Entrepreneurship Over the Life-Cycle: The Role of Human versus Financial Capital Accumulation

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Question

- How important is human vs financial capital accumulation in determining entry into entrepreneurship over the life-cycle?
- Why care?

1) Entrepreneurs are on average 41.9 years old at business start Azoulay et al.(2020)
2) Three-quarters of business income (private pass-through profits) reflect entrepreneurial human capital Zwick et al.(2019)
3) Entrepreneurs significantly contribute to economic growth and job creation (Haltiwanger et al. (2011))

What we do

- Build new dataset combining firms and business owners' characteristics using population of Danish entrepreneurs
- Document importance of human capital vs wealth for entrepreneurial outcomes
- Propose quantitative model of entrepreneurship consistent with empirical evidence
- Use model to quantify role of human vs financial capital for business creation
- Discuss implications for policy interventions

Some definitions

- Entrepreneur: Owner of business + positive revenues + hires at least 1 employee
  - Focus on first time entrepreneurs
  - Summarize all information at the individual level
- Human capital: Skills accumulated through labor market experience that increase business productivity
  - Examples: Management abilities, social contacts, organizational and relational skills etc.
  - How we measure it: Entrepreneur's wage in last job before starting the business

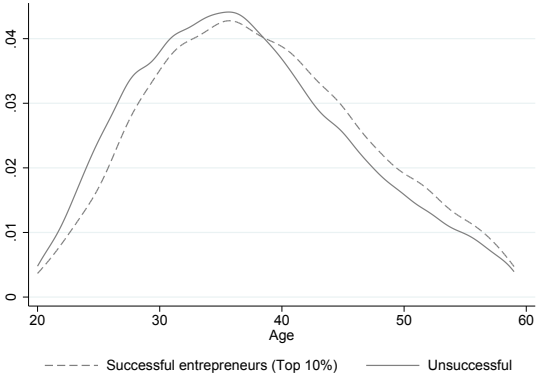
Plan

1) Empirical Evidence
2) The Model Economy
3) Mapping Model to Data
4) Quantitative Analysis

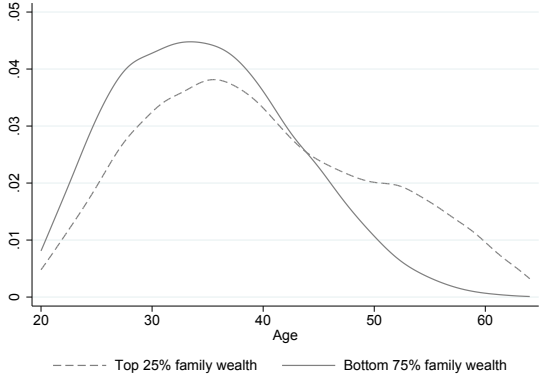
Empirical Evidence

Life-cycle patterns

- Age distribution at founding



Successful entrepreneurs vs rest

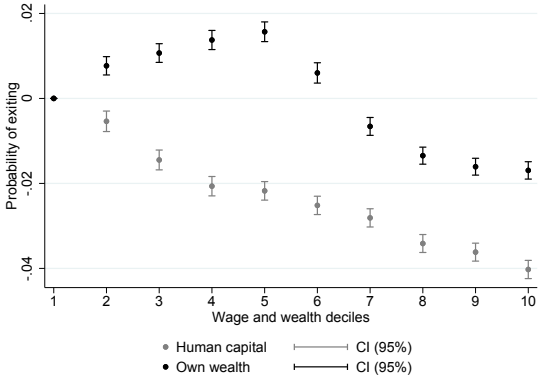


Role of family wealth

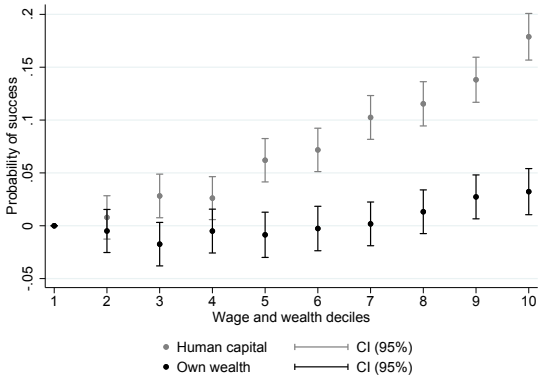
▸ By Sector

Entrepreneurial outcomes

Probability of exiting



Probability of success



▸ Additional results

▸ Family wealth

Model economy

Environment

- Life-cycle model with working and retirement phase
  - Occupational choice each period: worker vs entrepreneur
- Three sources of idiosyncratic risk:
  1) Labor productivity risk (worker)
  2) Entrepreneurial ability risk
  3) Mortality risk
- Incomplete markets

