Declining Hours Worked Among Entrepreneurs

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Abstract

I document a substantially stronger decline in working hours of entrepreneurs than for workers in the US. Weekly hours decreased by 3.8 hours more than for workers in the last 35 years. This number already adjusts for compositional changes and the decline is not driven by specific sub-groups of gender, age, education, number of children, occupation or industry. At the same time, the share of entrepreneurs dropped and the hourly income of entrepreneurs relative to workers stayed unchanged. I use these observations to discipline a Roy model of occupational choice with an intensive margin of labor supply and an earnings function that is non-linear in hours. I estimate the model at two points in time and find that the curvature of the earnings function for entrepreneurs is key in explaining the drop in hours together with a drop in the share of entrepreneurs.

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1 Introduction

There is evidence suggesting that the US saw a decline in common measures of business dynamism in recent decades. Firm entry and exit rates have trended down, fewer young firms account for job creation and the share of entrepreneurs in the labor force has decreased (e.g. Decker et al., 2014, 2016). This has caused some concern among policymakers and researchers alike. However, a concluding consensus on the nature of these trends has yet to be formed.

I contribute a new perspective on the slowing business dynamism and document a decline in working hours among entrepreneurs in the US and Germany. The average entrepreneur in the US worked about 45 hours in 1989, while entrepreneurs in 2022 worked slightly less than 40 hours. At the same time, the hours of workers in paid employment fluctuated around 40 hours and declined by less than one hour during the same period. This fact is surprisingly robust and after accounting for compositional changes in terms of gender, age, education, number of children, occupation and industry, reduces the decline in hours only to 3.8 hours relative to workers over the last 35 years. The declining trend is not only statistically significant, but also economically significant if one compares this to the long-run development of market hours over the last 150 years (see Boppart and Krusell, 2020).

This paper will adopt a simple definition of an entrepreneur that can be consistently applied in several surveys over a long period of time and between countries. I define an entrepreneur as any individual reporting to work for themselves as opposed to for a private company, the public sector or a non-profit organization. This wide definition includes a diverse group of self-employed individuals with and without employees and of different forms of incorporation. However, robustness analyses indicate a broad-based decline that likely also includes those entrepreneurs who are given a prominent role for business dynamism. This raises the question whether and how this phenomenon is connected to the declining share of entrepreneurs in the labor force.

To connect the decline in working hours with the slowing business dynamism, the paper documents two more facts about entrepreneurs and uses these facts to discipline a model of occupational choice that can shed more light on the underlying mechanism. Apart from the decline in working hours of entrepreneurs, the second fact this paper establishes is that the fall in the share of entrepreneurs is only visible for individuals working more than 45 hours and hence, the decline in working hours comes from the top of the distribution of hours. The third fact this paper documents is an almost stable hourly income of entrepreneurs relative to workers during this period, which casts doubt on an income effect as the underlying mechanism for the decline in hours.

The exploration of possible mechanisms starts with a simple model of labor supply. The simple model highlights, that an income effect requires a counterfactually large increase in the hourly wage. Furthermore, the model allows the returns to an additional hour of work to depend on the level of hours. This means that the model permits the possibility that high returns to an additional hour of work are only realized when working many hours. I show that changes in the earnings schedule and in particular the curvature with respect to hours can potentially be promising in matching the development of hours

and income of entrepreneurs. However, the simple model does not make any predictions about the share of entrepreneurs.

The simple model is then developed further into a quantitative model that allows for an occupational choice between being a worker and an entrepreneur, such that the decline in the share of entrepreneurs can be used as an additional restriction on the mechanism behind the decline in hours. I estimate the model at two points in time and target key moments on the hours of workers and entrepreneurs, the share of entrepreneurs and their income relative to workers.

The estimation of the quantitative model identifies the shape of the entrepreneurial earnings function to be the most important mechanism that can jointly explain the decline in the hours of entrepreneurs and their share in the labor force. More specifically, the estimation suggests that the returns to working many hours substantially decreased for entrepreneurs, while it stayed unchanged for workers. This can explain 56 % of the observed decline in hours and 53 % of the fall in the share of entrepreneurs. However, one remaining question is what could have changed the returns to working many hours.

In order to attach more economic meaning to the change in the shape of the entrepreneurial earnings function and in particular its curvature with respect to hours, I show that this can be connected to the demand elasticity that entrepreneurs face for their goods or services. Starting from a simple inelastic demand function, I connect the curvature of the entrepreneurial earnings function with their demand elasticity. In this framework, a decrease in the demand elasticity decreases the returns to working many hours. I find that the estimated earnings elasticity is quantitatively in line with changes in the demand elasticity coming from markup estimations in e.g. De Loecker et al. (2020).

Contribution to the literature. This paper contributes to several strands of the literature. First, the paper speaks to the literature on the slowing business dynamism. Among one of the first papers to document a decline in firm entry and exit rates was Haltiwanger et al. (2011). This was further documented in Decker et al. (2014) and Decker et al. (2016). Since then, a series of attempts have been made to find a cause for the slowing business dynamism. Examples of related papers are Karahan et al. (2019) and Hopenhayn et al. (2022), who propose a theory that links the slowing business dynamism with the aging of the population, Kozeniauskas (2022) and Salgado (2020) and Jiang and Sohail (2023), who propose theories that skill-biased technical change can account for this, and Akcigit and Ates (2023), who combine the observation on rising market concentration with the slowing business dynamism in a unified framework. This paper contributes another, yet unexplored, observation on the slowing business dynamism by documenting a decline in the hours worked among entrepreneurs. It also connects the hours with the share of entrepreneurs in a model of occupational choice and points to a mechanism that can explain both at the same time.

Second, the empirical analysis of the paper also contributes to papers documenting a general decline in market hours in developed countries. In particular, I add to the observations of, for example, Aguiar and Hurst (2007, 2016) and Boppart and Krusell (2020) by documenting that the decline in aggregate market hours per worker is to a large extent driven by entrepreneurs. More closely related are Yurdagul (2017) and

Wellschmied and Yurdagul (2021), who document the level of hours of entrepreneurs but do not document the evolution over time. To the best of my knowledge, this paper is the first to document a decline in the hours among entrepreneurs. Moreover, I also show that this decline in hours of entrepreneurs is also visible in Germany. Thus, I believe that this paper provides valuable insights into the labor supply of entrepreneurs over time, that can inform macroeconomic models on entrepreneurship with such an intensive margin choice. For example, the models used in Yurdagul (2017), Allub and Erosa (2019) and Wellschmied and Yurdagul (2021).

Third, this paper identifies a mechanism that crucially relies on a non-linear relationship between earnings and hours to explain the decline in hours and the drop in the share of entrepreneurs at the same time. The literature on non-linear earnings and its effects on labor supply has a long history and examples of early papers on this topic are Rosen (1976) and Moffitt (1984). More recently this topic received further attention by French (2005), Prescott et al. (2009), Rogerson (2011), Goldin (2014) and Bick et al. (2022). I contribute to this long strand of literature by providing further evidence for non-linear earnings functions for both workers and entrepreneurs. In addition, I also provide estimates of these earnings elasticities and how they have changed over time.

Fourth and finally, the quantitative model used in the estimation is closely related to a recent series of papers that use an occupational choice model in the spirit of Roy (1951) with an intensive margin of labor supply. In particular, the papers Erosa et al. (2022a,b) and Erosa et al. (2023) estimate a similar occupational choice model with a focus on workers only. The main innovation in this paper is that I am the first to estimate such models over time and apply them to the context of entrepreneurship.

The paper proceeds as follows. Section 2 describes the data used and Section 3 documents the empirical facts about the declining hours, the fall in the share of entrepreneurs and the income development of entrepreneurs and workers over time. I then introduce a simple static model of labor supply and derive some predictions for different potential causes in Section 4.1. Section 4.2 develops the simple model into a quantitative model with an occupational choice, estimates this model at two periods and evaluates the estimated parameter changes. Section 5 concludes.

2 Data

The main data source used in this paper is the Current Population Survey (CPS). This survey is administered by the US Census Bureau and is also used to compute the official unemployment statistics of the US. The design of the survey is the following. Each sampled household is interviewed for four consecutive months and after a break of eight months again for the same four months of the following calendar year. There is a set of questions in the basic monthly interview that is asked every month and that includes the question on hours worked. In the fourth interview of each block, a sub-sample of households is asked more questions about their wage and income. This survey is called the outgoing rotation group (ORG). Unfortunately, the sub-sample of households is chosen based on the class of worker and this results in the fact that the entrepreneurs in my definition are not included in the ORG. However, in March every year, the survey con-

tains additional questions on several topics, including income in the previous year, which is called the Annual Social and Economic Supplement (ASEC). The questions in this supplement were also asked of entrepreneurs and data on income for both entrepreneurs and workers in this paper is taken from there. All data from the CPS is extracted using IPUMS-CPS (see Flood et al., 2022).

To classify respondents as workers or entrepreneurs, I use the question on the class of worker (CLASSWKR). This question is contained in the basic monthly interview and thereby available each month, including the March supplement. I classify respondents as entrepreneurs if they report "working for self". That includes unincorporated as well as incorporated self-employed individuals.[1] This classification is the same as applied in Jiang and Sohail (2023), who also use the CPS. However, the distinction between incorporated and unincorporated self-employed individuals can only be made after 1983.

The hours worked are measured using the question on actual hours worked on all jobs including overtime in the week before the interview (AHRSWORKT). There are also other questions on usual hours worked and hours worked on other jobs than the main job. These questions are contained in the basic monthly interview from 1989 onward. The March supplement already contained questions on actual hours worked, usual hours worked and weeks worked since 1968. However, up until 1983, the incorporated self-employed individuals were included in the class of workers.

Data on income is taken from the March supplement (ASEC). As mentioned above, self-employed respondents are not included in the earner-study of the ORG (interview month four and eight), which is usually the preferred way to measure wages (see Bick et al., 2022). In order to measure income consistently for workers and entrepreneurs I take data on income exclusively from the ASEC. More specifically, I use data on total personal income (INCTOT) that includes income from all sources including capital income. I define earned income as income coming from wages (INCWAGE), business (INCBUS) or farm income (INCFARM). I use this to calculate unearned income by simply deducting earned income from total personal income. All nominal variables are deflated using the CPI to obtain real income. Information on federal and state tax liability does not come from direct questioning of respondents but are simulation outputs of the Census Bureau's tax model.

I apply standard sample restrictions and only include individuals in the labor force who are between 22 and 60 years old. I further exclude unpaid family members who might be working for the family business or farm. The final sample consists of around 700,000 observations per year, of which 80,000 observations are on entrepreneurs. This large sample allows me to analyze differences in hours worked among many detailed subgroups, which cannot be done in any other survey containing data on hours worked. I apply some additional sample restrictions for data from the CPS ASEC to obtain a less noisy measure of income. In particular, I restrict the sample to individuals with at least 350 annual hours of work and who have an hourly earned income that is above half the CPI-adjusted federal minimum wage. Since the March supplement is only asked

[1]The precise question text in the survey is the following: "(Were/Was) (name/you) employed by government, by a private company, a nonprofit organization, or (was/were) (you/he/she) self -(or working in the family business?)?" The respondent is then asked follow-up questions about the incorporation status of the business.

in March every year, the resulting sample size of the ASEC sample is around 50,000 observations with about 5,000 of them on entrepreneurs. In all analyses of the basic monthly interview I use the final CPS sample weights (WTFINL) and in all analyses of the ASEC, I use the ASEC sample weights (ASECWT).

Table 1: Summary statistics of basic characteristics for workers and entrepreneurs over two periods of time.

Period	**1989-1993**		**2015-2019**	
Worker / **E**ntrepreneur	**W**	**E**	**W**	**E**
Share female (in %)	46.9	30.3	47.9	36.1
Age	37.5	41.7	40.2	44.6
Years of education	13.2	13.6	14.1	14.0
Share living with partner (in %)	67.3	77.8	67.7	74.5
Number of children	1.00	1.16	0.93	1.10
Share of the labor force (in %)	88.9	11.0	90.9	9.1

Notes: Data from the CPS basic monthly interview.

Table 1 shows summary statistics of workers and entrepreneurs and how they changed between two sub-periods, which are chosen to reflect the two periods of focus in the quantitative analysis of the second half of the paper. We can see that workers and entrepreneurs are broadly similar in some characteristics, but differ in a few respects. First, We can see a much higher share of women among workers than among entrepreneurs. Second, entrepreneurs are on average four years older and this difference has changed relatively little over time. Further, they have a very similar education but tend to cohabit slightly more and have slightly more children. The last line highlights a significant change in the share of entrepreneurs in the labor force between the two periods.

As a robustness analysis, I also document that the same decline is visible in other US surveys that ask about hours worked: the Survey of Consumer Finances (SCF) and the Panel Study of Income Dynamics (PSID). Furthermore, I also use the Socio-Economic Panel (SOEP), a German longitudinal survey starting in 1984, to confirm that the declining trend is also visible in Germany. In all of these surveys, I attempt to keep the definition of entrepreneurs and the sample restrictions as close as possible to the procedure described above for the CPS.

3 Empirical Facts

This section documents three main facts about entrepreneurs. The first fact is the decline in hours worked. I document that hours worked for entrepreneurs started from a much higher level, but then steadily declined until it reached a similar level as for workers. I measure the decline in hours relative to workers in a regression framework that allows me to keep the composition fixed over time and conclude that compositional changes cannot account for the decline in hours. I then decompose the average decline into components from different sub-groups along the following dimensions: gender, age,

education, number of children, occupation, industry and status of incorporation. This exercise shows that the decline is broad-based and, except for a few small occupation and industry groups, visible in all sub-groups. The second fact I document is a fall in the share of entrepreneurs in the labor force during the same time period. I corroborate results from other papers (e.g. Decker et al., 2016) and show that the decline in the share of entrepreneurs is primarily associated with the top of the hours' distribution. The third fact I document is that the difference in the hourly income of entrepreneurs to workers in this period was stable. However, I also show that there was a significant fall in the income of entrepreneurs, coming from the fact that entrepreneurs reduced their hours worked.

3.1 Hours

First, I will use actual weekly hours worked on all jobs including overtime from the basic monthly interview to document the evolution of working hours for entrepreneurs and workers. In all analyses, I compute average hours conditional on observing positive working hours. This takes out extensive margin variation in hours worked due to e.g. unemployment spells, vacation or sick leave that are not the focus of this analysis.

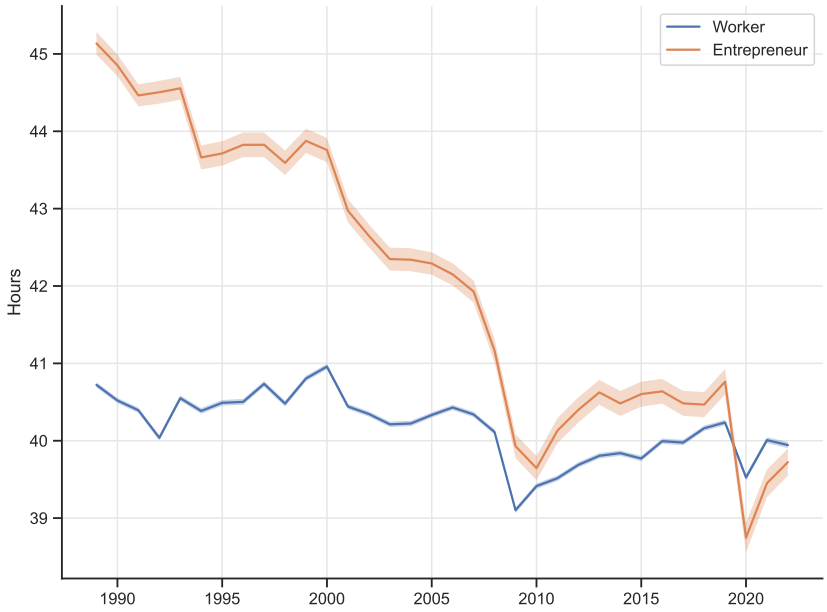


Figure 1: Average weekly hours worked of workers and entrepreneurs.

