SPRING 2019
NEW YORK UNIVERSITY
SCHOOL OF LAW

"The Effects of Capital Gains Rate Uncertainty on Realization"

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February 5, 2019
Vanderbilt Hall – 208
Time: 4:00 – 5:50 p.m.
Week 3

SCHEDULE FOR 2019 NYU TAX POLICY COLLOQUIUM
(All sessions meet from 4:00-5:50 pm in Vanderbilt 208, NYU Law School)

1. Tuesday, January 22 – Stefanie Stantcheva, Harvard Economics Department.

2. Tuesday, January 29 – Rebecca Kysar, Fordham Law School.

3. Tuesday, February 5 – David Kamin, NYU Law School.

4. Tuesday, February 12 – John Roemer, Yale University Economics and Political Science Departments.

5. Tuesday, February 19 – Susan Morse, University of Texas at Austin Law School.

6. Tuesday, February 26 – Ruud de Mooij, International Monetary Fund.

7. Tuesday, March 5 – Richard Reinhold, NYU School of Law.

8. Tuesday, March 12 – Tatiana Homonoff, NYU Wagner School.

9. Tuesday, March 26 – Jeffery Hoopes, UNC Kenan-Flagler Business School.

10. Tuesday, April 2 – Omri Marian, University of California at Irvine School of Law.

11. Tuesday, April 9 – Steven Bank, UCLA Law School.

12. Tuesday, April 16 – Dayanand Manoli, University of Texas at Austin Department of Economics.

13. Tuesday, April 23 – Sara Sternberg Greene, Duke Law School.

14. Tuesday, April 30 – Wei Cui, University of British Columbia Law School.

THE EFFECTS OF CAPITAL GAINS RATE UNCERTAINTY ON REALIZATION

David Kamin and Jason S. Oh*

DRAFT: Last Revised, July 2018.

Taxpayers should expect capital gains rates to fluctuate in light of frequent historical changes and the current divergence of rates preferred by Democrats and Republicans. This paper is the first to model the effect of such rate uncertainty on the realization incentives of asset holders and finds those effects to be potentially large. There are several implications. First, rate uncertainty may alleviate the lock-in effect of the realization rule when rates are low and exacerbate lock-in when rates are high. Second, there could be significant inaccuracies extrapolating the elasticity of capital gains realizations measured at one rate to another. Third, some policy solutions aimed at addressing distortions created by the realization rule may not work as well as expected.

Keywords: uncertainty, capital gains, realization

JEL Codes: D84, H25, H26

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I. INTRODUCTION

Behavior in response to tax rates can be affected not only by the tax rates now in place but expectations as to what those tax rates might be in the future. This article focuses on a particular type of behavior that may be sensitive to future rate uncertainty: the decision to realize gains or losses on property.

In the United States, as in many other countries, the realization rule applies to property transactions. Under this rule, gains or losses on property are only includible in income when those gains or losses have been realized, as opposed to when they accrue. This gives taxpayers a significant degree of control over when they include gains or losses in their income.

The realization rule has spawned an extensive literature. This includes on the “lock-in” effect—how people will tend to defer gain to reduce the value of their tax liability in net present value and to take advantage of step up in basis at death (e.g., Landsman and Shackelford, 1995). Scholars have noted the inefficiency that can result due to this incentive (e.g., Hendershott, Toder, and Won, 1991). Another strain of the literature has examined the sensitivity of realization behavior to changes in the tax rate (e.g., Dowd, McClelland, and Muthitacharoen, 2015).

This article is the first to examine the possible effects of capital gains rate uncertainty on realization behavior. Capital gains rates have varied significantly; since 1980, they have ranged between 15 percent and nearly 30 percent. Currently, the top federal capital gains rate stands at 23.8 percent—taking into account the effect of all relevant provisions—and there are active efforts by the now-Republican majority to cut the rate, even as Democrats have proposed rate increases. Others in the academic literature have previously noted that expected capital gains tax rate changes could affect realization behavior (e.g., Auerbach, 1988, 605), and the popular media has reported times at which people were either accelerating or deferring gains in response to possible imminent changes in tax rates, including most recently in 2017 as Congress considered a variety of tax measures (Ehrenfreund and Paletta, 2017). But, the magnitude of the effect and its possible implications have never been extensively analyzed.

We find that capital gains rate uncertainty can create significant financial incentives to change the timing of realization. For instance, as tax rate rise to the upper end of the likely distribution of such rates, this produces significant incentive to defer until rates fall. By waiting to sell assets, taxpayers are not only getting the time value of deferring gains but also playing a favorable lottery for lower rates. At the top of the rate distribution, uncertainty and time-value considerations push in the same direction—towards deferring realization.

When capital gains rates are near the bottom end of the distribution, expected future rate increases may cause taxpayers to accelerate gains and forego the advantage of deferral. Expected rate changes and the time value effect point in opposite directions. The relative magnitude of these effects depends on a number of factors, including the investment time horizon, the degree of risk aversion, and the likelihood of future rate changes.

These findings have a number of implications. First, as a descriptive matter, this suggests that the effect of the realization rule on taxpayer behavior is more complicated than previously understood. At high rates, this tends to aggravate the "lock in" effect. However, at low rates, it works in the opposite direction to reduce the distortions of the realization rule and, in fact, potentially generate a different distortion—that of selling the asset earlier than an investor otherwise would absent the effect of taxes.

Second, this raises concerns about current methods for extrapolating the sensitivity of capital gains realizations to changes in the tax rate at a given level. Elasticities measured at one rate level may not extrapolate to another rate level without taking into account the effects of future tax rate uncertainty—which calculations so far have not done. In our models of rational investors who incorporate rate uncertainty into their decision-making, we find that the elasticity of capital gain realizations may vary substantially across the rate distribution—with the greatest elasticity in the middle of the rate distribution and lower elasticity towards either end of the rate distribution. The intuition is that the middle of the rate distribution represents a "tipping point," where small changes in incentives will tend to flip a relatively large number of investors from holding to realizing their gains or vice versa. At the top and the bottom of the rate distribution, small rate changes do not have as large an effect. That's because uncertainty generates relatively powerful "hold" or "sell" incentives at the top and bottom of the distribution, and, under reasonable assumptions about the distribution of investors, there would then be fewer investors sensitive to rate changes at those points. The specific assumptions underlying this finding are discussed further below.

Third, this suggests that the revenue-potential and efficiency of capital gains taxation can be reduced or enhanced by not just the current rates in place but by changes in expectations of future rates. So, a rate cut, for instance, could undermine the revenue-raising potential of a reversal of the tax cut by causing investors to assign a greater probability to rates being cut again.

Fourth, this has implications for policies aimed at addressing the distortions created by the realization rule. Two broad families of reforms have been proposed to try to alleviate these distortions: (1) Taxing gains based on the tax rates in the years in which the gain is accrued rather than realized, such as through a form of mark-to-market taxation (e.g., Glogower, 2016; Miller, 2008); (2) Taxing gains only at realization and using tax rates at that time, but using systems that reduce or eliminate the time value of money benefit from deferring gains (e.g., Shakow, 1986, 1223). Importantly, only the first family of reforms would necessarily reduce the distortions generated by rate uncertainty. The second family would not, since the tax rate is based on that at the time of realization, which is uncertain.

Finally, some of the insights on the possible role of tax rate uncertainty apply to other areas. The basic dynamic described here is relevant anytime people or entities have the ability to adjust behavior so as to adjust the year and rate at which taxation occurs. For instance, the build-up in unrepatriated corporate profits overseas in the lead up to the 2017 tax reform reflects this basic dynamic as corporations waited for an expected lower tax rate at which to subject those gains to taxation. The one-time holiday in 2004 on these unrepatriated profits—and continued discussions in Congress of another such holiday—helped create expectations of future rate reductions that likely led to less repatriations and less revenue (De Simone et al., 2017).

II. CAPITAL GAINS RATE UNCERTAINTY

A. Realization and Rate Uncertainty

The "realization" rule—the rule that gains on property are not subject to tax until a gain is realized— "is the foundational timing rule of our tax system," and it has been in place from the beginning of the income tax (Schizer, 1998, 1551). The rule gives discretion to property owners as to when to pay tax on accrued gains since taxation only occurs upon realization, often in a sale of the property.

The tax rates that apply to these property transactions have varied over time. Most gains on property transactions are subject to preferential capital gains rates that apply to "capital assets" held over one year. The top effective capital gains rate on most long-term gains now stands at 23.8 percent. This includes the regular capital gains income tax rate of 20 percent and the 3.8 percent surtax on unearned income added in the Affordable Care Act. Since 1980, that rate has ranged from a low of about 15 percent in the wake of the 2003 tax cuts to a high of just over 29 percent from 1993 to 1996, combining both the statutory capital gains rate and the effect of the income-based limitation on itemized deductions.

In the period since 1980, there have been a total of eleven changes to the effective capital gains rate (including both the statutory rate and the effect of other provisions) exceeding a shift of 0.1 percentage point—or a change in the rate more than once every four years. Table 1 shows the distribution of those changes. Five of those changes were roughly 1 percentage point or less (ranging between 0.2 and 1.2 percentage points) and due to the effects of the income-based limitation on itemized deductions that was in effect in many years and was suspended recently by the 2017 tax law. That limitation effectively imposed an additional tax on capital gains and other types of income. Five of those changes were five percentage points or larger and reflect a combination of changes in the statutory capital gains rate, introduction of a surtax on unearned income in 2013, and the limitation on itemized deductions (Department of the Treasury, 2016).

