

Earnings Dynamics and Income Insurance in Germany: A Cohort View

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Introduction

- Income risk has a negative impact on risk averse agents' welfare
- Macroeconomic models typically include uniform income processes for all households
- Individual earnings growth risk is crucial for household (consumption) decisions
- Do younger cohorts face increased earnings risk?
- Can the households and the welfare state mitigate income risk?
- Are the idiosyncratic income changes persistent?

Literature

- Emerging literature on nonlinearities and non-normality of income processes and insurance against income risk
 - **France:** Aghion et al. (2023)
 - **Germany:** Bartels and Bönke (2013), Busch et al. (2022), Drechsel-Grau et al. (2022), Pessoa (2021)
 - **Italy:** Hoffmann and Malacrino (2019), Hoffmann et al. (2022),
 - **Netherlands:** De Nardi et al. (2021)
 - **Norway:** Blundell et al. (2015), Halvorsen et al. (2020)
 - **UK:** De Nardi et al. (2020b)
 - **US:** Hryshko et al. (2017), De Nardi et al. (2020a), De Nardi et al. (2021), Guvenen et al. (2021)
- Great Moderation: Variance decreased in US between 80s and 90s, attributable to both permanent and transitory shocks: Sabelhaus and Song (2010)
- Increased earnings inequality for younger cohorts: Hoffmann et al. (2022)

Contribution

- Document volatility and higher order income risk for different cohorts in Germany
- Investigate earnings dynamics for both women and men
- Illustrate persistence of income shocks
- Identify the role of the household (incl. children) and welfare state
- Decomposition: Hourly wages are the most important driver of earnings risk
- Broad assessment of earnings dynamics, cohort effects, income insurance, and welfare implications

Preview of results

- Growth in labor earnings, household earnings and net household incomes: younger cohorts face higher volatility (-) and higher skewness (+) as well as lower kurtosis (+)
- Men's labor income growth exhibits lower volatility than women's earnings growth
 - This difference disappears when restricting the sample to people without children
- Skewness of labor earnings growth decreased strongly during the Great Recession
- However, earnings changes of younger female cohorts were unaffected
- Income shocks have a high persistence
- Both the household and the welfare state are quite effective insurance mechanisms

The data

- Taxpayer Panel (TPP)
 - Administrative data based on the universe of personal income tax returns
 - Years 2001-2016, 5% subsample, well over 50 million observations
 - Only those with positive earnings and no income from self-employment
 - Minimum income threshold equivalent to 2300 EUR in 2018
 - Birthyears 1942-1991 in 10-year cohorts (and possibly more granular)

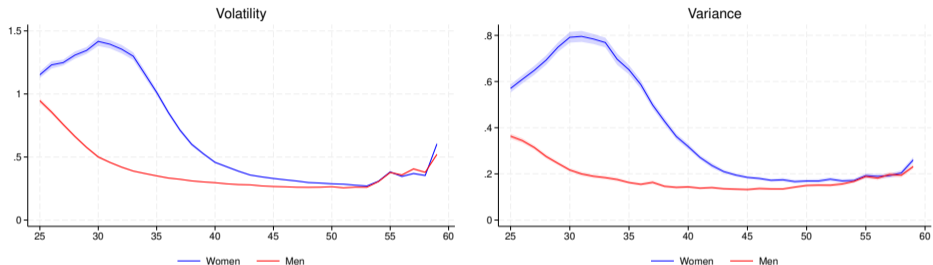
Concepts of income risk

- Focus on residualized income growth, i.e. residualized first difference in log income
 - Outcome variable $x_{i,t}$ for individual i in year t :

$$\Delta_k \ln x_{i,t} = \ln x_{i,t+k} - \ln x_{i,t}$$

- Regression using age and year interactions as baseline income path
- Idiosyncratic growth rate $\Delta_k \ln \tilde{x}_{i,t}$
- A measure of unexpected changes in income
- In practice, this measure also captures expected income changes to some degree
- Percentile based measures of risk:
 - Volatility $P90 - P10$
 - Kelley skewness $\frac{(P90 - P50) - (P50 - P10)}{P90 - P10}$
 - Crow-Siddiqui measure of kurtosis $\frac{P97.5 - P2.5}{P75 - P25}$

