

Female Labour Supply, Human Capital and Welfare Reform

Richard Blundell, Monica Costa-Dias, Costas Meghir and
Jonathan Shaw

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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

- 1 How should **labour supply, work experience dynamics and education decisions** be accounted for in the evaluation of tax and welfare reform?
 - Focus on in-work benefits targetted at low wage families
- 2 To what extent do **dynamic 'longer-run' issues** change our view of the impact and of the evaluation of these policies directed at low income workers?

Underlying questions that must be addressed:

- How are education and working experience related and how do they affect wages?
- How do these aspects of human capital interact with labour supply decisions?

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The approach we take

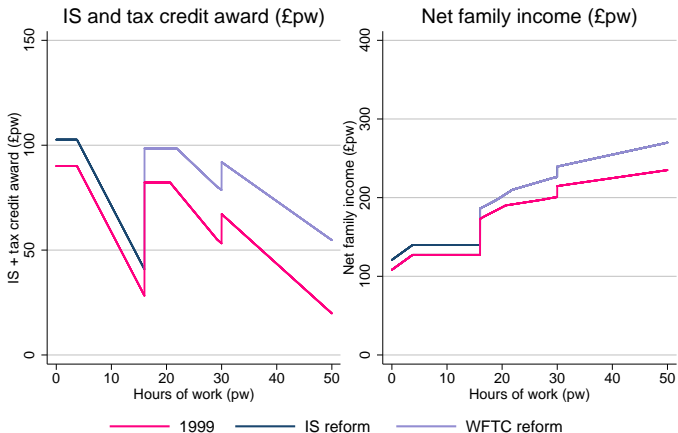
- A structural evaluation/estimation approach
 - Use the time series of tax, tax credit and welfare benefit reforms for new cohorts of women to identify parameters
 - Condition on life-history family background variables
- Comparing with Diff-in-Diff/quasi-experimental contrasts where possible

Tax and Welfare Reform in the UK

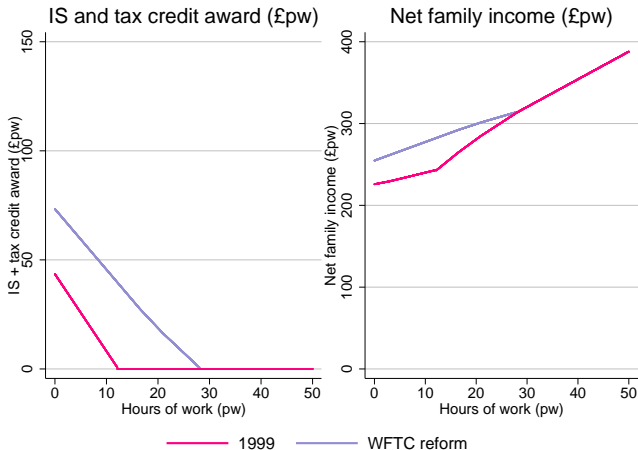
- Focus on the **Working Families Tax Credit (WFTC)** and **Income Support (IS)** reforms of 1999/2000
 - Increase in the generosity of the welfare and earned income tax credit system for families with children
- Motivation for these policies: by incentivising women, particularly mothers, into work helps **preserving labour market attachment and reducing skill depreciation**
- Hours rules incentivises part-time work

The UK (WFTC) Tax Credit and IS Reform

IS and Tax credit award for lone parent with 1 child

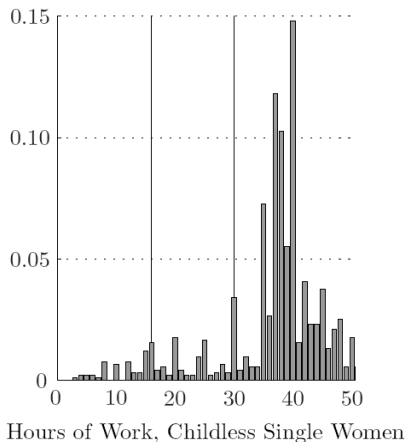
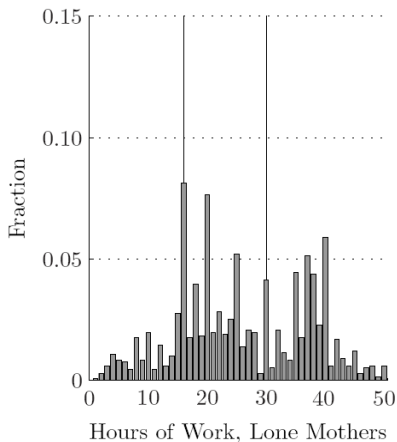


