Female labor force participation and intergenerational mobility

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Introduction

- Major development over the last half century: large scale entry of married women into the labor force.

- A massive change in way families allocate time and nature of investments in children.

- Did this affect the transmission of socioeconomic status across generations?
  - And if so, in what direction?

This paper

- Document trends in mothers' LFP and intergenerational elasticity (IGE) in Norway (cohorts born 1960s-1990s).

- Decomposition of changes in IGE into parts due to
  - Changes in mothers' LFP (entry and selection)
  - Structural changes

- Illustrate theoretical link between mothers' labor force participation and intergenerational persistence. Answer ambiguous.

How can female LFP affect intergenerational transmission?

- Basic premise: child human capital is a function of parental money inputs and time inputs.(Del Boca et al., 2014; Agostinelli and Sorrenti, 2020; Caucutt et al., 2020)

- Women's entry into LF – shift away from time inputs toward money inputs.

- Effect on intergenerational persistence depends on:
  - Degree and *nature* of assortative mating.
  - Child human capital production function:
    - Relative importance of time and money inputs.
  - Selection of mothers into labor force.
    - Wage and income elasticities of women's labor supply.

Preview of the results

- In time series, cross-county panel, and individual level data: **negative** association between mothers' LFP and IGE.

- Decomposition: about 40-60% of decline in IGE attributable to changes in mothers' LFP. Selection of women in LF has a smaller effect (and in the opposite direction).

- Statistical model highlights the role of:
  - Time inputs in the production of human capital
  - Nature of assortative mating: high income men married to women with high child-rearing productivity.

Related literature

- Large literature investigating relationship between parents' and children's SES:
  - Empirical literature on intergenerational mobility (Surveys: Solon, 1999; Black and Devereux, 2011; Mogstad and Torsvik, 2023)
  - Theory of intergenerational transmission (Becker-Tomes, 1979, 1986; Cunha and Heckman, 2007; Lee and Seshadri, 2019)

- Child development production function (Cunha et al., 2010; Del Boca et al., 2014; Agostinelli and Sorrenti, 2021; Caucutt et al., 2020).

- Inequality and assortative mating (Fernández and Rogerson 2001; Fernández, Guner and Knowles, 2005; Mogstad et al., 2019; Lang and Gihleb, 2020)

- IGE, maternal labor supply and child development in Norway (Bütikofer et al. 2022; Havnes and Mogstad, 2011, 2015)

- Mothers and the IGE (Modern Sweden: Nybom and Vosters, 2023; historical US: Althoff et al., 2024)

Data

- Norwegian individual-level full-count administrative data
  - Excellent intergenerationally linked data
  - Society with low IGE and high degree of gender equality.

- Excellent data on income of parents and children, for cohorts born between 1960s and 1990s.

- Individual annual labor income; spouses taxed separately.

Data Details

Trends in mothers' labor force participation

Share of mothers of 5-year olds that are working
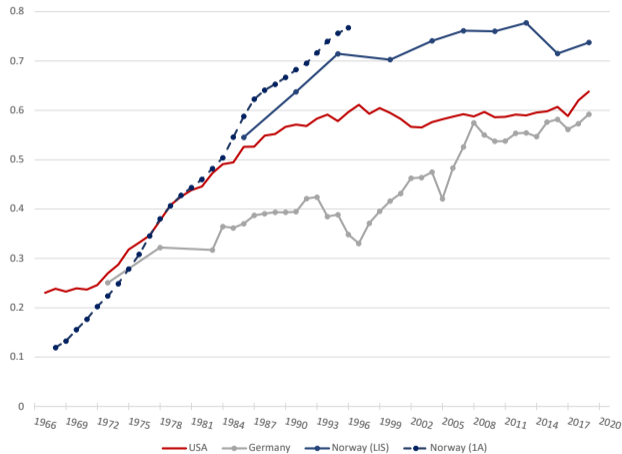
Data details: measuring the IGE

- Focus on father-son IGE.
  - Measure used in vast majority of literature, analytical tractability, similar trends if family income/daughters.