This article uses the historical range of capital gains rates and the frequency and size of historical changes to the capital gains rate to estimate the effects on taxpayer decisions. Throughout the article, we will refer to this as "uncertainty" although Knight (1921) famously distinguishes between what he calls risk, where the distribution of outcomes is known, from uncertainty, where the distribution of outcomes is unknown. Using the Knightian framework, our model incorporates how investors are affected by risk rather than uncertainty, since we are using historical rate changes to estimate the effect on taxpayers. In actuality, the distribution of future rate changes is not known with certainty, although the historical range of capital gains rates has been stable. Over the last forty years, changes to the capital gains rate have followed a mean reverting pattern. A Dicky-Fuller unit-root test has a t-statistic of -0.57 (using a 90% critical value, the t-statistic must be below -1.61 to conclude that the series is non-stationary). As a result, understanding how taxpayer realizations respond to Knightian risk is an important first step in understanding how taxpayers respond to the Knightian uncertainty of future capital gains rates.

B. Literature on Rate Uncertainty

There is an extensive literature on overall economic policy uncertainty and economic effects (e.g., Baker, Bloom, and Davis, 2016), as well as the specific role of tax uncertainty (Oh and Tausanovitch, 2016). The literature on tax uncertainty has largely considered how tax rate uncertainty might affect saving, investment, and production (e.g., Hassett and Metcalf, 1999; Zangari, Caiumi, and Hemmelgarn, 2017). There has, as yet, not been a thorough consideration of the effects of tax rate uncertainty on realization behavior and how the incentives interact with the better-studied effects from time value of money and step-up in basis at death.

The possible effects of tax rate uncertainty on realization behavior have not gone unnoticed, but without thorough consideration of the potential magnitude and direction of the effects. In discussing the effects of tax rate uncertainty on capital gains realizations, Alan Auerbach wrote "one would expect the degree of uncertainty about such tax rates to matter…since holding a capital gain is like buying an option based on future tax rates," (Auerbach, 1988, 605), but, in that study, Auerbach didn't test the effects of uncertainty on realization behavior, even as he explored other effects of taxation on realization. Others too have noted the effects of uncertainty on behaviors similar to realizing capital gains. For instance, in the context of U.S. corporations repatriating foreign earnings (under the pre-2018 tax system), scholars have noted how deferring the income can be encouraged by an expectation of a future rate reduction on those profits and the buildup of unrepatriated profits seems associated with events suggesting a higher probability of such future rate reductions, even as they are not yet enacted (De Simone et al., 2017).

This article builds off this prior literature as the first to try to quantify the magnitude of financial incentives created by capital gains tax rate uncertainty and the possible effects on capital gains realizations.

III. QUANTIFYING EFFECTS OF RATE UNCERTAINTY

A. Simplified Two-Period Framework

Rate uncertainty affects the decision whether to realize a gain presently or not as it can generate a financial incentive to either defer the gain or realize it. This basic intuition can be illustrated with a stylized example. In a two-period world, a taxpayer is deciding whether to hold or sell an asset with a built-in gain in the first year. In the second year, the taxpayer will sell the asset in any case. The asset is worth $100 at the beginning of the first year and the basis is $25.[1] Further assume that capital gains tax rates can range from 15 percent to 28 percent—the range of the last forty years in the statutory capital gains rate, and that the rate in the first year and the rate in the second year are independent.[2] Finally, assume that this and other assets make a 5 percent rate of return and that there is no risk aversion. A number of these assumptions will be varied in later modeling.

The incentive effects in that case are relatively intuitive. The expected value of the tax rate in the second year is halfway in between the low and high rates of 15 and 28, or 21.5 percent. Thus, rate uncertainty will tend to push toward selling in the first year if the rate is below the 21.5 percent and will tend to push toward holding if the rate is above that. The effect is

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[1] We use an example of a highly appreciated asset to better illustrate the effects of rate uncertainty on those with such appreciated appropriated. Overall, the Survey of Consumer Finance (SCF) suggests that over 20 percent of net worth in the United States is in the form of unrealized capital gains (Looney and Moore, 2016, 90 fig.5). However, there is considerable variance by assets, and, for those with the greatest net worth, the share of wealth in the form of unrealized capital gains is considerably higher. For instance, the SCF suggests that between 40 and 50 percent of net worth for the wealthiest 0.1 percent is in the form of unrealized capital gains, and that share should vary by asset (Looney and Moore, 2016, 98 tbl.6b).
[2] Irrespective of the rate in the first year, there is an equal chance of the rate being any rate from 15 to 28 percent.

entirely driven by whether the expected value of the second year's capital gains rate is above or below the first year's. There is then also the time value of money benefit of deferring gain, which would tend to push toward holding.

In that case, the decision whether to hold or sell the asset in the first year is described by the following equation. The asset should be sold for an investment in an alternative asset under the following condition:

$$E\left[v\left(1+r_c\right)\left(1-t_2\right)+b\left(t_2\right)\right]<E\left[\left(v\left(1-t_1\right)+b\left(t_1\right)\right)\left(1+r_a\left(1-t_2\right)\right)\right] \quad (1)$$

Where $v =$ FMV; $r_c =$ return on current asset; $r_a =$ return on alternative asset; $b =$ basis of asset; $t_i =$ tax rate in year i

The taxpayer calculates the expected value of holding and selling over all of the possible second-period tax rates. Table 2 illustrates.

The rightmost column in the table shows whether a taxpayer would sell or hold assuming the alternative asset that the taxpayer could purchase pays the same rate of return as the initial one being held. At low rates, there is a tax incentive to sell the current asset, and, at high rates, a tax incentive to hold the asset rather than sell. The dividing line is between the tax rates of 20 and 21 percent.

The second column from the right further shows the source and magnitude of the distortion. It does this by calculating the return premium that must be offered by an alternative asset for the taxpayer to be indifferent between holding the current asset and selling in favor of the alternative asset. In a world without tax (or at least a tax regime using mark-to-market rather than the realization rule), taxpayers would sell and invest in an alternative asset if that alternative offered a higher rate of return. That is not the case once tax incentives are considered, and this column shows us how distorted taxpayer behavior is at various tax rates.

For instance, at a 28 percent rate, the alternative asset would have to pay a rate of return that is 9.20 percentage points higher than the current asset (assumed to be paying a 5 percent rate of return) for the taxpayer to be indifferent between selling and buying. At low tax rates, the effect works in the opposite direction, and the alternative asset would have to pay a lower rate of return than the current one for the taxpayer to be indifferent. (This assumes that the taxpayer could not simply sell the current asset and repurchase it; thus, the assumption is that, if the taxpayer sells, then he is limited to the alternative asset.)

This reflects the combined effect of uncertainty and the time value of money. The table roughly decomposes the magnitude of the two effects. It does this by calculating the same rate premium under two different assumptions: The first assumption is that there is no time value of money benefit from deferring a tax liability (with the government essentially imposing an interest charge on the deferred tax liability), but that there is still rate uncertainty. The second assumption is that there is no rate uncertainty and that rates will be unchanged in the second year, but that there is the time value of money benefit from deferring gain. The decomposition is rough since the two effects interact to a modest degree. As expected, at the lowest rates, rate uncertainty generates a penalty for holding—and an alternative asset could in fact pay a lower rate of return on a pre-tax basis and the taxpayer would still switch assets. That penalty is offset to some degree by the time value of money benefit from holding for another year (and deferring the tax on the gain by a year), but, at the lowest rates, the effects of rate uncertainty outweigh considerably. This generates the incentive to sell. Rate uncertainty and the time-value of deferring are in tension at the bottom of the rate distribution.

At higher rates, both the time-value of money and rate uncertainty work in the same direction. Rate uncertainty reinforces the time-value considerations at the top of the rate distribution. By waiting, the taxpayer defers the recognition of gain and is likely to face a lower tax rate when he sells in the second year.

Figure 1 provides an alternative way to visualize the effect of rate uncertainty on realization. The dotted line shows the rate premium required for the taxpayer to sell the asset in the absence of rate uncertainty. This line is relatively flat. The required premium rises only modestly as the capital gains rate increases. The solid line shows the rate premium required if there is capital gains rate uncertainty. This curve is much steeper. The additional slope is due to the expected change in the capital gains rate between the first and second year. For low capital gains rates, a capital gains rate increase is expected. For high capital gains rates, taxpayers anticipate a rate decrease on average.

This simple framework is of course highly stylized. The point is to show how rate uncertainty can generate significant financial incentives and large ones relative to the traditional time value of money benefit from deferring gain on a highly appreciated asset. This means that the distortions created by the realization rule can depend significantly on where the current tax rate falls within the distribution of future rates.

B. Expanding the Model

In the toy example, it appears that expected changes in the tax rate is more important than time-value of money when determining the distortions created by the realization rule. However, the toy model makes two assumptions that overemphasize the effect of expected future rate change relative to the effect of time-value of money. There is a high probability of a rate change (i.e., there is no status quo bias) and there is only a one-year time horizon.

The two-period model can be expanded to begin to illustrate the effects of rate changes and uncertainty more realistically. Below, we further build out the model considering rate inertia, heterogeneous time horizons, the ability to foresee rate changes, risk aversion, and heterogeneous asset returns and built-in-gain.