The budget constraint for second-earner parents



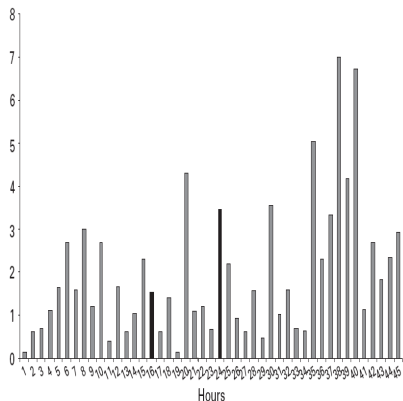
Do the hours rules impact on observed behaviour?

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

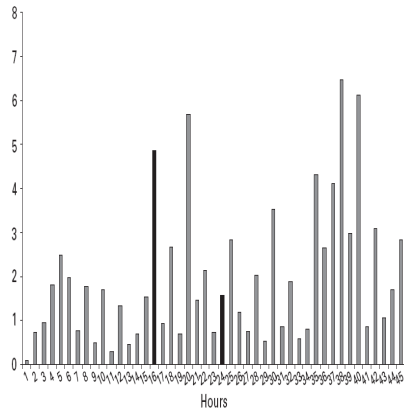


Lone Parent Hours

Before 16 Hour Rule (1990)



After 16 hour rule (1993)



What we find

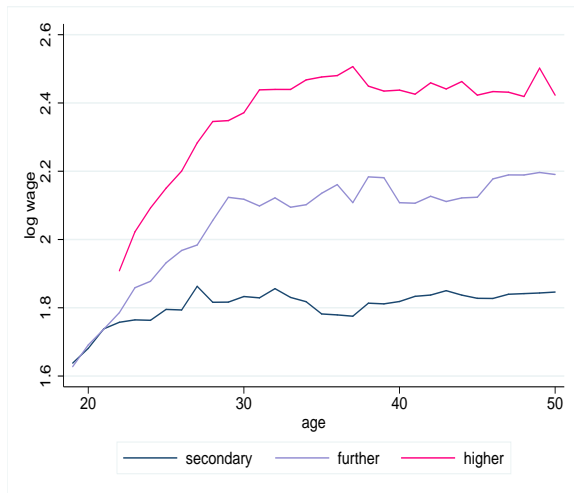
- **Incentive effects:** labour supply elasticities are found to vary systematically by education group, family type and age
- **Experience matters:** but only for those with more than basic formal education, and especially for those in full-time employment
- **Part-time wage penalty:** experience effects 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 our previous evaluations for low educated women provided a relatively accurate prediction of the 'shorter-run' impact of these policy reforms

- **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)

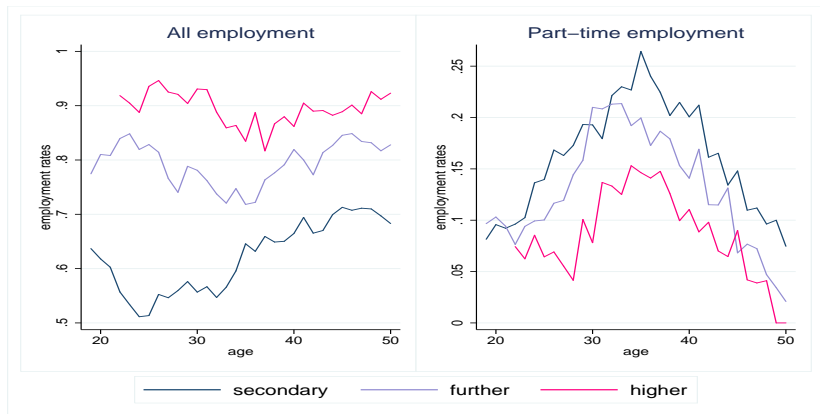
Data: British Household Panel Survey (BHPS)

