

It Runs in the Family: Occupational Choice and the Allocation of Talent

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Why is Income Correlated Across Generations?

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- Earnings and labor market success shaped by **environment**
- Parental background and place of birth determine **opportunities**

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Sorting

- Earnings is the outcome of individuals' productive skills
- Parents and children share the same skills
- **Sort on skill advantage** into same occupations (Roy, 51)

Opportunities

- Earnings and labor market success shaped by environment
- Parental background and place of birth determine opportunities
- **Unequal access and barriers** to entering occupations

Both consistent with **occupational following**
but differ starkly in implication

Implications for Efficiency and Equity

Inequality **but** Efficiency

- Children inherit skills and knowledge from parents

(Laband-Lentz, 85)

- Inequality, immobility & output move together

(Galor-Tsiddon, 97; Jovanovic, 14)

Inequality **and** Inefficiency

- Misallocation of talent inc. inequality, reduces mobility & output

(Bell-Chetty-Jaravel-Petkova-Van Reenen, 19; Hsieh-Hurst-Jones-Klenow, 19)

This Paper

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- Consequences for intergen. mobility — Implications for efficiency

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Setting: Swedish sons & fathers

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Empirical evidence: A play in two acts

1. **Structural Roy model**

- ◇ Occupational choice depends on skills & background
- ◇ **Counterfactual experiment:** Equal opportunity

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Empirical evidence: A play in two acts

1. Structural Roy model

- ◇ Occupational choice depends on skills & background
- ◇ Counterfactual experiment: Equal opportunity

2. Reduced form

- ◇ Quasi-experimental evidence — occupational decline
- ◇ Same regressions on model-generated data

Preview of Results

Prevalent occupational following

- Children 10-100× more likely to choose parent occ than other occs

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Prevalent occupational following

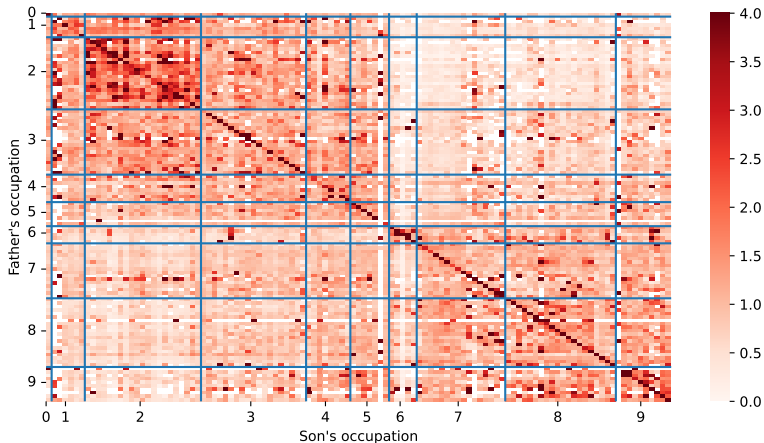
- Children 10-100 \times more likely to choose parent occ than other occs

Misallocation of talent

- Equalizing opportunities **reduces following** by more than **50%**
- **Increase** in intergenerational mobility, **concentrated at the bottom**
- **Output gains** are small in general equilibrium
- **Similar reduced-from evidence**

Occupational Following

Occupational Mobility Bias: Fathers & Sons



0 - Armed forces

1 - Legislators, senior officials, managers

2 - Professionals

3 - Technicians & assoc. professionals

4 - Clerks

5 - Service & sales

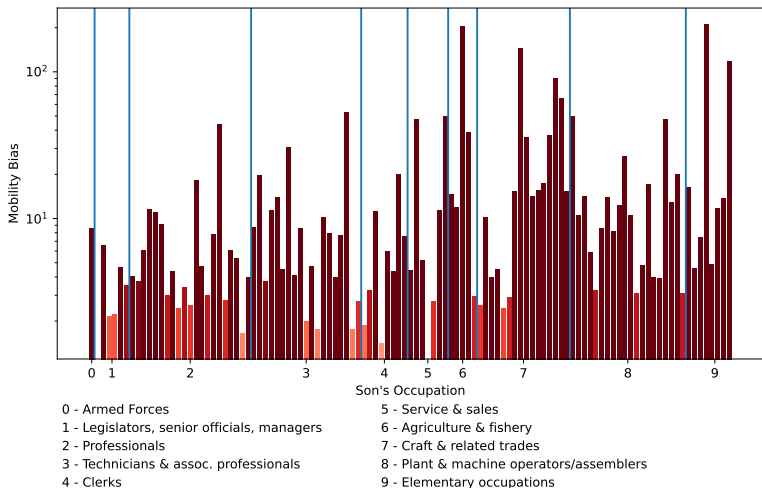
6 - Agriculture & fishery

7 - Craft & related trades

8 - Plant & machine operators/assemblers

9 - Elementary occupations

Occupational Mobility Bias: Fathers & Sons



Roy Model of Occupational Choice

Model of Occupational Choice

Model developed in two steps

First: Basic model to illustrate mechanisms

Second: Extend to structural GE model that fits Swedish data

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Basic Roy (1951) model

(Ohnsorge-Trefler, 07; Mayer, 08; Adão, 15; Nakamura-Sigurdsson-Steinsson, 22)

- Workers have **heterogeneous skills** in Fishing & Hunting

Model of Occupational Choice

Model developed in two steps

First: Basic model to illustrate mechanisms

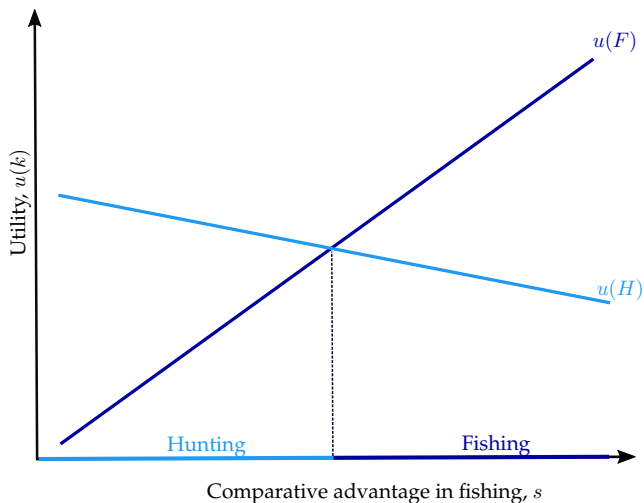
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Basic Roy (1951) model

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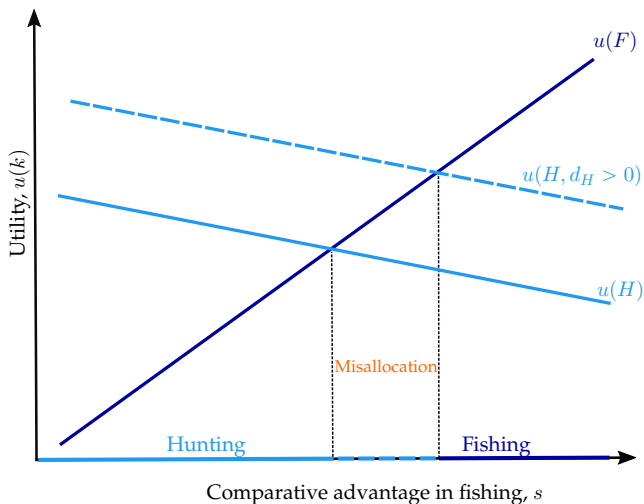
- Workers have **heterogeneous skills** in Fishing & Hunting
- **Heritability:** Skills of children and parents (imperfectly) correlated
- **Costly to enter** occupations — Education, training, etc
- Costs **depend on family** — Information, barriers, bequests, etc

Occupational Sorting by Comparative Advantage



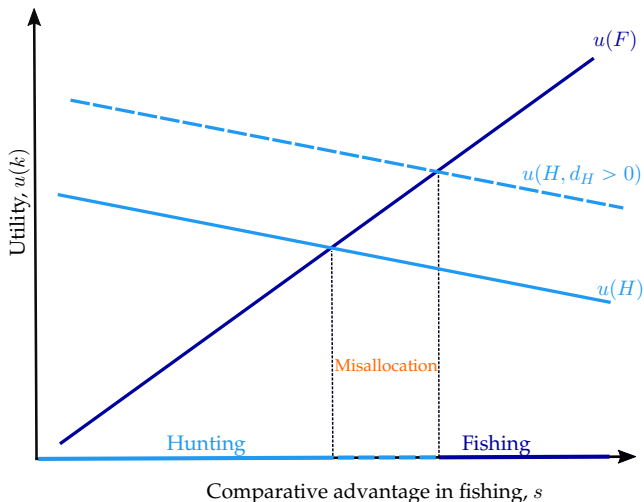
$$u(i, g, k) = \underbrace{y_{i,k}}_{\text{Earnings}} - \underbrace{m_k}_{\text{Entry costs}}$$

