Labor Income Risk over the Business Cycle: Gender, Households, and Sources of Risk

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Summary and policy implications

Labor income risk plays a key role in household saving, portfolio choice, and the design of social security systems. Yet, little is known about how downside earnings risk differs across workers and over the business cycle. We use administrative data for the Netherlands from 1989 to 2024 to study the distribution of annual earnings changes across periods of economic expansion and contraction, defined using annual GDP growth. Additionally, we examine how cyclical earnings risk differs by gender and sector, decompose earnings changes into hourly wages and hours worked, and investigate the role of household insurance. We find that women face greater overall dispersion in earnings changes, although this gap has narrowed over time, while men's earnings more strongly display pro-cyclical skewness. The cyclicality of earnings skewness operates primarily through hours rather than wages. Sectoral exposure is also an important source of heterogeneity, with downside risk being concentrated in cyclically sensitive industries. These individual risks also carry over to households: household income changes become more negatively skewed during periods of contraction, and large negative earnings changes are associated with transitions into income replacement programs, especially unemployment insurance and pension benefits.

1. Introduction

Understanding labor income risk is essential when analyzing household saving behavior, portfolio choice, and retirement preparedness. Because labor constitutes the main source of income for most households during their working lives, the distribution and downside asymmetry of labor income risk are crucial for determining how much financial risk individuals and households can bear. A key challenge is that labor income risk is not constant over time. Earnings changes vary systematically over the business cycle and across demographic groups, so workers may face very different levels of exposure to downside risk, depending on macroeconomic conditions, gender, sector, hours worked, and household structure.

Previous research has documented that the persistence of earnings is nonlinear and that earnings risk is negatively skewed, such that downside income risk is more pronounced than upside risk (Arellano et al., 2017; Guvenen et al., 2021; De Nardi et al., 2020, 2021, 2025). During recessions, the distribution of earnings changes becomes more negatively skewed. This phenomenon, known as countercyclical skewness, has been documented for the United States using Social Security and survey data (Guvenen et al., 2014; Busch and Ludwig, 2023; Almuzara et al., 2025) and has also been observed in several European countries (Busch et al., 2022). These findings challenge standard modeling assumptions that treat income shocks as normally distributed without variance over the business cycle.

While this literature has significantly improved our understanding of earnings risk, several important questions remain. First, who bears cyclical downside risk? An important strand of the existing evidence focuses on the dynamics of male workers, potentially overlooking gender differences in wage and hours adjustments. This limitation is particularly relevant given the substantial increase in female labor force participation over recent decades (Goldin, 2017) and the growing importance of part-time employment among women in many countries, particularly in labor markets such as the Netherlands where part-time work is extremely prevalent (OECD, 2019). Differences in working hours, employment arrangements, and labor-market attachment may therefore play an important role in shaping earnings risk across genders.

Second, which margins and sectors are affected by cyclical earnings risk? Many existing studies focus on overall earnings changes without disentangling the labor-market mechanisms that generate these fluctuations. Earnings dynamics may reflect changes in hourly wages, adjustments in hours worked, transitions into and out of employment, or movements into income replacement programs to cover unemployment, disability, or pension benefits. In addition, sectors differ in their exposure to aggregate shocks, and men and women are not evenly distributed across sectors. Understanding these sources of risk

is important for assessing which workers are most exposed to downturns and how cyclical shocks affect household resources.

Third, how do individual earnings changes translate into household-level risk? Partners may partly insure each other against individual labor-market shocks. At the same time, household earnings may remain exposed to downside risk if negative shocks are correlated across earners, especially during contractions. Studying household income is therefore important for understanding whether individual earnings risk is smoothed within the household or remains a source of cyclical financial vulnerability.

In this paper, we study labor income risk over the business cycle using rich administrative data from Statistics Netherlands covering the period 1989-2024. This 35-year sample period captures several major macroeconomic downturns, including the early-1990s slowdown, the early-2000s slowdown following the dotcom bust, the global financial crisis of 2008-2009, the euro-area sovereign debt crisis, and the COVID-19 recession, as well as major structural changes in the Dutch labor market, including growing female labor force participation and shifts in employment arrangements. This allows us to examine whether the distribution of earnings changes responds systematically to macroeconomic conditions across very different economic environments, whether these patterns differ by gender, and how they vary across labor market margins, sectors, and household versus individual income measures.

Our analysis proceeds as follows. We start by establishing that the distribution of earnings changes in the Netherlands exhibits pronounced countercyclical skewness, similar to the patterns observed in the United States. During economic downturns, the distribution becomes more downside-skewed: large positive earnings changes are less frequent, while large negative changes are relatively more prevalent.

We then examine three dimensions of these patterns. First, we show that earnings risk differs across genders both in overall dispersion and in its cyclical asymmetry. Women experience larger overall fluctuations in annual earnings than men and, particularly in times of economic expansion, their earnings changes are more positively skewed. For men, on the contrary, contractions are associated with a stronger shift toward negative skewness. These differences are particularly relevant in the Dutch context, where part-time employment among women is common and may affect how earnings adjust over the business cycle, especially through changes in hours worked.

Second, we investigate the sources of cyclical earnings risk by decomposing earnings changes into changes in hourly wages and hours worked, and by examining heterogeneity across sectors. The wage-hours decomposition shows that cyclical asymmetries are more pronounced for hours worked than for wages. Sectoral exposure further shapes the distribution of losses: downside risk is concentrated in industries that are more sensitive to

the business cycle, such as construction, manufacturing, trade, transport, and employment-agency work, while earnings changes in education and the public sector are less cyclical.

Third, we study how individual earnings risk is transmitted at household level and through income replacement programs. Household earnings also become more downside-skewed during contractions, showing that households remain exposed to cyclical downside risk despite the potential for risk sharing within couples. We also show that large negative earnings changes are associated with transitions into income replacement programs, particularly unemployment insurance and pension benefits. These patterns indicate that downturns reshape not only the dispersion and asymmetry of earnings changes, but also the margins through which shocks are realized, the sectors in which losses are concentrated, and the channels through which risk is transmitted to households and income replacement programs.

Our results provide new insights into the nature of labor income risk and its determinants over the business cycle and highlight important gender differences in earnings dynamics. In the Netherlands, these issues have gained additional importance since the new pension agreement that was reached in 2023, which requires pension providers to account for the risk capacity of participants when determining investment profiles. The same is true of other countries with defined-contribution pension systems, where the retirement amount depends on contributions and on the investment gains and losses in the participant's account. Since labor-income risk varies across the business cycle, gender, and labor-market margins, our estimates provide inputs for assessing heterogeneity in the capacity of participants to bear financial risk.

More broadly, this paper contributes to the earnings-dynamics literature (Arellano et al., 2017; De Nardi et al., 2021; Guvenen et al., 2021). The estimates are well-suited for incorporation into structural life-cycle models of household saving and retirement preparedness (De Nardi et al., 2020; Paz-Pardo, 2024).

The remainder of the paper proceeds as follows. Section 2 describes the data, sample selection, and empirical approach. Section 3 presents the main results on earnings risk over the business cycle, including gender differences, wage and hours adjustments, sectoral heterogeneity, household-level risk, and transitions into benefit receipt. Section 4 contains conclusions.

