Technology enabled Disruption
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Asymmetric Information and Entrepreneurship

Deepak Hegde *New York University*

Justin Tumlinson *Ifo Institute at the University of Munich*

Related Literature

Who becomes an entrepreneur?

Psychology: internal locus of control (McClelland 1964), overconfidence (Camerer & Lovallo 1999)

Economics: Risk-return tradeoff (Knight 1971), Heterogeneous skills (Jovanovic 1994), jack of all trades (Lazear 2005), desire to be own boss (Hamilton 2000), drawn from the tails of the ability distribution (Åstebro, Chen & Thompson 2011), smart & illicit (Levine & Rubinstein 2015), Capital constraints (Blanchflower & Oswald 2008)

Evidence: "less educated and unemployed workers, lower-paid wage workers, and men who have changed jobs a lot are more likely to enter self-employment…These results are consistent with the view that 'misfits' are pushed into entrepreneurship" (Evans & Leighton 1989)

Jobs was refused a job at Hewlett-Packard

We went to Atari and said, 'Pay our salary, we'll come work for you. 'And they said, 'No'. So then we went to Hewlett-Packard, and they said, 'Hey, we don't need you. You haven't got through college yet'

--Steve Jobs

Kuom's job application was rejected by Facebook

San Jose State University drop-out Jan Kuom started Whatsapp! in 2009 and sold it to Facebook in 2014

Kumar won the green card but not employment

Kumar opened the Dosa Cart in 2001; won the Wendy Cup in 2007

Does asymmetric information drive entrepreneurship?

AN ASYMMETRIC INFORMATION THEORY OF ENTREPRENEURSHIP

1. Wages depend on ***observable signals*** (*e.g.* educational qualifications)
   - Employers cannot see ability/productivity directly —wage offers *ex ante*, then team production

2. Signals ***correlate*** to ability but ***imperfectly***
   - Individuals know their own ability better than anyone

3. Productivity depends on ***ability***
   - Employers keep synergistic productivity minus wage
   - Entrepreneurs keep own productivity

Most able relative to signals become entrepreneurs

Asymmetric Information and entrepreneurship

Three Empirical Predictions:

1. Entrepreneurs are *more able* than employees with the same signals

2. Entrepreneurs have *weaker signals* than employees of same ability

3. Entrepreneurs *earn more* (conditional on signals, on average) and their *wages exhibit greater variance*

Predictions hold with endogenous investment in signals

Who is an entrepreneur?

- Entrepreneurs are **residual claimants**

- Empirically, entrepreneurs are "**self-employed**" individuals
  - Owned at least 50 percent of a business
  - Principal managing partner of a business
  - Filed a form SE for federal income taxes

- Self-employed include **independent contractors, freelancers, and small-business owners**
  - Alternative measure: incorporated businesses owners

Sample: National Longitudinal Study of Youth (NLSY)

- Longitudinal study of 12,686 US residents born 1957-64
  - 6,111 members representative of the population of civilian youth aged 14 to 21 resident in U.S. in 1979
  - 5,295 members belonged to disadvantaged groups (after 1990, 1,643 members of this sample were dropped)

- Data collected annually 1979-1994, biennially since 1994
  - Coordination with the Current Population Survey and Employer Supplement Surveys (sponsored by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics respectively)
  - Track individuals from 1979 to 2010 (when respondents were 46-53 years old)

- Estimation sample: 11,476 individuals in full-time employment during at least one year between 1979-2010
  - 176,379 person-year observations

The NLSY Sample: Variables & Measures

NLSY Survey Round	Salaried	Self-employed	Full-time employed
1979	96.5%	3.5%	5,108
1980	97.4%	2.6%	5,704
1981	97.5%	2.6%	6,305
1982	97.2%	2.8%	9,241
1983	96.8%	3.2%	9,387
….			
1989	93.0%	7.0%	9,035
1990	92.9%	7.1%	8,951
1991	92.2%	7.8%	7,627
1992	91.9%	8.1%	7,644
1993	91.6%	8.4%	7,534
…			
2004	88.3%	11.7%	6,604
2006	87.5%	12.6%	6,572
2008	87.3%	12.7%	6,619
2010	87.4%	12.6%	6,252
Total Observations	92.9%	7.1%	176,379

The NLSY Sample: Variables & Measures

Current-year drop-outs				
Past year employment status	AFQT Score	Education	Annual Income	Drop-our Rate
Salaried	37.4	12.2	52,042.0	10.7
Self-employed	39.8	12.3	75,254.8	12.9
Current-year survivors				
Past year employment status	AFQT Score	Education	Annual Income	Survival-rate
Salaried	44.1	13.0	48,754.1	89.3
Self-employed	46.3	13.0	57,737.5	87.1

