Declining Hours Worked Among Entrepreneurs

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Abstract

I show that over the past 35 years, weekly hours worked by entrepreneurs in the US have fallen by five hours more than for workers. This accounts for the bulk of the fall in total hours and is robust to adjusting for compositional effects in terms of gender, age, education, number of children, occupation, and industry. The decline originates from the top of the hours distribution and occurs without noticeable changes in the relative hourly income of entrepreneurs. I interpret these facts using a Roy model of occupational choice with an intensive labor supply margin that allows the marginal return of working an additional hour to depend on the level of hours. I estimate the model at two points in time and find that a fall in the marginal return at higher hours worked is key for explaining the drop in hours and the drop in the share of entrepreneurs.

*Oesterreichische Nationalbank. *Disclaimer: The views expressed in this paper do not necessarily reflect those of the Oesterreichische Nationalbank or the Eurosystem.* I am grateful for the invaluable guidance and support from Per Krusell, Kurt Mitman, Timo Boppart, and Kieran Larkin.

1 Introduction

Entrepreneurs are important in many ways: they create jobs, innovate, foster resource reallocation, and thereby contribute to productivity growth. For these reasons, policymakers wish to increase the number of entrepreneurs and small businesses and have introduced various policies, such as government loan guarantees or tax credits. Nevertheless, empirical measures of business dynamism in the US have trended down in recent decades. Firm entry and exit rates decelerated, fewer young firms account for job creation, and the share of entrepreneurs in the labor force has decreased.[1]

I contribute a new perspective on the slowdown in 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 over 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 to only 3.8 hours relative to workers over the past 35 years. The declining trend is not only statistically significant but also economically important when compared with the long-term decline of five to six hours for the entire working-age population over the past 100 years (see Ramey and Francis, 2009) or the fairly stable market hours of employed men since the 1970s.

In addition to the decline in hours worked by entrepreneurs, this paper documents two more facts about them. The second fact is a decline in the share of entrepreneurs who work many hours. Individuals working more than 45 hours are now less likely to be entrepreneurs. Thus, the decline in working hours comes from the top of the hours distribution. The third fact concerns their income. The total income of entrepreneurs moved closely with their hours, so the relative hourly income of entrepreneurs to workers was surprisingly stable over this period. I document these facts with data from the Current Population Survey (CPS) for the US but confirm that the decline in hours is also visible in the Panel Study of Income Dynamics (PSID), the Survey of Consumer Finances (SCF), and the Socio-Economic Panel (SOEP) in Germany.

Entrepreneurs play a prominent role in business dynamism and we would like to measure the hours of those entrepreneurs who contribute most to it. I define an entrepreneur as any individual who reports working for themselves, as opposed to working for a private company, the public sector, or a non-profit organization. This broad definition includes a diverse group of self-employed with and without employees and with different forms of incorporation but has the advantage that it can be applied across different surveys. However, robustness analyses indicate a broad-based decline and show that this is likely to include those entrepreneurs who play a prominent role in business dynamism. This raises the question of whether and how the declining hours are connected to the slowing business dynamism and the declining share of entrepreneurs in the labor force.

The paper then sets out to find the most likely explanation for these facts, starting with

[1] For an extensive review of the recent literature, I refer the interested reader to Akcigit and Ates (2023).

a simple model of labor supply. The simple model highlights that an income effect going through the level of earnings requires a much larger increase in the hourly income than observed in the data. Importantly, 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, hold promise for matching the evolution of hours and income of entrepreneurs. However, without further restrictions on the model, we cannot identify the most likely mechanism using only observations on entrepreneurs.

The simple model is then extended to include an occupational choice between being a worker and an entrepreneur. Thus, I use this extended model to study the joint decision of the occupational choice with the labor supply decision. This adds further restrictions on the mechanism behind the declining hours of entrepreneurs. In particular, the decline in the share of entrepreneurs and data on workers can be used to shed more light on the mechanism. To do so, I estimate the model at two points in time and jointly target several key moments for workers and entrepreneurs. More specifically, one group of moments consists of the hours of workers and entrepreneurs, which captures the initial level difference and the decline in the hours of entrepreneurs. The second group of moments relates to the share of entrepreneurs, which ensures that the underlying mechanism is consistent with the occupational choice, and the share of individuals working more than 45 hours, which ensures that the decline in hours comes from the top of the hours distribution. Finally, the last group of key defining moments is the relative income of workers and entrepreneurs and their respective dispersion, which are important for restricting the strength of the income effect going through the level of earnings.

The estimation suggests that the returns to working an additional hour at the top of the hours distribution fell substantially for entrepreneurs, while it stayed largely unchanged for workers. In the model, this mechanism is captured by a change in the curvature of the non-linear earnings function. In line with the previous literature, this function is found to be convex, but I show that it has become more linear over time. This change alone can explain 70% of the observed decline in average hours, predicts 117% of the observed decline in the share of entrepreneurs working more than 45 hours, and 65% of the fall in the share of entrepreneurs in the labor force over this period. No other source of change in the model is more successful in explaining the joint movement of hours and the share of entrepreneurs. Therefore, to the extent that these two features of the data are related, the analysis suggests a change that maps to the convexity of the earnings function must be the source.

The remaining question is what changed the return to working many hours. A promising explanation for a decrease in the returns to working many hours is a change in the market structure of the output good provided by the entrepreneur. I show that a change in the curvature of the entrepreneurial earnings function can be connected to the demand elasticity that entrepreneurs face for their goods or services. Starting from a reduced-form demand function, I link the curvature of the entrepreneurial earnings function with the consumer's price elasticity of demand for the entrepreneurial output good. In this framework, a decrease in the price 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).

Thus, the change in competition that has been discussed extensively elsewhere now also appears as a likely explanation for the declining hours worked of entrepreneurs.

I also explore a change in the tax progressivity as another plausible explanation of a change in the curvature of the earnings function. Several observations speak against this as a likely cause, however. First, the fact that the same decline is visible in Germany implies that Germany would have needed to make the same changes in the tax code as the US, which appears rather unlikely. Second, I estimate a decrease in the tax progressivity for both workers and entrepreneurs, which is in line with evidence by e.g. Borella et al. (2023). Finally, many entrepreneurs are unincorporated or choose a pass-through corporation, which implies that they are being taxed in the same way as workers. Thus, if anything, this increased the returns to working long hours.

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), which propose a theory that links the slowing business dynamism with the aging of the population. Neira and Singhania (2022) investigate how much the reduction of effective corporate tax rates contributed to the fall in the startup rate and conclude that this can explain at most one-fifth of the decline. Salgado (2020), Kozeniauskas (2022), and Jiang and Sohail (2023) propose theories that skill-biased technical change can account for this. The paper by Akcigit and Ates (2023) combines the observation on rising market concentration with the slowing business dynamism in a unified framework and related to this Deb (2023) also establishes a link between the rise in markups and the fall in the share of entrepreneurs. 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 the rise in market power as a likely explanation. Thus, supporting the argument by Akcigit and Ates (2023) and Deb (2023).

Second, the empirical analysis of the paper also contributes to papers documenting a general decline in market hours of developed countries. In particular, I add to the observations of, for example, Aguiar and Hurst (2007, 2016), Ramey and Francis (2009), and Boppart and Krusell (2020) by documenting that the decline in aggregate market hours per employed person 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, this paper provides valuable insights into the labor supply of entrepreneurs over time, that can inform macroeconomic models on entrepreneurship with 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 on 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, 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. Section 4 introduces a simple static model of labor supply, derives some predictions for different potential causes and develops a quantitative model with an occupational choice that is then estimated and interpreted. Section 5 concludes.

2 Data

The Current Population Survey (CPS) is the primary data source used in this paper. This survey is administered by the US Census Bureau and the basis for 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 includes questions on hours worked. In the fourth interview of each block, a subsample of households is asked more questions about their wage and income. This survey is called the outgoing rotation group (ORG). Unfortunately, the subsample of households is selected based on the employee class and excludes the self-employed. As a result, the entrepreneurs in my definition are not included in the ORG. However, in March of each year, the survey includes additional questions on several topics, including income in the previous year, in the so-called 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 therefore available each month, including the March supplement. I classify respondents as entrepreneurs if they report “working for self”. This includes unincorporated as well as incorporated self-employed individuals.[2] The classification is the same as applied in Jiang and Sohail (2023), who also use the CPS. Unfortunately, the design of the CPS only allows me to distinguish between incorporated and unincorporated self-employed individuals 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). The CPS also contains 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, until 1983, the incorporated self-employed 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. This is especially valuable since there are large differences in the level of hours worked between subgroups of the population (e.g. gender and occupation). 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 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 shows summary statistics of workers and entrepreneurs and how they differ between two sub-periods, which are chosen to reflect the two periods of focus in the

[2]The precise question text in the survey is the following: "(Were/Was) (name/you) employed by the 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.

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

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.

quantitative analysis. We can see that workers and entrepreneurs differ in a few characteristics. First, we can see a much higher share of women among workers than among entrepreneurs. Second, entrepreneurs are on average four years older, which changes relatively little over time. Further, they have very similar education but tend to cohabit slightly more and have slightly more children. The last line highlights a significant decrease in the share of entrepreneurs in the labor force between the two periods and reflects the slowing business dynamism.

To show that the decline in hours is not only a peculiarity in the CPS, I also use data from other US surveys that cover hours worked: the Survey of Consumer Finances (SCF) and the Panel Study of Income Dynamics (PSID). The declining trend can clearly be seen in both of these surveys as well. 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 facts about entrepreneurs. The first fact is the decline in hours worked. The hours worked for entrepreneurs started from a much higher level, but then steadily declined until they 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 break the average decline down into contributions from different subgroups 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 subgroups. The second fact is a fall in the share of entrepreneurs in the labor force during the same time. I corroborate results from other papers (e.g. Decker et al., 2016) and additionally show that the decline in the share of entrepreneurs is primarily associated with the top of the hours distribution. The third fact is a stable difference in the hourly income of entrepreneurs and workers in this period. Consequently, there was a significant fall in the total annual income of entrepreneurs, coming from a reduction in the weekly hours worked of entrepreneurs.

3.1 Hours

I 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.

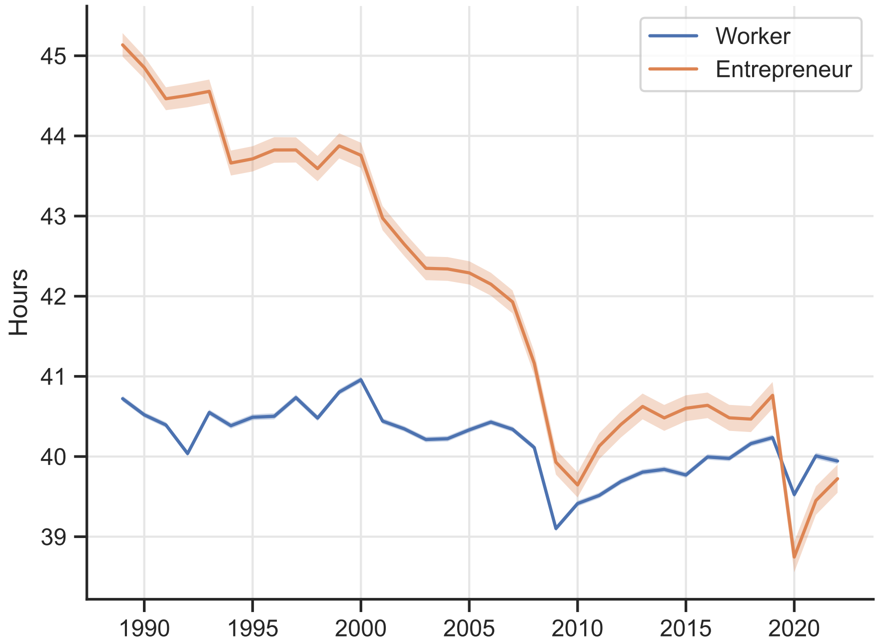

Figure 1: Average weekly hours worked of workers and entrepreneurs.

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 on average about 45 hours 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 16 in Appendix A shows that the same trend can also be observed in the SOEP for Germany. Apart from some minor level differences between the two surveys, the slope of the difference is very similar. In both cases, the hours of entrepreneurs decreased by around five hours.

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

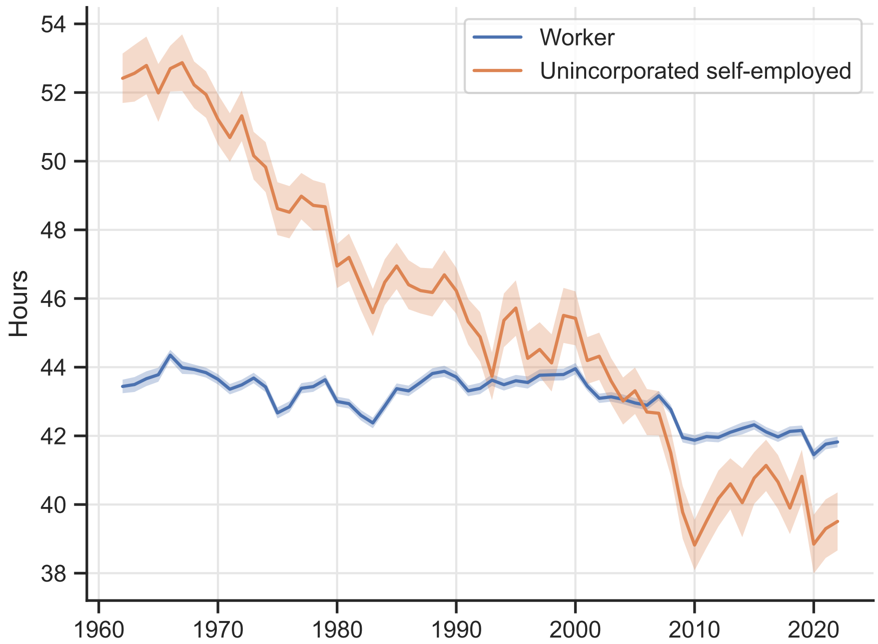

Figure 2: Average weekly hours worked of male workers (including incorporated self-employed) and unincorporated self-employed men.

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.

declining trend has already started in the late 1960s for at least the unincorporated self-employed males. Note that the generally higher level of hours comes from the fact that these series focus on males only. There are two messages to take away from this figure. First, the observation that the decline started already so early, makes it unlikely that the decline was caused by the adoption of information and communication technology. Second, the fact that this trend is strongly visible among males only, indicates that the decline is not driven by compositional changes in terms of gender. An increasing share of female entrepreneurs, who work a few hours less on average, could otherwise have pushed down the average hours of entrepreneurs.

Figure 3 confirms that the decline is even visible among women. Although female entrepreneurs worked 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.

To investigate compositional changes more systematically and to obtain the decline in the difference of hours between workers and entrepreneurs by subgroups, I first run a fixed-effects regression that takes out flexible time trends for different subgroups common to both entrepreneurs and workers. This is what columns (1) to (3) of Table 2 report. The exact regression equation for these three columns is the following:

$$h_{iy} = \beta_1 \cdot Entr_{iy} + \beta_2 \cdot t \cdot Entr_{iy} + \sum_{j=1989}^{2023} \boldsymbol{\theta}'_j \cdot \mathbb{1}_{j=y} \cdot \mathbf{X}_{iy} + \varepsilon_{iy} \tag{1}$$

where h_{it} are the weekly hours of individual i in year y, $Entr_{it}$ is an indicator if individual

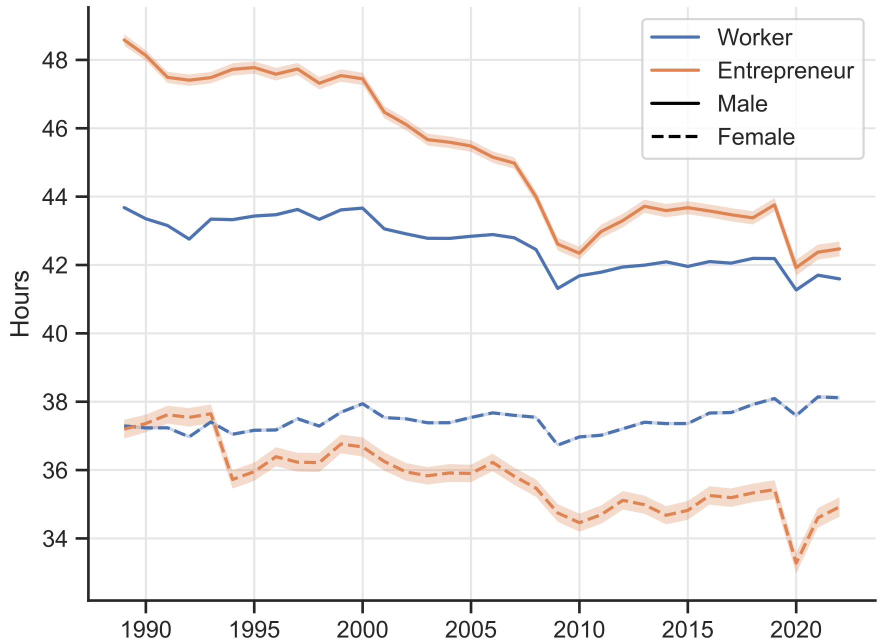

Figure 3: Average weekly hours worked by gender.

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.

i was an entrepreneur in year y, t is years since 1989, $\mathbb{1}_{j=y}$ is a year dummy, and $\mathbf{X}_{iy}$ captures a vector of dummy variables for gender, three-year age bins, five education groups, four groups for the number of children, 25 occupation groups, and 12 industry groups.

