WPEG 2007

Tax-Credit Policies for Low Income Families: Impact and Optimality

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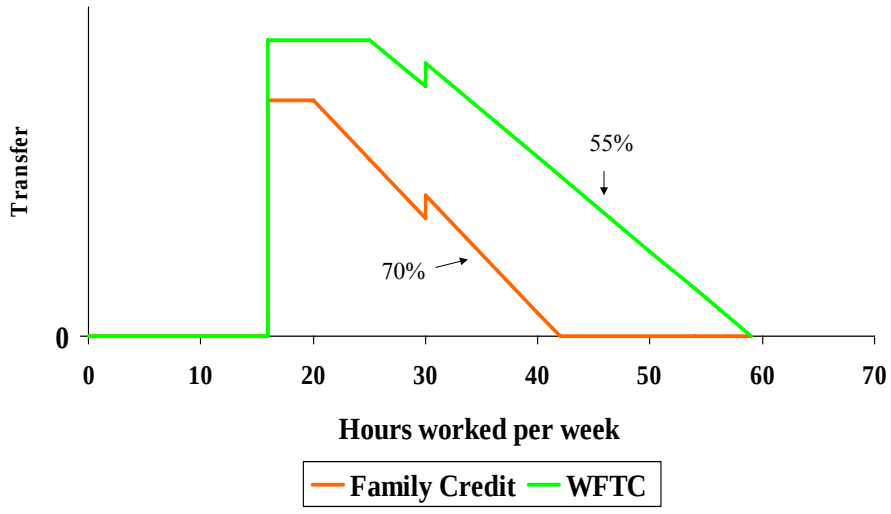
Tax-Credit Policies for Low Income Families

- This research concerns the impact of tax and tax-credit reform on working decisions.
- It looks at the *impact* and the *'optimal' design*
- Two questions:
  - How should we measure the impact of tax and tax-credits on work decisions?
  - How should we assess the optimality of tax and tax-credit proposals?
- Focus on single mothers and the UK reforms

Tax Credit reforms in the UK

- Sequence of Tax Credit expansions
  - FC (family credit) before 2000, expanded early in 1990s
  - WFTC (working families tax credit) reform in 2000, and subsequent expansions in 2002
  - influenced by the success of the EITC expansion in the US
  - especially generous to families with young children
- WTC (working tax credit) and CTC (child tax credit) reform in 2004
  - extension of eligibility to individuals without children

The WFTC Reform

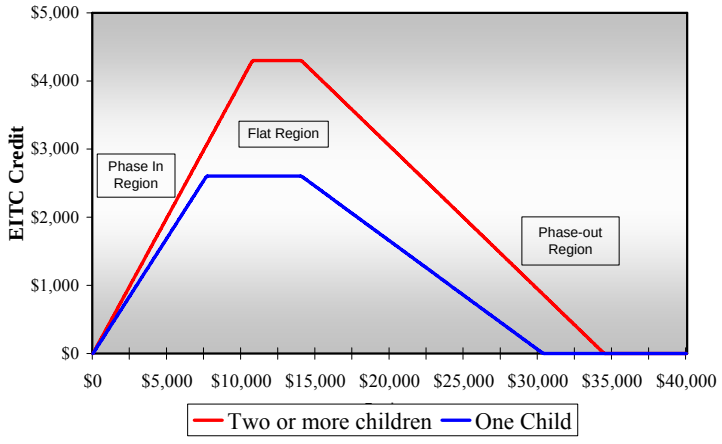


transfers per week for a min. wage lone parent

General form of Earned Income Tax Credits

- Credit depends on *earnings* and *number of children*:
  - Phase-in: credit is flat percentage of earned income or jump in at minimum hours threshold
  - Flat range: receive maximum credit
  - Phase-out: credit is phased out at a flat rate
- Credit based on *family* earnings
  - Creating 'interesting' incentives among couples

EITC Schedule in US – Single Parent Families, 2004

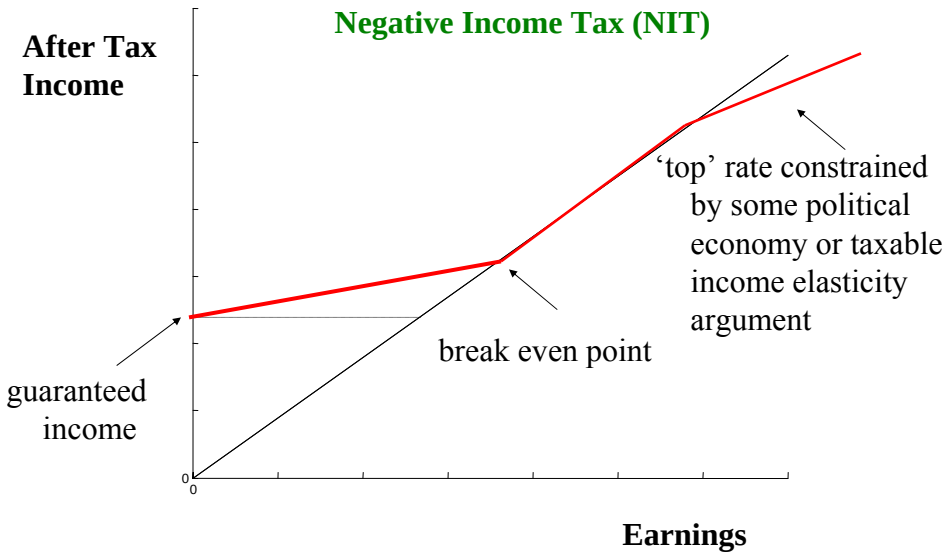


➢ Larger credit, covering higher earners for families with two or more children.

Can a WFTC type design be 'optimal'?

- Does the WTFC represent an optimal transfer for low income families?
- New insights from optimal tax theory show some negative marginal tax rates can be an optimal design
- Labour supply estimation suggest extensive margin is more responsive to incentives than intensive margin
- This turns out to be a key observation for optimal tax design

Tax Credit Policies for Low Income Families



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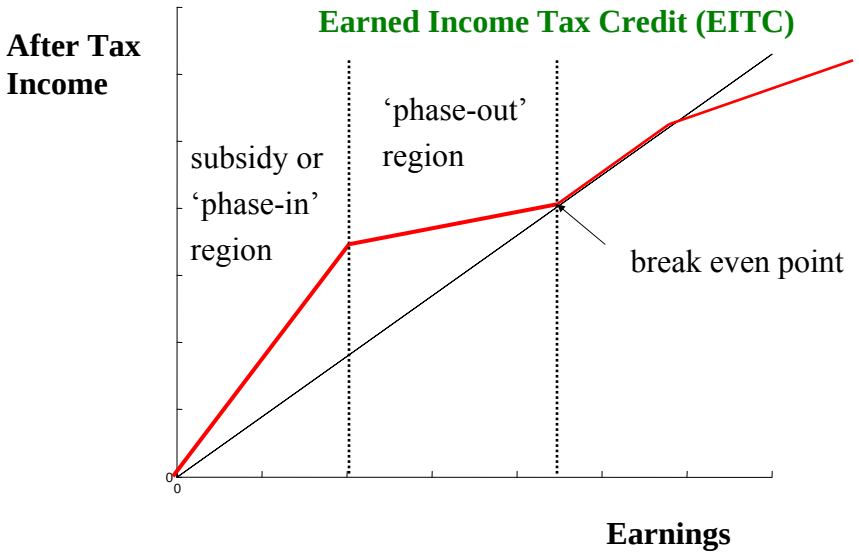


The Analysis of Tax Credit Policies

In the research design reported here, the analysis of tax-credit policy is tackled in two steps:

- The first step is a positive analysis of how household work decisions respond. There are two empirical approaches - both prove useful:
  - (a) A 'quasi-experimental' evaluation of the impact of historic reforms
  - (b) A 'structural' estimation of individual behaviour based on a general discrete choice model
- The second step is the normative analysis or optimal policy analysis

A simple optimal design framework

- Two 'new' approaches
- solve directly given the microeconometric estimates of discrete choice behaviour and tax-benefit constraints
- take approximations in terms of underlying elasticities and welfare weights on different incomes – Diamond/Saez
- choose transfers and taxes 'T' to maximise welfare
- extend the standard Mirrlees framework to allow for responses at the extensive and intensive margin

A (simple) optimal tax framework

Suppose U is the 'utility' of a single mother

$$U(c, h; X, \varepsilon)$$

from working h hours with net income c, where X are observable characteristics of her and her child and ε represents unobserved characteristics.

Budget constraint:

$$c \equiv wh - T(w, h; X)$$

Choose h from a set of discrete alternatives reflecting part-time work, full-time work etc.

A simple optimal tax/tax-credit framework

Social welfare, for single parents of type X

$$W = \sum_i \int_w \int_\varepsilon \Gamma(u(w_i h_i - T(w_i, h_i; X), h_i^*; X, \varepsilon)) dF(\varepsilon) dG(w; X)$$

where Γ is the social welfare transformation.

