

THE SENSITIVITY OF THE TAX ELASTICITY OF CAPITAL GAINS TO LAGGED TAX RATES AND MIGRATION

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May 2024

ABSTRACT

Understanding how capital gains realizations respond to changes in capital gains tax rates is critical for understanding the potential revenue effects of these changes. A frequently relied on estimate of this responsiveness, or elasticity, comes from Dowd, McClelland, and Muthitachoen (2015). Using individual-level federal tax return data, they found a short-term (within the current year) tax elasticity of -1.2 and a long-term (beyond the current year) tax elasticity of -0.72. More recently, several studies have found smaller long-term elasticities in absolute value, suggesting less taxpayer responsiveness and a larger potential revenue gain from higher capital gains tax rates. This paper replicates the original Dowd, McClelland, and Muthitachoen (2015) estimates and investigates their sensitivity to model specification changes including additional lagged tax rates, dropping taxpayers that migrated across states, and limiting the sample to millionaires. We find that introducing additional lags reduces the elasticity to between -0.41 and -0.59, with the most lags producing the largest elasticity. Restricting to taxpayers who don't move to another state increases the elasticity to -0.65. We are unable to produce precise estimates for our sample of millionaires. Although more research is necessary, this suggests that an elasticity of -0.6 may better capture the effect of tax rates on gains.

In 2020, taxpayers reported more than \$720 billion in long-term capital gains. These gains are subject to preferential tax rates; the maximum federal tax rate on long term capital gains was 23.8 percent in 2020 compared to 37 percent on wages, interest, and other forms of “ordinary income.”

Proponents of the preferential rate argue there are a variety of reasons to provide preferential treatment to capital gains held for more than one year. Taxpayers can choose when to realize capital gains, making it relatively easy to avoid taxation by not realizing the gains. A higher tax rate could both reduce realizations and potentially create an inefficient lock-in effect, where taxpayers hold assets longer than market forces would normally dictate to avoid the tax implications of selling. Moreover, higher tax rates could reduce the incentive to invest in productive capital assets. Additionally, capital gains on corporate equities often represent income that has already been taxed at the corporate level. Opponents of the preferential rate for capital gains argue that the benefit accrues to wealthier, higher-income individuals, reducing the progressivity of the federal income tax system.

Because of these competing views on the correct tax treatment of capital gains, there has been much research on the degree to which taxpayers time their realizations in order to reduce their tax liability. Dowd, McClelland and Muthichaeron (2015) (DMM hereafter) estimated that a permanent 10 percent increase in capital gains tax rates would decrease realizations by about 7 percent. In their study, they use a panel of taxpayers over a 10-year period and relate the change in gains to changes in tax rates in prior, current, and future years. The inclusion of the tax rate in the future year is important, because taxpayers can realize capital gains in advance of a pending tax increase or defer realizations in advance of a pending tax cut¹. The inclusion of the prior year’s tax rate allows for an adjustment period. However, it is possible that taxpayers respond over a longer time horizon.

Dowd and McClelland (2019), using a completely different method and dataset, found that realizations would decrease by about 8 percent if rates were raised 10 percent. These responses can be summarized as “permanent elasticities” of -0.7 and -0.8. Bakija and Gentry (2014) used aggregate state-level data from 1950 to 2007, finding an overall elasticity of -0.66, a statistically insignificant difference in results from DMM.

Other studies have found lower elasticities, suggesting a larger potential revenue gain from increasing capital gains tax rates. For example, Agnersnap and Zidar (2021) used a panel of aggregate state-level data from 1980 to 2016, relating changes in gains to changes in tax rates in the prior 10 years, the current year and 10 future years. They also found that changes in tax rates led to substantial migration of owners of capital assets into states with higher or lower tax rates, even over a two-year period. Overall, they found an elasticity of -0.3 to -0.5². In some of their specifications, they also controlled for other taxes that might affect aggregate realizations³.

