

# Empirical Evidence and Tax Policy Design: Lessons from the Mirrlees Review

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# Empirical Evidence and Tax Policy Design

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- First, a little background to the Mirrlees Review
- Then a discussion on the role of evidence loosely organised under five headings:
  1. Key margins of adjustment to tax reform
  2. Measurement of effective tax rates
  3. The importance of information, complexity and salience
  4. Evidence on the size of responses
  5. Implications for tax design
- Focus on earnings tax and indirect tax design as leading examples

# The Mirrlees Review

## *Reforming the Tax System for the 21st Century*

### Editorial Team

*Chairman: Sir James Mirrlees*

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# The Mirrlees Review

- Review of tax design from first principles
  - For modern open economies in general and UK in particular
  - Reflect changes in the world, changes in our understanding and increased empirical knowledge
- Two volumes:
  - ‘Dimensions of Tax Design’: a set of 13 chapters on particular areas co-authored by international experts and IFS researchers, along with expert commentaries (MRI)
  - ‘Tax by Design’: an integrated picture of tax design and reform, written by the editors (MRII)
  - <http://www.ifs.org.uk/mirrleesReview/publications>
- MRI on the web and at OUP.

# Dimensions of Tax Design: commissioned chapters and expert commentaries (1)

- The base for direct taxation

*James Banks and Peter Diamond; Commentators: Robert Hall; John Kay; Pierre Pestieau*

- Means testing and tax rates on earnings

*Mike Brewer, Emmanuel Saez and Andrew Shephard; Commentators: Hilary Hoynes; Guy Laroque; Robert Moffitt*

- Value added tax and excises

*Ian Crawford, Michael Keen and Stephen Smith; Commentators: Richard Bird; Ian Dickson/David White; Jon Gruber*

- Environmental taxation

*Don Fullerton, Andrew Leicester and Stephen Smith; Commentators: Lawrence Goulder; Agnar Sandmo*

- Taxation of wealth and wealth transfers

*Robin Boadway, Emma Chamberlain and Carl Emmerson; Commentators: Helmuth Cremer; Thomas Piketty; Martin Weale*

## Dimensions of Tax Design: commissioned chapters and expert commentaries (2)

- International capital taxation

*Rachel Griffith, James Hines and Peter Birch Sørensen; Commentators: Julian Alworth; Roger Gordon and Jerry Hausman*

- Taxing corporate income

*Alan Auerbach, Mike Devereux and Helen Simpson; Commentators: Harry Huizinga; Jack Mintz*

- Taxation of small businesses

*Claire Crawford and Judith Freedman*

- The effect of taxes on consumption and saving

*Orazio Attanasio and Matthew Wakefield*

- Administration and compliance, Jonathan Shaw, Joel Slemrod and John Whiting; Commentators: John Hasseldine; Anne Redston; Richard Highfield

- Political economy of tax reform, James Alt, Ian Preston and Luke Sibieta; Commentator: Guido Tabellini

# Increased empirical knowledge: – some examples

- labour supply responses for individuals and families
  - at the intensive and extensive margins
  - by age and demographic structure
- taxable income elasticities
  - top of the income distribution using tax return information
- consumer responses to indirect taxation
  - importance (or not) of nonseparability and variation in price elasticities
- intertemporal responses
  - consumption, savings and pensions
- Income uncertainty
  - persistence and magnitude of earnings shocks over the life-cycle
- ability to (micro-)simulate marginal and average rates
  - simulate ‘optimal’ reforms

# Empirical Evidence and Tax Policy Design

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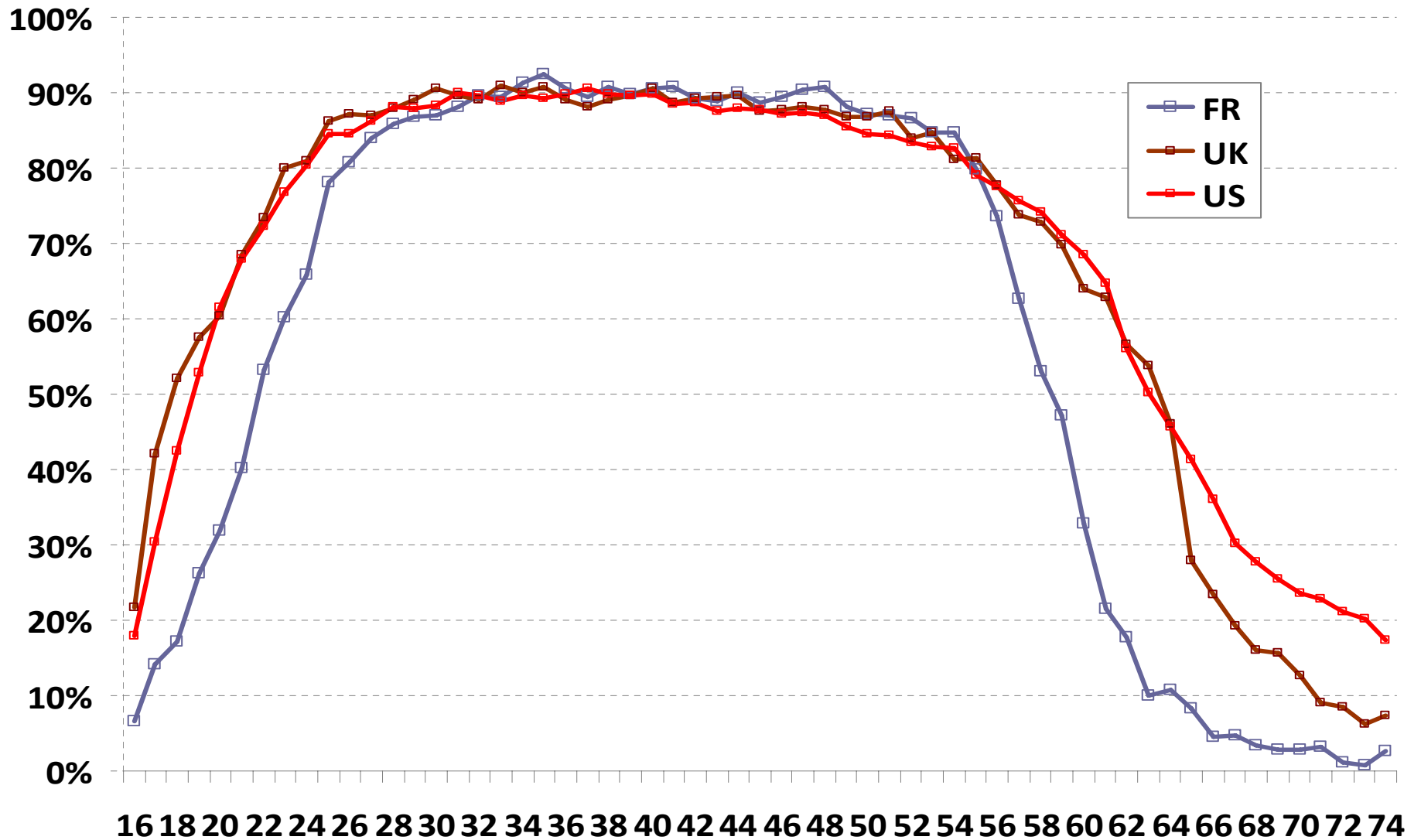
- Here I will focus on earnings taxation and indirect taxation:
- Leading examples of the mix of theory and evidence
- Key implications for tax design
- Earnings taxation, in particular, takes most of the strain in distributional adjustments of other parts of the reform package



# Key Margins of Adjustment

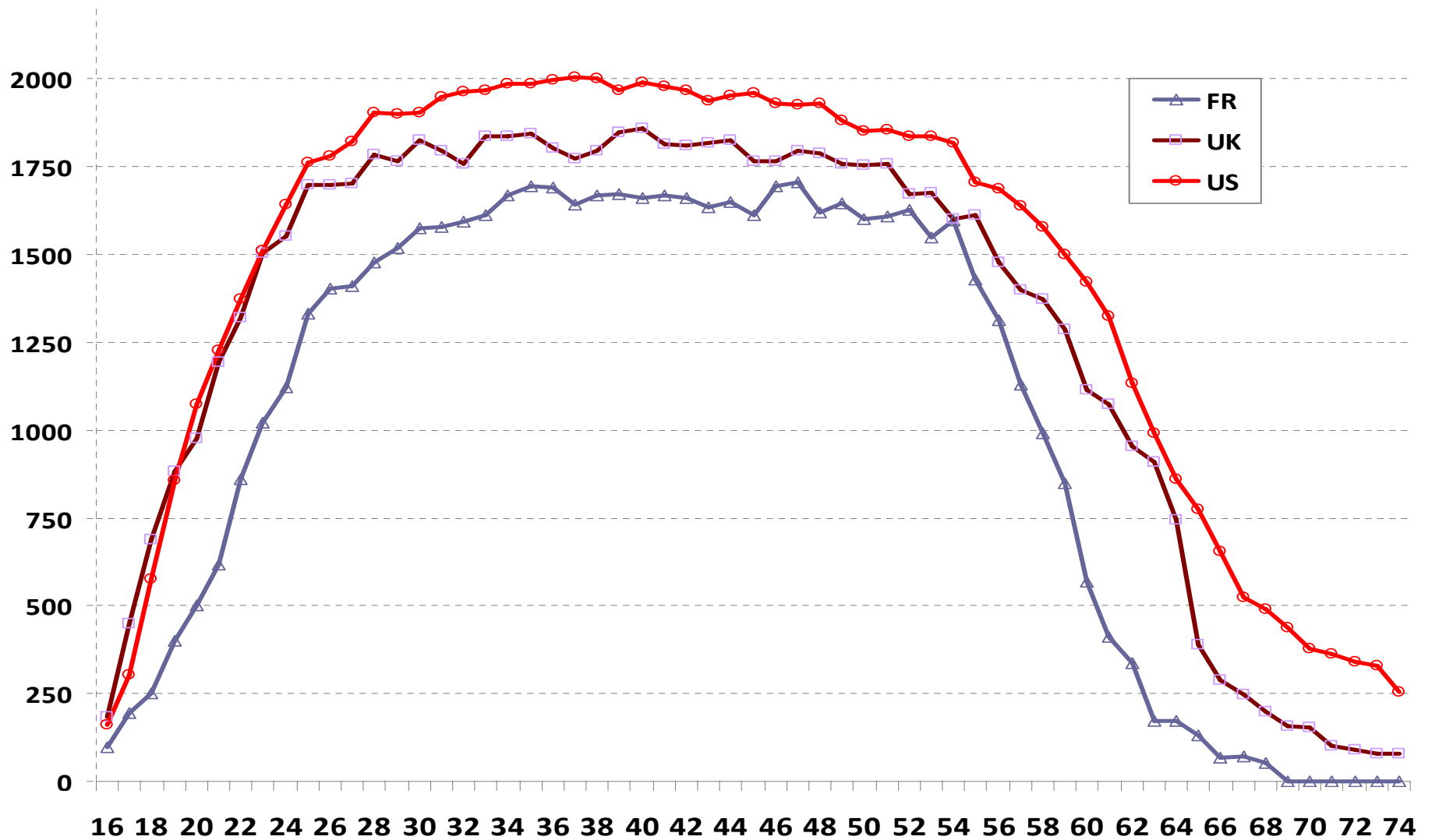
- Extensive and intensive margins of labour supply
- Its not all the extensive margin
  - Intensive and extensive margins both matter
  - They matter for tax policy evaluation and design
  - And they matter in different ways by age and demographic groups
- Getting it right for men

# Employment for men by age – FR, UK and US 2007



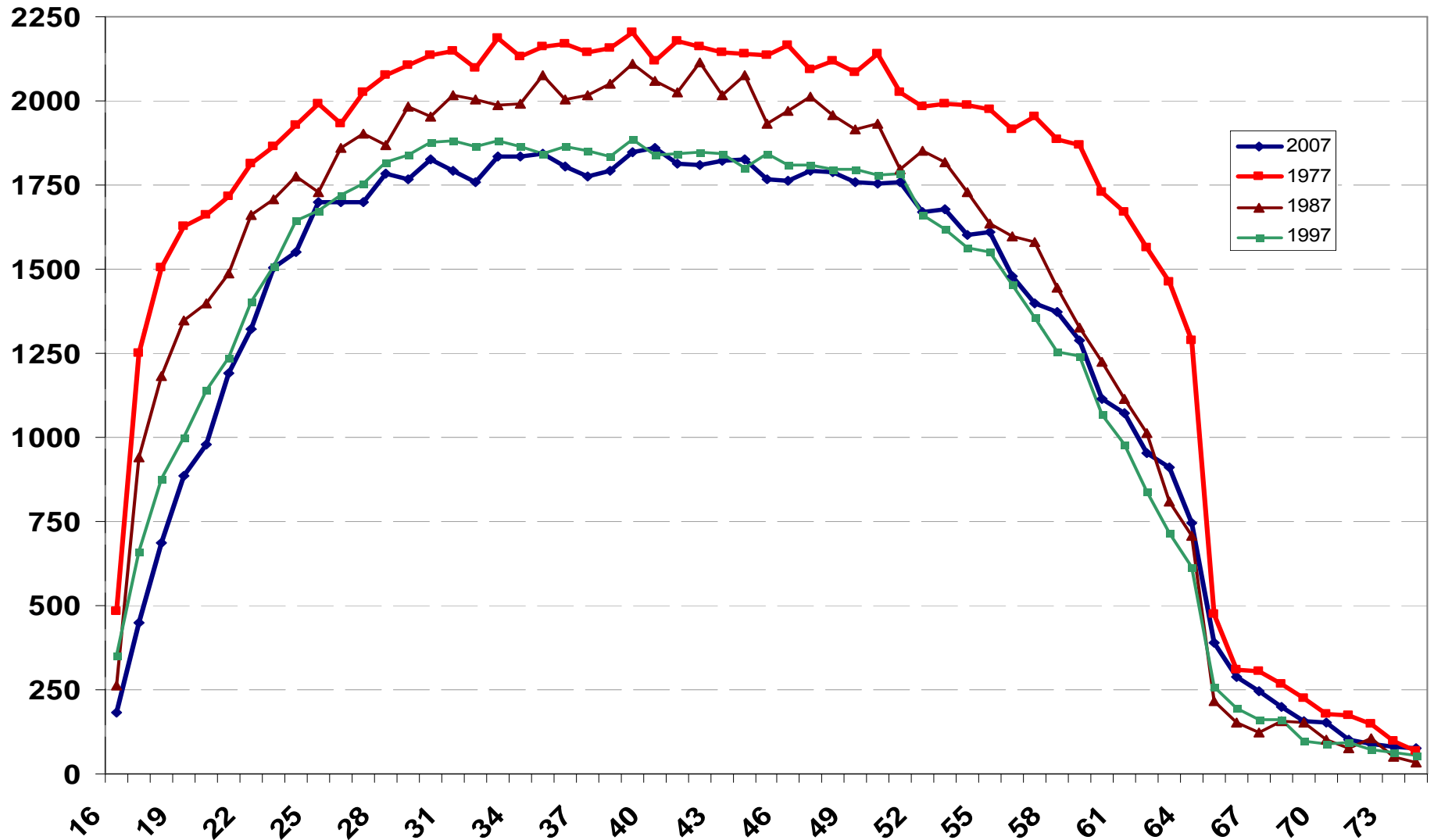
Blundell, Bozio and Laroque (2010)

# Total Hours for men by age – FR, UK and US 2007



Blundell, Bozio and Laroque (2010)

# Total Hours for men by age in the UK: 1977 - 2007

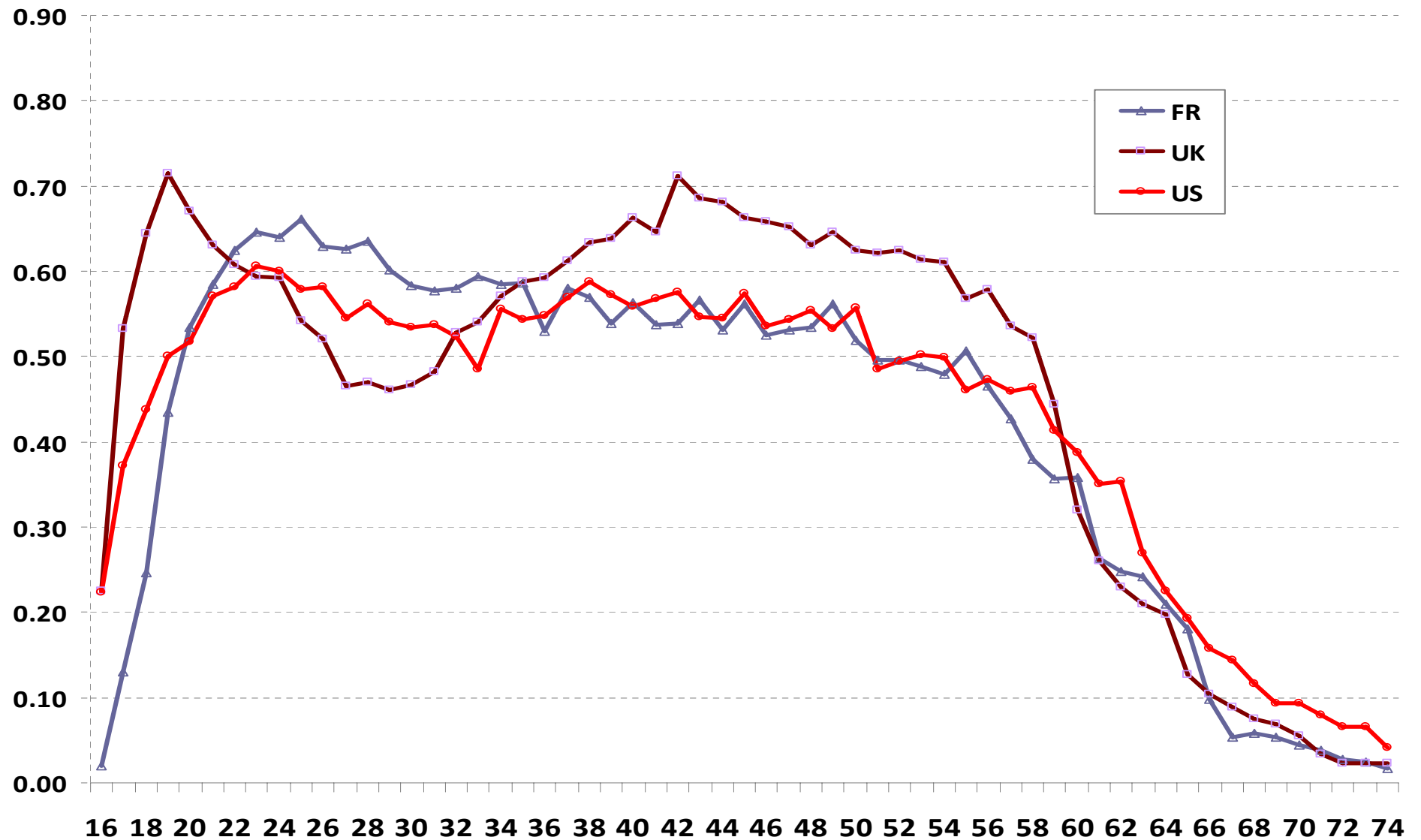


Blundell, Bozio and Laroque (2010)

