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JEL Classification: E21, E24, J24

Keywords: Recursive utility

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Heterogeneous Risk Preferences, Entrepreneurship, and Wealth †

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Abstract

This paper studies how individual risk attitudes shape occupational choice and wealth accumulation. Using self-reported individual risk preferences from the German Socioeconomic Panel (GSOEP), we estimate that an increase in risk tolerance raises the probability of a worker transitioning to self-employment. We also develop a life-cycle model of occupational choice with Epstein-Zin preferences and heterogeneous risk attitudes to study how risk aversion interacts with entrepreneurial ability and wealth in determining entry into self-employment and its aggregate implications. Counterfactual simulations show that increasing business risk reduces entry but improves selection by entrepreneurial skills. In contrast, Germany's "1-Euro GmbH" reform of 2008 weakened the role of risk tolerance for entry and increased participation by more risk-averse individuals.

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Keywords: recursive utility, individual risk preferences, occupational choice, business risk, limited liability

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1 Introduction

What drives individuals to become entrepreneurs rather than wage workers, and how do risk preferences shape this choice? Although entrepreneurs represent only a small share of the population, they play a crucial role in the economy: they accumulate wealth, create jobs, dominate the upper tail of the wealth distribution, and drive innovation. Transitions into self-employment are therefore not only key to understanding individual occupational choice but also central to explaining aggregate patterns of wealth accumulation and inequality. Willingness to bear risk lies at the heart of entrepreneurship, but this willingness is unequally distributed across individuals.[1] According to Metzger (2015), evidence from the *Entrepreneurship Monitor* of the Kreditanstalt für Wiederaufbau, Germany's main business development bank, reveals that "...the lack of willingness to accept financial risk is the highest hurdle facing budding entrepreneurs," ahead of financing constraints or regulatory red tape. Yet despite the likely importance of risk attitudes for occupational sorting and wealth accumulation, they remain underexplored in quantitative macroeconomic analysis.[2]

Against this background, we address the following questions: How does an individual's risk attitude affect her occupational choice, and which role do other determinants, such as available assets or entrepreneurial skills, play? Does risk aversion deter able and potentially successful individuals from pursuing entrepreneurship even if they possess sufficient financial means? Our analysis explicitly focuses on the heterogeneity of risk preferences across individuals, which we measure using survey data. We then examine how this heterogeneity shapes the sorting into self-employment and the resulting patterns of wealth accumulation and distribution.

We focus our analysis on Germany due to the availability of high-quality survey data from the German Socio-Economic Panel (GSOEP), which includes rich information on individual wealth and self-reported risk attitudes, and also because entrepreneurs matter for the wealth distribution. The GSOEP is a longitudinal household survey tracking approximately 30,000 individuals annually since 1984, and it provides detailed data on labor market status, income sources, asset holdings, and risk attitudes (see Section 3 for details). Research by Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner (2011) has validated these risk attitude measures as reliable proxies for actual risk preferences. Germany is particularly well suited for studying the link between risk preferences and entrepreneurship, since wealth is highly concentrated, and entrepreneurship plays a key role in wealth accumulation. From 1998 to 2019, self-employed households accounted for just 9% of the workforce but held over 30% of total wealth, with a median net wealth three times that of employed household heads.[3] Entrepreneurs are significantly overrepresented at the top of the wealth distribution. These patterns highlight the importance of understanding who becomes an entrepreneur, what drives this choice, and how it contributes to wealth inequality.

We make three main contributions to the literature on entrepreneurship and wealth. First, by focusing on transitions to self-employment and measuring individual risk attitude and wealth *prior* to a potential transition, we address endogeneity issues regarding wealth and generate reliable esti-

[1] This paper uses entrepreneur, self-employed, and business owner interchangeably.

[2] The KfW Entrepreneurship Monitor is a representative telephone survey on entrepreneurial activity in Germany, which has been conducted annually since the year 2000 from August through December among the adult population. It is a sequence of cross-sections with information provided by 50,000 annually randomly selected individuals residing in Germany.

[3] Data source: GSOEP waves 2002, 2007, 2012, and 2017.

mates of the effects of risk attitudes, ability differentials, and wealth on occupational choices. Second, we embed empirically validated heterogeneous risk attitudes in a binary occupational choice model with Epstein-Zin preferences. This allows us to disentangle risk aversion from the elasticity of intertemporal substitution (IES), a distinction that is crucial for isolating the role of risk attitudes, independent of intertemporal smoothing, in shaping occupational choice and wealth accumulation. Our results are consistent with insights gained from the portfolio choice literature in macro / finance that studies how asset allocations over households' life-cycle vary with the shape of the distribution of risk preferences across agents.[4] Third, we use the model to conduct counterfactual policy experiments, quantifying how changes in the risk environment, such as business risk or limited liability, affect not only the self-employment rate but also the composition of entrepreneurs and the distribution of wealth.

Our analysis combines an empirical investigation with a structural model to understand how individual risk preferences determine entrepreneurial decisions and wealth accumulation. In the empirical part, we use the GSOEP to investigate the links between individual risk attitude, self-employment, and wealth accumulation. Departing from the observation that self-employed individuals exhibit greater risk tolerance than salaried workers, we estimate a fixed-effects logit model that accounts for key confounding factors, including individual wealth, education, age, nationality, and labor market success. We find that the individual willingness to take risks plays a statistically and economically meaningful role: a one-point increase in risk tolerance for employed workers raises the probability of becoming self-employed by 0.15 percentage points. Heterogeneity in risk preferences matters because it helps explain who selects into entrepreneurship and why.

To better understand the underlying mechanisms - and, in particular, which other factors can compensate for high risk aversion in the decision to become self-employed - we turn to a structural life-cycle model of occupational choice. Building on the framework of Cagetti and De Nardi (2006), we introduce Epstein and Zin (1989) preferences and incorporate empirically observed heterogeneity in risk attitudes from the GSOEP. The model captures how individuals with different preferences sort into entrepreneurship, conditional on their skill levels and asset positions, and how these choices shape aggregate wealth outcomes.[5]

In our model, risk-averse individuals face a higher utility cost of income uncertainty and therefore require either greater ability or more wealth to justify starting a business. Assets serve both as a consumption buffer and as collateral for productive investment. As a result, self-employment is more attractive for individuals who are either less risk-averse or more talented, or who have accumulated sufficient wealth to self-insure against entrepreneurial risk. In our model, less risk-averse entrepreneurs run larger businesses, stay in business longer, and build more wealth. The interaction between heterogeneous risk preferences, entrepreneurial ability, and financial constraints gives rise to selection along both the risk and skill dimensions, consistent with key features of the German data: less risk-averse individuals are overrepresented among entrepreneurs; entrepreneurs

[4] See, e.g., Coen-Pirani (2004), or Gomes and Michaelides (2005). The latter authors show that with a fixed cost of participating in the stock market, it is risk averse agents who are more likely to hold stocks, albeit to a lesser extent than risk-prone ones. Our work differs from theirs mainly in that we focus on how an individual's wealth interacts with her risk attitude when making an occupational choice, and our distribution of risk preferences is empirically grounded.

[5] Epstein-Zin preferences formulate agents' indirect utility as a non-linear functional equation, thereby enabling us to meaningfully study the interaction between risk attitude and future expected uncertainty for individual choices. We maintain a constant intertemporal substitution elasticity that is identical for all agents.

are disproportionately concentrated at the top of the wealth distribution; and aggregate wealth inequality declines as the average level of risk aversion increases.

To quantify the policy relevance of this mechanism, we conduct two counterfactual experiments that illustrate how institutions and business risk affect entry into self-employment, the composition of entrepreneurs, and wealth. First, we increase the risk associated with entrepreneurship by varying the probability of going out of business. In this scenario, the overall self-employment rate declines, but the one-year survival rate of new businesses increases. The composition of entrepreneurs shifts toward individuals with lower risk aversion and higher ability, as more risk-averse or marginally qualified individuals are discouraged from entry. This highlights how heterogeneous risk preferences shape not just the extensive margin (how many people enter entrepreneurship), but also the duration of entrepreneurship. Second, we examine a policy that reduces entry risk: the 2008 German "1-Euro GmbH" reform, which lowered capital requirements for incorporating a limited liability company. Empirically, we show that this reform weakens the magnitude of the effect of risk tolerance for entry by about 50 percent because it reduces the downside risk associated with business failure. More risk-averse individuals are thus more willing to become entrepreneurs, expanding the entrepreneur pool without significantly lowering its average ability level. This demonstrates that policy can alter the selection margin by mitigating the deterring effect of risk aversion.

Our results show why modeling heterogeneous risk attitudes with Epstein-Zin preferences is essential for understanding entrepreneurial selection and wealth accumulation. By capturing how risk preferences interact with financial constraints and institutional settings, the model highlights how policies that reduce personal financial risk, such as limited liability provisions, can broaden access to entrepreneurship by enabling more risk-averse but capable individuals to enter, without lowering the average quality of entrants.

The remaining paper is structured as follows. Section 2 connects our work to the existing literature. Section 3 explains the data and provides descriptive statistics. In Section 4 we illustrate and discuss our empirical results. Section 5 contains the formal model. Section 6 presents simulation results, and Section 7 reports the outcome of two counterfactual exercises. Section 8 concludes.

2 Related Literature

This paper bridges two main strands of the literature: an empirical literature on economic determinants of an individual's choice to enter self-employment, and a model-based one in quantitative macroeconomics on entrepreneurship and wealth.

On the empirical side, our work relates to the numerous studies of economic determinants of entrepreneurship and associated decisions that comprise micro-econometric as well as experimental investigations. They investigate either the selection into entrepreneurship or what determines entrepreneurs' decisions to expand or reduce an existing business. Although commonly viewed as crucial for self-employment, this literature has paid limited attention only to the role of individual risk attitude for starting or maintaining one's business. Noteworthy exceptions are Cramer, Hartog, Jonker, and Van Praag (2002)'s study of the occupational choices of former school children in the Dutch province of Noord-Brabant and how their risk attitude and financial situation affected these choices, Andersen, Di Girolamo, Harrison, and Lau (2014)'s field experiment on potential and actual

small business entrepreneurs in Denmark, or Hincapié (2020)'s study of U.S. American men's occupational choice and how it relates to their risk attitude, or their expected business success. This literature has focused instead on the role of available assets for alleviating liquidity constraints (Evans and Jovanovic (1989), Blanchflower and Oswald (1998), and Hurst and Lusardi (2004)), or (potential) entrepreneurs' age or expected productivity (Evans and Leighton (1989) as relevant variables. We add to this literature by exploiting unique information from the German SOEP on individuals' risk attitudes, accumulated wealth, and other characteristics relevant to entrepreneurship. Firstly, we use self-reported evidence on individual risk attitudes that Dohmen et al. (2011) corroborated as a reliable proxy for the unobserved true risk attitude for estimating the link between individual risk aversion and selection into (self-) employment.[6] Secondly, to avoid timing and endogeneity issues, we exploit the panel structure of the SOEP, measure all variables within a narrow time frame, and thereby ensure that potential determinants of self-employment are taken *prior* to an individual's occupational choice.[7]

The quantitative macro literature on entrepreneurship and liquidity constraints, pioneered by Evans and Jovanovic (1989), includes applications to development and growth (Banerjee and Newman (1993), Lloyd-Ellis and Bernhardt (2000)), wealth inequality (Quadrini (1999, 2000), Cagetti and De Nardi (2006), Tan (2022)), (potential) entrepreneurs' financing decisions (Herranz, Krasa, and Villamil (2015), and Peter (2021)), or human capital accumulation considerations as a way to hedge against the risk involved Indraccolo and Piosik (2023). Models in this literature treat wage employment as tantamount to stable income and safe investment opportunities, and self-employment as synonymous with risky investment opportunities and variable income. Moreover, they typically use a time-additive expected utility setting, which mechanically restricts the coefficient of relative risk aversion to equal the inverse of the elasticity of intertemporal substitution (EIS). Except for Herranz et al. (2015), they abstract from preference heterogeneity.

We add to this literature by studying how heterogeneous risk preferences impact individuals' selection into entrepreneurship and the resulting composition of entrepreneurs by wealth, ability, and risk aversion. We do so by implementing Epstein-Zin preferences in a binary occupational choice model. We allow for measurable heterogeneous risk preferences across agents, but maintain a constant, identical intertemporal substitution elasticity. We also assess how selection into entrepreneurship and its composition change when the business environment becomes riskier, or when potential entrepreneurs can limit their personal liability and, thus, reduce operational risk.

3 Data

We base our empirical analysis mainly on the German Socio-economic Panel (GSOEP). The GSOEP is a representative panel that interviews approximately 30,000 individuals and 15,000 households at an annual frequency and contains various socio-demographic characteristics as well as information on employment spells and different types of income. The GSOEP is especially suitable for our

[6] Dohmen et al. (2011) carry out a controlled field experiment using a paid lottery on a small sample that closely resembles the one underlying the SOEP, thereby addressing concerns regarding the validity of responses based on hypothetical lottery questions. See, e.g., Holt and Laury (2002) on the hypothetical bias when eliciting risk attitudes.

[7] Our panel allows us to measure an individual's risk attitude at various points in time. Following Schildberg-Hörisch (2018), who discusses the stability of alternative risk measures across time, we check our measures for internal consistency and stability in Appendix A.1.3.

purpose since it reports self-reported individual risk attitudes at an annual frequency since 2008 and also at a quinquennial frequency since 2002, as well as information on a household's level and composition of wealth. Self-reported individual risk attitudes are a reliable proxy for an individual's actual risk preference, and measured wealth can be indicative of whether or not a potential entrepreneur is financially constrained before deciding about self-employment. Our sample covers the waves from 2000 to 2020. It includes all working-age household heads and their partners, i.e., those between 18 and 64 years old who live and work in Germany. Apart from an individual's risk attitude and accumulated wealth, our sample also contains information on individual characteristics, e.g., age, education completed, marital status, and nationality, as well as information about employment status, e.g., tenure at last employer. This leaves us with an unbalanced sample of 415,310 observations on 75,953 individuals.[8]

3.1 Summary Statistics

Table 1 presents a comprehensive summary of key individual characteristics, categorized by employment status. Within our sample, we distinguish between the stock of self-employed individuals and those who moved into self-employment during our sample period. We refer to the latter group as 'founders' and to the others as established entrepreneurs. We further subdivide founders into those who transitioned from salaried employment (Founder (E)) and those who were previously not employed (Founder (U)).[9]

As highlighted in Table 1, established entrepreneurs possess on average over three times more net wealth than the general population. Moreover, their net liquid asset ratio is almost 40%, indicating that their businesses contribute to over one-third of their total wealth.[10]

Table 2 provides a comprehensive analysis of the wealth distribution in Germany, with a particular emphasis on the subset of the self-employed. Examining this subsection unveils a notable overrepresentation of self-employed individuals within the upper percentiles of the wealth distribution. Specifically, within the top 5% of the wealth distribution, entrepreneurs account for 22% of the population. This contrasts starkly with the broader demographic, where the average prevalence of entrepreneurs in the German working-age population over the entire period of observation stands at 7.2%.

