

Econ 230B

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Problem Set 2 Solution

1. CEO Pay response to the 2016 US tax increase

The goal of this exercise is to repeat the Goolsbee (2000) analysis of CEO pay around the 2016 top tax rate increase (instead of the 1993 top tax rate increase as Goolsbee did).

a) First stage: Using online sources, calculate the change in the top marginal tax rate for labor income compensation generated by the 2016 tax increase including both the change in the Federal tax rate, and the Affordable Care Act surtax. How does the size of the change compare with the 1993 tax increase from Goolsbee (2000) study?

The official IRS tables show an increase of 4.6% at the top marginal tax bracket for both married joint filers and single filers.¹ The Affordable Care Act increased the tax rate by 0.9% for the top bracket, see the link, and an investment tax of 3.8% for incomes above \$200K for single filers and above \$250K for married joint fillers.

This changes are substantial, but smaller then those in Goolsbee (2000). Goolsbee analysed an 8.6% increase in the marginal tax from 31% to 39.6% for the top bracket, above \$250K, and an increase from 31% to 36% for incomes between \$140K-\$250K. The top marginal tax increased by 5.6% between 2012 to 2016 for labor income, and by 8.4% for investment income.

b) Timing of the reform: search online to figure out whether people knew in advance that the 2016 tax increase would take place? Is it reasonable to think that executives could respond to the tax change as they did with the 1993 tax change?

It is clear that individuals knew, and could respond. Indeed, the bill was introduced in July 2012 and only enacted in January 2013.² In addition, fiscal policy was the highest profile issue of the 2012 election: Obama's victory was therefore almost a guarantee that any budget compromise would involve tax increases on top earners.

c) Expected behavioral responses: Based on what we have learned in class about behavioral responses and your response in question b), through what channel do you expect CEOs to respond in the short and the medium-run to the 2013 tax change?

¹See the links here for the 2012 and 2016 federal tax tables: [federal tax rates 2012 link](#), [federal tax rates 2016 link](#).

²By comparison, the 1993 reform applied retroactively: it was introduced in May 1993, implemented in August and applied to taxable years beginning after 2002

The CEOS could:

1. in the short run: change the timing of realization (e.g., stock options, accelerating deferred compensation).
2. in the longer run: decrease taxable income (either by lowering their efforts or by doing sophisticated tax planning that involves income shifting or by outright evasion)

d) Empirical analysis using CEO pay: use the execucomp data extract posted online (link here) to create a table similar to table 2 in Goolsbee for years 2011 to 2014. From this table, is there evidence of a behavioral response? What components of CEO pay seem to respond the most? Using numbers from this table and the answer to question a), how large is the elasticity of compensation with respect to the net-of-tax rate in the short-run (2012 vs. 2013) and in the medium-run (2011 vs. 2014)? [no standard error required]

The Table below shows the results for different sample restrictions. The tables show no evidence of top earning responding to the expected tax change.

	Averages in thousands of Dollars							
	salary	bonus	stock	options	non-equity	other	Total	option exercised
2011	832	224	2252	1123	1223	170	6319	2005
2012	861	216	2403	965	1255	215	6497	3174
2013	894	209	2630	1051	1348	221	6511	3331
2014	912	208	2985	1086	1427	272	7496	4150

Table 1: All CEOs

Compensation are stable but there is a spike in the value of stock options exercised around the reform. Let s_t be the share of option exercised in total compensation:

$$e = \frac{\ln s_t - \ln s_{t-1}}{\ln(1 - MTR_t) - \ln(1 - MTR_{t-1})}$$

The SR elasticity of value option exercised is -0.42, the long run one is -5.16.

2. Mobility of High Income US Taxpayers across States

The goal of this exercise is to estimate the mobility of high income US taxpayers across US states due to variation in state income top tax rates across states and over time. High income US taxpayers are defined as tax filers reporting Adjusted Gross Income (AGI) above \$1m.

a) Find online information on the state top income tax rates across all states for **2016** incomes. List the ten states with the highest top tax rates (group T) and the ten states with the lowest top rates (group C) along with the top tax rates in those 10 states. (NOTE: do not exclude zero tax states, if you have ties, keep the largest states in terms of population to have exactly ten states in each group).

