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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Sorting

- Earnings is the outcome of individuals' **productive skills**
- Parents and children share the **same skills**

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

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- 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)
- Growth, inequality and immobility move together
  (Galor-Tsiddon, 97; Jovanovic, 14)

Inequality **and** Inefficiency

- Misallocation of talent increases inequality, reduces mobility and lowers growth (Bell-Chetty-Jaravel-Petkova-Van Reenen, 19; Hsieh-Hurst-Jones-Klenow, 19)

This Paper

Does **occupational following** reflect misallocation of talent?

- Consequences for intergen. mobility — Implications for efficiency

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Setting: Swedish sons & fathers

- Data on individuals' cognitive and noncognitive skills back to 1960s

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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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2. **Reduced form**
   - ◇ Quasi-experimental evidence — occupational decline
   - ◇ Same regressions on model-generated data

Preview of Results

Prevalent occupational following

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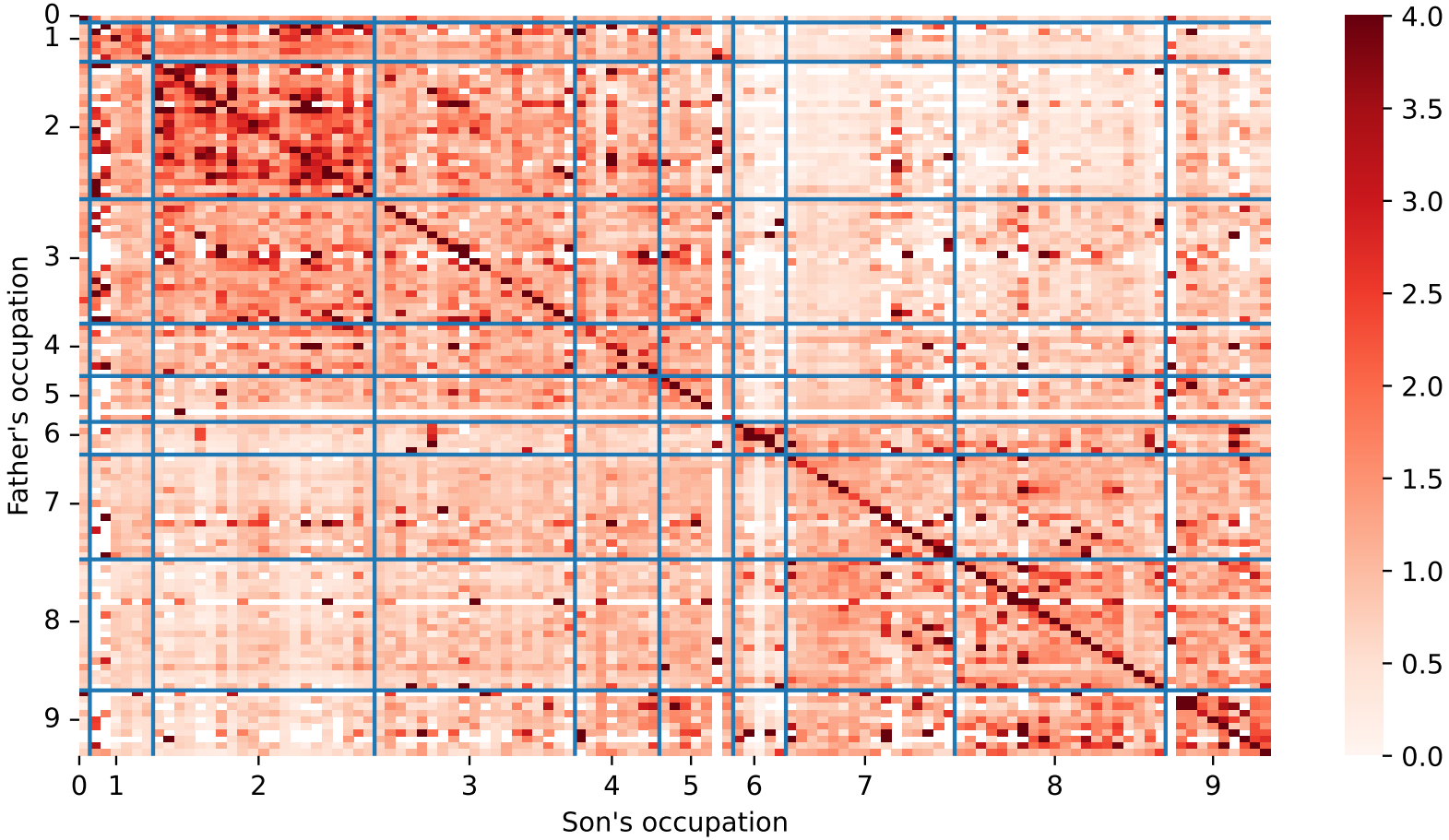
Misallocation of talent

- 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
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9 - Elementary occupations

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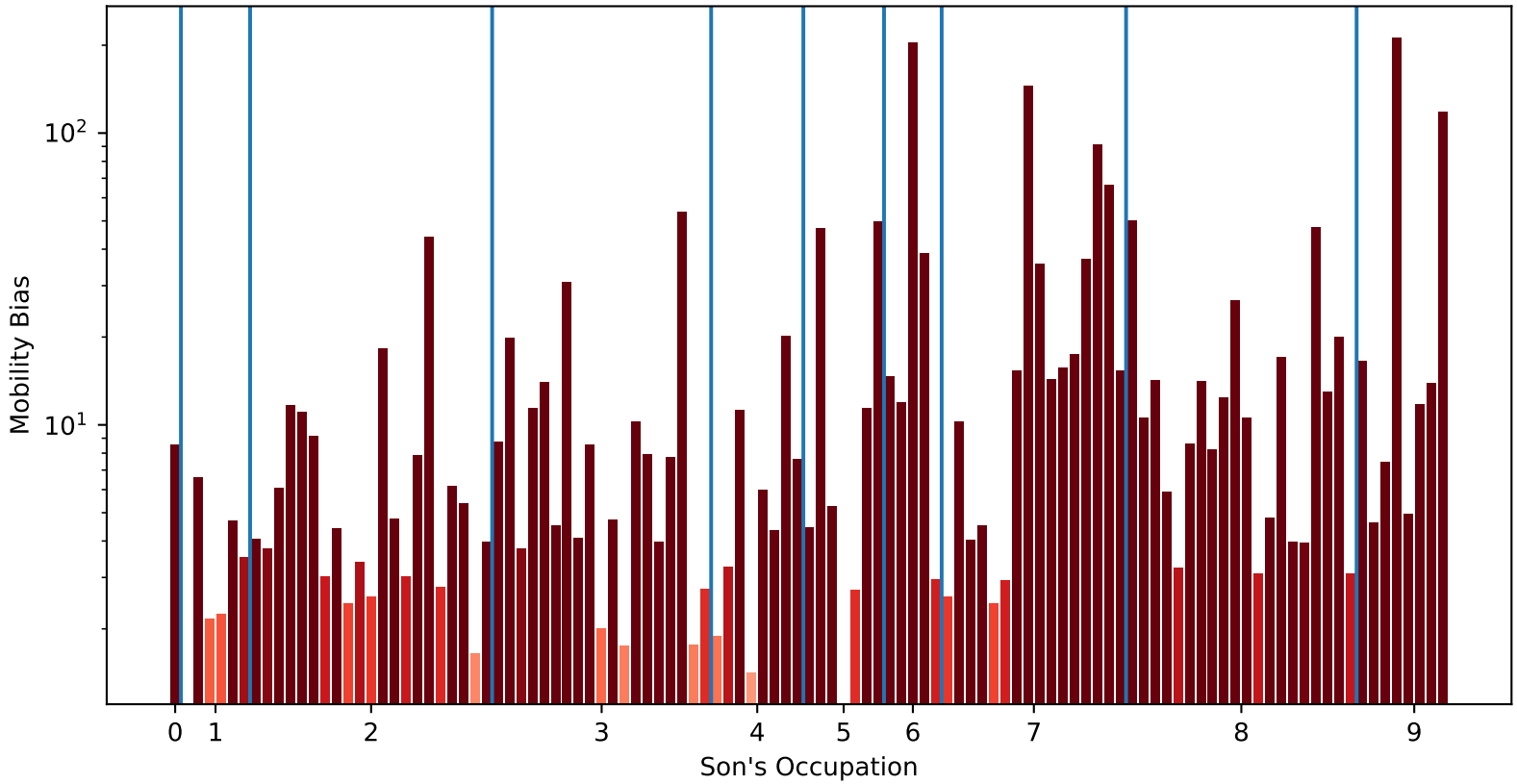

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Roy Model of Occupational Choice

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

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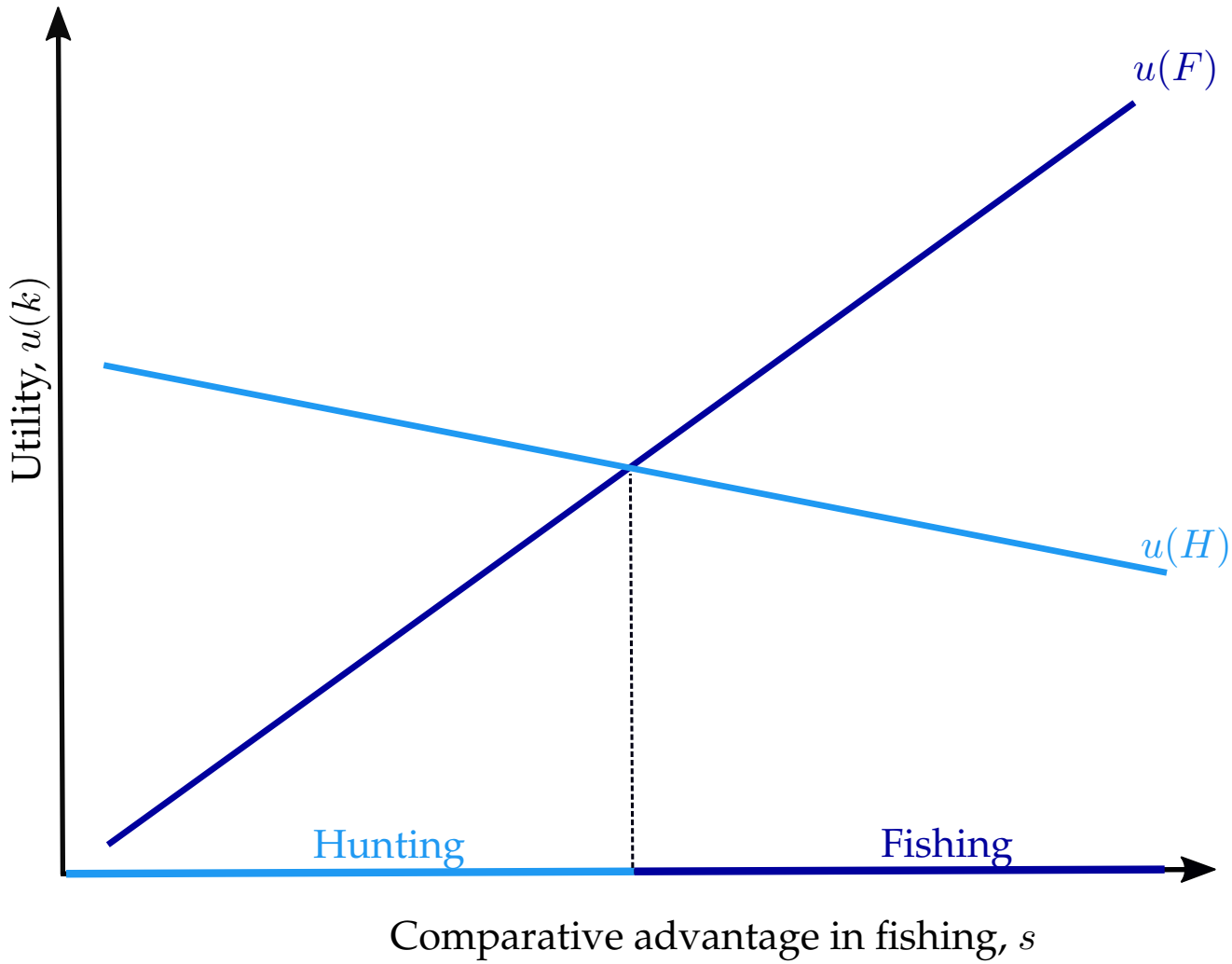
Basic Roy (1951) model

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

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

More

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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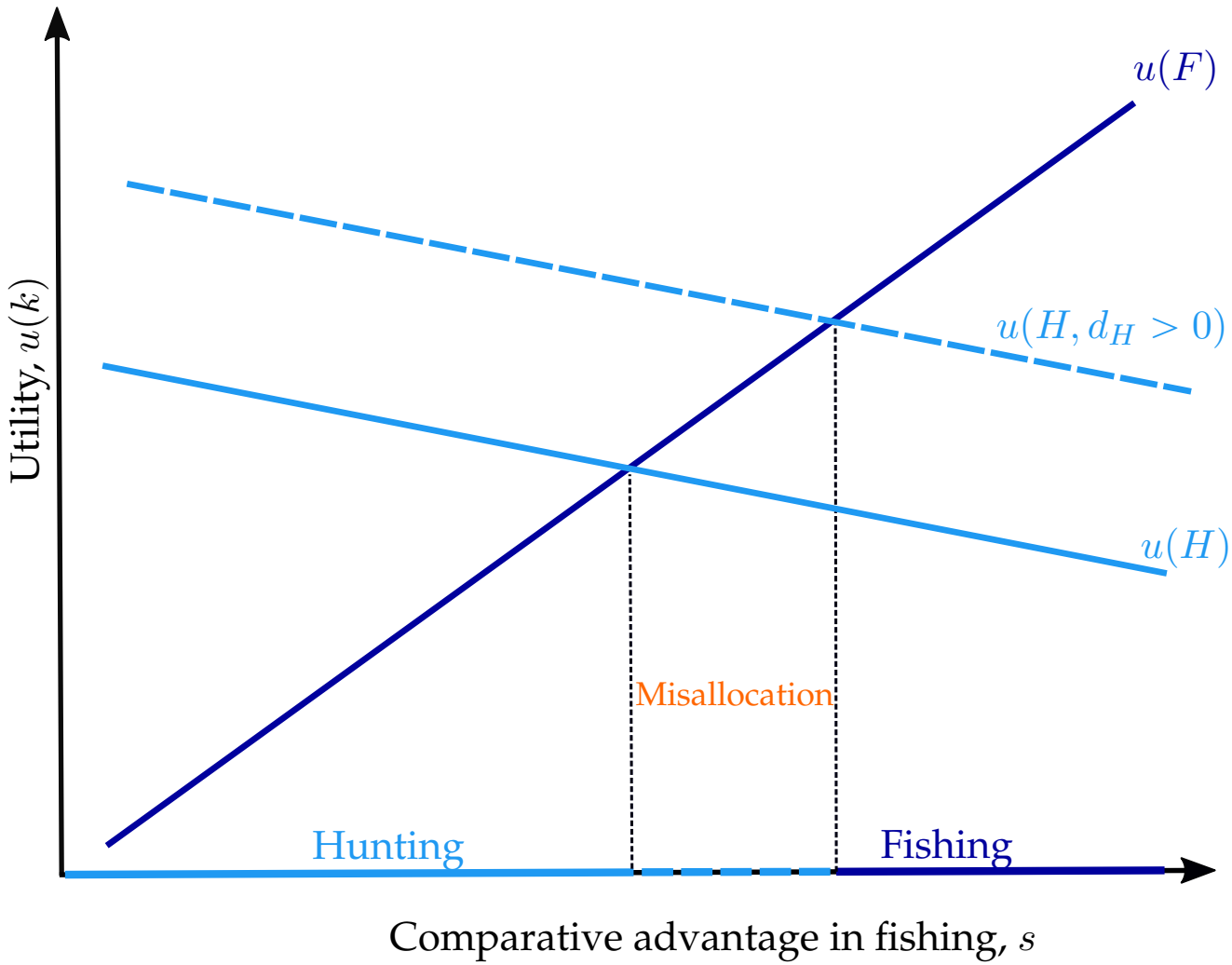

$$u(i, g, k) = \underbrace{y_{i,k}}_{\text{Earnings}} - \underbrace{m_k}_{\text{Entry costs}} + \underbrace{d_k \mathbb{I}_{i,k^g = k^{g-1}}}_{\text{Cost discounts}}$$

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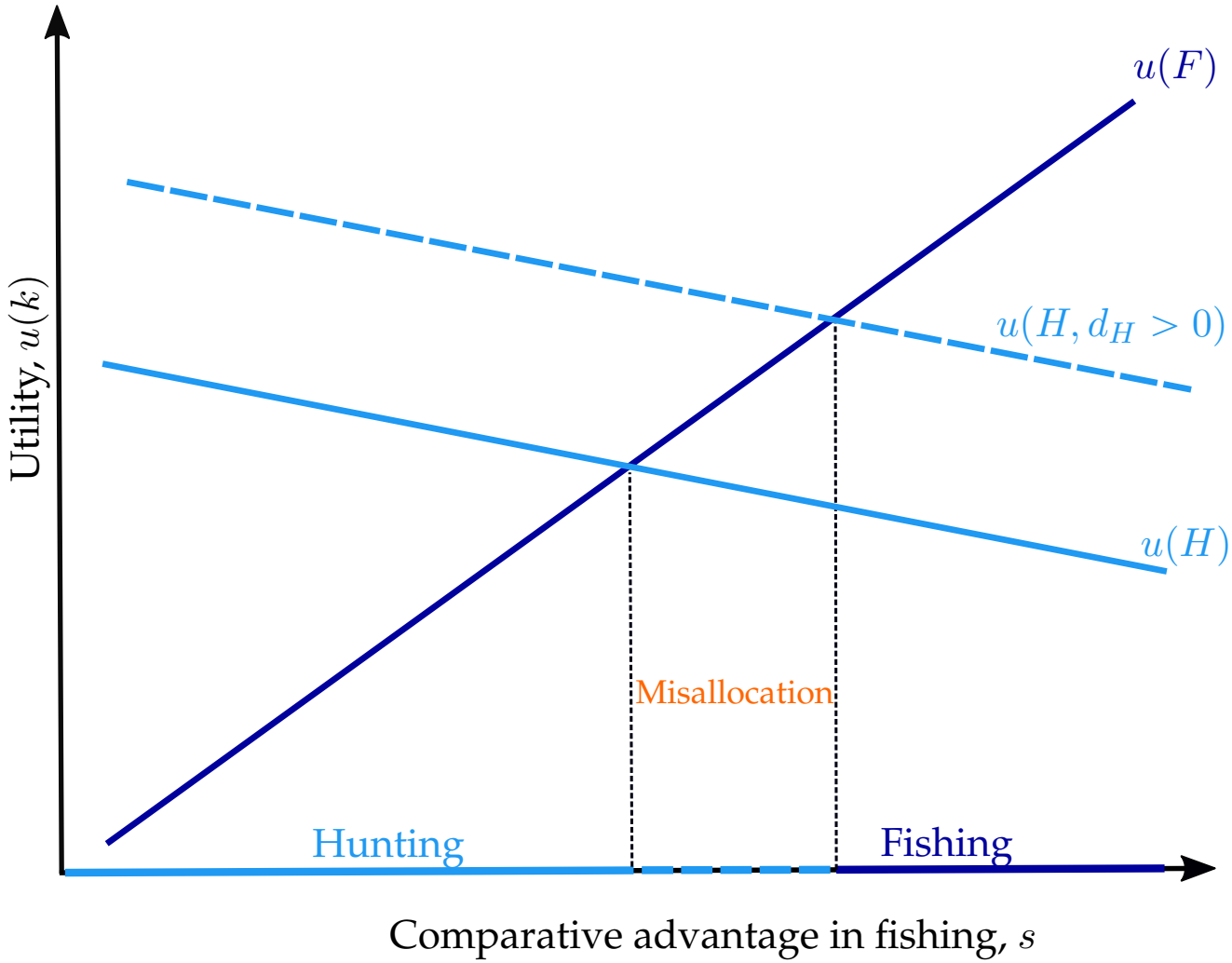
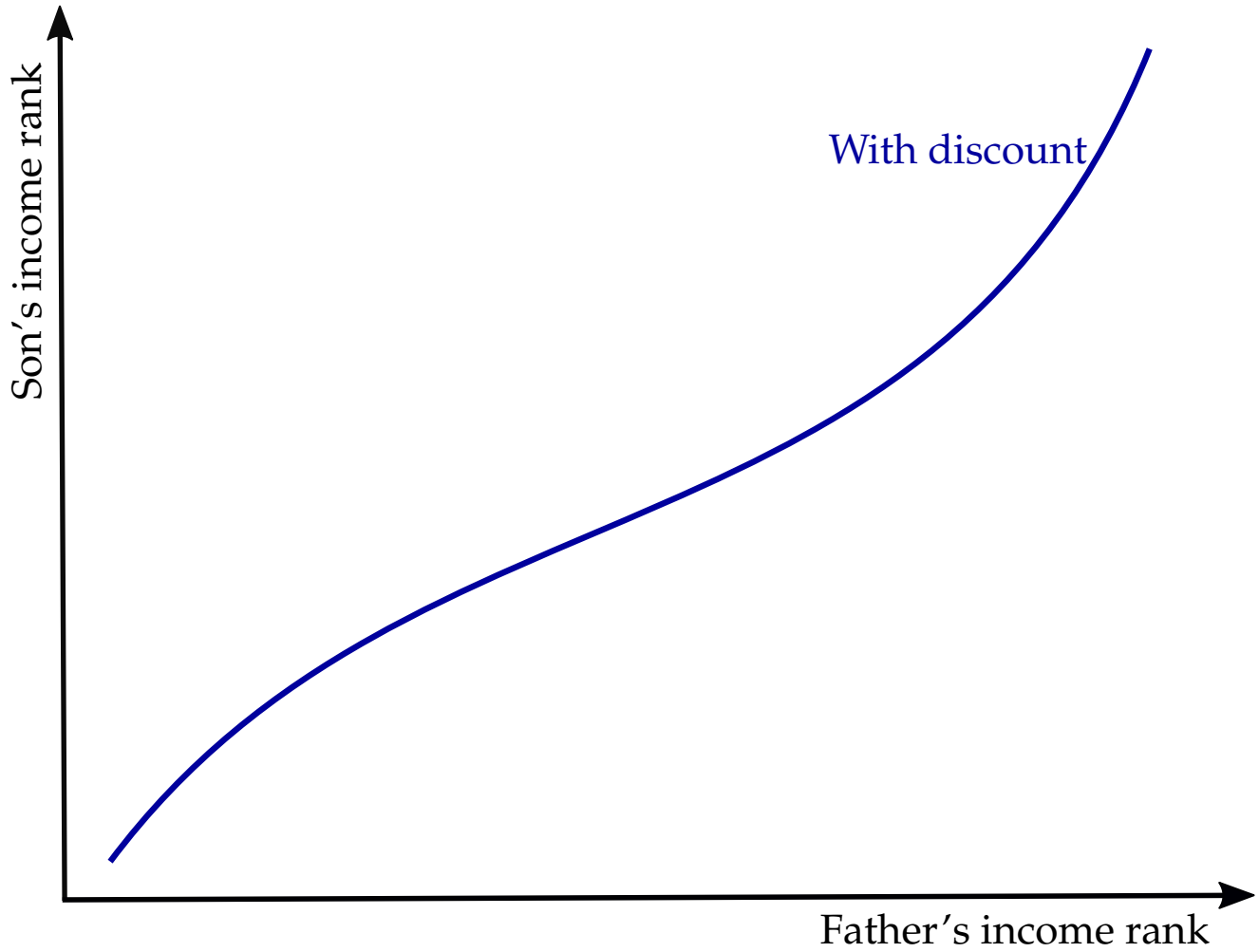


Misallocation: Sons of hunters that become hunters but have comparative advantage in fishing