3.2 Transitions into Self-Employment and Survival Probability

Figure 1 illustrates the annual transition rates into self-employment from employment and unemployment within our sample.[11] The transitions out of employment are notably higher than those out of unemployment. Moreover, this figure shows that transitioning into self-employment is a rare event. On average, less than 1% of the working-age population undertakes the step into self-employment each year.

[8] As wealth information is available for the years 2002, 2007, 2012, and 2017 only, we impute data on wealth holdings between these waves to preserve the panel structure of the model. See Appendix A.4.1 for details regarding the wealth imputation procedure.

[9] It is important to note that the terms unemployment and non-employment are used synonymously in this context. According to the Socio-Economic Panel (SOEP), individuals are classified into three categories: employed, self-employed, or neither, without further differentiation within non-employment statuses.

[10] Liquid assets include financial and business assets. Illiquid assets are real estate, tangible, and other assets.

[11] Figure 11 in Appendix A.1.1 also reports the age distribution of founders.

Table 1: Summary Statistics

Variable	Total sample	Employed	Self-employed	Founder
Share in sample	1.00	0.87	0.05	0.08
Age [y]	45.91	45.83	49.12	44.89
	(11.63)	(11.79)	(9.93)	(10.58)
Education completed [y]	12.32	12.17	13.34	13.24
	(2.66)	(2.59)	(2.88)	(2.86)
Monthly net income [€]	1,715	1,673	2,390	1,720
	(2,421)	(1,087)	(9,278)	(1,890)
Mean net wealth [€]	141,731	118,157	470,258	194,251
	(467,149)	(258,723)	(1,560,954)	(640,355)
Median net wealth [€]	28,795	24,717	170,592	37,744
Net liquid assets [f]	0.18	0.11	0.37	0.32

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 are entrepreneurs who transition to self-employment at least once in our sample. Income and wealth denoted in real (2015=100) €. [y] denotes years, [f] indicates fractions. Values in parentheses are standard deviations.

Table 2: Wealth Distribution in Germany

	Wealth Percentile, Top			
	1%	5%	10%	20%
Overall Population				
Share Wealth	18%	39%	54%	74%
Self-employed				
Share of self-employed in percentile	36%	22%	16%	11%
Share of total net wealth in percentile	41%	29%	24%	19%

Notes: Figures are computed including individuals above the age of 65 to ensure comparability with other data sources. The share of self-employed in the percentile indicates the fraction of self-employed in each of the top percentiles. For details on the computation of wealth, see Figure 1.

Figure 2 depicts the average survival rate of founders in our sample. This rate indicates the proportion of founders who maintain their self-employment status over a given time period. It reflects the notion that self-employment is associated with a high risk of business failure. The survival rate of newly self-employed is around 60% after one year. After five years, this rate is down to below 40%.

3.3 Risk Measurement

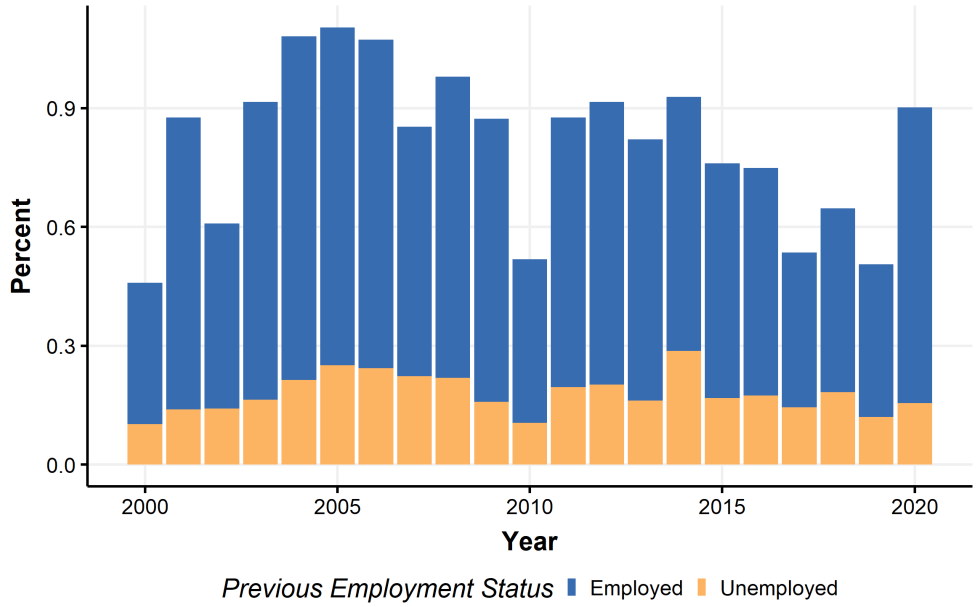
Key to our work are measures of risk attitudes that have been available in the SOEP since the 2004 wave. To determine an individual's willingness to take on risk, we use a survey question that deals with attitudes towards risk in general.[12] The question asked in the GSOEP is:

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

Respondents indicate their general willingness to take risks on an 11-point scale ranging from 0

[12] We have experimented with alternative questions on the willingness to take on financial risk, but our results remained essentially unchanged. However, the sample size decreases considerably.

Figure 1: Distribution of Founders by Year



Notes: The percentage refers to founders in our sample population. They transition either from employment or from unemployment.

(complete unwillingness) to 10 (complete willingness). We calculate each participant's average risk attitude across time and attribute this time-average to the individual for every year in our dataset.[13] By doing so, we can significantly increase the number of observed transitions, since this question was only posed in 2004, and 2006, and at a yearly frequency starting in 2008.[14] In this section, we directly compare the self-reported willingness to take on risk for individuals of different employment states; in our empirical analysis, we also account for household net wealth.

Table 3 presents statistical moments of the distribution of the willingness to take on risk by employment status. The moments for the continuously self-employed and founders are quite similar and uniformly exceed those associated with the group of salaried employees.

Figure 3 graphically illustrates the distribution of the willingness to take on risk by employment status.[15] While the distribution for salaried workers appears to be right-skewed, the distributions for those engaging in entrepreneurial activity are left-skewed. Individuals who are self-employed at some point in our sample seem to be more willing to take on risk compared to workers.

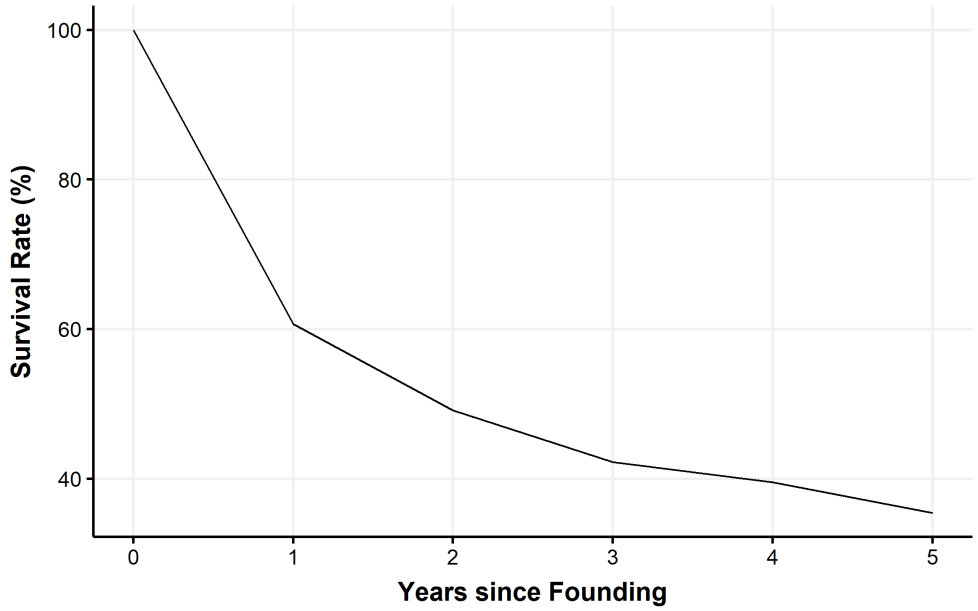
We map the empirical distribution of ordinal risk preferences from the SOEP to CRRA coefficients by discretizing the data into three risk types and assigning each group a corresponding σ_i based on the method of Dohmen et al. (2011). This procedure allows us to incorporate observed heterogeneity in risk attitudes directly into the model, as further detailed in Section 5.3 and Appendix A.7.1.

[13] For instance, if a participant is present in our dataset from 2000 to 2020 and recorded a willingness to take on risk of 8 in 2004 and 2006, but 7 from 2008 to 2020, their average willingness to take on risk is computed as 7.13. This average score is then applied to all the years from 2000 to 2020 for that individual.

[14] In model (4) and (7) of our empirical specifications we only consider transitions for which we observe the willingness to take on risk in the preceding year. The results stay qualitatively the same.

[15] Figure 3 depicts spikes around whole numbers, as a large number of SOEP participants do not alter their responses.

Figure 2: Survival Rate of Newly Self-Employed



Notes: The percentage refers to the share of founders who are still self-employed after a certain number of years. Underlying this figure are all individuals who are older than 18 years to ensure that we do not under-report the survival rate of older founders. We also only consider individuals who are still in the SOEP 5 years after founding.

Figure 3: Distribution of Willingness to Take on Risk by Employment Status

Notes: Entrepreneurs comprise the stock of continuously self-employed and both types of founders.

Table 3: Willingness to Take on Risk by Employment Status

Moment	Total Sample	Employed	Self-Employed	Founder
1st Quantile	3.27	3.20	4.00	3.91
Mean	4.59	4.49	5.35	5.17
Median	4.60	4.50	5.44	5.20
3rd Quantile	5.89	5.75	6.87	6.50
Standard Deviation	1.84	1.81	1.98	1.82

Notes: Self-Employed represents the stock of self-employed who did not transition to self-employment in our sample period. Founders are entrepreneurs who transition to self-employment.

3.4 Success in the Labor Market (LMS)

One dimension that should influence the decision to become self-employed is how successful an individual is in the labor market. Therefore, we compute year-cohort-specific gross income distributions and assign each individual their rank in the distribution.[16] This rank indicates how successful that individual is compared to their cohort. We expect that if the individual has a low rank, they are more likely to try self-employment.

3.5 Wealth and Selection into Self-Employment

Investigating what determines the transition into self-employment is crucial, particularly in light of evidence showing that established entrepreneurs typically possess larger wealth holdings compared to non-entrepreneurs (see Table 1). By focusing on nascent entrepreneurs within our panel data structure, we gain valuable insights into the wealth accumulation process that occurs following their transition into self-employment.

Since the SOEP reports wealth data at a quinquennial frequency only, we focus on three founding cohorts. This allows us to observe their wealth one year *prior* to transiting and at least once following the transition into self-employment.

Table 4 illustrates the development of all founders' net wealth holdings over the four SOEP waves that contain detailed wealth information regardless of how long those founders remain in business. Regarding the group who founded in 2003, we observe that 15 years later, only roughly 15% continue to be self-employed. Especially surviving entrepreneurs managed to increase the average net wealth significantly (see Table 15 in Appendix A.1.2), a fact that underlines the view that successful entrepreneurship is essential for significant wealth accumulation in an economy.

4 Estimation Results

The aim of our empirical analysis is to identify the role of risk attitudes in individuals' decisions to become self-employed in Germany between 2000 and 2020. To this end, we employ a fixed-effects logit model to estimate the determinants of transitions into self-employment. We are especially interested in the qualitative and quantitative effect of an individual's risk attitude on the likelihood of transitioning into self-employment. We estimate the following empirical specification:

[16] For the unemployed, we impute the LMS with the last known value.

Table 4: All Founders' Net Wealth

Founded in	Year	Population	Mean	Median	Standard Deviation
2003					
	2002	140	185,194	35,819	699,725
	2007	91	543,193	178,904	886,970
	2012	46	797,316	181,897	1,352,617
	2017	21	1,239,902	356,617	1,370,570
2008					
	2007	118	188,622	43,815	353,523
	2012	85	161,765	64,853	230,406
	2017	51	406,989	329,353	420,965
2013					
	2012	183	153,228	28,358	327,416
	2017	126	481,098	124,378	441,865

Notes: Wealth is denoted in real €(2015=100). Similar to Figure 2 reported values relate to all founders at any age. The information is aggregated for both types of founders. Population refers to the number of founders who are still self-employed in the indicated year.

$$\text{logit}(p_{i,t}) = \log\left(\frac{p_{i,t}}{1-p_{i,t}}\right) = \beta_0 + \beta_1 X_{i,t} + \delta_t + \delta_{\text{sector}} + \varepsilon_{i,t} \tag{4.1}$$

where $p_{i,t}$ is the probability of an individual i transitioning into self-employment in period t, β_0 is the intercept, $X_{i,t}$ is a vector of explanatory variables (e.g. education, income, net wealth, risk attitude), and δ_t and δ_{sector} are time and sector fixed effects.[17]

Table 6 presents the summary statistics for our logit models. Models 1 through 4 focus on the transitions from employment into self-employment. Models 5 through 7 analyze the transitions from unemployment into self-employment. We observe 1,087 transitions into self-employment that originate from employment and 316 that originate from unemployment.

Models 1 and 5 serve as our benchmark specifications. At this stage, the coefficients of the Logit models are not directly interpretable. However, we note that, aside from the willingness to take on risk, the determinants for transitioning into self-employment vary significantly between individuals previously employed and those unemployed.

In Models 2 and 3, we introduce interactions between the willingness to take on risk and the education level (Model 2), or Labor Market Success, LMS (Model 3). With the help of these interactions, we aim to investigate potential synergies, such as whether a combination of high risk-taking propensity and education, or risk-taking propensity and LMS influences the likelihood of transitioning into self-employment. However, none of these interaction terms are statistically significant. Furthermore, our results remain robust when restricting the sample to individuals who transition into self-employment only once (N = 859); see Appendix A.6 for details.

