Education, Labour Supply and Welfare

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September 12, 2012

Introduction

- There has been a long-standing interest in female labor supply for a number of reasons
  1. In general women are thought to be be more responsive to incentives, particularly when they have children
  2. Many women end up being single mothers, vulnerable to poverty
  3. The career breaks and the observed male/female wage differentials point towards the importance or otherwise of returns to experience

Introduction

- Over the recent decades we have built a welfare system mainly designed to aleviate poverty and encourage women into work
- The idea is that by incentivizing women into work even when they have young children they preserve an attachment ot the labor market so that their skills do not depreciate
- A key question is how this welfare system affects careers
  - This includes, education choice, human capital accumulation over the life-cycle and work behaviour

Introduction

- We specify and estimate a dynamic model of female labour supply with the following features:
  - Education choice is endogenous
  - Wages depend on accumulated experience
  - Women can work part-time, full time, or not at all
  - Marriage, spousal income and children are stochastic (but exogenous)
- Use it to assess the impact of the major welfare reforms implemented at the turn of the century in UK

Introduction

Key references for this paper are:

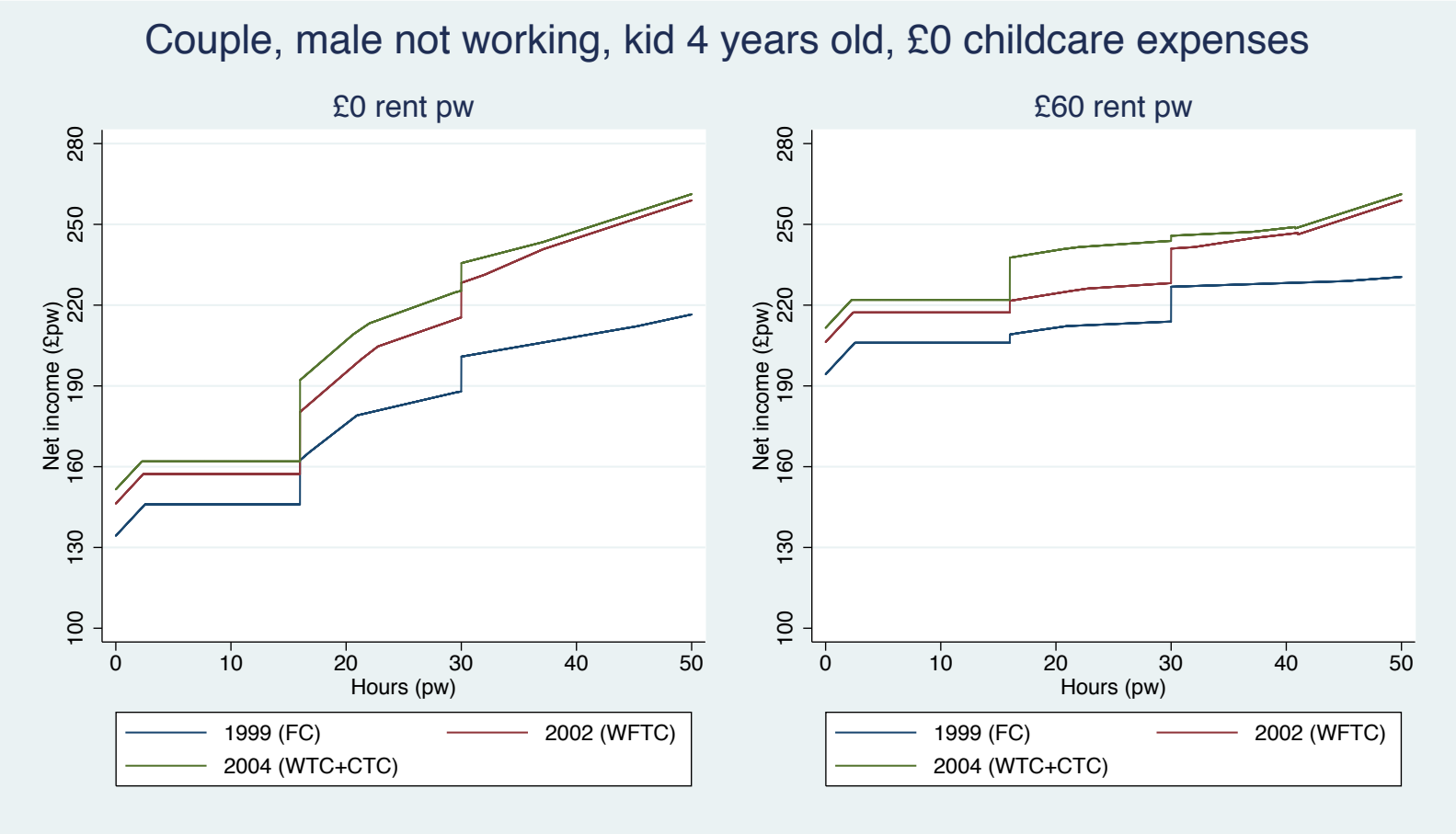
- Labour supply/career models: Eckstein and Wolpin (1989), Keane and Wolpin (1997), Adda, Dustmann, Meghir and Robin (2011), Attanasio, Low and Sanchez (2008)
- Human capital accumulation in life-cycle models: Kathy Shaw (1989), Imai and Keane (2004)
- Labour supply and taxes: Keane and Moffitt(1995), Blundell, Duncan and Meghir (1998) among many others
- The impact of tax credits: Blundel, Duncan, McCrea and Meghir (1999), Brewer et al, 2006, Francesconi and van der Klaauw, 2004, Eissa and Liebman, 1996, Meyer and Rosenbaum, 2001, Hotz and Scholz, 2003, Card and Robins, 2005

Policy background

	April 1999 (FC)	April 2002 (WFTC)	April 2004 (WTC/CTC)
Basic award	£64.95	£88.95	£131.82
30-hour premium	£11.05	£11.65	£12.31
Earnings threshold	£80.65	£94.50	£97.31 and £961.54
Taper rate	70% (net earnings)	55% (net earnings)	37% and 6.67% (gross earnings)
Help with childcare	Disregard up to £60 of childcare expenses from income	Max award increased by 70% of childcare expenses up to £135	Max award increased by 70% of childcare expenses up to £135

Notes: All values are on a per-week basis. Families with children are eligible if at least one adult works 16 or more hours per week. Help with childcare requires all adults to work more than 16 hours per week. The increase in generosity between WFTC and WTC/CTC is exaggerated because the reform also incorporated elements of other benefits.