Intergenerational Income Mobility



Labor income: $y^g_{i,k} = w_k + \beta_k z^g_{k,i}, \qquad \beta_F > \beta_H$

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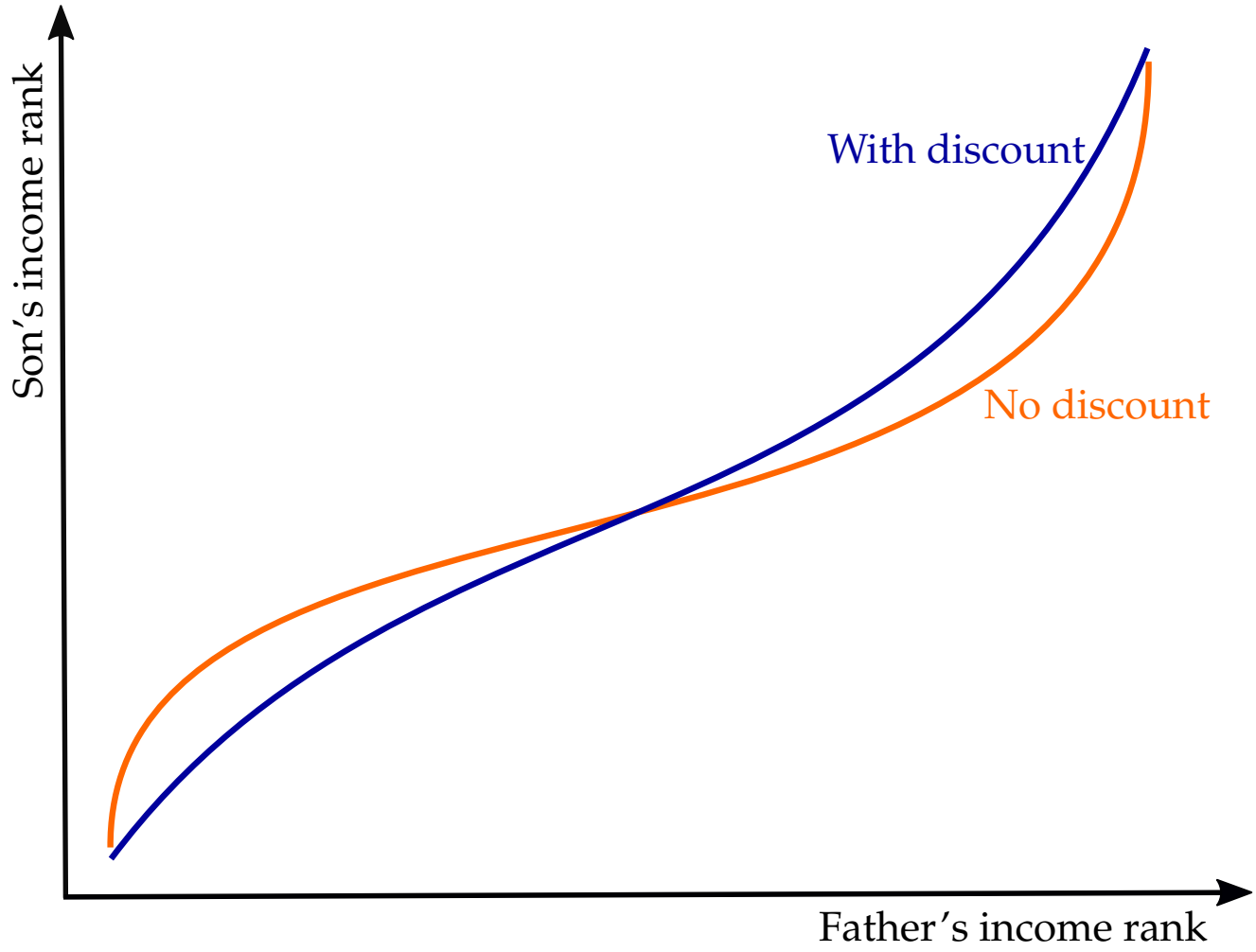

d_F: Sons of high-income fathers stay in F

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
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Cognitive skills

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Noncognitive skills/personality traits

- Psychological energy (focus, perseverance), Intensity (activation w/o external pressure), Emotional stability (stress tolerance), Social maturity (extroversion)
- 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

$\Rightarrow$ Skills of incumbents can be used to measure skill requirements

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- Returns to cognitive skills as technology complement (e.g. Katz-Murphy, 92)
- Returns to noncognitive skills for interpersonal interaction (e.g. Deming, 17)

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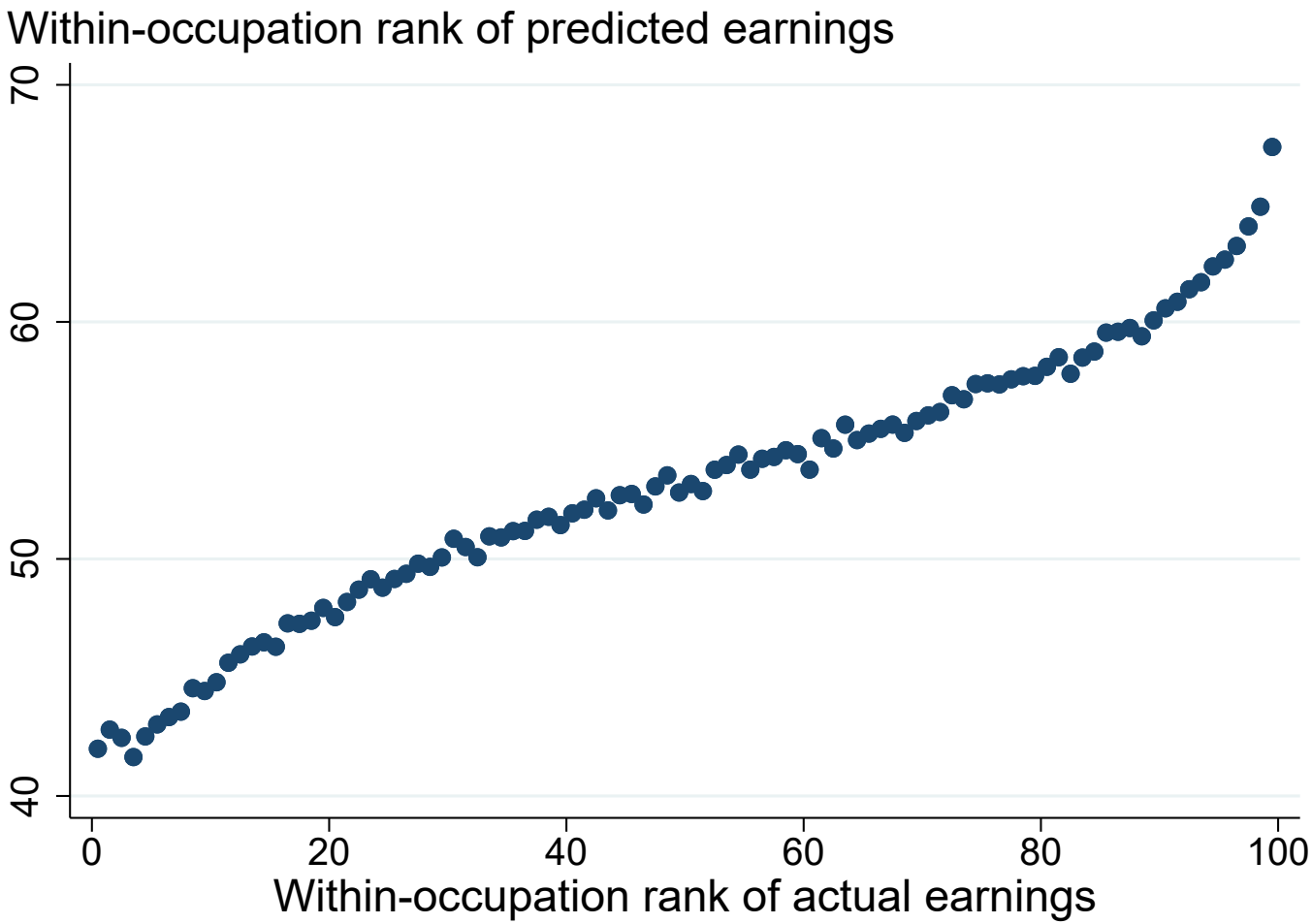
Predict earnings ("Roy-productivity") and entry probability (skill fit)

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

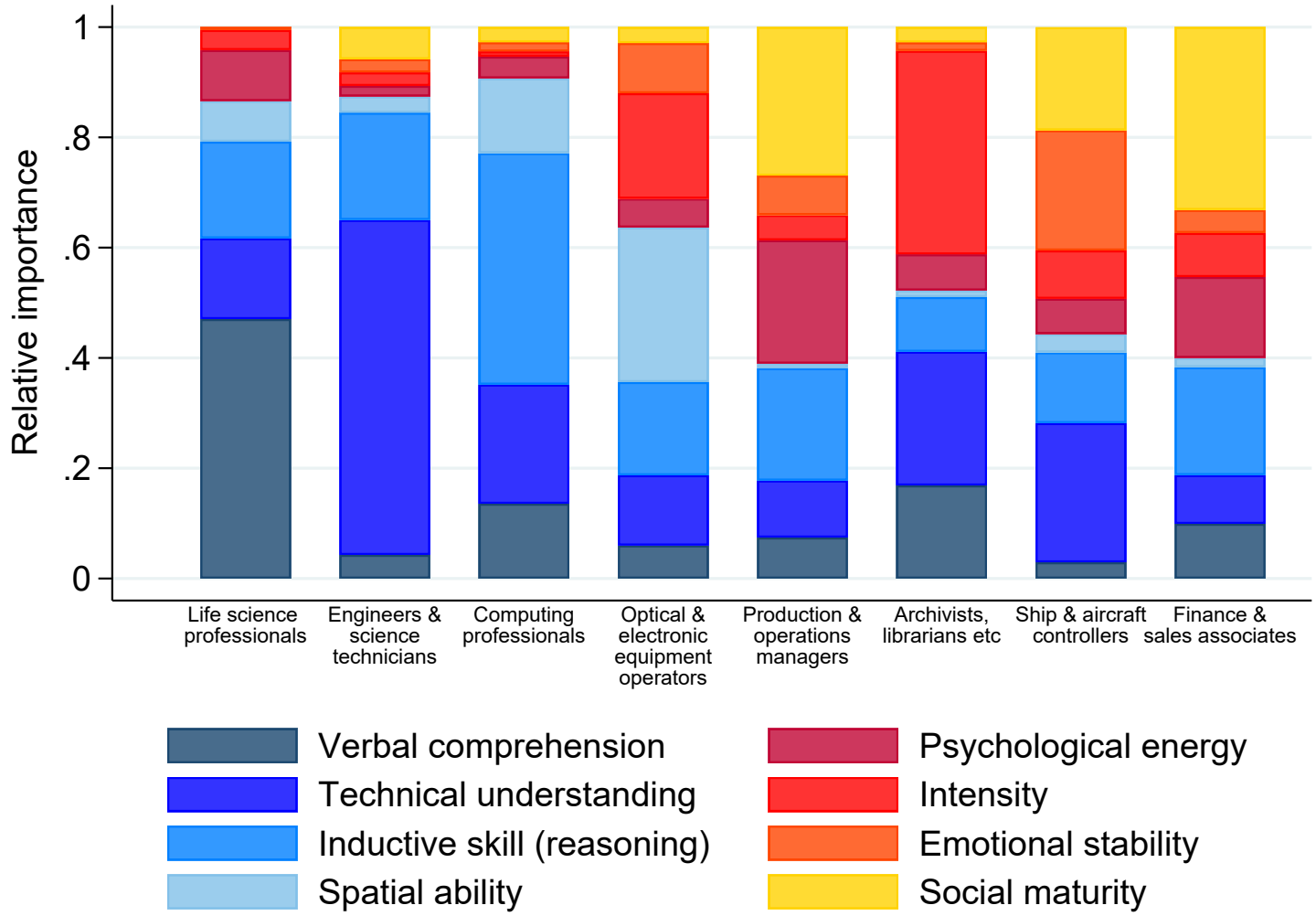
More

Actual and Predicted Earnings



Earnings Prediction Probability

Factor Importance



Brother differences UGU O*NET

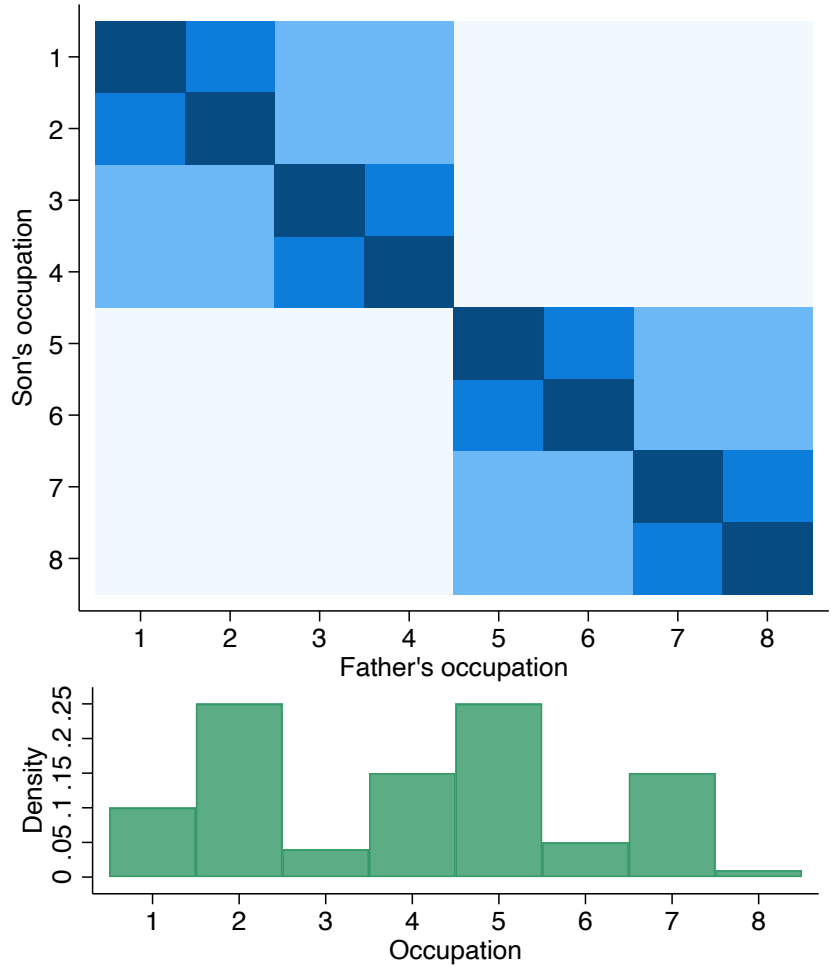
Structural Roy Model

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**: $\varepsilon_k(i)$, i.i.d. across workers & occupations

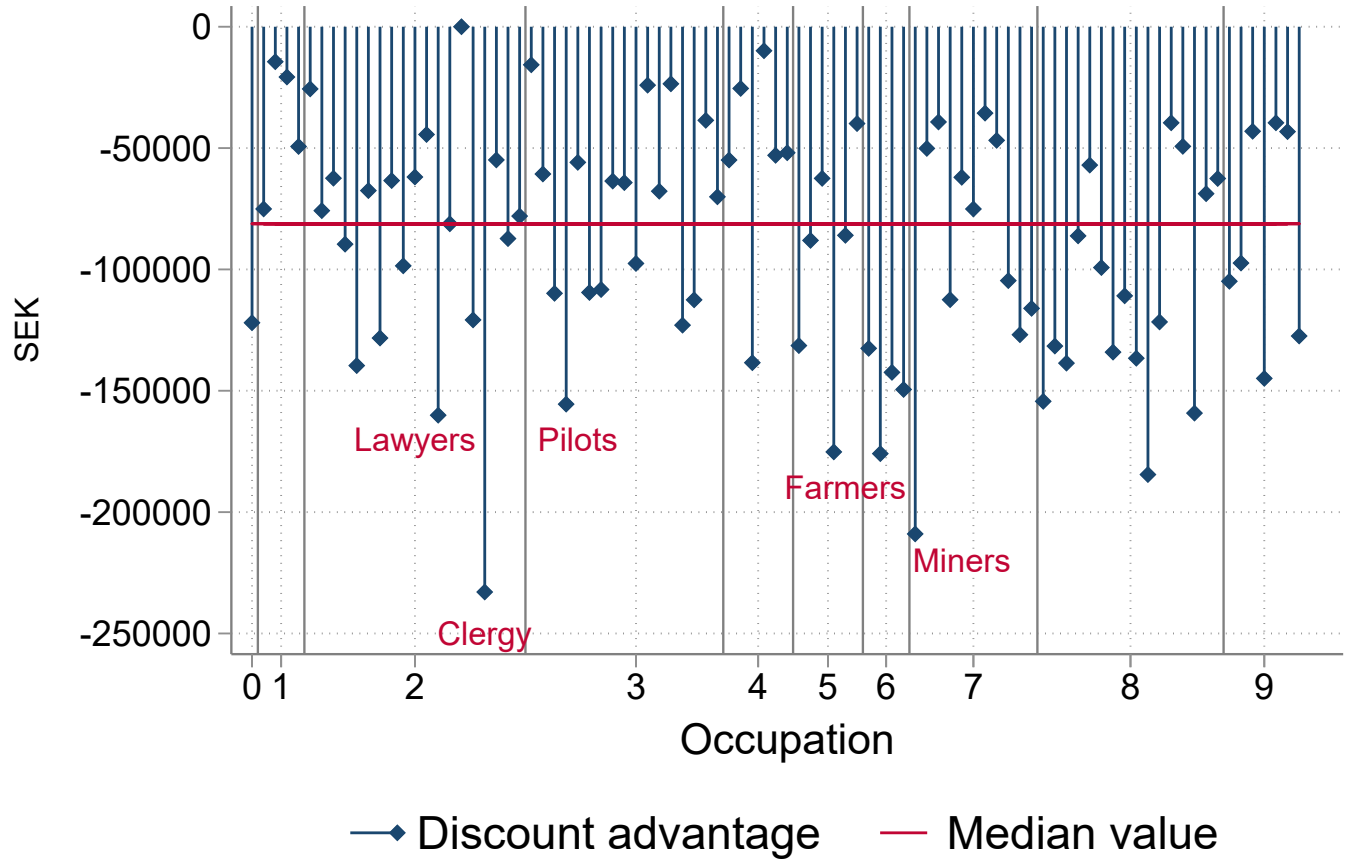
Entry Cost Estimation



- 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

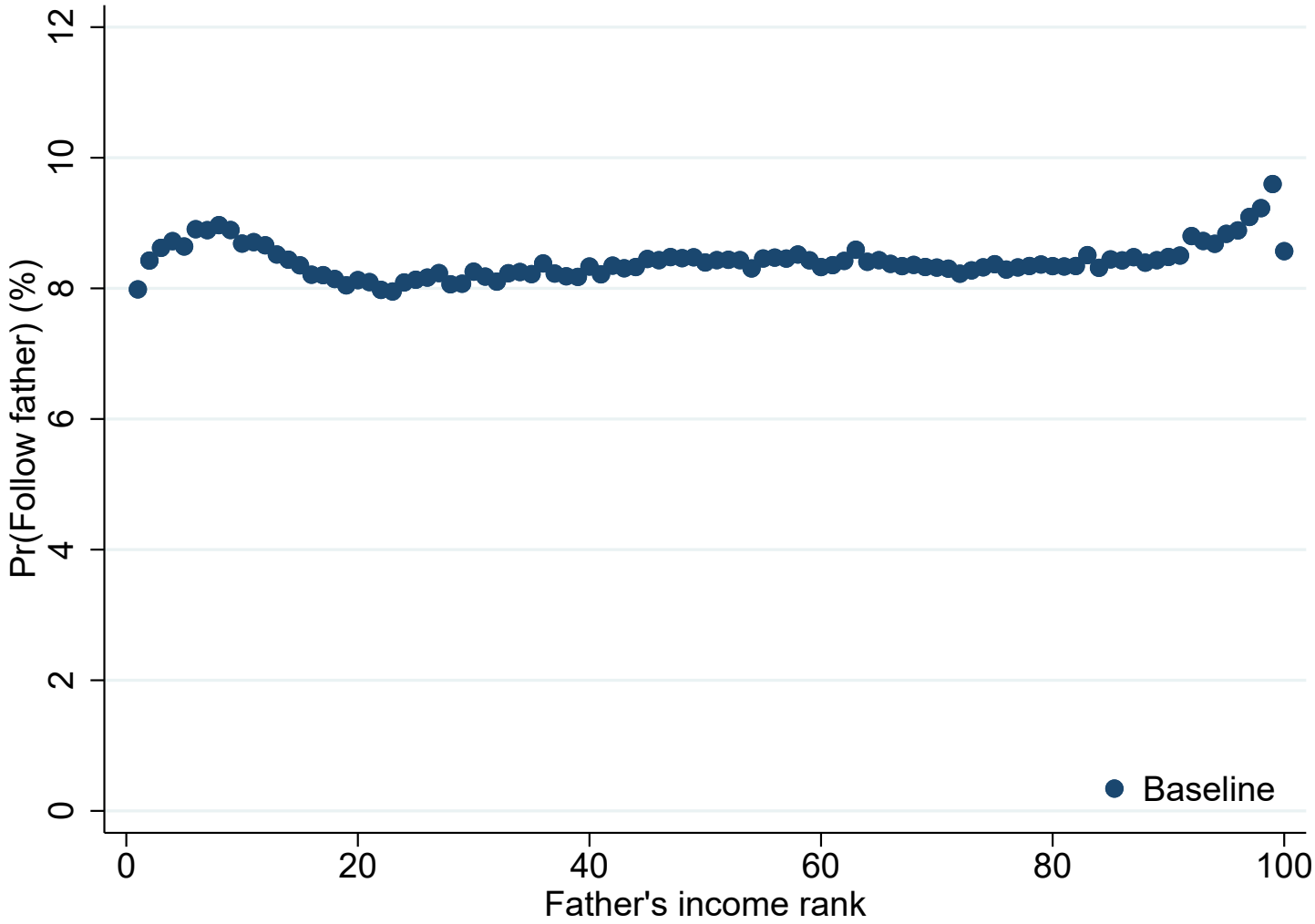
Counterfactual Experiment

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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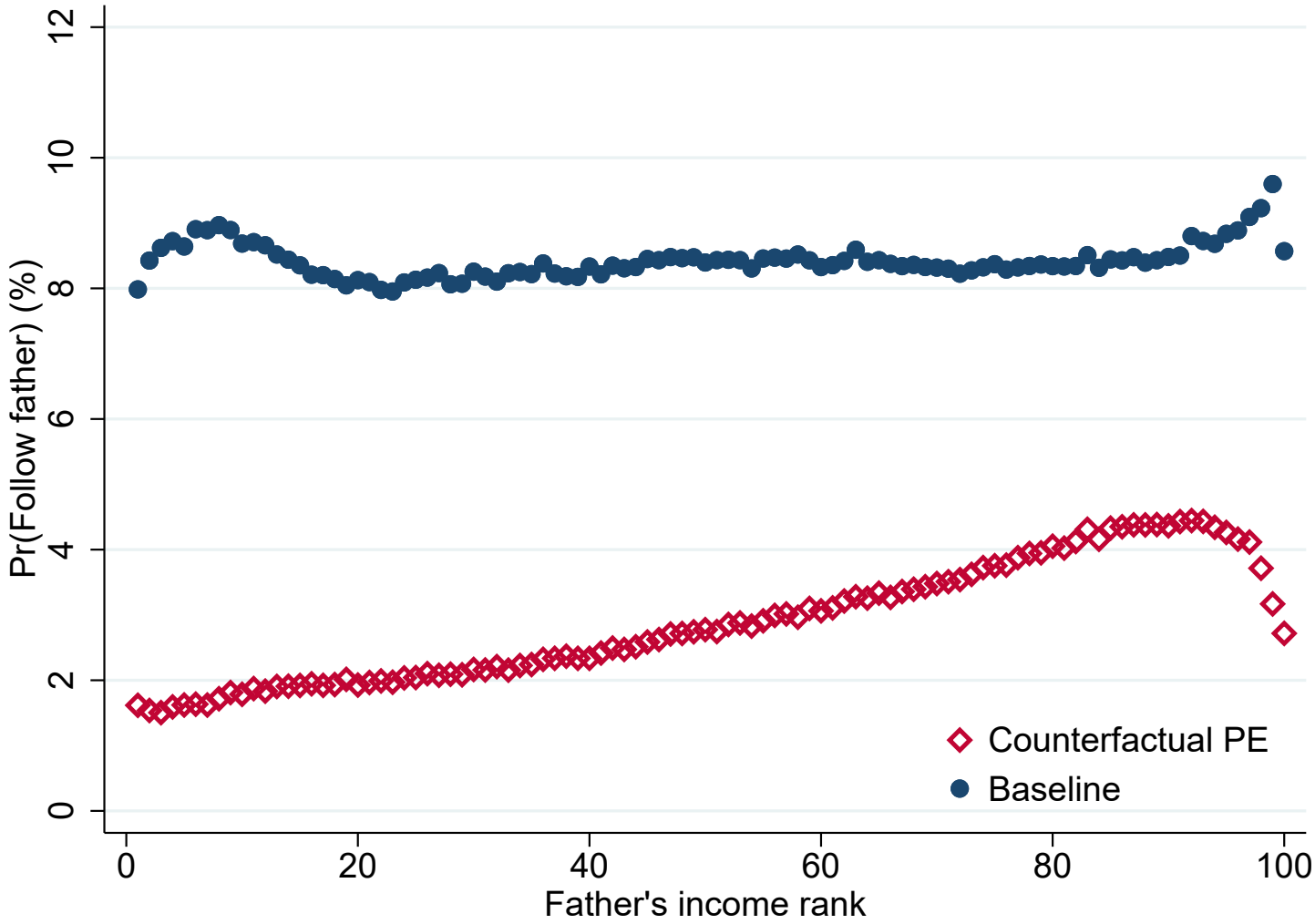