2. Data and empirical approach

This section provides an overview of the data we employ, the sample selection criteria, the variables used in our empirical analysis, and our empirical approach.

Data

We use two data sets for our main analysis: (1) administrative tax records from the Dutch Income Panel Study (IPO), which contain detailed information on various income sources, and (2) administrative data on hours worked from the Dutch payroll administrations (DPA).

The IPO data set includes detailed information on personal income, household income, demographics, and labor market status for approximately 100,000 sampled individuals and all members of their households. As a result, the data set covers roughly 220,000-280,000 individuals annually, depending on the year. The IPO panel runs from 1989 to 2014; for later years, full-population register data become available, and we use these up to 2024.

The IPO data set has several important advantages over survey data. First, the data are often collected or checked by a third party. For instance, income measures are derived from tax records and complemented with information provided by banks and other financial institutions. In addition, Statistics Netherlands performs several checks to guarantee data quality. This substantially reduces the incidence of missing observations and measurement error. Second, individuals are included in the panel from their year of birth (for immigrants, the year of arrival) and followed for the entire period that they reside in the Netherlands (as of December 31 of the sample year). Hence, attrition only occurs as a result of migration or death. Third and very importantly, unlike other administrative data sets, such as that of the US Social Security Administration, the IPO data set tracks households (rather than individuals) and includes a detailed breakdown of labor and asset income, taxes, social insurance premiums paid, and transfers (broken down into unemployment insurance, disability insurance, social assistance, and pensions) received by household members. These crucial features enable us to investigate the role of both family and government insurance in reducing income fluctuations across the business cycle.

The DPA payroll data provide very rich information on the number of days and hours worked. They have been available since 2001 and are obtained directly from employers. Dutch legislation mandates that all employers maintain up-to-date payroll records and report them to the relevant government agencies on a monthly basis. The payroll records include information on (a) the start and end dates of the employment period, (b) earnings, (c) the number of regular hours, (d) the number of overtime hours that each employee worked in a given month, and (e) sector of employment.

These data are not only relevant for the processing and payment of salaries but also for the computation of holiday entitlements, social insurance benefit payments, and pensions.

Sample selection

We restrict our sample to individuals with annual earnings of at least 2,200 euros (in 2024 prices) in both *t* and *t+1*. This minimum earnings threshold is intended to capture individuals with at least some attachment to the labor market in each year and is also necessary because our analysis is conducted in logs. Similar thresholds are standard in the literature on earnings dynamics. In addition, we restrict the sample to individuals aged 25 to 60, exclude institutionalized individuals, and retain only the head of the household and partner. Table 1 shows the gender composition by wave, sector, and age, and the sample descriptives for the main variables used in our analysis separately by gender.

Table 1. Sample descriptives by gender, 1990–2024.

	Men (%)	Women (%)	Sample (%)		Men (%)	Women (%)	Sample (%)
Year				**Sector**			
1990	67.9	32.1	2.0	Agri and food	67.7	32.3	3.7
1991	66.5	33.5	2.0	Construction	90.3	9.7	3.7
1992	65.2	34.8	2.0	Industry	82.8	17.2	11.7
1993	64.0	36.0	2.1	Retail	50.8	49.2	12.8
1994	63.2	36.8	2.1	Transport	74.8	25.2	5.3
1995	62.6	37.4	2.2	Health	14.9	85.1	18.6
1996	61.7	38.3	2.3	Education	33.2	66.8	8.1
1997	61.1	38.9	2.4	Public	61.4	38.6	9.6
1998	60.3	39.7	2.5	Financial and services	57.5	42.5	16.4
1999	59.4	40.6	2.6	Employment agencies	54.9	45.1	2.5
2000	58.3	41.7	2.7	Other	46.4	53.6	6.0
2001	57.6	42.4	2.8	Unknown	61.6	38.4	1.6
2002	56.6	43.4	2.9	**Age group**			
2003	55.7	44.3	3.0	26-35	49.3	50.7	24.3
2004	55.0	45.0	3.0	36-45	53	47	35.2
2005	54.7	45.3	3.0	46-55	56.6	43.4	31
2006	54.0	46.0	3.1	56-60	61.4	38.6	9.5
2007	53.3	46.7	3.2		**Men**	**Women**	
2008	52.5	47.5	3.3	**Earnings (euro), Wages (euro), Hours**			
2009	51.8	48.2	3.3	*Mean*			
2010	51.3	48.7	3.3	Earnings, yearly	79,400	41,800	
2011	50.9	49.1	3.4	Wages, hourly	43.6	31.8	
2012	50.5	49.5	3.4	Hours, yearly	1947	1404	
2013	50.3	49.7	3.3	*Median*			
2014	50.1	49.9	3.3	Earnings, yearly	69,500	35,400	
2015	50.3	49.7	3.4	Wages, hourly	36.0	27.2	
2016	49.9	50.1	3.3	Hours, yearly	2080	1402	
2017	49.6	50.4	3.2	*P25*			
2018	49.2	50.8	3.2	Earnings, yearly	52,700	20,800	
2019	48.8	51.2	3.1	Wages, hourly	27.4	20.2	
2020	48.4	51.6	3.1	Hours, yearly	2064	1045	
2021	48.1	51.9	3.0	*P75*			
2022	47.8	52.2	2.9	Earnings, yearly	94,500	54,400	
2023	47.4	52.6	2.9	Wages, hourly	49.4	36.2	
2024	47.0	53.0	2.8	Hours, yearly	2080	1848	
Total	**54.0**	**46.0**	**100**				

Note. The table reports the gender composition within each category and the category's share of the total sample. Percentages are based on person-year observations. The sample consists of 2,522,280 person-year observations from 212,474 unique persons. Earnings, wages, and hours are reported separately by gender.

Earnings changes

Labor earnings are the primary source of income for most households during their working lives (e.g., for the Netherlands, Alessie et al., 2025). Following the earnings-dynamics literature, we construct earnings changes from age-adjusted log real earnings. We first deflate nominal labor earnings using an aggregate price index and take logs. We then regress log real earnings on a third-order polynomial in age (i.e., age, age squared, and age cubed) and use the residual as our measure of age-adjusted log real earnings.

The age polynomial removes the average life-cycle earnings profile in a flexible but parsimonious way, allowing earnings to rise, flatten, and possibly decline over the working life. We do not include calendar-year effects in the residualization, since these would absorb the aggregate real earnings fluctuations that are central to our comparison of contractions and expansions. Thus, the adjustment removes predictable age-related variation and nominal price changes, while preserving cyclical variation in real earnings. This procedure should not be interpreted as isolating a structural measure of earnings risk. Deviations from the age profile may also reflect persistent individual heterogeneity or human capital investment. Our analysis does not require separating these components, because the object of interest is the cyclical behavior of the cross-sectional distribution of earnings changes, especially whether downside earnings changes become more prevalent in recessions.

