Measuring the behavioural effects of tax changes
Lecture 2 Labour Supply Responses

Richard Blundell
University College London

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A brief look at optimal design of earnings taxation
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- Families
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The government cannot observe effort, only earnings. So can’t distinguish a high ability person working few hours from a low ability person working a large amount.

So has to balance redistributive aims with effort incentives. If it taxes the high ability types too much they may choose to supply much less effort. Thus we need to know supply elasticities.
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- *welfare effect*, and it is a loss to society. How large is this loss depends on the redistributive tastes of the government.
• With no behavioural response, increasing the top rate will increase government revenue. This is the mechanical effect on tax revenue, and this is a benefit to society, as the revenue can be used for government spending or higher transfers.

Increasing the top rate may also induce top bracket taxpayers to reduce their earnings (but not below the top bracket, because nothing has changed below this point) because of the substitution effect described above. This is known as the behavioural response on tax revenue, and it is a cost to society as tax revenues will fall.

Finally, any increase in the top rate will reduce the welfare of top bracket taxpayers. This is the welfare effect, and it is a loss to society.

If the government values redistribution, then, for incomes above a certain level, it will consider that the marginal value of income is small. In the limit, the welfare effect will be negligible relative to the mechanical effect on tax revenue.
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Consider a reform that changes the top tax rate $\tau$ by a small amount $d\tau$. Let $z$ be the earned income being considered for taxation. The top bracket begins at income $z$. Assume there are $N$ taxpayers in the top bracket.

Mechanical effect of higher marginal tax rate on incomes above $z^*$:

$$dM = N \left[ \frac{z}{z^*} \right] d\tau > 0$$

Behavioural effect will depend on the elasticity $e$ – the elasticity of earnings with respect to the net of tax rate $(1 - \tau)$. Reported income will be reduced by $dz = ezd\tau / (1 - \tau)$. Hence revenue will be reduced by $dB = Nezd\tau / (1 - \tau)$.
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  \[
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Welfare effect of higher marginal tax rate on incomes above $z^*$:

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Summing these we get

$$dM + dB + dW = Nd\tau[z - z^*][1 - g - e.a.\tau/(1 - \tau)]$$

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At the optimum this has to be zero

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- Note that \( a \) is a parameter of the upper tail of the Pareto distribution

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Approximately 1.67 in the recent UK data (figures)
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Figures and differences in differences tables.
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- Policy context: taxation of low income families in the UK – especially single mothers.
To understand the differences in the impact of the earned income tax credit expansions in the US and the UK
Tax Reform for Low Income Families

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Tax Reform for Low Income Families

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- As is (assumed) in the British, Irish and NZ tax credit systems.
- To present (new) tax (-credit) and transfer designs that condition on the age of children.
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2. A ‘structural’ estimation based on a general discrete response model with (unobserved) heterogeneity
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The second step is the normative analysis or optimal policy analysis.
The first step is a positive analysis of household work decisions. There are two empirical approaches - both prove useful:

1. A ‘quasi-experimental’ evaluation of the impact of historic reform
2. A ‘structural’ estimation based on a general discrete response model with (unobserved) heterogeneity

The second step is the normative analysis or optimal policy analysis: Examines how to best to design benefits, in-work tax credits and income tax rates for low-skilled groups.
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- Figures on US EITC and implicit marginal tax rates
The UK WFTC - eligibility

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- **Income eligibility**
  - If a family's net income is below a certain threshold, adult credit plus age-dependent amounts for each child
  - If income is above the threshold then the amount of credit is tapered away at 55% per extra pound of net income – previously 70%
FC (family credit) in various forms since 1970s, expanded early in 1990s
Earned Income Tax Credit Reforms in the UK

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Blundell (University College London)
**Earned Income Tax Credit Reforms in the UK**

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WFTC (working families tax credit) reform in 1999/2000, and subsequent expansions in 2002
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  - especially generous to families with young children
How should we assess the impact of such policies?

