Heterogeneous Risk Preferences, Entrepreneurship, and Wealth Inequality *

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Introduction

- Entrepreneurs matter for economic growth
  - Accumulate wealth and create jobs
- They are overrepresented in the top wealth percentiles
  - 7% of working-age population vs. 17% P90 of wealth distribution
- Self-employment associated with high risk, but also high expected returns
  - Entrepreneurial return: mean/median = 9
  - Avg. net wealth of entrepreneurs increases by 80% 5 years after transition

Introduction II

Research Questions

How does an individual's risk attitude affect her occupational choice?
What are the implications for aggregate wealth and its distribution?

- Use German household panel data to measure individual risk preferences to
  - estimate importance of risk preferences for becoming self-employed
  - discipline a life-cycle model featuring heterogeneous risk preferences and occupational choice

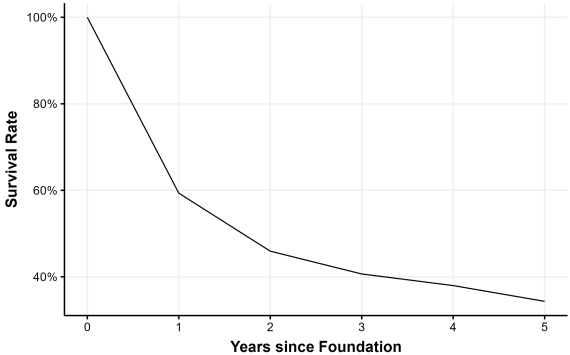
Literature

Data I - Entrepreneurs

Figure Newly SE in the Working-Age Pop.

Data: SOEP. Details

Figure Survival Rate of New Enterprises



Data: SOEP.

Data II - Willingness to Take on Risk

Individual Willingness to Take on Risk

- SOEP participants indicate willingness to take on risk on Likert-scale Details
- Question asked in 2004, 2006 and yearly since 2008
- We calculate individual averages to counteract missing values
- Dohmen et al. (2011) validate subjective measure using experiments Details

Figure Willingness to Take on Risk by Empl. Status

Data: SOEP.

Empirical Model

$$logit(p_{i,t}) = \beta_0 + \beta_{i,t} X_{i,t} + \delta_t + \delta_{sector} + \epsilon_{i,t}$$

- Probability to transition into self-employment
- Control variables
  - Age, Wealth Group, Household Net Income, Migration background, Education Completed, Tenure at last Employer...

All controls

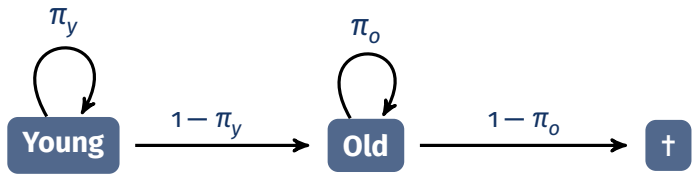
Table Model Summary

	(1)	
	Coefficient	Avg. Marginal Effects
Willingness to take on Risk	0.16	0.001
	(0.03)***	(0.0002)***
Constant	−32.53	
	(1.51)***	
Fixed Effects	Year+Sector	
Transitions into SE	939	
Observations	126,846	
Log Likelihood	−4,059	
Akaike Inf. Crit.	8,202	
pseudo R^2	0.1211	

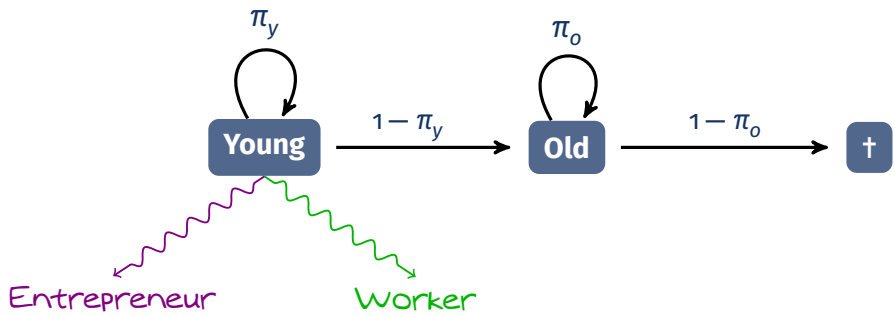
Note: * p<0.1; ** p<0.05; *** p<0.01
Only employed to self-employed transitions. Control variables not reported.