We do not additionally control for education in the baseline residualization. While education is an important determinant of earnings levels and life-cycle profiles, consistent with the standard Mincer earnings framework (Mincer, 1974), our focus is on higher moments of earnings changes across the business cycle rather than on returns to education or long-run earnings growth. The age adjustment is therefore used only to remove the main predictable life-cycle component before computing earnings changes.[1]

Definition of contractions

Our focus is on downturns that matter for the labor market. We therefore identify contractions as consecutive quarters in which the unemployment rate is rising, following the business cycle approach common in the labor market literature.[2] This definition captures deteriorating labor market conditions that typically lag slowdowns in real activity. We measure unemployment using the OECD harmonized unemployment rate; this follows the ILO concept and is designed to be comparable over time and across countries. To reduce

1 A further practical reason is that education is not observed consistently for all cohorts in the CBS registry data. For older cohorts, information on educational attainment is only partly available and is based primarily on Labour Force Survey records.

2 Unlike in the United States, where the NBER's Business Cycle Dating Committee dates peaks and troughs, there is no comparable expert panel for the Netherlands. As an external benchmark, the OECD publishes business cycle turning points for the Netherlands in its Composite Leading Indicators system, using a simplified Bry-Boschan routine (OECD, 2012).

spurious one-quarter movements, an episode must last at least two quarters of a year, and we treat a one-quarter interruption as part of the same episode when unemployment rises again in the following quarter.

Figure 1 plots real GDP growth and the unemployment rate for the Netherlands and highlights the resulting unemployment-rising episodes (contractions). The left-panel figure uses quarterly data, while the right-panel figure uses yearly data, which aligns with the yearly measurement of our earnings data in the analysis. In total, the period of analysis contains six largely multi-year expansion–contraction phases rather than frequent short-lived fluctuations. This allows us to compare income dynamics across different phases of the business cycle.

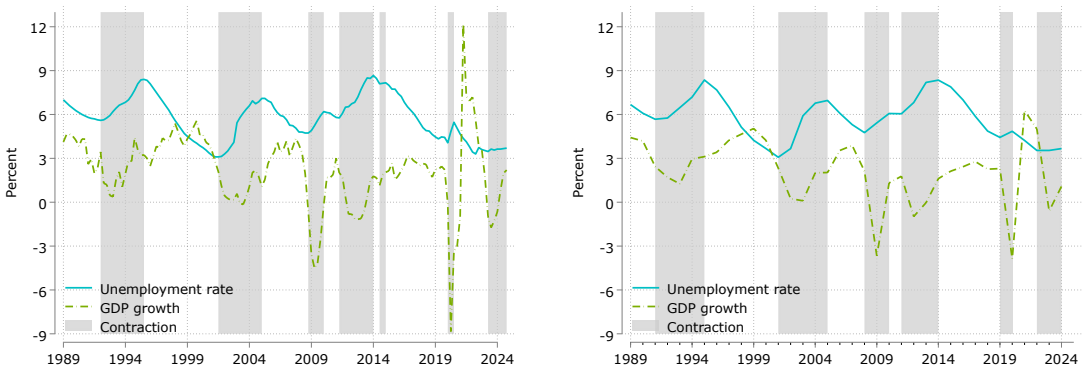
As the figure shows, these episodes of worsening labor market conditions follow a period of weak or negative GDP growth (typically with a short delay) and correspond to the subsequent downturns and crisis periods in the Netherlands and Europe. The 1992-1995 contraction followed the European Monetary System/Exchange Rate Mechanism (ERM) crisis, when currency market pressure strained Europe's exchange rate system and monetary policy tightened to defend exchange rate commitments, affecting the real economy and labor market conditions (Eichengreen, 2000). The 2002-2005 contraction reflects the early-2000s slowdown after the dotcom bust, with weak growth and a prolonged deterioration in labor market conditions (OECD, 2004). The 2009-2010 contraction captures the major downturn during the Global Financial Crisis (OECD, 2010). The 2011-2013 contraction spans the euro-area sovereign debt crisis and renewed weakening in economic activity, reflecting a continued labor market deterioration (the "double-dip" recession) (OECD, 2014).

The 2020 contraction coincides with the COVID-19 pandemic, when containment measures caused a sudden drop in activity and employment, followed by a rebound as policy measures supported employment (OECD, 2021). The most recent contraction reflects the post-pandemic slowdown and weaker growth conditions from 2023 onward (OECD, 2023).

Table 2: Expansion and contraction phases in the Netherlands, 1989-2024.

Expansion (years)	Contraction (years)	Name of contraction
1989–1991	1992–1995	EMS/ERM crisis / early-1990s downturn
1996–2001	2002–2005	Dotcom bust / early-2000s slowdown
2006–2008	2009–2010	Global Financial Crisis
2011	2012–2014	Euro-area sovereign debt crisis
2015–2019	2020	COVID-19 recession
2021–2022	2023–2024	Post-pandemic slowdown
20 years	**16 years**	

Figure 1: Contractions in the Netherlands, 1989-2024, using quarterly (left) or yearly (right) data, identified using OECD data: (i) real GDP growth rate (seasonally adjusted; expenditure approach; constant prices; National Accounts) and (ii) unemployment rate (seasonally adjusted; ages 15+; percent of the labor force; Labour Force Survey).