1. Rate Inertia

The model can be made more realistic by better reflecting the inertia in tax rates from year-to-year. As described earlier, the effective capital gains rate has stayed the same in 71 percent of years since 1980 (through 2018). Further, in the 28 percent of years with a rate change, there was variation in size with six changes to the top capital gains rate ranging from over 0.1% to just over 1%, one change of 5%, three changes of 8%, and one change of 10%. Looking forward, we can use these transition probabilities to estimate the effect of rate inertia on realization. This iteration of the toy model assumes a 71 percent chance of the rate staying the same, and, if there is a rate change, then drawing from the distribution described above consistent with the rate changes since 1980.[3] This distribution of rate changes is a mean-reverting process consistent with what has been observed over the last several decades.[4]

Table 3 below shows the penalty or benefit from holding for an additional year under these assumptions. In that case, the effects of rate uncertainty are still significant relative to the effects of time value of money but are much smaller than in the previous stylized example. The asset holder then has an incentive to sell if the rate in the first period is between 15 and 19

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[3] Upward and downward changes in rates are equally likely unless the change would take the capital gains rate outside of the range of possible rates. If the change would take the rate outside of the range then the rate change only occurs in one direction. If the change would take the rate outside the range in either direction, then we assume that the change has an equal chance of either increasing or decreasing the rate to the ends of the range (28% or 15%).

[4] Note that capital gains rates in some states have not followed a mean-reverting process. Capital gains rates in these states have been steadily increasing over time. The incentives generated by steadily-increasing tax rates would be different than those shown here and would tend to lead to earlier realization. There is wide variation in state capital gains rates from a rate of zero in several states that do not have income taxes (Alaska, Florida, Nevada, New Hampshire, North Dakota, Tennessee, Texas, Washington, and Wyoming) to 13.3 percent in California. For this paper, we focus on the potential effect of federal rates.

percent, and to hold if the rate is 20 percent or higher. Note that the effects of rate uncertainty continue to be driven entirely by expectations of future rate changes and the relationship of the current rate to the mid-point of the range, with an incentive generated to hold if the rate is above the mid-point and the opposite if it is below.

These results can be compared with Table 2. The time value of money is unaffected by the change in future rate uncertainty. But, the effects from rate uncertainty are much smaller in Table 3 than Table 2. Status quo bias substantially reduces the expected penalty of future rate uncertainty when rates are low and reduces the expected benefit of future rate uncertainty when rates are high. Deferral becomes a relatively more important consideration when rates are sticky.[5] Figure 2 shows the relative effects of uncertainty and the time-value of money. The dotted line shows the rate premium required for the taxpayer to sell the asset if tax rates are fixed. This line shows just the effect of time-value of money. The line is relatively flat. The rate premium required rises only modestly as the capital gains rate increases.

The solid line shows the rate premium required if there is rate uncertainty. This curve has a more dramatic shape. The effect of rate uncertainty varies as one moves along the rate distribution. The solid line in Figure 2 is substantially less steep than the corresponding solid line in Figure 1. This is because Figure 2 incorporates status quo bias. The effect of uncertainty is more muted when rate changes are less likely. Rate inertia reduces the value of playing the rate lottery in hopes of a lower capital gains rate in the next year. For example, consider the return premium required if the current capital gains rate is 28%. With rate inertia (Table 3), the

[5] This makes intuitive sense. As the status quo bias gets larger (as rates are stickier), the detriment or benefit due to rate uncertainty becomes smaller and smaller. In the limit where there is no rate uncertainty at all, there would be no detriment or benefit due to rate uncertainty, and the taxpayer would always defer in the toy model.

taxpayer requires a return premium of 2.91% to sell. Without rate inertia (Table 2), the taxpayer requires a return premium of 9.20%.

The return premium required for taxpayers to sell is a reasonable proxy for the distortion created by the realization rule. As in Table 2, rate uncertainty generally reduces that distortion at low capital gains rates, as it offsets the deferral incentive created by the time value of money. In fact, at tax rates ranging from 15% to 19%, the combined effect generates a small distortion by encouraging taxpayers to sell assets even if the alternative would pay a slightly lower rate of return. When rates are high, the effects of rate uncertainty magnify the distortion created by the time-value-of-money benefit from deferring gain. If the capital gains rate is 28%, the taxpayer requires a return premium of 2.91% in order to trigger the gain and switch investments.

2. Longer Time Horizons

The results are sensitive to the time horizon involved. The longer is the time horizon, the greater is the incentive to hold an asset as a result of the uncertainty of tax rates. The basic intuition is that it becomes more probable that there will be an intervening year in which the tax rate will be lower or at least equal to the current one that applies, and the asset holder will have the option of selling in that low-rate year. Unlike in the two-period case, future changes in tax rates do not only generate an incentive to hold if tax rates are above the mid-point in the range and the opposite if tax rates are below. That is because, with multiple years involved, the uncertainty essentially creates an option to wait until the capital gains rate is lower than it is currently to realize the gain. That option gets extinguished if the gain is realized immediately. As with financial options, the value of that option depends on the current tax rate, future rate uncertainty, and the time horizon. Due to this option value, the effect of uncertainty thus tends to strengthen lock in over longer periods—adding to the already existing incentive to hold assets due to the ability to defer tax liability.

Here, we explore the effects of several different time horizons: one year (analyzed in the prior examples), four years, and twenty years. The concept of the "time horizon" is stylized. It represents the point at which the investment will be liquidated, whether for consumption or for other purposes. For the most part, people's time horizons will not end in this cliff-like way, and the factors defining the time horizon will vary, from retirement or other needs for liquidity to no longer wanting to be an active manager of a given asset (i.e., owner of a business). In Section 3, we make more realistic assumptions by calculating the aggregate effect on all taxpayer behavior by assuming a heterogeneous population of taxpayers with different levels of built-in-gain and diverse investment horizons.[6]

The model, as before, assumes that there is rate inertia. With a multi-year model, the decision-making framework grows more complicated. The value of holding depends on expected decisions in future years as to whether to hold or sell.

Consider the three-period problem in which the taxpayer must make two decisions, whether to hold or sell at the beginning of the first year and the second year. In each year the taxpayer faces uncertain future capital gains rates. We solve for the taxpayer's decisions by starting with the decisions in year two. These decisions are identical to the two-period model discussed earlier. We can solve for the taxpayer's decisions in year two based on the expected distribution of year-three rates when the taxpayer has to sell and recognize any remaining gain. This in turn allows us to solve for the taxpayer's year-two expected utility conditional on the year-two capital gains rate.

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[6] See infra footnote 11.

The year-two expected utilities allow us to solve for the taxpayer's decisions in the first year. This is because the year-one decisions depend on the year-one rate, the expected distribution of year-two rates, and the expected utility conditional on that distribution.

This same approach can be used for longer time horizons. If the investment horizon is n-periods, we start with the decisions and expected utilities in period n. We then solve for the decisions and expected utilities in period n-1. In turn, these can be used to solve for the decisions and expected utilities in period n-2 until we reach the first period. By working backwards, we can solve for the hold-sell decisions of taxpayers facing rate uncertainty over several periods.

As the investment horizon gets longer, the deferral advantage increases. At the same time, the effect of uncertainty also shifts. There is a higher possibility of the taxpayer enjoying a very low capital gains rate at some point before they are forced to sell the asset. One way to see the interaction of these two effects is to focus on the return premium required for taxpayers to trigger gain in their assets and switch to an alternative asset. Table 4 provides the return premium required for taxpayers with various investments horizons. Figure 3a and Figure 3b plot the return premium required for a 4-year and 20-year investment horizon respectively. Lengthening the investment horizon has two effects. First, at low capital gains rates, it increases the rate of return required on the alternative asset for the taxpayer to realize the gain. If the current capital gains rate is 15%, a taxpayer with a 1-year investment horizon will sell the asset and trigger the gain even if the alternative asset offers no return premium. By contrast, a taxpayer with a 20-year horizon will only sell the asset and switch to alternative if the alternative has a return premium of 0.32% or greater.

Second, a longer investment horizon reduces the rate of return required on the alternative asset if the current tax rate is relatively high. The last row in the table focuses on a capital gains rate of 28%. A taxpayer with a 1-year horizon will require a 2.91% premium to switch to an alternative investment. By contrast, a taxpayer with a 20-year horizon will require only a 1.62% premium to switch. This is because the investor with the longer time horizon will enjoy the return premium for a longer period of time.

Although not as steep as the curve in Figure 2 (1-year investment horizon with rate inertia), the curve in Figure 3a shows that the effect of rate uncertainty is substantial on the investor with a four-year investment horizon. Uncertainty encourages realization at low rates and discourages realization at high rates. Figure 3b shows a somewhat different effect of uncertainty for taxpayers with longer time horizons. Rate uncertainty still discourages realization at high rates. However, at low rates, rate uncertainty does not significantly incentivize realization - the dashed and solid lines track each other. The intuition is that taxpayers do not need to realize gains at the low rate currently because they can wait on rates to come back down even if they go up; they know they will have the valuable option of waiting to realize the gain until rates are low again, as they are likely to be. At high rates, by contrast, taxpayers know that there is a substantial probability that the rate will be lower at some point within their investment horizon – and, thus, rate uncertainty continues to generate a significant financial incentive to defer realizing the gain.[7]

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[7] Another simplification in the model is that the taxpayer can voluntarily realize his gains at most one time before the end of the investment period. For example, if the taxpayer has a 10-year investment horizon and sells in year 2, the model assumes that the taxpayer will realize any additional gains accruing in subsequent years at the end of 10 years. This assumption has the effect of reducing the incentive to realize gains in any year. By selling in year 2, the taxpayer loses a valuable option to realize subsequent gains in a future year when he has more capital gains to realize and the tax rate is as low or lower. We adapted the model to allow for multiple realizations, but the results are not substantially altered, especially for relatively short investment horizons. Because the computational cost of allowing for multiple realizations is high and the difference in results is small, the remainder of the paper employs a model in which the taxpayer chooses to realize gains at most one time before the end of the investment horizon.