Caliendo, Fossen, and Kritikos (2009) emphasize the importance of using the willingness to take risks in the year preceding the transition into self-employment. They argue that because entrepreneurs face greater risk, their risk perception shifts after they become self-employed. In our benchmark specification, we use the average willingness to take on risk for each participant, which

[17] See Figure 13 in Appendix A.1.4 for an overview in which sector self-employed are active.

raises the number of transitions observed by at least 40%. To validate that using the average does not qualitatively alter our findings, Models 4 and 7 replicate the benchmark models but restrict the sample to include only those transitions where we have data on the willingness to take on risk in the year preceding the transition.

We compute average marginal effects (AME) to make evaluating the coefficients of our Logit models more intuitive. Table 5 summarizes the AME for Models 1 and 5, and Figure 4 graphically represents them. The AME for willingness to take on risk suggests that for each unit increase in willingness to take on risk, the probability of transitioning into self-employment increases by 0.15 pp for employed and by 2.94 pp for unemployed.[18]

Table 5: Average Marginal Effects on the Probability to Transition to Self-Employment

	Model 1: E-S Transition	Model 5: U-S Transition
Age	0.0001	0.0148
	(0.0003)	(0.0121)
Age^2	0.0000001	−0.0001
	(0.000001)	(0.0001)
Education completed (years)	0.0011	0.015
	(0.0002)***	(0.006)**
Female	−0.0037	
	(0.001)***	
LMS	−0.0090	
	(0.0019)***	
Household net income (log)	0.0022	0.0152
	(0.0007)***	(0.021)*
Migration background	0.0023	−0.0240
	(0.0009)**	(0.0372)
Net wealth > 700K	0.0085	0.2033
	(0.0011)***	(0.0631)***
Number of children		0.0002
		(0.0145)
Parents self-employed	0.0051	
	(0.0009)***	
Self-employed voluntary		0.1847
		(0.0445)***
Tenure at last employer (years)	−0.001	0.0015
	(0.0001)***	(0.003)
Willingness to take on risk	0.0015	0.0294
	(0.0002)***	(0.008)***

Note: *p<0.1; **p<0.05; ***p<0.01

Notes:. Model 1 includes individuals who transitioned from employment into self-employment. Model 5 includes individuals who transitioned from unemployment into self-employment. LMS denotes labor market success.

[18] This relatively strong effect for the unemployed arises from our definition of the control group. This group only includes unemployed individuals who remain unemployed to ensure a precise comparison. However, this definition leads to a smaller sample.

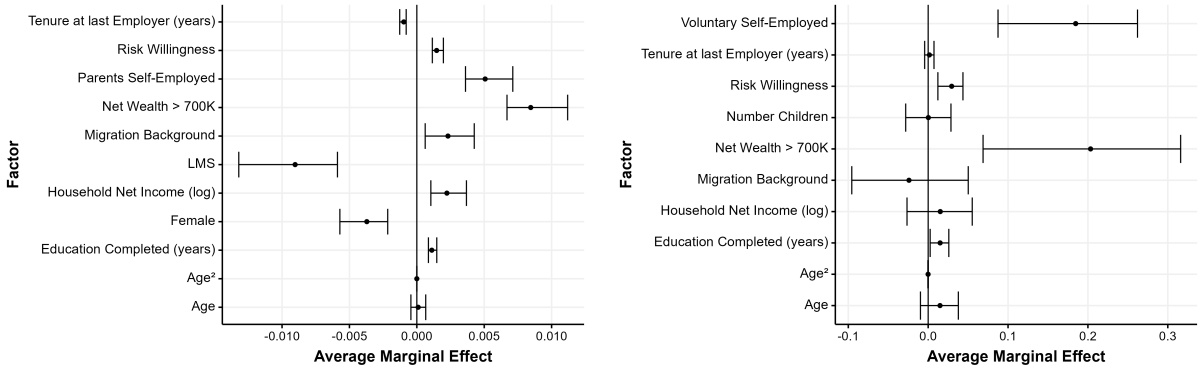
Table 6: Model Summary

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Age	0.02	0.02	0.02	0.01	0.10	0.10	−0.03
	(0.04)	(0.04)	(0.04)	(0.05)	(0.08)	(0.12)	(0.10)
Age^2	0.0001	0.0001	0.0001	0.0001	−0.001	−0.0005	0.001
	(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Education completed (years)	0.16	0.23	0.16	0.17	0.10	0.06	0.13
	(0.02)***	(0.06)***	(0.02)***	(0.03)***	(0.04)**	(0.08)	(0.05)***
Female	−0.52	−0.52	−0.53	−0.63			
	(0.12)***	(0.12)***	(0.12)***	(0.15)***			
LMS	−1.31	−1.30	−1.80	−1.51		0.16	
	(0.27)***	(0.26)***	(0.67)***	(0.32)***		(0.75)	
Household net income (log)	0.32	0.32	0.31	0.40	0.11	0.33	0.12
	(0.10)***	(0.10)***	(0.10)***	(0.12)***	(0.15)	(0.26)	(0.17)
Migration background	0.33	0.34	0.33	0.51	−0.17	0.02	−0.23
	(0.13)**	(0.13)***	(0.13)**	(0.16)***	(0.26)	(0.39)	(0.33)
Net wealth > 700K	1.22	1.23	1.22	1.09	1.42	2.67	1.30
	(0.16)***	(0.16)***	(0.16)***	(0.19)***	(0.45)***	(0.65)***	(0.62)**
Number of children					0.001	0.24	0.12
					(0.10)	(0.15)	(0.12)
Parents self-employed	0.73	0.73	0.73	0.86			
	(0.12)***	(0.12)***	(0.12)***	(0.15)***			
Self-employed voluntary					1.29	1.28	1.39
					(0.32)***	(0.47)***	(0.45)***
Tenure at last employer (years)	−0.14	−0.14	−0.14	−0.13	0.01	−0.06	0.02
	(0.02)***	(0.02)***	(0.02)***	(0.02)***	(0.02)	(0.03)**	(0.02)
Willingness to take on risk	0.21	0.40	0.18	0.12	0.21	0.29	0.15
	(0.03)***	(0.13)***	(0.05)***	(0.03)***	(0.06)***	(0.09)***	(0.06)**
Interaction risk:education		−0.01					
		(0.11)					
Interaction risk:LMS			0.09				
			(0.11)				
Constant	−22.43	−23.43	−22.14	−23.66	−8.30	−7.69	−5.98
	(1.23)***	(1.50)***	(1.28)***	(1.47)***	(2.12)***	(3.45)**	(2.56)**
Fixed Effects	Year+Sector	Year+Sector	Year+Sector	Year+Sector	Year+Sector	Year+Sector	Year+Sector
Number of transitions into S	1,087	1,087	1,087	748	316	197	172
Observations	137,214	137,214	137,214	95,662	1,423	730	974
Log Likelihood	−4,549.73	−4,547.03	−4,549.00	−3,043.80	−583.31	−263.44	−344.18
Akaike Inf. Crit.	9,225.47	9,222.07	9,225.99	6,213.61	1,286.61	644.89	798.36
pseudo R^2	0.167	0.1674	0.1672	0.1737	0.2181	0.2635	0.3106

Note: *p<0.1; **p<0.05; ***p<0.01

Model 1-4: Transitions from employment (E) to self-employment (S), Model 5-7: Transitions from unemployment (U) to self-employment (S). Models 1-3 and 5-6 use the time-average of an individual's willingness to take on risk. Models 4 and 7 use the willingness to take on risk *prior* to the transition. LMS denotes labor market success.

Figure 4: Average Marginal Effects



(a) Model 1: E-S Transition

(b) Model 5: U-S Transition

Note: Average marginal effects indicate by how many percentage points the dependent variable changes if the independent variables increase by one unit.

Aside from the willingness to take on risk, the effects for the two subgroups are quite different. Household net income increases the likelihood of transitioning into self-employment for the previously employed. That may be because total household net income serves as an insurance device. A person's financial safety net is stronger if they are part of a household with a larger net income. According to Figure 2, almost half of all newly created businesses fail within the first year. Having financial security in the form of a larger income is a plus during this turbulent period.

LMS decreases the transition probability for the employed.[19] It may be that the more successful a worker is in comparison to their cohort, the less likely they are to pursue self-employment. This is the inverse message of what we addressed for household net income; nonetheless, it is vital to distinguish between individual labor-market success and household net income. The former is used to assess individual performance in the labor market within one's cohort, while the latter assesses financial security.

The variable *Net Wealth > 700K* is a dummy that indicates if the individual's net wealth is greater than €700,000. When imputing wealth, we create eight broader wealth groups to reduce the imputation error.[20] Among all imputed wealth groups, this is the only one for which we find a statistically significant effect on the probability of transitioning into self-employment. This suggests that high levels of net wealth increase the likelihood of transitioning into self-employment, consistent with the findings of Indraccolo and Piosik (2023).

5 The Model

For our quantitative analysis, we propose a perpetual youth model with occupational choice that builds on Blanchard (1985) and extends the framework in Cagetti and De Nardi (2006) by incorporating heterogeneity in agents' risk preferences. We introduce Epstein and Zin (1989) preferences

[19] In the benchmark for the unemployed (model (5)), we exclude LMS because they have no income in the period before they transition, and even if we impute the LMS with the last known value, we lose almost half of all transitions.

[20] Appendix A.4.1 provides details on the wealth imputation.

that break the tight link between individual risk attitudes and the elasticity of intertemporal substitution (EIS). Moreover, by formulating an agent's lifetime utility as a non-linear function, they are very suitable for studying the role of heterogeneous risk preferences, varying risk, and the implied individual behavior. As in Cagetti and De Nardi (2006), agents in our model face earnings risk and mortality risk. In addition, we subject all entrepreneurs to the risk of going out of business. Time is discrete, and there is no aggregate uncertainty.

Demographics and the Labor Market The model is populated by a continuum of agents of measure one. Each agent experiences a life cycle that consists of two stages: young and old age. Those stages typically last for several periods. A young person faces the constant probability of remaining young in each period, π_y. Similarly, an old person remains old with probability π_o. Young agents make an occupational choice: they decide whether to work for pay or be self-employed. This choice is always reversible, so it is repeated in every period until retirement. Old agents, on the other hand, are retired and receive a fixed pension ξ. They face a constant risk of dying and exiting the model, which we denote by π_d. There is no bequest motive. Upon death, agents exit the model, and their assets are redistributed across the young generation, preserving the stationary distribution.
Entrepreneurs face the additional risk of going out of business which happens with probability π_u. Upon exiting, they lose a fraction κ of their capital stock, but they receive a uniform public transfer payment b that equals a fraction of the lowest wage in the economy. The risk of going out of business is large, mirroring the empirical fact that the survival rate of newly established enterprises is low, especially in their initial years (see Figure 2).

Preferences Agents derive utility from consumption, c, only. We employ Epstein and Zin (1989) preferences, which distinguish between risk aversion and the elasticity of intertemporal substitution. We allow agents to differ in their risk preferences and model this by assigning each individual a unique, innate, and constant risk aversion parameter, σ_i. The elasticity of intertemporal substitution, γ, is identical for everyone. Epstein-Zin preferences are represented by the following non-expected recursive utility function:

$$V(\sigma_i) = \left[c^{1-\frac{1}{\gamma}} + \beta \left[E\, V'(\sigma_i)^{1-\sigma_i} \right]^{\frac{1-\frac{1}{\gamma}}{1-\sigma_i}} \right]^{\frac{1}{1-\frac{1}{\gamma}}}, \tag{5.1}$$

with the common discount factor, β, lying strictly between 0 and 1, $\sigma_i > 0$ and $\gamma > 0$, where it is required that $\sigma_i \neq 1$ and $\gamma \neq 1$. Current utility is the aggregate of current consumption and the *certainty equivalent* of future utility.[21]

Technology Each young person is endowed with two types of ability, which we treat as exogenous random variables that are positively auto-correlated over time but mutually uncorrelated. Worker ability, z, captures the capacity to produce income out of labor. Entrepreneurial ability, θ, is the capacity to generate returns from capital investment as an entrepreneur. By assumption, the realized values of z and θ are observable and known to everyone at the beginning of a period.

[21] Note that if the mean risk aversion σ equals the inverse of γ, the utility function in (5.1) would resemble the time-additive separable CRRA utility that is widely used in macroeconomics.

Output production occurs in two sectors, a (small) entrepreneurial sector and another one where many non-entrepreneurial firms operate a standard CRS production technology in a competitive environment. To produce output they use a given technology level A, salaried workers, L, and physical capital, K, as inputs:

$$Y = AK^{\alpha}L^{1-\alpha}. \tag{5.2}$$

A worker's effective wage income equals the product of the market wage rate – the marginal product of labor, $\bar{w}$ – and her individual productivity level, z. Workers cannot borrow but save at the risk-free market interest rate r. To operate as an entrepreneur, an agent can borrow at rate r and invest capital k in a technology whose return depends on her own entrepreneurial ability. When k is invested, output production equals $y = \theta k^{\nu}$, where ν lies within the interval (0,1).[22]

Borrowing Constraint We impose an exogenous borrowing constraint that keeps entrepreneurs from borrowing unlimited amounts. It is defined as

$$k - a \leq (\lambda - 1)a, \tag{5.3}$$

where $\lambda \in [1, \infty)$. This implies that the amount of debt each entrepreneur can incur in a period to finance her working capital, k , is crucially determined by the available assets, a, which serve as collateral. All debt is cleared at the end of a period.

Government The government collects a lump sum tax τ from young agents in the economy except for failed entrepreneurs to finance subsistence pay and pension payments. By assumption, the government maintains a balanced budget:

$$N\tau = SE^{f}b + N^{O}\zeta, \tag{5.4}$$

where N denotes all young agents in the economy except for failed entrepreneurs. SE^{f} captures failed entrepreneurs, b their subsistence pay, and N^{O} denotes the mass of old agents who receive pension payments ζ.

5.1 Households

All agents know their innate risk preferences. Moreover, at the beginning of each period, before any economic decisions are made, the realized values of all ability levels are observed and known to everyone, but next period's levels remain unknown.