Notes: Data from the CPS basic monthly interview. The average hours are conditional on working positive hours. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

Figure 1 shows the hours worked by workers and entrepreneurs and highlights the strong decline in working hours of entrepreneurs over the last 35 years. In 1989, entrepreneurs worked about 45 hours on average and this number decreased to under 40 in 2022. The hours of workers have remained relatively stable during this period and only exhibit a small decline of less than one hour between 1989 and 2022. Figure 15 in Appendix A shows that the same trend can also be observed in German in the SOEP. Apart from

some minor level differences between the two surveys, the picture is very similar and the slope of the difference is very similar. In both cases, the hours of entrepreneurs decreased by around 5 hours.

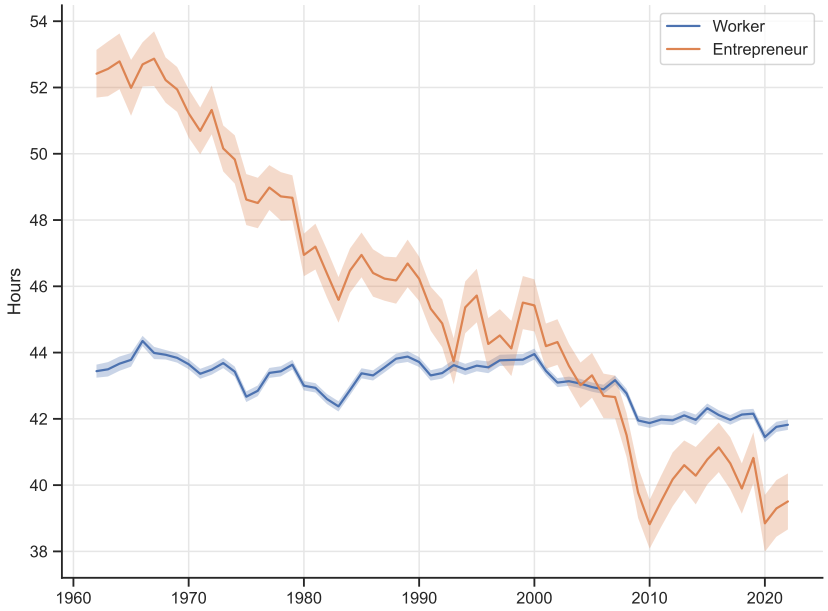


Figure 2: Average weekly hours worked of male workers (including incorporated self-employed) and unincorporated self-employed men.

Notes: Data from the March supplement (CPS ASEC). The average hours are conditional on working positive hours. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

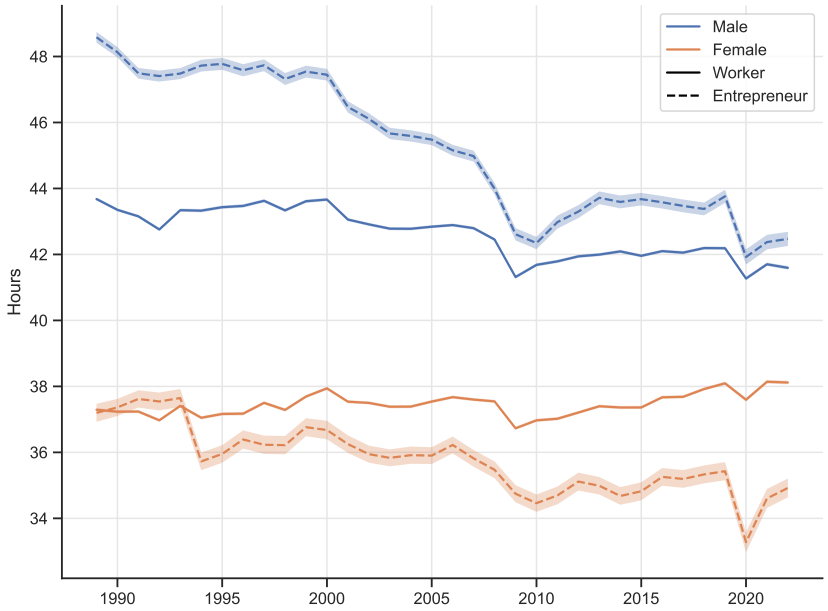


Figure 3: Average weekly hours worked by gender.

Notes: Data from the CPS basic monthly interview. The average hours are conditional on working positive hours. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

The March supplement allows us to go slightly further back in time, but does not allow us to separate the incorporated self-employed from the workers. Figure 2 shows that this declining trend has already started in the late 1960s for at least the unincorporated self-employed males. The fact that this trend is strongly visible among males only, indicates that the decline is not driven by a higher share of female entrepreneurs, who work a few hours less on average.

In fact, Figure 3 confirms that the decline is even visible among women. Although female entrepreneurs work very similar hours compared to female workers in 1989, they too reduced their working hours. However, part of the increase in the difference among females is coming from a slight increase in the hours of female workers.

Table 2: Average annual decline in hours worked.

Dependent Variable:	Weekly Hours				
Model:	(1)	(2)	(3)	(4)	(5)
Entr	4.370***	2.880***	2.179***		
	(0.0501)	(0.0484)	(0.0485)		
t × Entr	-0.1477***	-0.1279***	-0.1097***	-0.1009***	-0.1112***
	(0.0027)	(0.0026)	(0.0026)	(0.0026)	(0.0026)
Year	Yes	Yes	Yes	Yes	Yes
Year-Gender		Yes	Yes	Yes	Yes
Year-Age		Yes	Yes	Yes	Yes
Year-Education		Yes	Yes	Yes	Yes
Year-Children		Yes	Yes	Yes	Yes
Year-Occ.			Yes	Yes	Yes
Year-Ind.			Yes	Yes	Yes
Entr-Gender				Yes	Yes
Entr-Age				Yes	Yes
Entr-Education				Yes	Yes
Entr-Children				Yes	Yes
Entr-Occupation					Yes
Entr-Industry					Yes
Entr-Incorporated					Yes
Observations	19,305,283	19,305,283	19,305,283	19,305,283	19,305,283
R^2	0.006	0.071	0.102	0.105	0.113

Clustered (individual) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Data from the CPS basic monthly interview. "Entr" denotes entrepreneur. Age codes 3-year age bins. Education codes 5 different educational attainment groups ranging from "less than high-school" to "more than Bachelor". Occupation (Occ.) codes 25 occupation groups and industry (Ind.) codes 9 industry groups. "t" is coded as years since 1989.

In order to formerly decompose the decline in the difference of the hours between workers and entrepreneurs by sub-groups, I first run a fixed-effects regression that takes out flexible time trends for different sub-groups by: gender, age, education, number of children, occupation group, industry group and incorporation status, that are common to both entrepreneurs and workers. However, taking out different time trends by sub-groups does not account for the fact that entrepreneurs in these different sub-groups might have different *levels* of hours worked and a change in the composition of male entrepreneurs

towards more female entrepreneurs could thereby create a decline in the average hours worked among entrepreneurs. In order to keep the composition fixed, we can add different means for entrepreneurs in the different sub-groups. The last column of Table 2 does exactly this and reports that weekly hours worked within each sub-group has declined by around 0.1112 hours. We can now decompose this coefficient and report the decline separately by the different sub-groups.

Let us first start with a decomposition by basic characteristics. Figure 4 shows how the slope coefficient varies along different dimension (e.g. gender or education). The average decline estimated in Table 2 is depicted with the dashed vertical line. Note that the horizontal axis has negative numbers and thus a marker further to the left indicates a stronger decline. The figure reveals that we can detect a significant decline among all sub-groups and that it is stronger among males and individuals with more children. Appendix A contains more figures that decompose the slope coefficient along age (Figure 19), occupation groups (Figure 20) and industry groups (Figure 21). They all confirm that this decline is broad-based along all age-groups, 23 out of 25 occupation groups (four insignificant) and all twelve industry groups (one being insignificant).

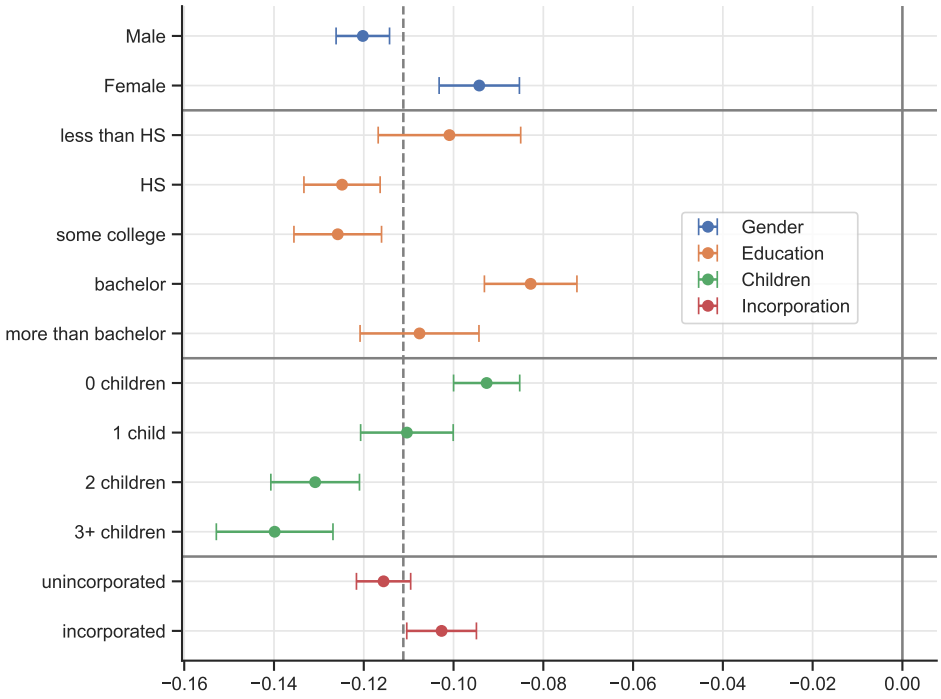


Figure 4: Decomposition of the decline in average weekly hours worked of entrepreneurs relative to workers by basic characteristics.

Notes: Data from the CPS basic monthly interview. Whiskers indicate 95 % confidence intervals.

In order to see where in the hours distribution the decline of the weekly hours comes from, we can look at the changes of the composition of weekly hours by nine hours bins in Figure 5. Not surprisingly, the hours distribution of workers is very concentrated at 36-40 hours and this concentration has slightly increased over time mainly due to the fact that it became more common for women to work full time. Generally, the distribution of hours among entrepreneurs is less concentrated and one can clearly see that they work

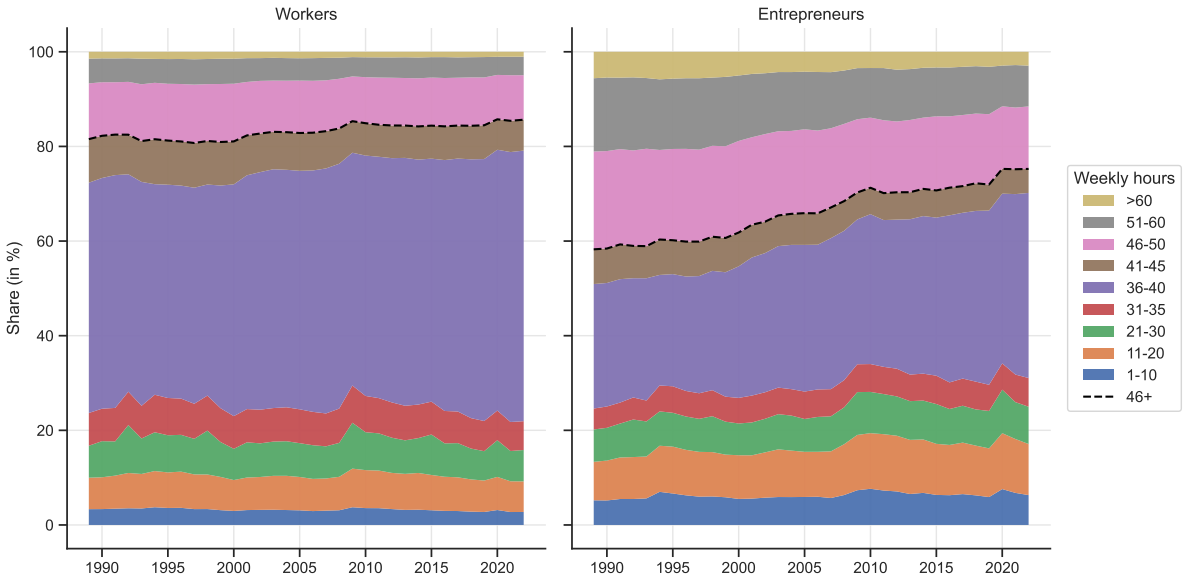


Figure 5: The distribution of hours over time for workers and entrepreneurs.

Notes: Data from the CPS basic monthly interview.

longer hours in the beginning of my sample. Looking at the shifts in the composition of the hours distribution reveals that the decline in the average weekly hours comes primarily from the top of the hours distribution. The share of entrepreneurs that work more than 40 hours declines from around 50 percent to around 30 percent. Most of this shift seems to be absorbed by the 36-40 hours bin, while also the share of entrepreneurs working 35 hours or less has increased slightly. Figure 22 in Appendix A shows the distribution of hours for men only. Apart from a level shift of all hour bins, the main conclusion that the drop in hours comes from the top of the distribution is unchanged.

One remaining question is how the decline in weekly hours transmits to annual hours, which consequentially also affects annual income measure below. I will answer this by decomposing annual hours worked into weeks worked and usual hours per week. Unfortunately, the basic monthly interview does not provide us with data on weeks worked in the previous year. This variable is only available in the March supplement. Therefore, I will resort to the CPS ASEC for this decomposition exercise.

Since annual hours are the product of weeks worked and usual hours per week, we can straightforwardly decompose the log of annual hours into the sum of the log of weeks worked and the log of usual hours. Figure 6 plots the difference of each logged series from 1988.[2] The green line corresponds to the usual hours worked and is the closest equivalent to the analysis using actual hours worked from above. Again, we see a similar picture as described above. Usual hours of workers are relatively flat, while there is a clearly visible downward trend for entrepreneurs. Furthermore, we see that the series for weeks worked depicted by the orange line, is fairly stable for entrepreneurs and exhibits a slight upward trend for workers. The sum of the series for weeks worked and usual hours worked add up to the series for annual hours worked shown in blue. While annual hours follow the

[2]Figure 23 plots the annual hours of workers and entrepreneurs in levels and shows a very similar picture as for weekly hours in Figure 1.

Figure 6: Decomposition of the annual hours into the weeks worked and usual hours per week.

Notes: Data from the CPS ASEC. All lines measure the difference of the respective series from 1988 in logs.

trend of weeks worked very closely for workers, annual hours of entrepreneurs follow the trend of usual hours more closely. Thus, we conclude that the decline in weekly hours also translates into a decline in annual hours for entrepreneurs.

Furthermore, Appendix A contains several robustness analyses. First, it shows that the decline in hours of entrepreneurs is also visible in other surveys in the US (see Figure 16 for the SCF and Figure 17 for the PSID). The panel dimension of the PSID also allows us to control for individual fixed effects and Figure 18 confirms that the decline holds regardless of that. Then, it shows that the decline is not driven by individuals holding other jobs, as Figure 24 and Figure 25 illustrate. Another concern could be a shift of hours within the household. However, Figure 26 plots the total hours of couples and shows the same declining trend. Figure 27 provides additional analyses in this direction, by plotting the hours of singles and cohabitating individuals by gender. The March supplement introduced a question about the firm size in 1992, which can be used to plot the weekly hours for entrepreneurs with more or less than ten employees. Surprisingly, apart from a level difference, we do not find a difference in the slope of the decline. Finally, the PSID and the SOEP contain data on business net-wealth and household net-wealth, respectively. Figure 29 shows weekly hours by the wealth quartiles. Although the estimates are less precise, the declining trend can be seen in all quartiles.