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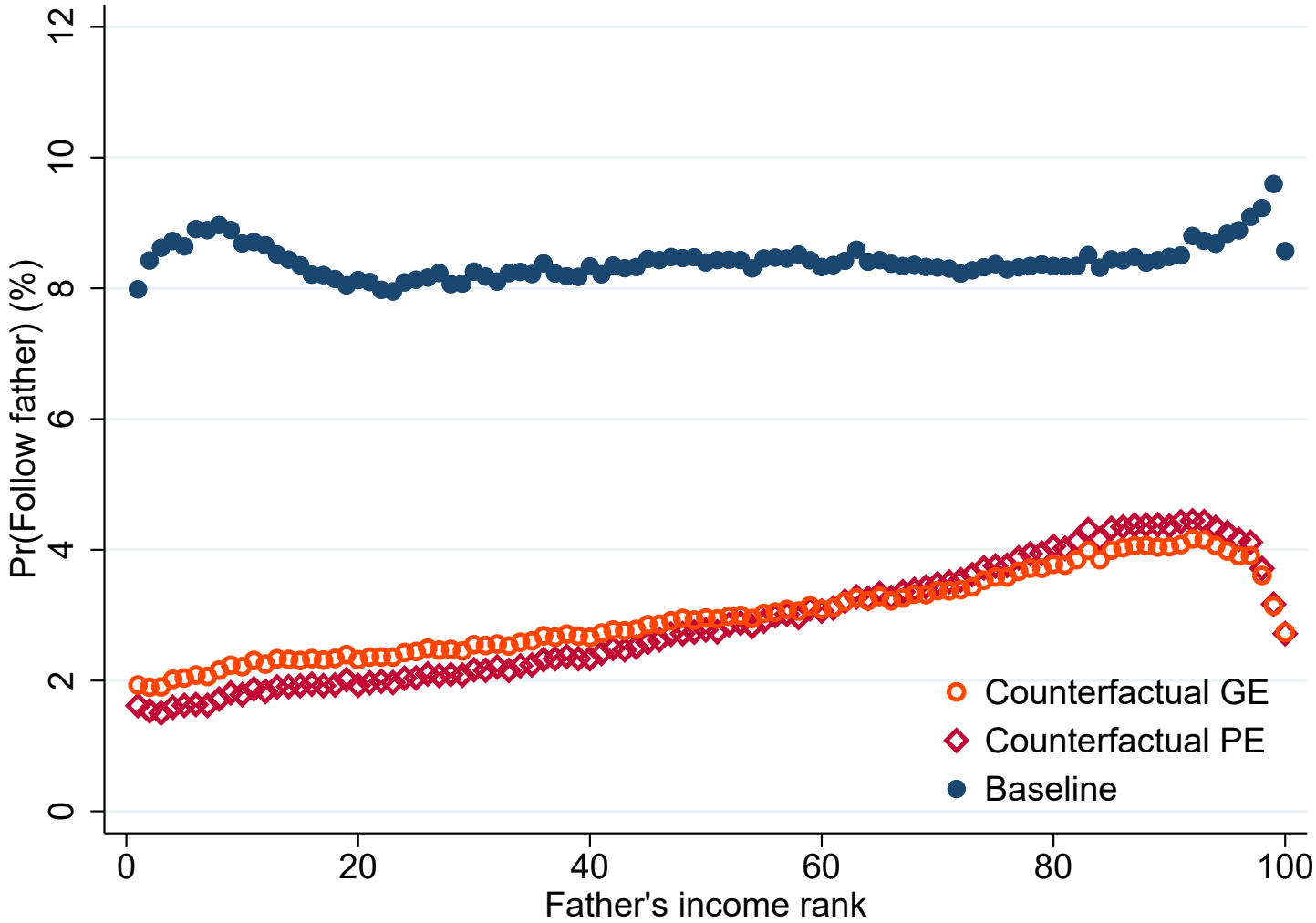
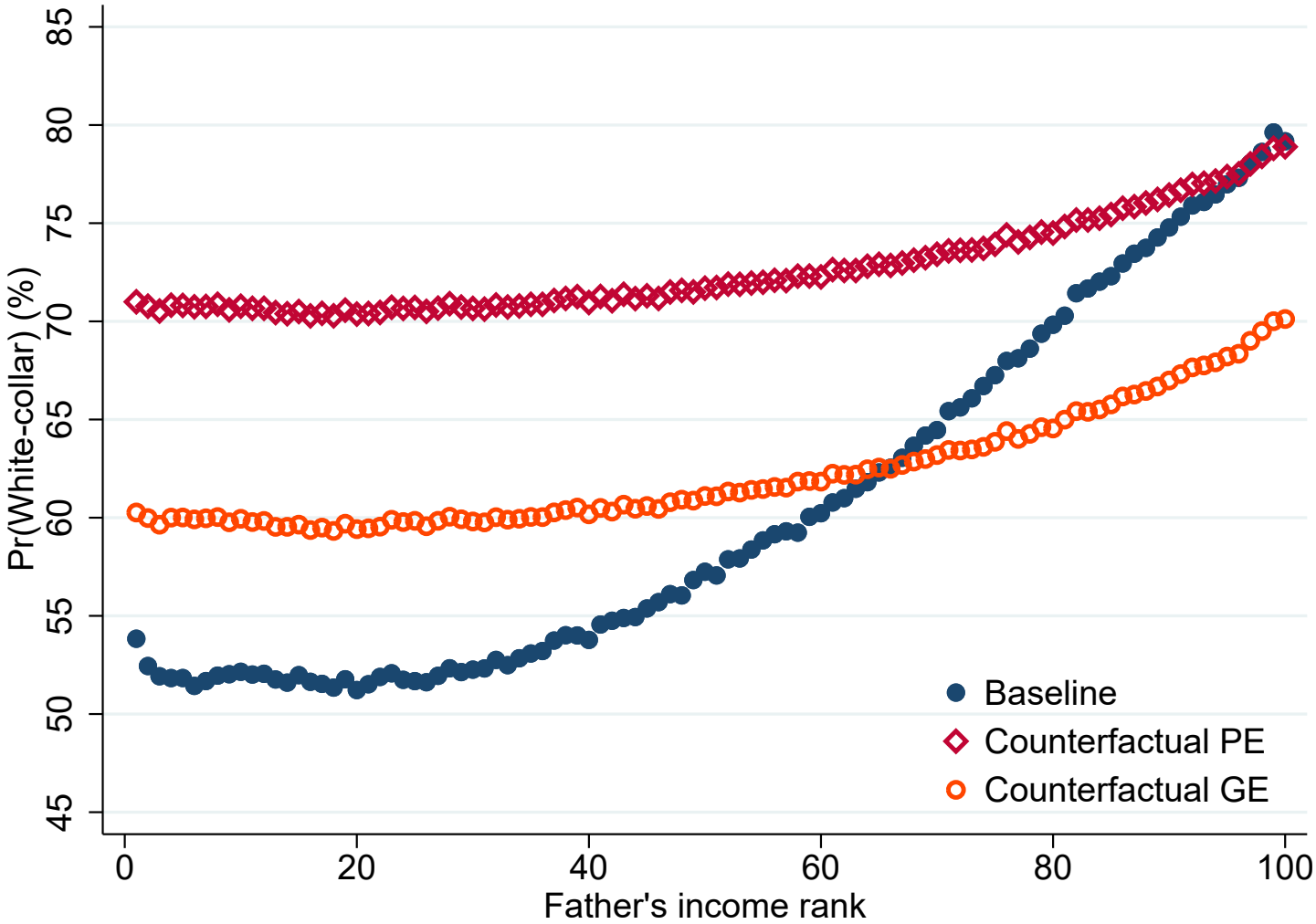


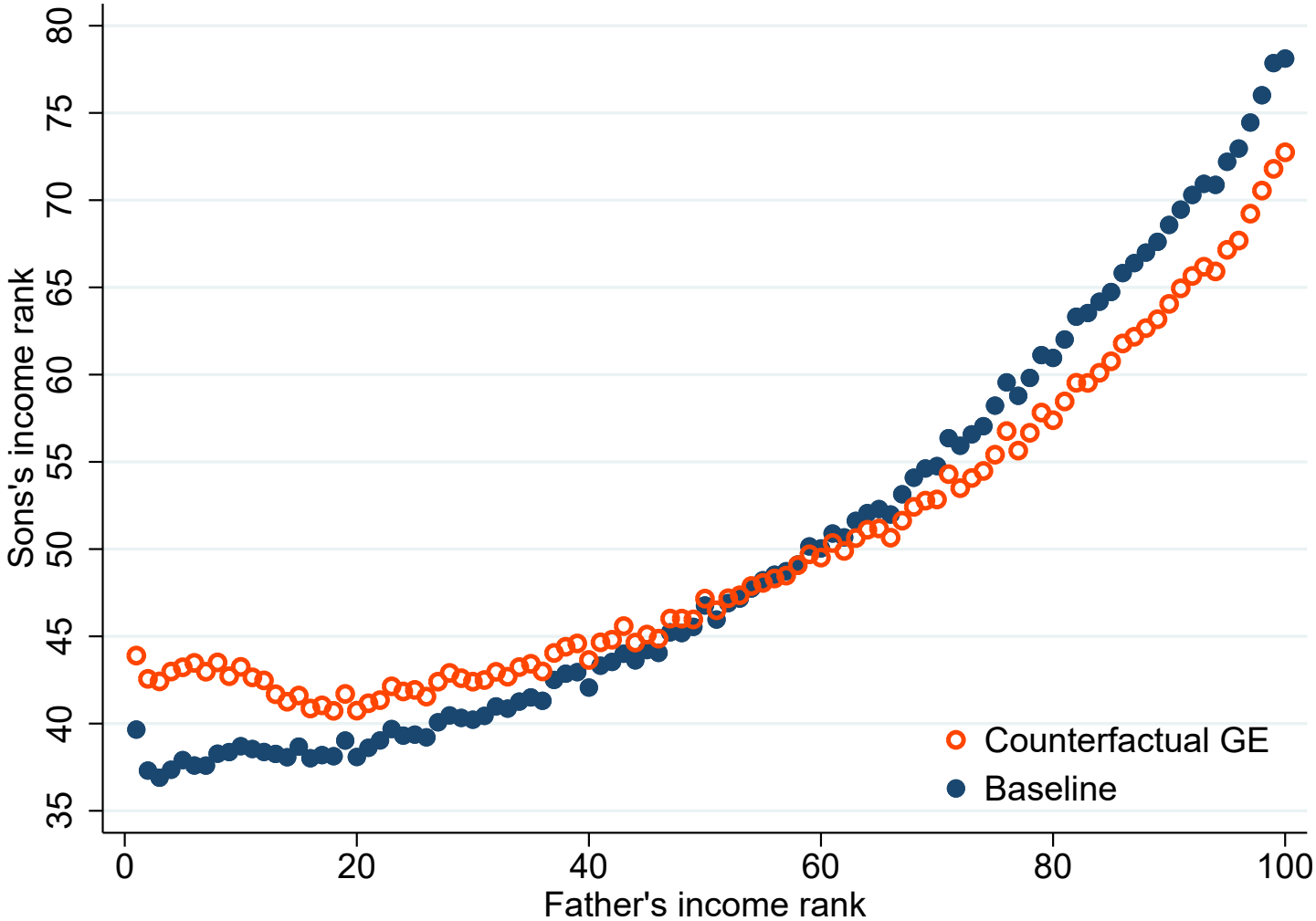
Drop in occupational following from 8.6% to 3.4% Occupations

White-Collar Occupations



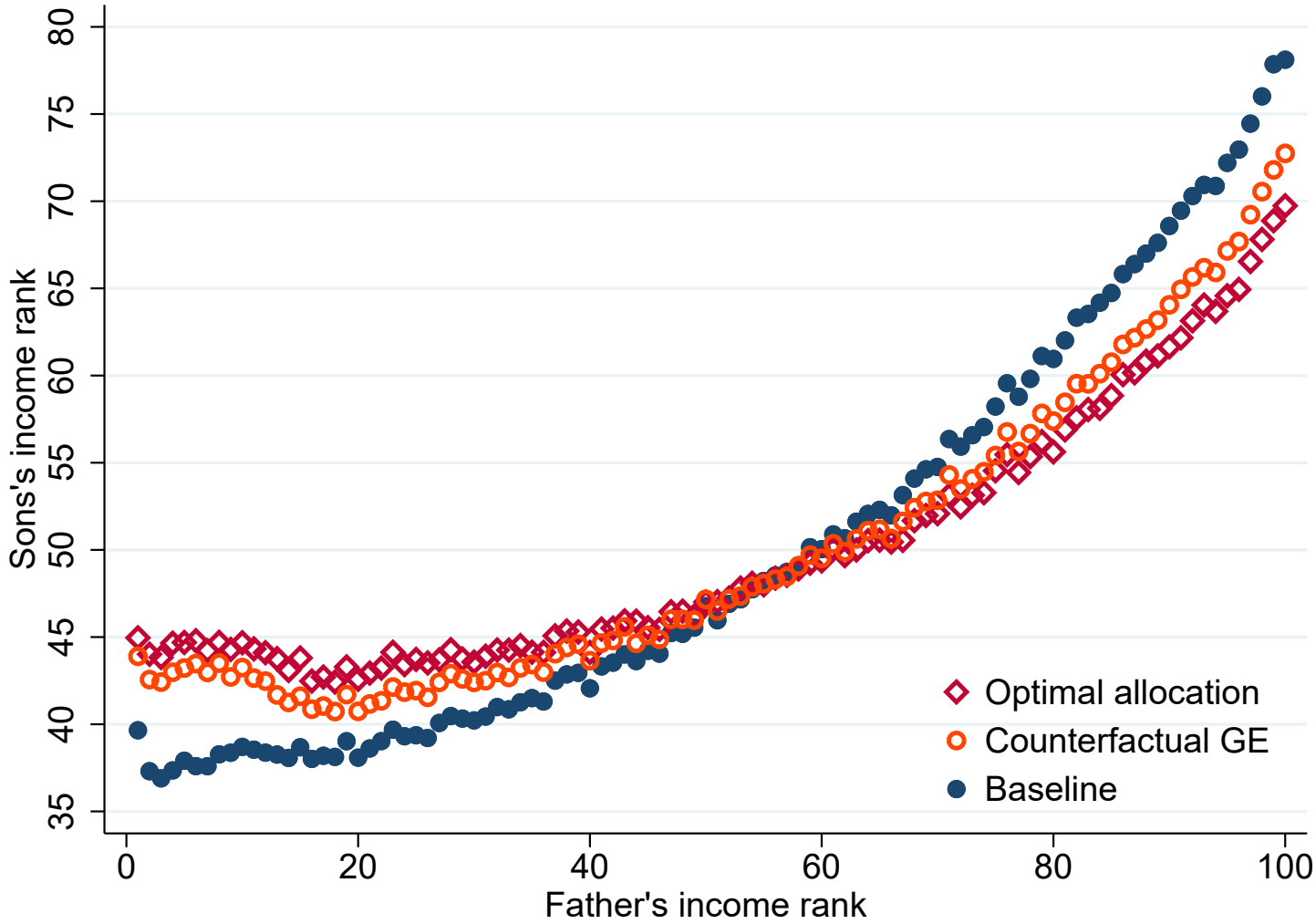
Occupational mobility: $\text{WC}^{\text{Son}} \mid \text{BC}^{\text{Father}}$ ↑from 47% to 54%

Intergenerational Income Mobility



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

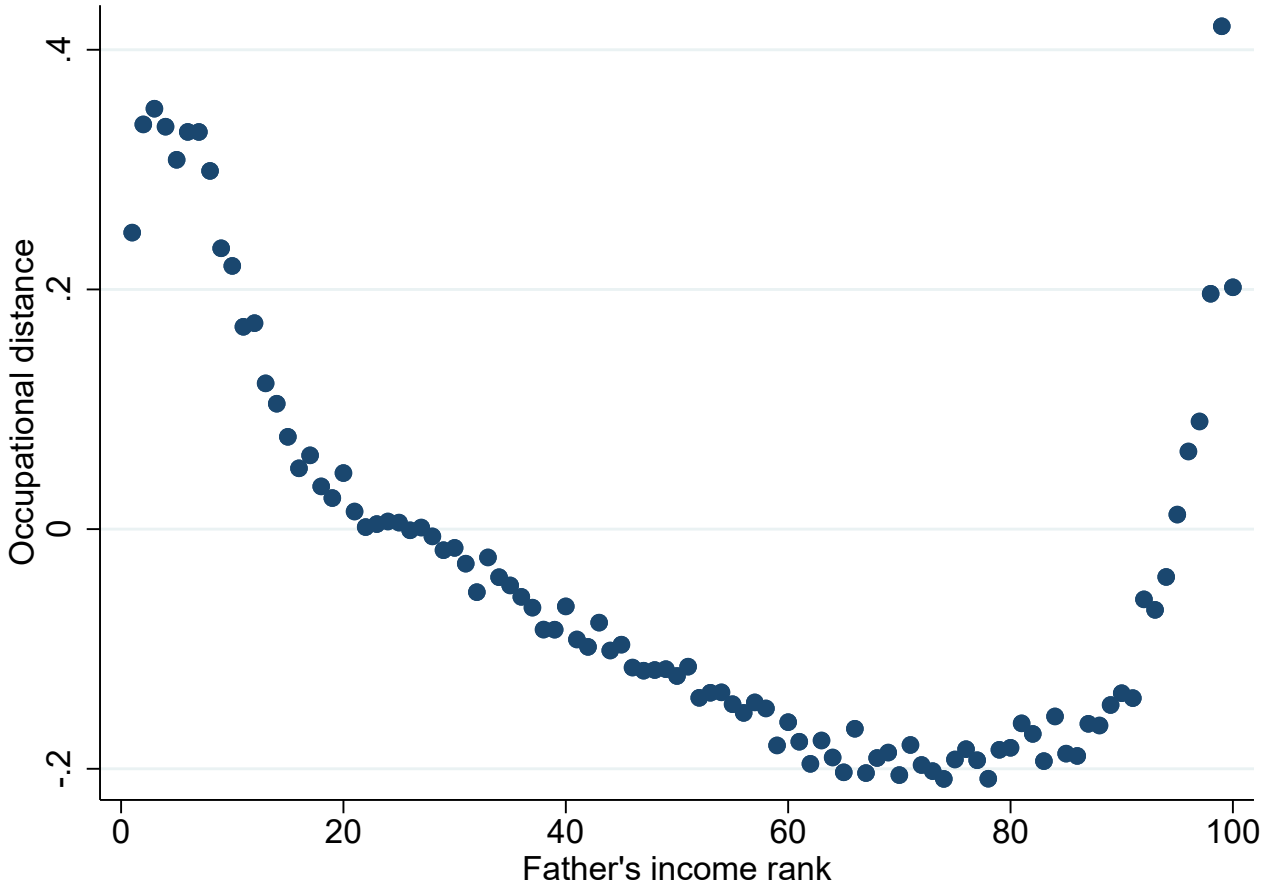
Intergenerational Income Mobility



Optimal allocation: Allocation that maximizes aggregate income

Skills | Real 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($Q1 \to Q5$)	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

Quasi-experimental Evidence

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**

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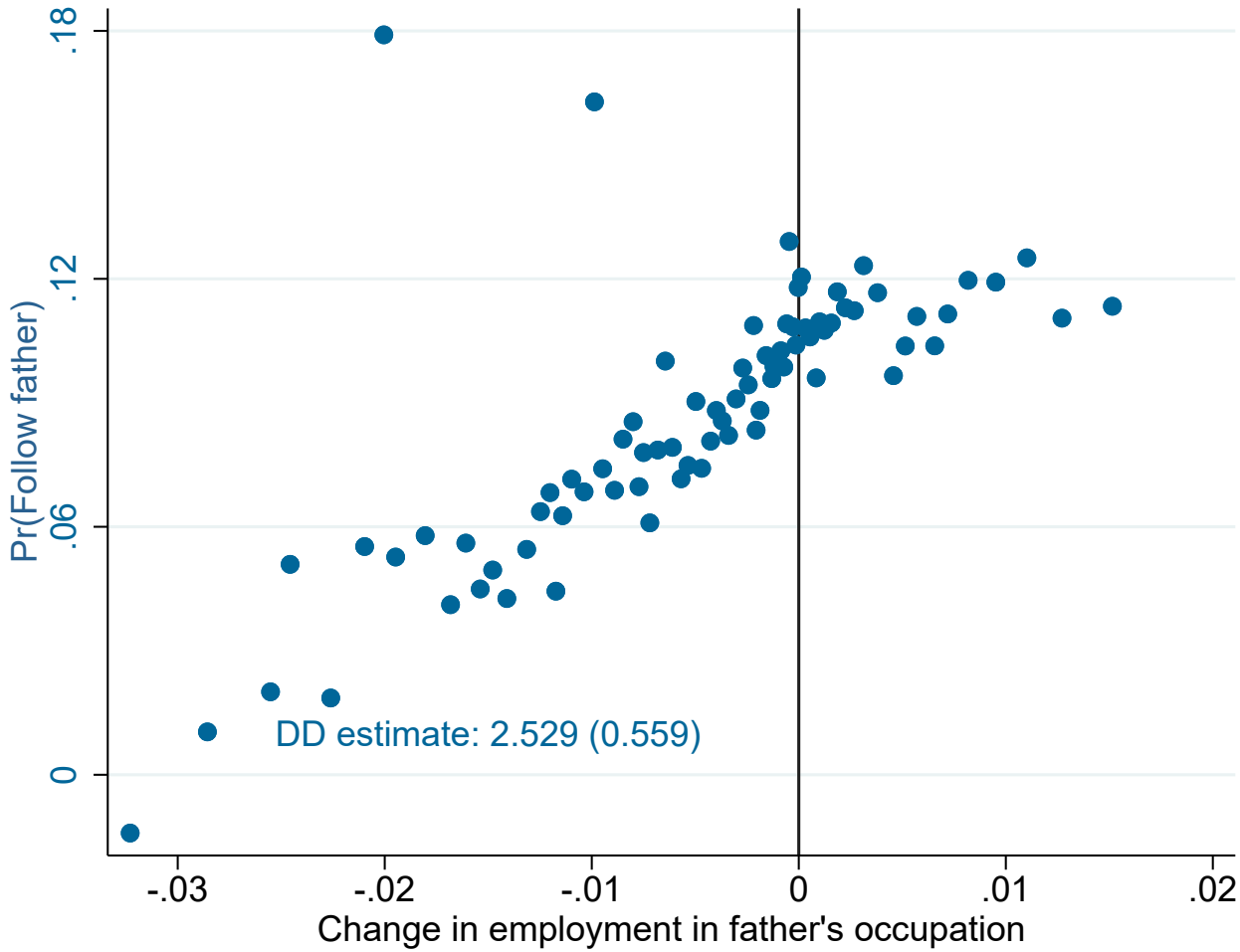
Structural employment decline in fathers' occupations

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

Automation

Employment Decline in Fathers Occupation



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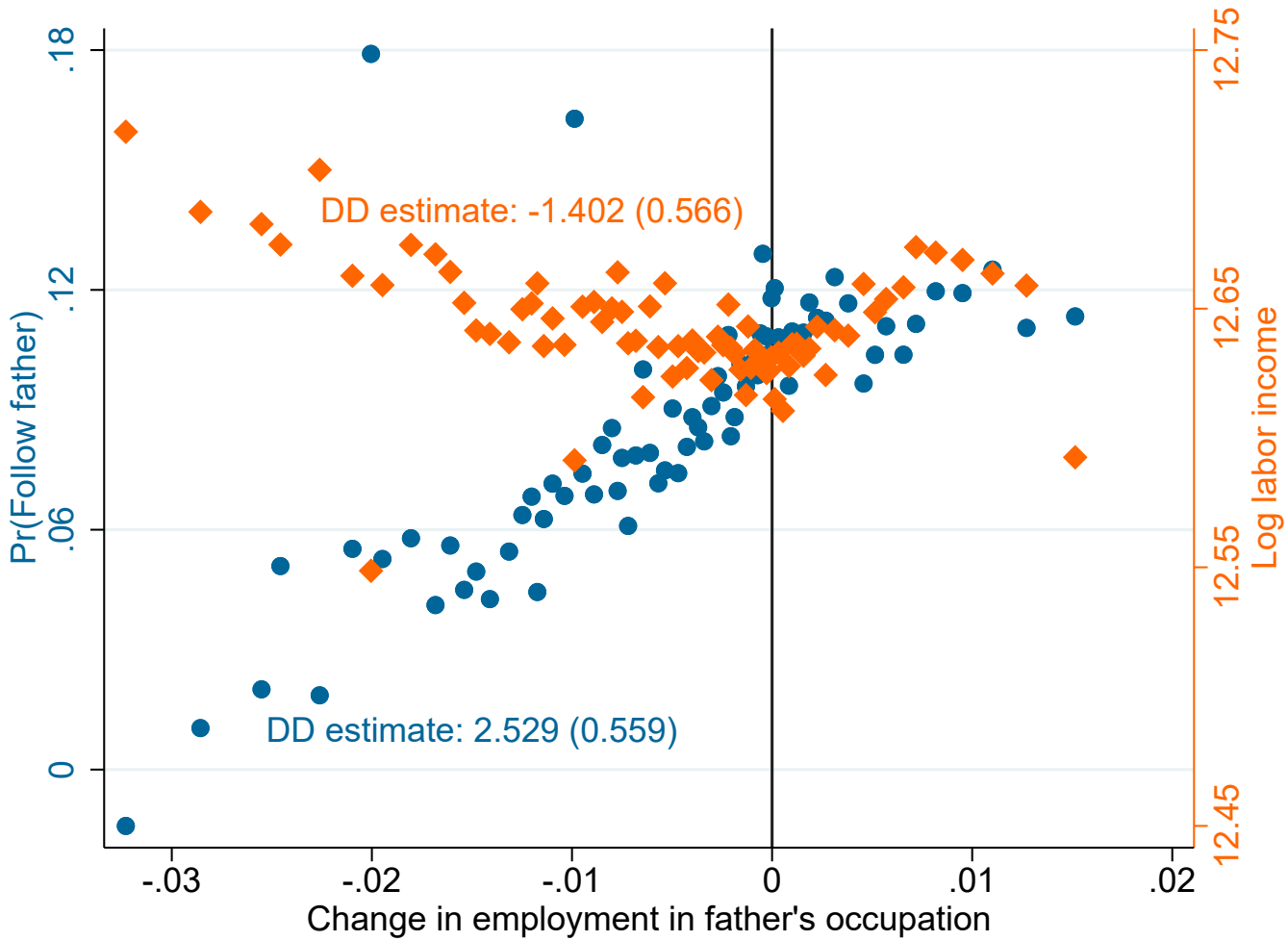