3. Step-Up in Basis at Death

The time horizon might also cover holding until death and then getting step up in basis, thus eliminating any gain subject to tax. This would tend to encourage deferral and potentially swamp the effect of uncertainty, especially if step up in basis is expected to occur shortly. Figures 4a and 4b illustrate the rate premium required for a person to trigger his built-in gain if he expects to take advantage of step up in basis at death within four years or twenty years and to pass on the assets to his heirs. This assumes that the taxpayer is certain that he will pass away at the end of the expected time period and not before (we relax this assumption below).

Once the step-up rule is incorporated into the model, the four-year investment horizon looks very different (Figure 4a). The taxpayer no longer needs to worry about a higher capital gains rate applying when the asset is transferred. The step-up rule effectively sets that rate to 0%. Uncertainty in the capital gains rate in the few interim years therefore has very little effect on the taxpayer's behavior. The dotted line and the solid line are virtually overlapping. Figure 4a sharply contrasts with Figure 3a, in which we ignored the possibility of stepping up basis at death.

However, when the step-up in basis is further off, capital gains rate uncertainty matters. Figure 4b shows the return premium that a taxpayer who expects to live exactly 20 years will require to sell. With capital gains rate uncertainty, the required premium is substantially higher. The taxpayer knows that there is a good chance that the capital gains rate will be lower in the future at a point in time when it makes sense to sell instead of waiting for the step-up in basis at death. The step-up is further off and thus less valuable relative to owning an alternative asset earning a higher return. As a result, Figure 4b looks very much like Figure 3b, in which we ignored the possibility of a basis step-up at death.

A more sophisticated approach is for taxpayers to make decisions based on two different sources of uncertainty, (1) future capital gains rates and (2) mortality. When we do this, the results depend on the life expectancy of those involved. For those with very short life expectancies, results look like those in Figure 4a – step up in basis dominates incentives. For those with longer life expectancies, results look more like those in Figure 4b.

The main takeaway from this section is that the possibility of getting a step-up in basis reduces the importance of rate uncertainty when taxpayers expect to live a relatively short time. However, for those with longer expected lives, rate uncertainty remains important to understand their incentives to realize gains.

4. Risk Aversion

To this point, the model has focused on the decisions of a risk-neutral taxpayer interested in maximizing their expected return. The model can be adapted to incorporate various degrees of taxpayer risk aversion. We employ the isoelastic utility function, which is indexed by the constant. When η=0, the taxpayer is risk-neutral. When η>0, the taxpayer is risk-averse. Higher values of η indicate higher levels of risk aversion.

(2)
$$u(c)=\begin{cases}\dfrac{c^{1-\eta}-1}{1-\eta},\eta\neq 1,\\ \ln c,\ \eta=1\end{cases}$$

Table 5 shows the rate premium required by taxpayers with a one-year or twenty-year investment horizon, and for a range of η. While there continues to be research and debate about the degree of risk aversion in the population, "the most widely accepted measures [of risk aversion] lie between 1 and 3" for this coefficient, though with considerable range in estimates from 0.2 to 10 and higher (Gandelman and Hernández-Murillo, 2015, 53). We test the results at an η of 0, 2, and 10.

Risk-averse taxpayers are more likely to sell the asset than the risk-neutral taxpayer - the return premium required for them to sell their assets is smaller. However, the effect is relatively small within the parameters that we explore. There are two reasons why. First, even though risk averse taxpayers are more likely to realize gains when facing rate uncertainty, the status quo bias is substantial—capital gains rates are much more likely to stay the same than to change. Thus, the advantage of deferral will often be more substantial than the effect of rate uncertainty on even a risk-averse taxpayer.[8] Second, over long periods of time, there is a significant probability that, even if rates change, there will be a low tax rate available in some year in the future, reducing the amount of risk. Table 5 shows that the effect of risk aversion is more dramatic for taxpayers with a shorter investment horizon, but, even for those with short time horizons, the magnitudes are in most cases small relative to the incentive effects of taxes. Finally, for a taxpayer with a long investment horizon, selling the asset in year 1 or any later year does not remove all uncertainty. The taxpayer is still exposed to final period rate uncertainty when the asset is ultimately liquidated, and any gain that accrued between year 1 and the investment horizon is taxed.

5. Ability to Foresee Rate Changes

The modeling so far has assumed that rate changes cannot be foreseen. However, based on past history, it is likely that rate changes for the immediate future (i.e. within a year) will be foreseen at least to some degree. Rate changes take time to legislate. Attempts at such legislation tend to be first prefaced by political campaigns where rate changes are proposed. Finally, when the legislation is actually enacted, the rate changes have often taken effect in the following year, giving asset holders an opportunity to sell and take advantage of prior rates if they so choose.

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[8] If we increase the probability of a rate change, risk aversion has a much more substantial effect on taxpayer decisions.

An ability to foresee rate changes has several effects. First, in this situation, there is no longer an incentive to sell an asset as a result of rate uncertainty before a rate increase is expected to occur—the lower rate can always be taken advantage of at that point. The taxpayer can simply wait (and take advantage of the time-value of deferring the tax liability) until the last moment when rates are due to increase. Second, there is an incentive to sell if the rate for the next year is expected to increase, though the strength of that incentive will depend on the existing rate and the investment horizon of the taxpayer; the longer the horizon, the greater the chance that the rate increase may subsequently be reversed.

Table 6 illustrates. It assumes a three-year time horizon and shows the incentive to hold or sell in the first year under several conditions:[9] First, it shows the incentive when rate changes for the next year are not yet known. Second, it shows the incentive when the rate changes for the next year are known for three different conditions: a rate increase, decrease, and no rate change. We focus on a simple example where the possible rates are limited to 15%, 20%, and 25%.

Consider first Table 6a, which summarizes the decision of a taxpayer who cannot sell immediately before a rate change. The taxpayer faces the same type of uncertainty as in the original toy model. The taxpayer has an incentive to sell in the first year if the rate is 15% to avoid the possibility of future rate increases. If the taxpayer has the opportunity to sell immediately before any rate change occurs, decisions change markedly in two ways. First, the taxpayer in the example is only incentivized to sell immediately before a rate increase. If the rate is currently 15%, and the taxpayer knows that the rate in the next year will increase to 20% or 25%, the taxpayer will trigger the capital gains at the lower rate.

[9] In this example, the basis is 0.1 and the fair market value of the asset is initially 1. The status quo bias is 80% - there is a 10% of switching to either of the other two rates in each period.

Second, in contrast to Table 6a, the taxpayer will not trigger capital gains if rates will remain unchanged or if rates will be reduced. The taxpayer is secure knowing that they can take advantage of deferral until a future rate increase is legislated (if ever). This is true even if the taxpayer can take advantage of the lowest possible rate of 15%.

This version of the model captures an important intuition from the literature. Anticipated rate changes both up and down can create a temporal shift in realizations. When there is an anticipated increase in capital gains rates, there is a measurable increase in realized gains in the year before the rate change occurs. In 1986 there was a sharp increase in realized gains in large part because the capital gains rate was set to increase to 28% in 1987.

Table 7a and 7b show what return premium is required for a taxpayer to sell the asset and switch to an alternative. In this simple example, the taxpayer requires substantial return premium in order to sell his asset unless the rate is about to increase. It is right before a rate increase that a taxpayer is most incentivized to sell. We can see the difference in behavior by focusing on Table 7a and the final few cells of Table 7b (in which the rate stays unchanged). In Table 7a, the taxpayer will sell if the rate is 15% even if there is no return premium. In contrast, a taxpayer that can anticipate rate changes will not sell even if the rate is at 15% unless the alternative asset offers a substantial return premium (at least 0.9%).

Thus, the realization rule distorts behavior even more if taxpayers know that they can trigger gains immediately before any future rate increases.

6. Losses

The above calculations illustrate the effects of uncertainty in the case of gains, but not losses. When it comes to capital losses similar forces are at play, though the direction of the effect differs. Generally, taxpayers, due to the time value of money, have the incentive to realize losses currently -- the opposite incentive that they have for gains. As for gains, rate uncertainty interacts and potentially can either reinforce the incentive to realize currently or, alternatively, work in the opposite direction and incentivize deferral. When capital gains rates are near the top of the distribution, the value of the loss deduction is highest (assuming the person has a steady stream of capital gains to offset) and, therefore, rate uncertainty increases the incentive to realize currently, while the opposite is true at low capital gains rates. Essentially, when it comes to the realization of losses, the effect of the time value and money and uncertainty work in reverse as compared to their effects on realization of gains.

This assumes a continuous stream of capital gains in excess of losses. If there is not, then there is a more complicated set of incentives as to when to realize those losses due to loss limitations. Under these limitations, losses can only be written off against capital gains or, in the absence of such gains, up to only a nominal amount of ordinary income ($3,000). To the degree the gains and losses are equal, tax rates and uncertainty shouldn't play a significant role since the investor is essentially perfectly hedged, and the investor can't try to concentrate the gains in low tax years and losses in high tax years due to the loss limitation. The same is also approximately true if losses exceed gains—tax rates and uncertainty don't matter—since the losses are for the most part not usable to the degree they exceed the gains.