5.1.1 Young Agents

Each young person starts the period with assets a, entrepreneurial ability θ, and worker ability z. In each period, she chooses whether to be an entrepreneur or a wage worker. She picks the occupation

[22] Diminishing returns to scale of physical capital in output production imply a limited firm size, or "span of control," as noted by Lucas (1978).

that maximizes her lifetime utility.

$$V_y(a,z,\theta;\sigma) = \max\Big(V_e(a,z,\theta;\sigma), V_w(a,z,\theta;\sigma) \Big) \tag{5.5}$$

The entrepreneur's decision problem can be expressed recursively as follows:

$$\begin{aligned} V_e(a,z,\theta;\sigma) = \max_{c,k,a'} \Bigg(& c^{1-\frac{1}{\gamma}} + \beta \Big[\pi_y \Big((1-\pi_u(e)) \mathbb{E}[V_y(a',z',\theta';\sigma)^{1-\sigma}] + \\ & \pi_u(e) V_u(a',z',\theta';\sigma)^{1-\sigma} \Big) + (1-\pi_y) V_o(a';\sigma)^{1-\sigma} \Big]^{\frac{1-\frac{1}{\gamma}}{1-\sigma}} \Bigg)^{\frac{1}{1-\frac{1}{\gamma}}} \\ a' = & (1+r)a + \theta k^{\nu} - c - (r+\delta)k - \tau \\ a \geq & 0 \\ k \geq & 0 \end{aligned} \tag{5.6}$$

With probability π_y, the agent remains young and again faces the occupational choice presented in Equation (5.5). Conversely, with probability $1-\pi_y$, the agent transitions to old age and retires. As long as an entrepreneur stays young and active, she can go out of business in each period with probability π_u. The law of motion for assets features the sum of the risk-free rate r and the per-period depreciation rate δ as the per-unit cost of working capital, k.
The wage worker's decision problem is summarized below:

$$\begin{aligned} V_w(a,z,\theta;\sigma) = \max_{c,a'} \Bigg(& c^{1-\frac{1}{\gamma}} + \beta \Big[\pi_y \Big(\mathbb{E}[V_y(a',z',\theta';\sigma)^{1-\sigma}] \Big) && (5.7) \\ & + (1-\pi_y) V_o(a';\sigma)^{1-\sigma} \Big]^{\frac{1-\frac{1}{\gamma}}{1-\sigma}} \Bigg)^{\frac{1}{1-\frac{1}{\gamma}}} && (5.8) \\ a' = & z\bar{w} + (1+r)a - c - \tau \\ a \geq & 0 \end{aligned}$$

In case the wage worker remains young, she again chooses next period's occupation that maximizes her value function. She turns old and retires with probability $1-\pi_y$.
An entrepreneur who has gone out of business solves the following decision problem:

$$\begin{aligned} V_u(a,z,\theta;\sigma) = \max_{c,a'} \Bigg(& c^{1-\frac{1}{\gamma}} + \beta \Big[\pi_y \mathbb{E}[V_y(a',z',\theta';\sigma)^{1-\sigma}] \\ & + (1-\pi_y) V_o(a';\sigma)^{1-\sigma} \Big]^{\frac{1-\frac{1}{\gamma}}{1-\sigma}} \Bigg)^{\frac{1}{1-\frac{1}{\gamma}}} \\ a' = & b + (1+r-\kappa)a - c \\ a \geq & 0 \end{aligned} \tag{5.9}$$

where $\kappa \in [0,1]$ denotes the share of capital that is lost, and b captures a public subsistence pay. Having been out of business for one period, the agent either re-enters the labor market, faces the occupational choice problem again, or turns old and retires.

5.1.2 Old Agents

Old agents receive fixed pension payments ξ and choose consumption and next period's assets. They face uncertainty regarding the time of their death only. They either remain old with probability π_o or die with probability $1-\pi_o$. In case of death, the value is zero, as they cease to exist, and their assets are distributed to young agents using the stationary distribution of productivity types.

$$
\begin{aligned}
V_o(a;\sigma) = &\max_{c,a'} \left(c^{1-\frac{1}{\gamma}} + \beta \left[\pi_o V_o(a';\sigma)^{1-\sigma} \right]^{\frac{1-\frac{1}{\gamma}}{1-\sigma}} \right)^{\frac{1}{1-\frac{1}{\gamma}}} \\
& a' = \xi + (1+r)a - c \\
& a \geq 0
\end{aligned}
\tag{5.10}
$$

5.2 Competitive Equilibrium

Consider an individual state vector $s = \{a, z, \theta, \sigma, L\}$, where a represents an asset level, z worker ability, θ entrepreneurial productivity, σ risk preferences, and L describes the agent's stage in life (young and worker or entrepreneur – active or failed –, or old and retired). The decision rules resulting from the agents' optimization problems 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.
Let **x** denote the aggregate state vector, where aggregation takes place across all individuals.

Definition. *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 allocations c, a, e, and k solve the agents' maximization problems.*
2. *The markets for capital and labor clear.*
3. *The government's budget is balanced, with tax income equaling subsistence pay and pension expenses.*
4. *The distribution P^* is the invariant distribution for the economy.*

5.3 Calibration

In this subsection, we outline the parameter choices used to match key moments of our empirical data. The model is calibrated to annual frequency. We normalize worker productivity z to one and set the capital share in production, α, to 0.33. We target an annual real interest rate of 3 percent. To ensure capital market clearing, we adjust the discount factor β, resulting in $\beta = 0.91$. The depreciation rate of capital, δ, to 0.06 (see Cagetti and De Nardi (2006)), and the elasticity of intertemporal substitution, γ, to 0.5, which is a standard value in the literature. π_y and π_o are calibrated to ensure that agents spend, on average, 39 years working and 20 years in retirement. These figures align with the observed durations of working life and retirement in Germany (Eurostat, 2024; Deutsche Rentenversicherung Bund, 2024).

We use individual measures of risk aversion from the SOEP, as discussed in detail in Section 3. To incorporate the empirical distribution of willingness to take risks into our model framework, we discretize the data and map ordinal risk preferences to risk aversion parameters, σ_i. Specifically, we begin by analyzing the distribution of ordinal risk preferences and discretizing it into three grid points. Next, we apply the method developed by Dohmen et al. (2011) to compute the CRRA parameters for each grid point (see Appendix A.7.1 for details), leveraging additional information provided in the SOEP. Table 8 summarizes the CRRA parameters used in our model and the corresponding probability masses. We set fixed pension payments, ξ, to 60% of the lowest income, and the public subsistence pay, b, which is received by entrepreneurs who go out of business, to 10% of the lowest income. Both values are consistent with the German institutional framework. Note that the subsistence pay corresponds to the "Bürgergeld" in Germany. The value of the lump-sum tax τ arises endogenously in steady state by solving for the balanced budget as in Equation 5.4. Furthermore, we set the equity ratio λ to 4.64, which corresponds to the inverse of the balance sheet equity of the KfW Bankengruppe from the year 2014 (see KfW Bankengruppe, 2023).

The idiosyncratic worker productivity process is discretized into a 3-state Markov chain using the method of Rouwenhorst (1995).[23] We use moments estimated by Bayer and Juessen (2012), setting the autocorrelation ρ to 0.922 and the standard deviation σ^Y to 0.172.[24]

Table 7: Externally Calibrated Parameters

Parameter	Value	Source
A	1	Normalization
α	0.33	Standard parameter
β	0.933	Annual real interest rate of 3 %
δ	0.06	Cagetti and De Nardi (2006)
γ	0.5	Standard parameter
π_y	0.9745	Average working duration of 39 years
π_o	0.9511	Average retirement duration of 20 years
σ_i	[3.05 5.26 10.04]	See text and Tab. 8
ξ	60% of lowest income	Institutional approximation
b	10 % of lowest income	Institutional approximation
τ		See text
λ	4.64	KfW Bankengruppe (2023)
ρ	0.922	Bayer and Juessen (2012)
σ^Y	0.172	Bayer and Juessen (2012)

Table 9 lists the parameters we calibrate internally. We calibrate a total of eleven parameters that jointly relate to self-employment.Note that θ_{Low} is externally calibrated, while θ_{Middle} and θ_{High} are determined within the model. We choose the same number of targets to ensure that our model is fully identified. We use a Generalized Method of Moments (GMM) approach to fit the model to the empirical targets.[25]

[23] Kopecky and Suen (2010) argue that Rouwenhorst's method is suited best to discretize AR(1) processes with a very strong auto-correlation compared to other methods predominantly used in the literature.

[24] Details on transition probabilities and grid points are provided in Appendix A.7.1.

[25] In our GMM strategy, we apply unequal weights to the moments by ranking them according to their relative importance. The largest weight is assigned to matching the share of entrepreneurs in the working-age population (7.2 percent), while entrepreneurs' share in the 90th percentile of the wealth distribution (15.9 percent) receives one of the lowest weights. This unequal ranking reflects our focus on capturing the extensive margin of entrepreneurship more

Table 8: Distribution of Risk Aversion

Willingness to Take on Risk	Probability Mass	Risk Aversion (σ_i)
$[0-3)$	34%	10.04
$[4-6)$	53%	5.07
$[7-10]$	13%	3

Notes: The willingness to take on risk is discretized into three intervals. The probability mass shows how these intervals are represented in the overall population. The parameter of relative risk aversion is the transformed willingness to take on risk. Its mean equals 6.49 and its standard deviation is 2.64.

The targeted moments are displayed in Table 10, which compares them with the corresponding empirical data. The moments include characteristics of entrepreneurial activity, such as the share of entrepreneurs in the working-age population, their contribution to GDP, and survival rates, as well as measures of inequality, including the Gini coefficient and the distribution of entrepreneurial wealth and returns. The model matches most of the empirical moments closely. The data moments are based on the German Socio-Economic Panel (GSOEP) for demographic and economic indicators and the Household Finance and Consumption Survey (HFCS, second wave for the year 2014) for entrepreneurial returns and business assets.[26,27]

Table 9: Internally Calibrated Parameters

Parameter	Value
π_θ	$\begin{bmatrix} 0.9872 & 0.0126 & 0.0003 \\ 0.0766 & 0.9101 & 0.0133 \\ 0.3018 & 0.0560 & 0.6422 \end{bmatrix}$
θ	[0 0.238 0.332]
ν	0.9321
π_u	0.1504
κ	0.4559

Although all calibrated parameters jointly determine the targets, some are especially informative for certain moments. ν and θ heavily influence wealth outcomes and the relationship between the mean and the median of returns, since they govern the distribution of entrepreneurial returns in our model. π_θ and π_u directly affect the survival rate of an enterprise and, hence, its stability. The target moments most affected by this are the share of nascent entrepreneurs out of all existing self-employed in a given year, and also the first-year survival rate of nascent entrepreneurs. κ indicates the severity of a going-out-of-business shock. This parameter matters most for the reported statistics capturing the wealth distribution.

precisely, while moments related to the upper tail of the wealth distribution are considered less central to the model's core mechanisms.

[26] Appendix A.2 contains an overview of percentile ratios and dispersion measures for business returns, self-employment income, and business assets for Germany.

[27] We selected moments from the second wave (2014) as calibration targets, as it represents a "tranquil time" compared to 2010, when the economy was recovering from the Great Recession, or 2020, which was impacted by COVID. The values from the third wave (2017) are quantitatively similar.

Table 10: Targeted Moments

Moment	Data	Model	Data Source
Share of entrepreneurs in working-age population	7.2%	6.7%	GSOEP
Share of GDP by entrepreneurs	10.0%	10.9%	BFB (2023)
Share of new entrepreneurs p.a. in working-age pop.	0.8%	1.0%	GSOEP
1-year survival rate of nascent entrepreneurs	60.6%	69.8%	GSOEP
Mean survival rate of entrepreneurs [yrs.]	3.58	3.60	GSOEP
Entrepreneurial earnings (mean/median)	2.02	2.39	HFCS Germany
Entrepreneurial earnings (std/mean)	1.72	2.21	HFCS Germany
Entrepreneurial earnings (P90/P50)	4.29	4.48	HFCS Germany
Business assets (std/mean)	3.52	2.56	HFCS Germany
Wealth Gini	0.75	0.82	GSOEP
Entrepreneurial share of P90 wealth	15.9%	18.7%	GSOEP

Notes: Data for entrepreneurial returns and business assets originate from the second wave (year 2014) of the HFCS for Germany. BFB is the acronym for Bundesverband der Freien Berufe e. V. (2023).

5.4 Model Validation: Transition Probability with Simulated Data

To validate our model, we use it as the data-generating process and re-estimate our empirical model from Equation 4.1 with the simulated data. This exercise serves as a sanity check to verify whether the model produces a relationship between risk aversion and the probability of transitioning into self-employment that is consistent with the observed data.

$$\text{logit}(p_{i,t}) = \log\left(\frac{p_{i,t}}{1-p_{i,t}}\right) = \beta_0 + \beta_1 X_{i,t} + \epsilon_{i,t} \tag{5.11}$$

where p_i is the probability of an individual i transitioning into self-employment, β_0 is the intercept, X_i is a vector of explanatory variables. Unlike our specification using GSOEP data, this estimation does not include time or sector fixed effects and only controls for worker productivity, entrepreneurial ability and wealth larger than 700K.

Table 11 reports the coefficients from the logistic regression and the average marginal effects (AMEs) from our model-based regression, comparing them to the empirical estimates from Model 1 in Table 5. Importantly, the model replicates the qualitative relationship observed in the empirical data: higher risk aversion (or, equivalently, lower willingness to take on risk) reduces the likelihood of transitioning into self-employment. Note that a higher willingness to take on risk (WTR) corresponds to a lower level of risk aversion σ, so the signs of marginal effects differ by construction.[28] In the model, a one-unit increase in risk aversion decreases the transition probability by 0.07 percentage points. While this effect is smaller than in the empirical estimation, this difference reflects the inherent simplifications of the model, making an exact quantitative match challenging.

6 Results

This section presents the main findings from our quantitative model of occupational choice. We pay special attention to the ways in which alternative ability levels – z and θ –, accumulated assets, and

[28] See Section 5.3 for how WTR maps into σ via Dohmen et al. (2011).