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  - Not for EITC or WFTC (but there is for the Canadian SSP)
Canadian Self Sufficiency Program

- Experimental design
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  - 50% earnings supplement – as a tax credit
  - at least 30 hours per week job
  - On earnings up to an annual limit of $36000
- provided to the individual, not the employer, as in EITCs
well designed social experiment
Canadian Self Sufficiency Program

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- Figures
Ex-post evaluation where there is no social experiment:

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- Differences in Differences data and table of impact estimates
Sensitivity analysis

- Choice of pre-treatment years

Results are robust to changing the pre-treatment time window. The hypothetical reform on pre-reform years shows a treatment effect of .07 (.11). How do we square these results with the larger impact on employment in the US? How does the observed effect accord with a decision-making model? What happened to the budget constraint?
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- not all eligibles take-up credit (Figure)
Interactions with other taxes and benefits in the UK

Unlike the US EITC the credit is based on net (rather than gross) family income

- interaction with other benefits and taxes matter (Figures)
  - differing size of the ‘treatment’ across eligibles (Figures: effects on hours)

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  - A ‘structural’ model
Key features of the structural model

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  - mixed-multinomial specification across discrete choices over ranges of hours.
Preferences typically approximated by polynomials

\[ U(y_h, h; X, \varepsilon) \]

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  - observed and unobserved heterogeneity
Net Income schedule:

Budget constraint:

\[ y_{hp} = wh + t(wh, I) - C_h + P\Psi(w, h, I) \]
\[ = \tilde{y}_h + P\Psi(w, h, I) \]

the tax-credit payment function \( \Psi(w, h, I) \) depends on:

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- earnings
- hours (through the hours condition of entitlement)
- other income \( I \)
- demographic characteristics \( X \)
Preferences and Take-up

Preferences:

\[ U_P(h, \tilde{y}_h, P; X, \varepsilon) = \alpha_{11}(\tilde{y}_h + P\Psi)^2 + \alpha_{22}h^2 + \alpha_{12}(\tilde{y}_h + P\Psi)h + \beta_1(\tilde{y}_h + P\Psi) + \beta_2h + \varepsilon_hP - P\eta \]

\[ = U(h, \tilde{y}_h + P\Psi; X, \varepsilon) - P\eta \]

where the 'cost' of receiving in-work support is given by:

\[ \eta = X_\eta \beta_\eta + \varepsilon_\eta \]

- The introduction of these additional terms is important in evaluation of a reform which increases generosity.
Claim credit $\Psi$ in WFTC at hours $h_j$ if

$$U_P(h, \tilde{y}_h + \Psi, P = 1; X, \varepsilon) > U_P(h, \tilde{y}_h, P = 0; X, \varepsilon)$$

utility cost among those who choose to claim WFTC must not exceed the utility gain from receipt of WFTC transfer income relative to non-receipt. Placing a bound on $\varepsilon_\eta < \Omega_U$ where

$$\Omega_U = U(h, \tilde{y}_h + \Psi, P = 1; X, \varepsilon) - U(h, \tilde{y}_h; X, \varepsilon) - X_\eta \beta_\eta$$
Assume stochastic relationship between total hours of childcare and maternal hours of work

\[ h_c = 1[h > 0].1[\epsilon_c < -\beta_c h](\beta_c h + \epsilon_c) \]

Child care expenditure is given by \( p_c h_c \), where \( p_c \sim F_c \) is the discretised distribution of childcare prices

- support probabilities for \( F_c \) are estimated
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- support probabilities for \( F_c \) are estimated
- both \( F_c \) and relationship above vary with \( X_c \)
Choice probabilities

These preferences, fixed costs, childcare costs and stigma cost expressions provide the choice probabilities:

\[
\Pr[h = h_j, P = p|X, ge) = \frac{\exp\{U(h_j, \tilde{y}_{h_j} + p\Psi, P = p; X, \varepsilon)\}}{\sum_k \max[\exp\{U(h_k, \tilde{y}_{h_k}, 0; X, \varepsilon)\}, E_{h_k} \exp\{U(h_k, \tilde{y}_{h_k} + \Psi, 1; X, \varepsilon)\}]} \]

where \(E_h\) is an indicator equal to unity if the individual is entitled to in-work tax credit.

- From which we construct the sample log likelihood.
Data from 1995-2003 (Family Resources Survey)
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- Jointly estimate wages, take-up, childcare and preferences by simulated maximum likelihood:
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  - Unobserved heterogeneity follows normal distribution with integrals approximated with 400 quasi-random draws
Robustness of the ex-ante evaluation model:

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- The idea is to simulate the quasi-experimental estimate (moment)
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WFTC impact

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  - this turns out to be a key observation for tax design
Focus on the extensive margin and the use of work conditions:

Some related literature

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- This paper examines the robustness of the empirical specification and looks deeper at: tax rate/credit schedule, hours-contingent and age-contingent designs.
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Simplified optimality results

