

# Lifetime inequality and redistribution

Mike Brewer, Monica Costa-Dias and Jonathan Shaw

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- What are the main determinants of lifetime inequality?
- In particular, what are the roles of conditions experienced early in life, the process of family formation, and the dynamics of employment and wages in driving persistent inequalities?
- How well do taxes and benefits, based on annual information, attenuate persistent inequalities?

- Distributional analysis is typically based on annual income
- But this tends to overstate
  - **inequality**: due to income mobility driven by transitory shocks and inter-temporal behaviour
  - and **how redistributive the transfer system is**: mixes inter- and intra-personal transfers
- Long-term income inequality is a better measure of the true economic disparities between individuals

## Study lifetime income inequality among women

- Income mobility is higher for them, with career breaks, time off paid work and short working hours prevalent among mothers of young children
- These episodes may have important long-term consequences for the employment and earnings capacity of women

Suggests that considering a long accounting period while controlling for the dynamics of employment and wages is especially relevant in distributional analysis for women

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# The approach we take

- Study the distribution of **equivalised family income**: accounts for the possibility of specialisation in the family
  - **Earned income** is the equivalised pre-tax labour income
  - **Disposable income** is earned income minus taxes net of benefits
- Use simulated data from a structural empirical model
  - **Life-cycle model** of education, labour supply, working experience, earnings and savings (Blundell et al., 2013)
  - Condition on a rich set of **initial conditions, family formation and policy environment**

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# What we find

- **More inequality annually than over longer periods:** the dispersion in earned income drops with the length of the accounting period
- **And also more redistribution:** the transfer system counteracts the differences in income dispersion by length of the accounting period
- **Initial conditions matter:** a substantial proportion of lifetime disparities are established at the start of life (~35%)
- **And so does family dynamics:** a non-negligible proportion can be linked to family dynamics (~20%)
- **Targeting families with children is especially inequality-moderating:** encouraging low-paid mothers with young children to work can reduce both lifetime and cross-section inequality



## 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: happens exogenously at age 60

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# Model: female life-cycle (Blundell et al., 2013)

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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 - separate heterogeneity from state dependence (experience effects)
- $\xi_{sit}$  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

$$\ln w_{s^m it}^m = \ln W_{s^m it}^m + \gamma_{s^m}^m \ln(t - 18) + v_{s^m it}^m + \xi_{it}^m$$

$$v_{s^m it}^m = \rho_{s^m}^m v_{s^m it-1}^m + \mu_{s^m it}^m$$

- Conditional on education, spouses' productivity processes are independent
  - Men arrive and depart with a probability that depends on her and his characteristics
- **Public transfers:** detailed 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
    - **Main omission: retirement pensions and benefits**

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# Model: post education optimisation problem

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

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

- $X$ : observed family circumstances
- $\theta$ : unobserved preferences for work
- Maximisation is subject to the dynamics of wages, experience, other income and family as described
- and 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 17 as the solution to

$$\max_s \{EV_{is} + \psi_s Z_i + \varepsilon_{is}\}$$

- Heterogeneous and uncertain returns,  $EV_s$ , depend on future earnings, family composition and policy environment
- Condition on family background variables at age 17,  $Z_i$ 
  - two principal components that may also affect preferences and productivity later on: parental education and occupation, siblings, region of birth...
  - parental earnings when woman is aged 16
- Allow for borrowing constraints, tuition costs and student loans

# 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
- We exclude top 3% of earnings distribution: distributional analysis only valid for bottom 90-95% of income distribution

- Estimate exogenous processes (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...

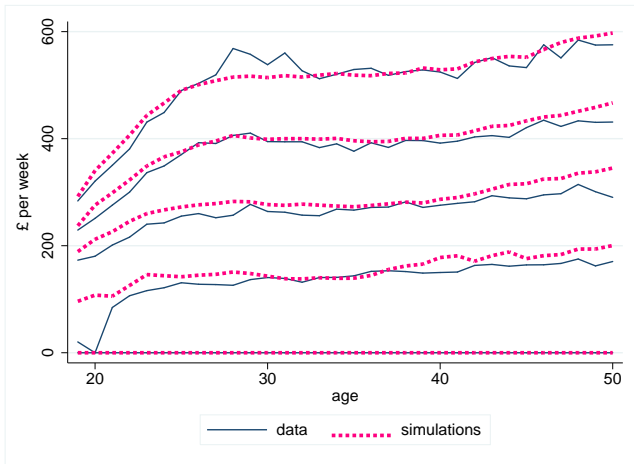
## Female wage equation estimates

	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)

# How well does the model capture persistent disparities in the distribution of family income?

- Bludell et al. (2013) extensively tested the model fit and ability to reproduce female's lifecycle profiles
- We now test its ability to reproduce crucial features of the **distribution of equivalised family income** in the cross-section and over longer periods
- Simulate the education choices and working life of 22,000 women through the ages of 17 to 60
  - Initial conditions on family background and parents earnings are drawn from the BHPS
  - Reproduce sequence of policy reforms that happen in the UK over the 1990s and 2000s
  - Compare model and BHPS moments (all outside the estimation set)

# Validation: equivalised earned income by age of woman



## Gini coefficients: BHPS vs model

	BHPS	model	difference
1 year	.41	.36	+.053
3 years	.37	.34	+.030
5 years	.35	.34	+.021
9 years	.32	.32	-.001

- We do not model high-frequency variation in wages that inflate measures of inequality in the short-term but are averaged out in the long-term



