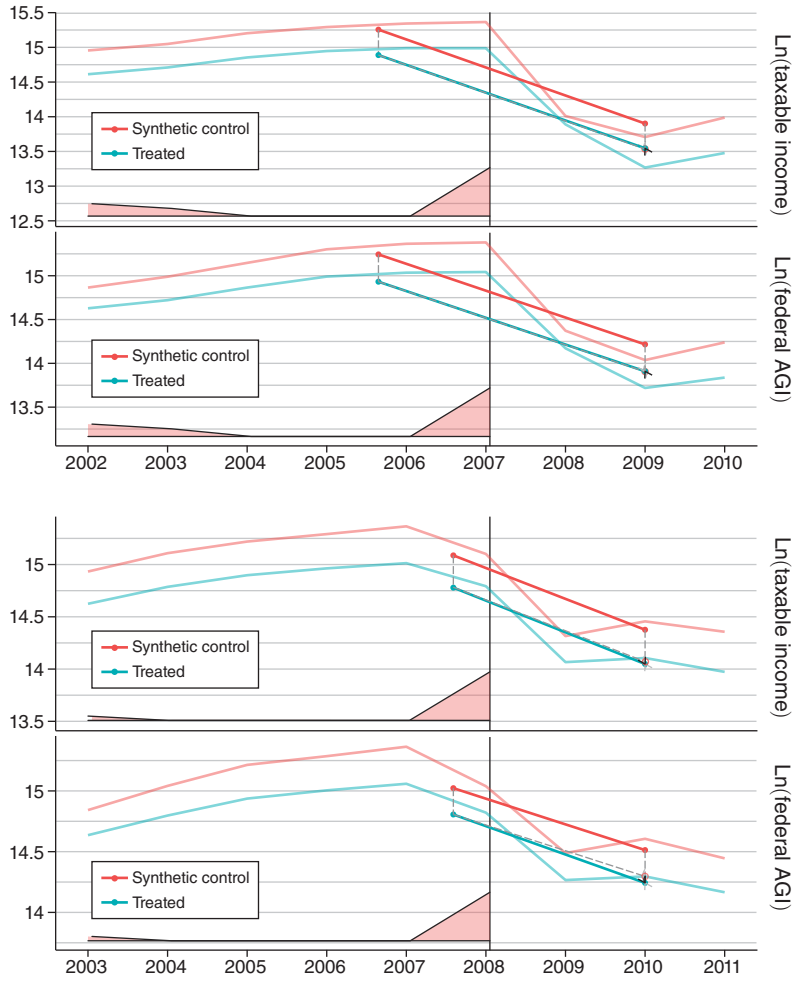

FIGURE 8. SDID PLACEBO ESTIMATES

Notes: These figures graphically show the results of the placebo SDID estimation, whose coefficients are shown in Table 8. The figure shows pretreatment and posttreatment trends in taxable income and federal AGI over time for California taxpayers (placebo treated) as well as the weighted average of control units (placebo synthetic control). The top graph shows the 2007 placebo treatment, and the bottom graph shows the 2008 placebo treatment. The arrows indicate the estimated effects. The results are generated using the "synthdid" R package provided by Arkhangelsky et al. (2021).

been used in the empirical applied microeconomics literature for decades. Online Appendix Figure A9 shows annual group averages for both logs and levels of AGI and taxable income without any matching or sample selection. The graphs highlight the differences in income variables seen in Table 6. We then proceed to conduct a propensity score matching procedure using a logistic regression on average levels of income across 2009–2010 for residents in the tax-similar states. This procedure ensures that neither parallel trends in 2009–2010 nor their continuation in 2011 would be an artifact of our matching procedure.

Table 9—Summary Statistics: Matched Samples

Statistic	Observations	Mean	SD	Pctl(25)	Median	Pctl(75)
Nonresident, matched, tax-similar states						
Federal AGI	21,033	4.04	11.95	1.29	1.96	3.62
Taxable income	21,033	4.04	10.09	1.32	1.96	3.44
Capital gains	21,033	0.93	7.36	−0.003	0.00	0.07
Married	21,033	0.66	0.47	0	1	1
Single	21,033	0.31	0.46	0	0	1
Age	21,033	52.83	12.40	45	52	60
Nonresident, matched						
Federal AGI	21,033	4.17	13.54	1.30	1.96	3.63
Taxable income	21,033	4.08	11.80	1.34	1.96	3.48
Capital gains	21,033	1.02	8.95	−0.003	0.00	0.09
Married	21,033	0.68	0.46	0	1	1
Single	21,033	0.29	0.45	0	0	1
Age	21,033	53.89	13.32	46	54	62