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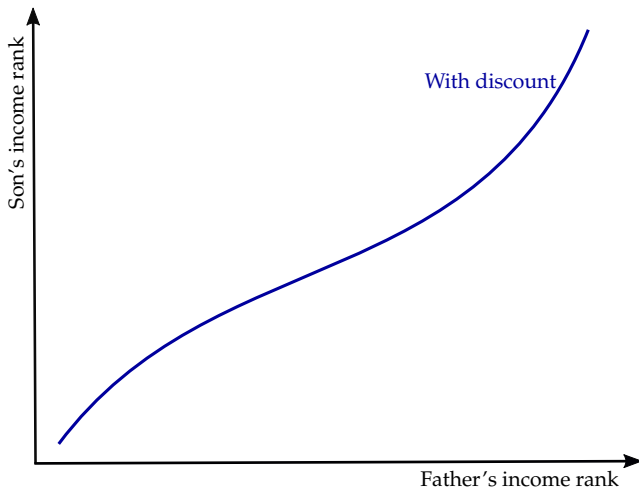
$$u(i, g, k) = \underbrace{y_{i,k}}_{\text{Earnings}} - \underbrace{m_k}_{\text{Entry costs}} + \underbrace{d_k \mathbb{I}_{i,k}^{g=k} 9^{-1}}_{\text{Cost discounts}}$$

Occupational Sorting by Comparative Advantage



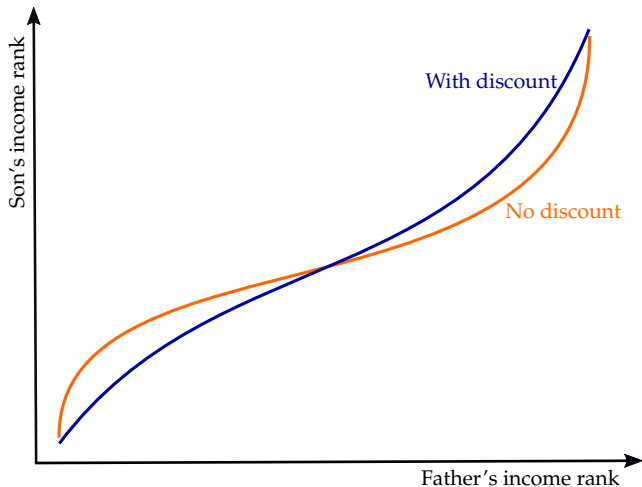
Misallocation: Sons of hunters that become hunters but have comparative advantage in fishing

Intergenerational Income Mobility



Labor income: $y_{i,k}^g = w_k + \beta_k z_{k,i}^g$, $\beta_F > \beta_H$

Intergenerational Income Mobility



d_F : Sons of high-income fathers stay in F

d_H : Sons of low-income fathers in H

Structural Roy Model

Structural Roy Model

General equilibrium Roy model to match the Swedish labor market

Extensions of the basic model

1. Measure occupation-specific productivity using **individuals' skills**

Skills of Individuals

Data on individuals' skills

- Military draft tests and evaluations
- Taken by all Swedish men at age 18 since 1969

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Cognitive skills

- Logic-inductive ability (fluid intel.), Spatial ability, Verbal comprehension (crystallized intel.), Technical understanding
- Standardized tests and scores

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Noncognitive skills/personality traits

- Psychological energy (focus, perseverance), Emotional stability (stress tolerance), Social maturity (extroversion), Intensity (activation w/o external pressure)
- Behavioral questions by trained psychologists — standardized scores

Measuring Returns to Skills and Occupation Skill Fit

Conceptual model: the “*task framework*” (Autor-Levy-Murnane, 03; Gibbons-Waldman, 04)

- Individuals are heterogeneous in skills
 - Occupations differ in tasks and, therefore, how productive skills are
- ⇒ Skills of incumbents can be used to measure skill requirements

(Lazear, 09; Gathman-Schönberg, 10; Autor-Handel, 13; Fredriksson et al. 18)

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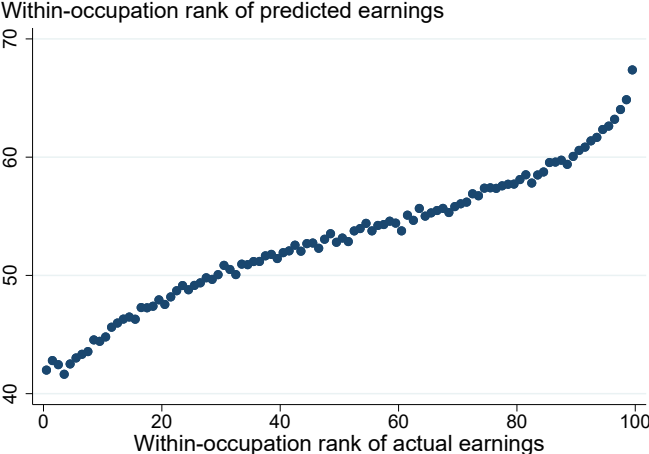
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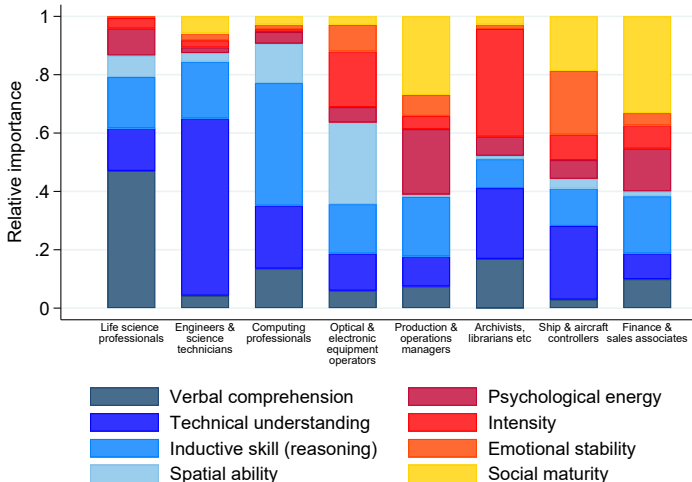
Predict earnings (“Roy-productivity”) and entry probability (skill fit)

- Random forest using skills of incumbents, excl. followers
- For each individual, predict earnings & skill fit to every occupation

Actual and Predicted Earnings



Factor Importance



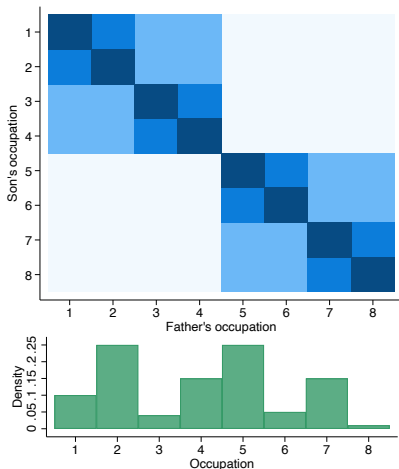
Structural Roy Model

General equilibrium Roy model to match the Swedish labor market

Extensions of the basic model

1. Measure occupation-specific productivity using **individuals' skills**
2. **Discounts** into father's occupation at 3 levels (broad to narrow)
3. **Consumption**: bundle of goods produced by occupations
4. **Occupations produce** using labor; **prices/wages** determined in GE
5. **Preference shocks**: $\varepsilon_{\kappa}(i)$, i.i.d. across workers & occupations