Group T: California (13.3%), Oregon (9.9%), Minnesota (9.85%), Iowa (8.98%), New Jersey (8.97%), Washington DC (8.95%), Vermont (8.95%), New York (8.82%), Hawaii (8.25%), Wisconsin (7.95%)

Group C: Indiana (3.3%), Pennsylvania (3.07%), North Dakota (2.90%), Alaska (0%), Florida (0%), Nevada (0%), South Dakota (0%), Texas (0%), Washington (0%), Wyoming (0%).

b) Use IRS state level data in excel format for tax year 2016 at ([link here](#)) to compare the fraction of high income earners in states in group C and states in group T. Fraction high earners is defined as the ratio of number of tax returns with AGI above \$1m to all tax returns in group.

Under what assumption does this comparison identify the effects of state income tax rates on mobility? Is this assumption realistic (how could it be tested)?

If this assumption holds, what is the elasticity of the number of high earners with respect to the net-of-tax rate at the state level?

Group T: California (0.400%), Oregon (0.200%), Minnesota (0.255%), Iowa (0.145%), New Jersey (0.435%), Washington DC (0.603%), Vermont (0.160%), New York (0.506%), Hawaii (0.147%), Wisconsin (0.192%)

Group C: Indiana (0.157%), Pennsylvania (0.224%), North Dakota (0.194%), Alaska (0.190%), Florida (0.294%), Nevada (0.274%), South Dakota (0.221%), Texas (0.263%), Washington (0.304%), Wyoming (0.286%).

Assumption: Exogenous state tax rates. Unlikely to be realistic

If the assumption holds then the elasticity is equal to $e = \frac{dh}{d(1-\tau)} \frac{1-\tau}{h}$, with h being the share of high earners by state and τ is the top marginal tax rate.

c) Find online information on the state top income tax rates across all states for **2000** incomes. Find the ten states which had the largest increases in top tax rates (group T) and the ten states which had the largest decreases in top tax rates (group C) from 2000 to 2016. List group C, group T, the 2000 and 2016 top tax rates in those states, and the change in top tax rates in those states

The following lists for each state in this order the 2016 tax rate, the 2000 one and the change in parenthesis:

Group T: California (13.3%, 9.3%, 4%), New Jersey (8.97%, 6.37%, 2.6%), Connecticut (6.99%, 4.50%, 2.50%), New York (8.82%, 6.85%, 1.97%), Minnesota (9.85%, 8.00%, 1.85%), Maryland (5.75%, 4.85%, 0.9%), Oregon (9.9%, 9%, 0.9%), Wisconsin (7.65%, 6.77%, 0.88%) Illinois (3.75%, 3%, 0.75%), Pennsylvania (3.07%, 2.8%, 0.27%),

Group C: North Dakota (2.9%, 12%, -9.1%), Massachusetts(5.1%, 12%, -6.9%) Rhode Island (5.99%, 10.29%, -4.3%), Montana (6.9%, 11%, -4.1%), New Mexico (4.9%, 8.2%, -3.3%), Ohio (5%, 7.23%, -2.23%), Utah (5%, 7%, -2%), North Carolina (5.80%, 7.75%, -1.95%) Kansas (4.6%, 6.45%, -1.85%), Oklahoma (5%, 6.75%, -1.75%),

d) Use IRS state level data in excel format for tax years 2000 and 2016 at (link here) to compare the changes in the fraction of high income earners in states in group T and states in group C from 2000 to 2016. Fraction high earners is again defined as the ratio of tax returns with AGI above \$1m to all tax returns.

Under what assumption does this comparison identifies the effects of state income tax rates on mobility? Is this assumption realistic (how could you test it)?

If this assumption holds, what is the elasticity of the number of high earners with respect to the net-of-tax rate at the state level?

The following lists for each state in this order the 2000 share of top earners, the 2016 one and the change in parenthesis:

Group T: California (0.409%, 400%, -0.005%), New Jersey (0.514%, 0.435%, -0.039%), Connecticut (0.815%, 0.626%, -0.094%), New York (0.608%, 0.506%, -0.051%), Minnesota (0.253%, 0.255%, 0.001%), Maryland (0.282%, 0.277%, -0.002%), Oregon (0.163%, 0.200%, 0.018%), Wisconsin (0.179%, 0.192%, 0.006%) Illinois (0.343%, 0.314%, -0.014%), Pennsylvania (0.208%, 0.224%, 0.008%),

Group C: North Dakota (0.088%, 0.194%, 0.053%), Massachusetts(0.498%, 0.474%, -0.012%) Rhode Island (0.210%, 0.193%, -0.009%), Montana (0.099%, 0.150%, 0.025%), New Mexico (0.179%, 0.109%, -0.035%), Ohio (0.150%, 0.172%, 0.011%), Utah (0.169%, 0.230%, 0.031%), North Carolina (0.169%, 0.192%, 0.012%) Kansas (0.170%, 0.197%, 0.014%), Oklahoma (0.157%, 0.171%, 0.007%),

