Labour Supply and Taxes
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Introduction

- Effect of taxes and benefits on labour supply a hugely studied issue in public and labour economics – why?
- Significant policy interest in topic
  - how should we design the tax and benefit system to encourage individuals on the margins of the labour market into employment?
  - What are the consequences of raising top income tax rates?
- Central to understanding interesting labour market phenomena
  - Substantial increase in employment rates among women
  - Role of LS in driving business cycle fluctuations
- Plan for this lecture
  - Outline simple static model of labour supply and introduce taxes
  - Discuss alternative methods of identifying effect of taxes on LS
  - On the way, introduce some empirical work in the field
Basic notions

• How should we measure labour supply?
  – Extensive margin: whether to work or not
  – Intensive margin: how much to work. Just hours? What about effort?
  – Individual or joint family decision?

• How should we think about effect of taxes on labour supply?
  – Income and substitution effect
  – Summarise reaction of LS with elasticity measure ($\varepsilon$)
  – But many elasticity concepts: important to think about what the relevant one is (see Blundell and MaCurdy, 1998)
A static model of labour supply

• Consider individual $i$ with characteristics $v_{it}$ and preferences over consumption $c_{it}$ and leisure $l_{it}$

• Individual problem to maximise within-period utility function
  
  \[ U(c_{it}, l_{it}, v_{it}) \]
  
  subject to budget constraint
  
  \[ c_{it} = \mu_{it} + w_{it} (T - l_{it}) \]
  
  where $T$ is time endowment and $\mu_{it}$ non-labour income

• Under certain conditions, have interior solution for hours of work
  
  Yields labour supply function
  
  \[ h_{it} = h^s(w_{it}, \mu_{it}, v_{it}) \]
  
  Uncompensated (Marshallian) effect $dh^s/dw$ measures how hours of work respond to a shift in hours worked holding $\mu_{it}$ constant
  
  Uncompensated elasticity defined as
  
  \[ \varepsilon^u = w/h \times \frac{dh^s}{dw} \]
  
  Compensated (Hicksian) effect holds utility constant instead
  
  By Slutsky have
  
  \[ \varepsilon^c = \varepsilon^u - \eta \]
  
  where $\eta = w \times \frac{dh^s}{d\mu}$, the income effect
Introducing taxes and benefits

• With proportional taxes and means-tested benefits, problem now
  \[ \text{Max } U(c_{it}, l_{it}, v_{it}) \text{ s.t } c_{it} = \mu_{it} + (1-\tau_t)w_{it}(T - l_{it}) \]
• Yields labour supply function \( h_{it} = h^s[(1-\tau_t)w_{it}, \mu_{it}, v_{it}] \)
  – Note labour supply now function of net rather than gross wage
  – More complicated with non-linear taxes (discuss later)
• Have possible corner solution: zero hours
  – Work only if \((1-\tau_t)w_{it} > w^* = U_l/U_c\) evaluated at \(h=0\)
  – Taxes unambiguously reduce probability of working versus \(\tau_t = 0\)
• But effect of taxes on hours worked unclear
  – Depends on which effect dominates: empirical question
  – Note \(\varepsilon^c\) determines distortionary costs of taxation
• How do we go about identifying these effects of interest?
Estimating the elasticity directly

- Model suggests hours worked are a function of marginal net-of-tax hourly wages ($w$) and other income ($\mu$)
- So why not just get some cross-sectional data and run regression of
  \[ h_i = \alpha + \beta w_i + \gamma \mu_i + \phi Z_i + \epsilon_i \]
- Selection: only observe wages for individuals in work
  - Running regression only on observations with positive hours means can bias estimates: low wage earners must really like work/dislike leisure
- Endogeneity: $w$ and $\mu$ in our hours equation are both likely to be correlated with error term resulting in biased OLS estimates
  - Heterogeneity in tastes for work
  - Progressive taxes $\Rightarrow$ reverse causality
  - Measurement error: results in attenuation bias
(Quasi) Natural Experiments

- Variation from tax reforms provide potential solution to these issues
  - Policy might act as exogenous source of variation, changing tax rates for some ‘treatment group’ but not another ‘control group’
  - Compare labour supply of ‘treated’ group to that of ‘untreated’ group
- Diff-in-diff approach relies on 2 key assumptions
  - Common trends
  - No group compositional change
- Lots of work exploiting the 1986 Tax Reform Act in US
  - E.g. Eissa (1996): high income women saw large reductions in marginal rates, but also substantial increase in non-labour (husband’s) income
  - Find small increase in hours, large increase in participation for ‘treated’
  - Problems: differential shocks, assortative matching, other reforms, group composition affected by reforms
New tax responsiveness literature

