

Innovation, inequality, and social mobility

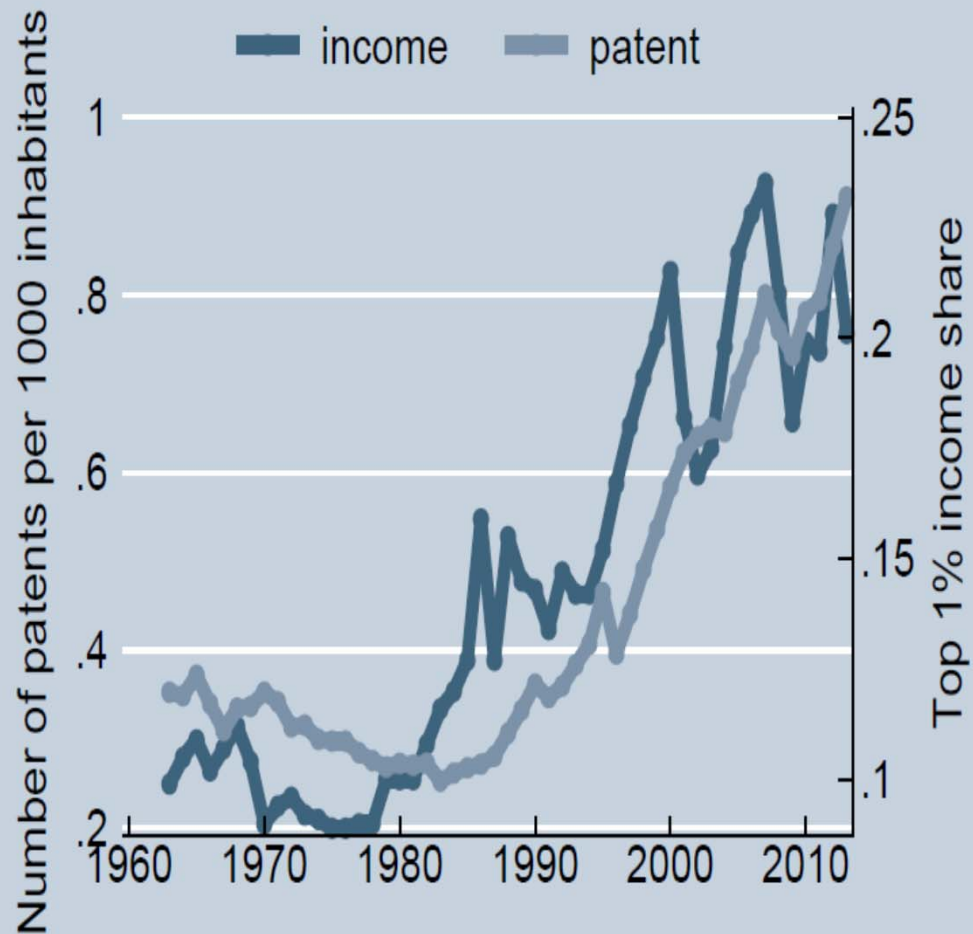
Philippe Aghion

Introduction

- What did (top) income inequality accelerate over the past three decades?
- In this presentation we argue that innovation is part of the explanation

Top Income Share and Patenting

United States, 1963-2013



Source: Aghion et. al. (2015).

Outline

- **Part 1:** Innovation and top income inequality using aggregate cross US state panel data
- **Part 2:** Innovation and between-firm wage inequality using UK individual and firm-level data
- **Part 3:** Innovation, inequality and social mobility using Finnish individual and firm-level data

Part 1: Innovation and top income inequality using aggregate US cross state panel data

- Joint work with U. Akcigit, A. Bergeaud, R. Blundell and D. Hemous

Top income inequality and innovation

- Our core empirical analysis is carried out at the US state level
- Our dataset covers the period 1975-2014, a time range imposed upon us by the availability of patent data
- Regressing top income inequality on innovativeness:

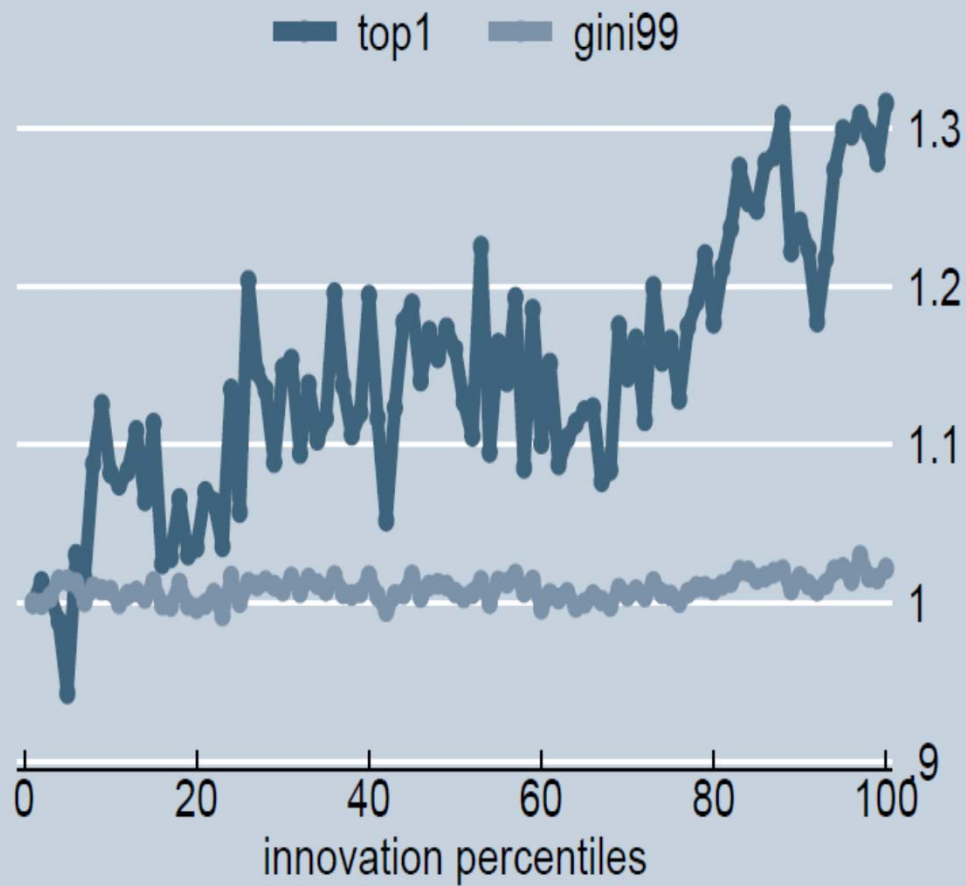
$$\log(y_{it}) = A + B_i + B_t + \beta_1(innov_{it-2}) + \beta_2 X_{it} + \varepsilon_{it}$$