Table 11: Model Summary

	Theoretical Model	Theoretical Model AME	Empirical Model (1) AME
Risk Aversion (σ)	−0.065	−0.0007	
	(0.008)***	(0.0001)***	
Willingness to take on Risk			0.0015
			(0.0002)***
Entrepreneurial Ability (θ)	1.02	0.011	
	(0.008)***	(0.0001)***	
Wealth > 700K	1.07	0.011	0.013
	(0.016)***	(0.0002)***	(0.0031)***
Worker Productivity (z)	−0.177	−0.0019	−0.0105
	(0.008)***	(0.0001)***	(0.0018)***
Constant	−6.55		
	(0.033)***		
Transition into SE	40,398		
Observations	3,738,246		
Log Likelihood	−208,991		
Akaike Inf. Crit.	417,992		
pseudo R^2	0.063		

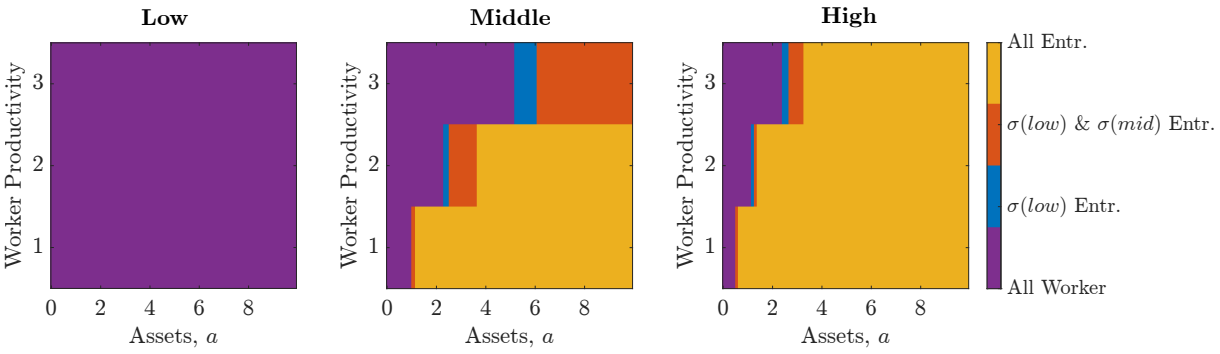
Note: *p<0.1; **p<0.05; ***p<0.01
Transitions from employment (E) to self-employment (S). The theoretical model presents results using simulated data from our quantitative model. Empirical Model (1) reports average marginal effects (AMEs) from our benchmark specification, which includes self-reported willingness to take on risk instead of the transformed measure of risk aversion. Since a higher willingness to take on risk corresponds to lower risk aversion, the AMEs for these variables exhibit opposite signs. The full specification of Empirical Model (1) is provided in Table 5.

risk preferences interact in determining agents' occupational choices and savings behavior. First, we graphically illustrate the interplay between those determining factors. Then, we report simulation results from the stationary equilibrium of our benchmark with heterogeneous risk preferences.

6.1 Occupational Choice

Figure 5 consists of three panels, each depicting the optimal behavior for agents with low, medium, or high entrepreneurial ability, respectively.

Figure 5: Occupational Choice by Entrepreneurial Ability and Risk Preferences



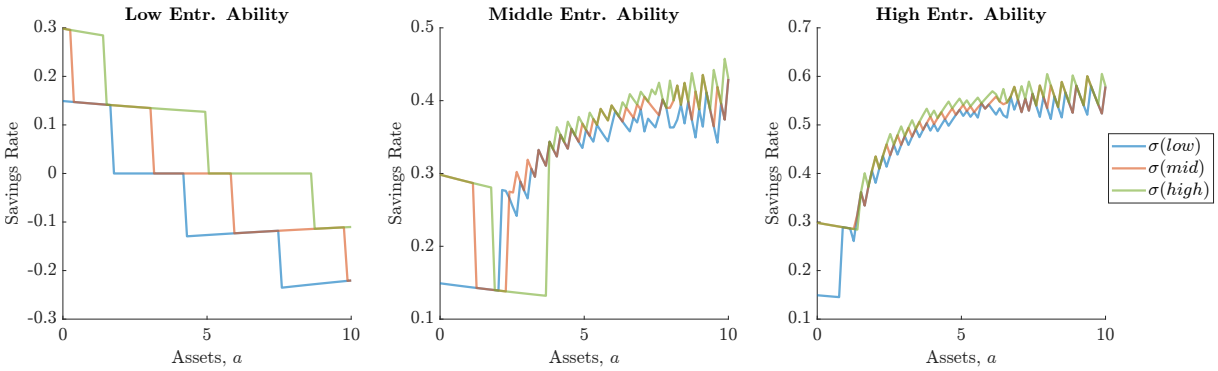
Several important facts stand out. Assets are required for self-employment due to borrowing constraints, but the threshold depends on entrepreneurial skill and risk aversion. For a given level of worker productivity, z, talented, risk-prone agents require the lowest asset level to transition to self-employment. However, having accumulated assets *per se* is not sufficient to start a business, especially if the productivity differential between self-employment and salaried employment, θ - z, is small. In this case, it is optimal to be a salaried worker, regardless of one's assets or risk tolerance (depicted in the left panel). The other two panels show that as the productivity differential increases, the asset threshold for entering self-employment decreases for a given level of risk aversion. Taken together, Figure 5 illustrates that the decision to enter self-employment hinges crucially on assets, as well as a certain productivity differential that favors entrepreneurship. Moreover, from an agent's perspective, accumulated assets can compensate for risk aversion in her decision to enter self-employment, as wealth helps buffer capital losses.
Next, we will characterize the different types of agents in our model by their predominant savings motives in an attempt to understand their actual savings behavior.

6.2 Savings Rates

Choosing how much income to save each period is a key decision agents face in our model. Three distinct savings motives drive this choice: precautionary savings, retirement savings, and savings for starting entrepreneurship. Irrespective of the underlying motive, savings increase with the degree of risk aversion. All agents engage in precautionary savings to safeguard against uninsurable earnings risk and longevity risk. The retirement savings motive is also the same for all agents, as they face an identical probability of transitioning into old age and, on average, their mean working-life income exceeds their pension income. The entrepreneurial savings motive, by contrast, varies

with entrepreneurial ability—it is strongest for high-ability individuals, but absent for those with low entrepreneurial skills who never become self-employed (see Figure 5). All motives taken together shape the savings rates that are defined as (a'-a)/income and shown in Figure 6 for a worker productivity level z equal to 2.[29]

Figure 6: Savings Rate by Entrepreneurial Ability and Risk Aversion



Note: Worker productivity is fixed at $z = 2$.

Several observations stand out. First, at low asset levels, all agents save a positive fraction of their income, which is similar across alternative entrepreneurial skills. Second, at any given asset level, savings rates rise in proportion to the degree of risk aversion, indicating that the precautionary savings motive is in effect for everyone. Third, when entrepreneurship is not a viable option, savings rates decline as assets increase. For agents with the lowest entrepreneurial ability, savings rates eventually turn negative, as accumulating more assets leads them to prioritize current consumption over further saving. Savings rates for all other agents start to *increase* beyond the asset level where entrepreneurship becomes attractive.

Given the perfect sorting of agents across occupations by their entrepreneurial skill, these observations are equivalent to saying that, *ceteris paribus*, (i) workers save less than entrepreneurs at a given asset level, and (ii) workers' savings rates decrease, whereas those of entrepreneurs rise in the level of accumulated assets. That's because assets serve as collateral for borrowing working capital. As long as the return from capital accumulation exceeds its total costs, entrepreneurs choose a capital stock such that the borrowing constraint is binding, i.e., they operate at maximal leverage. Taken together, these stark differences in savings behavior by agents who differ in their occupations or in the degree of risk aversion contribute to the wealth inequality that our model implies. We will elaborate on this important aspect in more detail in Section 6.4 below.

6.3 Stationary Equilibrium

We have simulated our model using the policy rules from Sections 6.1 and 6.2 and computed the stationary equilibrium for the cross-section of workers and entrepreneurs.

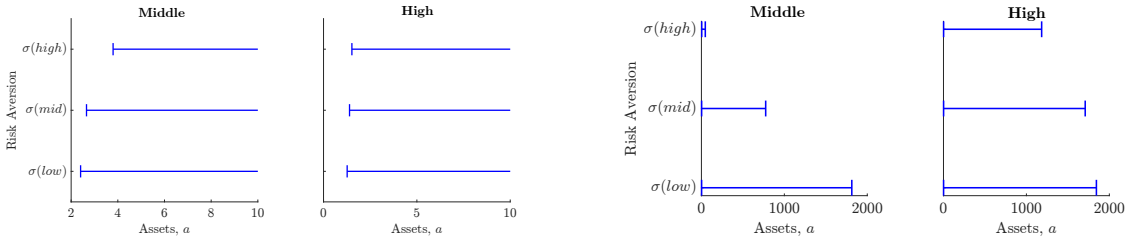
Our benchmark with heterogeneous risk preferences yields a share of entrepreneurs within the working-age population that equals 6.7%. This value lies in the range from 5.9% to 7.6%, which

[29] The savings profiles are consistent with the ones documented by Cagetti and De Nardi (2006) whose model includes an additional bequest motive, but abstracts from heterogeneity in risk aversion.

Bonin, Krause-Pilatus, Rinne, Koch, and Nenzel (2022) report for Germany. In addition, our model predicts that entrepreneurs are disproportionately drawn from the less and moderately risk-averse segments of the population (see the distribution of risk aversion in Appendix A.8).

To better understand the underlying forces at work, it helps to look more closely at the interplay between capital accumulation, risk attitude, and entrepreneurship in our stationary equilibrium. Towards this end, Figure 7 illustrates this interaction for two alternative productivity differences – *middle -z*, and *high-z* –, along the lower end of the asset grid (panel *a*) where most entries occur, and also along the entire asset grid (panel *b*) to capture exits from self-employment. This figure conveys an important message. Although highly risk-averse agents accumulate more assets than other risk types before starting a business, they exit at lower asset levels than anybody else. That is mainly because they fear losing their wealth, and exiting is a way to safeguard against such a loss. In contrast, risk-prone agents require the lowest asset levels to start a business. Since they willingly accept higher business risks and capital losses in the event of failure, they tend to stay in business for a longer period than others, thereby benefiting from high business returns for an extended time and accumulating substantial wealth levels.

Figure 7: Occupational Choice by Level of Risk Aversion and Entrepreneurial Skill



(a) Bottom End of Asset Grid **(b)** Whole Asset Grid

Notes: Worker productivity equals $z = 2$. *Middle* and *High* denote the entrepreneurial ability. Part (a) displays the bottom end of the asset grid (as in Figure 5) to highlight the asset thresholds at which entrepreneurship becomes optimal. The vertical axes depict the levels of risk aversion from our benchmark model. Part (b) replicates the same content for the whole asset grid.

These differences in agents' occupational choices along the asset grid also become apparent in Table 12, which presents detailed model-based characteristics of entrepreneurs by type of risk aversion. Although risk-tolerant entrepreneurs make up the smallest group within the entrepreneurial population, they are overrepresented relative to their share in the general population (see Appendix A.8). They also achieve the highest survival rates and accumulate the most significant amount of entrepreneurial capital. More generally and consistent with empirical evidence, entrepreneurs are overrepresented among the wealthy and contribute disproportionately to GDP, with those of medium risk aversion leading in output, wealth accumulation, and capital ownership.

Interestingly, our findings regarding the link between risk aversion, savings behavior, and risky entrepreneurship when agents have Epstein-Zin preferences mirror those reported by Gomes and Michaelides (2005) from studying empirically observed patterns of stock market participation over the life cycle in a model of asset allocation. When participating in the stock market is costly, risk-averse agents are most likely to accumulate the wealth required to enter the stock market, although they invest cautiously once participating, out of fear of losing accumulated wealth.

Table 12: Entrepreneurs by Degree of Risk Aversion

	Overall	σ(Low)	σ(Middle)	σ(High)
Share of Entrepreneurs in Working-Age Population [%]	6.7	14.58	61.94	23.48
Entrepreneurial Capital [k]	135	153	156	81
Share with θ(Middle) [%]	85	13.8	59.5	26.6
Share of GDP [%]	10.9	12.9	63.3	23.8
Share in P90 of Wealth [%]	18.7	13.9	65.2	20.9
1-Year Survival Rate of Entrepreneurs [%]	69	74	74	61

Notes: Results are based on the stationary steady-state of our benchmark model.

6.4 Model-Based Wealth Distribution by Risk Aversion

Table 13 presents model-implied moments of the asset distribution that relate to the groups sorted by the degree of risk aversion, or to the entire model population. The mean exceeds the median by far for the entire population as well as for each subpopulation, indicating that all distributions are strongly right-skewed. Moreover, the mean and median are highest for agents with a moderate degree of risk aversion, while risk-loving agents exhibit the lowest median but the largest wealth inequality, as measured by the Gini. In contrast, highly risk-averse individuals display the most compressed distribution, with the mean closely aligned with the 75th percentile and the lowest Gini of all sub-groups. In fact, the Gini decreases as the degree of risk aversion rises, and this is consistent with the empirical evidence from the SOEP. When looked at through the lens of our model, that's because risk-prone agents require few assets to enter entrepreneurship, but conditional on having entered, they stay in business rather long and continue to accumulate wealth. Their implied wealth distribution is highly unequal. The situation for risk-averse agents is essentially the opposite, which explains their rather low Gini.

Table 13: Population-Wide Asset Distribution by Degree of Risk Aversion

σ	**P1**	**P10**	**P25**	**P50**	**Mean**	**P75**	**P90**	**P95**	**Gini**	**Gini (SOEP)**
Low	0	0	0.51	2.40	18.70	7.08	18.15	58.43	0.876	0.81
Middle	0	0	1.01	3.42	21.69	8.98	25.41	83.36	0.852	0.75
High	0	0	1.52	4.94	10.94	11.56	22.74	38.66	0.68	0.72
Overall	0	0	1.01	3.79	17.70	9.49	24.04	55.98	0.820	0.75

7 Counterfactuals

This section examines how heterogeneous risk preferences determine the size and composition of the entrepreneurial sector and the resulting wealth distribution under alternative business environments. We do so with the help of two counterfactual exercises that are based on our quantitative model. First, we analyze the impact of an increase in business risk. For Germany, survey-based indicators such as the *ifo Business Climate Index*[30] provide information on entrepreneurs' assessments of the current business situation and expectations for the near future, reflecting changes in demand conditions and operational uncertainty. As this measure varies over the business cycle, we

[30] See the ifo Business Climate Index of the ifo Institute.

are motivated to study in a counterfactual setting how changes in business risk at different points in time (i.e., different steady states) affect transitions into entrepreneurship and wealth accumulation. Second, we explore the implications of limiting entrepreneurs' private liability for business losses. This exercise mirrors the introduction of a new form of limited-liability companies (LLC), so-called *Unternehmergesellschaften (UG)*, in Germany in late 2008 with the intention of reducing personal risk, thereby rendering entrepreneurship more attractive. Since UGs require an initial minimum capital of just one euro, they are also referred to as "1-euro GmbH".

