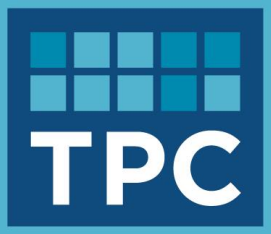


TAX POLICY CENTER
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# INVESTOR RESPONSIVENESS TO CAPITAL GAINS TAXES DURING THE GREAT RECESSION

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# ABSTRACT

This paper uses a large panel of transaction-level capital asset sales data to investigate whether tax responsiveness varies with economic conditions. We estimate the tax elasticity associated with a large notch in the capital gains tax schedule, when the tax treatment changes from higher, ordinary income tax rates to lower, preferential tax rates. We estimate this elasticity for each year from 2007 to 2012. Surprisingly, these elasticities were highest during the throes of the financial panic.


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# CONTENTS

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Tim Dowd and Jacob Mortenson's work on this report 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. This work is integral to the Joint Committee on Taxation staff's work and its ability to model and estimate the effects of changes in the tax treatment of capital gains.

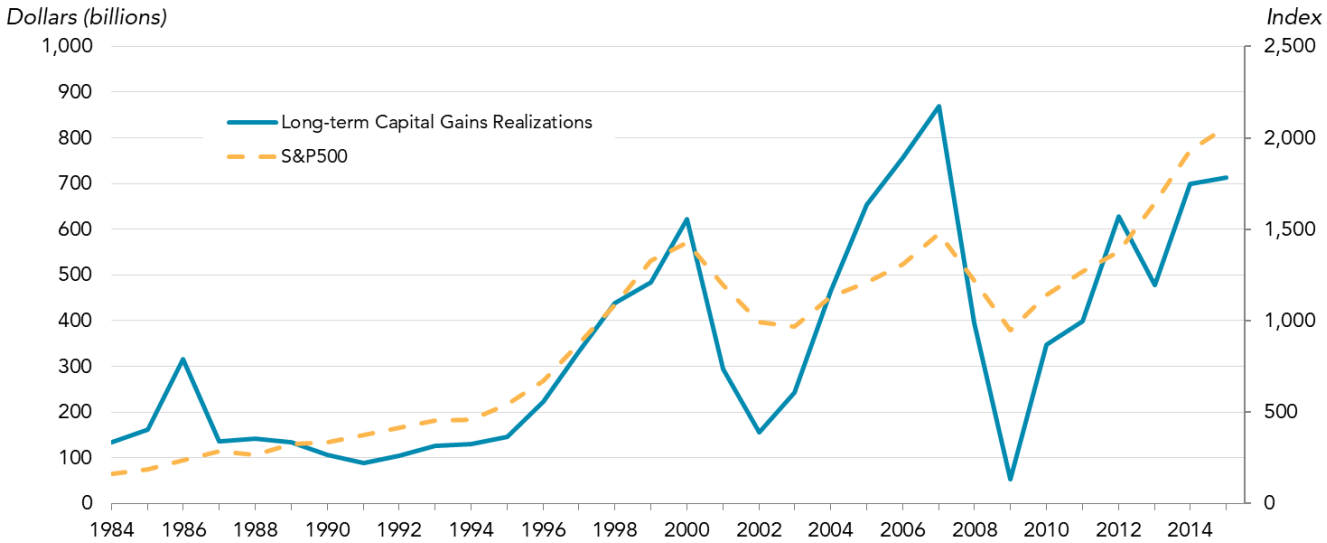
Between January 2003 and October 2007, the Standard and Poor's 500 Index (S&P 500) increased by approximately two-thirds. The onset of the Great Recession in 2008 and 2009 substantially reversed this trend. Between October 2007 and March 2009, the S&P 500 declined in value by over 50 percent, dropping over 25 percent below its (nominal) value in January of 2003. Other asset classes, residential real estate in particular, experienced a similar rise and fall in value. These dramatic swings in asset prices caused many investors to sell assets in a panic and caused other investors to purchase assets at perceived low prices (Hoopes et al. 2016). In the aftermath of the recession, asset prices slowly rebounded, and the S&P 500 did not regain its October 2007 nominal value until early 2013.

Capital gains realizations, which are subject to federal and state income taxes, closely track variation in asset prices of publicly held securities. Figure 1 displays the amount of realized capital gains in the United States in each year from 1984 to 2015 along with the nominal level of the S&P 500. Tax responses are clearly visible in years preceding tax reforms, such as 1986 and 2012, as are realizations corresponding with run-ups in asset prices (e.g., in 2007).

FIGURE 1

## Long-term Capital Gains & S&P500

1984–2015




**Source:** IRS Statistics of Income data, authors' calculations, and S&P Dow Jones Indicies LLC, S&P [SP500], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/SP500, August 27, 2019.

Although less recognized, these dramatic swings in asset values should also affect the responsiveness of capital gains to taxation for at least three reasons. First, investors' limited attention may turn to more urgent factors, such as the possible collapse of financial firms, and away from changes in tax rates. Second, these swings may make investors more risk averse and less willing to wait for the period when preferential tax rates

apply to realize gains. Finally, as discussed by Dowd and McClelland (2019), the responsiveness of realizations is partially determined by the pool of unrealized gains. When that pool shrinks, the scope for realizing gains in response to tax cuts shrinks as well.

In this report, we use a large set of nationally-representative, transaction-level tax data and variation in tax rates associated with the length of time an asset is held to investigate how business cycle fluctuations affect investor responsiveness to capital gains taxes. We start by examining the behavior of gains at a quarterly level. Although the data are too sparse to estimate elasticities, simply plotting the data reveals the contours of the financial crisis and bear market.

We then estimate capital gains tax elasticities separately for each year from 2007 to 2012, allowing us to examine the variation of timing responses through the recession and financial panic in 2009. To estimate these elasticities, we draw on recent research on the bunching of capital gains realizations for tax year 2012 (Dowd and McClelland 2019). We conclude that investors exhibit timing responses even during the financial crisis.

Our work directly contributes to the small body of work exploring the relationship between taxpayer responsiveness and the business cycle. The most notable paper in this literature comes from Hargaden (2018), who finds that responses to notches in an Irish tax schedule disappear during the Great Recession. Our work also contributes to bodies of research estimating income responses to tax reforms, capital gains tax elasticities, and investor responsiveness to asset fluctuations. Recent estimates of transitory and permanent tax elasticity of capital gains are about -1.2 and -0.7, respectively (Dowd, McClelland and Muthitacharoen 2015). Several papers investigate the effects of the reported income response, including capital gains realizations responses, to the recent tax increases in 2013 (Auten, Splinter and Nelson 2016; Saez 2017). Our research is also related to work on the responsiveness of investors to market conditions and their portfolio performance and choice (Poterba 2001; Hoopes et al. 2016; Poterba, Venti and Wise 2013).

## THE TAXATION OF CAPITAL GAINS

Income from the appreciation of capital assets is taxed at the time of sale. If capital assets are held for less than a year, gains from their sale are considered short-term gains and are taxed as ordinary income. If the assets are held for at least a year before sale, gains are considered long-term gains and are taxed at lower, preferential tax rates.

Taxable gains can be reduced by realizing losses in the same year. However, the rules governing how losses are matched with gains are not simple. Short-term losses are subtracted from short-term gains and long-term losses are subtracted from long-term gains. If the taxpayer has a net short-term loss, that loss is subtracted from net long-term gains. If the taxpayer has a net long-term loss, it is subtracted from net short-term gains. If overall net losses exceed net gains, up to $3,000 of losses can be used to offset ordinary income. If the taxpayer has both net short-term and net long-term losses, short-term losses are first used to offset up to $3,000 of ordinary

income and long-term losses can be used for any remaining offset (if net short-term losses are less than $3,000). Beyond the $3,000 that can be used to offset ordinary income, net short-term losses can be carried over into the following year to offset future short-term gains. Similarly, net long-term losses can be carried over into the following year to offset future long-term gains.

