

Female Labour Supply, Human Capital and Welfare Reform

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How do 'in-work benefits' and the welfare system affect the education choices, employment, hours of work and the accumulation of working experience of women?

Long-standing interest in the labour supply of women

- Many end up being lone mothers, vulnerable to poverty
- Women labour supply found to be more responsive to incentives, especially that of low wage women with young children
- Time out of paid work and short working hours are especially prevalent among mothers and point to the potential importance of returns to experience

Suggests that accounting for the interaction between human capital dynamics and the labour supply of women is important for the evaluation of tax and welfare reform

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Key issues to be addressed

- 1 How are education and working experience related and how do they affect wages?
- 2 How do these aspects of human capital interact with the labour supply decisions of women?
- 3 How should labour supply, working experience and education investments be accounted for in the design and evaluation of welfare reform?
 - Focus on transfers to low wage families in the form of in-work benefits
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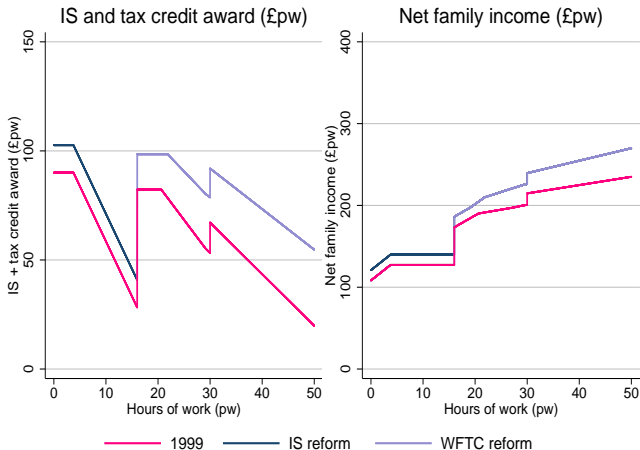
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Tax and Welfare Reform in the UK:

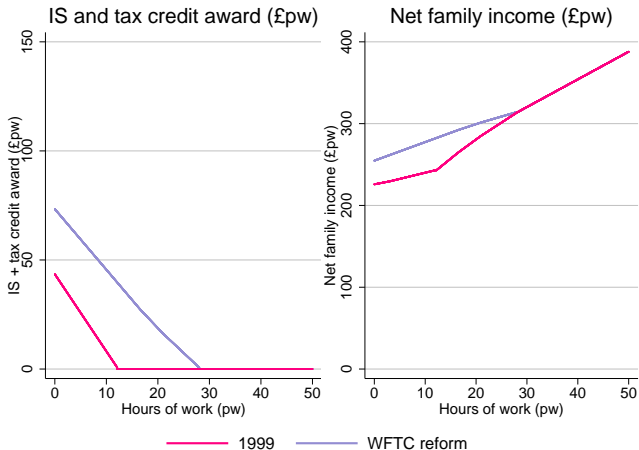
- Focus on a specific reform - **Working Families Tax Credit (WFTC) and Income Support (IS)** in 1999/2000
- This involved an **increase in the generosity of the welfare and earned income tax credit system** for families with children
- Motivation for these policies: incentivising women into work, even when they have young children, **helps preserving labour market attachment and reducing skill depreciation**
- Peculiarity of the UK tax-credit system: **minimum hours eligibility rules** focus incentives on part-time work