- Unbalanced panel of almost 4,000 women over 18 waves, 1991-2008
- Measures education, labour market outcomes, work-related and not-work-related training, childcare, detailed demographics, (limited) assets information
- **Linked life histories** capture choices at age 16: detailed family background measures include parental education, number of siblings, sibling order, whether lived with parents, 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**

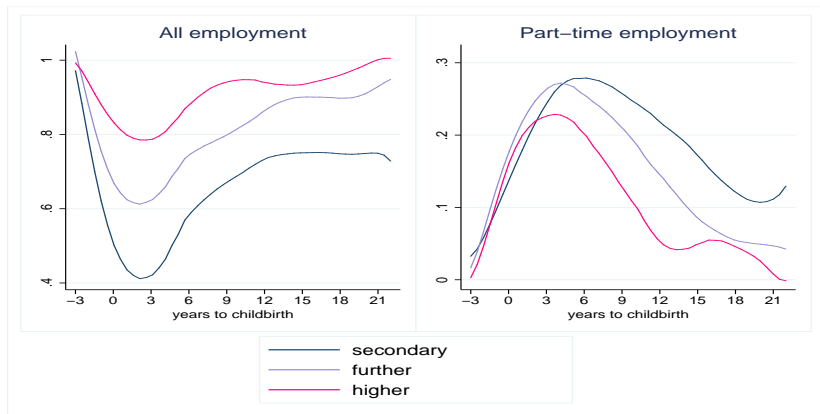
Wage Profiles by Education by Age



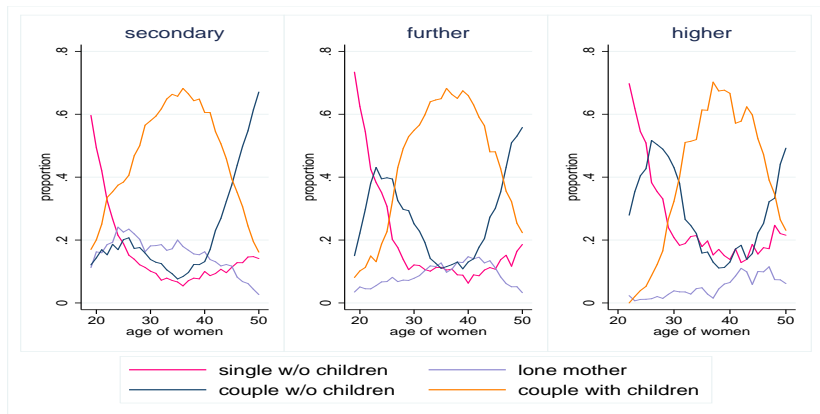
Employment over the life-cycle



Employment of mothers



Family Composition by Age



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

Life in three stages, decisions under uncertainty and credit constraints

- **Education** 's=0,1,2': three levels chosen sequentially up to age 18/21
 - secondary (GCSE, 16), further (A-levels or vocational, 18), higher (university, 21)
- **Working life:**
 - consumption c and asset a accumulation
 - labour supply l (0 hours, part-time and full-time)
 - accumulated experience e determines wages
 - marriage and fertility are exogenous but stochastic
- **Retirement:** pension incomes take effect exogenously at age 60

Wage equation for individual i at age t
school level s , experience e , labour supply l

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

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

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

- $g(l_{sit})$ set to unity for full-time, part-time is estimated
- persistence of 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

Fertility and marriage behavior are 'weakly exogenous' but women account for the implications of their choices on marriage and fertility

- Children

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

- Partner:

- arrival rate depends on female education and age
- characterised by education, employment status, prior marriage, children and earnings
- departure probability depends on female age, presence of child and male education