- Income:
  - Baseline: Income at age 30 or 35 (3-year average), combined with father's income at age 5.
  - Sample: father-son pairs in which father participates in LF when son is 5 years old.
  - Cohorts: pool together three adjacent birth years.
  - Sample sizes: roughly 25,000-90,000 depending on cohort.

- As in IGE literature, use $y = \log(\text{annual income})$
  - For child generation, add $0.01 \times$ *population mean income* before taking logs, to include those with zero income
  - Extensive robustness to alternative treatment of zeros.

Father-son intergenerational elasticity
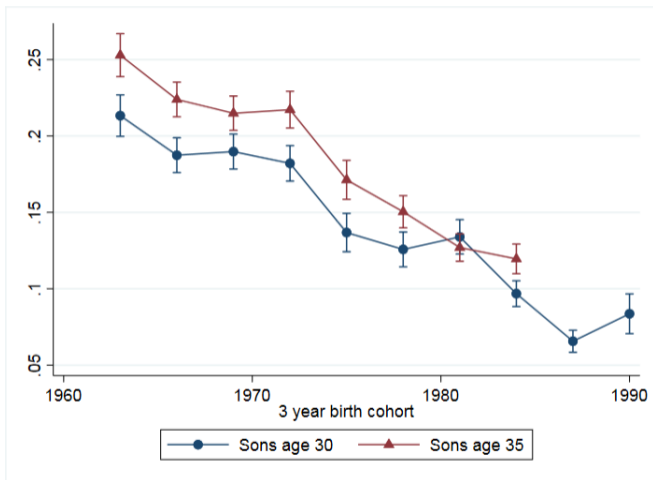
Clear downward trend in father-son IGE

Regional level analysis

- Repeat same analyis at the regional level (19 counties, same time period)

- Simple TWFE model in first differences.

$$\Delta IGE_{c,t}^{S} = \alpha + \beta \Delta LFP_{c,t} + \delta_t + \gamma_c + \epsilon_{c,t}$$

where

- c indexes county, t indexes cohort.
- ΔIGE is change in father-son IGE.
- ΔLFP is change in mother's LFPR.

Dependent variable: ΔIGE^S at county-cohort level

	(1)	(2)	(3)	(4)
Son's income	$log(y' + 0.01\overline{y'})$	$log(y')$	$log(y' + 0.01\overline{y'})$	$log(y')$
Δ Mother's LFPR	-0.607	-0.328	-0.860	-0.561
	(0.248)**	(0.185)*	(0.318)***	(0.260)**
Observations	171	171	133	133
R^2	0.193	0.202	0.156	0.121
Son's Age	30	30	35	35
County FEs	Y	Y	Y	Y
Cohort FEs	Y	Y	Y	Y

Higher increase in mothers' LFP is associated with stronger *decrease* in intergenerational (father-son) persistence

Individual level data
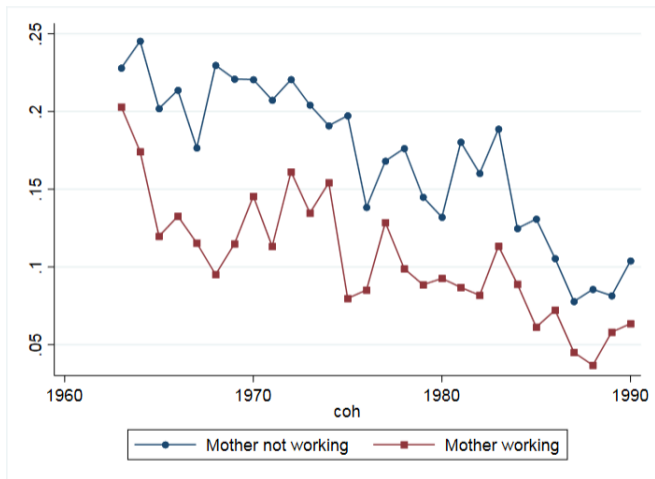
IGE is consistently higher in families in which mother does not work.