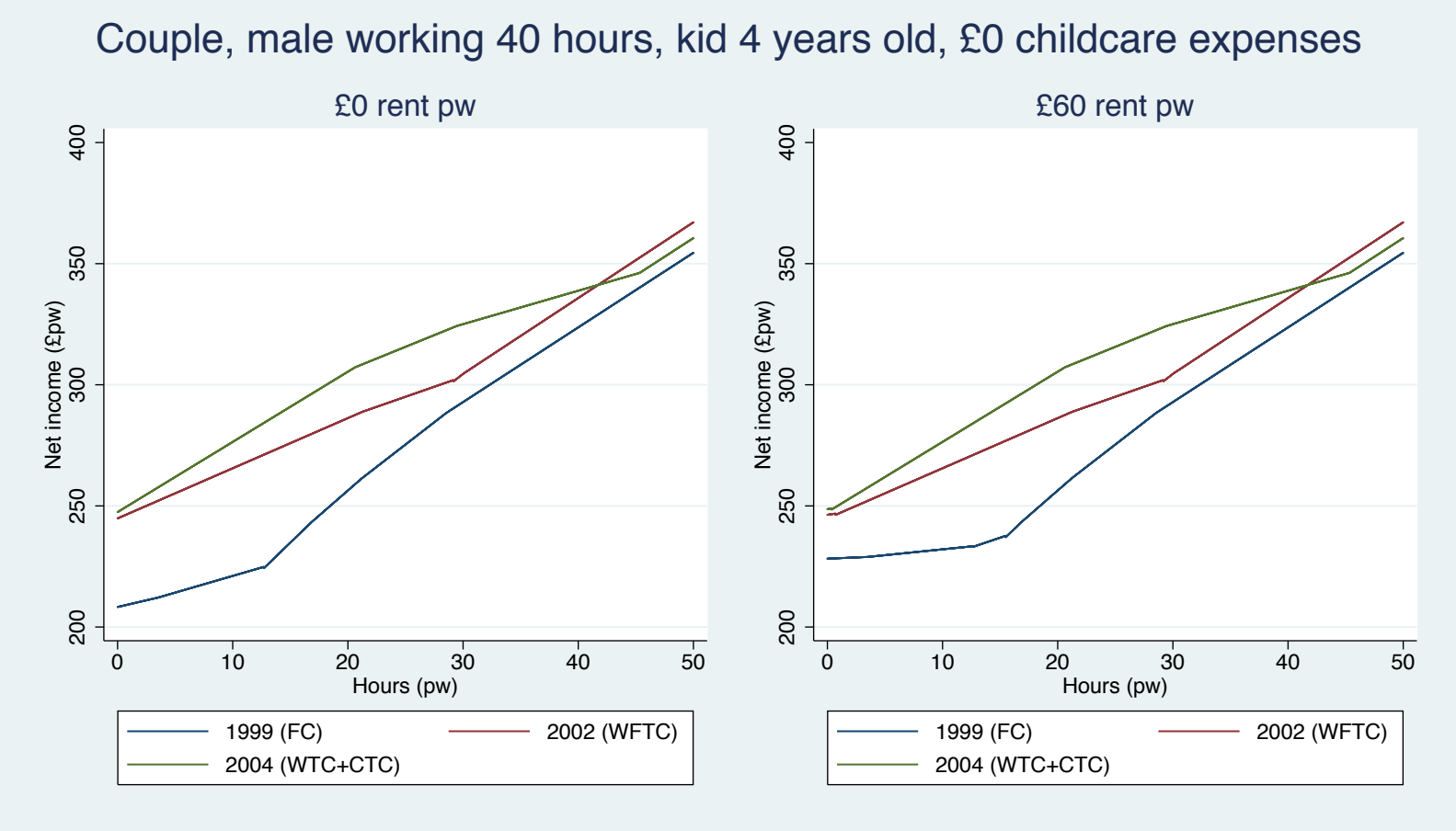
Figure 5: Net income per week by tax regime



Notes: Woman earns £4.6 per hour. Fortax simulations.

Policy background (WFTC/IS)

Figure 7: Net income per week by tax regime



Notes: Man and woman both earn £4.6 per hour. Fortax simulations.

Model: female life-cycle

- Life in three stages
  - Three education levels chosen sequentially up to age 18/21
    - secondary, A-levels (high school) or vocational, university
  - working life
    - consumption and asset accumulation
    - labour supply (0, 20 and 40 hours per week) (0-9, 10-24, 25+ in the data)
    - experience accumulation
    - marriage and childbearing
  - retirement: happens deterministically at the age of 60

Model: female earnings

- Wage equation

$$\begin{aligned} \ln w_{sia} &= \ln W_s + \gamma_s \ln(e_{sia}+1) + \upsilon_{sia} \\ \upsilon_{sia} &= \rho_s \upsilon_{sia-1} + \mu_{sia} \\ e_{sia} &= e_{sia-1}(1-\delta_s) + g_s(l_{sia}) \end{aligned}$$

  - $g(l_{sia}) = 1$ for full-time, part-time estimated
  - Persistence of shocks - so we distinguish heterogeneity from state dependence (experience effects)
  - Correlation of initial shock with preferences
  - Concave profile of experience effects
  - Depreciation of human capital - cost of not working

Model: exogenous family dynamics

- Children
  - model youngest child, with exogenous arrival rate
  - arrival probability depends on female age, education, presence of partner and older children
  - departure with certainty when child reaches age 18

Model: exogenous family dynamics

- Partner
  - random arrival depending on level of education and age
  - characterised by education, employment status and earnings
  - arrival probability for male with given education depends on female age and education
  - departure probability depends on female age, presence of child and male education
- In couples, female acts as second earner, partly insuring for shocks in other sources of income with labour supply

Model: other family income

- Male log-wage equation

$$\begin{aligned} \ln w^m_{s^m ia} &= \ln W^m_{s^m} + \gamma^m_{s^m} \ln (a-18) + \upsilon^m_{s^m ia} \\ \upsilon^m_{s^m ia} &= \rho^m_{s^m} \upsilon^m_{s^m ia-1} + \mu^m_{s^m ia} \end{aligned}$$