Male earnings

- Male employment depends on his education and on whether he worked in the previous period or not
- Wage equation similar to that for women

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

Public transfers

- Microsimulation 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

Model: post education optimisation problem

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

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

- subject to the dynamics of wages, experience, other income and family composition
- and the budget constraint

$$a_{it+1} = (1+r)a_{it} + l_{it} w_{sit} + d_{it}^m l_{it}^m w_{it}^m - T(X_{it}, l_{it}, l_{it}^m) - CC_t(t_{it}^k, l_{it}, l_{it}^m, X_{it}) - c_{it}$$

$$a_{it+1} \geq 0$$

Education decisions are taken when the individual is 16

- Heterogeneous and uncertain returns depend on future earnings and family composition
- Costs correlated with initial level of productivity
- Allow for borrowing constraints, tuition costs and student loans
- Condition on family background variables at age 16
 - parental education/occupation, financial circumstances, siblings or region of birth
 - these may affect education and earnings capacity

$$V^s = x' \gamma_s + EV^s + e_s \text{ for } s = \text{sec}, \text{high}, \text{coll}$$
$$s = \text{argmax}\{V^{\text{sec}}, V^{\text{high}}, V^{\text{col}}\}$$

x includes:

- family background (two principal components) that also enter preferences
- earnings of parents and whether parents present when child was 16

| | sec | high | college |
|-------------------|----------|--------|---------|
| factor 1 | -.072** | .008 | .064*** |
| factor 2 | -.030** | -.048* | .078*** |
| factor 1 post 99 | .016 | -.018 | .002 |
| factor 2 post 99 | .031* | .012 | -.043** |
| parental earnings | -.029*** | -.003 | .025*** |

- Two factors drawn from characteristics of the parental home when the respondent was 16
- Factors also enter wages and preferences for work
- Parental earnings act as an exclusion restriction

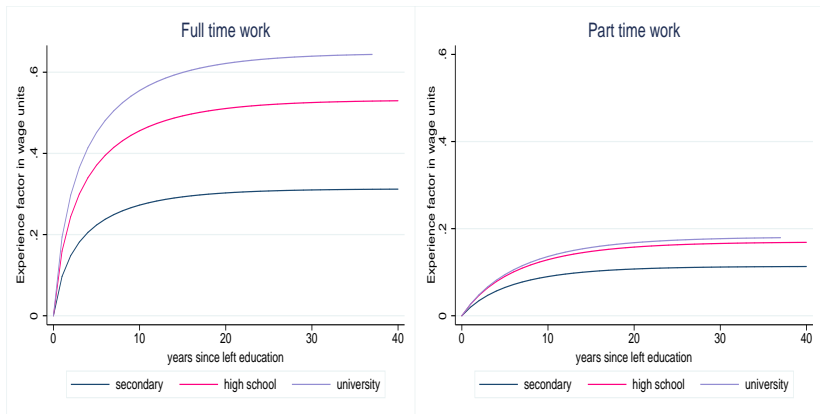
Structural Estimation

- Estimate processes for **male earnings and employment, family dynamics and childcare costs**, recursively 'outside' the model.
- **Method of Simulated Moments** for the remaining parameters
 - Matched moments include employment rates, employment and hours transition rates, moments of the distribution of earnings, earnings at entrance in working life, education achievement, all by education, family composition and background factors
- 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