Avg. Marginal Effects

Model sketch



Model sketch



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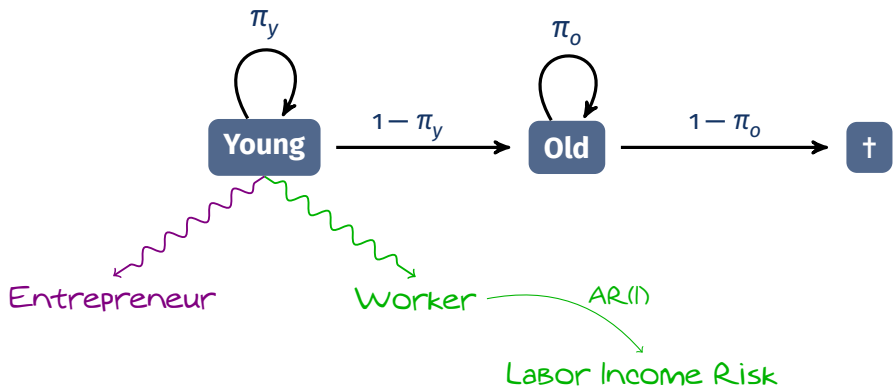

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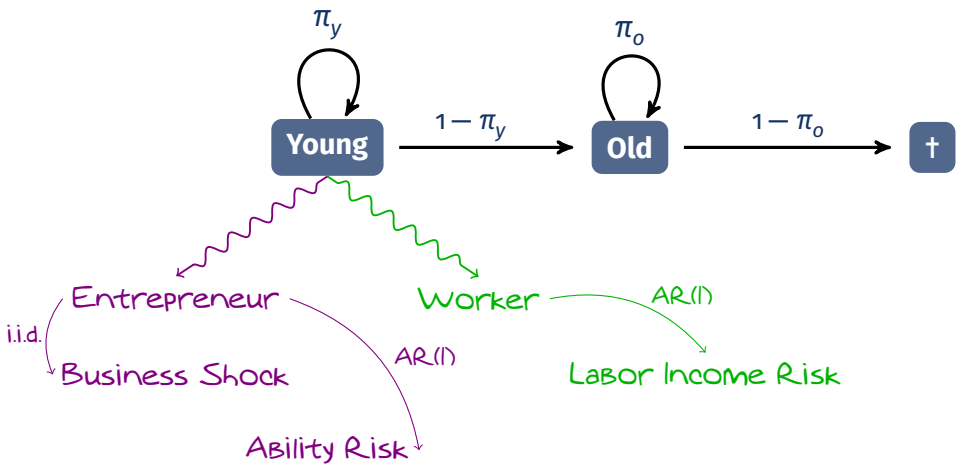


Model sketch II

- Epstein-Zin Preferences
  - Innate heterogeneous risk preferences, $\sigma_i > 0 \ \& \neq 1$
  - Uniform elasticity of intertemporal substitution, $\gamma > 0 \ \& \neq 1$

$$V(\sigma_i) = max\left[c^{1-\frac{1}{\gamma}} + \beta\left(EV'(\sigma_i)^{1-\sigma_i}\right)^{\frac{1-\frac{1}{\gamma}}{1-\sigma_i}} \right]^{\frac{1}{1-\frac{1}{\gamma}}}$$