McClelland and Smith (2023) used the DMM model on a panel of individual data from 2012 through 2021. They focused on those taxpayers with more than \$1 million of taxable income (without long-term capital gains). They found an elasticity of -0.35, but the elasticity was about -0.6 when a dummy variable for California was included⁴.

In this research, we extend the original DMM dataset by three years, allowing us to relate gains to tax changes in the past four years, as well as the current and future year. If using only one lag biased the original DMM results, estimates using

four years of lags would only be biased if taxpayers were substantially adjusting their portfolios five years after a tax change. Alternatively, results could be biased if taxpayers with a relatively large gain had not reverted to their long-run average four years later.

In addition, we isolated the effects of state migration by re-estimating DMM's model but drop all taxpayers who changed states of residence during the study period. Finally, we re-estimate the model on a sample of taxpayers with at least \$1 million in taxable income excluding long-term capital gains.

We find that using two lags lowers the permanent elasticity to -0.49 and using three lags lowers it to 0.41, but using four lags returns the elasticity to -0.60. Limiting the data to taxpayers that did not change states of residence results in an elasticity of about -0.55 with one lagged tax rate and -0.65 with four lagged tax rates—only slightly lower than the original estimate. While McClelland and Smith (2023) include taxpayers with \$1 million or more in non-gains income in their estimates, this paper finds that estimating the model only on millionaires with our panel data results in confidence intervals so large that we are unable to make any useful inferences about the elasticity.

Capital gains are the difference between the proceeds from the sale of an asset and its cost when purchased, after adjusting for improvements, depreciation, and purchasing costs. Gains from assets held more than a year are designated long-term capital gains and subject to preferential tax rates⁵. Gains from assets held less than a year are considered short-term gains and taxed at the same rate as ordinary income, such as wages and salaries⁶. When a taxpayer dies, the basis is reset to the asset's market value and the asset passes income-tax-free to the decedent's heirs. This provides a strong incentive for taxpayers with capital assets to not realize gains during their life.

When determining overall taxable income from realized gains, net long-term gains occur when long-term gains exceed long-term losses. If losses exceed gains, the taxpayer has net long-term losses. Similarly, net short-term gains occur when short-term gains exceed losses, and net short-term losses occur when short term losses exceed gains. Net-short term losses are subtracted from long-term gains. Net losses of up to \$3,000 can be used to reduce taxable income from other sources. Losses in excess of \$3,000 can be carried forward and used to reduce net gains in future tax years.

DATA

We use the same data as DMM: a 10-year panel of federal tax returns over tax years 1999 to 2008, created by the Internal Revenue Service's Statistics of Income Division (SOI). The data are a stratified random sample of returns selected in tax year 1999, augmented to include data from the Social Security Administration on age and gender of the primary taxpayer and spouse⁷. The data include items on federal tax form 1040 and schedules, including Schedule D, which contains information on capital gains and losses.

In tax year 1999, the panel data contained 88,123 tax returns, equivalent to 123 million returns once population-based weights are applied. By tax year 2008, the sample shrinks to 75,402 tax returns due to attrition.

We restrict our sample to taxpayers who did not have a change in their marital status and did not have a change in their population weight of more than 5 percent from 1999 to 2008. We further restrict the sample by dropping all dependent returns and keep only adult returns. We also drop tax returns with a long-term capital gains tax rate in excess of 40 percent and any return with a missing value for a variable needed in the estimation process. These restrictions leave us with a 1999 sample of 61,335.

In this research we extend the dataset back to 1996, allowing us to calculate tax rates for three additional years (1996, 1997, and 1998). We therefore estimate a model with four previous years of tax rates rather than just one. While it is possible that, even after four years, some taxpayers have not adjusted to a change in tax rates, we assume that most taxpayers, or those responsible for most gains, have.