3.2 Share of Entrepreneurs

Next, I document a decrease in the share of entrepreneurs within the labor force, alongside the decline in hours. Again, I will use data from the CPS basic monthly interview. Several papers have pointed at a slowing business dynamism, e.g. Decker et al. (2014,

2016), Salgado (2020) and Jiang and Sohail (2023), that had a decline in the share of entrepreneurs as a consequence. I corroborate these findings and show that this also holds for the sample in the CPS and the specific definition of entrepreneur that I adopt in this paper. Given that the decline in the share of entrepreneurs is already a known and well-documented fact, the analysis in this section focuses on the fall in the share of entrepreneurs by the level of hours worked.

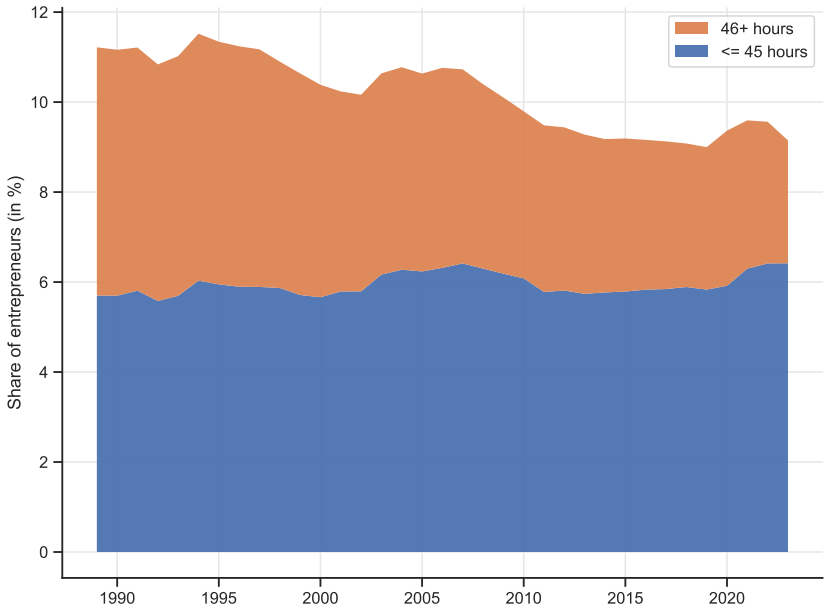


Figure 7: The share of entrepreneurs split by the number of hours.

Notes: Data from the CPS basic monthly interview.

First, Figure 7 shows that the share of entrepreneurs in the labor force was 11 % in 1989 and declined to 9 % in 2022. A number close to what other papers found as well (e.g. Jiang and Sohail (2023)). The figure also shows the decline in the share of entrepreneurs for entrepreneurs working up to 45 hours and more than 45 hours. The figure highlights the fact that the decrease in the share of entrepreneurs comes from entrepreneurs working many hours.

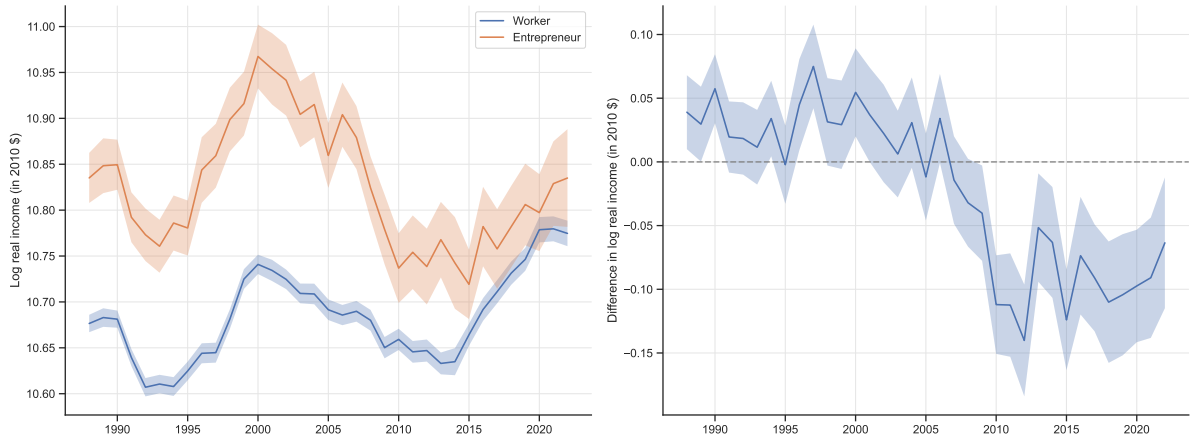
Appendix A contains further plots on the share of entrepreneurs with more detailed information and other splits of the data. Figure 30 shows the evolution of the share of entrepreneurs by gender over the same period and highlights that the decline is mainly driven by men. Furthermore, Figure 31 shows the occupational mix of entrepreneurs over time. Unsurprisingly, about a quarter of entrepreneurs have an occupation within management in business, science and arts. Figure 32 shows the industry composition and that the biggest industries these entrepreneurs operate in is construction, retail trade, business and repair services as well as professional and related services.

3.3 Income

In standard models of labor supply, the decision of how many hours of work to supply is tightly linked to the wage or other sources of income. A substantial increase in the

income of entrepreneurs could potentially be able to explain why their hours have trended downwards. This motivates a closer look at whether there are differential trends in income for workers and entrepreneurs.

Income for entrepreneurs is only observed in the March supplement and thus the entire analysis on income is based on the CPS ASEC. Since several other mechanisms might have affected the income development of women and the decline in hours worked is even stronger among men, the analysis in this section will only focus on men. Further, I restrict the sample to individuals who reported to have worked at least 350 hours (about 2 months of full-time employment) in the previous year. I then calculate the wage as total earned income (income from wages, business or farm) divided by total annual hours and exclude everyone that has a wage of half the CPI-adjusted federal minimum wage.



(a) Log real income **(b)** Difference with fixed effects removed

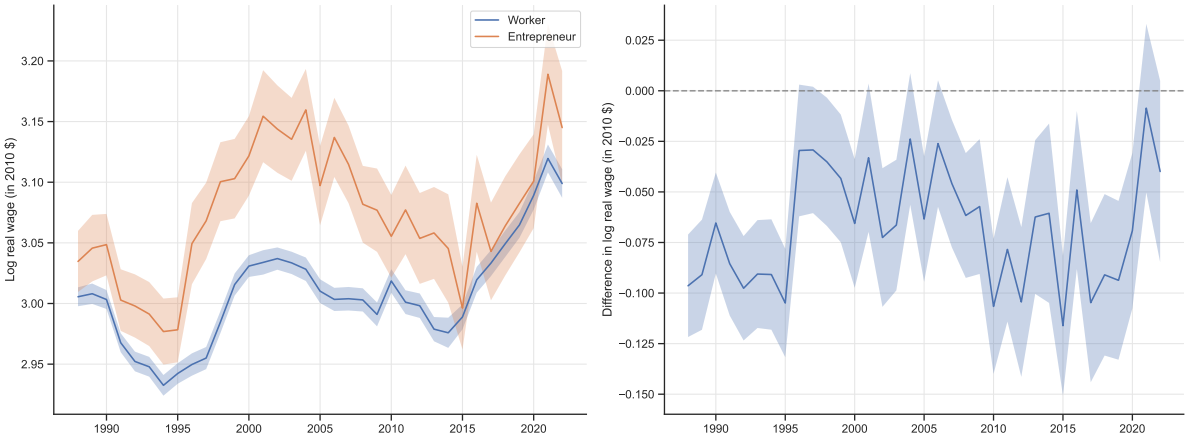
Figure 8: Development of log real income for workers and entrepreneurs and the difference in income from a regression with fixed effects.

Notes: Data from the CPS ASEC. Sample includes only men. Shaded areas indicate 95 % confidence intervals. Fixed effects in (b) include: year x (age, education, number of children, 25 occupation group, 12 industry groups, state).

Figure 8 shows that entrepreneurs about 20 log points higher income than workers in the beginning of the sample. However, this gap has disappeared almost entirely by 2020. Panel (b) of Figure 8 shows the log difference in income between entrepreneurs and workers after accounting for some demographic fixed effects. Interestingly, the fixed effects can already account for all of the initial income gap and this suggests that there was actually a gap *opening* up in the income between entrepreneurs and workers. Figure 33 shows income for workers and entrepreneurs working more or less than 45 hours separately and highlights two facts. First, income for both workers and entrepreneurs working more than 45 hours is significantly higher, suggesting a strong positive correlation between income and hours. Second, it also highlights that the income of entrepreneurs and workers working more than 45 hours has been very similar. This already suggests that the decline in the average income of entrepreneurs comes from their declining hours.

Turning our attention to the development of hourly income, we can see in Figure 9 that wages of entrepreneurs and workers have evolved fairly similarly.[3] Again, the differ-

[3]The fairly big jump in the difference of the wage in 1996 in panel (b) of Figure 9 partly comes



(a) Log real wage **(b)** Difference with fixed effects removed

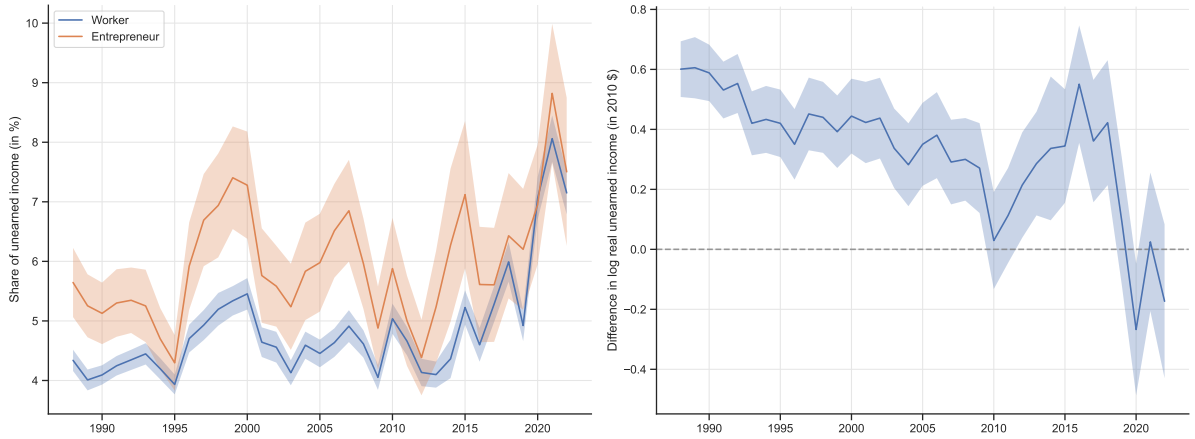
Figure 9: Development of log real wages for workers and entrepreneurs and the difference in wage from a regression with fixed effects.

Notes: Data from the CPS ASEC. Sample includes only men. Shaded areas indicate 95 % confidence intervals. Fixed effects in (b) include: year x (age, education, number of children, 25 occupation group, 12 industry groups, state).

ence between entrepreneurs and workers becomes negative, when controlling for fixed effects. This corroborates findings from previous research (see e.g. Hamilton, 2000 and Moskowitz and Vissing-Jørgensen, 2002), which found that entrepreneurs seem to be motivated by more than just financial returns. Figure 34 in Appendix A shows the log real wage for everyone working more and less than 45 hours. In contrast to income, the real wage is much less positively correlated. Interestingly, the wage for workers seems to be higher if they work more than 45 hours, but the opposite is true for entrepreneurs.

As the simple model in the next section shows, an increase in unearned income will unambiguously decrease the optimal hours choice. Therefore, I now turn to the role of unearned income and how its share has changed for workers and entrepreneurs. As Figure 10 shows, unearned income is only a small fraction and accounts for about 5-6 % of total personal income. Most important, however, is the change of its share over time, which has declined relative to workers. Thus, a simple model of labor supply would predict that the decline in the relative share should increase the relative hours supplied by entrepreneurs. The opposite of what we observe in the data.

from the redesign of the CPS questionnaire that captured income sources in more detail and led to an increase in the income of entrepreneurs in my sample. Thus, the data before 1996 should be interpreted with some caution.



(a) Share of unearned income **(b)** Difference in log unearned income

Figure 10: Share of unearned income for workers and entrepreneurs.

Notes: Data from the CPS ASEC. Sample includes males with at least 350 annual hours and an implied hourly income of more than half the federal minimum wage. Shaded areas indicate 95 % confidence intervals.

To summarise, looking at the difference in total income between workers and entrepreneurs seems to suggest that the total income of entrepreneurs relative to workers decreased over the same time as hours declined. The hourly income of entrepreneurs relative to workers was therefore very stable over this period. We also noted that unearned income is only a small fraction of total income and shows a similar trend for both workers and entrepreneurs. This already hints at the fact that an income effect might not be the cause of the decline in hours for entrepreneurs. The next section develops a model to investigate the cause of this decline further.

4 Model

This section first introduces a simple model of labor supply to highlight that several forces can lead to a decrease in hours and then develops this model further into a quantitative model with an occupational choice. Importantly, I do not restrict the earnings function to be linear in hours. The simple model shows that the increase in the hourly income that is required to cause a decline in hours similar to the decline in the data, by far exceeds the observed increase in the wage of entrepreneurs relative to workers. It further shows that a change in the curvature of the earnings function can potentially be quite powerful.

I then develop a quantitative model of occupational choice in the spirit of Roy (1951) adapted to workers and entrepreneurs. The two occupations are allowed to differ in the profile of their earnings function, similar to Erosa et al. (2023). I estimate the model at two points in time and let the model suggest, which parameters must have changed in order to be consistent with the empirical observations on the hours of the two occupations, the share of entrepreneurs and their hourly income relative to workers. I find that the single most powerful parameter that can explain the decline in hours of

entrepreneurs and the fall in the share of entrepreneurs is the curvature of the earnings function.

4.1 A Simple Model of Labor Supply

In what follows I will describe a simple static model that purposefully abstracts from dynamic considerations. The reason for this is the fact that the decline in hours among entrepreneurs is happening relatively steadily over a longer period of time. This suggests that short-run fluctuations are less informative in identifying the cause of this long-run trend. In addition, the simple model also highlights the basic mechanisms that could lead to a decline in hours.

The model features an agent that has utility over consumption and dis-utility from labor. More specifically, I will assume MaCurdy (1981) preferences with the functional form:

$$u(c,h) = \frac{c^{1-\sigma}-1}{1-\sigma} - \varphi \frac{h^{1+\frac{1}{\theta}}}{1+\frac{1}{\theta}}. \tag{1}$$

Hours can freely be chosen, but they potentially differ in the shape of their earnings function. In particular, I will assume that both workers and entrepreneurs have an earnings function of the following form:

$$E(z,h) = zh^{\eta}. \tag{2}$$

For workers that are being paid an hourly wage, this earnings function is typically assumed to be linear in hours, i.e. the earnings elasticity $\eta = 1$ and the productivity z is given by the wage rate. For entrepreneurs or also for salaried workers, it is less obvious, whether this earnings function is linear in hours. Erosa et al. (2023), for example, highlights that there might be substantial differences in hours worked between occupations of workers, that stem from differences in the earnings elasticity of the particular occupation.

