Human Capital, Labour Supply and Tax Reform

Richard Blundell (UCL & IFS)
(based on joint work with Monica Costa-Dias (IFS), Costas Meghir (Yale & IFS) and Jonathan Shaw (IFS & UCL)).
Paper and references on my web page.

Dale Mortensen Lecture

SED, Warsaw, June 2015

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- An economist who took theory and data seriously.
- Effortlessly moving between implications for micro and macro behaviour.
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1. How should interactions between education decisions, work experience dynamics and labour supply be accounted for in the evaluation of tax and welfare reform?
2. Especially in the design of transfers to low wage families in the form of 'in-work benefits' or 'earned income tax credits'.
3. To what extent do dynamic issues change our view of the impact and of the evaluation of these policies directed at low income workers?
4. What is the 'insurance value' of redistributive policies of this kind? And how does the trade-off between insurance and incentives play out?

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Human Capital, Labour Supply and Tax Reform

And look forward to some key related developments...

1. Tax design with human capital dynamics: Mirrlees models with persistent wage shocks, heterogeneous endowments, human capital investments and credit constraints.
2. Alternative forms of human capital (on the job): detailed measures of training spells and the 'direct' costs of training.
3. Restrictions and Frictions: layering in arrival rates, layoff rates and restricted choice sets with human capital investments.
4. Human capital and the 'gender gap' in the earnings distribution: experience capital and the part-time 'penalty'.

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Focus here is on the *labor supply, experience and education decisions* of women:

- Labour supply of women has been found to be be more responsive to incentives, especially low wage women with school age children.
- Time 'out of paid work' points towards the potential importance of returns to experience.
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Policy Background

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.
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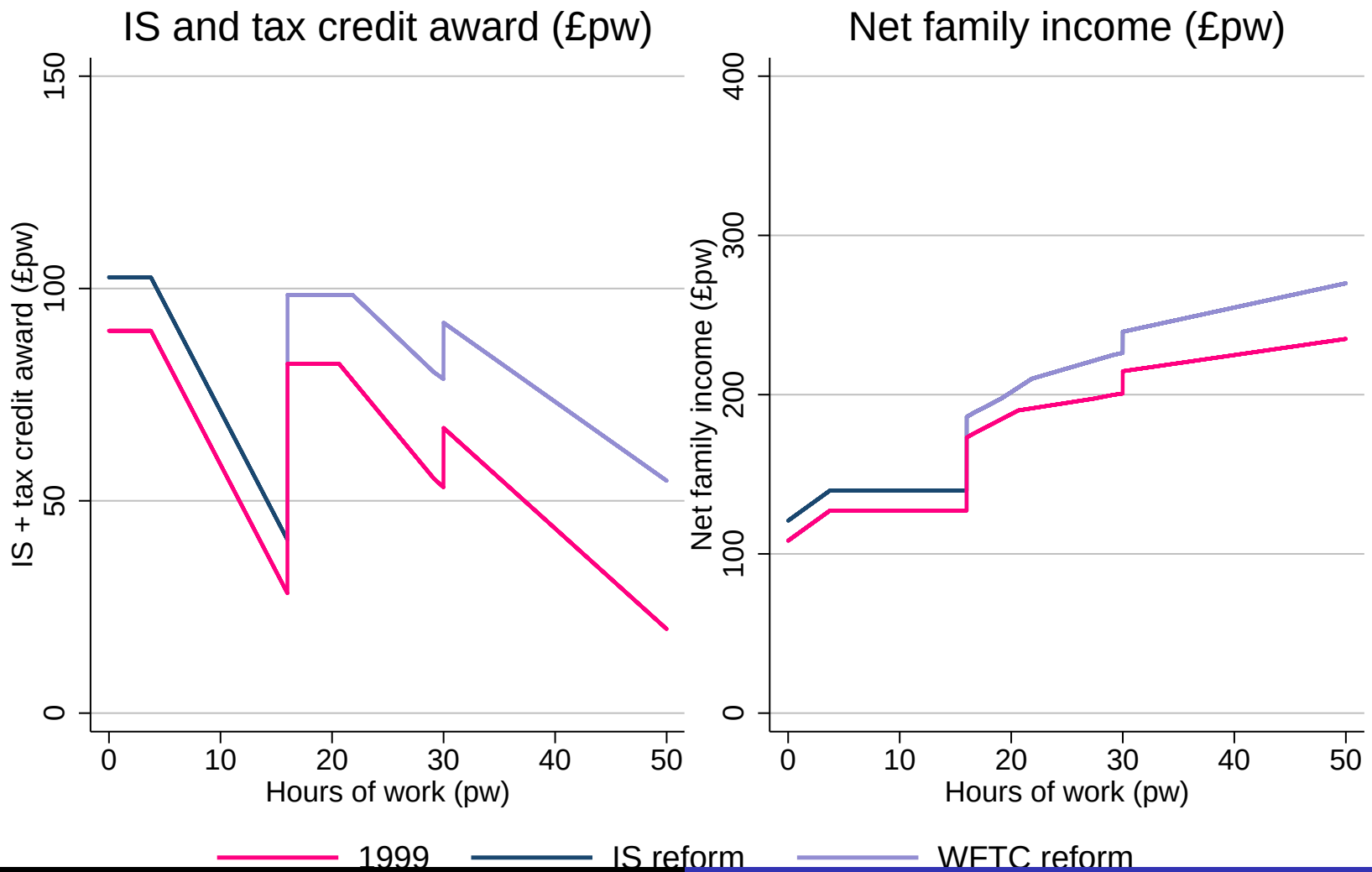
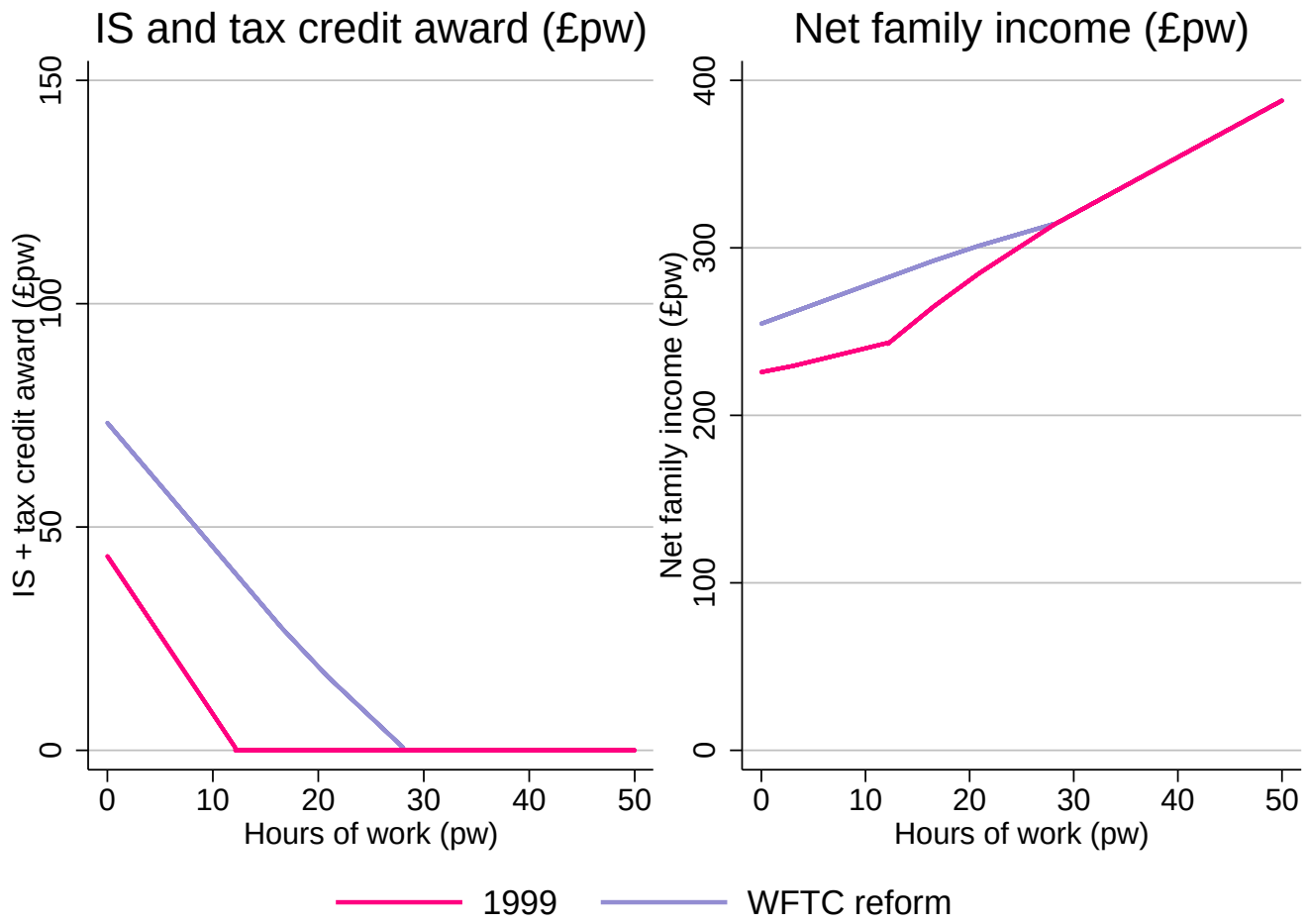
The UK (WFTC) Tax Credit and IS Reform

Figure 1: Income Support and Tax credit award for lone parent with 1 child



Impact on married women in couples

Figure 2: The budget constraint for second-earner parents



Hours rules

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- Do the hours rules impact on observed behaviour?