## Key Margins of Adjustment

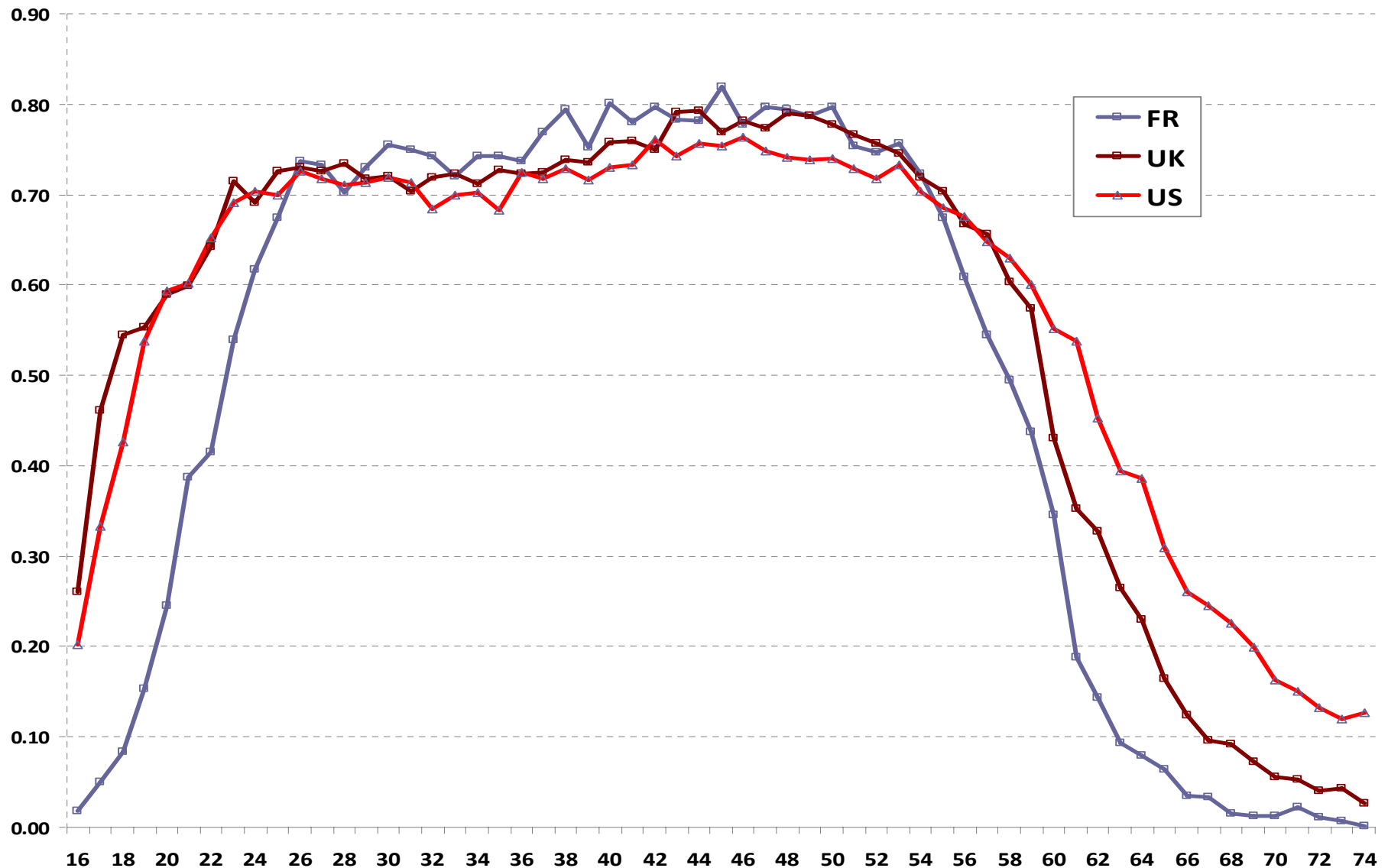
- Extensive and extensive margins for women

# Female Employment by age – US, FR and UK 1977



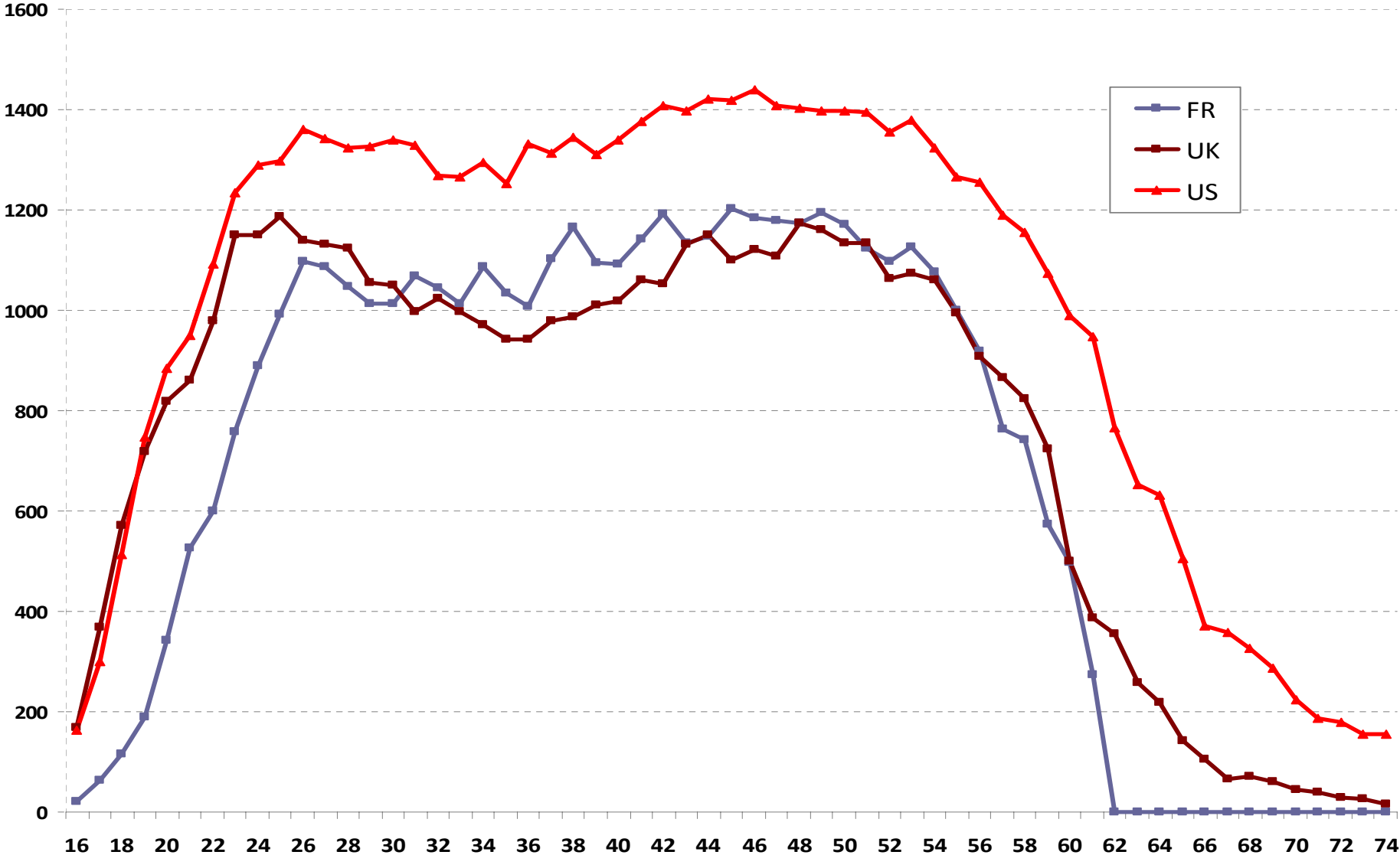
Blundell, Bozio and Laroque (2010)

# Female Employment by age – US, FR and UK 2007



Blundell, Bozio and Laroque (2010)

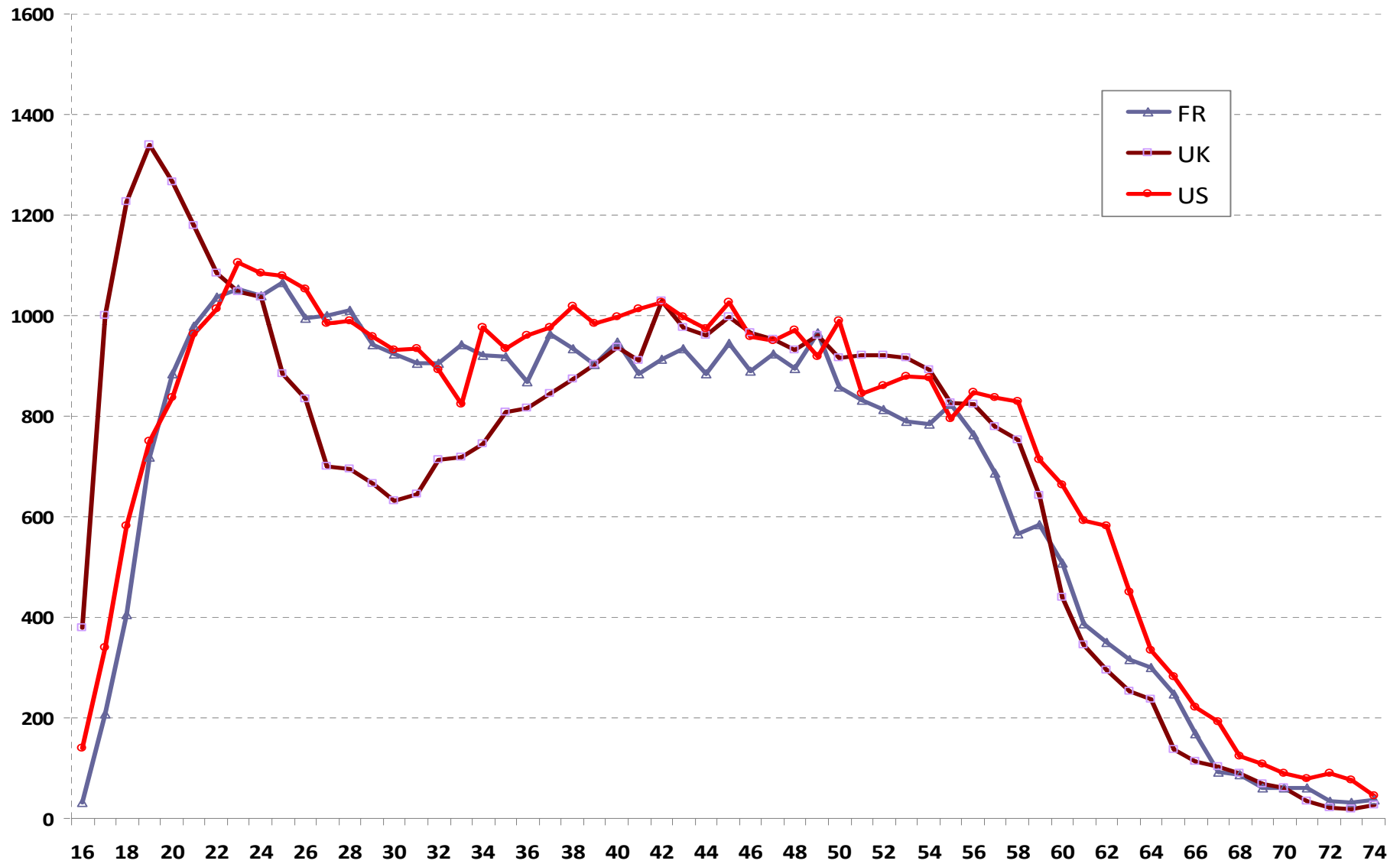
# Female Hours by age – US, FR and UK 2007



Blundell, Bozio and Laroque (2010)



# Female Hours by age – US, FR and UK 1977



Blundell, Bozio and Laroque (2010)

## The extensive – intensive distinction is important for a number of reasons

- Understanding responses to tax and welfare reform
  - Heckman, Rogerson, Wise, .. all highlight the importance of extensive labour supply margin
  - Blundell, Bozio and Laroque (2010)
- The extensive and intensive elasticities are also key parameters in the recent literature on tax design – used heavily in the Mirrlees Review.
- But these elasticities have changed over time and the relative importance of the extensive margin is specific to particular groups
- I'll examine a specific example in more detail in what follows

# Why is this distinction important for tax design?

- Some key lessons from recent tax design theory (Saez, Laroque, ..)
- A 'large' extensive elasticity at low earnings can 'turn around' the impact of declining social weights
  - implying a higher transfer to low earning workers than those out of work
  - a role for earned income tax credits
- But how do individuals perceive the tax rates on earnings implicit in the tax credit and benefit system - salience?
  - are individuals more likely to 'take-up' if generosity increases?
- Importance of margins other than labour supply/hours
- Use of taxable income elasticities to guide choice of top tax rates

# An Analysis in Two Steps

- The first step (impact) is a positive analysis of household decisions. There are two dominant empirical approaches to the measurement of the impact of tax reform
  - both prove useful:
    - 1. A ‘quasi-experimental’ evaluation of the impact of historic reforms /and randomised experiments
    - 2. A ‘structural’ estimation based on a general discrete choice model with (unobserved) heterogeneity
- The second step (optimality) is the normative analysis or optimal policy analysis
  - Examines how to best design benefits, in-work tax credits and earnings tax rates with (un)observed heterogeneity and unobserved earnings ‘capacity’

## Alternative approaches to measuring the impact:

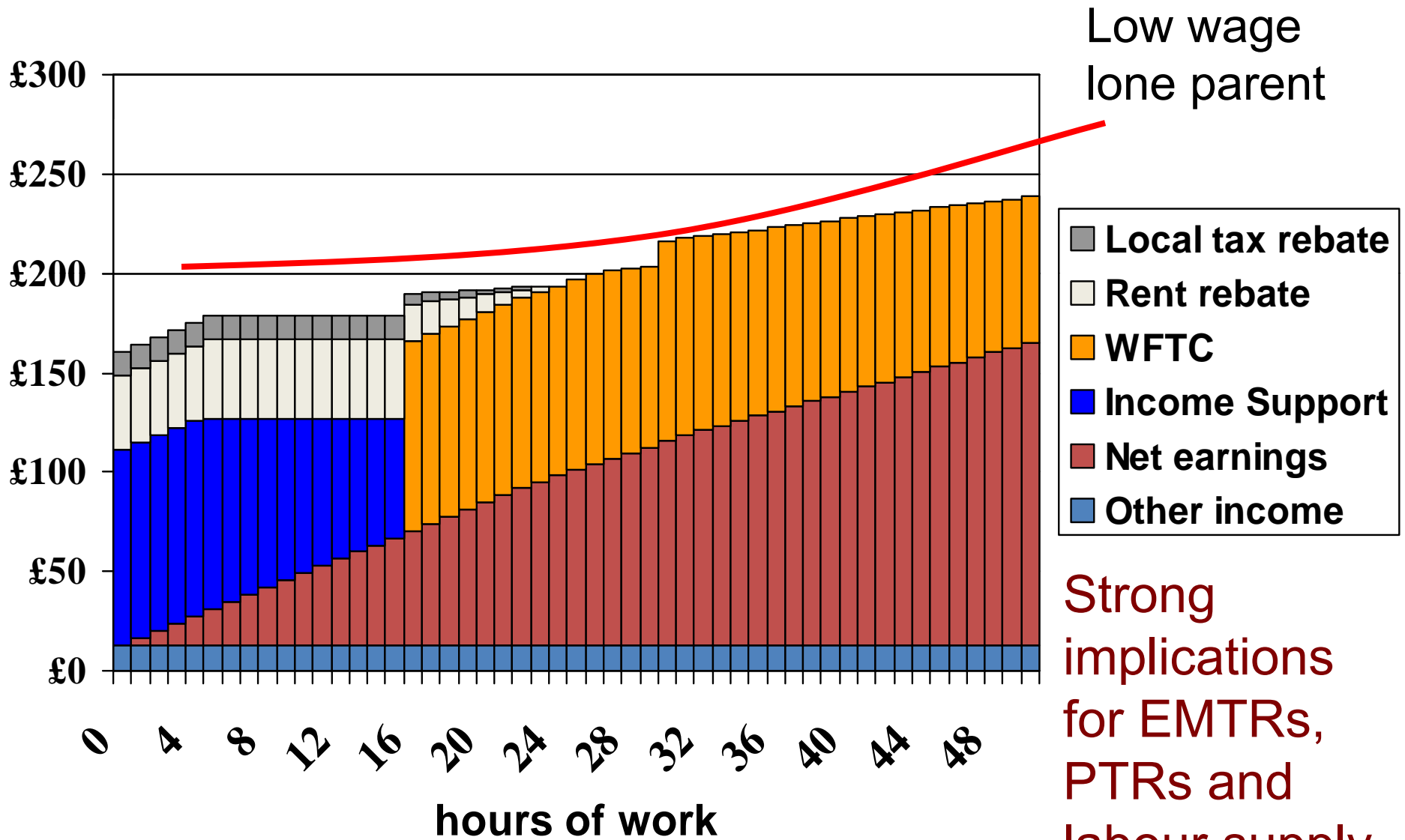
- Structural model
  - Simulate effect of actual or hypothetical reforms
  - Useful for optimal design too, but, robust?
- Quasi-experiment/Difference-in-differences
  - Compares outcomes of eligibles and non-eligibles and estimates 'average' impact of past reform
  - Only indirectly related to what is needed for optimal design
- Randomised experiment? SSP?