Thus, we can write the utility maximization problem of both workers and entrepreneurs in the following way:

$$\max_{c,h} \; u(c,h) \quad \text{s.t.:} \; \begin{aligned} c &= E(z,h) + y \\ h &\geq 0, c \geq 0 \end{aligned} \tag{3}$$

where consumption is the sum of earnings $E(z,h)$ and unearned income y that could be anything from unemployment benefits for part of the year to capital income and dividends. Solving this problem gives us a labor-supply condition that implicitly defines optimal hours:

$$h = \left(\frac{[E(z,h)+y]^{-\sigma}}{\varphi} \frac{\partial E(z,h)}{\partial h} \right)^{\theta} = \left(\frac{[zh^{\eta}+y]^{-\sigma}}{\varphi} \eta \frac{zh^{\eta}}{h} \right)^{\theta}. \tag{4}$$

Assuming no unearned income, i.e. $y = 0$, we get a closed form expression for hours:

$$h = \left(\frac{\eta z^{1-\sigma}}{\varphi} \right)^{\frac{\theta}{1+\theta-\eta(1-\sigma)\theta}} \tag{5}$$

and average hourly income is then given by:

$$\bar{w} = z \left(\frac{\eta z^{1-\sigma}}{\varphi} \right)^{\frac{\theta(\eta-1)}{1+\theta-\eta(1-\sigma)\theta}} . \tag{6}$$

What is directly visible in these two equations is that under standard parameters with $\sigma > 1$ and $\theta \approx 0.5$ a drop in z leads to a drop in hourly income $\bar{w}$, but it *increases* the optimal hours choice. Hence, changes in productivity move hours and average hourly income in opposite directions. If an increase in productivity or z, was the cause of the decline in hours, we would need to observe an increase in the general hourly income of entrepreneurs. This is in contrast to the data, where we see a rather flat development or even a decrease of around 5 % in hourly income.

How much does the hourly income have to increase in order to generate a drop in hours of around 7.5 % relative to workers as seen in the data?[4] The answer to this question first and foremost depends on whether the income effect (IE) dominates the substitution effect (SE). If the income effect dominates, we need an increase in the wage in order to generate a drop in hours. If, however, the substitution effect dominates, we require a drop in the wage. Figure 11 illustrates the change in $\bar{w}$ necessary to generate a drop in hours h of 7.6 %. First, in the case of no unearned income $y = 0$, the income effect always dominates the substitution effect and we have that only an increase in hourly income of around 35 % can generate a drop in hours of 7.6 %. To see this, note that we can divide the hours of the latter period h' with the hours of the first period h using equation 5 to get an expression that defines the change in z necessary for a drop in hours of 7.6 %. We can use this to calculate the necessary drop in $\bar{w}$:

$$1 - 0.076 = \frac{h'}{h} = \left(\frac{z'}{z} \right)^{\frac{\theta(1-\sigma)}{1+\theta-\eta(1-\sigma)\theta}} \iff \frac{z'}{z} = \left(\frac{h'}{h} \right)^{\frac{1+\theta-\eta(1-\sigma)\theta}{\theta(1-\sigma)}} \tag{7}$$

$$\frac{\bar{w}'}{\bar{w}} = \frac{z'}{z} \left(\frac{h'}{h} \right)^{\eta-1} = \left(\frac{h'}{h} \right)^{\frac{1+\sigma\theta}{\theta(1-\sigma)}} = 1.354 \tag{8}$$

Note that this increase in $\bar{w}$ is independent of the parameter η as it drops out of the calculations. This is certainly a sizable increase and far away from what we see in the survey data.[5] Second, if there is some unearned income $y > 0$, then the increase in hourly income has to be even larger.

[4] The decrease of 7.5 % is measured for men between the two periods used later in the quantitative model as well: 1989–1993 and 2015–2019.

[5] This corresponds to about a 1 p.p. higher growth rate of productivity for entrepreneurs relative to workers. However, it is not implausible if we think that entrepreneurs can also invest in sweat capital as in Bhandari and McGrattan (2021) and eventually sell their business to a high value.

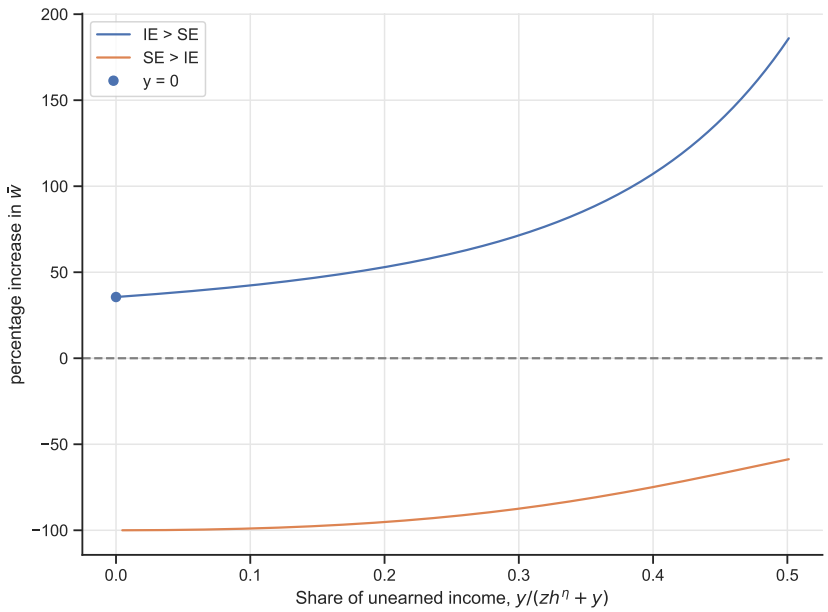


Figure 11: Changes in $\bar{w}$ necessary to generate a 7.6 % drop in hours by different levels of unearned income.

Notes: Value for other parameters: $\theta = 0.54, \varphi = 1, \sigma = 2, z = 1$.

Inspecting the labor supply condition in closed form in (5) and (6) reveals that both the preference parameter φ and the earnings elasticity η could lead to a drop in hours and a drop in average hourly income at the same time. To illustrate this, we can ask how much either η or $1/\varphi$ has to be in order to generate a drop of 7.6 % in hours of entrepreneurs. Figure 12 shows the change in percent of either only changing η or only changing $1/\varphi$. The initial values of both η and φ are fixed to 1.5.[6] The percentage change of the respective parameter is on the horizontal axis and percentage changes in hours (left panel) or percentage changes in hourly income (right panel) are on the vertical axis. We can see that a decrease of η (while keeping φ fixed) by about 27 % decreases hours by exactly 7.6 % as observed in the data. Turning to a change in φ only, we see that also a decrease of $1/\varphi$ by about 29 % can generate the same decline in hours.

However and importantly, the implications for the hourly wage is a different one, which helps us distinguish a change from η from a change in φ. While a change of η only decreases hourly income by 0.8 %, a decrease in φ has a much stronger decline of 3.9 % as a consequence. The estimation of the quantitative model in the next section will use this key insight to distinguish the drop in hours from a change in η and a change in φ.

[6] If η was fixed to an initial level that is below one, then a decrease in η would lead to a decrease in hours, but to an increase in the hourly wage. This is contrary to what we observe in the data and therefore I focus on the case where $\eta > 1$.

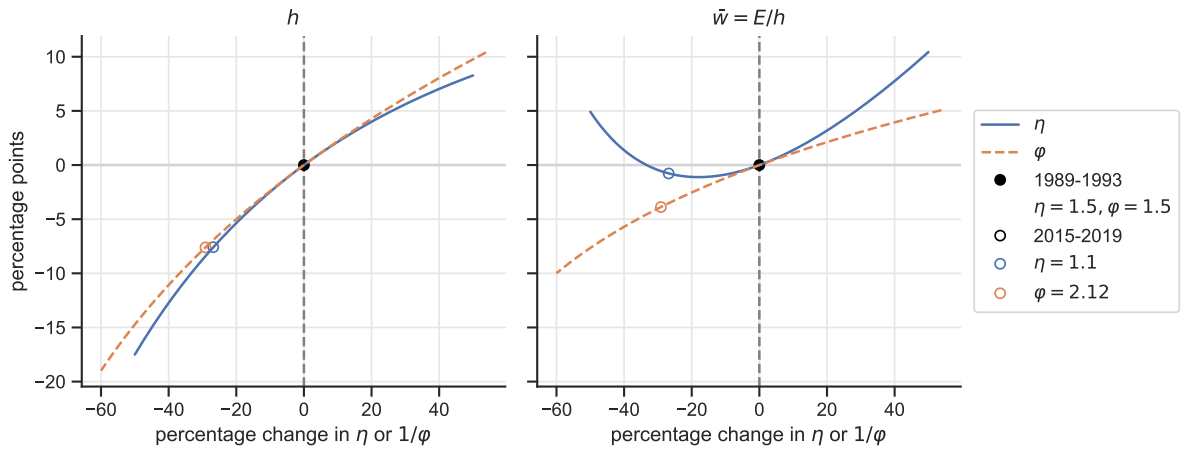


Figure 12: Changes in η necessary to generate a 10 % drop in hours for two different values of σ.

Notes: Value for other parameters: $\sigma = 2, \theta = 0.54, z = 1, y = 0$.

4.2 A Quantitative Model of Occupational Choice

The simple model above highlighted that a change in the curvature of the earnings function holds promise in explaining the decline in hours without a substantial change in the hourly income. However, another salient feature of the data is the drop in the share of entrepreneurs. This is useful information that we can use to identify the mechanism behind the decline in hours of entrepreneurs. The simple model cannot make predictions for the share of entrepreneurs, since it does not allow individuals to make an occupational choice. This section advances the simple model and introduces an occupational choice between being a worker and an entrepreneur.

The quantitative model is set in a static environment without any inter-temporal choices made by the agents, but I will estimate the model at two points in time. Again, the assumption of a static environment seems to be reasonable against the background of the long-run steady decline in the working hours of entrepreneurs. The estimation of the model will target three key moments. First, the level of average working hours for workers and entrepreneurs. Second, the share of entrepreneurs and third, the average difference in wages between workers and entrepreneurs. These key moments will then identify which parameters in the model need to be adjusted to match the change over time. A more detailed description of the model follows.

The economy is populated by a unit mass of agents indexed by i who maximize utility. Each agent chooses to be either a worker or an entrepreneur. The two occupations are indexed by $j \in \{w, e\}$ and differ in the shape of their earnings function. Agents differ in their productivity as worker z_{iw}, in their productivity as entrepreneur z_{ie}, in their taste for work φ_i and in the non-pecuniary benefits ε_i that they receive as an entrepreneur. The inclusion of non-pecuniary benefits is motivated by the fact that many entrepreneurs seem to have a lower real wage than comparable workers as shown in Section 3.3. Additionally, each agent also chooses how many hours to work. Since this is a static model, agents directly consume all their earnings and do not face a

consumption-savings choice. Since there was little change in unearned income between workers and entrepreneurs as shown in Figure 10 of Section 3.3, I also abstract from unearned income. The maximization problem can be formulated in two stages.

In the first stage, agents draw a vector of their four states $(z_{iw}, z_{ie}, \varphi_i, \varepsilon_i)$ and choose how many hours to work, conditional on the choice of the occupation. More specifically, they solve the following utility-maximization problem:

$$V_{ij} = \max_{c_{ij}, h_{ij}} u_i(c_{ij}, h_{ij}) + \varepsilon_i \mathbb{1}_{[j=e]} \quad \text{s.t.:} \quad \begin{aligned} c_{ij} &= e_{ij} \\ h_{ij} &\geq 0, c_{ij} \geq 0. \end{aligned} \tag{9}$$

The utility function $u_i(c_{ij}, h_{ij}) = \frac{c_{ij}^{1-\sigma}-1}{1-\sigma} - \varphi_i \frac{h_{ij}^{1+\frac{1}{\theta}}}{1+\frac{1}{\theta}}$ is individual-specific since the taste for work φ_i is allowed to be different for individuals, but otherwise is the same as in the simple model. Consumption is directly given by earnings, reflecting the assumption of no unearned income and no consumption-savings decision. Importantly, the earnings function is given by:

$$e_{ij} \equiv E_j(z_{ij}, h_{ij}) = z_{ij} h_{ij}^{\eta_j}. \tag{10}$$

Note that the earnings function differs between the two occupations only in the curvature with respect to hours η_j. As shown by Heckman and Honoré (1990), without any parametric assumptions on the distributions, from which individuals draw their idiosyncratic states, Roy models of this form can match any cross-sectional distribution of hours and wages. Therefore, I will assume that all idiosyncratic states are drawn from independent distributions. The productivity states for the two occupations are drawn from two independent log-normal distributions and z_{ij} has a mean of μ_z^j and standard deviation of σ_z^j. Further, the taste for work, which is assumed to be the same for the two occupations, is also drawn from a log-normal distribution and the resulting mean and standard deviation of φ_i is given by μ_φ and σ_φ, respectively. Finally, the value for the non-pecuniary benefits as an entrepreneur ε_i is drawn from a normal distribution with mean $\mu_\varepsilon = 0$ and standard deviation σ_ε.

In the second stage, agents compare the value they would obtain in each occupation and choose the one that gives them a higher value. I abstract from the measure zero individuals who are indifferent between the two occupations. What matters most, which occupations agents choose depends first and foremost on their relative productivity between the two occupations z_{ie}/z_{iw}. If an agent has a comparative advantage as an entrepreneur, the likelihood of this agent choosing to be an entrepreneur is higher. The decision is also influenced by the other two idiosyncratic states. The taste for work φ_i also plays an important role as the optimal hours for each occupation potentially differ. This follows from the fact that the earnings functions and in particular their curvature η_j are different for the two occupations. Although, the non-pecuniary benefits from entrepreneurship ε_i influence the occupational choice, it does in fact not enter the decision problem of how many hours to work, conditional on the choice of the occupation.

4.3 Estimation Strategy

This section outlines the estimation strategy to estimate the quantitative model of occupational choice described in the previous section. The estimation is performed on an

early period (1989–1993) and a later period (2015–2019). It describes which parameters are fixed and which parameters are estimated and are allowed to vary between the two estimation periods 1989–1993 and 2015–2019. Further, it explains which moments are targeted, how they are measured in the data and how they map to the model. Conceptually, the strategy will be to normalize the model to the first period (1989–1993) and measure the respective moments in the data always relative to that period by using weights that adjust the composition in the second period to the composition in the first period. Thus all data moments should be interpreted as moments with the 1989–1993 composition of workers and entrepreneurs.

First, I fix some parameters to standard values. The coefficient of relative risk aversion of the utility function with respect to consumption is fixed to $\sigma = 2$. The parameter that controls the Frisch elasticity of labor supply in dynamic models, θ, is taken from Chetty et al. (2011) and fixed to 0.54. The mean of the productivity distribution for workers μ_z^w is normalized to be one in the first period, but is allowed to vary in the second period. Alternatively, I could have chosen the mean of the taste for work μ_φ as a normalization.

This leaves us with eight parameters to be estimated in the first period and nine parameters to be estimated in the second period. The two parameters of the highest interest are η_e and η_w, the two curvature parameters of the earnings function for each occupation. Then, there are two parameters for the taste of work, the mean μ_φ and standard deviation σ_φ of the distribution of φ_i. Further, we have the parameters associated with the distributions of the idiosyncratic productivity for each occupation. The two means μ_z^j and the two standard deviations σ_z^j. However, since we have used $\mu_z^w = 1$ as a normalization in the first period, we only have three parameters associated with the productivity distributions to be estimated in the first period. Finally, the last parameter to be estimated is the standard deviation of the non-pecuniary benefits σ_ε.

These eight parameters are estimated by matching eight model moments for each period and one moment that ensures a consistent normalization between the two periods. The eight model moments for each period are the following. First and foremost, the log of mean hours for entrepreneurs and workers. Then, the share of entrepreneurs and the mean difference in log wages between entrepreneurs and workers. I further use the share of entrepreneurs and workers working more than 45 hours and eventually the log standard deviation of wages for entrepreneurs and workers. The one moment that links the two periods is the mean of log income for workers. This moment is needed as the level of income in the first period is endogenous and the result of the chosen normalization and the estimated parameters. Therefore, I perform the estimation of the two periods jointly together.

In order to estimate the model, I use a simulated method of moments approach. For each period, I simulate one million agents, solve their labor supply and occupational choice decisions and compute the model moments. When computing these moments in the data, I average over a five-year period to smooth year-specific variation. In order to deal with compositional changes, I first produce composition adjustment weights for the second period (2015–2019) such that it weights the respondents to correspond to the composition in the first period (1989–1993). This reweighting is performed for the usual dimensions of age, education, number of children, occupation and industry used in Section 3.