IV. ELASTICITY OF CAPITAL GAINS REALIZATIONS

The basic insight of this paper—that rate uncertainty could have significant incentive effects—has potentially important implications for how tax rate changes affect the level of capital gains realizations. The elasticity of capital gains realizations measures the percent change in capital gains realizations divided by the percent change in the tax rate. Economists have, for years, studied this elasticity and arrived at a variety of results. As discussed in the next section, the elasticity has important implications for the revenue that would be raised or lost from changing capital gains rates and also the efficiency effects of those changes.

However, despite the many years of study, the empirical work so far has not explicitly considered the role of rate uncertainty on the elasticity of capital gains realizations. Many of these studies have differentiated among transitory, short-run, and permanent effects. The transitory elasticity measures the change in capital gains realization when rates changes are explicitly temporary; short-run measures the change in capital gain realization immediately after a permanent rate change; and permanent measures the change in realization in the long-run after a permanent rate change. At a theoretical level, our analysis calls into question whether there is such a thing as permanent elasticity and whether it has ever been measured. Measurement of realizations always occurs in an environment of rate uncertainty.

To be sure, some of these studies would naturally have incorporated the effect of uncertainty at the time. But to call any rate change permanent is to overstate the stability of capital gain rates. Perhaps, a better term for what economists have thus far measured is a "persistent" elasticity of capital gains realization. Further, analyses extrapolating the elasticity of capital gains realizations from historical experience has not seriously considered how tax rate uncertainty might affect those extrapolations.

To begin to illustrate how these effects might work, we model how tax rate uncertainty might affect the elasticity of capital gains realizations across a range of tax rates. We model the effects from 15 percent to 28 percent, again reflecting the range of statutory capital gains rates over the last several decades.

We assume a distribution of asset holders—varying characteristics across several dimensions. First, we assume that asset holders have a range of investment horizons. We vary the horizon from zero to twenty years, assuming investor time horizons are evenly distributed across those periods.[10] Second, we assume that the returns that asset holders currently earn are normally distributed with a mean of 5% and a standard deviation of 2%.[11] The taxpayers all have the opportunity to switch into an alternative asset that returns five percent. Third, we assume variance in the amount of gain in the assets. We assume that the gain varies from 99 percent to none of the value of the underlying asset, assuming an even distribution across that range.

Absent such variation in characteristics, changes in the amount of realizations would be highly discontinuous. If the population were entirely homogeneous, the elasticity would be zero except at the point at which the change in the tax rate flipped asset holders from choosing to sell the asset or vice versa. We of course observe a much more continuous pattern in realization behavior, reflecting a variation in characteristics across asset holders.

We also assume a baseline of realizations that are unaffected by rate changes. These may include high-frequency traders focused on short-term factors other than tax rates, traders who simply are not tracking tax rate changes, investors who are realizing gains to use capital losses, and realizations triggered at death. We set the baseline so that elasticity estimates are roughly in the range of those estimated in the literature, though there has been significant variance in those estimates.

For instance, analysts from the Joint Committee on Taxation and the Congressional Budget Office estimated that the long-run elasticity of capital gains realizations was -0.72 looking at the period from 1999 to 2008 and based on two rate changes at the federal level in this

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[10] Varying the investment horizon allows the model to capture at least to first order more realistic taxpayers who face a probability of facing a liquidity event (e.g., family illness, vehicle replacement) in any given year without frictionless access to borrowing. This taxpayer is effectively a weighted average of taxpayers with a variety of different investment horizons.

[11] In other words, the taxpayers vary in their expectations of future returns. The important fact is that there are heterogeneous expectations regarding the difference between the return on the asset they currently hold and alternative assets, and this could occur either through variation in the expected return on the asset they hold or the alternative asset or some combination.

period as well as state-level tax rate variation (Dowd, McClelland, and Muthitacharoen, 2015). Other major studies in recent decades find a permanent elasticity as low as -0.18 (Burman and Randolph, 1994) and as high as -1.72, though that same study found a much lower elasticity (of -0.34) in an alternative specification (Auerbach and Siegel, 2000). Our estimates are roughly centered in this range, though the level is not of substantial importance to our analysis. Rather, our point is to illustrate how uncertainty could affect the pattern of realization elasticity across a range of tax rates.

Our model incorporates the effects of uncertainty and estimates elasticities across different tax rates. Because we are running a computer simulation, we can explicitly calculate the elasticity of realized gains at every possible capital gains rate. To be clear, our model is estimating long-run elasticity in anticipation of future rate changes rather than short-run or transitory elasticities when rate changes are known.

Figures 5a and 5b graph the results, showing the pattern of elasticities across the rates. Figure 5a uses the version of our model assumes that taxpayers are not given the opportunity to sell immediately before any rate changes. Figure 5b assumes that taxpayers can trigger gains immediately before or after a rate change. In each figure, we plot elasticities for two different levels of uncertainty with regard to future rate changes: without uncertainty (the tax rate will stay the same) and with uncertainty consistent with rate changes since 1980.

The pattern of elasticities becomes U-shaped with uncertainty introduced under these conditions. There are smaller elasticities at the top and bottom of the rate distribution and larger (more negative) elasticities in the middle. The U-shaped pattern results from the way uncertainty affects incentives to either sell or hold. At high rates, uncertainty tends to strengthen the tax incentive to hold; at low rates, it does the opposite. By generating these more extreme incentives at low and high rates, uncertainty tends to result in lower elasticities at either end of the rate distribution than toward the middle—where there is a tipping point in terms of expected future tax rates.

A thought experiment can help illustrate why the U-shaped pattern occurs based on the tax rates we use: At a high rate, of say, either 27 or 28 percent, it requires a relatively large premium on an alternative asset to incentivize an investor to sell and subject the built-in gain to that high tax rate. This is because of the probability of the investor being able to take advantage of a lower rate in the future. Further, under our assumptions of those alternative returns – a normal distribution of differences between the return of the alternative asset and that of the current asset, centered at zero – there is a relatively small change in the number of investors for whom it makes sense to realize gains between those two rates. The elasticity is, as a result, relatively low. By contrast, toward the middle of the distribution, a change in rates results in a larger change in realizations, as there are more investors who flip between holding and selling given the returns available on alternative assets.

This finding – of a U-shape – is thus dependent on the underlying distribution of the differences in returns on the current assets and alternative assets. The U-shape in elasticities emerges whenever the differences are concentrated closer to zero than the extremes.

In our modeling, the pattern of elasticities is also somewhat uneven and does not form a smooth "U." That uneven pattern results from how we assign probabilities of rate changes based on the distribution of rate changes since 1980. The probabilities are somewhat discontinuous since we assume that any change that would go "out of range" (the range of 15 to 28 percent) would not occur. Thus, some rate changes become possible in discontinuous fashion. As a sensitivity analysis, we have analyzed the pattern of elasticities assuming a smoother pattern of possible rate changes, and the "U" pattern remains—just with the curve forming a smoother "U."

Elasticity studies so far have not been designed to measure whether elasticity varies in this way due to rate uncertainty. The effects shown here should be seen as illustrative of the kinds of effects on elasticity that would result if people are sensitive to the financial incentives created by long-run rate uncertainty. For example, if a study estimated separate elasticities for three different ranges of federal rates: low (15-20%), medium (20-25%), and high (25-30%.) Such an empirical study would allow us to verify whether the predicted effects of rate uncertainty actually influence the measure of elasticity in the expected fashion.

It is interesting to consider the results of a recent CBO study measuring elasticities from 2001-2008 (Dowd et al., 2012). The paper provided a point estimate of -.792. However (as a robustness check), they repeated their study focusing on several sub-periods. We also include the data from Auerbach & Siegel (2000) which used a similar methodology to measure permanent elasticity using data from 1986-1993.

With the exception of the elasticity measure from the 2004-2005 subperiod, the other measures of permanent elasticity follow the expected pattern.[12] Elasticities are low at 15%. They are relatively higher at 20% and then are much lower at 28%.[13] This is preliminary and speculative but encouraging nonetheless.[14]

It is worthwhile to note several limitations of the model presented. First, we are only focused on the long-run elasticity. We do not consider short-run or transitory elasticities. The

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[12] Note that the estimate of transitory elasticity for the 2004-2005 subperiod has the wrong sign. There may be something strange going on with that particular subperiod.

[13] It should be noted that Dowd et al. include additional variables in their regressions. When they apply the Auerbach and Siegel methodology to their data, they get even larger permanent elasticities than those reported in their paper. Thus, Table 8 may underreport the difference in elasticities at high rates and low rates.

[14] This provides an alternative explanation for why studies that have focused on different subperiods have arrived at elasticity estimate that are significantly different from each other. For example, Bogart & Gentry (1995) estimates an elasticity of -1.500 using data from 1979-1985 but only an elasticity of -0.854 using data from 1987-1990. The capital gains rate was much higher in the rate distribution in the latter time period.

literature shows that (1) when a rate increase is imminent, many taxpayers trigger gains and (2) when taxpayers have a temporary dip in income that results in a transitory reduction in their capital gains rate, realizations also increase. Second, the model only focuses on the top capital gains rate. Third, the model assumes a relatively simplified universe of built-in-gain assets, and does not consider the influence of strategic behavior in triggering gains to match realized losses. Fourth, the model assumes that all taxpayers are rational and have complete information in incorporating rate uncertainty into their decision-making. We have attempted to deal with the third and fourth issues by deflating the elasticity measures assuming an arbitrary number of realized gains in each year by taxpayers that are not rate sensitive.