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

$$\sum_i \int_w \int_\varepsilon T(w_i, h_i; X) dF(\varepsilon) dG(w; X) = \overline{T}(X) (= -R(X))$$

Simplified expressions - for intuition

- Suppose we distinguish between earnings groups
  - 'no' earners: group 0
  - 'higher' earners groups i = 1, 2,…
- Suppose the social welfare weight is higher for group 0, and monotonically decreasing
- Choose taxes (and transfers) T to maximise welfare
- Can derive expressions in terms of elasticities and social welfare weights across the income distribution

Simplified expressions

Optimal design gives:

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

where

ζ_i is the labour supply elasticity

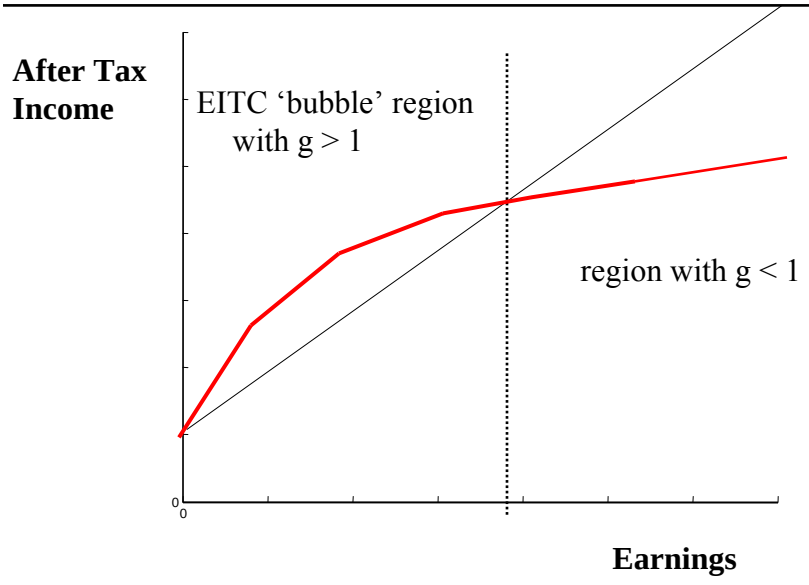
$-T_i$ is the subsidy given to group i

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 weighted sum of g's =1

An Optimal Schedule



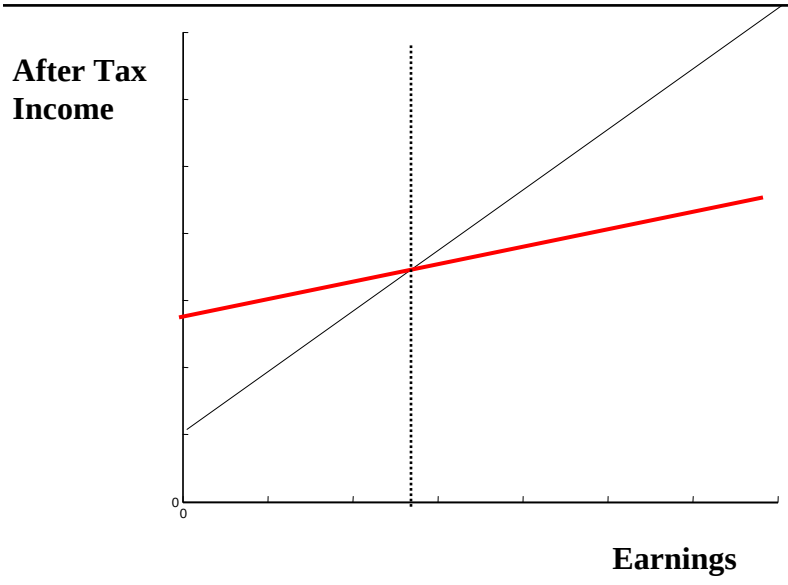
Simplified expressions

e.g. for two groups:

$$\frac{T_1 - T_0}{c_1 - c_0} = \frac{g_0 - 1}{\zeta_1}$$

which leads to a standard NIT

An Optimal Schedule



The intensive and extensive margin

Suppose we now introduce an intensive and extensive margin

$$\frac{T_i - T_{i-1}}{c_i - c_{i-1}} = \frac{1}{\zeta_i} \sum_{j=i}^{I} [1 - \hat{g}_j]$$

where

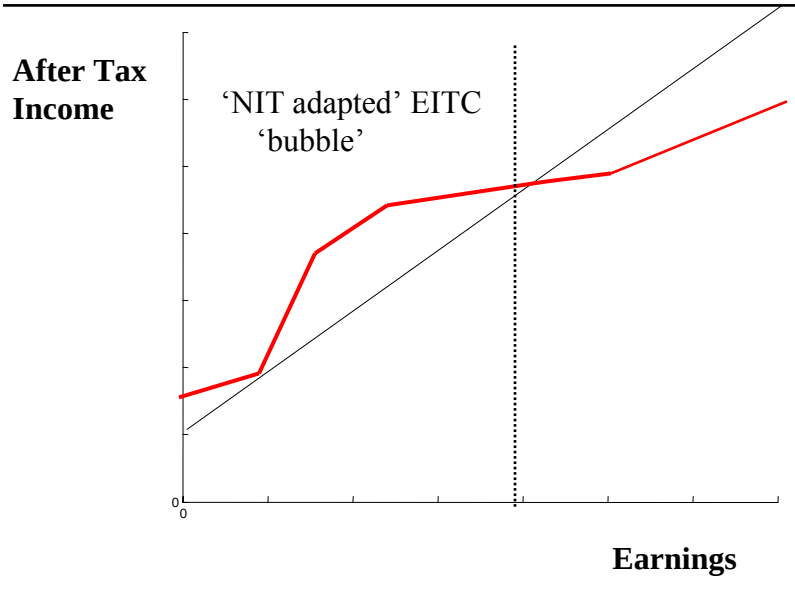
$$\hat{g}_j = g_j + \eta_j k,$$

ζ_i is the intensive elasticity

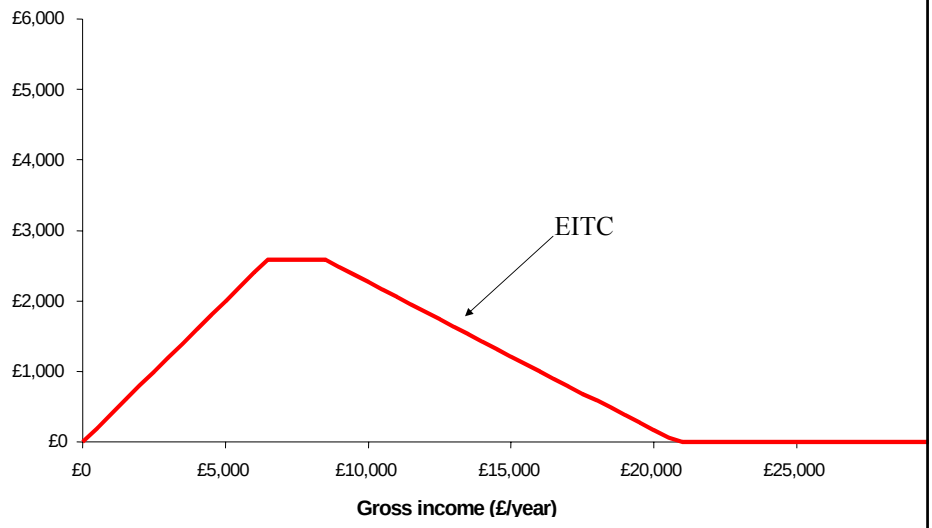
and η_j is the extensive elasticity

a 'large' extensive elasticity can 'turn around' the impact of social weights - implying a higher transfer to low wage workers than to those out of work – a tax-credit

A 'Typical' Optimal Schedule



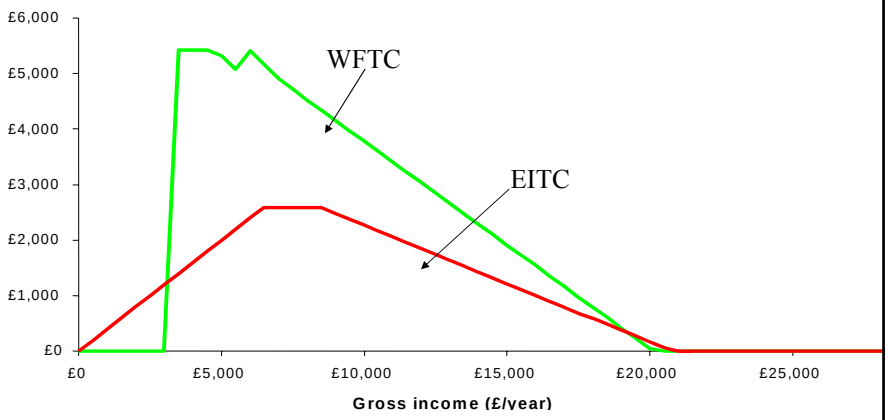
The US Earned Income Tax Credit



The WFTC design: eligibility criteria

- work eligibility
  - 16 or more hours per week
- family eligibility
  - children (in full time education or younger)
- 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%

The UK and US tax credit systems compared



- A puzzle on the relative impact of WFTC and EITC

The WFTC design

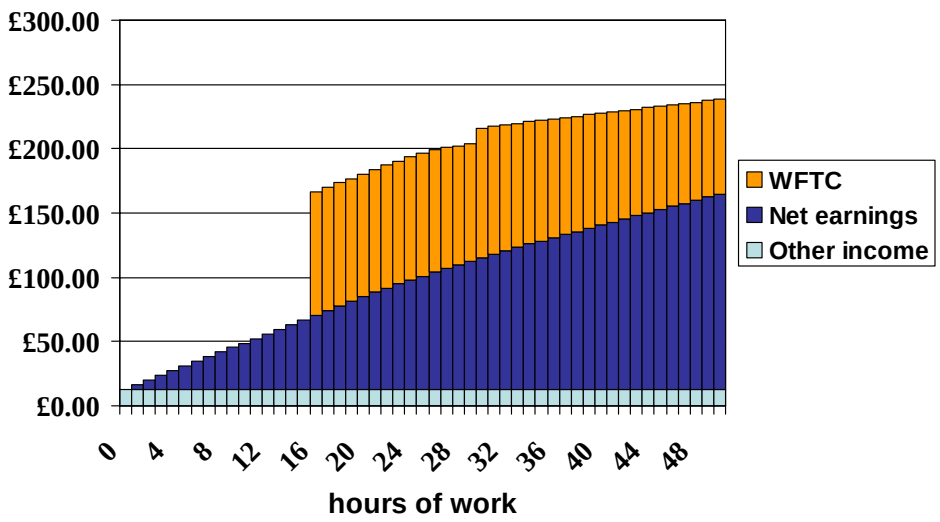
- Is this an 'optimal' design given efficiency and distributional considerations:
- Is an hours eligibility rule optimal?
- At what hours point should it be set?
- Is the overall structure of the WFTC optimal?