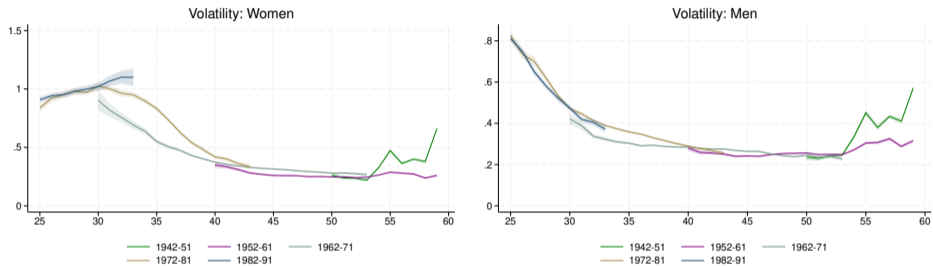
Earnings risk over the life cycle



Note: Prime age individuals in the TPP, years 2001-2016

- U-shaped volatility/variance of idiosyncratic earnings changes for men, excess risk for women peaking at age 30
- Similar in levels at the beginning of working life and beyond 50

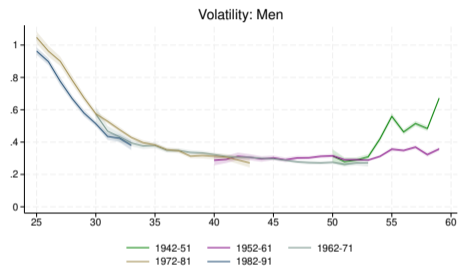
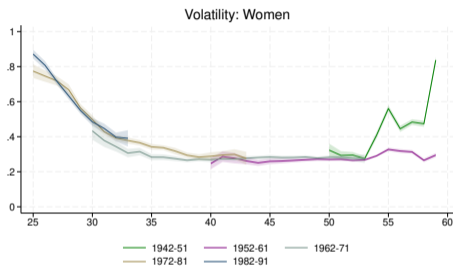
Earnings risk by cohort and age



Note: Prime age individuals in the TPP, years 2001-2016

- Younger cohorts (both women and men) face higher earnings growth risk
- Few exceptions for the oldest cohorts at higher ages

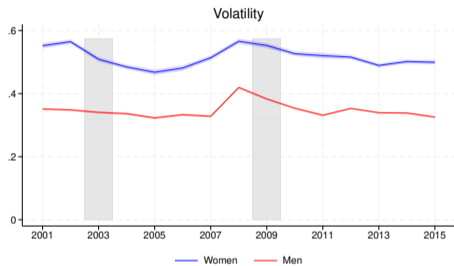
Sample without parents



Note: Prime age individuals in the TPP, years 2001-2016

- Women without children exposed to a much lower earnings volatility
- Childless men and women very similar

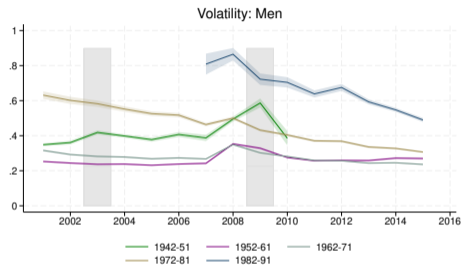
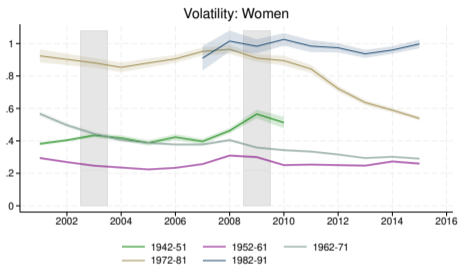
Excursion: The business cycle & earnings growth risk



Note: Prime age individuals in the TPP, years 2001-2016

- Great recession affected men to larger extent, 2003 recession insignificant
- Note that we plot $t \rightarrow t + 1$, so recession shows up one year ahead