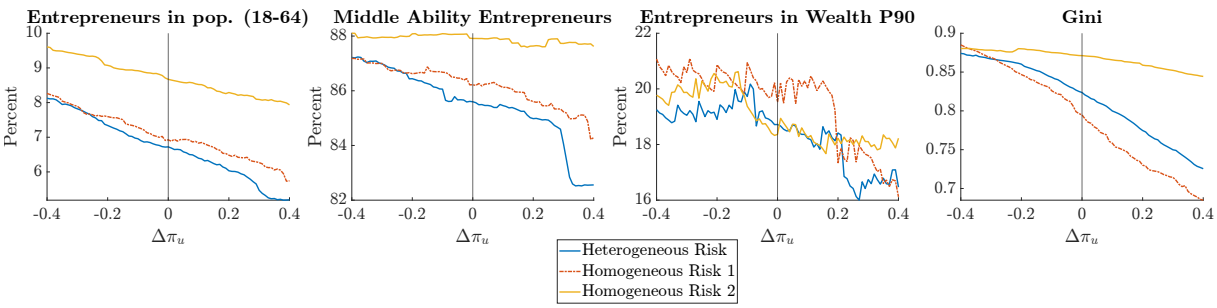
To assess the role of heterogeneity in risk aversion, we compare our benchmark model to two alternative specifications with homogeneous risk preferences. In the first variant (Homogeneous RA I), we fix the coefficient of relative risk aversion σ at 6.49 for all individuals—the population average in the benchmark model.[31] In the second specification (Homogeneous RA II), we set $\sigma = 2$ for everyone, which corresponds to the inverse of the elasticity of intertemporal substitution (EIS), replicating the standard case of CRRA utility with time-additive preferences. Appendix A.9 compares the occupational choice in our benchmark model to the homogeneous risk aversion cases.

When all agents are assigned the mean value of σ (Homogeneous RA I), the share of entrepreneurs closely matches that in the benchmark model. By contrast, setting $\sigma = 2$ (Homogeneous RA II) implies uniformly lower risk aversion across the population, leading to a marked increase in self-employment. In this case, the share of entrepreneurs in the working-age population rises to 8.67%, accompanied by a higher entrepreneurial contribution to GDP.[32]

7.1 Increased Risk of Doing Business

We have argued all along that agents' risk attitude matters for individual choices and also for aggregate outcomes. In this section, we use our occupational choice model to investigate how a change in the riskiness of doing business affects the economy. To be specific, we vary the risk of going out of business, π_u, in the range of ± 40% around its calibrated value of 0.15 and trace out the resulting changes in the quantitative importance of entrepreneurs as well as wealth inequality. We do so for our benchmark model (dashed blue line), and also for the two versions with homogeneous preferences, each (dashed orange line for σ=6.49 and solid yellow line for $\sigma = 2$).

Figure 8: Selected Model Outcomes by Varying π_u



Notes: Outcomes are deviations from the steady-state of our benchmark model (see Table 12). They originate from varying the risk of business failure, π_u, around its calibrated value 0.15 and imposing heterogeneous or homogeneous risk preferences, respectively. Markets always clear.

[31] This value falls within the range reported in studies based on U.S. data, e.g., Kimball, Sahm, and Shapiro (2009), Kimball, Sahm, and Shapiro (2008).

[32] In our counterfactual scenarios, we fix the tax rate at 31.7; rebalancing it would not meaningfully affect the results.

Figure 8 displays in four panels from left to right the resulting changes in the share of entrepreneurs (i) in the working-age population, (ii) with an intermediate ability level, (iii) in the top decile of the wealth distribution, and (iv) the wealth Gini of the total population.A few facts stand out. Except for when the risk of business failure is extremely low, under heterogeneous risk preferences, all shares of entrepreneurs are smaller and also more sensitive to a change in π_u than when risk preferences are homogeneous. These patterns reflect the underlying occupational sorting across asset levels for all agents, as well as across risk types when risk preferences are heterogeneous.

To understand this sorting better, recall that the distribution of risk preferences featured in our benchmark model is strongly right-skewed with the mean exceeding the median (see Table 8). We also know from Figure 7 that the less risk averse agents are, the fewer assets they accumulate before entering entrepreneurship and the longer they remain in business. Hence, it is not surprising that in steady state, the share of entrepreneurs is lowest in our benchmark model: risk-tolerant agents' savings are relatively low, while highly risk-averse agents avoid self-employment altogether—even when business risk varies. In contrast, when all agents are gamblers with a σ equal to 2, the share of entrepreneurs in the working-age population and that of entrepreneurs with an intermediate ability are significantly larger than in the other two preference scenarios. Moreover, these shares are the least sensitive to changes in the risk of doing business, simply because risk-prone entrepreneurs are least deterred by rising risk. For similar reasons, the share of entrepreneurs whose wealth lies in the top decile is most resilient to changing business risk.

Finally, the wealth Gini for the entire population decreases with a rise in business risk, since entrepreneurship becomes less attractive under all preference scenarios considered. However, this decline is weakest if all agents are risk-prone, and strongest if everyone is rather risk-averse. In the former case, precautionary savings are low, whereas the typical firm size tends to be large. The opposite holds true in the latter scenario. With additional occupational sorting by risk preferences, our benchmark model delivers a wealth Gini that lies between these two extremes.

7.2 Introduction of the €1 GmbH in Germany

In this subsection, we examine a real-world reform that resembles an insurance mechanism for entrepreneurial risk. In our model, agents cannot insure against business failure. If this happens, they lose a positive fraction κ of their assets. In many countries, legal structures are in place that act as an insurance device against personal liability in case a business fails. A common example are limited liability companies (LLC), designed to make entrepreneurship more accessible. In Germany, they are called *GmbH*. In 2008, the country launched a simplified version which is officially called *Unternehmergesellschaft (UG)*, but commonly referred to as *"€1-GmbH"*. Unlike a traditional *GmbH*, which requires a minimum share capital of €25,000, the UG allows businesses to be established with as little as €1 in share capital. However, UGs are legally obligated to allocate a share of annual profits to a reserve until the standard minimum capital requirement of €25,000 is fulfilled. The main motivation for launching this new legal form was to facilitate entrepreneurship for sole proprietors by reducing the financial barrier to entry and also the downside risk of doing business.[33]

[33] According to the KfW's *Entrepreneurial Monitor*, more than two-thirds of all nascent entrepreneurs are sole proprietors. They are personally liable for any losses they incur. Figure 14 in Appendix A.3 shows that the share of "€1-GmbH equals about 16 percent of all newly founded LLCs in a given year, while the overall share of LLCs among new businesses has steadily increased.

In the context of our model, this policy has the potential to reduce the importance of an individual's willingness to take on risk for transitioning into self-employment.
In this section, we quantitatively assess the implications of this policy. To do so, we empirically re-estimate the importance of our risk measure for transitioning into self-employment after the introduction of the "€1-GmbH". Then we mimic limited liability in our benchmark model by varying the fraction of capital loss if entrepreneurs go out of business. This allows us to analyze the implications this insurance policy has for occupational sorting in general and the rate of nascent entrepreneurs in particular.

7.2.1 Empirical Investigation

Below, we estimate the effect that the launch of the *€1-GmbH* in 2008 has had on the individual probability of transitioning into self-employment. We augment Equation 4.1 by an interaction term that interacts our measure of risk tolerance with a shift-dummy that takes the value 1 starting in 2008. We include time-fixed effects to account for year-specific shocks, such as the Great Recession, that may affect all observations in a given year.[34]
Table 14 reports both the coefficients of the logistic regression and the average marginal effects. Prior to the reform in 2008, an increase in the willingness to take on risk increased the transition probability by 0.2 pp. This effect has dropped to 0.1 pp since the *€1 GmbH* was introduced. This significant reduction in the AME shows how much insurance against private liability matters for the decision to become self-employed. Put differently, by limiting individual liability, an individual's risk attitude becomes significantly less relevant for starting a business. This result aligns with the findings of Klapper, Laeven, and Rajan (2006), who use the European Amadeus database to empirically document that higher costs associated with meeting regulatory requirements for establishing a limited liability company hinder firm entry.

Table 14: Model Summary

	Model (8)	Model (8) AME	Model (1) AME
Willingness to take on risk	0.30	0.0021	0.0015
	(0.04)***	(0.0003)***	(0.0002)***
Interaction:Willingness to take on risk*LLC	−0.13	−0.001	
	(0.06)**	(0.0004)**	
Constant	−23.19		
	(1.52)***		
Fixed Effects	Year+Sector		
Number of transitions into S	1,087		
Observations	137,214		
Log Likelihood	−4,544.96		
Akaike Inf. Crit.	9,217.93		
pseudo R^2	0.168		

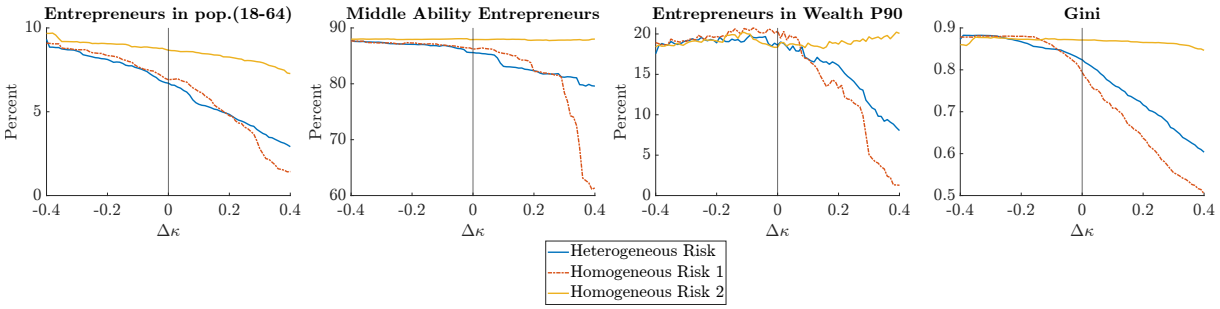
Note: *p<0.1; **p<0.05; ***p<0.01; The dependent variable is the individual probability of transition to self-employment from employment. The complete list of controls used in the regressions is identical to those reported in Table 6.

[34] Note that the time-fixed effects absorb the shift-dummy itself, as it varies only over time.

7.2.2 Model-based Analysis

To investigate the effect that varying levels of insurance against capital loss in case of business failure have for entrepreneurship and the implied wealth distribution, we vary κ continuously in the range $\pm$ 40% around this parameter's calibrated value of 0.456. Figure 9 displays in four panels from left to right the resulting changes in shares of entrepreneurs (i) in the working-age population, (ii) with an intermediate ability level, (iii) in the top decile of the wealth distribution, and (iv) the wealth Gini of the total population. It does so for the three preference scenarios we consider.

Figure 9: Selected Model Outcomes by Varying κ



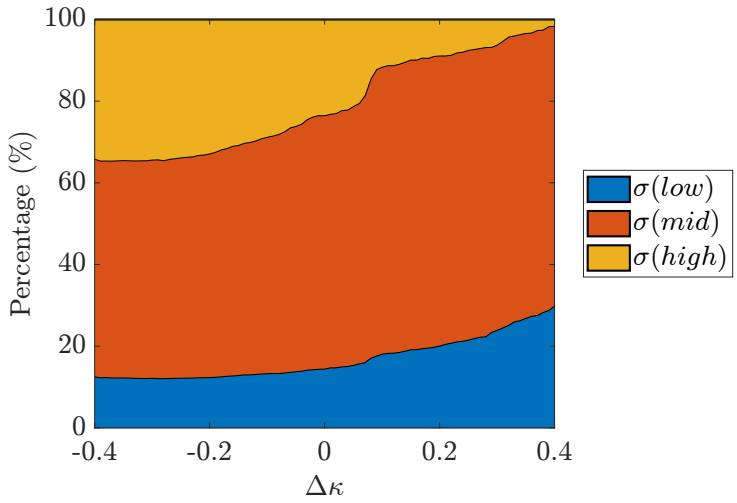
Notes: See Figure 8. Outcomes originate from varying the share of lost capital, κ, around its calibrated value 0.456 and imposing heterogeneous or homogeneous risk preferences, respectively. Markets always clear.

All entrepreneurial shares are sensitive to a changing cost of business failure, κ, but the sensitivity is smallest if all agents are risk-prone. Moreover, as κ becomes very small, all entrepreneurial shares rise, and they rise to a similar level across the different risk types. Hence, entrepreneurship becomes more attractive, and the lower the fraction of capital lost in the event of failure, the less agents' risk attitudes influence their occupational choices.

These developments are mirrored in the way the wealth Gini responds to changes in κ. As κ increases, wealth inequality declines, as fewer agents enter entrepreneurship and existing entrepreneurs face greater wealth losses in the event of failure. These dynamics are strongest when all agents are risk-averse and weakest when everyone is risk-prone. As discussed earlier, that's because a high degree of risk-aversion lets agents withdraw from entrepreneurship well before others if failure becomes very costly. They accumulate much less capital than risk-prone agents. As heterogeneous preferences introduce an extra dimension of occupational sorting, the reaction of the Gini to a change in κ is more gradual than under homogeneous preferences. Figure 7 illustrates the entry and exit behavior by asset levels for alternative risk types. The strong aggregate responses are also due to the fact that a larger mass of entrepreneurs is concentrated in the wealth bins where middle and low risk aversion types are active, as shown in Table 13.

Finally, we address the question of who benefits most from liability insurance. Figure 10 depicts the changing composition of entrepreneurs by risk types as κ varies. The area left of $\Delta\kappa = 0$ corresponds to an environment with increasing liability insurance for entrepreneurs. As the level of insurance rises, the share of risk-averse agents increases most notably, up to a third of all entrepreneurs, whereas the other shares slightly decrease. Hence, having access to insurance against personal liability tilts the occupational choice of risk-averse agents more towards self-employment than that of others. In other words, when the cost of business failure is lower, risk aversion plays a smaller role

Figure 10: Composition of Entrepreneurs by Degree of Risk Aversion



Notes: See Figure 9.

in determining occupational choice.

Taken together, our counterfactual exercises highlight why modeling heterogeneous risk aversion matters. Unlike with homogeneous risk preferences, where predictions are driven by the specific choice of σ, our model aligns the distribution of risk preferences with the data. This allows for more refined and empirically grounded predictions of occupational choices and macroeconomic responses to policy changes.