However, taking out different time trends by subgroups does not account for the fact that entrepreneurs in these different subgroups might have different *levels* of hours worked. Therefore, a change in the composition of entrepreneurs towards more female entrepreneurs could cause a decline in the average hours worked among all entrepreneurs. To keep the composition fixed and only estimate the decline within each subgroup, we can add different means for entrepreneurs in the respective subgroups. Formally, I run the following regression:

$$\begin{aligned} h_{iy} &= \beta_2 \cdot t \cdot Entr_{iy} \\ &\quad + \sum_{j=1989}^{2023} \boldsymbol{\theta}'_j \cdot \mathbb{1}_{j=y} \cdot \mathbf{X}_{iy} + \boldsymbol{\delta}' \cdot Entr_{iy} \cdot \mathbf{Y}_{iy} + \varepsilon_{iy} \end{aligned} \tag{2}$$

where $\beta_1 \cdot Entr_{iy}$ is now fully absorbed by the entrepreneur-specific intercepts in the last term before the error and $\mathbf{Y}_{iy}$ are the same dummy variables in $\mathbf{X}_{iy}$ plus a dummy for the status of incorporation of an entrepreneur. The regression coefficient β_2 then captures the average annual decline *within* each subgroup. The last column of Table 2 reports that weekly hours worked within each subgroup have declined by around 0.1112 hours per year. This regression framework also allows me to break this coefficient down and report the decline separately by the different subgroups. I do this by interacting the first term, which captures the entrepreneur-specific slope, with dummies for each

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-Occupation			Yes	Yes	Yes
Year-Industry			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 an entrepreneur dummy. Age codes three-year age bins. Education codes 5 different educational attainment groups ranging from "less than high school" to "more than Bachelor". Children codes 4 groups for the number of children. Occupation codes 25 occupation groups and industry codes 9 industry groups. Incorporated is a dummy for an entrepreneur being incorporated. "t" is coded as years since 1989.

possible value of the demographic characteristic D. For example, for gender, I interact it with a male and female dummy. Formally, I run the following regression:

$$\begin{aligned} h_{iy} = &\sum_{d\in\mathcal{D}} \beta_{2d} \cdot t \cdot Entr_{iy} \cdot \mathbb{1}_{D=d} \\ &+ \sum_{j=1989}^{2023} \boldsymbol{\theta}'_j \cdot \mathbb{1}_{j=y} \cdot \mathbf{X}_{iy} + \boldsymbol{\delta}' \cdot Entr_{iy} \cdot \mathbf{Y}_{iy} + \varepsilon_{iy} \end{aligned} \tag{3}$$

where $\mathcal{D}$ is the set of possible values for the demographic characteristic D considered below. I then repeat this regression for each characteristic separately. The coefficient β_{2d} captures the average slope for all individuals with characteristic $D = d$.

Let us first start with a breakdown of the decline in hours by basic characteristics. Figure 4 shows how the slope coefficient varies along different dimensions (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

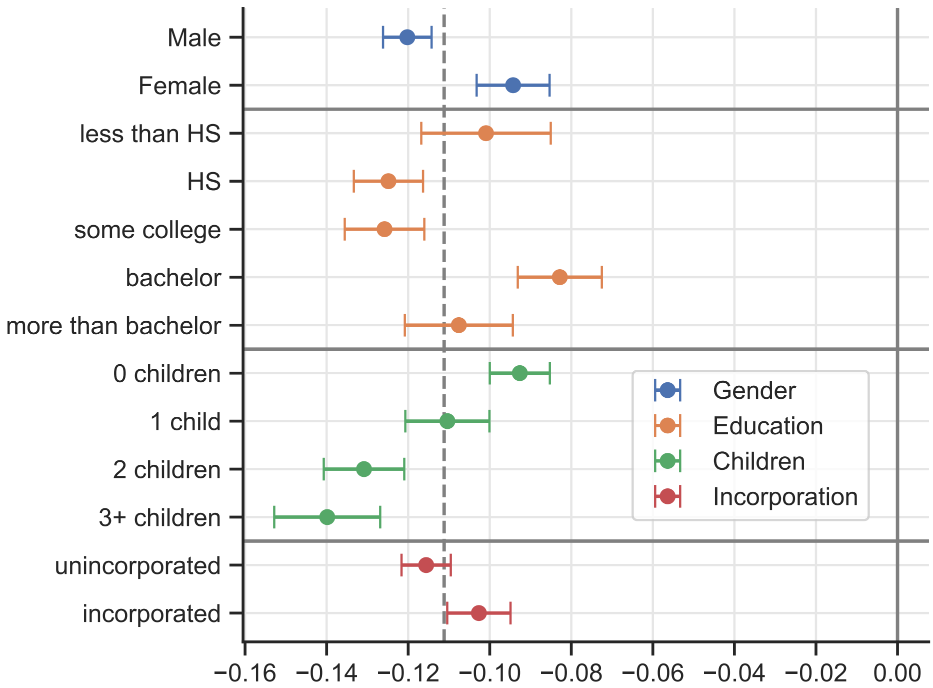

Figure 4: Breakdown of the decline in average weekly hours worked of entrepreneurs relative to workers by basic characteristics.

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

indicates a stronger decline. The figure reveals a significant decline among all subgroups and steeper slopes for males and individuals with more children. Appendix A contains more figures that break the slope coefficient down by age (Figure 20), occupation groups (Figure 22), and industry groups (Figure 21). They all confirm that this decline is broad-based among all age groups, 23 out of 25 occupation groups (four insignificant), and all twelve industry groups (one being insignificant). It further contains the raw difference in weekly hours between entrepreneurs and workers by occupation group (Figure 23) and by industry group (Figure 24), further highlighting the broad-based decline.

In the hope of capturing likely “true” entrepreneurs, I also estimate the slope coefficient for a particular subgroup of men. Those that are between 40–55 years old, with at least some college education, and reporting to be in the management occupation. The slope coefficient for this particular subgroup is -0.101 (with a standard error of 0.006). Again, this shows that the decline is not driven by particular subgroups and also visible among likely “true” entrepreneurs often referred to in the context of the slowing business dynamism.

To see where in the hours distribution the decline of the weekly hours comes from, we can look at the changes in the composition of weekly hours in Figure 5. The figure shows the share of workers and entrepreneurs in nine bins for weekly hours. Not surprisingly, the hours distribution of workers is very concentrated at 36-40 hours and the share of workers in this bin increased over time. This likely reflects the fact that it became more common for women to work full-time. The distribution of hours among entrepreneurs is generally less concentrated and the longer working hours at the beginning of the sample

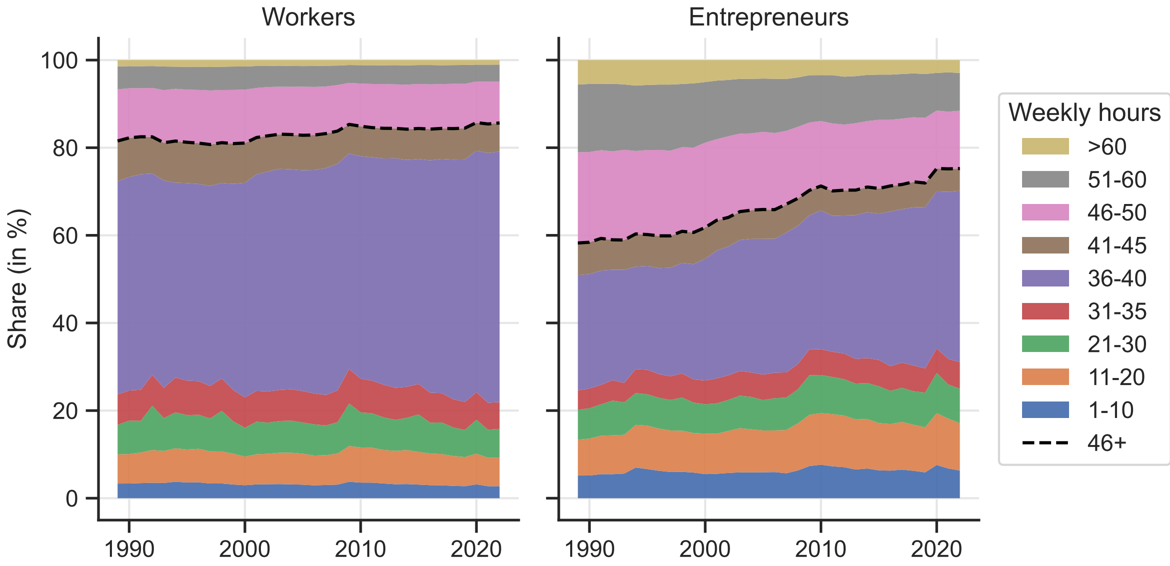

Figure 5: The composition of hours for workers and entrepreneurs over time.

Notes. Data from the CPS basic monthly interview.

are clearly visible in the share of entrepreneurs working more than 45 hours. Looking at the shifts in the composition of the hours distribution reveals that the decline in the average weekly hours primarily comes from the top of the hours distribution. The share of entrepreneurs, who work more than 45 hours, declined from around 40 percent to around 25 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 25 in Appendix A shows the distribution of hours for men only. Apart from a level shift of the shares of all hour bins, the main conclusion, that the drop in hours comes from the top of the distribution, is unchanged.

The SOEP in Germany contains a question about how many hours respondents would like to work taking into account a corresponding decrease in their income. Interestingly, Figure 26 in the appendix, shows that both workers and entrepreneurs would prefer to work fewer hours, but entrepreneurs would prefer to reduce their hours to a greater extent. The gap between actual and desired hours of work has been very stable for workers but decreased with the actual hours of work for entrepreneurs. Hence, it appears that entrepreneurs managed to get closer to their desired hours of work.

One remaining question is how the decline in weekly hours transmits to annual hours, which consequentially also affects annual income measures reported 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.

Figure 6 shows the difference of the log of annual hours, the log of weeks worked, and the log of usual hours worked to their respective values in 1988.[3] First, focussing on the

[3]Figure 27 plots the annual hours of workers and entrepreneurs in levels and shows a very similar

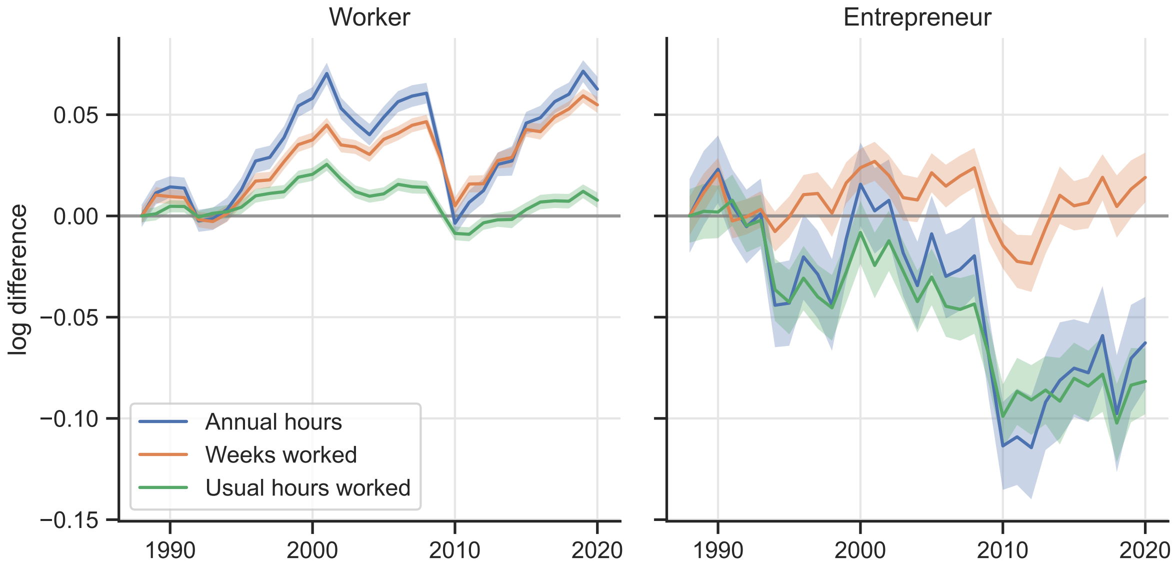

Figure 6: Decomposition of the annual hours into the weeks worked and usual hours per week.

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

series for annual hours worked (blue line), we can see a slight increase for workers and a substantial decrease for entrepreneurs. 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. 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 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. While the annual hours of workers follow weeks worked more closely, the annual hours of entrepreneurs follow 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 a series of robustness analyses. I show that the decline in hours of entrepreneurs is also visible in other surveys in the US (see Figure 17 for the SCF and Figure 18 for the PSID). I exploit the panel dimension of the PSID and estimate a similar decline in hours worked while controlling for individual fixed effects (see Figure 19). I show that the decline is not driven by individuals holding other jobs, as Figure 28 and Figure 29 illustrate. Figure 30 plots the total hours of couples and shows the declining trend cannot be explained by shifts of hours within the household. Figure 31 provides additional analyses in this direction, by plotting the hours of singles and cohabitating individuals by gender. Another very interesting robustness analysis shows that the decline in hours can also be seen for entrepreneurs with more

picture as for weekly hours in Figure 1.

than ten employees. The March supplement introduced a question in this respect in 1992. 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 34 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

The second fact I document is a fall in the share of entrepreneurs within the labor force alongside the decline in hours. This paper is not the first, several other papers have documented this before, e.g. Decker et al. (2014, 2016), Salgado (2020), and Jiang and Sohail (2023). I corroborate these findings and establish a similar decline for the sample and specific definition of entrepreneur in this paper. Given that the decline in the share of entrepreneurs is already well-documented, the analysis in this section focuses on the fall in the share of entrepreneurs by the level of hours worked.

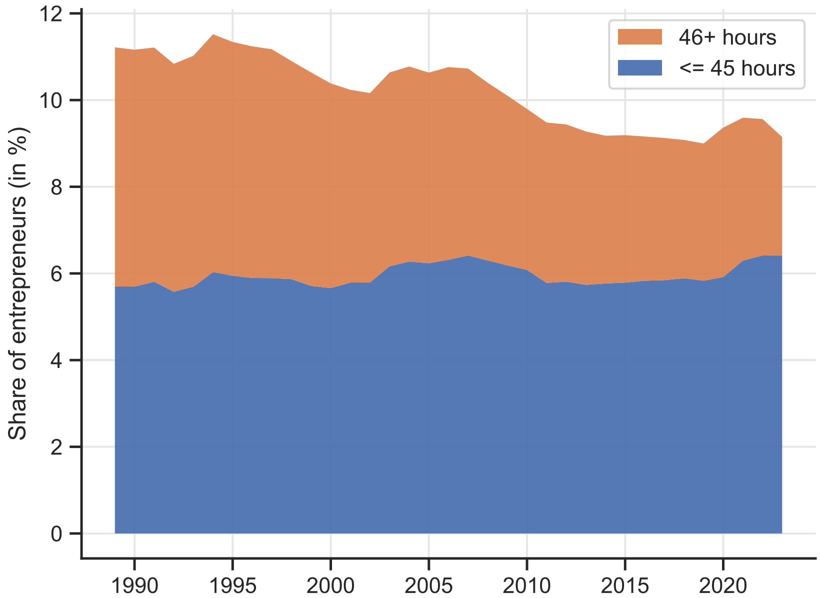

Figure 7: The share of entrepreneurs split by the number of hours.

Notes. Data from the CPS basic monthly interview.

Figure 7 shows that the total share of entrepreneurs in the labor force went from 11% in 1989 to 9% in 2022. A number close to what other papers find as well (e.g. Jiang and Sohail, 2023). The figure also splits the share of entrepreneurs by those working up to 45 hours and those working more than 45 hours. It highlights that the decrease in the share of entrepreneurs comes entirely from entrepreneurs working more than 45 hours.

Appendix A contains further plots on the share of entrepreneurs with more detailed information and other splits of the data. Figure 35 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 36 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 37 shows the industry composition and that the biggest industries these entrepreneurs operate in are construction, retail trade, business and repair services as well as professional and related services. However, the fall in the share of entrepreneurs is not a phenomenon of a single industry or occupation and can be seen in many rather diverse subgroups.

3.3 Income

In standard static models of labor supply, the decision of how many hours of work to supply is tightly linked to the wage and unearned income. A substantial increase in the income of entrepreneurs could potentially explain why hours have trended down. This motivates a closer look at differential trends in income for workers and entrepreneurs.

Given that the income for entrepreneurs is only recorded in the March supplement, the entire analysis on the income of workers and entrepreneurs is based on data from the CPS ASEC. Since several other mechanisms might have affected the income development of women, the analysis in this section will only focus on men to keep it as clean as possible. Further, I restrict the sample to individuals who reported having 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, and farm) divided by total annual hours and exclude everyone with a wage less than half the CPI-adjusted federal minimum wage.

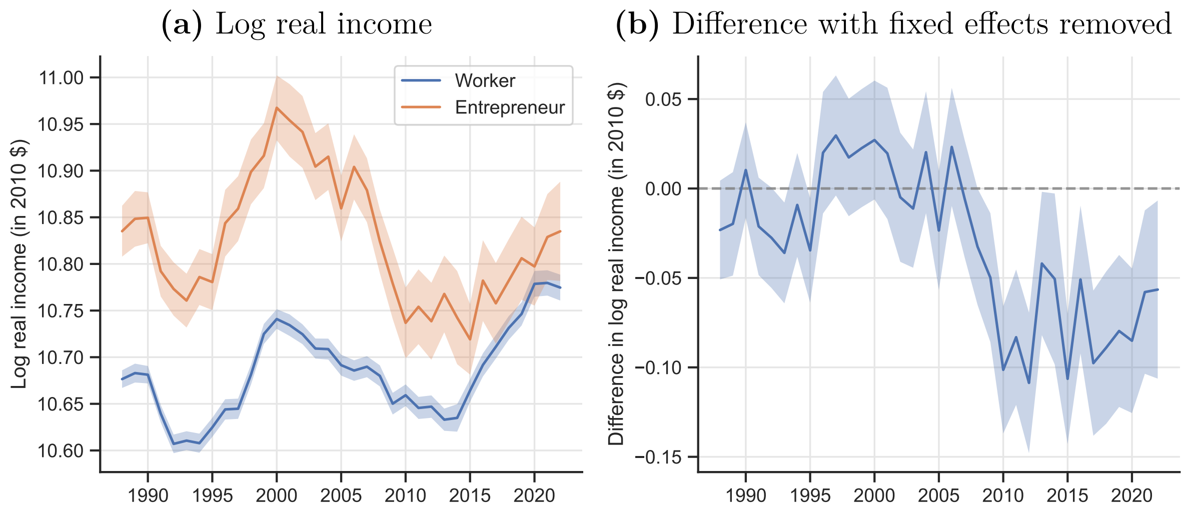

Figure 8: Real income developments.