  Conditional on education, male and female productivity processes are independent

- Detailed model of UK tax and benefit system (FORTAX)
  - Taxes: income tax, NI, council tax
  - Benefits: child benefit, maternity grant, tax credits, income support, housing benefit, council tax benefit, free school meals

The female chooses $\{c_{ia}, l_{ia}\}_{a=\underline{a},....,\bar{a}}$ during her working life to maximise lifetime utility

$$V_a(X_{ia}) = E_a\left[\sum_{\alpha=a}^{\bar{a}} \frac{(c_{ia}/n_{ia})^{\eta}}{\eta} \exp\left(f\left(l_{i\alpha}, X_{i\alpha}\right)\right) \middle| X_{ia}\right]$$

subject to the budget constraint

$$k_{ia+1} = (1+r)k_{it} + l_{ia}w_{sia} + d^m_{ia} l^m_{ia} w^m_{s^m ia} - T\left(X_{ia}, l_{ia}, l^m_{ia}\right) - CC_a\left(X_{ia}\right) - c_{ia}$$

- non-separability
- uncertain environment: earnings (own and partner's) and family composition
- $f\left(l_{i\alpha}, X_{i\alpha}\right)$ is a function of family composition, education and male, unobserved heterogeneity by female employment
- liquidity constraints: $k > 0$ but allow $k > -£15,000$ for university students

Model: optimisation problem

Education

- One-off decision in knowledge of utility and monetary costs of education
- Costs correlated with initial level of productivity

Data and estimation

- BHPS
  - Unbalanced panel of around 6,600 females over 16 waves
  - 10% observed in all 16 periods 60% in 6 or fewer periods 25% observed leaving education and entering working life
  - Labour market outcomes during working life, income information, detailed demographics, limited assets information

Data and estimation

- Set IES, interest rate and discount rate (Blundell, Browning and Meghir, 1993))
- Estimate exogenous parameters outside model: male earnings and employment, family dynamics, childcare costs
- Method of Simulated Moments for the rest: simulate individuals under different tax regimes; Compute overall moment to match with those in the data.
- 207 moments, including employment rates by family type, transition rates, means, variances and percentiles of earnings distribution, earnings at entrance in working life, change in earnings by past hours, education achievement,...
- 55 parameters to estimate

Estimates: female wage equation

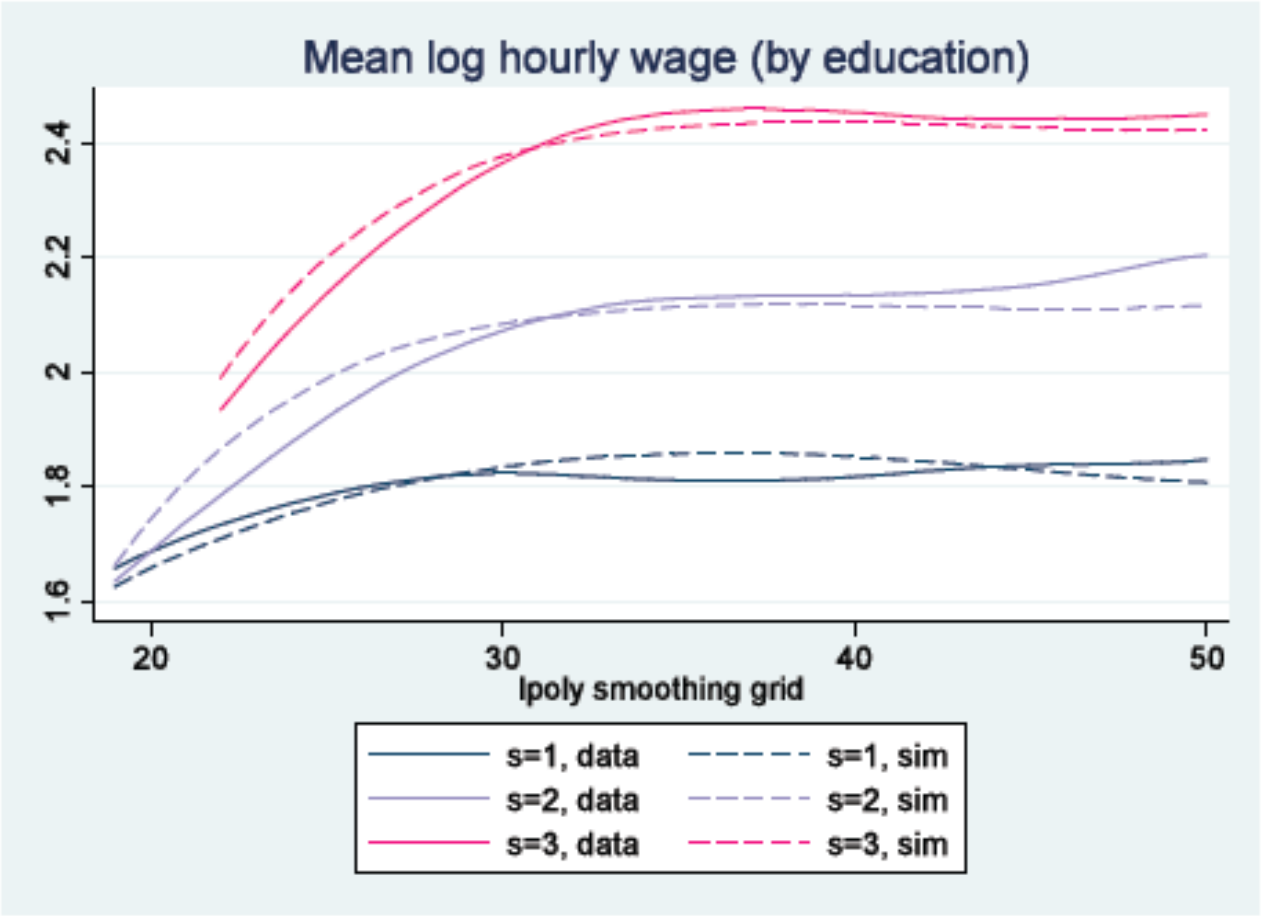
	second.-GCSE	HS A-Level	university
wage rate (0 experience)	4.5	4.9	6.3
returns to experience	0.15	0.23	0.28
autocorrelation coef	0.92	0.95	0.88
se innovation	0.13	0.13	0.12
initial prod: mean high pref for work	0.11	0.10	0.20
initial productivity: se	0.30	0.26	0.26
depreciation rate	0.12	0.11	0.11
accumulation of HC in PTE	0.15	0.12	0.10