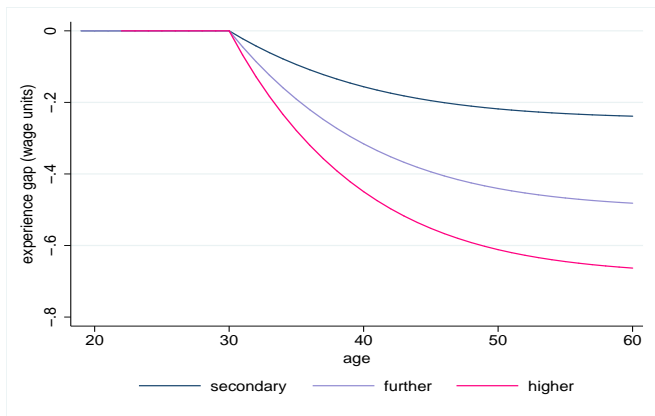
Female wage equation estimates

| | 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) |

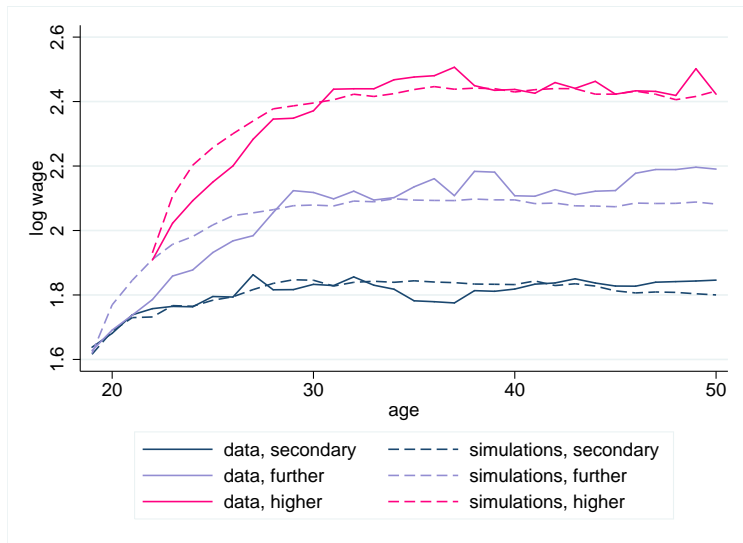
Experience Effects



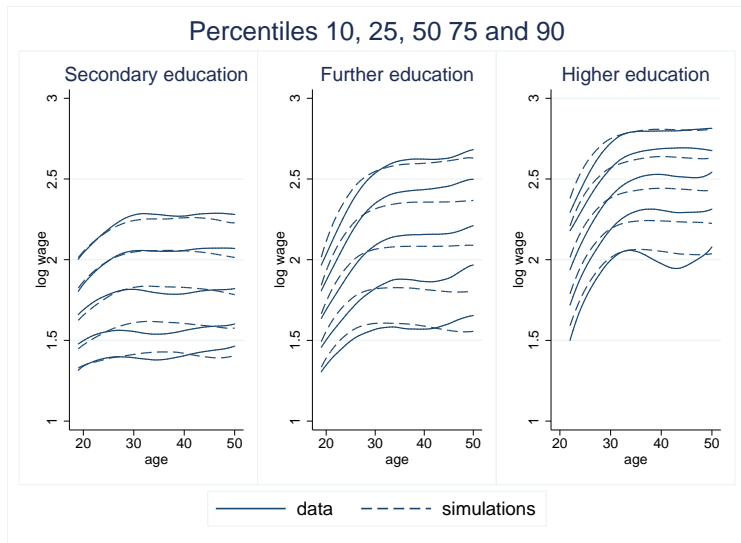
Part-time Experience Penalty



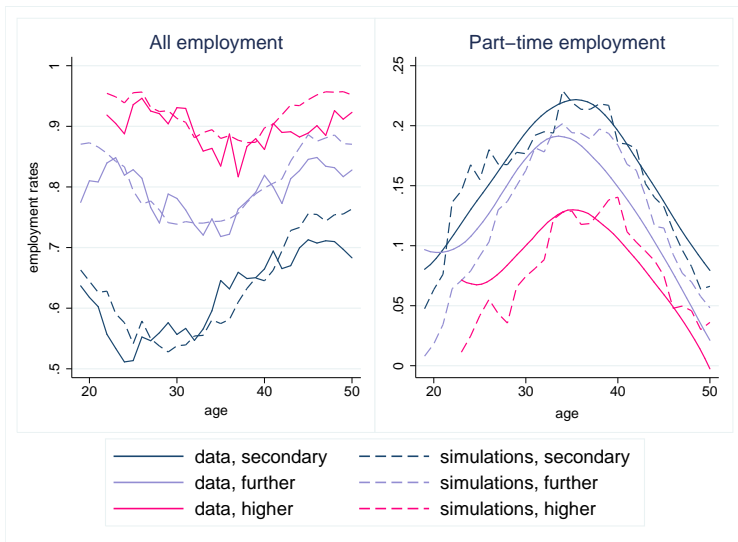
Life-cycle profiles of wages



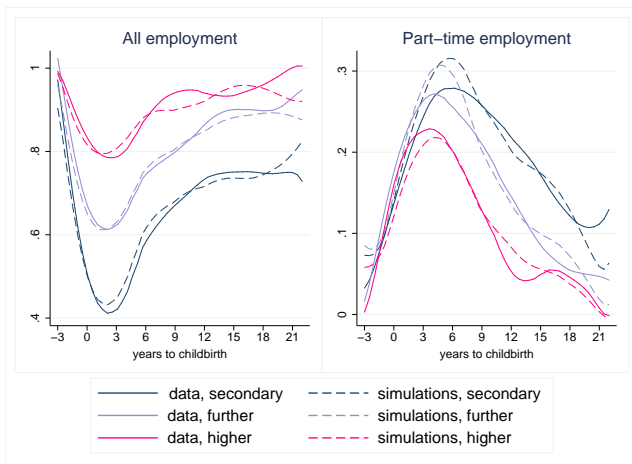
Distribution of female wage rates by age



Employment over life-cycle



Employment of mothers



WFTC and IS Reforms for Lone Mothers

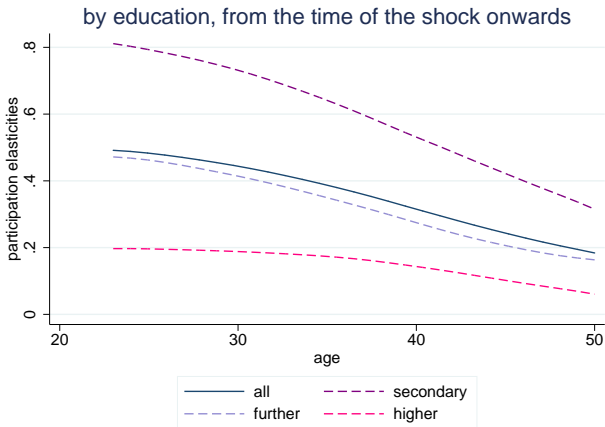
% Point employment impact and matched diff-in-diff for low educated lone parents:

| 1999 - 2002 | Average Impact |