- Individuals might respond on margins other than hours/employment
  - Intensity of effort; human capital investment

- New tax responsiveness literature: look instead at taxable income
  - Taxable income a proxy for total effort: includes various channels
  - Feldstein (1995): ETI a `sufficient statistic’ for welfare analysis

- Basics of approach
  - Summary parameter indicating how responsive taxpayers are to changes in their marginal tax rate
  - Compare taxable income of some group affected by a reform to that of an unaffected group
Example: the 50p rate of income tax debate

• Budget 2009 announced introduction of 50p rate of income tax for those with incomes above £150,000 from April 2010
  – At the time, HMT scored measure as increasing tax revenues by £2.7bn a year post-behavioural response (£6.8bn pre-response)

• In Budget 2011, the Chancellor asked HMRC to produce a report on how much 50p rate was raising
  – Suggested yield of £1 billion using revised estimate of the ETI
  – Revised estimate based on work exploiting the reform

• Revenue yield sensitive to estimated ETI
Revenue yield highly sensitive to the ETI

<table>
<thead>
<tr>
<th>Taxable income elasticity</th>
<th>Revenue raised by 50p rate assuming:</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Indirect tax revenues unaffected (£ billion)</td>
<td>Expenditure falls as much as income (£ billion)</td>
</tr>
<tr>
<td>0.20</td>
<td>4.1</td>
<td>2.9</td>
</tr>
<tr>
<td>0.25</td>
<td>3.5</td>
<td>2.2</td>
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<tr>
<td>0.30</td>
<td>3.0</td>
<td>1.6</td>
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<tr>
<td>0.35</td>
<td>2.4</td>
<td>0.9</td>
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<tr>
<td>0.40</td>
<td>1.8</td>
<td>0.3</td>
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<tr>
<td>0.45</td>
<td>1.3</td>
<td>–0.4</td>
</tr>
<tr>
<td>0.46 (BSS)</td>
<td>1.1</td>
<td>–0.5</td>
</tr>
<tr>
<td>0.50</td>
<td>0.7</td>
<td>–1.0</td>
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Source: Browne (2012) IFS Green Budget
How did the HMRC estimate the ETI?

• HMRC produced estimate of income growth in 2009–10 and 2010–11 among those with incomes above £150k in the absence of the 50p rate, using information on:
  – income growth among the group with incomes between £115k and £150k in 2009–10 and 2010–11 and
  – stock market growth 2009–10 and 2010–11

• For this estimate to be unbiased, requires income growth among those with lower incomes to be unaffected by reforms. Unlikely:
  – If people reduce their income below £150k in response to 50p rate, would increase total income of this lower income group
  – Lower income group may also be affected by other policies introduced at the same time, e.g. withdrawal of personal allowance above £100k

• Also need to account for a forestalling effect
Accounting for forestalling

• Affected individuals might bring income forward to 40p regime:
  – HMRC estimate suggests £16bn to £18bn shifted forward to 2009–10
  – Overall, incomes among those with incomes above £150k increased by 14% in 2009–10 but fell by 25% in 2010–11
  – Particularly for dividend income: grew by 78% among this group in 2009–10 and then fell by 73% in 2010–11
  – Actual incomes therefore much higher in 2009–10 than in counterfactual scenario without 50p rate, and much lower in 2010–11

• Part of the fall in income in 2010 – 11 the result of forestalling, and part the result of other changes in behaviour
  – Forestalling will only affect the first few years’ yield: can only bring a certain amount of income forward to avoid 50p rate
  – To get the medium term costing, need to separate out unwinding of forestalling from other behavioural changes
  – HMRC attempt to distinguish between the two effects, but requires assumption about how quickly forestalling unwound
Total income among those with incomes above £150k, 2008–09 to 2010–11

- **Estimate**: £18bn forestalling
- Partly brought forward from 2010–11, but also behavioural response
How did the HMRC estimate the ETI?