The UK (WFTC) Tax Credit and IS Reform

IS and Tax credit award for lone parent with 1 child

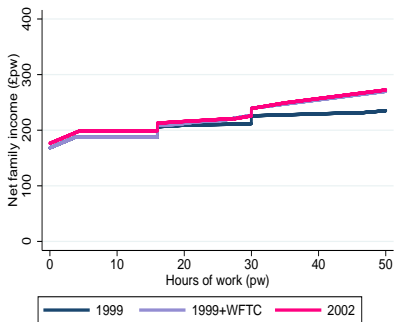


The budget constraint for second-earner parents



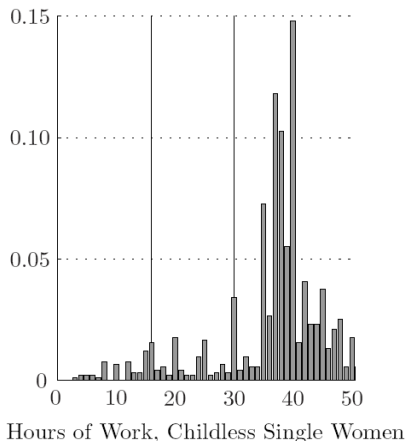
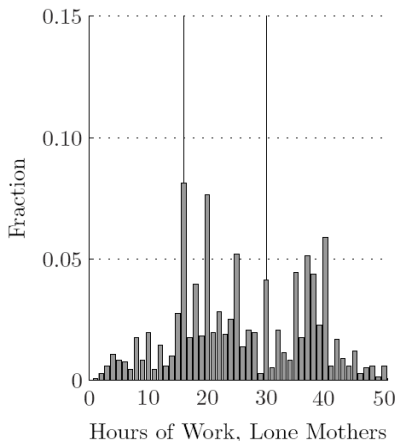
Budget constraints for women in rented accommodation

Lone mothers



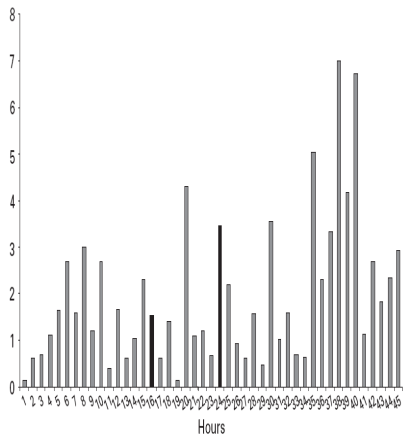
Do the hours rules impact on observed behaviour?

The Distribution of Weekly Hours of Work for Low Education Single Women with and without Children in the 1993 FRS

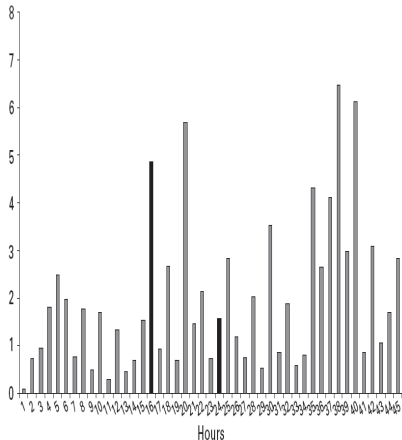


Lone Parent Hours

Before 16 Hour Rule (1990)



After 16 Hour Rule (1993)



The approach we take

- A structural evaluation/estimation approach
 - Use the **time series of tax, tax credit, welfare benefit and tuition reforms for new cohorts of women** over a period of 18 years to identify parameters
 - Condition on **life-history of family background variables**
- Comparing with Diff-in-Diff/quasi-experimental contrasts where possible

What we find

- **Incentive effects:** labour supply elasticities vary systematically by education group, family type and age
- **Experience matters:** but only for those with more than basic formal education, especially in full-time employment
- **Part-time wage penalty:** experience effects can explain the part-time penalty in female wages
- **Education choices:** there is a small but important impact of tax policy reforms on education choices
- **Previous WFTC/IS policy reform evaluations:** the results can explain why previous evaluations for low educated women provided a relatively accurate prediction of the 'shorter-run' impact of these policy reforms

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- **Impact of in-work credits:** Eissa and Liebman (1996), Eissa and Hoynes (1998), Hotz and Scholz (2003) revise the literature for the US, Card and Robins (2005) and Card and Hyslop (2005) look at the Canadian SSP, Blundell and Hoynes (2004) and Brewer, Duncan Shepherd and Suarez (2006) assess the UK reform
- **Labour supply and taxes:** Saez (2002), Keane and Moffitt(1995), Blundell, Duncan and Meghir (1998) among many others
- **Female labour supply and gender differentials:** Blau and Kahn (1997, 2000), Altonji and Blank (1999), Goldin (2006, 2014), Adda, Dustmann and Stevens (2011)
- **Female labour supply over the life-cycle:** Heckman and MaCurdy (1980), Eckstein and Wolpin (1989)
- **Education, work experience and human capital:** Shaw (1989), Heckman, Lochner and Taber (1998), Keane and Wolpin (2007)

Model: female life-cycle

Empirical dynamic life-cycle model of labour supply and human capital accumulation

Life in three stages: uncertainty and credit constraints

- Education 's=0,1,2': levels chosen sequentially up to age 18/21
 - secondary (16), further/high school (18), higher (21)
- Working life
 - consumption c and asset a accumulation
 - labour supply l (0 hours, part-time and full-time)
 - accumulation of experience e determines wages
 - partnering and childbearing are exogenous but stochastic
 - women account for the implications of their choices on marriage and fertility
- Retirement: pension incomes take effect exogenously at age 60