Notes: This table compares 2011 covariate values for two resident-matched samples of nonresidents. Matching is done on 2009–2010 data, using the total value of income across those two years for three separate variables: Federal AGI, Taxable Income, and Capital Gains. For the top-panel "tax-similar states" sample, the control pool used is Hawaii (11 percent top rate); Oregon (9.9 percent top rate); Minnesota (9.85 percent top rate); Iowa (8.98 percent top rate); New Jersey (8.97 percent top rate); Vermont (8.95 percent top rate); Washington, DC (8.95 percent top rate); and New York (8.82 percent top rate). The bottom panel uses the entire nonresident sample of persistent high earners as the pool. Taxable income for California residents is the taxable income as reported on their tax return, which is generally worldwide income. Taxable income for nonresidents is the taxable income of the taxpayer if they had been a California resident and their full income had been subject to California state taxation, and therefore has a directly comparable definition.

We conduct matching on two potential control samples: the sample of all persistently top-income nonresidents from the similar-tax states and the sample of all persistently top-income nonresidents from any state of other than California. For the similar-tax states sample, the control pool used is Hawaii (11 percent top rate); Oregon (9.9 percent top rate); Minnesota (9.85 percent top rate); Iowa (8.98 percent top rate), New Jersey (8.97 percent top rate); Vermont (8.95 percent top rate); Washington, DC (8.95 percent top rate); and New York (8.82 percent top rate). Table 9 shows the main income and demographic covariates in the resulting matched samples. Compared to Table 6, these matched samples show considerably more alignment on observables with the resident sample in Table 6 than the full nonresident sample at the bottom of Table 6 does.

Figures 9 and 10 show the difference-in-differences analysis with the matching done on the tax-similar-state sample. Specifically, Figure 9 shows annual group averages for both logs and levels of AGI and taxable income, in the specification where only tax-similar states are used for the matching. For this purpose, we show analysis with log income variables (top graphs) as well as the level taxable income winsorized at 99.5 percent (bottom graphs). Given the skewness of the income distribution, the level of winsorization heavily affects the quantitative value of the results, so we do not emphasize these level specifications. However, they are broadly consistent with the log results, and we find them useful as we proceed in the section below to consider income decompositions, which create situations where certain income categories such as capital gains may have zero or negative values. Figure 10 graphically shows the shows the differences between the California residents in the sample and the matched nonresidents from high-tax states. We note that these differences

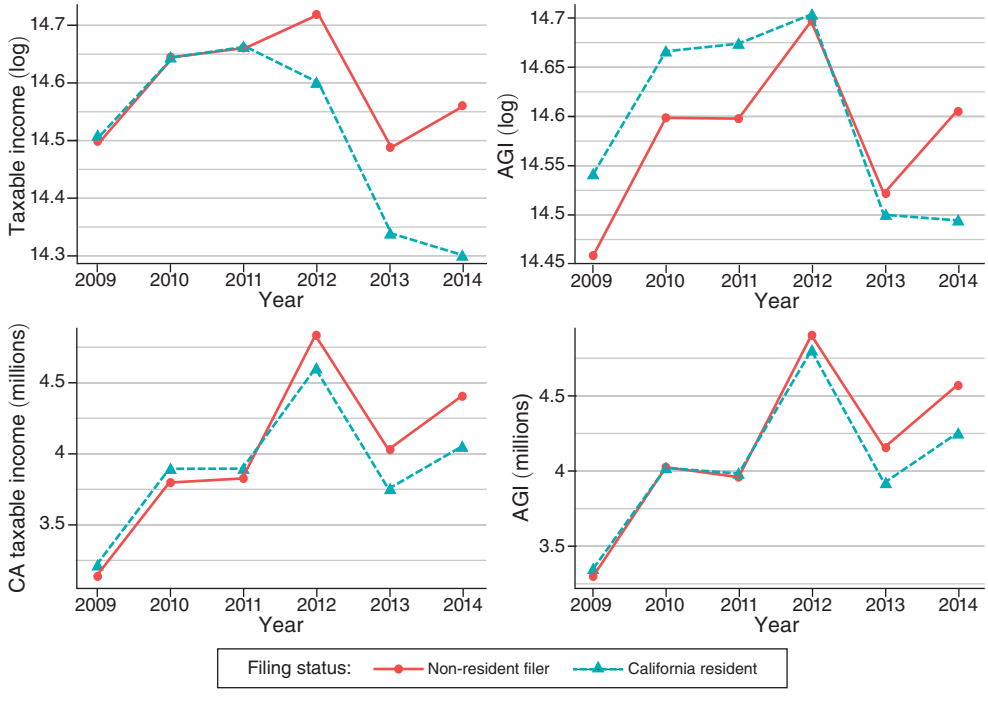

FIGURE 9. MATCHED SAMPLE INCOME TRENDS: SIMILAR-TAX STATES CONTROL GROUP RESTRICTION

Notes: This figure shows annual group averages for both logs and levels of AGI and taxable income, when only tax-similar states are used for the matching. The matching procedure only matches on average levels of income across 2009–2010. Therefore, neither parallel trends in 2009–2010 nor their continuation in 2011 is an artifact of our matching procedure.

contain no controls for taxpayer fixed effects. Visually, the log differences in taxable income display essentially no trend prior to the treatment year, with a sharp drop thereafter. The general absence of deviation from parallel trends observed in the pretreatment years shows that matching on tax-similar states largely addresses concerns about differential pre-trends. However, the extent of pre-trend may not be zero, and again this procedure relies on the logistic regression with a selection of the matching variable to produce the result.