Interactions with other taxes and benefits

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

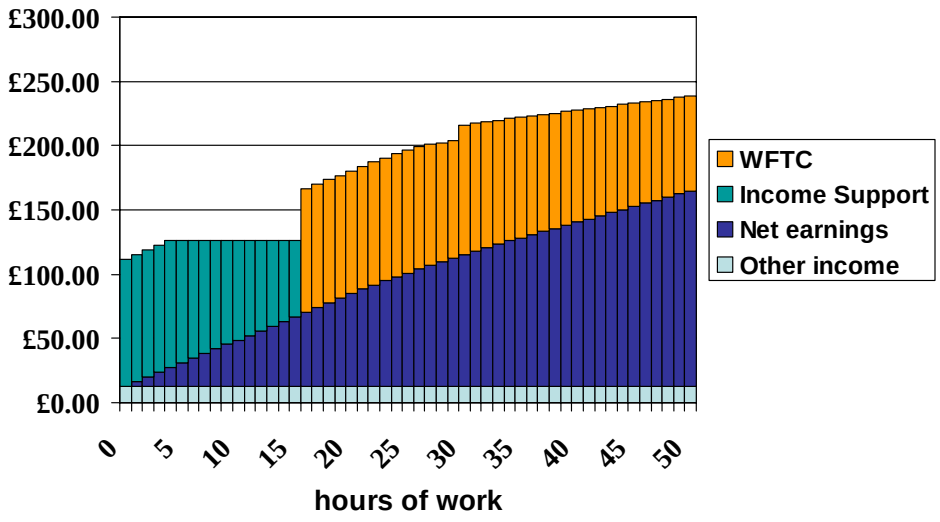
- interaction with other benefits and taxes matter
  - differing size of the 'treatment' across eligibles
- coincident reforms to Income Support (IS)
  - different direction of these reforms to US

WFTC interactions with other taxes and benefits in the UK



single parent on minimum wage

WFTC interactions with other taxes and benefits in the UK



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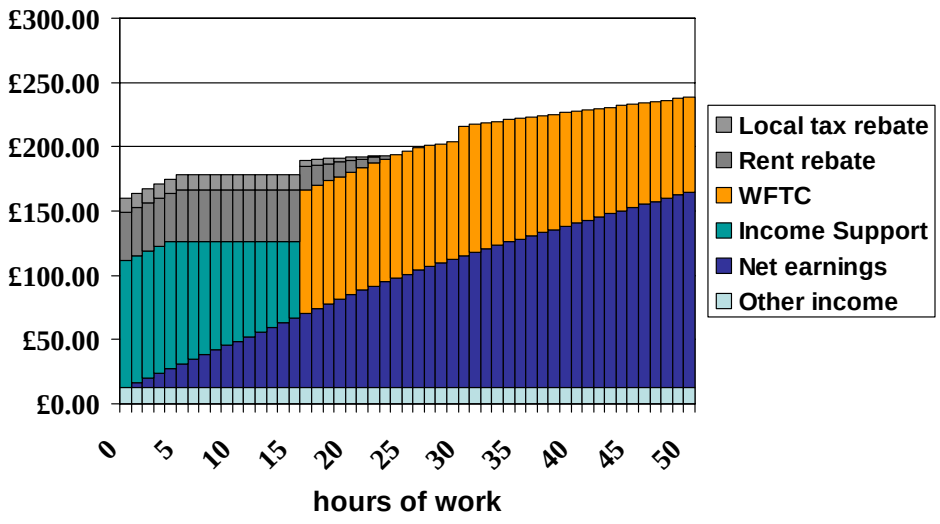
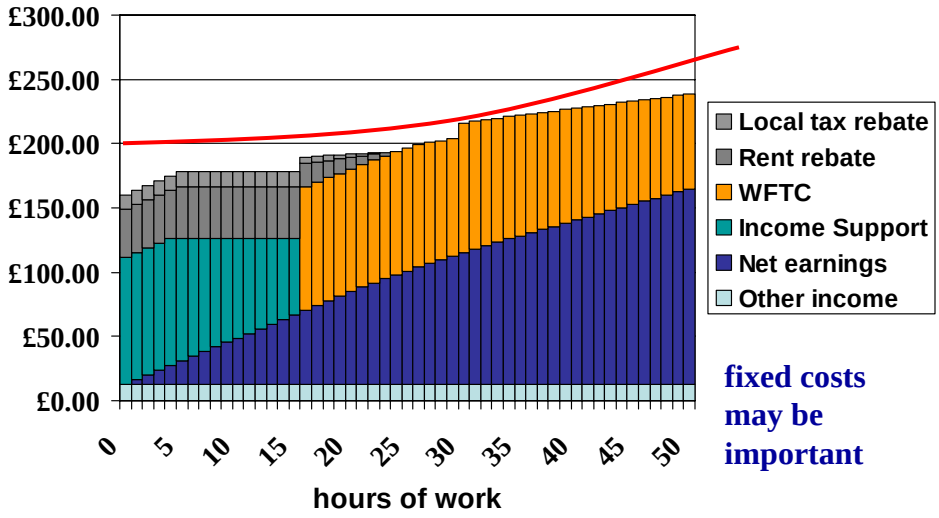


The interaction with other benefits



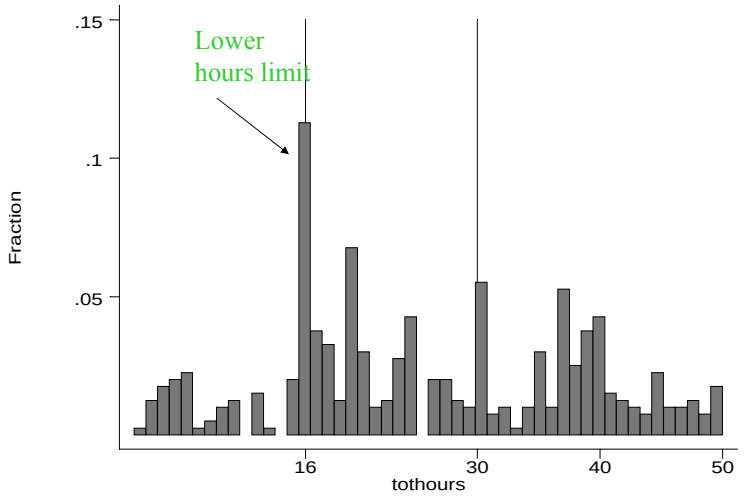
fixed costs may be important

Assessing the design

- Requires a reliable structural simulation model that captures decisions and the budget constraint accurately
- Two components:
  - budget constraint is approximated by number of discrete points.
  - choose hours of work according to discrete choice model with hours options:

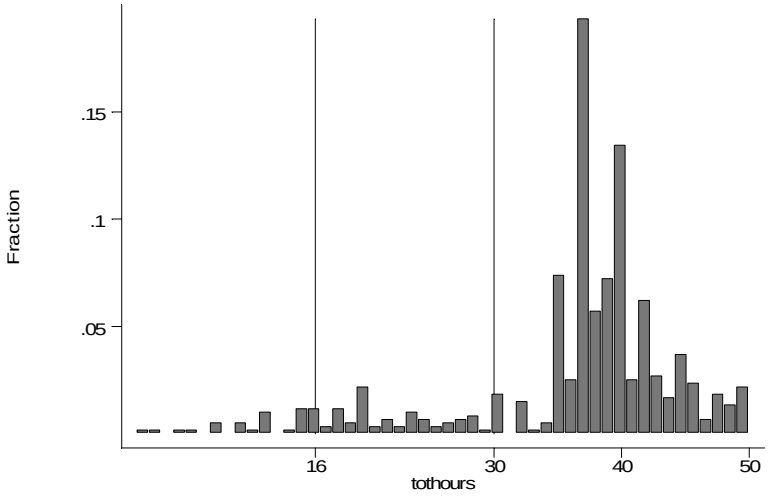
Weekly Hours Worked

Low Education Single Mothers (aged 18-45)



Weekly Hours Worked

Low Education Single Childless Women (aged 18-45)



Key features of a 'realistic' structural model

- budget constraint that allows for tax/benefit interactions
- discrete decisions over hours worked
- heterogeneity – demographics, ethnicity,., unobs. het.
- fixed costs of work – obs. and unobs. het.
- stigma/hassle costs – take-up versus eligibility
- childcare costs
- do individuals behave this way?

