Choosing When to Pay Capital-Gains Taxes

Scott Macdonell
The University of Texas at Austin

Draft: October 13, 2008

Abstract: Political pundits often note that capital gains tax revenues have historically increased after decreases in the capital gains tax rate, seemingly arguing that we are on the wrong side of the capital gains tax Laffer curve. Although many find an optimal capital-gains tax rate of zero, economists widely recognize the pundits' analysis ignores an important feature of capital gains tax cuts: rational taxpayers should try to realize their gains when taxes are lower. We should then expect revenue increases to be at least partly due to taxpayers shifting realizations they would have otherwise taken in different periods. In order to evaluate the magnitude of this effect, I first examine a deterministic analytical model, and then use dynamic programming to solve a utility maximizing taxpayer's choice problem when faced with a stochastic life cycle where taxpayers are allowed to choose when to realize their gains.

> *"Because gains can easily be shifted in response to legislation as taxpayers attempt to realize gains when tax rates are low, behavioral effects cannot easily be separated from other effects. Moreover, how taxpayers will actually respond to changes in the taxation of capital gains is highly uncertain."*
>
> - May 2008 Congressional Budget Office report (Seibert 2008 pp. 5)

Introduction:

In the April 16th, 2008 Democratic Presidential Primary Debate moderator Charles Gibson asked the following question about capital gains taxes to Senator Obama:

> *"[I]n each instance, when the rate dropped, revenues from the tax increased; the government took in more money, and in the 1980s, when the tax was increased to 28 percent, the revenues went down. So why raise it at all[?]"* ABC (2008)

Economists generally recognize that Gibson's analysis, looking at the year before, and the year after a tax change, is insufficient to judge its long run budgetary impacts. Capital gains tax revenues can be strongly influenced by stock market performance over the tax year, leading to the possibility that market shocks could mask the impact of taxes. This paper focuses on another explanation for jumps in revenues after tax rate cuts. Given people's ability to choose when to pay the tax conventional wisdom suggests we should expect taxpayers to shift their realizations towards periods of lower taxes. If there were a risk of a fall (or rise) in capital gains tax rates, rational taxpayers would have an incentive to try to realize their gains after (or before) the new rates were enacted. What impact might we expect taxpayer's attempts at timing their realizations to have?

Studying panel data on tax rates across U.S. states Burman & Randolph (1994) support this idea empirically, finding significant differences between the 'permanent' and 'transitory' affects of changes in capital gains tax rates. Using data on the investment decisions of individuals who hold "stock in both taxable and tax-deferred accounts," Ivkovic, Poterba & Weisbenner (2005) find a significant difference between people's strategies in taxable and tax-deferred accounts. Under certain restrictive assumptions Stiglitz (1983) shows how a rational taxpayer could potentially avoid paying any capital gains taxes. While the literature seems well aware of taxpayer's abilities to time realizations based on the current tax environment it seems to lack a computable model which allows agents this option. Such a model, if well developed, could significantly improve our ability to both understand and predict how taxpayers will respond to variations in the tax rate. Furthermore, many models tend to assume capital income is taxed upon creation, as opposed to realization. A computable model that allows taxpayers to strategically time their realizations would allow us to evaluate any bias introduced by leaving this feature out of other models. In that light, I take a first step towards these goals by developing and solving an overlapping generations (OLG) model with stochastic taxes and returns to study the short and long term revenue implications of consumers' capital gains realization decisions.

Simple Model:

Before moving on to the infinite horizon case, it may be helpful to examine a simple two period model in order develop some intuition. Consider an agent facing two more periods of life. In periods one and two she faces capital gains tax rates and receives (after-tax) other income of of τ_1, and τ_2, and w_1, and w_2, respectively, respectively. In the first period she has assets of k_1, for which she paid $\rho_1 k_1$, making ρ_1 her fractional basis. She will receive a pretax return of R on assets between periods one and two and discounts future utility at rate β. Letting l_1 and s_1 denote period one realizations and new investments, respectively, we know $k_2 = (k_1 - l_1 + s_1)R$ and $\rho_2 = \frac{(k_1-l_1)\rho_1+s_1}{(k_1-l_1+s_1)R}$. and In each period she receives utility $u(c_t)$ from consumption satisfying the standard assumptions, $u^{'}(c_t) > 0, u^{''}(c_t) < 0$ and $\lim_{c\to 0}\left(u^{'}(c)\right) = \infty$ such that the solution involves strictly positive consumption in both periods. Obviously, she will realize any remaining assets in period two and therefore her consumption in both periods is merely a function of her period one investment and realization decisions. We can then write

