

Welfare-Based Measures of Income Insecurity in Fixed Effects Models by N. Rhode, K. Tang, C. D'Ambrosio, L. Osberg, P. Rao
Discussion by Tobias Schmidt (Deutsche Bundesbank)

This presentation represents the authors' personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank or its staff. Do not cite or circulate.

Objectives and Contributions

- **Extent** the current **techniques** used for the analysis of **household-level income risk**:
 - Use **panel data and fixed effects models** to generate **predictive distributions** of future income
 - Allow for **individual specific residual variance** in income risk
 - Use Expected Utility Theory and Prospect Theory to generate indices of welfare loss or gains
- **Apply** the **extended techniques to US and German micro-data** for the period 1992 to 2010
- Study the **effects of particular covariates** on the distribution of insecurity

Methodology – Panel Regression

- Set up a **model which allows for individual specific variance** over time
=> Fixed-effects Condition heteroscedasticity model

$$\ln(y_{it}) = \alpha_i + \mathbf{x}'_{it}\beta + \varepsilon_{it} \quad \varepsilon_{it} \sim N(0, \sigma_{it}^2), \quad \sigma_{it}^2 = \exp(\gamma + \mathbf{x}'_{it}\theta)$$

- Covariates in the variance equation can include **time-invariant regressors** (race, gender, age)
- Model can account for “**predictable fluctuations**” (mean equation) and “**unpredicted shocks**” (variance equation)
- Estimate using **maximum likelihood** method and generate predictive densities for income
- **Summarize the risk** implied by the estimated distributions using **Expected Utility Theory (EUT) and Reference Dependent Utility functions (RDU)**

Methodology – Welfare Indices – Expected Utility Theory

- **Expected Utility Theory:** focus on **absolute value and relative volatility**

- I_{it}^{DN} - Dalton(1920) – index for the loss in welfare due to unequal distribution

increasing in the variability of income and decreasing in the level

$$I_{it}^{DN} = 1 - \frac{E[U(y_{it+1})]}{U(E[y_{it+1}])} \quad \text{with } U(y)=\ln(y) \text{ becomes} \quad I_{it}^{DN} = 1 - \frac{\hat{\alpha}_i + \mathbf{x}'_{it+1}\hat{\beta}}{\hat{\alpha}_i + \mathbf{x}'_{it+1}\hat{\beta} + \frac{1}{2} \exp(\hat{\gamma} + \mathbf{x}'_{it+1}\hat{\theta})}$$

- I_{it}^{AT} - Atkinson(1970) – index based on inequality metric

increasing in the variability of income

$$I_{it}^{AT} = 1 - \frac{U^{-1}(E[U(y_{it+1})])}{E[y_{it+1}]} \quad \text{with } U(y)=\ln(y) \text{ becomes} \quad I_{it}^{AT} = 1 - \exp\left(-\frac{1}{2} \exp(\hat{\gamma} + \mathbf{x}'_{it+1}\hat{\theta})\right)$$

Methodology – Welfare Indices

- **Reference Dependent Utility: focus on changes** instead of levels, appropriate if level is unimportant

$$V(\tilde{y}) = \int_{-y_{it}}^0 \lambda(-\tilde{y})^\xi f(\tilde{y}) d\tilde{y} + \int_0^\infty \tilde{y}^\xi f(\tilde{y}) d\tilde{y} \quad \text{and} \quad v(\tilde{y}) = \begin{cases} \tilde{y}^\xi & \tilde{y} \geq 0 \\ \lambda(-\tilde{y})^\xi & \tilde{y} < 0 \end{cases}$$

With **risk preference parameters** from Tversky and Kahneman (1992)