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Model: female earnings

Wage equation for individual i , age t , in each birth cohort;
with school level s , experience e , labour supply l

$$\ln w_{sit} = \ln W_{si} + \gamma_s \ln(e_{sit} + 1) + v_{sit} + \xi_{sit}$$

$$v_{sit} = \rho_s v_{sit-1} + \mu_{sit}$$

$$e_{sit} = e_{sit-1}(1 - \delta_s) + g_s(l_{sit})$$

- $g(l_{sit})$ set to unity for full-time, part-time is estimated
- persistent shocks - distinguish heterogeneity from state dependence (experience effects)
- ξ_{sit} is a transitory shock/measurement error
- correlation of initial shock with preferences
- concave profile of experience effects
- depreciation of human capital - cost of not working

- Men log wages in couples

$$\begin{aligned}\ln w_{s^m it}^m &= \ln W_{s^m it}^m + \gamma_{s^m}^m \ln(t - 18) + v_{s^m it}^m + \xi_{it}^m \\ v_{s^m it}^m &= \rho_{s^m}^m v_{s^m it-1}^m + \mu_{s^m it}^m\end{aligned}$$

- conditional on education, the spouses' productivity processes are independent
 - in couples, female labour supply acts partly to insure shocks in other sources of income
- Public transfers: detailed microsimulation model of UK tax and benefit system (FORTAX)
 - Taxes: income tax, NI, council tax
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Model: post education optimisation problem

Annual **employment and consumption** are chosen over the life-cycle to maximise

$$E_t \left[\sum_{\tau=t}^T \beta^{\tau-t} \frac{(c_{i\tau}/n_{i\tau})^\eta}{\eta} \exp(f(l_{i\tau}, l_{i\tau}^m, X_{i\tau}) + \theta_i l_{i\tau}) \middle| X_{it} \right]$$

- subject to the dynamics of wages, experience, other income and family as described
- plus the budget constraint

$$\begin{aligned} a_{it+1} &= (1+r)a_{it} + l_{it} w_{sit} + d_{it}^m l_{it}^m w_{it}^m - T(X_{it}, l_{it}, l_{it}^m) - CC_t(t_{it}^k, l_{it}, l_{it}^m, X_{it}) - c_{it} \\ a_{it+1} &\geq 0 \end{aligned}$$

Education decisions are taken when the individual is 16

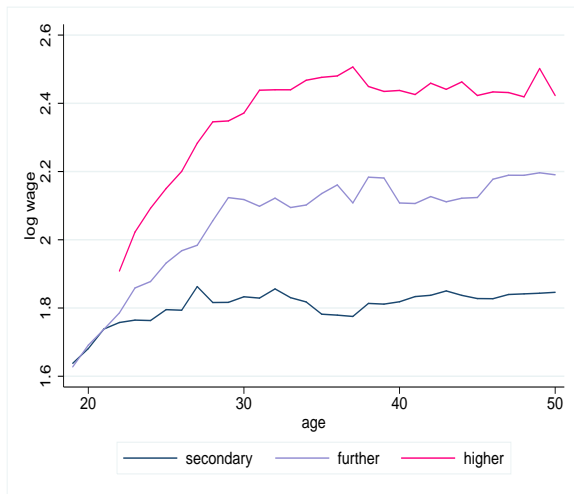
- Heterogeneous and uncertain returns depend on future earnings and family composition
- Allow for borrowing constraints, tuition costs and student loans
- Condition on family background variables at age 16
 - parental education and occupation, financial circumstances, siblings, region of birth
 - these may affect education and earnings capacity later in life

Data: British Household Panel Survey (BHPS)

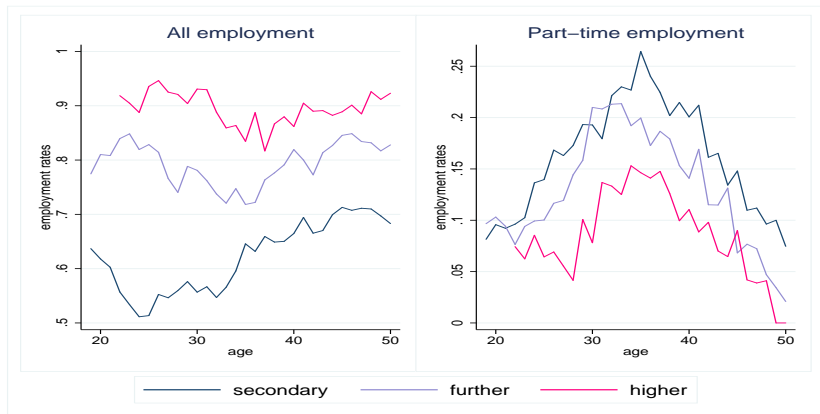
Unbalanced panel of 5,200 working age females over 18 waves, 1991-2008