Table 10 shows the difference-in-differences regression estimates on the tax-similar-state sample matching, corresponding to equation (7), with the inclusion of taxpayer fixed effects. The first row of the table shows that we do not estimate statistically or economically significant placebo treatment effects in 2011, which corroborates the graphical analysis. Across specifications, we estimate economically and statistically significant treatment effects of Proposition 30 in years 2012–2014. The estimated log effects are considerably larger than in the SDID specifications, but again we prefer SDID due to its rigorous approach to using weights to establish parallel trends.

Online Appendix Figures A9 and A10 show differences between the California residents in this sample and the matched nonresidents drawing on all nonresidents, not just those from the high-tax states. Again, the differences in levels of taxable income and the differences in the levels of AGI do display some downward trends

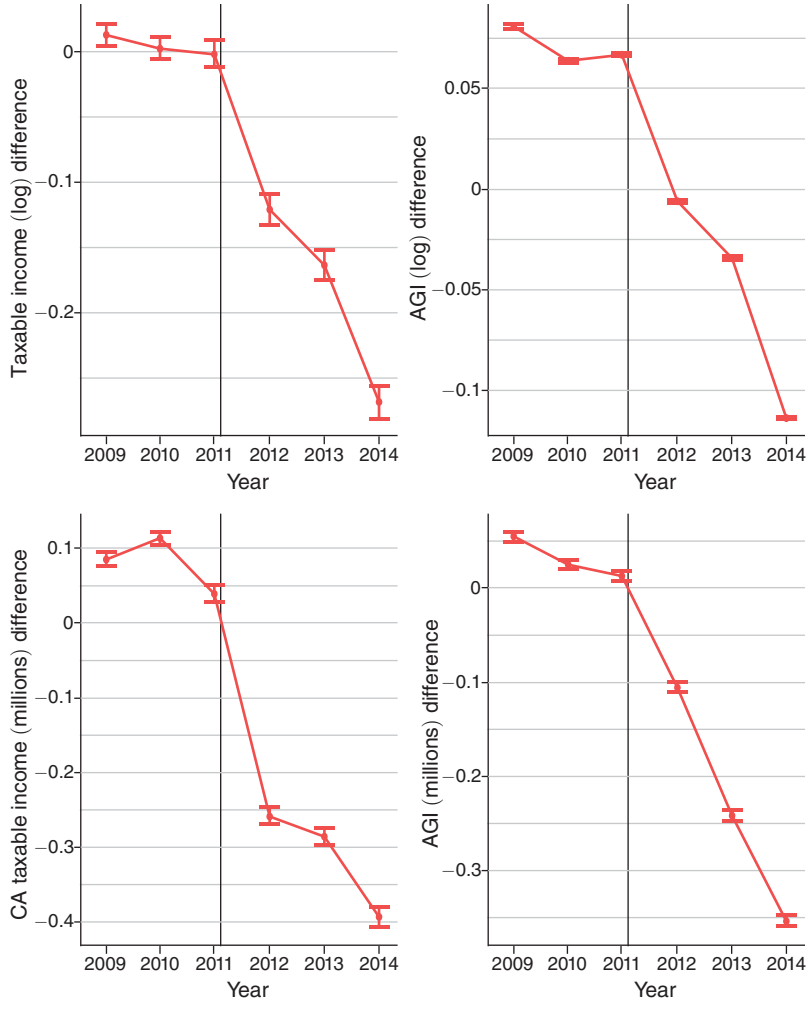

FIGURE 10. INCOME TREND DIFFERENCES BETWEEN CALIFORNIA RESIDENT AND NONRESIDENT FILERS

Notes: This figure shows annual average income differences between California resident and matched nonresident filers from similar-tax states, with error bands showing plus and minus two standard errors of the mean. The matching procedure only matches on average levels of income across 2009–2010. Therefore, neither parallel trends in 2009–2010 nor their continuation in 2011 is an artifact of our matching procedure.

in the years prior to the treatment, but visually there is a sharp drop thereafter. The difference in AGI levels do not show a clear trend break. Overall, these figures suggest that the parallel trends assumption with baseline matching to all states is valid for taxable income, though perhaps not for AGI when we use match candidates from all states. This supports an emphasis on the results based on the matching with nonresidents in similar-tax states.