The original dataset in DMM used the tax calculator described in Bakija (2009) to generate federal and state marginal tax rates by year for each observation. In this research, we use the current generation of that tax calculator on the tax years 1996 to 2008 (Bakija, 2022). To test the latest version of the calculator, we apply it to the original dataset and find that the estimated elasticity was nearly identical.

As in DMM, we drop any return with a calculated total capital gains marginal tax rate of less than zero or greater than 0.4 (we believe that these come from phase-outs of various provisions).

EMPIRICAL MODEL

We estimate DMM's two-stage model but extend it by adding more lagged tax rates:

$$(1) \quad I_{it} = \sum_{j=1}^4 \alpha_j \tau_{i,t-j} + \alpha_5 \tau_{it} + \alpha_6 \tau_{it+1} + X_{1it} \alpha_7 + \epsilon_{1it}$$

$$(2) \quad \ln g_{it} = \sum_{j=1}^4 \beta_j \tau_{i,t-j} + \beta_5 \tau_{it} + \beta_6 \tau_{it+1} + X_{2it} \beta_7 + \delta \lambda_{it} + \epsilon_{2it} \quad I_{it} = 1$$

where i indexes individuals, t indexes years. In equation (1) I_{it} is an indicator representing the decision to realize long-run capital gains, and in equation (2) $\ln g_{it}$, represents the natural log of net long-term personal gains before carryover losses are applied⁸. The tax variables τ_{it} are the combined federal and state marginal tax rates on long-term capital gains, λ_{it} is the inverse Mills ratio, and X_{1it} is a vector of control variables, with X_{2it} being a strict subset of X_{1it} .⁹ The control variable vector X_{it} includes imputed wealth variables, income, demographic variables, and brackets for the number of short-term transactions.

The variable excluded from the second stage is an indicator variable equal to one if there are losses in the prior year in excess of \$3,000, which can be carried over to reduce taxes in the current year. The presence of a carryover loss provides an incentive to realize long-term capital gains (so it belongs in the first stage), but it does not provide an incentive to realize a larger or smaller amount of gains of any particular magnitude (and so it can be omitted from the second). Because the inverse Mills ratio is evaluated using variables in the first stage, the carryover variable effectively acts as an instrument that causes independent variation in the ratio, allowing its coefficient to be identified.

To identify the coefficients on tax rates, we rely on independent variation in state-level tax rates. Over this time period, there was one significant change in federal tax rates (the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003), and numerous state-level changes. With the possible exception of migrating to low-tax states (which we investigate below), we assume taxpayers take these tax changes as given and adjust their behavior accordingly. For more details about this, and other aspects of data construction, see DMM¹⁰.

To calculate the permanent elasticity, we extend the model of DMM to four years of lagged tax rates.

$$(3) \eta_p = \tau_{ip} (\sum_{j=1}^6 \beta_j + \lambda_{it} \sum_{j=1}^6 \alpha_j)$$

where τ_{ip} is the permanent tax rate calculated, as in Auerbach and Siegel (2000), using τ_{t+1} and λ_{it} is the inverse Mills ratio. Standard errors are calculated using a bootstrap with 400 repetitions.

RESULTS

To begin, we re-estimate the model with the original DMM dataset, which had a single lag as shown in Table 1. Due to the correction of a coding error, we estimate a permanent elasticity of -0.78 rather than -0.72 found in DMM. In this model, we used the natural log of capital gains from the years 2000 through 2007, with tax rates calculated using the 2009 Bakija calculator.

We then added one additional lag in tax rates by shortening the period over which capital gains are estimated. In this model, we use the natural log of capital gains from 2001 through 2007, allowing us to use lagged tax rates going back as early as 1999. The permanent elasticity falls to -0.69, suggesting that realizations of capital gains are less responsive over a longer time-period, or that mean reversion may have biased the original results. Both results are statistically significant at the 1 percent level.