4.4 Estimation Results

Table 3 reports the estimated parameters for both periods. The first two rows of the table show the earnings elasticity of entrepreneurs and workers. We can see a substantial drop in the elasticity for entrepreneurs η_e, while the elasticity for workers η_w stays almost unchanged. This already indicates that η_e seems to be important to match the data moments, which the decomposition exercise further down confirms. The next two rows show the parameters for the distribution of φ_i. Both parameters show little change over time. Turning to the mean of the productivity distributions from which agents draw their productivity values, we first note that μ_z^e is substantially lower than μ_z^w. However, the reader should note that this is the mean of the underlying theoretical distributions from which agents draw their productivity value. It does not tell us anything about the ex-post realized value of productivity of entrepreneurs after selection. Comparing these values between the two periods, we can see hardly any change for μ_z^e, but a substantial increase in μ_z^w. Even though μ_z^w is fairly unchanged over time, the standard deviation of the entrepreneurial and worker productivity distributions have both increased. Eventually, we also see a slight increase in the standard deviation of the non-pecuniary benefits.

Table 3: Estimated parameters

Parameter	**Value**		**Description**
	1989-1993	2015-2019	
η_e	1.546	1.229	Earnings elasticity of entrepreneurs
η_w	1.181	1.200	Earnings elasticity of workers
μ_φ	0.991	1.014	Mean, disutility of labor, φ_i
σ_φ	0.085	0.107	Std., disutility of labor, φ_i
μ_z^e	0.365	0.378	Mean, entrepreneurial productivity distribution
μ_z^w	1.000	1.199	Mean, worker productivity distribution
$\sigma_{log(z)}^e$	1.251	1.397	Std., entrepreneurial productivity distribution
$\sigma_{log(z)}^w$	0.496	0.583	Std., worker productivity distribution
σ_ε	0.808	0.940	Std., non-pecuniary benefits

Next, we turn to the fit of the model with the data. Table 4 shows the targeted moments for the data and the corresponding values from the estimated model in both periods. Overall, the model does a fairly good job of matching all targeted moments. Looking at the first two rows, we see the mean weekly hours of entrepreneurs and workers. The model cannot perfectly match the hours of entrepreneurs in the first period, but otherwise compares well with the data. However, almost equally important is the share of entrepreneurs and workers working more than 45 hours. There we can see that the model does a good job for both entrepreneurs and workers in the two periods. Given our parametric assumptions on the distributions, it is not surprising that the model cannot perfectly match all moments as the reported hours worked in the data tend to bunch at "round" numbers like 40 or 45 and not reflect a log-normal distribution. Further, the model slightly undershoots the share of entrepreneurs in both periods. The remaining moments are matched almost perfectly.

Table 4: Targeted moments

Moment	I) 1989-1993 Data	I) 1989-1993 Model	II) 2015-2019 Data	II) 2015-2019 Model
Mean hours of entrepreneurs	47.81	45.97	42.80	42.39
Mean hours of workers	43.26	43.03	41.95	41.69
Share of entrepreneurs with 46+ hours (in %)	48.22	50.08	32.98	33.37
Share of workers with 46+ hours (in %)	27.33	27.30	22.14	22.47
Share of entrepreneurs (in %)	14.07	13.36	12.09	11.48
$mean(\log(e_{ie}/h_{ie})) - mean(\log(e_{iw}/h_{iw}))$	0.04	0.04	-0.00	-0.00
$std(\log(e_{ie}/h_{ie}))$	0.66	0.66	0.77	0.77
$std(\log(e_{iw}/h_{iw}))$	0.46	0.46	0.54	0.54
Difference of $mean(log(e_{iw}))$ to first period	–	–	0.13	0.13

Notes: The moments on the mean hours of entrepreneurs and workers were converted from the logarithm of mean hours to mean weekly hours for readability. The actual targeted moments enter in logarithms into the objective function of the estimation to ensure a fair weighting with the other moments that are either expressed in percentage points or logarithms as well.

To see the effect of each parameter, we can perform a decomposition of the parameter changes. To do this, I start from the estimated model in the first period (period I). I then change parameters one after the other and report the mean hours of entrepreneurs, workers and the share of entrepreneurs along the way. Eventually, we end up with the estimated model in period II.

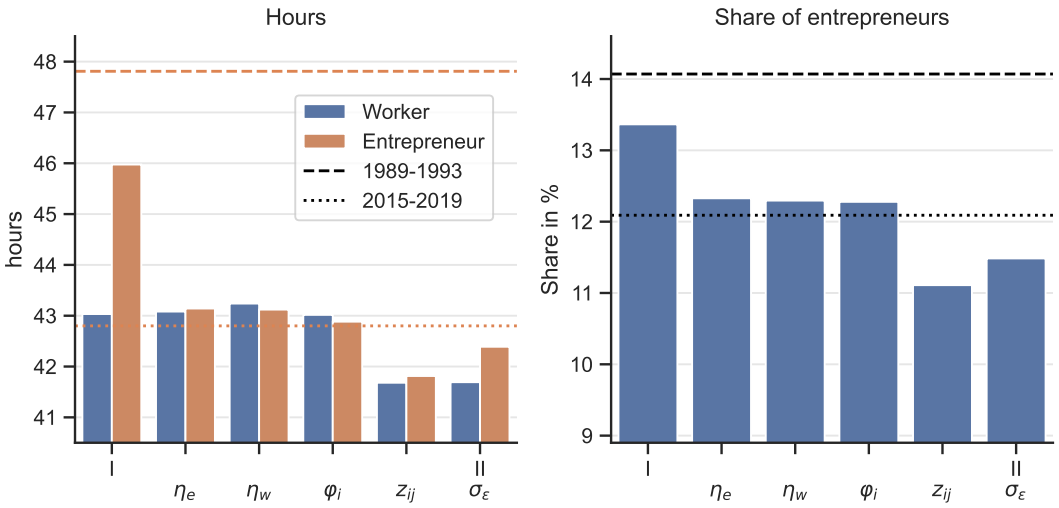


Figure 13: Decomposition of parameter changes.

Figure 13 shows the result of this exercise. The first two bars of the left panel for hours labeled with "I" show the hours from the estimated model in the first period. The dashed and the dotted lines show the data moments for the first and second period. Note that the moments for the hours of workers are not shown. Likewise, the first bar on the right panel shows the share of entrepreneurs from the estimated model in period I. The next group of bars labeled with η_e in the left panel shows the hours of entrepreneurs and

workers when only changing η_e to the value estimated in period II. As we can see, a change in this parameter can reduce the mean hours of entrepreneurs substantially and brings it already very close to the target for period II. In fact, a change in η_e reduces the hours of entrepreneurs by 2.8 hours, which is 56 % of the total decline in average hours observed in the data. Turning to the share of entrepreneurs and the bar labeled with η_e, we can see that a change in η_e has also a substantial drop in the share of entrepreneurs as a consequence. It can explain about 53 % of the overall fall in the share of entrepreneurs in the data. As we now move to the next group of bars labeled with η_w, we not only change η_e to the value of the estimated model in period II, but we additionally change η_w. Since this parameter changes very little between the two periods, the effect on hours and the share of entrepreneurs is negligible. Next, we change the two parameters that are associated with the distribution of φ, the mean μ_φ and the standard deviation σ_φ. Also this parameter changes little between the two parameters and reduces the hours of both workers and entrepreneurs only marginally. Changes in the four parameters that describe the two productivity distributions, labeled with z_{ij}, have a substantially larger effect. Like η_e, it reduces the hours and the share of entrepreneurs. However, an important distinction is that it also lowers the hours of workers and entrepreneurs similarly. Finally, we have the standard deviation of the distribution of non-pecuniary benefits, which increases the hours and the share of entrepreneurs.

Instead of cumulatively changing parameters, we can also evaluate the isolated effect of these parameters. Figure 14 again departs from the model estimated in period I, but then changes one parameter (or group of parameters for the case of φ_i and z_{ij}) at a time. The reader should note that the dashed line now shows the model moments from the first period, which corresponds to the height of the bars labeled with I. The result from this exercise corroborates the findings from the decomposition of the parameter changes. The parameter η_e is very powerful in moving both the hours of entrepreneurs and their share down. While changes in the parameter associated with the productivity distributions are also powerful in moving the share of entrepreneurs, they move the hours of entrepreneurs by far less. Thus, we can conclude that η_e is the single most powerful parameter that can both cause a decline in the hours of entrepreneurs and a fall in their share.

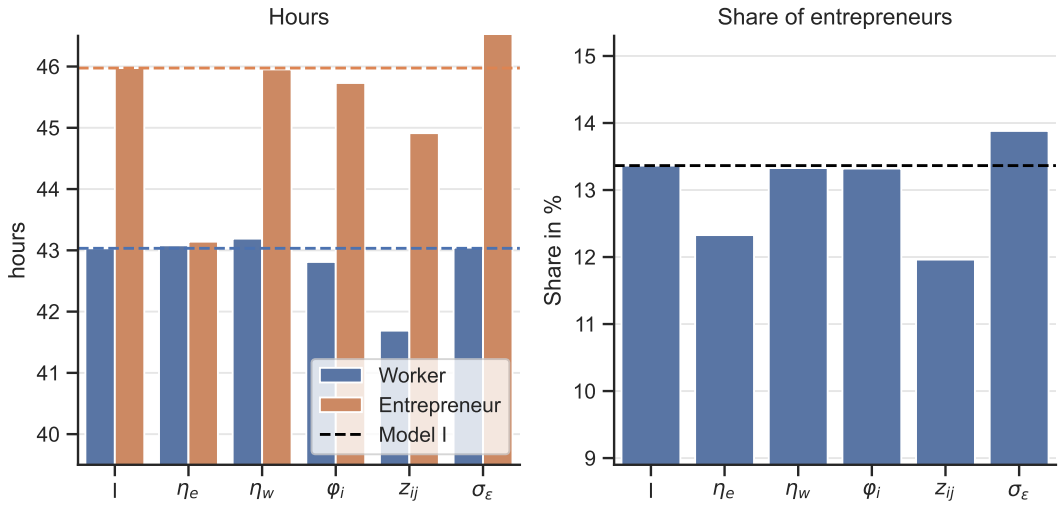


Figure 14: Isolated effect of each parameter or group of parameters.

Since the effect of certain parameters that change very little from one period to the other, mechanically show up as having very little effect, we can also look at the elasticities of these parameters. Figure 35 in Appendix A shows the elasticities of hours and the share of entrepreneurs with respect to a one percent increase in every single parameter. It confirms the conclusion that η_e is the single most important parameter that can move the hours and the share of entrepreneurs. Further, despite the little difference in μ_φ between the two estimated periods, it shows that also this parameter is powerful in moving the hours. However, it moves the hours of workers and entrepreneurs by a similar magnitude and only reduces the share of entrepreneurs marginally.

4.5 Interpreting a Drop in η

One remaining question is how this drop in the earnings elasticity of entrepreneurs can be interpreted. In order to answer this question, I will set up a very simple example, in which an entrepreneur faces an inelastic demand and will argue that a change in the demand elasticity can produce a situation, that makes a decrease in the demand elasticity observably identical to a drop in her earnings elasticity η_e.

Consider an entrepreneur i, who faces an inelastic demand for her goods or services. In particular, let us assume that the demand function is given by the following functional form:

$$q(p_i) = \left(\frac{p_i}{P}\right)^{-\epsilon} Q \qquad \text{or by} \qquad p(q_i) = \left(\frac{q_i}{Q}\right)^{-\frac{1}{\epsilon}} P. \tag{11}$$

Here $-\epsilon$ is the price elasticity of her quantities with respect to an increase in her price p_i. The terms P and Q are aggregate terms, which are fixed in this partial equilibrium analysis.[7] Then, it directly follows that the entrepreneur's total revenues are given by:

$$p(q_i)q_i = Q^{-\frac{1}{\epsilon}} P q_i^{\frac{\epsilon-1}{\epsilon}}. \tag{12}$$

Further, let us also assume that the entrepreneur can produce one unit of output, by working ζ_i hours. Thus, her production function is given by: $q_i(h_i) = \zeta_i h_i$ and we can express her earnings as:

$$e_{ie} = Q^{-\frac{1}{\epsilon}} P \left(\zeta_i h_i\right)^{\frac{\epsilon-1}{\epsilon}} = z_{ie} h_i^{\eta_e}, \tag{13}$$

where I collected terms in $z_{ie} = Q^{-\frac{1}{\epsilon}} P \zeta_i^{\frac{\epsilon-1}{\epsilon}}$ and $\eta_e = \frac{\epsilon-1}{\epsilon}$. A decrease in the elasticity of demand (a decrease in ϵ) could then cause a decline in her earnings elasticity η_e.

We just saw in this simple example that a decrease in the demand elasticity would be able to generate a change in the earnings elasticity η_e measured in the quantitative model. In turn, the interpretation of a decrease in ϵ is that her customers are now less price sensitive, which allows her to raise her markup and lower quantities. One scenario, in which the demand elasticity could change is a change in the market structure. For example, a decrease in competition could lead to a lower price elasticity.

[7] The demand function can be micro-founded assuming consumers have a CES utility function over entrepreneur i's and her competitors' goods.

In the previous section, I estimated a fall of η_e of 20.5 %. We can compare this number with estimates from De Loecker et al. (2020), who estimated a fall of ϵ of 24.8 %. Hence, quantitatively the change in ϵ and η are fairly close, even in this extremely simplified example, and a further exploration of a connection with the demand elasticity or competition looks promising.

5 Conclusion

This paper documents a new fact about the working hours of entrepreneurs in the US and confirms the fact in Germany. It shows a substantial decline of 5.2 weekly hours relative to workers over the last 35 years. At the same time, the hours of workers decreased by less than one weekly hour. After controlling for compositional changes for gender, age, education, 25 occupation groups, 12 industry groups and the number of children, the trend reduces slightly to 3.8 weekly hours over the last 35 years. Further, I show the decline is broad-based and visible in almost all sub-groups, except two small occupation groups. Most of the decline in working hours seems to originate from the top of the hours' distribution. The share of entrepreneurs working more than 45 hours has dropped by around 20 percentage points.

The paper also documents two other salient facts that are important to identify the cause of this decline. The second fact shows that the decline in the share of entrepreneurs comes from entrepreneurs working more than 45 hours and the share of entrepreneurs working up to 45 hours was stable over time. This fact adds to the recent literature on the slowing business dynamism and connects it with the decline in working hours of entrepreneurs. The third fact shows that the hourly income of workers and entrepreneurs during the last 35 years has evolved very similarly and that the income of entrepreneurs proportionally fell with their hours.

Using a simple static labor supply model, I explore several possible mechanisms that could have caused the decline in hours. First, a pure income effect coming from an increase in the productivity of entrepreneurs relative to workers can explain a reduction in the hours of entrepreneurs. However, the simple model shows that under reasonable parameter calibrations, this would imply an increase in the hourly income of about 35 %. A number far away from the empirically observed development of stable hourly income for entrepreneurs relative to workers. The simple model further reveals that a change in the curvature of the earnings function of entrepreneurs holds promise in explaining the decline.

With the insights from the simple model, I then develop a quantitative model of occupational choice in which agents are allowed to choose between being a worker or an entrepreneur. This delivers a prediction for the share of entrepreneurs and the relative income between workers and entrepreneurs that can be used in combination with the data to identify the mechanism behind the decline in hours of entrepreneurs. The estimation of the model in 1989–1993 and in 2015–2019 shows that the curvature of the non-linear earnings function of entrepreneurs is a key parameter that changed substantially over time. The change in this parameter alone can explain 56 % of the decline in hours and 53 % of the fall in the share of entrepreneurs. Further sensitivity analysis

shows that this parameter is the single most important parameter that can explain a drop in the hours and the share of entrepreneurs at the same time.