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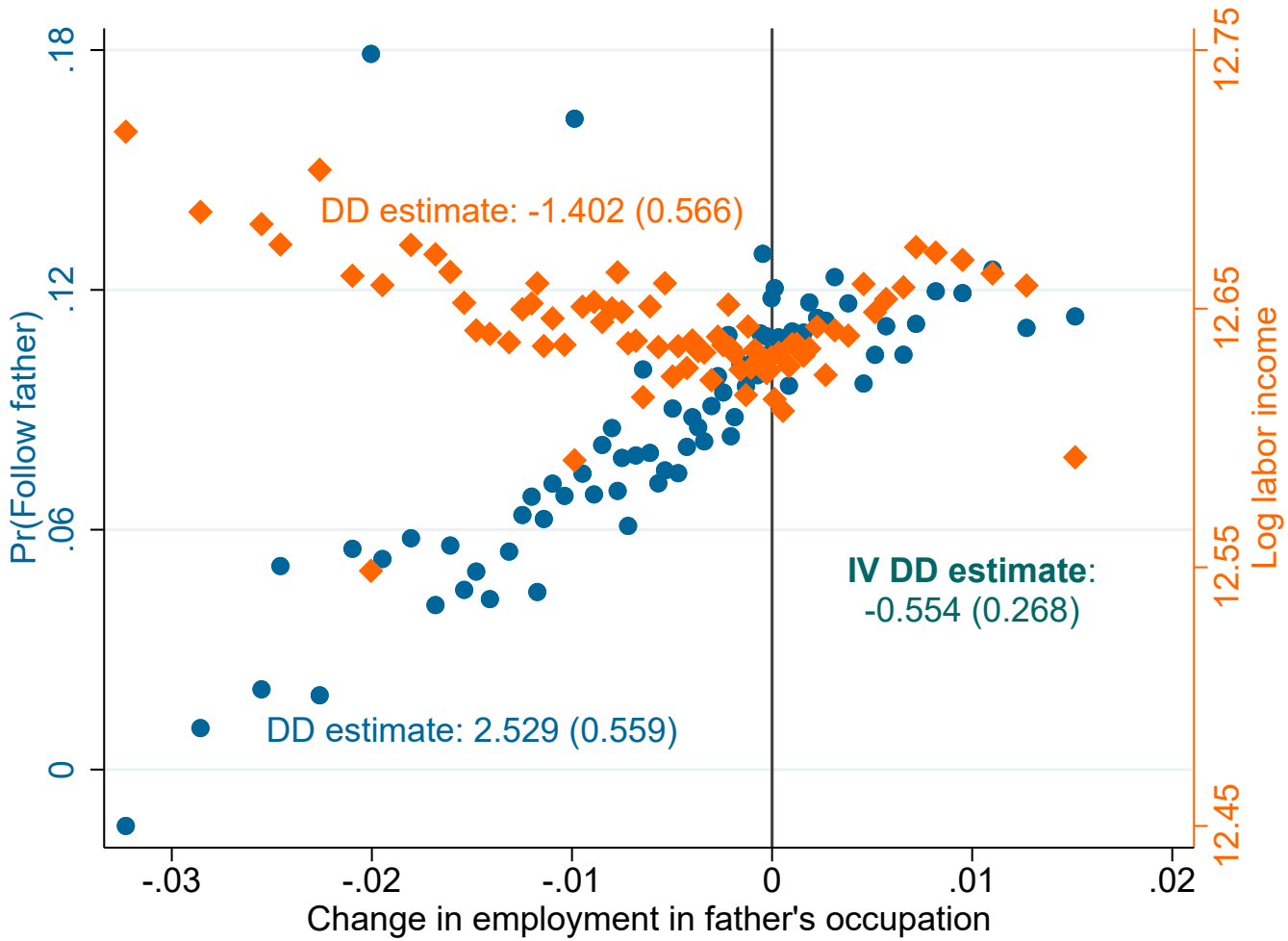

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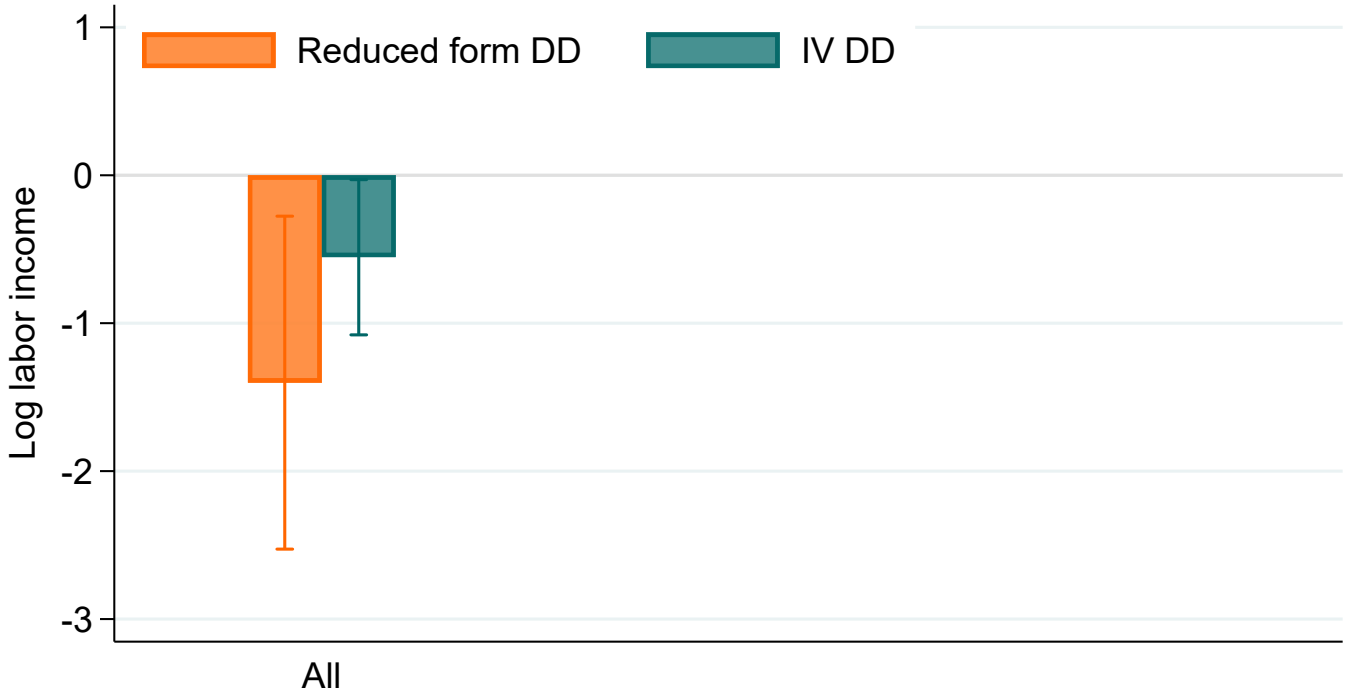
Effect of Employment Decline by Background



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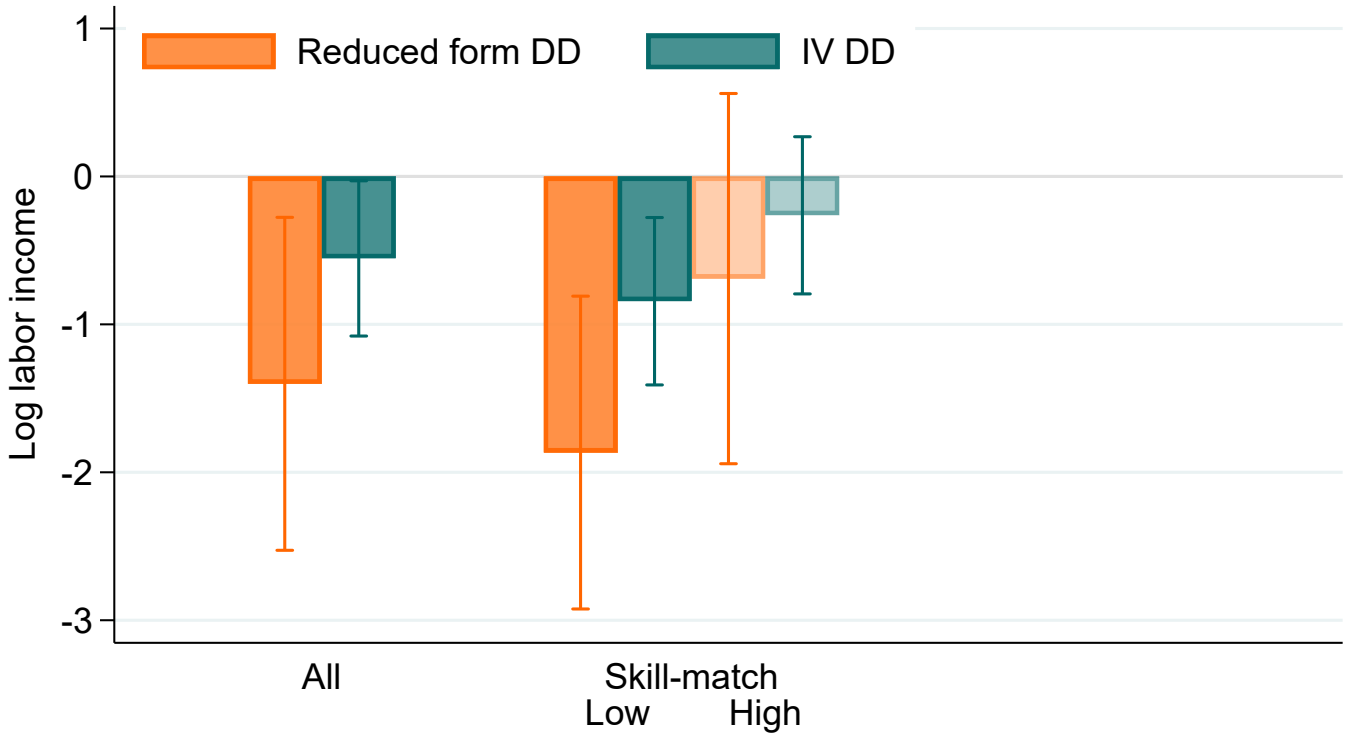

Earnings losses from following among **badly matched sons**

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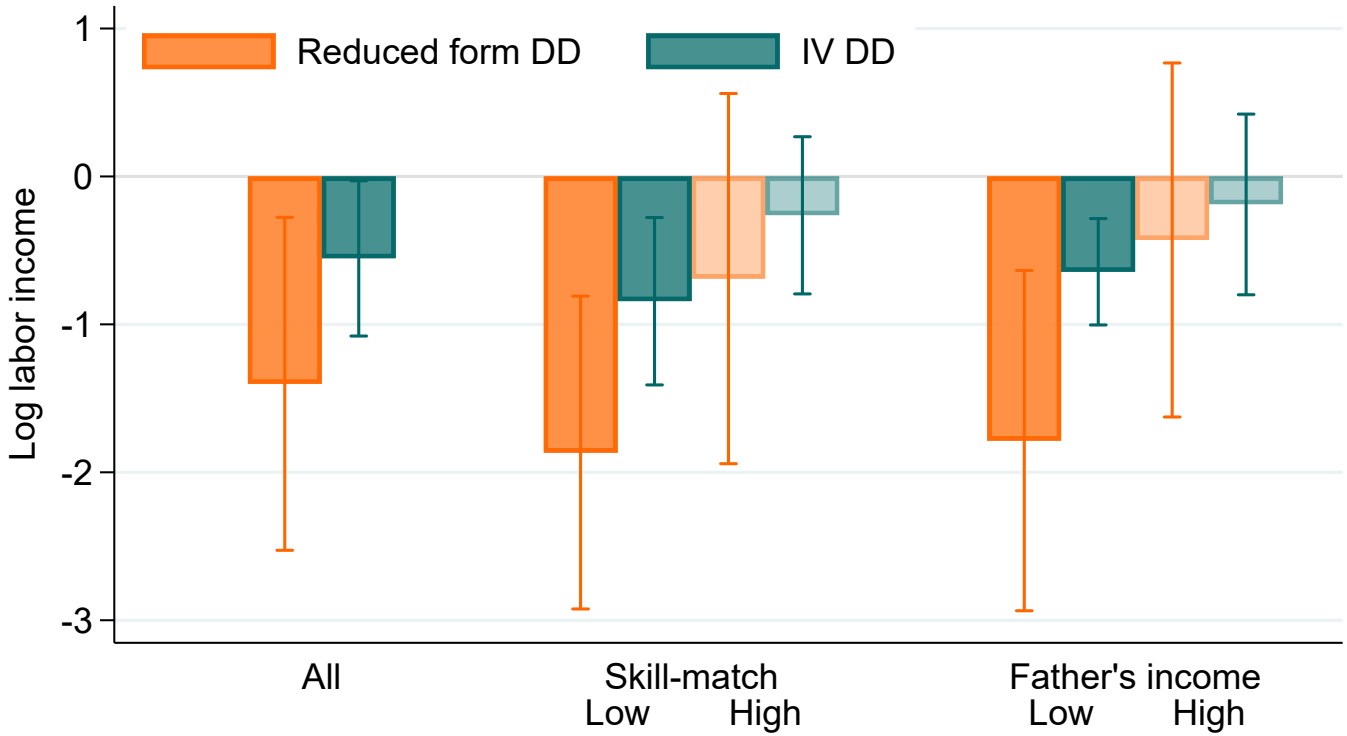


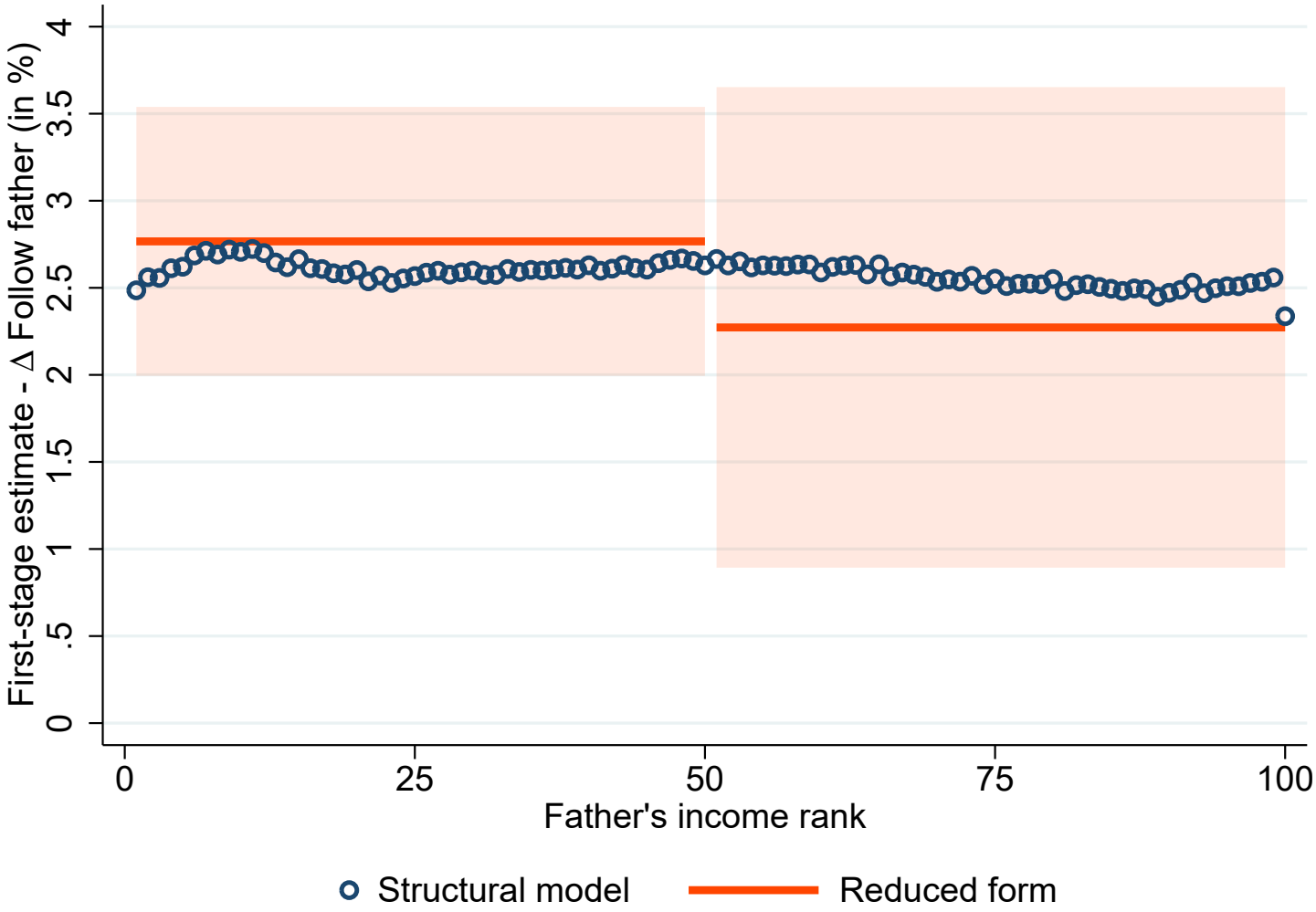
Earnings losses from following among **sons of poorer fathers**

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



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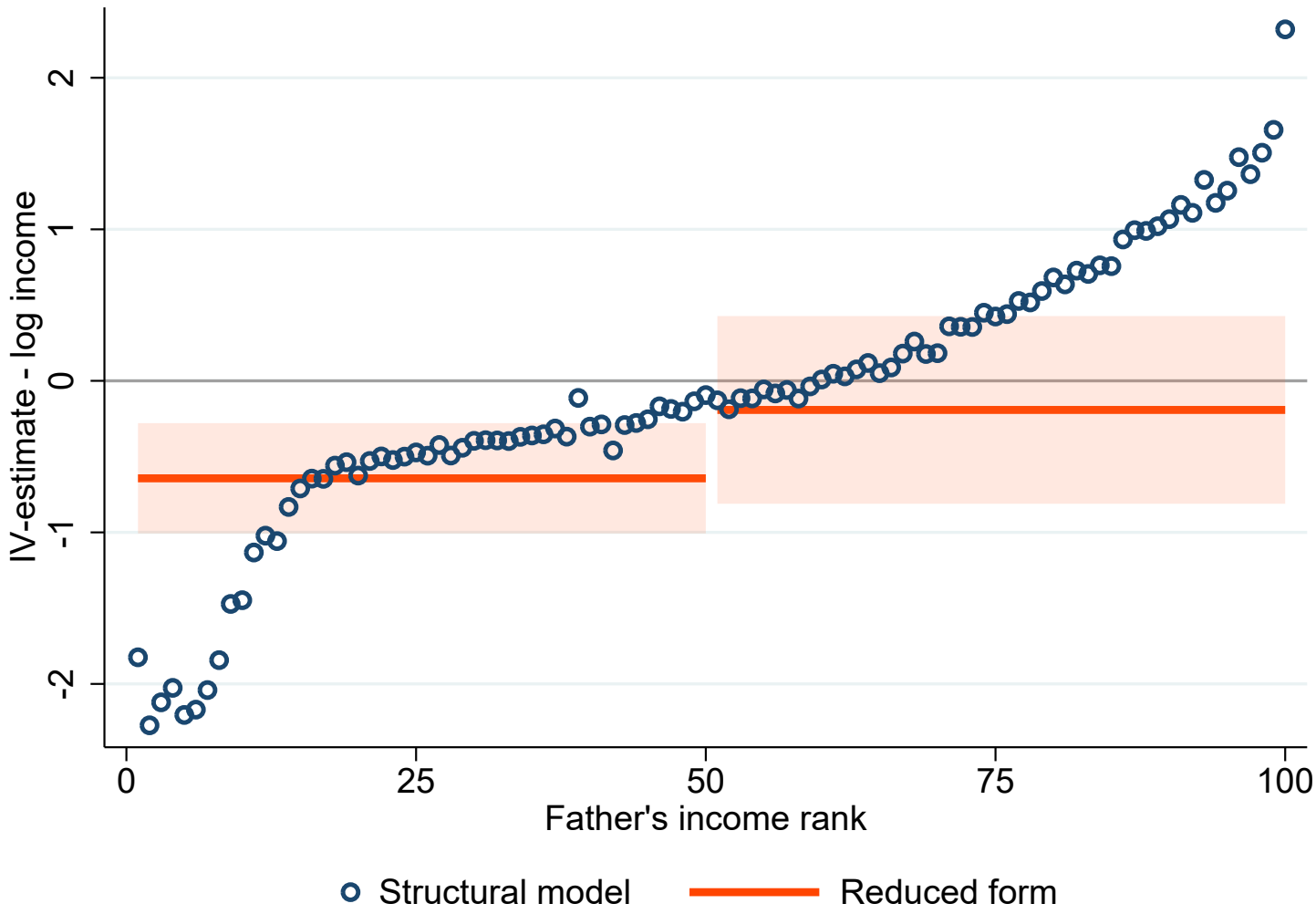

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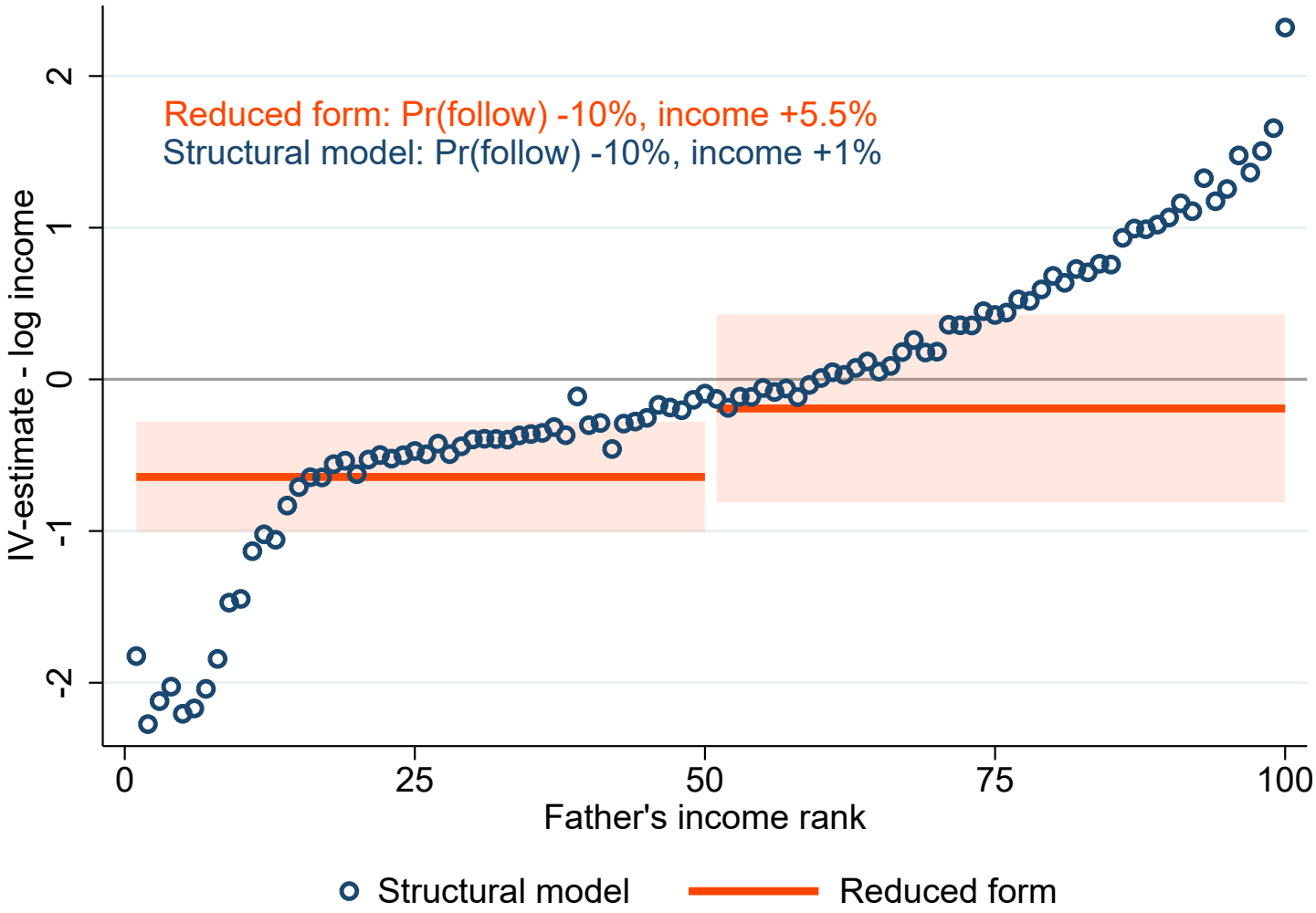

Conclusion

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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 Back