TABLE 1
Permanent Tax Elasticity of Capital Gains

Model	Elasticity	Standard Error	Second Stage Sample Size	First Stage Sample Size
Original years, tax rates				
One lag	-0.78	0.11	70,327	341,600
Two lags	-0.69	0.17	59,278	290,713
Additional years, new tax rates				
One lag	-0.75	0.13	68,859	331,474
Two lags	-0.49	0.12	67,844	322,764
Three lags	-0.41	0.13	66,956	315,352
Four lags	-0.59	0.14	66,105	307,713
Migration and millionaires, new tax rates				
No migration, 1 lag	-0.55	0.37	59,053	289,914
No migration, 4 lags	-0.65	0.32	56,740	270,063
Millionaires, 1 lag	0.22	0.73	27,141	46,426
Millionaires, 4 lags	0.80	7.95	21,094	36,088

Notes: Estimated elasticities are weighted estimates of equation 3. Standard errors are calculated from 400 bootstrap replications and are clustered by taxpayer.

We then estimate the model using between one and four lags with the current Bakija tax calculator. This yields a range of elasticities from -0.75 to -0.41. In each estimate, we use the natural log of capital gains from 2000 through 2007. When the model with four lags is estimated, tax rates as early as 1996 are used. The permanent elasticity with one lag reproduces the DMM model but with the current Bakija calculator, which leads to a slightly smaller elasticity in absolute value (-0.75 versus -0.78).

As with the original data and rates, using two lags results in a lower elasticity; in this case the elasticity is 0.49. Adding a third lag moves the elasticity toward zero (-0.41), while adding a fourth lag moves it to 0.59. Given the size of the standard errors, the difference in elasticities likely reflect sampling variation rather than an actual pattern of behavior.

Using the original DMM years with the current tax calculator, we then explore four additional models. In the first, we remove the effect of migration into and out of states as tax rates changed. This is important because Agersnap and Zidar (2021) found a strikingly large elasticity of migration. In their base specification, nearly one-third of the effect of tax changes came from migration, even over periods of two years or less.

If their estimate (which is calculated using the total number of residents rather than taxpayers realizing gains) is too high, their estimate of the combined effect of tax rates on those who stay will be too low. Using their results, we recalculate their elasticity under the assumption that taxpayers do not migrate immediately after a change in state tax rates of between 0 and 5 percentage points. We find that their elasticity in the baseline specification rose from -0.53 to -0.84. The elasticity in their specification that controls for other state taxes rose from -0.35 to -0.67.

We re-estimate our model using only those taxpayers that did not change states, which results in a 13 percent drop in sample size to 59,053 for the second stage regressions. This results in an elasticity of -0.55, although it is not statistically significant.

Next, we estimate the model for taxpayers that did not change their state of residence and use four lags. The estimate of the permanent elasticity rises to an absolute value to -0.65 and is now statistically significant at the 5 percent level. This represents a 13 percent reduction in the absolute value of the elasticity relative to the whole sample using only 1 lag.¹¹ These results suggest that the larger elasticities in Agersnap and Zidar's analysis, at least over a two-year period, may be closer to the correct values.

Finally, we limit the sample to those with more than \$1 million in taxable income. McClelland and Smith (2023) used the universe of taxpayer with more than \$1 million of taxable income (not including long-term capital gains) in 2018 dollars for the years 2012 to 2021. They found a tax elasticity of capital gains of only -0.35.

We do not limit our sample as stringently as McClelland and Smith (2023) because our dataset is only a sample rather than the entire study population. As a consequence, using their method on our data creates a very small subset. Instead, we limit the sample to those taxpayers with more than \$1 million in taxable income (not including long-term capital gains) over three consecutive years. This reduces our sample to 27,141 in the second stage regressions. The elasticity estimate is +0.22 and not statistically significant. Introducing four lags to the millionaire sample reduces the sample further to 21,094 and results in an even larger positive elasticity of 0.8 and very large standard errors. This is likely due to a relatively small sample and tax rates that are highly correlated over time.