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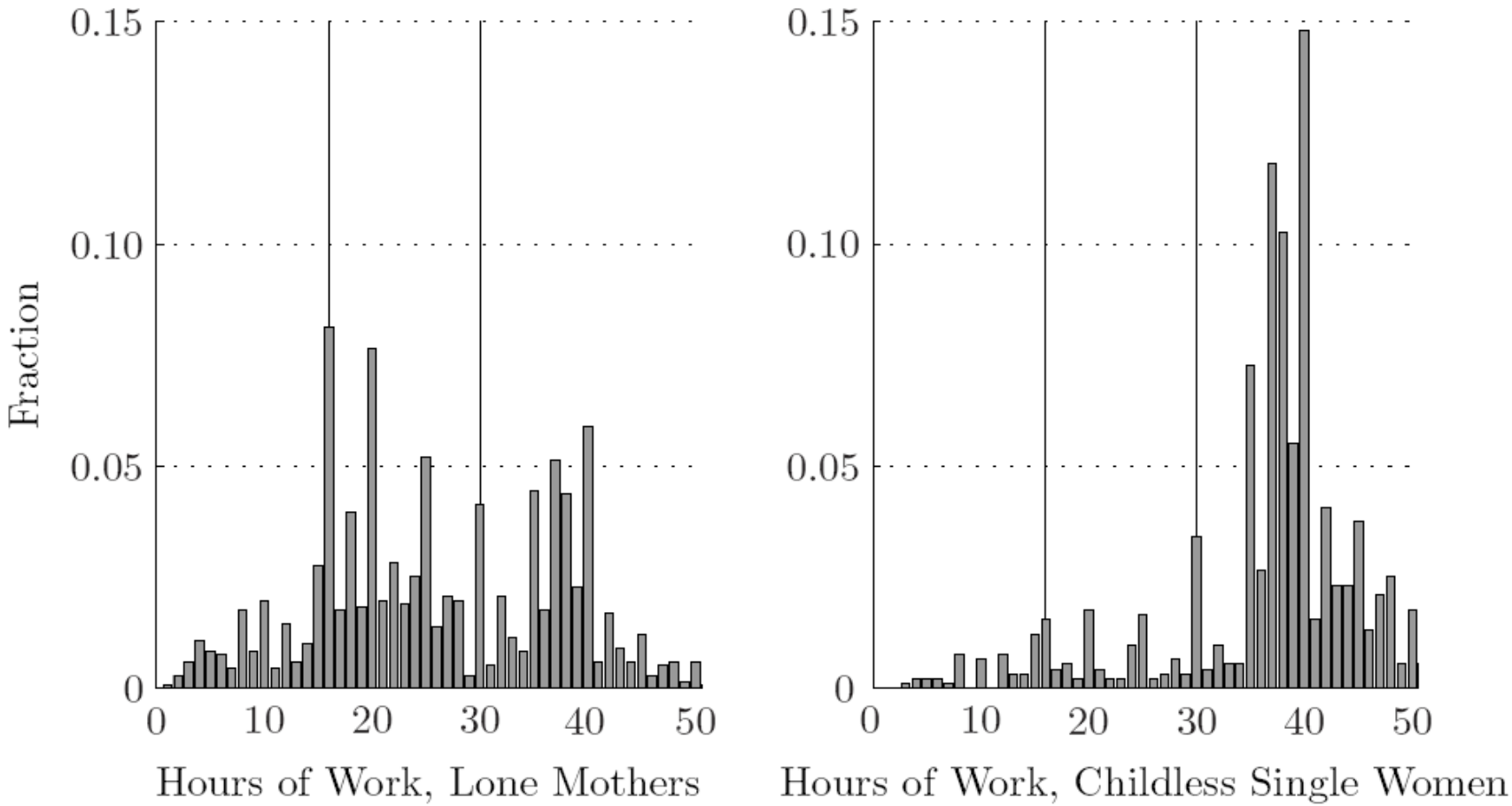
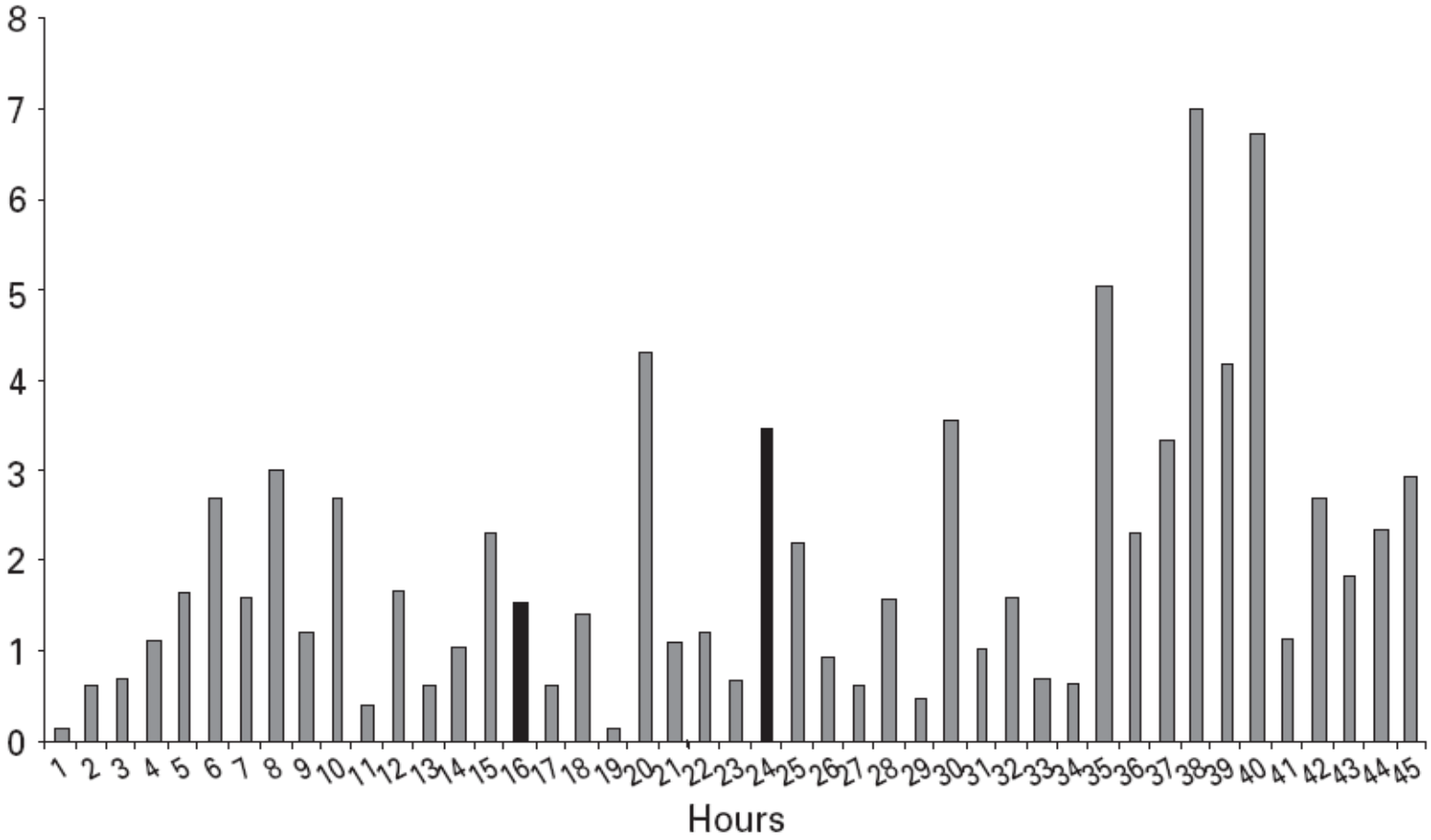
The Distribution of Weekly Hours of Work

Low Education Single Women with and without Children in the 1993 FRS.