Occupational Mobility Bias

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

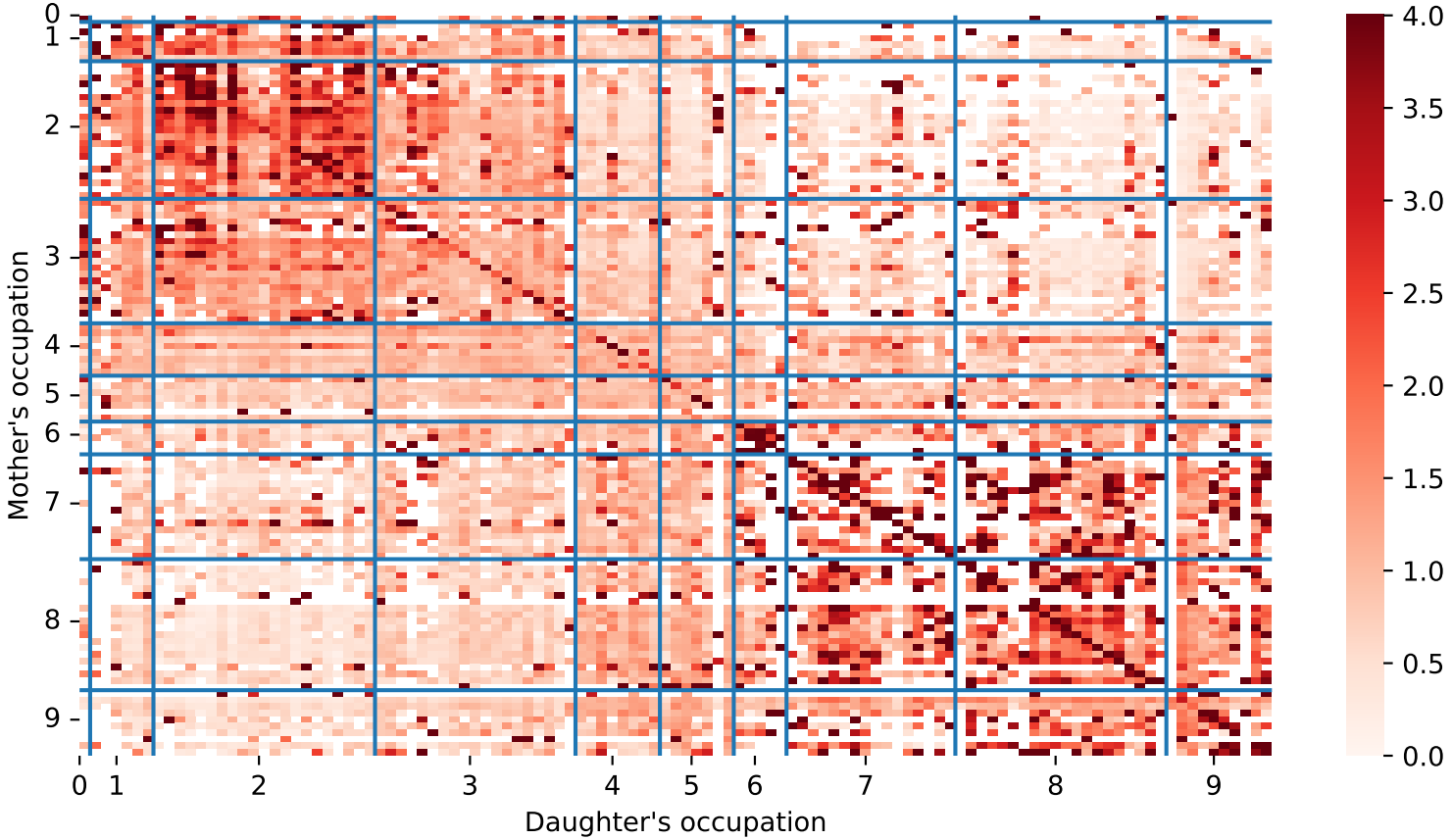
$$\text{OMB}_{p,c} = \frac{share_{p,c,child}}{share_{c,child}}$$

where $p : parent$ and $c : child$ index occupations.

Random assignment: $\text{OMB} = 1$

Back

Occupational Mobility Bias: Mothers & Daughters



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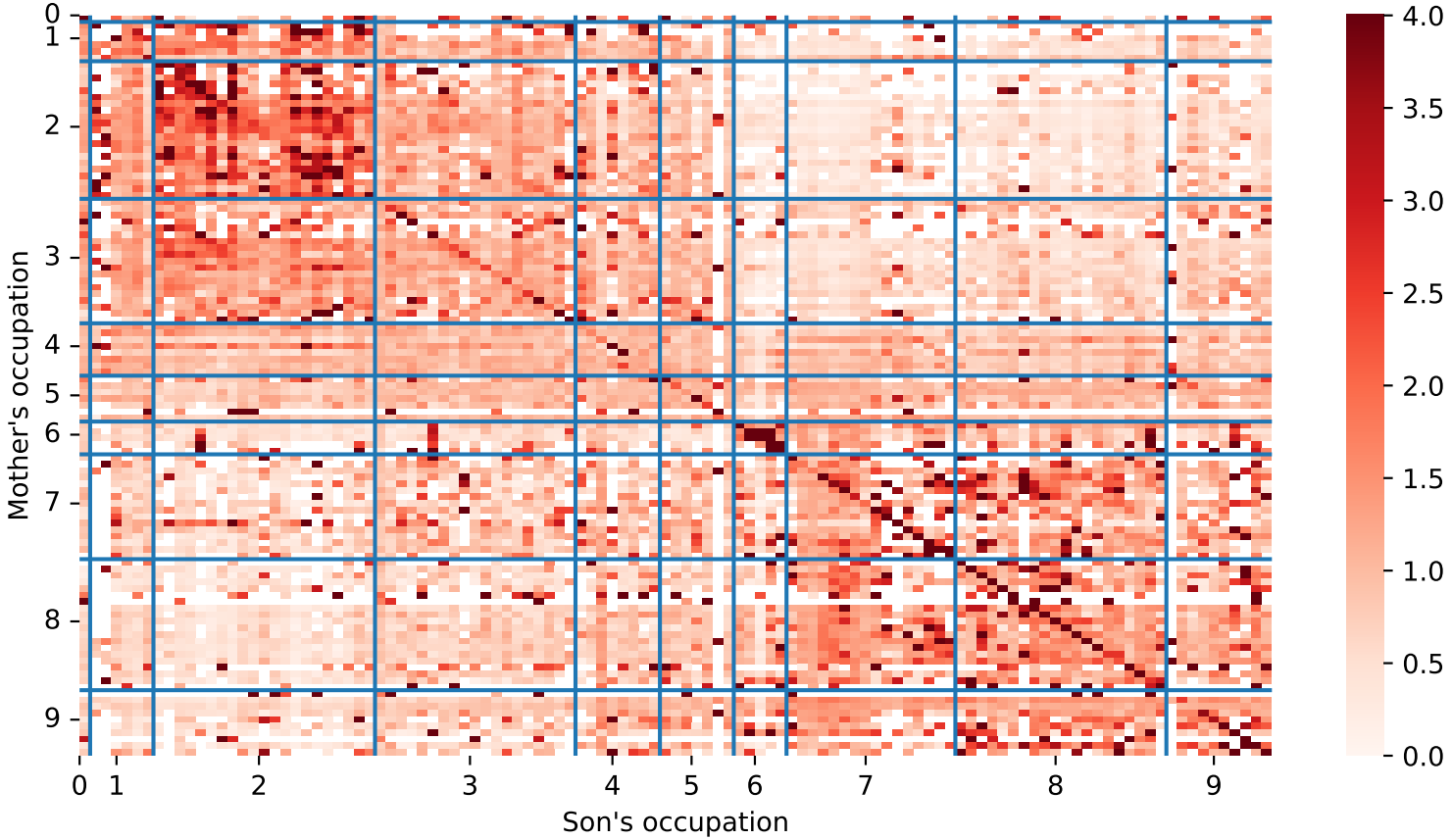
Occupational Mobility Bias: Sons & Mothers



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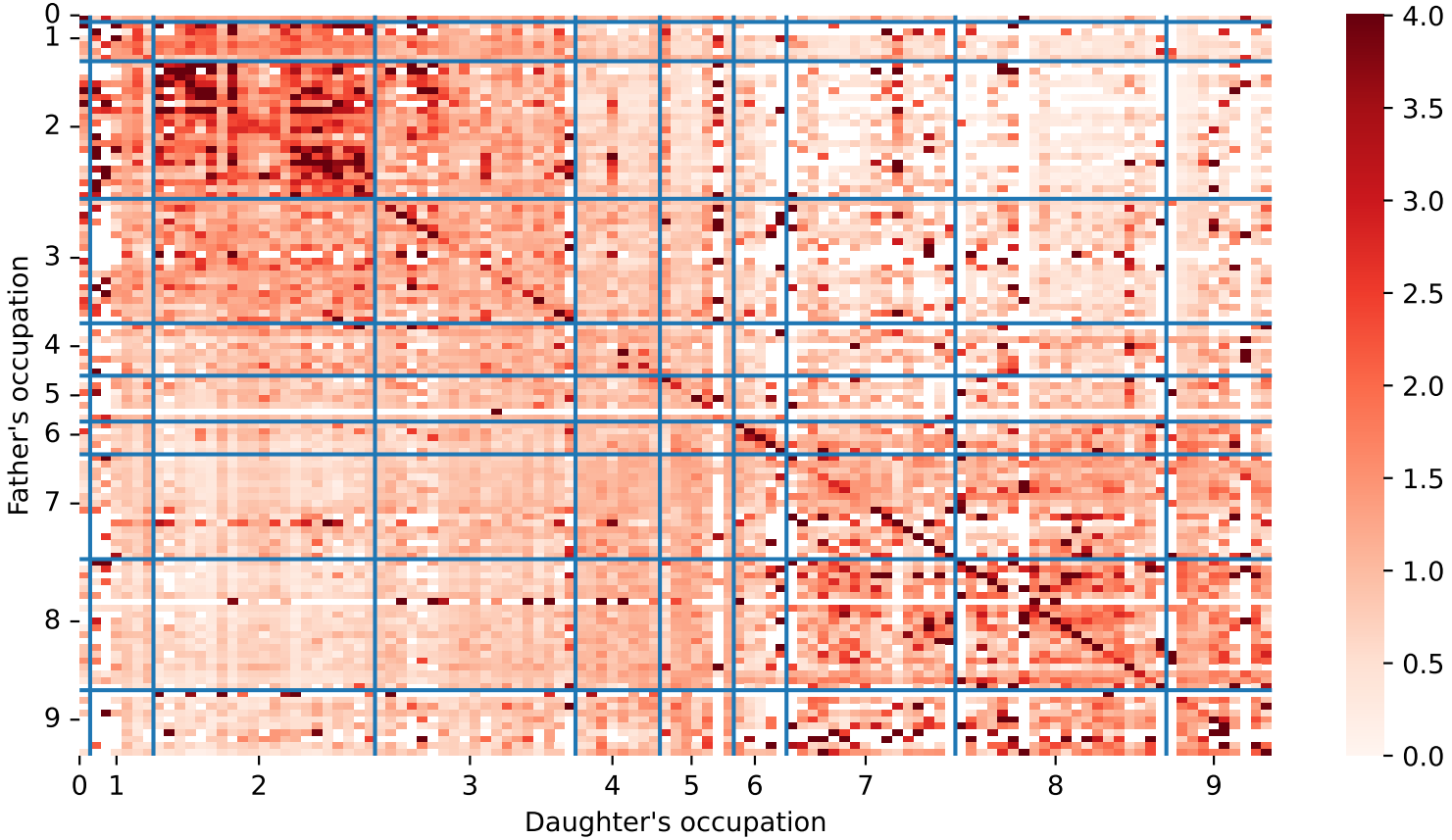
Occupational Mobility Bias: Daughters & Fathers



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

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Skills

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

$$(Z^g_{i,H}, Z^g_{i,F})$$

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

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$$(Z^g_{i,H}, Z^g_{i,F})$$

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

Children inherit skills from their parents according to:

$$z^g_{i,k} = \tau z^{g-1}_{i,k} + (1-\tau)\varepsilon^g_{i,k},$$

where τ governs the inheritability of traits

Joint distribution of $\varepsilon^g_{i,k}$ bivariate normal ($\mu_k = 0$, $\sigma^2_k = 1$), and correlation ρ (> 0)

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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

Earnings, Costs, and Utility

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The logarithm of labor income:

$$y^g_{i,F} = w_F + \beta_F z^g_{F,i}$$

$$y^g_{i,H} = w_H + \beta_H z^g_{H,i}$$

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

Earnings, Costs, and Utility

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Utility:

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

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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

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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:
  $\ln(earn_i) = \rho_o + \delta_c + \gamma_y + \varepsilon_i$
  ρ_o, δ_c, and γ_y 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

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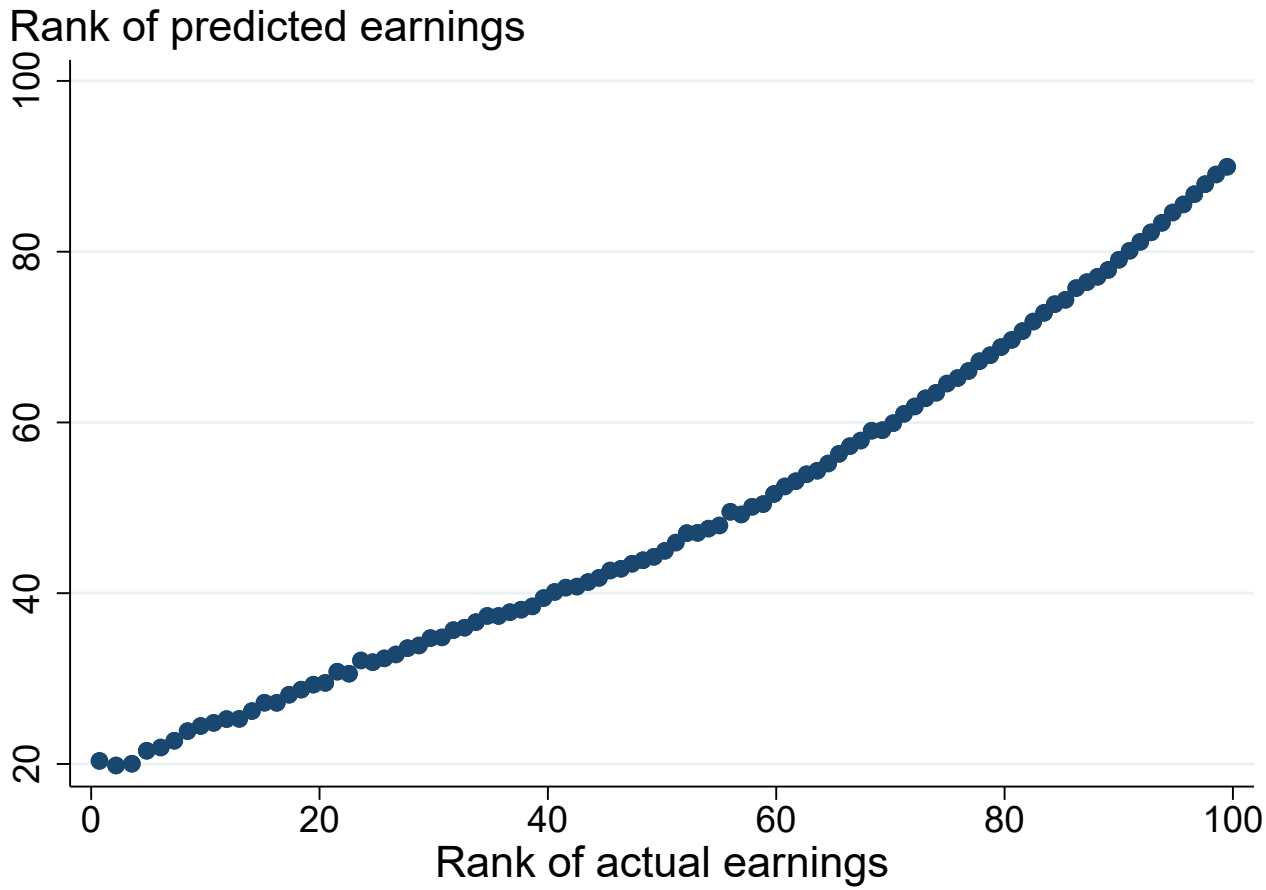
Actual and Predicted Earnings



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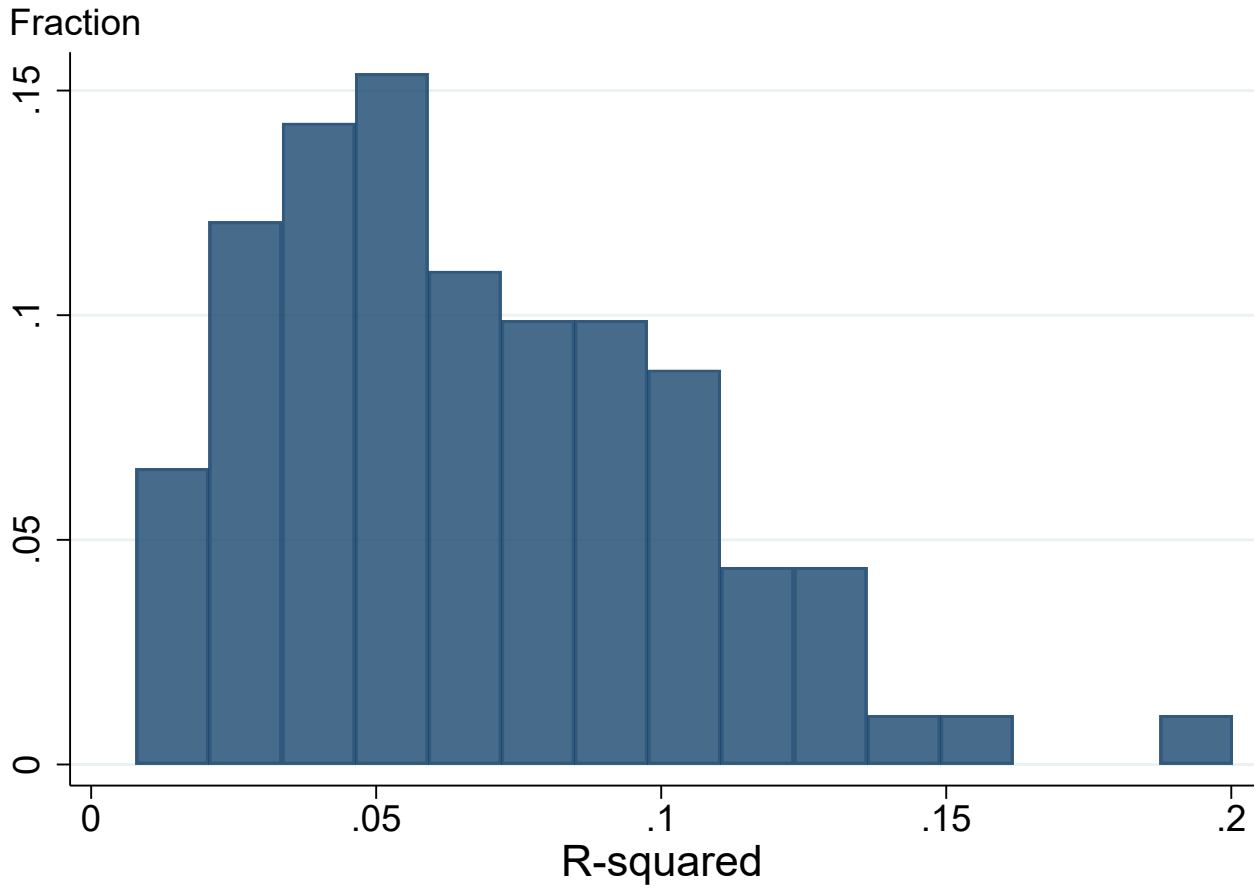
Random Forest Prediction R^2



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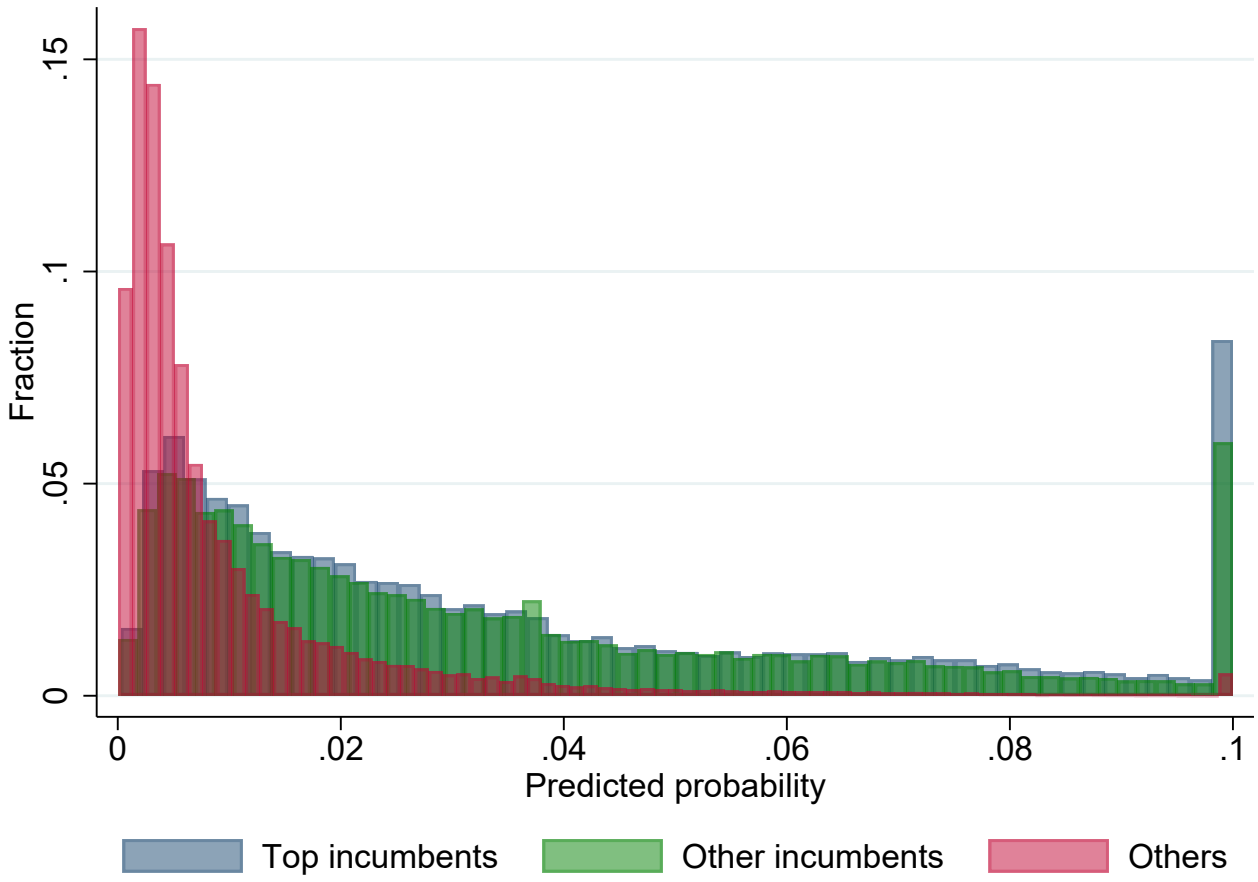
Predicted Probability of Occupation Entry



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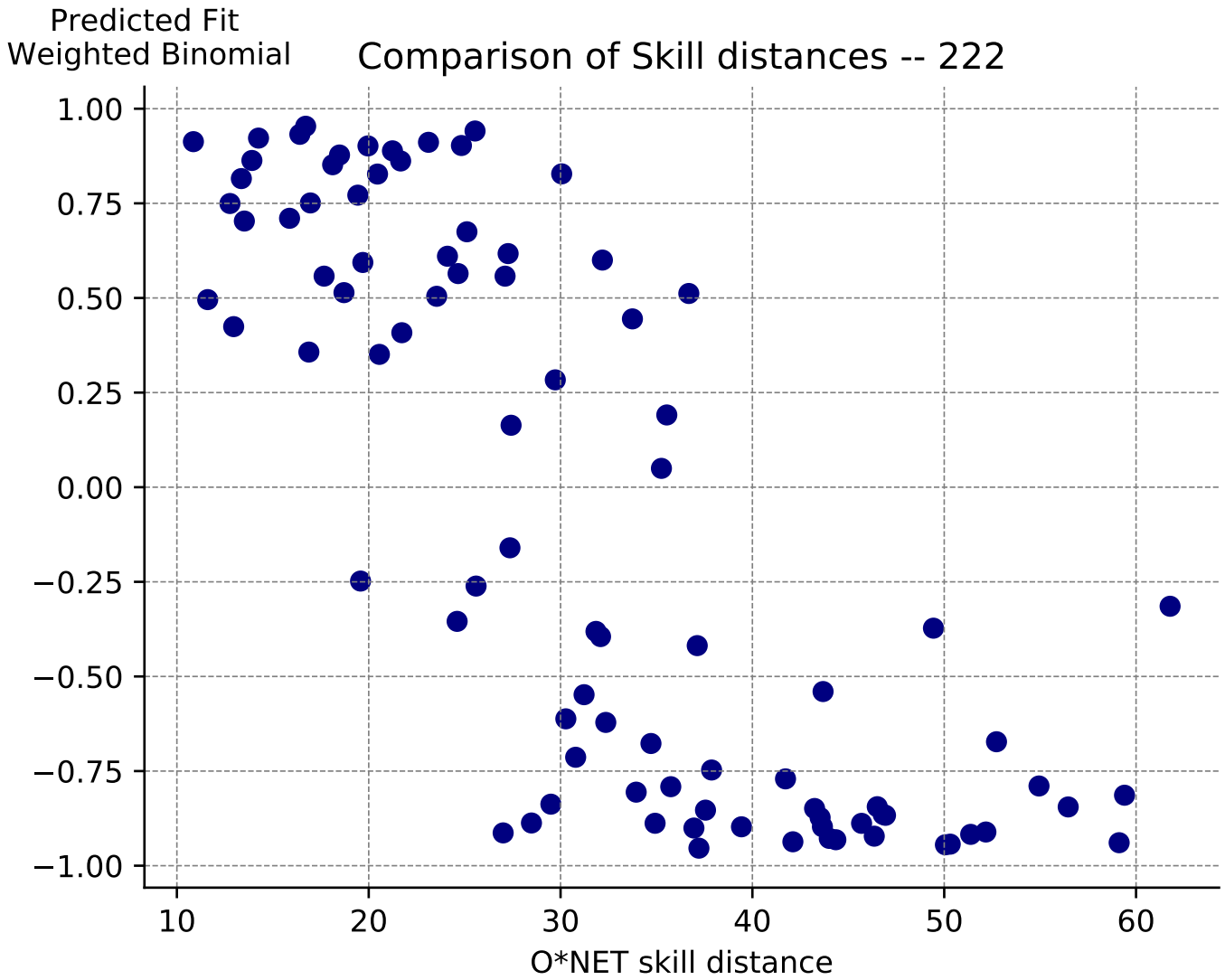
Skill distance according to O*NET