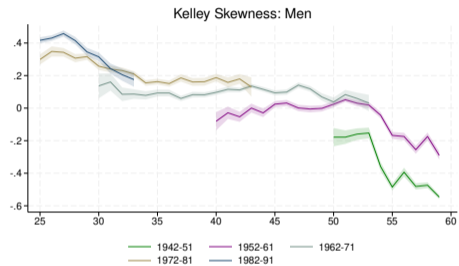
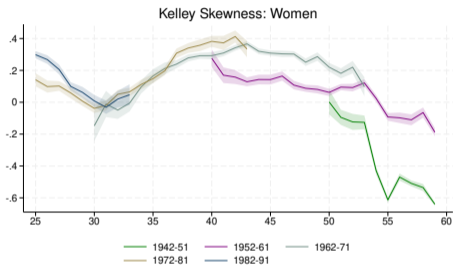
Earnings risk by cohort and year



Note: Prime age individuals in the TPP, years 2001-2016

- Men across all cohorts were faced with increased volatility in 2009
- Recession effect much lower for women, some cohorts virtually unaffected

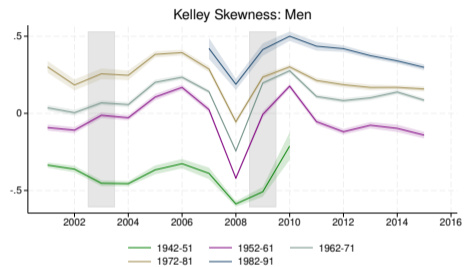
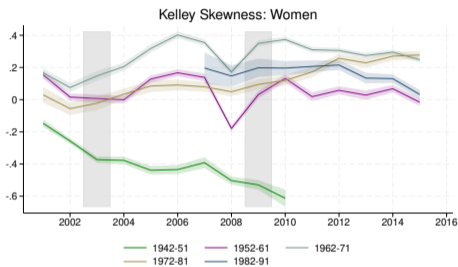
Higher order risk



Note: Prime age individuals in the TPP, years 2001-2016

- Negative shift in skewness over the life-cycle
- Distribution of idiosyncratic earnings shocks relatively more right-skewed in younger cohorts

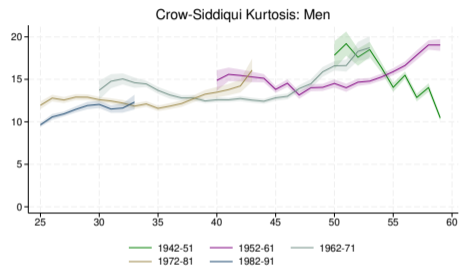
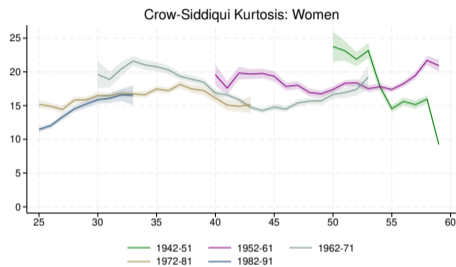
Skewness over the business cycle



Note: Prime age individuals in the TPP, years 2001-2016

- Procyclical skewness as found in Busch et al. (2022)
- Skewness for women in younger cohorts unaffected during Great Recession

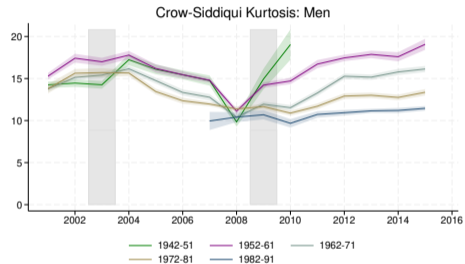
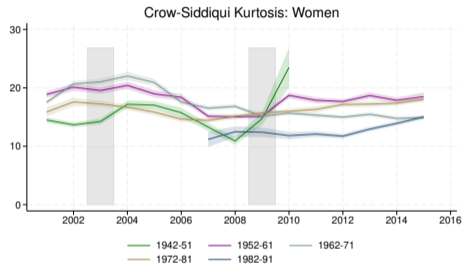
Kurtosis



Note: Prime age individuals in the TPP, years 2001-2016

- Less pronounced life-cycle and cohort effects on kurtosis
- Distribution of idiosyncratic earnings shocks mostly less leptokurtic in younger cohorts