IV regressions – Main results with Appropriation Committee

Measure of Inequality Innovation Lag of instrument	(1) Top 1% Patents 2 years	(2) Top 1% Patents 3 years	(3) Top 1% Cit5 2 years	(4) Top 1% Cit5 3 years	(5) Top 1% Qual4 2 years	(6) Top 1% Qual4 3 years
Innovation	0.173 (1.57)	0.212* (1.75)	0.180* (1.88)	0.173** (1.99)	0.267* (1.78)	0.275* (1.84)
Gdppc	-0.094 (-0.88)	-0.131 (-1.13)	-0.228 (-1.61)	-0.229* (-1.71)	-0.215 (-1.52)	-0.233 (-1.61)
Popgrowth	0.266 (0.26)	0.321 (0.32)	0.062 (0.05)	0.038 (0.03)	0.085 (0.07)	0.073 (0.06)
Sharefinance	0.006* (1.76)	0.006* (1.87)	0.009** (2.10)	0.009** (2.19)	0.009** (1.98)	0.009** (2.00)
Gvtsize	-0.091 (-1.64)	-0.076 (-1.31)	0.005 (0.06)	0.008 (0.10)	-0.033 (-0.41)	-0.020 (-0.25)
Outputgap	-0.009 (-1.42)	-0.010 (-1.55)	-0.012 (-1.57)	-0.013* (-1.66)	-0.011 (-1.50)	-0.012 (-1.59)
Highways	0.020 (1.50)	0.023* (1.66)	0.026* (1.74)	0.028* (1.84)	0.027 (1.64)	0.030* (1.71)
Military	0.008* (1.77)	0.008* (1.79)	0.013* (1.87)	0.011* (1.79)	0.012* (1.88)	0.010* (1.74)
R ²	0.905	0.898	0.889	0.891	0.881	0.878
1 st stage F-stat	16.62	14.57	11.73	14.11	9.64	9.72
N	1798	1798	1548	1548	1548	1548

Innovation and Inequality

Top 1% Share and Bottom 99% Gini

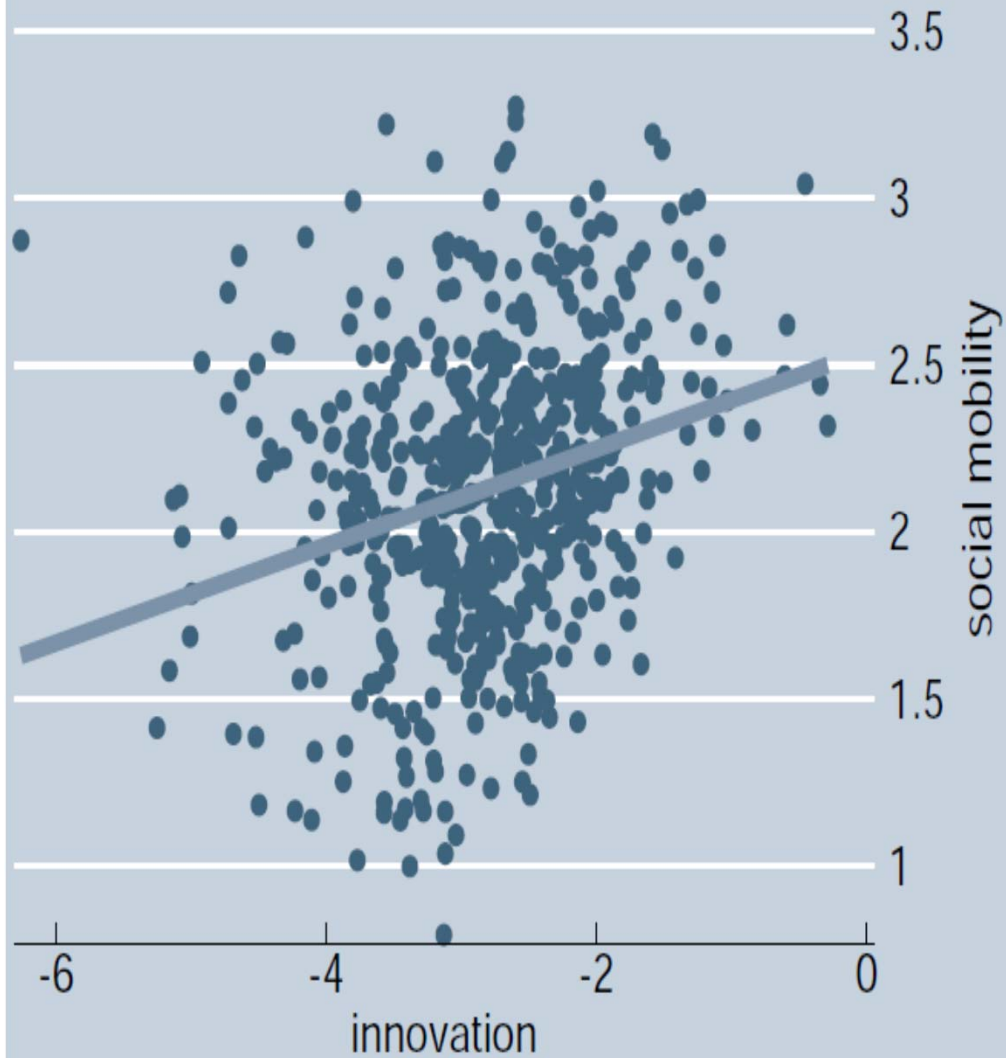


Source: Aghion et. al. (2015).