Environment

- Workers:
  - Exogenous labor supply
  - Key ingredient: Accumulate entrepreneurial (human) capital through LBD technology
  - Make consumption/savings choice
- Entrepreneurs:
  - Exogenous labor supply
  - Key ingredient: Accumulate entrepreneurial (human) capital through LBD technology
  - Demand external labor and capital
  - Face collateral constraints
  - Make consumption/savings choice

Workers:

- Human capital accumulation:

$$h_{j+1} = (1-\delta)h_j + \xi_i e(z,j) h_j^{\phi_1}$$

- Where $e(z,j)$ is the worker's labor productivity:

$$e(z,j) = \exp(z_j)\left(\lambda_0 + \lambda_1 j + \lambda_2 j^2\right)$$
$$z_j = \rho z_{j-1} + \epsilon_j$$
$$\epsilon_j \sim \mathcal{N}(0, \sigma_\epsilon^2)$$

- ξ_i is individual learning ability

Entrepreneurs:

- Human capital accumulation:

$$h_{j+1} = (1-\delta)h_j + \theta_j h_j^{\phi_1}(k_j)^{\psi}$$

- Where entrepreneurs' human capital shocks:

$$\theta_j = \zeta\theta_{j-1} + \nu_j$$
$$\nu_j \sim \mathcal{P}(a,b)$$

- DRS production technology:

$$y_j = h_j\left(k_j^{\gamma}(n_j)^{1-\gamma}\right)^{\nu},\ \nu \in [0,1)$$

Dynamic programming problem

- Workers solve:

$$
\begin{aligned}
V_j^w(\mathbf{x}_j) &= \max_{c_j, a_{j+1}} \left\{ u(c_j) + s_{j+1}\beta \mathbb{E}\left[V_{j+1}(\mathbf{x}_{j+1}) \right] \right\} \\
&\text{s.t} \\
c_j + a_{j+1} &= we(z,j) + (1+r)a_j \\
a_{j+1} &\geq 0 \\
h_{j+1} &= (1-\delta)h_j + \xi_i e(z,j) h_j^{\phi_1}
\end{aligned}
\tag{1}
$$

- With:
  - State vector at age j: $\mathbf{x}_j = (a, z, \theta, h, \xi, f)$
  - $V_j(\mathbf{x}_j) = \max \left\{ V_j^w(\mathbf{x}_j), V_j^e(\mathbf{x}_j) \right\}$

Dynamic programming problem

- Entrepreneurs solve:

$$
\begin{aligned}
V_j^e(\mathbf{x}_j) = \max_{c_j, a_{j+1}, k_j, n_j} & \left\{ u(c_j) + s_{j+1} \beta \mathbb{E} \left[V_{j+1}(\mathbf{x}_{j+1}) \right] \right\} \\
\text{s.t} & \\
c_j + a_{j+1} &= \pi(h_j, k_j, n_j) + (1+r) a_j \\
k_j &\leq \lambda a_j \\
a_{j+1} &\geq 0 \\
n_j &\geq 0 \\
h_{j+1} &= (1-\delta) h_j + \theta_j h_j^{\phi_1} (k_j)^{\psi}
\end{aligned}
\tag{2}
$$

- With:
  - State vector at age j: $\mathbf{x}_j = (a, z, \theta, h, \xi, f)$
  - $V_j(\mathbf{x}_j) = \max \left\{ V_j^w(\mathbf{x}_j), V_j^e(\mathbf{x}_j) \right\}$

Profits

- Profit maximization:

$$\pi = \max_{k_j, n_j} \left\{ h_j \left(k_j^{\gamma} (n_j)^{1-\gamma} \right)^{\nu} - (r+\delta) k_j - w n_j - F \right\}$$

s.t

$$k_j \leq \lambda a_j$$

$$n_j \geq 0$$

Mapping Model to Data

Functional forms

- Learning ability ξ drawn from:
  - $\xi \sim \mathcal{LN}(\mu_\xi, \sigma_\xi)$
- Financial frictions:
  - Fraction π (90%) of population is financially constrained
  - Set λ to match median debt to asset ratio in first year of business activity
- $u(c)$: CRRA class
- Two stage calibration strategy