- Measures education, labour market outcomes, childcare, detailed demographics, (limited) assets information
- **Linked life histories** capture education choices at age 16: detailed family background measures include parental education, number of siblings, sibling order, whether lived with parents when aged 16, books at home as a child, etc
- Some women observed living with parents as children and followed into working life: parents are panel members themselves
- **Different cohorts observed entering the labour market under different tax regimes**

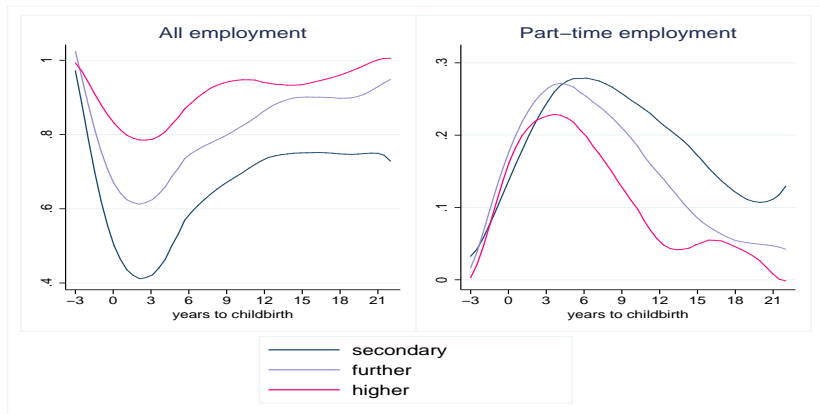
Wage Profiles by Education by Age



Employment over the life-cycle



Employment of mothers

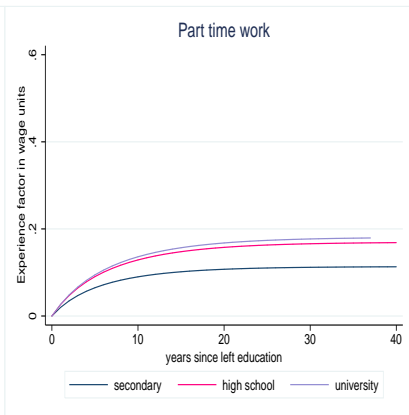
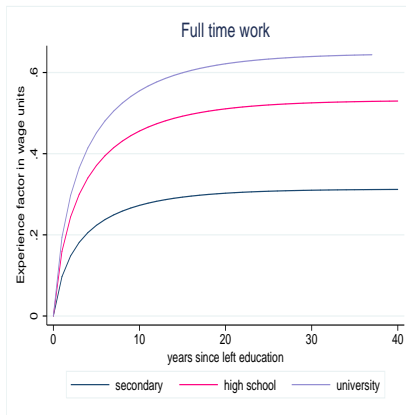


- Estimate processes for **male earnings and employment, family dynamics and childcare costs**, 'outside' the model
- **Method of Simulated Moments** for the remaining parameters
 - Matched moments include employment rates by family type, employment and hours transition rates, means, variances and percentiles of earnings distribution, earnings at entrance in working life, change in earnings by past hours, education...
- Identification relies on rich longitudinal data for a **long period with many and substantive tax and welfare reforms**
 - Simulate individuals under the sequence of tax regimes faced by their cohort
 - Match quasi-experimental effects of reforms
 - Explore differential responses by background parental information and family circumstances