Specifying a structural labour supply model

- For lone parents say, utility function defined over net income and hours:

$$U(h, y_h) = u(h, y_h) + \varepsilon_h$$

- Where ε_h is a discrete hours choice specific error
- Approximate function by:

$$U(h, y_h) \approx \alpha_{11} y_h^2 + \alpha_{22} h^2 + \alpha_{12} y_h h + \beta_1 y_h + \beta_2 h + \varepsilon_h$$

- Heterogeneity enters model through α and β
  - observed and unobserved heterogeneity

Specifying a structural labour supply model

- lone parents choose hrs/wk point

$$h \in \{0, 10, 19, 26, 33, 40\}$$

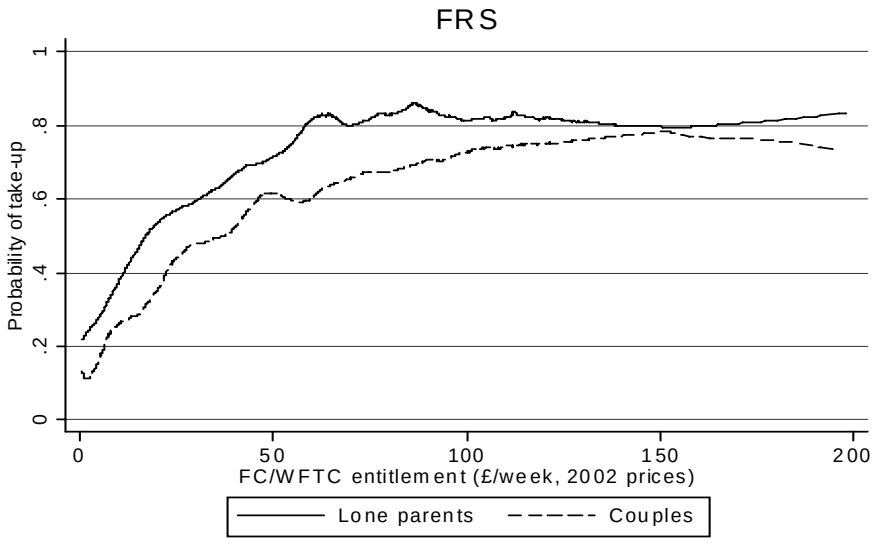
- to maximise utility. With extreme value errors:

$$\Pr[h = h_j] = \exp\{U(h_j, y_{h_j})\} \Big/ \sum_{k \in \Theta} \exp\{U(h_k, y_{h_k})\}$$

- Model additionally allows for:
  - Unobserved work-related (fixed) costs, *WRC*
  - Childcare costs, *CC*
  - Programme participation (hassle or 'stigma') costs, *P*

Take-up and WFTC

Variation in take-up probability with entitlement to FC/WFTC



Estimation

- Data from 1995-2003 (Family Resources Survey)
  - 1995-1999: pre-reform estimation data (ex-ante)
  - 2002-2003: 'post-reform' validation sample
  - Use complete sample for ex-ante analysis of 2004 and more recent reform proposals

Structural Model Elasticities

(a) Youngest Child Aged 11-18

Earnings	*Density*	*Extensive*	*Intensive*
0	0.3966		
80	0.1240	0.5029	0.5029
140	0.1453	0.7709	0.3944
220	0.1723	0.7137	0.2344
300	0.1618	0.4920	0.0829
Participation elasticity		1.1295	

Structural Model Elasticities

(c) Youngest Child Aged 0-4

Earnings	*Density*	*Extensive*	*Intensive*
0	0.5942		
80	0.1694	0.2615	0.2615
140	0.0984	0.6534	0.1570
220	0.0767	0.5865	0.1078
300	0.0613	0.4984	0.0834
Participation elasticity		0.6352	

- Check the robustness of the structural model by the ability to simulate the impact of the WFTC reform

Structural Evaluation Simulation Results: WFTC Expansion

	All	y-child 0 to 2	y-child 3 to 4	y-child 5 to 10	y-child 11 to 18
Change in employment rate:	5.95	3.09	7.56	7.54	4.96
	0.74	*0.59*	*0.91*	*0.85*	*0.68*
Average change in hours:	1.79	0.71	2.09	2.35	1.65
	0.2	*0.14*	*0.23*	*0.34*	*0.2*

Notes: Simulated on FRS data; Standard errors in italics.

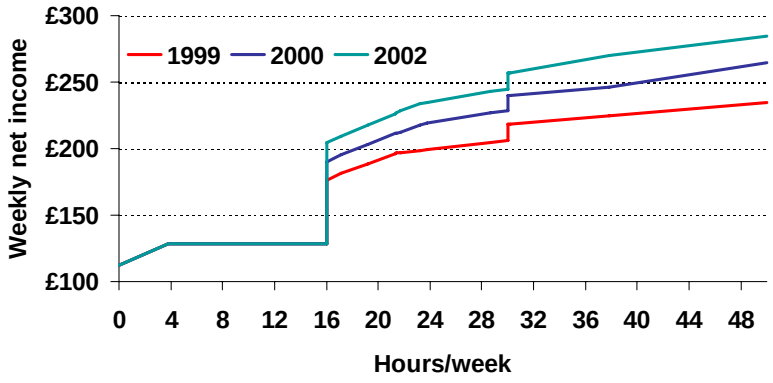
All: 5.12 without change in take-up – key impact effect

Adult and Child Elements of the WFTC

	Adult	Child Awards by Age		
		child 0 to 10	child 11 to 15	child 16 to 18
Mar-99	£58.80	£16.40	£22.60	£28.00
Oct-99	£56.60	£21.50	£22.60	£28.00
Mar-00	£56.60	£22.60	£22.60	£28.00
Jun-01	£61.90	£27.30	£27.30	£28.00
Jun-02	£64.40	£27.30	£27.30	£28.00
Increase	19.70%	66.40%	20.50%	0.00%

Note: All monetary amounts are expressed in April 2003 prices.

Impact of WFTC reform on lone parent, 2 children



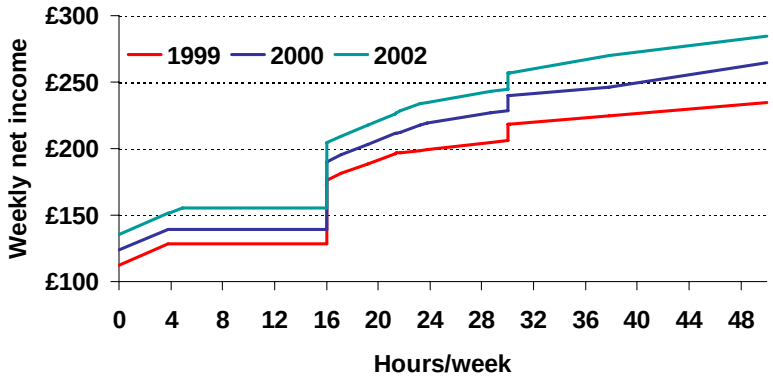
- ***Notes:*** **Two children under 5. Assumes hourly wage of £4.10, no housing costs or council tax liability and no childcare costs.**

Child Rates of *Income Support*

	child 0 to 10	child 11 to 15	child 16 to 18
Mar-99	£21.90	£28.00	£33.50
Oct-99	£27.00	£28.00	£33.50
Mar-00	£28.40	£28.40	£33.80
Mar-01	£33.00	£33.00	£33.80
Oct-01	£34.50	£34.50	£35.40
Mar-02	£34.50	£34.50	£35.40
Increase	57.50%	23.30%	5.70%

Note: All monetary amounts are expressed in April 2003 prices.

Impact of WFTC & increases in welfare benefit on lone parent, 2 children



- ***Notes:*** **Two children under 5. Assumes hourly wage of £4.10, no housing costs or council tax liability and no childcare costs.**

Structural Evaluation Simulation Results: All Reforms

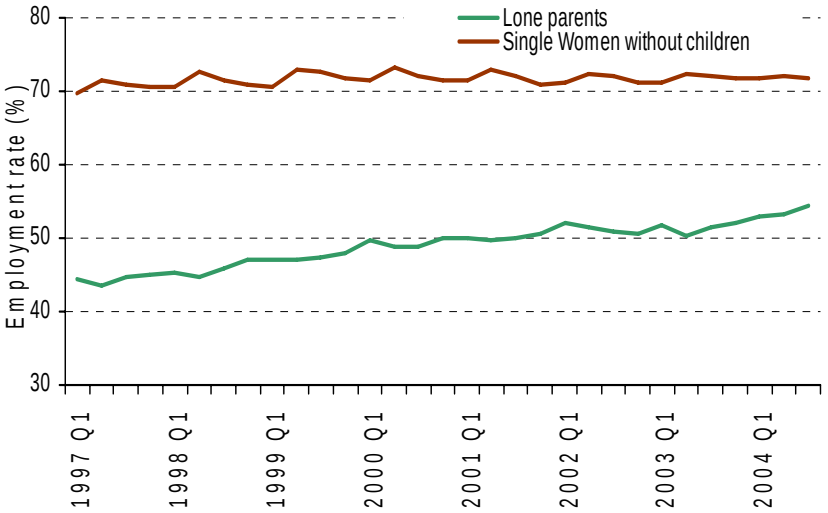
	All	y-child 0 to 2	y-child 3 to 4	y-child 5 to 10	y-child 11 to 18
Change in employment rate:	3.68	0.65	4.53	4.83	4.03
	0.84	*0.6*	*0.99*	*0.94*	*0.71*
Average change in hours:	1.02	0.01	1.15	1.41	1.24
	0.23	*0.21*	*0.28*	*0.28*	*0.22*

Notes: Simulated on FRS data; Standard errors in italics.

Robustness of the structural model:

- Compare structural model simulations based on estimated parameters to quasi-experimental ex-post evaluation
- The idea is to simulate the quasi-experimental estimate (moment)
- comparing work decisions of eligible versus those who are not eligible before and after the reform
- identify average employment impact on eligibles by *assuming* a structure on *unobservables*
  - separability
  - common trends across groups
  - invariance in group heterogeneity over time
    - *conditional* on a set of (matching) covariates X

Employment rates of single women in the UK



Difference-in-Differences: Lone Mothers Employment

Single Women	Marginal Effect	Standard Error	Sample Size
Family Resources Survey	**3.57**	***0.81***	**74,959**
Labour Force Survey	**3.81**	***0.33***	**233,208**

Data: Spring 1996 – Spring 2003.

Drop: Summer 1999 – Spring 2000 inclusive; individuals aged over 45.

Outcome: employment. Average impact x 100, employment percentage.

Matching Covariates: age, education, region, ethnicity,..