## DATA

We use a unique dataset drawn from a panel of tax returns from 2007 to 2012. The Statistics of Income division of the Internal Revenue Service (SOI) edits and processes tax returns to examine the sales of capital assets (SOCA) database. They contain all lines from Schedule D of Form 1040, which separately list all short and long-term transactions.[1] We also merge the transaction-level data information to data from the front page of the Form 1040; those data allow us to estimate federal and state marginal tax rates, including both ordinary income tax rates and preferential tax rates on long-term capital gains realizations. We use the National Bureau of Economic Research's TAXSIM model for these estimates.[2]

The data are structured as a panel, and prior to any aggregation, each observation consists of a sale by a taxpayer at a point in time. Taxpayers are sampled in the base year, 2007, to create a cross-section of capital asset sales in that year. The taxpayers from that year are then tracked through 2012. The initial sample is stratified to capture more returns with high incomes.[3] Beginning in 2008, supplementary taxpayers are added in every year to account for attrition of taxpayers, and to ensure the sample is representative of the tax filing population in each year. Hence, the panel is unbalanced but representative of the population in each year. We drop tax returns filed by dependents and limit the transactions we analyze to those with non-missing purchase price (basis) and dates of purchase and sale.

These realizations are aggregated by the number of weeks that they are held. For example, realizations on assets held for 18 weeks in a given year are aggregated, with means, medians, or sums calculated for that week. Because this aggregation method doesn't keep track of the taxpayer's relative gains and losses through the year, we abstract from the timing issue by restricting our sample to taxpayers with a net positive capital gain at the end of the year. This restriction likely creates a sample of investors with fewer and smaller losses than is typical in the population, especially in 2009. We also limit transactions to assets held for at least 24 days, which avoids capturing the behavior of investors focused entirely on short-term gains, and to assets held no more than 740 days, which avoids capturing behavior by investors who are focused on long-term gains over much longer time periods.

Table 1 reports the summary statistics for our sample of transactions. The table contains the number of taxpayer observations and the number of transactions for our base data, prior to any aggregation. For tax year 2007 we are able to use the full SOI cross-section SOCA data with about 83 thousand taxpayer observations. In each of the years after 2007, the panel members of the 2007 forward panel are tracked, as are the additional members that are added to keep the sample representative of the tax filing population in each year. The number of unweighted taxpayer observations drops by about half in the years after 2007 while the size of the weighted sample falls by about 12 percent. Across all the years and without restricting the data to an approximate holding period of two years, there are a total of 17 million transactions in the sample that weight up to 1.3 billion transactions for the population. Restricting the sample to transactions held no more than 740 days reduces the number of transactions to 12.2 million unweighted and 849 million weighted transactions. Measured by the weighted number of transactions, 2008 had the largest number of sales and 2010 had the fewest.

TABLE 1

## Taxpayer Panel Data

Values in thousands

| Year | Taxpayer Observations | | Transactions | | Transactions held < 741 days | |
|---|---|---|---|---|---|---|
| | Unweighted | Weighted | Unweighted | Weighted | Unweighted | Weighted |
| 2007 | 83 | 16,988 | 5,966 | 225,757 | 4,371 | 144,978 |
| 2008 | 41 | 15,886 | 3,034 | 274,339 | 2,178 | 180,225 |
| 2009 | 39 | 14,791 | 2,351 | 218,762 | 1,715 | 145,423 |
| 2010 | 39 | 14,716 | 1,592 | 179,432 | 1,116 | 111,272 |
| 2011 | 38 | 14,528 | 1,789 | 203,242 | 1,241 | 129,067 |
| 2012 | 41 | 14,942 | 2,325 | 228,050 | 1,568 | 138,596 |
| **Total** | **281** | **91,850** | **17,058** | **1,329,582** | **12,189** | **849,561** |

**Source:** IRS Statistics of Income data and author's calculations.

In Table 2, we present summary statistics for transactions aggregated by the number of weeks assets were held before sale. The second and third columns present the average short- and long-term gain. The remaining columns summarize the tax rates (combined state and federal) separately for population weighted and gains weighted rates. The population-weighted rates are those faced by a typical investor; the gains-weighted rates are those faced by a typical dollar of capital gain. Because capital gains are concentrated among very–high income taxpayers, a large share of capital gains dollars are realized by those facing the maximum statutory tax

rates. This means that the tax rate faced by the typical dollar of capital gain is larger than the tax rate faced by the typical person.

TABLE 2

## Holding Week Aggregated Data

Values in thousands

| | Panel A: Holding Week Aggregated Data | | | | | |
|---|---|---|---|---|---|---|
| | Average Combined Federal and State Tax Rate | | | | | |
| | Average Gains | | Population Weighted | | Gains Weighted | |
| Year | Short Term | Long Term | Short Term | Long Term | Short Term | Long Term |
| 2007 | 931 | 1,668 | 22.4 | 15.9 | 25.3 | 18.0 |
| 2008 | 1,083 | 1,750 | 5.6 | 4.8 | 12.2 | 10.2 |
| 2009 | 1,120 | 1,389 | 7.7 | 6.4 | 12.5 | 8.7 |
| 2010 | 863 | 1,801 | 10.2 | 7.8 | 16.0 | 11.5 |
| 2011 | 894 | 1,556 | 11.2 | 8.7 | 16.1 | 12.9 |
| 2012 | 694 | 1,227 | 15.5 | 11.1 | 20.9 | 14.9 |
| **Total** | **922** | **1,574** | **12.9** | **9.7** | **18.6** | **13.7** |

| | Panel B: Holding Week Aggregated Data Taxpayers with Net Gain | | | | | |
|---|---|---|---|---|---|---|
| | Average Combined Federal and State Tax Rate Gains Weighted | | | | | |
| | Average Gains | | Netting of Losses | | No Netting of Losses (Gross Gains) | |
| Year | Short Term | Long Term | Short Term | Long Term | Short Term | Long Term |
| 2007 | 928 | 1,760 | 29.8 | 19.8 | 32.5 | 19.8 |
| 2008 | 1,962 | 4,771 | 26.5 | 18.3 | 30.0 | 18.3 |
| 2009 | 1,604 | 2,935 | 30.1 | 19.4 | 31.2 | 19.4 |
| 2010 | 1,249 | 3,241 | 29.6 | 20.2 | 31.7 | 20.2 |
| 2011 | 1,146 | 2,165 | 27.2 | 20.1 | 30.8 | 20.1 |
| 2012 | 799 | 1,544 | 29.9 | 20.1 | 32.9 | 20.1 |
| **Total** | **1,085** | **2,094** | **29.2** | **19.8** | **31.9** | **19.8** |

**Source:** IRS Statistics of Income data and author's calculations.

The two separate panels, A and B, differ in their sample. Panel A includes all investors, subject to sampling criteria, regardless of their end-of-year gains position (i.e., positive or negative). Panel B is limited to those taxpayers that end the year in a positive gains position.

Panel A contains some surprising statistics. Tax year 2012 had the smallest average gain for both short and long term realizations ($694 and $1,227, respectively), while 2008 had the highest long-term gains ($1,750) and 2009 had the highest short-term gains ($1,120). This would occur if the financial crisis lowered or eliminated the gains of those investors who typically realize smaller gains but had a smaller effect or no effect on those realizing larger gains.