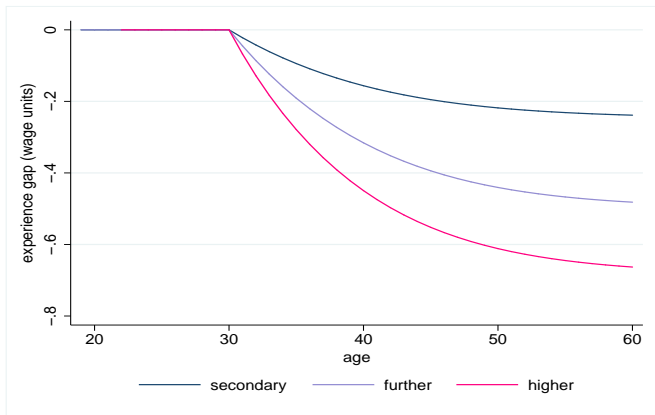
Female wage equation estimates

	Secondary	Further	Higher
wage rate (0 experience)	4.5 (.01)	4.9 (.02)	6.3 (.03)
returns to experience	.14 (.01)	.23 (.01)	.28 (.01)
autocorrelation coef	.92 (.00)	.95 (.00)	.89 (.01)
se innovation	.13 (.00)	.13 (.00)	.12 (.01)
initial prod	.10 (.01)	.10 (.01)	.20 (.01)
initial productivity: se	.30 (.01)	.26 (.01)	.26 (.03)
depreciation rate	.12 (.02)	.11 (.01)	.11 (.03)
accumulation of HC in PTE	.15 (.01)	.12 (.01)	.10 (.01)

