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The Tax Elasticity of Capital Gains and Revenue-Maximizing Rates†

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This paper uses a direct-projections approach to estimate the effect of capital gains taxation on realizations at the state level and then develops a framework for determining revenue-maximizing rates at the federal level. We find that the elasticity of revenues with respect to the tax rate over a 10-year period is −0.5 to −0.3, indicating that capital gains tax cuts do not pay for themselves and that a 5 percentage point rate increase would yield $18 to $30 billion in annual federal tax revenue. Our long-run estimates yield revenue-maximizing capital gains tax rates of 38 to 47 percent. (*JEL* E62, H25, H71)

The tax elasticity of capital gains realizations features centrally in US fiscal policy debates. In the 1990s' "capital gains tax wars," US Treasury and economic officials argued that the responsiveness of realizations to capital gains tax rates was large enough that capital gains tax cuts would pay for themselves (Auten and Cordes 1991). Others (for example, Gravelle 1991) asserted that the true responsiveness was much lower, so capital tax cuts would generate substantial fiscal cost. This issue has reemerged in every presidential administration since 1990 and plays a key role in ongoing tax reform plans. For instance, this elasticity is the central parameter governing the revenue scores of President Biden's plan to increase capital gains rates as well as President Trump's proposal reducing capital gains taxes.

Informing these policy debates is difficult because a wide range of estimates exist. Feldstein, Slemrod, and Yitzhaki (1980), for example, estimate an elasticity with respect to the capital gains tax rate of −3.8, whereas the estimate of Burman and Randolph (1994) is −0.22. Moreover, there is limited empirical evidence in recent decades when there has been lower inflation, more widespread use of diversified investment vehicles, and a bigger role of pass-through firms, which have accounted for nearly half of capital gains realizations in recent years (Smith et al. 2019).

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This paper estimates the effect of capital gains taxes on tax revenues and quantifies the implications for revenue-maximizing tax rates in the United States. We use a direct-projections approach and new state-level panel data on capital gains realizations and the migration of the wealthy to estimate the effects of state capital gains tax changes on realizations and location decisions. Our data, which range from 1980 to 2016, allow us to characterize responsiveness in a more recent period than most of the literature, and our direct-projections approach enables us to estimate effects over different time horizons and test for dynamic effects. We then build a simple framework to relate these state-level effects to a policy-relevant elasticity at the national level, which is the state-level realization response after removing migration effects and accounting for average state taxes and a minor aggregation adjustment term. We find that this policy-relevant elasticity of realizations with respect to capital gains tax rates over a 10-year period is approximately -0.3 to -0.5 depending on the specification and that the estimates are larger in absolute value in the short and medium run than in the long run.

We highlight three implications of these elasticity estimates. First, these estimates are well below an elasticity of one in absolute value, which indicates that capital gains tax cuts do not pay for themselves. We formally test and reject the null of an elasticity of -1.0. Second, these estimates suggest that raising capital gains tax rates by 5 percentage points (in the current regime with unlimited deferral and step-up basis at death) would yield \$18 to \$30 billion in annual tax revenue, roughly twice the amount implied by the current approach of the Joint Committee on Taxation (JCT), which according to Gravelle (2021) currently uses an elasticity of -0.7 to score proposals.[1] Third, our long-run elasticity estimates correspond to point estimates for the revenue-maximizing capital gains tax rates of 38 to 47 percent.

Using state-level panel data provides more reforms and closer comparison groups than time series analysis at the federal level. At the federal level, there are not only fewer reforms but also many confounding factors. Figure 1 plots realizations and the maximum long-run capital gains tax rate since 1980. It shows that some capital gains tax changes are associated with sizable movements in realizations, but the responses are quite unequal across reforms. It is also quite difficult to separate these movements from unrelated macroeconomic trends and asset price fluctuations. One approach is to difference out macroeconomic trends by comparing the realization series in one county with that of a similar country. In panels B and C of Figure 1, we implement this approach using the realization series of the United Kingdom around cuts to the US capital gains tax rate in 1997 and 2003. These panels, however, show how precarious this approach is: it yields unstable elasticity estimates that exhibit large variance in non-tax-related country-year shocks and inherits the limitations of cross-country regressions.

Our state-level approach complements prior work by Bogart and Gentry (1995), who use state panel data from 1979 to 1990 to estimate the effect of capital gains tax rates on state-level realizations per tax return, and ongoing work by Bakija

[1] Gravelle (2021) also notes that the Treasury had used an estimate of -1.0 previously but has since moved closer to the JCT's estimate. In addition, Dowd, McClelland, and Muthitacharoen (2015), whose paper first appeared as a technical working paper (JCX-56-12) of joint work of the staff of the JCT and the Congressional Budget Office, estimate an elasticity of -0.72.