In 2007 the tax rate faced by the typical person realizing a long-term gain was 15.9 percent, while the rate faced by the typical dollar realized was 18.0 percent. Similarly, the tax rate faced by typical person realizing a short-term gain was 22.4 percent, while the typical dollar of capital gain faced a tax rate of 25.3 percent.

Scanning the columns over the years reveals considerable variation in the average amount of gains realized and in both the average short-term tax rate and the average long-term tax rate, regardless of whether it is weighted by population or gains. This occurs because the tax rate on net capital gains is determined by a taxpayer's income over the year, and the tax rate on net capital losses is zero. During times when most capital assets are generally appreciating, many investors end the year with net capital gains rather than net capital losses. In this case, average tax rates are high. When asset prices broadly decline, many investors end the year with capital losses. In that case, the average tax rates fall because investors have incomes in lower tax brackets or because investors have capital losses.

Variation in tax rates during the financial panic was quite large. When assets were appreciating in 2007, tax rates were high regardless of weighting because most investors had net capital income at the end of the year. In that year, the gains-weighted average short-term rate was 25.3 percent and average long-term rate was 18 percent. In 2008, when the stock market crashed, the rates fell to 12.2 and 10.2, respectively, despite the increase in average gains described above. However, these are gross gains rather than net gains for those investors who realized a gain in 2008. Population-weighted, short-term rates fell to 5.6 percent and long-term rates fell to 4.8 percent. From 2009 through 2012, tax rates rose each year as the financial system recovered. They did not reach 2007 levels, however, as investors lowered their rates by applying losses carried over from 2008 and 2009.

To avoid confounding our results with the loss mechanics, we next limit our analysis to those taxpayers in a net-gain position at the end of the year. Panel B describes the average short-term and long-term gains among those in a net gain position at the end of the year, and two measures of tax rates. Columns 2 and 3 report the average gain, which largely follows that reported in Panel A. Columns 4 and 5 report the average short and long term rate when we allow for netting of losses against gains.[4] Tax rates on gains are substantially higher than those reported in Panel A and the dip in 2008 and 2009 is much smaller because we are not averaging the tax rate on those with net gains with the zero rate faced by those with net losses. Losses still affect the tax rate, however, to the extent that losses reduce net income used to determine the tax rate. This effect can be eliminated by measuring the tax rate without calculating gains net of losses. Columns 6 and 7 report that these tax rates on gross gains are higher than the rates on net gains, although the increase is much smaller than the increase from panel A.

## ANALYSIS

In this section, we analyze capital gains realizations aggregated by the number of weeks the asset was held prior to being sold (i.e., holding period weeks). Because the marginal tax rate on realized capital gains depends on how long the asset is held, aggregating data by holding period week allows us to study how investors time their realizations in response to specific features of the tax system. We also measure the elasticity of capital

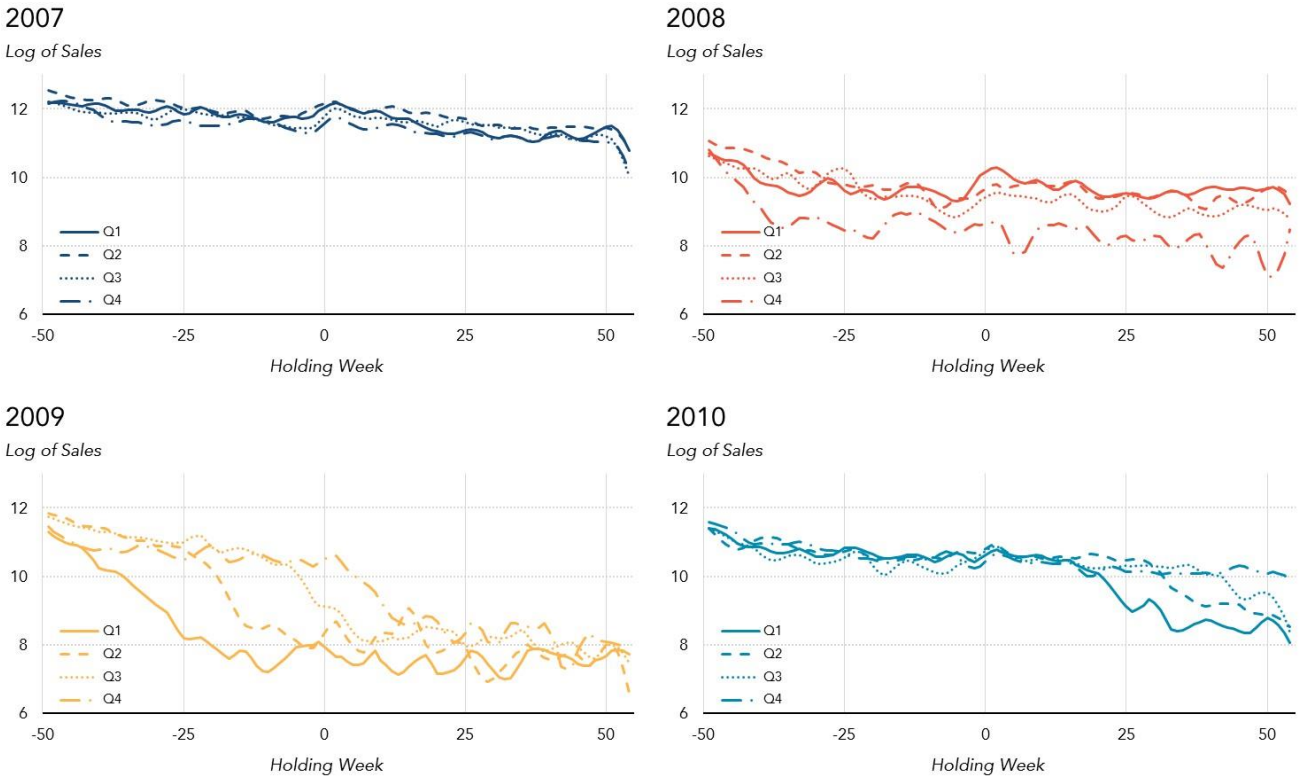
gains to tax rates in each year by comparing actual gains to those predicted to have been realized in the absence of a change in rates.

We start by using quarterly data to examine within each year how the financial crisis affected how long assets were held before sale. Because the smaller number of sales at the quarterly level results in noisier data, we smooth our results with a Loess regression.[5] We also focus on the number of transactions resulting in a gain rather than the value of the realizations themselves, because transactions follow the same general pattern as realizations but are not affected by the size of the realization.

In Figure 2, we plot the natural log of total transactions resulting in a net gain for each quarter between 2007 and 2010. In this and other figures in this section, week 1 is the first week in which gains are taxed at the long-term rate. Week -1 is the last week in which gains were taxed at the short-term rate, week -2 is the second to last week they were taxed at the short-term rate, and so on. Each panel of the figure displays the four quarters in a given year. In each of the four quarters of 2007 and the first three quarters of 2008 we see that sales decline the longer that assets are held. However, by the fourth quarter of 2008, the level of sales is much lower than in any quarter in 2008, and there is not a perceptible response to the 52-week discontinuity. The financial panic is most evident in the first quarter of 2009, where sales declined rapidly with the length of time the assets were held. Compared to 2007, assets sales are sharply lower for each holding period. We see the levels rebound gradually through the four quarters of 2009, but the responsiveness to the discontinuity is still largely absent until the local maxima at week zero returns in 2010.