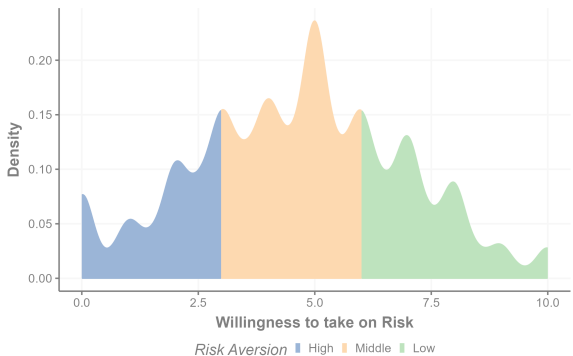
- Production in two sectors
  - small entrepreneurial sector $\rightarrow y = \theta k^{\nu}$, where $\nu \in (0, 1)$
  - non-entrepreneurial firms operate a standard CRS production technology in a competitive environment
- Entrepreneurs can borrow $k \leq \lambda * a$, where $\lambda > 1$

From WttoR to CRRA

1. Utilize a lottery question in the SOEP.
   * Hypothetical €100,000 how much to invest?
   * Lose half
   * Double it
2. Calculate the average investment per willingness to take on risk.
3. Calculate average liquid wealth per willingness to take on risk.
4. Calculate the CRRA parameter using the certainty equivalence Details

	Value	Stationary Distribution
$\sigma(low)$	3.05	13%
$\sigma(middle)$	5.26	52%
$\sigma(high)$	10.14	35%

Figure Willingness to Take on Risk



Data: SOEP.

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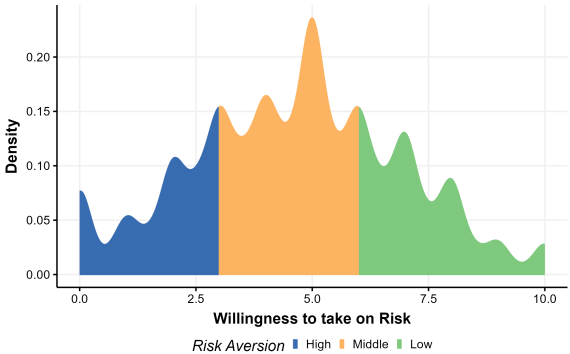
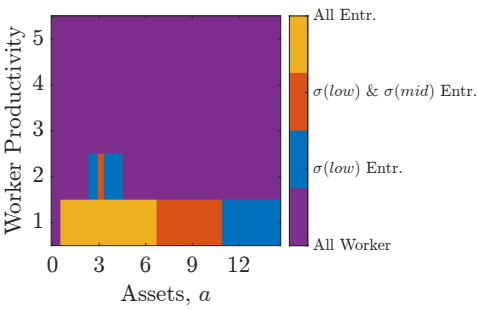


Data: SOEP.

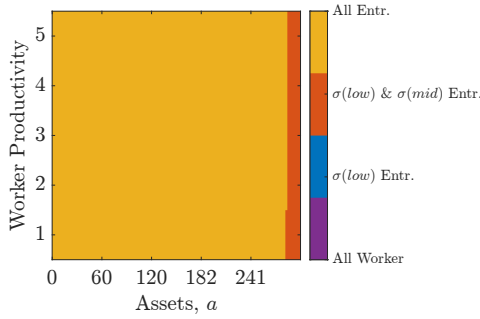
Results I - Occupational Choice

How important is the role of heterogeneous risk aversion for occupational choice in our model?