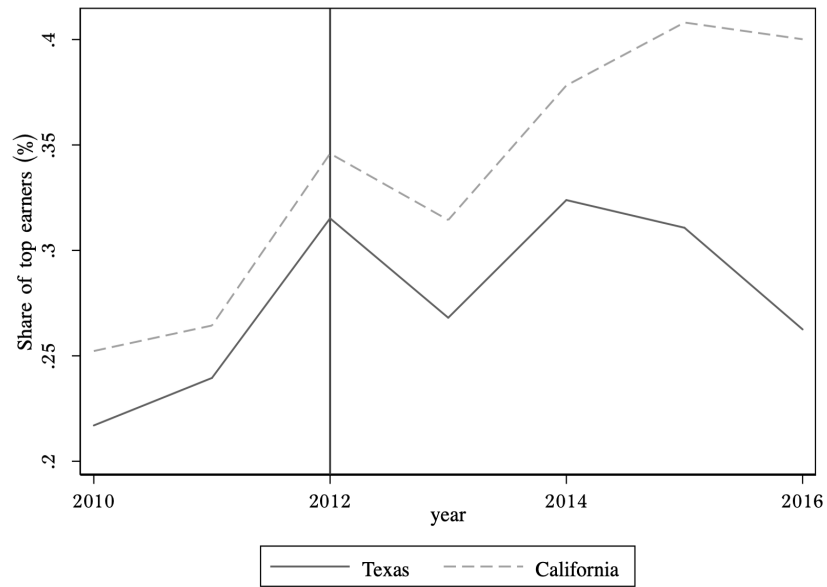
Assumption: parallel trend assumption.

Elasticity is given by:

$$e = \frac{(\log h_{2016}^T - \log h_{2016}^C) - (\log h_{2000}^T - \log h_{2000}^C)}{(\log(1 - \tau_{2016}^T) - (\log(1 - \tau_{2016}^C))) - (\log(1 - \tau_{2000}^T) - (\log(1 - \tau_{2000}^C)))}$$

$$e = 2.44$$

e) Let us use the California tax increase at the top of 2012 to identify the effects of top tax rates. Plot the number of fraction of tax filers with \$1m+ AGI in California (treatment group) and Texas (control group) from 2010 to 2016. Estimate the DD effect using 2010-2011 as the control years and 2012-2016 as the treatment years. Does this DD estimate pass the parallel trend assumption? How could you construct a more convincing control group using information available from all the other states?



The estimated elasticity using the formula above plugging CA and TX 2016 and 2010 data is approximately -2.6 .

Parallel trend assumption is likely not to hold. We could try to re-weight the two groups.

3. Tax Reform Analysis:

Consider an economy where the government sets a flat tax at rate τ on earnings to raise revenue. We assume that the economy is static: the total population remains constant and equal to N over years and there is no overall growth in earnings.

Individual i earns $z_i = z_i^0(1 - \tau)^e$ where the tax rate is τ . z_i^0 is independent of taxation and is called potential income. e is a positive parameter equal for all individuals in the economy. The government wants to set τ so as to raise as much tax revenue as possible.

a) What is the parameter e ? Show that the tax rate maximizing total tax revenue is equal to $\tau^* = 1/(1 + e)$.

e is the elasticity of income with respect to the net-of-tax rate $1 - \tau$. There are no income effects, so this elasticity is both compensated and uncompensated.

Total tax $T = \tau \sum_i z_i = \tau(1 - \tau)^e \sum_i z_i^0$.

FOC in τ gives $\tau^* = 1/(1 + e)$.

b) The government does not know e perfectly and thus requests the help of an economist to estimate e . The government can provide individual data on earnings for two consecutive years: year 1 and year 2. In year 1, the tax rate is τ_1 . In year 2, the tax rate is *decreased* to level τ_2 . Suppose that the government can provide you with two cross-section random samples of earnings of the same size n for each year. This is *not* panel data.

How would you proceed to estimate e from this data? Provide a formula for your estimate \hat{e} and a regression specification that would allow you to estimate e with standard errors.

$$\hat{e} = \frac{(1/n) \sum_i \log(z_{i2}) - (1/n) \sum_i \log(z_{i1})}{\log(1 - \tau_2) - \log(1 - \tau_1)}$$

obtained by OLS regression $\log(z_{it}) = \alpha + e \log(1 - \tau_t) + \epsilon_{it}$

c) Suppose now that the economy is experiencing exogenous economic growth from year to year at a constant rate $g > 0$. The population remains constant at N . How is the estimate \hat{e} biased because of growth? Suppose you know g , how would you correct \hat{e} to obtain a consistent estimate of e ? (provide an exact formula of this new estimate).