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 had about 16 log points higher income than workers at 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 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.

The decline in the average income of entrepreneurs likely comes from a higher share of entrepreneurs working up to 45 hours. To support this claim, Figure 38 in the appendix shows the income for workers and entrepreneurs working more or less than 45 hours separately and highlights two more observations. First, the income for both workers and entrepreneurs working more than 45 hours is significantly higher than for those working up to 45 hours, 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 evolving very similarly.

There is also no evidence for differential trends of after-tax income between workers and entrepreneurs. Figure 40 in the appendix also shows a time series for the estimated after-tax disposable income. To obtain after-tax income, I deduct federal and state tax estimates provided by IPUMS-CPS (Flood et al., 2022) from total personal income. The overall conclusions in the difference between workers and entrepreneurs are unchanged, but both saw a larger increase in real income over time. This is likely due to a fall in the tax progressivity that I estimate in Section 4.6.

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

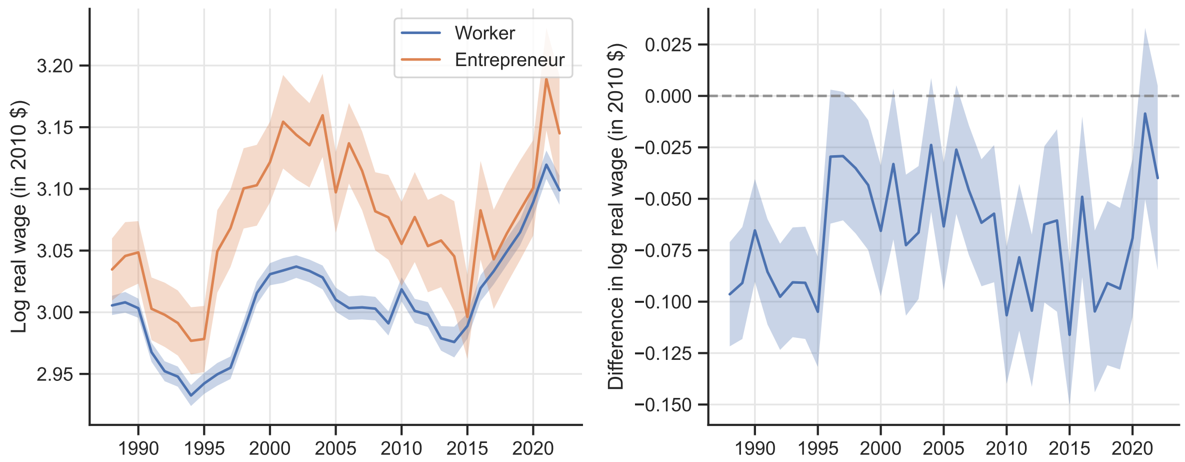

Figure 9: Real wage developments.

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).

Turning our attention to the development of hourly income, Figure 9 shows no obvious diverging trend in the wage of entrepreneurs relative to workers.[4] Similar to income, the difference in wages between entrepreneurs and workers also becomes negative when controlling for fixed effects. Thus, the wage rate of individuals in paid employment, who are comparable to entrepreneurs, is slightly higher. This corroborates findings from

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

previous research (see e.g. Hamilton, 2000 and Moskowitz and Vissing-Jørgensen, 2002), which finds that entrepreneurs seem to be motivated by more than just financial returns. Figure 39 in the appendix shows the log real wage for those working more and less than 45 hours. In contrast to income, the real wage is much less positively correlated with hours. Interestingly, the wage for workers seems to be higher if they work more than 45 hours, but the opposite is true for entrepreneurs.

One might be concerned that the decline in hours worked is driven by substantial changes in higher moments of the income or wage distribution. The top-coding of income in the CPS data is not ideal to accurately compute higher moments. However, looking at the standard deviation of log income and log wages is still informative. Figure 41 and 42 in the appendix show the standard deviation of log income and log wages respectively. Two facts stand out: first, the standard deviation is slightly higher for entrepreneurs and second, there is an increasing trend for both workers and entrepreneurs which is consistent with findings of e.g. Moffitt and Zhang (2018) using PSID data. Importantly, however, there is no evidence that the standard deviation of log income or log wages for entrepreneurs has evolved substantially differently for the male entrepreneurs considered in this sample.

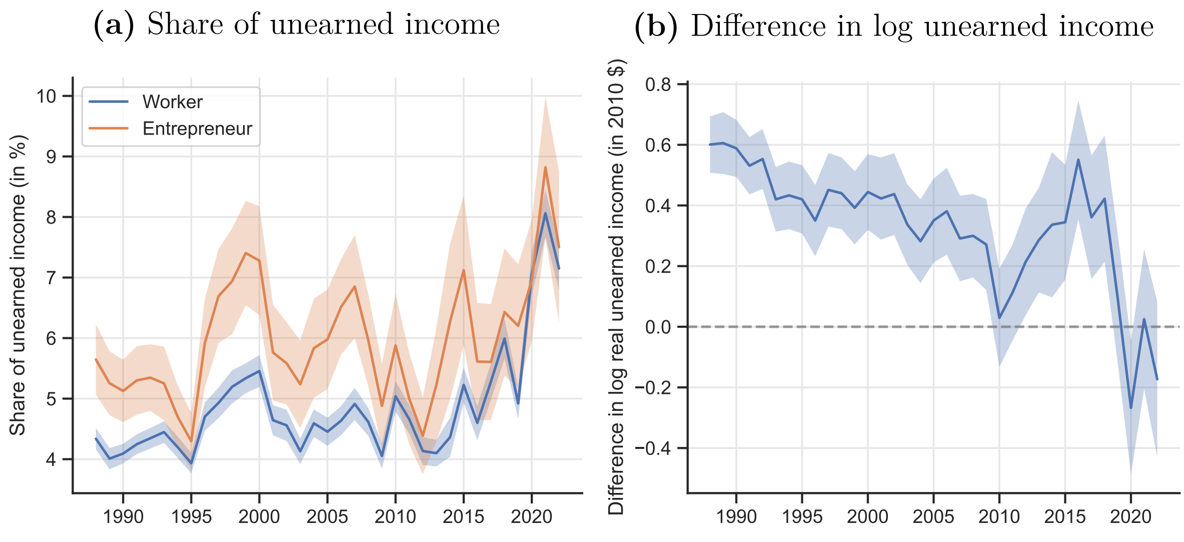

Figure 10: Share of unearned income for workers and entrepreneurs.

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.

As the simple model in the next section shows, an increase in unearned income will unambiguously decrease the optimal hours choice through a pure income effect. Thus, if a bigger share of entrepreneurs' total income comes from unearned income, like capital income or rent income, this could potentially explain the decline in hours worked. Therefore, I now take a closer look at the role of unearned income and how its share has changed for workers and entrepreneurs during the period in question. Figure 10 shows that unearned income is only a small fraction of total personal income and accounts for about 5-6% of it. Most importantly, however, the relative share of unearned income between entrepreneurs and workers has declined over the entire sample period and was mainly driven by an increase in the share of unearned income of workers. Thus, if unearned income was the source behind the declining hours, then a simple model of labor supply would predict a stronger decline in the hours of workers instead.

To summarize, we can note that the decline in hours worked of entrepreneurs went hand in hand with a decline in their income. This is mainly driven by a reduction in hours as the hourly income of entrepreneurs relative to workers does not exhibit a noticeable trend. We can further note that unearned income is a small fraction of total income and shows a larger increase for workers. These observations suggest that an income effect is unlikely the reason for the decline in hours of entrepreneurs, which the next section investigates in more detail.

4 Model

This section first introduces a simple model of labor supply to highlight the forces leading 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. To explain the observed decline in hours, the simple model requires an increase in the hourly income that is far greater than the observed increase in the wage of entrepreneurs relative to workers. It further shows that a change in the curvature of the earnings function is powerful in affecting the optimal hours choice without affecting the hourly income too much.

Without further restrictions on the mechanism, the quantitative magnitude of a change in the curvature is difficult to pin down. Therefore, I develop a quantitative model of occupational choice in the spirit of Roy (1951) and adapt it to workers and entrepreneurs. The two occupations are allowed to differ in the profile of their earnings functions, similar to Erosa et al. (2023). I estimate the model at two points in time and let the estimation suggest, which parameters must have changed 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 their earnings function.

Both, the simple and the quantitative model, purposefully abstract from dynamic considerations to keep the complexity of the analysis to a minimum. This is because the decline in hours of entrepreneurs is happening steadily over a longer period, which suggests that short-run fluctuations are less informative in identifying the underlying causes of this long-run trend.

4.1 A Simple Model of Labor Supply

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

$$u(c,h) = \frac{c^{1-\sigma}-1}{1-\sigma} - \varphi\frac{h^{1+\frac{1}{\theta}}}{1+\frac{1}{\theta}}. \tag{4}$$

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

$$E(z,h) = zh^{\eta}. \tag{5}$$

For workers, who are being paid an hourly wage, this earnings function is typically assumed to be linear in hours, i.e. the earnings elasticity is one ($\eta = 1$) 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 necessarily linear in hours. Erosa et al. (2023) highlight substantial differences in hours worked between occupations of workers that stem from differences in the earnings elasticity of the particular occupation.

The utility maximization problem of both workers and entrepreneurs can be written in the following way:

$$\begin{aligned} \max_{c,h}\ u(c,h) \quad \text{s.t.: }\ & c = E(z,h) + y \\ & h \geq 0, c \geq 0 \end{aligned} \tag{6}$$

where consumption is the sum of earnings $E(z,h)$ and unearned income y, which 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:

$$h = \left(\frac{[E(z,h)+y]^{-\sigma}}{\varphi}\frac{\partial E(z,h)}{\partial h}\right)^{\theta} = \left(\frac{[zh^{\eta}+y]^{-\sigma}}{\varphi}\eta\frac{zh^{\eta}}{h}\right)^{\theta}. \tag{7}$$

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

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

and average hourly income is then given by:

$$\bar{w} = z\left(\frac{\eta z^{1-\sigma}}{\varphi}\right)^{\frac{\theta(\eta-1)}{1+\theta-\eta(1-\sigma)\theta}}. \tag{9}$$

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 *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 relative to workers.

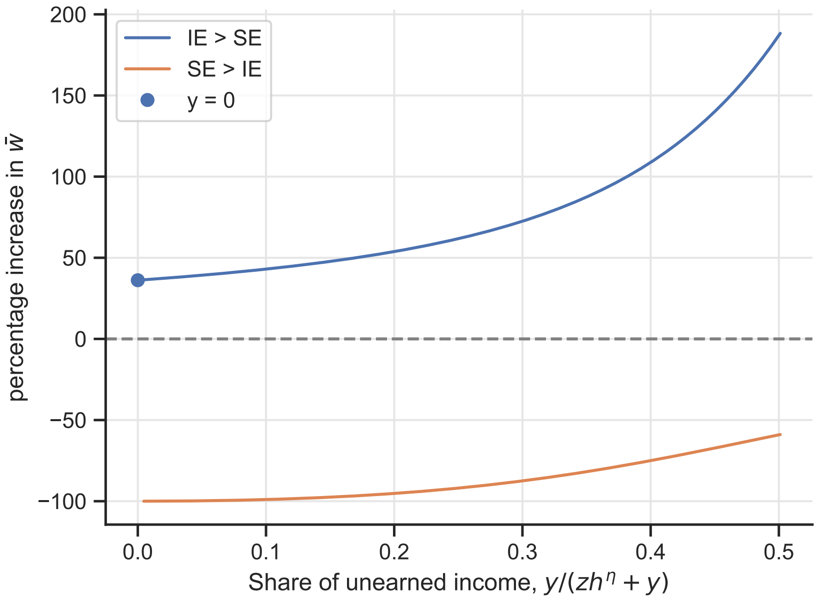

Figure 11: Changes in $\bar{w}$ necessary to generate a 7.7% drop in hours by different levels of unearned income.

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

How much does the hourly income have to change to generate a drop in hours of around 7.7% relative to workers as seen in the data?[5] 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 to generate a drop in hours. If, however, the substitution effect dominates, the opposite is true and we require a drop in the wage. Figure 11 illustrates the change in $\bar{w}$ necessary to generate a drop in hours h of 7.7%. 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 36% can generate a drop in hours of 7.7%. 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 8 to get an expression that defines the change in z necessary for a drop in hours of 7.7%. We can use this to calculate the necessary drop in $\bar{w}$:

$$1 - 0.077 = \frac{h'}{h} = \left(\frac{z'}{z}\right)^{\frac{\theta(1-\sigma)}{1+\theta-\eta(1-\sigma)\theta}} \iff \frac{z'}{z} = \left(\frac{h'}{h}\right)^{\frac{1+\theta-\eta(1-\sigma)\theta}{\theta(1-\sigma)}} \tag{10}$$

$$\frac{\bar{w}'}{\bar{w}} = \frac{z'}{z}\left(\frac{h'}{h}\right)^{\eta-1} = \left(\frac{h'}{h}\right)^{\frac{1+\sigma\theta}{\theta(1-\sigma)}} = 1.362 \tag{11}$$

Note that this increase in $\bar{w}$ is independent of the parameter η. This is certainly a sizable increase and far away from what we see in the data.[6] Second, if there is some non-zero unearned income $y > 0$, then hours can either increase or decrease depending

[5] The decrease of 7.7% is measured for men between the two periods used later in the quantitative model as well: 1989–1993 and 2015–2019.

[6] 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.

on the relative strength of the income effect and the substitution effect. If the income effect dominates, then the increase in hourly income has to be even more pronounced for higher levels of unearned income. If the substitution effect dominates at low levels of unearned income, then the fall in hourly income has to be so large that it almost needs to fall to zero. In case unearned income makes up around half of total income, then hourly income still has to decrease by around 60%. These reductions in the hourly income appear unrealistically large. Therefore, it seems unlikely that the substitution effect dominates the income effect in the data.

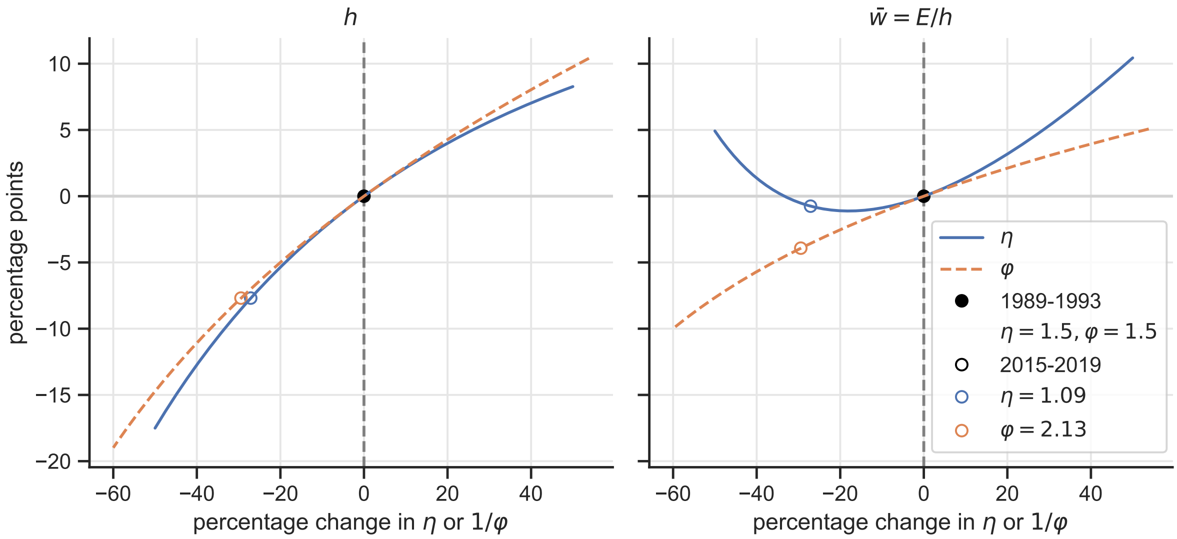

Figure 12: Changes in η necessary to generate a 7.7% drop in hours for two different values of σ.

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

Inspecting the labor supply condition in Equation (8) and (9) reveals that changes in 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 $1/\varphi$ have to change to generate a drop of 7.7% in the hours for 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.[7] 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 axes. We can see that a decrease of η (while keeping φ fixed) by about 27% decreases hours by exactly 7.7% as observed in the data. Turning to a change in φ, we see that also a decrease of $1/\varphi$ by about 29% can generate the same decline in hours.

Importantly, the implications for the hourly wage are different, 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 insight in com-

[7]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 $\eta > 1$.

bination with observations on the hourly income to distinguish the drop in hours from a change in η and a change in φ.

4.2 A Quantitative Model of Occupational Choice

The simple model above highlights that a change in the curvature of the earnings function holds promise for explaining the decline in hours without a substantial change in the hourly income. However, to properly quantify its effect, we need further restrictions on the mechanism that can be linked to data. Another salient feature of the data is the drop in the share of entrepreneurs. We can use this information 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. Therefore, I advance the simple model and introduce 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. However, I estimate the model at two points in time. Again, the static environment is well-suited for this analysis, since we see a long-run steady decline in the working hours of entrepreneurs. The estimation of the model targets three key moments: the level of average working hours for workers and entrepreneurs, the share of entrepreneurs, and the average difference in wages between workers and entrepreneurs. These key moments identify the necessary changes in the model parameters to match the observed changes 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 over consumption and hours worked. Each agent chooses to be either a worker or an entrepreneur. The two occupations are indexed by $j \in \{w, e\}$. 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 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. Given the 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 inclusion of unearned income only complicates the computation of the optimal hours decision without adding any substantial benefits.