FIGURE 2

## Log Total Sales by Weeks Held Relative to 52 Weeks: Quarterly, for 2007-2010

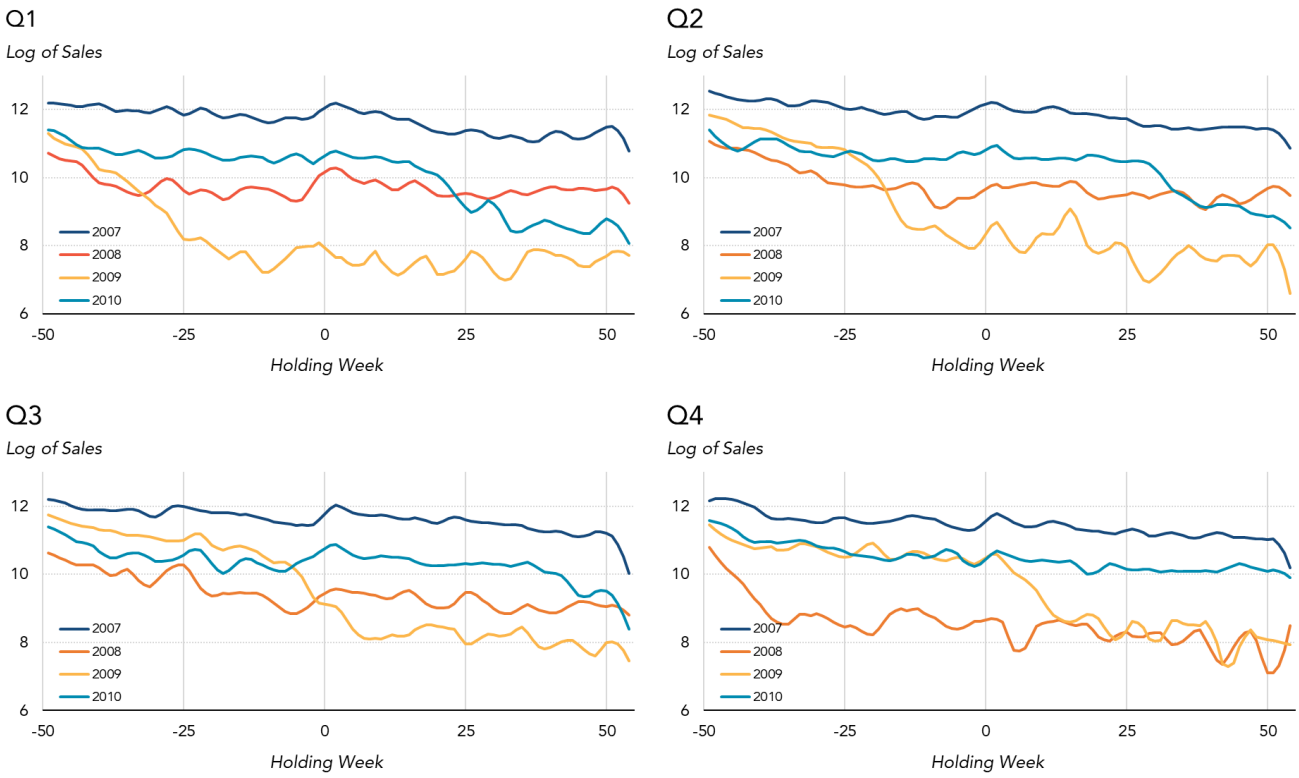



**Source:** IRS Statistics of Income data and authors' calculations.
**Note:** Each of the four panels separately displays total sales by holding week in each year for a given quarter. Total sales are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis shows log sales. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. The series are smoothed using a local regression (LOESS), with a span of 0.1.

Figure 3 conveys the same information, but the four panels of the figure are for each quarter, with the quarters for different years displayed separately within a panel. Beginning in quarter 4 of 2008, corresponding with the drop in the S&P 500 and other indices, the number of sales resulting in gains falls dramatically. Sales with short holding periods re-emerge in quarter 2 of 2009, but sales with holding periods qualifying for long-term capital gains do not return to the level and shape of quarter 3 2008 level until the fourth quarter of 2010.

FIGURE 3

## Log Total Sales by Weeks Held Relative to 52 Weeks: 2007-2010, by Quarter




**Source**: IRS Statistics of Income data and authors' calculations.
**Note:** Each of the four panels separately displays total sales by holding week in each year for a given quarter. Total sales are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis shows log sales. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. The series are smoothed using a local regression (LOESS), with a span of 0.1.

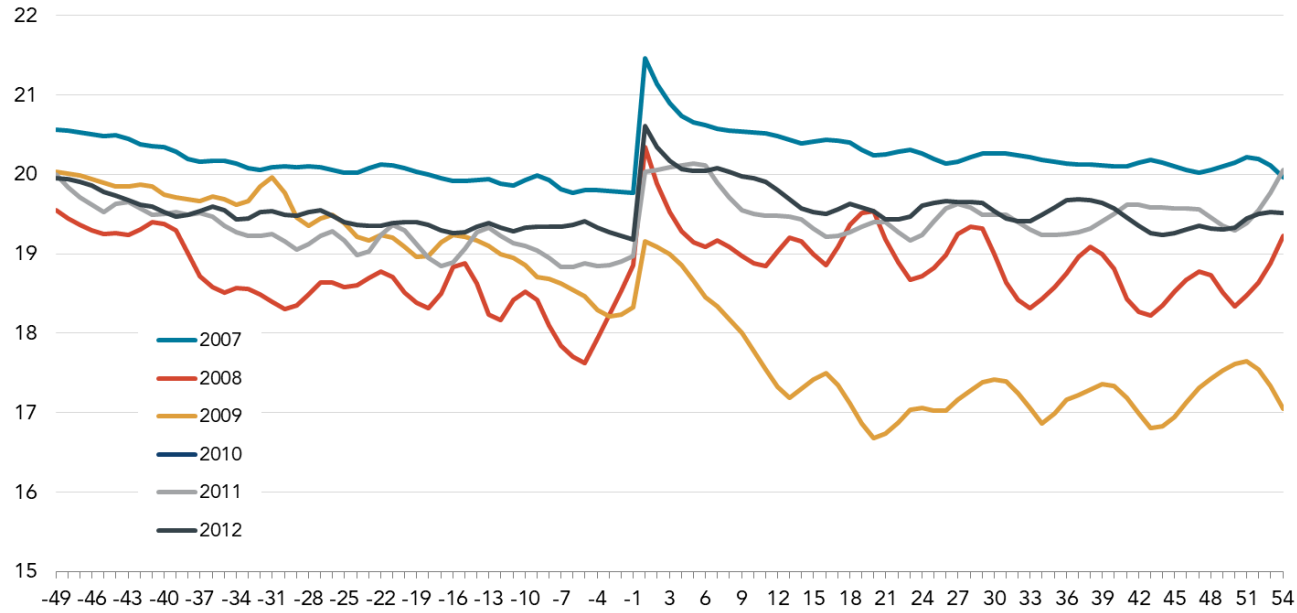
Figure 4 displays the natural log of total gains by the number of weeks held, for gains realized in each year from 2007 through 2012.[6] Gains in each of the years clearly show the presence of patient investors aware of the lower long-term rate for gains from the sale of assets held at least one year. Focusing on 2007, during the weeks prior to the one-year point, we see total gains declining each week as fewer gains are left to be realized. But some gains are held back, and at the first week in which the long-term rate applies, there is a discontinuity as gains spike. Gains again decline after the discontinuity, but they are generally larger than gains before the

discontinuity. That difference reflects the fact that lower tax rates on long-term gains than short-term gains results in more long-term gains being realized than short-term gains.

FIGURE 4

## Log Total Gains by Weeks Held Relative to 52 Weeks

2007–12




**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. The series are smoothed using a local regression (LOESS), with a span of 0.2.
are also excluded. The series are smoothed using a local regression (LOESS), with a span of 0.2.