Online Appendix Table A9 shows the analogous results to Table 10, but using the full sample of nonresidents for the control pool on which the matching is conducted. Given the clear issues with imperfect parallel trends in this specifiation, we also show several statistics that emerge from robustness tests for possible parallel

Table 10—Matched Difference-in-Differences: Similar-Tax States Control Group Restriction

	Dependent variable			
	log(Taxable income + 1) (1)	Taxable income (millions) (2)	log(Fed. AGI + 1) (3)	Fed. AGI (millions) (4)
Resident × 2011	−0.002	−0.012	−0.003	−0.056
	(0.011)	(0.090)	(0.011)	(0.093)
Resident × 2012	−0.149	−0.321	−0.052	−0.180
	(0.025)	(0.130)	(0.016)	(0.135)
Resident × 2013	−0.206	−0.360	−0.093	−0.326
	(0.039)	(0.096)	(0.019)	(0.105)
Resident × 2014	−0.318	−0.436	−0.176	−0.404
	(0.040)	(0.108)	(0.020)	(0.118)
Observations	151,482	151,482	150,467	151,482
R^2	0.450	0.702	0.721	0.731
Adjusted R^2	0.339	0.642	0.665	0.677

Notes: All regressions include taxpayer fixed effects. California residents are weighted to 1. The California nonresident control group has weights applied with mean 1 and reflecting matched sample with replacement. 2009–2010 is the pre-period. Levels variables are winsorized at 99.5 percent. Standard errors are clustered by taxpayer. "Taxable income" is under the California definition—that is, for California residents, it is California taxable income; for California nonresidents, it is the taxable income of the taxpayer if they were a California resident and their full income were subject to California state taxation.

trend violations, following Rambachan and Roth (2020). The statistic *Threshold M* is defined as the highest value of M in the procedure of Rambachan and Roth (2020) for which the entire 95 percent confidence interval for the 2012 treatment lies below 0. The fact that $M > 0$ in columns 1–3 implies robustness to any data-implied linear deviation from parallel trends implied by the Rambachan and Roth (2020) procedure, and the results are further robust even to some degree of nonlinear deviation from parallel trends. For column 4, while the specification would not be robust to deviation from parallel trends as estimated under this procedure, the 95 percent confidence interval for the 2012 treatment when $M = 0$ (allowing for data-implied linear deviation from parallel trends) is $[-0.399, 0.037]$.

Using the 2011 average taxable income of $4.15 million among residents as a baseline, the levels magnitudes are smaller than the log estimates in each year. That is, the average percentage treatment effect is larger than the cumulative percentage response. This outcome could be generated by the presence of a few taxpayers experiencing high income growth while the majority of others see a decline, a plausible scenario given our setting in California.

An alternative approach to matching within the tax-similar state sample is matching with taxpayers in all states but conducting further analysis to address deviations from parallel trends. In online Appendix Table A10, we present the results of the dynamic event study specification shown in equation (8). In this specification, the omitted year is the year before the treatment, and the test for deviation from parallel trends is the extent to which the pre-period would show opposite signed and significant coefficients. While the log AGI specification shows a small and statistically significant positive coefficient in 2009, we generally do not see significant evidence of deviation from parallel trends in these dynamic specifications that include taxpayer fixed effects.

Overall, for taxable income, in logs the treatment effects appear somewhat smaller in the all-states control sample, while in levels the treatment effects are somewhat

Table 11—Matched Difference in Differences: Income Decomposition

	Dependent variable					
	Taxable income (1)	Tax. income – Invest. income (2)	Investment income (3)	Capital gains (4)	Dividends (5)	Interest (6)
Resident × 2011	−0.023	−0.20	0.009	0.023	−0.004	−0.002
	(0.087)	(0.070)	(0.051)	(0.055)	(0.006)	(0.003)
Resident × 2012	−0.327	−0.316	0.016	−0.0003	−0.004	0.004
	(0.114)	(0.087)	(0.064)	(0.067)	(0.008)	(0.004)
Resident × 2013	−0.387	−0.358	−0.046	−0.002	−0.016	0.002
	(0.093)	(0.081)	(0.053)	(0.052)	(0.007)	(0.005)
Observations	100,988	100,988	100,988	100,988	100,988	100,988
R^2	0.763	0.756	0.733	0.631	0.860	0.929
Adjusted R^2	0.684	0.673	0.642	0.508	0.813	0.905

Notes: "Investment income" is the sum of capital gains, dividends, and interest. All regressions include taxpayer fixed effects. California residents are weighted to 1. The California nonresident control group has weights applied with mean 1 and reflecting matched sample with replacement. 2010 is the pre-period. Standard errors are clustered by taxpayer. All variables are denominated in millions of 2015 dollars. "Taxable income" is under the California definition—that is, for California residents, it is their California taxable income; for California nonresidents, it is the taxable income of the taxpayer if they were a California resident and their full income were subject to California state taxation.

larger. For AGI, the estimates appear to be similar or slightly larger, with the 2012 effect having lost statistical significance. To provide conservative estimates, we base our headline elasticity calculations on the taxable income levels of the tax-similar state control group.