# Focus here on tax rates on lower incomes

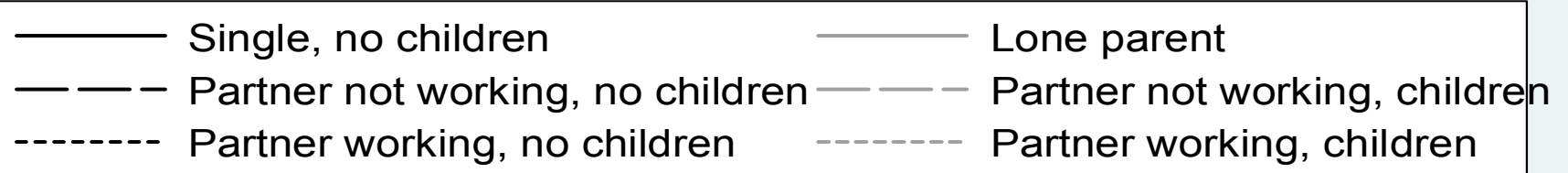
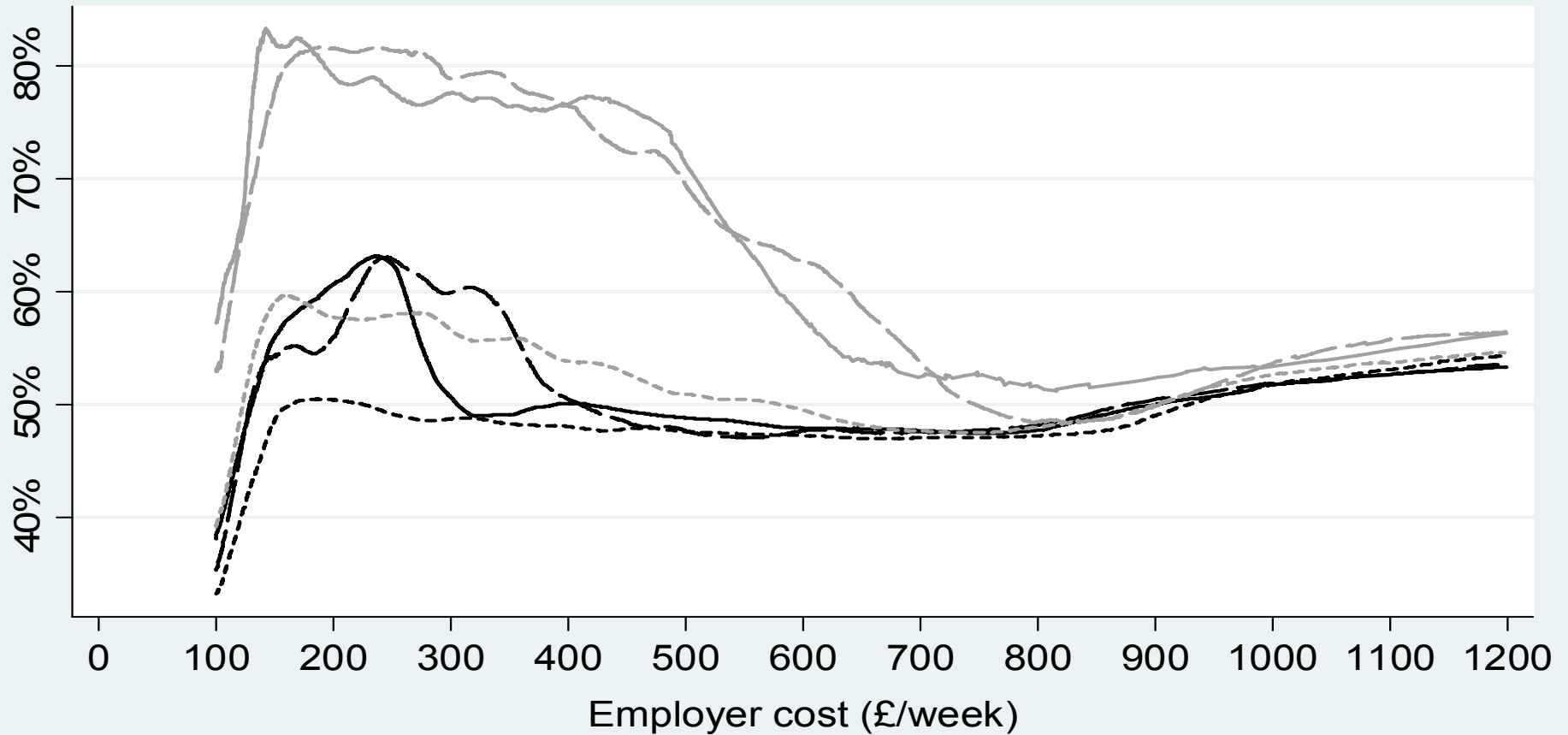
## Main defects in current welfare/benefit systems

- Participation tax rates at the bottom remain very high in UK and elsewhere
- Marginal tax rates are well over 80% for some low income working families because of phasing-out of means-tested benefits and tax credits
  - Working Families Tax Credit + Housing Benefit in UK
  - and interactions with the income tax system
  - for example, we can examine a typical budget constraint for a single mother...

# The interaction of WFTC with other benefits in the UK



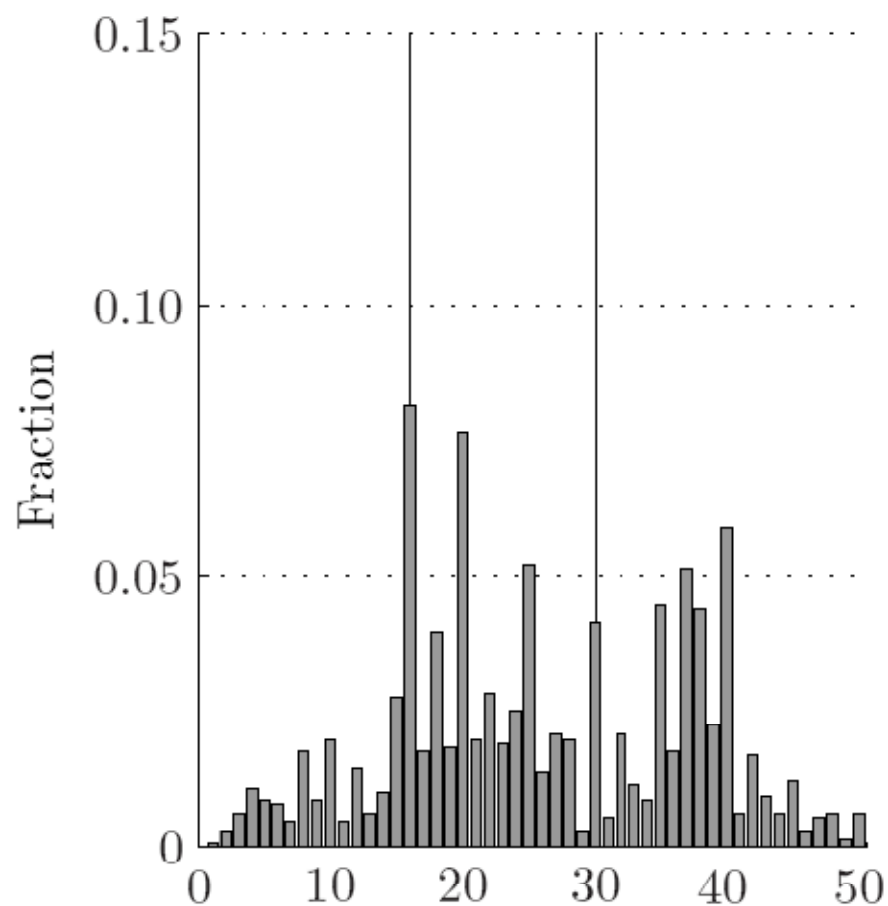
# Average EMTRs across the earnings distribution for different family types



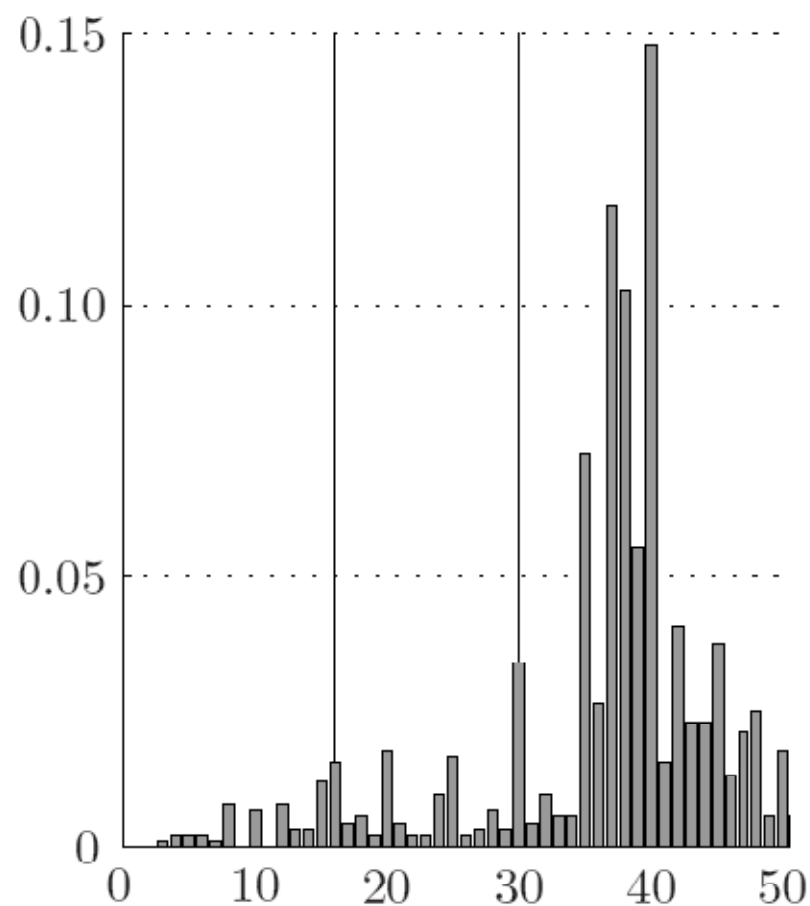


# Can the reforms explain weekly hours worked?

Single Women (aged 18-45) - 2002



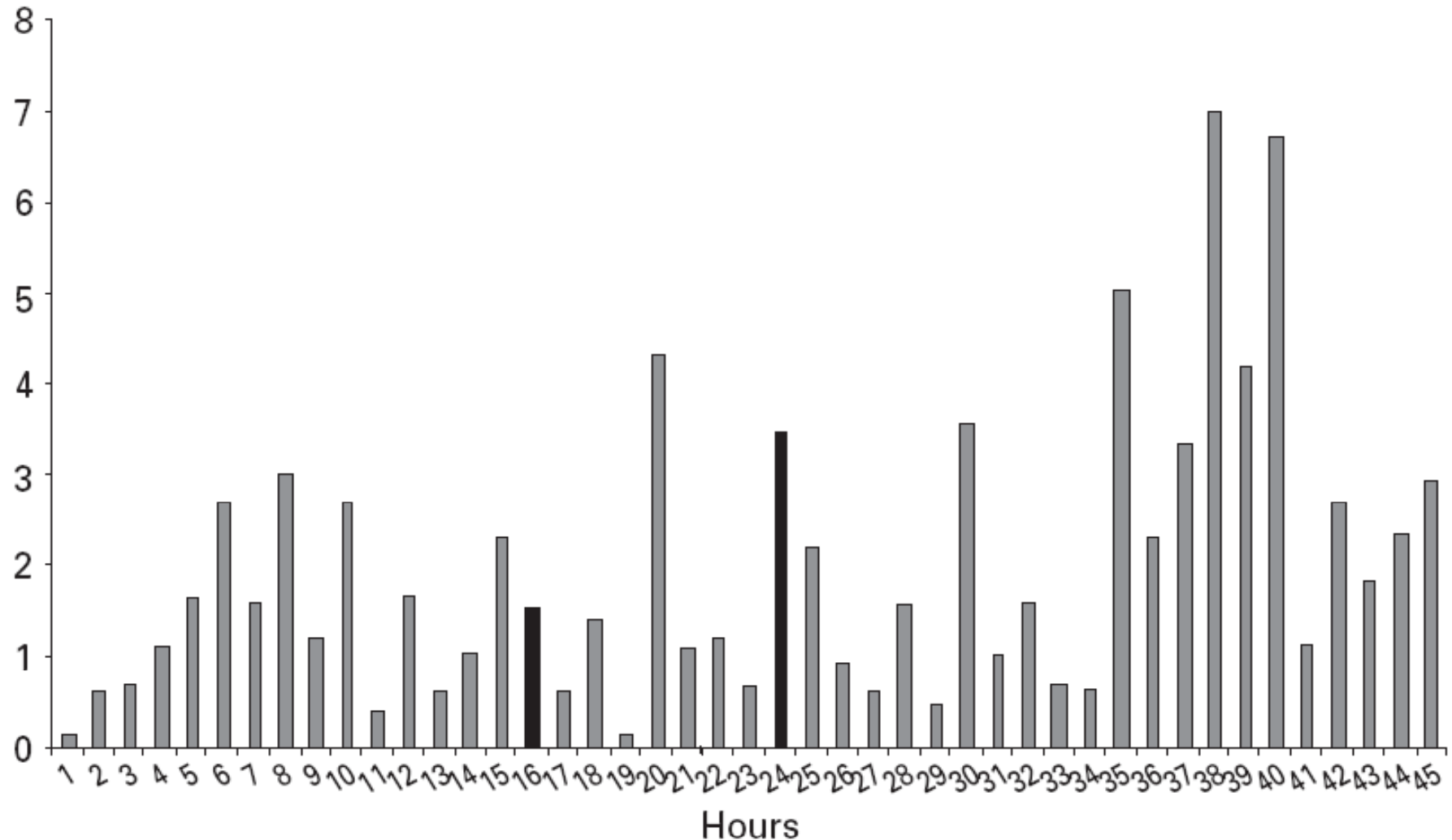
Hours of Work, Lone Mothers



Hours of Work, Childless Single Women

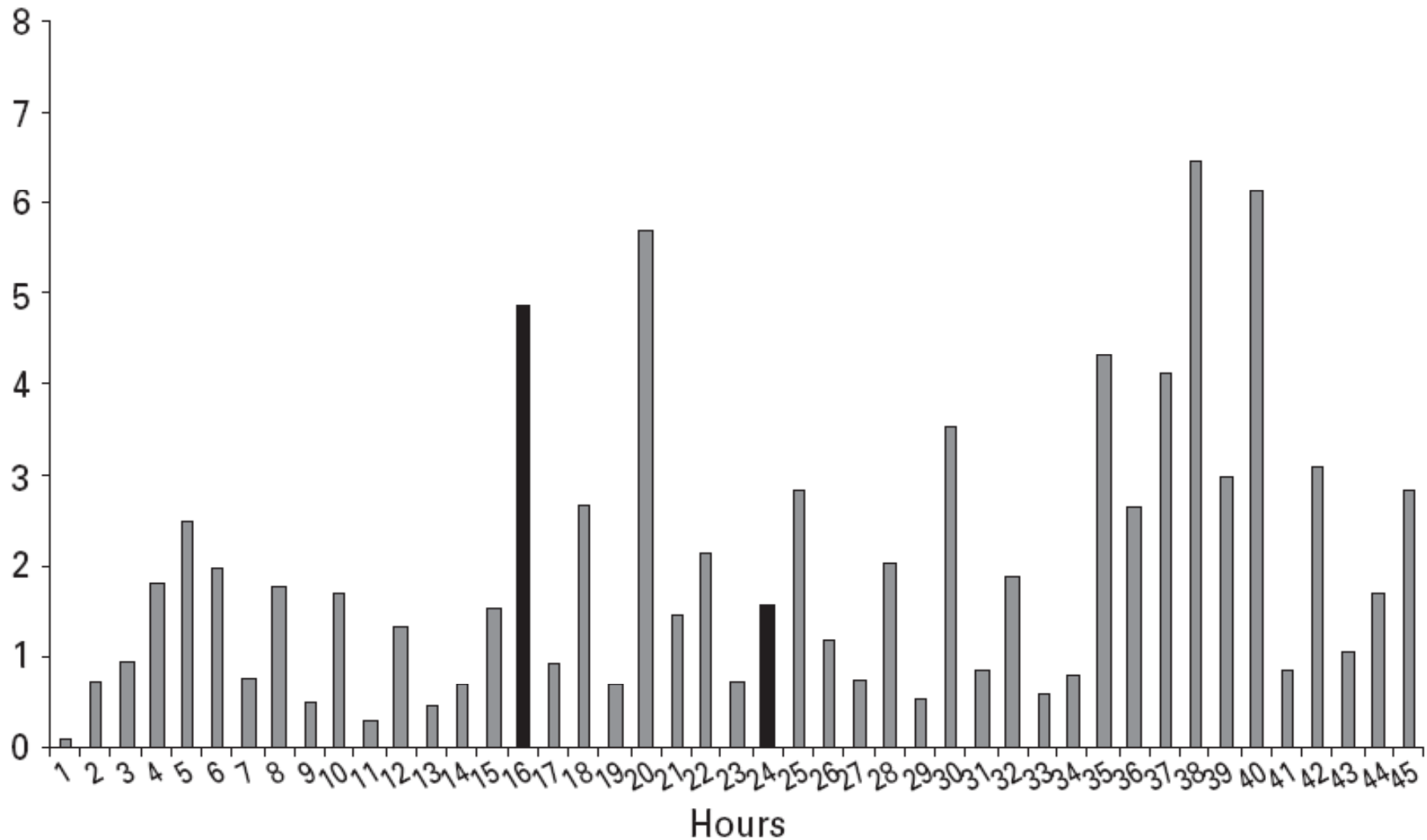
Blundell and Shephard (2010)

# Hours' distribution for lone parents, before



Blundell and Shephard (2010)

# Hours' distribution for lone parents, after



Blundell and Shephard (2010)

## WFTC Reform: Quasi-experimental Evaluation Matched Difference-in-Differences

Average Impact on % Employment Rate of Single Mothers

<i>Single Mothers</i>	Marginal Effect	Standard Error	Sample Size
Family Resources Survey	3.5	1.55	25,163
Labour Force Survey	3.6	0.55	233,208

Data: FRS, 45,000 adults per year, Spring 1996 – Spring 2002.

Base employment level: 45% in Spring 1997.

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

But quasi-experimental evidence is rarely enough for tax design

## Key features of the structural model

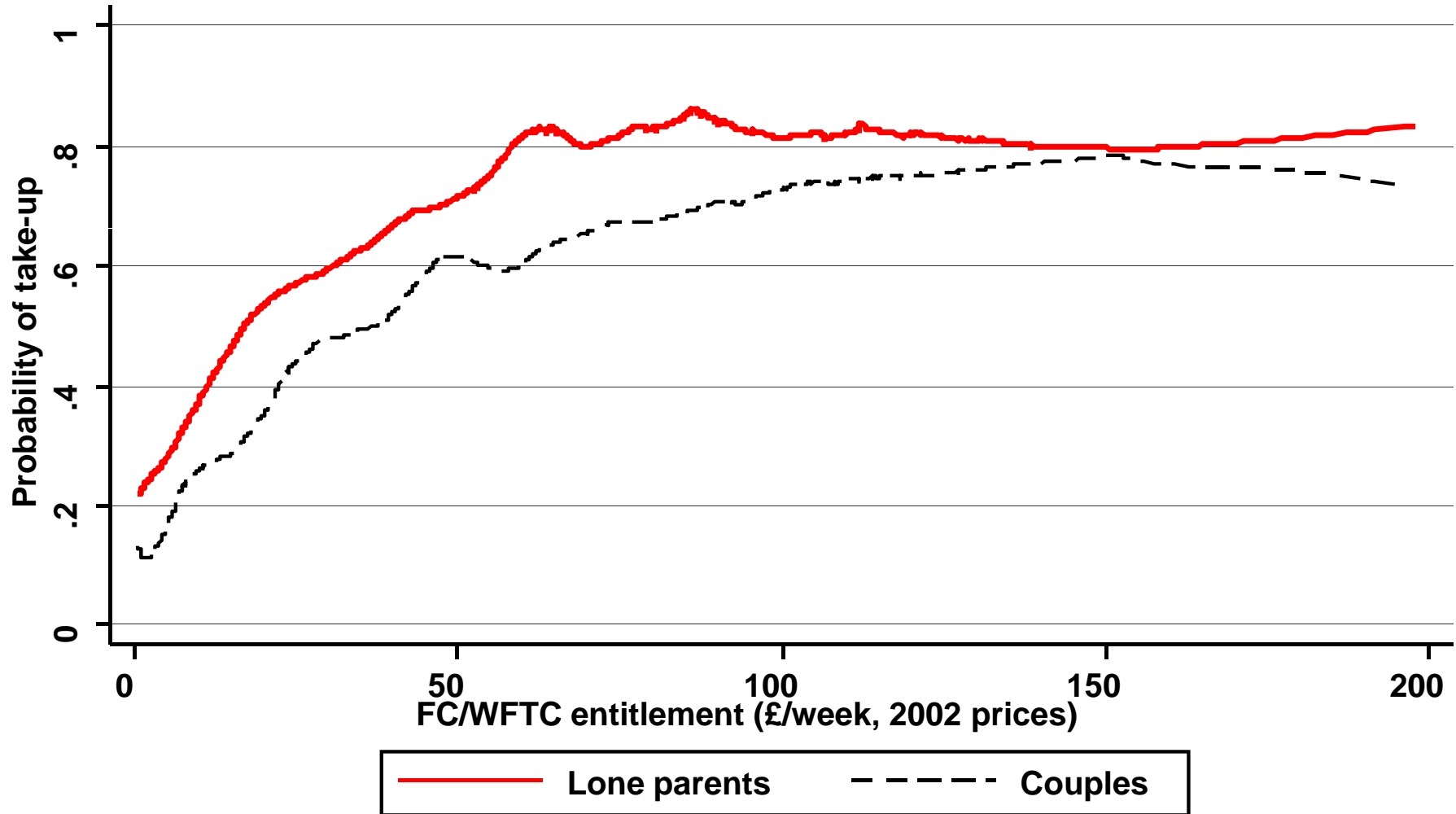
Preferences  $U(c_h, h; X, \varepsilon)$

typically approximated by shape constrained sieves

- Structural model also allows for
  - unobserved work-related fixed costs
  - childcare costs
  - observed and unobserved heterogeneity
  - programme participation 'take-up' costs

# Importance of take-up and information/hassle costs

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



# Key features of the structural model

## *main elements:*

- budget constraint – tax/tax-credit and benefit interactions
  - heterogeneity – demographics, ethnicity, etc; unobs. het.
  - fixed costs of work – obs. and unobs. het.
  - stigma/hassle costs – take-up versus eligibility; unobs het.
  - childcare costs
- mixed-multinomial specification across discrete choices over ranges of hours.