8 Conclusion

In this paper, we subject the conventional view that one's willingness to take risk matters for starting and succeeding with one's own business to a thorough quantitative investigation. We provide new evidence from the German Socioeconomic Panel (GSOEP) on the empirical distribution of individuals' willingness to take risk. We combine these risk measures with individual wealth for the workforce in Germany and empirically assess how important individual risk aversion is for selection into self-employment. Our estimation results strengthen the view that risk aversion is a decisive determinant of individuals who choose to become self-employed. Risk aversion also matters for the implied wealth distribution: It is more equally distributed as agents turn more risk-averse, requiring more assets before entering business and staying for a shorter period than risk-prone individuals.

To interpret these findings and explore their macroeconomic relevance, we extend the canonical model of occupational choice by Cagetti and De Nardi (2006) to include Epstein-Zin preferences and empirically grounded heterogeneity in risk attitudes. This framework allows us to disentangle risk aversion from intertemporal substitution and to quantify how risk preferences interact with individual wealth and ability to shape entrepreneurial entry and success. Our structural analysis highlights that self-employment is most attractive to individuals who are either less risk-averse, more talented, or wealthier.

We use the model to evaluate how changes in the business environment, such as heightened entrepreneurial risk or policies that reduce liability, affect entry into self-employment, the composi-

tion of entrepreneurs, and wealth distribution. Under increased business risk, entry rates fall, and the entrepreneur pool becomes more positively selected based on ability and risk tolerance, raising the average quality of entrants while reinforcing wealth concentration. In contrast, policies that reduce downside risk, such as limited liability reforms, broaden the entrepreneur base by encouraging entry from more risk-averse individuals, with limited deterioration in the average quality of entrants.

However, our findings reveal an important trade-off. While insurance-type policies increase participation in entrepreneurship, particularly for the risk-averse, these individuals tend to stay in business for shorter periods and accumulate less wealth. As a result, such policies can unintentionally raise aggregate wealth inequality by expanding the lower tail of entrepreneurial outcomes without significantly altering the upper tail. A comprehensive welfare assessment of these policies that improve access but may also reinforce inequality, is therefore complex and beyond the scope of this paper.

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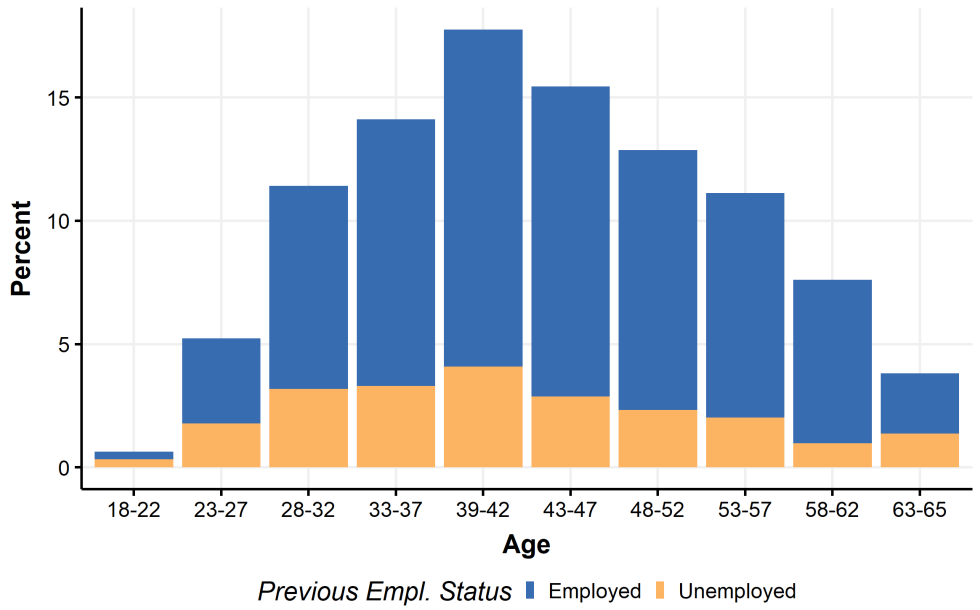
A Appendix

A.1 Data

A.1.1 Age Distribution of Founders

Figure 11 shows the age distribution of founders in our sample. Almost 20% of all founders are between 39 and 42 years old.

Figure 11: Age Distribution of Founders



Notes: The percentage refers to the share of founders in a specific age range out of all founders in our sample. They either transitioned from employment or from unemployment.

A.1.2 Net Wealth of Surviving Founders

Table 15 depicts the net wealth of surviving founders. The table presents the mean, median, and standard deviation of net wealth for founders who remained self-employed, disaggregated by founding cohort, and observed at different points in time. This allows for a comparison to the net worth of all founders illustrated in Table 4 and over time.

A.1.3 Variation in the Willingness to Take on Risk

We assume that risk preferences are time-invariant at the individual level, allowing us to pool data across years.[35] This significantly increases our sample size, as we no longer lose observations from years in which this question was not included in the SOEP. To justify this assumption, this subsection checks how much the individual willingness to take on risk actually varies over time.

[35] See Schildberg-Hörisch (2018) for a discussion on the stability of risk preferences over time.

Table 15: Surviving Founders' Net Wealth

Founded in	Year	Population	Mean	Median	Standard Deviation
2003					
	2002	27	497,989	86,651	1,232,170
	2007	17	900,482	424,657	1,160,527
	2012	15	1,737,019	1,411,492	1,801,254
	2017	11	1,224,156	369,950	1,503,524
2008					
	2007	48	221,822	136,164	259,372
	2012	25	210,857	70,530	26,241
	2017	15	450,518	328,358	557,137
2013					
	2012	125	191,451	67,579	386,554
	2017	53	527,666	131,940	476,769

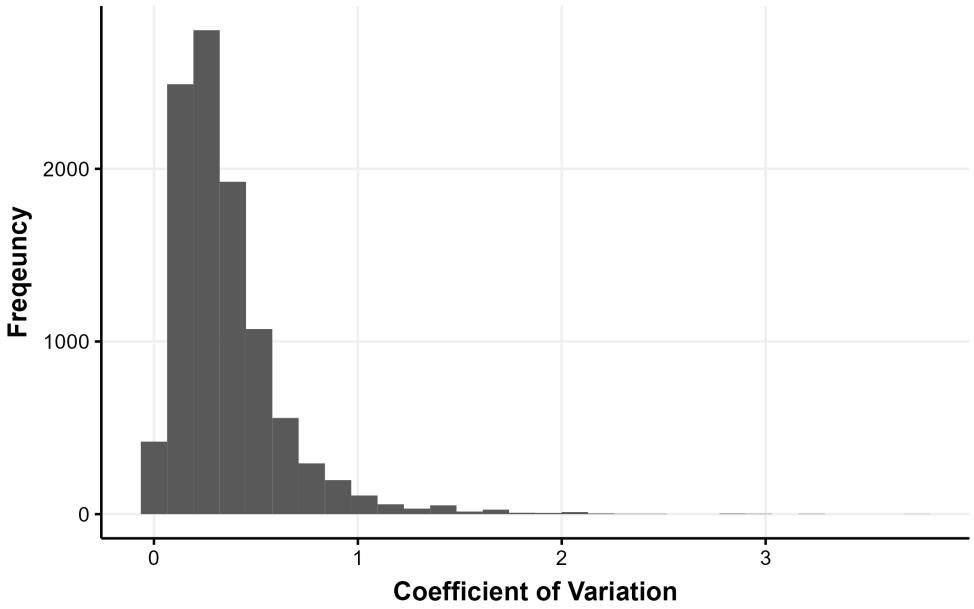
Notes: Wealth is denoted in real €(2015=100). Similar to Figure 2 reported values relate to all founders at any age. The information is aggregated for both types of founders. Population refers to the number of founders who are still self-employed in the indicated year.

We provide two different indicators that suggest that the variation at the individual level is moderate. First, Figure 12 reports the frequency of individual coefficients of variation for the variable willingness to take on risk.

$$CV_i = \frac{\eta_i}{\mu_i} \tag{A.1}$$

where CV_i is the coefficient of variation, η_i is the standard deviation and μ_i is the individual time average.

Figure 12: Distribution of the Coefficients of Variation of Willingness to Take on Risk



Notes: This figure plots the frequencies of the coefficient of variation for the willingness to take on risk at the individual level.

Figure 12 shows that most of the CV_i's are below 0.5 indicating a low variation on the individual level.

As an alternative measure of variability, we calculate the intra-class correlation coefficient (ICC) using a mixed-effects model.

$$Risk_{i,t} = \mu + \alpha_i + \epsilon_{i,t} \tag{A.2}$$

where $Risk_{i,t}$ is the individual and time-specific willingness to take on risk, μ is the population average, α_i is the random effect of individual i, and $\epsilon_{i,t}$ is unobserved noise. From this mixed effects model, the ICC can be derived as follows:

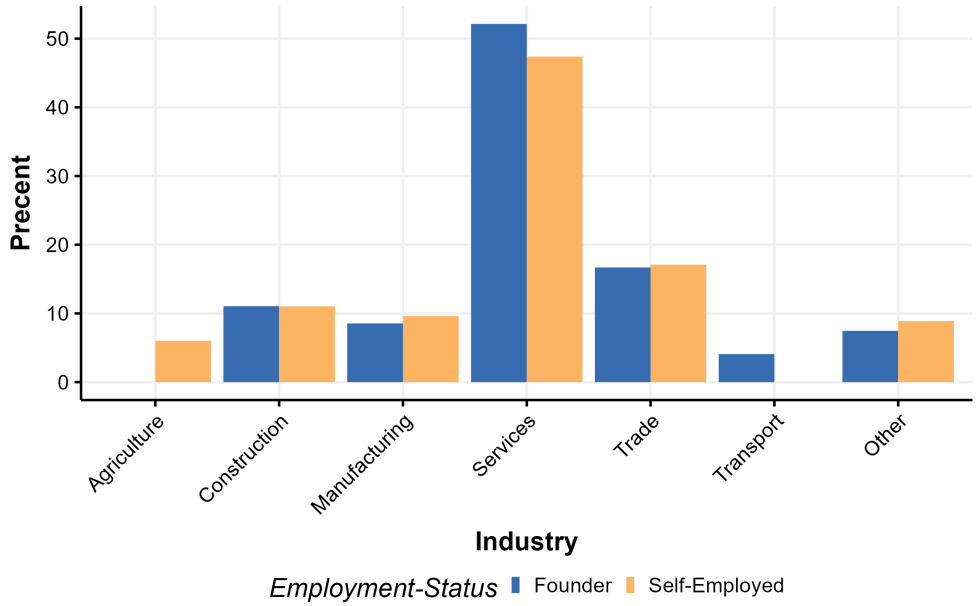
$$ICC = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_\epsilon^2} \tag{A.3}$$

where σ_i^2 is the variation of α_i and σ_ϵ^2 is the variation of $\epsilon_{i,t}$. Using Equation A.3, we find an $ICC = 0.524$, which indicates modest stability at the individual level.

A.1.4 Sectors of Self-Employed

This subsection reports on the sectors in which self-employed and founders are active. We report the 1-digit industry code provided in the SOEP.

Figure 13: Industry Distribution by Employment-Status



Notes: Self-employed corresponds to the stock of self-employed individuals for whom we do not record a transition in our sample. Founder captures the flow of nascent entrepreneurs.

Figure 13 reports the sectors for the stock and the flow of self-employed. We explicitly report the top 5 industries and aggregate the rest into *Other*. The percentage of entrepreneurs in the sectors is very similar between the two groups. However, for self-employed agriculture is the fifth most popular sector, while for founders it is transport.

A.2 Evidence on Business Returns, Self-Employment Income and Business Assets

This subsection presents summary statistics and dispersion measures for self-employed individuals in Germany, derived from the Household Finance and Consumption Survey (HFCS) provided by the European Central Bank. Statistics are reported for self-employment income/entrepreneurial earnings (variable DI1200) and business assets (variable DA1200) from the second wave (2014) of the HFCS.[36,37] Following Cagetti and De Nardi (2006), business returns are calculated as the ratio of self-employment income to business assets. All values are weighted using the cross-sectional household weight (HW0100) and are deflated using the Consumer Price Index (CPI). We use the 90th-to-median percentile ratio, the ratio of the mean to the median, and the ratio of the standard deviation to the median for self-employment income, as well as the ratio of the standard deviation to the mean for business assets, as targets in our model calibration (all marked in bold; see also Table 10).

[36] Self-employment income is defined as the total gross income (profits or losses) from unincorporated enterprises earned by all household members over the last 12 months.

[37] Business assets include real estate properties used for business activities and the total value of self-employed business wealth.

Table 16: Summary Statistics

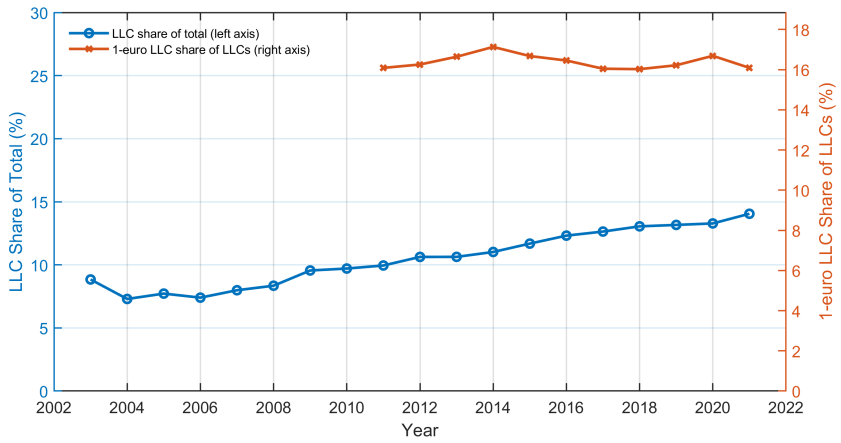
Statistic	Mean	Median	Std	P90/P50	Mean/Median	Std/Mean
Entrepreneurial Earnings	56.60	28.00	97.48	4.29	2.02	1.72
Business Assets	299.16	22.00	1,052.19	31.91	13.60	3.52
Business Returns	20,457.73	101.74	784,853.46	19.66	201.07	38.36

Note: This table displays summary statistics of business returns, self-employment income, and business assets for self-employed individuals in Germany, based on data from the Household Finance and Consumption Survey (HFCS, wave 2 for the year 2014). Business returns are calculated as the ratio of self-employment income (DI1200) to business assets (DA1200). All values are deflated to 2020 euros and weighted using household weights.