Table 11 examines the contribution of different income components—and, specifically, investment income—to the main estimates. In the data, we are able to consistently observe dividends and interest for the full sample of taxpayers from 2010 through 2013. (In other years, these variables are missing for at least 90 percent of our sample.) Thus, in this specification we restrict to years 2010–2013, using the year 2010 as the only pre-period. We further restrict to regressions in levels (not logs). This provides a natural setting for a decomposition, as logs admit additive decomposition.

In column 1, we first confirm that the results from the main estimates carry through with this altered sample; they are smaller in magnitude but still economically and statistically significant. Column 3 shows that the estimated treatment effects persist when subtracting out investment income. Column 3 through 6 show no statistically significant impacts on investment income. Given the data items available, the results do not allow us to say more about the intensive margin mechanism beyond the fact that it is not driven by investment income, and as much as 80 percent of the log taxable income effect also appears in federal AGI.

This leaves several mechanisms that could explain the effects. First, our evidence would be consistent with the offshoring of business activity to other countries, or the shifting of pass-through business income to other states through changing the location of sales under California's single-sales apportionment rule. Administrative data sources that provide more detail on the business activity of California pass-through entities are necessary to test this hypothesis. Second, the results could reflect direct labor supply effects, where high earners choose to supply less labor or different types of labor due to the tax disincentive effect. Data sources that provide more granular information as to the income generating activity of high earners would allow us to

test this effect directly. Finally, we cannot rule out that the results to some extent reflect income deferral or the shifting of the composition of compensation toward deferred compensation. For example, wages and restricted stock units are taxed immediately, whereas stock options are taxed only upon exercise. Disentangling these mechanisms constitutes an important avenue for future research.

D. *Elasticity Calculation*

If the nonresident control group is assumed not to respond at all to the California tax change, then the elasticity of taxable income that emerges from our analysis is simply the policy-induced change in log taxable income scaled by the percent change in the net-of-tax keep rate. As discussed in Section IID, under Proposition 30 the top marginal net-of-tax rate for California residents is 48.83, whereas without it would be 50.64. The log difference between these is 3.63 percent; this quantity is therefore the denominator in the elasticity calculation. For the numerator, we use the main all-post SDID estimates in Table 7, which show a behavioral change in log taxable income of –0.109. The implied elasticity from our results is therefore $0.109/0.0363$, or 3.0.

The above calculation ignores the fact that some portion of the high earners at this point in time are in the range of the federal AMT, under which deductions are disallowed but the marginal tax rate is lower. Again using figures from Section IID, the log difference in the net-of-tax rate between the California residents and the California nonresidents is 5.19 percent. For the 18 percent of millionaire taxpayers facing the AMT, the implied elasticity would be $0.109/0.0519$, or 2.1. A weighted average of $18.0\% \times 2.1 + 82.0\% \times 3.0$ yields a weighted average of 2.8.

A further refinement would reflect the fact that in 2011, 6.5 percent of nonresident income in the treatment group is in fact California-source income (see online Appendix Table A4) and would incorporate an assumption about the elasticity of this group's income with respect to the tax rate. If one assumes that the California income group is just as responsive as the income of the treatment group, the elasticity calculation would be reduced by 6.5 percent to 2.6. Given the lack of salience of the tax change for the nonresident group, this is likely assuming too large of a response for the nonresident group, but we nonetheless conclude with an elasticity range of 2.6–3.0.

The above calculations use the all-post elasticity estimate from Table 7. The 2014 estimates are significantly larger than the all-post elasticity, as the treatment effect appears to increase over time. Implementing the above calculations on an SDID estimate of -0.179 results in an elasticity range of 4.4–4.7. We do not emphasize these figures so as to avoid placing too much weight on the point estimates from one year, but we do note that the behavioral responses are increasing over time.

VII. Policy Implications

A. *California Tax Revenue*

We use the estimates from our intensive margin estimation exercise to perform a back-of-the-envelope calculation, aimed at quantifying the fraction of windfall

revenue accruing to the state of California from the Prop 30 policy shift that was lost to behavioral responses.

Intensive Margin.—We use the main SDID all-post log estimate of -0.109 to calibrate the estimate of the intensive margin. Tax bracket cutoffs vary across such cells. So for each marital status in 2011, we define a representative taxpayer as having the mean taxable income. For each such earnings profile, we compute the revenue gains to California from Proposition 30's tax increases assuming no behavioral change. We then use the econometric estimate to compute the revenue gains from Prop 30 under observed behavioral changes. Aggregating up across marital status cells using population ratios allows us to compute the percentage of windfall revenue gains dissipated by behavioral responses on the intensive margin. Table 12 shows these calculations.