# What about the size of labour supply responses?

## Structural Model Elasticities – low education lone parents

### (b) Youngest Child Aged 4-11

<i>Weekly Earnings</i>	<i>Density</i>	<i>Extensive</i>	<i>Intensive</i>
0	0.4327		
50	0.1575	0.380 (.020)	0.085 (.009)
150	0.1655	0.321 (.009)	0.219 (.025)
250	0.1298	0.172 (.005)	0.194 (.020)
350	0.028	0.068 (.003)	0.102 (.010)
<i>Employment elasticity</i>		0.820 (.042)	

Blundell and Shephard (2010)



## Structural Model Elasticities – low education lone parents

(b) Youngest Child Aged 11-18

<i>Weekly Earnings</i>	<i>Density</i>	<i>Extensive</i>	<i>Intensive</i>
0	0.3966		
50	0.1240	0.144 (.018)	0.130 (.016)
150	0.1453	0.153 (.008)	0.387 (.042)
250	0.1723	0.097 (.004)	0.340 (.035)
350	0.1618	0.045 (.002)	0.170 (.015)
<i>Employment elasticity</i>		0.601 (.036)	

Blundell and Shephard (2010)

## Structural Model Elasticities – low education lone parents

(c) Youngest Child Aged 0-3

<i>Weekly Earnings</i>	<i>Density</i>	<i>Extensive</i>	<i>Intensive</i>
0	0.5942		
50	0.1694	0.168 (.017)	0.025 (.003)
150	0.0984	0.128 (.012)	0.077 (.012)
250	0.0767	0.043 (.004)	0.066 (.010)
350	0.0613	0.016 (.002)	0.035 (.005)
<i>Participation elasticity</i>		0.536 (.047)	

- Differences in intensive and extensive margins by age and demographics have strong implications for the design of the tax schedule... Non-monotonic in age of youngest child

But do we believe the structural model estimates?

# Structural Simulation of the WFTC Reform:

## WFTC Tax Credit Reform

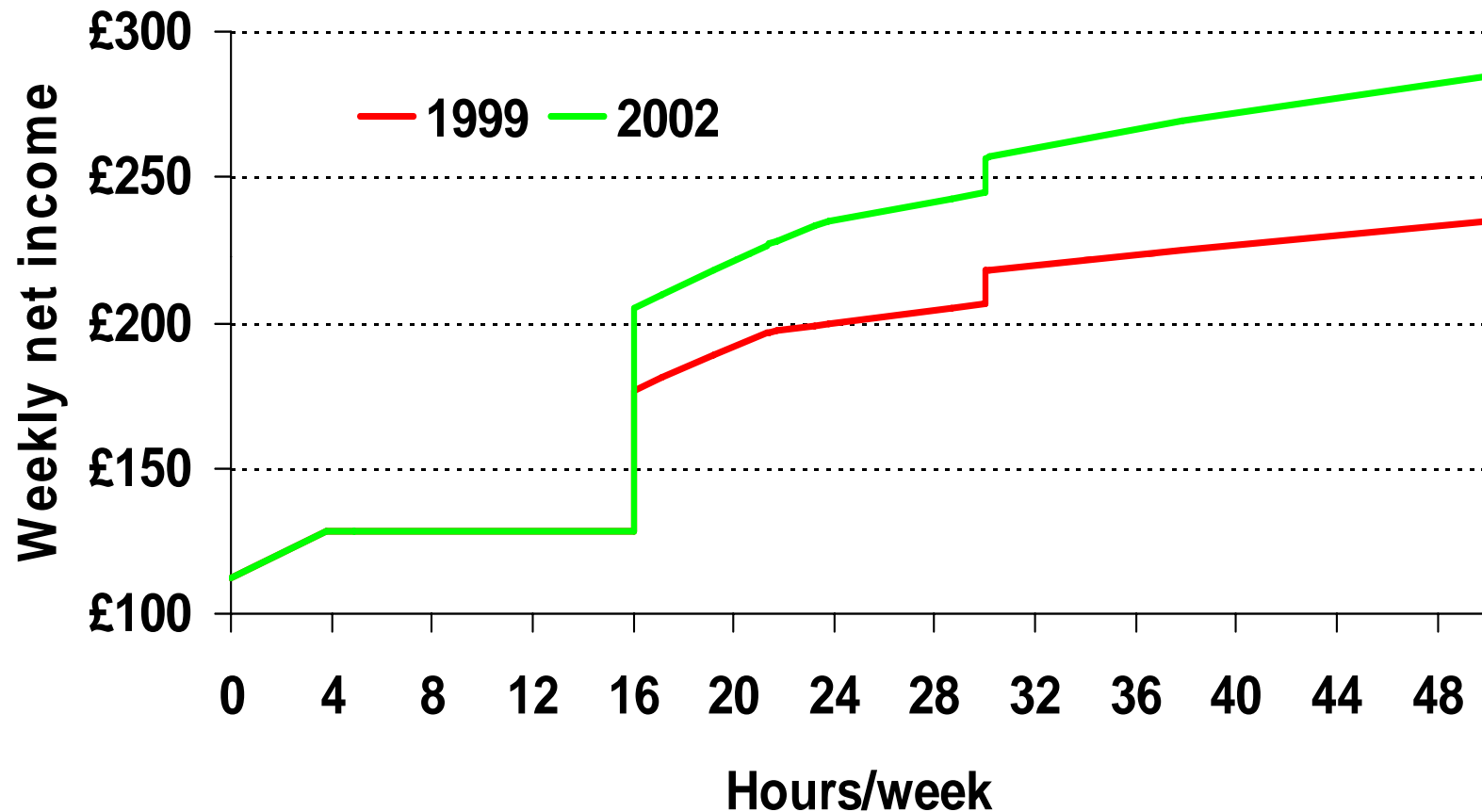
	All	y-child	y-child	y-child	y-child
		0 to 2	3 to 4	5 to 10	11 to 18
Change in employment rate:	<b>5.95</b>	3.09	7.56	7.54	4.96
	<b>0.74</b>	<i>0.59</i>	<i>0.91</i>	<i>0.85</i>	<i>0.68</i>
Average change in hours:	1.79	0.71	2.09	2.35	1.65
	<i>0.2</i>	<i>0.14</i>	<i>0.23</i>	<i>0.34</i>	<i>0.2</i>

– relatively ‘large’ impact

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

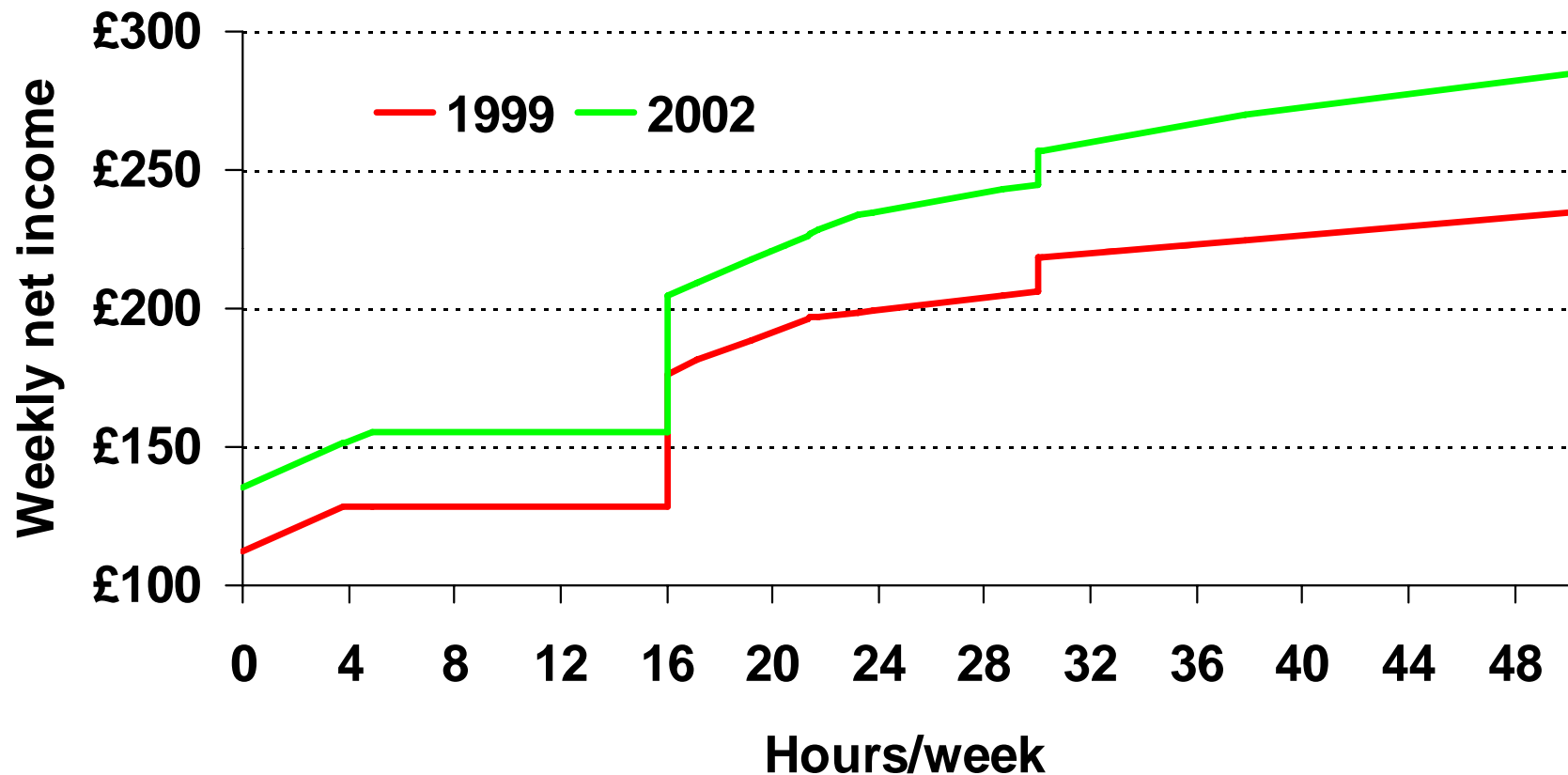
Blundell and Shephard (2010)

# 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.

# Impact of WFTC and IS reforms 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 Simulation of the WFTC Reform:

## Impact of all Reforms

	All	y-child	y-child	y-child	y-child
		0 to 2	3 to 4	5 to 10	11 to 18
Change in employment rate:	<b>3.68</b>	0.65	4.53	4.83	4.03
	<b>0.84</b>	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

- shows the importance of getting the effective tax rates right especially when comparing with quasi-experiments.
  - Compare with experiment or quasi-experiment.

## Evaluation of the ‘ex-ante’ structural model

- The diff-in-diff impact parameter can be identified from the structural evaluation model
- *Simulated* diff-in-diff parameter
- The structural model then defines the average impact of the policy on the treated as:

$$\alpha_{SEM}(X) = \Pr[h > 0 | X, D = 1] - \Pr[h > 0 | X, D = 0]$$

- Compare *simulated diff-in-diff moment* with *diff-in-diff*

$$\alpha_{SEM}^{DD} = \int_X \int_X \int_{\varepsilon} f(X, \varepsilon, D = 1) dF_{\varepsilon}^{T=1, t=1} dF_X - \int_X \int_{\varepsilon} f(X, \varepsilon, D = 0) dF_{\varepsilon}^{T=1, t=0} dF_X$$

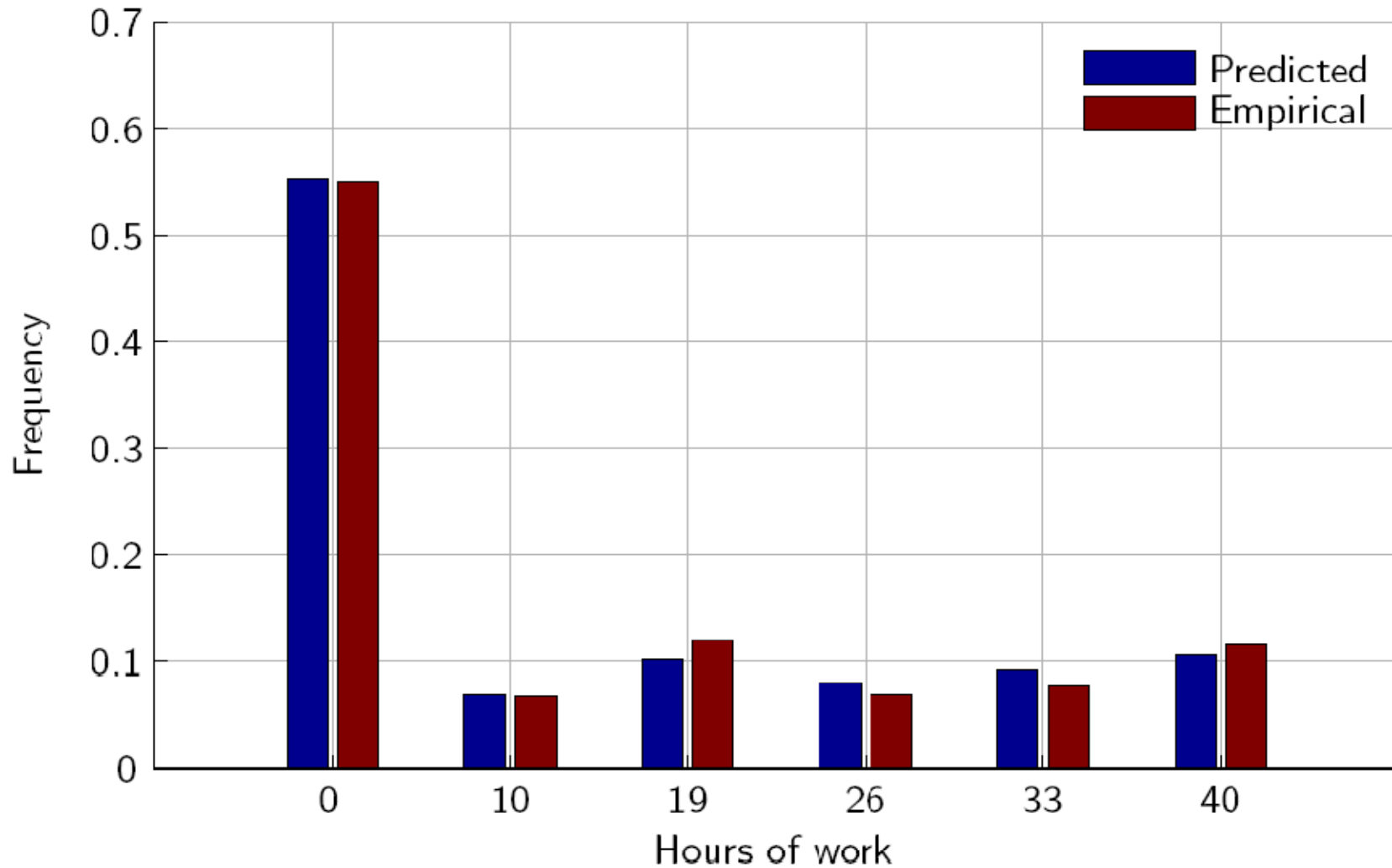
$$- \left[ \int_{\varepsilon} f(X, \varepsilon, D = 0) dF_{\varepsilon}^{T=0, t=1} dF_X - \int_X \int_{\varepsilon} f(X, \varepsilon, D = 0) dF_{\varepsilon}^{T=0, t=0} dF_X \right]$$

## 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 [ 3.6 (.55) ]
- 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)



# Structural Model Comparisons



## A optimal tax design framework

- Assume earnings (and certain characteristics) are all that is observable to the tax authority
  - relax below to allow for ‘partial’ observability of hours

Social welfare, for individuals of type  $X$

$$W = \sum_{w, X} \int \int \Gamma(U(wh^* - T(w, h^*; X), h^*; X, \varepsilon)) dF(\varepsilon) dG(w, X)$$

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

to:

$$\sum_{w, X} \int \int T(wh^*, h^*; X) dF(\varepsilon) dG(w, X) = \bar{T} (= -R)$$

for a given  $R$ .

