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Income and job satisfaction. The role of comparison processes

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Outline

1. Theoretical Considerations

2. Data and Estimation Strategy

3. Empirical Evidence

4. Summary

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1. **Theoretical Considerations**

2. Data and Estimation Strategy

3. Empirical Evidence

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A Utility Function of Absolute and Relative Income

- Utility function: $U_i = U(S(y_i, y_j), V(y_i, F_i))$, where $S = f(y_i - y_j)$

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- Sorting of incomes: 2 comparison groups within reference group

$$\underbrace{y_1^P < ... < y_{i-1}^P}_{\substack{\text{downward comparison} \\ \text{(poorer reference individuals)}}} < y_i < \underbrace{y_{i+1}^R < ... < y_n^R}_{\substack{\text{upward comparison} \\ \text{(richer reference individuals)}}}$$

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- Measuring income inequality (Fehr and Schmidt; 1999):

$$S = \underbrace{\frac{a}{n-1} \sum_{j=i+1}^{n} (y_j^R - y_i)}_{\substack{\text{disadvantageous} \\ \text{inequality} \\ \text{(DI)}}} + \underbrace{\frac{b}{n-1} \sum_{j=1}^{i-1} (y_i - y_j^P)}_{\substack{\text{advantageous} \\ \text{inequality} \\ \text{(AI)}}}$$

Possible Effects of Income Inequality on Utility

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comparison group	parameter value	interpretation
upward comparison	$a > 0$	information effect
	$a < 0$	envy, deprivation
downward comparison	$b > 0$	prestige
	$b < 0$	regret

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Data: The Socio-Economic Panel Study (SOEP)

- Representative longitudinal study of private households in the entire federal republic of Germany

- Provides information on employment, earnings, health and satisfaction indicators etc.

- Sample:
    - dependent employees
    - full-time employment ($\geqslant$ 35 hours per week)
    - only West Germans (no foreigners)
    - monthly gross labor income for income comparison
    - control variables: education, age, sex, marital status, household size, number of children, house owner, self rated health status, branch of industry (NACE), firm size, worry about job security, interview characteristics, wave dummies

- Job-satisfaction question: "How satisfied are you with your job?"

- The data was extracted using PanelWhiz (Haisken-DeNew and Hahn; 2006).

Reference Groups and Income Inequality

Two reference groups:

1. **Region**: employees who live in the same geographical district
2. **Occupation** (ISCO-88)

	Reference group	
	Region	**Occupation**
number of groups	321	266
average group size	12.5	17.2
minimum group size	2	2
maximum group size	133	165
I(0)	0.131	0.131
I(0) Within	0.121	0.093
I(0) Between	0.010	0.039
n	10311	10260
nT	43014	42118

Note: I(0) is the mean logarithmic deviation (Shorrocks; 1984).
Source: SOEP 1992, 1994-2004.

Model Statement

Regression equation:

$$JS_{rit} = \beta_0 + \beta_1 DI_{rit} + \beta_2 AI_{rit} + \mathbf{x}'_{rit}\boldsymbol{\beta} + \eta_{rit}$$

1. Controlling for reference-group-specific and individual-specific unobserved heterogeneity using a **cross-classified model**:

$$\eta_{rit} = \mu_r + \alpha_i + \epsilon_{rit}, \ \ \mu_r \sim N(0, \sigma_\mu^2), \ \epsilon_{rit} \sim N(0, \sigma_\epsilon^2)$$

2. Correlation between random effects and (some of the) covariates is assumed to have the following structure (Mundlak; 1978):

$$\alpha_i = \overline{\mathbf{z}}'_i\boldsymbol{\gamma} + \nu_i, \ \ \nu_i \sim N(0, \sigma_\nu^2)$$

3. Covariance structure:

$$E(\eta_{rit}\eta_{qjs}) = \begin{cases} \sigma_\mu^2 + \sigma_\nu^2 + \sigma_\epsilon^2, & i = j, t = s, r = q; \\ \sigma_\mu^2 + \sigma_\nu^2, & i = j, t \neq s, r = q; \\ \sigma_\nu^2, & i = j, t \neq s, r \neq q; \\ \sigma_\mu^2, & r = q, i \neq j, \forall t, s; \\ 0, & r \neq q, i \neq j, \forall t, s. \end{cases}$$