Kurtosis over the business cycle



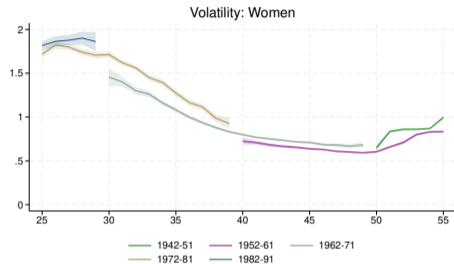
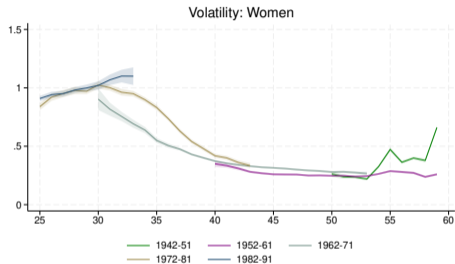
Note: Prime age individuals in the TPP, years 2001-2016

- Lower density at the tails of the distribution during the Great Recession

Persistence of earnings shocks

- Short-term effects or longer-term income loss
- People care about persistent or permanent (negative) shocks
- Do the patterns we found for $t \rightarrow t + 1$ hold for $t \rightarrow t + 5$?

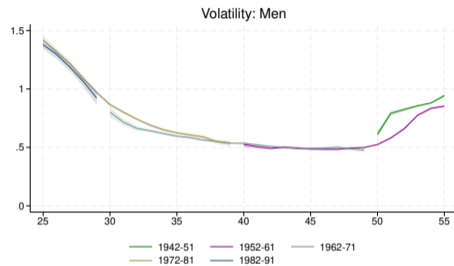
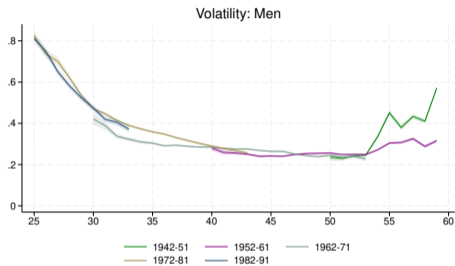
1 vs. 5 years ahead: Women



Note: Prime age individuals in the TPP, years 2001-2016

- Longer term volatility larger
- Cohort effects more clear cut

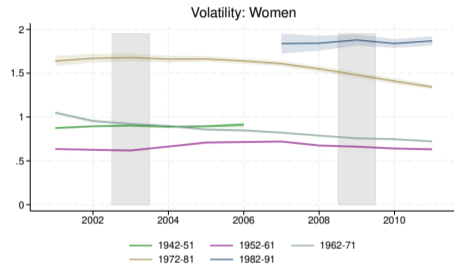
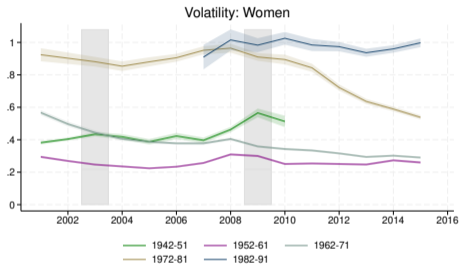
1 vs. 5 years ahead: Men



Note: Prime age individuals in the TPP, years 2001-2016

- Volatility much larger over 5 years
- Cohort effects disappear almost completely

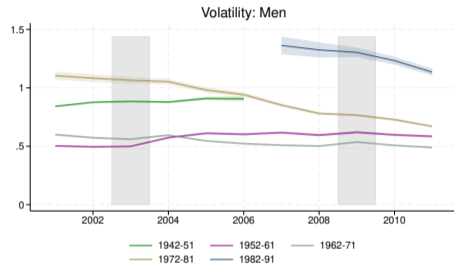
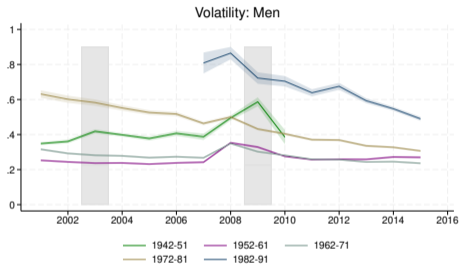
1 vs. 5 years ahead: Women