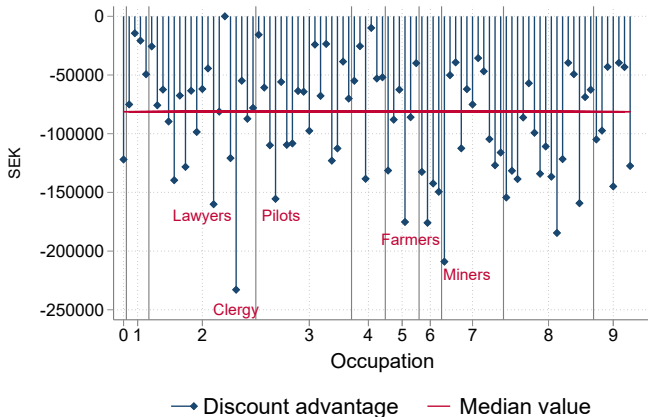
Entry Cost Estimation



- **Occ following:** 91 + 10 + 2 discounts to hit transition matrix Success
- **Distribution:** 91 entry costs to hit the densities Success
- **Parameters:** 192 (2 normalized to 0) Entry costs Costs vs Educ Expenditure shares

Follower Discounts

Entry-cost discount relative to children with fathers in other occs



Median follower discount ~ 80 kSEK (\$7,500) — 27% of earnings

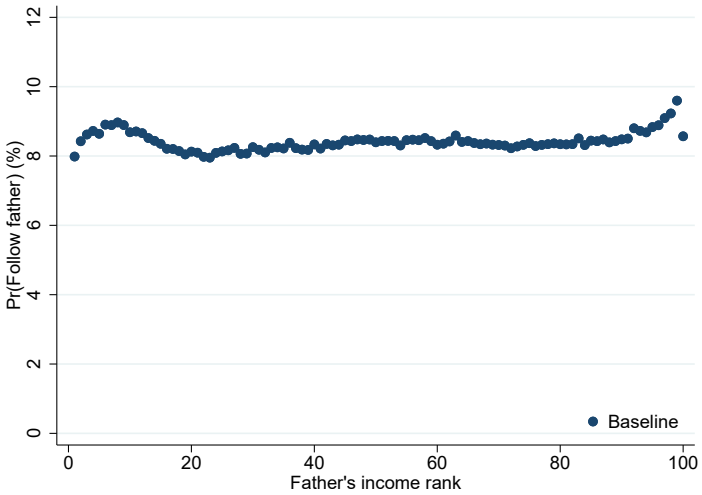
Counterfactual Experiment

The 'Equal Opportunities' Experiment

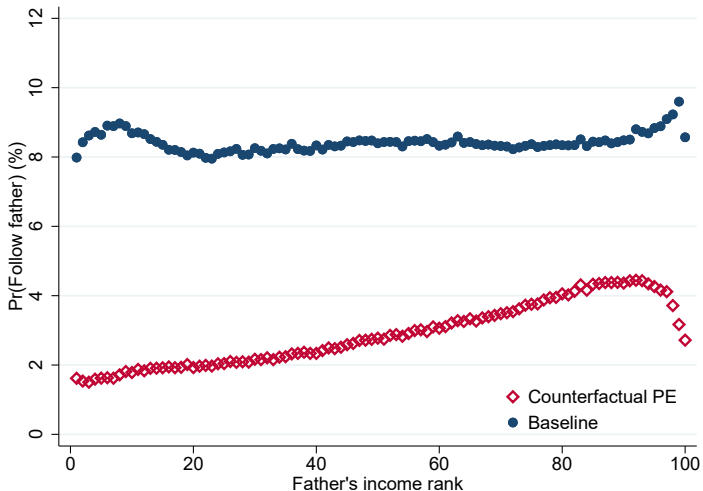
The experiment: Equal opportunity for occupational entry

- **Neutralize all follower discounts**
- Common entry costs unchanged
- Solve for occupational allocation and prices/wages in GE

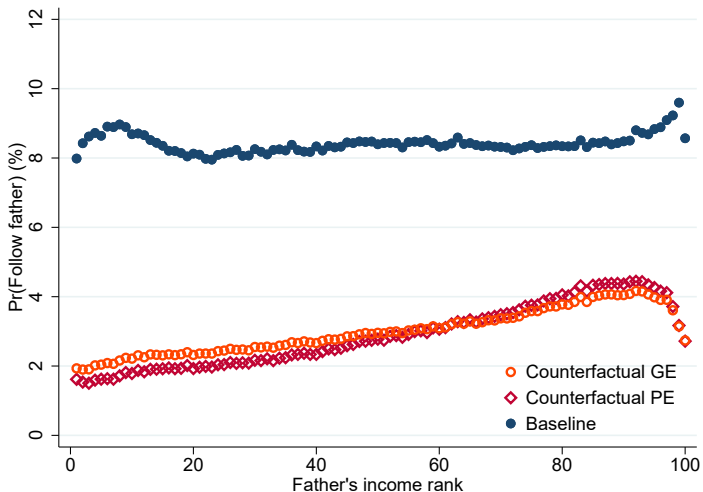
Drop in Occupational Following



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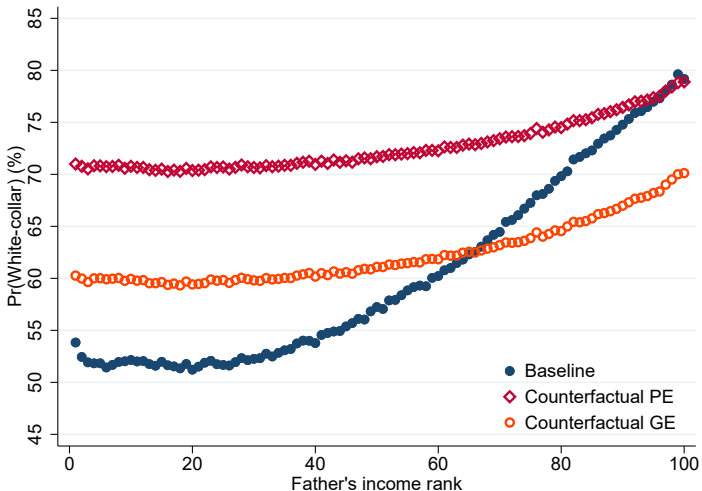


Drop in Occupational Following



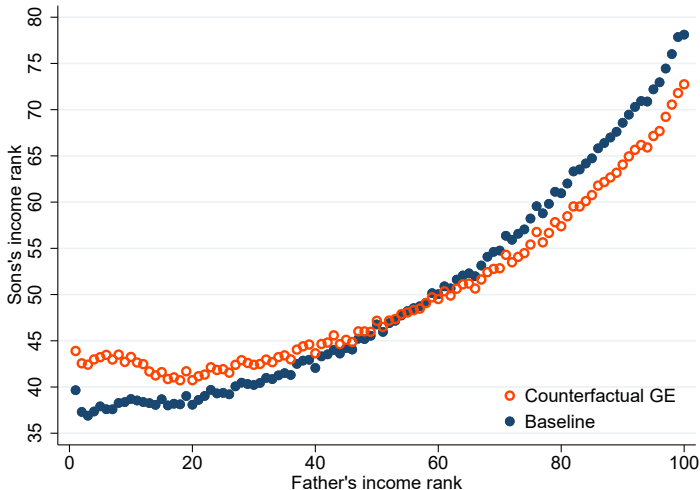
Drop in occupational following from 8.4% to 3.0% Occupations

White-Collar Occupations



Occupational mobility: $WC^{\text{Son}} | BC^{\text{Father}} \uparrow$ from 47% to 54%

Intergenerational Income Mobility

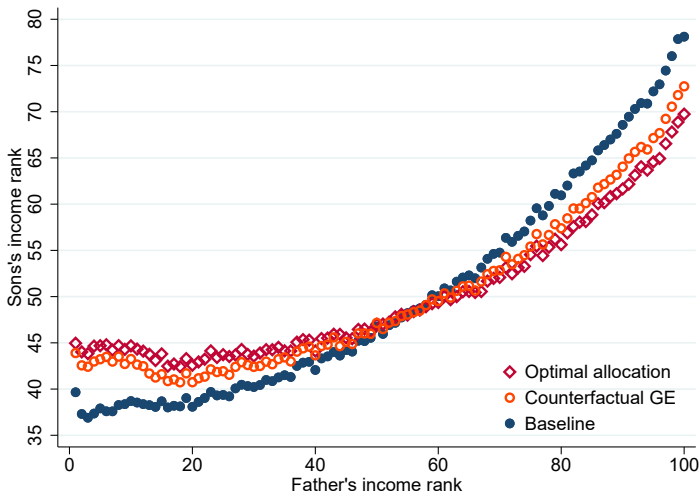


Decomposition: Paternal occ background accounts for 26% of intergenerational earnings persistence