Model fit

- Calibrated parameters: $\Theta = (\zeta, a, b, \delta, \phi_1, \psi, F, \nu, \mu_\xi, \sigma_\xi)$
- Targeted moments:

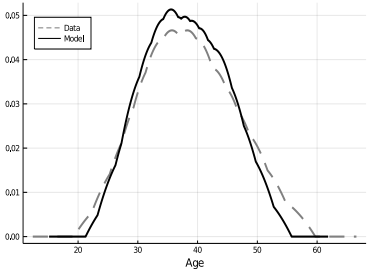
Moment	**Data**	**Model**
Average age at founding of entrepreneur belonging to rich family	37.5	37.8
Standard deviation age at founding of entrepreneur belonging to rich family	7.9	7.1
Second decile age at founding of entrepreneur belonging to rich family	31	31
Median age at founding of entrepreneur belonging to rich family	37	37
Eighth decile age at founding of entrepreneur belonging to rich family	44	44
Share of entrepreneurs	3.3%	3.3%
Exit rate	4.0%	2.8%
Share of entrepreneurs of age 50	4.8%	6.4%
Median E/W wealth age 40	4.9	7.1
Median E/W wealth age 50	3.8	3.7

Table 1: Targeted moments

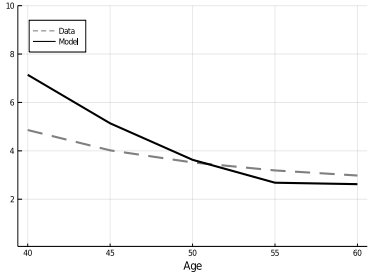
▸ Parameter values

Model fit

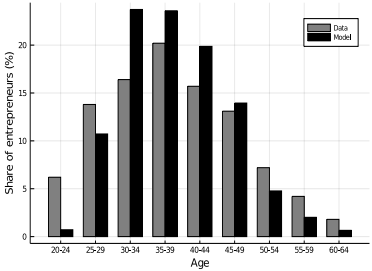
- Untargeted data profiles:



Founding age distribution



Evolution of wealth ratios



Share entrepreneurs by age

Quantitative Exercise

Eliminating financial frictions

Compare:

a) Baseline economy with endogenous human capital

b) Traditional model without human capital

On:

- Share of entrepreneurs in economy and age composition
- Firm productivity distribution at business start – *Skip today*

Why?

- Assess role of endogenous human capital accumulation
- Understand interaction with collateral constraints

Which model fits reality best?

- Use danish policy reform to compare model predictions with data

▸ Traditional model

Comparing the models

Two exercises:

- Full reform: completely eliminate financial frictions ($\lambda = \infty$)
- Partial reform: set $\lambda_L = 2.9 \rightarrow$ loosen collateral constraint by 37.5%

Increase in individuals who ever start a business:

	Traditional model		Human capital model	
	Full reform	Partial reform	Full reform	Partial reform
Increase in entrepreneurship	+163%	+23.6%	+13.1%	+4.1%

New business formation

▸ Share entrepreneurs by age

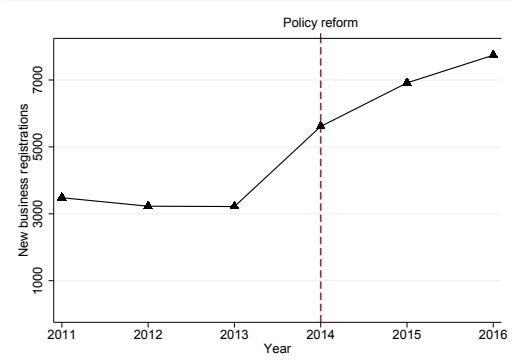
Model predictions vs Data

In 2014 Denmark:

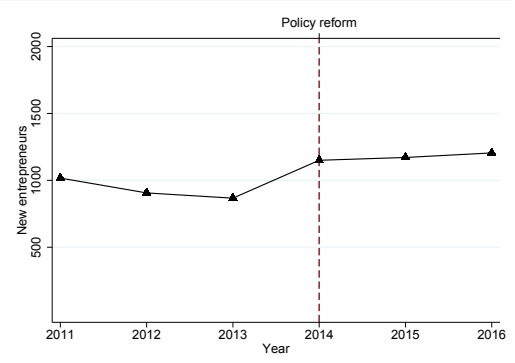
- Reduced initial capital requirements of incorporated firms from 80K dkk to 50K dkk
- Introduced new legal type of firm to be started with 1 dkk
- Policy indirectly relaxes borrowing constraint

Q: What was the response in new business formation to the policy?