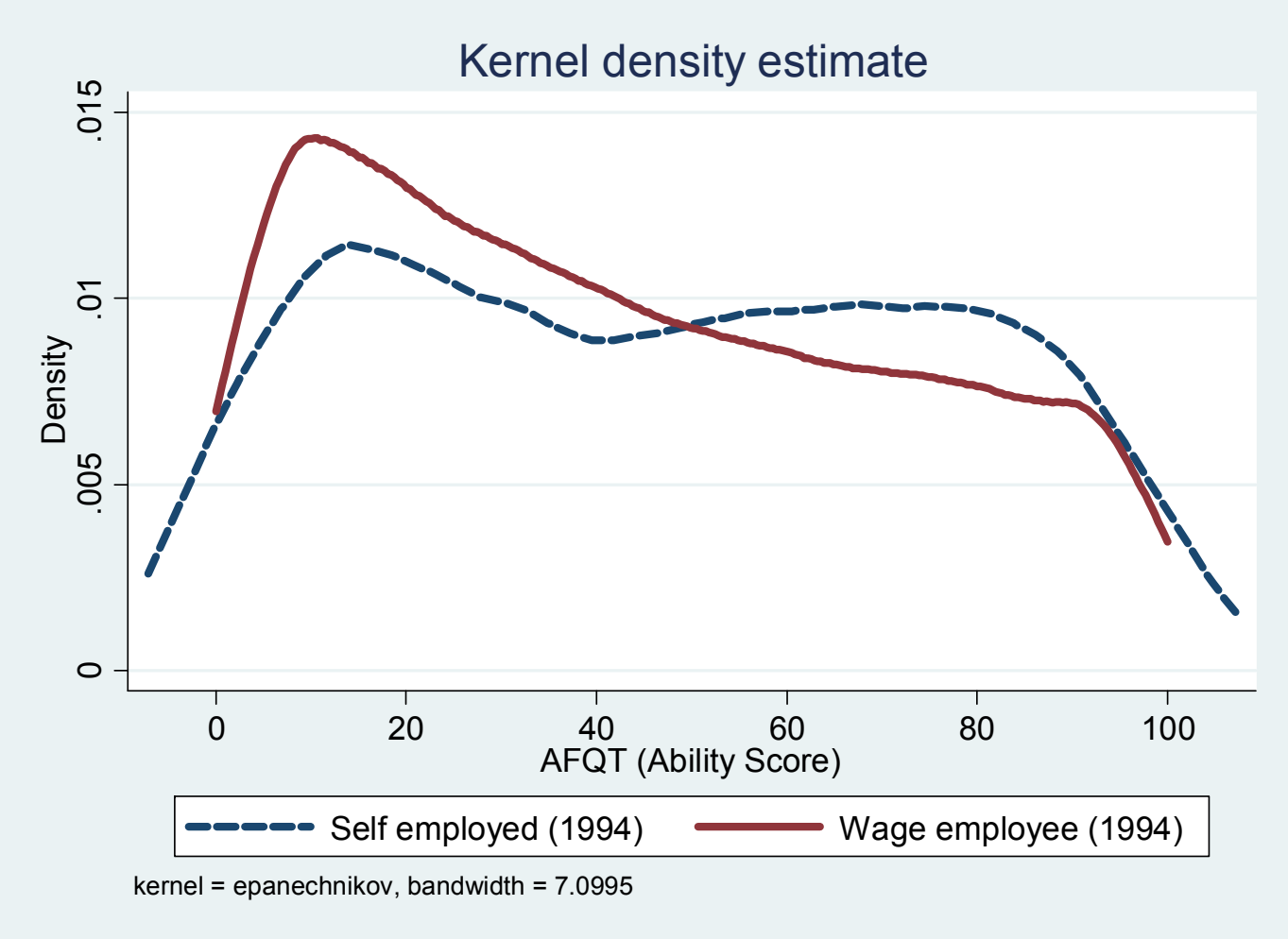
The NLSY Sample: Variables & Measures

- Ability is measured by **AFQT Score**
  - Administered in 1980 to all NLS respondents (age 16-23)
  - Percentile scores derived from arithmetic reasoning, word knowledge, paragraph comprehension, & numerical operations sections (age-adjusted according to Altonji)
  - Widely used as indicator of general intelligence (Angrist and Krueger 2001, Heckman 2006, Levin and Rubinstein 2015)

- Signals are measured by **educational qualifications**
  - Years of education
  - Highest degree earned
  - College/University rankings (NLSY Geocode data)