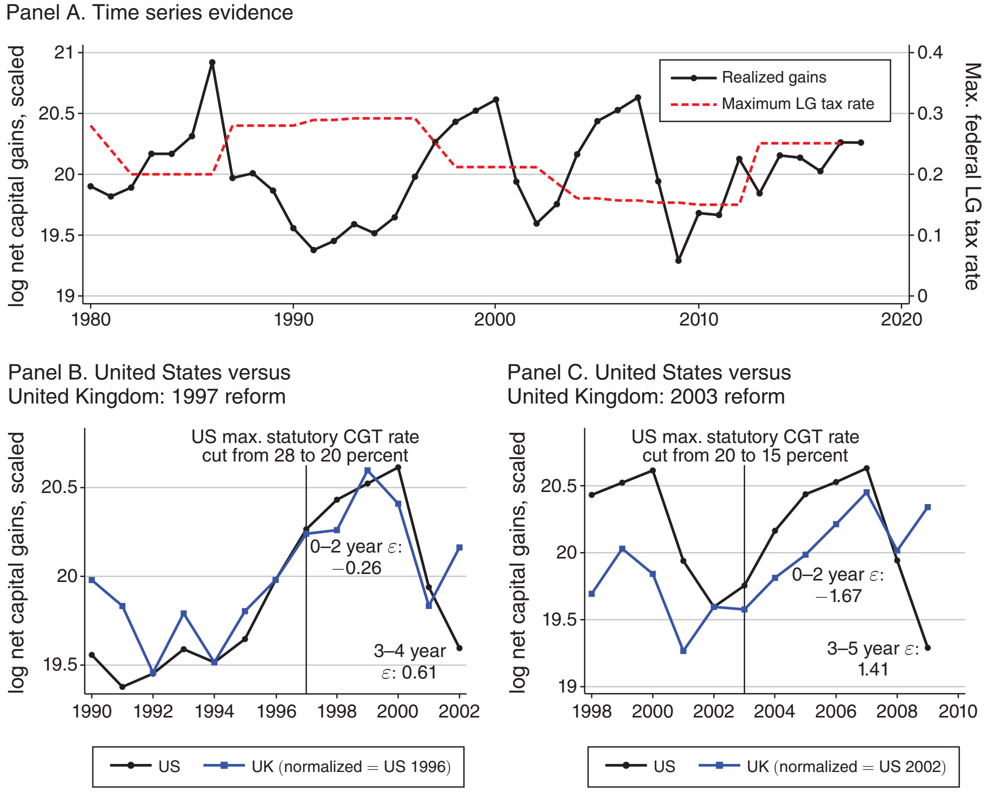

FIGURE 1. CAPITAL GAINS REALIZATIONS AND TAX RATES IN THE UNITED STATES

Notes: In all panels, net capital gains have been scaled by the ratio of a country's real GDP in 2000 to the country's real GDP in a given year (for example, US capital gains for 2005 were multiplied by the US GDP in 2000 divided by the US GDP in 2005). Panel A shows the evolution of realized capital gains and the maximum federal long-term capital gains tax rate in the United States from 1980 to 2018. Panels B and C compare realized capital gains in the United States to those in the United Kingdom around the time of US reforms. In all panels, net capital gains have been scaled by the ratio of a given country-year's GDP to the country's GDP in 2000. In both panels B and C, the UK capital gains tax rate was constant throughout the period shown. The UK series has been normalized to equal the US series in the year prior to the reform. We calculate the short-term (0–2 years) and medium-term (3–4 or 3–5 years) tax elasticities provided in panels B and C by normalizing the UK series in the year before reform, calculating the average difference between the normalized UK series and the US series during the period, and dividing that difference by the difference in US log net-of-tax rates before and after the reform. This calculation gives us elasticities with respect to the net-of-tax rate, which we then multiply by $-0.22/(1-0.22)$ to convert into elasticities with respect to the tax rate, at a tax rate of 22 percent. We use this tax rate to facilitate comparisons between these numbers and those given in Table 2, where we also use a rate of 22 percent to calculate tax elasticities given net-of-tax elasticities. If instead we had calculated the tax elasticities in panels B and C using the prevailing US federal tax rates prior to each reform, we would have obtained tax elasticities in panel B of -0.48 in the short run and 0.85 in the medium run and in panel C of -1.64 in the short run and 1.28 in the medium run. We do not include the fifth year post-reform in the medium-term analysis of panel B because this fifth year coincides with the 2003 tax reform shown in panel C.

and Gentry (2014), who use a similar approach for a longer panel from 1950 to 2007. Relative to this valuable work, our paper uses a different empirical approach and new data to provide new policy-relevant elasticity estimates based on a more recent sample that is closer to current conditions in terms of inflation, pass-through prevalence, and tax code. By having a better measure of location decisions of the wealthy, our approach also provides a more accurate accounting for migration effects, and thus policy-relevant realization effects, which difference out migration responses. Moreover, we use a direct-projections approach that contributes new graphical evidence on the dynamics of realizations around tax changes. Scoring capital gains tax changes requires estimating how realizations evolve over a ten-year period around the tax change, which, to the best of our knowledge, has not been done in prior work.

Much of the literature on capital gains in the 1990s and 2000s (for example, Burman and Randolph 1994, Auerbach and Siegel 2000, Poterba 2002, Auten and Joulfaian 2004) has focused on the distinction between temporary and permanent effects and used individual-level data to estimate these effects. The interpretation of these individual-level results, however, is complicated by factors such as strategic loss harvesting, observations with zero realizations, and movement in and out of top income brackets depending on the timing of big realizations. While standard approaches for addressing these concerns exist (for example, selection corrections (Heckman 1979) to account for realization decisions and instruments for tax rates), aggregating within a state-year cell avoids these complexities and also provides a longer panel than many existing individual-level studies. In addition, mapping estimates of micro-level responses, which are often person weighted rather than dollar weighted, into policy-relevant macro effects on tax revenues can be difficult.[2] Indeed, JCT (1990) highlighted similar concerns when evaluating the available literature to score reforms during the capital tax wars. Some recent promising work using bunching approaches (for example, Dowd and McClelland 2019, Buhlmann et al. 2020) also faces the challenge of mapping bunching responses into policy-relevant elasticities. Our state-level approach has the benefit of estimating aggregate responses while also providing considerable variation over a long panel.

I. Data on Capital Gains Taxation and Realizations

Our primary outcome variable is realized capital gains by state and year from Smith, Zidar, and Zwick (2020), which is the sum of short-term and long-term net realizations and is available from 1980 to 2016.[3] We inflate nominal data using CPI-U from the Bureau of Labor Statistics to measure realizations in 2018 dollars. We also use data from 1980 to 2016 on the number of wealthy individuals by state and year from Smith, Zidar, and Zwick (2020). Specifically, we focus on the number of individuals in the top 10 percent and top 1 percent of the national wealth distribution. Finally, some specifications use population and output data from the Census Bureau and Bureau of Economic Analysis.

We relate these state-level outcomes to the net-of-capital-gains tax rate in state s in year t, which is $(1 - \tau_{s,t})$, where $\tau_{s,t}$ is the maximum marginal federal and state tax rate. This variable comes from NBER TAXSIM and measures the combined effect of federal and state taxes, incorporating the deductibility of state and local taxes, the phaseout of deductions, and other state-year-specific features of the tax code. For instance, in terms of deductibility, $1 - \tau_{s,t} \equiv 1 - \tau_t^{fed} - (1 - \tau_t^{fed}) \times \tau_{s,t}^{state}$.

[2] For example, choosing the weights (especially for those with losses) and accounting for heterogeneous responses introduces difficulties when aggregating from micro to macro.

[3] The vast majority of realizations are long-term realizations (online Appendix Figure A.3).