In 2008, total short-term and long-term gains fell relative to 2007. They are also generally lower than gains in 2010–12, reflecting the bear market that ran from the fourth quarter of 2007 through the first quarter of 2009. Assets sold in 2008 were likely purchased during a bull market, but they were sold in a bear market. The pattern of short-term gains in 2009 is similar to the pattern in subsequent years, although assets held for a short time realized slightly larger gains, and those held between 40 and 52 weeks are lower. At 52 weeks, gains spiked, demonstrating that even during a tumultuous market, some investors waited for the long-term rate to apply before selling. Gains on assets held for more than 52 weeks were markedly lower than any other year, however. Opportunities for long-term gains were limited because, although asset prices began rebounding in 2009, many long-term gains came from assets purchased in 2008 before the market's nadir.

The years 2010 through 2012 show similar patterns to 2007, albeit at lower levels. Short-term gains fell as the holding period lengthened, followed by a sharp spike as investors waited for the long-term rate to apply before selling. Long-term gains also declined as holding periods lengthened, but again long-term gains settled at higher levels than short-term gains. Between 2010 and 2012, we see a similar upward spike as soon as the long-term rate applies. In each year, some investors extend their holding period to achieve the lower tax rate on

realized gains. For example, in 2010, gains jump from $220 million in the final week that the short-term tax rate applies to $1.2 billion in the first week the long-term rate applies.

To estimate the elasticities, we need to compare the actual pattern of gains with those that would have occurred in the absence of a rate change. Our counterfactual predictions use the predicted gains in each year based on the bunching method described in Kleven and Waseem (2013) and are broadened to include bunching over time on capital gains realizations as reported in Dowd and McClelland (2019). In this method, we fit a fourth-order polynomial to the curve shown in each of the figures, which includes a dummy variable for each week in a window beyond week 1. This is shown in equation 1:

$$G_t = \sum_{i=0}^{4} \beta_i t^i + \sum_{i=1}^{ub} \gamma_i I(t = i) + v_i \qquad (1)$$

where $G_t$ is the gains in week t, *ub* is the upper bound of the window starting at week 1, and *I*(·) is an indicator function equal to 1 when the relationship holds and 0 otherwise. The counterfactual pattern of gains is estimated as the predicted value from the estimated polynomial (omitting the effect of the dummy variables in the second summation) and is shown in equation 2:

$$\widehat{G_t} = \sum_{i=1}^{4} \widehat{\beta}_i t^i + \overline{G_L} \qquad (2)$$

where $\overline{G_L}$ is the average long-term capital gain for the year. The addition of $\overline{G_L}$ adjusts for the fact that the amount of long-term gains realized are, on average, higher at the long-term rate. For most years, this slightly increases predicted gains. In 2009, it decreased those gains. Using this method, predicted gains follow the trend of actual gains over time, but in the window following week 1, the trend is predicted without including the spike. The change in gains in week *t* induced by the tax change is $\widehat{G_t} - G_t$, and the total change in gains is the sum across all weeks in the window. In Figures 5 through 10 we plot both the actual gains and our predictions of the gains that would have occurred without a change in tax rates. In Figure 7, predicted gains drop sharply once the long-term rate applies. Predicted gains in weeks three through nine appears to be flat because of the effect of removing the mean $\overline{G_L}$. Below, we discuss the implication of that term for estimating elasticities.

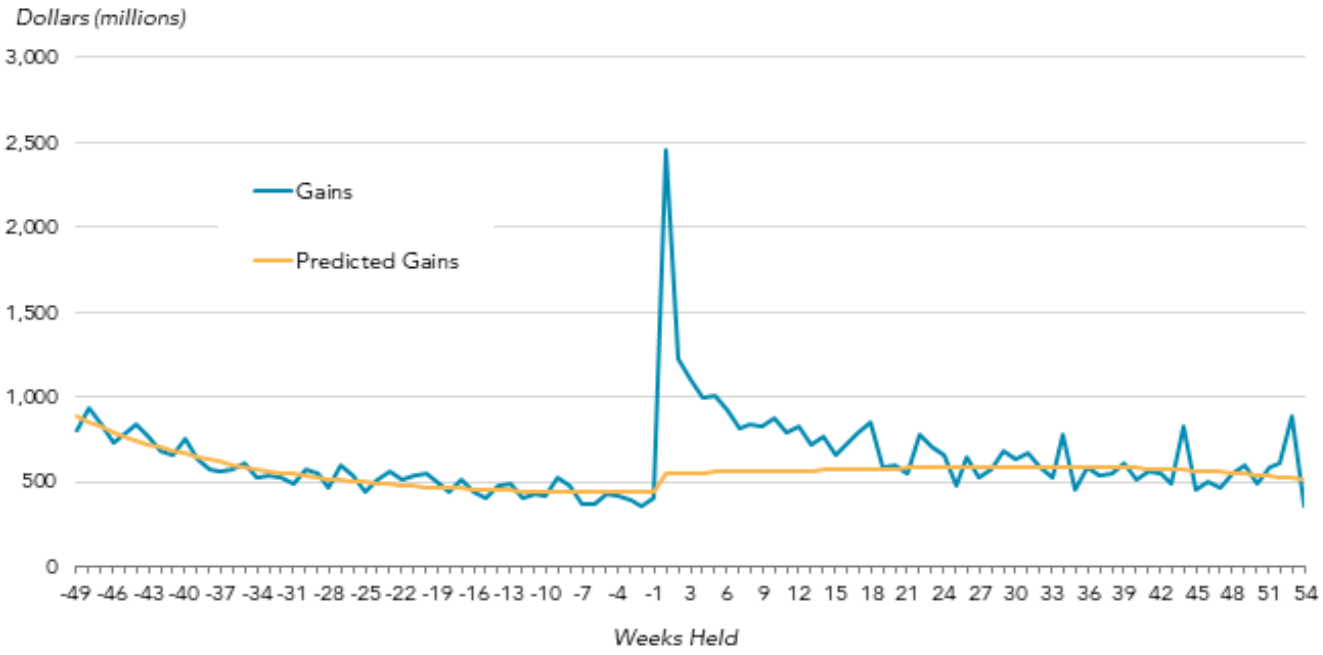
To define the window, we assume that short-term gains deferred to take advantage of the long-term tax rate are realized in week 1 or soon after, rather than many months later. For that reason, we initially set the upper bound to week 2 and we proceed as follows: the model in equation (1) is estimated and the counterfactual amount of gains in equation (2) is calculated. If actual gains in the week representing the upper bound (such as week 2) exceed the counterfactual gains, we increase the upper bound by one week and the process is repeated. When actual gains are the same or lower than counterfactual gains, the process stops.

Figure 5 shows the results of this process for tax year 2007. The blue line represents the actual gains aggregated by holding week. After assets are held for 52 weeks there is a striking surge in capital gains realizations to almost $2.5 billion. The yellow line depicts the counter-factual estimate of what gains realizations

would have looked like in 2007 if there had not been a change in the tax rate. At week 1 there is a slight discontinuity reflecting the increase in the average gain for assets held for long term assets.