Estimates: preferences

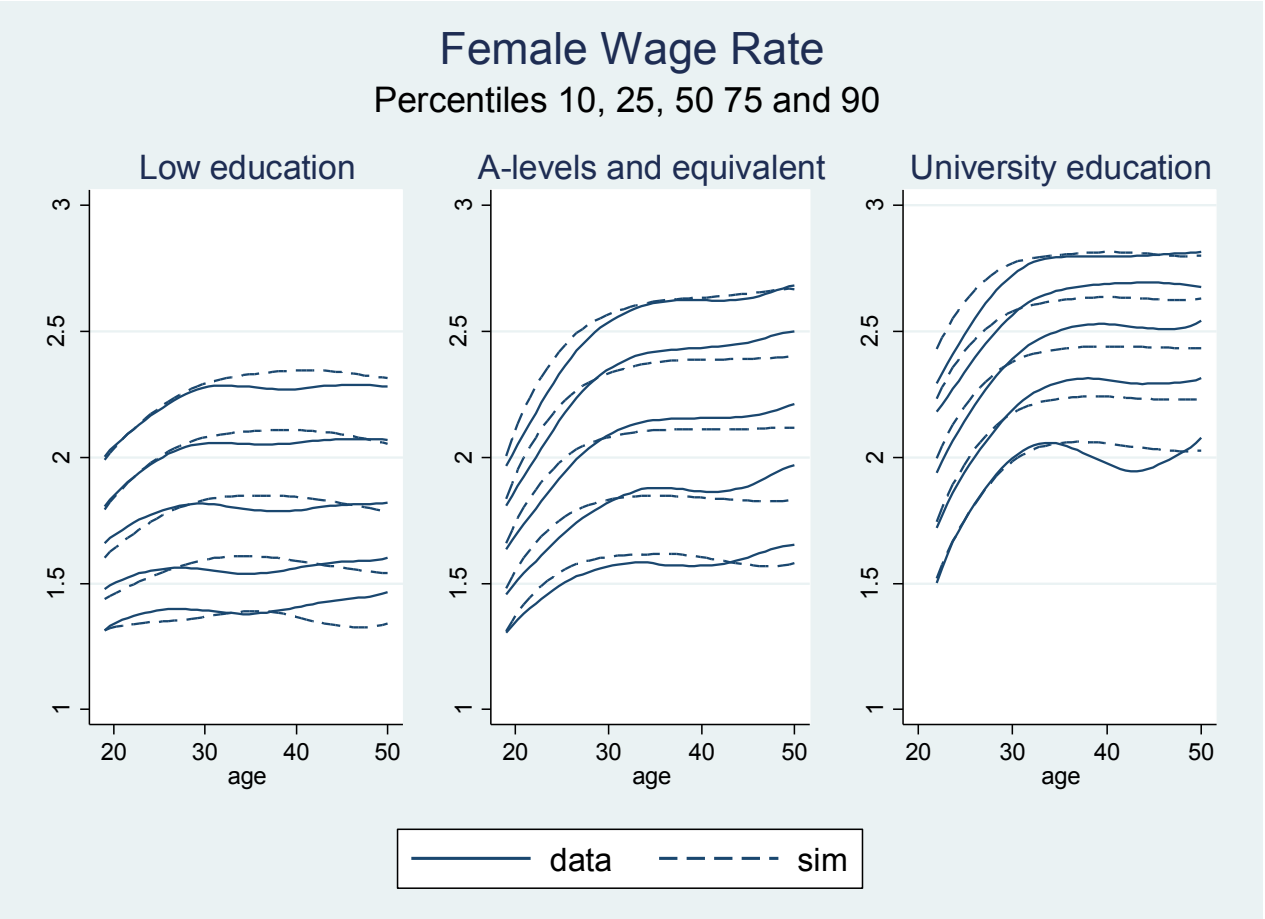
	all employment			PT employment		
	secondary	HS	university	secondary	HS	university
intercept	0.41	0.41	0.47	-0.15	-0.16	-0.19
children	0.05	0.05	0.05	-0.06	-0.05	-0.06
child aged 0-2	0.15			-0.05		
child aged 3-5	0.07			-0.06		
child aged 6-10	-0.02			0.03		
child aged 11-18	-0.07			0.06		
male	-0.06			-0.02		
male working	-0.17			0.09		
High pref work (p=0.51)	-0.16			-0.07		