IGE and FLFP – individual level

	(1)	(2)	(3)	(4)
Log father's inc	0.136***		0.136***	0.150***
	(71.81)		(71.44)	(67.55)
Mother's LF (0/1)		0.0259***	0.0244***	0.669***
		(10.69)	(10.07)	(12.73)
f. inc * mother LF				-0.0525***
				(-12.28)
Constant	10.51***	12.15***	10.51***	10.34***
	(449.76)	(2769.55)	(448.04)	(379.01)
Child cohort dummies	Yes	Yes	Yes	Yes
Observations	535244	542970	533448	533448

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Summary

- In time series, panel data, there is a negative association between mothers' LFP and intergenerational elasticity.

- Individual level data: IGE is lower in families in which mothers work. Possible interpretations:
  - Direct effect of mother's employment on transmission of economic status.
  - Selection: in families in which IGE is lower, mothers more likely to enter LF.

- Can we say anything about the mechanisms driving intergenerational transmission based on these patterns?
  - Accounting exercise: decompose ΔIGE into parts due to changes in mothers' LFP, selection, structural changes.
  - Statistical model: understand the role of assortative mating, time and money investment in children.

Accounting exercise: decomposing changes in the IGE

- We are interested in decomposing the change in IGE: $\Delta IGE \equiv \Delta \frac{Cov(y,y')}{V(y)}$

$$\Delta IGE = \frac{\Delta Cov(y,y')}{V(y)} + Cov(y,y')\Delta\frac{1}{V(y)}$$

- IGE can fall because:
  - $Cov(y,y')$ falls.
  - $V(y)$ increases.

Intermediate steps

- Define two groups: mother works ($g = 1$) and mother does not work ($g = 0$).
- y_g, y'_g are father's & son's income for group g.
- Define π as share of families with $g = 1$.

- We show that ΔIGE can be written as a sum of three terms:

    1. **Labor force effect**: due to entry of mothers into LF.

    2. **Selection effect**: which mothers enter the labor force? Married to high or low income husbands?

    3. **Structural effect**: all other factors affecting the transmission of economic status across generations (technological changes, institutions, skill premium, education reforms, etc.)

Decomposition details

Labor force effect

- Definitions:
    - π: share of families in which mother works ($g = 1$).
    - y_g, y_g': father and son's income in group g.

- Labor force effect

$$\frac{1}{V(y)}\Big(Cov(y_1, y_1') - Cov(y_0, y_0') \Big)\Delta[\pi]$$

- $\Delta\pi > 0$: LF effect is negative (IGE decreases) if $\Big(Cov(y_1, y_1') - Cov(y_0, y_0') \Big) < 0$

- Intuition: more weight to families with smaller IGE.

Selection effect

- Selection effect:

$$\frac{1}{V(y)}(\overline{y}_1 - \overline{y}_0)(\overline{y'}_1 - \overline{y'}_0)\Delta[\pi(1 - \pi)]$$

$$+\frac{1}{V(y)}\pi(1 - \pi)\Delta[(\overline{y}_1 - \overline{y}_0)(\overline{y'}_1 - \overline{y'}_0)]$$

- Sign of this term depends on $(\overline{y}_1 - \overline{y}_0)$, $(\overline{y'}_1 - \overline{y'}_0)$ and $\Delta[(\overline{y}_1 - \overline{y}_0)(\overline{y'}_1 - \overline{y'}_0)]$

- Selection of women into labor force, gap in children outcomes between working/non working mothers, and how these change over time.
  - Observable in the data.

Selection of mothers into LFP

Coefficient from regression of mothers' LFP indicator on fathers' income
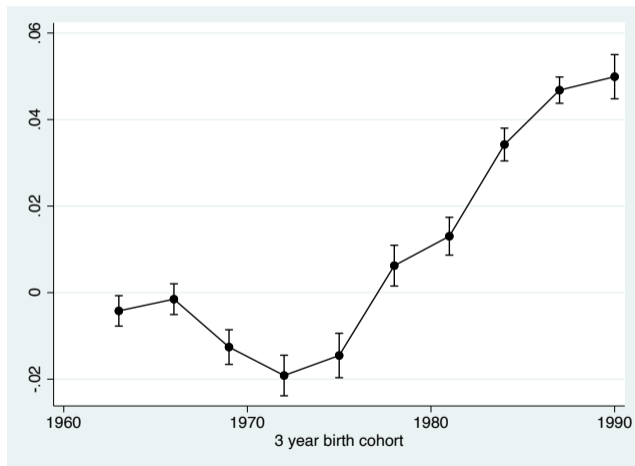
Accounting exercise: results