FIGURE 5

Actual and Predicted Gains by Weeks Held Relative to 52 Weeks
2007



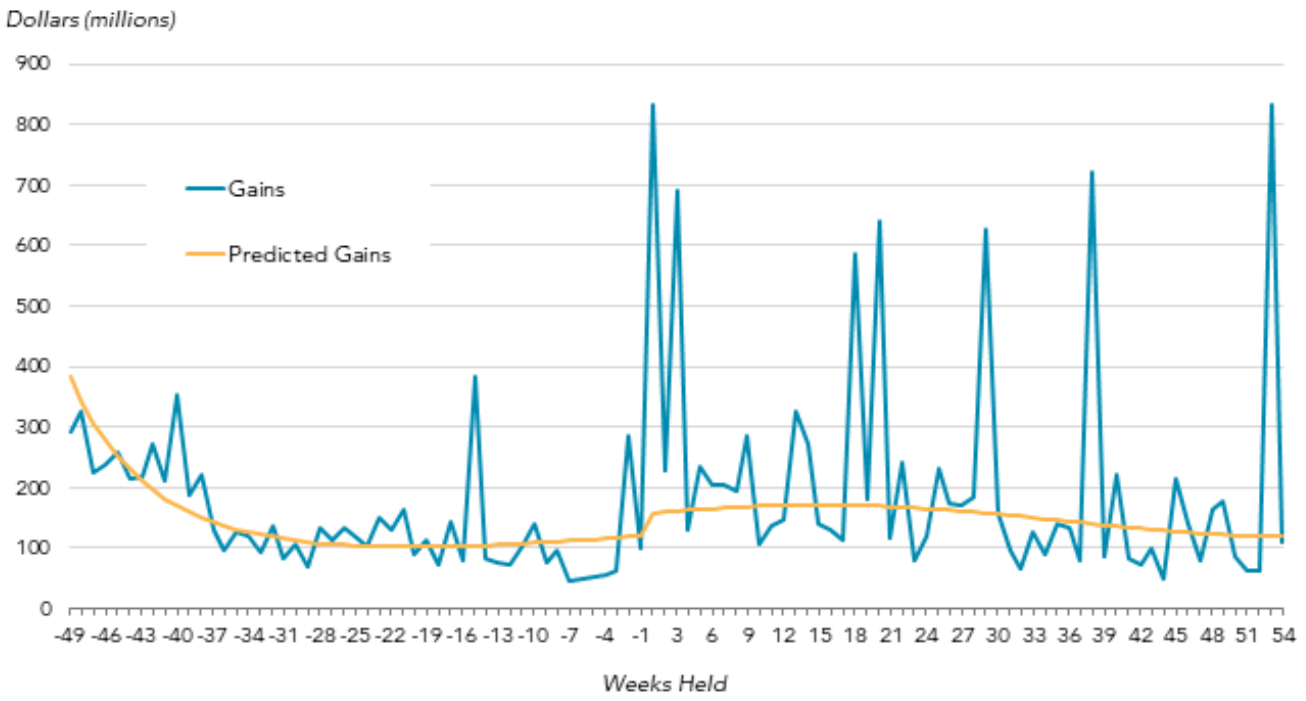

**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. Predicted gains are estimated as described in section 3.

Figure 6 shows the actual and predicted capital gains realizations for tax year 2008. The financial crisis in 2008 is exhibited in this graph with substantially more volatility and a lower level of capital gains realizations; the spike in realizations is just over $800 million and predicted long-term gains fluctuates between just over $100 million and $170 million compared with over $500 million in 2007.

FIGURE 6

## Actual and Predicted Gains by Weeks Held Relative to 52 Weeks

2008



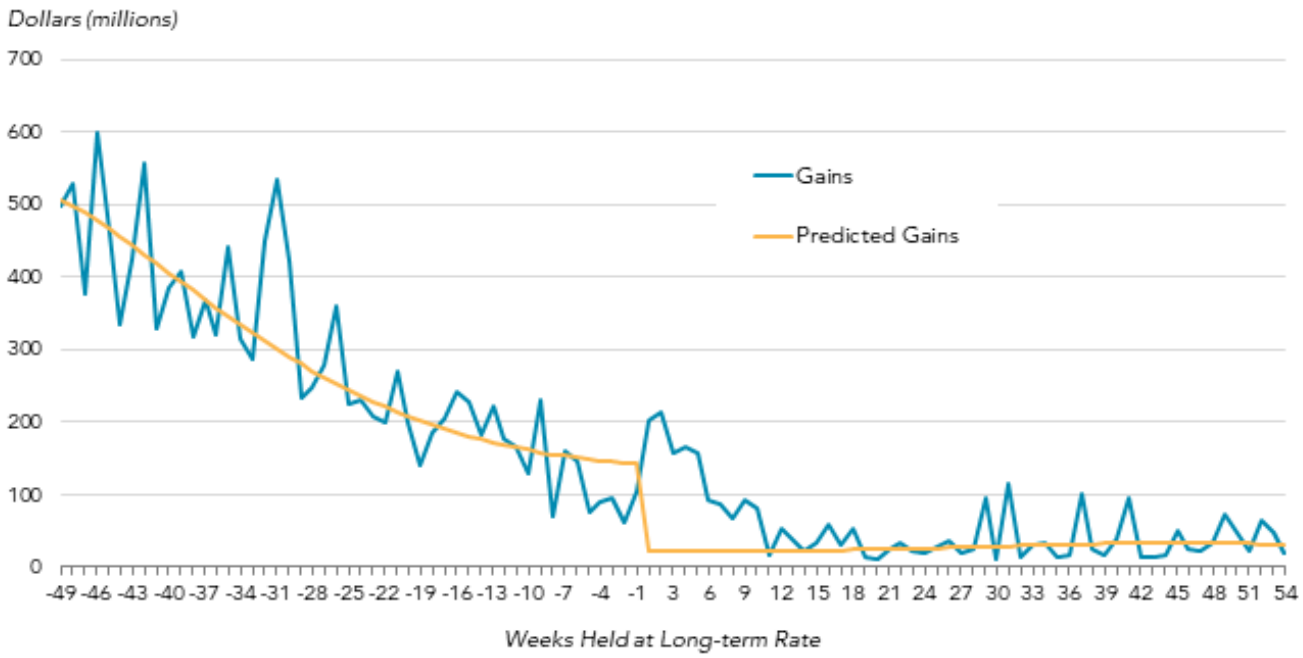

**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. Predicted gains are estimated as described in section 3.

Figures 7-10 show the actual and predicted capital gains realizations for the years 2009-2012. Like Figure 6, Figure 7 shows the collapse in capital gains realizations with a small spike in week 1. In contrast to 2008, in 2009 actual and predicted long term gains are lower than actual and predicted short term gains. Capital assets held for 18 months and sold in 2009 were likely bought near the peak of the market in 2007, resulting in little in the way of capital gains.

In Figures 8-10 for tax years 2010-2012, we see a return to the pronounced spike in capital gains realizations in week 1 with over $1.2 billion in capital gains in 2010.