Table 1—Summary Statistics on State Capital Gains Realizations and Tax Rates

	Observations	Mean	Standard deviation	Minimum	Maximum
Capital gains realizations					
Capital gains income (billions of dollars)	1,887	9.33	16.50	0.19	176.12
Log capital gains income	1,887	15.25	1.22	12.14	18.99
Per capita capital gains income (thousands of dollars)	1,887	1.58	1.21	0.18	20.12
Tax variables					
State capital gains tax rate ($\tau_{s,t}^{state}$)	2,091	0.04	0.03	0.00	0.15
Keep rate	2,091	0.75	0.05	0.63	0.85
Log keep rate	2,091	−0.29	0.07	−0.46	−0.16
Indicator for $\Delta\tau_{s,t}^{state} \neq 0$	2,040	0.29	0.45	0.00	1.00
$\Delta\tau_{s,t}^{state}$ if $\Delta\tau_{s,t}^{state} \neq 0$	584	0.00	0.01	−0.08	0.09
Indicator for $\Delta\tau_{s,t}^{state} \geq 0.01$	2,040	0.04	0.19	0.00	1.00
$\Delta\tau_{s,t}^{state}$ if $\Delta\tau_{s,t}^{state} \geq 0.01$	75	0.03	0.02	0.01	0.09
Indicator for $\Delta\tau_{s,t}^{state} \leq -0.01$	2,040	0.03	0.16	0.00	1.00
$\Delta\tau_{s,t}^{state}$ if $\Delta\tau_{s,t}^{state} \leq -0.01$	53	−0.02	0.01	−0.08	−0.01

Notes: This table summarizes capital gains and tax variables used in our analysis, which are observed at the state-year level. We report counts and magnitudes for changes in state capital gains tax changes in three bins: nonzero changes, increases of 1 percentage point or more, and decreases of 1 percentage point or more. The sample ranges from 1980 to 2016 for realizations and from 1977 to 2017 for tax rates. All dollar values are in 2018 dollars. We use capital gains income data from Smith, Zidar, and Zwick (2020) and data on state population from the Census Bureau via FRED. Data on state and federal capital gains tax rates are from NBER TAXSIM. Keep rates $(1 - \tau_{s,t})$ are net of federal and state taxes on capital gains, accounting for deductibility and other provisions described in Section I. See online data Appendix B for additional details.

The tax rate data are available from 1977 to 2017, which is a slightly longer range of years than the realizations and count data. We use these extra years when estimating longer-term effects. For example, although we cannot use a state tax reform in 1978 to identify the short-term impact on realizations, it can still contribute to the identification of longer-term effects.[4]

Table 1 provides summary statistics. On average, state capital gains tax rates are 4 percent, but they range from 0 to 15 percent in our sample. Figure 1 plots the maximum federal tax rate over time. The current maximum capital gains tax rate is 23.8 percent. Combining both tax rates and accounting for interactions and phaseouts results in an effective keep rate of 75 percent on average, indicating that \$1 of realized capital gains amounts to \$0.75 after taxes.

We find a total of 584 changes in state capital gains tax rates throughout our panel. Most of these changes are fairly small, which reflects the fact that our tax rate measure includes the effect of deductions and other minor provisions of state tax codes, so any changes to these provisions can cause the capital gains tax rate to change. The largest changes, however, are in excess of 4 percentage points (online Appendix Table A.1). In total, we have 128 state tax changes that exceed 1 percentage point in absolute value. In online Appendix Figure A.2, we provide a histogram of all changes. As we show below, our results are robust to using variation from only these larger tax changes.

[4] We generally use the terms "reform" and "tax change" interchangeably to indicate any nonzero value of $\Delta\log(1 - \tau_{s,t})$.

We examine the relationship between changes in state capital gains tax rates and economic and policy conditions in online Appendix Table A.2. Specifically, we regress indicators for capital gains tax increases and decreases on lags of state unemployment rates, GDP per capita, and state tax rates on personal and corporate income.[5] Most coefficients are insignificant and small, though notably, higher unemployment in the previous year is associated with a higher probability of increasing the capital gains tax rate. In our main analysis, we include specifications that condition on unemployment prior to tax reforms and do not find evidence that this relationship affects our estimates.

II. Methods

A. *Estimating the Annual Effects of Capital Gains Tax Changes*

We investigate the effects of log net-of-tax rates on log realized capital gains and on log counts of wealthy residents. We run direct-projections regressions for different time horizons $h \in \{-10, -9, \ldots, 9, 10\}$:

$$y_{s,t+h} = \beta_h \Delta\log(1 - \tau_{s,t}) + \mathbf{X}'_{s,t}\boldsymbol{\Lambda}_h + \gamma_{s,h} + \phi_{t,h} + \varepsilon_{s,t,h}, \tag{1}$$

where s and t index state and calendar year, $y_{s,t+h}$ is the outcome variable in year $t + h$ (log realized capital gains in our main specification), $\gamma_{s,h}$ and $\phi_{t,h}$ are horizon-specific state and year fixed effects, and $\mathbf{X}_{s,t}$ is a vector of controls. The main parameters of interest are the sequence of $\{\beta_h\}_{h=-10}^{10}$, which describe the path of realized capital gains around the tax change. The variable $\Delta\log(1 - \tau_{s,t})$ is the one-year change in the log net-of-tax rate. Using first differences helps deal with serial correlation concerns and facilitates estimating an impulse response function. To express the results as elasticities at different horizons, we normalize the coefficients to be relative to the coefficient in the year before the tax change—that is, we define elasticities $\delta_h \equiv \beta_h - \beta_{-1}$. For example, $\delta_5 = \beta_5 - \beta_{-1}$ measures the elasticity of realized capital gains five years after the reform with respect to the capital gains net-of-tax rate, where the change in realizations is relative to the year before the tax event. We plot the δ_h estimates in our main figures.

In our baseline specification, we control for the vector $\mathbf{X}_{s,t}$ of leads and lags of changes in the log net-of-tax rate, that is, $\mathbf{X}'_{s,t}\boldsymbol{\Lambda}_h = \sum_{r=-10,r\neq 0}^{10} \lambda_r^h \Delta\log(1 - \tau_{s,t+r})$. Controlling for these other leads and lags of capital gains tax changes isolates the effect of a given tax reform. Without these controls, estimates would reflect the effect of not just the tax reform of interest but also any other reforms occurring within the event window.[6] To check robustness, we also run specifications featuring additional controls in $\mathbf{X}_{s,t}$, including GDP in pre-reform year $t - 1$, GDP-growth-bin-by-year dummies, state unemployment in pre-reform year $t - 1$, and changes in state corporate and personal income taxes. Finally, we include a specification that interacts the

[5] Online Appendix Table A.3 also shows that changes in state capital gains tax rates are often accompanied by changes in state personal income tax rates. We include specifications that do (as well as those that do not) control for leads and lags of changes in state tax rates on personal and corporate income.

[6] In online Appendix Figure A.9, we run a specification that excludes the vector of controls for other reforms and find similar results.

tax change with indicators based on the size of the tax change and report estimates for β_h coming from only larger tax reforms that exceed 1 percentage point in absolute value.