Note: Prime age individuals in the TPP, years 2001-2016

- Business cycle effects are smoothed out

1 vs. 5 years ahead: Men



Note: Prime age individuals in the TPP, years 2001-2016

- No visible persistent shocks during recessions

Conclusions

- Earnings risk is highest at the beginning of working life, decreases and then remains constant from age 40 until close to retirement age
- Women face higher earnings risk, especially around 30
- Having children explains women's higher earnings volatility to a large extent
- Higher risk faced by younger cohorts at given age/year
- Procyclical earnings growth skewness, driven by both tails
- Cohort effects more (less) visible in persistent labor income shocks for women (men)

Insurance mechanisms

- Insurance against Income Risk: The Role of the Household and the German Tax-Transfer System
- Main findings
 - Income pooling and the tax-transfer system are important channels of insurance
 - Household and the tax and transfer system mitigate welfare loss caused by increased earnings growth risk
 - Variance decomposition: Wages, hours and months are all important drivers of earnings risk

Methodology

- What we have learned about individual labor income risk:
 - Earnings risk is highest at the beginning of working life.
 - Women face substantially higher risk from late 20s to 40
 - Large impact of Great Recession on idiosyncratic earnings risk
- To what extent is this risk mitigated via the household and the welfare state?
- Using SOEP for better coverage of household context and detailed information on taxes and transfers
- Socio-Economic Panel (SOEP)
 - Representative, annual survey of households in Germany
 - Years 1991-2018
 - Only those with positive earnings and no income from self-employment
 - 10-year cohorts
 - We look at couples only
- Residualized first differences in individual labor earnings, household income before and after taxes and transfers

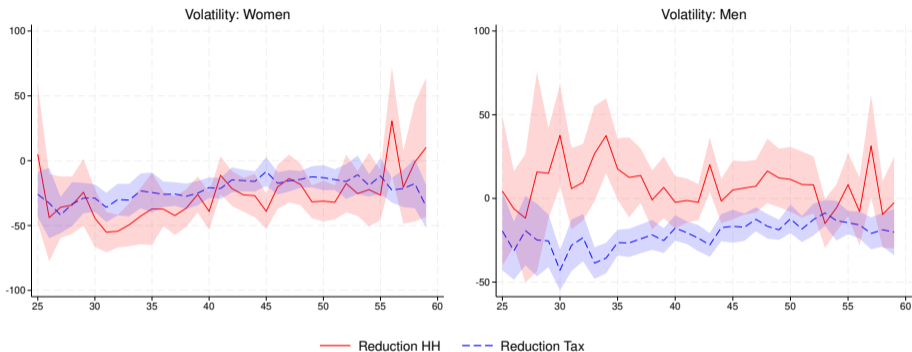
Insurance effects



Note: Prime age individuals in the SOEP, years 2001-2016

- Life cycle risk profile much flatter as a household
- Post-government income volatility often significantly lower than individual labor earnings volatility

Percentage change



Note: Prime age individuals in the SOEP, years 2001-2016

- Female partner experiences a steady and equally large reduction in earnings growth risk across all ages through household and welfare state
- Volatile income of the spouse even increases men's household income volatility vis-a-vis labor earnings

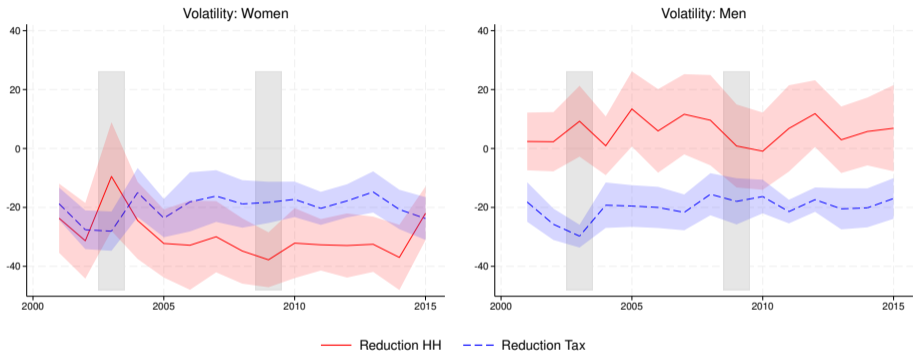
Insurance effects



Note: Prime age individuals in the SOEP, years 2001-2016

- Women see clear insurance effects via both channels in every year

Percentage change



Note: Prime age individuals in the SOEP, years 2001-2016

- Significant volatility reduction through taxes and transfers throughout the years
- Risk reduction via household close to zero for men