- Earnings and wealth
  - Annual net income and Net worth

P1: Entrepreneurs have higher ability, *conditional* on signals

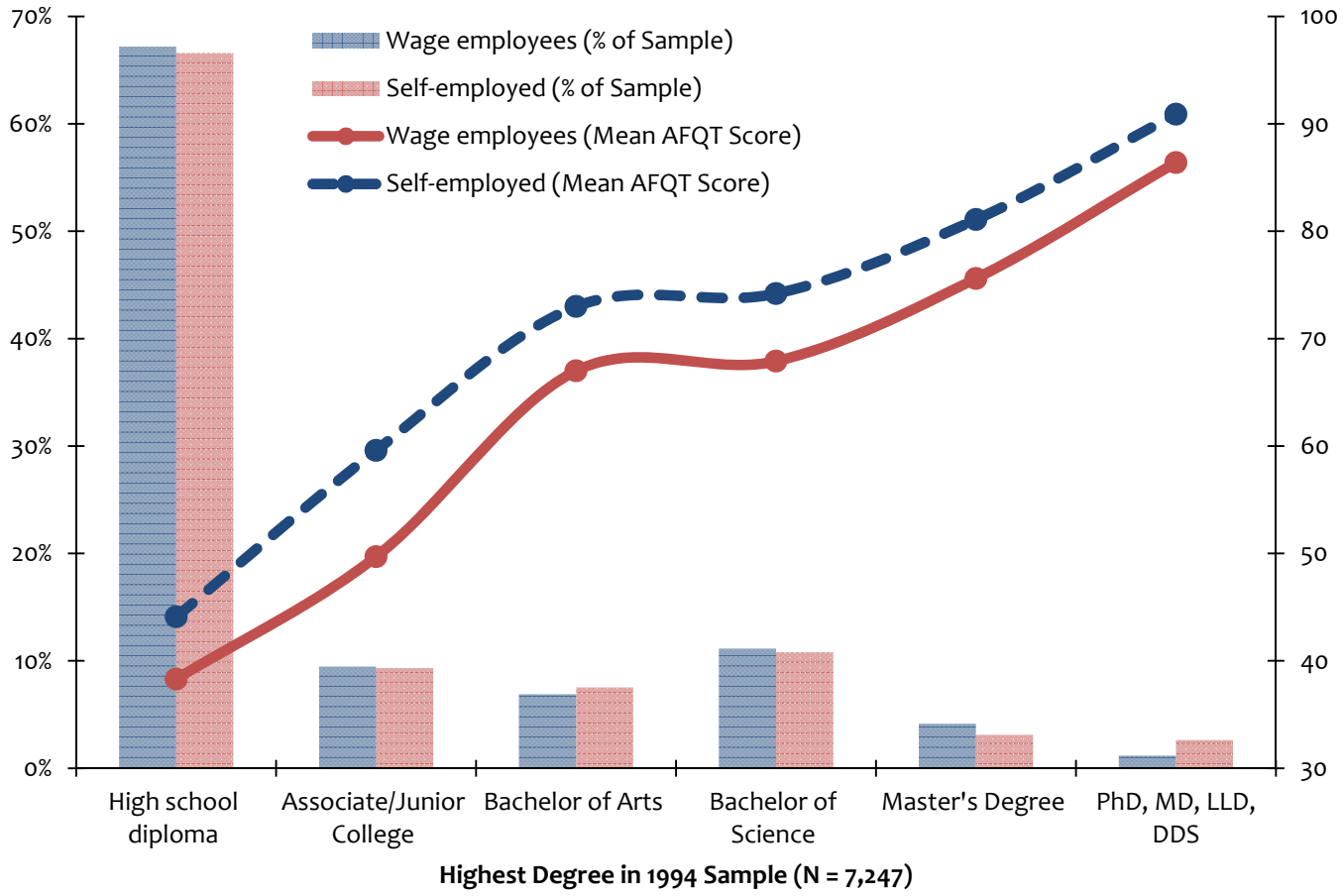


P1: Entrepreneurs have higher ability, *conditional* on signals

	NLSY 1994 Sample		
Ability-Test Scores	Wage employees	Self-employed	**Difference**
AFQT	43.2	47.8	**4.6****
PSAT MATH	44.1	46.5	**2.4****
PSAT VERBAL	40	41.5	**1.5***
ACT MATH	16.6	18.9	**2.3****
ACT VERBAL	17.1	18	**0.9***
SAT MATH	443.5	444.9	**1.4***
SAT VERBAL	403.6	412.5	**8.9****

** indicates $p<0.01$; * $p < 0.05$

P1: Entrepreneurs have higher ability, *conditional* on signals



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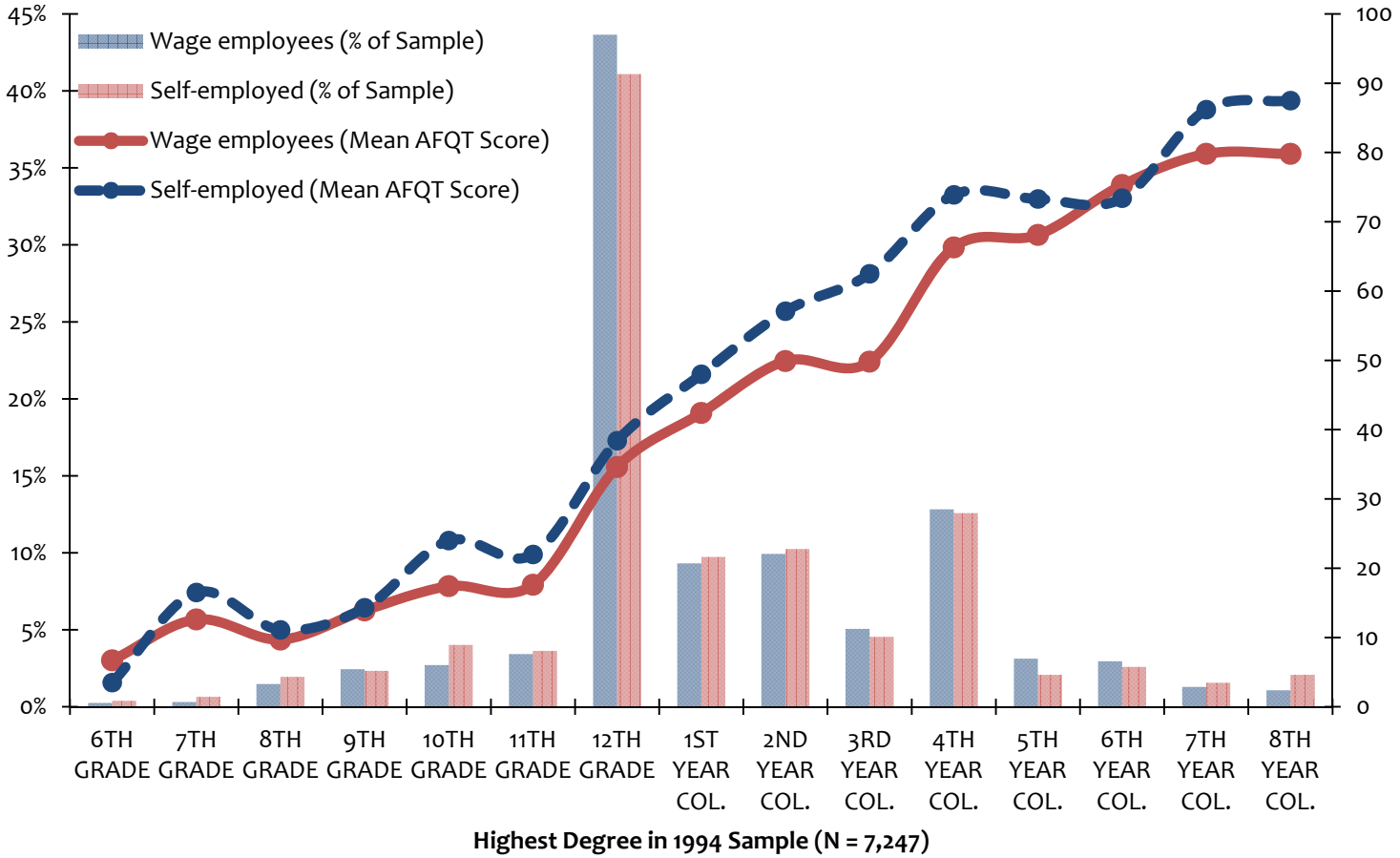
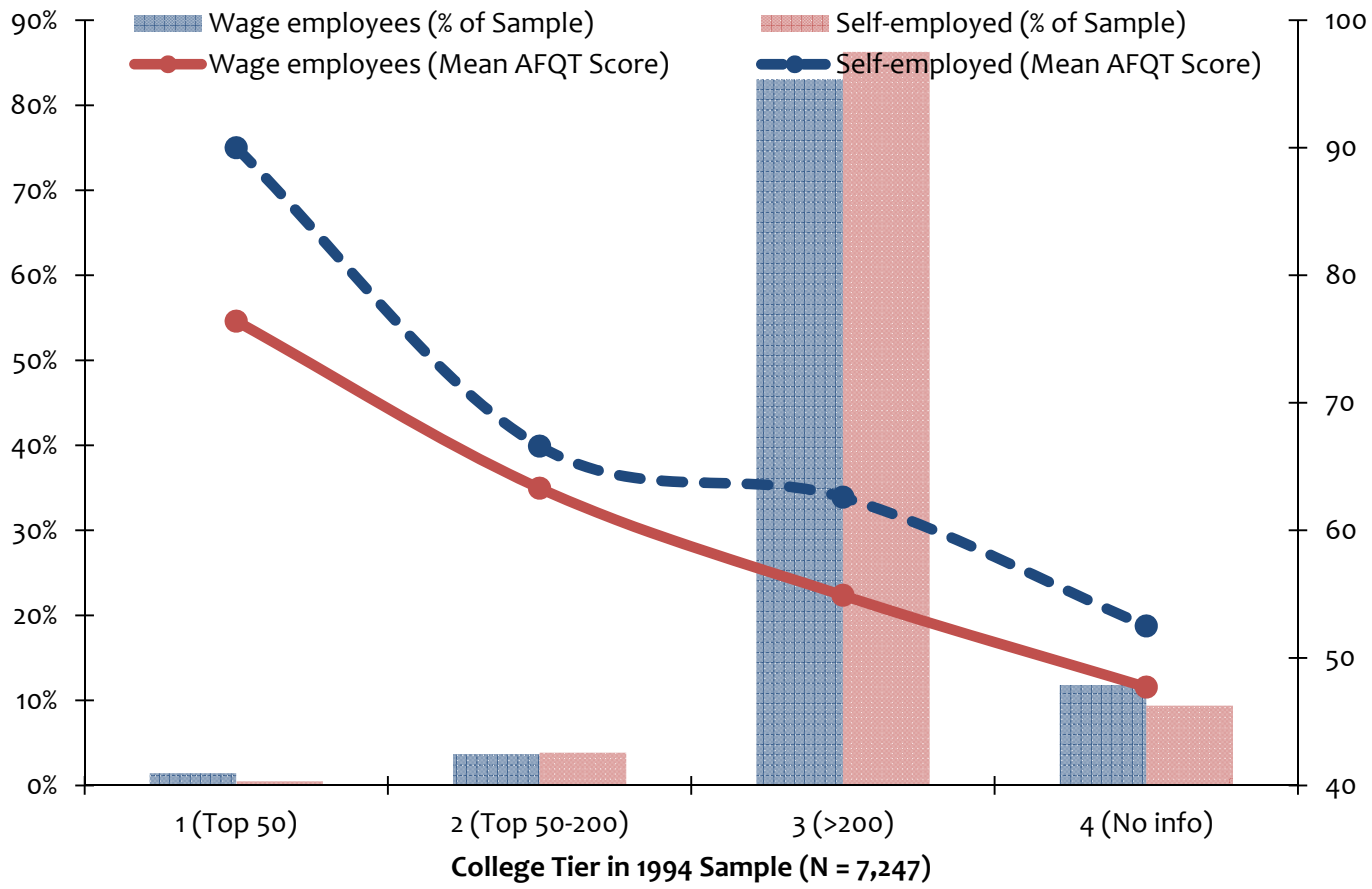