OLS regressions – CZ – Innovation on Mobility

Measure of Mobility Innovation	(1) AM25 Patents	(2) P1-5 Patents	(3) P2-5 Patents	(4) AM25 Patents	(5) P1-5 Patents	(6) P2-5 Patents	(7) P5 Patents
Innovation	0.024*** (3.07)	0.108*** (3.13)	0.063*** (2.70)	0.019** (2.40)	0.073** (2.10)	0.046* (1.76)	0.022 (1.17)
Gdppc	-0.094* (-1.81)	-0.225 (-1.09)	-0.204 (-1.48)	-0.139*** (-3.33)	-0.384* (-1.84)	-0.356** (-2.39)	-0.271** (-2.31)
Popgrowth	0.177 (0.61)	0.603 (0.55)	0.711 (0.87)	0.236 (0.76)	0.588 (0.48)	0.731 (0.84)	0.611 (0.89)
Gvtsize	0.000 (1.43)	0.002 (1.30)	0.001 (0.84)	0.000 (0.06)	-0.000 (-0.19)	-0.001 (-0.77)	-0.000 (-0.37)
Participation Rate	0.600*** (3.76)	1.356** (2.19)	1.274** (2.45)	0.726*** (4.50)	2.067*** (3.22)	1.692*** (3.14)	1.087** (2.55)
School Expenditure	0.116** (2.07)	0.550** (2.65)	0.349** (2.20)	0.096* (1.81)	0.417** (2.05)	0.298* (1.91)	0.153 (1.36)
College per capita				0.081 (1.52)	0.075 (0.35)	0.081 (0.49)	0.119 (0.98)
Employment Manuf				-0.333*** (-3.43)	-1.566*** (-4.27)	-1.273*** (-4.18)	-0.677*** (-2.86)
R ²	0.201	0.182	0.163	0.243	0.215	0.211	0.160
N	637	645	645	546	546	546	546

Innovation and Social Mobility



Source: Aghion et. al. (2015).

Conclusions from Part 1

- Innovation is a source of top income inequality
- Innovation does not increase broad inequality
- Innovation enhances social mobility

By contrast, lobbying...

- Increases top income inequality
- Increases inequality at large
- Reduces social mobility
- Does not enhance growth

Part 2: Innovation and between-firm wage inequality using UK individual and firm-level data

- Joint ongoing work with A. Bergeaud, R. Blundell and R. Griffith

Questions

- Recent work by Bloom et al (2016) suggests that increased wage inequality is more between firms than within firms
- Here we look at relationship between innovativeness and between-firm wage inequality

Data sample

- We use ONS data on R&D by all UK firms with more than 400 employees between 2004 and 2010
- We match these data with detailed individual information on skill (occupation), wage and hours worked for 1% of UK population randomly selected