Markov Chain Monte Carlo (MCMC) Estimation

- Noninformative prior distributions

- Gibbs-Sampling (Starting values: Iterative Generalized Least Squares ignoring the cross-classified model structure)

- Raftery and Lewis (1992) statistic indicates that length of Markov chain of 5000 iterations is sufficient to calculate the 2.5% and 97.5% quantiles of the a posteriori distributions of the parameters of interest. (Burn-in length: 500)

- Model comparison: Deviance Information Criterion (Spiegelhalter et al.; 2002)

- Methods implemented in software package MLwiN V2.02 (Browne; 2003).

Interpretation
Decomposition of the marginal effect of an increase in income

Including the average of an x-variable allows to distinguish a **transitory** and a
permanent effect (Ferrer-i-Carbonell and Van Praag; 2003):

$$u_{it} = \beta x_{it} + \gamma \overline{x}_{i\cdot} = \beta(x_{it} - \overline{x}_{i\cdot}) + (\beta + \gamma)\overline{x}_{i\cdot}.$$

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Estimation Results
First Specification (without reference-group-specific effect)

Variable	Model 1: ML		Model 2: MCMC	
	Coefficient	S. E.	Coefficient	S. E.
Log of gross labor income	0.285***	0.040	0.285	0.040
M: Log of gross labor income	-0.115**	0.047	-0.114	0.047
Log of working hours	-0.296***	0.078	-0.299	0.078
Further controls	yes		yes	
Constant	9.197***	0.341	9.207	0.340
$\hat{\sigma}_{\nu}^2$	1.224	0.028	1.227	0.029
$\hat{\sigma}_{\epsilon}^2$	2.093	0.016	2.095	0.016
Log-Likelihood	-83688		-83688	
DIC	—		162454.54	

Note: Significance levels: ***$\leqslant$1%, **$\leqslant$5%, *$\leqslant$10%. $n = 10363, nT = 43582$. M: denotes a
Mundlak-term. DIC is the *Deviance Information Criterion* (Spiegelhalter et al.; 2002).
ML-estimation with command *xtmixed* in Stata MP 10, MCMC-estimation in MLwiN V2.02.
Source: SOEP 1992, 1994-2004.

Estimation Results
Second Specification (reference-group: region)

Variable	Coefficient	S. E.	2.5%-Quantil	97.5%-Quantil
Disadvantageous inequality: $\hat{\beta}_1$	-0.108	0.034	-0.175	-0.042
Advantageous inequality: $\hat{\beta}_2$	0.046	0.024	0.000	0.092
Log of gross labor income: $\hat{\beta}_3$	0.129	0.057	0.019	0.240
M: Disadvantageous inequality: $\hat{\gamma}_1$	-0.018	0.055	-0.131	0.089
M: Advantageous inequality: $\hat{\gamma}_2$	0.045	0.034	-0.023	0.113
M: Log of gross labor income: $\hat{\gamma}_3$	-0.148	0.070	-0.288	-0.010
Log of working hours	-0.346	0.079	-0.501	-0.194
Further controls	yes			
$\hat{\sigma}^2_\mu$	0.042	0.007		
$\hat{\sigma}^2_\nu$	1.181	0.028		
$\hat{\sigma}^2_\epsilon$	2.085	0.016		
DIC	160161.6			

Note: $n = 10311$, $nT = 43014$. M: denotes a Mundlak-term.
Source: SOEP 1992, 1994-2004.

- Disadvantageous inequality $\rightarrow$ **deprivation/envy effect**

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- Advantageous inequality → **prestige effect**

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- Disadvantageous inequality $\rightarrow$ **deprivation/envy effect**
- Advantageous inequality $\rightarrow$ **prestige effect**
- Permanent effect of absolute income is zero.