Assuming that incomes are multiplied by $e^g > 1$ because of growth from year 1 and year 2, previous \hat{e} is biased upward. To get consistent estimate of e , need to subtract the growth rate from the numerator:

$$\hat{e} = \frac{(1/n) \sum_i \log(z_{i2}) - (1/n) \sum_i \log(z_{i1}) - g}{\log(1 - \tau_2) - \log(1 - \tau_1)}$$

d) Suppose now that you do not know g but that the government gives you a new cross-section of data for year 0 in which the tax rate was equal to τ_1 as in year 1. Using data on year 0 and year 1, provide an estimate of g and the corresponding regression specification.

Using data for all 3 years, provide a single regression specification and a formula for a consistent estimate \hat{e}_R of e that takes into account growth.

$$\hat{g} = (1/n) \sum_i \log(z_{i1}) - (1/n) \sum_i \log(z_{i0})$$

obtained by OLS regression $\log(z_{it}) = \alpha + g t + \epsilon_{it}$

Using all three years, DD estimate:

$$\hat{e}_R = \frac{[(1/n) \sum_i \log(z_{i2}) - (1/n) \sum_i \log(z_{i1})] - [(1/n) \sum_i \log(z_{i1}) - (1/n) \sum_i \log(z_{i0})]}{\log(1 - \tau_2) - \log(1 - \tau_1)}$$

Obtained with OLS regression: $\log(z_{it}) = \alpha + \beta t + e \log(1 - \tau_t) + \epsilon_{it}$

e) We now assume again that there is no growth. Suppose that the parameter e differs across individuals and is equal to e_i for individual i . Assume that there are N individuals in the economy. Individual i earns $z_i = (1 - \tau)^{e_i} z_i^0$. As above, z_i^0 is not affected by taxation.

As in question 1, express the tax rate maximizing tax revenue τ^{**} as a function of the e_i and the realized incomes z_i . Show that the tax rate τ^{**} can be expressed as $\tau^{**} = 1/(1 + \bar{e})$ where \bar{e} is an average of the e_i 's with suitable weights. Give an analytic expression of these weights and provide an economic explanation.

$$\text{Total tax } T = \tau \sum_i z_i = \tau \sum_i (1 - \tau)^{e_i} z_i^0.$$

$$\text{FOC: } \sum_i z_i - \tau \sum_i e_i (1 - \tau)^{e_i - 1} z_i^0$$

$$\text{implies } \sum_i z_i = [\tau / (1 - \tau)] \sum_i e_i (1 - \tau)^{e_i} z_i^0$$

$$\text{that is, } \sum_i z_i = [\tau / (1 - \tau)] \sum_i e_i z_i$$

Let us note $\bar{e} = \sum_i e_i z_i / \sum_i z_i$ the average elasticity weighted by incomes (high incomes have a disproportionate effect on total elasticity), we have:

$$\tau / (1 - \tau) = 1 / \bar{e}, \text{ that is, } \tau = 1 / (1 + \bar{e}).$$

f) Suppose now that the parameter e is the same for all individuals and that the government redistributes the tax collected as a lump-sum to all individuals. I note R this lump-sum which is equal to average taxes raised. Suppose that the level of this lump-sum R affects labor supply through income effects. More precisely, the earnings of individual i are given by $z_i = (1 - \tau)^e z_i^0(R)$. The potential income $z_i^0(R)$ now depends (negatively) on the lump-sum R .

Suppose that the government still wants to set τ so as to raise as much taxes as possible in order to make the lump-sum R as big as possible. Should the government set the tax rate τ higher or lower than $\tau^* = 1/(1 + e)$ obtained in question a)?

$$\text{Total tax } T = \tau \sum_i z_i = \tau \sum_i (1 - \tau)^{e_i} z_i^0(R).$$

$$\text{FOC: } \sum_i z_i - [\tau / (1 - \tau)] e \sum_i z_i + \tau \sum_i (1 - \tau)^{e_i} (z_i^0)'(R) \partial R / \partial \tau = 0$$

but last term is zero because at the optimum, R is maximized and thus $\partial R / \partial \tau = 0$. Therefore, the FOC is the same as in a) and $\tau = 1/(1 + e)$ as in a).