$\lambda = -2.25$ loss aversion

$\xi = 0.88$ degree of concavity/convexity for gains/losses

- I_{it}^{EL} expected loss of welfare in the coming period – **sensitive to predicted changes**

$$I_{it}^{EL} = -V(\tilde{y}_{it})$$

- I_{it}^{RD} difference in utility between scenario where person receives expected income change and scenario with unpredicted change – **sensitive to unpredicted changes**

$$I_{it}^{RD} = v(\hat{y}_{it+1} - y_{it}) - V(\tilde{y}_{it})$$

Results – Income Insecurity in the US and Germany

Table 1: Fixed Effects Income Models with Conditionally Dependent Heteroskedasticity: - US and Germany

Variable Type	Variable Name	US		Germany		
		Mean	Log Variance	Mean	Log Variance	
Individual/Household	Constant	10.380***	-1.203***	9.735***	-3.964***	
	Education	-0.033***	0.018***	-0.008**	0.039***	
	Married	0.146***	-0.289***	0.134***	-0.264***	
	Separated/Divorced	0.083***	-0.062***	0.065**	0.080**	
	Widowed	0.088***	0.191***	0.201***	-0.008	
	Household Head	-0.542***	0.316***	-0.235***	0.321***	
	Household Size	-0.031***	-0.043***	0.089***	-0.071***	
	Children	-0.062***	-0.098***	-0.518***	-0.193***	
	Part Time Work	-0.147***	0.197***	-0.044***	0.266***	
	Not Working	-0.434***	0.831***	-0.124***	0.371***	
	Work Hours	5.4E-05***	-6.2E-05***	7.9E-05***	-6.1E-05***	
	Trend	0.271***	-0.246***	0.009***	0.002	
	Aggregate	Employment Rate (S)	0.051**	0.012*	-0.730***	1.903***
		Employment Rate (E)	8.5E-06***	-1.1E-05	0.224***	0.365***
PC Output (S)		0.011***	0.005***	1.6E-05***	1.0E-05***	
Fixed	Age		-0.020***		-0.037***	
	Age Squared		2.5E-04***		2.9E-04***	
	Female		0.011		0.151***	
	Non-White		0.356***			
Supplemental	No. Groups	27619		23732		
	No. Observations	149342		100249		
	Log likelihood	-96379		3699		
	Pseudo R ²	0.599		0.692		
	D	3074		3373		

Good fit
between actual
and predicted
log incomes

Note: The table provides parameter estimates for EQ (3) for US and German harmonized panel data 1993-2009. The dependent variable is the log of equalized household income and dummies are defined relative to a reference individual who is unmarried and engaged in full time employment. *, ** and *** denote significance at 10%, 5% and 1% respectively.

- **Coefficients generally in line with expectations** and consistent **across countries**
- Married individuals, in full-time employment, in richer areas have higher income
- In many cases, changes that lead to an increase in income point to a reduction in risk

Results – Income Insecurity in the US and Germany

Table 1: Fixed Effects Income Models with Conditionally Dependent Heteroskedasticity: - US and Germany

Variable Type	Variable Name	US		Germany		
		Mean	Log Variance	Mean	Log Variance	
Individual/Household	Constant	10.380***	-1.203***	9.735***	-3.964***	
	Education	-0.033***	0.018***	-0.008**	0.039***	
	Married	0.146***	-0.289***	0.134***	-0.264***	
	Separated/Divorced	0.083***	-0.062***	0.065**	0.080**	
	Widowed	0.088***	0.191***	0.201***	-0.008	
	Household Head	-0.542***	0.316***	-0.235***	0.321***	
	Household Size	-0.031***	-0.043***	0.089***	-0.071***	
	Children	-0.062***	-0.098***	-0.518***	-0.193***	
	Part Time Work	-0.147***	0.197***	-0.044***	0.266***	
	Not Working	-0.434***	0.831***	-0.124***	0.371***	
	Work Hours	5.4E-05***	-6.2E-05***	7.9E-05***	-6.1E-05***	
	Trend	0.271***	-0.246***	0.009***	0.002	
	Aggregate	Employment Rate (S)	0.051**	0.012*	-0.730***	1.903***
		Employment Rate (E)	8.5E-06***	-1.1E-05	0.224***	0.365***
		PC Output (S)	0.011***	0.005***	1.6E-05***	1.0E-05***
Fixed	Age		-0.020***		-0.037***	
	Age Squared		2.5E-04***		2.9E-04***	
	Female		0.011		0.151***	
	Non-White		0.356***			
Supplemental	No. Groups	27619		23732		
	No. Observations	149342		100249		
	Log likelihood	-96379		3699		
	Pseudo R^2	0.599		0.692		
	D	9074		3973		