Skills

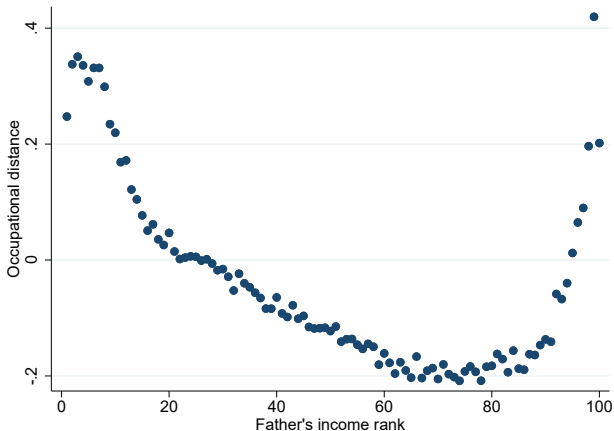
Real Income

Intergenerational Income Mobility



Optimal allocation: Allocation that maximizes aggregate income

Occupational Skill Distance Moved



- Measure skill distance between occupations using O*NET O*NET
- Most misallocation among sons of bottom 20% and top 10% fathers

Aggregate Effects

| | Occupational following | Pr(Q1→Q5) | Δ P90/P10 | Δ Aggregate earnings | Δ Wage of blue collar |
|-------------------|---------------------------|-----------|------------------|--------------------------------|---------------------------------|
| Baseline | 8.4% | 9.7% | — | — | — |
| Counterfactual PE | 2.9% | 12.6% | -3.9% | 2.0% | — |
| Counterfactual GE | | | | | |

- \uparrow intergen. occupation & income mobility, \uparrow income equality

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| Counterfactual GE | 3.0% | 12.5% | -4.5% | 0.1% | 4.35% |

- \uparrow intergen. occupation & income mobility, \uparrow income equality
- Marginal \uparrow in aggregate earnings in GE

Quasi-Experimental Evidence

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Ideal experiment: Equalize access to occupations

- Hard (impossible) to find the *ideal natural* experiment
- We use structural model as a laboratory
- Model cannot distinguish between inherited **preferences** & **barriers**

Quasi-experimental Evidence

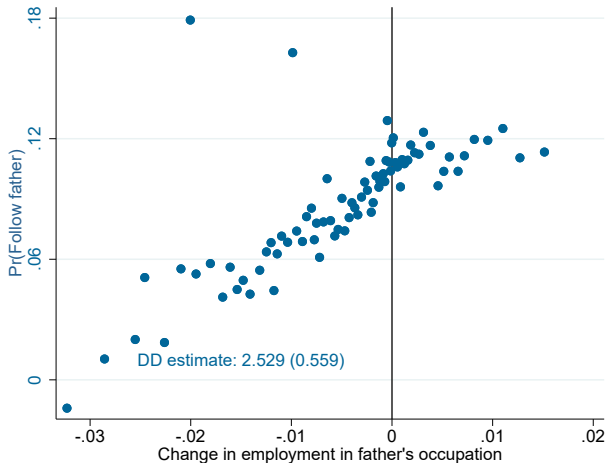
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Structural employment decline in fathers' occupations

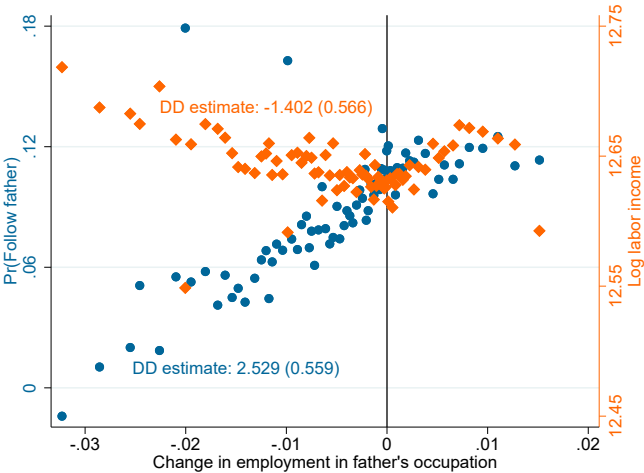
- Father's network/information less useful
- Preferences of fathers & sons not directly affected
- Interpret as variation in follower 'discounts'

Employment Decline in Fathers Occupation



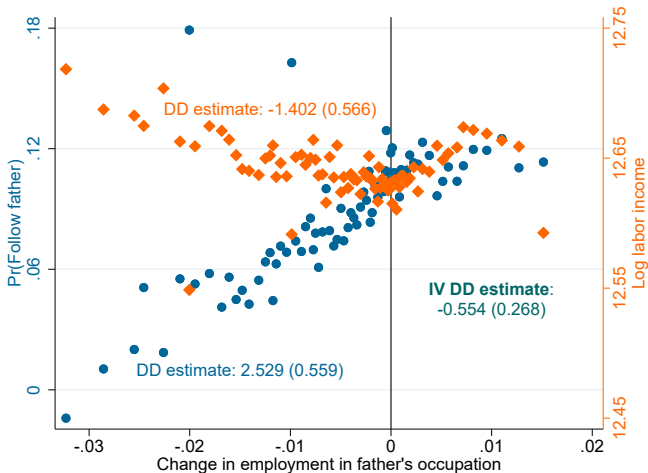
$$\text{follow}_{i\text{ot}} = \alpha_o + \beta \Delta \text{emp}_{\text{ot}} + \delta_t + \mathbf{X}'_i \gamma + \varepsilon_{i\text{ot}}$$

Employment Decline in Fathers Occupation



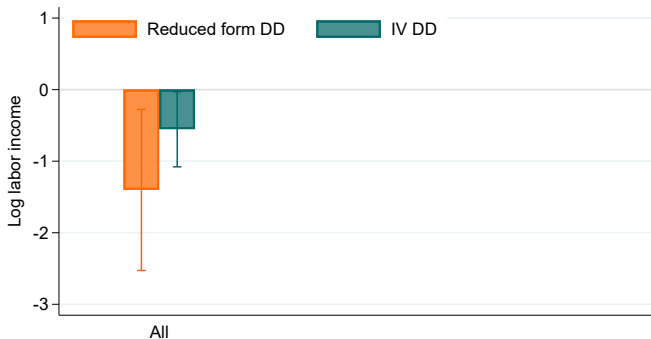
$$y_{iot} = \alpha_0 + \beta \Delta emp_{ot} + \delta_t + \mathbf{X}'_i \gamma + \varepsilon_{iot}$$

Employment Decline in Fathers Occupation

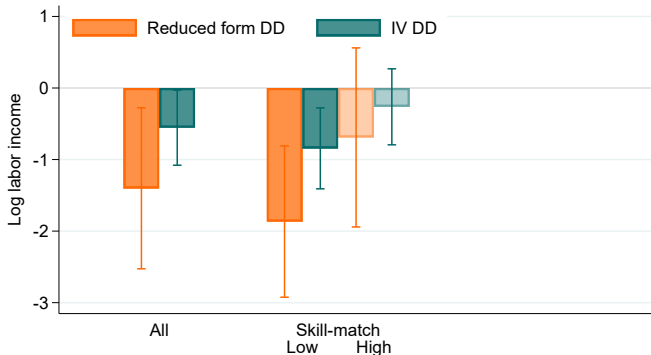


$$y_{i0t} = \alpha_0 + \phi \text{follow}_{i0t} + \delta_t + \mathbf{X}'_i \gamma + \varepsilon_{i0t}$$