$c_1 = w_1 + l_1(1-(1-\rho_1)\tau_1) - s_1$ and $c_2 = w_2 + k_2(1-(1-\rho_2)\tau_2)$. Her maximization problem can then be written:

$$\max_{s,l}\{u(c_1) + \beta u(c_2)\}$$

s.t. $$l_1 \in [0, k_1],\ s_1 \geq 0$$

An algebraic solution to this problem exists, but is cumbersome enough to obfuscate any underlying intuition. Instead, take the solution as given and consider three sets of circumstances: constant, strictly decreasing and strictly increasing tax rates. Denote tax rates and choice variables in each case by $*$, d and i superscripts, respectively. As such, $\tau_1^* = \tau_2^*$, and assume $\tau_1^d \geq \tau_1^* \geq \tau_2^d$, $\tau_1^i \leq \tau_1^* \leq \tau_2^i$,[1] and $\tau_x^y \in (0,1)\ \forall\, x, y$. In the cases where tax rates are equal or decreasing over time, gains will only be realized in the first period when the agent is decreasing her net asset position. She will never realize gains and make new investments simultaneously as this strategy is strictly dominated by decreasing realizations by ε while decreasing new investments by $(1-\tau_1)\varepsilon$, leaving current consumption unchanged while increasing future consumption. In fact, even in the case where tax rates are increasing, stepping up one's basis only makes sense when

(1) $$\boldsymbol{\tau_1 \leq \frac{\tau_2}{R(1-\tau_2)+\tau_2}}.$$ [2]

Note that the denominator on the right hand side is strictly larger than numerator.[3] For this strategy to make sense the lower basis under high tax rates has to make up for lowering the level of investment by paying taxes now.

While the potential income effects of switching between the proposed tax schemes depend on a variety of factors,[4] the substitution effects are straightforward and discussed here. The model with

[1] For both of the preceding expressions suppose at least one of the inequalities holds strictly.
[2] See Appendix A.
[3] Resetting one's basis during periods of low taxes becomes less attractive as R increases, such as when considering sales in the more distant future.

increasing tax rates lowers the cost of current consumption in terms of future consumption. Fewer realizations must be made to finance the same current consumption, and/or any investments forgone would have yielded lower after tax returns in the future. This would tend to decrease investments held or made as well increase current consumption. Additionally, if equation (1) holds, all gains will be realized immediately, even if some realizations are reinvested. The model with decreasing tax rates raises the cost of current consumption in terms of future consumption. More realizations must be made and/or any investments forgone would have yielded higher after tax returns. This would tend to increase investments held or made while decreasing current consumption.

The standard Laffer Curve argument posits that lowering the tax rate on, for instance, labor income, increases agents' returns to labor, inducing them to choose to more. The larger labor income at least partially offsets the decrease in revenues per dollar of labor income. We see a very different mechanism at work in the model with lower first period tax rates. Lower taxes on investment income today relative to tomorrow increase the incentives to make that income apparent to tax authorities today instead of tomorrow. Here, the current decrease in revenue per dollar of investment income is offset by an increase in realizations (and corresponding decrease in investments held). Relatively lower taxes on capital gains in the first period discourage investment! In the case of the model with decreasing capital gains taxes, we see tomorrows decrease in revenue per dollar of investment offset by an increase in realizations coming not from concurrent investment decisions (as tomorrow is the end of time), but from prior ones.

In this simple model, agents have a powerful ability to shift realizations across time. This would seem to decrease investment activity and increase realizations in periods with lower capital gains tax rates while having the opposite impact in periods of higher capital gains tax rates.

---

[4] Especially which period the agent wishes to realize gains.

Model:

In order to allow for longer periods of employment than retirement within the OLG framework (without specifying value functions for many different age groups) I used Gertler's (1999) aging structure. There are two types of agents, young and old (workers and retirees). Each period a young agent remains young next period with probability ω and becomes old with probability $1-\omega$. Old agents survive with probability γ and die with probability $1-\gamma$. All young agents are assumed to have a fixed outside (after-tax) income i while old agents receive a portion thereof, αi.[5] Both types of agents share a common discount factor β and utility function $u(c)=\frac{c^{1-\sigma}}{1-\sigma}$. We could allow government actions into the utility function, but I'm implicitly assuming $\frac{\partial^2 u(c)}{\partial c \partial g}=0, \forall\, c, g$, where g is any metric of government action (e.g. expenditures financed by taxation). This way, we may ignore any impact from government revenues in the consumer's problem.

In the interests of computational tractability, agents have only one asset available. In the U.S. changes in tax rates are usually determined before they become effective. So, my model allows agents to anticipate next period's tax rate. An agent's state can then be represented as (k, ρ, τ, τ'), where k, ρ, τ and τ' are: the current real value of her asset holdings, her basis, represented as a fraction,[6] the current and next period's capital gains tax rates, respectively. Each period, assets grow by a factor of R, which could be drawn from a distribution, but is a constant in the current version of the program. The tax rate is assumed to evolve according to an AR(1) process to be described below.[7]

---

[5] This represents income from all sources other than capital gains, e.g. wages, social security.

[6] If an agent only held assets they had purchased last period for nine units, and they were today worth ten, her $\rho = 0.9$.