Note: The table provides parameter estimates for EQ (3) for US and German harmonized panel data 1993-2009. The dependent variable is the log of equivalized household income and dummies are defined relative to a reference individual who is unmarried and engaged in full time employment. *, ** and *** denote significance at 10%, 5% and 1% respectively.

Comments:

A) Effect of education unclear

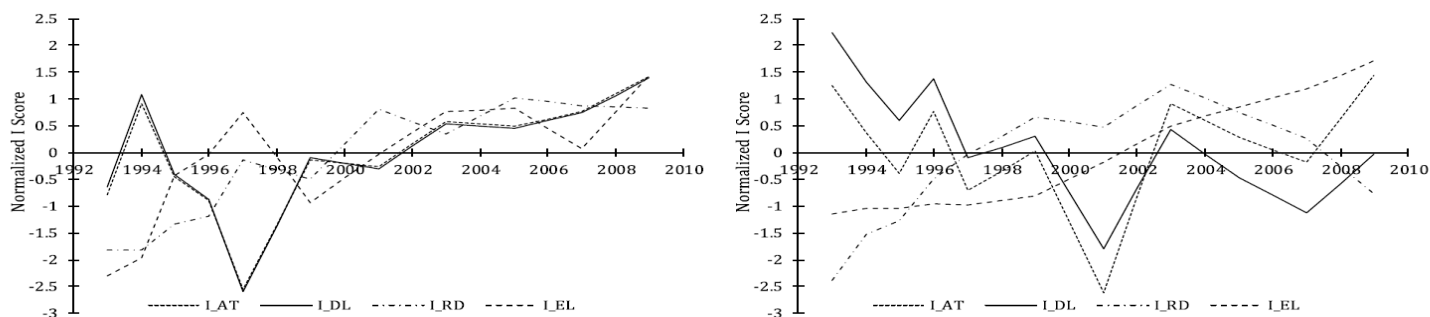
B) Explain variables in more detail (e.g. hh head variable, multi-person households)

C) Household equivalized income vs aggregation of individual income

Results – Income Insecurity in the US and Germany

- All four welfare indices higher in the US than in Germany
- I_{it}^{DN} indicates that in the US 1% of welfare derived from income is lost through uncertainty, in Germany 0.3%.
- Seem to be driven by the country-specific autonomous component of income uncertainty, i.e. related to factors fixed over individuals and time, but not across countries (e.g. welfare state, labor laws, other institutional factors).
- Trends USA: increasing insecurity after 1997 independent of measure/index used
- Trends DE: I_{it}^{DN} and I_{it}^{AT} decline until 2001 and then increases
 I_{it}^{RD} and I_{it}^{EL} increase over the whole horizon

Figure 1: Average Insecurity Estimates 1993-2009 United States and Germany



Note: The left panel gives trends in all four normalized indices for the US from 1993-2009 while the right panel gives the equivalent trends for Germany. The raw (non-normalized) data are available in the appendix. Source: Authors' own calculations from CNEF data set.

Results – Drivers of Income Insecurity Trends in US and Germany

- **US:** Changes in hh structure, increase in non-white population, passage of time captured by trend important, labour conditions less important
- **No clear picture** emerges for **Germany**, but **age** seems to be important

⇒ **Passage of time an important driver**

⇒ **Look at factors omitted from the model** that truly affect insecurity and change over time

Comments:

- A) Some large/huge coefficients for Germany on household head, household person, employment state, education
- B) Why does the size of coefficients differ so greatly between Germany and US estimates?