FIGURE 7

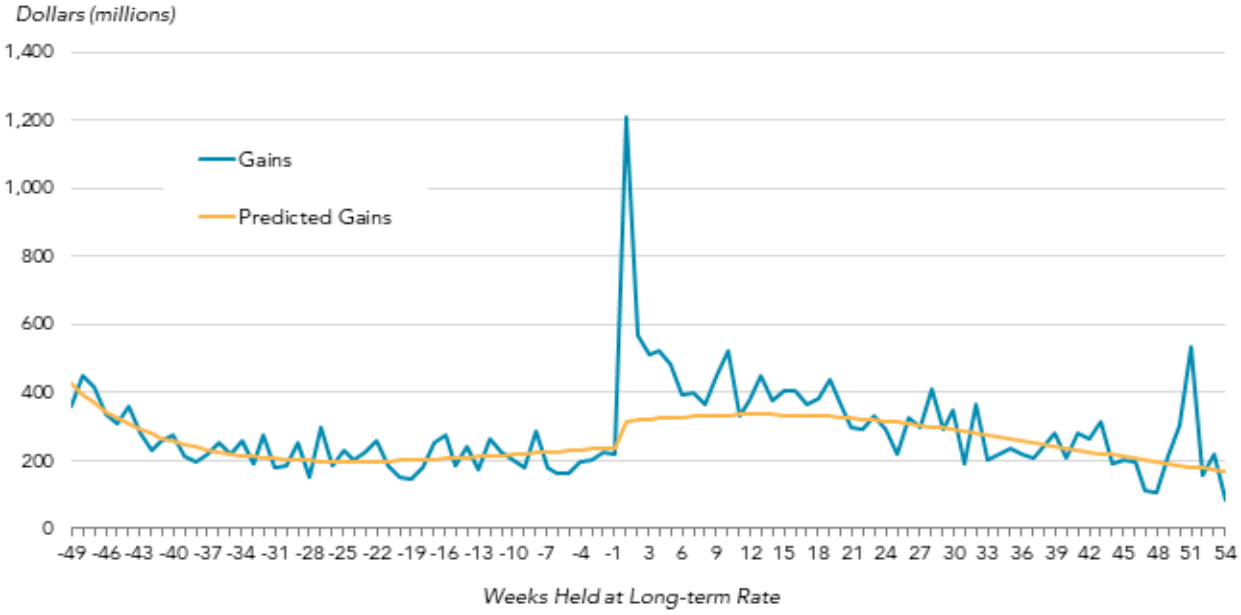
## Actual and Predicted Gains by Weeks Held Relative to 52 Weeks
2009




**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. Predicted gains are estimated as described in section 3.

FIGURE 8

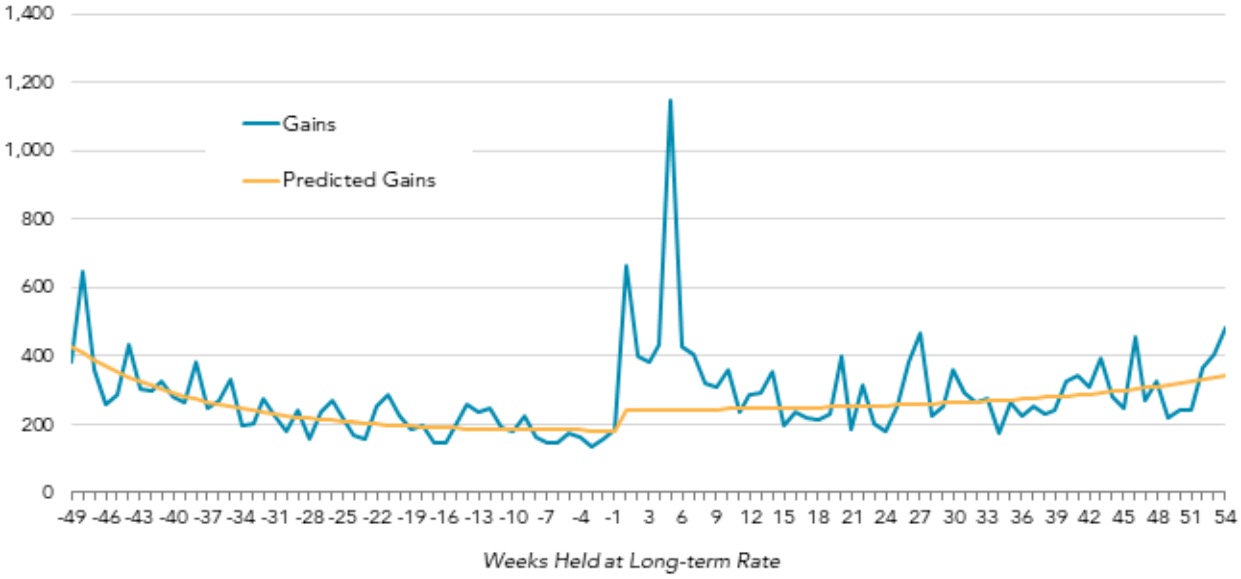
## Actual and Predicted Gains by Weeks Held Relative to 52 Weeks
2010




**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. Predicted gains are estimated as described in section 3.

FIGURE 9

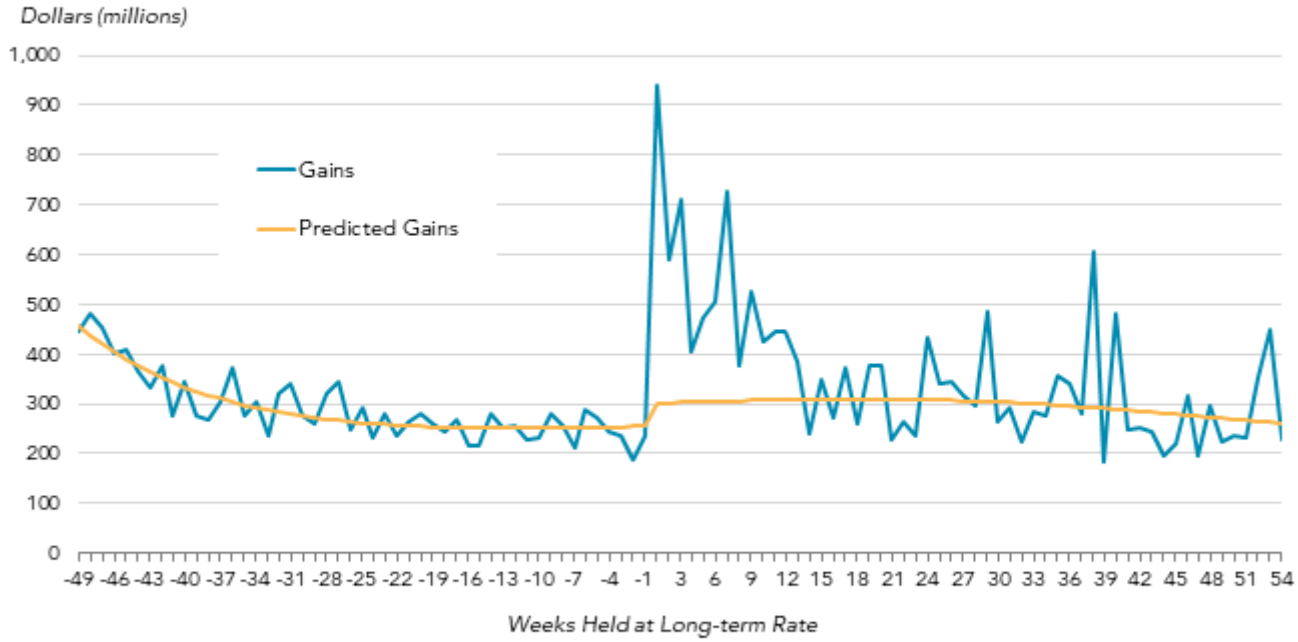
## Actual and Predicted Gains by Weeks Held Relative to 52 Weeks
2011




**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. Predicted gains are estimated as described in section 3.

FIGURE 10

## Actual and Predicted Gains by Weeks Held Relative to 52 Weeks
2012




**Source:** IRS Statistics of Income data and authors' calculations.
**Notes:** Total gains are calculated for each holding period week in each year, and are log-transformed. Weeks are centered on week 52, which is the time period at which preferential long-term gains begin. The vertical axis are log dollars, after dollar values have been adjusted to 2016 price levels using the CPI. Transactions with missing sales or purchase dates are excluded. Transactions by tax units with net negative capital gains positions are also excluded. Predicted gains are estimated as described in section 3.

Figures 5-10 graphically represented the results of our methodology for calculating the counter factual predicted amount of capital gains realizations. Next, we present our results on the implied elasticity estimates using the different tax rates as reported in Table 2 panel B.