Lone Parent Hours

Before 16 Hour Rule (1990)



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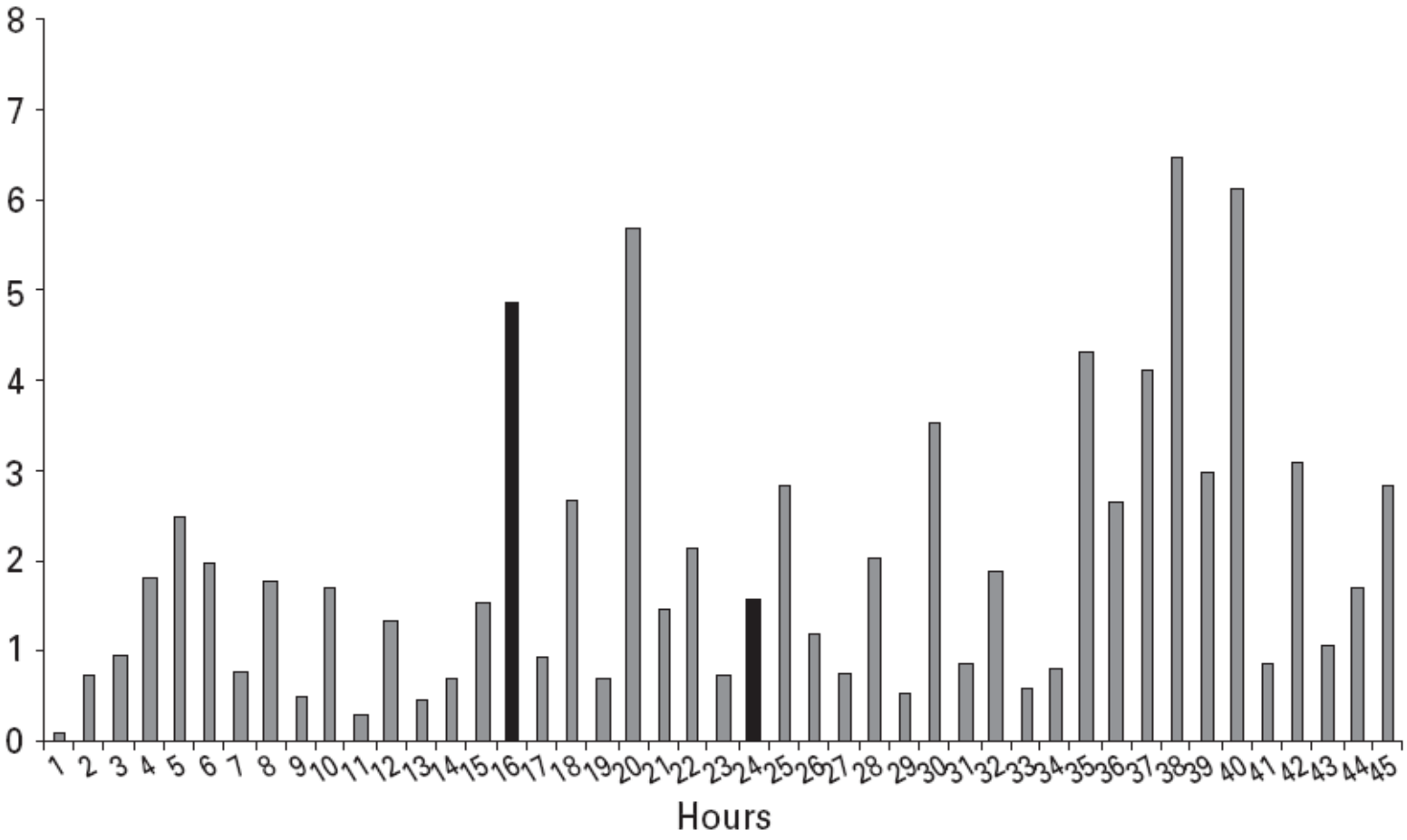

Policy Background

The key question we ask is:

- How do the features of this broad kind of tax, tax-credit and welfare benefit system affect education choices, experience capital accumulation, employment and hours of work over the life-cycle?

The approach we take:

- A structural dynamic approach, using the time series of tax, tax credit, welfare benefit and tuition reforms for new cohorts of women to identify parameters. Conditioning on life-history family background variables.
- Comparing with quasi-experimental contrasts where possible.

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British Household Panel Survey (BHPS)

Unbalanced panel of 4,200 females over 17 waves, 1991-2007

- Measures of education, labour market outcomes, work-related and not-work-related training, childcare, detailed demographics, and assets.

IFS taxben working on every wave:

- Taxes: income tax, NI, council tax, tax credits
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Linked life histories capture choices at age 16: educational qualifications; and detailed background measures, including