[7] In democracies, taxes are indirectly chosen by taxpayers through their elected officials. In fact, papers such as Krusell & Ríos-Rull (1999) specifically model tax choices, and so my assumption that changes in tax rates come as surprises to taxpayers may be overly restrictive. However, Dai et al. (2008) find evidence that “news that sharply increased the probability of a reduction in the capital gains tax rate” affected the asset market. This certainly doesn't prove that capital gains tax rates follow an AR(1) process, but suggests that at least to some degree

Agents have two choices to make: how much of the asset to sell (and thus how much of their gains to realize), and how much of the asset to buy at its current price denoted l and s, respectively. Agents were not allowed to borrow, or sell short[8] thus restricting $l, s, k > 0$, and $l \leq k$. As outside income is assumed to be weakly decreasing for all agents in this economy, borrowing should have no use for consumption smoothing. Short selling is suboptimal even if we made the asset risky as long as it provides positive expected returns.

Given the above we can now describe the transition processes for k:

$$k' = R'[(k - l) + s]$$

and ρ:

$$\rho' = \frac{(k - l)\rho + s}{\big((k - l) + s\big)R'}$$

Inherent in this equation for ρ' are two important assumptions about the way this economy works. First, even if today's assets are the accumulation of multiple purchases over many years, only the average basis matters. Agents cannot choose which of multiple purchases to realize gains from.[9] Additionally, there is no change in the real basis due to inflation. In reality, people may pay taxes on nominal gains when actually facing real losses. Since the nominal (taxable) basis in a sense depreciates more quickly than one's real basis, we might expect agents in my model (without inflation) to have a

changes in tax rates are unforeseen. It seems plausible to think that while the direction of changes within the next few years might be expected to some degree, their timing and magnitude may be to some degree unforeseen. (Will Congress pass legislation this session or next? Will they raise/cut the top rate by three or four percent?) Furthermore, even given a deterministic relationship between voter (taxpayer) demographics and tax rates, long run predictions may only be made in expectation when faced with potential demographic shocks. The assumption of exogenous tax rate determination should be viewed as intermediate step before developing a model which can explain the variation in tax rates.

[8] These restrictions violate Stiglitz's (1983) assumptions and prevent me from obtaining his unrealistic result of no taxes paid in equilibrium.

[9] In reality, taxpayers approaching retirement and expecting an increase in the capital gains tax rate may want to realize gains and reset their basis on assets they only plan to hold for a short time longer to avoid the higher future rate, while avoiding taxes on assets they plan on holding longer to allow their gains to continue to grow untaxed.

stronger incentive (relative to real taxpayers) to “reset” their basis under lower tax rates. This effect may be moderated by dividends, as I discuss in the next section.

Using the above notation and transition equations, an old agent’s recursive problem becomes:

$$V_o(k,\rho,\tau,\tau') = \max_{l\epsilon[0,k],s\geq 0}\{u(c) + \beta\gamma \,\mathrm{E}\, V_o(k',\rho',\tau',\tau'')\}$$

$$s.t. \quad c + s \leq \alpha i + [1 - \tau(1-\rho)]l$$

Similarly, a young agent’s recursive problem is:

$$V_y(k,\rho,\tau,\tau') = \max_{l\epsilon[0,k],s\geq 0}\{u(c) + \beta[\omega \,\mathrm{E}\, V_y(k',\rho',\tau',\tau'') + (1-\omega)\,\mathrm{E}\, V_o(k',\rho',\tau',\tau'')]\}$$

$$s.t. \quad c + s \leq i + [1 - \tau(1-\rho)]l$$

Limitations

Many models attempt to determine the optimal capital gains tax rate[10] in a more general equilibrium framework. While this model currently ignores effects beyond domestic taxpayers’ demands for assets, this focus allow us to better study how consumers’ make their realization decisions. While changes in savings behavior would no doubt affect other aspects of the economy, the direct effects on the U.S. asset market of changes in the U.S. capital gains tax rates may well be muted by facts like some foreign investors being exempt from U.S. capital gains taxes on certain gains and the pervasive use of tax deferred accounts, such as IRAs, by U.S. taxpayers.[11] Furthermore, this paper may be viewed as the development of a part of a larger equilibrium framework.

[10] For example Chamley (1986) finds it should be zero, while under different assumptions Aiyagari (1995) finds it should be strictly positive.

[11] For more information on how U.S. capital gains taxes apply to the citizens of various foreign countries, refer to U.S. I.R.S. Publication 901. (Available at http://www.irs.gov/pub/irs-pdf/p901.pdf as of August 5th, 2008)

Also, my model assumes a constant (marginal) capital gains tax rate that agents use to make their decisions. In reality, with enough credits and a low income some taxpayers may face marginal capital gains tax rates of zero, while others with high incomes and no deductions face much higher rates. However, accounting for these factors is beyond the scope of this paper.

At the last minute I discovered some troubles with the code for the above model, and suspect trouble with the Matlab code for interpolation. This unfortunate surprise required me to scrap much of my analysis of this new model. So I also include some results from my original submission. That model (henceforth, "the old model") is the same with the following exceptions: It is calibrated more crudely, agents are unaware of next periods tax rate(τ' is not a part of the state space), and asset returns are stochastic.

Data and Parameterization:

For the basic parameters of both models I simply used values from Gertler (1999), setting $\omega, \gamma, \text{and } \beta$ to 0.977, 0.9 and 0.96 respectively. I set σ to 1.5 as this is commonly used for this class of utility functions.[12] Deriving the other parameters was more complex.