However, the goal of the model is not to estimate the elasticity of capital gains in the United States or any other country. Rather the goal is to use a stylized model to show how elasticity might change across capital gains rates due to rate uncertainty. Taxpayers face a very different probability distribution of future relative rates when the current rate is 15% than when the rate is 28%. This difference should be expected to have a substantial effect on measured elasticities.

V. POLICY IMPLICATIONS

A. Revenue and Efficiency of Capital Gains Taxation

The analysis here has possible implications for the revenue and efficiency of capital gains taxation.

First, rate uncertainty generates incentives that distort the decision whether to sell or hold an asset. The overall efficiency implications of this are complicated and interact with other distortions produced by the tax system. As has been explored in previous literature, the tax system tends to encourage people to hold assets both due to the value of deferring tax liability and due to step-up in basis at death (e.g., Landsman and Shackelford, 1995). At times, rate uncertainty will tend to exacerbate these effects. This will especially be true at tax rates at the higher end of the range. As shown in the modeling above, there will be an additional incentive to hold at that point awaiting a lower tax rate.

However, tax rate uncertainty may offset the tax incentives to continue holding assets and even prompt realizations that would otherwise not occur in the absence of taxation. These incentives to accelerate realizations would occur for instance at low tax rates and if taxpayers believe they may not have enough forewarning to sell in time to avoid a future enacted rate increase. They would also occur when tax rate increases are expected shortly and to take advantage of a current, low rate.

Second, these results have implications for revenue generation. The results suggest that revenue estimates that extrapolate elasticity as measured at one rate and uses these estimates for significantly different rates may be inaccurate. For small changes in the rate, realizations could potentially be especially sensitive toward the middle of the distribution of possible tax rates, and revenue from tax increases in this range could under-perform as compared to what otherwise would be expected to the extent the effect of rate uncertainty were not taken into account.

Third, these efficiency and revenue effects are also dependent on the political context and the degree of uncertainty that results. If uncertainty falls generally, these effects probably become less significant. Further, taxpayer responses to rates will change as the *range* of possible rates changes. The discussion in this paper was anchored to a distribution of possible rates of 15 percent to 28 percent, the range of federal statutory capital gains rates observed in the United States since 1980. However, if we look at the range of rates for the three decades immediately preceding those, the range of capital gains rates was much greater, between 20 percent and 40 percent. This has important policy implications. For example, a rate of 25 percent would be relatively high in the distribution of rates since 1980 but would be relatively low in the distribution of rates from 1950-1980. This paper has emphasized understanding the capital gains rate within the context of likely future rates. That distribution of likely future rates has been treated as fixed and exogenous, but it need not be so. Oh & Tausanovitch (2016) use role call voting data to argue that political preferences for capital gains rates have been relatively fixed since 1986. However, it is possible that rate preferences will change again in the future, contracting, expanding, or shifting the range of possible rates.

Take the legislative machinations and revenue effects in 2017. Federal revenues in the first part of the year disappointed as compared to expectations. While the exact sources are not known, one reasonable theory is that people were deferring realizations given increased legislative uncertainty and a greater likelihood of a rate cut (Ehrenfreund and Paletta, 2017). However, defeat of tax legislation to reduce the rate might unwind those deferrals and have lasting effects—reducing uncertainty and increasing the expected value of future capital gains rates, with attendant effects on long-term realization behavior.

The bottom line is that the efficiency and revenue generation of current tax rates depends not just on the level of those rates but the expectation of future rate changes, and those expectations are dependent on a range of factors, including past changes in law and current positioning of key political actors.

B. Reforms to the Realization Rule

There have been calls for reform to the realization rule, and this paper highlights how the realization rule introduces an additional source of distortion as compared to those normally discussed—that of the effects of rate uncertainty. In this way, it suggests an additional benefit of reforming the realization rule. However, one way of reforming realization would address the distortions in realization behavior generated by rate uncertainty; another way would not.

In reforming realization, there are at least two ways for determining the appropriate tax rate to apply to the gain. One way would tax accrued gains at rates in place in the years in which gains accrued, using an annual mark-to-market system or some average of rates over the period. The liability might then be deferred, with a charge applied for such deferral. However, the tax rate applied to the gain would be set in the previous years (e.g., Glogower, 2016; Miller, 2008; Auerbach, 1991). This approach tends to be recommended for publicly-traded assets, and some would apply a version to non-publicly traded assets. A second approach would use the tax rate in the year in which the gain is realized but apply some penalty for having deferred paying taxes as the gain accrued. This has been suggested by some for non-publicly traded assets (e.g., Shakow, 1986, 1223).

However, while both approaches could mitigate or eliminate the incentive resulting from the time-value-of-money benefit from deferring gain, only the first would address distortions created by rate uncertainty. The key insight is that the second type of reform would not eliminate the incentives created by future tax rate uncertainty since the systems would continue to tax gain at the rate in place at the time that gain is realized. Thus, rate uncertainty is a reason to use a system that imposes tax based on past tax rates, whether via mark-to-market taxation (particularly for publicly traded assets) or some averaging of those previous tax rates (particularly for non-publicly traded assets).

C. Other Tax Policies and Rate Uncertainty

Some of the lessons of this analysis should apply beyond capital gains. The basic model here is relevant anytime the tax system gives taxpayers a choice as to the year in which income will be taxed by re-timing an activity. Of course, some activities are likely to be more sensitive to the effects of rate uncertainty than others.

One other activity that illustrates the potential power of rate uncertainty in affecting such behavior was the choice by U.S. corporations whether to repatriate profits earned overseas, prior to the 2017 tax reform legislation. Prior to that legislation, the profits from the international operations of subsidiaries of U.S. corporations would only face tax in the United States when they were considered "repatriated" to the U.S. parent corporation. Absent that repatriation, the U.S. tax liability would be deferred. However, assuming a constant tax rate, corporations were not actually reducing the value of the tax liability owed to the U.S. government by deferring the liability—so long as the funds were eventually repatriated. This is because the liability grew with the amount of deferred earnings, which continued to grow as they were invested (Hartman, 1985). Still, in recent years before the 2017 tax reform, unrepatriated earnings built up to trillions of dollars (Joint Committee on Taxation, 2016), and one likely impetus was rate uncertainty.

The large build up in unrepatriated earnings occurred in the wake of the 2004 repatriation holiday that allowed corporations to repatriate earnings at a special low rate in that one year. While it was a one-time holiday, it generated uncertainty about future tax rates on unrepatriated earnings, and the existing tax rate was seen by many as the upper end of the likely range. The result was a build-up in unrepatriated earnings—very much akin to holding onto a capital asset and waiting to realize a gain at a lower tax rate (Brennan, 2010).

This is an illustration that the basic concepts explored here apply beyond and to any situation in which taxpayers can adjust activity to choose what year's tax rate applies to a gain. In that case, uncertainty about tax rates in future years will have important incentive effects on behavior today and whether or not to recognize the gain.

VI. CONCLUSION

The realization-rule's effects on taxpayer behavior has been the subject of considerable study, but, for the most part, previous work has not considered the effects of long-term rate uncertainty on realization behavior. This article suggests that the effects could be important and might create significant financial incentives that interact in complicated ways with other tax-generated distortions, such as the time-value-of-money benefit from deferring gain. The analysis in this article is largely theoretical using simulations of possible taxpayer behavior. And, while previous empirical work suggests that elasticities of capital gains might vary significantly over time—as is predicted by the analysis in this paper—that evidence is only suggestive, and future work could help illuminate the power of tax rate uncertainty by looking at realization behavior across different time periods and at different tax rates. In the meantime, there is reason to take the issue of uncertainty seriously, both in analyzing realization behavior and in considering policy changes to capital gains rates and realization rules.

ACKNOWLEDGMENTS

The authors thank Jon Bakija, Lily Batchelder, Ryan Bubb, Ed Fox, Lewis Kornhauser, and participants at the 2017 NTA Annual Meeting and the NYU Internal Law and Economics Workshop for helpful comments on earlier drafts. The authors also thank Heejin Hwang and Adam Kern for their able research assistance.

DISCLOSURES

The authors have no financial arrangements that might give rise to conflicts of interest with respect to the research reported in this paper.

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Table 1
Distribution of Capital Gains Rate Changes Since 1980

% Change (+/-)	Number of Changes	Year of Change and Direction
0-1	6	1991 (+), 1993 (+), 2006 (-),2008 (-), 2010 (-), 2018 (-)
5	1	2003 (-)
8	3	1981 (-), 1987 (+), 1997 (-)
10	1	2013 (+)
Total	11	

Source: Authors' calculations based on historical data from the Department of Treasury.