B. *Discussion of Alternative Specifications and Semi-elasticities*

To facilitate comparisons to prior estimates, we discuss the theoretical and empirical implications of using logs and semi-logs in online Appendix C. We also provide estimates using a semi-log specification, which delivers similar results. We prefer our net-of-tax formulation because it measures the relevant price governing behavior and is standard in the broader literature (Saez, Slemrod, and Giertz 2012).

Compared with an event-study specification, which centers around the outcome year rather than the policy reform year, the direct-projections approach accurately recovers elasticities in simulations (see online Appendix D for details).[7] In the online Appendix we also provide results using event-study specifications (online Appendix Figure A.8, Figure A.13, and Table A.5). Results are similar.

C. *Estimating Effects over Multiple Years*

We extend the method in equation (1) to estimate the elasticity of capital gains realizations over longer time horizons. First, we consider a direct-projections specification that estimates the effect of tax reforms on realizations in three-year bins, yielding estimates of the elasticity in the short (0–2 years), medium (3–5 years), and longer run (6–8 years):

$$(2) \qquad y_{s,t+h} = \tilde{\beta}_h \Delta_3 \log(1 - \tau_{s,t}) + \mathbf{X}'_{s,t}\tilde{\mathbf{\Lambda}}_h + \tilde{\gamma}_{s,h} + \tilde{\phi}_{t,h} + \tilde{\varepsilon}_{s,t,h},$$

where $\Delta_3 \log(1 - \tau_{s,t})$ represents the three-year change in the log net-of-tax rate (that is, $\Delta_3 \log(1 - \tau_{s,t}) = \log(1 - \tau_{s,t}) - \log(1 - \tau_{s,t-3})$). For each value of $h \in -9, -6, \ldots, 6, 9$, we estimate a separate instance of this regression. The controls for other reforms in this regression are also specified in three-year bins: the vector of controls $\mathbf{X}_{s,t}$ now contains the variables $\Delta_3 \log(1 - \tau_{s,t+r})$ for $r = -9, -6, -3, 3, 6, 9$. We use the notation $\tilde{\beta}$, $\tilde{\Lambda}$, etc., to distinguish the parameters in equation (2) from their analogs in equation (1).

To understand why this specification correctly identifies the average elasticity over the specified three-year periods, consider a simple example. Suppose a state changes its capital gains tax rate exactly once in year 2000. Then $\Delta_3 \log(1 - \tau_{s,t})$ takes a value of zero for this state in every year except three: $t = 2000, 2001, 2002$. Now consider the regression above for $h = 0$. The variable $\Delta_3 \log(1 - \tau_{s,t})$ is nonzero whenever the left-hand-side variable is $y_{s,2000}$, $y_{s,2001}$, or $y_{s,2002}$. Therefore, the coefficient $\tilde{\beta}_0$ will capture the average effect of the tax reform on capital gains in these three years. Suppose instead $h = -3$. In this case, our left-hand-side variable

[7] Since the direct-projections approach centers leads and lags on the policy reform year, it includes fewer pre-observation controls when estimating the effect of post-observation reforms or vice versa. However, it also facilitates controlling for pre-treatment conditions and handling locations with multiple events (and associated issues with adjusting standard errors).

of $y_{s,t+h}$ becomes $y_{s,t-3}$. Since $\Delta_3 \log(1 - \tau_{s,t})$ is still zero for all t except 2000, 2001, and 2002, $\tilde{\beta}_{-3}$ captures the effect of the tax reform on $y_{s,1997}$, $y_{s,1998}$, and $y_{s,1999}$ (the only $y_{s,t-3}$ such that $t \in 2000, 2001, 2002$). Now, define $\tilde{\delta}_0 \equiv \tilde{\beta}_0 - \tilde{\beta}_{-3}$. The parameter $\tilde{\delta}_0$ measures the difference in realizations in the periods immediately after and before the reform. In our example, $\tilde{\delta}_0$ represents the difference between average realizations in post-reform years 2000–2002 and average realizations in pre-reform years 1997–1999. In other words, $\tilde{\delta}_0$ identifies the average elasticity over a 0–2-year horizon relative to the reform year. Similarly, $\tilde{\delta}_3 \equiv \tilde{\beta}_3 - \tilde{\beta}_{-3}$ would identify the impact of the reform on the difference between average realizations in 2003–2005 and 1997–1999, thus giving us an average elasticity over a 3–5-year horizon, and so on.

We use a similar approach to estimate effects in the post period (that is, in years 0–10) and in the long-run (that is, years 6–10). To get a single estimate of the effect of capital gains tax reforms on realizations in the decade following the reform, we use the following specification:

$$y_{s,t} = \beta_\ell \Delta_{11} \log\big(1 - \tau_{s,t}\big) + \mathbf{X}'_{s,t} \acute{\boldsymbol{\Lambda}}_h + \acute{\gamma}_{s,h} + \acute{\phi}_{t,h} + \acute{\varepsilon}_{s,t,h}, \quad (3)$$

where $\Delta_{11} \log(1 - \tau_{s,t}) = \log(1 - \tau_{s,t}) - \log(1 - \tau_{s,t-11})$.[8] To estimate the elasticity for the 0–10-year estimate, we take the point estimate β_ℓ from this regression and subtract off the point estimate $\tilde{\beta}_{-3}$ from (2). Finally, the long-run estimate for years 6–10 is implemented similarly to equation (3) but using a 5-year rather than 11-year difference for the right-hand-side tax change variable (that is, replacing Δ_{11} with Δ_5) and using $y_{s,t+6}$ as the outcome variable.

III. Capital Gains Tax Changes and Realizations at the State Level

Figure 2 shows the results of our baseline specification from equation (1). The figure illustrates how capital gains realizations evolve before and after a change in the capital gains net-of-tax rate, controlling for other state capital tax reforms. We see no clear pre-trend: in each of the ten pre-reform years, capital gains realizations tend to be stable. We then see a jump soon after the reform, after which the point estimates decline modestly throughout the post-period. Unlike the 1986 and 2012 national reforms shown in Figure 1, we do not see evidence of anticipation effects preceding state capital gains tax reforms, which would have manifested as a downward spike at year -1.

On average across post-reform years zero through ten, the point estimates directly provide an elasticity estimate of capital gains realizations with respect to the net-of-tax rate of around 3.18. The dynamics of this response are also of interest. In Figure 2, there is a modest downward trend over the post-period. Combining some of our individual year point estimates, the estimated short-run elasticity $(1/3)\sum_{h=1}^{3}\hat{\delta}_h$ is 3.61 (SE 1.22), whereas the longer-run estimate $(1/3)\sum_{h=8}^{10}\hat{\delta}_h$ is somewhat lower at 2.59 (SE 1.42). However, we cannot reject the null that these effects are the same.