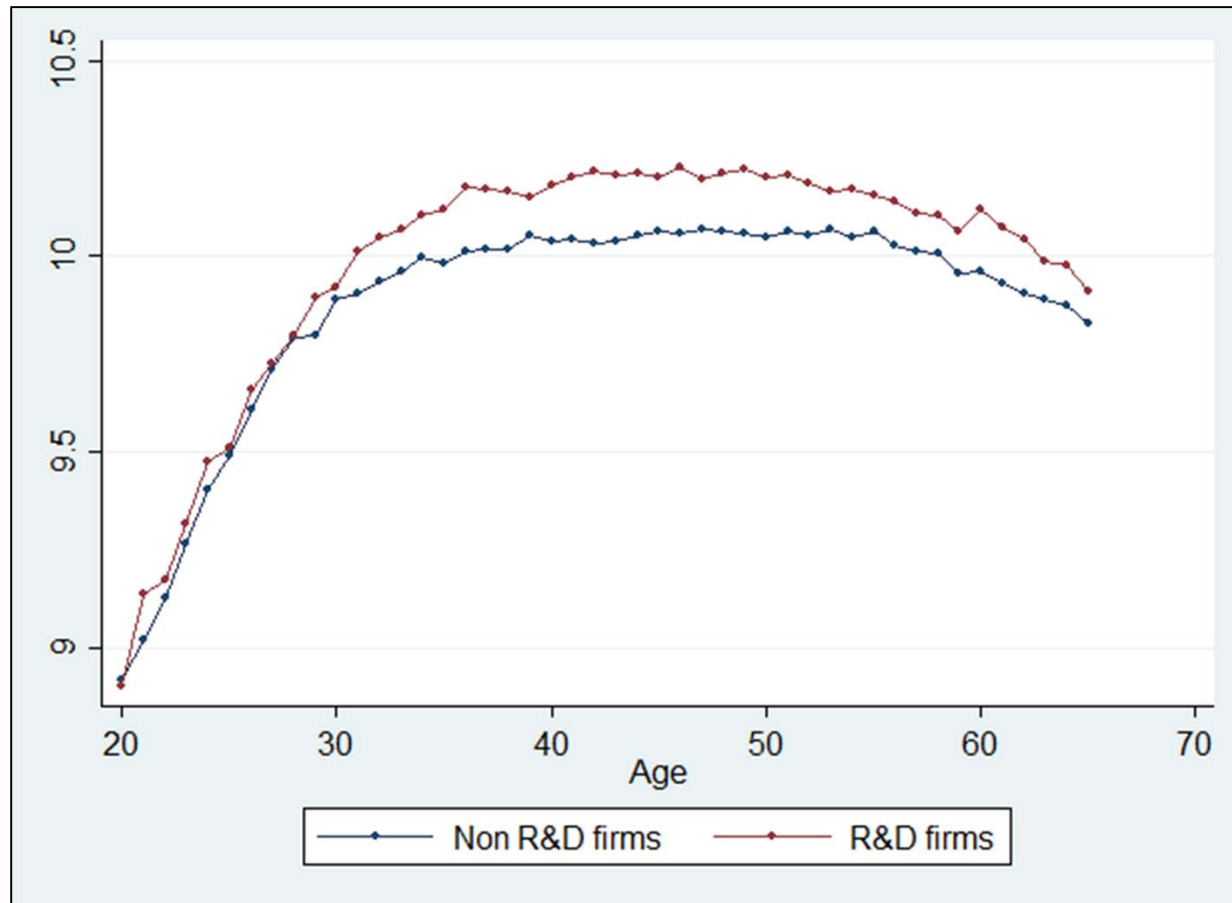
A first regression

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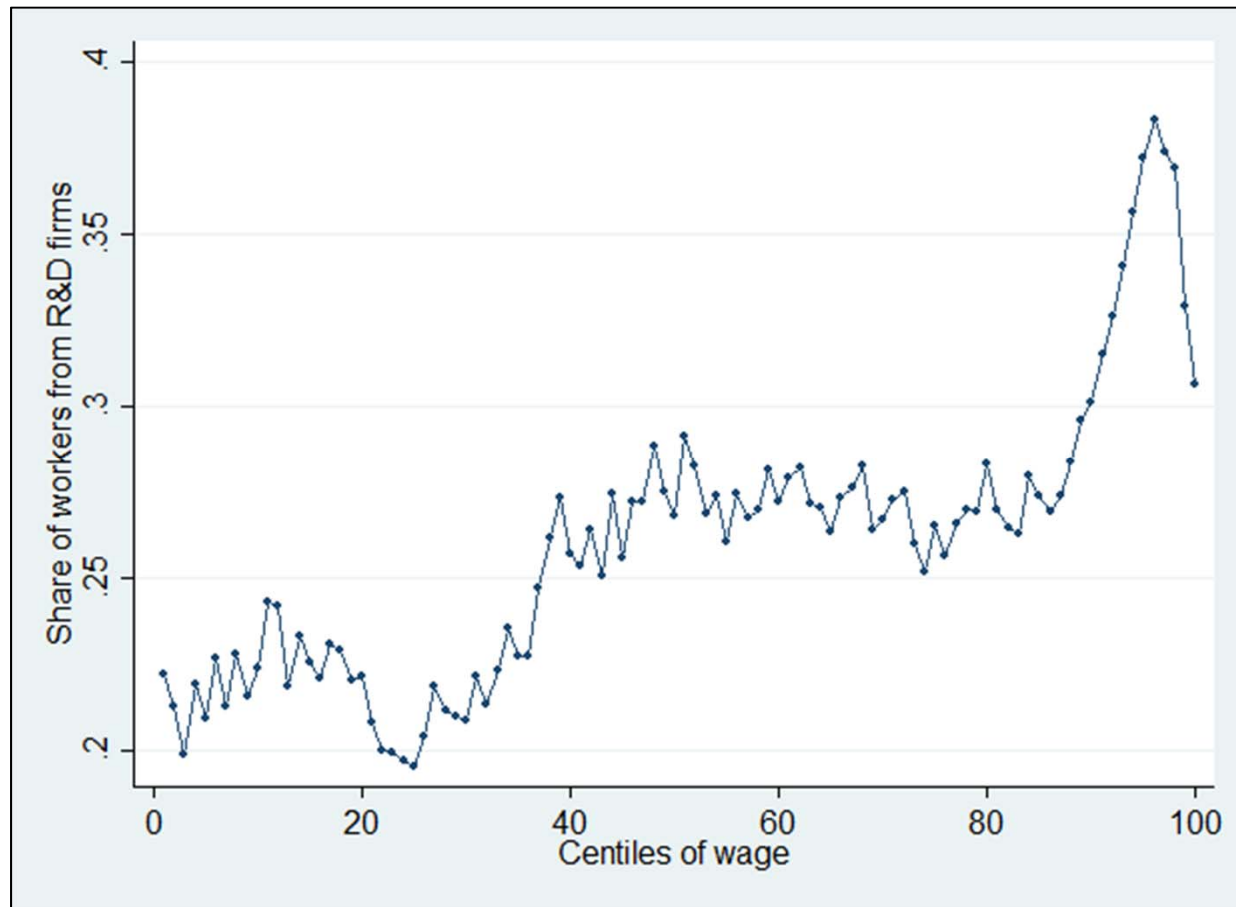
log_w	(1)	(2)
RD_intensity	0.187*** (0.0102)	0.133*** (0.00913)
Age	0.122*** (0.0009)	0.084*** (0.00077)
Age2	-0.0013*** (-0.00001)	-0.00088*** (-0.0000)
Size	-0.0243*** (-0.00093)	0.00013 (0.00084)
Gender	0.222*** (0.0032)	0.182*** (0.0029)
N	509,281	509,281
Fixed effects	Year	Labour Mkt