The maximization problem can be formulated in two stages. In the first stage, agents draw a vector of four states (z_{iw}, z_{ie}, φ_i, ε_i) and choose how many hours to work, conditional on the choice of the occupation. More specifically, they solve the following utility-maximization problem:

$$V_{ij} = \max_{c_{ij}, h_{ij}} \; u_i(c_{ij}, h_{ij}) + \varepsilon_i \mathbb{1}_{[j=e]} \quad \text{s.t.: } \begin{aligned} & c_{ij} = e_{ij} \\ & h_{ij} \geq 0, c_{ij} \geq 0. \end{aligned} \tag{12}$$

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 identical to 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:

$$e_{ij} \equiv E_j(z_{ij}, h_{ij}) = z_{ij} h_{ij}^{\eta_j}. \tag{13}$$

Note that the earnings function differs between the two occupations only in the curvature with respect to hours η_j. Heckman and Honoré (1990) showed that, 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 make specific parametric assumptions about the distributions from which all idiosyncratic states are drawn. 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 φ_i, 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 is given by μ_φ and σ_φ, respectively. As a robustness analysis I also allow for a correlation between the disutility of work φ_i and the productivity of each occupation μ_z^j, where I denote the correlation coefficient $\rho_{\varphi j}$. 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 of each occupation and choose the one with the higher value. That is, agent i chooses to become an entrepreneur if the following holds:

$$V_{ie} > V_{iw}. \tag{14}$$

I abstract from the measure zero individuals who are indifferent between the two occupations. Agents' occupational choice depends first and foremost on their relative productivity draw of 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 plays an important role as the optimally chosen hours of each occupation potentially differ. This follows from the fact that the earnings functions and in particular their curvature η_j are different. Agents with a particularly low φ_i are more likely to select into entrepreneurship if $\eta_e > \eta_w$ and, thus, the optimal hours as an entrepreneur are higher than as a worker. Although the non-pecuniary benefits from entrepreneurship ε_i influence the occupational choice, it does not enter the decision problem of how many hours to work in a particular occupation. However, non-pecuniary benefits can still affect average hours and average hourly income through selection effects. If an agent with a very low z_{ie} chooses to be an entrepreneur because of the high non-pecuniary benefits, this agent then chooses to work many hours at a relatively low hourly income rate.

4.3 Estimation Strategy

The estimation of the quantitative model is performed on an early period (1989–1993) and a later period (2015–2019) using observations on males only. I use the first period (1989–1993) as a base period and measure the respective moments in the second period using compositional adjustment weights. Thus, all data moments should be interpreted as moments with the 1989–1993 composition of workers and entrepreneurs.

In the model, I first fix some parameters to standard values. The coefficient of relative risk aversion of the utility function with respect to consumption is fixed to $\sigma = 2$. This allows an income effect to be active, unlike in models with log-utility in which income and substitution effects cancel. The parameter θ, which controls the Frisch elasticity of labor supply in dynamic models, 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. This acts as a normalization for the level of earnings in the first period.[8]

After fixing these parameters we are left 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 values μ_z^j for the mean and the two values σ_z^j for the standard deviation. Since $\mu_z^w = 1$ acts as a normalization in the first period, there are only three parameters associated with the productivity distributions that have 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 most importantly, I use the log of mean hours for entrepreneurs and workers, the share of entrepreneurs, and the mean difference in log wages between entrepreneurs and workers, which captures the three main empirical facts. I further use the share of entrepreneurs and workers working more than 45 hours to match the fact that the decline in hours comes primarily from the top of the hours distribution. Then, I use the log standard deviations of wages for entrepreneurs and workers, which help pin down the standard deviation of the two productivity distributions. Finally, the one moment that links the two periods is the mean of log earned 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.

When computing these moments in the data, I average over the two five-year periods to smooth year-specific variations. In order to deal with compositional changes, I first produce composition adjustment weights for the second period (2015–2019) such that observations are weighted 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 as used in Section 3. To estimate the model, I use the simulated method of moments. For each period, I simulate three million agents (corresponding to the number of observations in the data), solve their labor supply and

[8] I further set $h = 1$ in the model to correspond to 40 hours per week in the data. Thus, the earnings of a full-time worker with average productivity is one.

occupational choice decisions, and compute the model moments. I then use the Nelder-Mead algorithm to search for the parameters that minimize the sum of squared residuals between the model moments and the data moments. To obtain confidence intervals, I repeat this procedure 300 times with different random draws.

4.4 Estimation Results

Table 3 reports the point estimates along with the confidence intervals of the 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 only decreases marginally. 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 the taste for work φ_i. While the mean disutility of labor has slightly decreased, the standard deviation almost stayed unchanged. However, the size of the confidence interval for the mean disutility makes this change hardly statistically significant. 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. The reader should note that this is the mean of the underlying theoretical distributions from which agents draw their productivity value. It does not necessarily inform us about the ex-post realized value of productivity for entrepreneurs after selection. However, comparing these values between the two periods, we can hardly see any change for μ_z^e, but a substantial increase in μ_z^w. Even though μ_z^e is fairly stable over time, the standard deviation of the entrepreneurial productivity distribution $\sigma_{\log(z)}^e$ has increased. Despite $\sigma_{\log(z)}^w$ is lower in levels, a similar proportional increase can also be observed for workers. Eventually, we also see a slight increase in the standard deviation of the non-pecuniary benefits σ_ε.

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 and the value of the objective function (sum of squared residuals). 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 high 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. 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 completely reflect a log-normal distribution. The remaining moments are matched almost perfectly. Overall, the fit of the model with the data is much better in the second period as in the first, which can be seen from the much lower value of the objective function. This is mainly due to the difficulty to explain the very high hours of entrepreneurs in the first period.

To see the effect of each parameter, we can perform a decomposition of the parameter changes shown in Figure 13. To do this, I start from the estimated model in the first period (period I). I then change the parameters one after the other and report the

Table 3: Estimated parameters

Parameter	Value 1989-1993	Value 2015-2019	Description
η_e	1.561 [1.365, 1.707]	1.174 [0.992, 1.369]	Earnings elasticity of entrepreneurs
η_w	1.202 [1.048, 1.315]	1.145 [0.965, 1.336]	Earnings elasticity of workers
μ_φ	1.003 [0.882, 1.092]	0.934 [0.792, 1.083]	Mean, disutility of labor, φ_i
σ_φ	0.104 [0.070, 0.148]	0.093 [0.069, 0.112]	Std., disutility of labor, φ_i
μ_z^e	0.381 [0.368, 0.392]	0.41 [0.391, 0.426]	Mean, entrepreneurial productivity distribution
$\sigma_{log(z)}^e$	1.251 [1.201, 1.289]	1.376 [1.313, 1.450]	Std., entrepreneurial productivity distribution
μ_z^w	1.0	1.233 [1.224, 1.245]	Mean, worker productivity distribution
$\sigma_{log(z)}^w$	0.494 [0.475, 0.508]	0.573 [0.546, 0.601]	Std., worker productivity distribution
σ_ε	0.829 [0.786, 0.866]	0.913 [0.865, 0.960]	Std., non-pecuniary benefits

Notes. Values in brackets report 95% confidence intervals obtained by 300 bootstrap iterations.

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	45.92	42.80	42.37
Mean hours of workers	43.26	43.07	41.95	41.70
Share of entrepreneurs with 46+ hours (in %)	48.22	49.78	32.98	33.20
Share of workers with 46+ hours (in %)	27.33	27.49	22.14	22.41
Share of entrepreneurs (in %)	14.07	14.06	12.09	12.09
$mean(\log(e_{ie}/h_{ie})) - mean(\log(e_{iw}/h_{iw}))$	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	–	–	0.12	0.12
Objective function value ($\times$1000)		19.07		1.71

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. The value of the objective function is multiplied by 1000.

mean hours together with the share working more than 45 hours for both workers and entrepreneurs and the share of entrepreneurs along the horizontal axis. Eventually, the last bars on the right side of each panel show the estimated model in period II. The numbers for all model moments are available in Table 7 in the appendix.

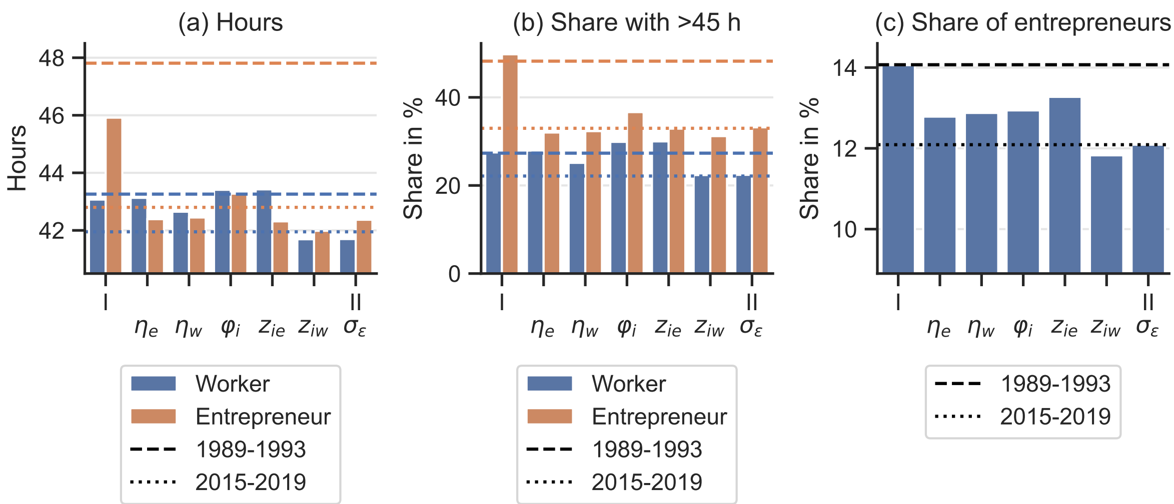

Figure 13: Decomposition of parameter changes.

Figure 13 shows the result of this decomposition exercise. The first (leftmost) two bars of panel (a) for hours, which are labeled with “I” on the x-axis, 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. The first two bars of panel (b) show the equivalent but for the share of individuals working more than 45 hours and panel (c) shows the equivalent for the share of entrepreneurs. This also illustrates the fit of the model for these three moments and we can see that both the share of entrepreneurs and the share of individuals working more than 45 hours fit the data moments very closely. However, the average hours of entrepreneurs are slightly too low.

The next group of bars labeled with η_e in panel (a) shows the hours of entrepreneurs and workers when only changing η_e to the value estimated in period II. A change in only this parameter reduces the mean hours of entrepreneurs substantially and brings it very close to the target for period II. In fact, a change in η_e reduces the hours of entrepreneurs by 3.5 hours, which is 70% of the total decline in average hours observed in the data. This single parameter change is even more successful in explaining the reduction at the top of the hours distribution. Compared to the observed fall in the share of entrepreneurs working more than 45 hours in the data, it predicts 117% of it. Turning to the share of entrepreneurs, we can see that a change in η_e substantially reduces the share of entrepreneurs. It can explain about 65% of the overall fall in the share of entrepreneurs in the data.

As we 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 the parameter changes for η_w are smaller between the two periods compared to η_e, it only reduces the hours of workers by 0.5 hours and the share of workers working more than 46 hours by about 2.8 pp. Next, we change the two parameters that are associated with the distribution of φ, the mean μ_φ and the standard deviation σ_φ. The change in these two parameters shifts the hours of both entrepreneurs and workers up by about 0.8 hours, but keeps the share of entrepreneurs mostly unchanged. Changes in the two parameters that describe the underlying productivity distribution of entrepreneurs, labeled with z_{ie},

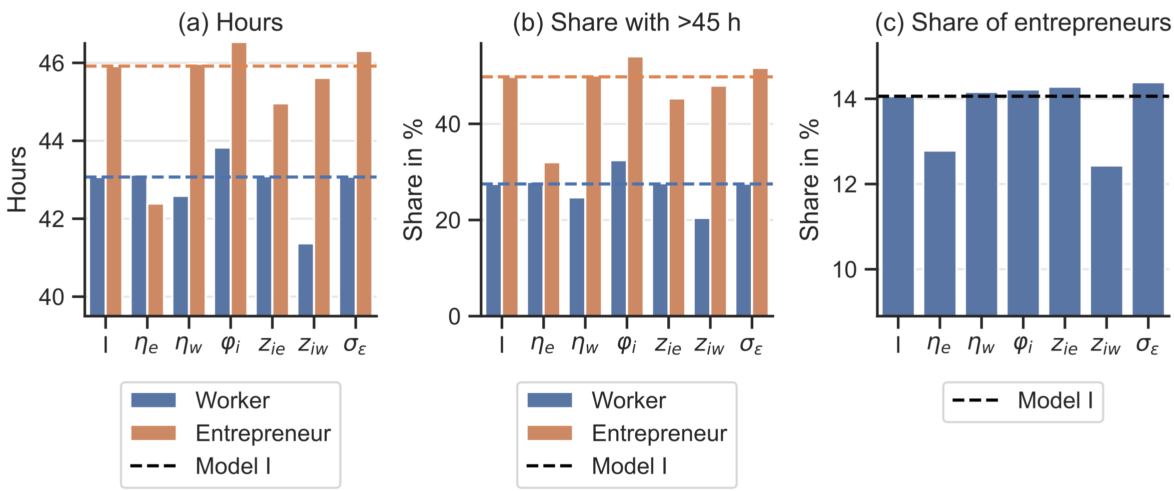

Figure 14: Isolated effect of each parameter or group of parameters.

reduce the hours of entrepreneurs, but an important distinction is that it also increases the share of entrepreneurs. This is very much in line with an income effect. The increase in productivity increases their income, lowers their optimal hours, but also makes it more attractive to become an entrepreneurs. Interestingly, the changes in the parameter for the productivity distribution of workers, labeled with z_{iw}, reduce the hours of workers, but surprisingly also has a substantial impact on the share of entrepreneurs and reduces it by 1.44 pp. Finally, the change in the standard deviation of the distribution of non-pecuniary benefits σ_ε only has small impact on the all moments.

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 changes one parameter (or group of parameters for the case of φ_i, z_{ie}, and z_{iw}) 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 decreasing both the hours of entrepreneurs and their share. While changes in the parameter associated with the productivity distribution of workers 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, especially at the top of the hours distribution, and a fall in the share of entrepreneurs in the labor force.

Since the effects of the parameters with a small change from one period to the other mechanically show up as having a small effect, we can also look at the elasticities of these parameters. Figure 43 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 that η_e is one of the most important parameters that can move the hours and the share of entrepreneurs in the same direction. Also the dispersion of the productivity distribution of entrepreneurs σ_z^e is identified to move all three moments of interest in the same direction, but changes in this parameter are more strongly restricted by other moments, especially the standard deviation of entrepreneur's hourly income. Further, despite the little difference in μ_φ between the two estimated periods, 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 Robustness With Linear Earnings Functions

The previous section explored the sensitivity to different model parameters, while assuming no correlation between the disutility of labor and the productivity of being an entrepreneur or worker. This section now relaxes this assumption and allows for a correlation between φ_i and z_{iw} as well as z_{ie}. However, I will still maintain the assumption that z_{iw} and z_{ie} are uncorrelated with each other. Thus, this puts a restriction on the correlation matrix to be well defined.[9] Depending on the variance of these terms, this puts an upper bound on the two correlation coefficients.

In order to keep the estimation just-identified without adding further data moments, I assume linear earnings functions for both workers and entrepreneurs (i.e. $\eta_w = \eta_e = 1$) during this exercise. Therefore, the estimation result of this model shows how much of the data can be explained with a linear model and a richer correlation structure instead.

Table 5: Targeted moments of non-linear (NL) and linear (L) model.

	I) 1989-1993			II) 2015-2019		
Moment	**Data**	**NL**	**L**	**Data**	**NL**	**L**
Mean hours of entrepreneurs	47.81	45.92	45.75	42.80	42.37	42.62
Mean hours of workers	43.26	43.07	43.08	41.95	41.70	41.54
Share of entrepreneurs with 46+ hours (in %)	48.22	49.78	49.17	32.98	33.20	33.98
Share of workers with 46+ hours (in %)	27.33	27.49	28.16	22.14	22.41	21.68
Share of entrepreneurs (in %)	14.07	14.06	13.80	12.09	12.09	12.09
$mean(\log(e_{ie}/h_{ie})) - mean(\log(e_{iw}/h_{iw}))$	0.04	0.04	0.04	-0.00	0.00	0.00
$std(\log(e_{ie}/h_{ie}))$	0.66	0.66	0.66	0.77	0.77	0.76
$std(\log(e_{iw}/h_{iw}))$	0.46	0.46	0.45	0.54	0.54	0.54
Difference of $mean(log(e_{iw}))$ to first period	–	–	–	0.12	0.12	0.12
Objective function value ($\times$1000)		19.07	21.66		1.71	2.96

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. The value of the objective function is multiplied by 1000.

Table 5 compares the benchmark non-linear model (NL) without any correlation between the disutility of labor and the productivity terms to the linear model (L) that allows for some correlation. Also the linear model manages to get reasonably close to the targeted moments, but like the non-linear model struggles to fit the very high hours of entrepreneurs in the first period. However, a closer inspection of the value of the objective function reveals that the linear model does not manage to improve the overall fit of the model. Indeed, the sum of squared residuals is 14% higher in period I and

[9] The correlation coefficient between φ_i and z_{iw} as well as z_{ie} cannot be one, while z_{iw} and z_{ie} are uncorrelated.

73% higher in period II. Therefore, we can conclude that assuming non-linear earnings functions fits the data better than assuming a correlation between the disutility of labor and the respective productivity terms.

4.6 Interpreting a Drop in η

One remaining question is how this drop in the earnings elasticity of entrepreneurs can be interpreted. This section investigates two possible explanations. The first is a change in the demand elasticity faced by entrepreneurs. It shows that a decrease in competition is compatible with a fall in the curvature of the earnings function. The second possible interpretation is a change in the tax progressivity. However, this is less promising as an explanation since I estimate a very similar fall in the tax progressivity for entrepreneurs and workers. If anything, the observed change in the tax progressivity has increased the returns to working long hours instead.

A change in the demand elasticity. To see what role the demand elasticity plays in the choice of hours, I set up a very simple example where an entrepreneur faces a downward-sloping demand curve, and argue that a change in demand elasticity can create a situation where a decrease in demand elasticity is observably identical to a decrease in earnings elasticity η_e.