Evaluation of the ex-ante model

- The *simulated* diff-in-diff parameter from the structural evaluation model is precise and does not differ significantly from the diff-in-diff estimate
- Compare *simulated diff-in-diff moment* with *diff-in-diff*
  - .29 (.73), chi-square p-value .57
- Consider additional moments
  - education: low education: 0.33 (.41)
  - youngest child interaction
    - Youngest child aged < 5: .59 (. 51)
    - Youngest child aged 5-10: .31 (.35)

What of the 'optimal' design?

- Given the structural discrete choice estimates and the implied elasticities at extensive and intensive margin, we can pose the question:
  - what is the optimal tax and transfer schedule?
  - is the WFTC+ 'optimal' for reasonable social welfare weights?

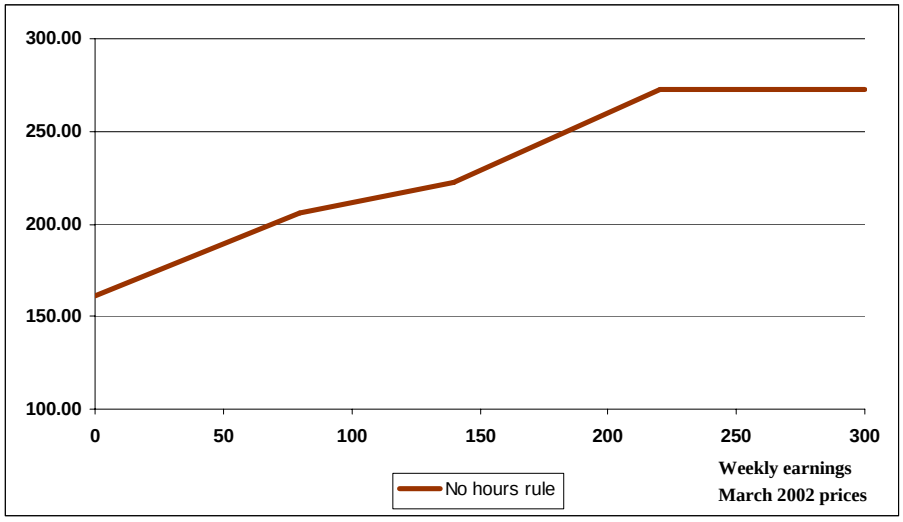
$$\Gamma(U \mid \theta) = \frac{1}{\theta}\left\{(\exp U)^{\theta} - 1\right\}$$

- When θ is negative, the function favours the equality of utilities; We solve the schedule for a series of values – central estimates us -0.2

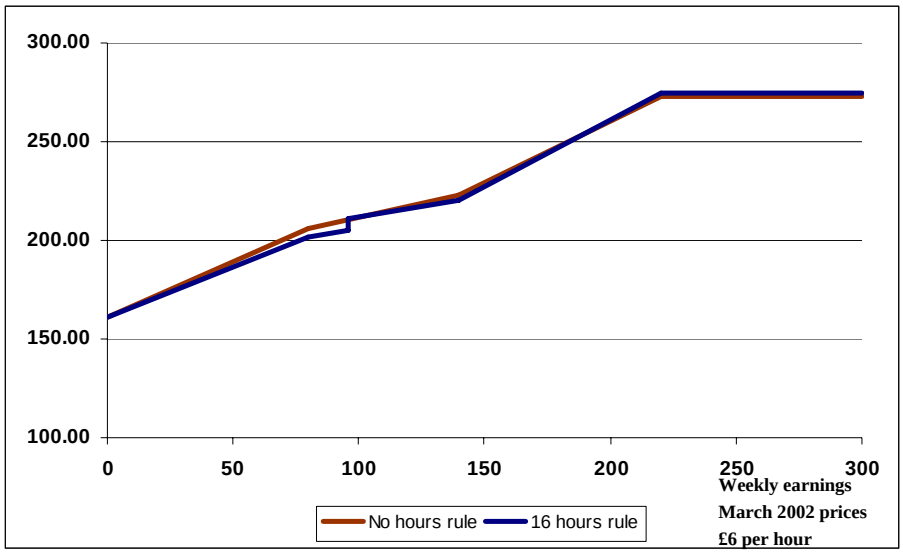
Should there be an hours eligibility condition or 'bonus'?

- Is it optimal to have a 'minimum hours' eligibility?
- If we can have a 16 hours condition, what should it look like?
- Is 16 the optimal choice?

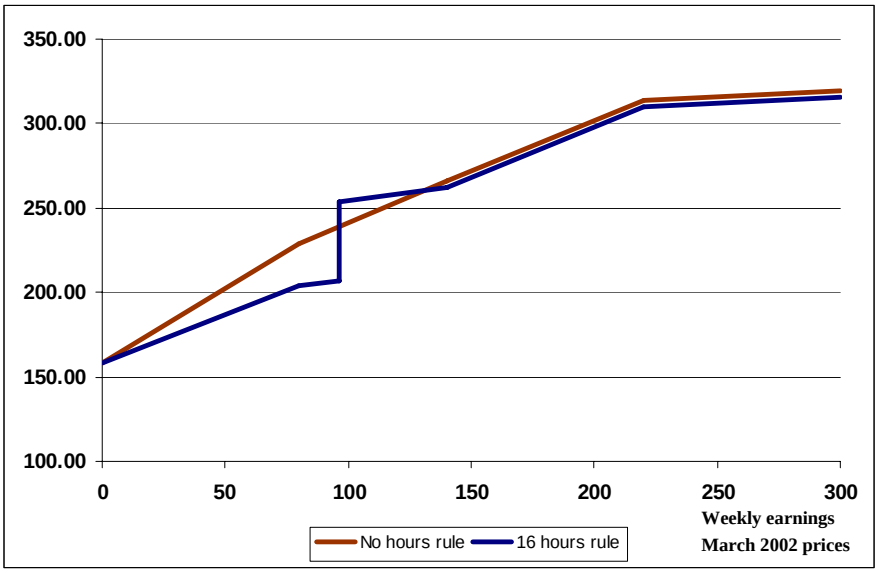
An Optimal Schedule, Youngest Child Aged 0-4



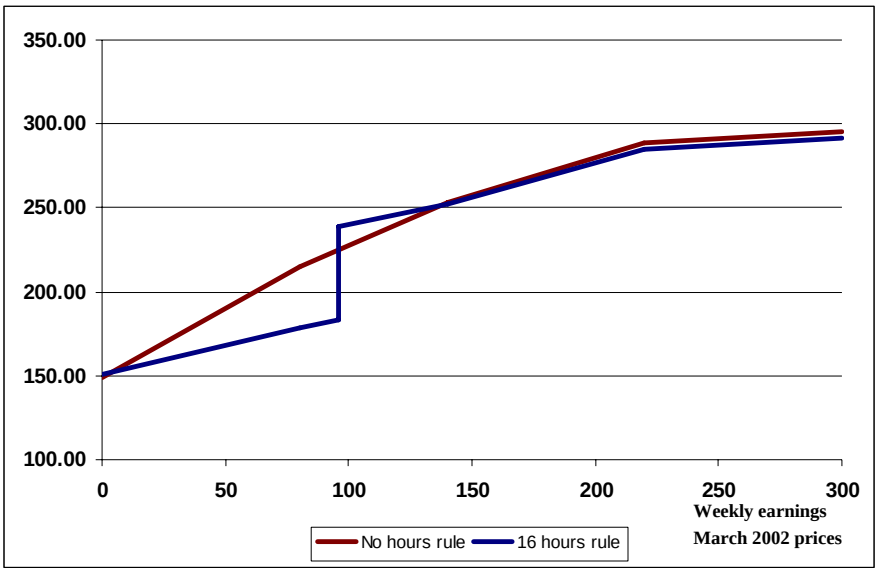
An Optimal Schedule, Youngest Child Aged 0-4



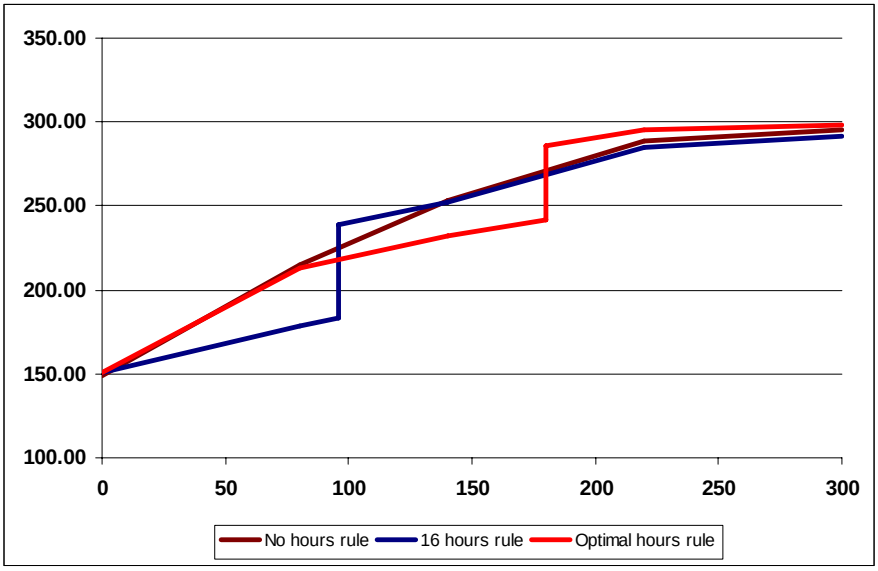
An Optimal Schedule, Youngest Child Aged 5-10