|----------------------|----------------|
| Simulations | +3.9 |
| Matched Diff-in-diff | +3.6 (0.5) |

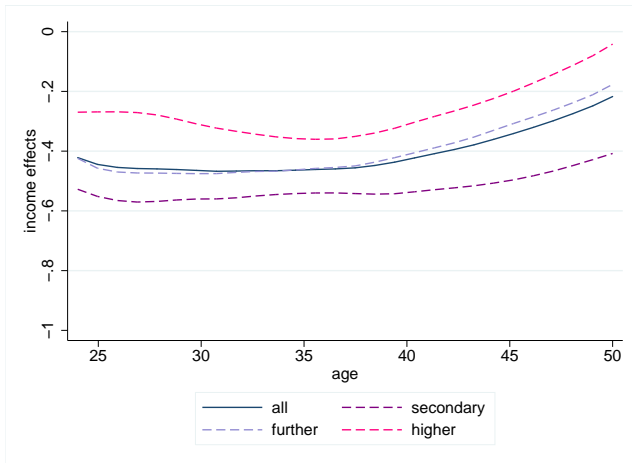
Overall Marshallian Labour Supply Elasticities

| | 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 margin



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 Younger Women:

| 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 |

Revenue Neutral Reform (basic tax rate adjustment):

| No Education Choice | | | | | | |
|---------------------|---------------|------|------|------------------|------|------|
| | Single Mother | | | Couple with Kids | | |
| | 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 |