P1: Entrepreneurs have higher ability, *conditional* on signals



P2: Entrepreneurs have lower signals, *conditional* on ability

Entrepreneurs have higher ability and lower signals

D.V.	Self-employed	Self-employed
	[1]	[2]
Log AFQT Score	0.004**	0.004**
	[0.002]	[0.002]
Log Years of Education	-0.006	-0.038***
	[0.010]	[0.009]
Demographic variables		Y
Non-cognitive traits		Y
Family background & wealth		Y
Year Dummies		Y
Industry Dummies		Y
Log-likelihood	-44600.82	-24845.22
Observations	176,379	117,204

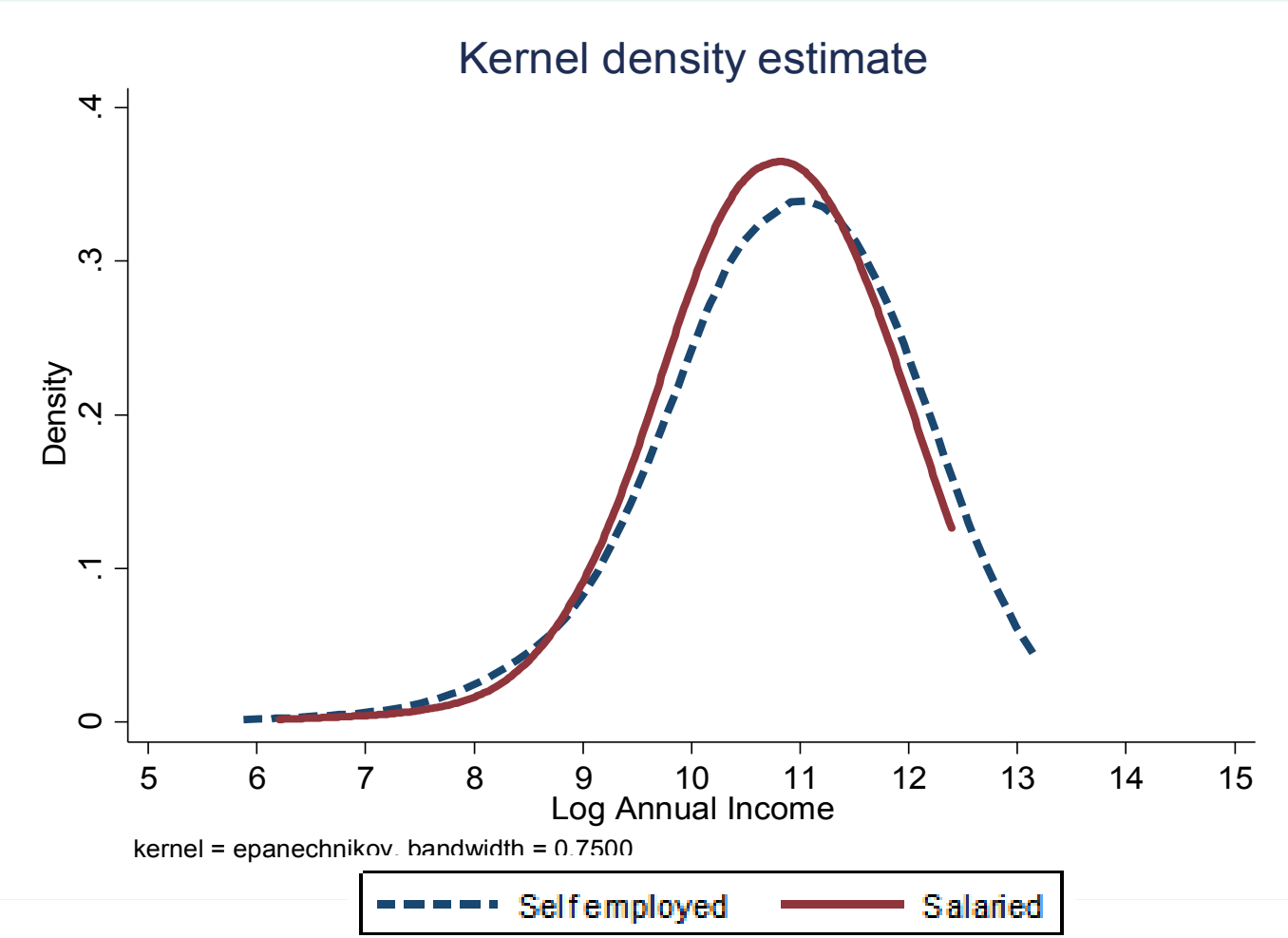
Probit Marginal Effects estimates; Individual-level clustered standard errors in brackets; ** p<0.01, * p<0.05, + p<0.1