To calibrate the tax rate process, I used capital gains realizations and revenues data from the U.S. Treasury Department.[13] This data covers 1954-2005 and reports the maximum rate on long term capital gains, as well as total realizations and tax revenues of reported capital gains for each year. Effective tax rates were revenues over realizations for each year. Adda & Cooper (2003, pp.56-59) present a method of using Markov transition to approximate AR(1) processes of the form:

---

[12] See, for example Huggett (1993)

[13] Available at http://www.treas.gov/offices/tax-policy/library/capgain1-2008.pdf as of August 5th, 2008

$$\tau_{t+1} = (1-\varphi)\mu + \varphi\tau_t + \epsilon_t$$

where the ϵ_t are the normally distributed shocks, and μ is the unconditional mean of the series.[14] Performing simple OLS of the effective tax rates on their lagged values provided estimates for φ, μ and the standard deviation of ϵ_t. Using these estimates and following the method of Adda & Cooper, I created the above Markov matrix.[15] With the old model tax rates were separated into quartiles, and the mean conditional on the rate being in each quartile was calculated, and I then created a Markov transition matrix based on the observed proportion of the time that rates went from one quartile to another.

New Capital Tax **Transition Matrix** and *Rates*				
		τ'		
		0.1376	*0.1754*	*0.2132*
τ	*0.1376*	**0.8159**	**0.1803**	**0.0038**
	0.1754	**0.1803**	**0.6394**	**0.1803**
	0.2132	**0.0038**	**0.1803**	**0.8159**

	Old Capital Tax **Transition Matrix** and *Rates*				
			τ'		
		0.142	*0.1513*	*0.1722*	*0.228*
τ	*0.142*	**0.4615**	**0.5385**	**0**	**0**
	0.1513	**0.4167**	**0.25**	**0.3333**	**0**
	0.1722	**0.0769**	**0.2308**	**0.5385**	**0.1538**
	0.228	**0**	**0**	**0.1538**	**0.8462**

For the new model I had to simplify away from stochastic returns to maintain computational tractability. Ibbotson & Chen (2003) examine the returns to the S&P 500 from the period 1926-2000 and report an average nominal return of 10.7% (including dividends), and an average inflation of 3.08% over the period. As such I use a real return of 7.62%.

For the old model I used the series CPIAUCNS from the St. Louis Federal Reserve's FRED and historical prices for the S&P 500 downloaded from Yahoo! Finance to calculate the real return to the

[14] This specification is not a reasonable assumption for the evolution of capital gains tax rates, which often exhibit no change for several periods, followed by a jump when rates change. However, this is only an intermediate step to create a Markov approximation, which does exhibit this behavior.

[15] I used Matlab code developed by Martin Flodén (2005). Available at http://swopec.hhs.se/hastef/papers/hastef0656.zip as of August, 5th 2008

S&P for each year 1950-2007. Then in my model, real returns were set to randomly take (with equal probability) the conditional means in each quintile (right).

***R*'s**
-0.1723
-0.0157
0.0529
0.1071
0.257

How I treated dividends in the new model deserves some discussion. Dividend income is subject to immediate taxation at different rates and represents a significant portion of the incentive to invest. Unfortunately, including them in capital appreciation then allows taxpayers in my model an option unavailable in reality, timing dividend income. However, excluding them unrealistically decreases savings incentives. Fortunately, within my model, the exclusion of inflation tends to counteract the overstatement of taxpayers' timing abilities induced by the inclusion of dividends. Nominal capital gains (excluding dividends) move in the direction of real returns (including dividends) relative to real capital gains (real returns minus dividends) by positive inflation.[16] Separating dividends and capital gains would overly complicate the model, and given the above discussion, taxes on real returns would seem to provide a reasonable approximation of taxes on nominal capital gains.

Finally, data from the U.S Current Population Survey[17] shows that in 2004 the mean income of households headed by someone over 65 was roughly 62.6% that of those headed by someone under 65.[18] Given this, I set $\alpha = 0.626$ implying a 37.4% reduction in outside income for retirees, and with young income then normalized such that $i = 2$, old agents had non-capital gains income of 1.252.

[16]Inflation greater than dividends would move nominal capital gains beyond real returns.
[17] The specific table was available at http://pubdb3.census.gov/macro/032005/hhinc/new02_001.htm as of August 5th, 2008.
[18] This ratio is a quite different 48.1% if looking at median income.

Method:

With the old model using value function iteration, I derived numerical values for $V_y(k, \rho, \tau)$ and $V_o(k, \rho, \tau)$ over a discritized state space. Also, I derived the associated policy functions for choices of l and s for agents in each age group. $G_{yl}(k, \rho, \tau)$, $G_{ys}(k, \rho, \tau)$, $G_{ol}(k, \rho, \tau)$, and $G_{os}(k, \rho, \tau)$.