- Suppose we distinguish between earnings groups
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- ‘higher’ earners groups $i = 1, 2, \ldots$
- Suppose the social welfare weight $g$ is higher for group 0, and monotonically decreasing
- Choose taxes (and transfers) $T$ to maximise welfare
Optimal design gives:

\[
\frac{T_i - T_0}{c_i - c_0} = \frac{1 - g_i}{\zeta_i}
\]

where

- \(\zeta_i\) is the labour supply elasticity (intensive margin)
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- \(-T_i\) is the subsidy given to group \(i\)
- \(c_i\) is the net of tax income for that group
- \(g_i\) is the social welfare weight for group \(i\) and \(g_0 > 1\), with the weights summing to unity.
The intensive and extensive margin

Suppose we now introduce different levels of earnings with an intensive and extensive margin

\[
\frac{T_i - T_{i-1}}{c_i - c_{i-1}} = \frac{1}{\zeta_i} \sum_{j=1}^{l} (1 - f_i)
\]

where

- \( f_i = g_i + \eta_i k \)
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- Buble Figures
Social welfare, for individuals of type $X, \varepsilon$

$$W(T) = \int_{X,\varepsilon} \int_{\varepsilon} Y(U(c(h^*; T, X, \varepsilon), h^*; X, \varepsilon, \varepsilon)) dF(\varepsilon) dG(X, \varepsilon)$$

where $Y$ is the ‘social welfare’ transformation.

The tax structure $T(\cdot)$ is chosen to maximise $W$, subject to:

$$\int_{X,\varepsilon} \int_{\varepsilon} T(wh^*, h^*; X) dF(\varepsilon) dG(X, \varepsilon) \geq \overline{T}(\equiv -R).$$

for a given $R$. 
Control preference for equality by transformation function:

$$Y(U; \theta) = \frac{(\exp U)^\theta - 1}{\theta}$$

When $\theta$ is negative, the function favors the equality of utilities. If $\theta < 0$ then conditional on $X$ and $\epsilon$ the integral over state specific errors is given by:

$$\frac{1}{\theta} \left[ \Gamma(1 - \theta) \times \left( \sum_{h \in \mathcal{H}} \exp(u(c(h; T, X, \epsilon), h; X, \epsilon)) \right)^\theta - 1 \right]$$

where $\Gamma$ is the gamma function.

- Figures of Redigned Tax Schedules
Change transfer/tax rate structure to match lessons from ‘new’ optimal tax analysis and empirical evidence:

- Lower marginal rates at the bottom means-testing should be less aggressive at least for some groups.
- Age-based taxation distinguishes by age of youngest child for mothers/parents.
- Hours rules? – at full time, welfare gains depend on monitoring.
- Impact of reforms on PTRs and EMTRs (MRII - Figures).

Blundell (University College London)

Uppsala Tax Course

March 2010
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Resolved the US-EITC, UK-WFTC puzzle
Implications

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Further Issues: Other Margins, Dynamics and Families

- Top Rates, Effort and Productivity
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Although the magnitude is small – a large group.
But how should we best model family labour supply behaviour:

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Blundell (University College London)
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- collective model . . . - dampens the effect
Optimal static design but dynamic incentives for self-sufficiency?

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Canadian Self-Sufficiency Project, example of the first
eligibility depends on income, children and work
Canadian Self Sufficiency Program

- eligibility depends on income, children and work
- eligibility depends on 12 months welfare receipt
Canadian Self Sufficiency Program

- eligibility depends on income, children and work
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- eligibility depends on finding a full-time job (30 hour per week)
Canadian Self Sufficiency Program

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- eligibility depends on finding a full-time job (30 hour per week)
- time limited receipt to 36 months after first eligible
But what of more dynamic effects?

- Longer term effects on employment?
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But what of more dynamic effects?

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- On earnings?
- On hourly wages?
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- See Blundell and Moffitt (2007), ….
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Other results, Taber etc, UK ERA, show some progression but quite small.
Follow hours and employment dynamics in BHPS before and after the FC and WFTC reforms
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- search model developed in Robin and Shephard (2008)
Time Limited Conditional Programs

- Need to know more about earnings progression and experience effects among low wage workers
Time Limited Conditional Programs

Need to know more about earnings progression and experience effects among low wage workers

The combination of time limited tax-credits or wage subsidies conditional on a minimum spell on welfare or UI is common in welfare-to-work programs
Targeting: results and thoughts:

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  - childcare/child supplement