Figure Occupational Policy Function



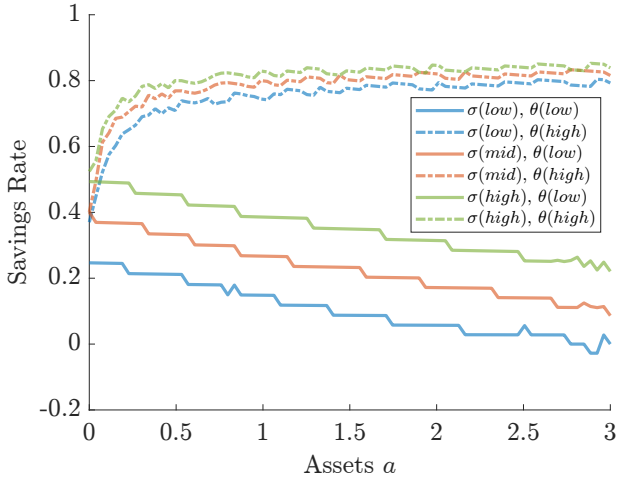
(a) θ = low



(b) θ = high

Results II - Savings Rate

Figure Savings Rate by Types



Worker productivity fixed at 3

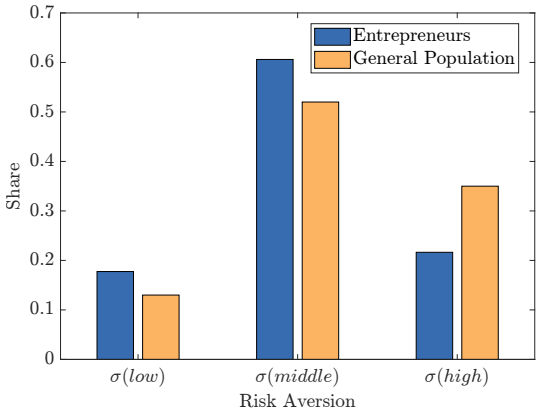
Results III - Stationary Equilibrium

Table General Statistics

	K/Y	Entrepreneurs	GDP produced by Entr.	1-year survival rate of Entr.	Wealth		
					Gini	P90/P50	Entr. in P90
Data	4.2	6-8%	10%	53%	0.74	8.71	17%
Model	4.2	8.1%	12%	38%	0.77	7.99	9.1%

Homogenous risk aversions

Figure Distribution Risk Aversion



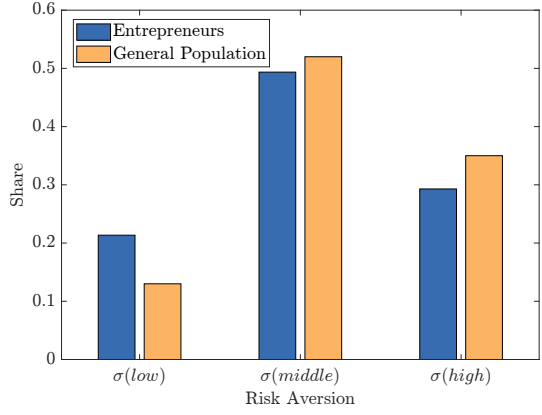
Details on Entrepreneurs

Results IV - Riskier Self-Employment

What if risk of business shock increases by 10%?

- Share of entrepreneurs in working-population decreases by 30%
- Share of entrepreneurs with low risk aversion increased by 20% Details
- Share of entrepreneurs with low ability decreased by 5%
- 1-year survival rate of entrepreneurs increases by 29%

Figure Distribution Risk Aversion



Conclusion

- Risk aversion is one determinant of occupational choice
- Agents with lower risk aversion
  - overrepresented among entrepreneurs
  - transition with higher asset and lower ability levels
- Changes in entrepreneurial risk
  - Decreases share of entrepreneurs
  - Changes composition of entrepreneurs

Refrences I

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Appendix - Literature

- Determinants of entrepreneurship: Evans & Leighton (1989), Evans & Jovanovic (1989), Blanchflower & Oswald (1998), Cramer et al. (2002), Hincapié (2020)

We use direct survey measure of risk aversion that we can measure in a narrow time frame close to the transition into self-emplyoment

- Entrepreneurs in quantitative macroeconomics: Banerjee & Newman (1993), Quadrini (1999, 2000), Lloyd-Ellis & Bernhardt (2000), Cagetti & De Nardi (2006), Herranz et al. (2015), Peter (2021), Indraccolo & Piosik (2023)