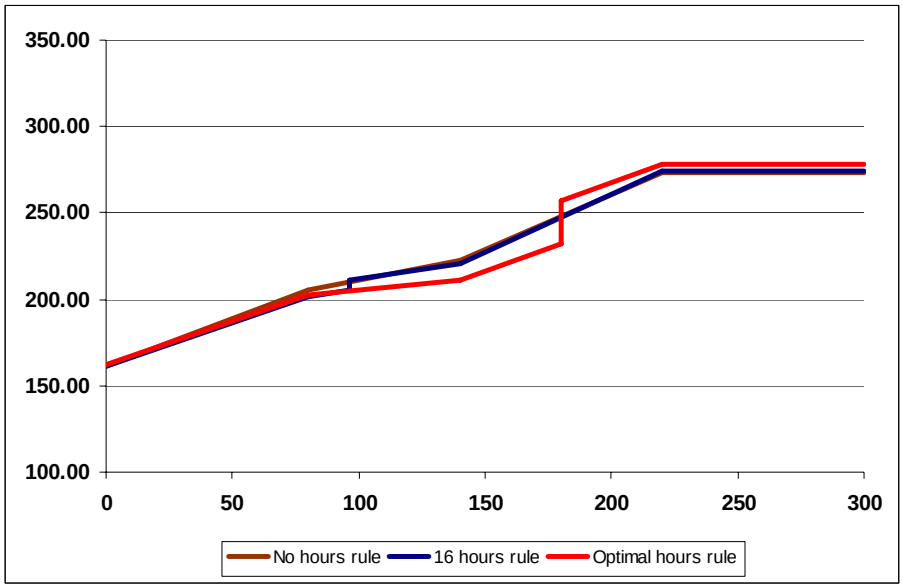
An Optimal Schedule, Youngest Child Aged 11-18



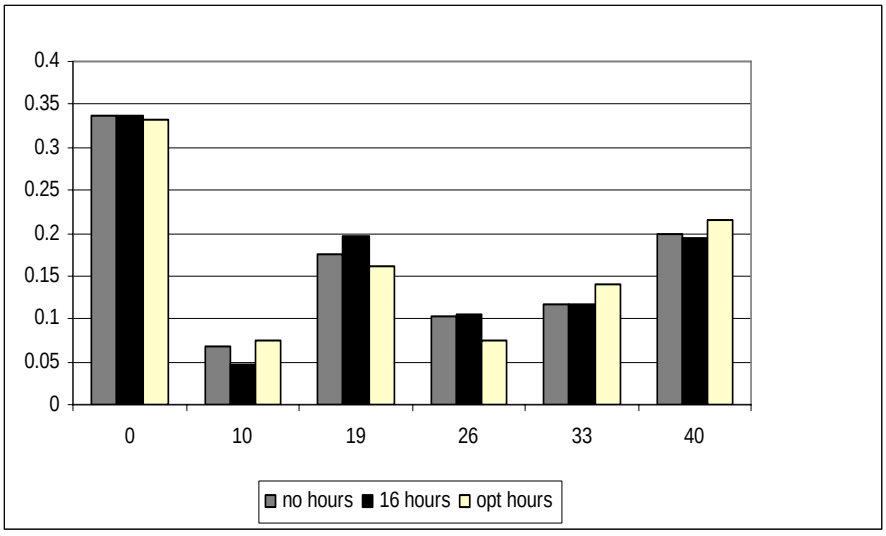
An Optimal Schedule, Youngest Child Aged 11-18



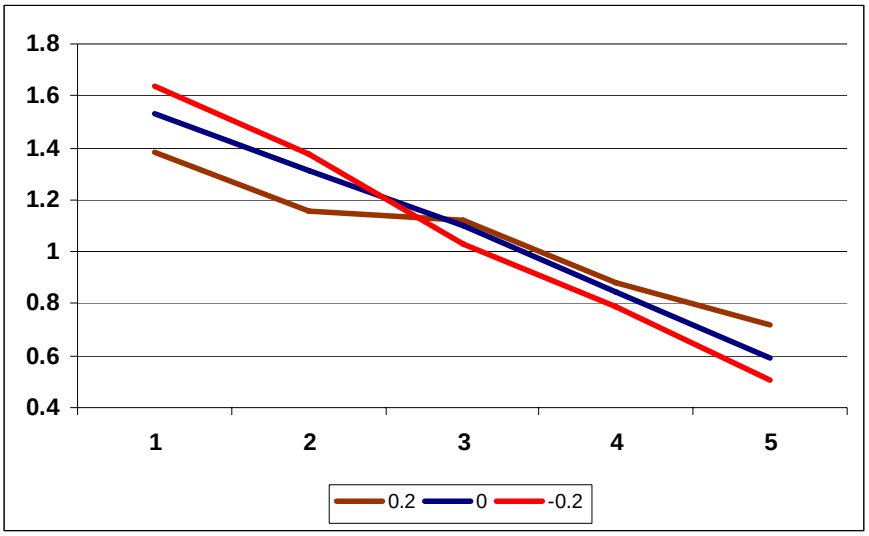
An Optimal Schedule, Youngest Child Aged 0-4



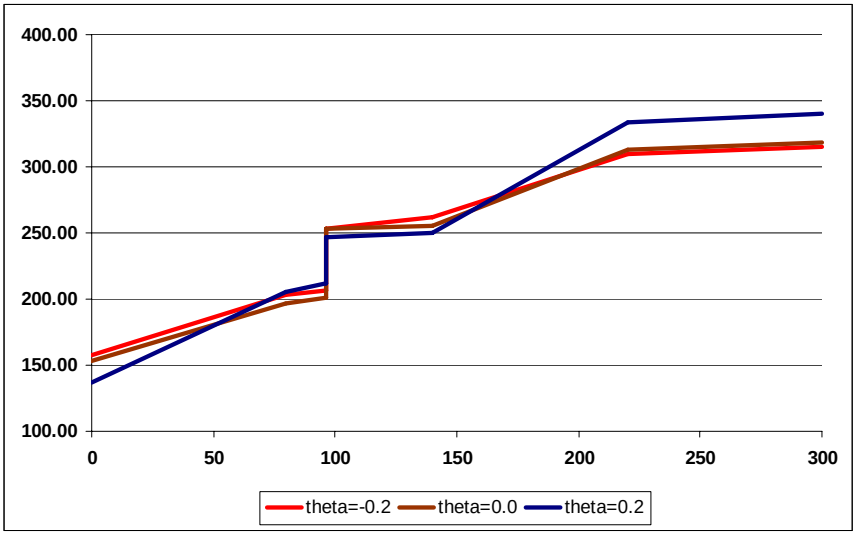
An Optimal Schedule, Impact on Hours worked, Youngest Child Aged 5-10



Social Welfare Weights



The impact of welfare weights: Youngest Child Aged 5-10



Implications?

- Resolved the US-EITC, UK-WFTC puzzle
- WFTC/IS type schedule looks optimal overall

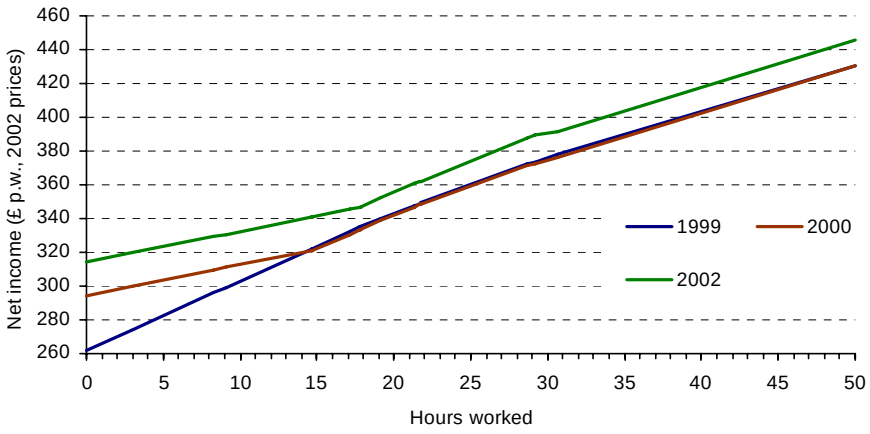
But

- Age of children matter
  - Only reduce current marginal tax rates on participation for parents with children of school age
- Hours rules can be optimal
  - No hours conditioning for mothers with youngest child less than 5, higher hours condition for mothers with older child.
- Administration and integration

Extensions: ….

- What of work experience and wages?
- Indeed what is the long-term program impact on gross wages?
- Couples decision making?
  - UK has moved to individual income taxation but in-work tax credits are family income based
  - targeting in collective labour supply models
- What impact on fertility and family formation?

Reform impacts on budget constraints for mother in couple

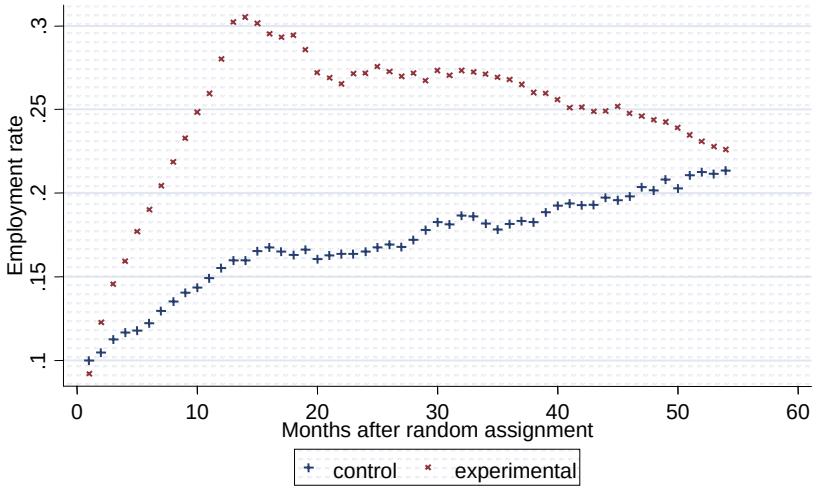


Notes: Two children under 5. Assumes hourly wage of £4.10, no housing costs or council tax liability and no childcare costs.
The first earner in the couple is assumed to earn £300 per week in 2002 prices.