3. Results

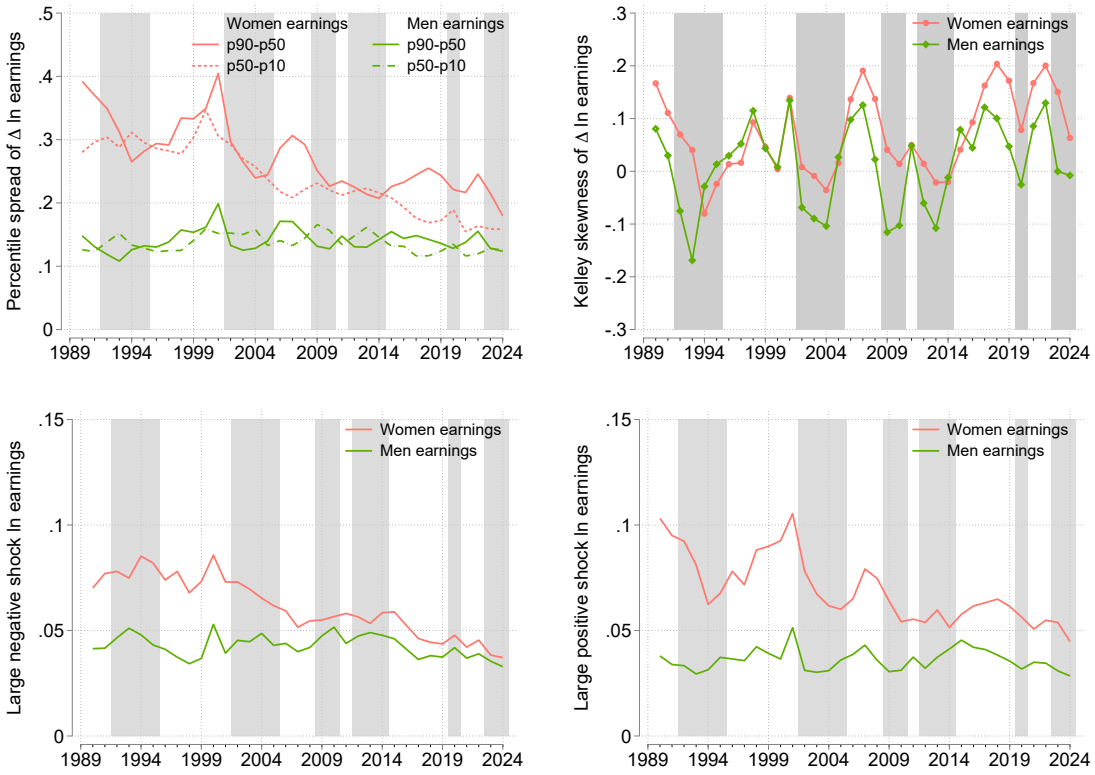
Earnings risks

Using the classification in Table 2, we first compare the distribution of annual log earnings changes between contraction and expansion years. For both men and women, the p90–p50 ratio tends to fall in contractions (Figure 2, top left panel), while the p50-p10 displays the opposite tendency, although less pronounced. The divergence of the p50-p10 and p90-p50 indicates that downturns are characterized less by a compression of the top and a widening of the bottom half of the distribution; i.e., earnings risk becomes more negatively-skewed in contractions, with negative shocks playing a larger role.

The magnitude of these differences across the business cycle is economically meaningful and differs by gender. For women, the p90–p50 was around 0.35–0.40 in the early 1990s and early 2000s, but has been closer to 0.20 in recent years. The contraction–expansion difference in p90–p50 is about 0.1 log points in the early episodes. For men, however, levels are lower throughout, with the p90-p50 typically around 0.15 in most years. Thus, overall, women exhibit greater dispersion than men, implying greater variability in annual earnings changes and a higher tendency for upside movements; however, variability has been declining and is more in line with that of male earnings changes in recent years.

Next, to examine the asymmetry between upside and downside movements, Figure 2 (top right panel) shows Kelley skewness *[(p90-p50)-(p50-p10)]/(p90-p10)*, which captures whether dispersion is driven more by the upper or lower tail. Kelley skewness is generally lower in contractions, consistent with countercyclical skewness and a shift toward more negative earnings changes in downturns. For men, skewness was about -0.15 in the early-1990s contraction, and -0.10 in the early-2000s and 2010s contractions, but it is close to zero in the contractions since the COVID-19 pandemic, indicating a roughly symmetric distribution of earnings changes. For women, skewness is positive in many expansion years (often around 0.10–0.20), and becomes only mildly negative in the mid-1990s contraction. Thus, contractions appear more downside-asymmetric for men than for women.

Figure 2: Distribution of annual log earnings changes in contractions and expansions.



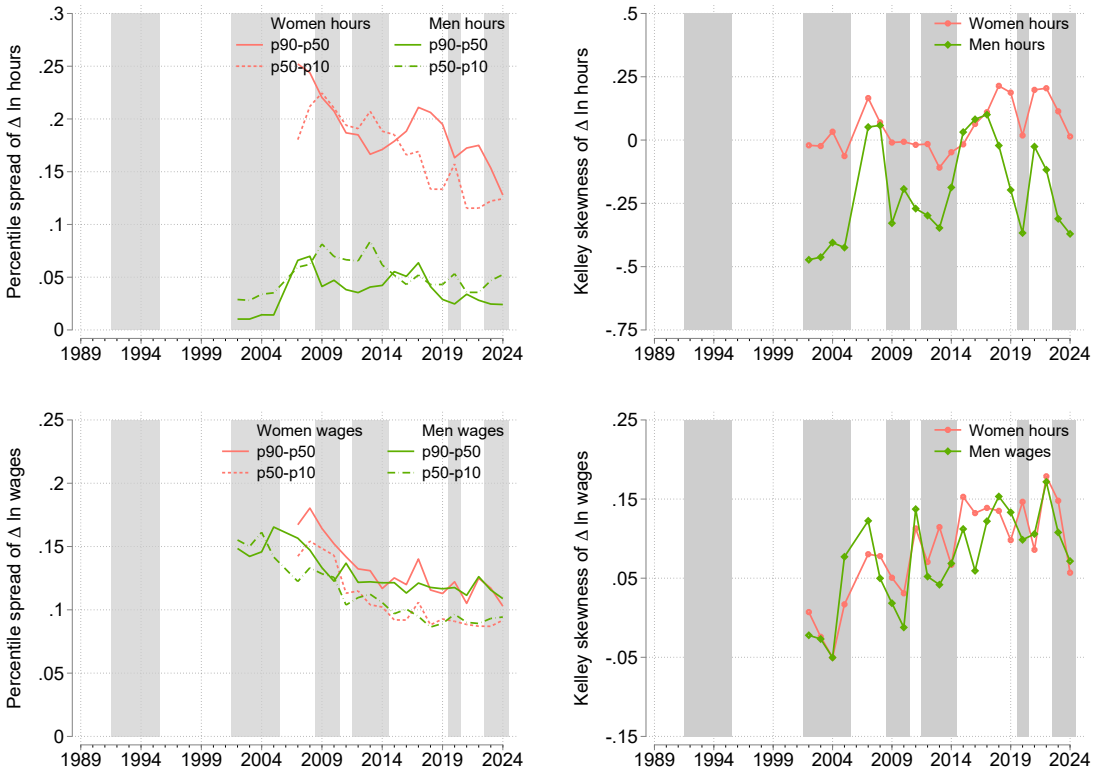
These results are confirmed by Figure 2, bottom panel, which documents the prevalence of large positive and large negative earnings changes, defined as changes in the top and bottom 5 percent of the distribution. For women, the prevalence of large shocks in both directions has declined since the early 2000s. In recent years, the incidence of large negative shocks has converged toward that of men, while large positive shocks remain slightly more prevalent among women, although the variability in positive adjustment shocks has become more muted over time. Negative shocks also display some countercyclical variation, but the differences across the business cycle are more moderate than for positive shocks. For men, on the other hand, the prevalence of large shocks is relatively stable over the 35-year sample period.

Hours versus wages

The patterns documented for earnings changes reflect variation in both hours worked and wages. Figure 3 shows the distribution of annual log changes in hours and wages during contractions and expansions. Because data on hours are available only from 2001 onward, this part of the analysis focuses on the more recent period. The figures show evidence of countercyclical skewness in both hours and wages, though it is more pronounced for hours worked. The p90-p50 and p50-p10 ratios also indicate greater variability for women than for men, again mainly through hours adjustments. For men, skewness in hours changes is

close to zero in expansions and becomes negative in contractions, indicating that downturns are associated primarily with an increase in the likelihood of negative hours adjustments. For women, skewness in hours changes is close to zero in contractions but becomes positive in expansions, highlighting the importance of positive hours adjustments during economic upturns.

