ECON 758 HW 2

1. **Why would you expect income to respond to tax rate changes? Give examples of different potential adjustment reactions that would lead to income changes.**

*A change in the tax on income will change the net income remaining that taxpayers have to dispose of into other consuming or investing activities. A taxpayer’s natural response is to engage in activities that minimize additional tax burden or maximizes a decreasing tax burden.*

*Taxpayers facing an increase in the marginal tax rate may choose to decrease labor force participation. This reaction may be more pronounced for individuals that are clustered near an end of a step between two income brackets.*

*Higher income taxpayers are likely to be more sensitive to tax changes and may engage in tax aversion strategies, or shift forms of compensation to compensation schemes less exposed to tax changes.*

1. **Familiarize yourselves with the data. Provide a table (Table 1) with summary statistics (means and standard deviations) of the variables included in the dataset.**

Table 1: Summary Statistics

|  |  |
| --- | --- |
|  | (1) |
|  | Summary Statistics |
|  | mean/sd |
| nchild | .5135882 |
|  | (.8474785) |
| married | .7967143 |
|  | (.4024742) |
| selfemp | .1300476 |
|  | (.3363816) |
| grossincr1000 | 2.977842 |
|  | (3.744029) |
| mtr | .4118874 |
|  | (.1287702) |
| mtr\_02 | .4057751 |
|  | (.1386803) |
| entrepreneur | .0741032 |
|  | (.2619594) |
| *N* | 6513 |

1. **Write down an estimation equation like equation (3) in GS02, but with the following modifications:**

* **Instead of the net-of-tax rate, use the marginal tax rate.**
* **Do not include the term used to estimate the income effect (GS02 did not include this term in their main Table 4 either).Do not include year dummies**
* **Do not include a spline function of income, but only the log of gross income in the base year (like in column (3) of Table 4 in GS02).**
* **Instead of the time indices 1 and 2, use t-1 and t, respectively. This will help you to translate this into program code later on.**
* **Include the “married” dummy and the number of children (both in t-1) instead of mars.**

1. **Estimate the equation from c) using OLS. Do not include log (gross income), you are asked to include this in l) only. Be careful about where to use logs, differences over time, or time lags. Do not use weighting, you are asked to use weighting in k) only. Present the results as well as the following IV results jointly in Table 2.**

*Please review part h for Table 2.*

1. **How large is the estimated tax rate elasticity of income? Describe this in words.**

*The OLS model reveals that the estimated tax rate of income is 0.0420857. This means that a change in gross income is close to being perfectly inelastic with respect to a change in marginal tax rates. A 10% increase in the change of marginal tax rate would increase gross income by 0.42%.*

1. **Why do you think this OLS estimate could be biased? In which direction do you expect the bias to go, and why? Hint: Germany has a progressive personal income tax schedule. Below you can find the schedule for 2002, 2007 and 2012.**

*We anticipate that the OLS estimate is downward bias because of measurement error. Many individuals may have a difficult time recalling the exact amount of gross income earned which results in imprecise measurement of that variable and an under-representation of gross income earned. Additionally, due the progressive personal income tax schedule, we anticipate a downward bias. The German progressive tax system over time between panel years has decreased marginal tax rates overall. We expect our X1 (current mtr) to be negatively correlated with X2 (decrease in mtr in later panel years). We would expect the coefficient on X2 to be positive since higher income taxpayers face a higher gross income from a lower tax burden in an environment with the decrease in mtr over time, decreasing mtr gives greater incentive to earn more and increase gross income of individual taxpayers. We can decompose the effects of the German progressive tax system on gross income overtime through an income and substitution effect. For an example, a less motivated tax payer might choose to not work more for a higher gross income and be satisfied by the lower marginal tax rate due to the progress tax system, illustrating an income effect. On the other hand, some tax payers might recognize the decrease in the marginal tax rate as an incentive to increase gross income and still a smaller marginal tax rate than the previous year, hinting at a substitution effect.*

1. **Discuss whether the change in log (mtr\_02) over time can be used as an instrument for the change in log(mtr). Comment on the relevance and exogeneity of the instrument and how the IV solves the endogeneity problem discussed in f). Why is it important that the tax schedule shown in f) changed between the observation years? (It also changed between 2007 and 2012, but not much, which is why this is hard to see in the graph.) Hint: The idea is essentially the same as the idea for the instrument in GS02. Instead of updating income from year 1 to year 2 in a 2-year pair in GS02, here we always use updated income from 2002 (the first year in our data), but this does not change the basic idea.**

*In our OLS model, is endogenous. To address this endogeneity, log(mtr\_02) is valid instrument because the virtual income earned in prior tax year 2002 is not dependent on motivation to earn income in year 2007 or 2012. Using 2002 income (exogenous variable) to calculate virtual income for 2007 and 2012 would also be exogenous since it is stimulated by the TAXSIM calculator and not “actual” income. The CPI index is exogenous because it is macro-economic index to make gross income in 2002 comparable to gross income that might have been earned in later panel years and making adjustments to purchasing power. This fulfills the exclusion restriction for a valid instrument. Furthermore, instrument is relevant because the change in log (mtr\_02) is calculated using the actual mtr of year 2007 and 2012. The mtr\_02 is correlated with mtr because it is tax schedule actually applied to the gross income during specific years.*

1. **Now re-estimate your regression equation using the IV method. Treat the change in the log tax rate as endogenous and use the instrument discussed in g).How does the estimated elasticity change? Again describe the elasticity in words. Is this effect consistent with your expectations concerning tax responsiveness? What are you learning about the direction of the bias in your OLS estimation, and is this consistent with your expectation in f)?**

The elasticity in the IV regression changed to -0.0880 with standard error of 0.0720 which is not significant at the 10% level. When compared to the initial regression coefficient value of *0.0420857* it is still quite inelastic. It is consistent with our hypothesis of downward bias as we expected the OLS to be overestimating the change of log marginal tax rate on the gross income.

An increase in the change of the marginal tax rate of 10% would yield a .88% decrease in gross income. Since the stimulus of a 10% increase in the change of the marginal tax rate is greater than the gross income response to that stimulus, we would say that taxpayers would be inelastic which is consistent with our expectations of tax responsiveness.

**i. Is the instrument strong enough, and how do you see that?**

*The test of joint significance we found is 212.5 which is greater than the 20 with rule of thumb which indicates that the instrument does not suffer as a weak identifying instrument. Using the xtivreg2 command, the regression output includes multiple tests including one for weak instruments, (Cragg-Donald Wald F statistic)*

**j. Bonus (not needed to achieve 100% of the grade): Test the endogeneity of the change in the log tax rate. What does the test result imply about your OLS and IV estimates? You might have to look into an econometrics textbook for this.**

*Using the Hausman test, we run a fixed effects model of the original regression. We compare this fixed effects model to a random effects model. Following this, we apply the hausman test, the results of which test the null hypothesis that the beta coefficient in the random effects model is consistent. Performing the test in our case, we reject this null hypothesis as the p-value =0.0000*

**k. Repeat this IV regression, but now weight by gross income as in Table 4 of GS02. How does the estimated elasticity change?**