Lecture Notes 2: Taxation and Labor Supply, continued

reference: Eissa (1995)

<u>Taxation and the Labor Supply of Married Women: TRA86 as a Natural Experiment</u>

In the first part of LN3 we learned that net-of-tax wages and labor hours are simultaneously determined.

For this reason we'd like to employ an instrumental variables technique to estimate the influence of wage (or taxes) on labor hours, but our theory of labor supply tells us that in the standard case there are no observable factors influencing wage (tax) that don't influence hours.

Eissa uses **exogenous variation in tax rates** resulting from an overhaul of the U.S. tax system in 1986 as an **instrument** that influences tax rates but does not directly influence the relative preference for leisure.

Other researchers find that married women's elasticity of labor supply is greater than that of other demographic groups. Eissa focuses on married women at the top of the income distribution as the segment of workers most likely to respond to the changes in the marginal tax rate in TRA86.

TRA86

Pre-1986 US personal income tax schedule: 14 brackets, 11 to 50%. Secondary earner deduction of 10% up to $30,000 earnings.

Pre-1986 once we include FICA and state and local income taxes some married women faced marginal income taxes on their first hour of work (taking husband's income as fixed) of 70%. This was relieved by 10% through the SED.

TRA86 collapsed the tax schedule to 2 brackets, with rates of 15% and 28%. Personal exemption changes caused a bracket of 33% in one higher income range ($65,400 to $136,000).

TRA86 was **revenue neutral**. In order to maintain revenue neutrality, it removed exemptions of capital gains, deductions for some interest expenses and IRA contributions, and the secondary earner exemption. Note that these are all tax exemptions that benefit the upper end of the income distribution most.

See Eissa Figure 1 depicting marginal income tax rates.

Nonparametric Identification of the Effect of Tax Cuts on the Labor Supply of Married Women

Figure 1 shows that women whose families are very high in the income distribution saw the most change in marginal tax. A woman in the top bracket earning < 30k saw a 36% increase in her after-tax wage.

[See Eissa table p9.]

One measure of the effect of the tax is $H_{ta} - H_{tb}$. Problem with this: trend upward in married women's labor supply in the '80s.

Establish treatment and control groups:

<u>Treatment</u> Married women with family incomes at or above the 99th percentile of the income distribution
→ saw largest tax cuts

Control — Married women with family incomes between the 75th and 80th percentiles of the income distribution
$\rightarrow$ saw very small tax cuts; are demographically similar to the treatment group

Note on construction of treatment and control: Since women's own income is endogenous to the tax change, income cutoffs don't depend on own income but are determined based on the family income minus the wife's income. This reflects the implicit assumption that women take husband's income as given when determining labor supply.

Before and after data are drawn from the March 1984-6 and 1990-2 Current Population Surveys. Families in the 99th group earn in excess of $90,000/yr, and 75th earn on avg $47,100/yr. Eissa Table I gives summary stats on these groups.

The **difference-in-differences** estimator assumes that $H_{ca} - H_{cb}$ demonstrates the trend in labor force activity experienced by both treatment and control groups independent of the tax reform.

D in D estimator: Test H_0 that $(H_{ta} - H_{tb}) - (H_{ca} - H_{cb}) = 0$

Note: The latent variable 'labor supply of high income women post-'86 without tax reform' is defined as high income women's labor supply before the reform plus moderate-income women's change in labor supply from before to after the reform,

and the D in D estimate is the difference between high income women's realized post-tax-change labor supply and this latent variable.

Second control — Women at the 75th and 99th percentiles of the income distribution may differ on observables and unobservables.

Therefore Eissa creates a second control group of married women who are between the 90th and 95th percentiles of the distribution, and therefore likely more similar to women at the 99th than are women at the 75th.

[See Eissa Figure II]. Note that marginal tax rates were calculated using the NBER's tax simulation model TAXSIM. Figure II demonstrates the trade-offs between using the 75th and 90th control groups.

Under the assumption that 75th and 99th women don't differ systematically, the D in D estimate is unbiased. A test of the validity of this assumption is:

(a) Estimate the response to the tax change for 99th using 75th as a control group.

(b) Estimate the response to the tax change for 99th using 90th as a control group.

(c) Estimate the response to the tax change for 90th using 75th as a control group.