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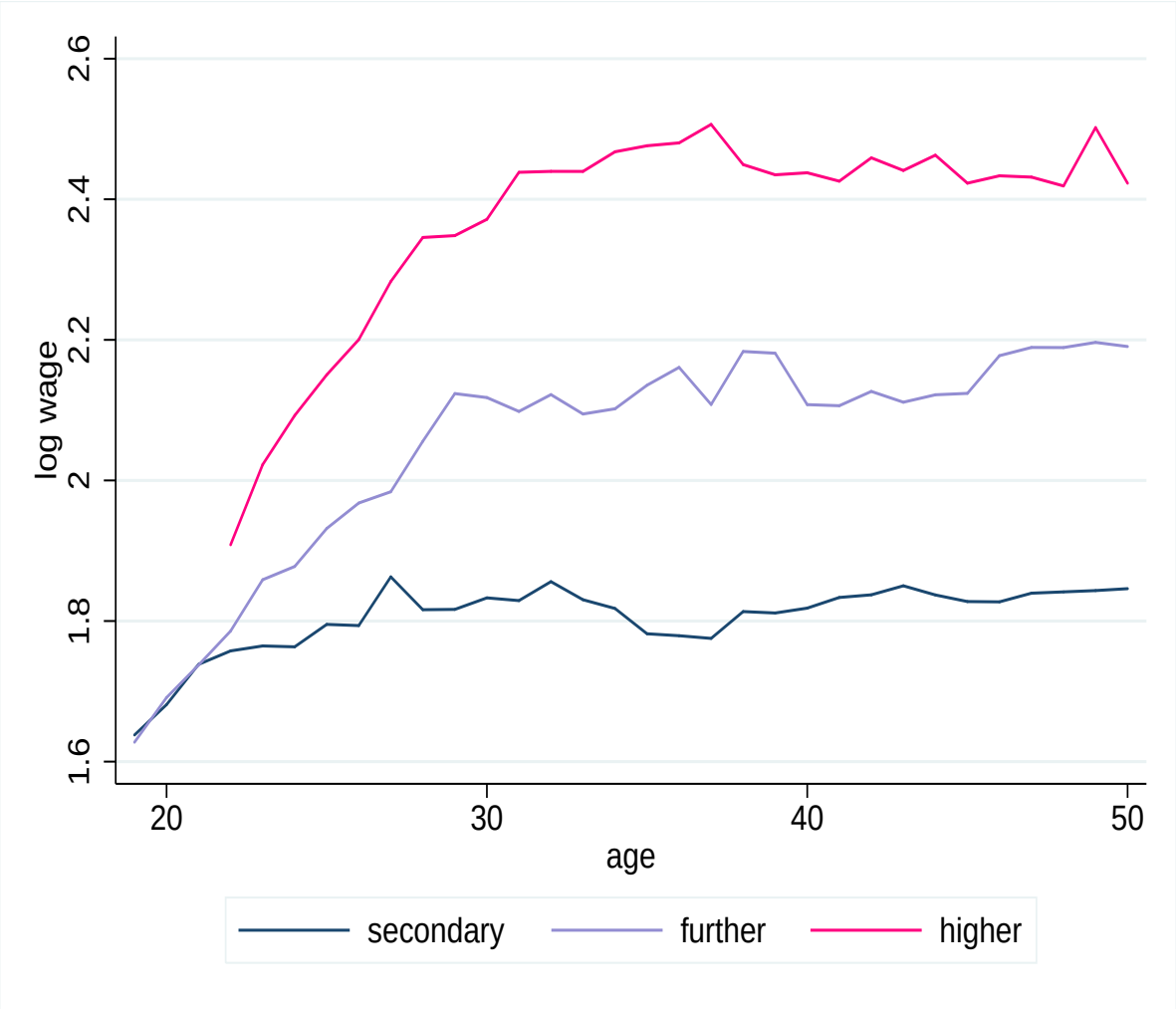
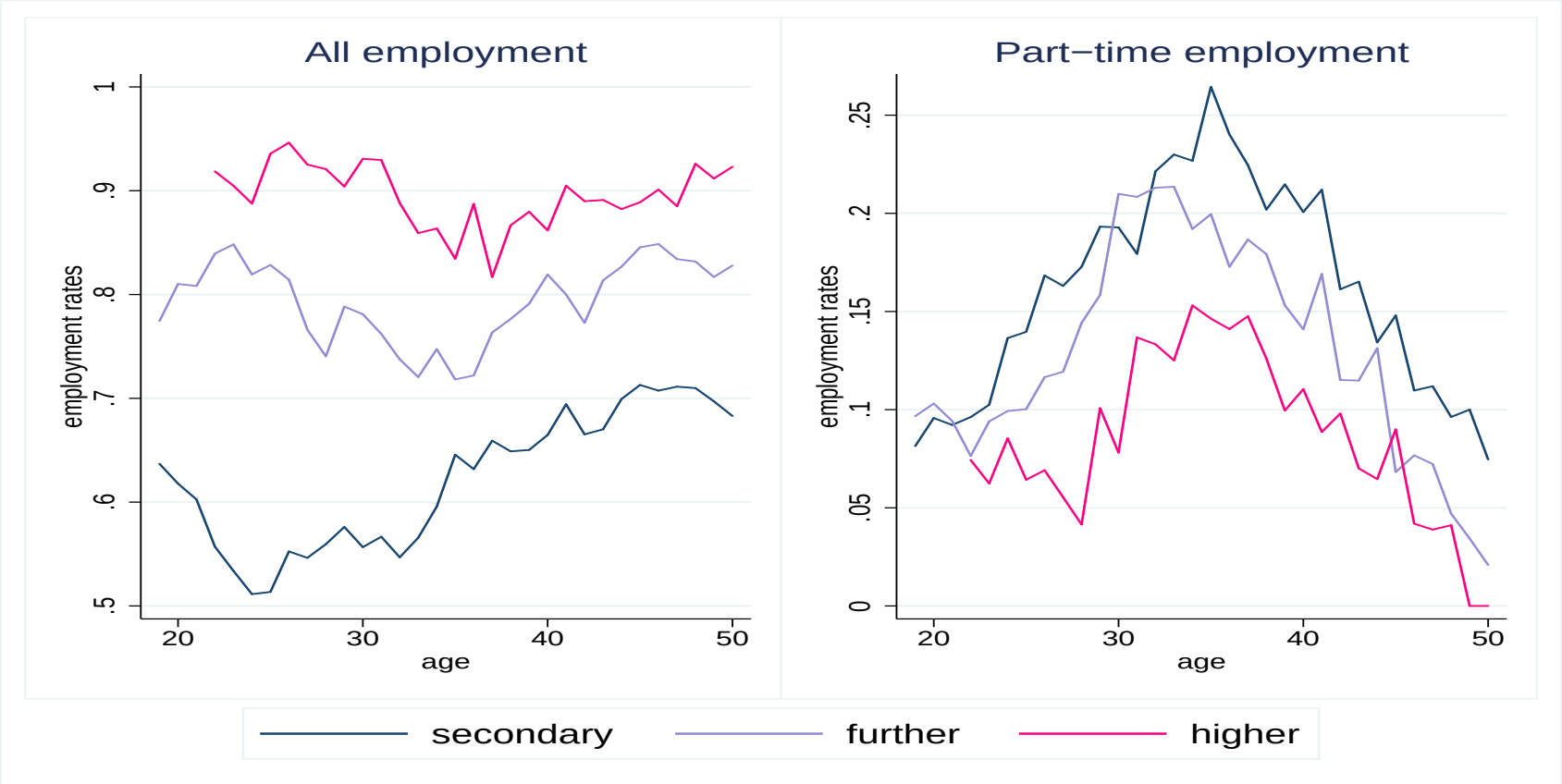
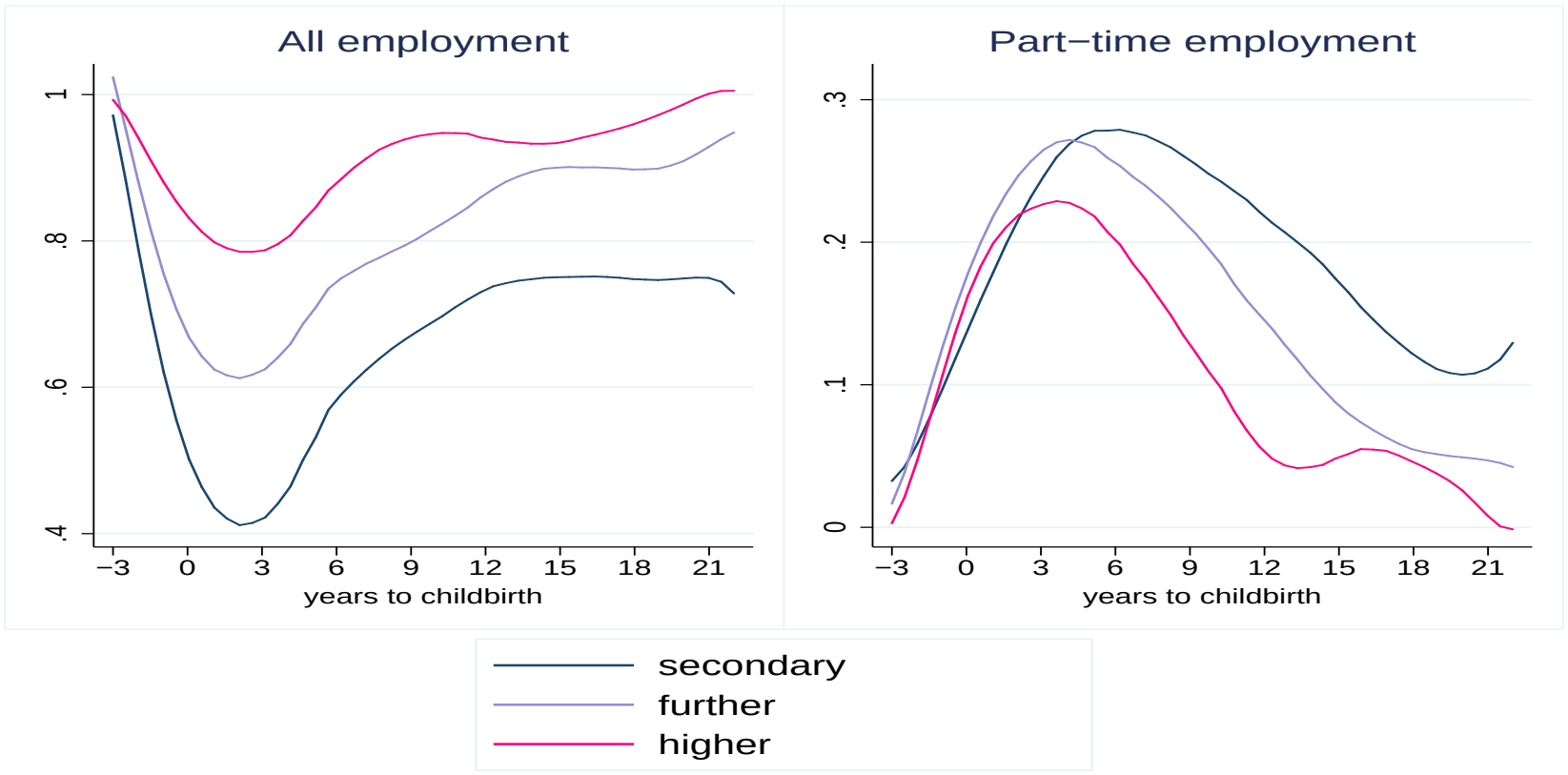
Wage Profiles by Education by Age