To illustrate, consider married California residents, who during 2012–2014 comprise approximately 67 percent of the sample.[40] The mean observed income for married California residents in the treatment sample in 2013 was \$4,562,175, in 2015 dollars. To compute the revenue gains to the state of California from Proposition 30 under their observed behavior, we calculate that this representative taxpayer pays an additional amount of $(631{,}732 - 526{,}444) \times 0.01 + (1{,}052{,}886 - 631{,}732) \times 0.02 = \$9{,}476$ over the 10.3 percent and 11.3 percent brackets. The taxpayer then has \$3,509,289 of income in the top bracket, on which the state of California collects an additional 3 percent, leading to a revenue gain of \$105,279. In total, the revenue gain the state has over and above what it would have had under the old tax code at the same level of income is therefore $\$105{,}279 + \$9{,}476 = \$114{,}755$.

Since in this example we are considering the case of reported 2013 income, the income used in the regressions is already net of the behavioral response. While the state has gained \$114,755 relative to what it would have received at the same income level under the old tax code, it has also lost revenue due to the behavioral response. Without the behavioral response, the log taxable income of the representative married taxpayer would have been 0.109 log points higher, or \$5,087,566. The individual therefore has earned \$525,391 less than they otherwise would have, and the state has lost 10.3 percent of this difference, or \$54,155. Thus, the state's net revenue gain has been $\$111{,}677 - \$54{,}155 = \$60{,}639$.

Now suppose there were no behavioral response. The additional revenue from inframarginal tax brackets does not change. However, the taxpayer has $\$3{,}509{,}289 + \$525{,}391$ of income in the top bracket, or \$4,034,680, on which California earns an additional 3 percent, leading to a revenue gain of \$130,516. This implies that among married couples, the intensive margin behavioral response dissipates $1 - (\$60{,}639/\$130{,}516) = 0.535$ of windfall revenue gains from taxation. This is aggregated with single and head of household figures through a weighted average (using the weights 0.67, 0.29, and 0.04), leading to the aggregate figure 51.4 percent.

[40] Single filers account for 29 percent, and head of household filers make up the remaining 4 percent.

TABLE 12—DISSIPATION

	Married	Single	Head of household
Observed 2013 mean (2015 $)	$4,562,175	$2,888,853	$3,153,112
Tax Table Cutoff 10.3% 2013	$508,500	$254,250	$345,780
Tax Table Cutoff 11.3% 2013	$610,200	$305,100	$414,936
Tax Table Cutoff 12.3% 2013	$1,017,000	$508,500	$691,560
Cutoff 10.3% 2013 in 2015 $	$526,443	$263,221	$357,981
Cutoff 11.3% in 2015 $	$631,732	$315,866	$429,577
Cutoff 12.3% in 2015 $	$1,052,886	$526,443	$715,962
Inframarginal Additional Tax	$9,476	$4,738	$6,444
Amount in Top Bracket	$3,509,289	$2,362,410	$2,437,150
Revenue Gain Top Bracket (3%)	$105,279	$70,872	$73,114
Gross Revenue Gain	$114,755	$75,610	$79,558
All-Post Treatment Effect from SDID	−0.109	−0.109	−0.109
Income Without Behavioral Response	$5,087,566	$2,590,522	$2,827,491
Loss Due to Behavior	−$54,115	−$30,728	−$33,539
Net Revenue Gain	$60,639	$44,882	$46,019
Amount in Top Bracket without Behavioral Response	$4,034,680	$2,660,741	$2,762,770
Additional Top Bracket Tax without Behavioral Response	$121,040	$79,822	$82,883
Total Revenue Gain without Behavioral Response	$130,516	$84,560	$89,327
Dissipation Percentage	53.5%	46.9%	48.5%
Weight	0.67	0.29	0.04

Overall dissipation percentage	
All-Post Treatment Effect (−0.109)	51.4%
Post-Treatment Effect 2013 (−0.081)	39.2%
Post-Treatment Effect 2014 (−0.179)	79.5%

Notes: This table shows the average dissipation calculation for married, single, and head of household high-income filers in the California treatment group. The Inframarginal Additional Tax is 1% of income in the 10.3 percent bracket and 2 percent of income in the 11.3 percent bracket. The Revenue Gain Top Bracket is 3 percent of the amount n the top bracket, and the Gross Revenue Gain is the Revenue Gain from the Top Bracket plus the Inframarginal Additional Tax. The All-Post Treatment effect comes from Table 7, and Income Without Behavioral Response calculates what the income level would have been had the observed 2013 mean been higher by 0.109 log points. The Loss Due to Behavior is the 10.3 percent that the state loses from taxpayers above the million-dollar threshold that would have been collected had their behavior not changed and the law had stayed constant. The Net Revenue Gain is then the Gross Revenue Gain minus the Loss Due to Behavior. The Dissipation Percentage is the percent of windfall gains lost due to taxpayer response. The bottom of the table also shows the dissipation calculation for year-specific treatment effects from Table 7.