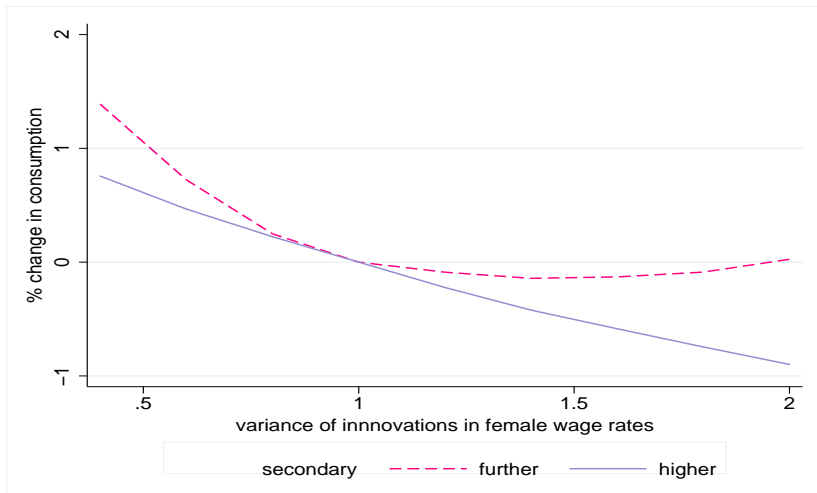
Classified according to original education choice.

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 |

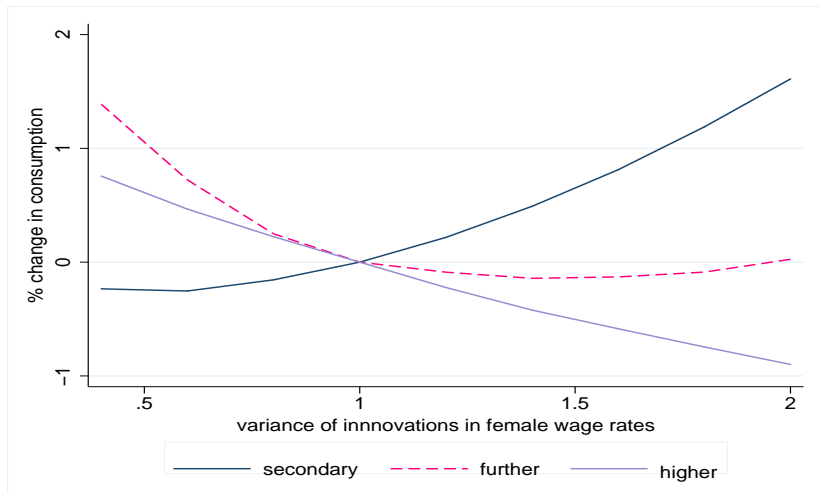
Risk Aversion and the Value of Insurance

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 |

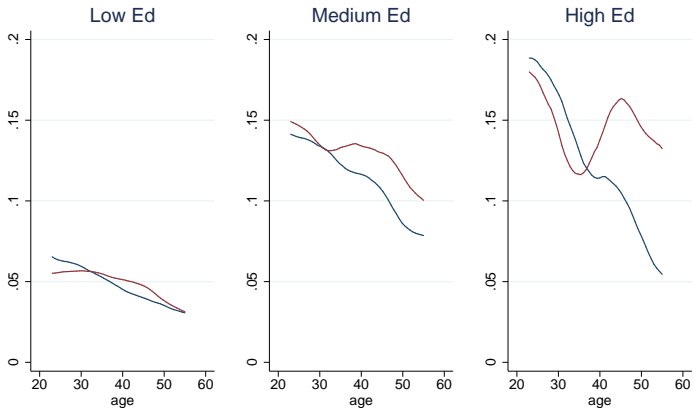
- Tax rate decreases by 0.97pp or Max Tax Credit increases by 16.6 pounds or increases IS by 3.4 pounds

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: sector choice, training, and frictions

Training participation rates by age and education

Work-related training participation rates (50h+)



— Men — Women