Effect of Employment Decline by Background

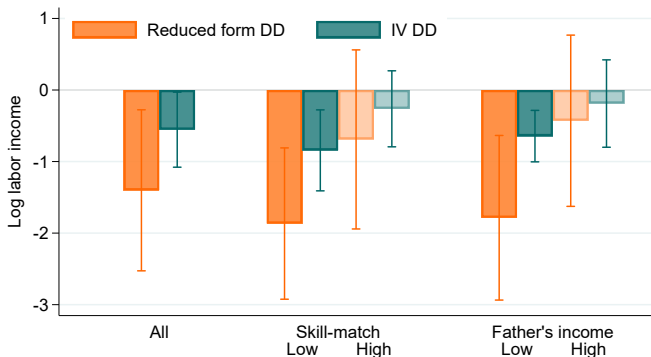


Effect of Employment Decline by Background



Earnings losses from following among **badly matched sons**

Effect of Employment Decline by Background



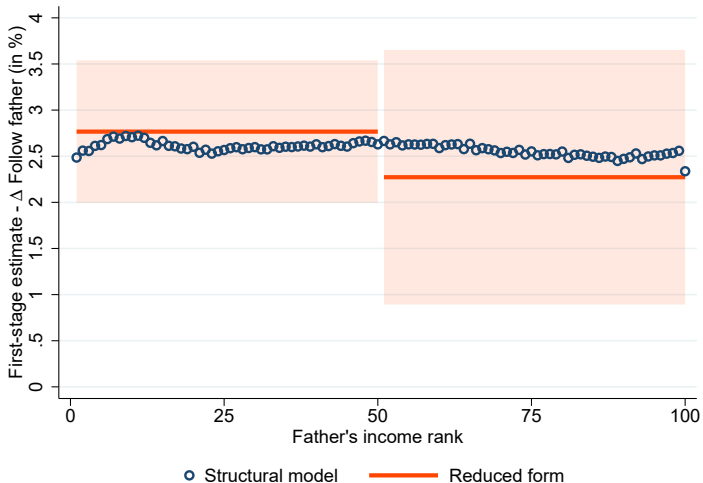
Earnings losses from following among **sons of poorer fathers**

Connection to the Structural Roy Model

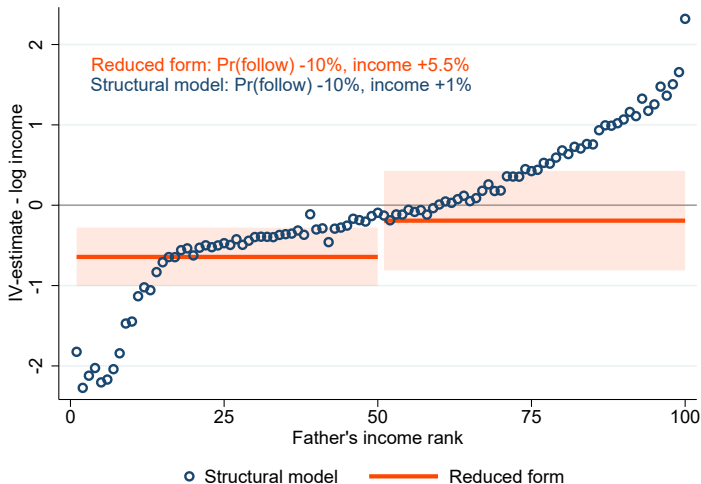
Replicate the reduced-form estimates using model-generated data (PE)

- Interpret occupational decline as exogenous variation in discounts
- Generate a **marginal change in discounts** into father's occupation
- **1st stage:** Change in following to a change in discount
- **IV:** Change in income due to a change in following

1st Stage Estimates: Roy Model vs. Reduced Form



IV Estimates: Roy Model vs. Reduced Form



Conclusion

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- Strong intergenerational persistence in occupations
- **Equal access to occupations** increases intergenerational mobility
- Following reflects not only selection but **misallocation of talent**
- Largest increase in mobility among sons of the **poorest fathers**
- Considerable increase in mobility **without a reduction in output**

Appendix

Data

1. Intergenerational register

- ◇ Connects children to father and mother – biological or adopting

2. Cognitive and non-cognitive skills

- ◇ Military draft tests and evaluations from the Swedish Military Archives — available from 1969

3. Labor market outcomes (e.g. occupation and earnings)

- ◇ Swedish national census, tax registers, establishment data on wages and occupation of 50% random sample every year

2 & 3 Defines our sample, i.e. sons that were 18 in 1969 and later and are observed at prime age (30-40)

Occupation and income

- Children: Model occupation between 30 and 40, and associated income
- Parents: Model occupation between 45 and 55, and associated income

Occupational Mobility Bias

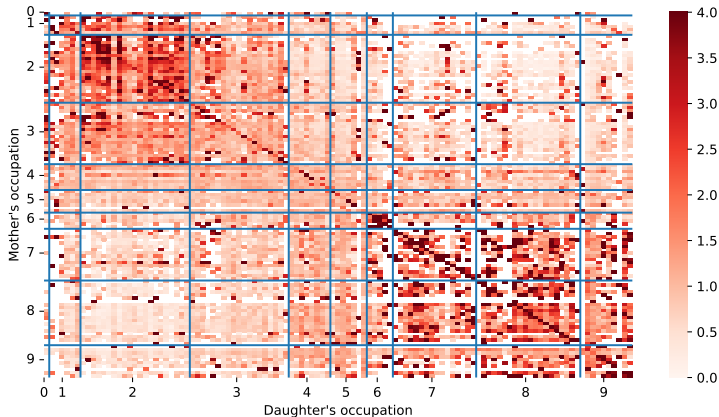
How disproportionately more likely are children to choose parent's occupation

$$OMB_{p,c} = \frac{\text{share}_{p,c,\text{child}}}{\text{share}_{c,\text{child}}}$$

where p : parent and c : child index occupations.

Random assignment: $OMB = 1$

Occupational Mobility Bias: Mothers & Daughters



0 - Armed forces

1 - Legislators, senior officials, managers

2 - Professionals

3 - Technicians & assoc. professionals

4 - Clerks

5 - Service & sales

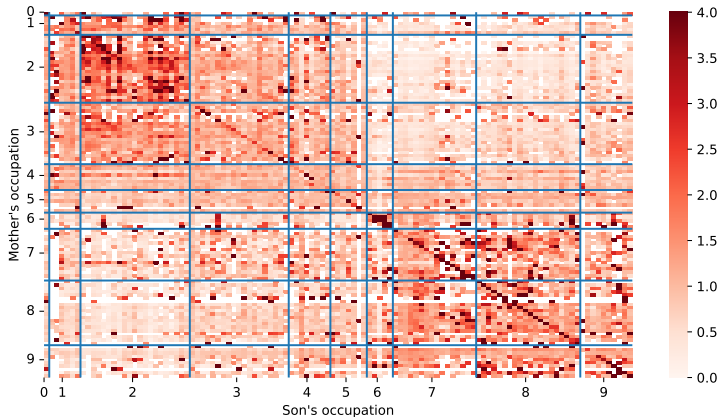
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Occupational Mobility Bias: Sons & Mothers



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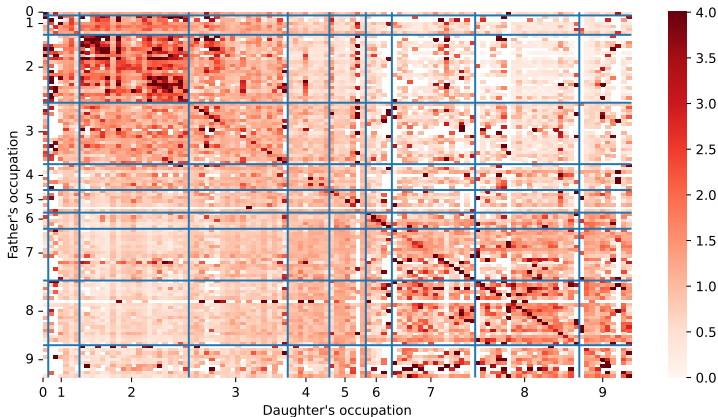
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Occupational Mobility Bias: Daughters & Fathers



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Skills

Individuals are endowed with a **bivariate skill vector**

$$(Z_{i,H}^g, Z_{i,F}^g)$$

where $Z_{i,k}^g$ is the productivity of individual i from generation g in occupation k .

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$$(Z_{i,H}^g, Z_{i,F}^g)$$

where $Z_{i,k}^g$ is the productivity of individual i from generation g in occupation k .