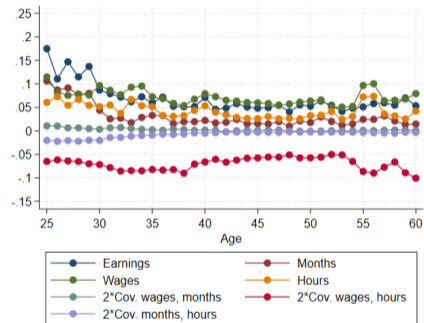
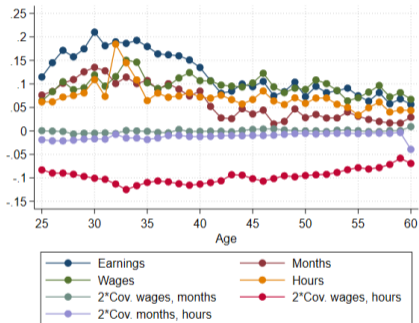
Decomposition of earnings growth variance

- What are the drivers of the increase in earnings risk?
- Decompose earnings (y) risk into months worked (m), hours of work per month (h), and hourly wages (w), all of which can be observed in the SOEP:

$$\ln y = \ln m + \ln h + \ln w \quad (1)$$

$$\begin{aligned} \text{Var}(\ln y) &= \text{Var}(\ln m) + \text{Var}(\ln h) + \text{Var}(\ln w) \\ &+ 2\text{Cov}(\ln m, \ln h) + 2\text{Cov}(\ln m, \ln w) + 2\text{Cov}(\ln h, \ln w) \end{aligned} \quad (2)$$

Decomposition of earnings growth variance



Residualized earnings growth. Prime age individuals in the SOEP, years 1991-2018

Interpretation

- Earnings risk is highest at the beginning of working life.
- Women face substantially higher risk from late 20s to 40
- Slight increase for younger cohorts.
- For men, wages are the most important driver.
- For women, months are more important at young ages.
- Negative covariance of hours and wages due to denominator bias and possibly a negative Marshallian labor supply elasticity.