The effect of the policy



Business registrations



Incorporated entrepreneurship

- Increase in incorporated entrepreneurship: +32.2%
- Overall increase in entrepreneurship across all legal types: +4.8%

Data

Concluding Remarks

We document:

- Entrepreneurs' human capital important for predicting:
  - Firm Survival
  - Firm Success
  - First-year productivity
- Wealth at business start matters little

Our findings:

- Need model with endogenous human capital to:
  - Match life-cycle patterns of entry into entrepreneurship
  - Match elasticity of new business creation to changes in financial conditions

Policy implications:

- Policies aimed at reducing financial barriers potentially less effective at spurring business creation than previously found

Appendix

New entrepreneurs

Table 2: Number new entrepreneurs by year

Year	E^0	E^1	E^2	E^2/E^0
2004	29,222	25,451	5,039	17.2%
2005	29,975	26,111	4,943	16.7%
2006	31,144	27,145	5,002	16.5%
2007	31,287	26,846	4,653	14.9%
2008	28,617	23,546	3,890	13.6%
2009	23,827	19,183	2,986	12.5%
2010	23,916	19,678	3,119	13.0%
2011	25,496	20,759	3,264	12.8%
2012	26,678	20,983	3,100	11.6%
2013	27,265	20,479	2,920	10.7%
2014	30,614	21,896	3,368	11.0%
2015	33,974	21,649	3,191	9.4%
2016	33,951	21,297	3,171	9.3%

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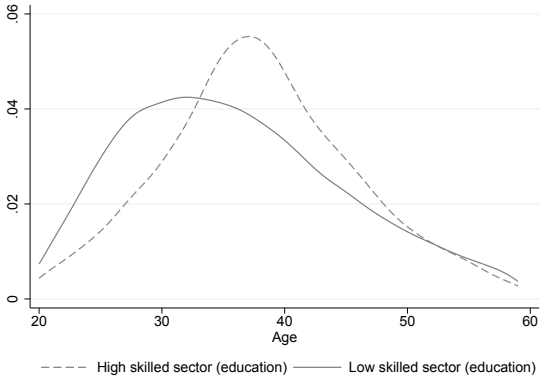
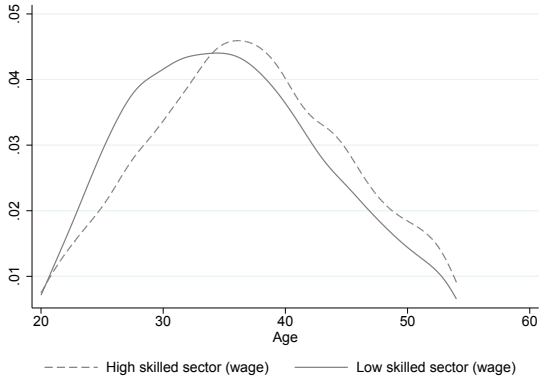
Facts: Age distribution at founding



Skill intensive sectors (education)



Skill intensive sectors (wage)

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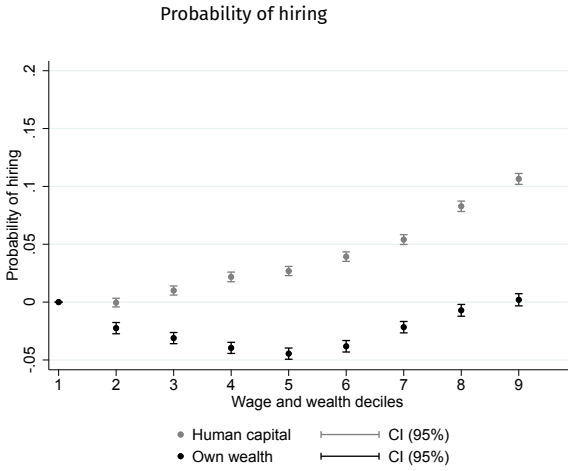
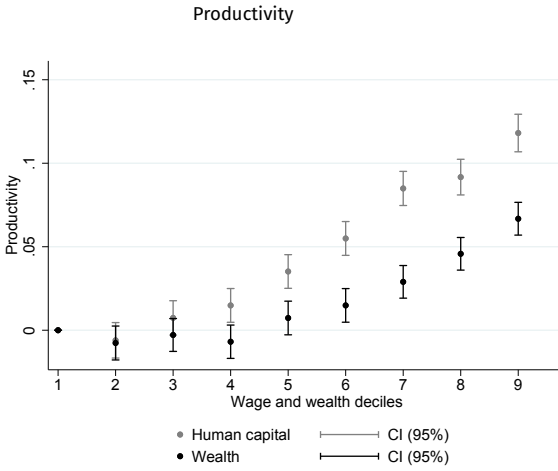
Additional results