Children inherit skills from their parents according to:

$$z_{i,k}^g = \tau z_{i,k}^{g-1} + (1 - \tau) \varepsilon_{i,k}^g,$$

where τ governs the inheritability of traits

Joint distribution of $\varepsilon_{i,k}^g$ bivariate normal ($\mu_k = 0$, $\sigma_k^2 = 1$), and correlation $\rho (> 0)$

Earnings, Costs, and Utility

Occupations as firms

- Linear production — Labor is the only factor
- Perfect competition and firms take fixed prices as given
- Workers get paid per efficiency unit of labor

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The logarithm of labor income:

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$$y_{i,H}^g = w_H + \beta_H z_{H,i}^g$$

$\beta_F > \beta_H$: Fishing is the higher paying occupation

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Utility:

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Comparative and Absolute Advantage

Comparative advantage in fishing

$$s \equiv Z_F^{\beta_F} / Z_H^{\beta_H}$$

Change in s only shifts y_F

Absolute advantage

$$a \equiv Z_H^{\beta_H}$$

Change in a shifts y_F and y_H equally

Predicting Earnings and Entry Probability

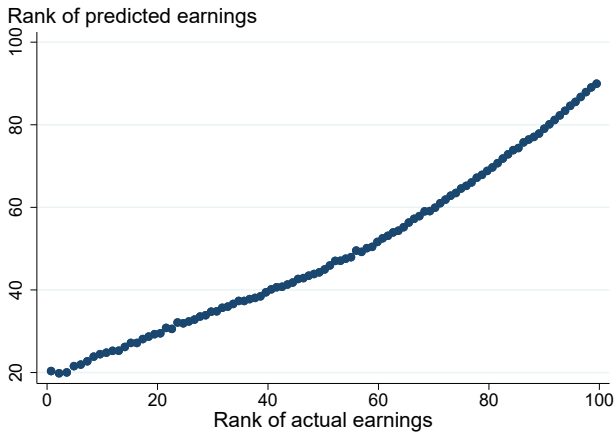
Predicting earnings using Random Forest

- For each occupation, train on incumbents, no followers
- The prediction is based on residualized income in logs:
$$\ln(\text{earn}_i) = \rho_o + \delta_c + \gamma_y + \varepsilon_i$$
$$\rho_o, \delta_c, \text{ and } \gamma_y \text{ are, respectively occupation, birth cohort, and year FEs}$$
- Split our sample into six periods, two per decade
- Predict for every individual earnings in every occupation

Predicting entry probabilities – Random Forest

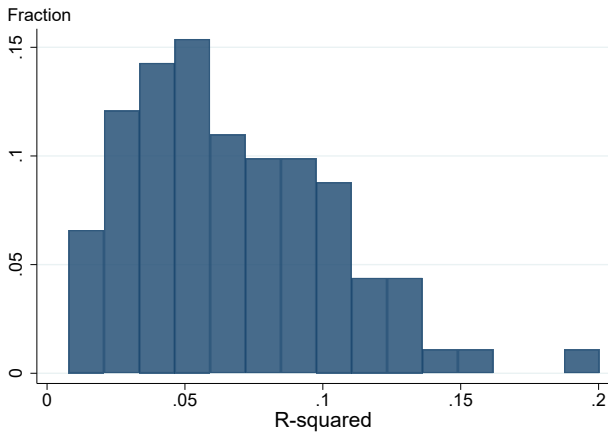
- For each occupation, train on incumbents, no followers, with top 20% earnings
- Predict for every individual probability of entering every occupation

Actual and Predicted Earnings

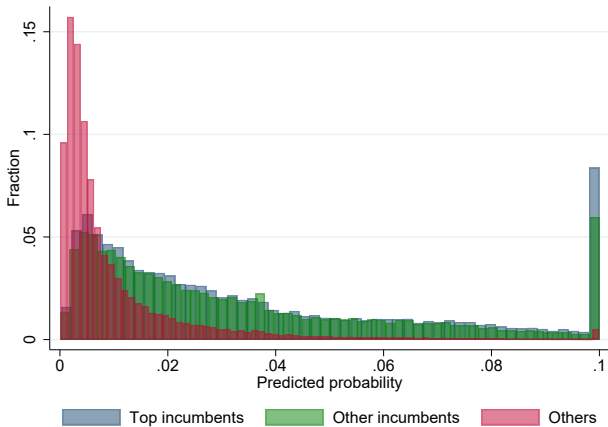


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Random Forest Prediction R^2

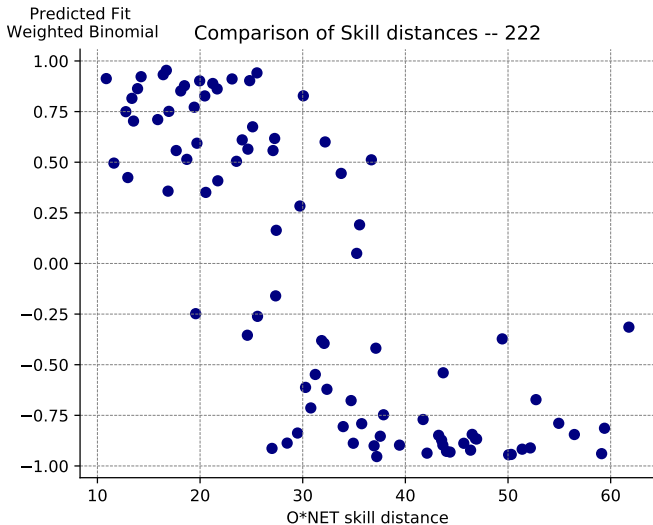


Predicted Probability of Occupation Entry



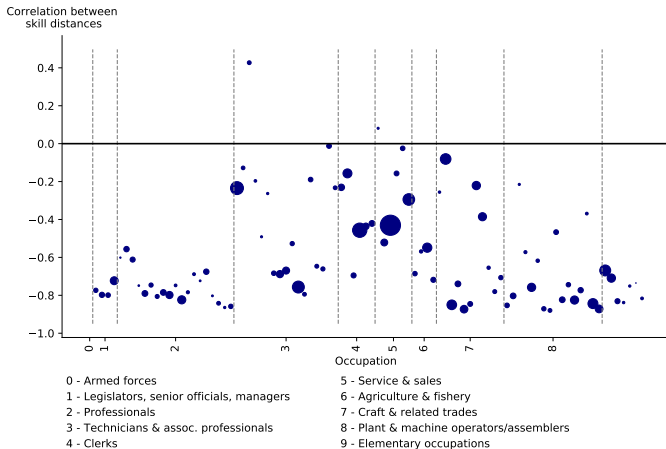
Skill distance according to O*NET

Comparison of skill closeness/remoteness using ONet data [Back](#)

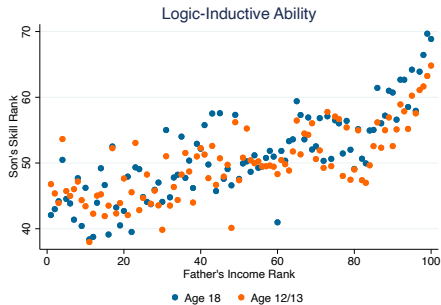


Skill distance according to O*NET

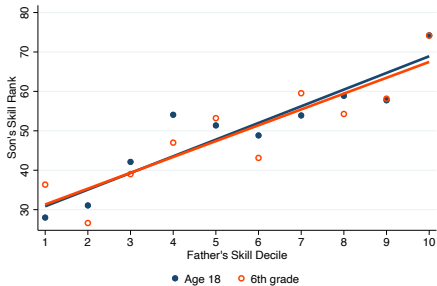
Comparison of distance measures across occupations [Back](#)