In panel B of Figure 2, we present five robustness tests of these results: (i) controlling for pre-event state GDP, (ii) controlling for pre-event state GDP growth,

[8] In this specification, the vector of controls $\mathbf{X}_{s,t}$ contains variables that are still three-year binned versions before and after the 11-year bin: $\Delta_3 \log(1 - \tau_{s,t+r})$ for $r = -17, -14, -11, 3, 6, 9$.

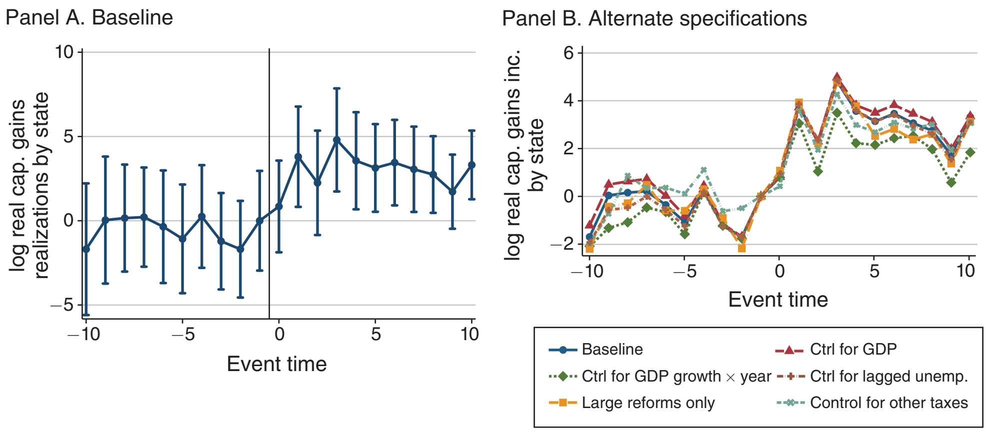

FIGURE 2. THE EFFECT OF NET-OF-TAX RATE CHANGES ON CAPITAL GAINS REALIZATIONS

Notes: This figure presents our main results of the impact of state capital tax rate changes on capital gains realizations. The points plotted are the estimated coefficients from equation (1) for the impact of a change in the total (federal and state) log net-of-tax capital gains tax rate on log capital gains realizations. The alternate specifications include the following: (i) controlling linearly for GDP in the year before the reform; (ii) controlling for a set of dummies interacting prior GDP growth tertiles and years, where the prior GDP growth tertile is determined using GDP growth over the most recent three years; (iii) controlling for prior unemployment rates; (iv) interacting the tax change variable with indicators for reforms greater or smaller than 1 percentage point and reporting the coefficients corresponding to large changes; and (v) controlling for other state personal and corporate income tax changes. Specifically, for (iv) we modify the baseline specification by estimating separate coefficients for large and small tax changes, that is, we fit $y_{s,t+h} = \beta_h^{big} \times \mathbf{1}(|\Delta(1-\tau_{s,t}^{state})| \geq 0.01) \times \Delta\log(1-\tau_{s,t}) + \beta_h^{small} \times \mathbf{1}(|\Delta(1-\tau_{s,t}^{state})| < 0.01) \times \Delta\log(1-\tau_{s,t}) + \mathbf{X}'_{s,t}\boldsymbol{\Lambda}_h + \gamma_{s,h} + \phi_{t,h} + \varepsilon_{s,t,h}$, where β_h^{big} and β_h^{small} are the tax-change-size-specific coefficients. We report the series based on the β_h^{big} coefficients. In all series, capital gains are in real terms, and the estimated coefficients are normalized to equal 0 at time -1, that is, we plot $\hat{\delta}_h$ as described in Section IIA. Standard errors are clustered at the state level.

(iii) controlling for pre-event state unemployment rates, (iv) using only large reforms that change the capital gains tax rate by at least 1 percentage point, and (v) controlling for changes in state income and corporate tax rates. The results are remarkably similar. We also provide a range of other robustness checks in online Appendix Figures A.7–A.12, including an event study version of the analysis, a specification without controls for other capital gains tax changes in the pre- and post-reform periods, and separate analyses for small and large states.

State capital gains tax rates often move in the same direction as state income tax rates (online Appendix Table A.3). Many states treat capital gains as regular income for tax purposes, in which case the capital gains tax rate will be identical to the income tax rate. We account for these possibilities using a specification that controls for changes in personal income and corporate taxes. Panel B of Figure 2 illustrates that the elasticity estimates from this specification are very similar to the baseline.

IV. Federal Revenue-Maximizing Rates

In this section, we present a framework that shows how to use the state-level estimates from above to infer the policy-relevant elasticity at the national level. We then derive an estimate for the revenue-maximizing tax rate and calculate revenue effects of a hypothetical 5 percentage point tax rate increase.

A. *A Simple Model of State-Level Capital Gains Realizations*

Consider a country with states $s \in S$. Residents of state s retain a share $(1 - \tau_F - \tau_s)$ of their realized capital gains after paying federal (τ_F) and state capital gains taxes (τ_s).[9]

We can decompose total realized capital gains in state s into two terms:

$$CG_s = N_s(1 - \tau_F - \tau_s, \tau_{-s}) R_s(1 - \tau_F - \tau_s), \tag{4}$$

where $N_s(1 - \tau_F - \tau_s, \tau_{-s})$ represents the number of residents in state s and $R_s(1 - \tau_F - \tau_s)$ represents realized capital gains per resident conditional on residing in state s.

Using equation (4), we can decompose the empirical elasticity of capital gains with respect to the net-of-tax rate:

$$\varepsilon^{CG} = \frac{\partial \log CG_s}{\partial \log(1 - \tau_F - \tau_s)} = \frac{\partial \log N_s}{\partial \log(1 - \tau_F - \tau_s)} + \frac{d \log R_s}{d \log(1 - \tau_F - \tau_s)} \tag{5}$$

$$= \varepsilon^N + \varepsilon^R.$$

Thus, ε_s^{CG} is the sum of two elasticities: a migration elasticity ε^N and a realization elasticity ε^R, which is the main object of interest and represents the "pure" per capita response of capital gains realizations to the net-of-tax rate.