- HMRC then estimate the elasticity of taxable income
  - Central estimate of 0.48: if net-of-tax rate rises by 1%, taxable income rises by 0.48% ⇒ 50p rate raises £1 billion relative to 40p
- But estimates produced by their model are very imprecise
  - Standard errors suggest that only two-thirds chance that true elasticity in the model is between 0.14 and 0.81
  - And as we saw, revenue estimates are highly sensitive to the ETI
- Overall, reasonable attempt using approach
  - Similar to IFS central estimate of 0.46 (based on tax cuts in the 1980s)
  - But estimated parameter depends on avoidance opportunities: suggests government can (to an extent) increase the revenue maximising rate by reducing avoidance opportunities
  - See Saez et al JEL 2012 for critical review of literature: mean reversion, anticipation effects, re-allocation over the lifecycle
Bunching at tax (and benefit) kink points

- Tax and benefit system make budget set highly non-linear
  - Progressive tax structure with numerous kinks
  - Withdrawal of means-tested benefits and odd cliff-edges
Non-linear budget sets in the UK

Source: TAXBEN, using April 2013 system. Hourly wage of £6.31 (2013 minimum wage)
Bunching at tax (and benefit) kink points

- Tax and benefit system make budget set highly non-linear
  - Progressive tax structure with numerous kinks
  - Withdrawal of means-tested benefits and odd cliff-edges

- Results in two main econometric problems
  - Reverse causality: $w$ and $\mu$ both functions of hours
  - Model mis-specification: no longer get structural parameter of interest
Bunching at tax (and benefit) kink points

• Also provides the possibility of identifying behavioural responses
  – Model predicts individuals should bunch at kink points of tax schedule
  – Only non-parametric source of identification with cross-sectional data

• Saez (2010) develops method that relates observed bunching to $\varepsilon^c$
  – Consider increase in marginal tax rate from $t$ to $t + dt$ at income level $z^*$
  – Highest (no-kink) income individual bunching at $z^*$ comes from $z^* + dz$
  – Bunching proportional to average $\varepsilon^c$ at income level $z^*$ and net-of-tax ratio

$$\varepsilon^c = \frac{dz}{dt} \frac{z^*}{(1 - t)}$$
Bunching at tax (and benefit) kink points

Source: Saez (2010) Figure 1
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Bunching at tax (and benefit) kink points

- Saez looks at kink points of Earned Income Tax Credit schedule
  - Use individual tax return administrative data
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Bunching at tax (and benefit) kink points

- Saez looks at kink points of Earned Income Tax Credit schedule
  - Use individual tax return administrative data
  - Find bunching at first EITC kink, especially for self-employed
  - But no bunching at other EITC kink points, and implied $\varepsilon^c$ very small
- Why don’t we see bunching at kink points?
  - Behavioural responses to taxation are actually small
  - Information and salience (Chetty & Saez, 2013)
  - Adjustment costs (Chetty et al, 2011)
- Kleven and Waseem (2013, QJE) extend approach to notches
  - Jump in average rather than marginal rates
  - Use proportion of individuals observed in dominated region to estimate adjustment costs
  - But also find elasticities low (for very selected sample in Pakistan)
Discrete choice models

- Alternative approach to dealing with non-linear budget sets is to model labour supply as a discrete choice
  - e.g. decision is to work full-time, part-time, or not at all
  - Can then apply well established maximum likelihood methods to retrieve labour supply parameters of interest
  - Advantage is can easily simulate effect of hypothesised policy reform once behavioural parameters have been uncovered
  - But requires (restrictive) assumptions on preferences and error terms

  - Examine effect of WFTC reform on labour supply of mothers
  - Find reform increased employment rate of lone mothers by around 5ppt but slightly reduced labour supply of couples with children

- See Blundell et al. (2007) for survey of approach
Summary

• Understanding effect of taxes on labour supply crucial for many areas of policy and bigger questions about labour market trends

• But identifying behavioural responses and LS parameters difficult
  – Endogeneity and selection hamper standard OLS approach in x-section
  – Hard to find credible treatment-control groups for experimental design

• Yet relative consensus on labour supply responses
  – Prime-aged males very unresponsive in intensive and extensive margin, but taxable income elasticities around 0.2-0.6
  – Married women more sensitive, particularly on extensive margin
  – Presence and age of children in household important
  – See Meaghir & Philips (2010) for accessible survey, and Blundell and MaCurdy (1999) for more comprehensive one
4. Bibliography