If we separate out the effects by year and apply a 2013 SDID treatment effect of −0.081 and a 2014 SDID treatment effect of −0.179, we find total dissipation of 39.2 percent via the intensive margin in 2013 and 79.5 percent via the intensive margin in 2014.

We note that in light of the very large intensive margin elasticity estimate, the revenue impact calculated above may seem smaller than expected. This is in part a reflection of the deductibility of state and local taxes during our sample period: whereas California raised top rates by 3 percent and state tax revenues reflect this fully, the state tax increase implicitly lowers the federal tax increase so that the effective top rate increases less than 3 percent. In particular, with a 39.6 percent top rate, a 3 percent state tax increase is accompanied by a $39.6\% \times 0.03 = 1.188\%$ drop in the federal tax rate, so that the effective top rate increase is 1.812 percent.

Extensive Margin.—To understand the impact together of the extensive and intensive margin estimates, we rely on the estimates in Table 5, which demonstrate that the out-migration effect is concentrated among taxpayers who have filed in the top California bracket three years in a row. In this manner we aim to arrive at an estimate that will inform the revenue implications of our behavioral estimates with regard to this particular class of high-earning taxpayers.

To incorporate this margin, we use the estimate that there was a 0.9 percentage point increase in the hazard rate of out-migration for taxpayers who had filed in the top California bracket 3 years in a row. Assuming that the representative taxpayer in this group earned $4.15 million in the year prior to Propositon 30, they were paying $515,135 in taxes to California.[41] Including this additional margin with the intensive margin disspiation estimate, the state loses an additional 4.2 percent of its windfall income, for a total of 55.6 percent.

Applying to the separate effects of 2013 and 2014, this results in total erosion of the windfall gain of 43.4 percent and 83.5 percent, respectively.

This calculation does not take into account the likely correlation between a taxpayer's residency choice and her elasticity of taxable income. The incomes of the taxpayers who leave California in response to Proposition 30 or who had already left before Proposition 30 do not enter the estimation of the intensive margin effects. For understanding revenue impacts for the state of California as we do in this section, this effect is not important. However, for external validity and for generalizing the intensive margin results to understand the effects of a federal tax change, as we do in the following section, these estimates will underestimate the intensive margin behavioral response.

B. *2018 Federal Tax Reform*

In 2018, Congress passed the TCJA. Under this law, the top rate is 37 percent for single and head of household filers earning over $500,000 and for married filers earning over $600,000. Despite this nominal cut to top rates, the legislation on net increased rates on top earners because it capped state and local deductions at $10,000 total.[42]

Intensive Margin.—First, we use our top line intensive margin elasticity estimate to provide a ballpark quantification of the federal tax revenue implications of the TCJA for the particular set of California high earners in our treatment group. As we showed in Section IID, incorporating the SALT deduction and the Pease provision, the net-of-tax rate for a California high earner in 2017 in the 13.3 percent bracket was $100 - \left[39.6 \times \left(1 - 0.133 + 0.03\right) + 13.3 + 2.35\right] = 48.83$. In 2018, with the capping of the SALT deduction, the net-of-tax rate for the same high earner is simply $100 - \left(37 + 13.3 + 2.35\right) = 47.35$. Using the elasticity estimate of 3.0, we

[41] This quantity is computed using TAXSIM assuming a married taxpayer earning all wage income, and that 80 percent of the taxable base moves out of California.

[42] The "Pease provision" was repealed by the TCJA until 2025 under this legislation. The Pease provision had reduced the marginal rate gains to itemized deductions by 3 percent.

compute that top-earner incomes for the particular group of high-income California residents in our sample would change by $3.0 \times \left[\log(47.35) - \log(48.83)\right] = -0.092$ log points.

Consider a married California taxpayer earning $4.15 million of wage income. In 2017, this taxpayer has taxable income of $3.78 million and pays a federal tax bill of $1,431,305. In 2018, incorporating the 0.092 log point income decrease, this taxpayer pays a federal tax bill of $1,301,736. This amounts to a 7.0 percent decrease in tax revenue, putting the TCJA on the wrong side of the Laffer curve for high-earning individuals in California. This calculation should be interpreted with caution, since our estimates are interpreted as an average treatment effect specific to our particular group of California high earners (that is, those filing in the top California tax bracket three years in a row). Further, the literature such as Gruber and Saez (2002) has found that taxpayer intensive margin decisions are more sensitive to state than to federal tax policy changes.