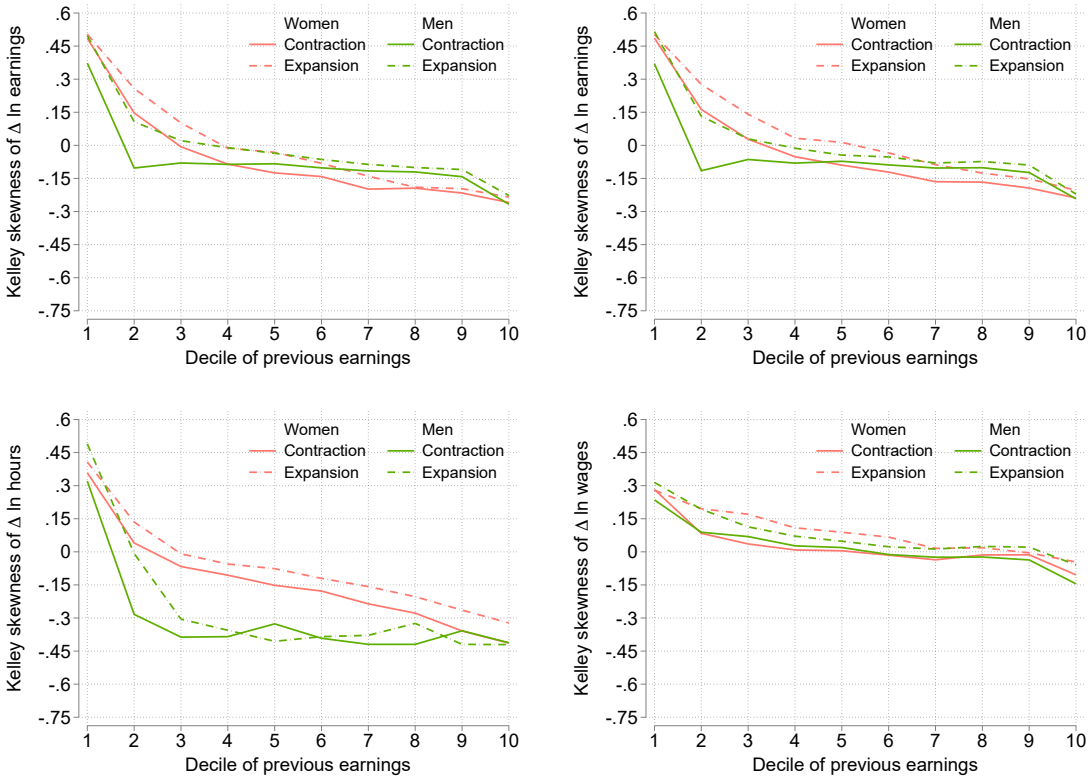
Figure 3: Distribution of annual log hours and wage changes in contractions and expansions.



To examine countercyclical skewness across the earnings distribution, the top-left panel of Figure 4 plots Kelley skewness in contraction and expansion years by the position of individuals in the earnings distribution in the year preceding the earnings change. The figure indicates more positive skewness in the first decile, corresponding to individuals with the lowest earnings. This is partly mechanical, as the lower bound truncates downside moves for the lowest earners. For the higher quintiles, skewness is approximately constant over deciles for men and slightly declining for women, and turns negative in contractions. The top-right panel presents the same information for the post-2001 period, when data on hours and wages are available, and shows a very similar pattern. The bottom panel reports skewness for hours and wages, showing more pronounced skewness in hours. For men in the middle and upper parts of the earnings distribution, skewness in hours becomes procyclical, with Kelley skewness being more negative in expansions than in contractions. This indicates that the asymmetry of hours changes differs across business-cycle phases,

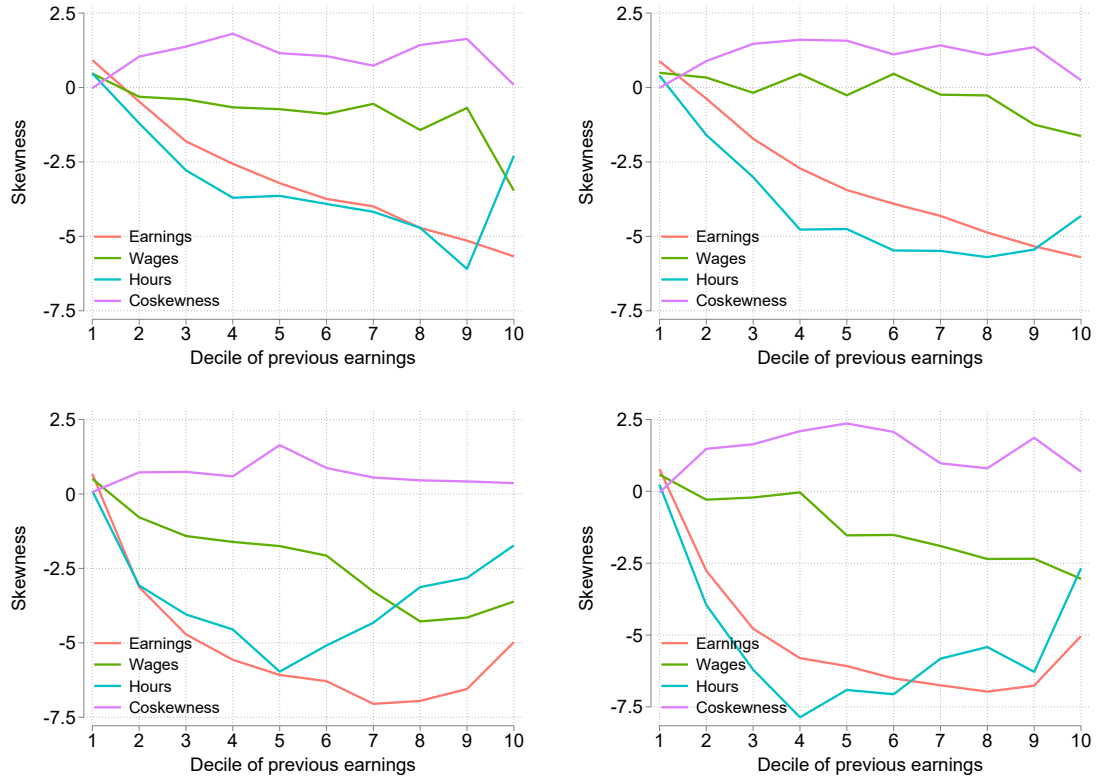
but it does not by itself identify the specific labor-market mechanism that generates this pattern. A possible interpretation is that hours adjustments among these workers partly reflect intensive-margin changes, such as changes in overtime, or transitions to jobs with different combinations of wages and hours.

Figure 4: Kelley skewness in contraction and expansion years by the position of individuals in the earnings distribution.



To better understand the sources of asymmetry in labor earnings risk, Figure 5 plots an alternative measure of skewness: the third central moment of the earnings change distribution. It decomposes this moment into the contributions of hours, wages, and their joint interaction. Because earnings equal wages times hours, changes in log earnings reflect adjustments along both margins. The skewness of earnings changes therefore depends not only on the asymmetry of wage and hours changes separately, but also on whether wage and hours changes reinforce each other asymmetrically. For example, earnings changes become more negatively skewed when large declines in wages and hours occur together more frequently, or more strongly, than comparable increases. The figure shows little variation in this joint component across gender, business cycle states, or the earnings distribution. The slightly positive joint component suggests that wage and hours changes tend to reinforce each other in the upper tail more than in the lower tail, although this interaction explains only a limited part of overall earnings skewness.