## Control preference for equality by transformation function:

$$\Gamma(U | \theta) = \frac{1}{\theta} \{(\exp U)^\theta - 1\}$$

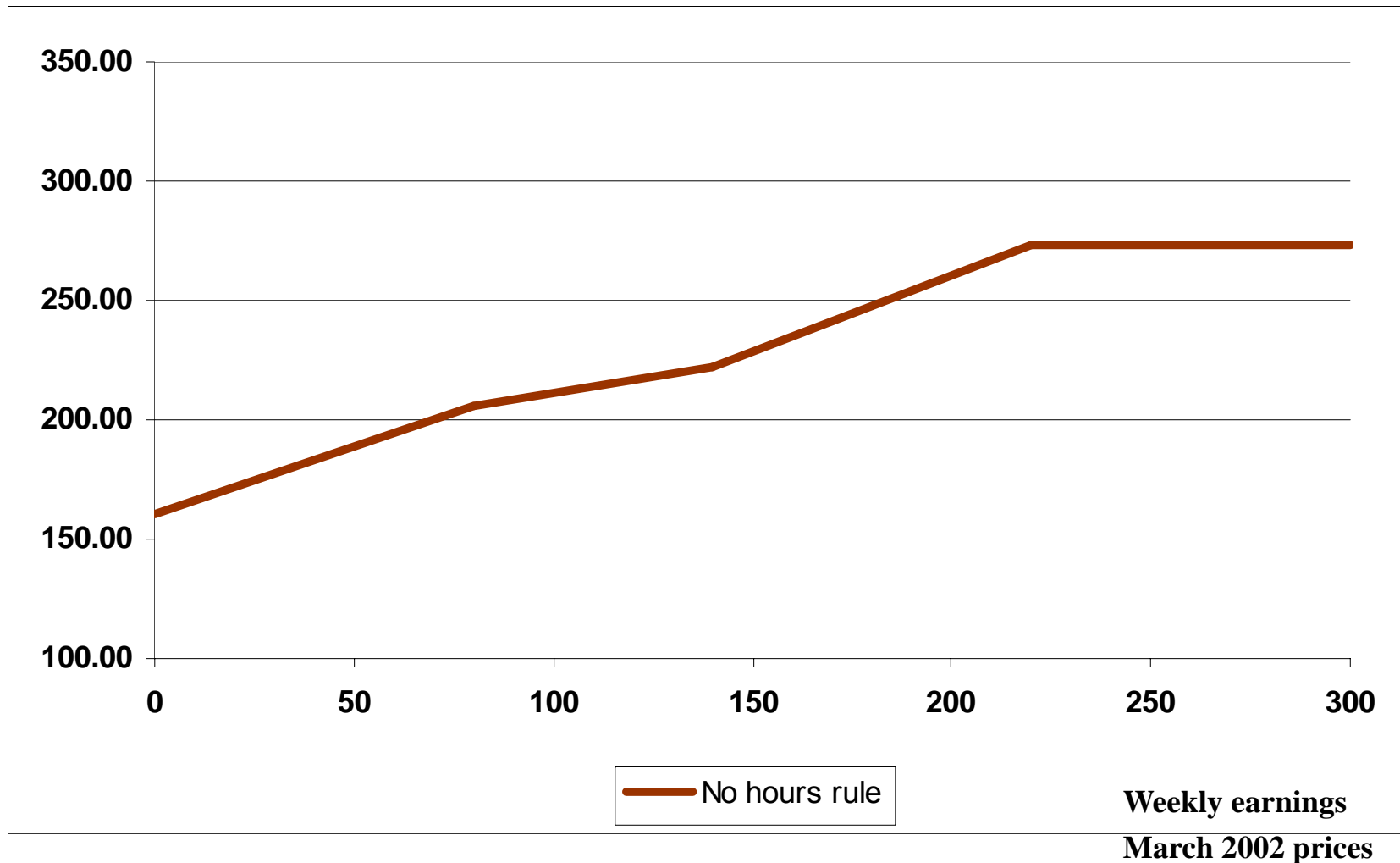
when  $\theta$  is negative, the function favors the equality of utilities.

Define  $u(j) = u(c_j, h_j; X, \varepsilon)$ .

If  $\theta < 0$  then the integral over (Type I extreme-value) state specific errors is given by:

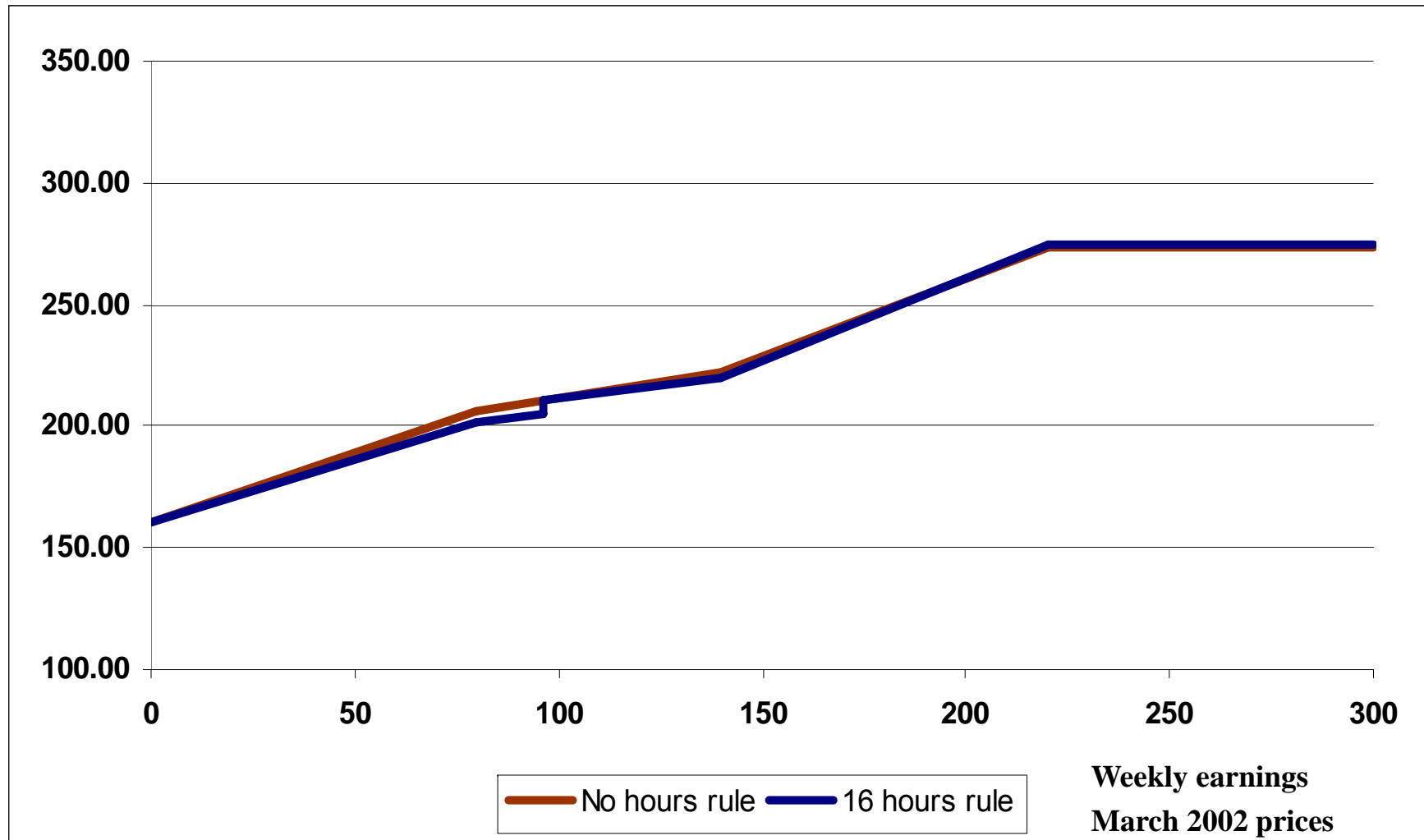
$$\frac{1}{\theta} \left[ \Gamma(1 - \theta) \cdot (\exp u(j))^\theta - 1 \right]$$

# Implied Optimal Schedule, Youngest Child Aged 0-3



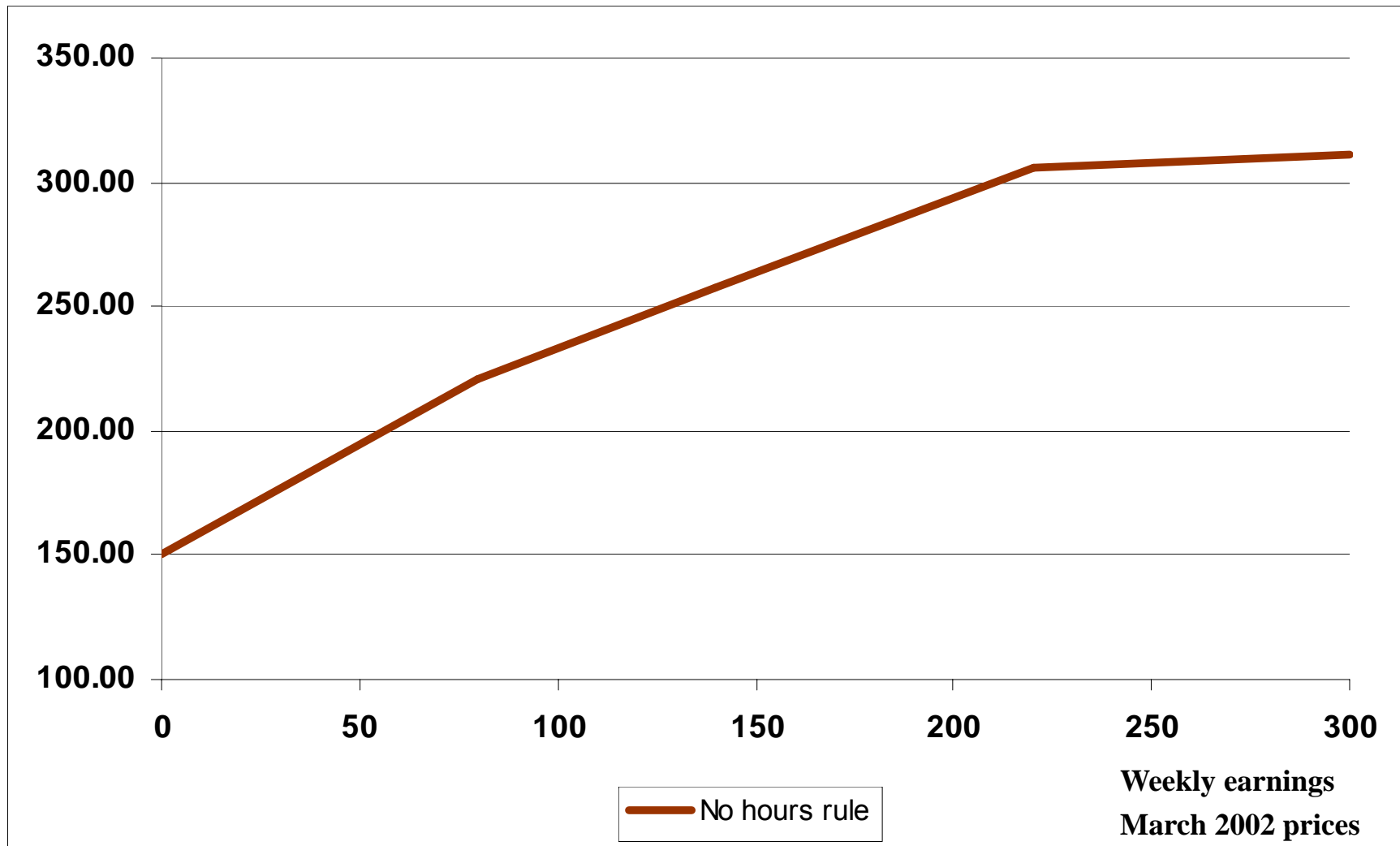
Blundell and Shephard (2010)

# Implied Optimal Schedule, Youngest Child Aged 0-3



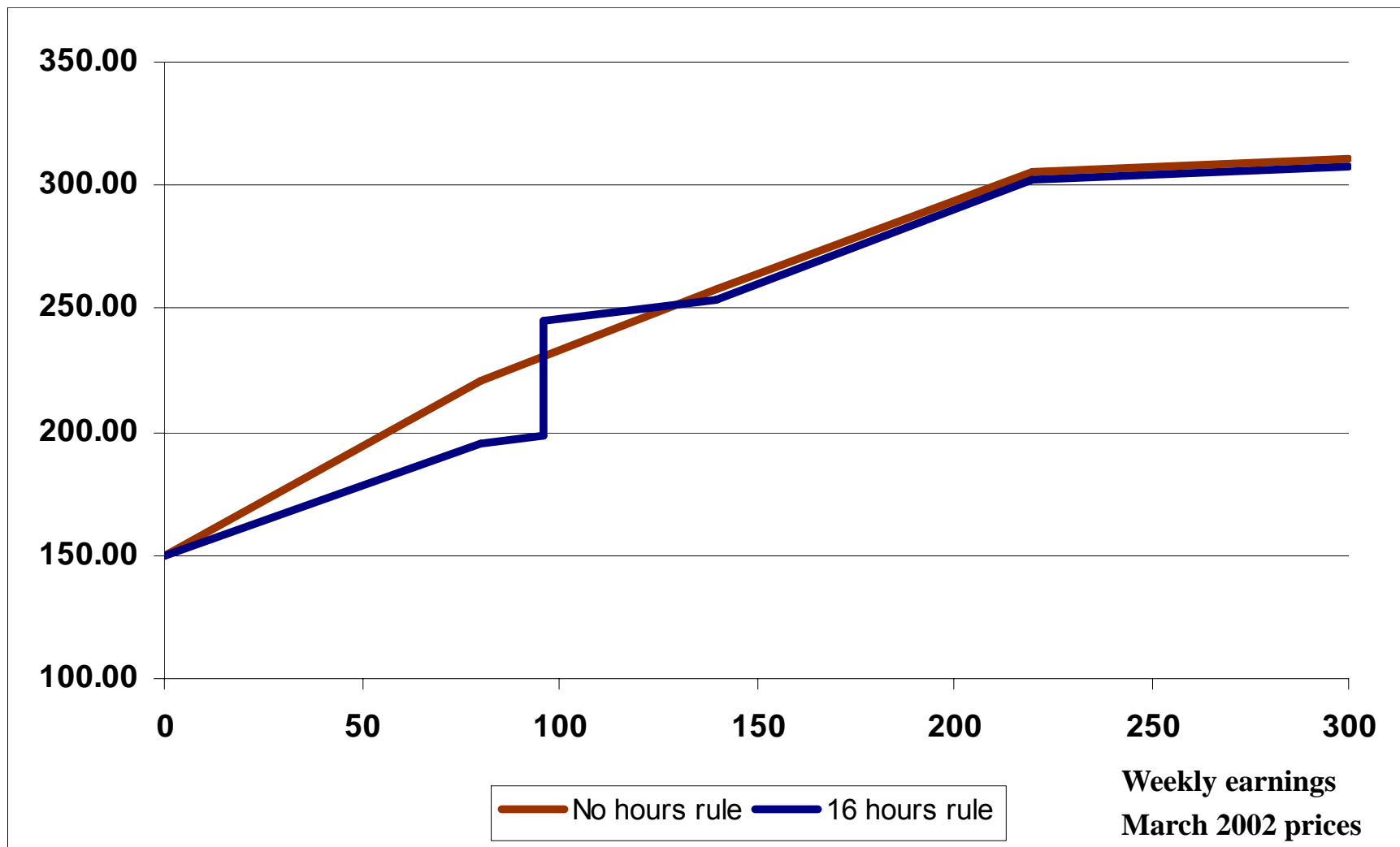
Blundell and Shephard (2010)

# Implied Optimal Schedule, Youngest Child Aged 4-10



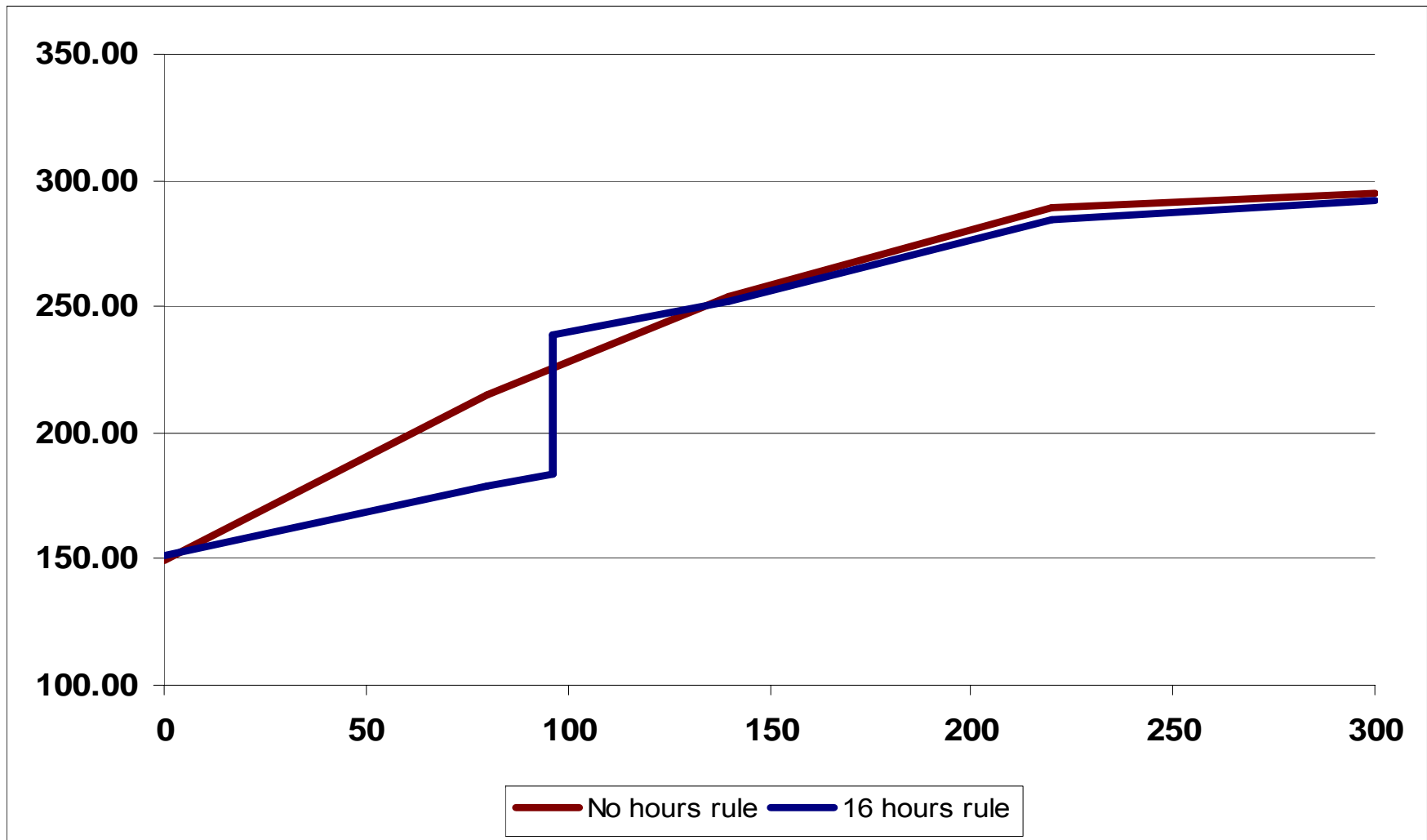
Blundell and Shephard (2010)

## Implied Optimal Schedule, Youngest Child Aged 4-10



Blundell and Shephard (2010)