Extensive Margin.—The TCJA led to changes in average tax rate differences between states as a result of the SALT deduction cap. In online Appendix Figure A11, we repeat the computations from Table 2 to assess how the 2018 California–other-state gap in average taxes paid grew over and above the 2017 California–other-state gap. The gap is reported only for the case of zero-income tax states. The zero-tax states in this period are the same as in the prior exercise, with the exception of Wyoming, which changed policy between 2017–2018.[43] Taxpayer behavior is still fixed at year 2012 levels, suitably inflation indexed. While we would ideally use year 2017 data, we do not have access to these data. We simply carry through 2012 behavior for parsimony and ease of comparison with our other calculations.

Comparing Table 2 to online Appendix Table A11 reveals that the TCJA increased incentives (in terms of the level of the average tax rate gap) to leave California for zero-tax states by 2.15 times the amount of Proposition 30 for those earning over $5 million and by a factor of 2.43 for those earning from $2 million to $5 million. Based on these scaling factors, we would predict an out-migration effect of 1.46 percent of those earning $2 million–$5 million and of 1.51 percent of those earning $5 million.

VIII. Conclusion

The issue of behavioral responses to income taxation is an important question in academic and policy circles. Prior research has made important progress in this area, but substantial controversy remains. In this paper we draw on rich microdata on the universe of tax returns from the California FTB to provide two new data points to inform this debate with a particular focus on the income taxation of high earners.

First, we document a substantial one-time out-migration response to increased state tax rates. Relative to the pre-period 2000–2010, the taxable income weighted rate of departures among top-bracket taxpayers was abnormally high by 0.8 percent

[43] This group is as follows: Alaska, Florida, Nevada, Texas, South Dakota, and Washington.

in 2012–2013. Consistent with the theoretical prediction that migration decisions respond to average tax rates, this migration effect increases with income and is concentrated among taxpayers earning over $2 million.

Second, we provide a simple, transparent framework to study the intensive margin response to Proposition 30's increased marginal tax rates for taxpayers who do not respond on the extensive margin. We use a difference-in-differences design that compares upper-income California resident taxpayers to a matched sample of nonresident California filers who are not subject to Proposition 30's higher tax rates (except through the small share of their income filed in California). Our design focuses on California taxpayers who are likely to earn top-bracket incomes in the absence of Proposition 30, defined as those who file in the new Proposition 30 top bracket in each of the years 2009, 2010, and 2011. To increase covariate balance between the treatment and control groups, we apply a propensity score matching method which matches only on 2009–2010 covariates. This procedure leaves the equality of covariate values in 2011 as a testable implication of the unconfoundedness assumption, which we cannot reject. This increases our confidence in the empirical design.

Our intensive margin estimates show a substantial intensive margin response to Proposition 30, which appears in 2012 and persists through the last year of our analysis in 2014. We find that this intensive margin response is concentrated in noninvestment income. Using the more conservative levels result from 2013 compared to the similar-states sample, the estimates imply an elasticity of taxable income with respect to the marginal net-of-tax rate of 3.0. Under the Diamond and Saez (2011) formulation, an elasticity of taxable income of 3 with respect to the marginal net-of-tax rate would translate into a total revenue-maximizing marginal tax rate of only 18 percent $(= 1/(1 + 1.5 \times 3))$, although the translation of the taxable income elasticity into a revenue-maximizing rate would depend heavily on the pareto parameter and functional form assumptions. Using a simple calculation of dissipation based on the average value of taxable income for high-income households of different filing statuses implies significant but not complete erosion of the state's windfall gains from behavioral responses.

Overall, we find strong behavioral responses to income taxation among high earners. Despite this, we are unable to provide convincing evidence as to the normative implications of the results. On the one hand, decreased high-earner income in response to taxation could reflect the distortion of productive activity among those residents, some of whom are California's most innovative residents. This could encompass the classic labor supply channel or other channels such as idea generation and innovation, as in Jones (2021). On the other hand, our results may also be driven by higher taxes reducing the incentive to engage in wasteful rent-seeking activities, such as wage negotiations by CEOs (Piketty, Saez, and Stantcheva 2014) or various types of tax sheltering activities that could involve substantial deadweight loss but also could be more neutral if they lead to resource reallocation (Chetty 2009). While we are able to perform simple calculations to inform the revenue consequences of our estimates, the broad policy and welfare implications of our work depend on these unanswered questions. Furthermore, there are several possible mechanisms that could explain our results: labor supply effects, offshoring to other countries, shifting of sales of pass-through

businesses to other states under California's single sales apportionment rule, and shifts to forms of compensation for which taxation is deferred. Understanding the relative roles of these mechanisms as well as welfare implications of these results constitute important avenues for future research.

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