Figure 5: Co-skewness of earnings in contractions and expansions for women and men.

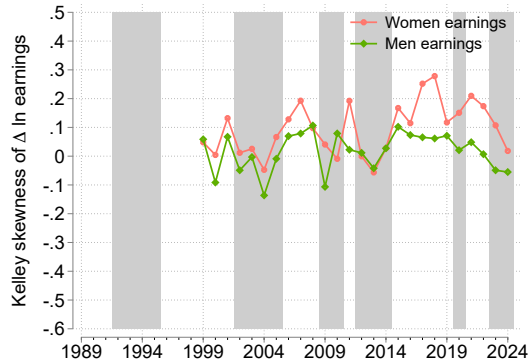


Sectoral heterogeneity

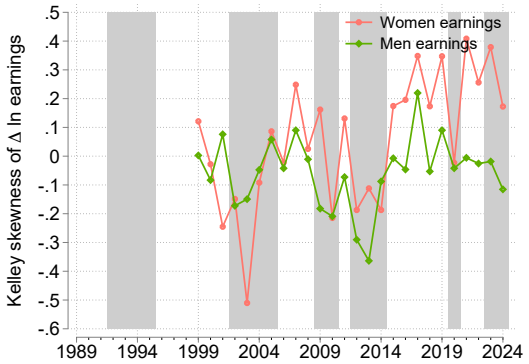
To assess whether cyclical earnings risk is concentrated in specific parts of the labor market, we next examine Kelley skewness by sector. This is important because sectors differ in their exposure to aggregate shocks and because men and women are not evenly distributed across sectors (see Table 1).

Figure 6 shows that earnings risk is substantially more cyclical in construction, manufacturing, trade, transport, and employment agency work. In these sectors, Kelley skewness falls more strongly during contractions, indicating a sharper shift toward downside earnings risk. Earnings changes in education and the public sector, on the other hand, are much less cyclical. The figure also suggests that gender differences are not explained solely by broad sectoral composition: within sectors, men's earnings generally become more negatively skewed in contractions than those of women. This may reflect differences in occupation, contract type, hours adjustments, or exposure to overtime and temporary work within the same sector.

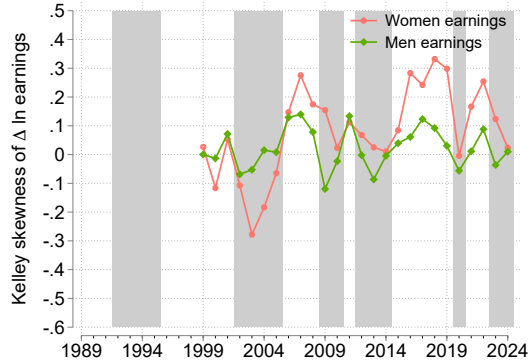
Figure 6: Distribution of annual log earnings changes in contractions and expansions across sectors.