Model fit

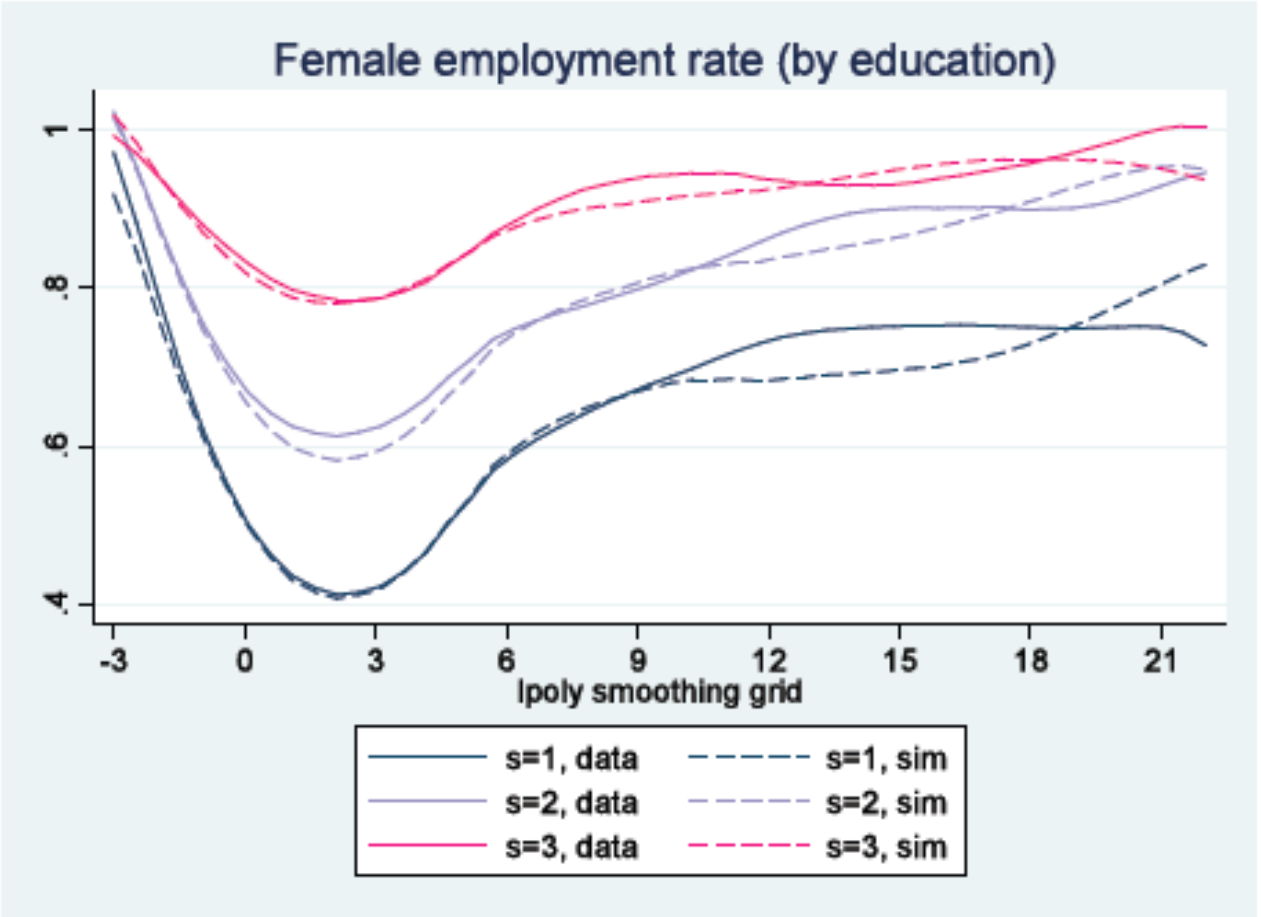
- Reproduce life-cycle profiles of wage distribution, employment, transition rates, as well as same profiles by age of child, including before and after child is present



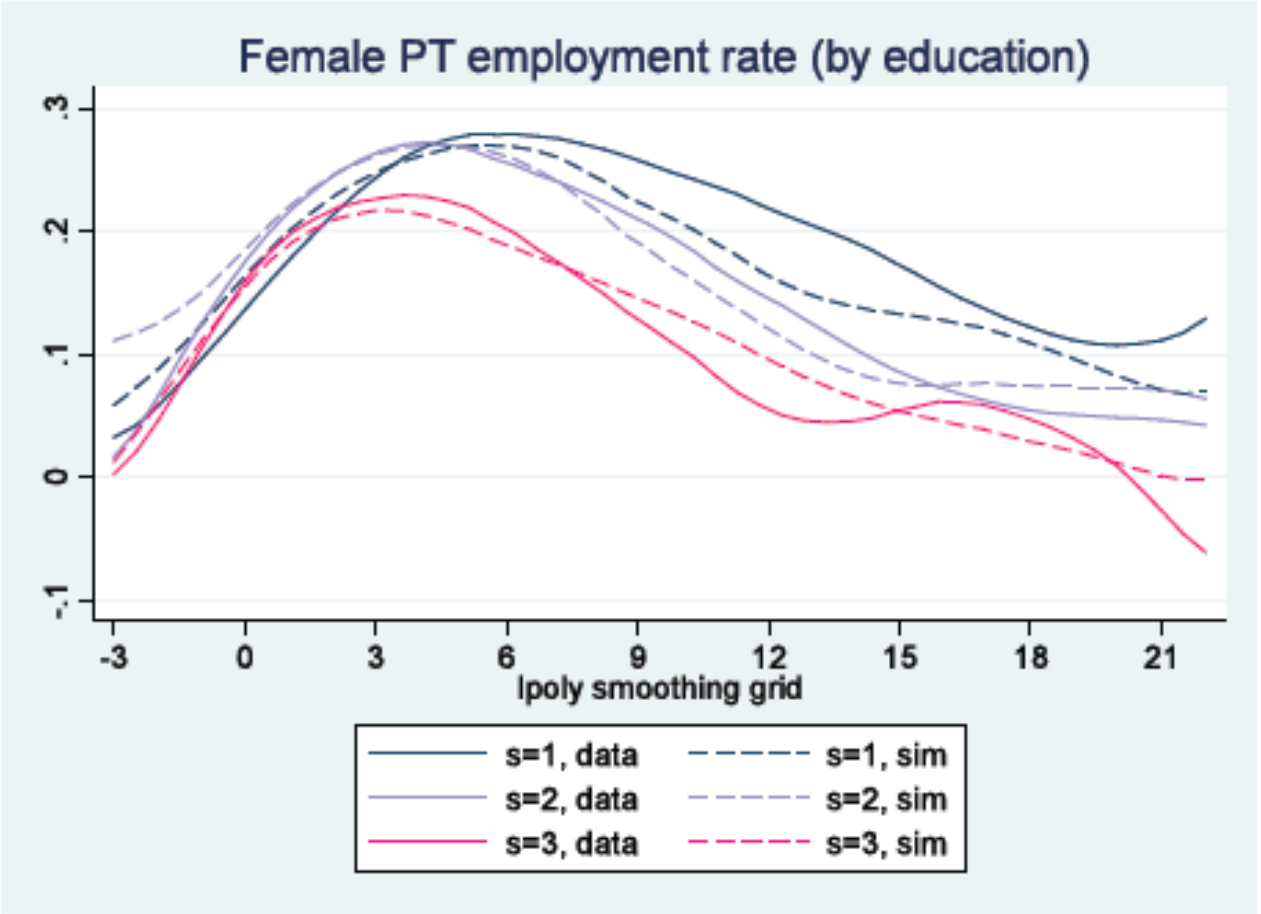
Model fit


Female Wage Rate
Percentiles 10, 25, 50 75 and 90
Low education
A-levels and equivalent
University education
1
1.5
2
2.5
3
20
30
40
50
age
data
sim

Model fit
Employment of mothers



Model fit


Female PT employment rate (by education)
.3
.2
.1
0
-.1
-3
0
3
6
9
12
15
18
21
lpoly smoothing grid
s=1, data
s=2, data
s=3, data
s=1, sim
s=2, sim
s=3, sim