B. *From State-Level Realizations to the Federal Revenue-Maximizing Tax Rate*

We show in online Appendix Section E that the federal capital gains tax rate that maximizes federal tax revenue from capital gains is

$$\tau_F^* = \frac{1 - \bar{\tau}_S}{1 + \varepsilon^R}. \tag{6}$$

This formula resembles familiar optimal tax models (Saez 2001, Diamond and Saez 2011) but has an additional aggregation adjustment term $\bar{\tau}_S$ that denotes the average population-weighted state tax rate. The policy-relevant elasticity at the federal level is our estimate of the elasticity of capital gains realizations at the state level less the migration elasticity, that is, $\varepsilon^R = \varepsilon^{CG} - \varepsilon^N$.

C. *Estimating the Federal Revenue-Maximizing Tax Rate*

We estimate ε^N based on the responses of those at the top of the national wealth distribution because the top groups account for essentially all capital gains (Smith, Zidar, and Zwick 2020). To do so, we fit equation (1) when the outcome is the share of the state population that belongs to either the top 10 percent or the top 1 percent of the national wealth distribution. Panels A and B of Figure 3 show

[9] When measuring keep rates net of federal and state taxes, we account for deductibility as described in Section I.

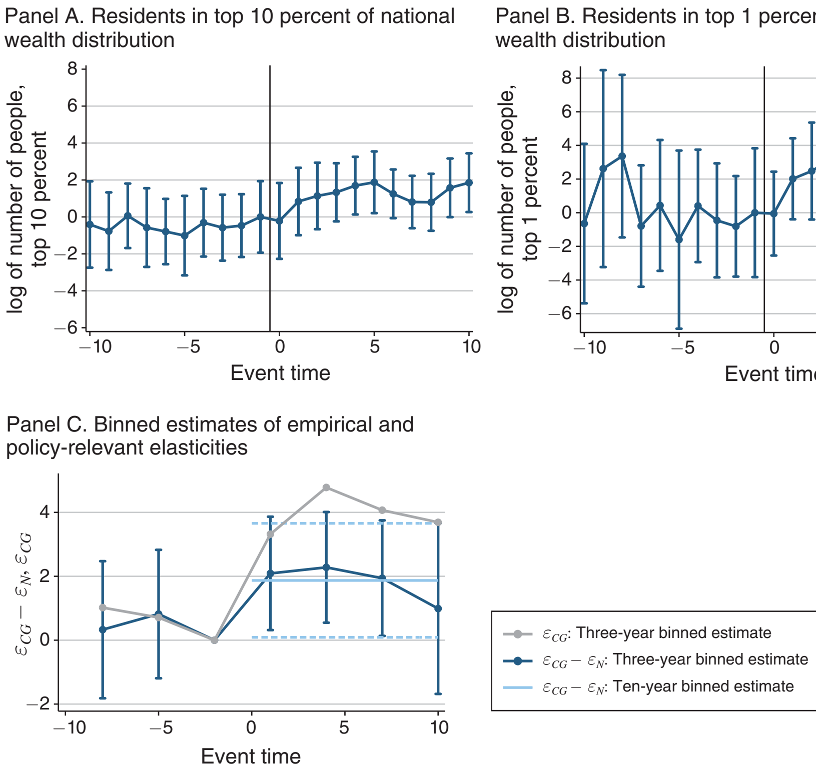

Figure 3. Migration Effects of State Capital Gains Taxes and Policy-Relevant Elasticity Estimates

Notes: Panels A and B of this figure show the impact of state capital gains tax reforms on migration of high–net worth residents using the specification in equation (1). The outcome in panel A is the log of the share of residents belonging to the top 10 percent of the national wealth distribution, and in panel B, it is the log share in the top 1 percent. The points plotted are the estimated coefficients for the impact of a one-period change in the total (federal and state) log net-of-tax capital gains tax rate on these outcome variables. In panel C, we estimate the empirical capital gains elasticity using a specification analogous to that in equation (1) but using three-year bins (see Section IIC for details). This estimate is represented by the grey point estimates. The dark blue point estimates represent our estimates of the policy-relevant elasticity $\hat{\varepsilon}^R = \hat{\varepsilon}^{CG} - \hat{\varepsilon}^N$ for each period. As described in Section IIC, $\hat{\varepsilon}^N$ is estimated using a state-year-specific dollar-weighted average of the migration responses of the top 1 percent and top 10 percent. The horizontal light blue line is our estimate of the policy-relevant elasticity using a binned specification for post-reform years 0–10 (see equation (3)). All specifications include state and year fixed effects and controls for tax reforms in years surrounding the reform. The estimated coefficients are normalized to equal 0 at time -1, and standard errors are clustered at the state level.

the outcome of this specification for the top 10 percent and top 1 percent groups, respectively. We see fairly stable pre-trends, though somewhat noisy in the earliest pre-periods for the top 1 percent group. Following an increase in the net-of-tax rate, the share of residents in each of the top groups grows, and the magnitude of the response is larger for the top 1 percent group.

Connecting these migration responses to the theory requires weighing the following trade-off. Focusing on the top 10 percent delivers a more precise estimate but risks putting too little weight on the responsiveness of those at the top who have substantial capital gains realizations in dollar terms. Our preferred measure of migration is a combination of the two groups. Specifically, we define the outcome variable as $\theta_s \ln N_{s,t}^{P99-P100} + (1 - \theta_s) \ln N_{s,t}^{P90-P100}$, which is a dollar-weighted convex combination of the two groups, where θ_s is the state's wealth share of the top 1 percent relative to the top 10 percent.[10]

To estimate ε^R, we first estimate ε^{CG} and ε^N using our binned specifications described in Section IIC, with log capital gains and our migration measure from above as outcome variables. We perform this estimation at various time horizons: the main estimate covering years 0–10 after each reform as well as three-year bins of 0–2 years, 3–5 years, 6–8 years, and 6–10 years. We then calculate $\hat{\varepsilon}_h^R = \hat{\varepsilon}_h^{CG} - \hat{\varepsilon}_h^N$ at each time horizon.

Panel C of Figure 3 shows the estimates from these binned regressions graphically. The grey series shows estimates of $\hat{\varepsilon}_h^{CG}$ at different horizons h, the dark blue series shows $\hat{\varepsilon}_h^R$, and the light blue shows the average policy-relevant elasticity over a decade following each reform, $\hat{\varepsilon}_{0-10}^R$.