Given these policy functions, I then simulated the behavior of an economy with a constant population of 100,000 agents for 400 periods. Agents were allocated across young and old types in the initial period so that the old who died would be exactly replaced by retiring young. Zero population growth was assumed, so new retirees were also replaced one for one. Furthermore, at death, all of an old agent's gains were realized, taxed and the rest was "accidentally bequeathed" to one of the newly born agents who took its current value as her basis (her $\rho = 1$).[19] In the first period, all agents, young and old were set to have one unit of assets with a basis of one. For each subsequent period, the economy progressed by agents obeying their policy functions, being born, retiring and dying as described above, and asset holdings growing at rate 1.03822.[20]

For the first 200 periods, I fixed the tax rate at the conditional mean of the third quartile, 0.1722. For the remaining periods the capital gains tax rate was dropped to the conditional mean of the second quartile, 0.1513 (about a 12% drop in the tax rate). Keeping the returns and tax rates fixed for 200 periods would be incredibly unlikely given the stochastic process I've assumed, but looking at only one change after many periods under a different regime allows us to better observe taxpayers' responses to capital gains rate changes. We don't have to wonder if the effects we're seeing are the result of this period's change, or the change three periods ago, or a recent favorable return shock.

[19] In the U.S. capital gains taxes are paid at death in a minority of cases. This has been changed in the code dealing with the new model.
[20] This is the inflation adjusted, annualized rate of capital gains on the S&P 500 from January, 1950 thru April 2008.

Similarly for the new model, I derived numerical values for $V_y(k,\rho,\tau,\tau')$ and $V_o(k,\rho,\tau,\tau')$ over a discritized state space. Also, I derived the associated policy functions for choices of l and s for agents in each age group. $G_{yl}(k,\rho,\tau,\tau')$, $G_{ys}(k,\rho,\tau,\tau')$, $G_{ol}(k,\rho,\tau,\tau')$, and $G_{os}(k,\rho,\tau,\tau')$.

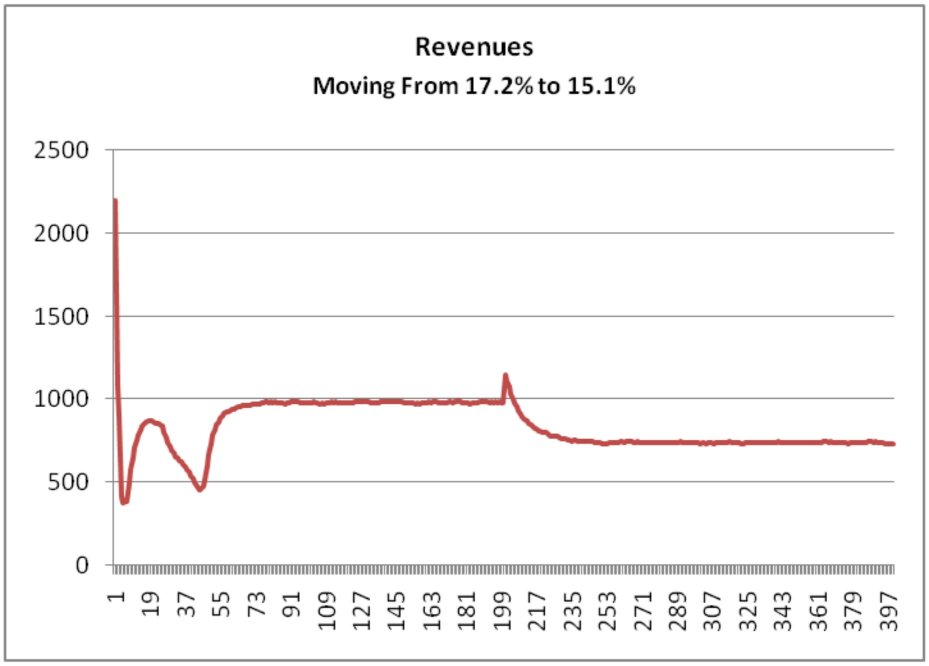
Given these policy functions, I then simulated the behavior of an economy with an initial population of 2,500 agents for 50 periods. With tax rates following their actual path from 1954-2005. Agents were allocated across young and old types in the initial period so that the old who died would be exactly replaced by retiring young while the population could grow at 1.2% per year.[21]. Furthermore, at death, all of an old agent's gains were "accidentally bequeathed" to one of the newly born agents who took its current value as her basis ($\rho = 1$) without paying any tax.[22] In the first period, all agents, young and old were set to have 5 units of assets with a basis of one. For each subsequent period, the economy progressed by agents obeying their policy functions, being born, retiring and dying as described above, and asset holdings growing at rate 1.0762.[23]