Table 2
Rate Premium (Alternative Versus Current Asset) Required for Taxpayer to Be Indifferent Between Selling and Holding

	Rate Premium (%)			Sell or Hold If No Rate Premium
Initial Tax Rate (%)	Effect of Rate Uncertainty Alone	Effect of Time Value of Money Alone	Combined Effect	
15	-6.99	0.64	-6.36	Sell
16	-5.97	0.69	-5.28	Sell
17	-4.92	0.74	-4.19	Sell
18	-3.86	0.79	-3.08	Sell
19	-2.78	0.84	-1.95	Sell
20	-1.68	0.89	-0.80	Sell
21	-0.56	0.94	0.37	Hold
22	0.58	0.99	1.57	Hold
23	1.74	1.05	2.78	Hold
24	2.92	1.10	4.02	Hold
25	4.12	1.16	5.27	Hold
26	5.35	1.22	6.56	Hold
27	6.59	1.27	7.86	Hold
28	7.87	1.33	9.20	Hold

Table 3
Rate Premium (Alternative Versus Current Asset) Required for Taxpayer to Be Indifferent Between Selling and Holding with Rate Inertia

	Rate Premium (%)			Sell or Hold If No Rate Premium
Initial Tax Rate (%)	Effect of Rate Uncertainty Alone	Effect of Time Value of Money Alone	Combined Effect	
15	-1.22	0.64	-0.59	Sell
16	-1.08	0.69	-0.40	Sell
17	-1.10	0.74	-0.37	Sell
18	-1.12	0.79	-0.34	Sell
19	-0.92	0.84	-0.09	Sell
20	-0.76	0.89	0.12	Hold
21	-0.06	0.94	0.88	Hold
22	0.07	0.99	1.06	Hold
23	0.81	1.05	1.85	Hold
24	1.02	1.10	2.12	Hold
25	1.28	1.16	2.44	Hold
26	1.31	1.22	2.52	Hold
27	1.34	1.27	2.61	Hold
28	1.58	1.33	2.91	Hold

Table 4
Return Premium Required to Sell, Longer Investment Horizons

	Rate Premium (%)			
	4-year Horizon		20-year Horizon	
Year 1 Capital Gains Rate (%)	Without Uncertainty	With Uncertainty	Without Uncertainty	With Uncertainty
15	0.59	-0.03	0.40	0.32
16	0.63	0.15	0.43	0.39
17	0.68	0.22	0.46	0.44
18	0.72	0.28	0.49	0.49
19	0.77	0.43	0.52	0.56
20	0.82	0.62	0.55	0.65
21	0.86	1.00	0.59	0.82
22	0.91	1.19	0.62	0.94
23	0.96	1.75	0.65	1.21
24	1.01	1.96	0.68	1.33
25	1.06	2.21	0.71	1.46
26	1.11	2.29	0.75	1.51
27	1.17	2.37	0.78	1.54
28	1.22	2.57	0.81	1.62

Table 5 Return Premium Required to Sell with Risk Aversion						
	Rate Premium (%)					
	1-year Horizon			20-year Horizon		
Year 1 Capital Gains Rate (%)	η=0	η=2	η=10	η=0	η=2	η=10
15	-0.59	-0.66	-1.00	0.32	0.32	0.31
16	-0.40	-0.47	-0.84	0.39	0.39	0.38
17	-0.37	-0.45	-0.83	0.44	0.44	0.43
18	-0.34	-0.43	-0.82	0.49	0.49	0.48
19	-0.09	-0.17	-0.51	0.56	0.56	0.54
20	0.12	0.04	-0.31	0.65	0.64	0.62
21	0.88	0.82	0.56	0.82	0.81	0.76
22	1.06	0.99	0.76	0.94	0.92	0.86
23	1.85	1.78	1.52	1.21	1.18	1.07
24	2.12	2.04	1.79	1.33	1.30	1.18
25	2.44	2.35	2.06	1.46	1.42	1.28
26	2.52	2.44	2.14	1.51	1.46	1.32
27	2.61	2.52	2.22	1.54	1.50	1.35
28	2.91	2.82	2.52	1.62	1.57	1.42

Table 6a Cannot Sell Immediately Before a Rate Change	
Rate (%)	Decision
15	Sell
20	Hold
25	Hold

Table 6b Can Sell Immediately Before a Rate Change	
Rate Increase (%)	Decision
15 → 20	Sell
15 → 25	Sell
20 → 25	Hold
Rate Decrease (%)	Decision
25 → 20	Hold
25 → 15	Hold
20 → 15	Hold
Rate Unchanged	Decision
15	Hold
20	Hold
25	Hold

Table 7a
Cannot Sell Immediately Before a Rate Change

Rate (%)	Return Premium Required to Sell
15	-0.2%
20	1.3%
25	3.5%

Table 7b
Can Sell Immediately Before a Rate Change

Rate Increase (%)	Return Premium Required to Sell
15 → 20	-0.8%
15 → 25	-1.7%
20 → 25	0.6%
Rate Decrease (%)	
25 → 20	0.9%
25 → 15	0.9%
20 → 15	1.8%
Rate Unchanged	
15	0.9%
20	1.8%
25	3.5%

Table 8
Reported Elasticity Measures

Permanent Elasticity	Federal Capital Gains Rate (%)	Year	Source
-0.34 (0.13)	20-28	1986-1993	Auerbach & Siegel
-0.91 (0.25)	20	2000-2001	Dowd et al.
-1.00 (0.42)	20-15	2002-2003	Dowd et al.
-1.41 (0.29)	15	2004-2005	Dowd et al.
-0.36 (0.14)	15	2006-2007	Dowd et al.