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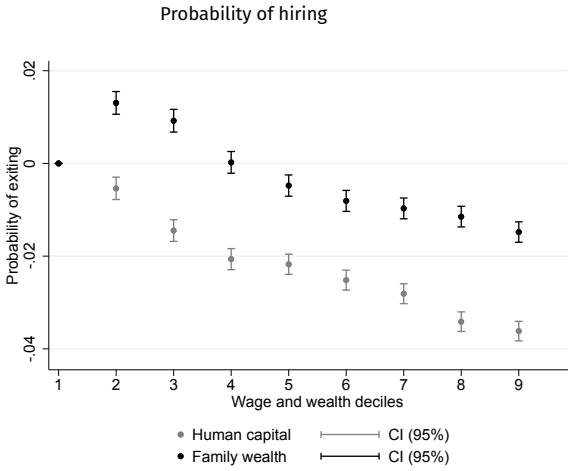
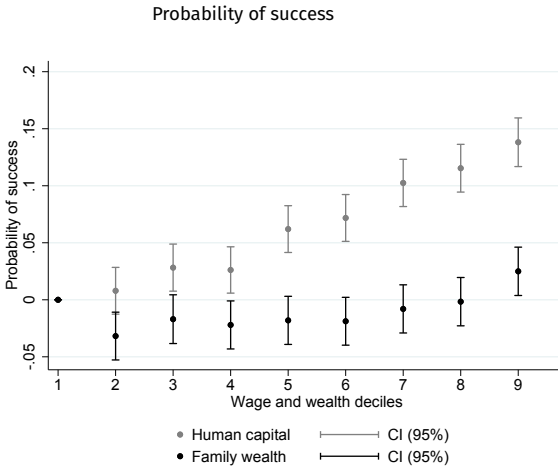
Results for family wealth





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Parameter values

Parameter	Value
ζ	0.92
a	3.32
b	0.18
δ	0.78
ϕ_1	0.43
ψ	0.36
F	4.4
v	0.41
μ_ξ	-3.94
σ_ξ	1.32

Table 3: Parameter values

Back

Calibration of traditional model

- Parameters to calibrate: $[\rho_2, c, d, F, v]$

Moment	Human capital model	Traditional Model
Share of entrepreneurs	3.3%	3.8%
Exit rate	2.8%	3.0%
Average age at founding	38.9	41.7
Median age at founding	38.0	42.0
Median E/W wealth age 40	4.9	5.4

Table 4: Targeted moments

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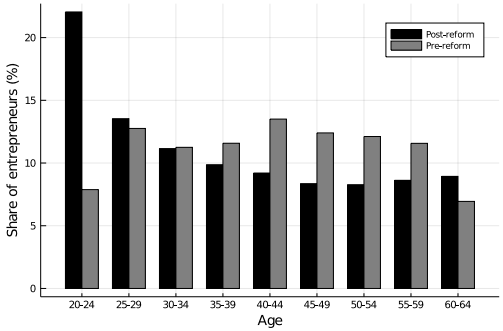
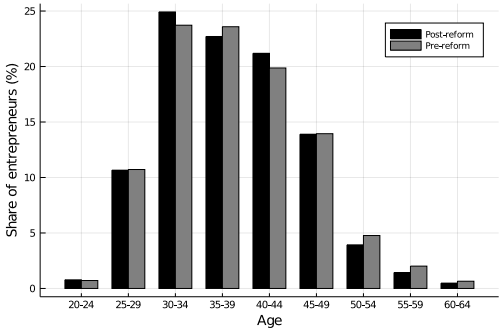
Share entrepreneurs by age

- Effect of full reform across two models



Traditional model



Human capital model

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Traditional model

- Traditional model following Cagetti and De Nardi (2006)
- Add realistic life-cycle structure
- Production technology:

$$y_j = \theta_j \left(k_j^{\gamma} (n_j)^{1-\gamma} \right)^{\nu}$$

$$\theta_{ij} = \rho_2 \theta_{ij-1} + \mu_{ij}, \qquad \mu_{ij} \sim \mathcal{P}(c, d)$$

- Remaining economic environment is the same

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Calibration