Logic-inductive ability: Age 18 vs. 12/13

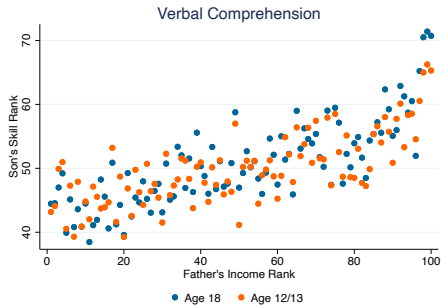


(a) Fathers' Income Rank

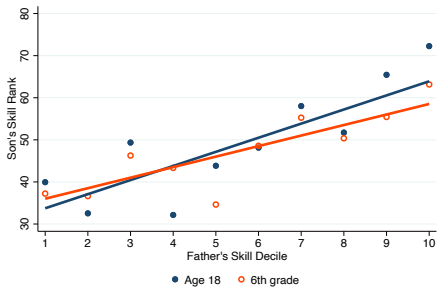


(b) Fathers' Skill Decile

Verbal Comprehension: Age 18 vs. 12/13

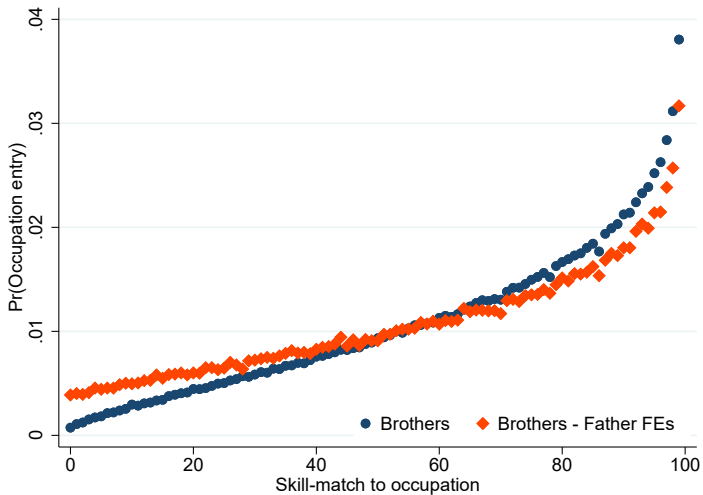


(a) Fathers' Income Rank

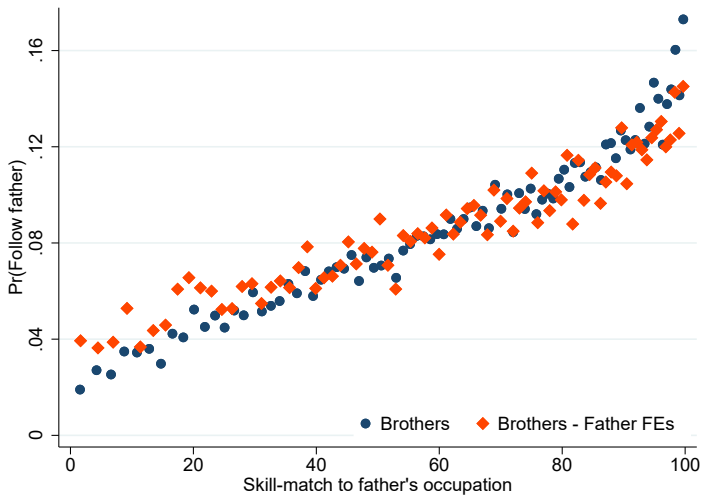


(b) Fathers' Skill Decile

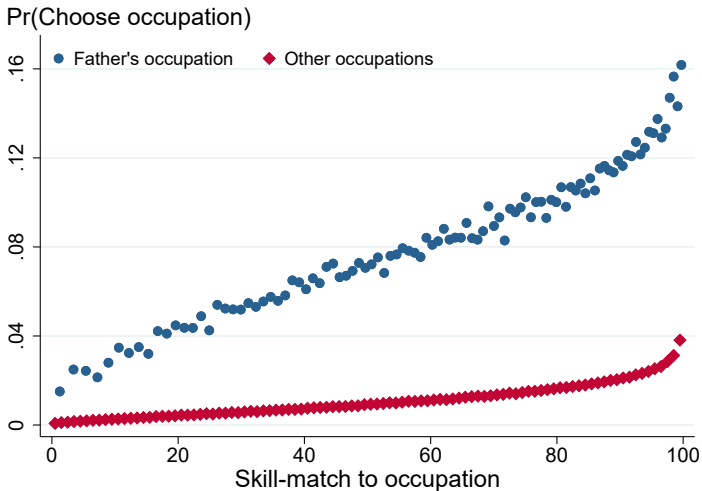
Occupational Choice and Skill Match: Brothers



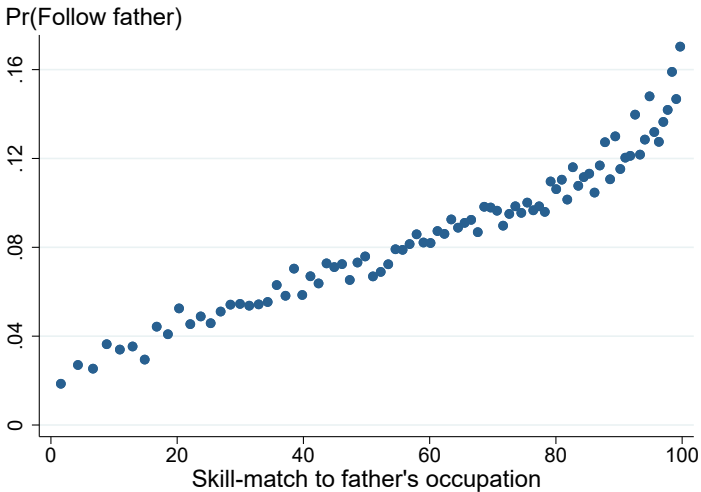
Occupational Following and Skill Match: Brothers



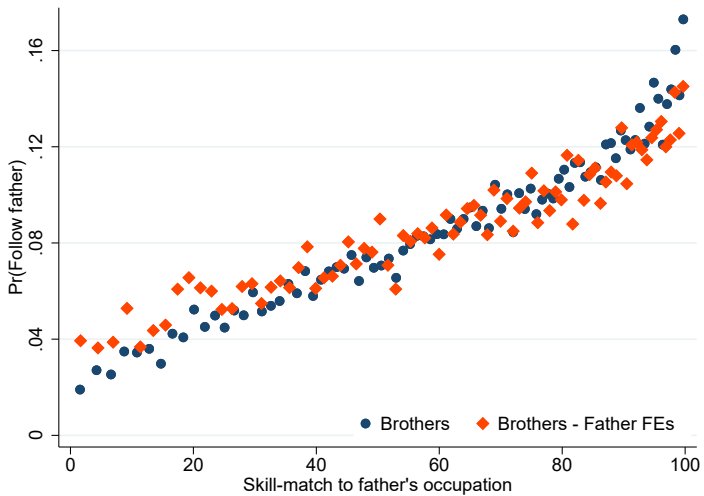
Occupational Following and Skill Match



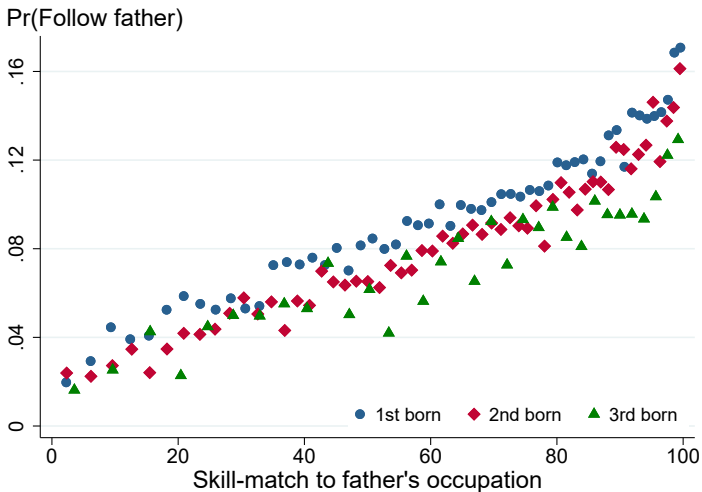
Occupational Following and Skill Match: Brothers



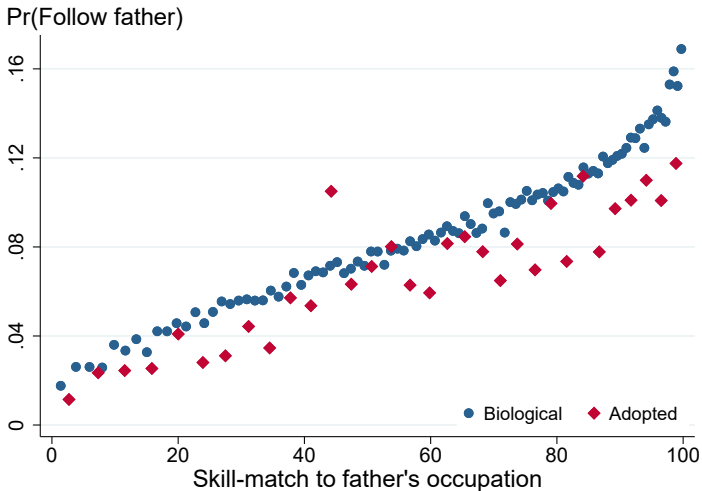
Occupational Following and Skill Match: Brothers