Results: validation against empirical estimates of the impact of WFTC

- Can reproduce empirical estimates of the impact of WFTC
- Effect after three years of reforms for cross section of women

Table 1: The impact of WFTC reform on employment: simulated versus empirical literature results

		lone mothers	married mothers		
			all	partner working	partner not working
		(1)	(2)	(3)	(4)
Simulated results					
(1)	own accommodation	+5.0%	-2.2%	-4.2%	+2.7%
(2)	rented accommodation	+2.4%	-1.2%	-2.3%	+1.4%
(3)	all population	+3.4%	-2.0%	-3.9%	+2.1%
Results in literature					
(4)	BBS, 2005	+3.6%		-0.1%	+2.6%
(5)	FRK, 2009		+0.7%*	+0.1-0.6%*	3.1%
(6)	BDSS, 2006	+5.0%	-0.5%		
(7)	BDSS, 2006 (combined)	+3.7%	-0.4%		

Elasticities

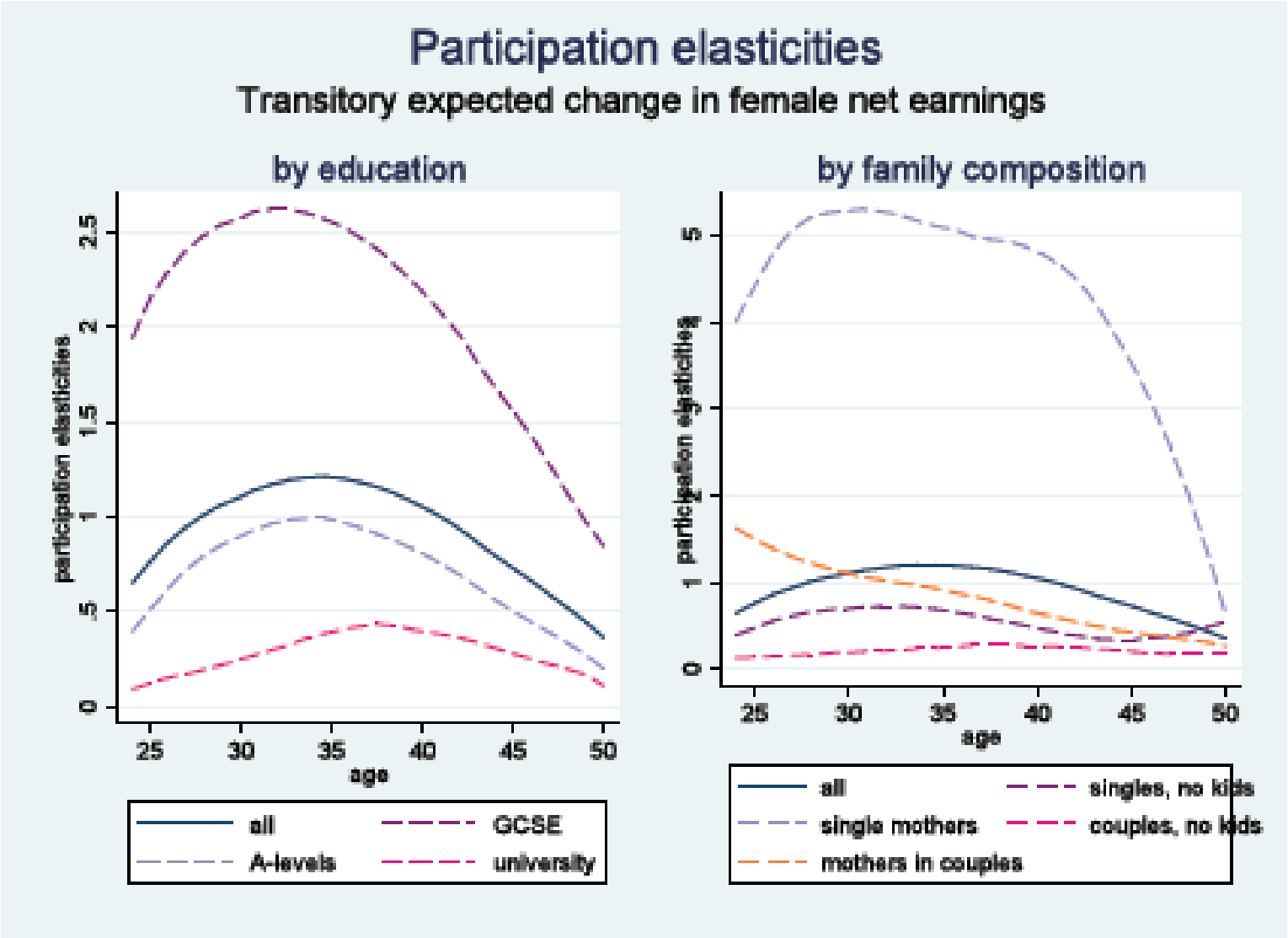
- Frisch Elasticity: effect of small and anticipated transitory change in net employment earnings
  - adjust initial assets so that marginal utility at start of life-cycle remains constant
- Marshallian Elasticity: permananent and unexpected change in net employment earnings
  - more relevant for welfare analysis

Results: wage elasticities of labour supply (extensive)