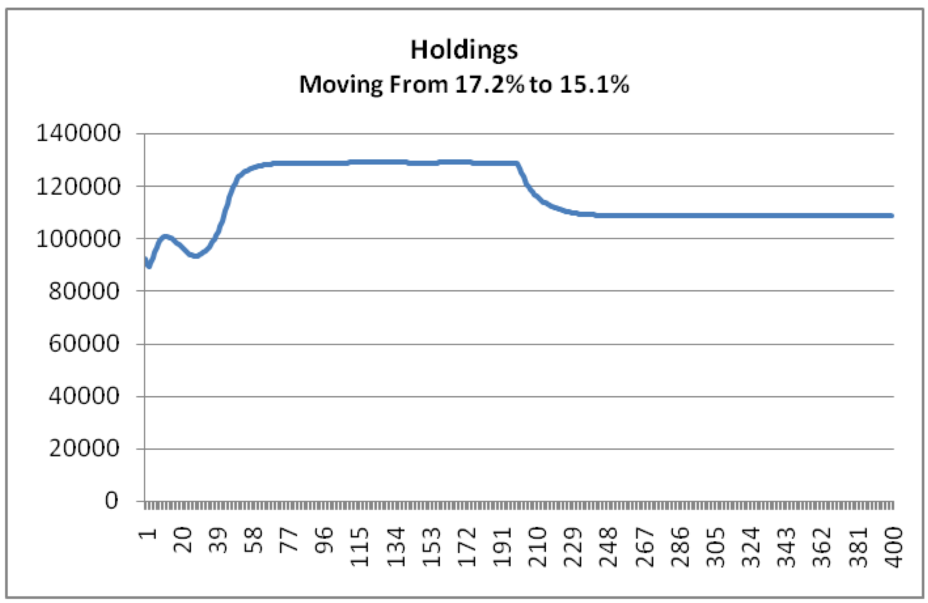
Results:

First, consider the simulation run with my old model. As you can see in the accompanying graphs (below), the economy seemed to reach a nearly constant level of both tax revenues and asset holdings after about 75 periods from the start, and then again 40 periods after the change in rates. We can easily see the effects of taxpayers trying to time their realizations to coincide with lower rates. Revenues increased by over 17% the first period after the tax reduction. Examining data from the

[21] According to the series POP from the St. Louis Fed's FRED, this is the average growth rate from 1952 through 2007 to the nearest tenth of a percent.
[22] In the U.S. this is a common tax treatment of assets upon death. However, various circumstances can cause a different treatment.
[23] This is the inflation adjusted, annualized rate of capital gains on the S&P 500 from January, 1950 thru April 2008. I had planned to have assets grow as the S&P actually realized, but that plan was interrupted by my technical difficulties.

simulation we can see that this surge was the result of a large (35%) increase in realizations. There was a modest (1.4%) increase in purchases of assets, suggesting that at least some of the increase in realizations was fueled by taxpayers' desires to "reset" their basis at the new lower rate.





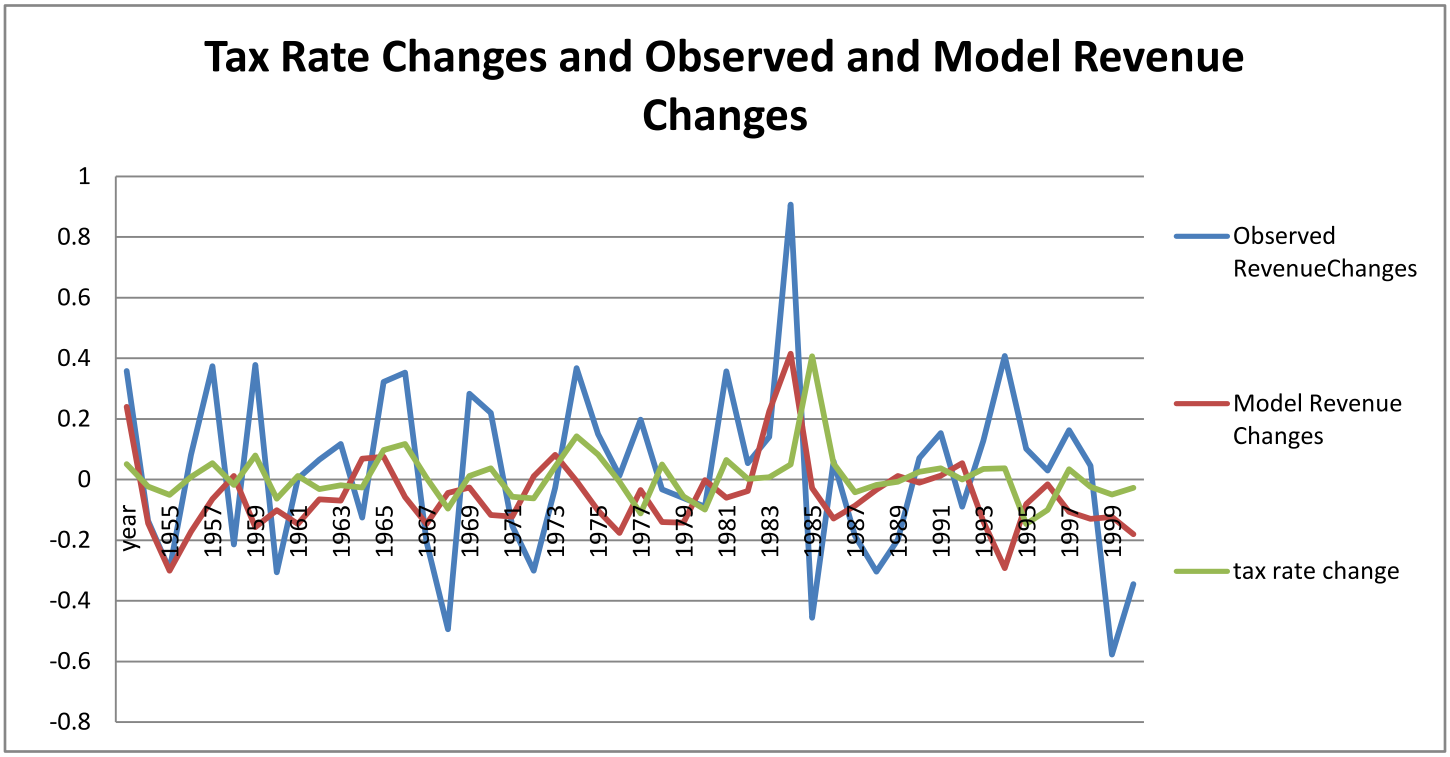
How does this compare with post-tax cut revenue increases in the data? Unfortunately most drops in the capital gains tax rates went into effect in the middle of a tax year. So, we have to compare the year before the change to the year after, instead of just looking at adjacent years. In 2002 the average capital gains tax rate was 18.2% and in 2004 it fell to 14.7%, a drop of nearly 20%, while revenues from the tax grew by nearly 50%, much larger drops and increases, respectively, than in the data I simulated. It seems as though my model can explain at least some of the increases in revenues after tax cuts. In both my model and the observed cuts, revenue increased more than the tax rate dropped.