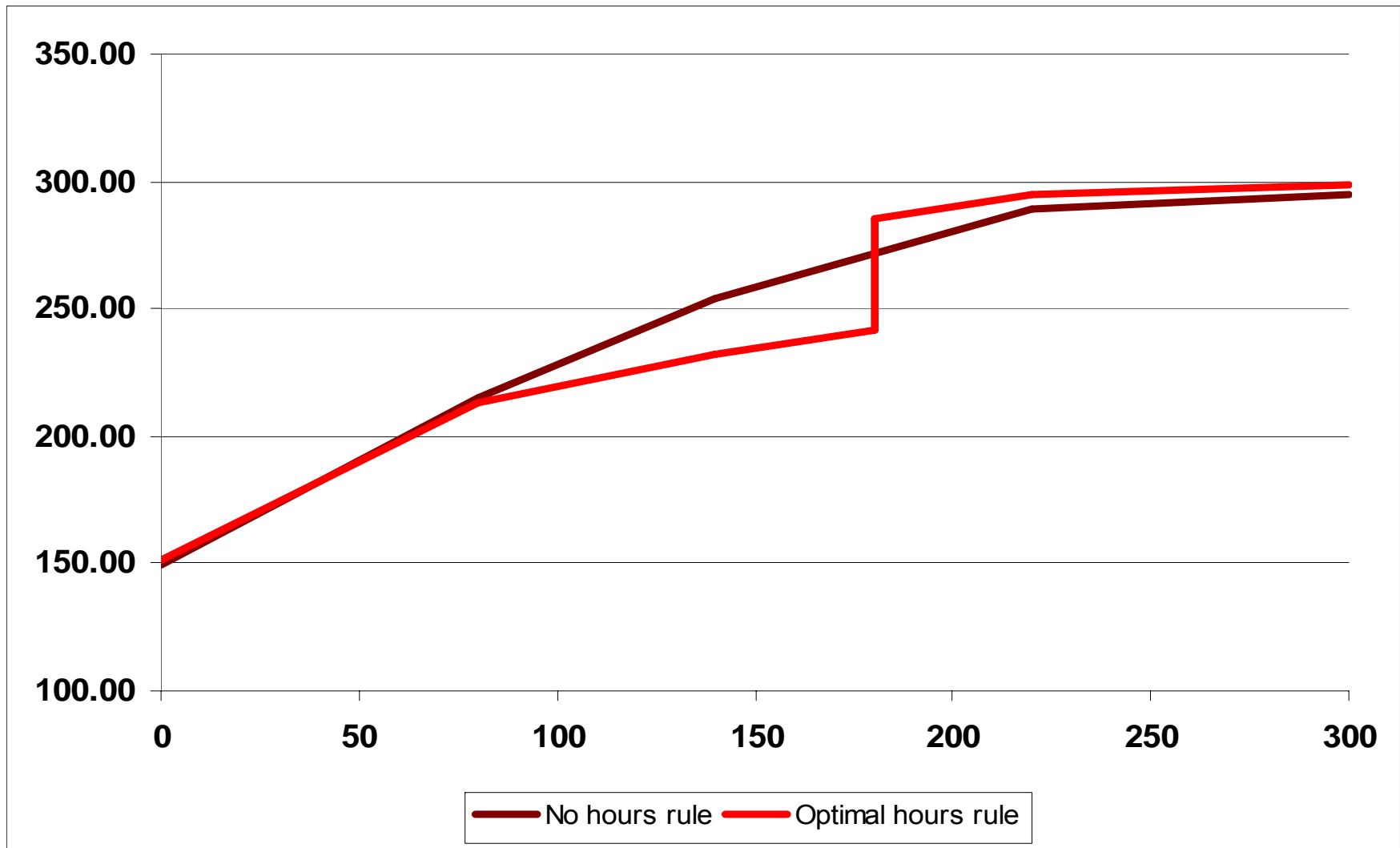
# Implied Optimal Schedule, Youngest Child Aged 11-18



Blundell and Shephard (2010)



# Implied Optimal Schedule, Youngest Child Aged 11-18

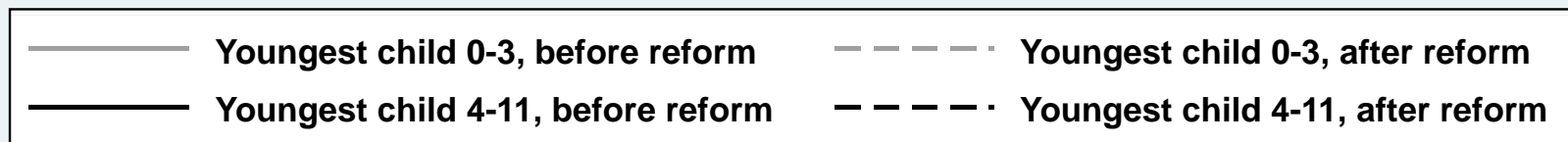
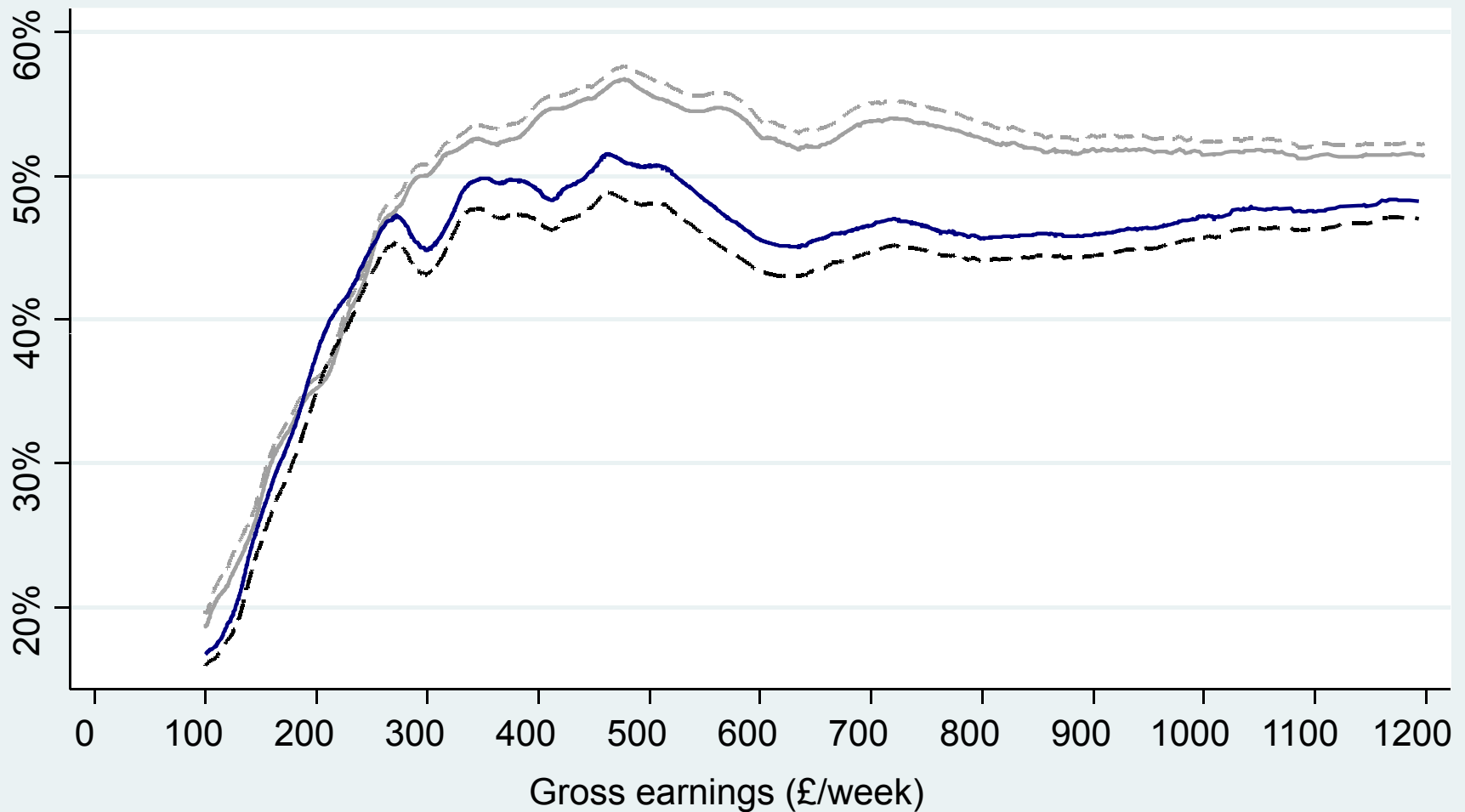


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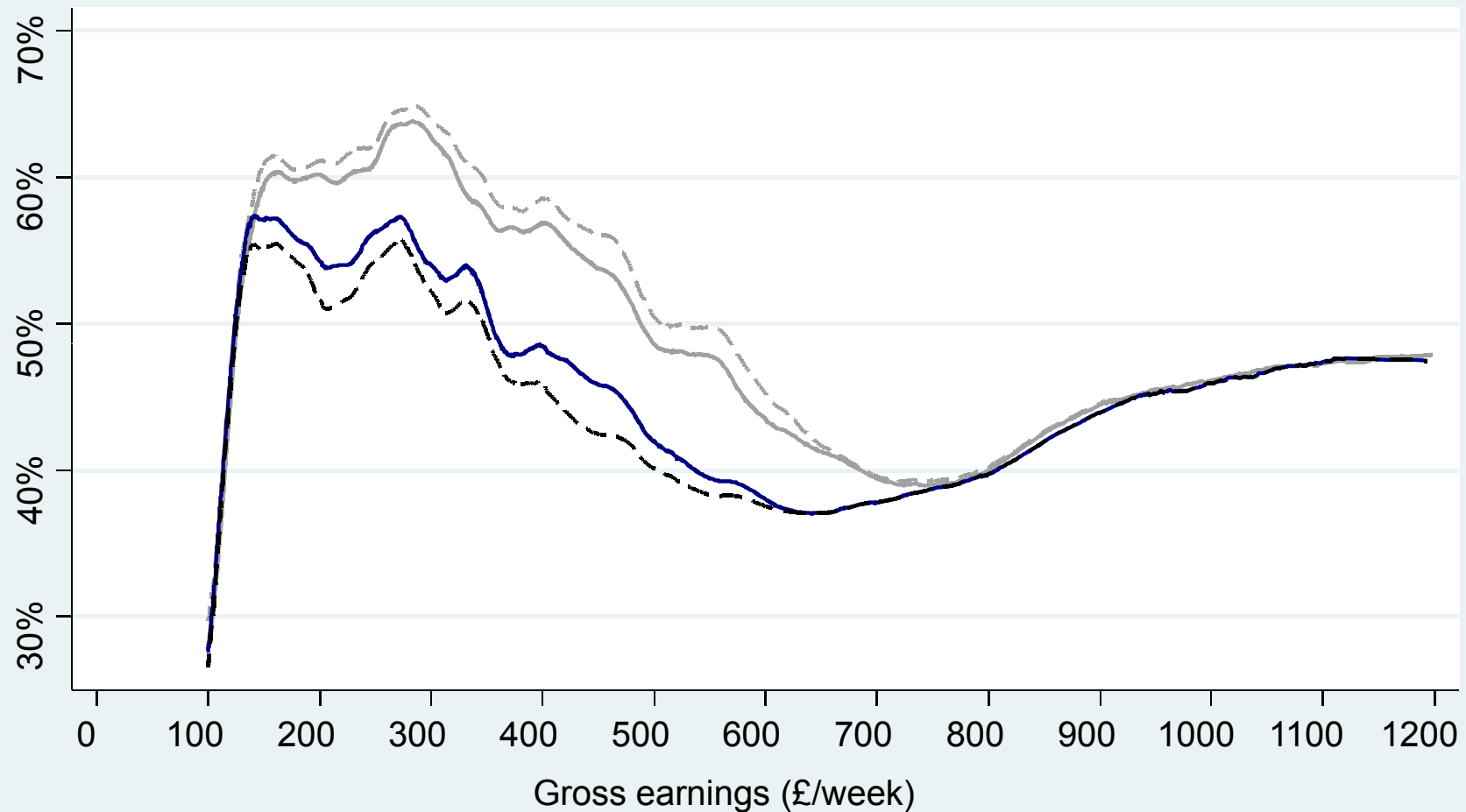
# Implications for Tax Reform

- 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 key groups =>
- Age-based taxation
  - distinguish by age of youngest child for mothers/parents
  - pre-retirement ages
- Hours rules? – at full time for older kids,
  - welfare gains depend on ability of tax authority to monitor hours
- Impact of reforms on PTRs and EMTRs (MRII) →

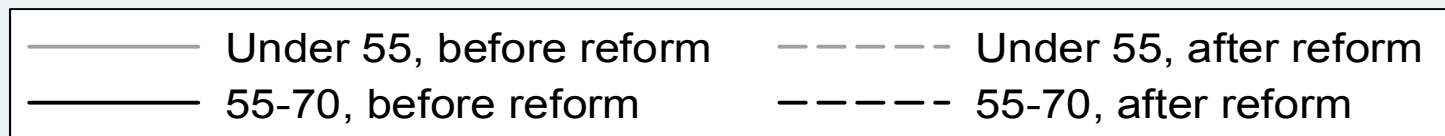
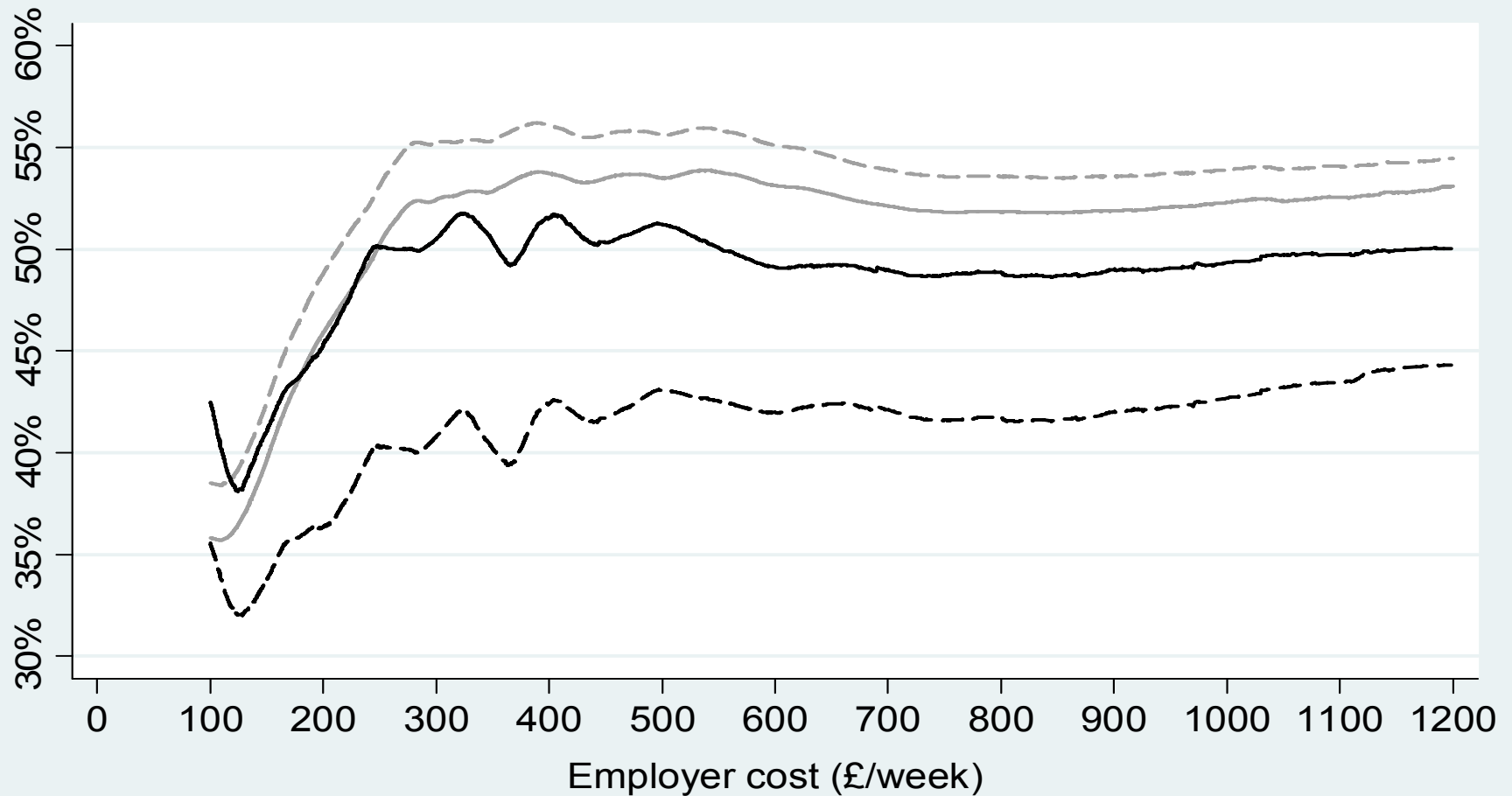
## Effect of child age revenue neutral reforms on average PTRs across the earnings distribution, by age of youngest child



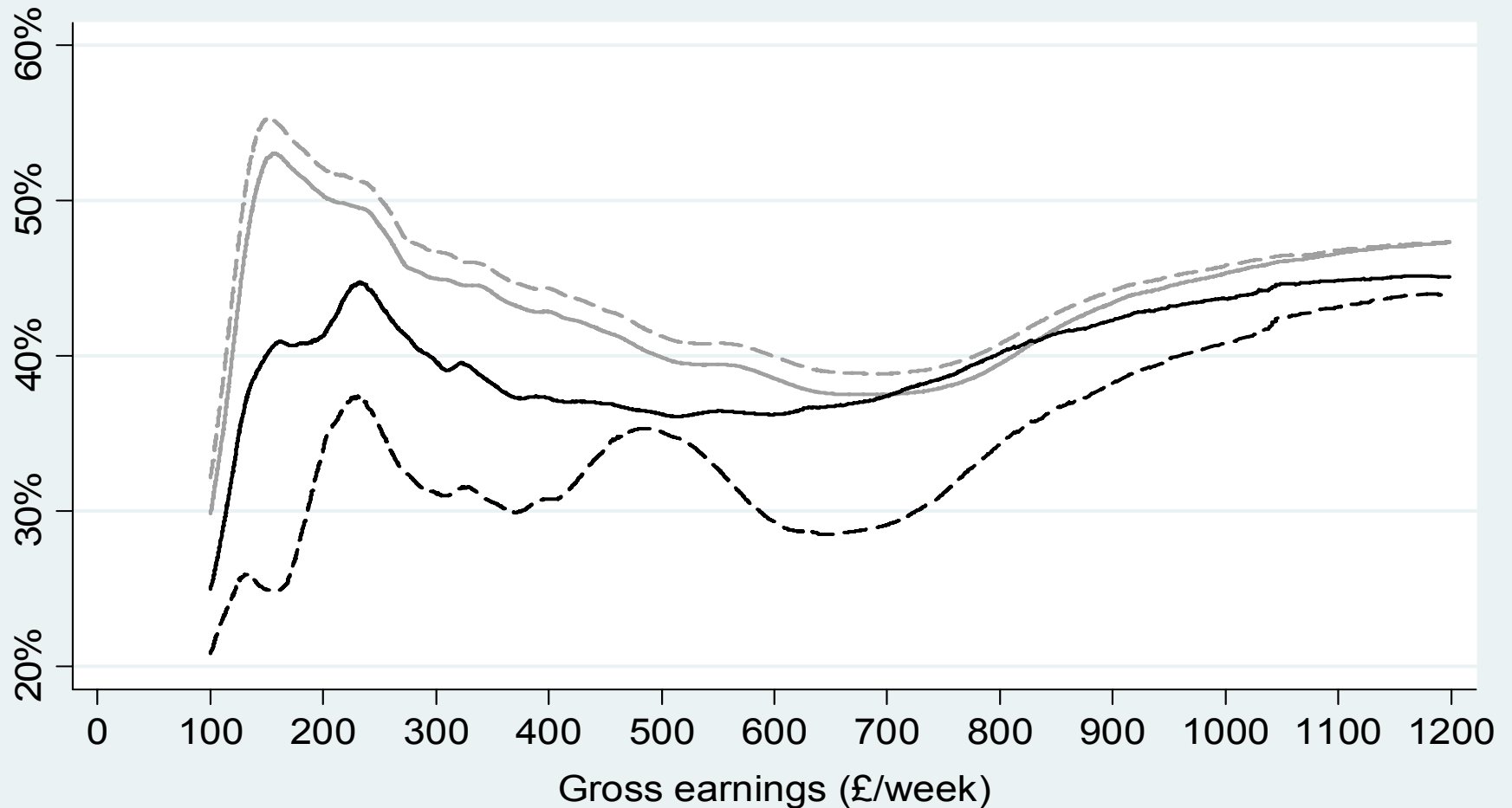
# Effect of child age revenue neutral reforms on average EMTRs across the earnings distribution, by age of youngest child