OLS
regression
with robust
standard
errors
clustered at
the
enterprise
level

Average log of wage for R&D firms versus non R&D firms

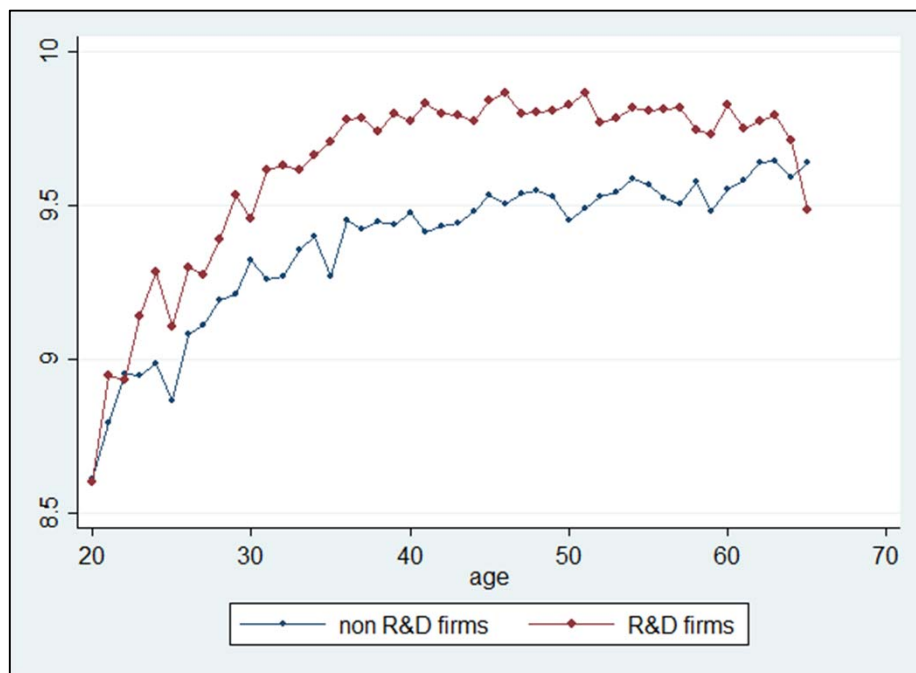


Share of R&D firms workers

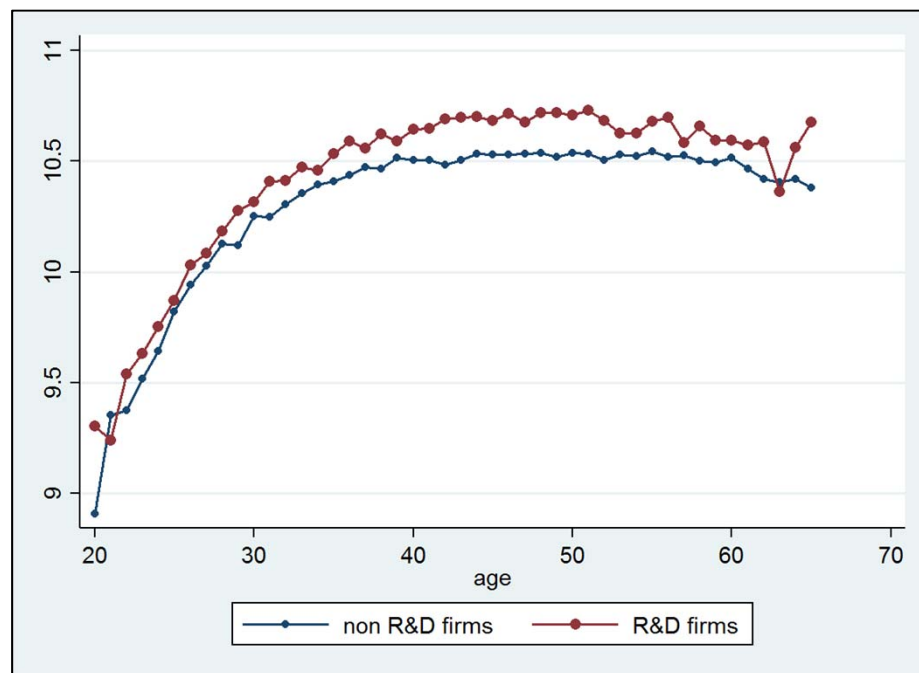


Note: each percentile aggregates around 5100 observations

Average log of wage by age and skill Level



Low Skill workers



High Skill workers

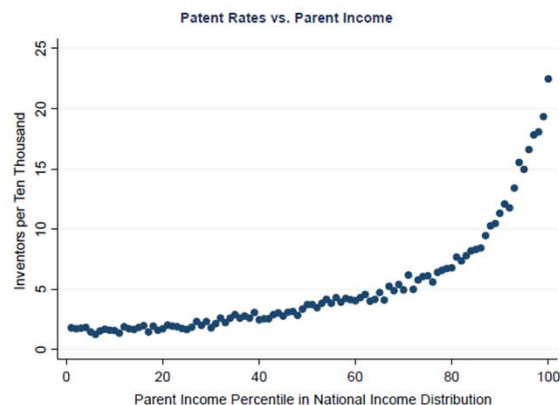
Conclusions from Part 2

- Average wage higher in more R&D intensive firms
- Surprisingly, firm-level R&D intensity affects low-skill wages more than high-skill wages
- Potential explanations:
 - Innovative firms become more selective (more O-Ring organizational forms?) and thus only keep the more experienced workers among the low-skill
 - Higher bargaining power of low skill workers in more innovative/O-Ring firms

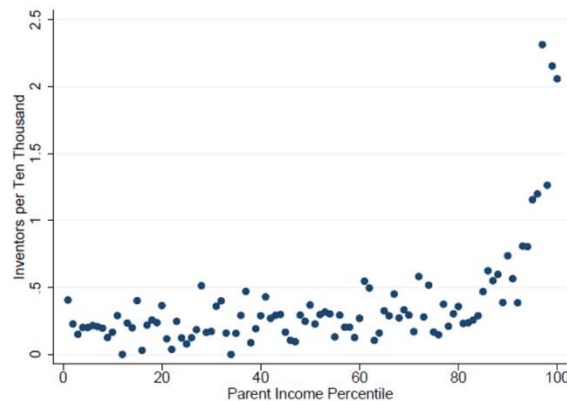
Part 3: Innovation, inequality and social mobility using Finnish individual and firm-level data

motivation

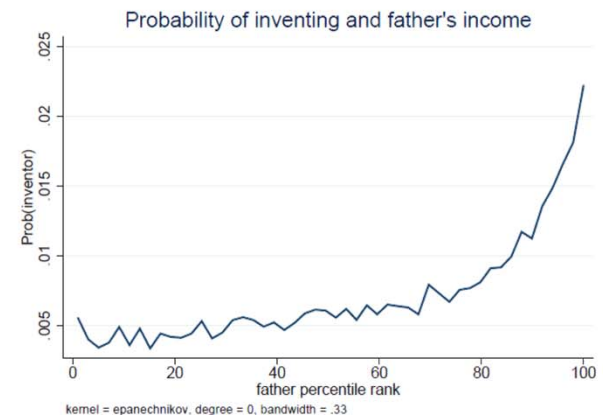
- “American Dream” implies that everybody in the society should have an equal opportunity to achieve success and upward social mobility.
- However, the data shows some striking patterns:



Bell et al (2015)
US IRS Data



Akcigit et al. (2016)
US Historical Census



This Paper
Finnish Census



data

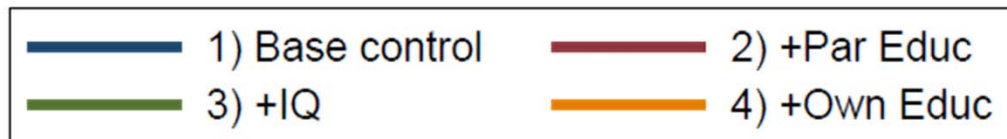
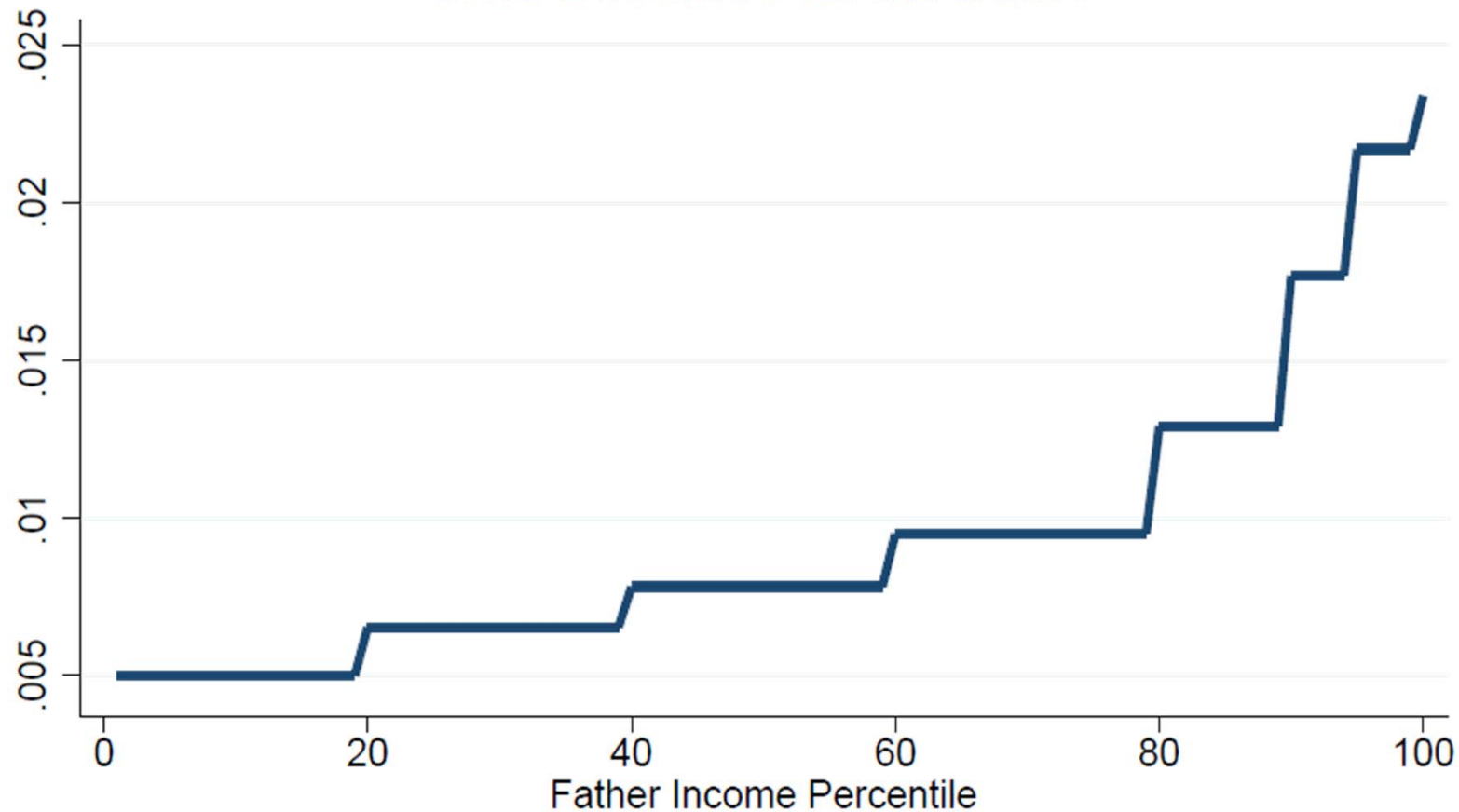
- We merge four Finnish datasets, 1988-2012:
 1. Individual data on income, education and other characteristics, from Statistics Finland (SF)
 2. Firm-level data (inventors' co-workers, senior/junior managers, entrepreneurs), from Statistics Finland (SF)
 3. Patent data from European Patent Office (EPO)
 4. IQ data from the Finnish Defence Force (FDF)



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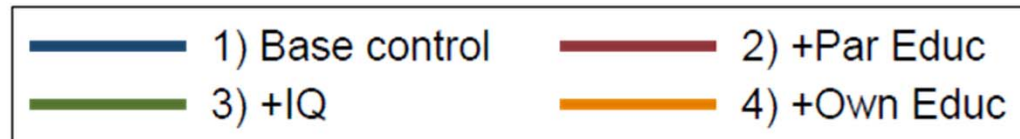
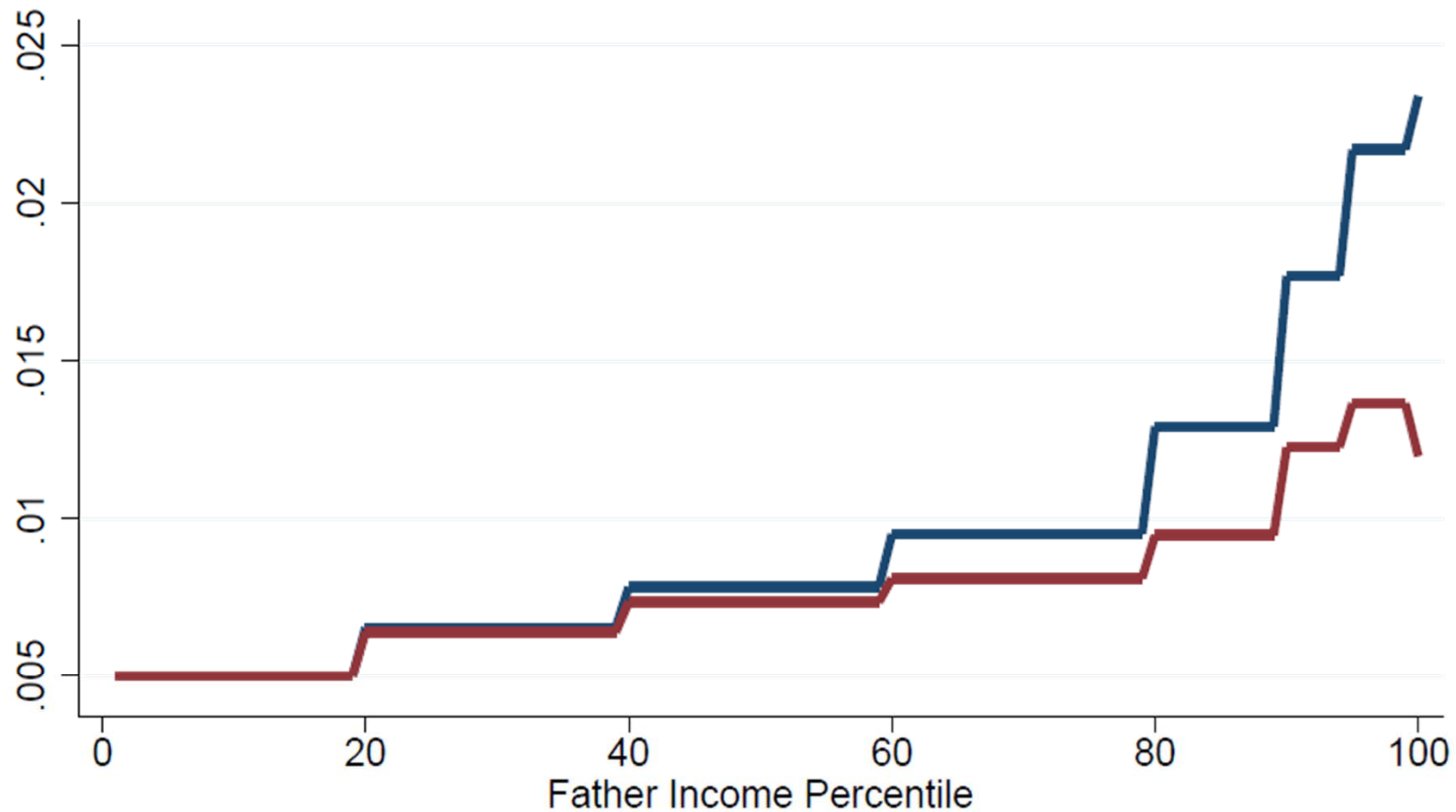
Who Becomes an Inventor?