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

$$q(p_i) = \left(\frac{p_i}{P}\right)^{-\epsilon} Q \qquad \text{or by} \qquad p(q_i) = \left(\frac{q_i}{Q}\right)^{-\frac{1}{\epsilon}} P. \tag{15}$$

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.[10] Then, it directly follows that the entrepreneur's total revenues are given by:

$$p(q_i)q_i = Q^{-\frac{1}{\epsilon}} P q_i^{\frac{\epsilon-1}{\epsilon}}. \tag{16}$$

Further, let us assume that the entrepreneur's production function is given by $q_i(h_i) = \zeta_i h_i^{\alpha}$ and we can express her earnings as:

$$e_{ie} = Q^{-\frac{1}{\epsilon}} P \left(\zeta_i h_i^{\alpha}\right)^{\frac{\epsilon-1}{\epsilon}} = z_{ie} h_i^{\eta_e}, \tag{17}$$

where some terms are collected in $z_{ie} = Q^{-\frac{1}{\epsilon}} P \zeta_i^{\frac{\epsilon-1}{\epsilon}}$ and in $\eta_e = \alpha\frac{\epsilon-1}{\epsilon}$. This is exactly the assumed functional form of the earnings function of workers and entrepreneurs. A decrease in the elasticity of demand (a decrease in ϵ) then causes a decline in her earnings elasticity η_e.

This simple example shows 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.

[10] Note that the demand function can be micro-founded assuming consumers have a constant-elasticity-of-substitution utility function over entrepreneur i's and her competitors' goods.

In turn, the interpretation of a decrease in ϵ is that her customers are now less price sensitive. This allows her to raise her markup, i.e. raise her price, and lower quantities. Furthermore, it also changes the curvature of the revenue function in the same way that the estimation suggested. One scenario, in which the demand elasticity could change, is a change in the market structure. For example, a decrease in competition or an increase in monopoly power could lead to a lower price elasticity. Quantitatively, the estimated 25% fall of η_e in this paper is very much in line with the increase in aggregate markups estimated by De Loecker et al. (2020), which implies a fall of $\frac{\epsilon-1}{\epsilon}$ of also 25%.

A change in the tax progressivity. The curvature of the earnings function for both workers and entrepreneurs is also affected by the tax system. More progressive taxation reduces the after-tax income for high earners. Since the empirical analysis showed a positive relationship between hours and income, a more progressive taxation would also change the curvature of the earnings function with respect to hours. This motivates a closer look at changes in the tax progressivity of the US.

Following Heathcote et al. (2017) and Borella et al. (2023), I model the US tax system with the following effective tax function:

$$T(Y) = Y - (1-\alpha)Y^{1-\tau}, \tag{18}$$

where τ is the strength of the tax-progressivity and α is the average tax rate when $Y = 1$. Thus, the after-tax disposable income is given by:

$$\hat{Y} = (1-\alpha)Y^{1-\tau}. \tag{19}$$

Taking logs, we can estimate the following equation in the CPS ASEC to obtain estimates for the tax-progressivity parameter τ_t over time:

$$\log(\hat{Y}_{it}) = \log(1-\alpha_t) + (1-\tau_t)\log(Y_{it}). \tag{20}$$

The after-tax disposable income is computed by taking the total personal income and subtracting federal and state tax estimates provided by IPUMS-CPS (Flood et al., 2022).

As we can see in Figure 15, the tax progressivity for both workers and entrepreneurs decreased substantially since the 1990s. However, there are no noticeable differences in the tax progressivity between workers and entrepreneurs. More importantly, this decrease in the tax progressivity increases the convexity of the earnings function. Therefore, it could partly explain the estimated increase in the convexity for workers but is unable to explain the decrease in the convexity for entrepreneurs.

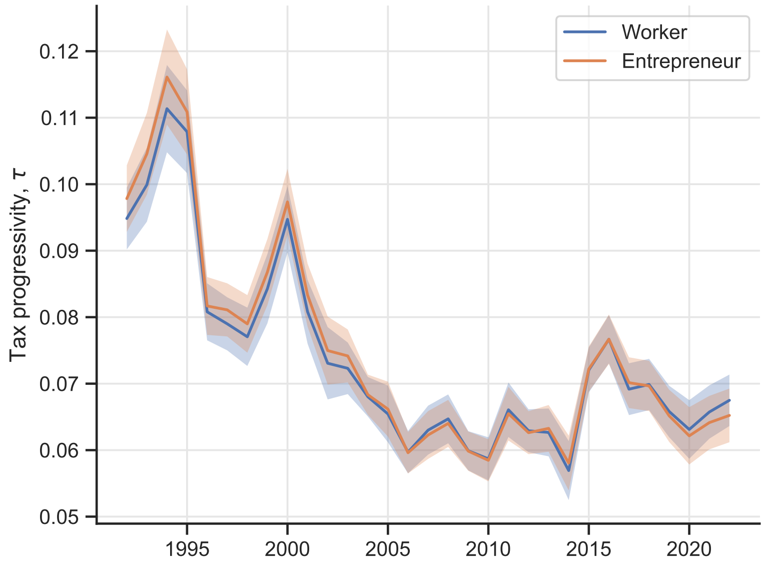

Figure 15: Estimated tax progressivity parameter τ_t for male workers and entrepreneurs over time.

Notes. Data from the CPS ASEC. Sample includes only males. τ_t is estimated using Equation 20. Shaded areas indicate 95% confidence intervals.

5 Conclusion

This paper documents a new fact about the working hours of entrepreneurs in the US. I find a substantial decline of 5.2 weekly hours relative to workers over the last 35 years. After accounting for compositional changes in terms of gender, age, education, 25 occupation groups, 12 industry groups, and the number of children, the downward trend is slightly reduced to 3.8 weekly hours over the last 35 years. The decline is broad-based and visible in almost all subgroups, except two small occupation groups. Further robustness analyses show, that the same trend can not only be observed in other US surveys, but also in Germany. The composition of hours reveals that the decline in working hours originates from the top of the hours distribution and the share of entrepreneurs working more than 45 hours has dropped by around 20 percentage points.

The paper documents two more 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. Therefore, 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 relates it to 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. Consequently, the income of entrepreneurs fell proportionally with their hours.

Using a simple static labor supply model, I explore several possible mechanisms as an explanation for 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 this would imply an increase in the hourly income of about 36% under reasonable parameter calibrations. This strongly contrasts with 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 without a big change in the hourly income.

With the insights from the simple model, I 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 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 70% of the decline in hours, predicts 117% of the observed decline in the share of entrepreneurs working more than 45 hours, and 65% of the fall in the share of entrepreneurs in the labor force. 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 maps to a decrease in the curvature of the entrepreneurial earnings function. A change in the market structure of entrepreneurs that led to a decreased price elasticity was identified to be a possible 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, Vol. 2). 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.

Borella, M., De Nardi, M., Pak, M., Russo, N., & Yang, F. (2023). The Importance of Modeling Income Taxes over Time: US Reforms and Outcomes. *Journal of the European Economic Association*.

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.

Deb, S. (2023). How Market Structure Shapes Entrepreneurship and Inequality. *manuscript*.

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.

Heathcote, J., Storesletten, K., & Violante, G. L. (2017). Optimal tax progressivity: An analytical framework. *The Quarterly Journal of Economics*, *132*(4), 1693–1754.

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.

Moffitt, R., & Zhang, S. (2018). Income volatility and the PSID: Past research and new results. *AEA Papers and Proceedings*, *108*, 277–280.

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

Neira, J., & Singhania, R. (2022). The role of corporate taxes in the decline of the startup rate. *Economic Inquiry*, *60*(3), 1277–1295.

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

Ramey, V. A., & Francis, N. (2009). A Century of Work and Leisure. *American Economic Journal: Macroeconomics*, *1*(2), 189–224.

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 Appendix

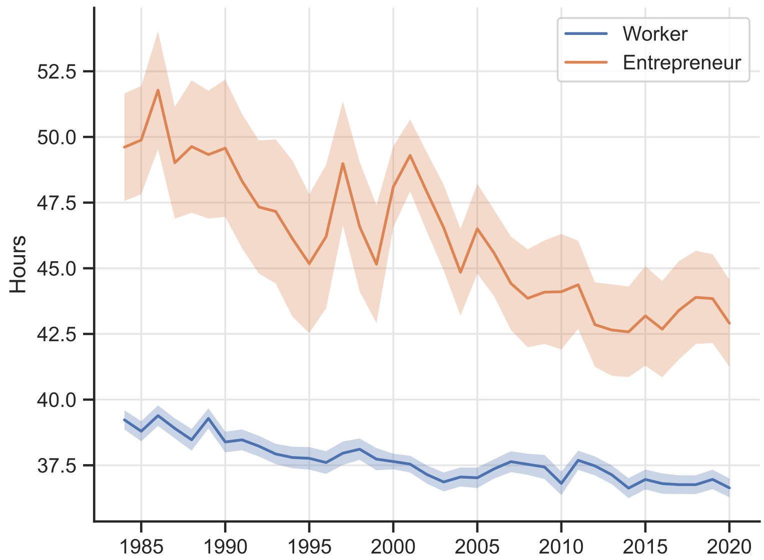

Figure 16: Average weekly hours worked in Germany.

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.

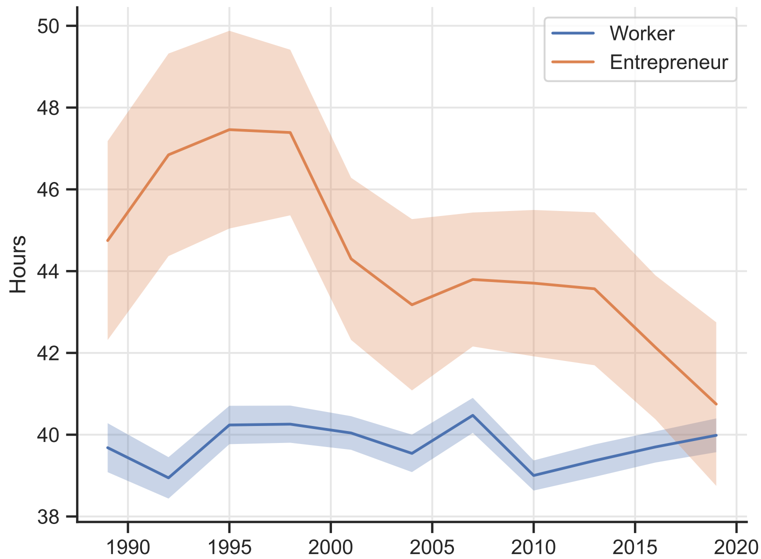

Figure 17: Average weekly hours worked in the US with data from the SCF.

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.

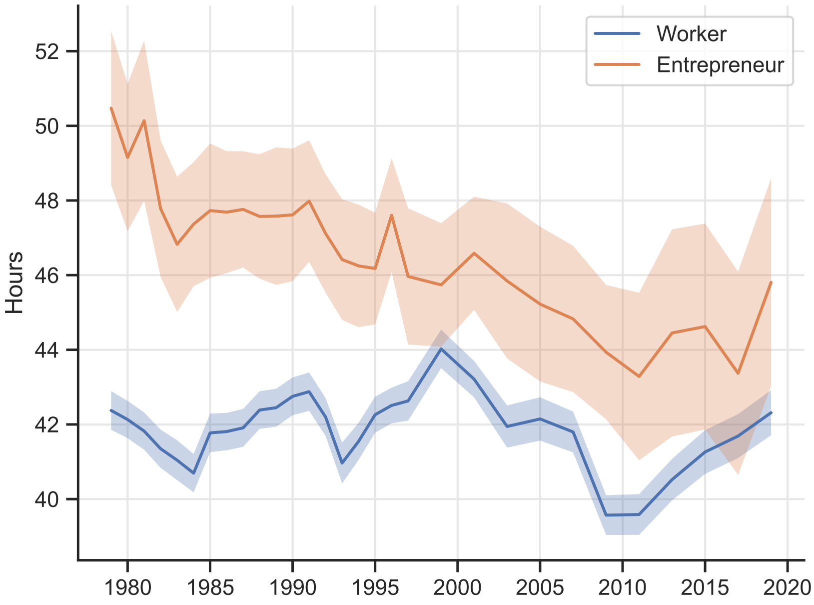

Figure 18: Average weekly hours worked in the US with data from the PSID.

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.

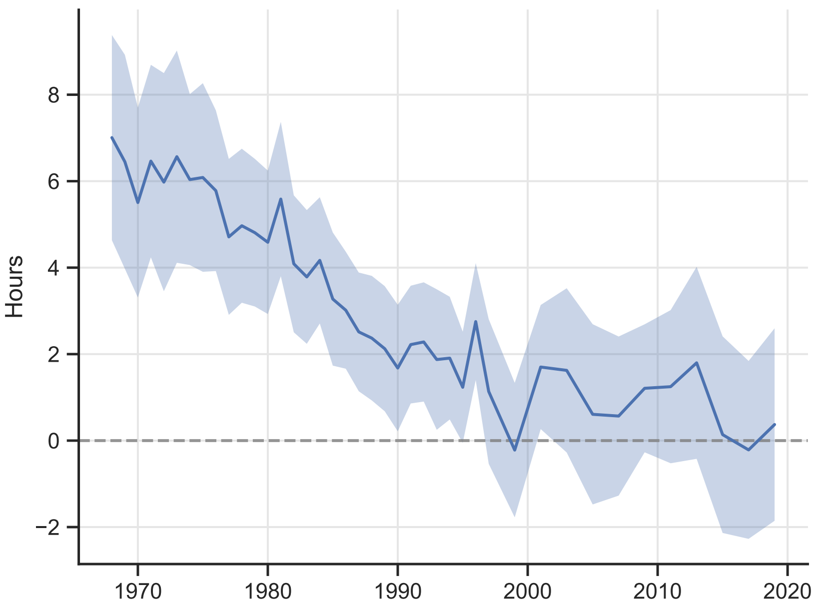

Figure 19: Difference in weekly hours worked between entrepreneurs and workers in the PSID from a regression framework with individual fixed effects.

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.

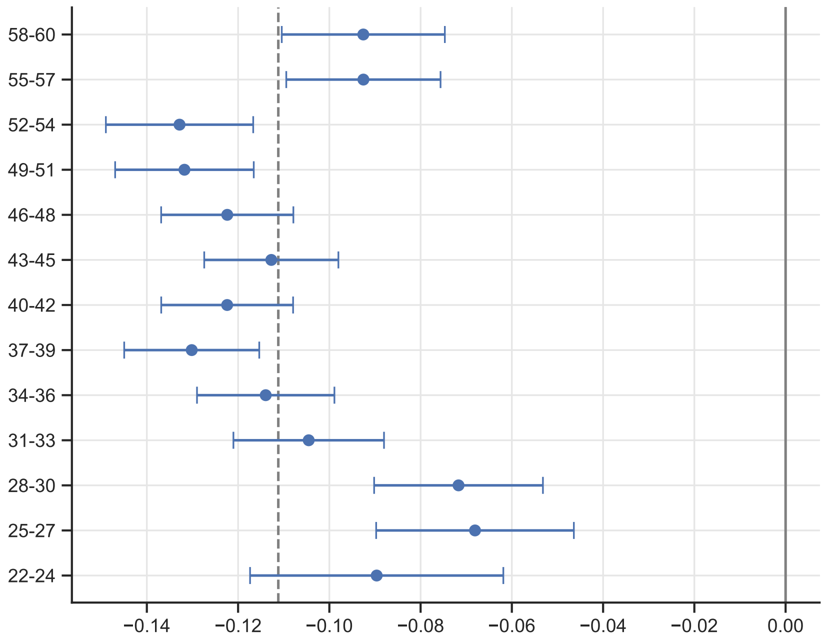

Figure 20: Breakdown of the decline in average weekly hours worked of entrepreneurs relative to workers by age bins.

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

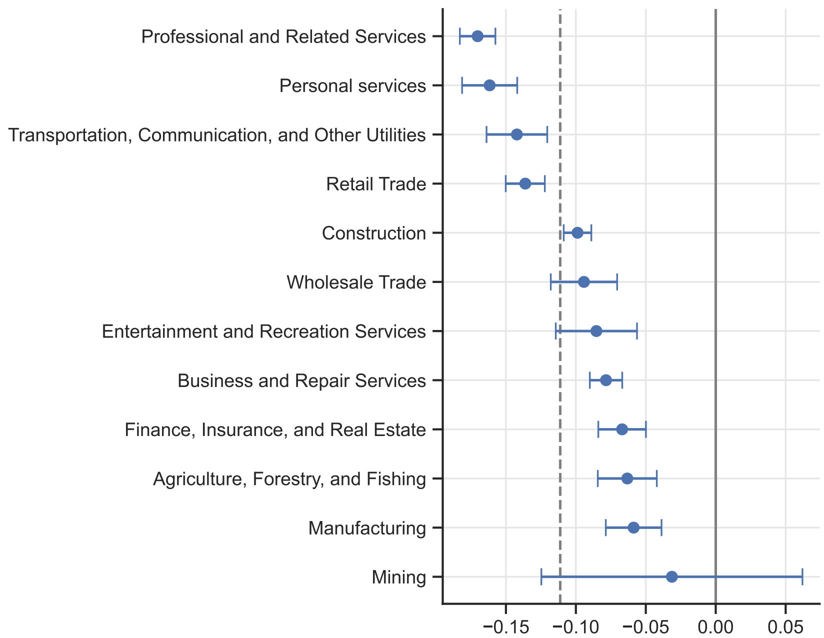

Figure 21: Breakdown of the decline in average weekly hours worked of entrepreneurs relative to workers by industry groups.