Given the actual and counterfactual gains, the elasticity is estimated as

$$\hat{\eta} = -\frac{\Delta(long\ term\ gains)}{\tau_S - \tau_L} \frac{\tau_L}{(\widehat{long\ term\ gains})} \quad (3)$$

where $\tau_L$ and $\tau_S$ are the tax rates on long-term gains and short-term gains, respectively. Long-term gains are those predicted to have been realized in the absence of a surge to realize gains at the lower long-term rate. The change in long-term gains in equation (3) is calculated as

$$\Delta(\widehat{long\ term\ gains}) = \sum_{t=1}^{ub}[G_t - \widehat{G_t}] \quad (4)$$

and the long-term gains are calculated as

$$\widehat{long\ term\ gains} = \sum_{t=1}^{ub} \widehat{G_t} \quad (5).$$

As discussed above, the ultimate tax rates applied to gains are determined by the amount of net gains. We address this by estimating the elasticities on both the full sample (including some taxpayers in a net loss position) and on the sample of taxpayers with a positive net gain at the end of the year. We use three separate tax rates for each sample. We start with the full sample in which investors may have either a net gain or a net

loss for the year and using the average long-term tax rate and short-term tax rate in each week. In this base case the tax rates are endogenous because some taxpayers are able to choose to realize losses and lower their marginal tax rate. These rates correspond to the gains-weighted tax rates in Panel A of Table 2. We next calculate the rate on gross gains without netting losses, meaning losses are not used in determining the tax rate. This rate implicitly assumes that taxpayers do not take into account their losses when evaluating whether to realize a capital gain. The tax rate on gross gains may still be endogenous, however, because realizing gains can move an investor into a higher tax bracket. To address this possibility, we calculate the elasticity using the maximum Federal and state rate, which avoid the endogeneity problem. Nevertheless, tax rates vary slightly from week to week because they represent average rates across investors in states with different state tax rates. Thus, if more investors in high-tax states realize gains in a given week, the tax rate increases slightly. We then limit the sample to those in a net-gain position at the end of each year and estimate the elasticity again using all three tax rates.

As shown in Table 3, below, there is substantial variation between the samples, across the methods, and over time. Starting in panel A with the full sample of positive capital gains realizations (regardless of the taxpayer's ultimate end of year net gain or loss position), the elasticity on net gains is greater in absolute magnitude than the other two methods. This reflects the fact that the percent difference in the tax rates on short-term and long-term gains is smaller when investors can reduce or eliminate their taxes by offsetting gains with losses. This is particularly true in 2008 and 2009, when the large losses reduced tax rates on short-term gains and, to a lesser extent, long-term gains. Nevertheless, the elasticity when calculated using the maximum rate also increased in 2008 and 2009, demonstrating that lowering tax rates is not the entire story. Another possible explanation for the large elasticity in 2008 is that the measure is confusing a response to taxation with the increased volatility in long-term gains, visible in Figure 6.

Excluding 2008 and 2009, the elasticities using the maximum tax rate are low in absolute value. These elasticities, although showing a consistent trend, may be low because they are estimated from a population that showed substantial losses in 2008 and 2009. If those taxpayers recognized that they would end the year with capital losses, they may not have responded to tax rates, especially tax rates measured without those losses. To account for this possibility, we estimate the elasticities only on those taxpayers ending the year with a net gain. Panel B of Table 3 presents the results. The elasticities are generally larger than those in Panel A, and the elasticities in 2008 and 2009 are much larger. This is especially true for the tax rate on gross gains, which increases in absolute magnitude from -0.61 to -1.76 in 2008 and from -0.88 to -2.70 in 2009. This strongly suggests that taxpayers who continued to realize gains were responsive to the preferential rate on long-term gains.

The wide shifting region in Figure 7, corresponding with the large elasticity in 2009, however, does not appear to be caused just by increased realizations. One source of the large elasticity is the sharp drop in predicted gains caused by removing average gains, $\overline{G_L}$, in calculating the counterfactual. To investigate how this affects the elasticity estimate, we re-estimate the predicted gains and elasticity without removing average gains. The elasticity calculated using the maximum tax rate falls in absolute value to -1.33 from -1.69. Performing the same calculation on the other two tax rates produce smaller changes in elasticities. Regardless of how average gains are treated, the overall patterns are similar over the 2008–11 period: elasticities rise in absolute value from 2008 to 2009, fall in 2010, and then rise in 2011.

TABLE 3

Short-Term Elasticities Using Three Measures of Taxes

| Year | Panel A: Elasticities for Full Sample | | |
|---|---|---|---|
| | Tax Rate on Net Gains | Tax Rate on Gross Gains | Maximum Tax Rate |
| 2007 | -1.39 | -0.81 | -0.68 |
| 2008 | -2.57 | -0.61 | -0.91 |
| 2009 | -3.10 | -0.88 | -1.46 |
| 2010 | -1.02 | -0.34 | -0.48 |
| 2011 | -1.91 | -0.59 | -0.74 |
| 2012 | -1.66 | -0.7 | -0.79 |

| Year | Panel B: Elasticities for Taxpayers with Net Gain | | |
|---|---|---|---|
| | Tax Rate on Net Gains | Tax Rate on Gross Gains | Maximum Tax Rate |
| 2007 | -1.32 | -0.91 | -0.65 |
| 2008 | -3.69 | -1.76 | -1.29 |
| 2009 | -3.40 | -2.70 | -1.69 |
| 2010 | -1.38 | -0.98 | -0.69 |
| 2011 | -2.35 | -1.32 | -0.95 |
| 2012 | -1.53 | -0.99 | -0.74 |

**Source:** IRS Statistics of Income data and author's calculations.

It is possible that gains in 2009 are not gains that were delayed until the long-term rate applied but instead are gains on the sales of assets that were accelerated because investors were concerned about assets suddenly declining in value. In other words, the peak in weeks 1 through 9 may have come from sales shifted from weeks 10 through 54 rather than sales shifted from week -49 to week -1. Even in this case, however, investors were mindful of the rate changes and did not accelerate sales so much that the short-term rate applied. Then the difference between actual and predicted gains still represents gains realized at the long-term rate that otherwise would have been realized at the short-term rate.

## CONCLUSION

We use a unique dataset of financial transactions by investors reported on their federal tax returns from 2007 to 2012 to show that tax rate responsiveness changes dramatically during periods of financial crisis. We do this by studying the degree to which investors delay the sale of their asset to benefit from the preferential long-term rate, which is available on assets held for at least 366 days. We present evidence that some investors continue to be patient and delay their sale of assets to take advantage of the preferential rate even during extreme periods of crisis, and they are possibly more responsive to tax rates during financial crises. This result holds for several definitions of tax rates and for both investors who had net gains over the course of a year and those who both made or lost money.

# NOTES

[1] Including transactions reported on Form 8949 (which is used to report most capital gains and losses), it might be helpful to indicate that this form is used for so the reader can get a sense why it is important to include --- starting with tax year 2011.

[2] TAXSIM is a publicly available simulation model available at the National Bureau of Economic Research and described in the literature (Feenberg and Coutts 1993). We use an in-house version of TAXSIM that is located on Joint Committee on Taxation servers to avoid any disclosure of confidential information.

[3] Details of the SOCA panel (Wilson and Liddell 2016) and the individual income tax return sample (Statistics of Income 2014) are reported in the literature.

[4] Note that the long-term rates without netting are the same as those with netting. This occurs because the tax rate calculated on gross gains will differ from the rate on net gains only when the investor has short-term gains but long-term losses. This occurs in less than 1 percent of our sample.

[5] A Loess regression fits a low-order polynomial to subsets of local data, thereby smoothing out the fitted line.

[6] We use a Loess regression procedure with a span of 0.2 to smooth the data presented in this figure, and we use a span of 0.1 in figures 2 and 3.

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