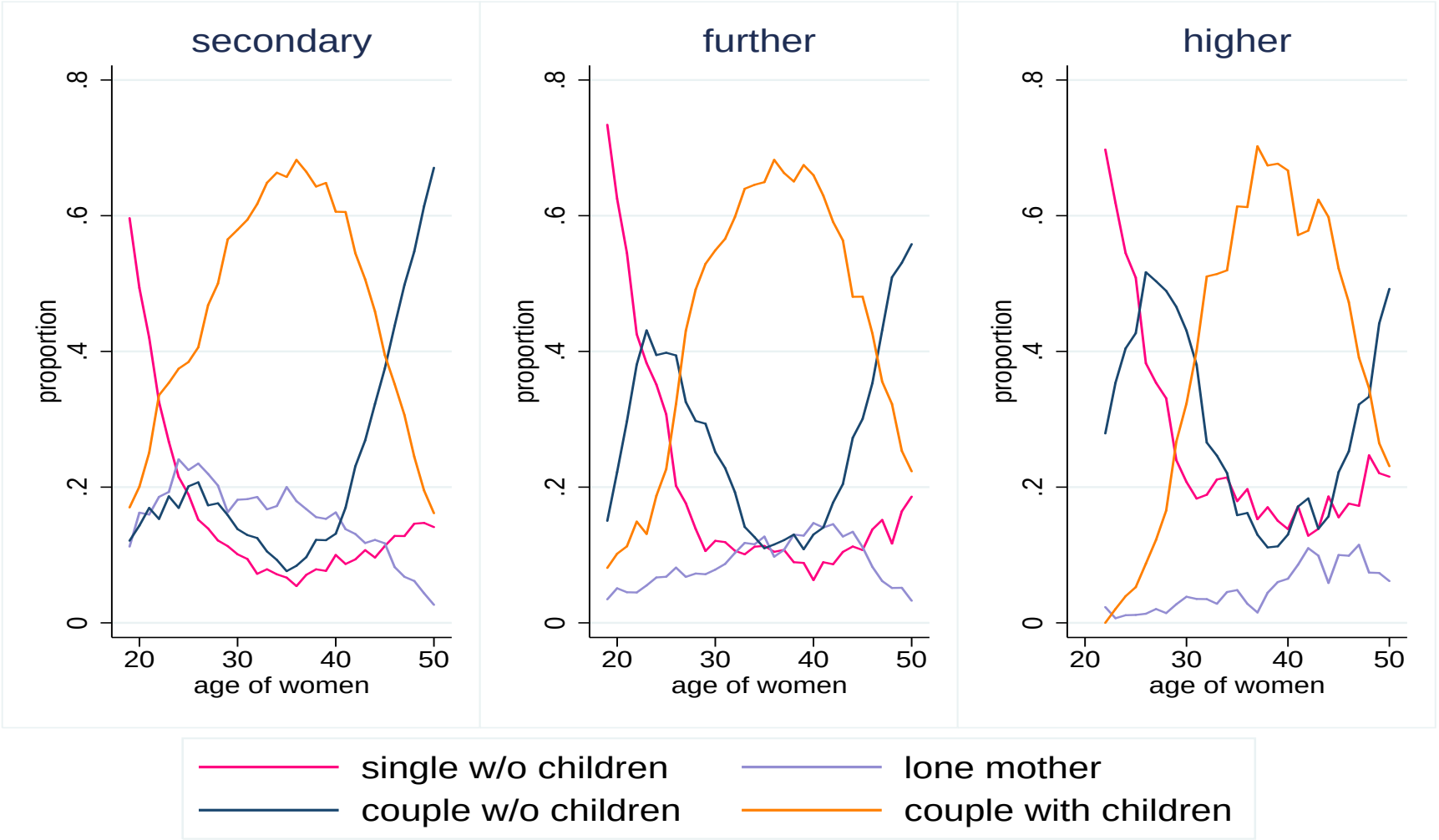
Employment over the life-cycle



Employment of mothers



Family Composition by Age



Key Model Features

- Labour supply and consumption choices are heterogeneous and are made in an uncertain environment with credit constraints.
- Wages depend on accumulated experience, with heterogeneity and persistent shocks.
- Experience is allowed to differ by education and by part-time/full time work.
- Education choices are made reflecting uncertainty, risk aversion and credit constraints, allowing for heterogeneity in the consumption value of education.
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What we find

- Incentive effects: labour supply elasticities are substantive and 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. We uncover strong complementarities.
- Education returns: there is a small but important impact of these tax policy reforms on education choices.
- Part-time wage penalty: 'experience' effects can explain the part-time penalty in female wages.
- Previous tax credit policy reform evaluations: we can explain why previous models for low educated women provided an 'accurate' picture of policy reform.

Model: female life-cycle

Life in three stages:

- Education 's=0,1,2': three levels chosen sequentially up to age 18/21
  - secondary (GCSE-level at 16), further/high school (A-levels or vocational at 18), higher (university and college at 21)
- Working life:
  - consumption 'c' and asset 'a' accumulation
  - labour supply 'l' (0, part-time and full-time)
  - experience accumulation
  - partnering
  - childbearing
- Retirement: pension incomes take effect exogenously at age 60 (Fan/Sheshadri/Taber paper).

Model: female earnings

Wage equation for individual 'i', age 't', in each birth cohort; with school level 's', experience 'e', labour supply '*l*'

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

- γ_s varies with schooling *s and* background factors.
- persistence of shocks - distinguish heterogeneity from state dependence (experience effects).
- ξ_{sit} is a transitory shock/measurement error.
- correlation of initial permanent shock with preferences.
- concave profile of experience effects that differ by schooling level and background factors.
- $g_s(l_{sit})$ set to unity for full-time, part-time is estimated.
- δ_s depreciation of human capital - cost of not working.

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Family formation dynamics

Children:

- Children are born with an (weakly) exogenous arrival rate,
  - arrival probability depends on female age, education, older children, next youngest child and presence of partner
  - departure with certainty when child reaches age 18
  - past employment(?).

$$\text{Prob}\left[t^k = 0 \,\middle|\, t, s, k_{t-1}, t^k_{t-1}, m_{t-1}\right]$$

Family Dynamics

Partner:

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

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Taxes and Assets

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Model: post education optimisation problem

$\{c_{it}, l_{it}\}_{t=\underline{t},....,\bar{t}}$ are chosen over the life-cycle to maximise

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

subject to the budget constraint

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

- net worth liquidity constraint: $a > a_s$.
- uncertain environment: earnings (own and partner's) and family composition.
- $f\left(l_{it}, l_{it}^{m}, X_{it}\right)$ is a function of family composition, education, partner, partner labour supply, background factors, and unobserved heterogeneity, see equation (2).
- θ_i unobserved types.
- childcare costs and housing rents vary by location and time.

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Model: education decisions

- Sequential discrete choice model.
  - Education costs correlated with initial level of productivity.
  - Future earnings and family composition are uncertain.
- Allow for borrowing constraints, tuition costs and student loans.
- Condition on factors formed of many family background variables at age 16, including
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- Sequential discrete choice model.
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Structural Estimation

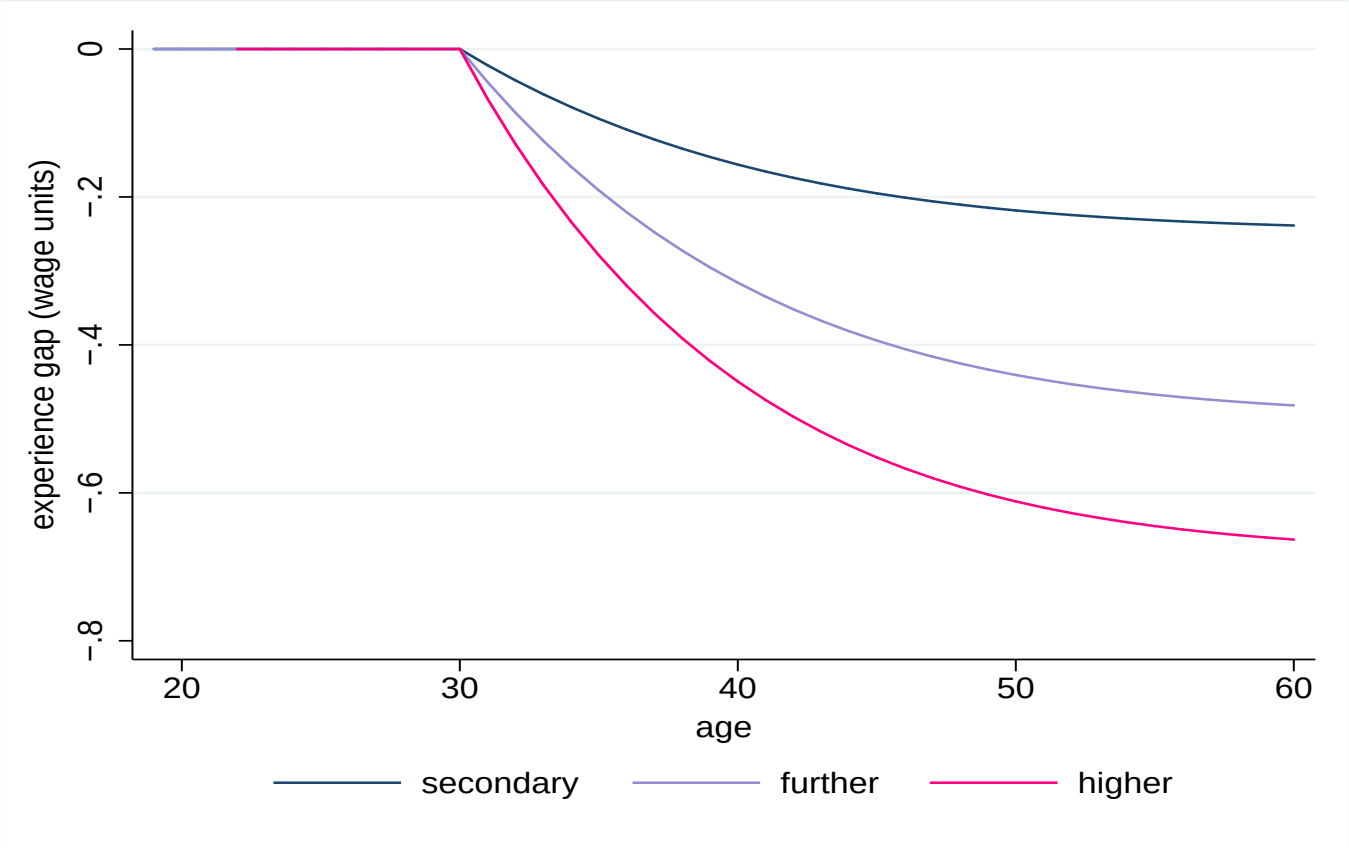
- Estimate processes for male earnings and employment, family dynamics and childcare costs, recursively 'outside' the model.
- Method of Simulated Moments for the remaining parameters: Simulate individuals under different tax regimes; Compute overall moment to match with those in the data.
- Matched 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 achievement.... see paper appendix.

Female wage equation estimates

	Secondary		Further		Higher	
baseline at age 25	5.40	(.042)	5.55	(.045)	6.94	(.11)
returns to experience	.15	(.01)	.23	(.01)	.31	(.02)
autocorrelation coef	.92	(.01)	.92	(.01)	.88	(.02)
se innovation	.12	(.01)	.15	(.01)	.14	(.01)
initial prod	.15	(.01)	.13	(.01)	.31	(.03)
initial productivity: se	.30	(.02)	.26	(.02)	.26	(.03)
depreciation rate	.11	(.01)	.06	(.01)	.07	(.01)
accumulation of HC in PTE	.17	(.02)	.10	(.02)	.12	(.02)

Notes: Interactions with background factors. See Table 5.