Comparison of skill closeness/remoteness using ONet data Back



Skill distance according to O*NET

Comparison of distance measures across occupations

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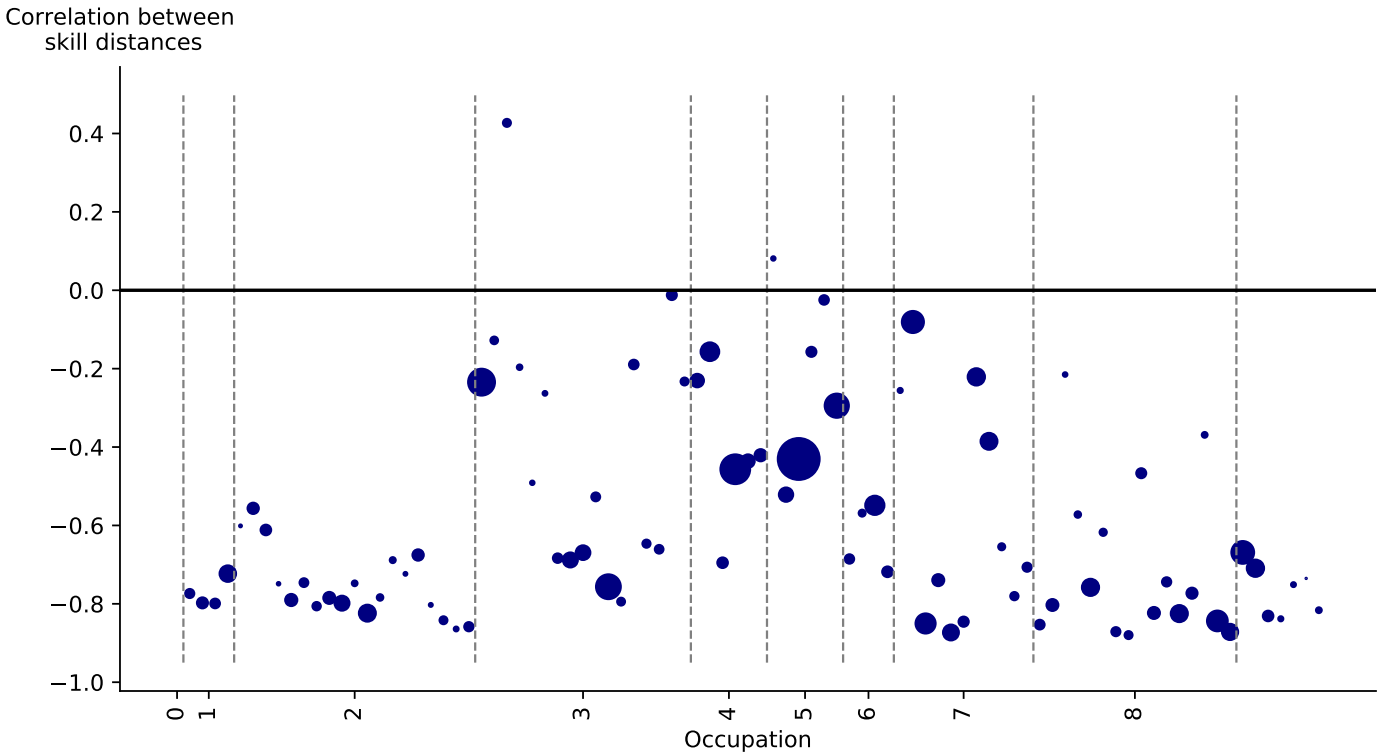

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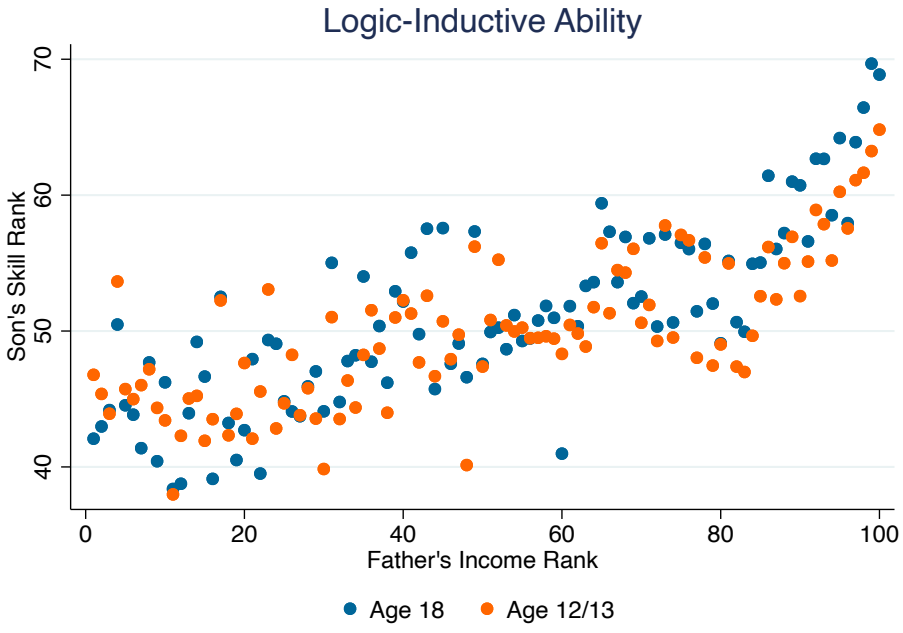
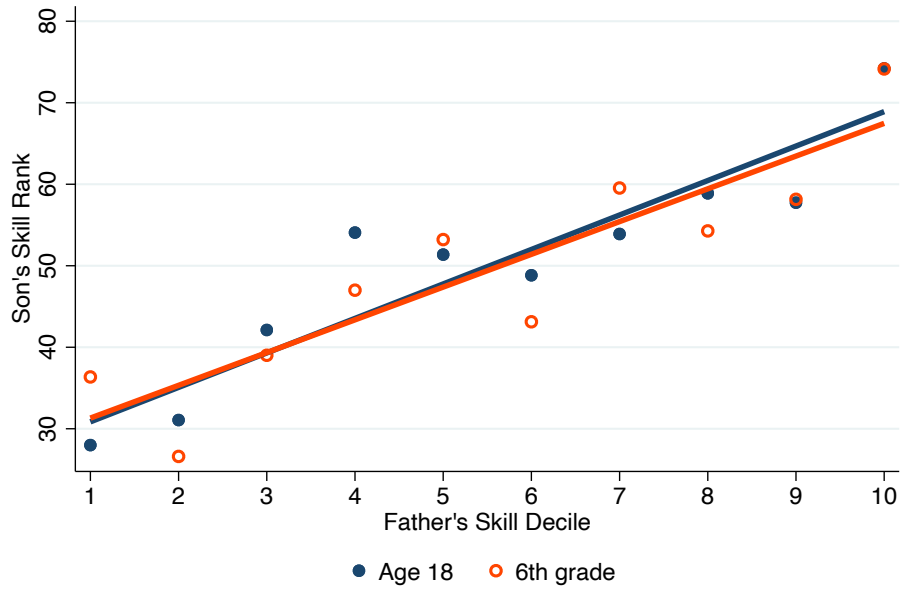
Logic-inductive ability: Age 18 vs. 12/13



(a) Fathers' Income Rank



(b) Farhers' Skill Decile

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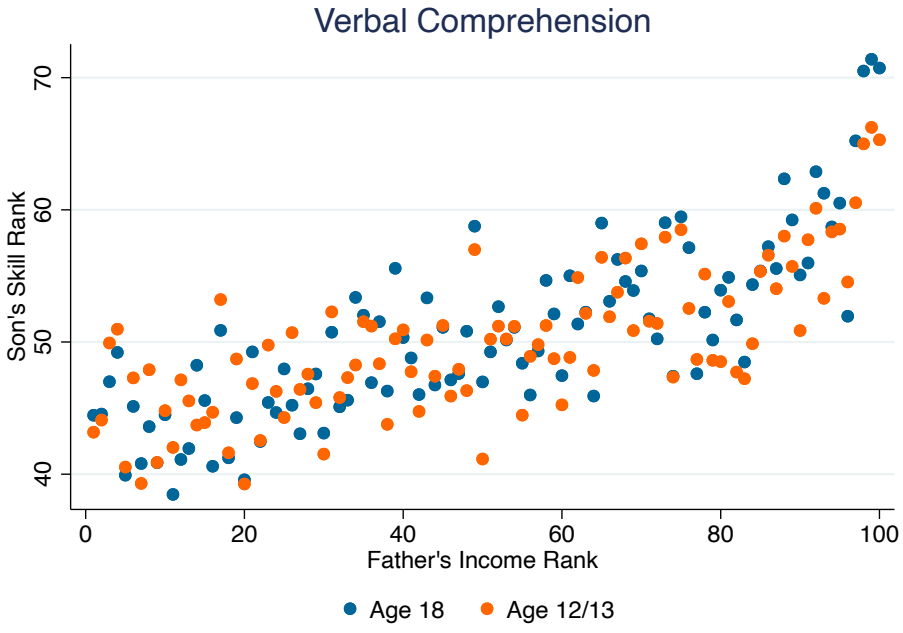
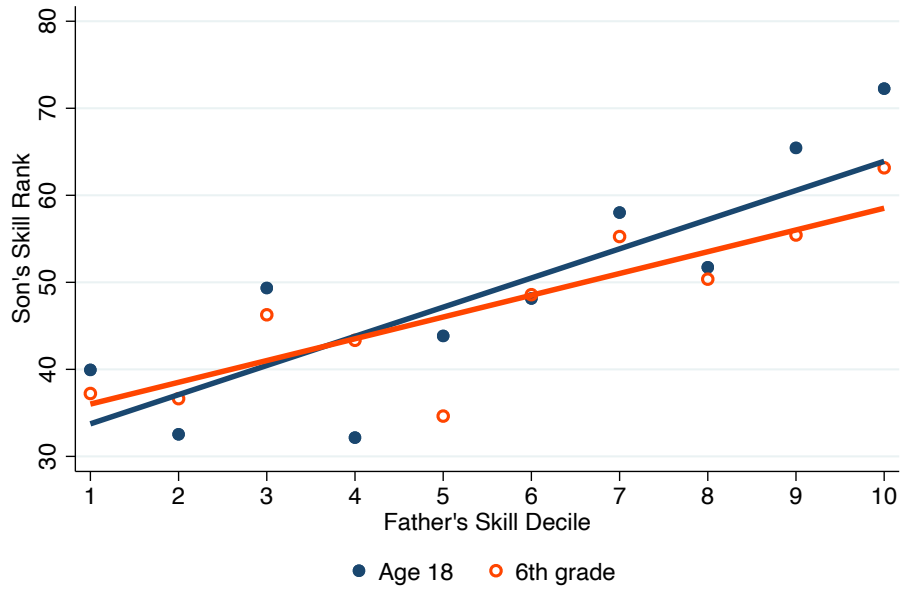
Verbal Comprehension: Age 18 vs. 12/13



(a) Fathers' Income Rank



(b) Farhers' Skill Decile

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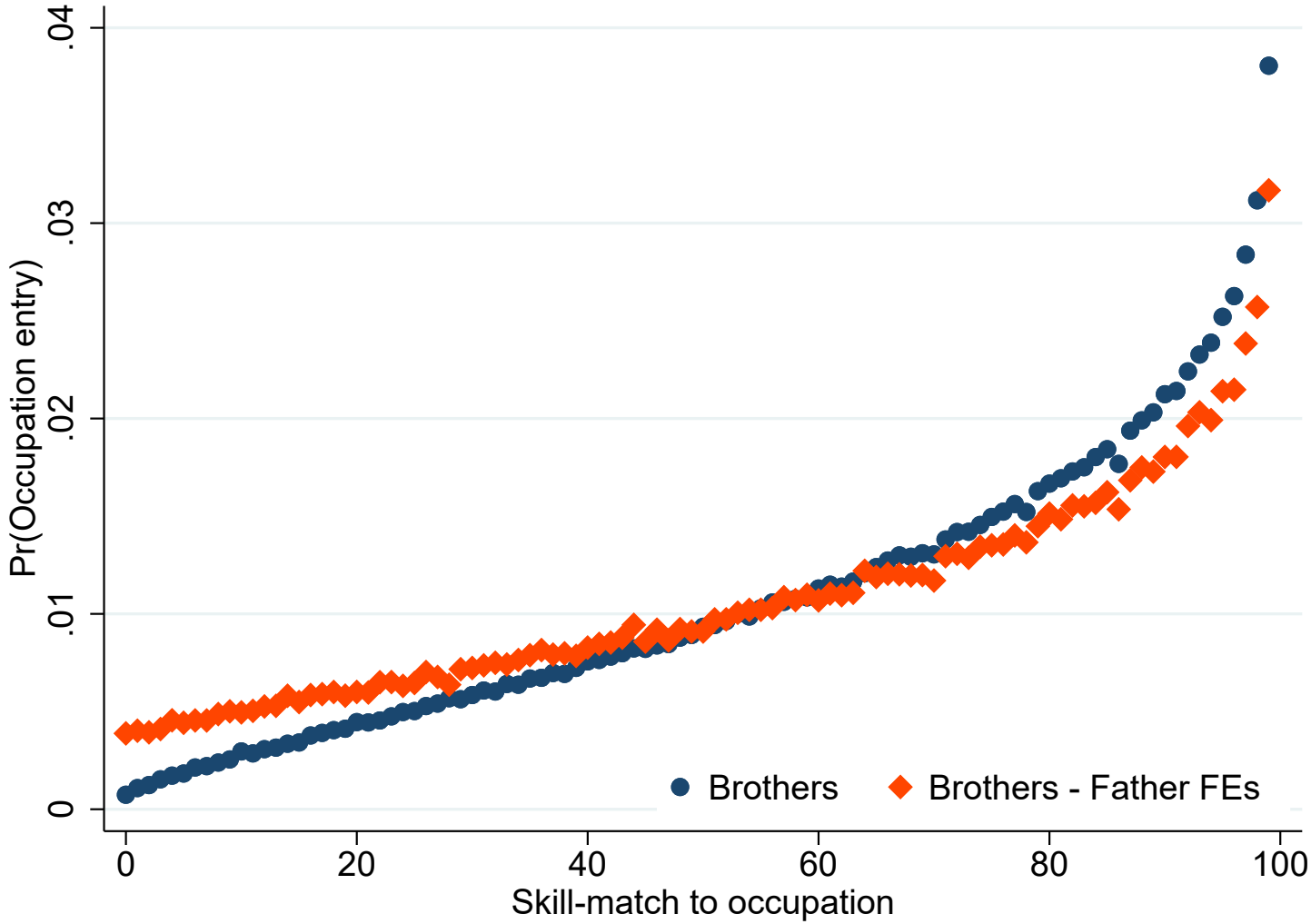
Occupational Choice and Skill Match: Brothers



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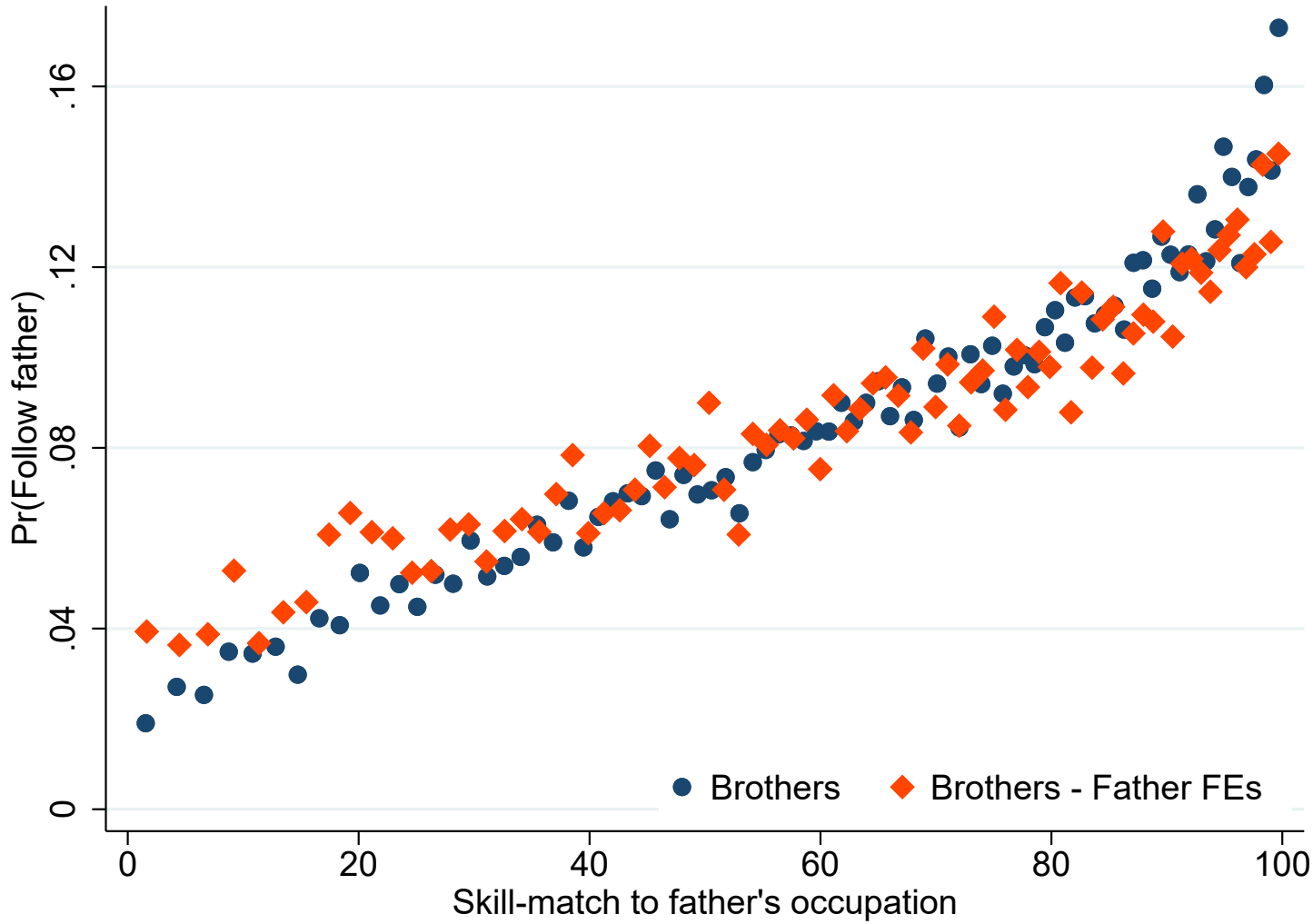
Occupational Following and Skill Match: Brothers



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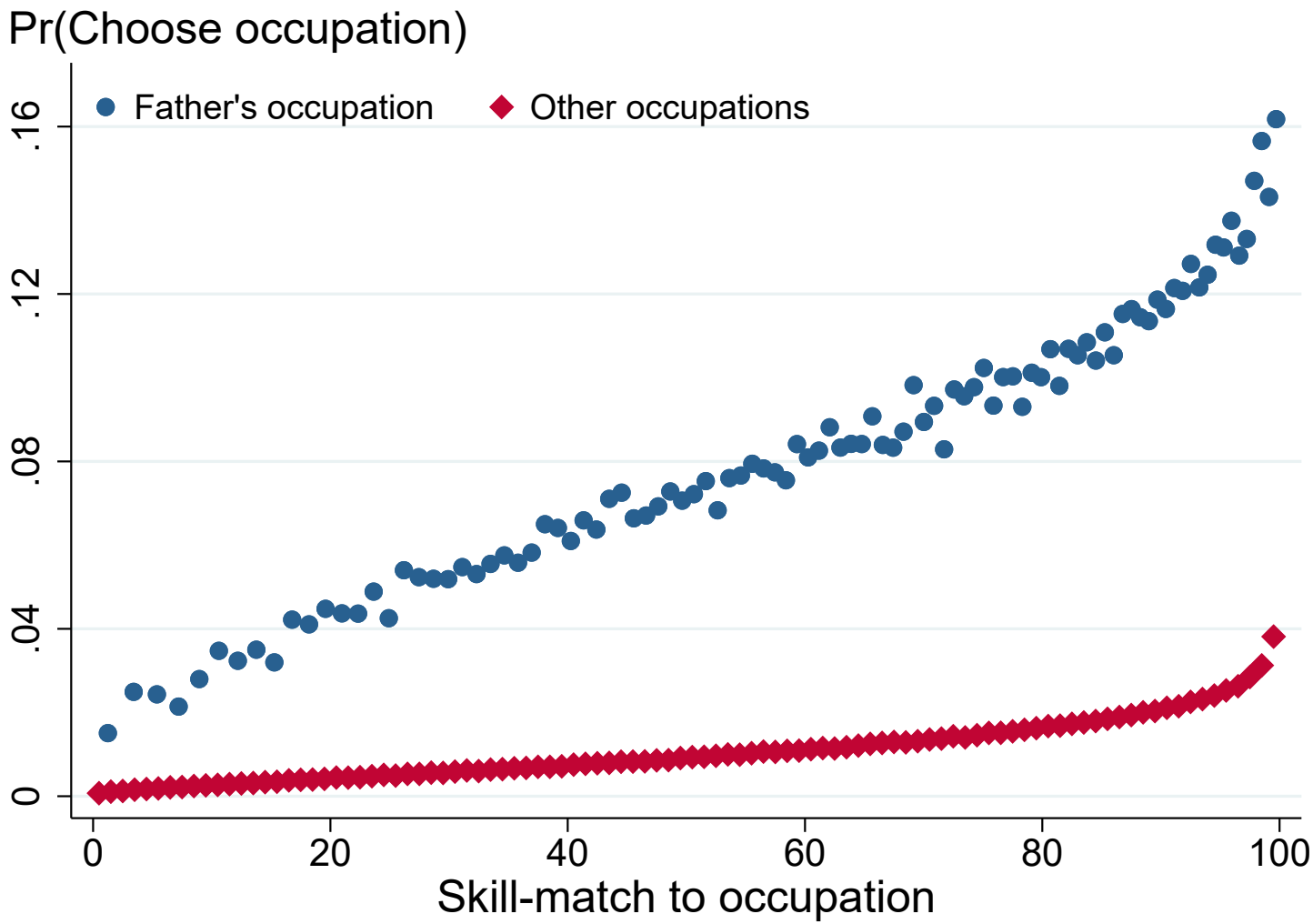
Occupational Following and Skill Match