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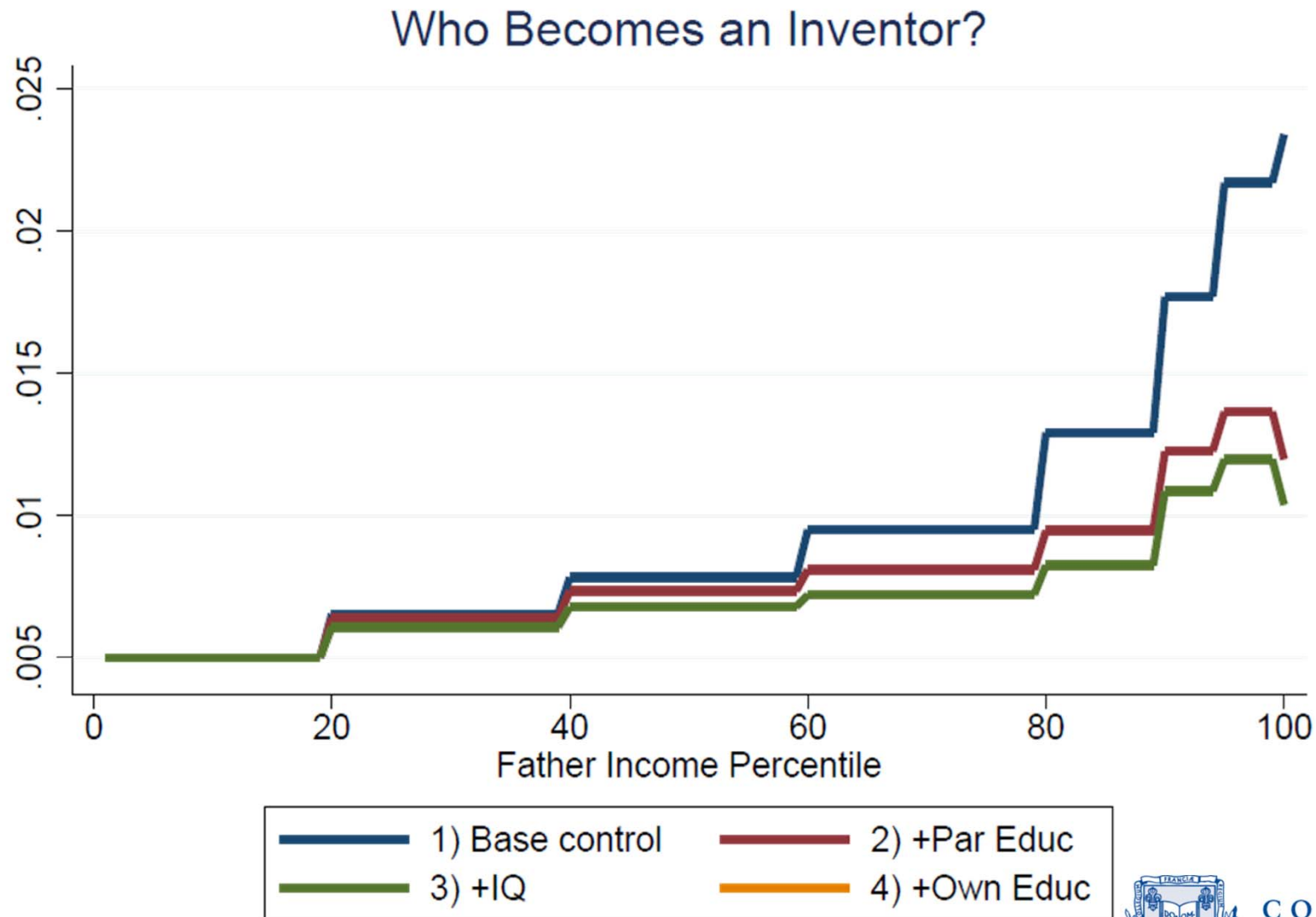


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Who Becomes an Inventor? Visual Representation