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

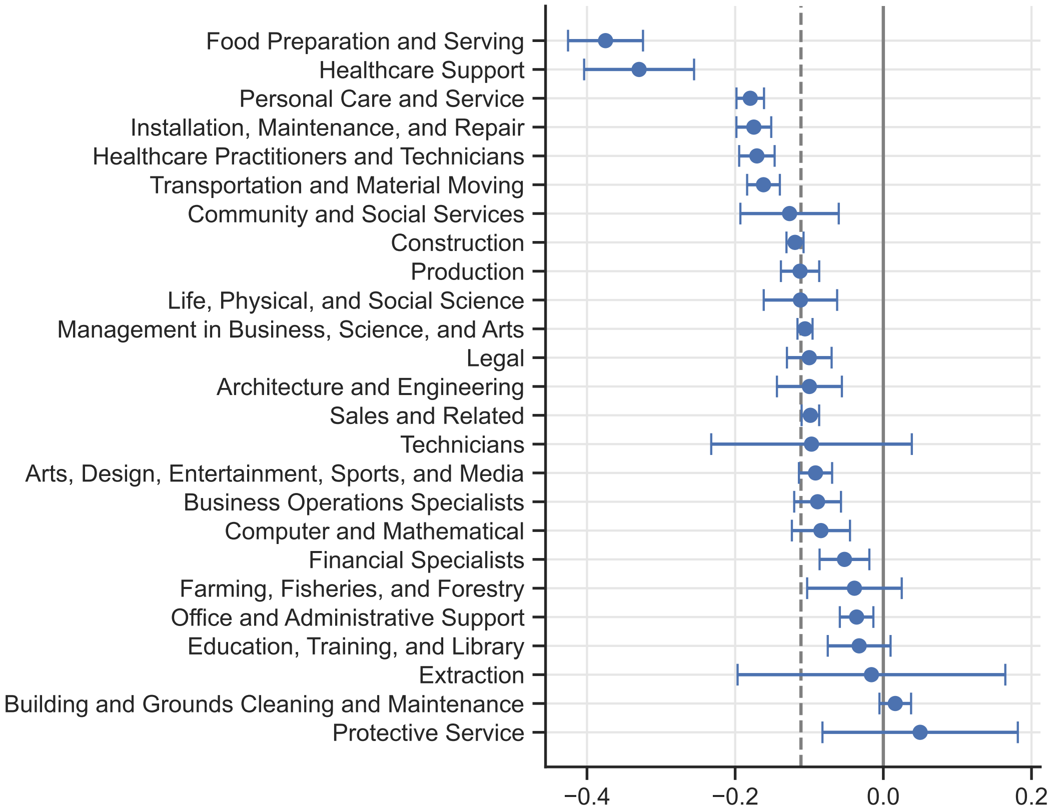

Figure 22: Breakdown of the decline in average weekly hours worked of entrepreneurs relative to workers by occupation groups.

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

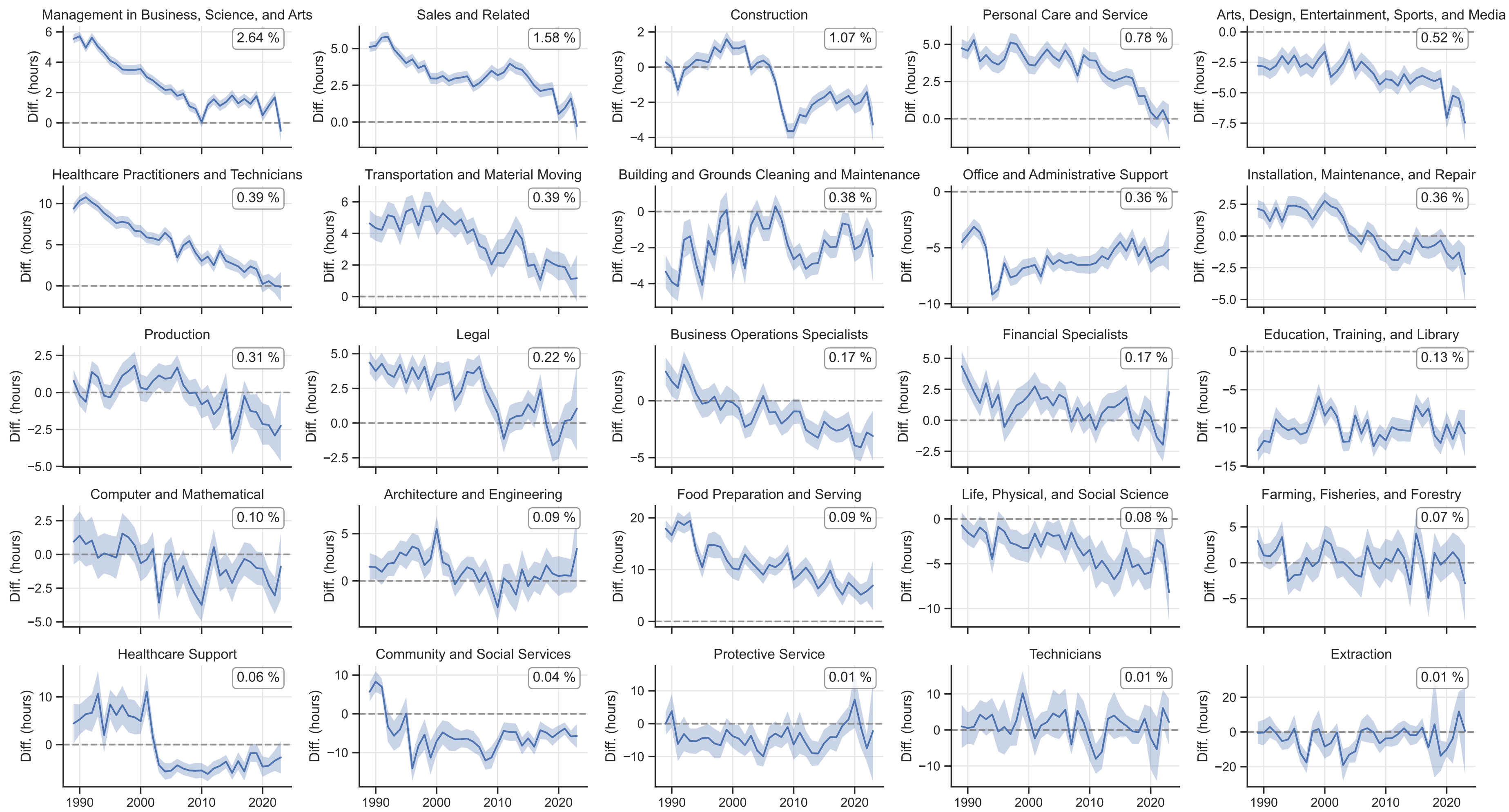

Figure 23: Difference in weekly hours worked between entrepreneurs and workers within each occupation group.

Notes. Data from the CPS basic monthly interview. Whiskers indicate 95% confidence intervals. The number in the box shows the average share of entrepreneurs in the labor force for the respective occupation group. The occupation groups are ordered by the average share of entrepreneurs.

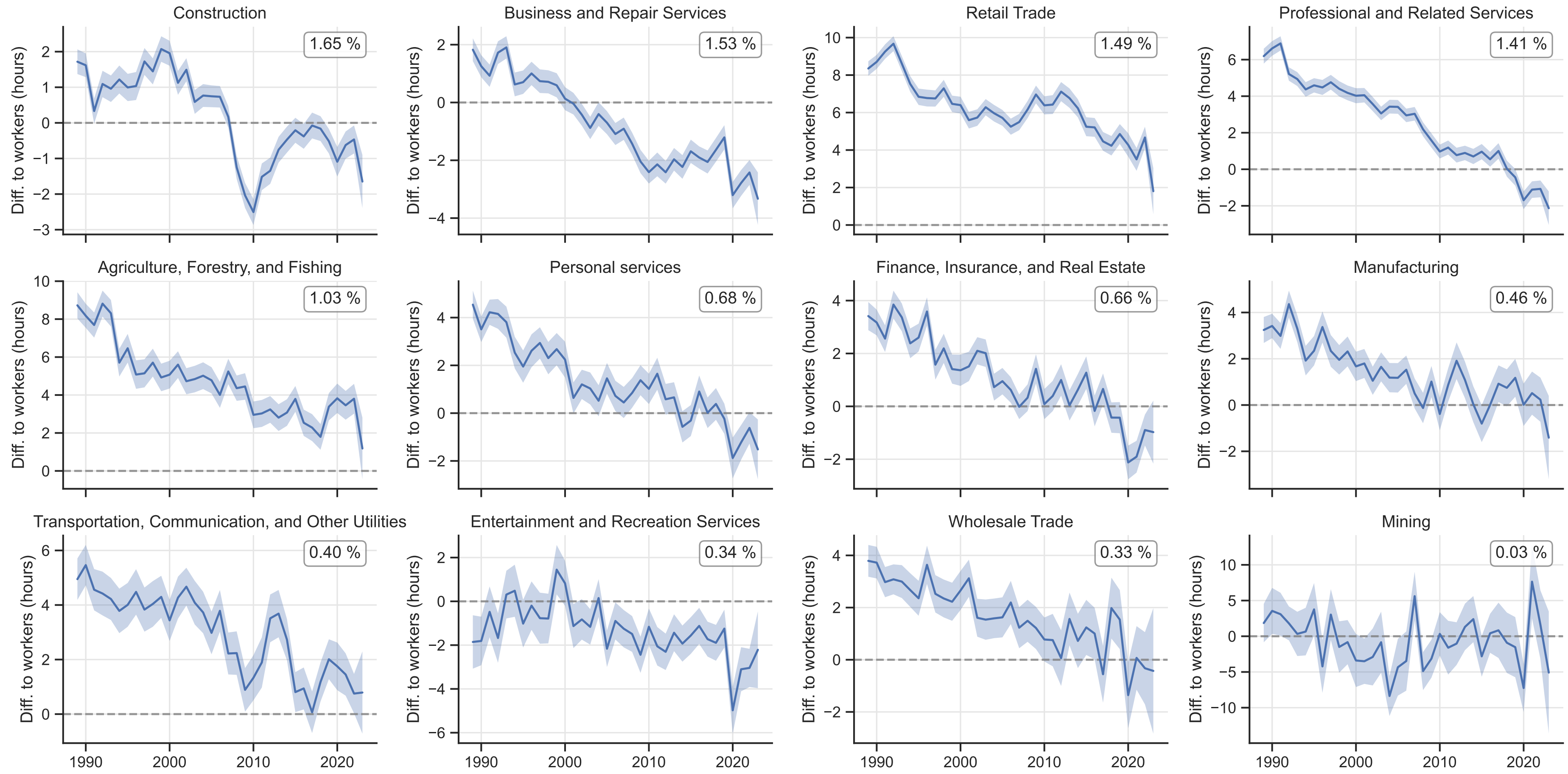

Figure 24: Difference in weekly hours worked between entrepreneurs and workers within each industry group.

Notes. Data from the CPS basic monthly interview. Whiskers indicate 95% confidence intervals. The number in the box shows the average share of entrepreneurs in the labor force for the respective industry group. The industry groups are ordered by the average share of entrepreneurs.

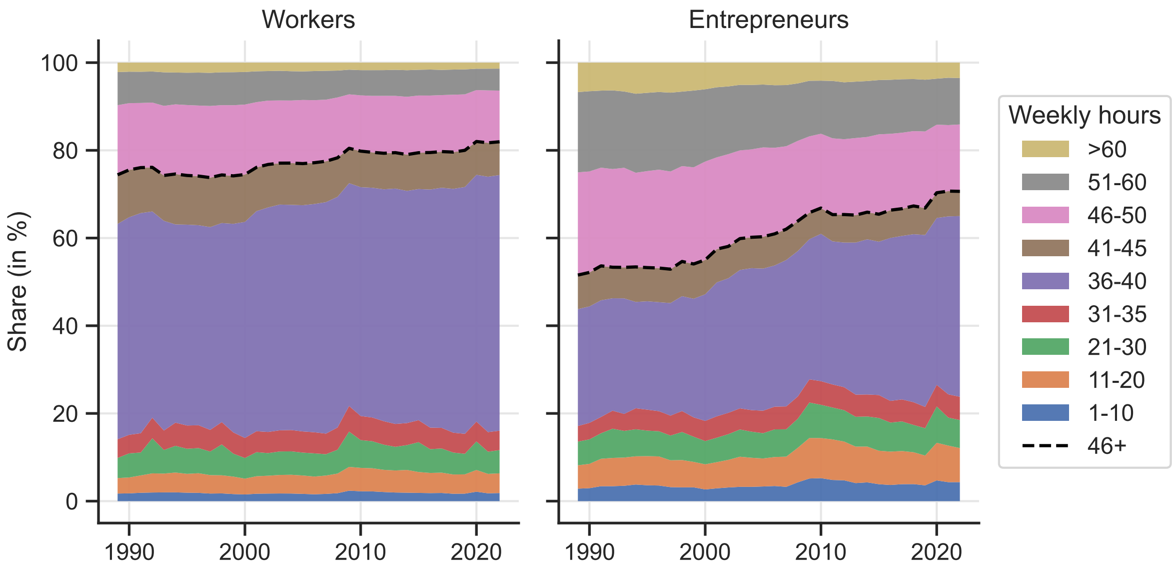

Figure 25: The composition of hours for male workers and entrepreneurs over time.

Notes. Data from the CPS basic monthly interview.

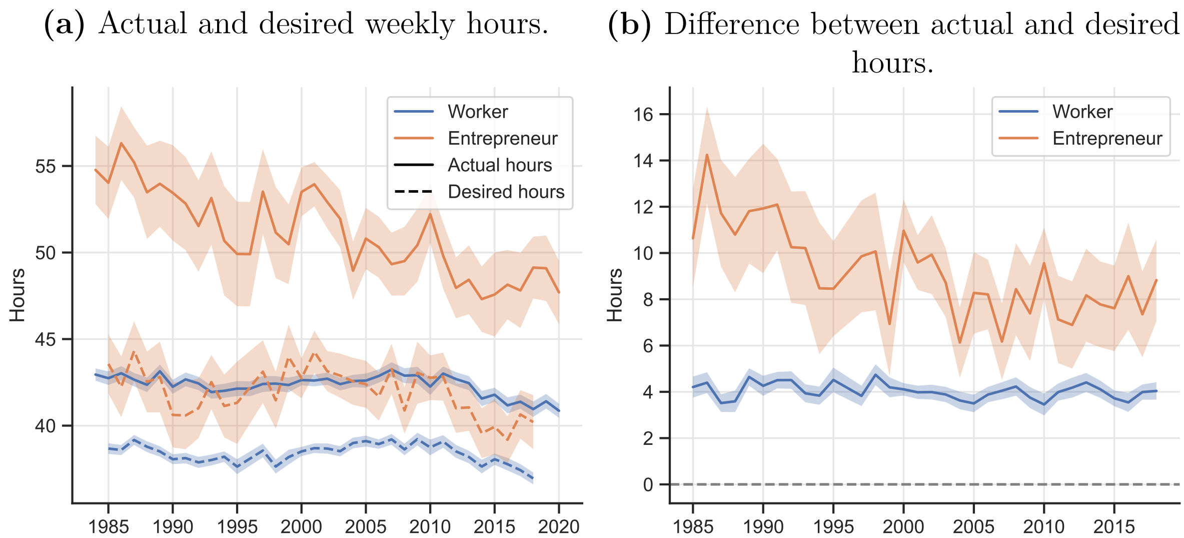

Figure 26: Actual and desired weekly hours for men in Germany.

Notes. Data from the SOEP in Germany. Weighted by sample weights. Shaded areas indicate 95% confidence intervals.

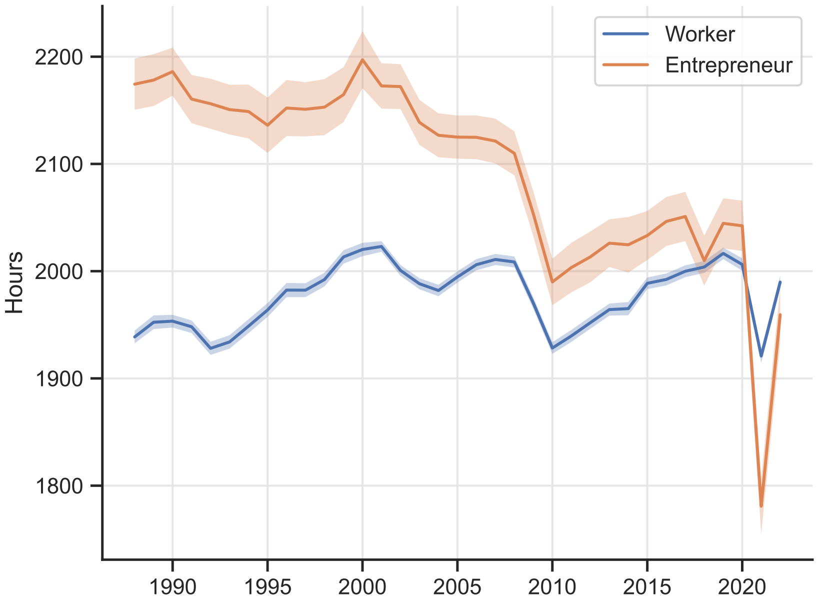

Figure 27: Annual hours worked for workers and entrepreneurs.

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.

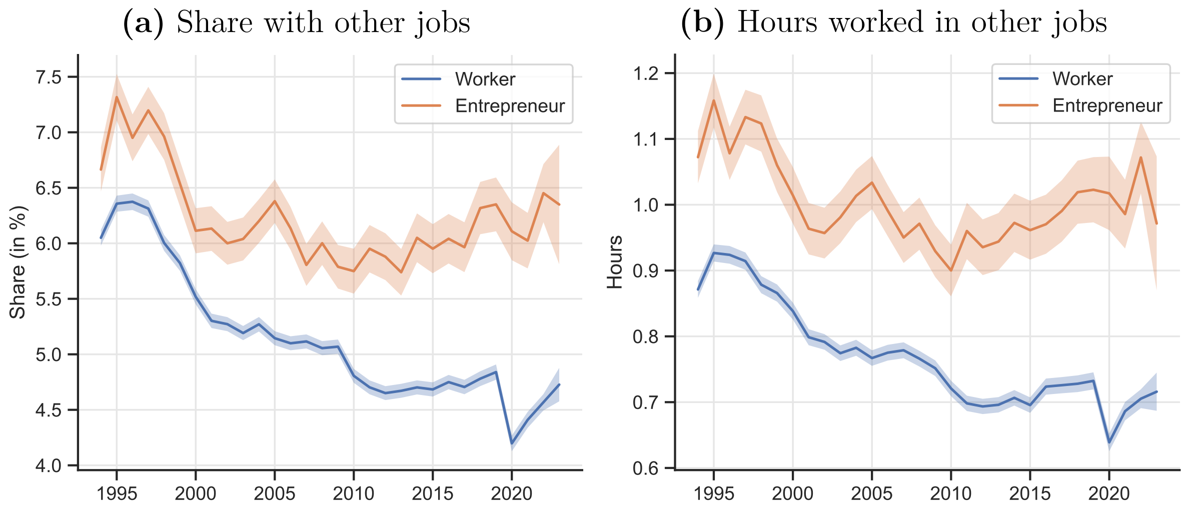

Figure 28: Share of individuals having more than one job and the total average hours worked on other jobs.