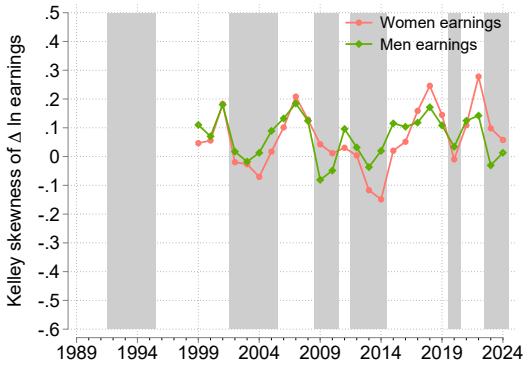
(a) Agri and food



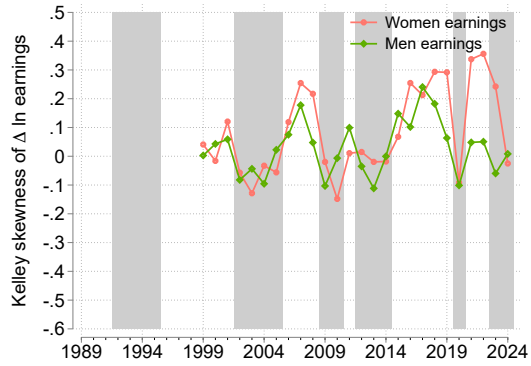
(b) Construction



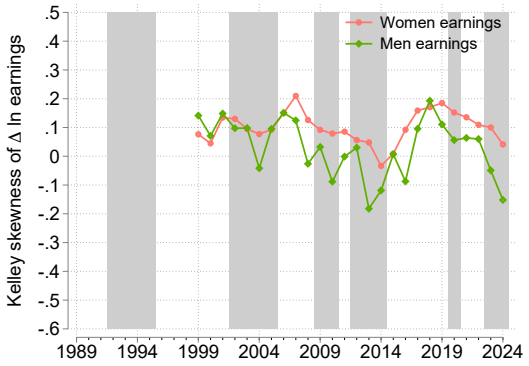
(c) Industry



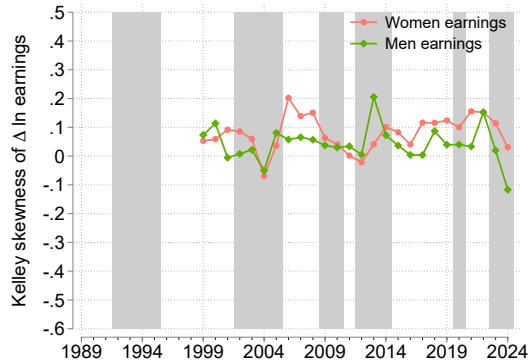
(d) Retail



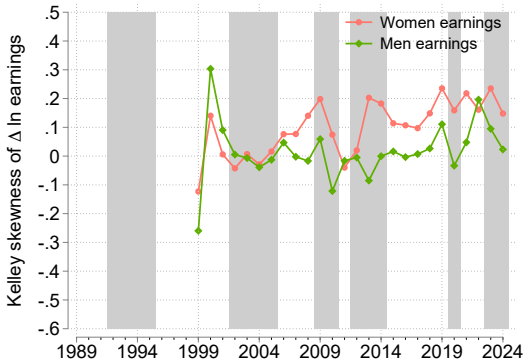
(e) Transport



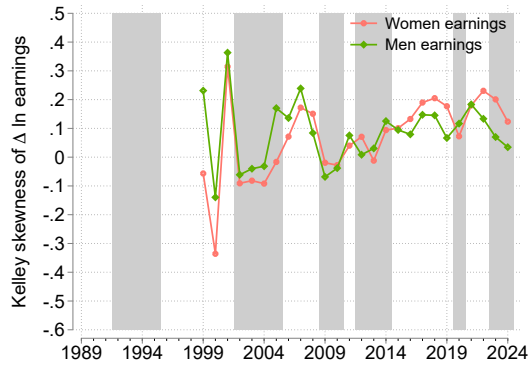
(f) Health



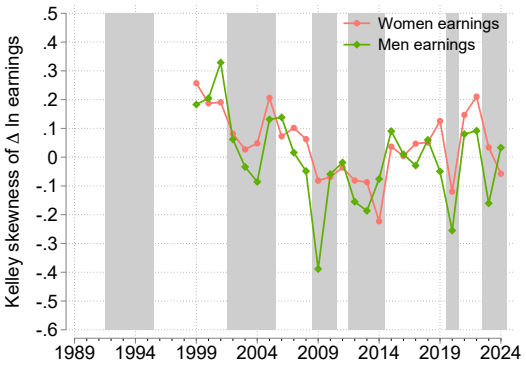
(g) Education



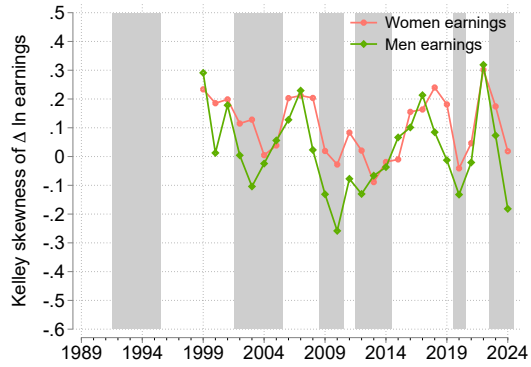
(h) Public other



i) Financial and services



(j) Employment agencies



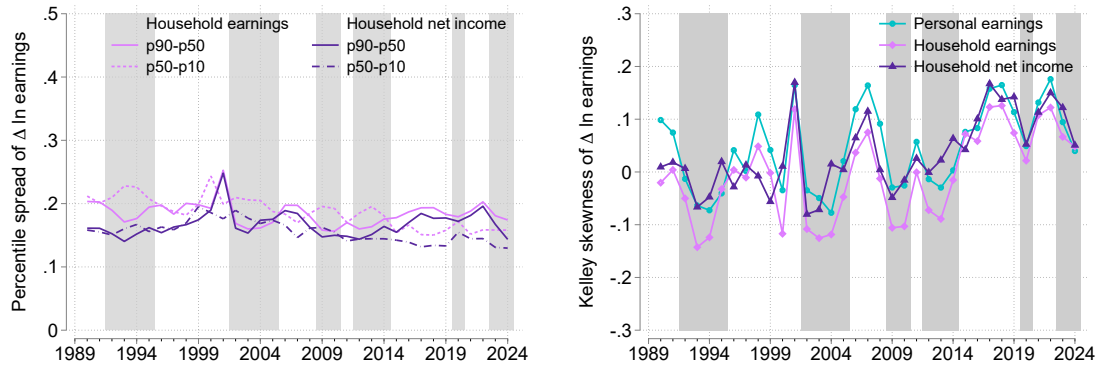
(k) Other

Household earnings

The analysis has focused so far on individual earnings risk. Household level risk may differ because partners can partly insure each other against individual earnings shocks. At the same time, household earnings may remain exposed to downside risk if negative shocks are correlated across partners, especially during downturns.

Figure 7 compares annual log household earnings changes in contractions and expansions, only including couples. The left panel reports percentile spreads, while the right panel reports Kelley skewness. Household earnings show a similar cyclical pattern to individual earnings: skewness becomes more negative in contractions, indicating a shift toward downside risk. The decline in skewness is somewhat stronger for household earnings than for personal earnings, particularly during recessions. This suggests that household earnings do not fully smooth individual labor market shocks and that negative shocks may be more correlated within households during downturns.

Figure 7: Distribution of annual log household earnings and net income changes in contractions and expansions.



Transitions into benefits

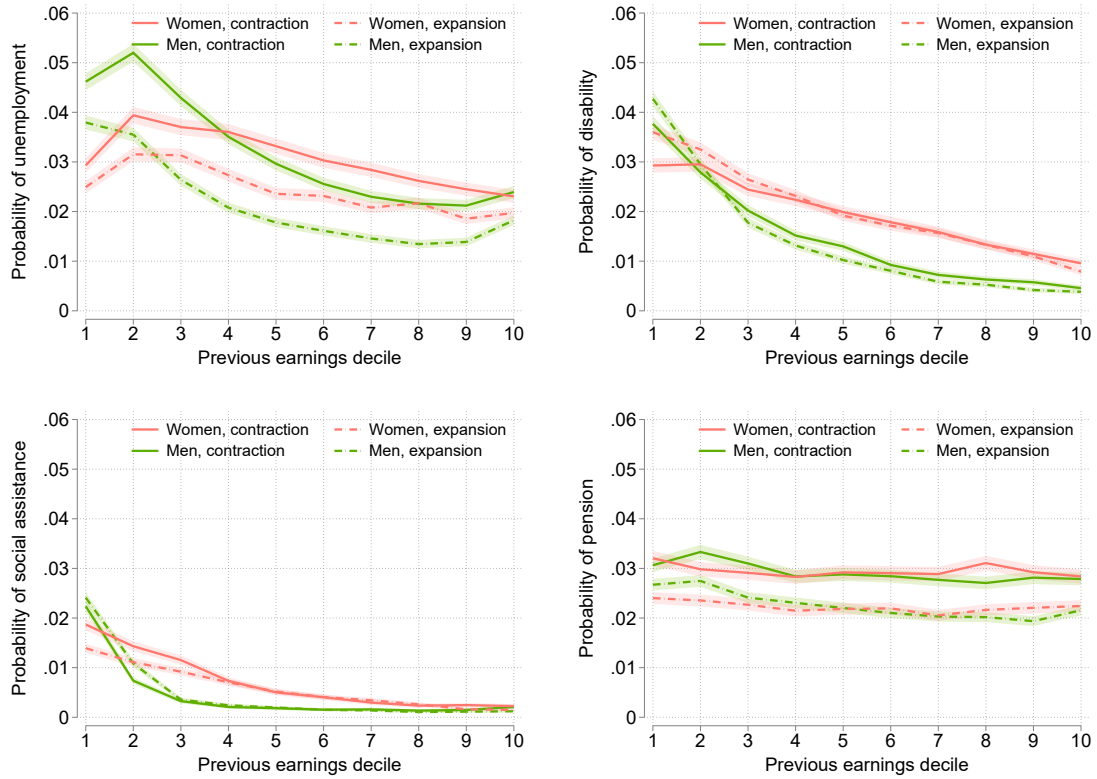
To examine how transitions into partial benefit receipt vary over the business cycle and across the previous earnings distribution, we estimate the following linear probability model:

$$U_{i,t+1} = \beta_0 + \sum_{j=2}^{10} \gamma_j \, \mathbf{1}\{d_{i,t} = j\} + \sum_{j=2}^{10} \delta_j \, \mathbf{1}\{d_{i,t} = j\} w_i + \sum_{j=2}^{10} \eta_j \, \mathbf{1}\{d_{i,t} = j\} R_{t+1} + \sum_{j=2}^{10} \xi_j \, \mathbf{1}\{d_{i,t} = j\} w_i R_{t+1} + X_{i,t}{}' \beta + v_{i,t+1}$$

where $U_{i,t+1}$ is a binary variable equal to 1 if the individual transitions into benefit receipt, conditional on not receiving that benefit in the previous period; $d_{i,t}$ denotes the previous earnings decile, w_i is a woman indicator, R_{t+1} is a contraction indicator, and X is a set of controls. Our controls include marital status, the presence of children in the household, age, age squared, and an individual's sector as reported in Table 2. Since the results are very similar without controls, we report the unadjusted figures.