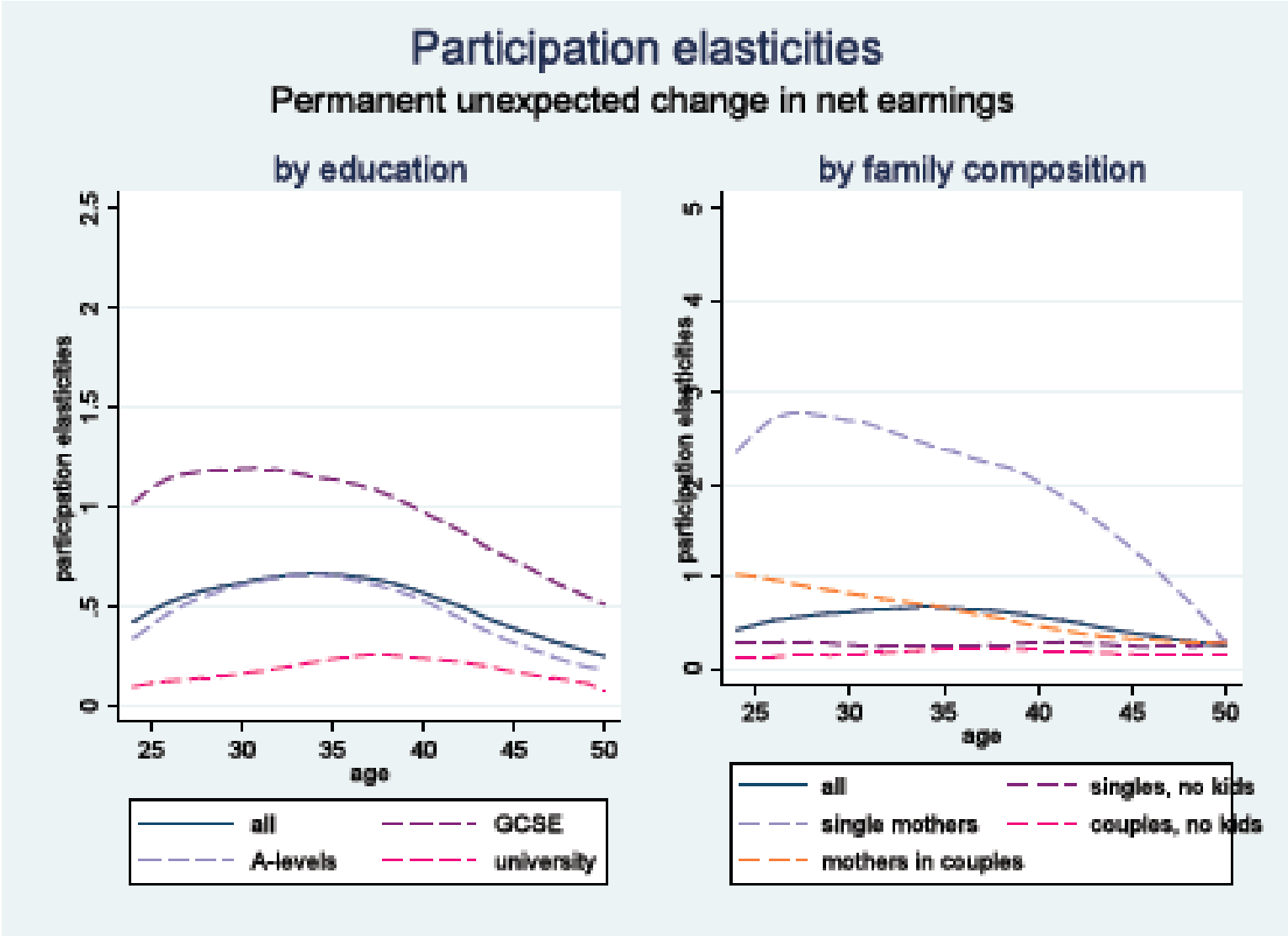
- Large Frisch elasticites, smaller responses to (uncompensated) permanent unexpected changes in earnings
- Overall values not at odds with recent estimates for women (Blundell, Pistaferri and Eksten, 2012)
- Very heterogeneous responses to changes in earnings and income, both especially high among low educated and lone mothers

	Frisch	Marshalian	Income effects
All	0.90	0.50	-0.41
Secondary	1.97	0.93	-0.53
A-levels	0.68	0.46	-0.40
University	0.28	0.18	-0.26
Lone mother	4.23	1.93	-0.91
Mothers in couples	0.70	0.51	-0.29
Childless women	0.33	0.20	-0.35