Interestingly, net asset holdings actually fell after the cut. One might have expected the opposite changes; given the transition matrix a lower rate today implies lower expectations of rates in the near future, and thus greater expectations of post tax returns. However, the estimated Markov process for tax rates is not particularly persistent, and it seems as though the optimal policy is to allow your stock of assets to grow when the tax rate is higher, and realize (and consume) those gains when the rates are lower (which given the transition process might not take too long).

Revenues remained higher than their pre-cut levels for five periods. However, after this revenues continued to fall towards a new, lower steady state. Given these two effects how do we measure the net impact of the change in tax rates on this government's budget? Assuming that the average revenues from the 100 periods before the tax cut, and the last 100 periods represent steady state revenues, we can then calculate the discounted present value of tax revenues both with and without the tax cut. Doing this, I find that the government would have to be unrealistically impatient/face unrealistically high *real* interest rates (roughly, $\beta<.88$, $r>.14$) for this to have a positive impact on their budget. Applying this analysis to cuts in the U.S. capital gains tax rates, it seems that, as far as government revenues are concerned, the short term effects of a tax cut increase revenues substantially, which are more than offset by significant revenue reductions in the future.

Finally, I repeated the simulation moving from the second and fourth quantiles to the ones immediately below. In all cases, after a brief but large increase, revenues fell below their previous levels, and total asset holdings fell.

Though I've made much progress towards making it usable, I was only able to get very basic results from my new model. In the above simulation it did predict revenue changes that weakly lined up with those actually observed. Using OLS to regress the percentage change in de-trended revenue from the treasury department data on that predicted by my model, we get a coefficient of 0.7834912 with a standard error of 0.3107074, implying significance at the 5% level. Moreover, the coefficient is not significantly different from one, which a "perfect" model would exhibit. However the fit is poor, as you can see in the below graph.



Conclusion:

I developed a relatively simple model where taxpayers can choose when to realize and pay taxes on capital gains. This model allows us to examine the budgetary impacts of capital gains tax rate changes at various time horizons in ways not previously possible, predicting substantial increases in tax revenues immediately following decreases in capital gains tax rates, which is consistent with the few similar observations in the data. It seems as though these increases are at least partially due to taxpayers timing their realization in order to avoid paying taxes at times when the rates are high. Unfortunately for the government's budget, it seems that these increases are fleeting, and more than offset by future revenue decreases. As is always the case with respect to anything, there is no free lunch with respect to capital gains tax cuts. My approach also demonstrates the importance of considering the dynamic effects of tax policies, especially when taxpayers can choose when to pay the tax.

References

2008. Obama and Clinton Debate. Available at: http://abcnews.go.com/Politics/DemocraticDebate/Story?id=4670271&page=1.

Adda, J. & Cooper, R., 2003. *Dynamic economics: quantitative methods and applications*, Cambridge, Mass.: MIT Press.

Aiyagari, S.R., 1995. Optimal Capital Income Taxation with Incomplete Markets, Borrowing Constraints, and Constant Discounting. *The Journal of Political Economy*, 103(6), 1158-1175.

Burman, L.E. & Randolph, W.C., 1994. Measuring Permanent Responses to Capital-Gains Tax Changes in Panel Data. *The American Economic Review*, 84(4), 794-809.

Chamley, C., 1986. Optimal Taxation of Capital Income in General Equilibrium with Infinite Lives. *Econometrica*, 54(3), 607-622.