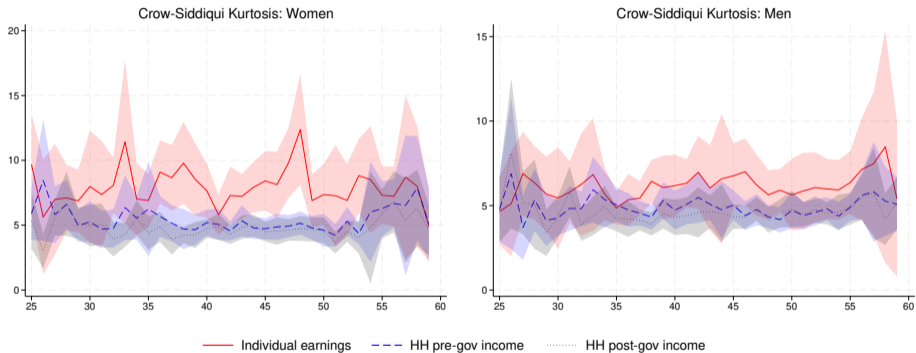
References I

- Aghion, P., Ciornohuz, V., Gravouelle, M., and Stantcheva, S. (2023). Anatomy of inequality and income dynamics in france.
- Bartels, C. and Bönke, T. (2013). Can Households And Welfare States Mitigate Rising Earnings Instability? *Review of Income and Wealth*, 59(2):250–282.
- Blundell, R., Graber, M., and Mogstad, M. (2015). Labor income dynamics and the insurance from taxes, transfers, and the family. *Journal of Public Economics*, 127:58–73.
- Busch, C., Domeij, D., Guvenen, F., and Madera, R. (2022). Skewed idiosyncratic income risk over the business cycle: Sources and insurance. *American Economic Journal: Macroeconomics*, 14(2):207–42.
- De Nardi, M., Fella, G., Knoef, M., Paz-Pardo, G., and Van Ooijen, R. (2021). Family and government insurance: Wage, earnings, and income risks in the Netherlands and the U.S. *Journal of Public Economics*, 193:104327.
- De Nardi, M., Fella, G., and Paz-Pardo, G. (2020a). Nonlinear Household Earnings Dynamics, Self-Insurance, and Welfare. *Journal of the European Economic Association*, 18(2):890–926.
- De Nardi, M., Fella, G., and Paz-Pardo, G. (2020b). Wage Risk and Government and Spousal Insurance. NBER Working Papers 28294, National Bureau of Economic Research, Inc.
- Drechsel-Grau, M., Peichl, A., Schmid, K. D., Schmieder, J. F., Walz, H., and Wolter, S. (2022). Inequality and income dynamics in germany. *Quantitative Economics*, 13(4):1593–1635.
- Feldstein, M. S. (1969). The effects of taxation on risk taking. *Journal of Political Economy*, 77(5):755–764.
- Guvenen, F., Karahan, F., Ozkan, S., and Song, J. (2021). What Do Data on Millions of U.S. Workers Reveal about Life-Cycle Earnings Risk? *Econometrica*, 89:2303–39.

References II

- Halvorsen, E., Holter, H., Ozkan, S., and Storesletten, K. (2020). Dissecting idiosyncratic earnings risk. CEPR Working Papers DP15395, CEPR.
- Heathcote, J., Storesletten, K., and Violante, G. L. (2017). Optimal tax progressivity: An analytical framework. *Quarterly Journal of Economics*, 132:1693–1754.
- Hoffmann, E. B. and Malacrino, D. (2019). Employment time and the cyclicity of earnings growth. *Journal of Public Economics*, 169(C):160–171.
- Hoffmann, E. B., Malacrino, D., and Pistaferri, L. (2022). Earnings dynamics and labor market reforms: The Italian case. *Quantitative Economics*, 13(4):1637–1667.
- Hryshko, D., Juhn, C., and McCue, K. (2017). Trends in earnings inequality and earnings instability among U.S. couples: How important is assortative matching? *Labour Economics*, 48(C):168–182.
- Pessoa, A. S. (2021). Earnings Dynamics in Germany. CESifo Working Paper Series 9117, CESifo.
- Sabelhaus, J. and Song, J. (2010). The great moderation in micro labor earnings. *Journal of Monetary Economics*, 57(4):391–403.

Insurance against higher order risk



Note: Prime age individuals in the SOEP, years 2001-2016

Insurance against higher order risk



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Welfare analysis

- Compare an older cohort (1962-71) to a younger cohort (1972-81)
- No savings, income = consumption
- CRRA utility function with risk aversion parameter γ
- By how much would the older cohorts income have to increase for them to be indifferent to be the counterfactual of them being born in the younger cohort?

Welfare analysis

Table: Welfare effects of changes in income distributions: SOEP cohorts 1962 and 1972

	$\gamma = 0$	$\gamma = 1$	$\gamma = 1.5$	$\gamma = 2$
<i>Women</i>				
Labor earnings	.154	.126	.100	.015
HH pre-gov income	.202	.174	.143	.087
HH post-gov income	.231	.219	.209	.197
<i>Men</i>				
Labor earnings	.078	.054	.034	-.012
HH pre-gov income	.129	.100	.076	.023
HH post-gov income	.164	.148	.139	.131

Note: Proportional income increase needed to make average individual in earlier cohort as well off as average individual in the later cohort for different values of CRRA parameter γ . Sample with positive labor income. Ages 31-44.

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- No risk aversion:
Necessary increase =
average real income
growth

Welfare analysis

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- Necessary increase drops dramatically with increasing risk aversion

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- No risk aversion: Necessary increase = average real income growth
- Necessary increase drops dramatically with increasing risk aversion
- Household and welfare state offset large parts of the higher moments