Cohort	IGE	ΔIGE	LF effect	Selection effect	Structural effect
1963	0.225	.	.	.	.
1975	0.146	-0.0788	-0.0349 (44.9%)	-0.000888 (0.5%)	-0.0430 (54.6%)
1990	0.0839	-0.0618	-0.0372 (63.3%)	0.00601 (-12.8%)	-0.0306 (49.5%)

- Findings:
  - LF effect accounts for 45%-63% of the total decline in IGE, depending on time period.
  - Selection effect negligible in early period, acts to slightly increase IGE in the later period.

- Next: reduced form model of son's income to shed light on mechanisms driving LF and selection effects.

- Reduced form, statistical model of child's earnings and mother's labor supply.
- Son's income y' is a function of father's income y, mother's labor productivity w, mother's time at home h and mother's productivity in childrearing q :

$$y' = \eta_0 + \eta_y y + \eta_w w(1 - h) + \eta_q qh + u \tag{1}$$

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- Mother's labor supply endogenous:

$$1 - h = \alpha_0 + \alpha_w w - \alpha_q q - \alpha_y y + \epsilon \tag{2}$$

Model: Implications for intergenerational mobility

- Conventional father-son IGE (intergenerational mobility): $IGE^S = \frac{Cov(y',y)}{V(y)}$

- Special case: IGE when mothers specialize in childrearing ($h = 1$, "regime 0"):

$$IGE_0^S = \eta_y + \eta_q \frac{Cov(y,q)}{V(y)}$$

- General case (mothers may work for pay, $h \leq 1$, "regime 1"):

$$IGE_1^S = IGE_0^S + \eta_q \left(\frac{Cov(y,w)}{V(y)} - \frac{Cov(y,q)}{V(y)} \right) E[1-h]$$

$$+ (\eta_w - \eta_q) \frac{Cov\left(y, w(1-h)\right)}{V(y)}$$

Decomposing the change in IGE

- Simplifying assumptions/notation: $E[w] = E[q]$; $\phi_w \equiv \frac{Cov(y,w)}{V(y)}$, $\phi_q \equiv \frac{Cov(y,q)}{V(y)}$.

- Then: Change in father-son IGE between any two periods can be written as

$$IGE_{t_1}^S - IGE_{t_0}^S = \underbrace{\eta_q(\phi_w - \phi_q)\Delta E[1-h]}_{\text{Labor supply effect}} + \underbrace{(\eta_w - \eta_q)\Delta\frac{Cov(y, w(1-h))}{V(y)}}_{\text{Selection effect}}$$

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- Womens' entry into the labor market has two effects:
  - Labor supply effect: Assortative mating affects IGE. Net effect depends on whether there is more sorting on w or q.
  - Selection effect: If mothers positively selected into LF ($Cov(y, w(1-h)) > 0$) and money inputs have a greater effect than time inputs ($\eta_w - \eta_q > 0$), mothers' entry into LF gives relative advantage to sons of high-income fathers – raises IGE.

Estimating the parameters

- We can say more by dividing the 1963-1990 period into two parts:

Data:

	ΔIGE	ΔLFP	ΔSEL
1963-1975	-0.090	0.308	-0.093
1975-1990	-0.062	0.329	0.345

- We can write estimating equation in matrix form:

$$\left[\begin{array}{c} \Delta IGE_{1975-1963} \\ \Delta IGE_{1990-1975} \end{array} \right] = \left[\begin{array}{cc} \Delta LFP_{1975-1963} & \Delta SEL_{1975-1963} \\ \Delta LFP_{1990-1975} & \Delta SEL_{1990-1975} \end{array} \right] \left[\begin{array}{c} \eta_q(\phi_w - \phi_q) \\ (\eta_w - \eta_q) \end{array} \right]$$

- The two composite parameters $\eta_q(\phi_w - \phi_q)$ and $\eta_w - \eta_q$ are just identified.