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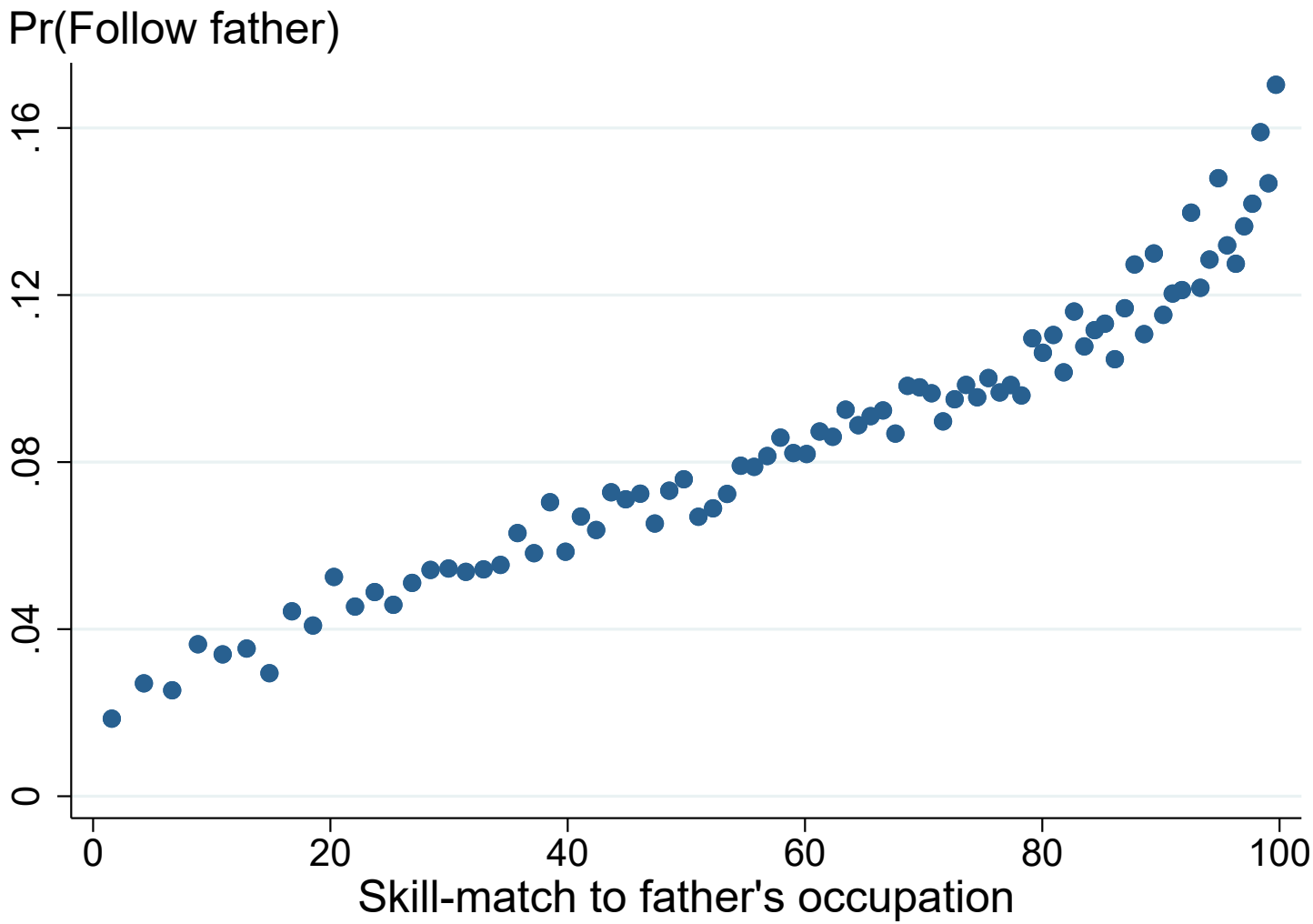
Occupational Following and Skill Match: Brothers



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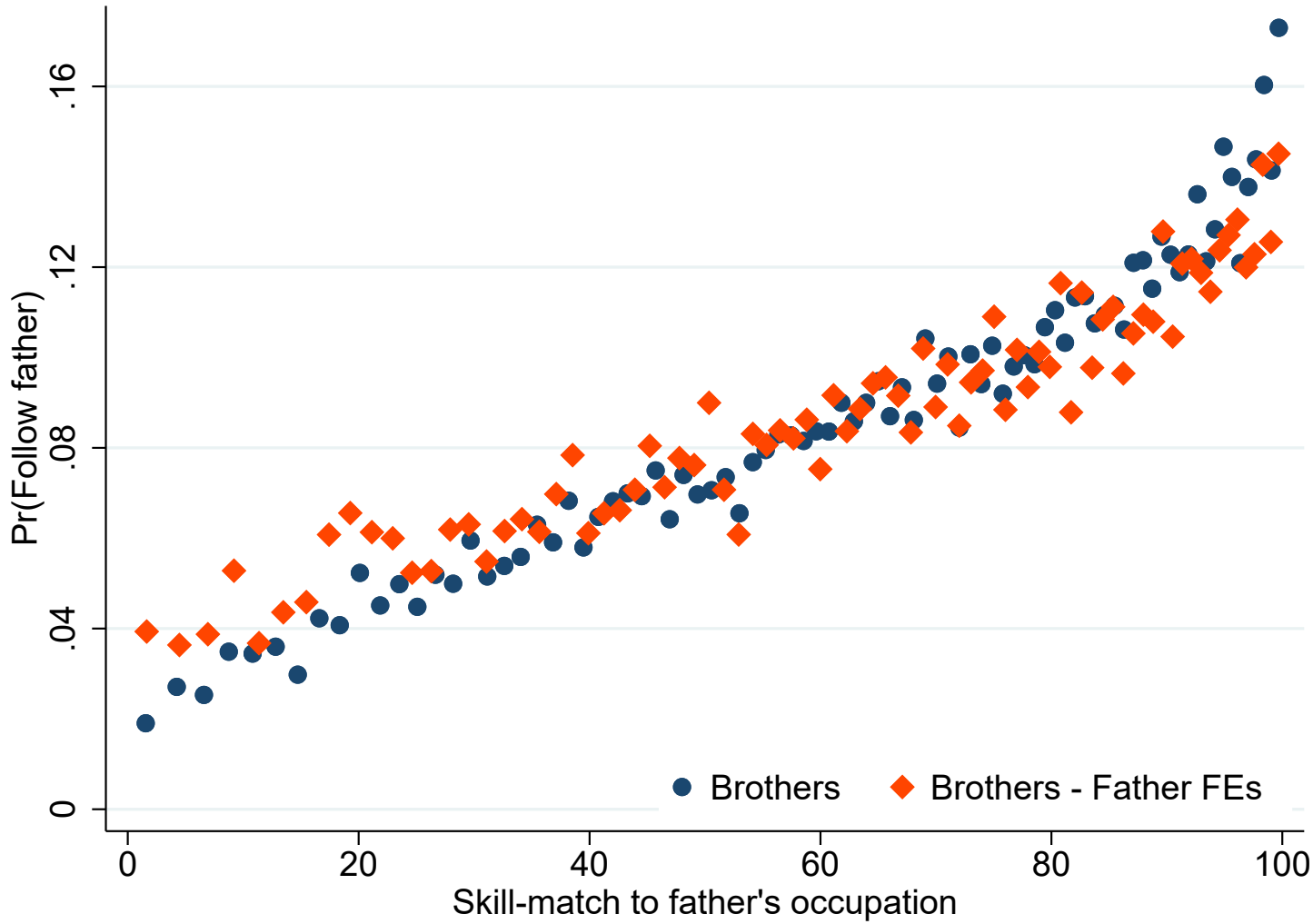
Occupational Following and Skill Match: Brothers



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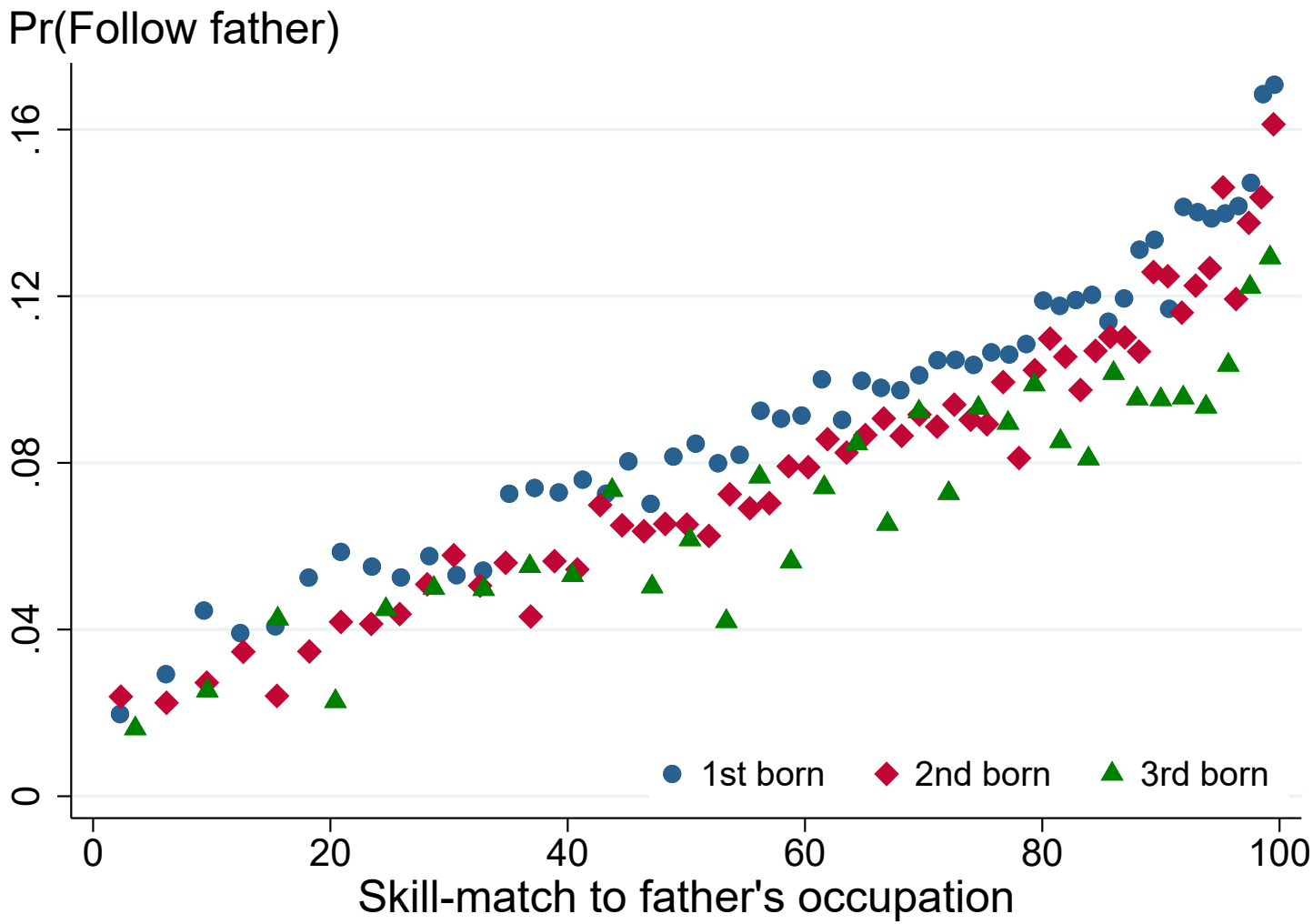
Occupational Following and Skill Match: Birth Order



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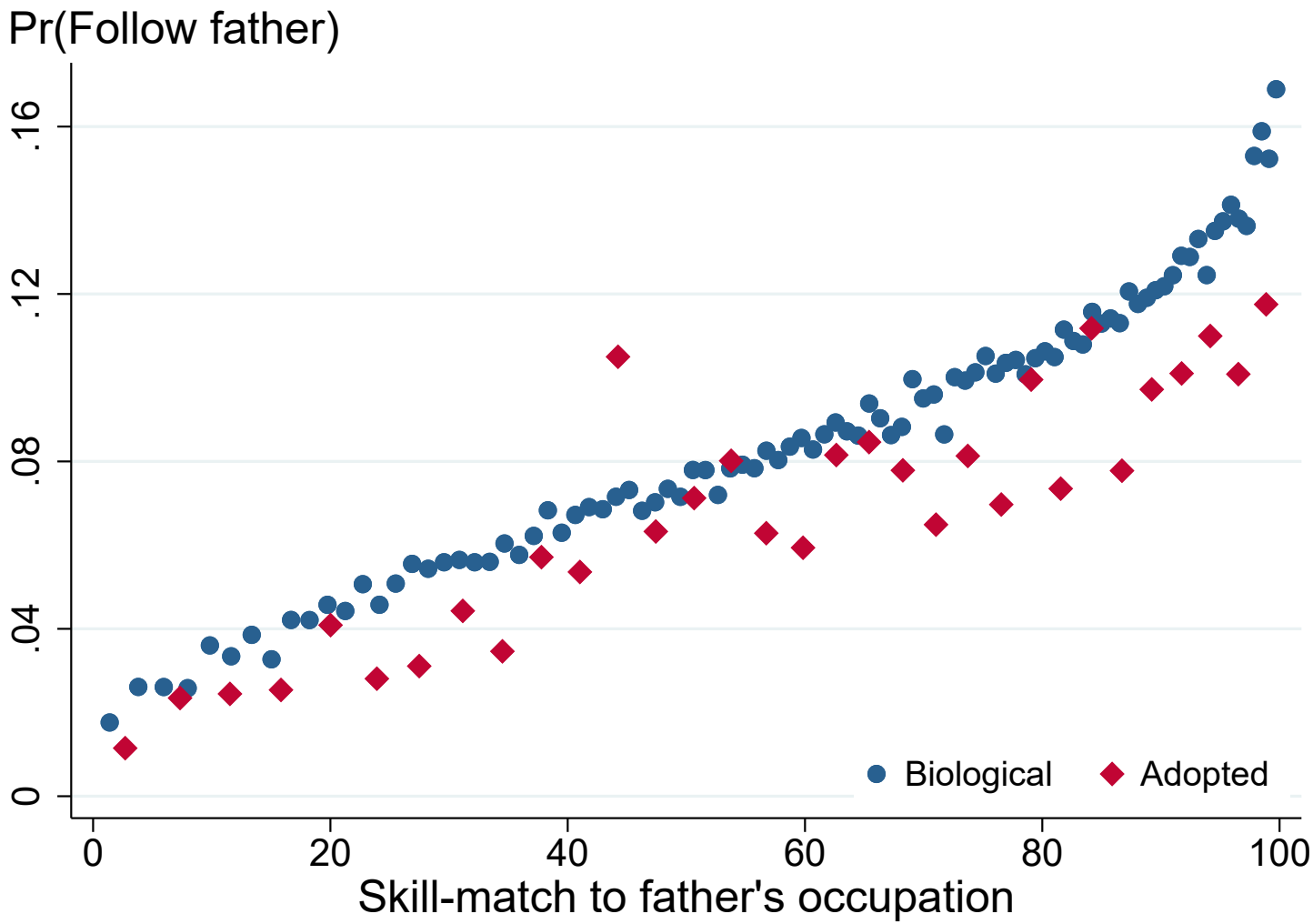
Occupational Following and Skill Match: Bio/Adopted



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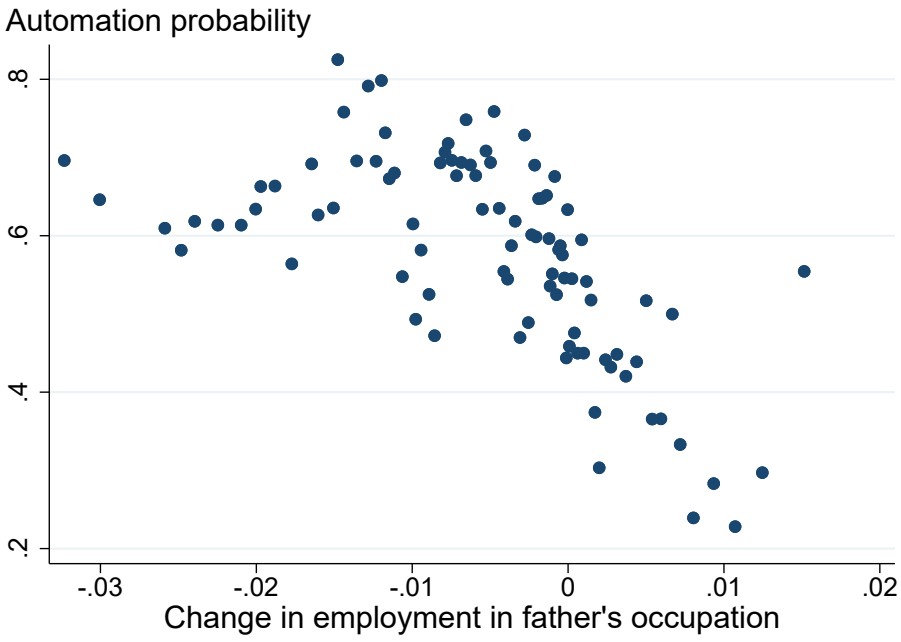
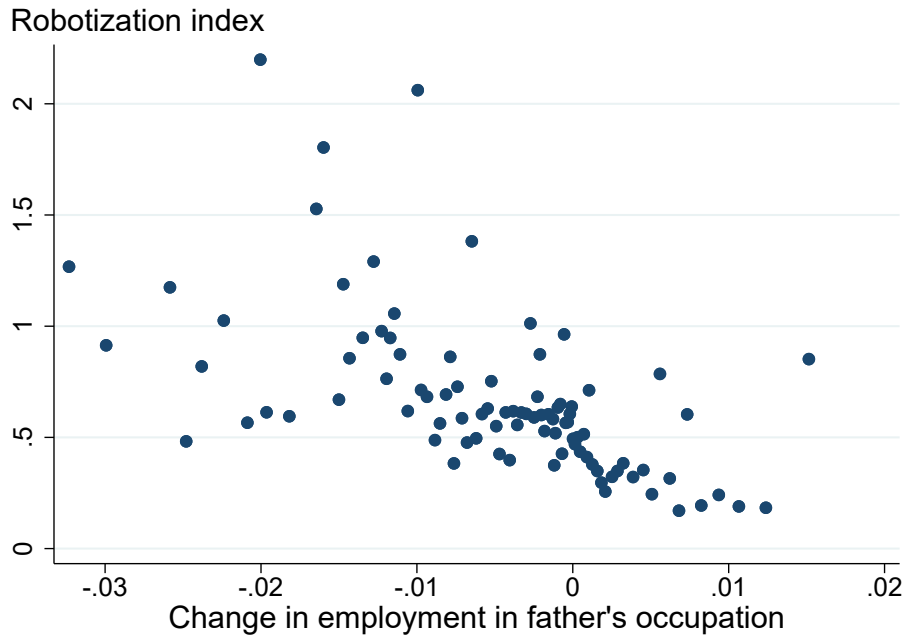
Occupational Decline: Automation and Robotization



(a) Automation (Frey and Osborn, 2007)



(b) Robotization (Webb, 2019)

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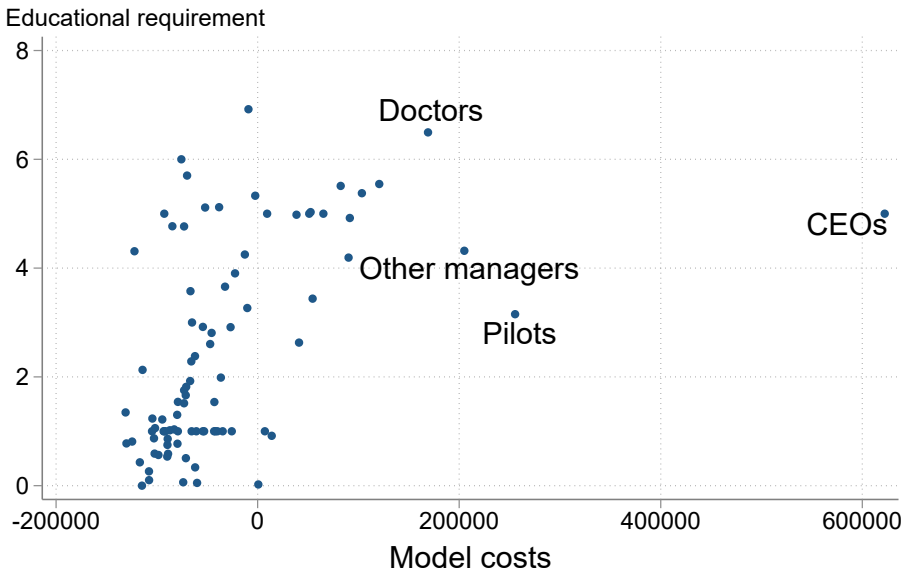
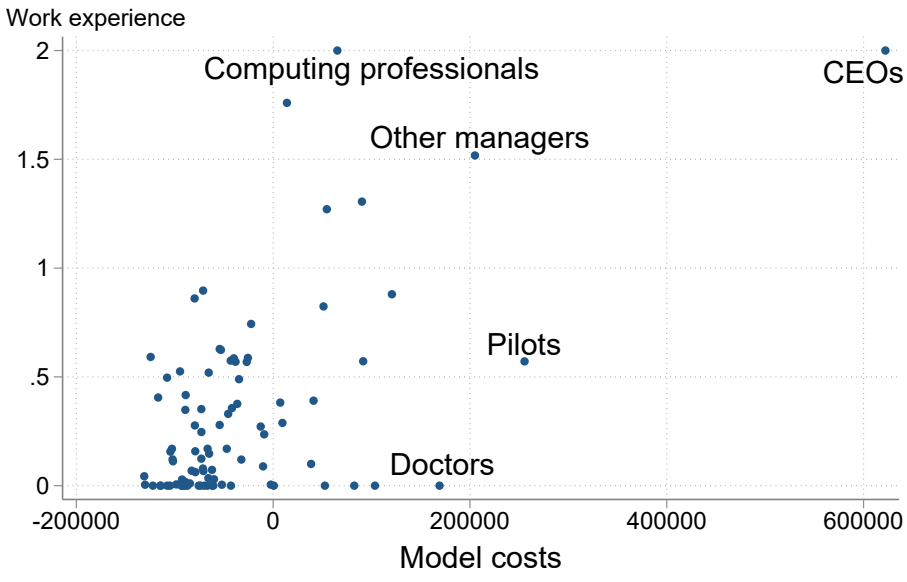
Entry Costs, Education, and Work Experience



(a) Costs and Educational Requirements



(b) Costs and Usual Work Experience

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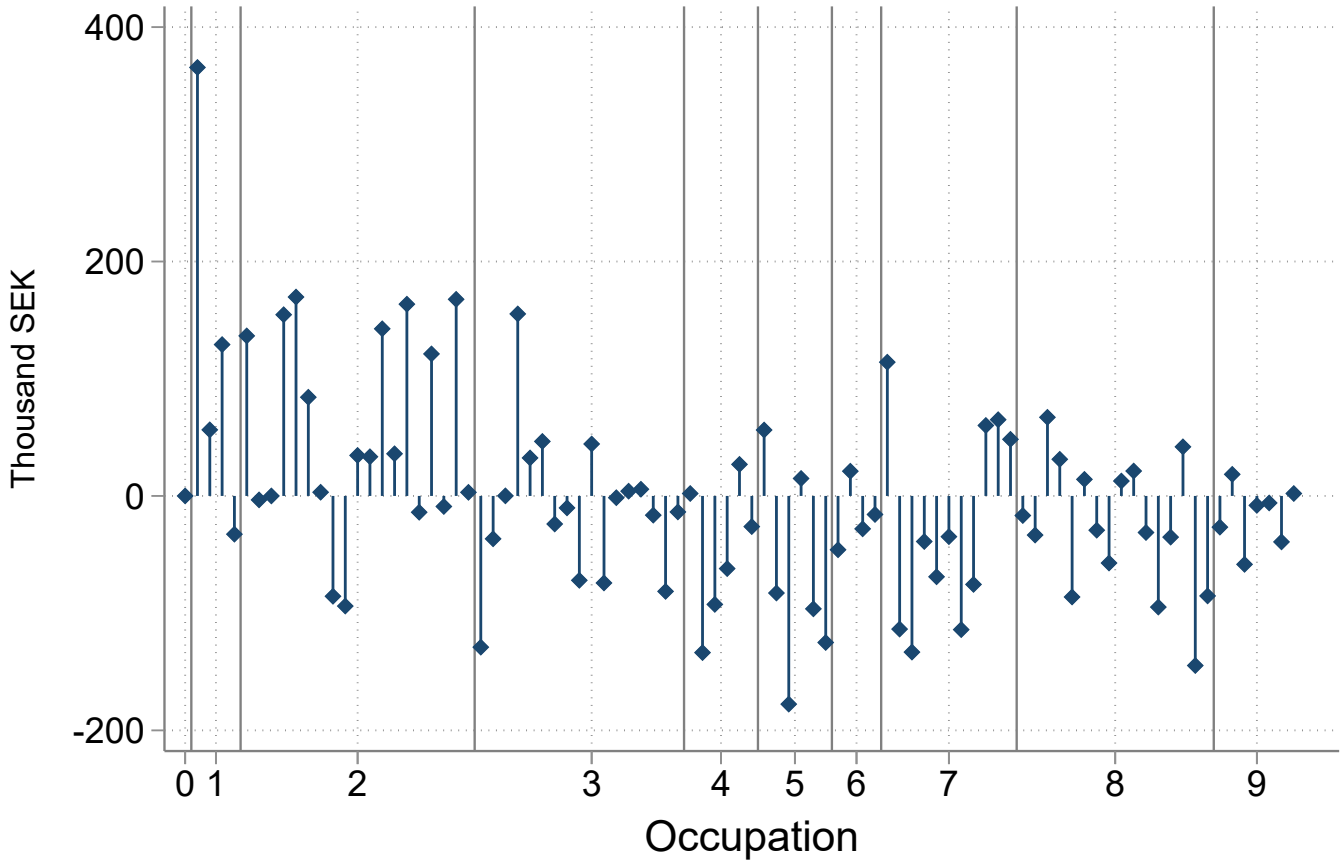
Model implied entry costs