A.3 Development of Limited Liability Companies in Germany

Figure 14 shows the share of Limited Liability Companies (LLCs) as a percentage of total new businesses between 2003 and 2021, as well as the share of 1-euro LLCs among all LLCs (as discussed in our counterfactual analysis in Section 7). We observe a steady increase in the share of LLCs, rising by approximately 6 percentage points over this period. The share of "1-euro GmbHs", which is available from 2011 onwards due to data limitations, accounts for more than 16 percent and remains relatively stable over time.

Figure 14: Development of LLC and 1-euro LLC Shares Over Time



Data Source: Gründungsstatistik (Kfw Gründungsmonitor), Business registrations (annual averages over monthly data) by legal form for Germany, 2003-2021.

A.4 Imputations

A.4.1 Wealth

Since the SOEP only provides detailed wealth data in 2002, 2007, 2012, and 2017 we impute household wealth between the waves using information on household capital income that is available at a yearly frequency. We illustrate our strategy using information for the years 2002 and 2003,

$$\text{Net Wealth}_{2003} = \text{Net Wealth}_{2002} + \text{Capital Gain}_{2003} \tag{A.4}$$

we have to do this for all years in between waves for which we have information on wealth. Since this method is rather simple, we define wealth groups and assign each household to one. With these coarser groups, our imputation can approximate the households' wealth group reasonably well.

Table 17: Wealth Groups

Wealth Group	Interval
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 18 reports the difference between imputed and actual wealth groups of households in 2007, 2012, and 2017. On average, our imputation is very close to the actual wealth group in all three years for which we conducted this consistency check.

Table 18: Difference between Imputed and Actual Wealth Groups

	2007	2012	2017
Difference	-0.058	0.015	0.004

Data: SOEP. The difference is the average distance between the wealth groups to which our imputation assigned households and their actual wealth groups.

A.5 Voluntary Self-Employment

This subsection describes how we define the variable voluntary self-employment, which is used in the estimation for transitions from unemployment to self-employment. With this variable we want to control for occupation groups that may not transition into self-employment because they have an intrinsic motivation for self-employment, but because it is common practice in their occupation. One example would be a taxi driver, who might prefer employment but the norm in this occupation is self-employment. Table 19 reports how we classify the ISOC-88 occupation codes into those we believe to be voluntary self-employment and those we believe not to be.

Table 19: Classification of Occupations

Voluntary	Involuntary
11 Legislators and senior officials (all subgroups)	214 Architects, engineers and related professionals
12 Corporate managers (all subgroups)	222 Health professionals (except nursing)
13 Managers of small enterprises (all subgroups)	223 Nursing and midwifery professionals
211 Physicists, chemists and related professionals	245 Writers and creative or performing artists
212 Mathematicians, statisticians and related professionals	341 Finance and sales associate professionals
213 Computing professionals	342 Business services agents and trade brokers
221 Life science professionals	346 Social work associate professionals
23 Teaching professionals (All subgroups)	347 Artistic, entertainment and sports associate professionals
241 Business professionals	513 Personal care and related workers
242 Legal professionals	514 Other personal services workers
243 Archivists, librarians and related information professionals	521 Fashion and other models
244 Social science and related professionals	61 Skilled agricultural and fishery workers (all subgroups)
246 Religious professionals	712 Building frame and related trades workers
247 Public service administrative professionals	713 Building finishers and related trades workers
31 Physical and engineering science associate professionals (all subgroups)	714 Painters, building structure cleaners and related trades workers
32 Life science and health associate professionals (all subgroups)	72 Metal, machinery and related trades workers (all subgroups)
33 Teaching associate professionals	73 Precision, handicraft, craft printing and related trades workers (all subgroups)
343 Administrative associate professionals	74 Other craft and related trades workers (all subgroups)
344 Customs, tax and related government associate professionals	832 Motor vehicle drivers
345 Police inspectors and detectives	833 Agricultural and other mobile plant operators
348 Religious associate professionals	834 Ships' deck crews and related workers
41 Office clerks (all subgroups)	911 Street vendors and related workers
42 Customer services clerks (all subgroups)	912 Shoe cleaning and other street services elementary occupations
511 Travel attendants and related workers	913 Domestic and related helpers, cleaners and launderers
512 Housekeeping and restaurant services workers	914 Building caretakers, window and related cleaners
516 Protective services workers	915 Messengers, porters, doorkeepers and related workers
522 Shop, stall and market salespersons and demonstrators	92 Agricultural, fishery and related laborers (all subgroups)
711 Miners, shotfirers, stone cutters and carvers	93 Laborers in mining, construction, manufacturing and transport (all subgroups)
81 Stationary plant and related operators (all subgroups)	
82 Machine operators and assemblers (all subgroups)	
831 Locomotive engine drivers and related workers	
916 Garbage collectors and related laborers	
010 Armed forces	

A.6 Robustness: Single Transition Subsample

In this section, we rerun our empirical models with a restricted sample that features individuals who transition into self-employment only once during our period of observation, resulting in N=859 single transitions. This robustness exercise ensures that the effects we find are not driven by individuals who transition into self-employment multiple times. The estimation results remain qualitatively unchanged, but several parameter estimates slightly increase in absolute value.

Table 20: Model Summary

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Age	0.04	0.04	0.04	0.04	0.07	0.10	−0.07
	(0.05)	(0.05)	(0.05)	(0.06)	(0.09)	(0.13)	(0.10)
Age^2	−0.0002	−0.0002	−0.0002	−0.0002	−0.0004	−0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education completed (years)	0.13	0.21	0.13	0.16	0.11	0.05	0.14
	(0.03)***	(0.07)***	(0.02)***	(0.03)***	(0.04)**	(0.08)	(0.05)***
Female	−0.53	−0.53	−0.54	−0.55			
	(0.14)***	(0.14)***	(0.14)***	(0.15)***			
LMS	−1.22	−1.21	−1.64	−1.37		0.24	
	(0.29)***	(0.29)***	(0.71)**	(0.34)***		(0.74)	
Household net income (log)	0.32	0.33	0.32	0.40	0.10	0.35	0.12
	(0.11)***	(0.11)***	(0.11)***	(0.13)***	(0.15)	(0.26)	(0.17)
Migration background	0.30	0.31	0.29	0.47	−0.21	0.05	−0.38
	(0.14)**	(0.14)**	(0.14)**	(0.17)***	(0.26)	(0.39)	(0.33)
Net wealth > 700K	1.03	1.04	1.03	0.93	1.53	2.76	1.34
	(0.19)***	(0.19)***	(0.19)***	(0.22)***	(0.45)***	(0.65)***	(0.63)**
Number of children					0.01	0.22	0.14
					(0.10)	(0.15)	(0.12)
Parents self-employed	0.65	0.65	0.65	0.82			
	(0.14)***	(0.14)***	(0.14)***	(0.17)***			
Self-employed voluntary					1.21	1.33	1.33
					(0.32)***	(0.48)***	(0.45)***
Tenure at last employer (years)	−0.16	−0.16	−0.16	−0.14	0.01	−0.07	0.02
	(0.02)***	(0.02)***	(0.02)***	(0.02)***	(0.02)	(0.03)**	(0.02)
Willingness to take on risk	0.21	0.42	0.18	0.12	0.16	0.26	0.11
	(0.03)***	(0.15)***	(0.06)***	(0.03)***	(0.06)***	(0.09)***	(0.06)*
Interaction risk:education		−0.02					
		(0.01)					
Interaction risk:LMS			0.08				
			(0.12)				
Constant	−22.53	−23.67	−22.28	−23.73	−7.34	−7.64	−4.99
	(1.33)***	(1.67)***	(1.42)***	(1.61)***	(2.09)***	(3.46)**	(2.49)**
Fixed Effects	Year+Sector	Year+Sector	Year+Sector	Year+Sector	Year+Sector	Year+Sector	Year+Sector
Number of transitions into S	859	859	859	634	299	187	166
Observations	136,622	136,622	136,622	95,423	1,406	724	964
Log Likelihood	−3,858.72	−3,856.11	−3,858.10	−2,739.33	−561.95	−259.79	−330.45
Akaike Inf. Crit.	7,843.44	7,840.21	7,844.20	5,604.65	1,243.91	637.58	770.90
pseudo R^2	0.1584	0.1589	0.1585	0.1676	0.2129	0.2535	0.3052

Note: *p<0.1; **p<0.05; ***p<0.01

All models use the sample with individuals who transition into self-employment exactly once during our period of observation. Model 1-4: Transitions from employment (E) to self-employment (S), Model 5-7: Transitions from unemployment (U) to self-employment (S). Models 1-3 and 5-6 use the time-average of an individual's willingness to take on risk. Models 4 and 7 use the willingness to take on risk *prior* to the transition. LMS denotes labor market success.

Table 21: Average Marginal Effects

	Model 1: E-S Transition	Model 5: U-S Transition
Age	0.0002	0.0092
	(0.0003)	(0.012)
Age^2	-0.0000001	−0.0001
	(0.000001)	(0.0001)
Education completed (years)	0.0008	0.015
	(0.0001)***	(0.006)**
Female	−0.0031	
	(0.0008)***	
LMS	−0.0058	
	(0.0016)***	
Household net income (log)	0.0018	0.0142
	(0.0006)***	(0.0205)
Migration background	0.0017	−0.0296
	(0.0008)**	(0.0361)
Net wealth > 700K	0.0059	0.2127
	(0.0011)***	(0.0614)***
Number of children		0.0014
		(0.0143)
Parents self-employed	0.0037	
	(0.0008)***	
Self-employed voluntary		0.1684
		(0.0437)***
Tenure at last employer (years)	−0.0009	0.0018
	(0.0001)***	(0.003)
Willingness to take on risk	0.0012	0.0229
	(0.0002)***	(0.008)***

Note: *p<0.1; **p<0.05; ***p<0.01
Notes: All models use only individuals who transition into self-employment exactly once during our period of observation. Model 1 includes individuals who transitioned from employment into self-employment. Model 5 includes individuals who transitioned from unemployment into self-employment. LMS denotes labor market success.

A.7 Model

A.7.1 Parameters

Worker Productivity

$$\pi_y = \begin{pmatrix} 0.9235 & 0.075 & 0.0015 \\ 0.0375 & 0.925 & 0.0375 \\ 0.0015 & 0.075 & 0.9235 \end{pmatrix}$$

$$y = \begin{pmatrix} 0.3556 & 0.668 & 1.253 \end{pmatrix}$$

The grid points are normalized such that the average productivity in the economy is one.

Mapping CRRA Parameter The transformation of the ordinal willingness to take on risk to the CRRA parameter follows Dohmen et al. (2011). The transformation includes four steps:

1. Utilize a lottery question in the SOEP where individuals were presented with the following hypothetical scenario. They receive €100,000 now they have the opportunity to participate in a lottery in which with equal probabilities they either lose half their investment or double it. How much would they like to invest?

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 following formula

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

A.8 Distribution of Risk Aversion

Figure 15: Distribution of Risk Aversion

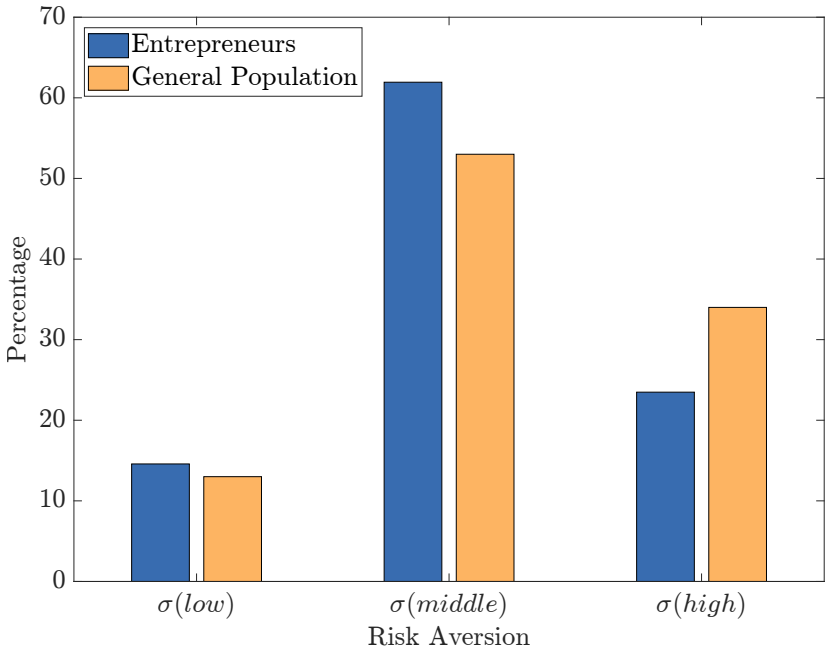


Figure 15 highlights a central implication of our quantitative model regarding the role of individual risk preferences in occupational choice. Compared to the general population, risk-tolerant agents are more likely to be found among entrepreneurs, reflecting the fact that self-employment inherently involves greater income uncertainty. Similarly, agents with moderate risk aversion are also overrepresented among entrepreneurs, while those who are highly risk-averse are underrepresented, as they are more reluctant to accept the financial risks associated with entrepreneurship. This model prediction is consistent with the empirical evidence documented in Section 4 that individuals exhibiting lower risk aversion are more inclined to pursue self-employment than others.

A.9 Occupational Choice by Type

Figure 16 illustrates occupational choices across the asset-productivity space for entrepreneurs with different levels of risk aversion. The three panels show the distribution of workers and entrepreneurs for the low, middle, and high risk aversion groups in our benchmark model. Individuals with low risk aversion never enter self-employment, while those with middle and high risk aversion do, but at different asset thresholds and productivity levels.

The figure also overlays occupational choices from two alternative scenarios with homogeneous risk aversion: Case 1 with high risk aversion ($\sigma = 6.49$) and Case 2 with low risk aversion ($\sigma = 2$). In Case 2, individuals transition into self-employment at very low asset levels, even earlier than the low-risk-aversion group in the benchmark model. In contrast, in Case 1, entry into self-employment occurs at higher asset levels than for the benchmark's middle-risk-aversion group.

Figure 16: Occupational Choice by Risk Aversion Type and Asset Level: Benchmark vs. Homogeneous Risk Aversion