Table 2: Decompositions of the Trend in EUT Measures - US and Germany

Variable	United States			Germany		
	Δx_{ij}	I^{DN}	I^{AI}	Δx_{ij}	I^{DN}	I^{AI}
Education	0.442	10.50	8.40	0.882	59.36	44.71
Married	-0.017	5.73	5.19	-0.014	6.51	4.75
Divorced/Separated	0.002	-0.13	-0.11	0.017	2.12	1.77
Widowed	-0.007	-1.34	-1.35	0.004	-0.17	-0.04
Household Head	0.031	12.62	10.35	0.052	30.17	21.60
Household Person	-0.186	8.50	8.41	-0.240	32.39	22.14
Children	-0.025	2.15	2.54	-0.033	7.87	8.23
Part Time Work	0.031	7.13	6.40	0.008	3.81	2.88
Not Working	-0.012	-11.76	-10.74	0.002	1.40	1.04
Work Hours	-62.43	4.77	4.07	-7.527	0.87	0.59
Employment State	0.001	-0.39	-0.33	-0.030	-100.82	-74.53
Employment Education	-0.004	-0.03	-0.05	-0.002	-1.30	-1.06
Income by State	-725.9	9.11	8.06	6701	99.36	90.27
Trend	8	39.44	46.07	8	18.82	23.99
Age	0.206	-4.60	-4.39	3.982	-249.94	-191.81
Age Squared	17.514	4.89	4.66	392.2	190.40	146.12
Female	0.001	0.01	0.01	-0.003	-0.84	-0.64
Nonwhite	0.034	13.40	12.78	-	-	-
Total		100%	100%		100%	100%

Note: Results represent decompositions of insecurity trends based upon averaged covariate vectors for 2001 and 2009. All estimates use linearized approximations to EQ (3) and EQ (4) and the results are standardized in terms of the total change in these indices. Results for the US are presented in the first three columns while results for Germany are in the last three.

Results – Drivers of Income Insecurity Trends in US and Germany

- **National level:**

- Changes in **policy regimes** for US state (liberal/conservative) can explain only a **small part** of observed trends in income insecurity
- Increasing **global competition** (e.g. through the supply of low wage labor in developing countries) seems to have **contributed to income insecurity in the US**, but **no clear picture** emerges for **Germany**

- **Changes affecting distribution of indices within a country (Decomposition):**

- Increase in **part time work** and **reduction in average working hours**:
 - **Most individuals would have slightly lower insecurity** scores in the absence of these changes
 - The **largest impact** of insecurity of these labor market conditions is observed **for low income individuals**
 - The **patterns are similar for Germany and the US**, but the quantitative impact is **smaller in Germany**
- **Declining household sizes** (less intra-household risk pooling possible)
 - **Insecurity increases due to shrinking household size** in Germany and to a lesser degree also in the US
 - **Effects** of shrinking households sizes are **small compared to changes in labor market conditions**

Summary and Conclusions

- **Income insecurity in the US** is much **higher than in Germany**
- Income insecurity in the **US appeared to rise steadily over time**, which can be traced in part to demographic changes (household composition, non-white population).
- Time trend is important and the evolving **political environment and increasing competition** seems to play a role for increasing insecurity in the US.
- For **Germany less coherent results** emerge: trends in insecurity show increase after 2001, but are contradictory before 2000.
- Changes in **labor market conditions** and to a lesser degree **household size increase income insecurity**, disproportionally for persons of lower socioeconomic status.

Additional Comments and Suggestions

- Well written paper, which provides insight into income risk and its drivers
- Add some **more information on the datasets**, variables, etc.
- Is there any evidence on **how individuals and households react** to growing insecurity? Do they adjust their consumption?
- Add **more countries** to the analysis, e.g. developing countries profiting from globalization.

Thank you for your attention !

Tobias.Schmidt@bundesbank.de