If (a) and (b) produce similar estimates for the high-income women but (c) shows little difference between the controls, then this increases confidence in the D in D estimator in (a), and in general in our assumption that women in the 75th and 99th groups don't differ in important ways.

Eissa Table II shows the **relative tax changes** for the treatment and two controls. Note that one objective of this study is to determine the wage (tax) elasticity of labor supply, and recall that this is the percent change in labor over the percent change in wage (tax).

Eissa Table III shows the raw D in D estimates.

What if we define the latent 'post-'86 participation of 99th women in absence of tax reform' assuming a **constant growth rate** in labor supply across the two groups?

This estimate is also described in table III, and gives an estimate of a 12.3% change in labor force participation from the tax change for the 75th control.

The initial estimate of labor supply elasticity is based on the Table II Panel C total hours D in D estimates, and is in the range of **.6 to 1.**

A further identifying assumption in this estimation: the relative gross market wage for the two groups remains constant over the period.

Examining this assumption: Eissa Table IV demonstrates that differences in the average market wages for treatment and control groups are rather small and are insignificant.

Overall result of the nonparametric approach: When the control is the 75th, the magnitude of the increase in labor supply of high-income married women in response to the tax cut is (borderline) significant for both participation and hours of work. Using the 90th control, the participation result holds up but the hours result is inconclusive.

Parametric Approach

A parametric approach is used for 2 reasons:

(1) Bias due to differences between treatment and control on observables can be reduced by including observables in a regression framework

(2) Sampling variance, which is large in the D in D estimates, can be reduced by adding information on demographics in a regression framework.

<u>Participation Model</u>

Probability of participation in the labor force is modeled as a Probit

$$P(lfp_{it}=1)=\Phi(z_{it}'\alpha)$$

where lfp_{it} is labor force participation of i at t & z_{it} is a vector of observable characteristics.

The Probit assumes a parametric specification of the error; it's mean 0 normal.

Consider the estimates of the alphas and variance sigma of the Probit model reported in Eissa Table V.

Adding demographic controls to the model produces the new D in D estimates reported in Table VI. VIa reports predicted participation rates at *mean values of characteristics* for the samples. This gives an estimate of 8.4% relative increase of high-income women's participation with the tax change. Eissa also uses estimates to *predict participation for each individual in the sample*; this yields a participation response estimate of 8.7%.

Elasticities: 99th women's tax rates fell by 26.5% from before to after the tax change, 75th's by 6.2%. The relative % change in tax is 20.3. From this we get an elasticity of participation of

0.4 = (.08/.20)

Hours Model

Assume observed hours conditional on working are $h_{it} = x_{it}\beta + \varepsilon_{it}$, with $\varepsilon_{it} \sim N(0,\sigma^2)$. The density of hours is then

$$f(h_{it}) = \frac{1}{\sigma}\frac{\varphi((h_{it} - x_{it}\beta)/\sigma)}{\Phi((x_{it}\beta)/\sigma)}$$

yielding log likelihood function

$$\ln L = -NT\ln[(2\pi)^{1/2}\sigma] - \frac{1}{2}\sum_i\sum_t(\frac{h_{it} - x_{it}\beta}{\sigma})^2 - \sum_i\sum_t \ln\Phi(\frac{x_{it}\beta}{\sigma})$$

Results of the maximization of the likelihood wrt beta and sigma are reported in Eissa Table VII.

Finally, Eissa predicts total hours of work using parameter estimates from the participation and hours models.

The mean number of hours conditional on working is

$$E(h_{it} \mid h_{it} > 0) = x_{it}\widehat{\beta} + \widehat{\sigma}\lambda_{it}$$

where λ_{it} is the inverse mills ratio that controls for truncation of the normal distribution

$$\lambda_{it} = \frac{\varphi(x_{it}\widehat{\beta}/\widehat{\sigma})}{\Phi(x_{it}\widehat{\beta}/\widehat{\sigma})}$$

The unconditional mean of total hours based on the parameter estimates is evaluated as

$$E(h_{it}) = \Phi(z_{it}'\widehat{\alpha})\cdot(x_{it}\widehat{\beta} + \widehat{\sigma}\lambda_{it})$$

Why use the above structure on hours and participation, instead of employing a Tobit model?

Comparison points:

→ Tobit would entail the restriction $\alpha = \beta$.

→ Tobit would not need the restriction applied in the above model that the error terms are uncorrelated. (The truncated hours expression contains only one error in the Tobit.)