Estimation Results
Third Specification (reference-group: occupation)

Variable	Coefficient	S. E.	2.5%-Quantil	97.5%-Quantil
Disadvantageous inequality: $\hat{\beta}_1$	0.055	0.032	-0.008	0.117
Advantageous inequality: $\hat{\beta}_2$	0.035	0.024	-0.010	0.083
Log of gross labor income: $\hat{\beta}_3$	0.272	0.053	0.168	0.376
M: Disadvantageous inequality: $\hat{\gamma}_1$	0.013	0.049	-0.082	0.106
M: Advantageous inequality: $\hat{\gamma}_2$	0.100	0.038	0.026	0.176
M: Log of gross labor income: $\hat{\gamma}_3$	-0.178	0.062	-0.302	-0.059
Log of working hours	-0.341	0.081	-0.501	-0.186
Further controls	yes			
$\hat{\sigma}_\mu^2$	0.017	0.005		
$\hat{\sigma}_\nu^2$	1.229	0.028		
$\hat{\sigma}_\epsilon^2$	2.084	0.016		
DIC	156943.5			

Note: $n = 10260$, $nT = 42118$. M: denotes a Mundlak-term.
Source: SOEP 1992, 1994-2004.

- Disadvantageous inequality $\rightarrow$ **information effect** (D'Ambrosio and Frick; 2007; Clark et al.; 2009)

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Summary

1. The **cross-classified model** that includes relative income clearly fits the data better than "traditional" models.

2. **Absolute income**: permanent effect $<$ transitory effect ($\Rightarrow$ adaptation)

3. **Relative income**
   - Advantageous inequality points to **prestige effect**
   - Permanent prestige effect $>$ transitory prestige effect
   - Disadvantageous inequality:
     - **deprivation effect** (regional reference groups)
     - **information effect** (occupational reference group)
     - see also D'Ambrosio and Frick (2007); Clark et al. (2009)
     - effect is higher for those at the bottom of the reference-group-specific income distribution
     - effect diminishes with increasing tenure: effect is zero after 17-year tenure

4. **Further research**: Do comparison processes affect workers' decisions?

5. First evidence published in Wunder, C. and Schwarze, J. (2009). Income inequality and job satisfaction of full-time employees in Germany, Journal of Income Distribution 18(2): 70-91

Outline

Preferences for Inequality

	$a > 0$ information effect	$a < 0$ envy, deprivation
$b > 0$ prestige	general preference for inequality	preference for advantageous inequality, aversion to disadvantageous inequality
$b < 0$ regret	preference for disadvantageous inequality, aversion to advantageous inequality	general aversion to inequality

Hierarchical vs cross-classified model structure

Hierarchical data structure

	P1	P2	P3
R1	t1, t2, t3		
R2		t1, t2, t3	t1, t2, t3

$$\begin{pmatrix} \boldsymbol{\Sigma}_i & & \\ \mathbf{0} & \boldsymbol{\Sigma}_i & \\ \mathbf{0} & \sigma_\mu^2 \mathbf{i}_T \mathbf{i}_T' & \boldsymbol{\Sigma}_i \end{pmatrix}$$

Cross-classified data structure

	P1	P2	P3
R1	t1, t2, t3		t1
R2		t1, t2	t2
R3		t3	t3

$$\boldsymbol{\Sigma} = \begin{pmatrix} \sigma_\eta^2 & & & & & & & & \\ \sigma_\mu^2 + \sigma_\nu^2 & \sigma_\eta^2 & & & & & & & \\ \sigma_\mu^2 + \sigma_\nu^2 & \sigma_\mu^2 + \sigma_\nu^2 & \sigma_\eta^2 & & & & & & \\ & & & \sigma_\eta^2 & & & & & \\ \mathbf{0} & & & \sigma_\mu^2 + \sigma_\nu^2 & \sigma_\eta^2 & & & & \\ & & & \sigma_\nu^2 & \sigma_\nu^2 & \sigma_\eta^2 & & & \\ \sigma_\mu^2 & \sigma_\mu^2 & \sigma_\mu^2 & 0 & 0 & 0 & \sigma_\eta^2 & & \\ 0 & 0 & 0 & \sigma_\mu^2 & \sigma_\mu^2 & 0 & \sigma_\nu^2 & \sigma_\eta^2 & \\ 0 & 0 & 0 & 0 & 0 & \sigma_\mu^2 & \sigma_\nu^2 & \sigma_\nu^2 & \sigma_\eta^2 \end{pmatrix}$$

Outline

Information Effect
Information effect is more effective for persons at the bottom of the reference group-specific income distribution.