Table 2 also provides estimates of our elasticities at various time horizons. We also translate our net-of-tax elasticity estimates into an elasticity with respect to the tax rate to facilitate comparisons to prior work. Table 2 includes estimates from two alternative specifications: one in which we identify all elasticities from state tax reforms of at least 1 percentage point and a second in which we control for all reforms to state income tax and corporate tax rates in a 21-year window around the capital gains tax reform in question.[11]

Overall, our baseline estimate at a 0–10-year horizon gives an elasticity with respect to the net-of-tax-rate of approximately 1.87, which translates into an elasticity of -0.53 with respect to the tax rate. The specification using only large tax changes yields an elasticity with respect to the tax rate of -0.42, and the specification controlling for other state tax changes yields an elasticity with respect to the tax rate of -0.29. While these point estimates are somewhat noisy, the point estimates are notably smaller in absolute value than the conventional elasticities used by tax analysts. Moreover, we can definitively test and reject the null hypothesis that this elasticity with respect to the tax rate equals 1 in absolute value. The p-values for the baseline, big-change-only, and other-tax-control specifications are 0.066, 0.021, and 0.031, respectively. This finding provides important evidence suggesting that capital gains tax cuts do not pay for themselves, which has been a prominent proposition in this literature (JCT 1990, Auten and Cordes 1991, Gravelle 1991, Burman 1999, Gravelle 2021).

As in Figure 2, the results in Table 2 across all specifications show an elasticity that is somewhat bigger in absolute value in the short to medium run and then declines in the longer run. This pattern could potentially reflect some transitory effects that are present in the short run but disappear over time. For instance, a tax cut may in the shorter run spur some individuals to realize accumulated gains to take advantage of the lower tax rate, particularly if they expect a possible reversal

[10] θ_s is defined as

$$\theta_s = \sum_t \frac{W_{s,t}^{P99-P100}}{W_{s,t}^{P90-P100}},$$

that is, it represents the average wealth share in state s of the top 1 percent within the top 10 percent across all years in our sample. Across all states in the sample, the mean of θ_s is 0.39. The minimum value is 0.28 (Iowa), while the maximum is 0.56 (Washington, DC), with Wyoming, Nevada, and New York also having values above 0.5.

[11] Online Appendix Tables A.6 and A.7 provide additional specifications that control for pre-reform unemployment and unemployment growth. These are very similar to the results in Table 2.

TABLE 2—CAPITAL GAINS ELASTICITIES AND REVENUE-MAXIMIZING TAX RATES

Specification	Total elasticity, ε^{CG}	Policy elasticity, $\varepsilon^{R} = \varepsilon^{CG} - \varepsilon^{N}$	Laffer rate, $\tau^{*} = \frac{1 - \bar{\tau}_S}{1 + \varepsilon^R}$	Elasticity with respect to tax, $\varepsilon^{tax} = \varepsilon^{R} \cdot \frac{-0.22}{1 - 0.22}$	χ^2-test: $\varepsilon^{tax} = -1$
Baseline					
0–10 years	3.39	1.87	0.33	−0.53	3.38
	(1.01)	(0.91)	(0.10)	(0.26)	(0.07)
0–2 years	3.32	2.09	0.30	−0.59	2.58
	(0.97)	(0.91)	(0.09)	(0.26)	(0.11)
3–5 years	4.78	2.28	0.29	−0.64	2.05
	(1.10)	(0.88)	(0.08)	(0.25)	(0.15)
6–8 years	4.07	1.94	0.32	−0.55	3.02
	(1.20)	(0.92)	(0.10)	(0.26)	(0.08)
6–10 years	3.66	1.47	0.38	−0.41	4.54
	(1.27)	(0.97)	(0.15)	(0.27)	(0.03)
Big changes only					
0–10 years	2.81	1.48	0.38	−0.42	5.31
	(1.02)	(0.89)	(0.14)	(0.25)	(0.02)
0–2 years	3.54	2.50	0.27	−0.71	1.14
	(0.97)	(0.98)	(0.07)	(0.28)	(0.29)
3–5 years	4.96	2.40	0.28	−0.68	1.54
	(1.10)	(0.92)	(0.07)	(0.26)	(0.21)
6–8 years	3.77	1.65	0.35	−0.46	4.35
	(1.19)	(0.91)	(0.12)	(0.26)	(0.04)
6–10 years	2.80	0.99	0.47	−0.28	6.48
	(1.30)	(1.00)	(0.24)	(0.28)	(0.01)
Control for other taxes					
0–10 years	2.28	1.01	0.47	−0.29	4.64
	(1.32)	(1.18)	(0.27)	(0.33)	(0.03)
0–2 years	2.38	1.25	0.42	−0.35	3.88
	(1.19)	(1.16)	(0.21)	(0.33)	(0.05)
3–5 years	3.58	1.64	0.36	−0.46	3.54
	(1.24)	(1.01)	(0.14)	(0.29)	(0.06)
6–8 years	3.32	1.40	0.39	−0.39	3.57
	(1.43)	(1.14)	(0.19)	(0.32)	(0.06)
6–10 years	2.98	1.18	0.43	−0.33	3.96
	(1.54)	(1.19)	(0.24)	(0.34)	(0.05)

Notes: This table shows estimates of main elasticities and associated revenue-maximizing rates for different specifications of equation (2). The 0–2, 3–5, and 6–8-year specifications use 3-year bins; the 6–10-year specification uses a 5-year bin; and the 0–10-year specification uses an 11-year bin as described by equation (3). As described in the main text, the empirical elasticities $\hat{\varepsilon}^{CG}$ and $\hat{\varepsilon}^{N}$ are calculated as the difference between the point estimate for each specific horizon and the point estimate for the $[-3,-1]$-year bin. Revenue-maximizing tax rates are estimated using the formula in equation (6), which is derived in online Appendix Section E. The term $\bar{\tau}_S$ adjusts for the average population-weighted state tax rate in 2016, which was 6.27 percent in 2016. All specifications control for reforms in the capital gains tax rate in three 3-year bins before and after the reform in question and include state and year fixed effects. The "big changes only" specification replaces the right-hand-side variable of interest—the 3-year (or 5-year or 11-year) change in the log net-of-tax rate—with two variables: one that sums the changes in the log net-of-tax rate in years where the state tax rate changed by more than 1 percentage point, leaving out smaller changes, and one that sums changes to the log net-of-tax rate in years where the state rate changed by less than 1 percentage point. Specifically, we replace the right-hand-side variable of interest—for instance, $\Delta_3 \log(1 - \tau_{s,t})$—with two variables: $\Delta_3^{big} \log(1 - \tau_{s,t}) \equiv \sum_{k=0}^{2} \Delta \log(1 - \tau_{s,t-k}) \times \mathbf{1}(|\Delta(1 - \tau_{s,t-k})| \geq 0.01)$, which sums all the tax changes greater than 1 percentage point in magnitude over the past year, and a corresponding variable that sums all tax changes smaller than 1 percentage point. We then report estimates for the variable that sums the big changes. The "control for other taxes" rows report results from a specification that includes controls for changes in state income and corporate tax rates. We control for the change in other tax taxes over the same 3-year (or 5-year or 11-year) bins that we use to identify our main point estimate in each regression as well as three 3-year bins before and after the main period. Standard errors are clustered at the state level. Values in parentheses in columns 1–4 represent standard errors; values in parentheses in column 5 (χ^2-test) represent p-values.