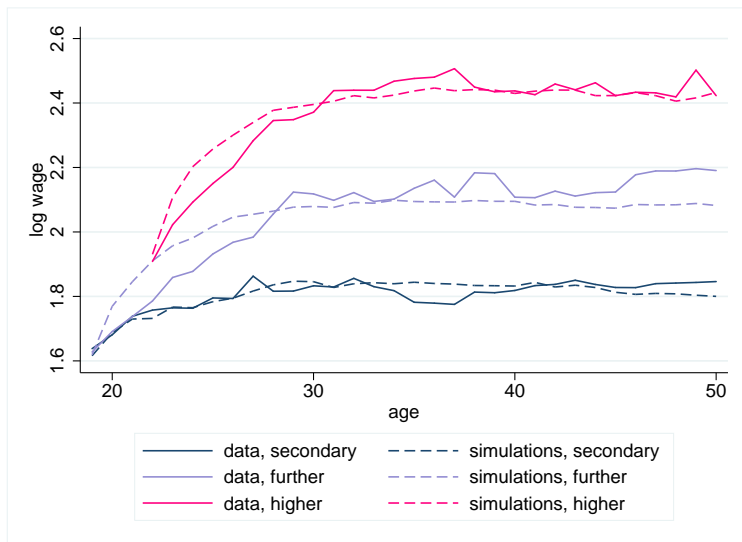
Experience Effects



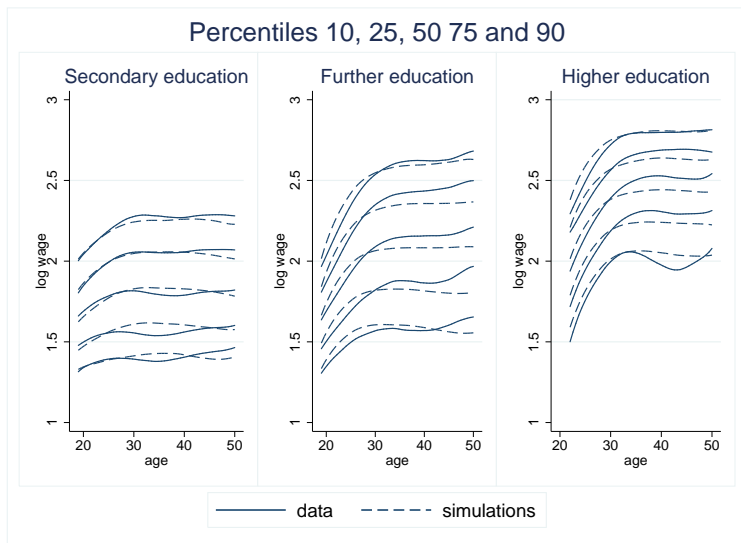
Part-time Experience Penalty



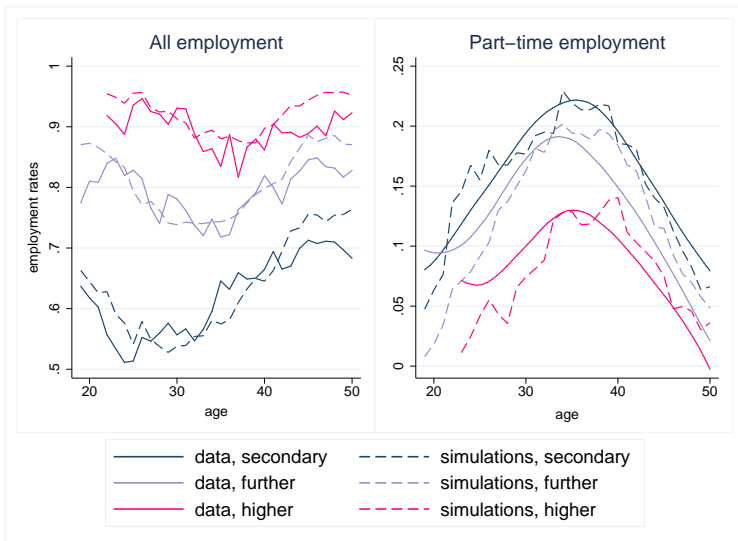
Life-cycle profiles of wages



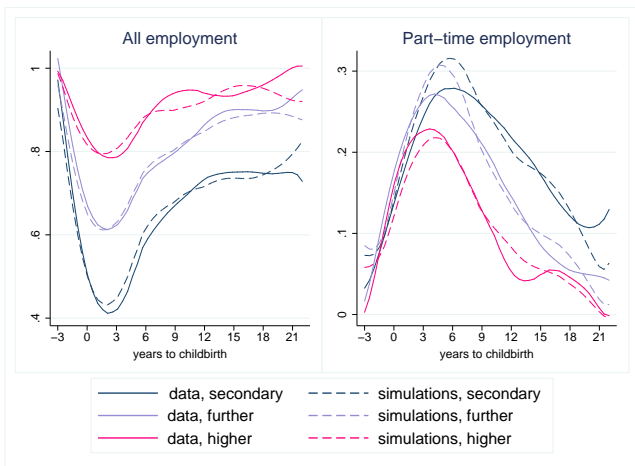
Distribution of female wage rates by age



Employment over life-cycle



Employment of mothers



WFTC and IS Reforms for Lone Mothers

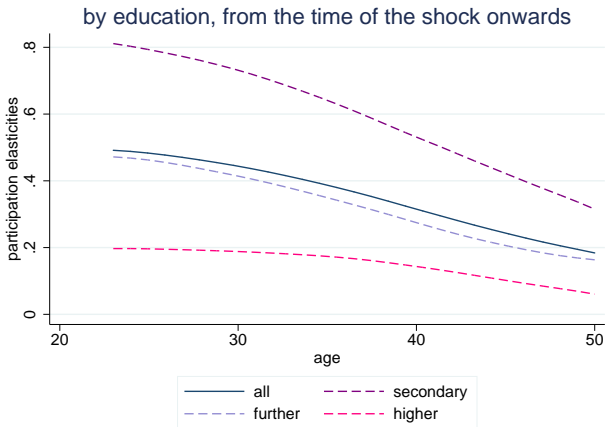
% Point employment impact and matched diff-in-diff for low educated lone parents:

1999 - 2002	Average Impact
Structural estimate	+3.9
Matched Diff-in-diff	+3.6 (0.5)

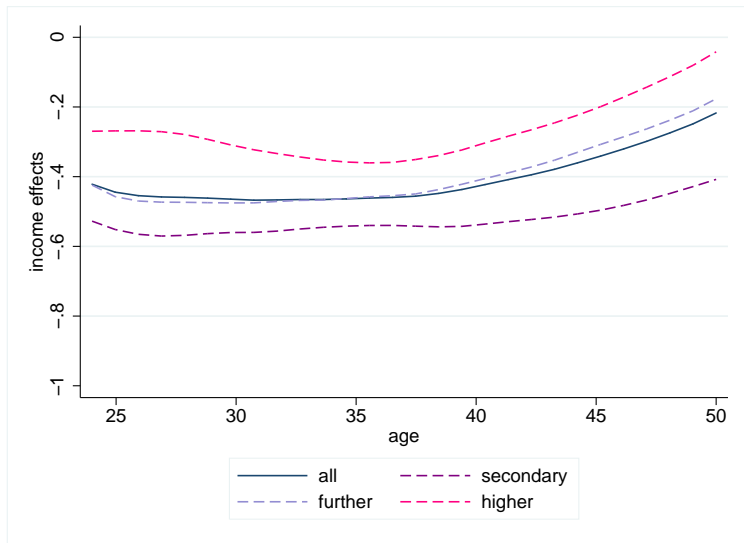
Overall Marshallian Labour Supply Elasticities

	extensive	intensive
All	0.50	0.38
Secondary	0.93	0.63
Further	0.46	0.37
University	0.18	0.18
Lone mother	1.93	0.78
Mothers in couples	0.51	0.50
Childless women	0.26	0.20