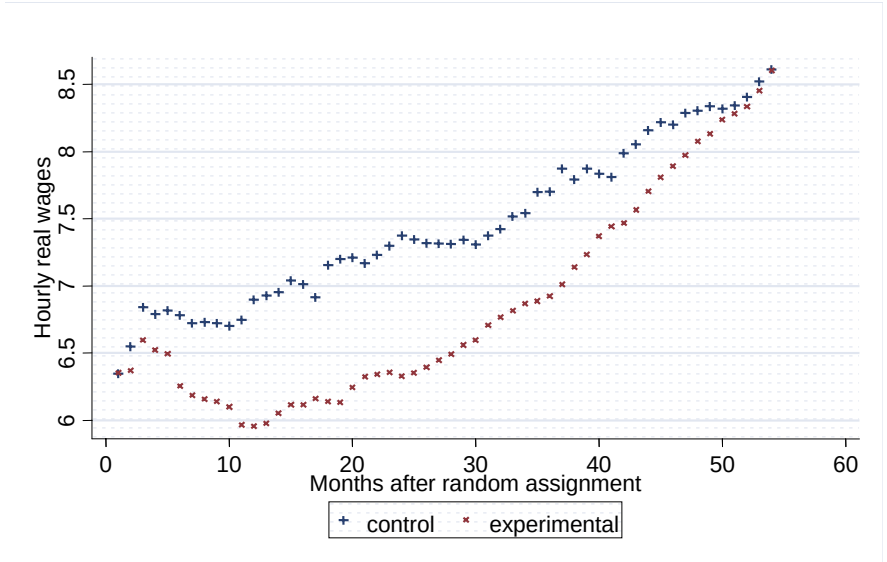
Experience and Wages

- Work experience and earnings?
  - Card and Hyslop (2004)
  - SSP Canadian single parents
- ERA results for the UK?

SSP experiment: dynamic effects on employment rates?



SSP experiment: dynamic effects on wages and productivity?



Extensions: More to do….

- The *Integrated Family Supplement*?
  - The '*IFS*'
- Mirrlees Review…
  - www.ifs.org.uk/mirrleesreview

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Extra Slides

Tax-Credit Policies for Low Income Families: Impact and Optimality

Table A1: Sample Descriptives for Single Women

		1996	1997	1998	1999	2000	2001	2002
No child	Work	0.753	0.762	0.769	0.770	0.774	0.767	0.775
	Age	26.789	26.906	26.799	26.957	27.104	27.317	27.450
	Non-white	0.073	0.077	0.080	0.084	0.091	0.098	0.102
	Left education before 16	0.078	0.072	0.062	0.057	0.052	0.047	0.043
	Left education at 16 or 17	0.394	0.381	0.375	0.375	0.363	0.353	0.356
	London and South-East	0.341	0.350	0.349	0.347	0.354	0.360	0.352
	Rented accommodation	0.343	0.353	0.358	0.340	0.339	0.350	0.346
	Observations	26243	24463	24410	23987	22558	23517	22846
Child	Work	0.417	0.425	0.444	0.464	0.477	0.487	0.496
	Age	32.330	32.580	32.655	32.863	33.181	33.280	33.288
	Non-white	0.100	0.099	0.091	0.098	0.106	0.112	0.111
	Left education before 16	0.209	0.196	0.189	0.169	0.154	0.161	0.155
	Left education at 16 or 17	0.632	0.627	0.633	0.635	0.646	0.641	0.637
	London and South-East	0.285	0.285	0.285	0.293	0.294	0.303	0.301
	Rented accommodation	0.686	0.704	0.708	0.696	0.697	0.694	0.676
	Number of kids	1.783	1.785	1.791	1.784	1.778	1.776	1.794
	Age of youngest child	6.187	6.249	6.272	6.414	6.592	6.612	6.676
	Observations	14613	14172	14550	14343	13572	14097	13996

Net Income schedule :

Tax

P: take-up

$$y_{hP} = wh + I - t(wh, I) - C_h + \Psi_0(w, h, I) + P\Psi_1(w, h, I)$$

Transfers

or $\quad y_{hP} = \tilde{y}_{hP} + P\Psi_1(w, h, I)$

the tax-credit payment function $\Psi_1(w, h, I)$ depends on:

- hours (through the hours condition of entitlement)
- other income I
- demographic characteristics X

Take-up

Utility 'cost' of receiving in-work support

$$\eta = X_\eta \beta_\eta + u_\eta$$

claim Ψ_1 in FC/WFTC at hours h_j if:

$$U_P(h_j, \tilde{y}_{h_j} + \Psi_1 - C, P = 1) > U(h_j, \tilde{y}_{h_j} - C).$$

where C is the fixed cost of work. The utility cost among those who are eligible for WFTC at hours h_j and choose to claim WFTC must not exceed the utility gain from receipt of WFTC transfer income relative to non-receipt:

$$\eta < U(h_j, \tilde{y}_{h_j} + \Psi_1 - C) - U(h_j, \tilde{y}_{h_j} - C)$$

$u_\eta < \Omega_U$ where $\Omega_U = U(h_j, \tilde{y}_{h_j} + \Psi_1 - C) - U(h_j, \tilde{y}_{h_j} - C) - X_\eta \beta_\eta$

Preferences and Take-Up

Preferences:

$$\begin{aligned} U_P(h, y_{hP}, P; C) &= \alpha_{11}(\tilde{y}_h + P \cdot \Psi_1 - C)^2 + \alpha_{22}h^2 + \alpha_{12}(\tilde{y}_h + P \cdot \Psi_1 - C) \cdot h \\ &+ \beta_1(\tilde{y}_h + P \cdot \Psi_1 - C) + \beta_2 h + \varepsilon_{hP} - (P \cdot E_h) \cdot \eta \\ &= U(h, \tilde{y}_h + P \cdot \Psi_1 - C) - (P \cdot E_h) \cdot \eta, \end{aligned}$$

where $E_h = 1(\Psi_1 > 0)$ is an indicator of eligibility at hours h,

C represents the 'fixed cost' of work

and $\eta = X_\eta \beta_\eta + u_\eta$ is 'cost' of receiving in-work support.

The introduction of these additional terms is important in evaluation of a reform which increases generosity

Stochastic specification

Stochastic Preferences

$$\begin{aligned} \beta_1 &= X_1 \beta_{1x} + u_y \\ \beta_2 &= X_2 \beta_{2x} + u_h \\ \alpha_{11} &= X_{11} \alpha_{11x} \\ \alpha_{22} &= X_{22} \alpha_{22x} \\ \alpha_{12} &= X_{12} \alpha_{12x} \end{aligned}$$

Fixed costs of work

$$\begin{aligned} WRC_1 &= X_{f1} \beta_{f1} + u_f \\ WRC_2 &= X_{f2} \beta_{f2} \end{aligned}$$

Childcare Costs

$$h_{cc} = G(h|X_{cc})$$

At price p_c for an hour of childcare per child

$$\begin{aligned} C(h;X_f,X_{cc},p_c,u_f) &= WRC_1 \cdot I_{h1} + WRC_2 \cdot I_{h2} + p_c \cdot h_{cc} \\ &= (X_{f1}\beta_{f1} + u_f) \cdot I_{h1} + (X_{f2}\beta_{f2}) \cdot I_{h2} + p_c \cdot G(h|X_{cc}) \end{aligned}$$

To estimate the childcare price per child p_c, we compute the empirical distribution of hourly child-care costs for various groups of working mothers defined by their family status and number and age of children X_{cc}.

Choice probabilities:

$$\Pr(h = h_j, P = p|\mathbf{X},\mathbf{u}) =$$

$$\frac{\exp\{U(h_j,\tilde{y}_{h_j}+p\cdot\Psi_{h_j},P=p)\}}{\sum_{k=1}^{J}\max[\exp\{U(h_k,\tilde{y}_{h_k},P=0)\},E_{h_k}\cdot\exp\{U(h_k,\tilde{y}_{h_k}+\Psi_{h_k},P=1)\}]}$$

where $\mathbf{u} = (u_w, u_y, u_h, u_{cc}, u_f)$

Likelihood specification

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

$$\Pr(h = h_j, P = p \mid X, u)$$

From which we construct the sample log likelihood:

$$\log L = \sum_i \log \int_{u_{-u_\eta}} [\int_{u_\eta \leq \Omega_U} \prod_j \Pr(h = h_j, P = 1|X,u)^{1(h=h_j, E_{h_j}=1, P=1)} f(u_\eta) du_\eta$$
$$+ \int_{u_\eta > \Omega_U} \prod_j \Pr(h = h_j, P = 0|X,u)^{1(h=h_j, E_{h_j}=1, P=0)} f(u_\eta) du_\eta$$
$$+ \int_{u_\eta} \prod_j \Pr(h = h_j, P = 0|X,u)^{1(h=h_j, E_{h_j}=0)} f(u_\eta) du_\eta$$
$$] f(u_{-u_\eta}) du_{-u_\eta}$$

where $u_{-u_\eta} = (u_w, u_y, u_h, u_f, u_{cc})$

Likelihood specification

$$\log L = \sum_i \log \int_{u_{-u_\eta}} [\int_{u_\eta \leq \Omega_U} \prod_j \Pr(h = h_j, P = 1|X,u)^{1(h=h_j, E_{h_j}=1, P=1)} f(u_\eta) du_\eta$$
$$+ \int_{u_\eta > \Omega_U} \prod_j \Pr(h = h_j, P = 0|X,u)^{1(h=h_j, E_{h_j}=1, P=0)} f(u_\eta) du_\eta$$
$$+ \int_{u_\eta} \prod_j \Pr(h = h_j, P = 0|X,u)^{1(h=h_j, E_{h_j}=0)} f(u_\eta) du_\eta$$
$$] f(u_{-u_\eta}) du_{-u_\eta}$$

where

$$\mathbf{u}_{-u_\eta} = (u_w, u_y, u_h, u_f, u_{cc})$$

Structural Evaluation Model: Parameter Estimates

	Parameter	Estimate	Standard Error	z	$P > \|z\|$
α_{11}:	Constant	−0.321	0.044	−7.290	0.000
	Youngest Child 0-2	0.210	0.074	2.844	0.004
	Youngest Child 3-4	0.212	0.065	3.244	0.001
	Youngest Child 5-10	−0.059	0.061	−0.969	0.332
α_{22}:	Constant	0.308	0.027	11.317	0.000
	Youngest Child 0-2	0.024	0.062	0.385	0.700
	Youngest Child 3-4	−0.152	−0.031	−2.401	0.016
	Youngest Child 5-10	−0.031	0.037	−0.833	0.405
α_{12}:	Constant	0.010	0.004	2.693	0.007
	Youngest Child 0-2	−0.019	0.005	−3.541	0.000
	Youngest Child 3-4	−0.015	0.006	−2.427	0.015
	Youngest Child 5-10	0.005	0.005	1.099	0.272