Part-time Experience Penalty



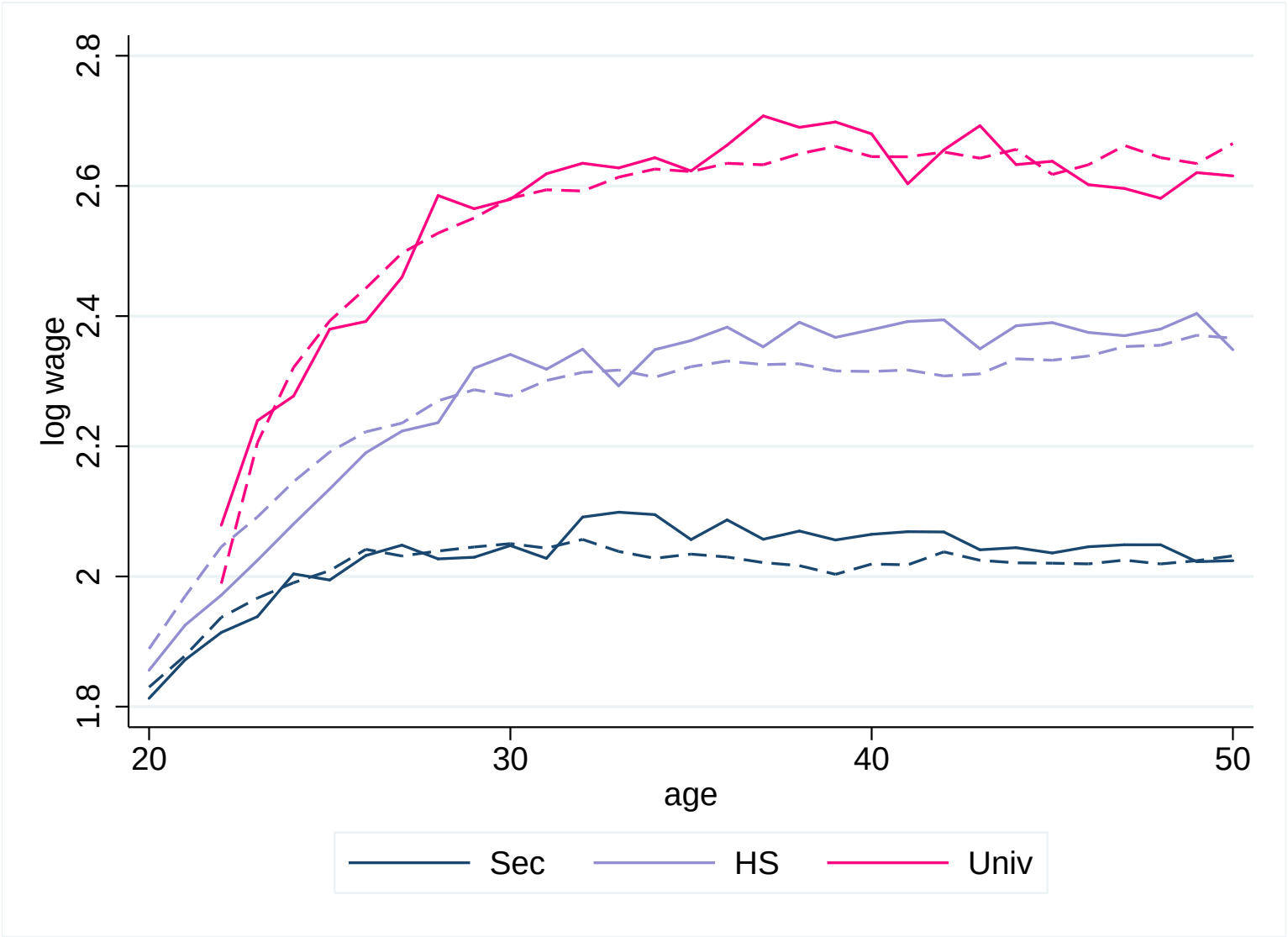
Estimates: preference parameters

	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)	

Notes: Full interactions in Table 6.