Introduce measurable heterogeneous risk preferences in a computable model of occupational choice and wealth accumulation

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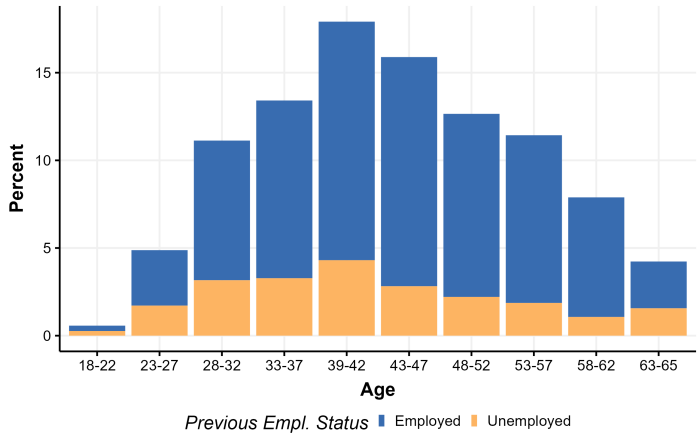
Appendix - Age Founders

Figure Newly Self-Employed by Age



Data: SOEP

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Appendix - Summary Statistics

Variable	Total sample	Employed	Self-employed	Founder (E)	Founder (U)
Share in sample	1	0.88	0.05	0.06	0.01
Age [y]	46	46	49	45	44
	(11.5)	(11.7)	(9.6)	(10.5)	(11.0)
Education completed [y]	12.7	12.1	13.3	13.4	12.5
	(2.7)	(2.6)	(2.9)	(2.96)	(2.66)
Monthly net income [€]	1,774	1,723	2,535	1,884	1,201
	(2,624)	(1,120)	(9,857)	(2,202)	(1,160)
Mean net wealth [€]	157,234	130,698	512,134	239,660	157,936
	(507,483)	(283,110)	(1,642,087)	(792,569)	(369,904)
Median net wealth [€]	34,497	30,064	191,716	50,374	20,124
Net liquid assets [f]	0.18	0.12	0.37	0.234	0.27

Notes: All variables relate to individuals in our sample. Self-employed represents the stock of self-employed who did not transition into self-employment during our sample period. Founders (E) are entrepreneurs who transition from employment to self-employment, whereas Founders (U) transition from unemployment to self-employment. The information on wealth originates from the years 2002, 2007, 2012, and 2017. Income and wealth denoted in real (2015=100) €. [y] denotes years, [f] indicates fractions. Values in parentheses are standard deviations.

Appendix - Wealth Imputation

- Wealth levels are only available quinquennially
- To retain panel dimension we use capital gains in between waves
- $wealth_{2003} = wealth_{2002} + capital\ gain_{2003}$
- Relative crude imputation
  - Use wealth groups
  - Absolute wealth amounts change, broader interval captures position

1. [*Debt*]
2. [0 — 1, 000)
3. [1, 000 — 5, 000)
4. [5, 000 — 15, 000)
5. [15, 000 — 50, 000)
6. [50, 000 — 200, 000)
7. [200, 000 — 700, 000)
8. [700, 000+)

Table Difference between imputed and actual wealth group

	2007	2012	2017
Difference	-0.06	0.01	0.004

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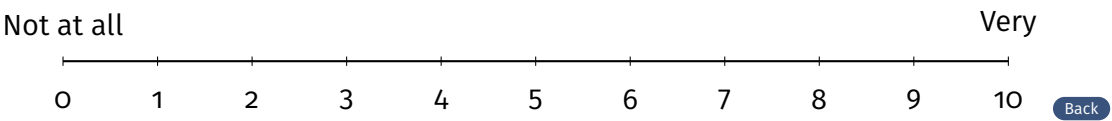
Appendix-Willingness to take on Risk

SOEP Question

Are you generally a person who is willing to take risks or do you try to avoid taking risks?