Parameter estimates

Identified parameters:

$\eta_q(\phi_w - \phi_q)$	-0.270 (0.040)
$\eta_w - \eta_q$	0.076 (0.063)

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Identified parameters:		$\eta_q(\phi_w - \phi_q)$	-0.270 (0.040)
		$\eta_w - \eta_q$	0.076 (0.063)

	$IGE_1^S - IGE_0^S$	$=$	$\eta_q(\phi_w - \phi_q)\Delta E[1-h]$	$+$	$(\eta_w - \eta_q)\Delta\frac{Cov(y_m,w(1-h))}{V(y_m)}$
	Change in IGE	$=$	Labor supply effect	$+$	Selection effect
1963-1975	-0.090	$=$	-0.083	$+$	-0.007
1975-1990	-0.062	$=$	-0.089	$+$	0.026

Discussion

- Implications for underlying parameters:
  - There is more sorting on women's childrearing productivity than labor productivity.
  - Money inputs and (productivity adjusted) time inputs in production of children's human capital have similar returns ($\eta_w \approx \eta_q$).

- Is this sensible? Is this consistent with the literature?

- More sorting on q than w:
  - Simple assortative mating model (Becker) predicts negative sorting on labor income, due to specialization.
  - Acting wife? (Bursztyn et al., 2017)

Concluding comments

- Large increase in mothers' LFP associated with strong decline in IGE in Norway between 1963 and 1990.

- Accounting exercise: about 45-63% of change in IGE accounted for by entry of mothers into labor force.

- Patterns can be rationalized by model with assortative mating on both market and child-rearing productivity if the latter dominates.

Thank You!

Additional slides

Data details: labor force participation

- No hours worked in income data; use income threshold to infer LF participation.
  - Treshold: Taxable income above public insurance index $1G$ (approx 12,000 USD in 2018 – common approach)
  - Can cross-check definition in census years (1970, 80, 90)

- Combine with data from Norwegian Census and LIS for international comparisons.

Back

Sensitivity of IGE to different treatment of zeros
Father-Son IGE

Graphs by transform_child
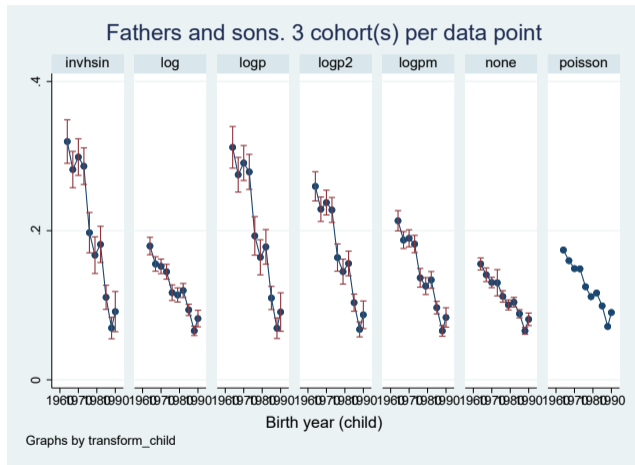
Downward trend robust to different treatment of zeros, but magnitudes differ.

Back

Decomposing ΔIGE

- After some algebra:

$$\Delta IGE = \underbrace{\frac{1}{V(y)}\Delta[\pi]\Big(Cov(y_1, y_1') - Cov(y_0, y_0')\Big)}_{\text{Labor supply effect}}$$

$$+ \underbrace{\frac{1}{V(y)}\Delta[\pi(1-\pi)](\overline{y}_1 - \overline{y}_0)(\overline{y'}_1 - \overline{y'}_0)}_{\text{Selection effect 1}}$$

$$+ \underbrace{\frac{1}{V(y)}\pi(1-\pi)\Delta[(\overline{y}_1 - \overline{y}_0)(\overline{y'}_1 - \overline{y'}_0)]}_{\text{Selection effect 2}}$$

$$+ \underbrace{\frac{1}{V(y)}\Big(\pi\Delta Cov(y_1, y_1') + (1-\pi)\Delta Cov(y_0, y_0')\Big) + Cov(y, y')\Delta\frac{1}{V(y)}}_{\text{Structural effect}}$$