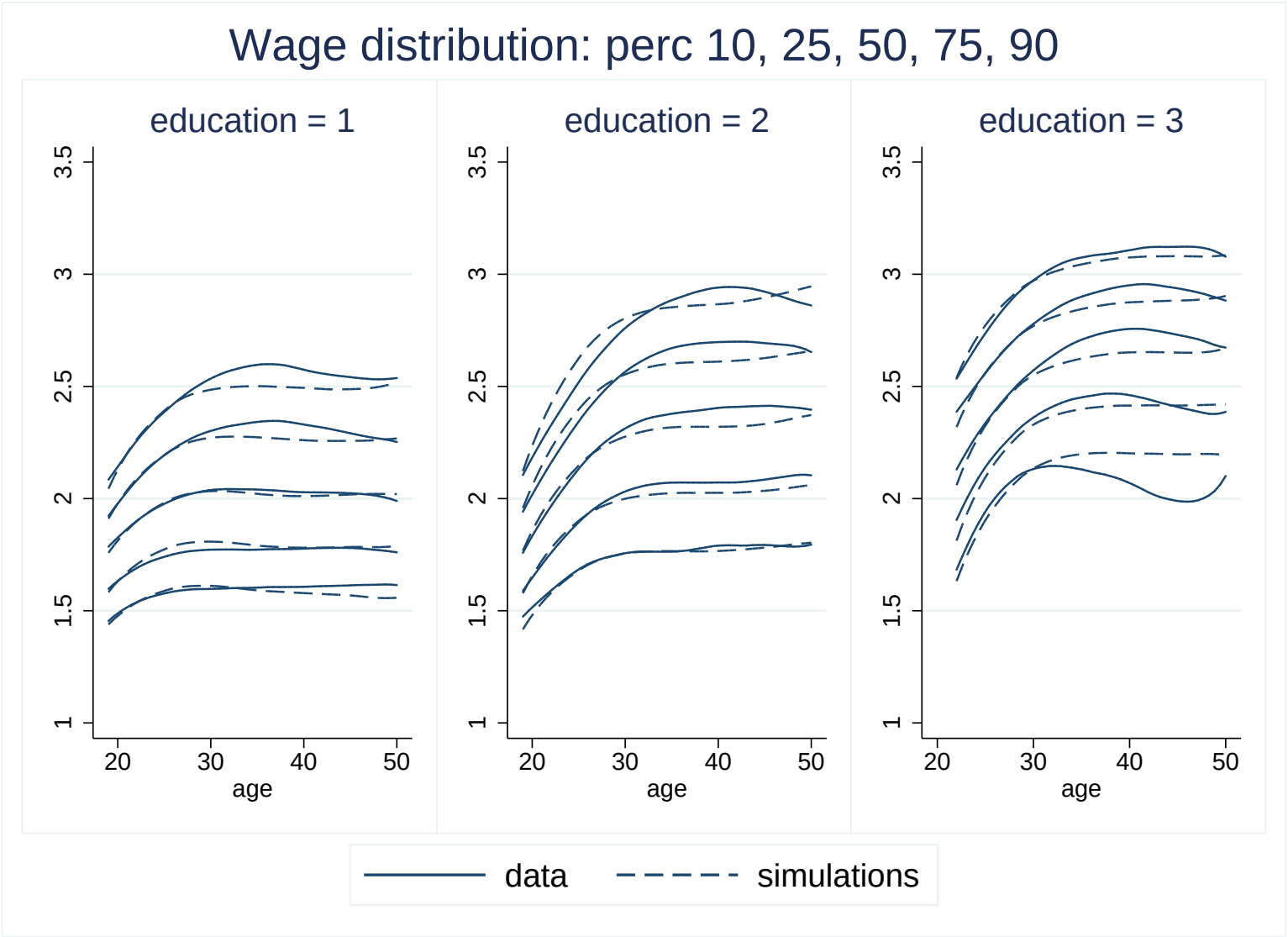
Model fit

Life-cycle profiles of wages



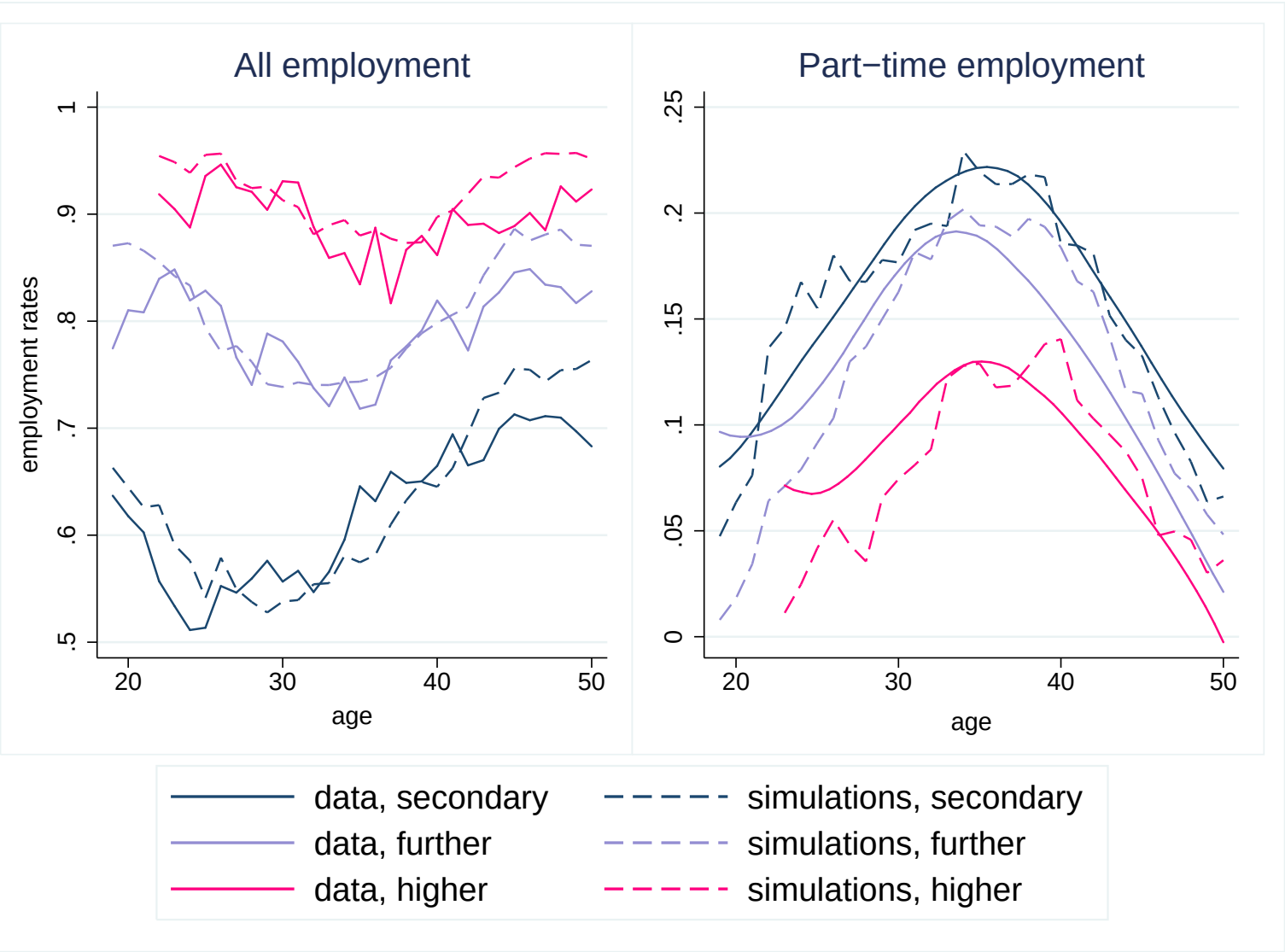
Model fit

Distribution of female wage rates by age

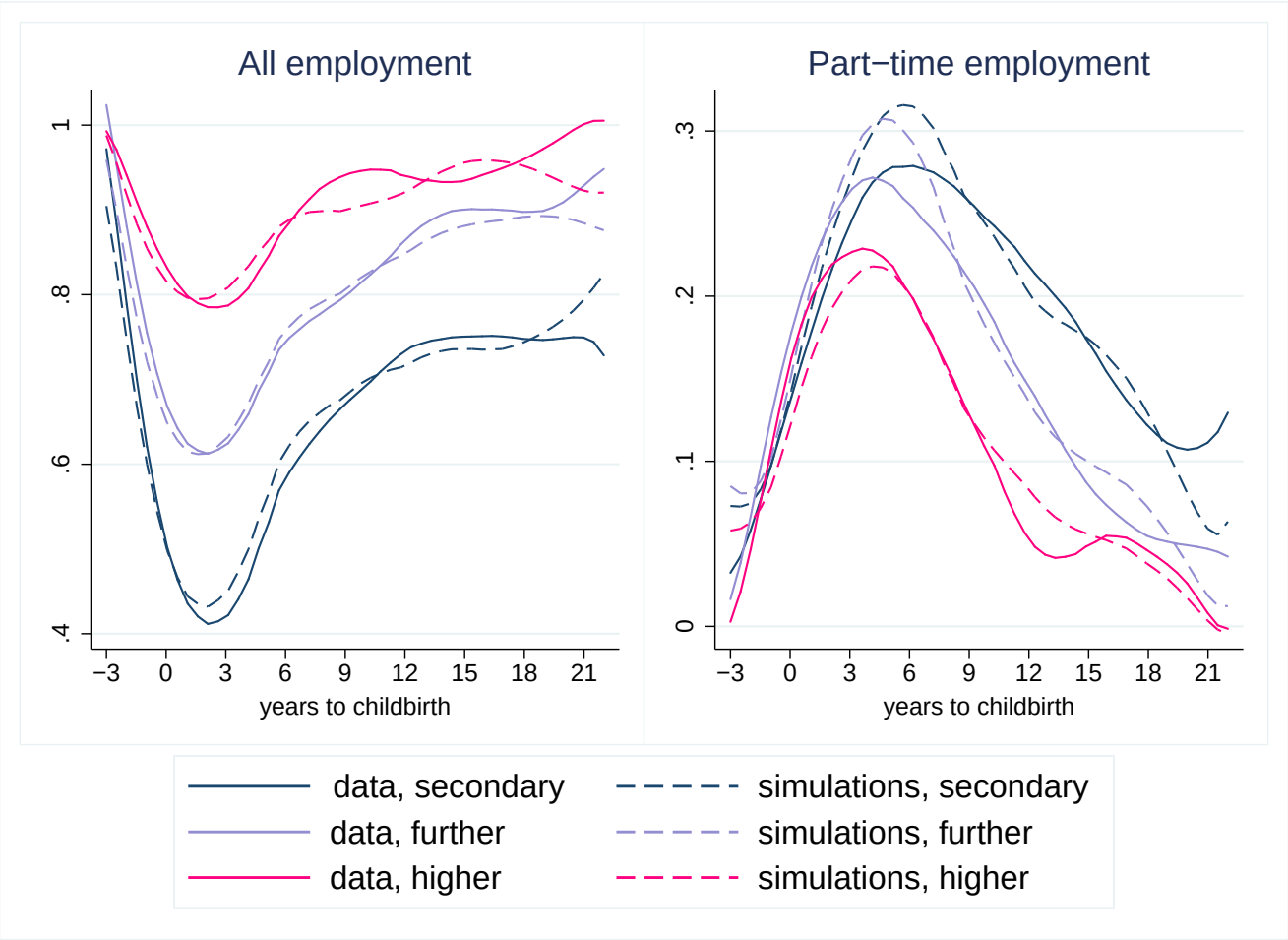


Model fit

Employment over life-cycle



Employment of mothers



Comparison with DiD

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	+4.4 (0.15)
Matched Diff-in-diff	+4.2 (0.31)

Frisch Labour Supply Elasticities

	extensive	intensive
All	0.64	0.26
Secondary	0.89	0.38
High School	0.61	0.23
University	0.42	0.18
Lone mother	1.87	0.56
Mothers in couples	0.75	0.33
Childless women	0.43	0.27

Notes: Distinct age patterns. See Figure 7 and Table 9.

Marshallian Labour Supply Elasticities

	extensive	intensive
All	0.47	0.22
Secondary	0.67	0.31
High School	0.43	0.20
University	0.30	0.17
Lone mother	1.07	0.44
Mothers in couples	0.58	0.31
Childless women	0.29	0.17

Notes: Distinct age patterns. See Figure 7 and Table 9.

Results: Impact of WFTC & Child IS Reform

Revenue Neutral Reform, basic tax rate adjustment

I. Impact on Employment of Younger Women (Table 11):

No Education Choice						
	Single Mother			Couple with Kids		
	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
employment	2.4	2.1	0.01	-0.46	-0.03	-0.01

II. Impact on Education Shares (Table 12):

	Sec.	Fur.	Uni.
1999	31.1	45.6	23.2
2002	31.8	45.4	22.8

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With Education Choice						
	Single Mother			Couple with Kids		
	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
employment	2.4	2.2	-0.00	-0.46	-0.03	-0.01