Occupational Following and Skill Match: Birth Order



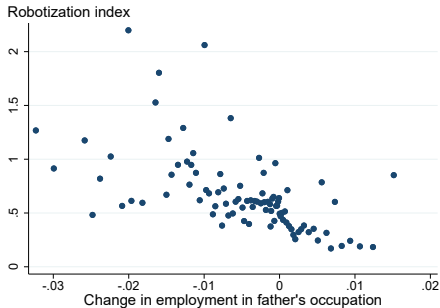
Occupational Following and Skill Match: Bio/Adopted



Occupational Decline: Automation and Robotization

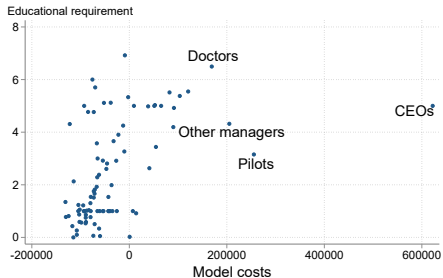


(a) Automation (Frey and Osborn, 2007)

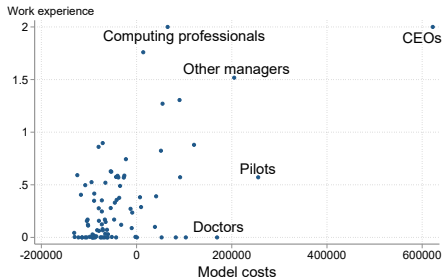


(b) Robotization (Webb, 2019)

Entry Costs, Education, and Work Experience



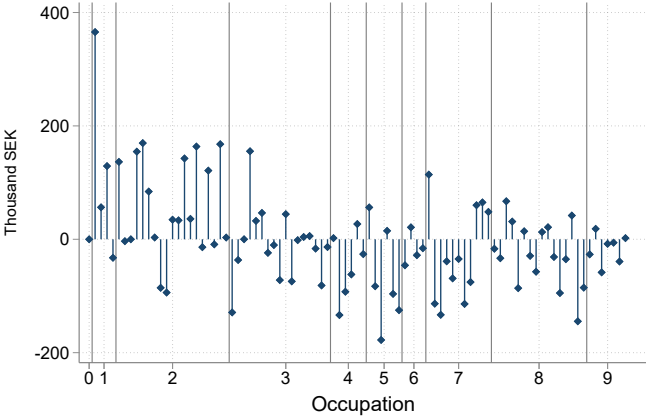
(a) Costs and Educational Requirements



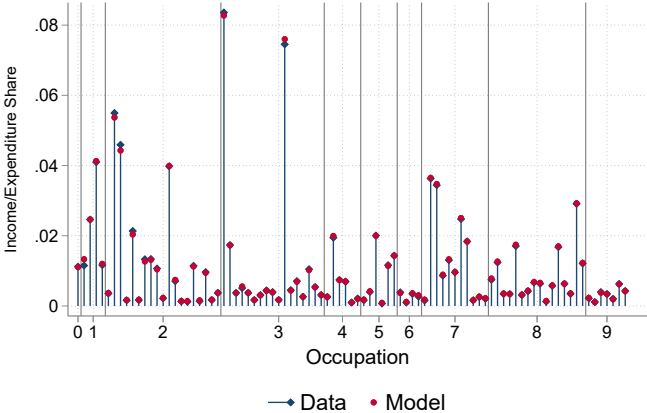
(b) Costs and Usual Work Experience

[Back](#)

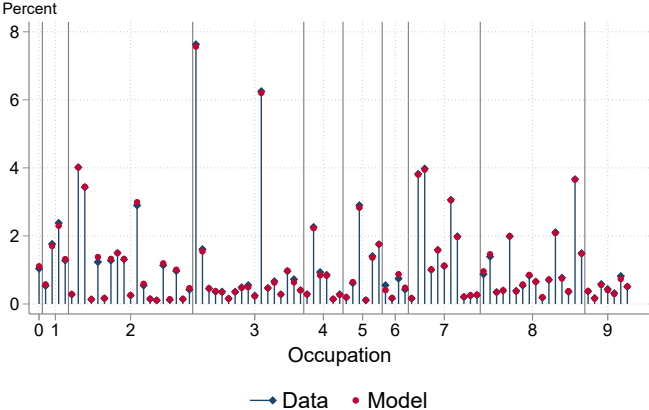
Model implied entry costs



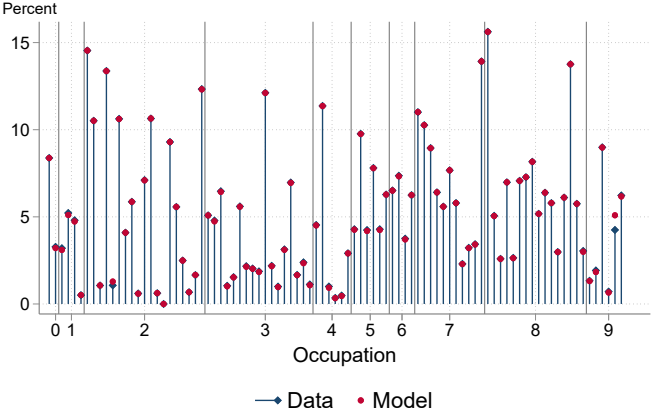
Model implied expenditure shares



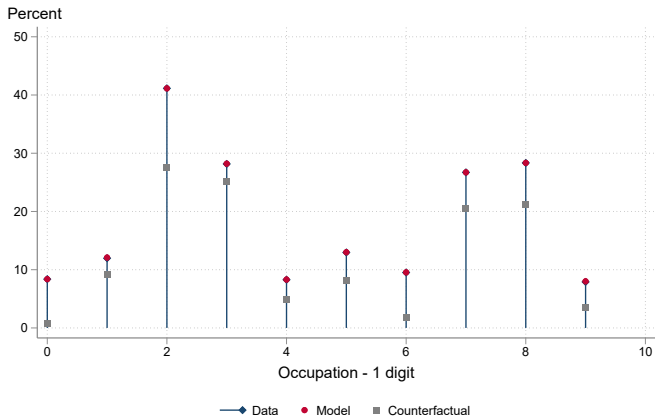
Occupational shares — Model and Data



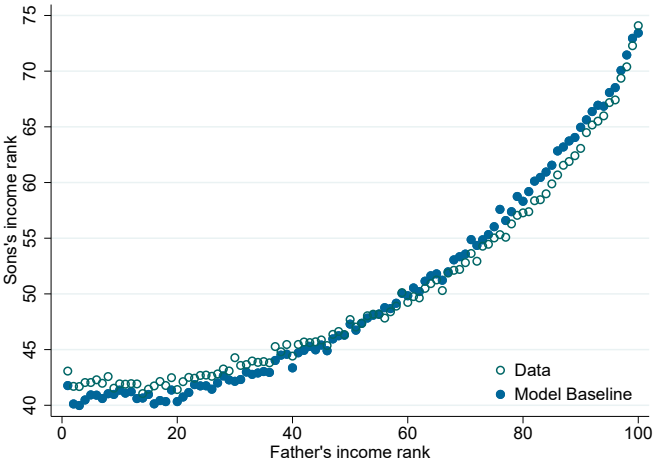
3-digit occupational following — Model and Data



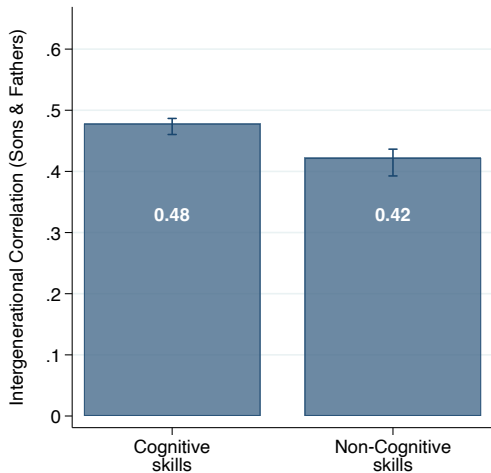
1-digit occupational following — Model and Data



Intergenerational Mobility: Model vs. Data



Intergenerational Correlation in Skills



IV using uncles: Grönqvist, Öckert, & Vlachos, 17

Change in Real Income