Entrepreneurs have higher ability and lower signals

D.V.	Self-employed	Self-employed	Self-employed (Unincorporated)	Self-employed (Incorporated)
	[1]	[2]	[3]	[4]
Log AFQT Score	0.004**	0.004**	0.003**	0
	[0.002]	[0.002]	[0.002]	[0.000]
Log Years of Education	-0.006	-0.038***	-0.041***	0.004*
	[0.010]	[0.009]	[0.008]	[0.002]
Demographic variables		Y	Y	Y
Non-cognitive traits		Y	Y	Y
Family background & wealth		Y	Y	Y
Year Dummies		Y	Y	Y
Industry Dummies		Y	Y	Y
Log-likelihood	-44600.82	-24845.22	-22615.13	-4552.33
Observations	176,379	117,204	116,261	92,362

Probit Marginal Effects estimates; Individual-level clustered standard errors in brackets; ** p<0.01, * p<0.05, + p<0.1

P3: Entrepreneurs earn more (conditional on signals), with greater variance in earnings



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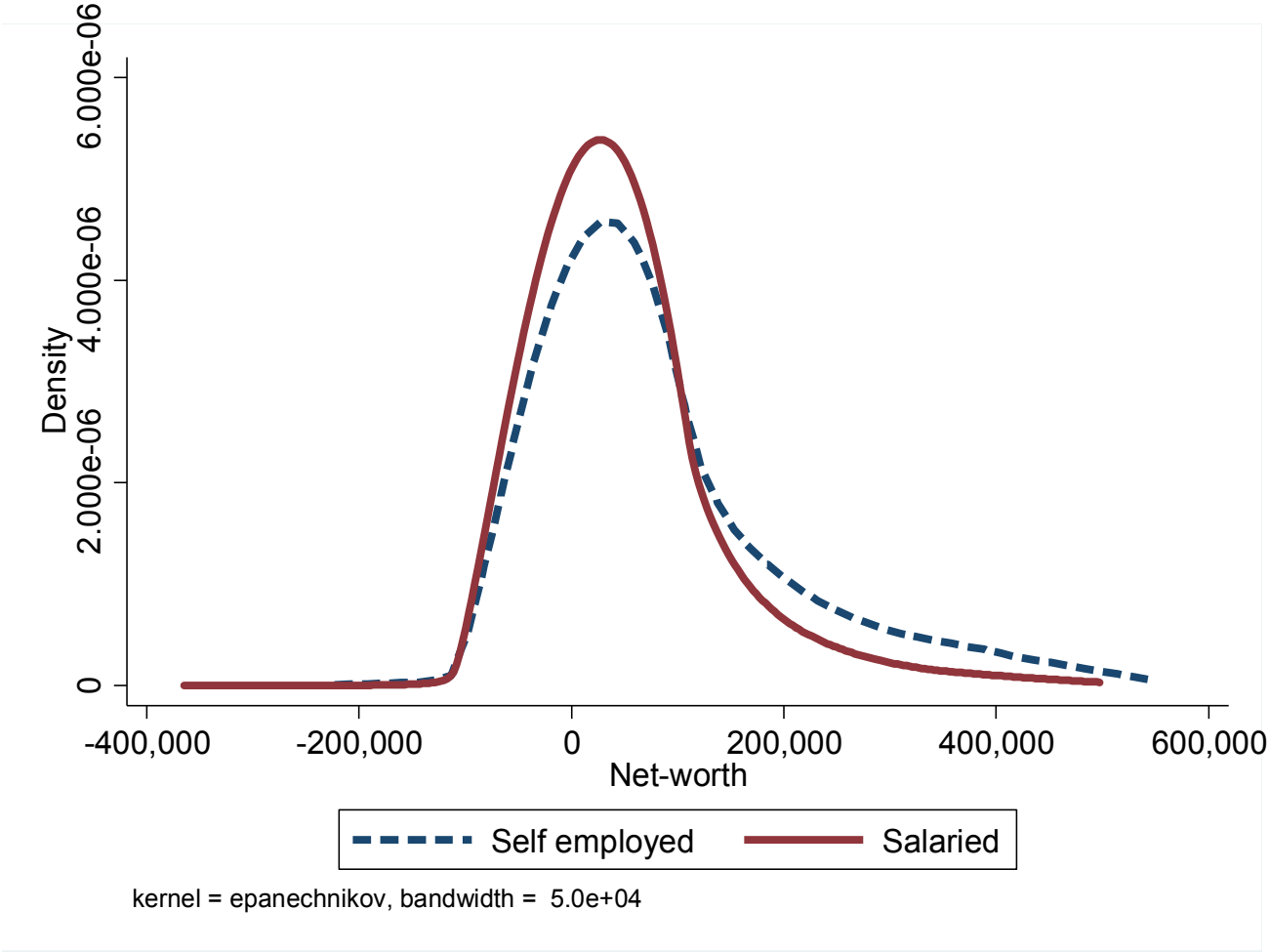
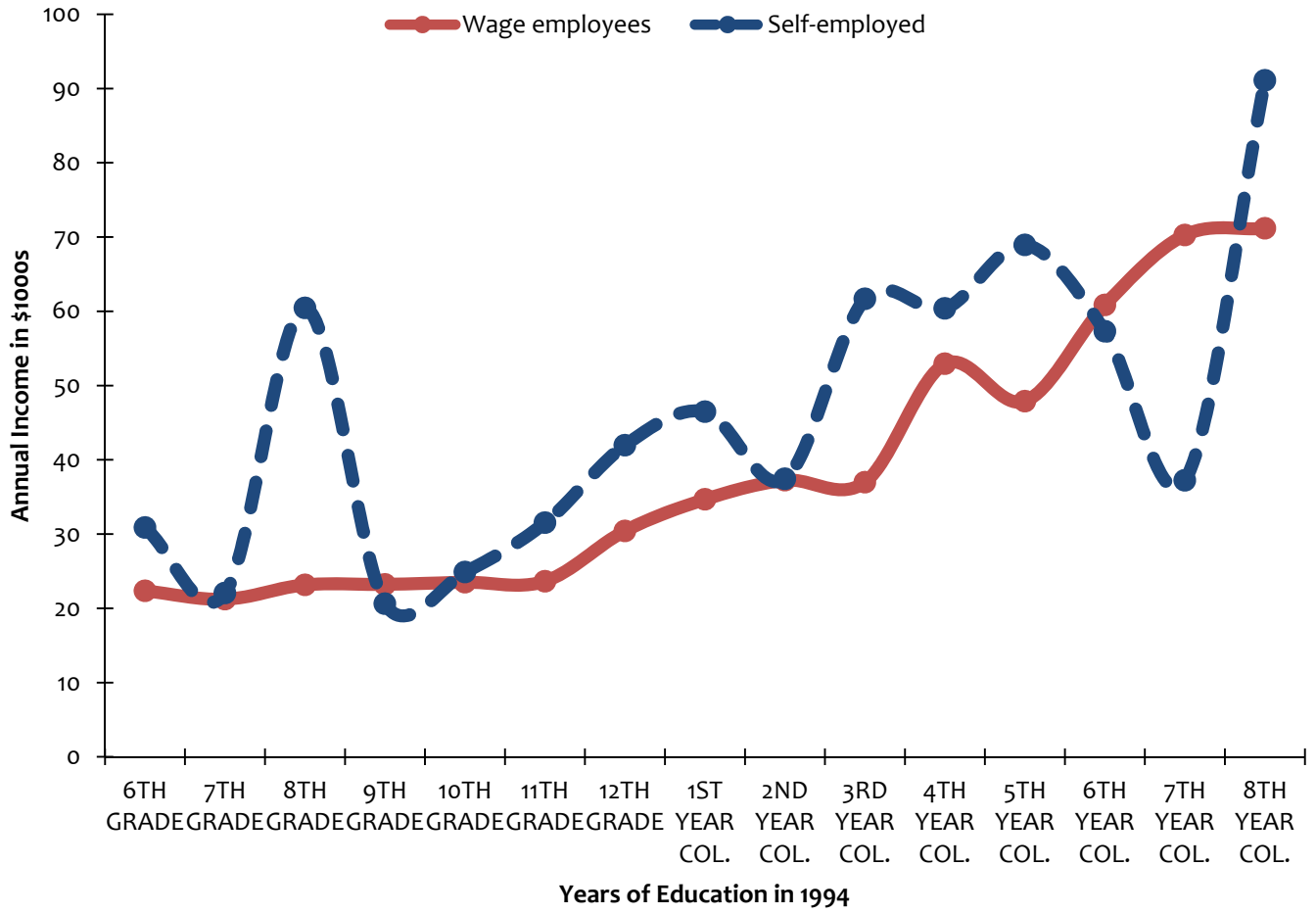
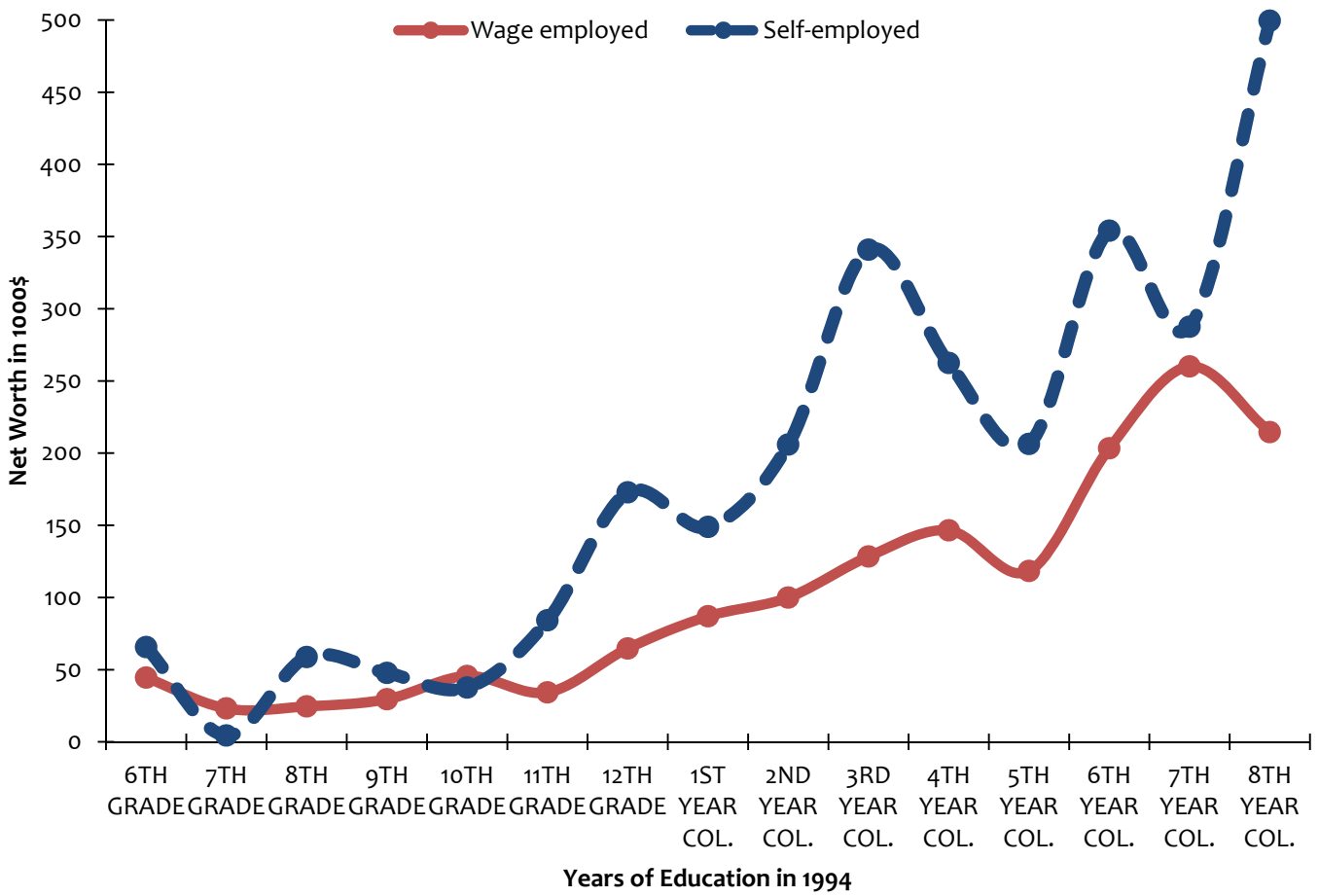