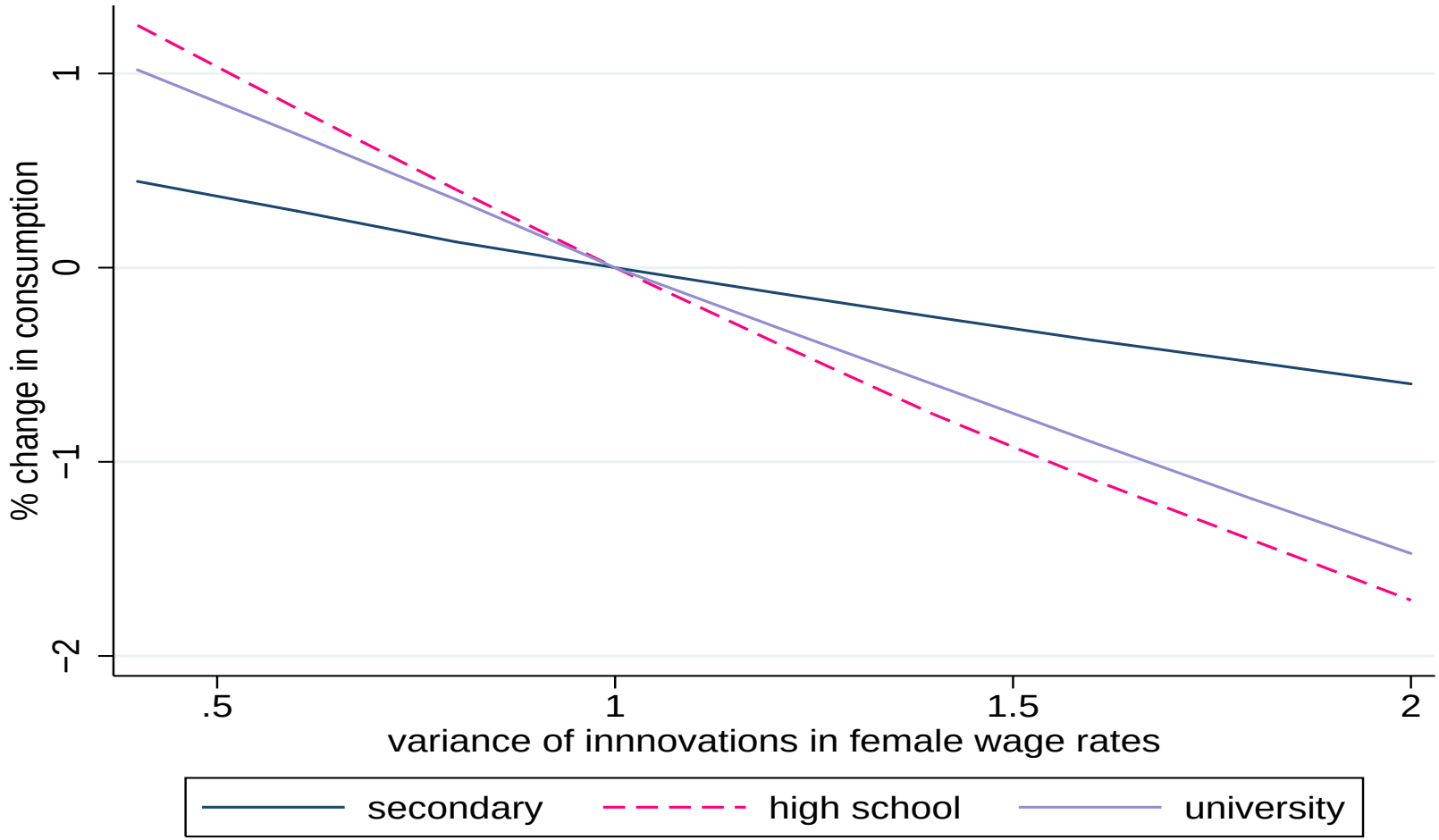
Notes: Classified according to original education choice.

Impact on Welfare and Income

WFTC and IS	pre ed. choice			post ed. choice		
	Sec.	Fur.	Uni.	Sec.	Fur.	Uni.
Welfare ($\triangle$%)	1.49	.55	-.18	1.36	.31	0.61
Lifetime Inc. ($\triangle$%)	.18	-.26	-.73	.02	-.57	-1.48

Risk Aversion and the Value of Insurance

Willingness to pay in consumption



Notes: See Figure 8.

Alternative policies

	Sec	HS	Uni	All
Tax Rate Adjustment				
Lifetime Disp. Income	.14	.16	.18	.16
Welfare	.64	.79	.90	.55
Tax Credit Adjustment				
Lifetime Disp. Income	1.18	.54	-.01	.61
Welfare	1.94	1.11	.18	1.15
Income Support Adjustment				
Lifetime Disp. Income	-.18	-.56	-.69	-.42
Welfare	.72	.44	.14	.46

- Notes: See Table 14
- 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 Income Support increases by 4.2 pounds

Summary and an Agenda...

- Experience effects imply strong complementarity between formal education and human capital on-the-job.
- Lower experience effects for those in part-time work.
- Lower education women with children have more elastic labour supply and larger income effects.
- There is a key effect of tax credit/welfare reform on education choice, attenuating some of 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 tax-credit type reforms.
- This work, and related work, provides a structural framework for tax and welfare policy and aligns with a new agenda:

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The agenda....

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   - These features can largely explain the earnings gap.
2. Tax design with human capital dynamics: Mirrlees models with persistent wage shocks, human capital and credit constraints.
   - Blundell and Shephard (2015) find an enhanced role for a progressive age-based tax schedule even with savings taxation.
   - Important new papers at this SED - Stantcheva, Kapicka, DeCosta/Santos, Krueger/Ludwig...
3. Alternative forms of human capital on the job: detailed measures of training spells by gender.
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Offer and Layoff Probabilities

		Working status at $t-1$	
		working	not working
(1)	secondary	0.982	0.995
(2)	high school	0.977	0.952
(3)	university	0.981	0.930

Impact on model:

- Overall behaviour of the low educated group remains.
- An increase in the returns to experience for the higher educated and an enhanced degree of complementarity.
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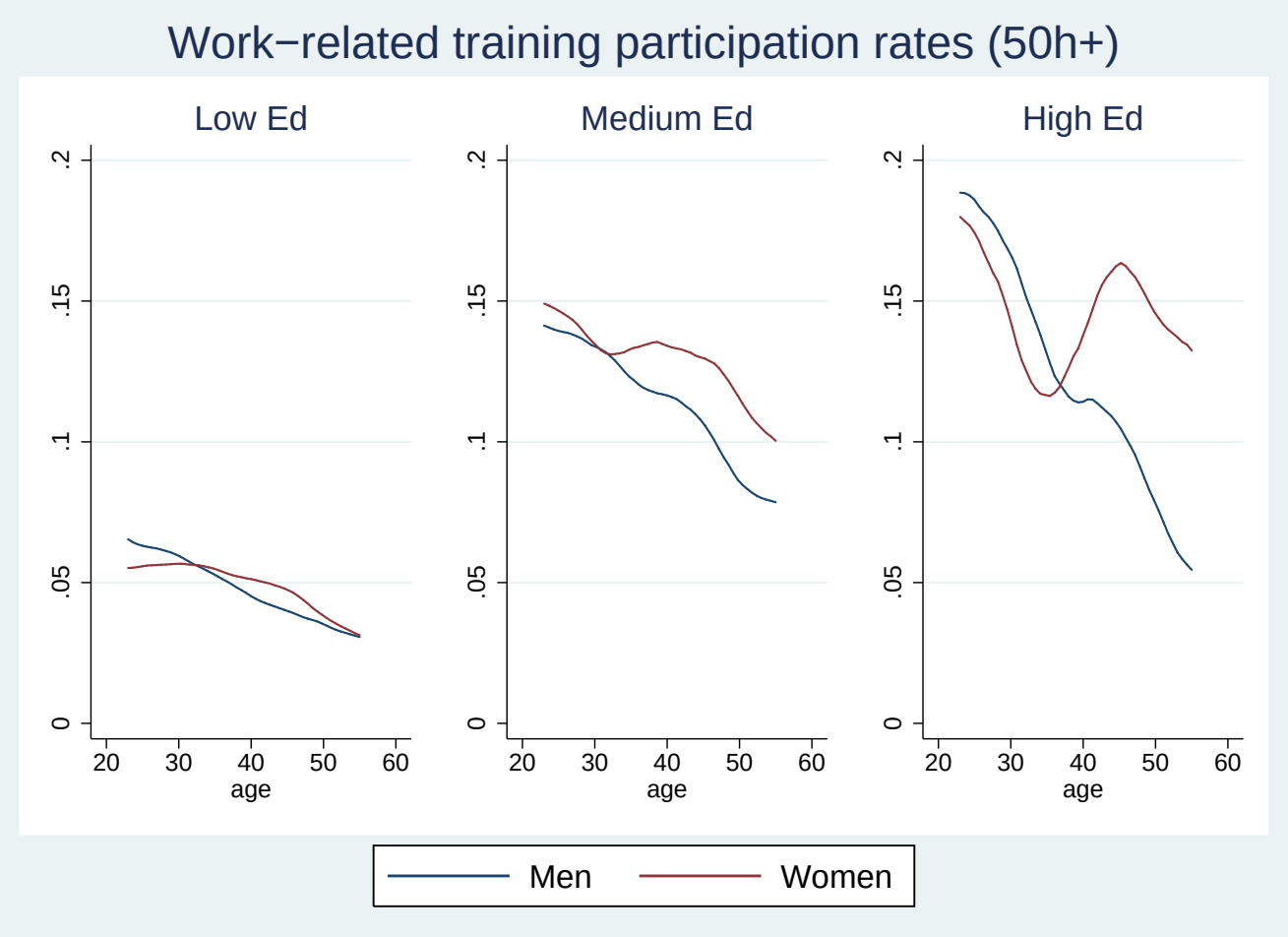
Training participation rates by age and education



- Strong complementarity with education.
- Training related to the return to work for educated women.

Thanks to Dale....

Human Capital, Labour Supply and Tax Reform

Summary of main results:

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- The insurance value of the tax/welfare system is substantial.
- The results explain previous structural and quasi-experimental results.

Human Capital, Labour Supply and Tax Reform

SED, Warsaw, June 2015