Figure 1
Return Premium Required When Capital Gains Rate is Uncertain

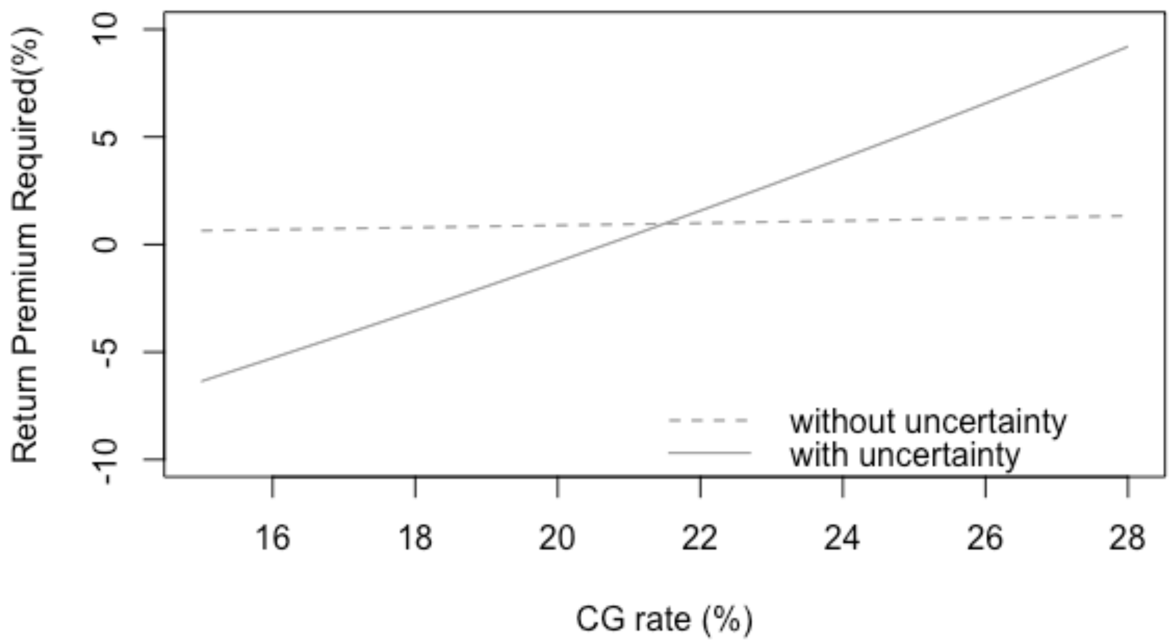


Figure 2
Return Required for Taxpayer to Sell with Rate Inertia

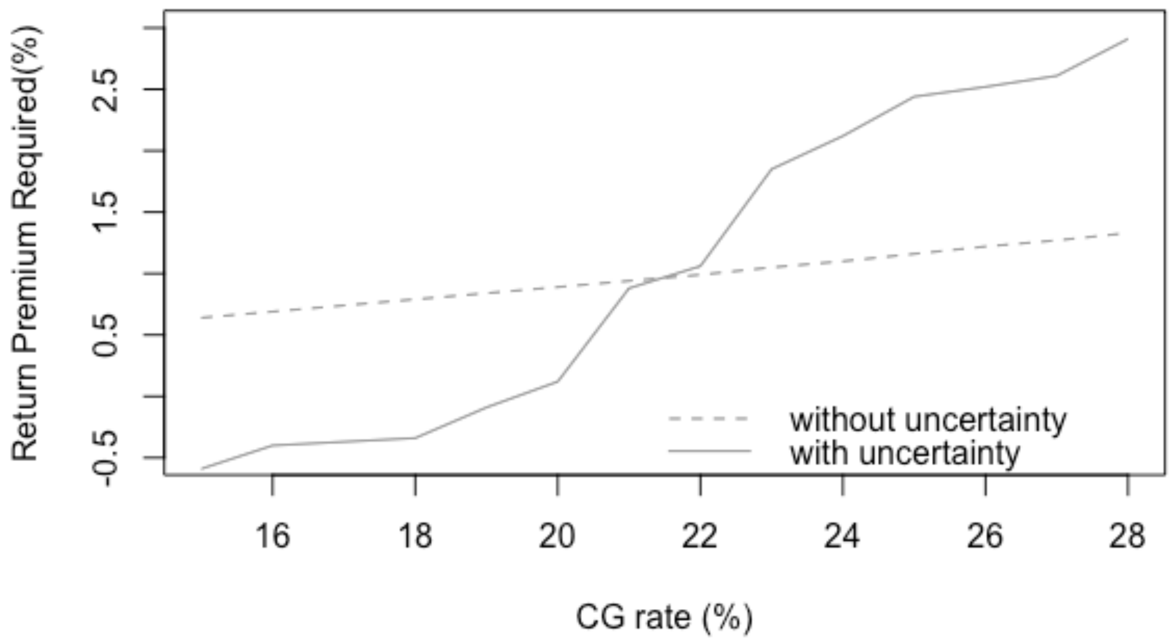
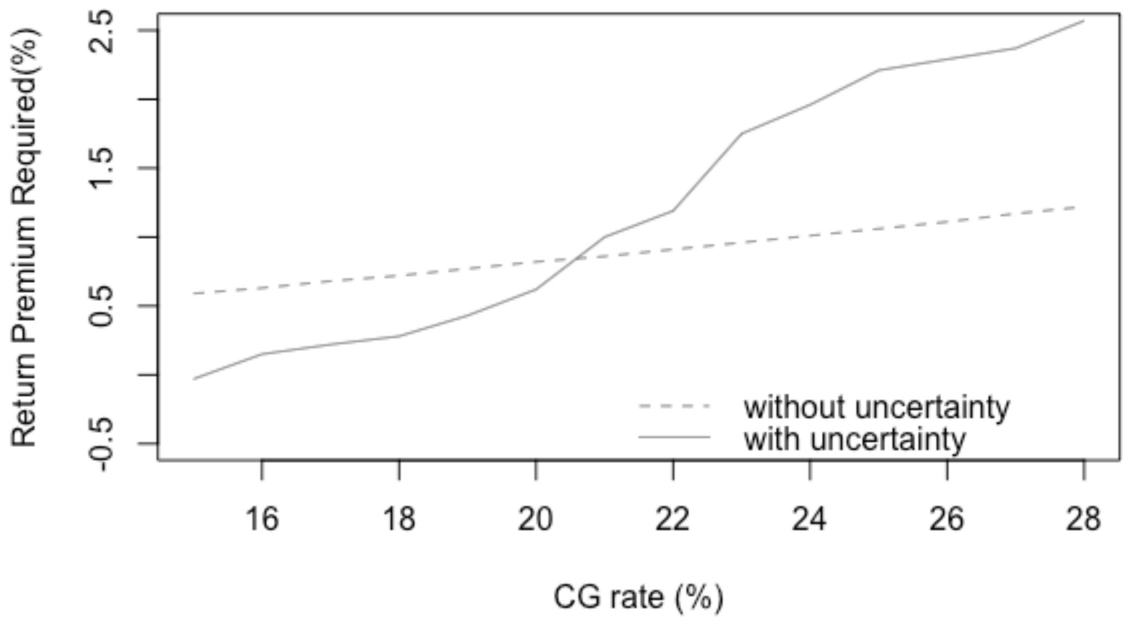


Figure 3
Return Required to Sell for Different Investment Horizons
(a) 4-Year, (b) 20-Year



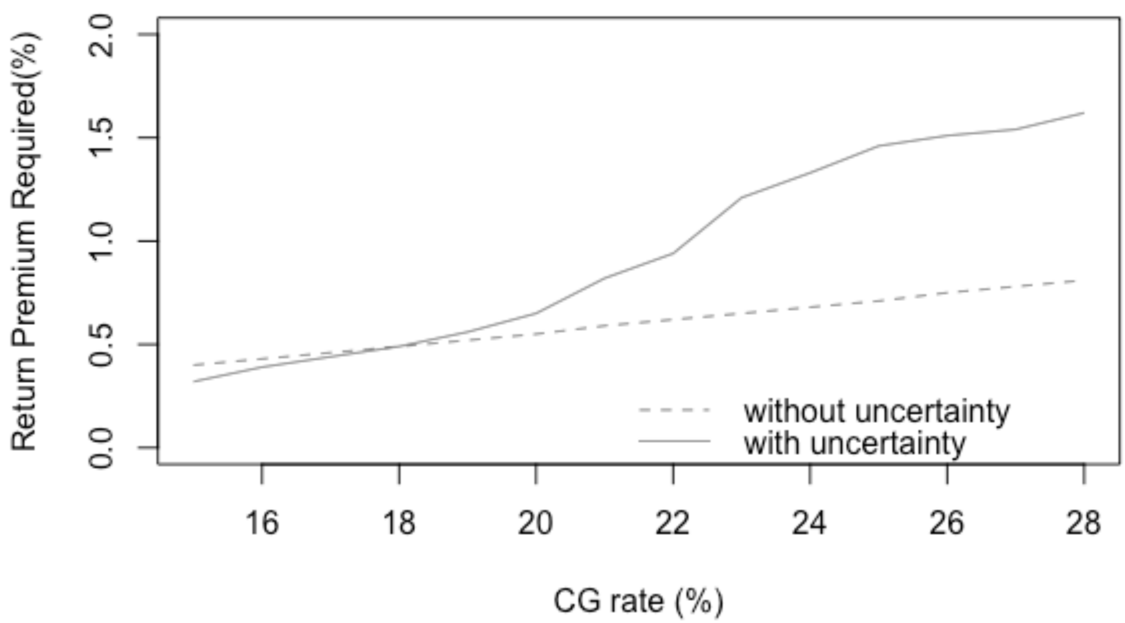


Figure 4
Simple Approach to Incorporating Step-Up in Basis
(a) 4-year, (b) 20-year

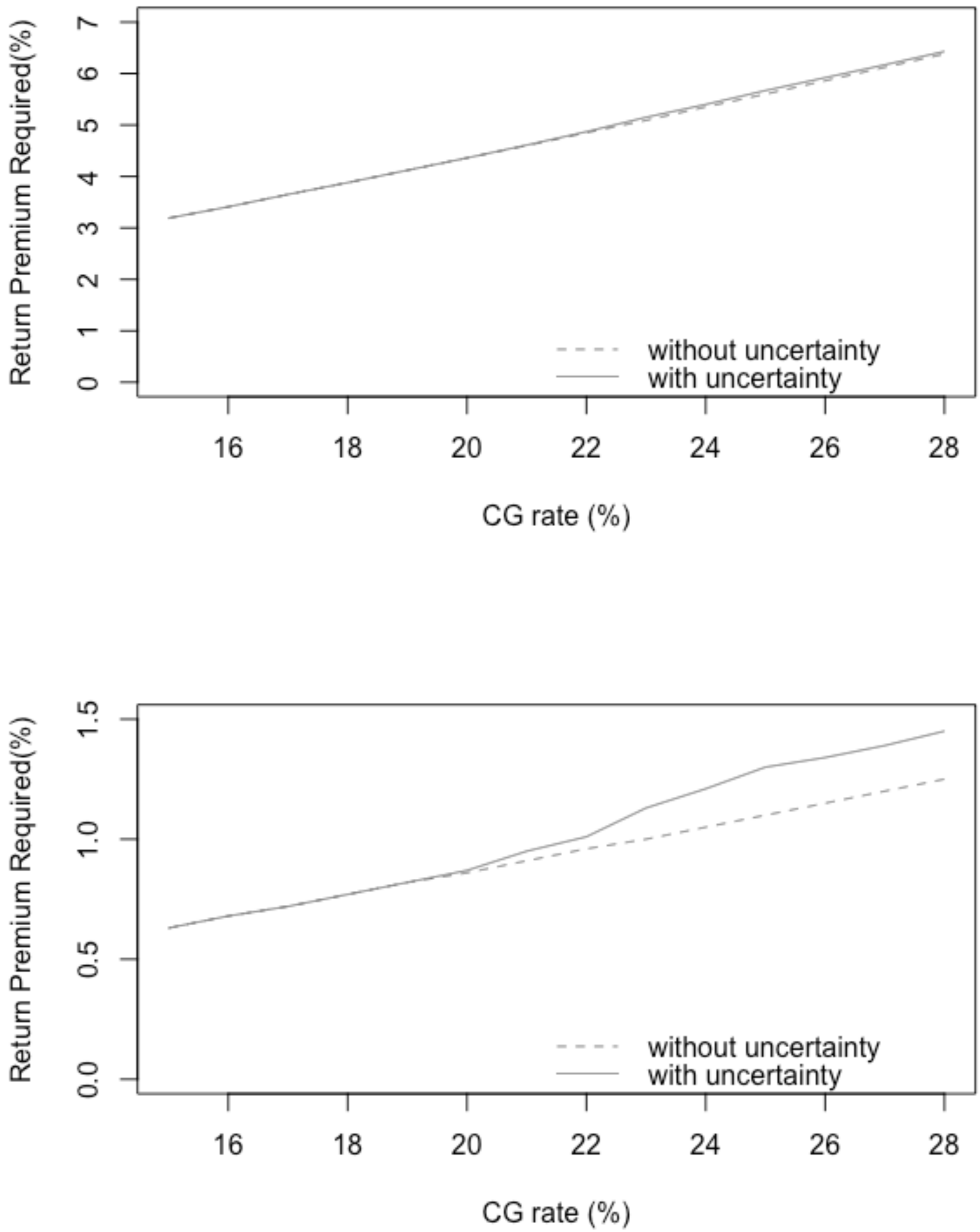


Figure 5
Elasticity of Capital Gains Realization With and Without Uncertainty
(a) Cannot Trigger Gains Before a Rate Change, (b) Can Trigger Gains Immediately Before a Rate Change