Appendix-Willingness to take on Risk II

- To counteract missing values, we calculate individual averages over time.

$$\text{risk willingness}_i = \frac{\sum_n^N \text{risk willingness}_n}{N}$$

- The mean coefficient of variation for the whole sample is 0.35

Appendix-Willingness to take on Risk III

Initial problem

$$0.5\left[\frac{(wealth+100,000+investment)^{1-\sigma_i}}{1-\sigma_i}\right]+0.5\left[\frac{(wealth+100,000-0.5*investment)^{1-\sigma_i}}{1-\sigma_i}\right]$$

Maximize and set equal to zero

$$\sigma_i = \frac{-ln(0.5)}{ln(\frac{wealth+100,000+investment}{wealth+100,000-0.5*investment})}$$

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Appendix - Control Variables

1. Age + Age^2
2. Education Completed (years)
3. Gender
4. Labor Market Success
5. Household Net Income (log)
6. Migration Background
7. Net Wealth $\geq$ 700K
8. Number of Children
9. Parents Self-Employed

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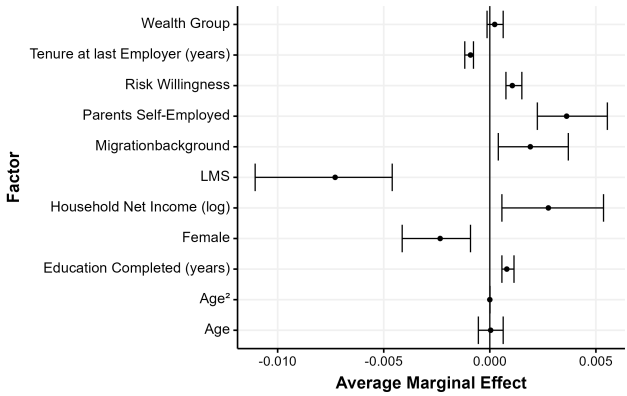
Appedix - Average Marginal Effects

Figure Average Marginal Effect



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Appendix - K/Y

$$r = \alpha \frac{K}{L}^{\alpha-1} - \delta \tag{1}$$

$$Y = K^{\alpha} L^{1-\alpha} \tag{2}$$

$$\frac{K}{L} = \mu \tag{3}$$

(2) into (3)

$$\frac{K}{K^{\alpha} L^{1-\alpha}} = \mu$$

$$\left(\frac{K}{L}\right)^{1-\alpha} = \mu$$

$$\frac{K}{L} = \mu^{\frac{1}{1-\alpha}} \tag{4}$$

(4) into (1)

$$r = \alpha \mu^{\frac{\alpha-1}{1-\alpha}} - \delta$$

$$r = \alpha \frac{1}{\mu} - \delta \tag{5}$$

Appendix - Value Functions

Decision problem of young agents

$$V_y(a, z, \theta; \sigma) = \max\Big(V_e(a, z, \theta; \sigma), V_w(a, z, \theta; \sigma)\Big)$$

Entrepreneur

$$\begin{aligned}
V_e(a, z, \theta; \sigma) = &\max_{c,k,a'}\Big(c^{1-\frac{1}{\gamma}} + \\
&\beta\Big[\pi_y\Big((1-\pi_u)\mathbb{E}[V_y(a', z', \theta'; \sigma)^{1-\sigma_i}] + \\
&\pi_u\mathbb{E}[V_u(a', z', \theta'; \sigma)^{1-\sigma_i}]\Big) + \\
&(1-\pi_y)V_o(a'; \sigma)^{1-\sigma_i}\Big]^{\frac{1-\gamma}{1-\sigma_i}}\Big)^{\frac{1}{1-\gamma}} \\
a' = &\theta k^{\nu} - (1+r)(k-a) + (1-\delta)k - c - \tau \\
a \geq &0 \\
k > &0
\end{aligned}$$