I propose a possible interpretation for the curvature of the entrepreneurial earnings function and connect it with the price elasticity of demand in a partial equilibrium setup with inelastic demand. This simple example shows that a decrease in the price elasticity, which is consistent with estimates of markups in De Loecker et al. (2020), quantitatively aligns with the decrease in the curvature of the entrepreneurial earnings function. Thus, a change in the market structure of entrepreneurs that led to a decreased price elasticity was identified to be a promising candidate for the decline of hours worked among entrepreneurs. Therefore, it seems promising for future research to investigate this link further.

References

Aguiar, M., & Hurst, E. (2007). Measuring trends in leisure: The allocation of time over five decades. *The quarterly journal of economics*, *122*(3), 969–1006.

Aguiar, M., & Hurst, E. (2016). The Macroeconomics of Time Allocation. In *Handbook of Macroeconomics* (pp. 203–253). Elsevier.

Akcigit, U., & Ates, S. T. (2023). What happened to US business dynamism? *Journal of Political Economy*, *131*(8), 2059–2124.

Allub, L., & Erosa, A. (2019). Financial Frictions, Occupational Choice and Economic Inequality. *Journal of Monetary Economics*, *107*, 63–76.

Bhandari, A., & McGrattan, E. R. (2021). Sweat Equity in US Private Business. *The Quarterly Journal of Economics*, *136*(2), 727–781.

Bick, A., Blandin, A., & Rogerson, R. (2022). Hours and Wages. *The Quarterly Journal of Economics*, *137*(3), 1901–1962.

Boppart, T., & Krusell, P. (2020). Labor Supply in the Past, Present, and Future: A Balanced-Growth Perspective. *Journal of Political Economy*, *128*(1), 118–157.

Chetty, R., Guren, A., Manoli, D., & Weber, A. (2011). Are Micro and Macro Labor Supply Elasticities Consistent? A Review of Evidence on the Intensive and Extensive Margins. *American Economic Review*, *101*(3), 471–75.

De Loecker, J., Eeckhout, J., & Unger, G. (2020). The rise of market power and the macroeconomic implications. *The Quarterly Journal of Economics*, *135*(2), 561–644.

Decker, R., Haltiwanger, J., Jarmin, R., & Miranda, J. (2014). The Role of Entrepreneurship in US Job Creation and Economic Dynamism. *Journal of Economic Perspectives*, *28*(3), 3–24.

Decker, R., Haltiwanger, J., Jarmin, R., & Miranda, J. (2016). Where has all the skewness gone? The decline in high-growth (young) firms in the US. *European Economic Review*, *86*, 4–23.

Erosa, A., Fuster, L., Kambourov, G., & Rogerson, R. (2022a). *Labor Supply and Occupational Choice* (tech. rep.). National Bureau of Economic Research.

Erosa, A., Fuster, L., Kambourov, G., & Rogerson, R. (2022b). Hours, Occupations, and Gender Differences in Labor Market Outcomes. *American Economic Journal: Macroeconomics*, *14*(3), 543–90.

Erosa, A., Fuster, L., Kambourov, G., & Rogerson, R. (2023). *Wage and Earnings Inequality Between and Within Occupations: The Role of Labor Supply* (tech. rep.). National Bureau of Economic Research.

Flood, S., King, M., Rodgers, R., Ruggles, S., Warren, J. R., & Westberry, M. (2022). Integrated Public Use Microdata Series, Current Population Survey: Version 10.0 [dataset]. *Minneapolis, MN: IPUMS, 2022*.

French, E. (2005). The Effects of Health, Wealth, and Wages on Labour Supply and Retirement Behaviour. *The Review of Economic Studies*, *72*(2), 395–427.

Goldin, C. (2014). A grand gender convergence: Its last chapter. *American economic review*, *104*(4), 1091–1119.

Haltiwanger, J., Jarmin, R., & Miranda, J. (2011). Historically large decline in job creation from startup and existing firms in the 2008–2009 recession. *Census Bureau Report*.

Hamilton, B. H. (2000). Does entrepreneurship pay? An empirical analysis of the returns to self-employment. *Journal of Political economy*, *108*(3), 604–631.

Heckman, J. J., & Honoré, B. E. (1990). The empirical content of the Roy model. *Econometrica: Journal of the Econometric Society*, 1121–1149.

Hopenhayn, H., Neira, J., & Singhania, R. (2022). From population growth to firm demographics: Implications for concentration, entrepreneurship and the labor share. *Econometrica*, *90*(4), 1879–1914.

Jiang, H., & Sohail, F. (2023). Skill-biased entrepreneurial decline. *Review of Economic Dynamics*, *48*, 18–44.

Karahan, F., Pugsley, B., & Şahin, A. (2019). *Demographic origins of the startup deficit* (tech. rep.). National Bureau of Economic Research.

Kozeniauskas, N. (2022). What's driving the decline in entrepreneurship. *manuscript*.

MaCurdy, T. E. (1981). An empirical model of labor supply in a life-cycle setting. *Journal of Political Economy*, *89*(6), 1059–1085.

Moffitt, R. (1984). The estimation of a joint wage-hours labor supply model. *Journal of Labor Economics*, *2*(4), 550–566.

Moskowitz, T. J., & Vissing-Jørgensen, A. (2002). The returns to entrepreneurial investment: A private equity premium puzzle? *American Economic Review*, *92*(4), 745–778.

Prescott, E. C., Rogerson, R., & Wallenius, J. (2009). Lifetime aggregate labor supply with endogenous workweek length. *Review of Economic dynamics*, *12*(1), 23–36.

Rogerson, R. (2011). Individual and aggregate labor supply with coordinated working times. *Journal of Money, Credit and Banking*, *43*, 7–37.

Rosen, H. S. (1976). Taxes in a labor supply model with joint wage-hours determination. *Econometrica: Journal of the Econometric Society*, 485–507.

Roy, A. D. (1951). Some thoughts on the distribution of earnings. *Oxford economic papers*, *3*(2), 135–146.

Salgado, S. (2020). Technical Change and Entrepreneurship. *SSRN*.

Wellschmied, F., & Yurdagul, E. (2021). Endogenous hours and the wealth of entrepreneurs. *Review of Economic Dynamics*, *39*, 79–99.

Yurdagul, E. (2017). Production complementarities and flexibility in a model of entrepreneurship. *Journal of Monetary Economics*, *86*, 36–51.

A Additional Figures

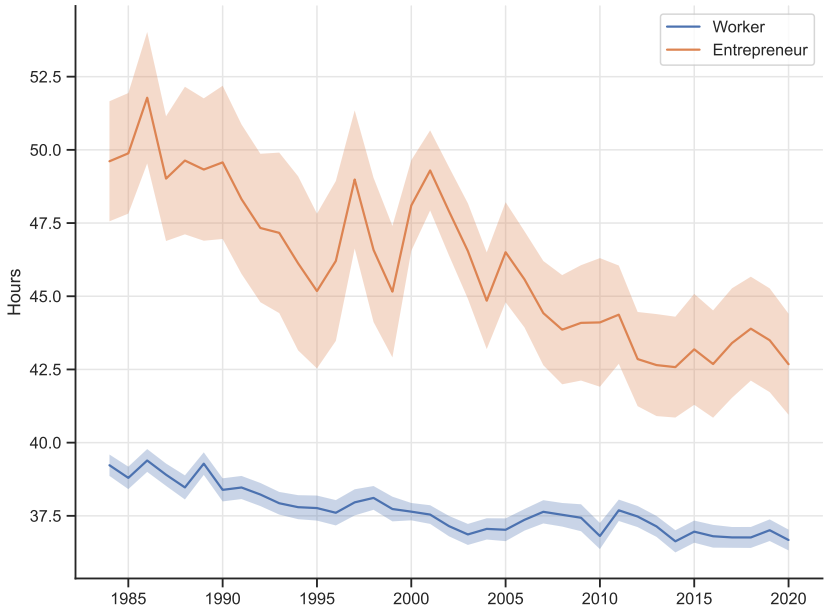


Figure 15: Average weekly hours worked in Germany.

Notes: Data source is the Socio-Economic Panel of Germany. The hours are conditional on working positive hours. Weighted by the SOEP sample weights. Shaded areas indicate 95 % confidence intervals.

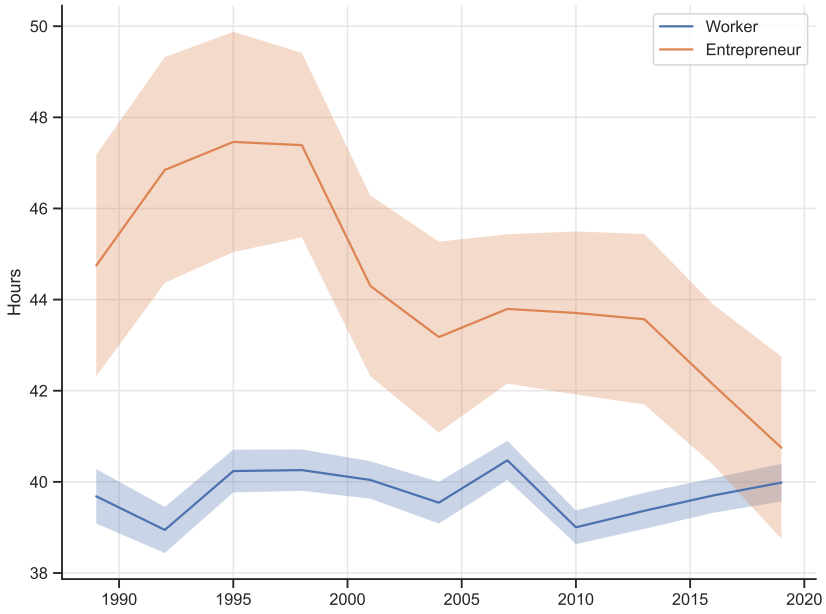


Figure 16: Average weekly hours worked in the US with data from the SCF.

Notes: Data source is the Survey of Consumer Finances (SCF). The hours are conditional on working positive hours. Weighted by the sample weights. Shaded areas indicate 95 % confidence intervals.

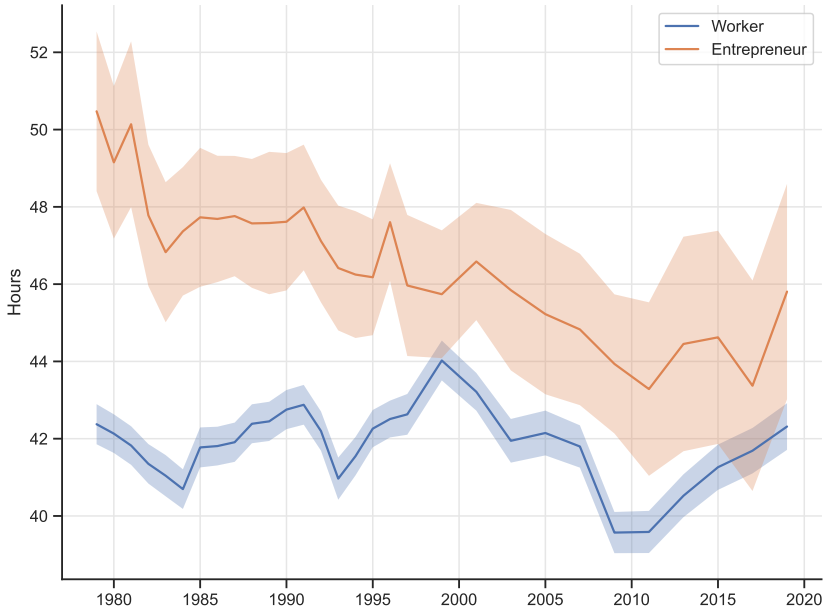


Figure 17: Average weekly hours worked in the US with data from the PSID.

Notes: Data source is the Panel Study of Income Dynamics (PSID). The hours are conditional on working positive hours. Weighted by the PSID sample weights. Shaded areas indicate 95 % confidence intervals.

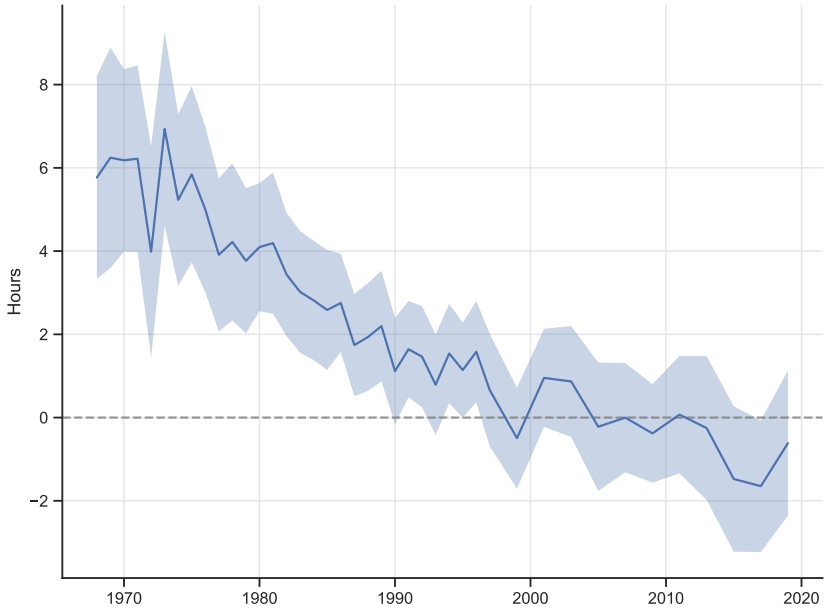


Figure 18: Difference in weekly hours worked between entrepreneurs and workers in the PSID from a regression framework with individual fixed effects.

Notes: Data source is the Panel Study of Income Dynamics (PSID). The hours are conditional on working positive hours. Coefficients are taken from a regression of weekly hours on the interaction of year-dummies with an entrepreneur dummy while absorbing individual and year FEs. Weighted by the PSID sample weights. Shaded areas indicate 95 % confidence intervals.

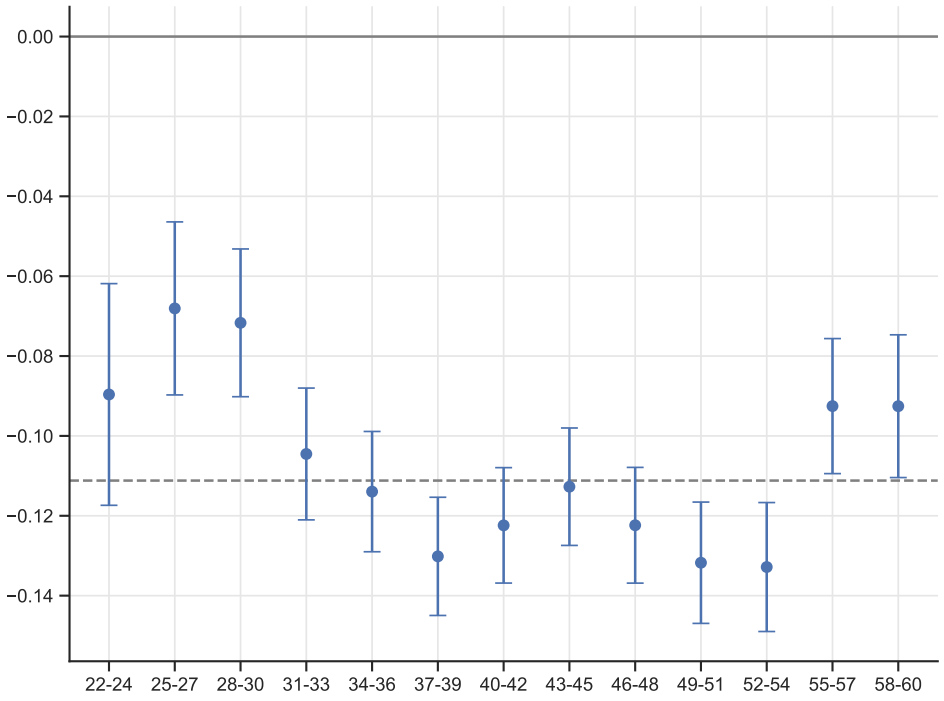


Figure 19: Decomposition of the decline in average weekly hours worked of entrepreneurs relative to workers by age bins.