# Validation: rank correlation in equivalised earned income over adjacent periods

By duration of the period; BHPS vs model

	1 year	3 years	5 years
BHPS	.836	.828	.805
model	.870	.843	.794

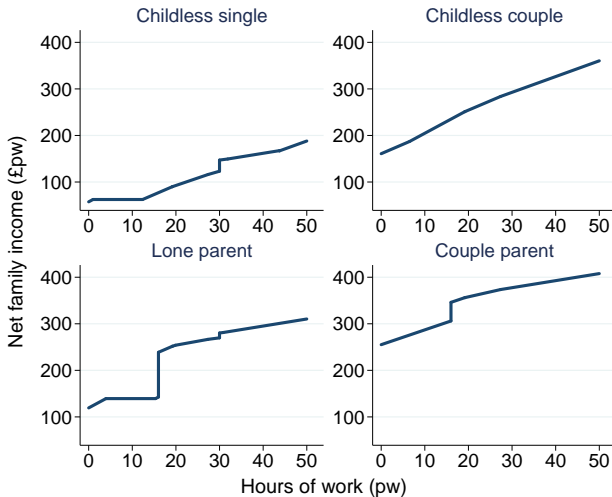
# Validation: transition rates in equivalised earned income

By duration of the period; BHPS vs model

	Same quintile		Same quintile or neighbouring	
	BHPS	model	BHPS	model
1 year	66.3	73.2	91.8	95.6
3 years	57.3	59.0	90.6	92.2
5 years	52.6	52.0	89.5	89.3

- Based on simulated data under constant tax and benefit system
- Focus on UK 2006 system
  - simple individual-based taxation of earned income
  - family-based benefits rely heavily on means-testing and depend strongly on family circumstances

# Budget constraints by family type: UK 2006 tax and benefit system

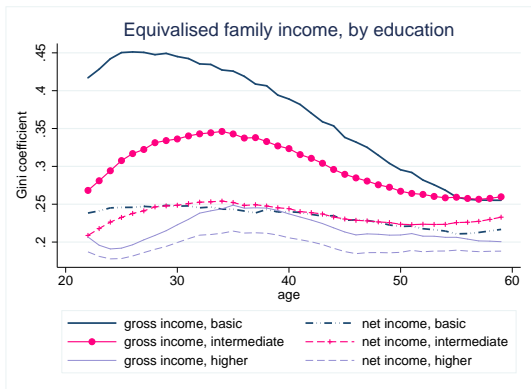


## Gini coefficients: earned and disposable income

	earned income		disposable income	
	annual	lifetime	annual	lifetime
all women	.37	.24	.28	.18
seconday	.42	.27	.24	.16
high school	.32	.21	.25	.16
university	.28	.15	.25	.14

- Higher annual than lifetime inequality, but better targeted by the transfer system
- Inequality drops with education, and so does the moderating impact of the transfer system

# Inequality: Gini coefficients by age and education



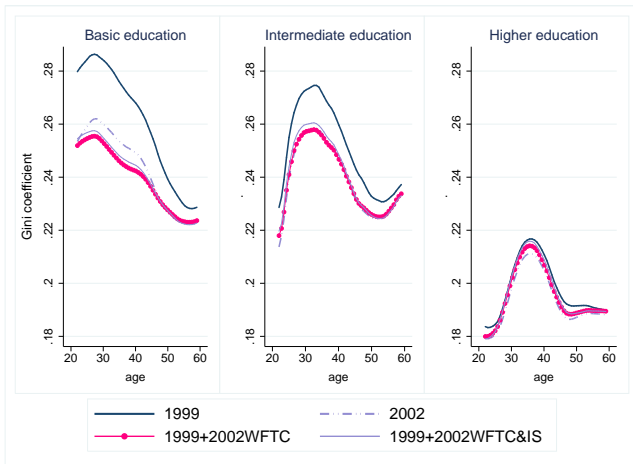
- More dispersion and redistribution during main child-rearing years, especially for women with basic education
- Suggests that policies supporting families with children are most progressive

# Inequality by age: effect of in-work benefits and income support

- Simulate effects of major welfare reform over the 90s, the WFTC-IS reform:
  - more generous in-work benefits, especially for low-wage lone mothers
  - more generous childcare subsidies for working families
  - more generous income support for non-working mothers

# Inequality by age: effect of in-work benefits and income support

## Gini coefficients: disposable income



Similar analysis of other welfare reforms showed no strong distributional



# Determinants of lifetime inequality

- Which inequality factors should a reform aimed at moderating inequality target?
- Decompose inequality by factor components using methodology suggested by Fields (2003)
- Follow a 2-step procedure
  - Divide sample in cells by initial conditions and education to separate variability in lifetime income explained by these factors
  - Then separate additional variability in residuals from first step explained by the unpredictable (from the start of life) family history

# Factor decomposition of lifetime inequality

% of variability in equivalised lifetime income explained by different factors

	initial cond	Family history			
	and education	couple	children	lone mother	total
earned income	.37	.03	.06	.08	.17
disposable income	.42	.03	.07	.01	.11

- Initial conditions and education are a strong predictors of lifetime income but estimate is lower than previously found for men (Huggett et al, 2011, Keane and Wolpin, 2007)
- The UK tax and benefit system looks particularly efficient in eliminating the earned income inequality driven by lone-motherhood
- Other inequality factors treated homogeneously

# Conclusions

- Inequality is higher and the transfer system is more redistributive when the accounting period is shorter
- And for women with basic education
- But the UK personal tax and benefit system does reduce lifetime inequality
- Work incentives for families with children seem particularly well-targeted to reduce lifetime inequality
- An important share of lifetime inequality is established at entrance in working life, by background factors and education; it is not particularly well-targeted by the transfer system we study