Marshallian Elasticities by Age: Extensive



Income Effects at Extensive Margin by Age



Results: Impact of WFTC & Child IS Reform

Revenue Neutral Reform, basic tax rate adjustment

I. Impact on Employment of Mothers:

No Education Choice						
	Single Mother			Couple with Kids		
	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
employment	3.8	3.5	1.5	-6.0	-3.5	-1.3

II. Impact on Education Shares:

	Sec.	Fur.	Uni.
1999	30.4	47.5	22.1
2002	32.3	47.1	20.6

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Revenue Neutral Reform (basic tax rate adjustment):

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	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
employment	3.8	3.5	1.5	-6.0	-4.4	-1.7

With Education Choice						
	Single Mother			Couple with Kids		
	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
employment	3.8	3.0	-3.6	-6.1	-4.7	-3.2

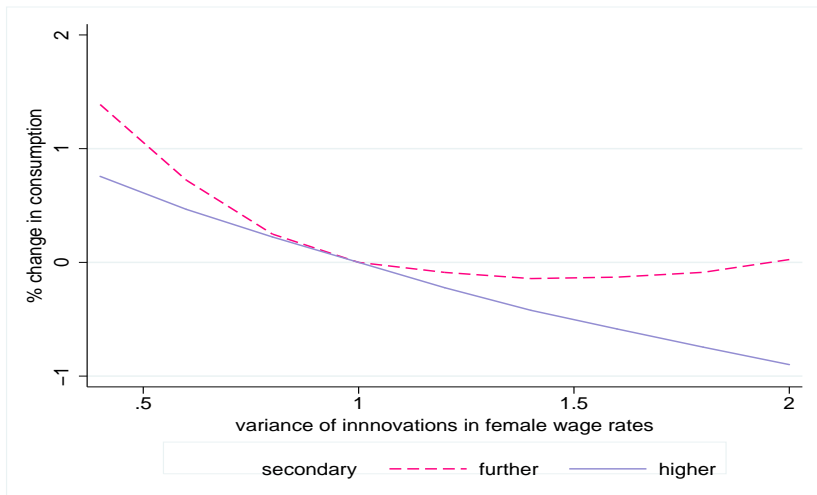
Classified according to original education choice.

Impact on Welfare and Income

WFTC and IS	pre education choice			post education choice		
	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
Welfare ($\Delta\%$)	2.06	.53	-1.0	1.69	-.32	-1.66
Lifetime Income ($\Delta\%$)	.63	-.85	-1.7	.11	-1.76	-4.15

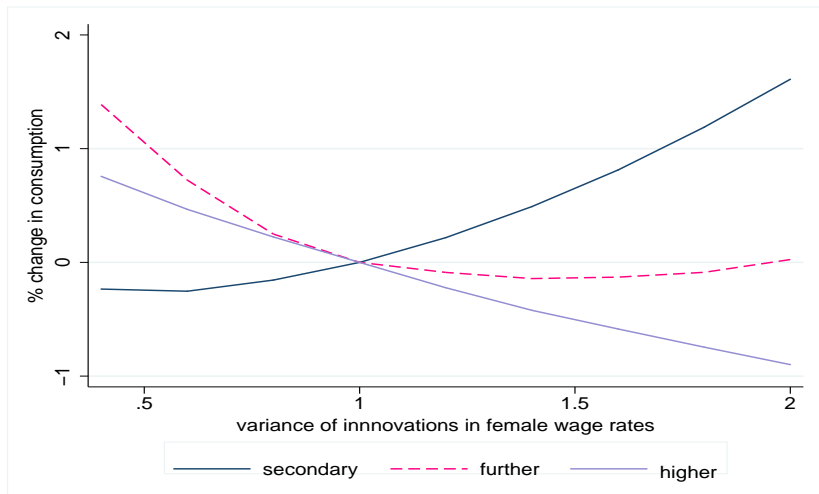
Risk Aversion and the Value of Insurance

Willingness to pay in consumption



Risk Aversion and the Value of Insurance

Willingness to pay in consumption



Program Preference - Insurance versus Incentives

No Education Adjustment

		Pre-reform education choice by baseline educ			
		sec	further	higher	all
		(1)	(2)	(3)	(4)
Panel A: Adjustment in basic tax rate					
(1)	Pre-Tax Earnings	.29	.21	.09	.20
(3)	Welfare (post-ed)	.40	.94	.77	.71
Panel B: Adjustment in tax credits maximum award					
(5)	Pre-Tax Earnings	1.32	-.01	-.18	.37
(7)	Welfare (post-ed)	1.58	1.30	.21	1.03
Panel C: Adjustment in IS award					
(9)	Pre-Tax Earnings	-2.49	-1.34	-.38	-1.40
(11)	Welfare (post-ed)	.90	.70	.09	.56