Worker

$$\begin{aligned}
V_w(a, z, \theta; \sigma) = &\max_{c,a'}\Big(c^{1-\frac{1}{\gamma}} + \\
&+\beta\Big[\pi_y\Big(\mathbb{E}[V_y(a', z', \theta'; \sigma)^{1-\sigma_i}]\Big) \\
&+(1-\pi_y)V_o(a'; \sigma)^{1-\sigma_i}\Big]^{\frac{1-\gamma}{1-\sigma_i}}\Big)^{\frac{1}{1-\gamma}} \\
a' = &z\bar{w} + (1+r)a - c - \tau \\
a \geq &0
\end{aligned}$$

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Appendix - Failed Entrepreneurs

Decision problem of failed entrepreneurs

$$
\begin{aligned}
V_u(a, z, \theta; \sigma) = & \max_{c, a'} \Bigg(c^{1-\frac{1}{\gamma}} + \\
& + \beta \Bigg[\pi_y \Bigg(\mathbb{E}[V_y(a', z', \theta'; \sigma)^{1-\sigma_i}] \Bigg) \\
& + (1 - \pi_y) V_o(a'; \sigma)^{1-\sigma_i} \Bigg]^{\frac{1-\gamma}{1-\sigma_i}} \Bigg)^{\frac{1}{1-\gamma}} \\
a' = & \, b + (1 + r - \kappa) a - c - \tau \\
a \geq & \, 0
\end{aligned}
$$

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Appendix - Old Agents

Decision problem of old agents

$$
\begin{aligned}
V_o(a;\sigma) = & \max_{c,a'} \Bigg(c^{1-\frac{1}{\gamma}} + \\
& + \beta \Bigg[\pi_o V_o(a';\sigma)^{1-\sigma_i} \Bigg]^{\frac{1-\gamma}{1-\sigma_i}} \Bigg)^{\frac{1}{1-\gamma}} \\
a' = & \xi + (1+r)a - c - \tau \\
a \geq & 0
\end{aligned}
$$

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Appendix - Calibration

Table Exogenous Parameter

Parameter	Value	Source
α	0.33	Standard parameter
δ	0.03	Standard parameter
π_y	0.9745	Eurostat (2023)
π_o	0.9511	RV (2023)
γ	0.5	Standard Parameter
z	5 states	Bayer & Juessen (2012)
ξ	$0.6 * \bar{w}$	Institutional approximation
b	$0.1 * \bar{w}$	Institutional approximation
K/Y	4.2	Pen World Table Details
λ	4.64	KfW Bankengruppe (2023)

Table Calibrated Parameters

Parameter	Value
π_θ	$\begin{bmatrix} 0.99 & 0.01 \\ 0.31 & 0.69 \end{bmatrix}$
θ	[0.53 6.85]
ν	0.56
π_u	0.08
κ	0.38

Discretization of z

Appendix - Worker Productivity

Using Rouwenhurst (1995) we discretize the German wage process into 5 states. The moments for persistence and variance come from Bayer & Juessen (2012).

$$\pi_z = \begin{bmatrix} 0.8529 & 0.1385 & 0.0084 & 0.0002 & 0.0000 \\ 0.0346 & 0.8571 & 0.1040 & 0.0042 & 0.0001 \\ 0.0014 & 0.0693 & 0.8585 & 0.0693 & 0.0014 \\ 0.0001 & 0.0042 & 0.1040 & 0.8571 & 0.0346 \\ 0.0000 & 0.0002 & 0.0084 & 0.1385 & 0.8529 \end{bmatrix}$$

$$z = \begin{bmatrix} 0.3722 & 0.5808 & 0.9064 & 1.4146 & 2.2077 \end{bmatrix}$$

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Appendix - Solution Procedure

We use backwards value function iteration

1. Make initial guess for β
   - We exogenously fix K/Y. This implies a fixed interest rate. Details
2. Start with value function for old agents, continuation value is zero
3. Adjust β such that markets clear
4. Change τ such that government budget is balanced