The results for the coefficient on the inverse Mills ratio in equation (2) are important. It was positive in DMM and the original dataset using the current Bakija tax calculator. It was also positive and statistically significant when we added additional lags. The positive coefficient means that when taxpayers are more likely to realize a gain, they tend to realize large gains. However, the Mills ratio turns negative (and it is statistically significant) when restricted to millionaires, meaning that taxpayers tend to more frequently realize relatively small gains. The coefficient on the inverse Mills ratio in McClelland and Smith (2023) was also negative.

DISCUSSION

Our results suggest that the elasticity of taxable gains may be lower in absolute value than the values in DMM and Dowd and McClelland (2019). Using the original data and tax calculator, adding a lag reduces the elasticity to -0.69. Expanding the dataset and increasing the number of lags to four, we find an elasticity of -0.59. In no case are the elasticities as large in absolute magnitude as the elasticity with a single lag. These results suggest that including additional lags to the model is important and has a material role in the estimated elasticity.

We are unable to test the effects of limiting the sample to millionaires due to the smaller data set compared to McClelland and Smith (2023). However, we are able to investigate the effect migration has on the estimated elasticities. We estimate that a model incorporating additional lags and limiting to taxpayers that do not change their state of residence

results in a negative and significant elasticity of -0.65. While we examine four lags, it is possible that over longer time horizons taxpayers migrate to states with lower tax rates. However, because state migration does not change the amount owed to the federal government, this long-run response does not play a role in the elasticity to use for estimating changes in federal revenues from changes in federal capital gains taxes.

An important caveat to these results (and those of other researchers using state tax rate changes) is that state tax rate changes, while numerous, tend to be small. Extrapolating from small rate change effects onto much larger federal tax reforms may not be correct. Dowd and Richards (2021) explore this and some of the other hazards in using estimated tax elasticities for calculating revenues and revenue maximizing tax rates.

CONCLUSION

In this paper we use a panel dataset of individual tax returns to test the sensitivity of the tax elasticity of capital gains to different specifications. We replicate the Dowd, McClelland, and Muthichaeron (2015) result using the same data and tax rates generated from Bakija (2022). The DMM model used three tax rates to estimate the permanent elasticity: the lagged tax rate, the current tax rate, and the one-year-ahead tax rate. We add additional years of data to the panel so that tax rates can be estimated for the period 1996 to 2008. This allows us to introduce additional lagged values of the tax rate.

We find evidence that the inclusion of additional lagged tax rates reduces (in absolute value) the estimated tax elasticity of capital gains from -0.75 to an average of approximately -0.56 across the four different lag specifications, with the smallest in absolute value occurring with the three lagged tax rates and the largest occurring with just one lagged tax rate.

We also investigate whether the tax elasticity of capital gains is sensitive to the migration of taxpayers across states. The main driver for tax rate variation in our data are changes in tax rates at the state level. Agersnap and Zidar (2021), using aggregate state level data on capital gains realizations and state migration, found that a significant portion of the tax elasticity appears to be associated with taxpayers that change their state of residence.

In order to investigate the degree to which the permanent tax elasticity of capital gains is sensitive to migration from state to state, we restrict our analysis to only taxpayers that do not change their state of residence during our sample period of 1999 to 2008. We find that using the base DMM model of one lagged tax rate restricted to non-movers results in a reduction in the elasticity from -0.75 to -0.55. However, it is not statistically significant, with a standard error of 0.37.

Including three additional lagged tax rates, four in total, results in an elasticity of -0.65, statistically significant at the 5percent level. This result is very close to the elasticity of -0.59 from the four-lag tax rate model, with no sample restriction. We interpret this result as strongly suggesting that the migration of taxpayers is not a significant driver of the tax elasticity of capital gains. This is consistent with results from Young, Varner, Lurie, and Prisinzano (2016), who find that millionaire tax flight is only marginally statistically significant.