Figure 8 plots the predicted probability of transitioning into benefit receipt, including pension benefit, in year *t+1*, by the position of individuals in the previous year's earnings distribution, separately for contractions and expansions. The four panels distinguish transitions into unemployment insurance, disability insurance, social assistance, and pension benefits. The figure therefore shows how downside labor market risk translates into different forms of benefit receipt over the business cycle and whether these transition probabilities are concentrated among workers with lower prior earnings.

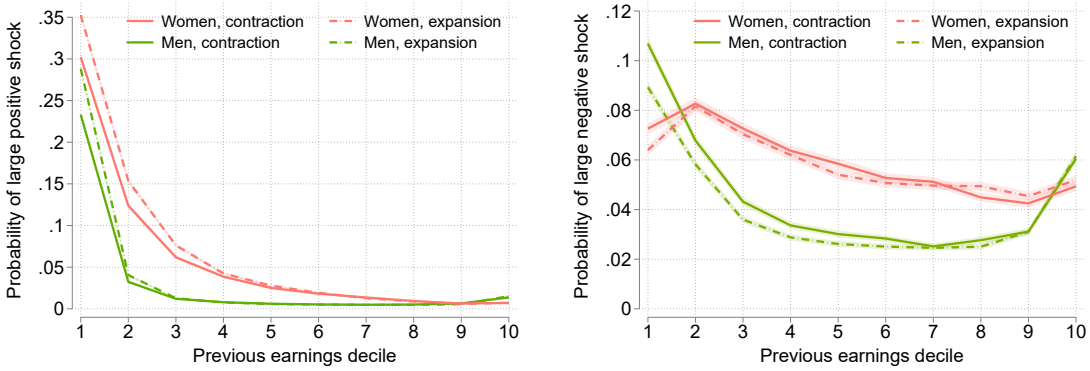
Figure 8: Transitions to full or partial benefits across contractions and expansions and previous earnings groups.



The figure shows clear cyclical patterns for unemployment and pension benefits, but much weaker patterns for disability insurance and social assistance. For disability insurance, the apparent procyclicality likely reflects the waiting period. For social assistance, cyclical differences are visible only for women in the lower part of the earnings distribution. For unemployment insurance, the probability of transition generally declines across earnings groups and is higher for men, but the difference between contractions and expansions is fairly similar across the income distribution. A similar pattern emerges for pension benefits, although transitions into pension benefits display a more linear gradient across earnings deciles and are broadly similar across gender. These findings show that downside earnings risk in downturns is linked not only to a fall in wages or hours but also to a higher likelihood of moving into income replacement programs.

Indeed, when plotting figures for the probability of a large negative or positive shock (the top or bottom 5 percent of earnings changes), the figure for a large negative shock shows a pattern that is very similar to that for unemployment (Figure 9).

Figure 9: Large negative and positive shocks in contractions and expansions.



4. Conclusion

This paper examines how labor earnings risk evolves over the business cycle for men and women in the Netherlands, using administrative data covering the period 1989-2024. As has been documented for men's earnings in the US and in several other European countries, we find evidence that the distribution of annual earnings changes becomes more negatively skewed in contractions. Positive earnings changes are relatively less frequent in downturns.

A central and novel finding is that these cyclical patterns differ by gender. Women exhibit greater overall dispersion in annual earnings changes than men, although this difference has narrowed over time. At the same time, contractions shift skewness downwards for both men and women, but the decline is larger for men. As a result, downturns generate a stronger shift toward downside asymmetry for men, while women's earnings changes remain relatively more influenced by positive shocks.

To better understand the mechanisms behind these patterns, we decompose earnings changes into hours and wages. We find evidence of countercyclical skewness in both components, but the pattern is more pronounced for hours worked. This suggests that cyclical earnings risk operates primarily through adjustments along the intensive margin. For women, the greater dispersion in earnings changes is also mainly driven by hours adjustments, consistent with the prominent role of part-time work in the Dutch labor market. The greater overall dispersion among women, therefore, appears primarily driven by hours adjustments rather than by stronger wage fluctuations. Across the earnings distribution, cyclical asymmetries are present throughout much of the distribution. Among higher-earning men, however, hours skewness becomes procyclical, suggesting that labor input in this group may adjust differently over the cycle, possibly because higher-paid jobs allow greater flexibility in hours, overtime, or workload during expansions.

We also document substantial heterogeneity across sectors and household structures. Cyclical downside risk is concentrated in more cyclically exposed sectors, such as construction, manufacturing, trade, transport, and employment agency work, while earnings changes in education and the public sector are substantially more stable over the business cycle. At the household level, earnings continue to become more downside-skewed during contractions, suggesting that household income pooling only partially offsets individual labor market shocks, consistent with the possibility that negative shocks become more correlated within households during downturns.

Lastly, we examine transitions into full or partial benefit receipt as an additional manifestation of downside labor market risk. Transitions into unemployment insurance and early pension benefits display clear cyclical patterns. The probability of entering unemployment insurance declines with prior earnings and is higher for men, but the gap between contractions and expansions is visible across the earnings distribution. These

findings show that downside earnings risk in downturns is linked not only to lower wages or hours but also to a higher likelihood of moving into income replacement programs.

These results have direct implications for pension funds. First, they show that labor-income risk is state-dependent: participants face more downside-oriented earnings risk during contractions than during expansions. Risk-capacity assessments that rely only on average earnings risk may therefore understate exposure to adverse labor market conditions. Second, our findings highlight substantial heterogeneity in labor income risk across gender, labor market margins, sectors, and household structure. Downside earnings risk is concentrated in more cyclically exposed sectors, while household-level earnings continue to exhibit downside asymmetry during contractions, suggesting that income pooling only partially offsets individual labor market shocks. Third, transitions into unemployment insurance and pension benefits indicate that downside earnings risk is linked to broader labor market disruptions, rather than only to wage adjustments. Taken together, these findings suggest that risk-capacity assessments and lifecycle investment profiles may benefit from incorporating heterogeneity in labor income risk across business-cycle states, gender, sector, and household structure. Participants with greater exposure to downside labor market risk may have lower capacity to bear financial risk, particularly when labor income losses coincide with unfavorable financial market conditions.

Finally, the empirical patterns documented in this paper can serve as inputs into structural life-cycle models of household saving, portfolio choice, and retirement behavior. Such models can help pension funds determine how much financial risk participants can optimally bear over the life cycle by incorporating heterogeneity in labor income risk across business-cycle states, gender, sector, and household structure.

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