Notes: Data from the CPS basic monthly interview. Whiskers indicate 95 % confidence intervals.

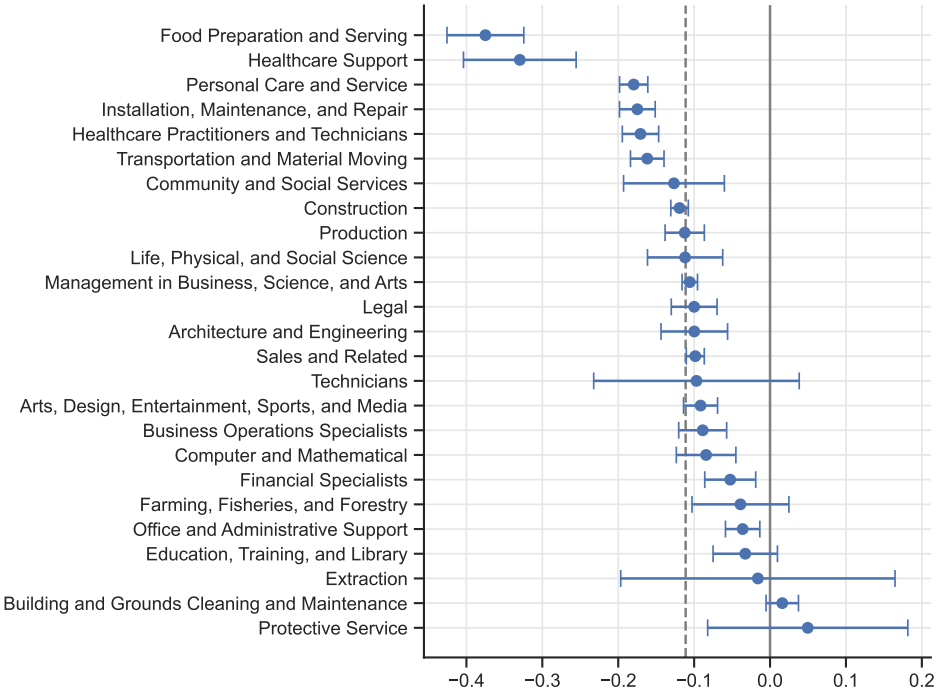


Figure 20: Decomposition of the decline in average weekly hours worked of entrepreneurs relative to workers by occupation groups.

Notes: Data from the CPS basic monthly interview. Whiskers indicate 95 % confidence intervals.

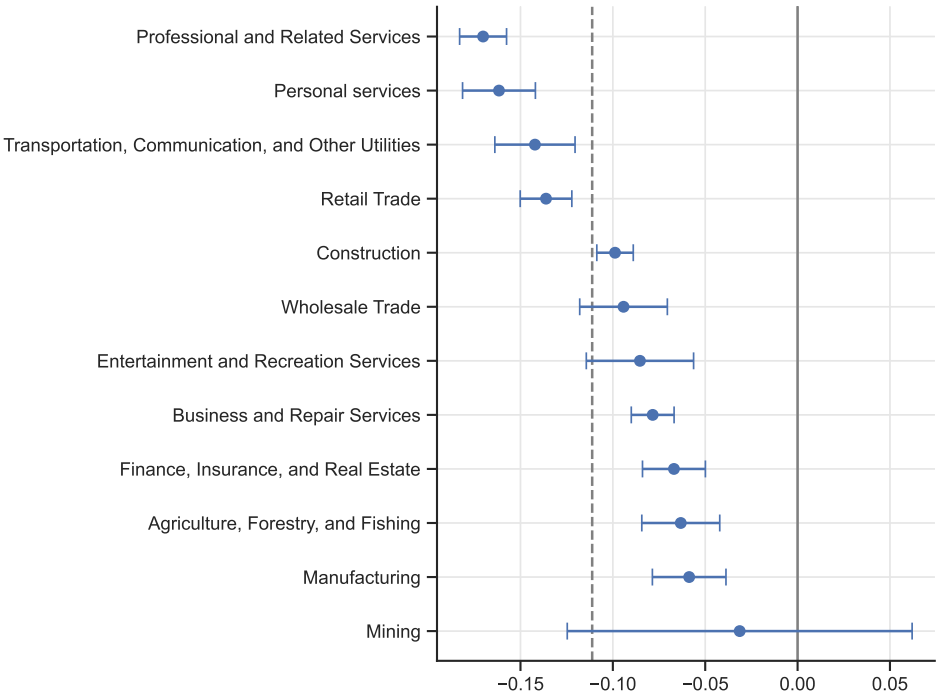


Figure 21: Decomposition of the decline in average weekly hours worked of entrepreneurs relative to workers by industry groups.

Notes: Data from the CPS basic monthly interview. Whiskers indicate 95 % confidence intervals.

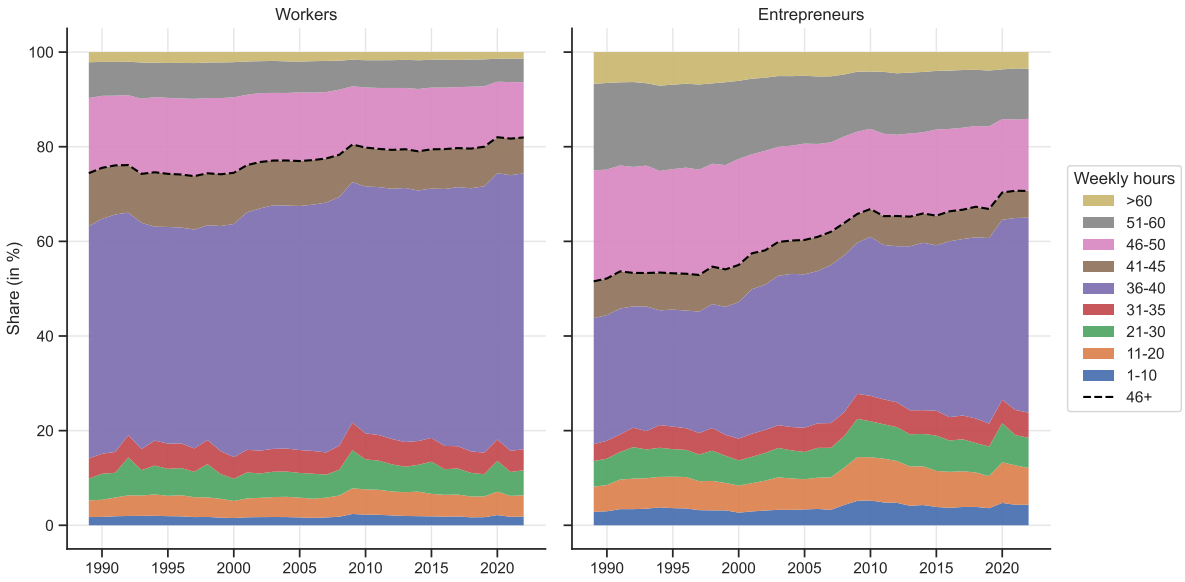


Figure 22: The distribution of hours over time for male workers and entrepreneurs only.

Notes: Data from the CPS basic monthly interview.

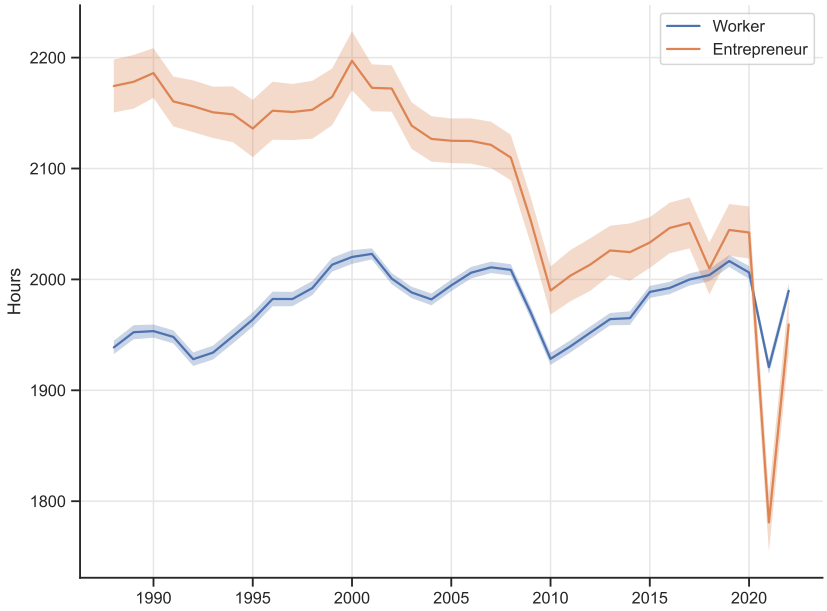
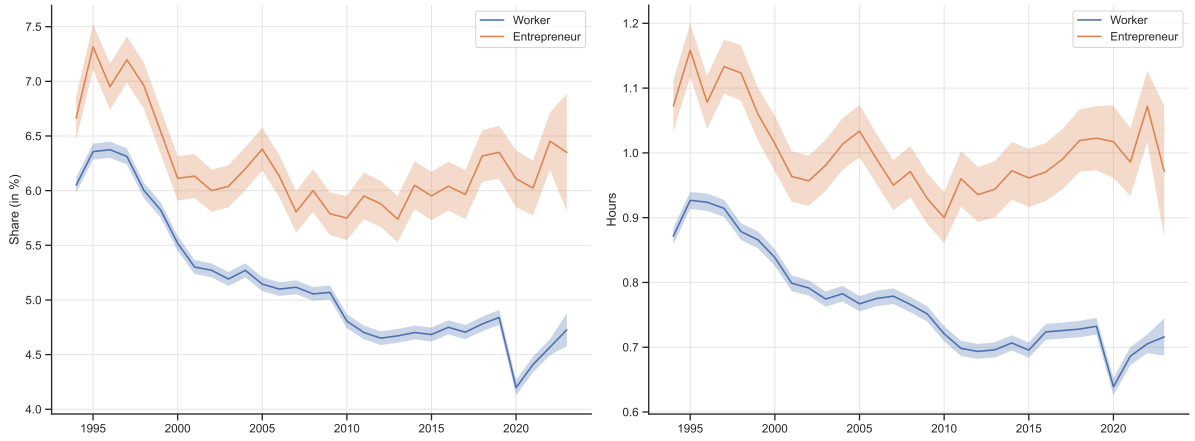


Figure 23: Annual hours worked for workers and entrepreneurs.

Notes: The hours are conditional on working positive hours over the whole year. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.



(a) Share with other jobs **(b)** Hours worked in other jobs

Figure 24: Share of individuals having more than one job and the total average hours worked on other jobs.

Notes: Data from the CPS basic monthly interview. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

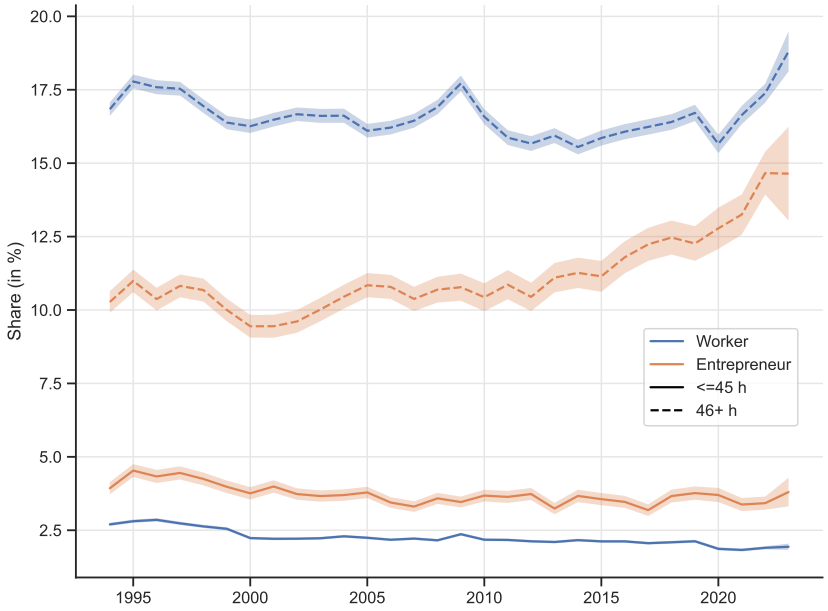
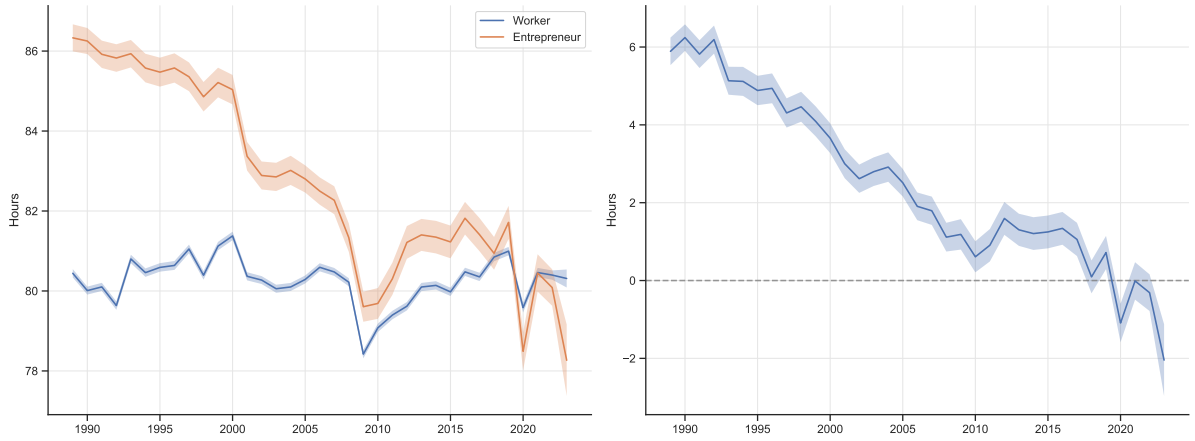


Figure 25: Share of individuals having more than one job split by working more or less than 45 hours.

Notes: Data from the CPS basic monthly interview. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.



(a) Weekly couple hours

(b) Difference in weekly couple hours

Figure 26: Weekly hours worked by the couple together.

Notes: Data from the CPS basic monthly interview. The sample only contains couples. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

(a) Male (b) Female

Figure 27: Weekly hours worked by gender and cohabitation status.