Finally, McClelland and Smith (2023) investigate the tax elasticity of capital gains for millionaires. They find that the elasticity is significantly lower for taxpayers that have income of \$1 million or more, excluding capital gains, for the period 2012 to 2018. We attempt to investigate this same issue for our time period. However, due to the sample size, our standard errors dramatically increase, and we are unable to make any conclusion regarding the tax elasticity for millionaires.

In sum, our best estimate is that the tax elasticity of capital gains ranges between -0.41 and -0.75, with a central tendency of -0.56. This is a 19 percentage point reduction from our original estimate using only one lagged tax rate. If taxpayers adjust their capital gains over a longer time frame, then the four-lag model with an elasticity of -0.59 may be appropriate. Furthermore, additional work looking at more recent time periods and a longer panel of taxpayers would allow for a more up-to-date estimate and the possibility of increasing the number of lags beyond four.

- ¹ See, for example, Slemrod (1995).
- ² A recent paper exploring the tax elasticity of capital gains in Canada finds that the repeal of a lifetime exemption increased long term capital gains realizations (Lavecchia and Tazhidinova, 2021).
- ³ Weber (2014) demonstrated that mean reversion can bias estimates of the elasticity of taxable income when comparing one-year changes in income to one-year changes in tax rates. In that paper, introducing as many as 8 lagged values to the regression analysis controls for the mean reversion observed in reported taxable income. A similar problem may exist in the tax elasticity of capital gains estimates with individual panel data.
- ⁴ This suggests that difference-in-difference models may be useful in future analyses.
- ⁵ For tax year 2023, the preferential rates for capital gains are 0%, 15%, and 20%, for taxpayers that are otherwise taxed at ordinary rates between 10% and 37%. In addition, taxpayers with adjusted gross income in excess of \$200,000 for single filers (\$250,000 for married filing joint) are subject to the Net Investment Income Tax of 3.8 percent.
- ⁶ Dowd and McClelland (2019) exploit this holding period difference by comparing the average realization before and after the one-year mark to the average tax rate before and after one year.
- ⁷ The data are stratified to include an oversample of high income taxpayers. See Weber and Bryant (2005) for a detailed description of the stratification and selection process of the 1999 edited panel.
- ⁸ See Burman and Randolph (1994) and Auerbach and Siegel (2000) for earlier versions and similar specifications. Long term personal capital gains are those that are reported on line 8 of schedule D, part II.
- ⁹ The inverse Mills ratio is the ratio of the standard normal density to the standard normal cumulative distribution function evaluated using variables in the first stage, and it adjusts for the selection bias that occurs because many taxpayers do not realize long-term gains. Excluding a variable from the second stage causes independent variation in the first stage, and hence also in the inverse Mills ratio. In effect, the excluded variable acts as an instrument for the inverse Mills ratio.
- ¹⁰ Because tax rates are endogenous, we use an instrumental variables approach, with the first-dollar marginal tax rate variables and the maximum combined federal and state tax rate variables. The first-dollar tax rate variable is computed with the amount of realized gains, state income taxes, property and sales taxes, charitable contributions, and passive and active losses from partnerships and S corporations all set to zero.
- ¹¹ This is consistent with Young, Varner, Lurie, and Prisinzano (2016), who used a census of million-dollar income earners and found that migration across states due to changes in taxes only occurred “at the margins of statistical and socioeconomic significance”.

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This research embodies work undertaken for the staff of the Joint Committee on Taxation, but as members of both parties and both houses of Congress comprise the Joint Committee on Taxation, this work should not be construed to represent the position of any member of the Committee.

The authors would like to thank Len Burman, Tracy Gordon, and attendees of the Fall 2023 conference of the National Tax Association for their comments, and Eric Heiser for his research assistance.

Robert McClelland's research was funded by Arnold Ventures. We are grateful to them and to all our funders, who make it possible for the Urban-Brookings Tax Policy Center to advance its mission.

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