# Effect of early retirement revenue neutral reforms on average PTRs across the earnings distribution, by age



## Effect of early retirement revenue neutral reforms on average EMTRs across the earnings distribution, by age



— Under 55, before reform      - - - - Under 55, after reform  
— 55-70, before reform      - - - - 55-70, after reform

# Reforming Tax Rates

- Change transfer/tax rate structure to match lessons from ‘new ‘microeconomic’ optimal tax’ analysis
- lower marginal rates at the bottom
  - means-testing should be less aggressive
  - distinguish by age of youngest child
- The child-age tax reforms redistribute to families with younger children and involve a relatively large increase employment and aggregate earnings
- Age-based taxation
  - pre-retirement ages
  - important employment increases from age-based reforms
- Undo distributional effects of the rest of the package...
- For example, base broadening in the structure of VAT

# Broadening the Base: Indirect Taxation

- Evidence on consumer behaviour => exceptions to uniformity
  - Childcare strongly complementary to paid work
  - Various other work/time related expenditures
    - conditional QUAIDS on FES, MRI
  - ‘Vices’: alcohol, tobacco, betting; also environmental externalities (three separate chapters in MR II)
- These do not line up well with existing structure of taxes
  - ⇒ Broadening the base – many zero rates in UK VAT
- Compensating losers, even on average, is difficult
  - Especially when we worry about work incentives too
  - Work with new set of direct tax and benefit instruments as in earnings tax reforms



# Indirect Taxation – UK case

	Cost (£m)
<b>Zero-rated:</b>	
Food	11,300
Construction of new dwellings	8,200
Domestic passenger transport	2,500
International passenger transport	150
Books, newspapers and magazines	1,700
Children's clothing	1,350
Drugs and medicines on prescription	1,350
Vehicles and other supplies to people with disabilities	350
<b>Reduced-rated:</b>	
Domestic fuel and power	2,950
Residential conversions and renovations	150
<b>VAT-exempt:</b>	
Rent on domestic dwellings	3,500
Rent on commercial properties	200
Finance and insurance	4,500

# Impact on budget share of an additional hour worked

Conditional on income and prices

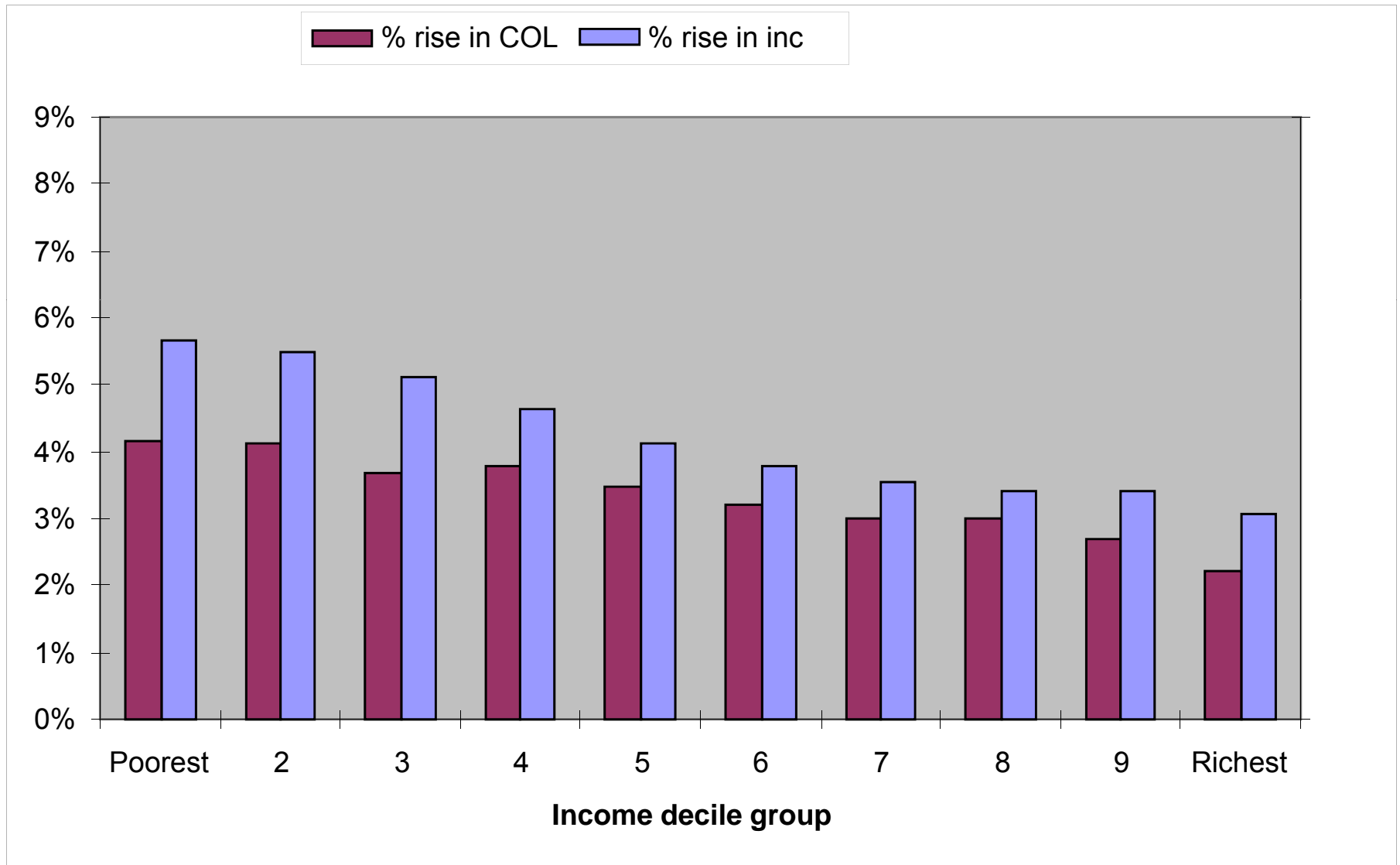
<b>Bread and Cereals</b>	<b>Negative</b>
<b>Meat and Fish</b>	<b>Negative</b>
<b>Dairy products</b>	<b>Negative</b>
<b>Tea and coffee</b>	<b>Negative</b>
<b>Fruit and vegetables</b>	<b>Negative</b>
<b>Food eaten out</b>	<b>Positive</b>
<b>Beer</b>	<b>Positive</b>
<b>Wine and spirits</b>	<b>Positive</b>
<b>Domestic fuels</b>	<b>Negative</b>
<b>Household goods and services</b>	<b>Positive</b>
<b>Adult clothing</b>	<b>Positive</b>
<b>Childrens' clothing</b>	<b>Negative</b>
<b>Petrol and diesel</b>	<b>Positive</b>
<b>Leisure goods and services</b>	<b>Positive</b>

Source: QUAIDS on UK FES, MRI

## Compensation and work incentives

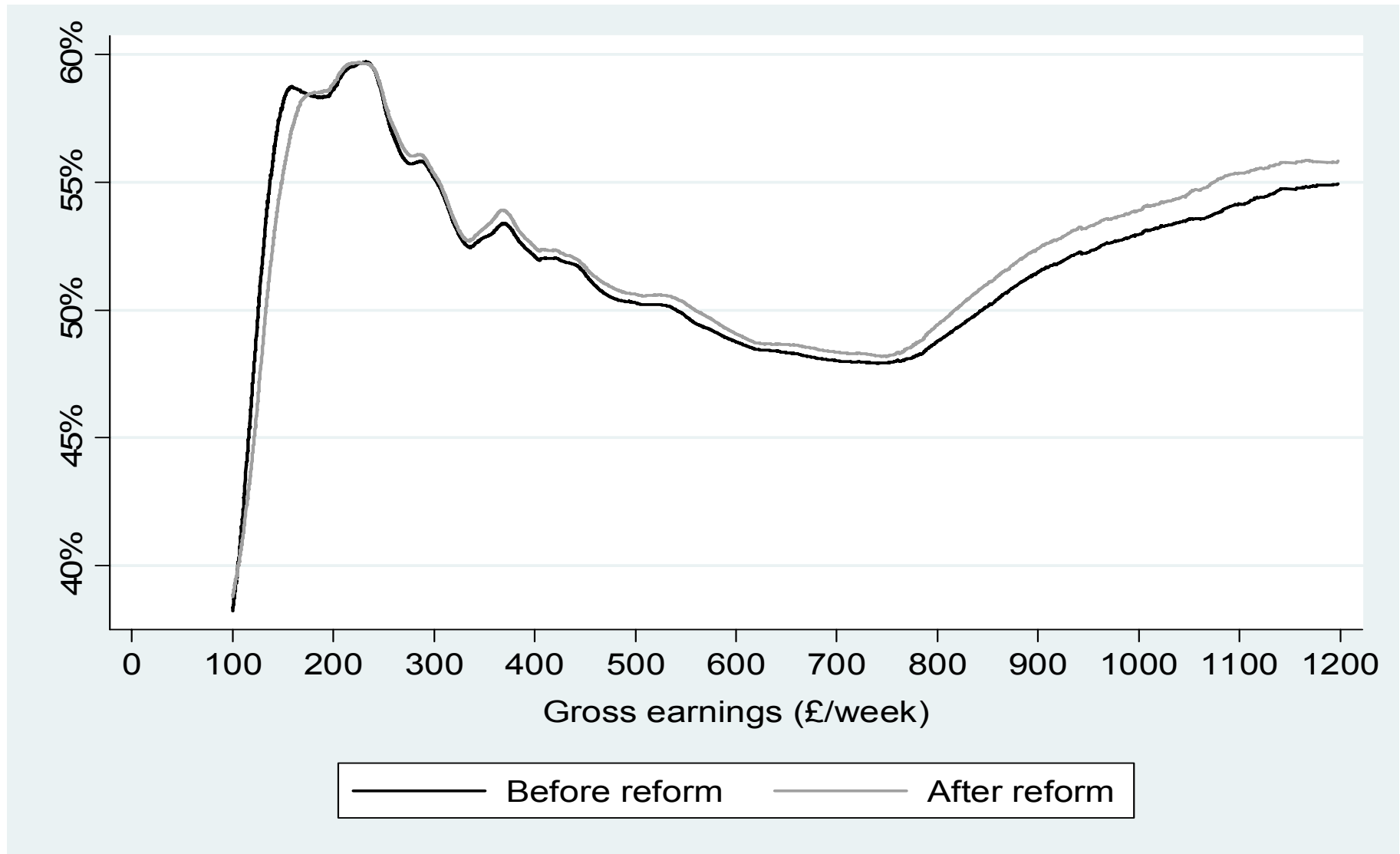
- Changes in benefits, tax credits and tax rates and thresholds.
- Relatively easy to compensate for income losses but no so easy to do so in a way that minimises labour supply distortions
- Incorporate child age and age-based reforms

# Effect of base broadening reform with earnings tax instruments as compensation (MRII), by income decile



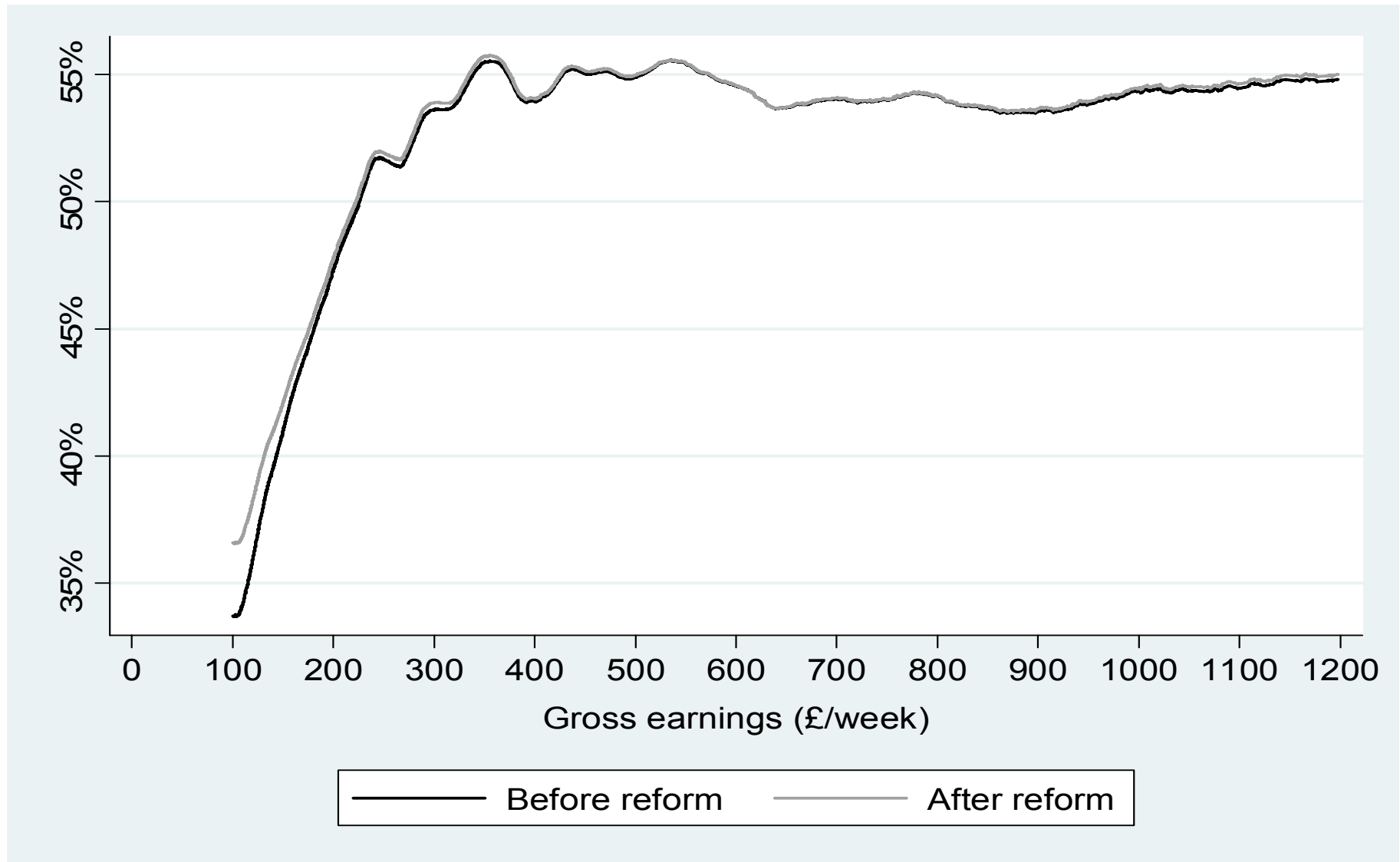
# Reform revenue neutral and designed to leave effective tax rates on earnings unchanged

*EMTR*: before and after indirect tax reform

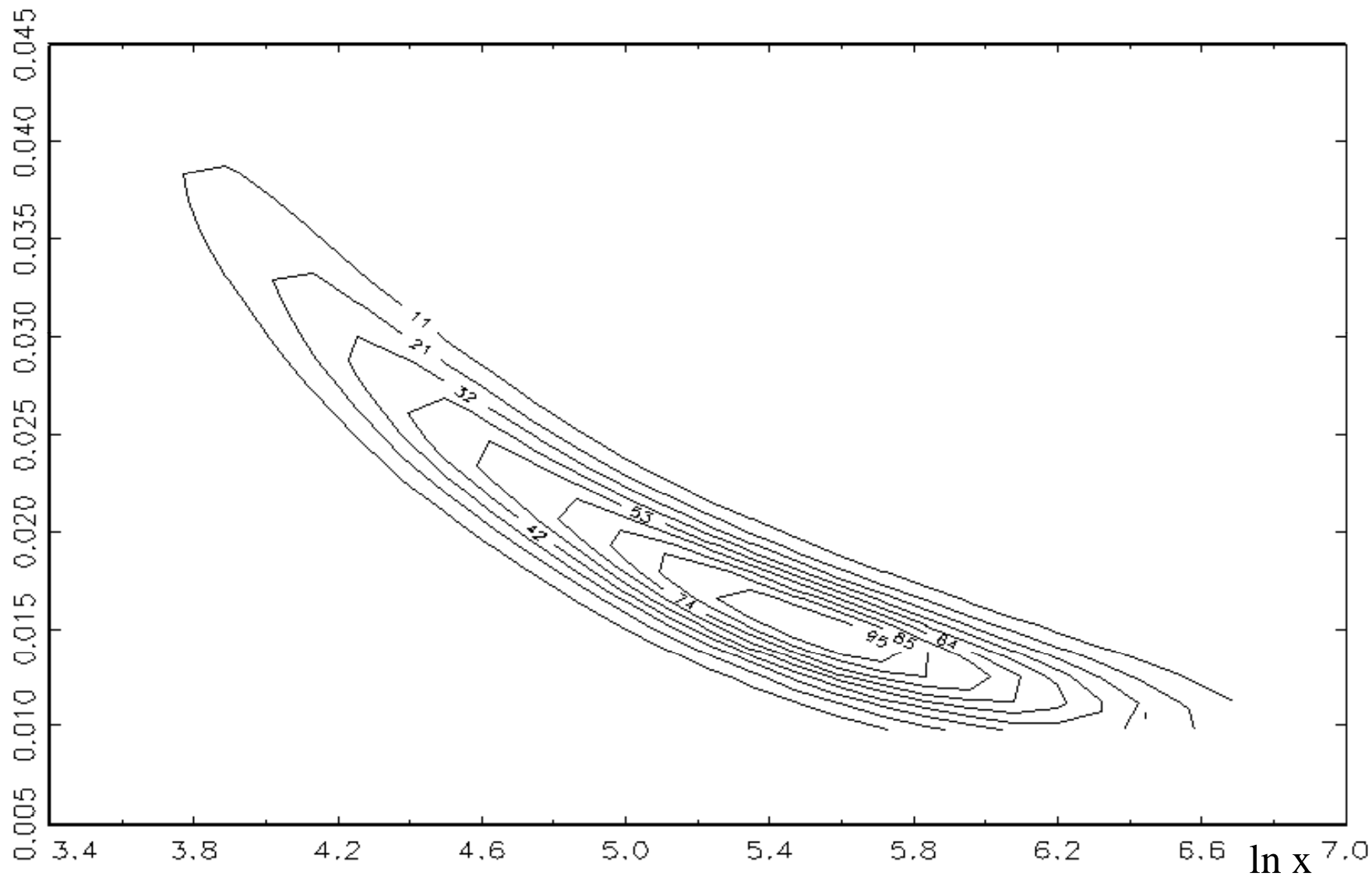


# Reform revenue neutral and designed to leave effective tax rates on earnings unchanged

*PTR*: before and after indirect tax reform



# Welfare gains - Distribution of EV/x by $\ln(x)$



Source: MREI

## (Some other) Key Margins of Adjustment

- Savings-pension-housing portfolio mix
  - ‘Life-cycle’ accumulation of savings and pension contributions
  - Expenditure tax treatment with certain ‘behavioural’ deviations and capturing all excess returns
- Forms of remuneration
  - CGT reforms and the non-alignment with labour income rates
  - Related to tax base and top tax rates
- Organisational form
  - UK chart on incorporations and tax reforms
- Look in the Review documents....