of the tax cut in the future. However, once many of these accumulated gains have been realized, the potential for realization of further gains is limited, and the magnitude of the behavioral effect declines in the longer run.[12] For this reason, we view our 6–10-year estimates as being the most likely to capture the long-run structural elasticity of capital gains to the net-of-tax rate, though some transitory effects might exist even beyond a 10-year horizon.

D. *Policy Implications*

These elasticity results have policy implications for revenue-maximizing tax rates and the revenue effects of capital gains tax reforms. Table 2 provides the corresponding estimates of the revenue-maximizing tax rate, $\hat{\tau}_F^*$. Our baseline elasticity estimate for the full 10-year period implies a revenue-maximizing rate around 33 percent, and the analogous estimates for the big-changes-only and control-for-other-tax-changes specifications are 38 percent and 47 percent, respectively. Thus, over a 10-year budget window, these results suggest that a capital gains tax rate of around 40 percent would maximize federal capital gains tax revenues. For analysis over years 6–10, we find somewhat higher revenue-maximizing rates, ranging from 38 percent to 47 percent across the three specifications.

We can use our elasticities from Table 2 to estimate how realizations and thus tax revenues change in response to a 5 percentage point tax increase. By the definition of these elasticities, we can estimate how realizations and thus tax revenues change for a given elasticity estimate and tax rate change. In 2017, the most recent year that our state and federal tax data covers, the average combined maximum state and federal tax rate was 27.82 percent.[13] We use this rate as an approximation to the average marginal tax rate. An increase of 5 percentage points in the tax rate implies that the net-of-tax rate decreases by $0.05/(1 - 0.2782) = 6.93$ percent. We relate this percentage change in taxes to a percentage change in realizations using our baseline 0–10-year policy-relevant elasticity of 1.87 from Table 2 and find that realizations would have been $6.93 \times 1.87 = 13$ percent lower, for a total of \$754.3 billion in realizations. To calculate counterfactual tax revenue given this realizations amount, we need to use the *average* tax rate, which differs from the marginal. In 2018, the most recent year for which we have data on federal tax revenue, total capital gains realizations were \$890.6 billion (Piketty, Saez, and Zucman 2018) and federal capital gains tax revenue was \$158.4 billion, yielding an average federal tax rate of $158.4/890.6 = 17.79$ percent. We assume that the 5 percentage point tax increase also applies to this number, for a counterfactual average tax rate of $17.79 + 5 = 22.79$ percent. Applying this average tax rate to the counterfactual realizations amount yields tax revenue of $0.2279 \times 754.3 = \$176.6$ billion, an increase of \$18.2 billion relative to the actual 2018 tax revenue. Repeating these

[12] This possibility seems consistent with the graphical evidence that we find when we examine the behavioral effects following tax increases and tax decreases separately, which are shown in online Appendix Figure A.10. Following a tax cut, we see a striking and immediate upward jump in realizations, and the effect grows even larger over the following three to four years. However, after this initial jump, the trend reverses, and the behavioral effect seven to nine years after a tax cut is much more modest. In contrast, the effect on realizations following a tax increase is much smaller and more stable over time.

[13] Online Appendix Figure A.6 shows how the following calculations would change if the elasticity were measured at a different initial tax rate.

steps but using the net-of-tax elasticity estimate of 1.01 from our specification with controls for other taxes would result in an increase of \$30.3 billion in tax revenues. In sum, we estimate that a 5 percentage point tax increase would yield between \$18 billion and \$30 billion in additional revenues.

Absent any behavioral response, which corresponds to an elasticity of zero, tax revenues from this 5 percentage point tax increase would increase revenues by \$44.5 billion. Thus, depending on the specification, our estimates indicate that at current tax rates, between a third and half of the mechanical revenue gains are lost due to behavioral effects.

Our central elasticity estimate is lower than those in most existing studies, and our estimated revenue-maximizing tax rate is correspondingly higher. In particular, it is interesting to compare our estimated elasticity to that used by the JCT to evaluate the budgetary impacts of tax reforms. They currently assume an elasticity with respect to the tax rate of 0.68 (Gravelle 2021), substantially higher than our estimate. This elasticity would imply a revenue gain from a 5 percentage point tax increase of only \$10.6 billion, or that about three-quarters of mechanical revenue gains are lost due to behavioral effects. Online Appendix Figure A.1 compares our elasticity estimate, implied revenue-maximizing tax rate, and revenue impact with estimates implied by previous studies. Note that all of these estimates apply to the current capital taxation regime with unlimited deferral and step-up in basis at death.

V. Conclusion

This paper estimates the effect of state capital gains tax changes on realizations at the state level. These estimates reflect the responsiveness of both capital gains realizations as well as the migration of the wealthy. These overall effects at the state level are of interest in their own right, as many states consider revenue-raising options to address budgetary pressures. We hope that estimates of how state-level realizations evolve around state capital gains tax changes may serve as useful inputs into this process as well as to the literature on state taxes, capital gains behavior, and migration.

We also provide policy-relevant elasticities at the federal level, which use a new framework to account for migration responses on the wealthy and other aggregation adjustments. Our main estimate is an elasticity of realizations with respect to the tax rate of -0.5 to -0.3 depending on the specification.

These main elasticity estimates are notably smaller than estimates used by official analysts to score federal tax reforms (Gravelle 2021). We hope that these elasticity estimates, as well as their implications for revenue-maximizing rates and tax revenue effects, will be considered when evaluating reforms to capital gains taxation, although we note that using these estimates to evaluate large tax rate changes may require extrapolation beyond the observed variation in our sample. In addition, revenue-maximizing rates may exceed welfare-maximizing rates to the extent that capital gains taxes reduce investment below optimal levels or create lock-in effects that misallocate capital. Overall, our bottom-line finding is that raising capital gains tax rates has sizable revenue-raising potential and that cutting capital gains tax rates has substantial fiscal cost.

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