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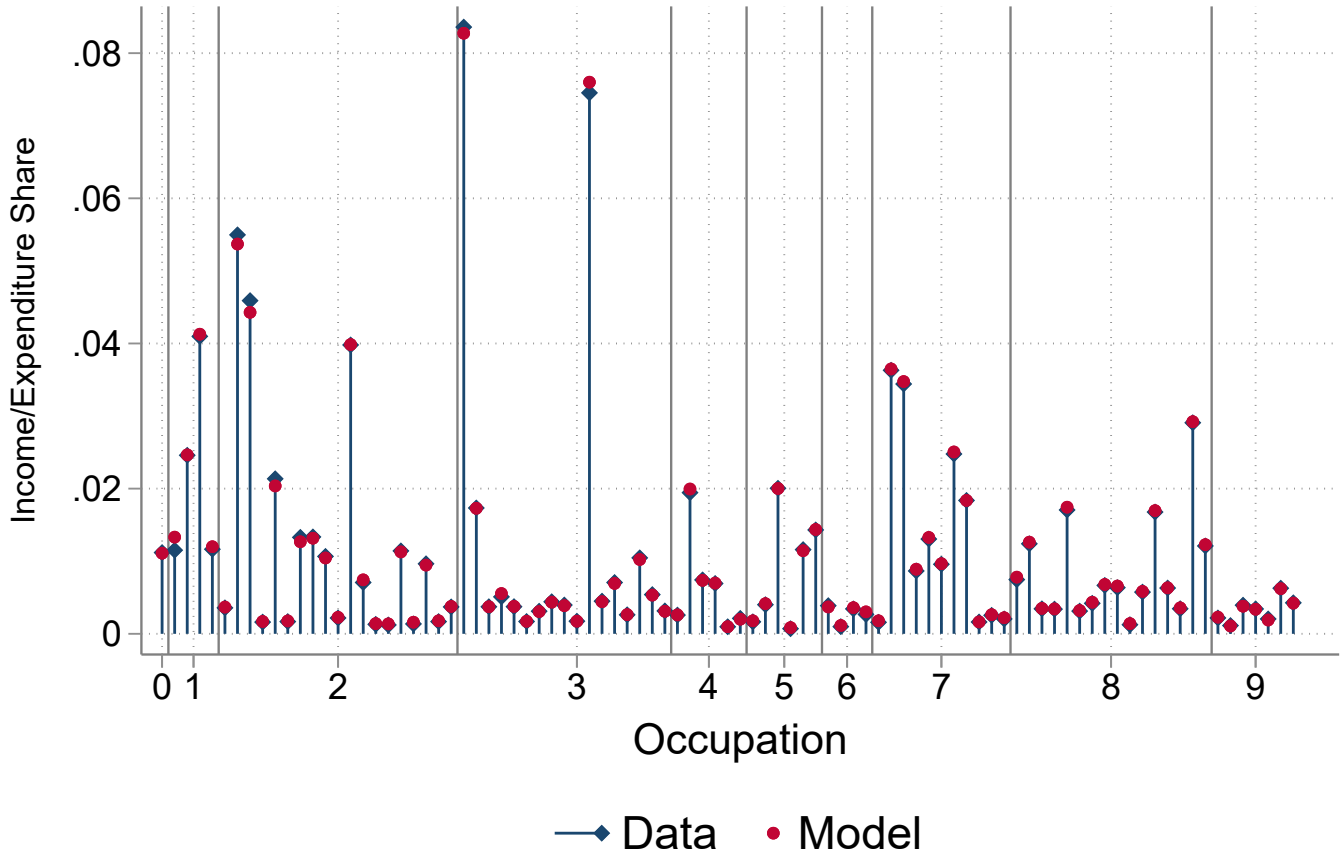
Model implied expenditure shares



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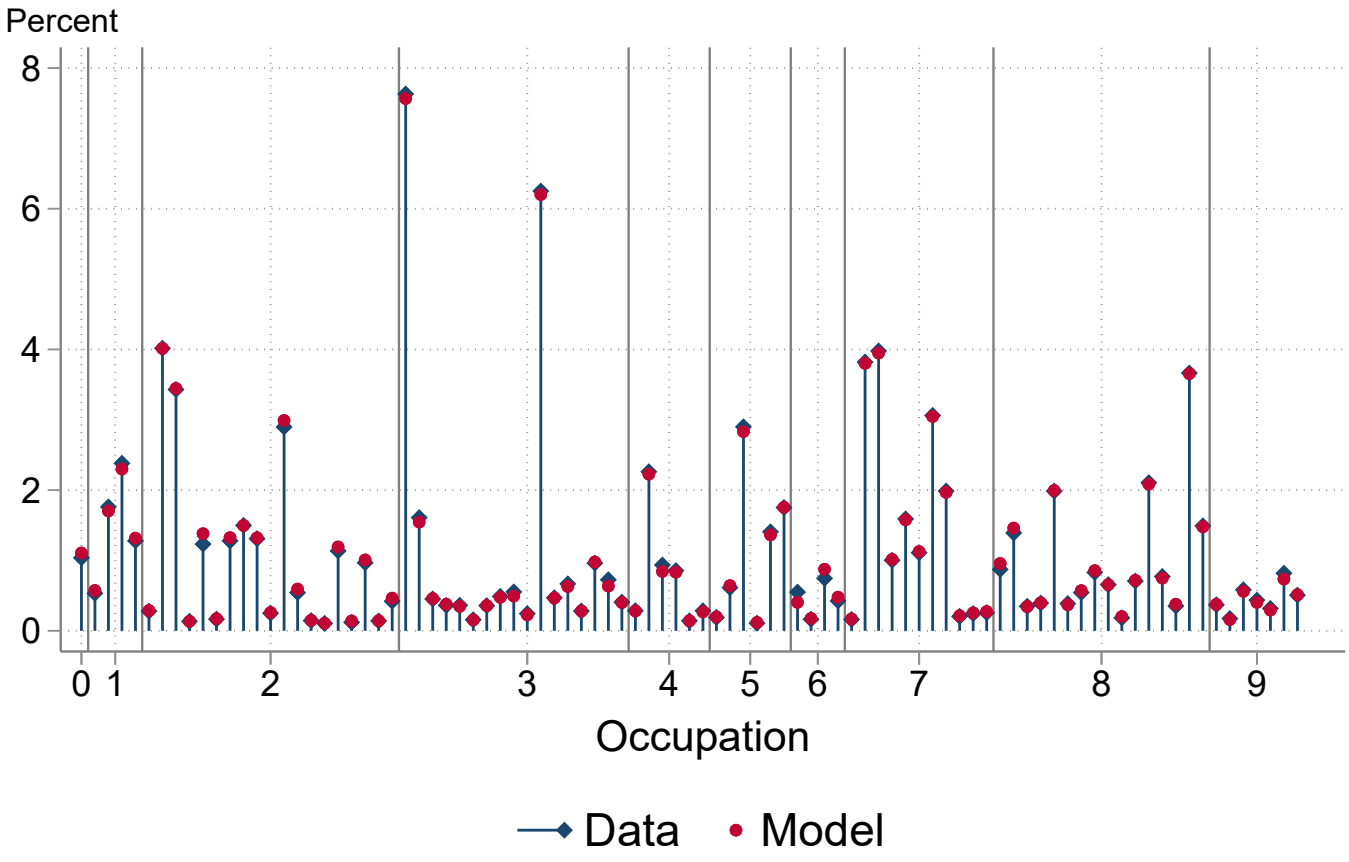
Occupational shares — Model and Data



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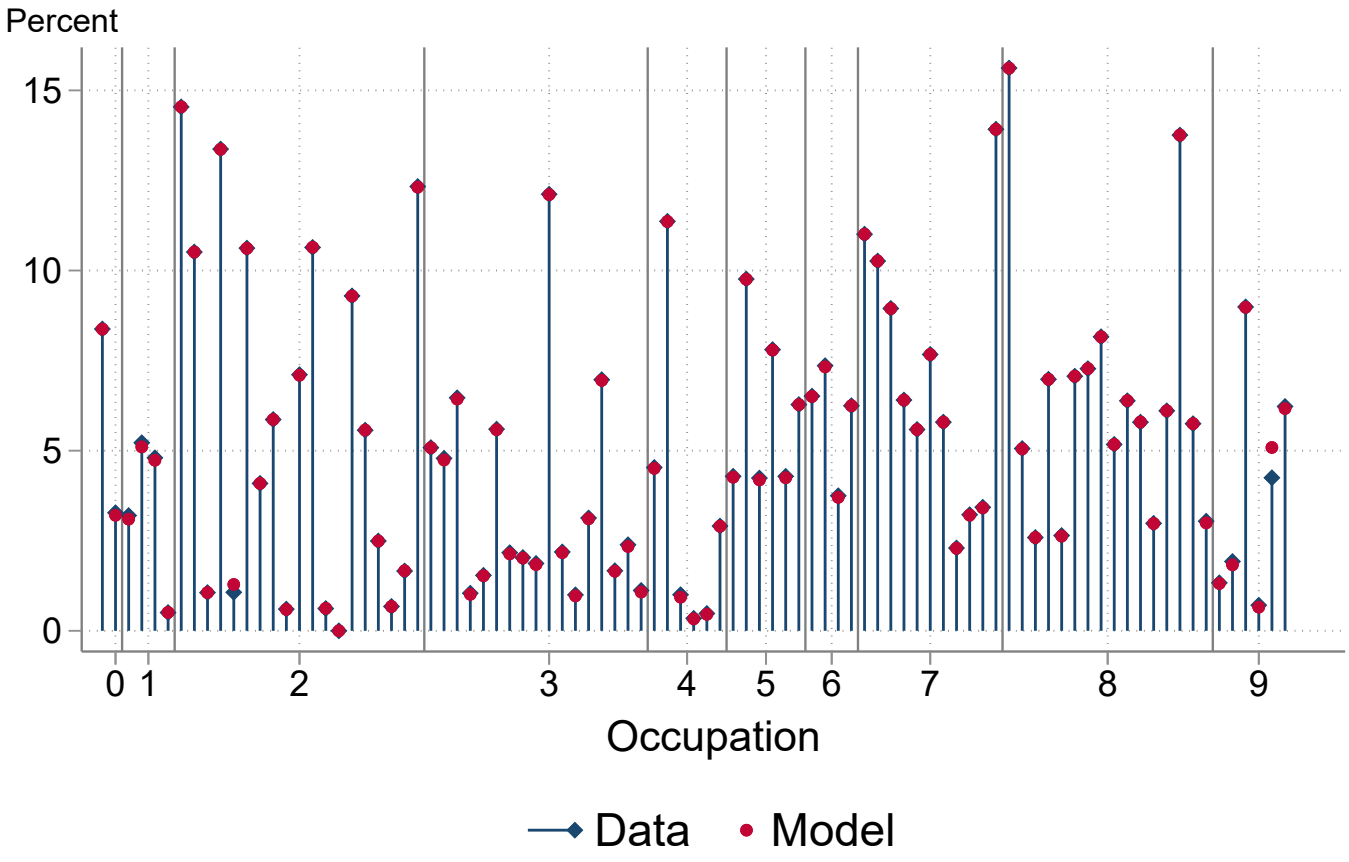
3-digit occupational following — Model and Data



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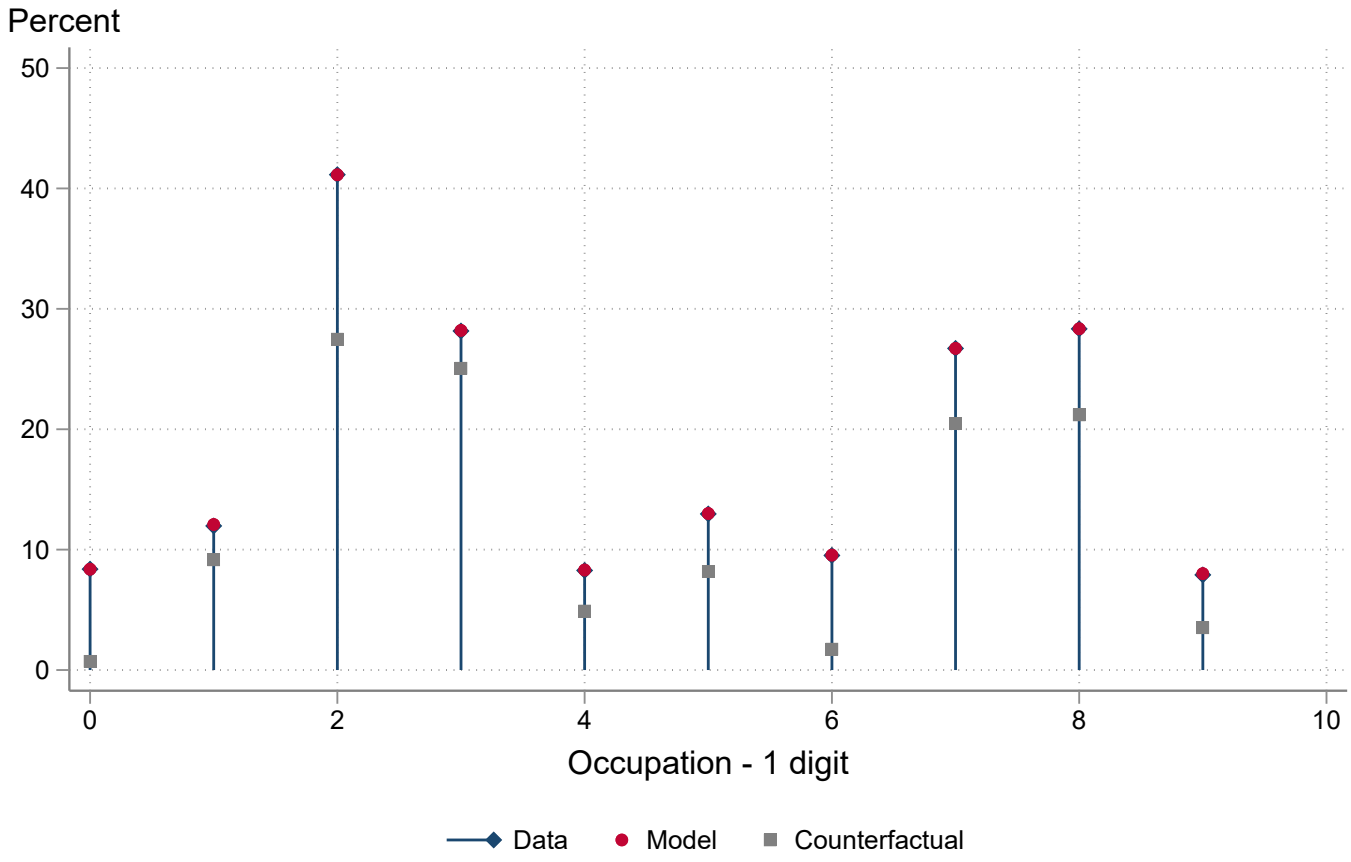
1-digit occupational following — Model and Data



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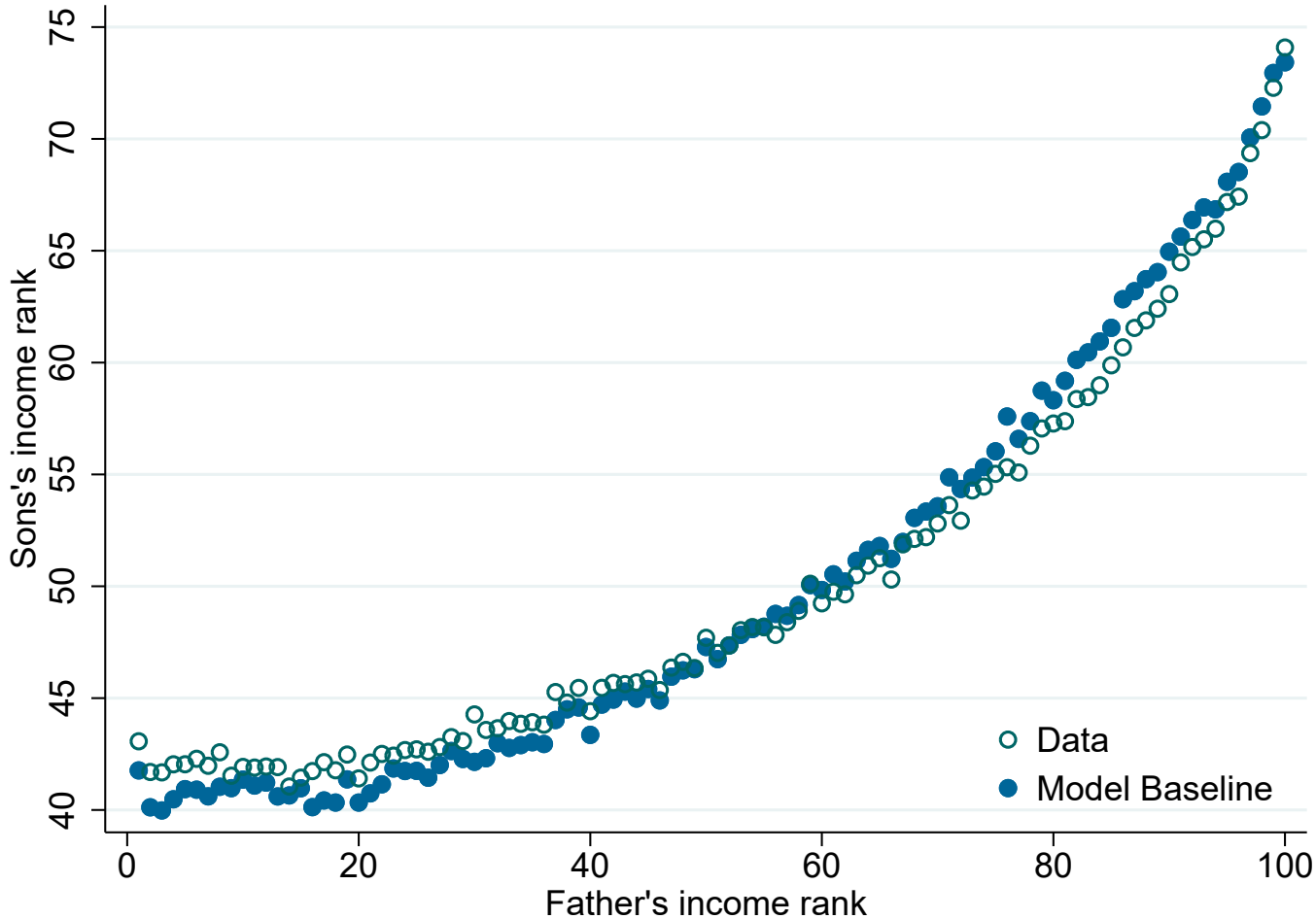
Intergenerational Mobility: Model vs. Data



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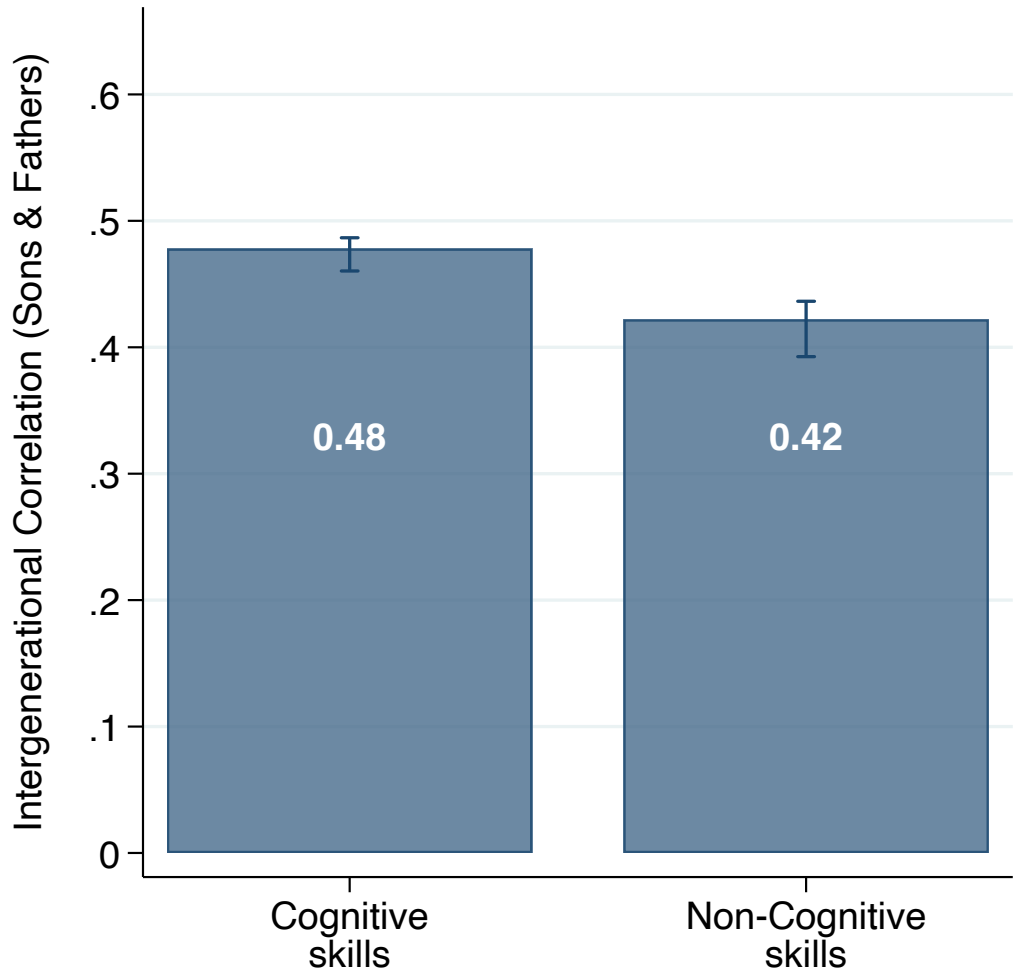
Intergenerational Correlation in Skills



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

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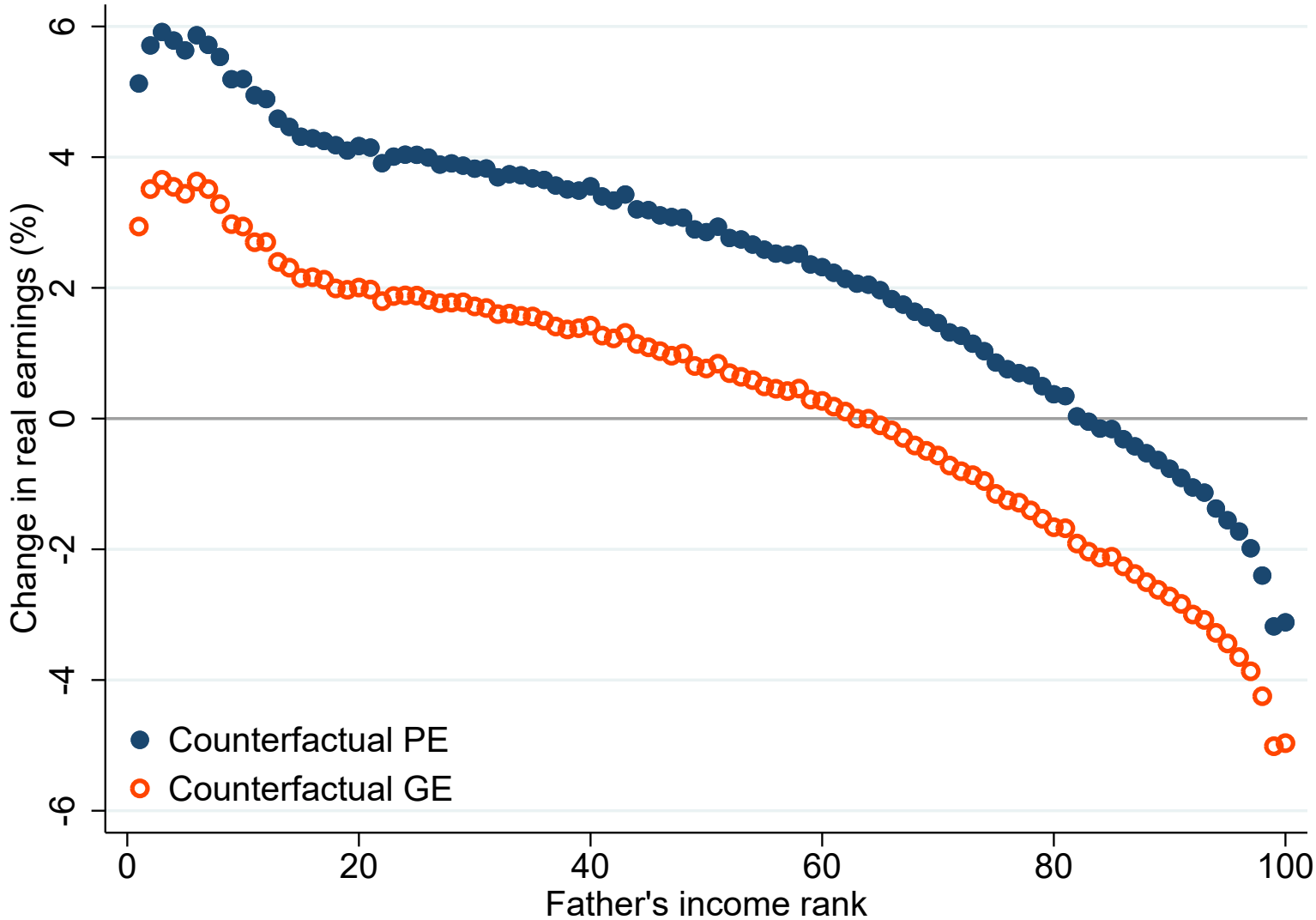
Change in Real Income



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