Model

Appendix - Equilibrium Definition

Given state vector $s = \{a, z, \theta, \sigma, L\}$ the decision rules combined with the exogenous Markov processes for entrepreneurial ability and earnings yield a probability distribution of next period's state vector s' conditional on s.
A stationary equilibrium is given by a market interest rate r, a wage w, lump sum tax τ, allocations for consumption $c(s)$, assets $a(s)$, occupational choice $e(s)$, entrepreneurial borrowing $k(s)$ and a constant distribution of agents over states s, P*(x), such that given r, w, and τ the following conditions are fulfilled:

1. The functions c, a, e, and k solve the maximization problems from above
2. The markets for capital and labor clear
3. The government's tax income exactly equals its expenses for unemployment benefits and pensions
4. The distribution P^* is the invariant distribution for the economy

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Appendix - Model Comparison

Table General Statistics

	K/Y	Entrepreneurs	GDP produced by Entr.	1-year survival rate of Entr.	Wealth		
					Gini	P90/P50	Entr. in P90
Data	4.2	6-8%	10%	53%	0.74	8.71	17%
Benchmarkmodel	4.2	8.1%	12%	38%	0.77	7.99	9.1%
Homog. risk aversion I	4.2	8.3%	9.3%	39%	0.76	8.26	9.6
Homog. risk aversion I	4.2	11%	8.9%	32%	0.81	12.05	8.8

$\sigma = 5.6$ for homogeneous risk aversion I and 2 for homog. risk aversion II

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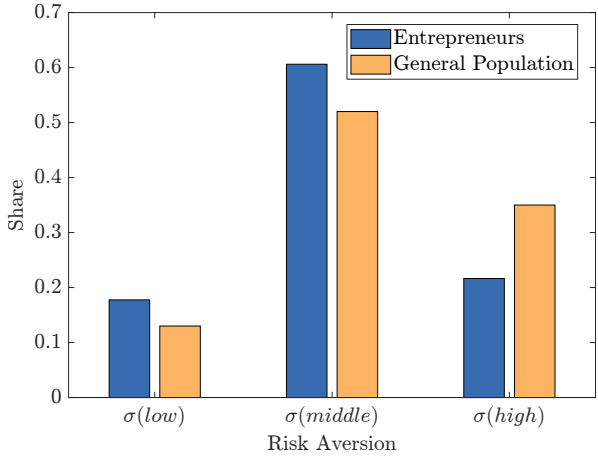
Appendix - Entrepreneurs

Table Entrepreneurs

	Overall	$\sigma(low)$	$\sigma(middle)$	$\sigma(high)$
share in woring-age pop. [%]	8.1	17.8	60.6	21.6
Leverage	4.36	4.4	4.3	4.4
entr. capital (k)	12	11.3	12.4	14
share with $\theta(low)$ [%]	55	14.8	66	19.2
share of GDP produced by [%]	12	6.5	30.5	63
share in P90 of wealth [%]	9.1	14	61	35
1-year survival rate of Entr. [%]	38	24	33	56

Source: Benchmark model

Figure Distribution Risk Aversion



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Appendix - Riskier Self-Employment

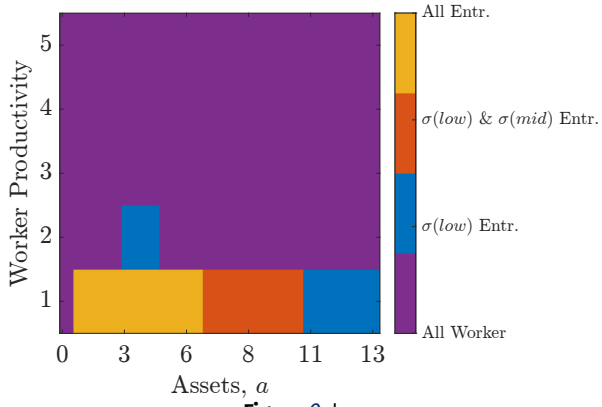

Figure θ=low

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