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

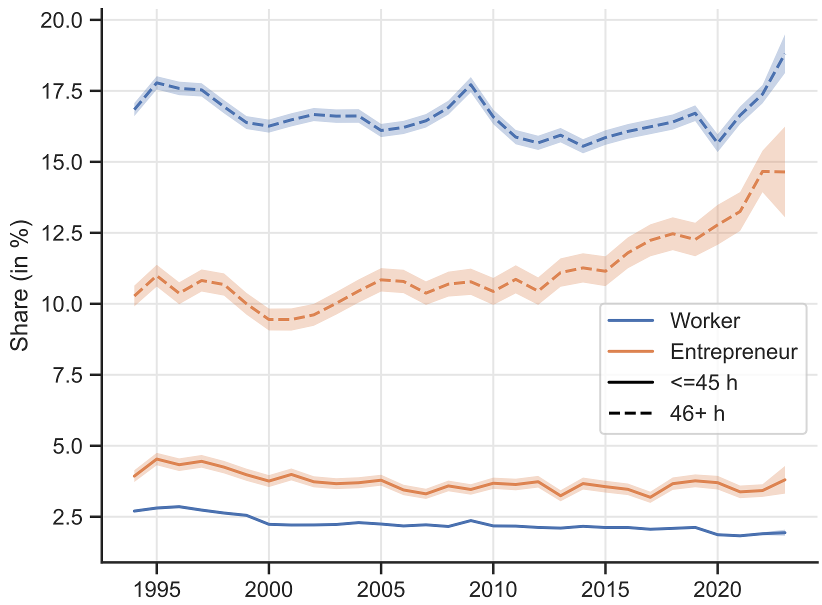

Figure 29: Share of individuals having more than one job split by working more or less than 45 hours.

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

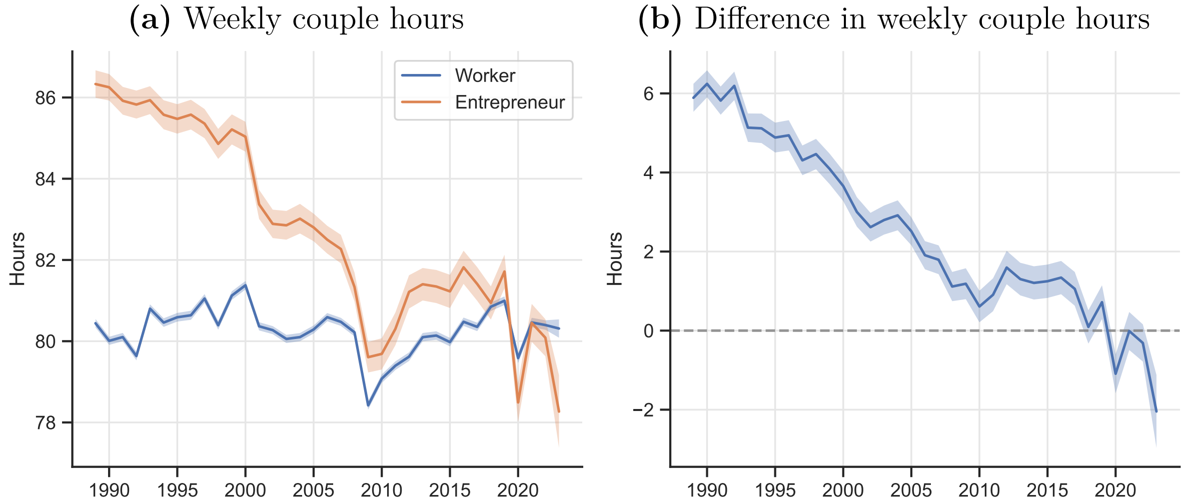

Figure 30: Weekly hours worked by the couple together.

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.

Figure 31: 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.

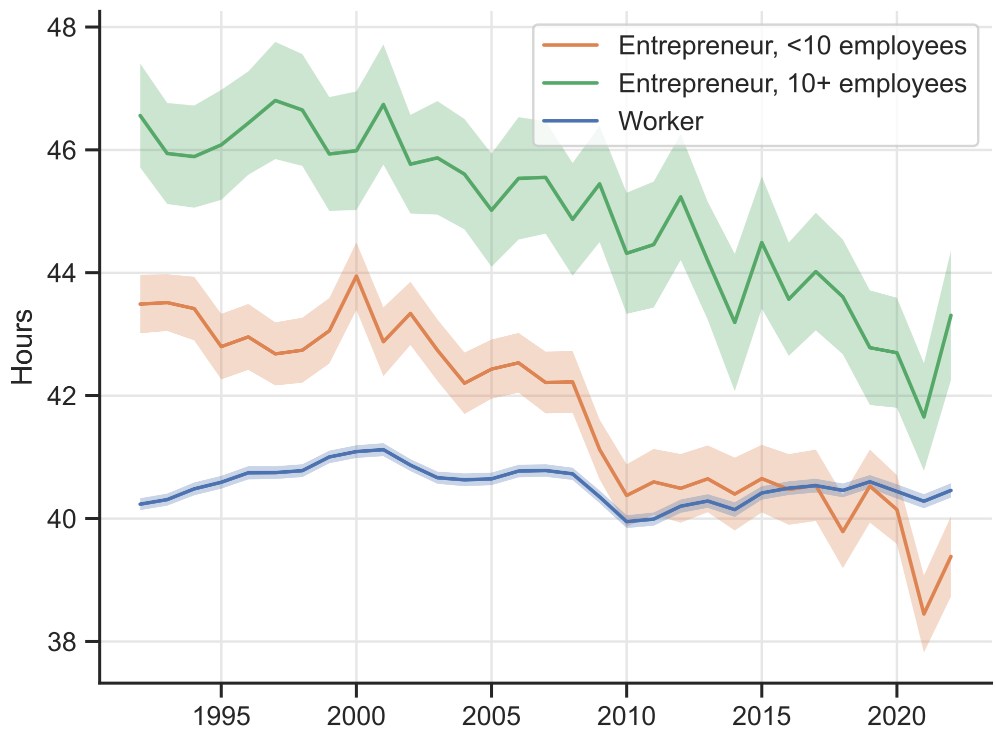

Figure 32: Weekly hours worked by firm size.

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

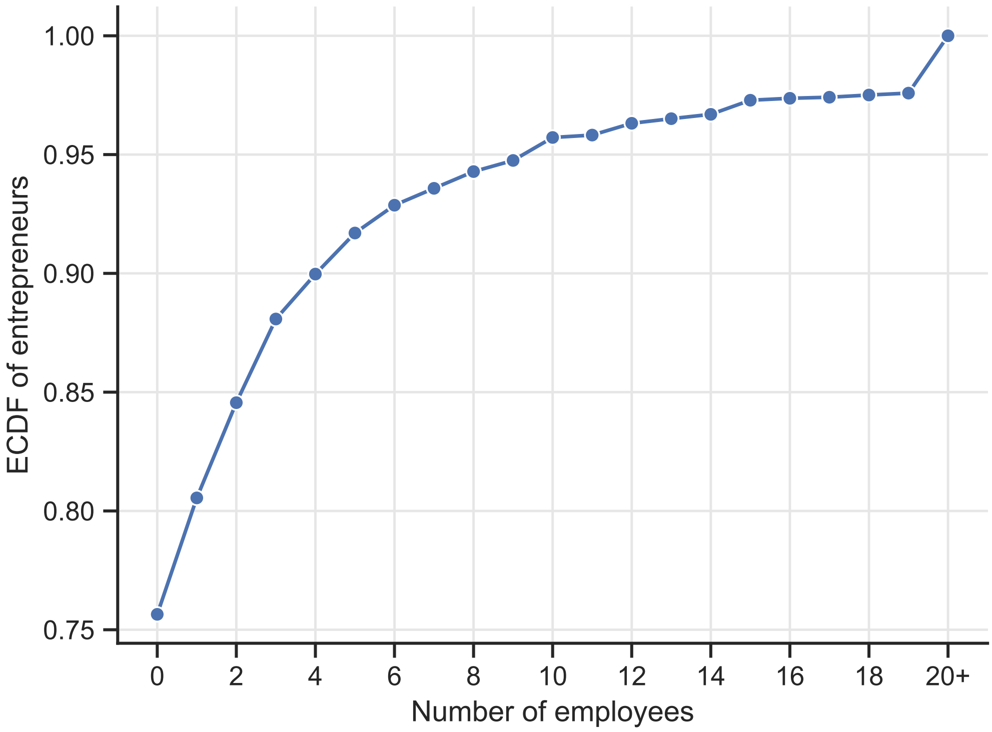

Figure 33: The distribution of number of employees among entrepreneurs in 2015.

Notes. Data from the CPS basic monthly interview in (2015 only). The line shows the empirical cumulative distribution function (ECDF) of the number of employees among entrepreneurs only. Weighted by the CPS sample weights.

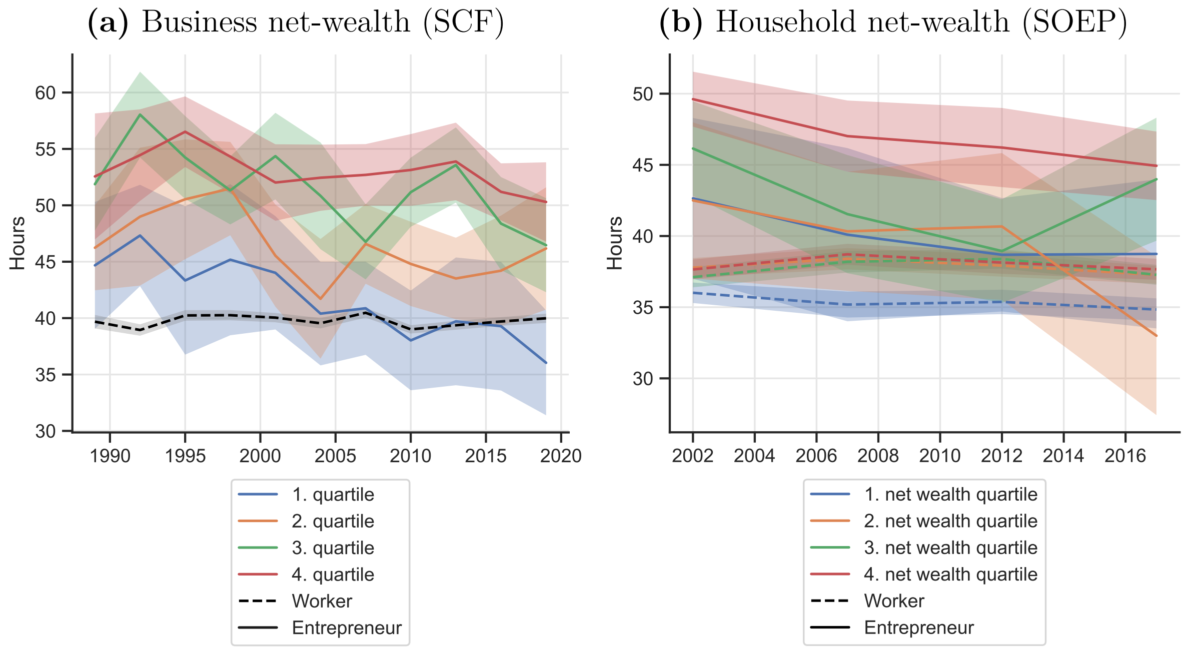

Figure 34: Weekly hours by net-wealth: business net-wealth (SCF) or household net-wealth (SOEP).

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.

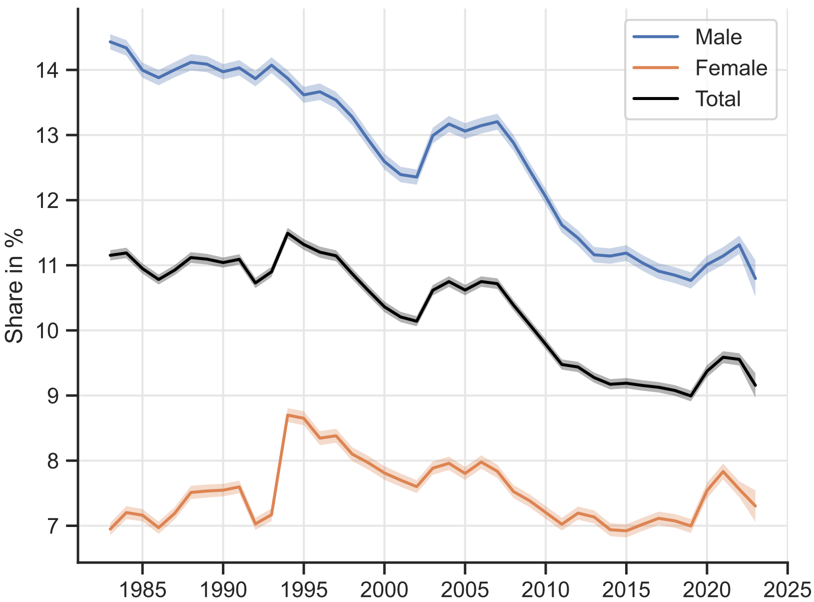

Figure 35: The share of entrepreneurs in the labor force by gender.

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

Table 6: The 35 largest 4-digit occupations among entrepreneurs in 2015.

Rank	Occupation	Entrepreneur Share	Entrepreneur Cum.	Worker Share	Worker Cum.
1	managers, nec (including postmasters)	9.07	9.07	2.35	2.35
2	first-line supervisors of sales workers	6.87	15.93	2.69	5.04
3	farmers, ranchers, and other agricultural managers	4.63	20.57	0.10	5.14
4	carpenters	3.00	23.57	0.74	5.88
5	driver/sales workers and truck drivers	2.71	26.27	2.34	8.22
6	construction laborers	2.69	28.96	1.11	9.33
7	chief executives and legislators/public administration	2.60	31.56	0.79	10.12
8	childcare workers	2.48	34.04	0.55	10.67
9	grounds maintenance workers	2.39	36.42	0.78	11.45
10	food service and lodging managers	2.28	38.71	0.80	12.25
11	hairdressers, hairstylists, and cosmetologists	2.06	40.77	0.31	12.57
12	real estate brokers and sales agents	2.06	42.83	0.38	12.94
13	constructions managers	1.88	44.71	0.37	13.31
14	lawyers, and judges, magistrates, and other judicial workers	1.74	46.45	0.68	13.99
15	management analysts	1.57	48.02	0.46	14.45
16	designers	1.40	49.42	0.55	15.00
17	painters, construction and maintenance	1.40	50.82	0.33	15.33
18	retail salespersons	1.38	52.20	2.01	17.34
19	property, real estate, and community association managers	1.31	53.51	0.32	17.66
20	physicians and surgeons	1.13	54.64	0.60	18.26
21	maids and housekeeping cleaners	1.11	55.76	1.08	19.34
22	automotive service technicians and mechanics	1.09	56.85	0.60	19.93
23	other teachers and instructors	1.02	57.87	0.46	20.39
24	bookkeeping, accounting, and auditing clerks	1.00	58.87	0.70	21.09
25	first-line supervisors of construction trades and extraction workers	0.98	59.86	0.48	21.57
26	janitors and building cleaners	0.98	60.83	1.53	23.10
27	first-line supervisors of landscaping, lawn service, and groundskeeping workers	0.92	61.76	0.08	23.18
28	artists and related workers	0.92	62.68	0.06	23.24
29	first-line supervisors of personal service workers	0.79	63.47	0.06	23.30
30	accountants and auditors	0.79	64.26	1.24	24.54
31	photographers	0.77	65.03	0.06	24.60
32	dentists	0.75	65.78	0.06	24.66
33	taxi drivers and chauffeurs	0.73	66.51	0.24	24.90
34	insurance sales agents	0.73	67.24	0.36	25.26
35	massage therapists	0.71	67.95	0.07	25.34

Notes. The first column shows the share and the second column the cumulated share of the respective occupation.

Table 7: Full decomposition of parameter changes from period I to period II.

Moment / Model version (Parameter)	I	(1) η_e	(2) η_w	(3) $\mu_\varphi, \sigma_\varphi$	(4) μ_z^e, σ_z^e	(5) μ_z^w, σ_z^w	II σ_ε
Mean hours of entrepreneurs	45.92	42.39	42.45	43.28	42.31	41.99	42.37
Mean hours of workers	43.07	43.13	42.65	43.41	43.42	41.69	41.70
Share of entrepreneurs with 46+ hours (in %)	49.78	32.01	32.33	36.65	32.89	31.20	33.20
Share of workers with 46+ hours (in %)	27.49	27.91	25.12	29.89	30.00	22.36	22.41
Share of entrepreneurs (in %)	14.06	12.78	12.88	12.94	13.27	11.83	12.09
$mean(\log(e_{ie}/h_{ie})) - mean(\log(e_{iw}/h_{iw}))$	0.04	0.08	0.08	0.07	0.17	0.03	0.00
$std(\log(e_{iw}/h_{iw}))$	0.66	0.70	0.70	0.70	0.76	0.76	0.77
$std(\log(e_{ie}/h_{ie}))$	0.46	0.46	0.47	0.47	0.47	0.54	0.54
Difference of $mean(log(e_{iw}))$ to first period	0.00	-0.00	-0.02	0.00	-0.00	0.12	0.12

Notes. The first column shows the model moments from the model estimated in period I. Each consecutive column cumulatively updates the respective parameters to the model estimate in period II.