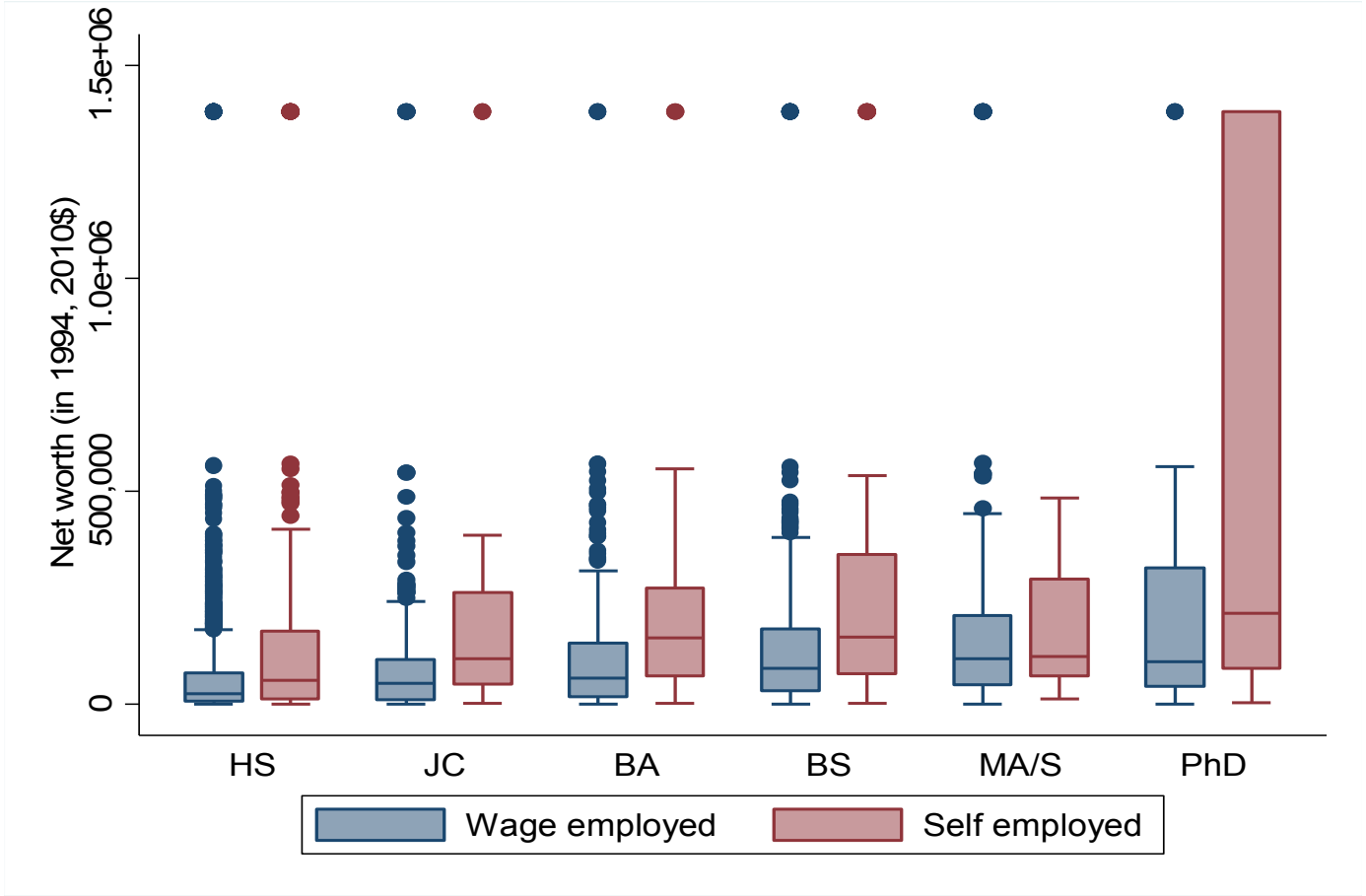
P3: Entrepreneurs earn more, *conditional* on signals