Frisch Elasticities

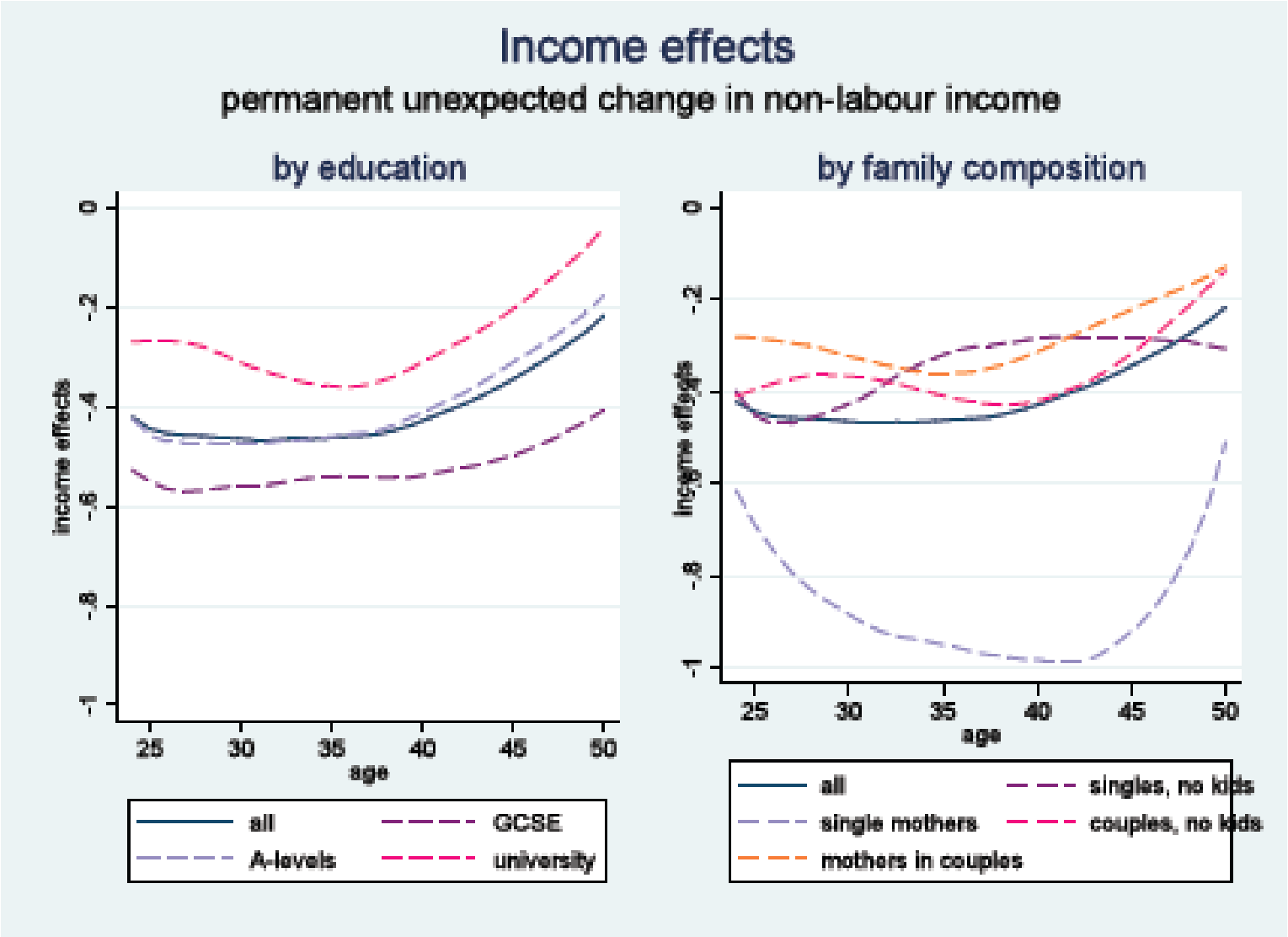


Marshallian Elasticities



Income Effects

Unearned income increased at each point in the lifecycle



Results: long-run effects of WFTC & IS (2002)

- Revenue neutral reforms
- No education choice

(ppt)	Single Mother			Couple with Kids		
	GCSE	HS	Uni	GCSE	HS	Uni
2002 WFTC						
employment	9.9	12.9	7.9	-6.2	-4.6	-2.0
FTE	4.9	2.6	-4.2	-3.4	-2.9	-1.7
2002 WFTC + IS						
employment	4.8	5.2	2.7	-7.1	-5.7	-2.4
FTE	3.1	0.6	-5.4	-3.7	-3.3	-2.0

Education Choice and WFTC & IS (2002)

- Impact relative to 1999 system, allowing for education choice, but by pre-reform (1999) education choice

(ppt)	Single Mother			Couple with Kids		
	GCSE	HS	Uni	GCSE	HS	Uni
2002 WFTC						
employment	9.9	12.3	1.5	-6.2	-4.9	-3.9
FTE	4.8	1.9	-9.7	-3.5	-3.4	-3.8
2002 WFTC + IS						
employment	4.8	4.4	-5.0	-7.2	-6.0	-4.6
FTE	2.9	-0.3	-12.4	-4.0	-4.0	-4.3

Impact on Education Shares

- Increase in unskilled labour

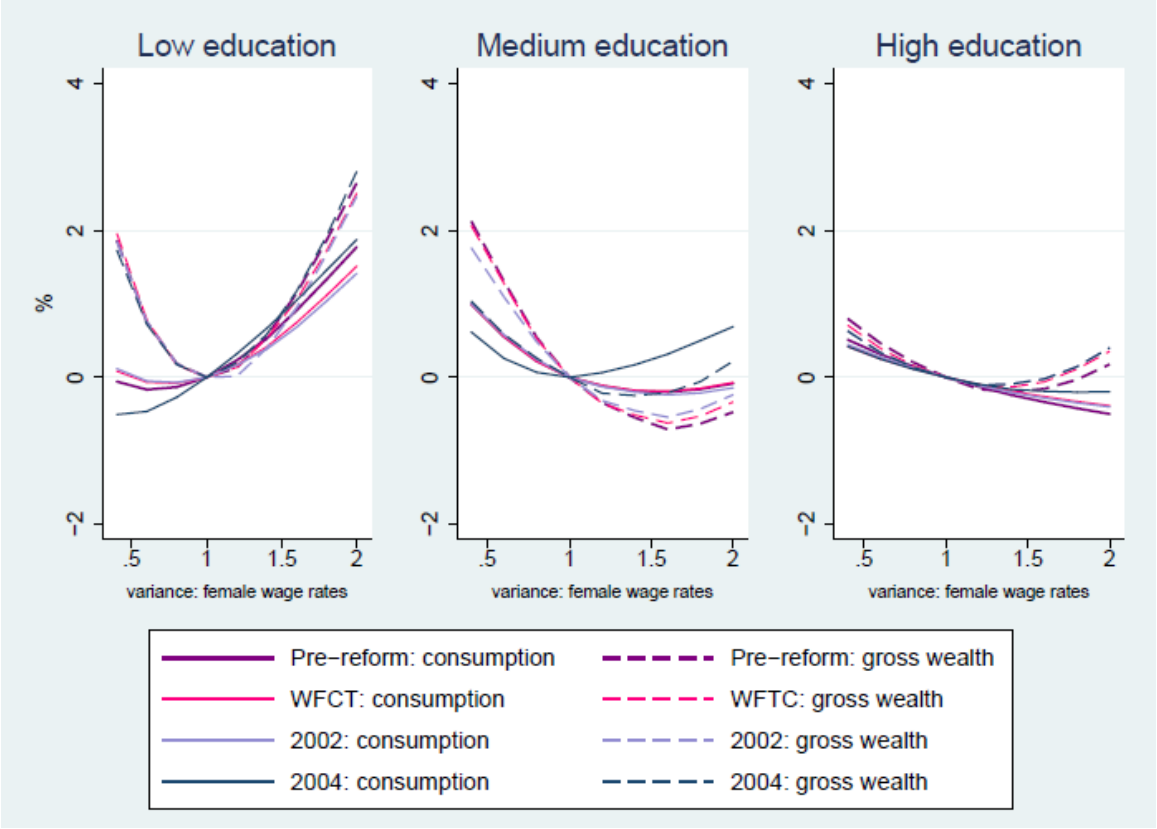
	GCSE	HS	Uni.
Pre-reform	31.8	47.2	20.9
2002 WFTC	33.2	46.9	19.7
2002 WFTC + IS	33.8	46.7	19.4

And how much does it cost?

- Adjustment in basic tax rate to keep budget deicit at pre-reform level

	Education choice	
	pre-reform	post-refom
2002 WFTC	+1.4	+2.1
2002 WFTC + IS	+2.3	+3.2

- Willingness to pay in consumption terms; compare to change in output (gross wealth).



Discussion

- Women with high labour market attachment respond less to the new incentives
- Women with low attachment have a very elastic LS and large income responses as well
- Tax credits have more or less equal and opposite responses for single and married women with children
- There is a small effect on education choice, pushing some women to obtain less education
- The insurance value of the welfare program is substantial, particularly for the lowest skill