Notes: Data from the CPS basic monthly interview. Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

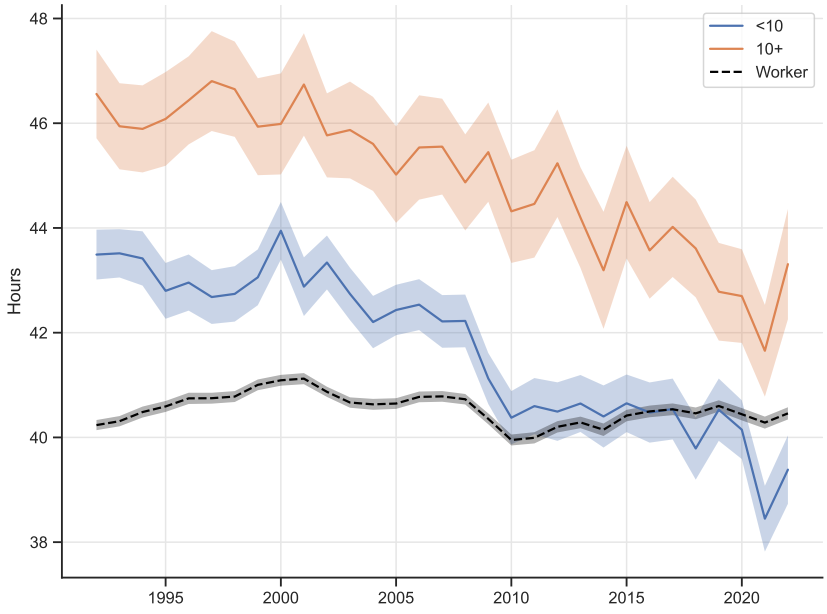
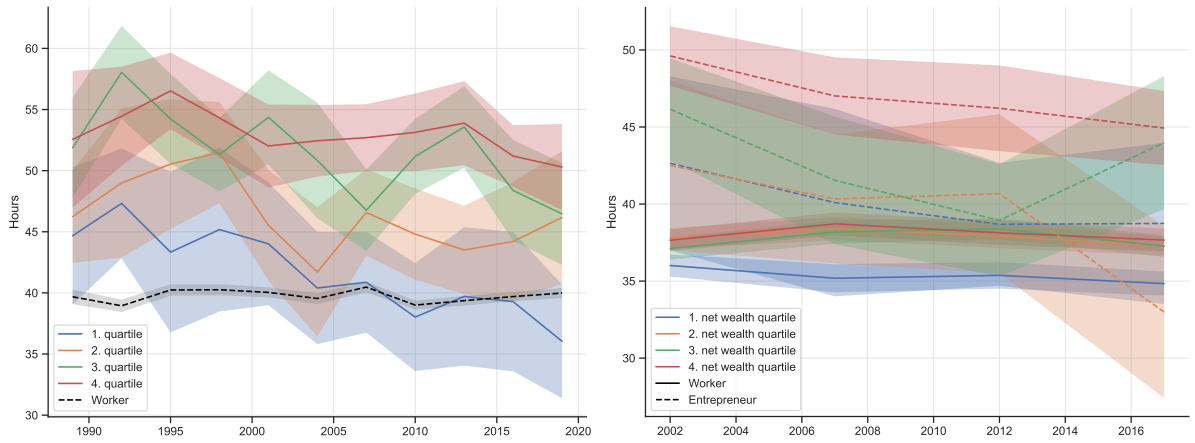


Figure 28: Weekly hours worked by firm size.

Notes: Data from the CPS March supplement (ASEC). Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.



(a) Business net-wealth (SCF) **(b)** Household net-wealth (SOEP)

Figure 29: Weekly hours by net-wealth: business net-wealth (SCF) or household net-wealth (SOEP).

Notes: Data for Panel (a) is from the Survey of Consumer Finances (SCF) and data for Panel (b) from the German Socio-Economic Panel (SOEP). Weighted by the CPS sample weights. Shaded areas indicate 95 % confidence intervals.

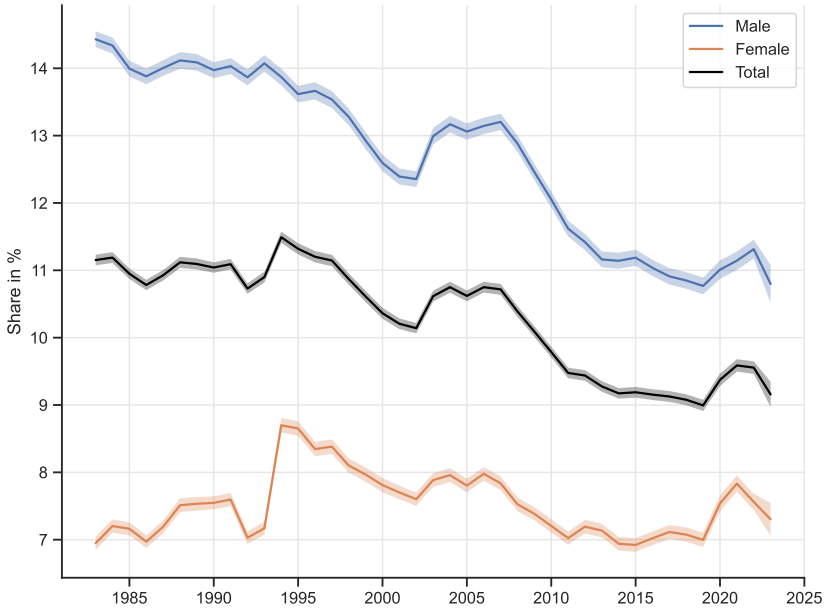


Figure 30: The share of entrepreneurs in the labor force by gender.

Notes: Data from the CPS basic monthly interview. Shaded areas indicate 95 % confidence intervals.

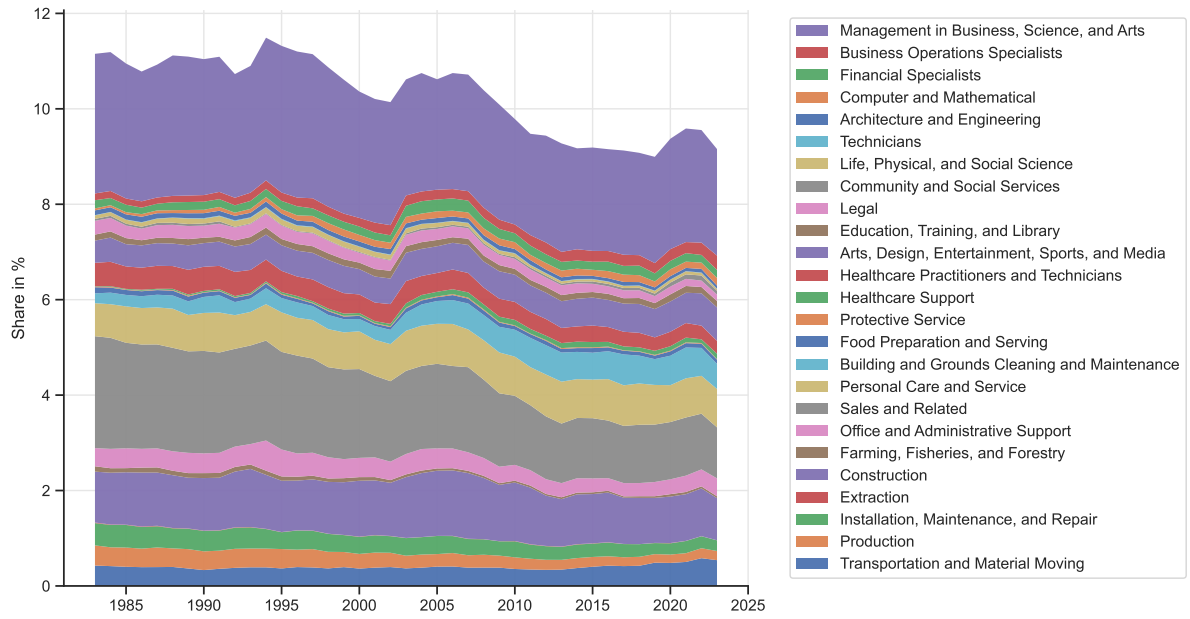


Figure 31: The occupational composition of entrepreneurs.

Notes: Data from the CPS basic monthly interview.

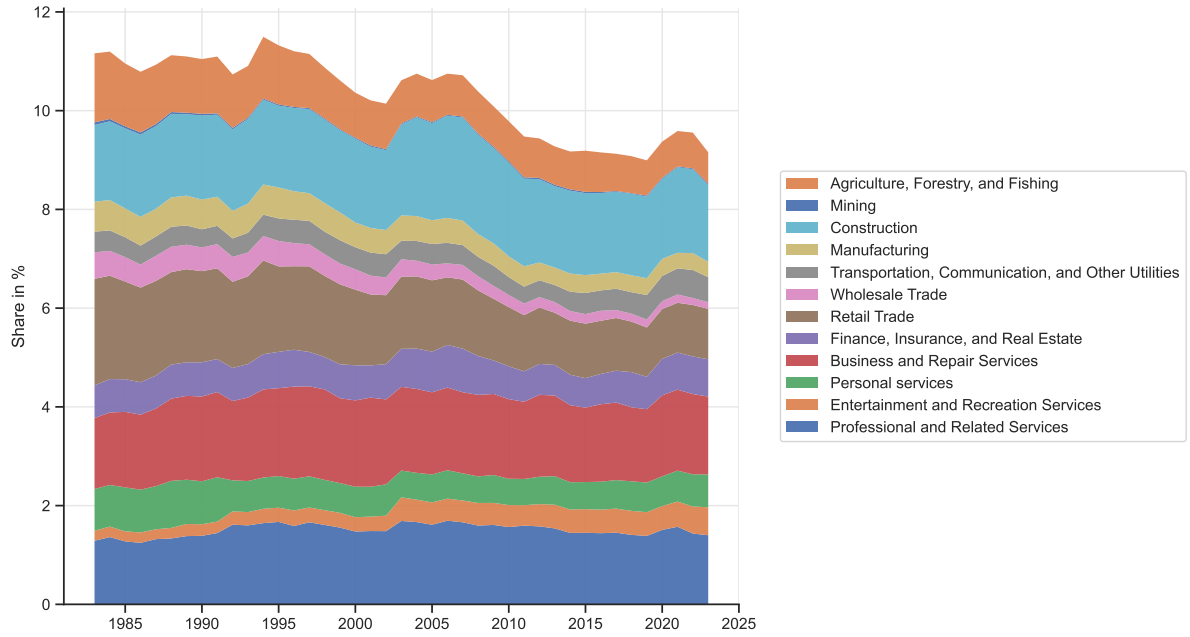
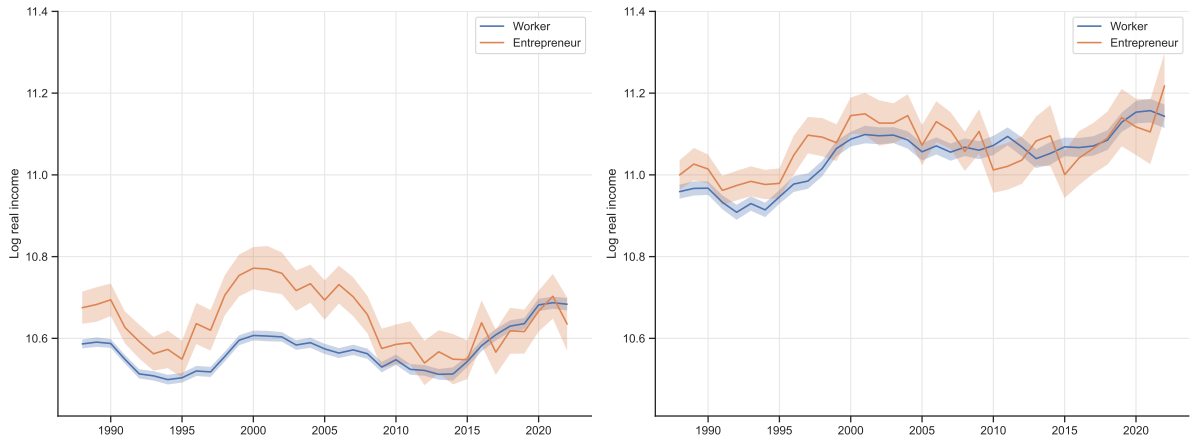


Figure 32: The industry composition of entrepreneurs.

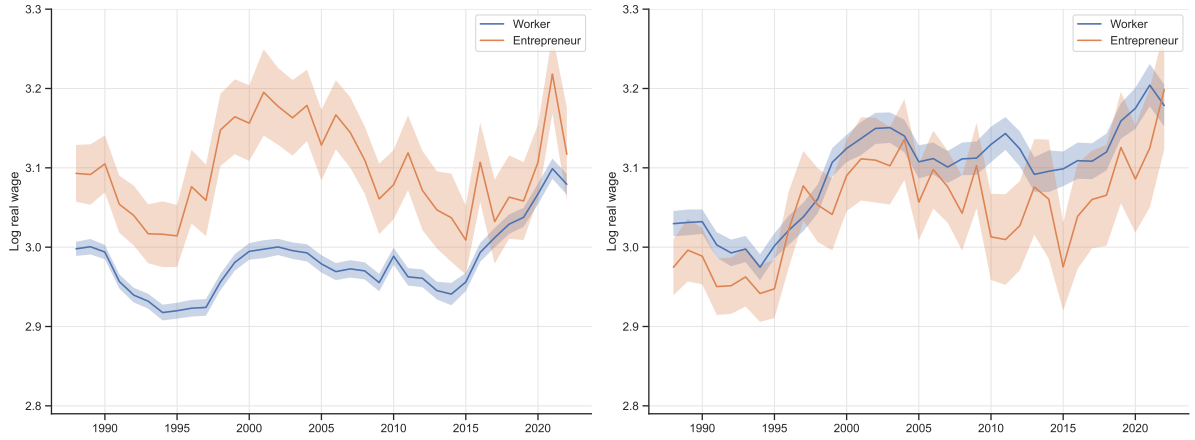
Notes: Data from the CPS basic monthly interview.



(a) up to 45 hours (b) 46+ hours

Figure 33: Log real income for workers and entrepreneurs split by working more or less than 45 hours.

Notes: Data from the CPS ASEC. Sample includes only men. Shaded areas indicate 95 % confidence intervals.



(a) up to 45 hours (b) 46+ hours

Figure 34: Log real wage for workers and entrepreneurs split by working more or less than 45 hours.

Notes: Data from the CPS ASEC. Sample includes only men. Shaded areas indicate 95 % confidence intervals.

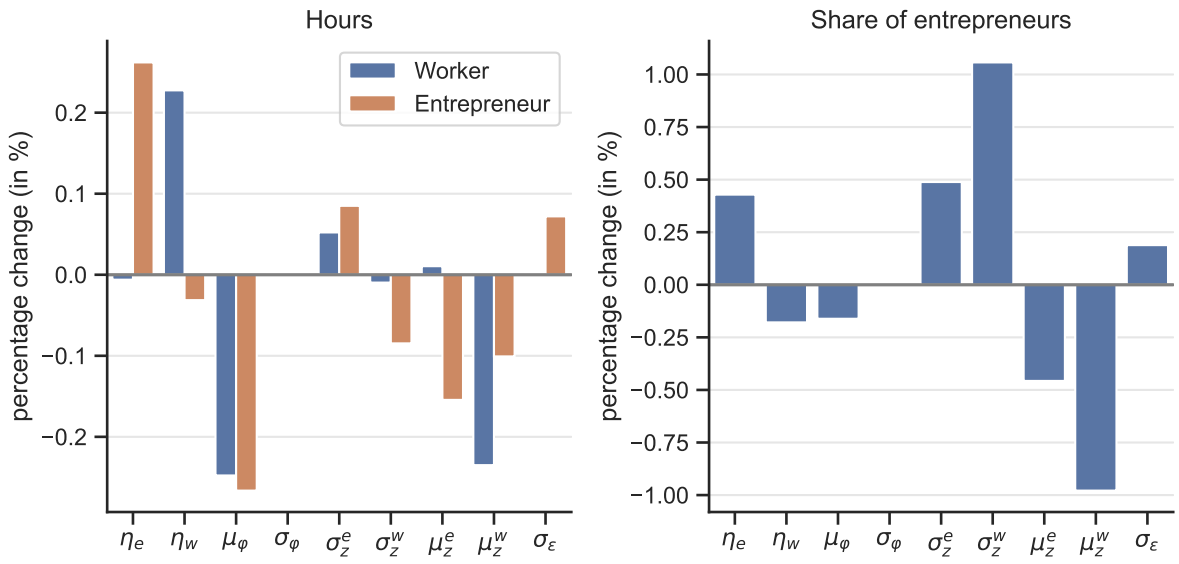


Figure 35: elasticities of hours and the share of entrepreneurs for each estimated model parameter.

Notes: Elasticities are obtained by setting all model parameters to the parameters estimated in period I except for the parameter in question, which is increased by one percent compared to period I. The bars show the effect of this one percent change in the parameter on hours of workers and entrepreneurs (left panel) and the share of entrepreneurs (right panel).