P3: Entrepreneurs earn more, *conditional* on signals



P3: Entrepreneurial earnings show higher variance, conditional on signals



P3: Entrepreneurs earn more, conditional on signals

Dependent Variable	Log Annual Income			
	[1]	[2]	[3]	[4]
Self-employed (all)	0.156***	0.067***		
	[0.010]	[0.010]		
Self-employed (unincorporated)			0.039***	
			[0.011]	
Self-employed (incorporated)				0.249***
				[0.028]
Log Years of Education		0.804***	0.796***	0.789***
		[0.017]	[0.017]	[0.017]
Demographic variables	N	Y	Y	Y
Non-cognitive traits	N	Y	Y	Y
Family background & wealth	N	Y	Y	Y
Year Dummies	N	Y	Y	Y
Industry Dummies	N	Y	Y	Y
Constant	10.781	6.779	6.811	6.721
Pseudo-R2	0.001	0.136	0.135	0.138
Observations	152,940	103,212	102,378	97,026

P3: Entrepreneurs earn more, conditional on signals

Dependent Variable	Net-worth			
	[5]	[6]	[7]	[8]
Self-employed (all)	38,608.147***	23,897.006***		
	[688.733]	[1,220.068]		
Self-employed (unincorporated)			18,786.008***	
			[1,267.766]	
Self-employed (incorporated)				124,545.554***
				[3,038.752]
Log Years of Education		30,059.258***	28,935.365***	26,912.014***
		[1,958.527]	[1,927.057]	[1,893.097]
Demographic variables	N	Y	Y	Y
Non-cognitive traits	N	Y	Y	Y
Family background & wealth	N	Y	Y	Y
Year Dummies	N	Y	Y	Y
Industry Dummies	N	Y	Y	Y
Constant	15,128.82	-237,033.28	-229,578.52	-215,039.80
Pseudo-R2	0.005	0.082	0.083	0.085
Observations	107,570	72,815	72,154	68,104

Matching on multidimensional ability delivers similar predictions

Suppose perfect information, but **2-D** ability (stochastically assigned in both dimensions) & CRS Cobb-Douglas productivity:

Entrepreneurial
$S(\theta, P) = k_s \theta^{\alpha} P^{1-\alpha}$

Traditional
$\pi(\theta, P) = k_\pi \theta^{\beta} P^{1-\beta}$

Individual chooses entrepreneurship if and only if
$S(\theta, P) = k_s \theta^{\alpha} P^{1-\alpha} > k_\pi \theta^{\beta} P^{1-\beta} = \pi(\theta, P)$

or equivalently

$$\underbrace{\left(\theta > P\left(\frac{k_s}{k_\pi}\right)^{\frac{1}{\alpha-\beta}}\right) \wedge (\alpha > \beta)}_{\text{Innate ability matters relatively more than acquired ability in entrepreneurship}} \text{ OR } \underbrace{\left(\theta < P\left(\frac{k_s}{k_\pi}\right)^{\frac{1}{\alpha-\beta}}\right) \wedge (\alpha < \beta)}_{\text{Innate ability matters relatively less than acquired ability in traditional employment}}$$

Matching on multidimensional ability delivers similar predictions

Suppose perfect information, but **2-D** ability (stochastically assigned in both dimensions) & CRS Cobb-Douglas productivity:

Entrepreneurial **Traditional**

If **ability is relatively more productive in entrepreneurship** and **education is relatively more productive in traditional employment**,
then matching delivers
Prop1, Prop 2 and part of Prop 3 (but not income variance)

$$\left(\theta > P\left(\frac{k_S}{k_\pi}\right)^{\alpha-\beta}\right) \wedge (\alpha > \beta) \text{ OR } \left(\theta < P\left(\frac{k_S}{k_\pi}\right)^{\alpha-\beta}\right) \wedge (\alpha < \beta)$$

Innate ability matters relatively more than acquired ability in entrepreneurship

Innate ability matters relatively less than acquired ability in traditional employment

Lower ability, higher signal individuals switch to wage-employment

D.V.	Self-employed	Switched-in to self-employment	Switched-out of self-employment
	[1]	[2]	[3]
Log AFQT Score	0.102**	-0.001	-0.026**
	[0.043]	[0.001]	[0.012]
Log Years of Education	-0.058***	-0.003	0.209***
	[0.017]	[0.005]	[0.065]
Log AFQT X Log Age	-0.026**		
	[0.012]		
Log Age	0.120**	0.024*	-0.242
	[0.060]	[0.013]	[0.153]
Demographic variables	Y	Y	Y
Non-cognitive traits	Y	Y	Y
Family background & wealth	Y	Y	Y
Year Dummies	Y	Y	Y
Industry Dummies	Y	Y	Y
Log-likelihood	-24844.54	-2936.51	-1583.75
Observations	45,081	32,749	3,297

Probit estimates; Robust standard errors in brackets; ** p<0.01, * p<0.05, + p<0.1

Returns to ability increases over time in employment

D.V.	Log Annual Income	
	Persistently salaried	Persistently self-employed
Log AFQT X Log Age	0.219***	-0.064
	[0.031]	[0.336]
Log AFQT Score	-0.661***	0.376
Log Age	-0.248	0.184
	[0.113]	[1.283]
Constant	6.76	3.332
Demographic variables	Y	Y
Non-cognitive traits	Y	Y
Family background & wealth	Y	Y
Year Dummies	Y	Y
Industry Dummies	Y	Y
Pseudo-R2	0.1634	0.1635
Observations	29,259	886

OLS estimates; Individual-level clustered standard errors in brackets; ** p<0.01, * p<0.05, + p<0.1

Pattern of returns inconsistent with matching; consistent with revelation of asymmetric information

Entrepreneurs are *undervalued individuals*

New theory of entrepreneurship driven by unobserved ability

1. Entrepreneurs have **higher ability** than employees ***with same education***
2. Entrepreneurs have **lower education** than employees ***with same ability***
3. Entrepreneurs' **earnings higher & more dispersed**, ***conditional on education***

Theory explains undereducated billionaire entrepreneurs and immigrant 'mom & pop' stores

- NLSY sample of youth born between 1957 and 1964 in US
- NCDS sample of all children born in 1 week in 1958 in UK

Entrepreneurial success linked to *why* set up own firm

- Lifestyle preferences ⇒ lower income
- Asymmetric information ⇒ higher income
- Increasing entrepreneurship ≠ increasing growth

Thank you