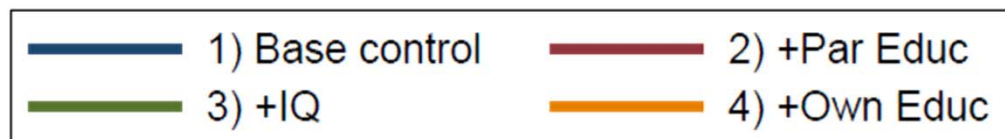
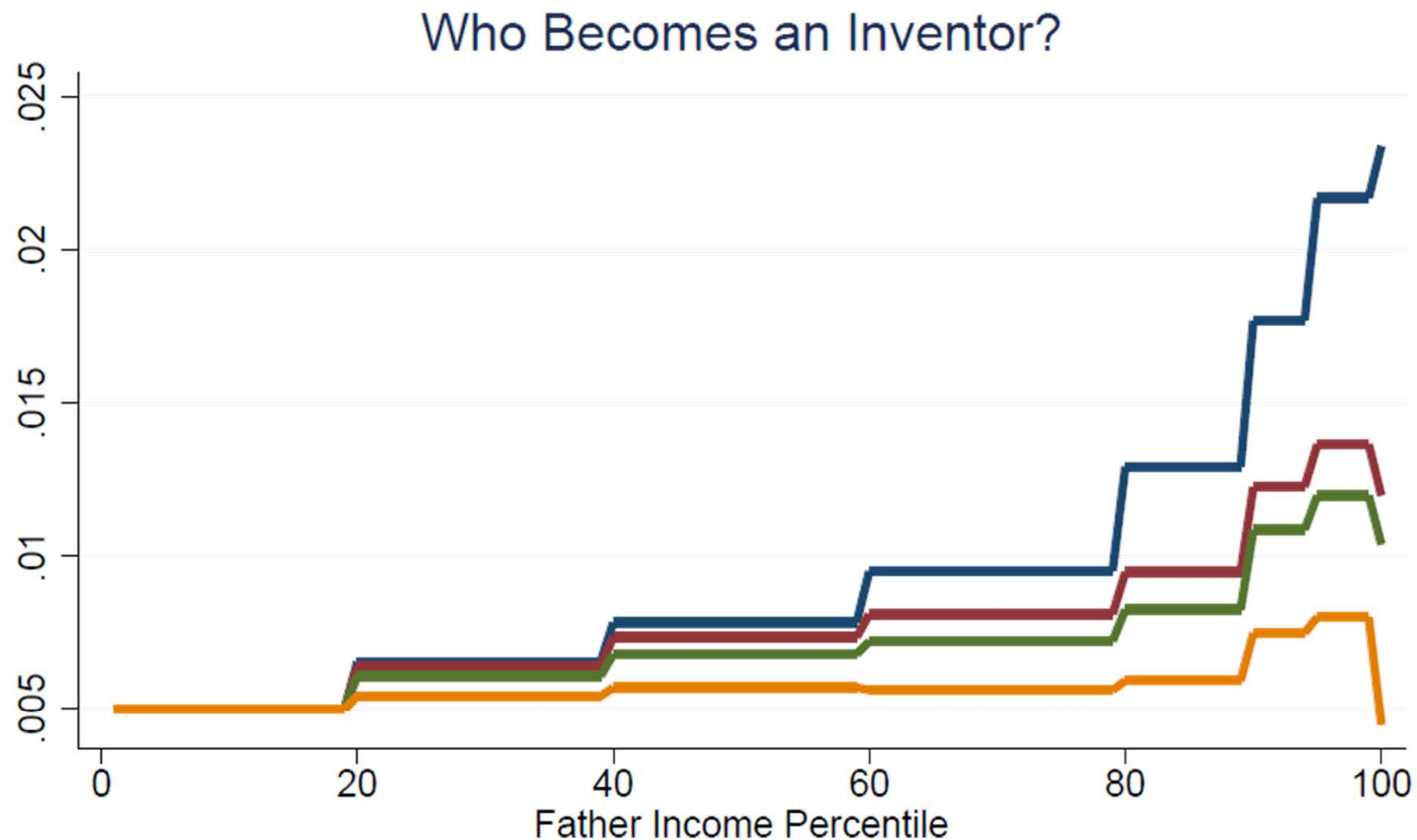


Who Becomes an Inventor?



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Who Becomes an Inventor?



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Returns to Innovation

Table: RETURNS TO INNOVATIONS

<i>FIXED EFFECT REGRESSION</i>					
time	inventor	b.c. coworker	senior manager	senior w-c	entrepreneur
t=0	0.0187***	0.0089***	-0.0037*	-0.0019*	0.0763
t=1	0.0116***	0.0080***	0.0077***	0.0030***	0.1695***
t=2	0.0071***	0.0027***	-0.0011	0.0015	0.0630**
t=3	0.0063***	0.0008*	0.0012	0.0020**	-0.0276
t=4	0.0059**	-0.0023***	0.0037**	0.0030***	0.0438
t=5	0.0099***	-0.0012***	0.0051***	0.0022**	0.0256
t=6	0.0072***	-0.0012***	0.0076***	0.0042***	0.0535***
t=7	0.0089***	-0.0004	0.0137***	0.0023**	0.0395**
t=8	0.0073***	-0.0014***	0.0093***	0.0053***	0.0639***
t=9	0.0049	0.0057***	0.0002	0.0007	0.0562***
t=10	0.0060**	0.0010**	-0.0056**	0.0019*	0.0404***
Observations	7,285,011				

- Fact: **Inventor** gains around **1%** for 10 years.

Returns to Innovation

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- Fact: Coworkers gain in the short run.

Returns to Innovation

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- Fact: Coworkers lose in the long run.

Returns to Innovation

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- Fact: Entrepreneur gains almost 10 times in the long-run.

Returns to Innovation

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- entrepreneur > senior manager > inventor > coworker

Additional Analysis

- Income Mobility: For non-inventors the wage at age 35 is a main determinant of wage at age 45, but conditional on inventing by age 33, initial wage at age 35 matters very little for wage at age 45 (inventor dummy is paramount)
- Social Mobility: For non-inventors, father's income percentile has a determinant effect on individual's income percentile (at age 35), but this correlation between father income and son income disappears for inventors (inventor dummy is paramount)



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Conclusions from Part 3

- Credit constraints are not an impediment to become an inventor.
 - What matters is education and IQ.
- Inventing is a social elevator for both the inventor and her co-workers
- Return is much higher for the entrepreneur than the inventor.
 - Important implications for tax policy



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Overall conclusion

- Innovation is one important factor behind the observed acceleration in wage and top-income inequality
- Innovation induces social mobility
- Implications for tax policy