Dai, Z. et al., 2008. Capital Gains Taxes and Asset Prices: Capitalization or Lock-In? *The Journal of Finance*, 63(2), 709-742.

Gertler, M., 1999. Government debt and social security in a life-cycle economy. *Carnegie-Rochester Conference Series on Public Policy*, 50, 61-110.

Huggett, M., 1993. The Risk-Free Rate in Heterogeneous-Agent Incomplete-Insurance Economies. *Journal of Economic Dynamics and Control*, 17(5/6), 953–970.

Ibbotson, R.G. & Peng Chen, 2003. Long-Run Stock Returns: Participating in the Real Economy. *Financial Analysts Journal*, 59(1), 88-98.

Ivkovic, Z., Poterba, J. & Weisbenner, S., 2005. Tax-Motivated Trading by Individual Investors. *The American Economic Review*, 95(5), 1605-1630.

Krusell, P. & Ríos-Rull, J., 1999. On the Size of U.S. Government: Political Economy in the Neoclassical Growth Model. *The American Economic Review*, 89(5), 1156-1181.

Seibert, K., 2008. *Sources of the Growth and Decline in Individual Income Tax Revenues Since 1994*, Washington, D.C.: Congressional Budget Office. Available at: http://www.cbo.gov/ftpdocs/90xx/doc9076/TaxTOC.2.1.htm.

Stiglitz, J.E., 1983. Some aspects of the taxation of capital gains. *Journal of Public Economics*, 21(2), 257-294.

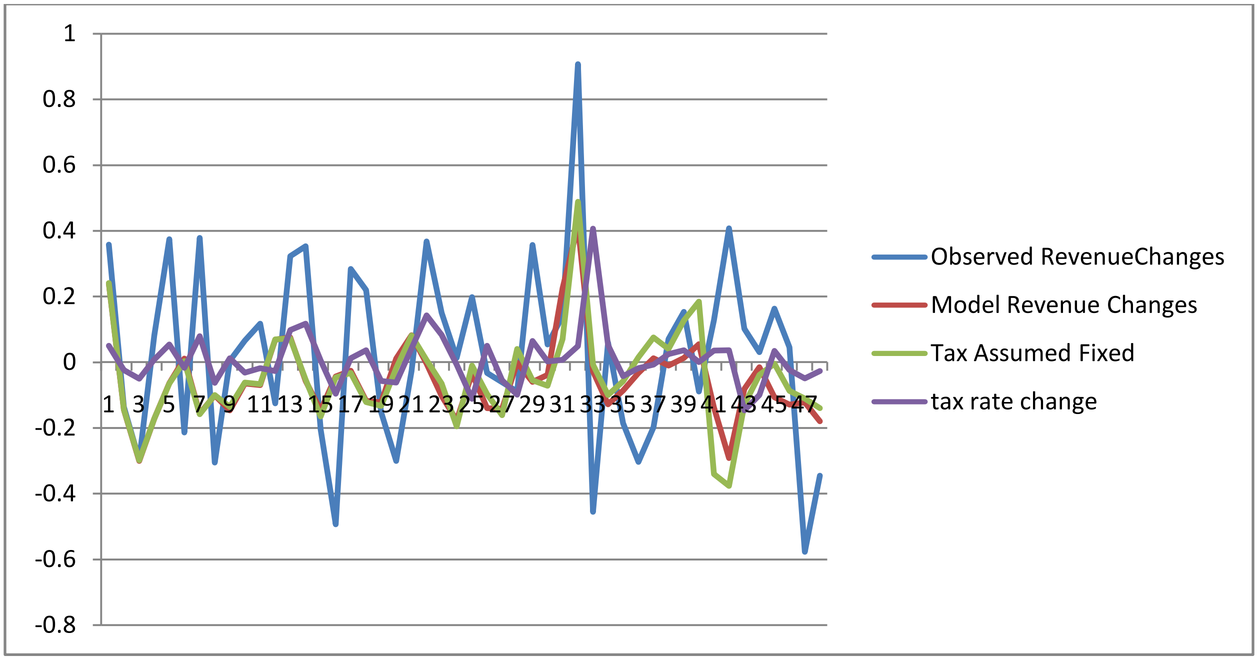
Appendix A:

If tax rates are going to increase (with certainty and permanently) we can quickly determine whether or not it makes sense to step up one's basis (i.e. sell the asset and repurchase with the proceeds). Consider the potential sale of an asset purchased with basis y and gains g, for a total value of $y + g$. Using the notation from the paper, taking advantage of the current low tax rate to step up ones basis makes sense when the after tax value of the future sale is higher if you step up your basis now instead of simply leaving it and paying all taxes in the future. Algebraically,

$$(y + g - \tau_1 g)R - \tau_2(y + g - \tau_1 g)(R - 1) > (y + g)R - \tau_2\big((y + g)R - y\big).$$

Solving, we find this is equivalent to

$$\tau_1 < \frac{\tau_2}{R(1 - \tau_2) + \tau_2}$$


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47
Observed RevenueChanges
Model Revenue Changes
Tax Assumed Fixed
tax rate change