# Top tax rates and taxable income elasticities

An 'optimal' top tax rate (Brewer, Saez and Shephard, MRI)

$e$  – taxable income elasticity

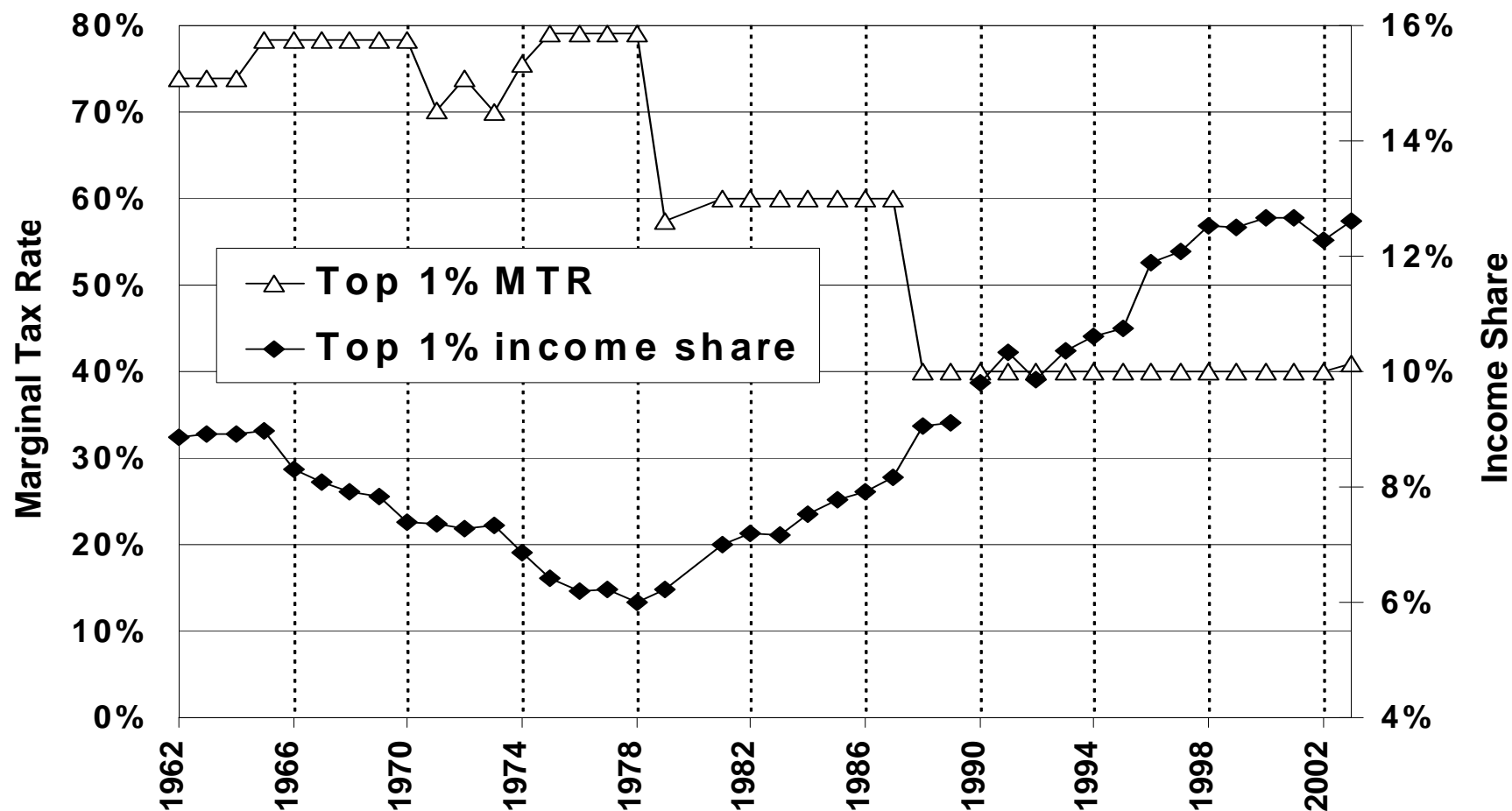
$t = 1 / (1 + a \cdot e)$  where  $a$  is the Pareto parameter.

Estimate  $e$  from the evolution of top incomes in tax return data following large top MTR reductions in the 1980s

Estimate  $a$  ( $\approx 1.8$ ) from the empirical distribution

# Top incomes and taxable income elasticities

## A. Top 1% Income Share and MTR, 1962-2003



Source: MR1, UK SPI (tax return data)

# Taxable Income Elasticities at the Top

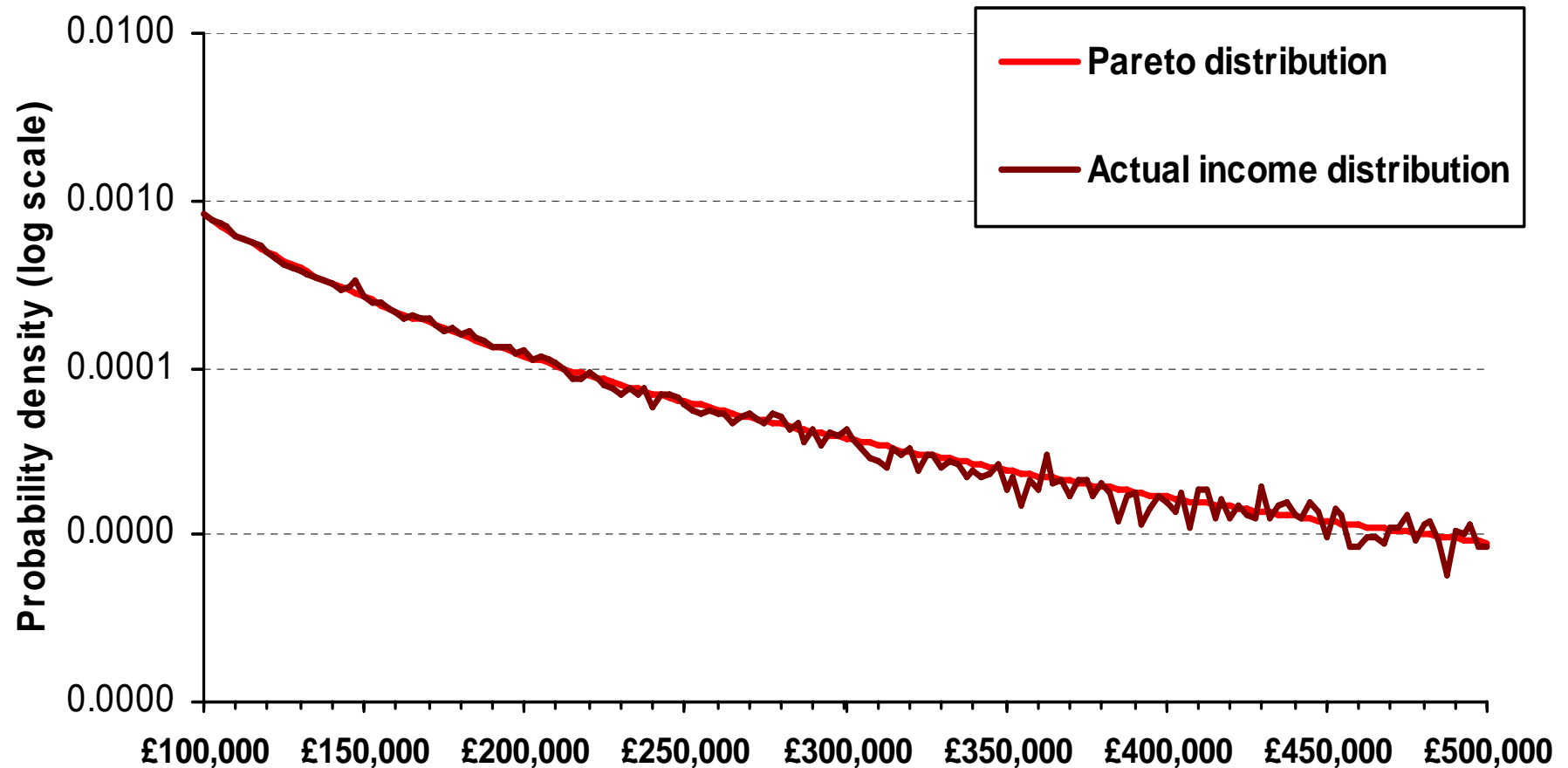
Simple Difference (top 1%)      DD using top 5-1%  
as control

1978 vs 1981	0.32	0.08
1986 vs 1989	0.38	0.41
1978 vs 1962	0.63	0.86
2003 vs 1978	0.89	0.64
Full time series	0.69	0.46
	(0.12)	(0.13)

With updated data the estimate remains in the .35 - .55 range with a central estimate of .46, but remain quite fragile

Note also the key relationship between the size of elasticity and the tax base (Slemrod and Kopczuk, 2002)

## Pareto distribution as an approximation to the income distribution



Pareto parameter quite accurately estimated at 1.8  
=> revenue maximising tax rate for top 1% of 55%.

# Empirical Evidence and Tax Policy Design: Lessons from the Mirrlees Review

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Five building blocks for the role of evidence in tax design....

- Key margins of adjustment to tax reform
- Measurement of effective tax rates
- The importance of information, complexity and salience
- Evidence on the size of responses
- Implications for tax design

see

<http://www.ifs.org.uk/mirrleesReview>

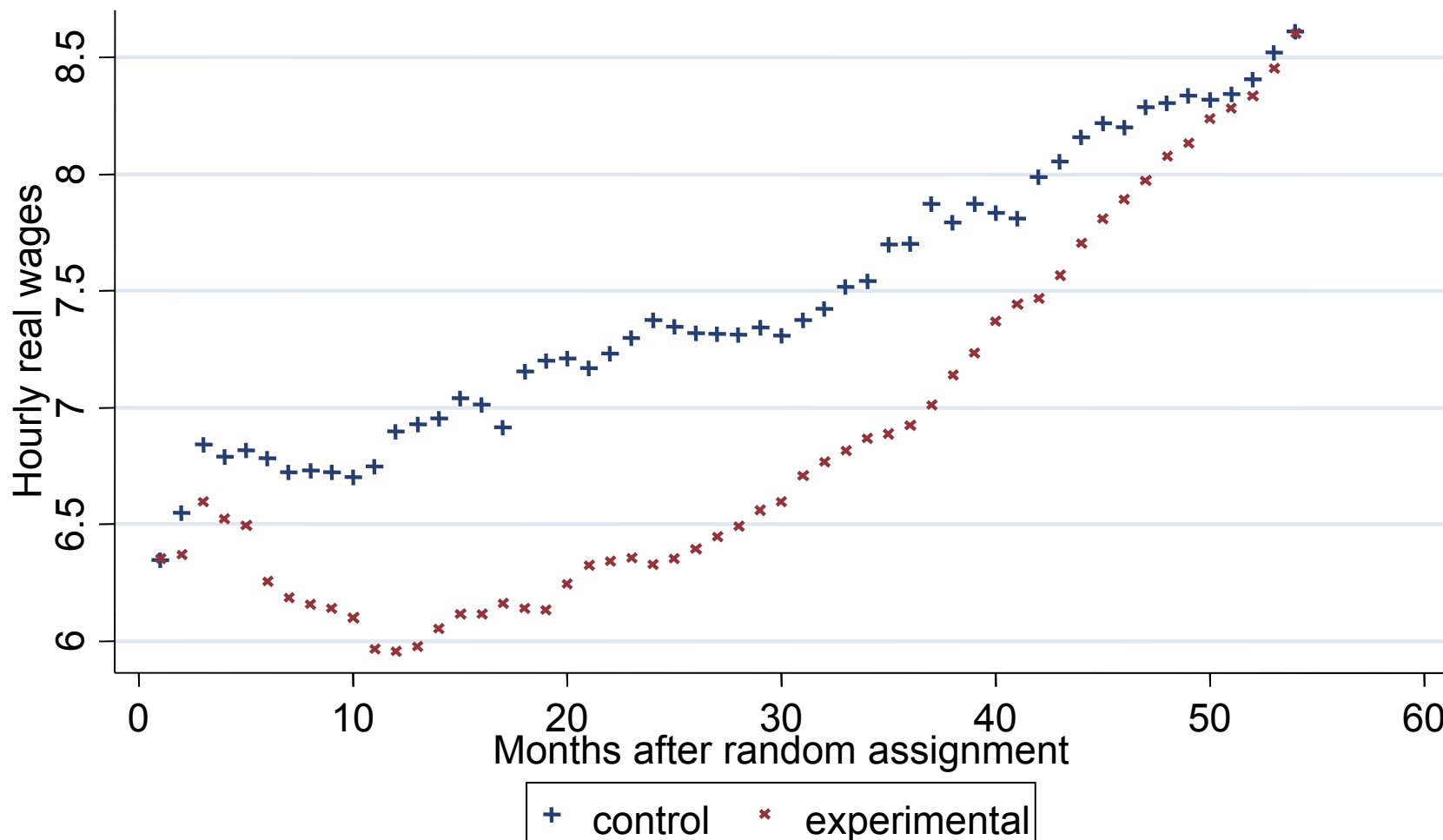
But (too) many key issues unresolved, and with little evidence base (!)

Including:

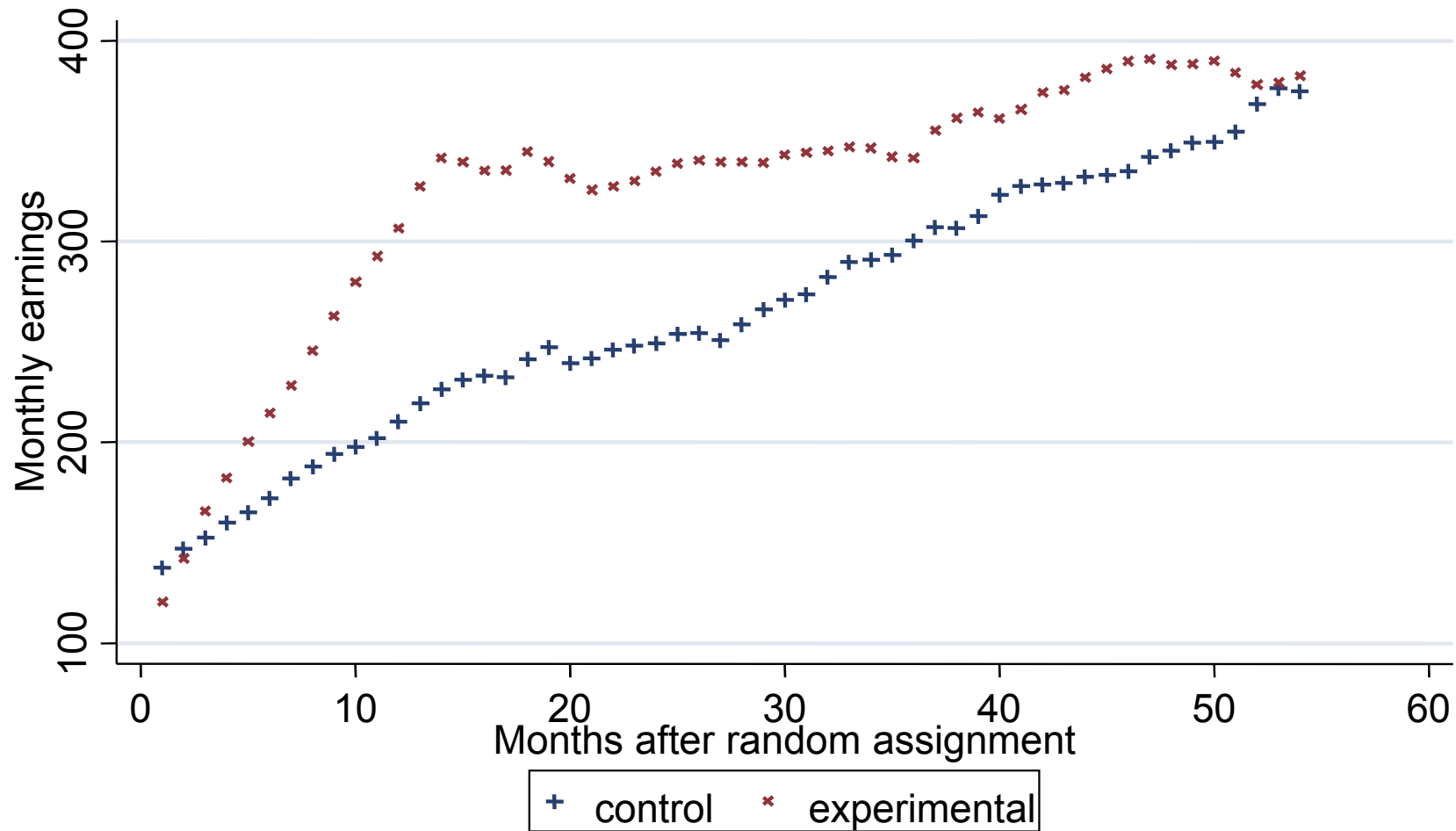
- Tax credits and earnings progression
- Distinction between dynamic and static policies
- Human capital investment bias and savings taxation
- Taxation of financial services
- Some transition issues and capitalisation
- ....

# Dynamic effects on wages for low income welfare recipients?

SSP: Hourly wages by months after RA



# SSP: Monthly earnings by months after RA





# Evidence from the SSP experiment

- Earnings and employment line up with control group after time limit is exhausted
- Little evidence of employment enhancement or wage progression
- Other evidence, Taber etc, show some progression but quite small
- Remains a key area of research

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