- Welfare Effects of increasing Expenditure by 0.5% of Earnings
- Tax rate decreases by 0.93pp or Max Tax Credit increases by 22 pounds or IS increases by 4.2 pounds

Program Preference - Insurance versus Incentives

With Education Adjustment

		Post-reform education choice by baseline educ			
		sec	further	higher	all
		(1)	(2)	(3)	(4)
Panel A: Adjustment in basic tax rate					
(1)	Earnings	.63	.23	.10	.32
(3)	Welfare (post-ed)	.42	.98	.81	.74
(4)	Welfare (pre-ed)				.68
Panel B: Adjustment in tax credits maximum award					
(5)	Earnings	.95	-.13	-1.04	-.07
(7)	Welfare (post-ed)	1.11	.91	.15	.72
(8)	Welfare (pre-ed)				.78
Panel C: Adjustment in IS award					
(9)	Earnings	-2.05	-1.16	-.89	-1.36
(11)	Welfare (post-ed)	.72	.55	.07	.45
(12)	Welfare (pre-ed)				.46

- Tax rate decreases by 0.97pp or Max Tax Credit increases by 16.6 pounds or increases IS by 3.4 pounds

Summary and Discussion

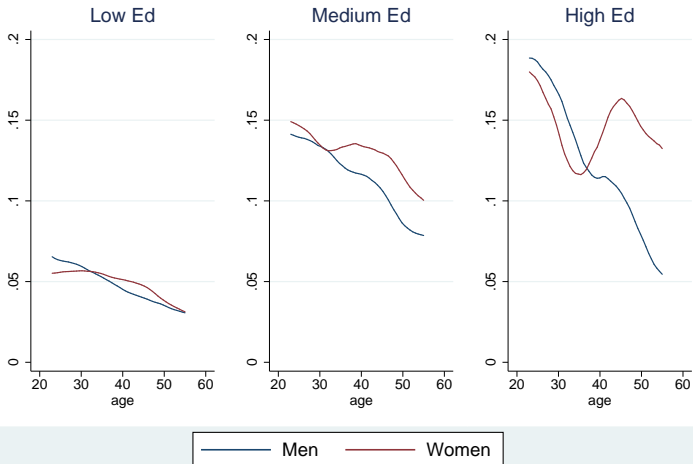
- Experience effects are lower for the lower educated and for those in part-time work, explaining the part-time penalty.
- Women with low labour market attachment have more elastic labour supply at younger ages and large income responses.
- There is a small effect of tax credits on education choice, with some women obtaining less education, and attenuating the employment gains of the reform.
- The insurance value of the welfare program is substantial, particularly for the lowest education/skill groups.
- The results can explain previous structural and quasi-experimental results for the WFTC/IS, and similar, reforms.

Next steps:

- frictions
- sector choice and training
- health, cognition and human capital
- family dynamics

Training participation rates by age and education

Work-related training participation rates (50h+)



Wage growth for continuously employed women

	Secondary	Further	Higher
intercept	.037 (.003)	.045 (.003)	.050 (.004)
PT work at time $t-1$	-.027 (.005)	-.033 (.005)	-.022 (.010)
training at time $t-1$.026 (.013)	.017 (.007)	.009 (.010)
training in PT work at $t-1$.024 (.029)	-.028 (.017)	-.046 (.031)

Revenue Neutral Reform:

	Sec.	Fur.	Uni.
1999	30.4	47.5	22.1
2002	32.3	47.1	20.6

Estimates: (conditional) preference parameters

	all employment			part-time employment		
	secondary	further	university	secondary	further	university
intercept	0.41 (.00)	0.41 (.00)	0.47 (.01)	-0.15 (.01)	-0.16 (.01)	-0.20 (.02)
children		0.05 (.01)			-0.06 (.01)	
child aged 0-2		0.15 (.01)			-0.05 (.01)	
child aged 3-5		0.07 (.01)			-0.06 (.01)	
child aged 6-10		-0.02 (.01)			0.03 (.01)	
child aged 11-18		-0.07 (.01)			0.06 (.01)	
male		-0.06 (.01)			-0.02 (.02)	
male working		-0.17 (.01)			0.09 (.01)	