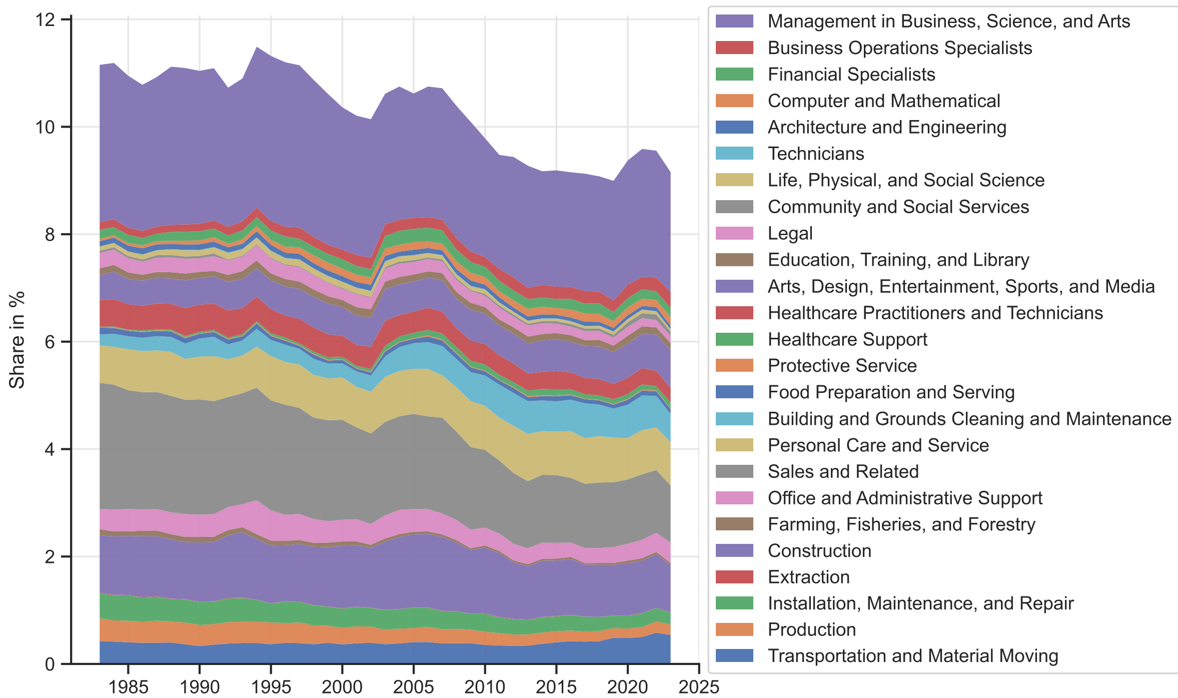

Figure 36: The occupational composition of entrepreneurs.

Notes. Data from the CPS basic monthly interview.

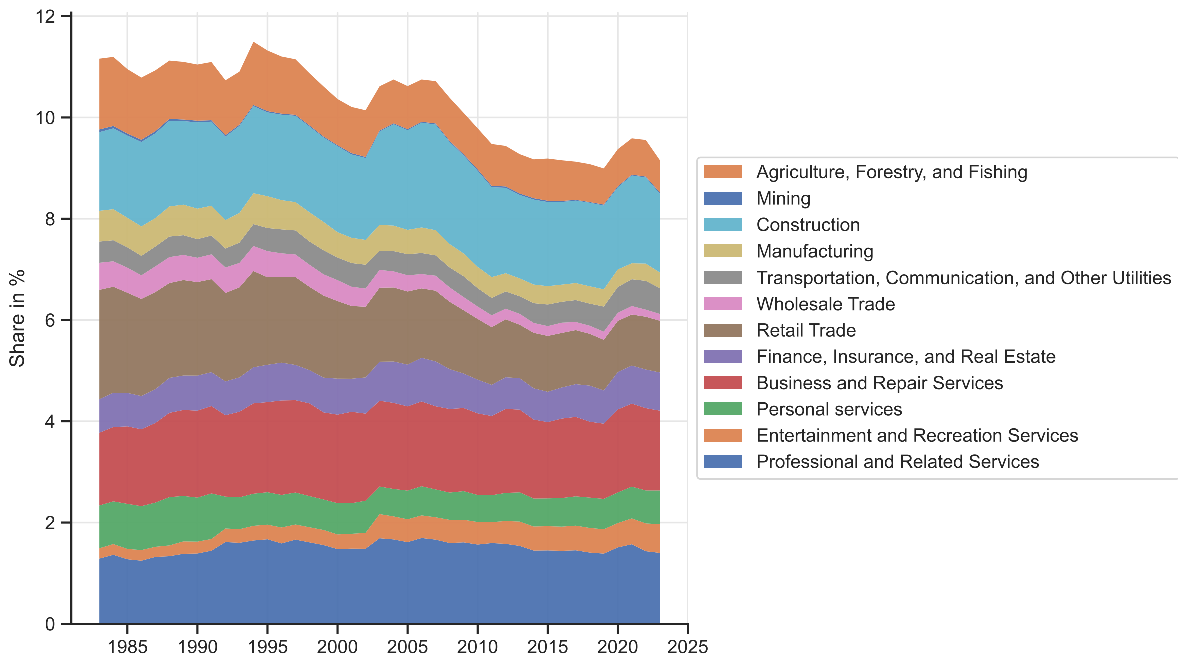

Figure 37: The industry composition of entrepreneurs.

Notes. Data from the CPS basic monthly interview.

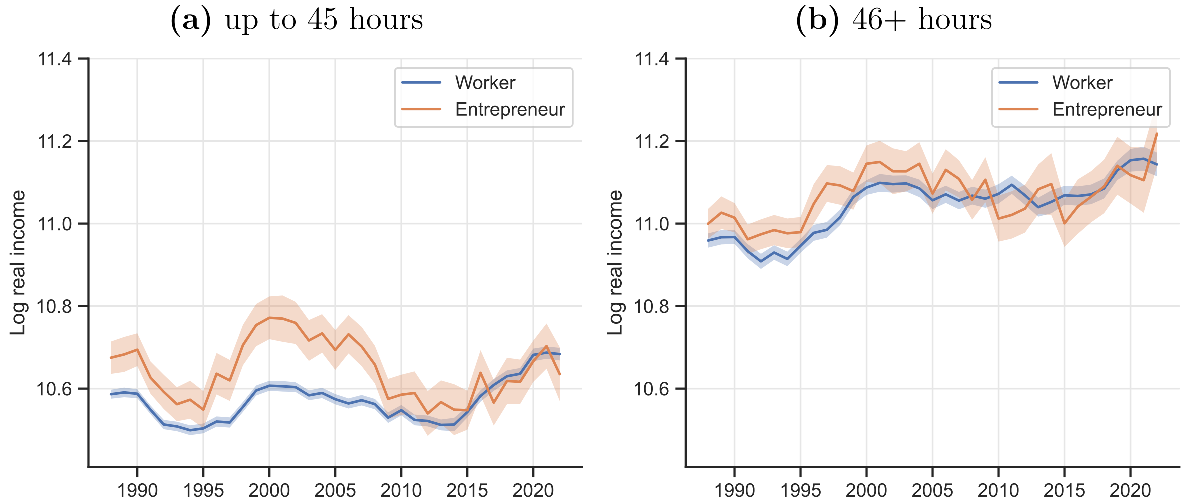

Figure 38: Log real income for workers and entrepreneurs split by working more or less than 45 hours.

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

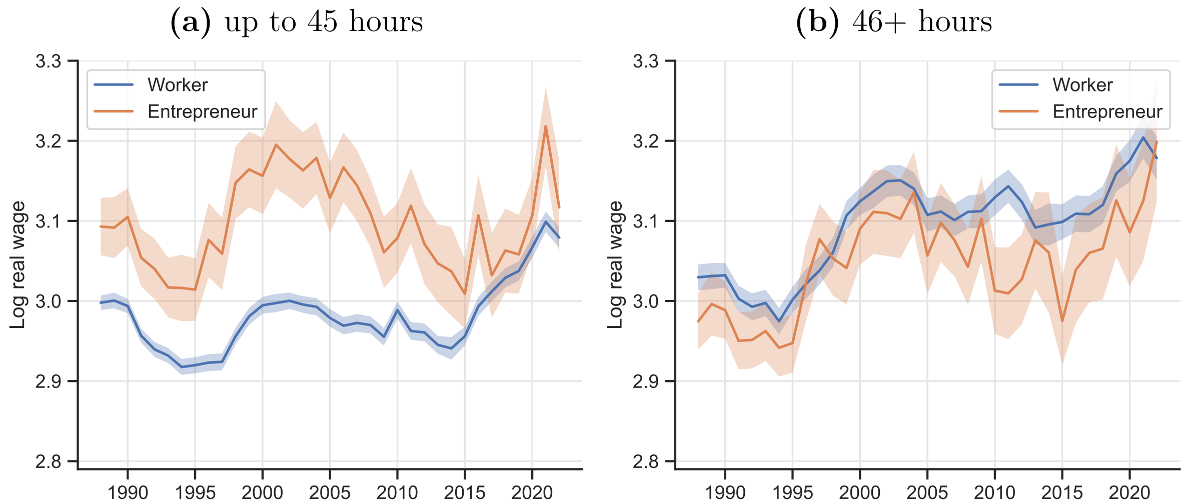

Figure 39: Log real wage for workers and entrepreneurs split by working more or less than 45 hours.

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

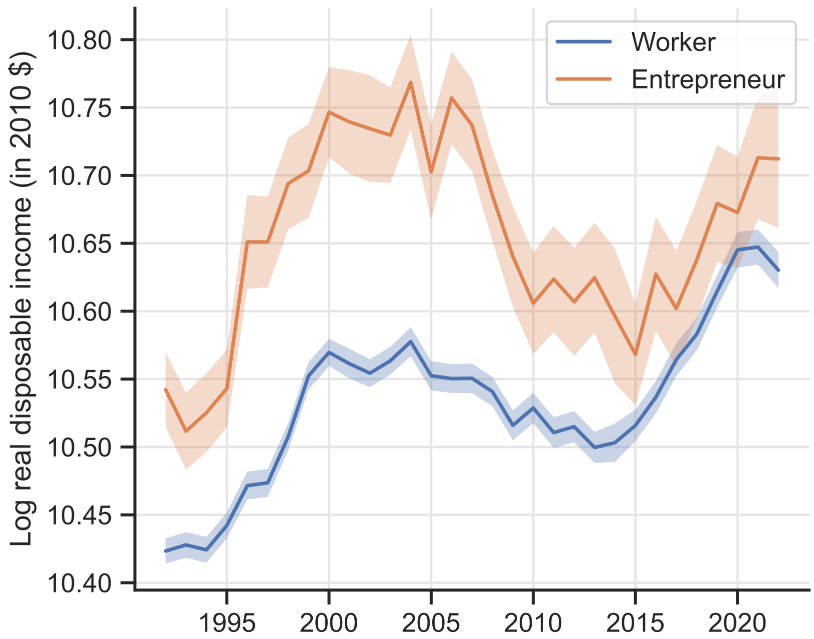

Figure 40: Log real after-tax disposable income for male workers and entrepreneurs.

Notes. Data from the CPS ASEC. Shaded areas indicate 95% confidence intervals. After-tax disposable income is computed by subtracting estimates for the federal and state taxes provided by IPUMS-CPS (Flood et al., 2022) from total personal income.

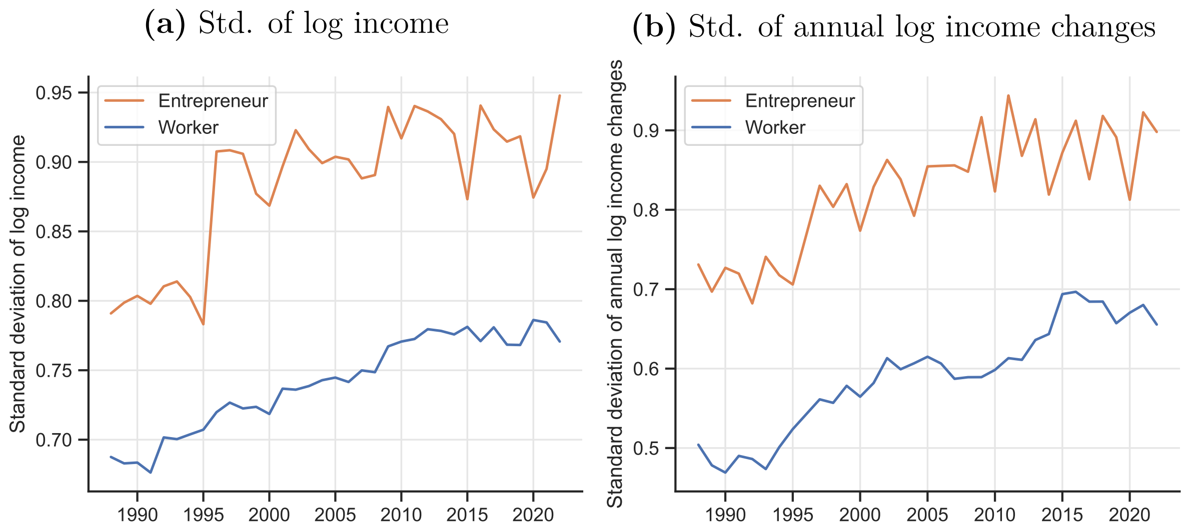

Figure 41: Standard deviation of log income and annual log income changes.

Notes. Data from the CPS ASEC. Sample includes only men. Panel (a) shows the cross-sectional standard deviation of log real income and panel (b) shows the standard deviation of individual changes in log real income from year $t-1$ to year t.

(a) Std. of log wages **(b)** Std. of annual log wage changes

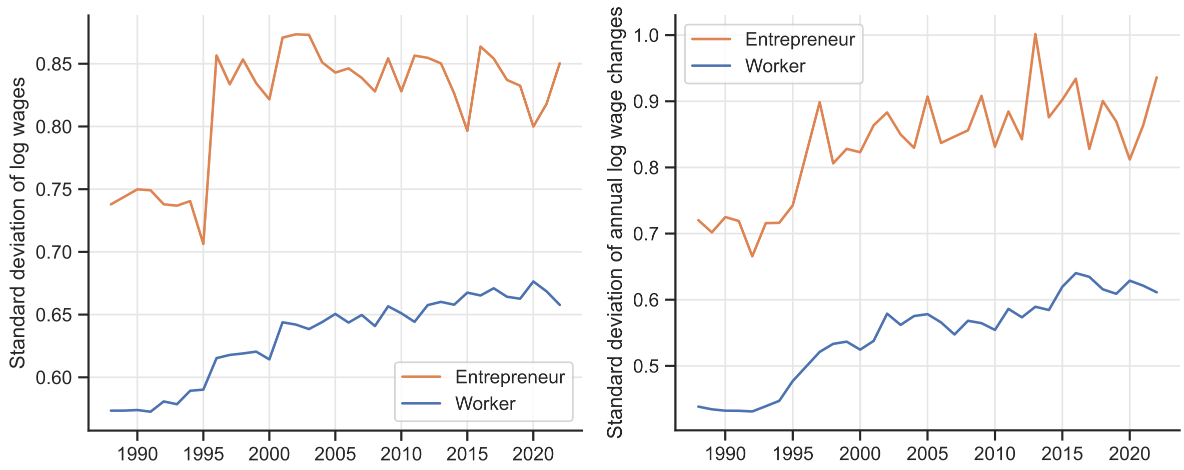

Figure 42: Standard deviation of log wages and annual log wage changes.

Notes. Data from the CPS ASEC. Sample includes only men. Panel (a) shows the cross-sectional standard deviation of log real wages (hourly income) and panel (b) shows the standard deviation of individual changes in log real wages from year $t-1$ to year t.

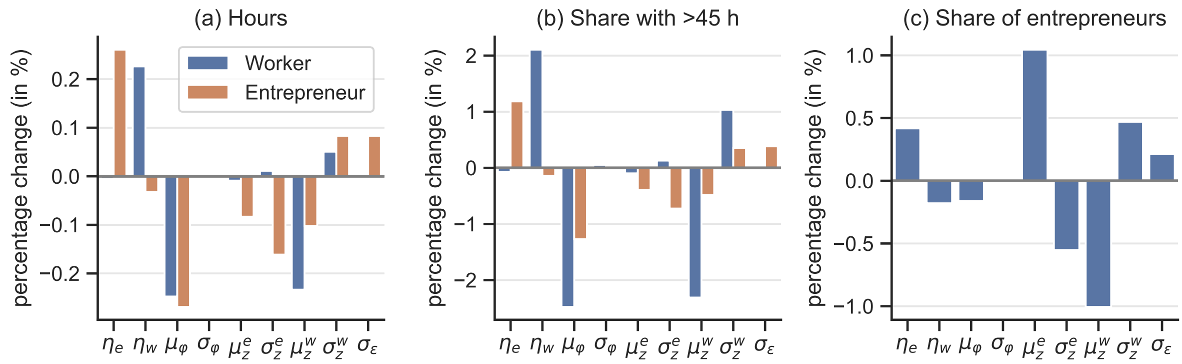

Figure 43: Elasticities of some selected model moments for each estimated model parameter.

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).

Table 8: Estimated parameters for the linear model.

Parameter	**Value** 1989-1993	2015-2019	**Description**
μ_{φ}	0.820 [0.794, 0.860]	0.820 [0.807, 0.834]	Mean, disutility of labor, φ_i
σ_{φ}	0.168 [0.107, 0.273]	0.091 [0.021, 0.147]	Std., disutility of labor, φ_i
μ_z^e	0.406 [0.387, 0.420]	0.415 [0.385, 0.443]	Mean, entrepreneurial productivity distribution
$\sigma_{log(z)}^e$	1.106 [1.096, 1.119]	1.314 [1.296, 1.335]	Std., entrepreneurial productivity distribution
μ_z^w	1.0	1.230 [1.212, 1.250]	Mean, worker productivity distribution
$\sigma_{log(z)}^w$	0.465 [0.457, 0.471]	0.555 [0.548, 0.564]	Std., worker productivity distribution
$\rho_{\varphi w}$	-0.001 [-0.004, 0.003]	-0.001 [-0.006, 0.003]	Correlation coefficient b/w φ_i and z_{iw}
$\rho_{\varphi e}$	-0.423 [-0.476, -0.337]	-0.168 [-0.327, -0.011]	Correlation coefficient b/w φ_i and z_{ie}
σ_{ε}	0.743 [0.715, 0.775]	0.850 [0.785, 0.899]	Std., non-pecuniary benefits

Notes. Values in brackets report 95% confidence intervals obtained by 300 boostrap iterations.