β_1:	Constant	0.327	0.023	14.538	0.000
	Age	−0.027	0.047	−0.579	0.563
	Age Squared	0.003	0.006	0.546	0.585
	Education 16	−0.015	0.009	−1.677	0.093
	Youngest Child 0-2	−0.085	0.037	−2.270	0.023
	Youngest Child 3-4	−0.046	0.035	−1.320	0.187
	Youngest Child 5-10	0.012	0.030	0.399	0.690
	Number of Children	0.012	0.007	1.889	0.059
	Non-white	−0.068	0.017	−3.966	0.000
	Random Term (SD)	0.004	0.009	0.400	0.689
β_2:	Constant	−0.213	0.015	−13.993	0.000
	Age	0.106	0.012	8.708	0.000
	Age Squared	−0.012	0.002	−7.334	0.000
	Education 16	0.034	0.003	13.188	0.000
	Youngest Child 0-2	0.017	0.027	0.614	0.539
	Youngest Child 3-4	0.062	0.028	2.197	0.028
	Youngest Child 5-10	−0.011	0.020	−0.553	0.581
	Number of Children	−0.012	0.003	−3.565	0.000
	Non-white	0.016	0.009	1.878	0.060
	Random Term (SD)	0.000	0.002	0.000	1.000

continues...

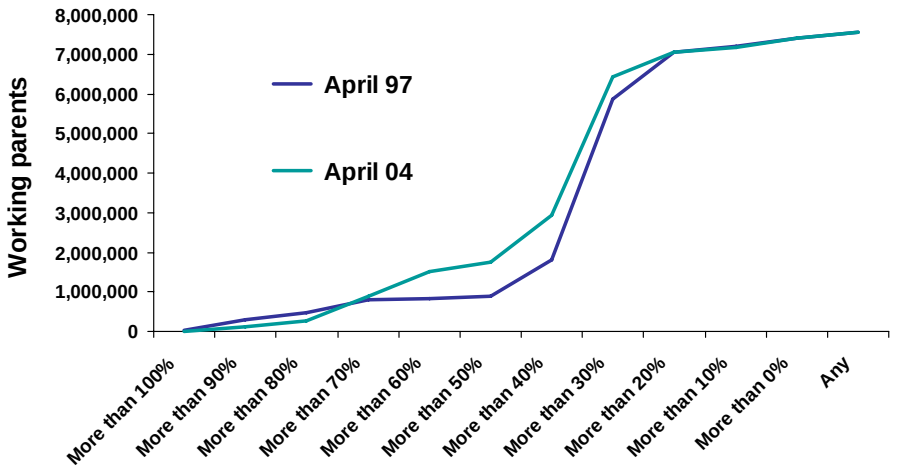
η:	Constant	−0.252	0.061	−4.120	0.000
	October 1999	0.024	0.113	0.213	0.832
	April 2000	−0.210	0.116	−1.809	0.071
	Age	−0.349	0.386	−0.905	0.365
	Age Squared	0.119	0.054	2.214	0.027
	Education 16	0.767	0.085	9.060	0.000
	Non-white	0.399	0.148	2.699	0.007
	Random Term (SD)	0.215	0.103	2.085	0.037
FC_1:	Constant	8.955	6.978	1.283	0.199
	Youngest Child 0-2	42.298	14.532	2.911	0.004
	Youngest Child 3-4	32.760	12.810	2.557	0.011
	Youngest Child 5-10	5.542	8.984	0.617	0.537
	Number of Children	3.015	2.836	1.063	0.288
	Non-white	38.256	13.018	2.939	0.003
	London	48.089	4.593	10.469	0.000
	Random Term (SD)	5.304	3.140	1.689	0.091
FC_2:	Constant	13.963	5.576	2.504	0.012
	Youngest Child 0-2	21.091	14.245	1.481	0.139
	Youngest Child 3-4	−4.638	11.045	−0.420	0.675
	Youngest Child 5-10	13.364	7.747	1.725	0.085
	Number of Children	4.558	3.476	1.311	0.190
	Non-white	−33.931	12.492	−2.716	0.007
	London	−13.858	5.952	−2.328	0.020
	Maximised Log Likelihood				-15564.720
	Observations				11594

Note: Standard errors are calculated analytically from the Simulated Maximum

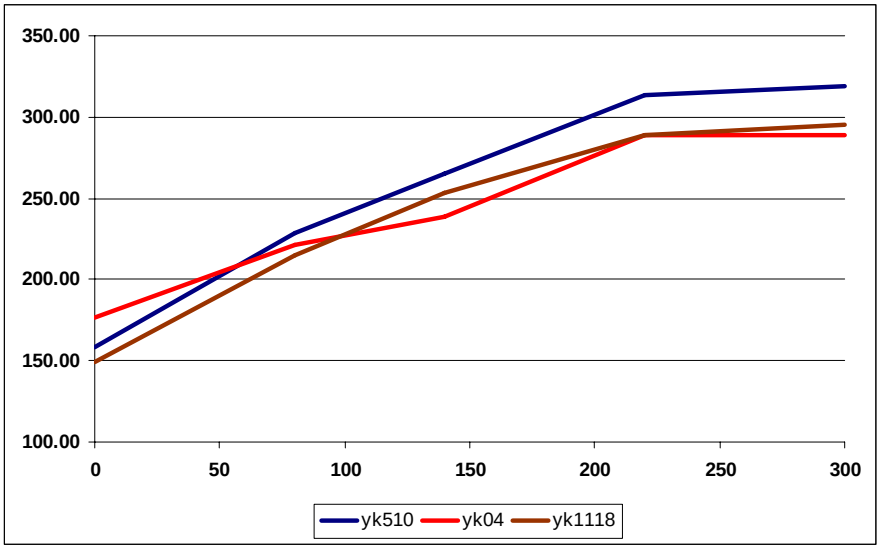
	Apr-99	Oct-99	Jun-00	Jun-02
	(FC)	(WFTC)	(WFTC)	(WFTC)
Basic Credit	49.8	52.3	53.15	62.5
Child Credit				
under 11	15.15	19.85	25.6	26.45
11 to 16	20.9	20.9	25.6	26.45
over 16	25.95	25.95	26.35	27.2
30 hour	11.05	11.05	11.25	11.65
Threshold	80.65	90	91.45	94.5
Taper	70% of earnings after income tax and NI	55% of earnings after income tax and NI	55% of earnings after income tax and NI	55% of earnings after income tax and NI
Childcare	Childcare expenses up to £60 (£100) for 1 (more than 1) child under 12 disregarded when calc income	Award increased by 70% of childcare expenses up to £100 (£150) for 1 (more than 1) child under 15	Award increased by 70% of childcare expenses up to £100 (£150) for 1 (more than 1) child under 15	Award increased by 70% of childcare expenses up to £135 (£200) for 1 (more than 1) child under 15

Changes in marginal tax rates: all working parents

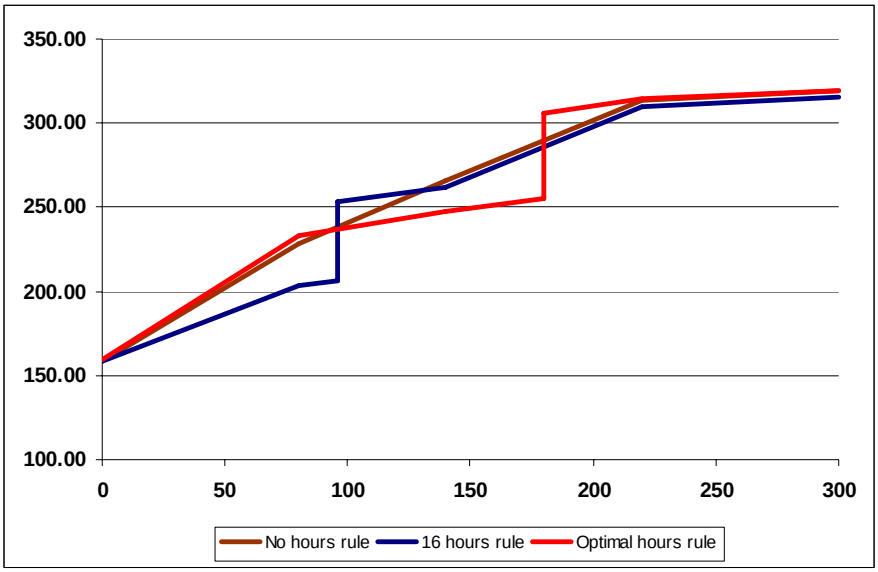
Marginal rates at the bottom remain high



An Optimal Schedule, no hours condition



An Optimal Schedule, Youngest Child Aged 5-10



The Structure of the Constraint, top-rate 50%