Variable	Coefficient	S. E.	2.5%-Quantil	97.5%-Quantil
Disadvantageous inequality: $\hat{\beta}_1$	-0.545	0.316	-1.151	0.074
Advantageous inequality: $\hat{\beta}_2$	0.065	0.025	0.017	0.113
Income quintiles (Reference: top quintile)				
Bottom quintile: $\hat{\delta}_1$	-0.179	0.068	-0.310	-0.047
2. quintile: $\hat{\delta}_2$	-0.158	0.063	-0.280	-0.034
3. quintile: $\hat{\delta}_3$	-0.084	0.059	-0.197	0.031
4. quintile: $\hat{\delta}_4$	-0.009	0.050	-0.108	0.090
bottom quintile $\times$ DI: $\hat{\theta}_1$	0.637	0.317	0.021	1.237
2. quintile $\times$ DI: $\hat{\theta}_2$	0.614	0.320	-0.010	1.224
3. quintile $\times$ DI: $\hat{\theta}_3$	0.526	0.329	-0.110	1.159
4. quintile $\times$ DI: $\hat{\theta}_4$	0.248	0.338	-0.411	0.892
Log of labor income	0.147	0.048	0.051	0.240
Log of working hours	-0.365	0.084	-0.533	-0.198
Further controls	yes			
$\hat{\sigma}_\mu^2$	0.059	0.016		
$\hat{\sigma}_\zeta^2$	1.369	0.035		
$\hat{\sigma}_\epsilon^2$	1.883	0.018		
DIC	133877.6			

Note: $n = 15013$, $nT = 36084$. Only reference groups with $n \geqslant 10$
Source: SOEP 1992, 1994-2004.

Information Effect
Information effect and tenure.

Variable	Coefficient	S. E.	2.5%-Quantil	97.5%-Quantil
Disadvantageous inequality: $\hat{\beta}_1$	0.085	0.032	0.024	0.149
Advantageous inequality: $\hat{\beta}_2$	0.069	0.028	0.013	0.123
Years of tenure $\hat{\delta}$	-0.017	0.002	-0.021	-0.012
Tenure $\times$ DI: $\hat{\theta}_1$	-0.005	0.002	-0.010	0.000
Tenure $\times$ AI: $\hat{\theta}_2$	0.000	0.001	-0.003	0.003
Log of labor income	0.219	0.044	0.134	0.307
Log of working hours	-0.384	0.082	-0.541	-0.221
Further controls	yes			
$\hat{\sigma}_\mu^2$	0.015	0.005		
$\hat{\sigma}_\gamma^2$	1.234	0.029		
$\hat{\sigma}_\epsilon^2$	2.076	0.017		
DIC	156734.6			

Note: $n = 10254$, $nT = 42101$. *Quelle*: SOEP 1992, 1994-2004.

Check of robustness
Simultaneous comparisons in regional and occupational reference groups

Variable	Model 1: MCMC				Model 2: Fixed-Effects	
	Coefficient	S. E.	2.5%-Quantil	97.5%-Quantil	Coefficient	S. E.
Inequality measures:						
Occupation: DI	0.076	0.027	0.024	0.130	0.036	0.042
Occupation: AI	0.044	0.029	-0.012	0.102	0.030	0.040
Region: DI	-0.130	0.029	-0.186	-0.073	-0.088	0.037
Region: AI	0.048	0.028	-0.006	0.102	0.030	0.037
Log of labor income	0.123	0.057	0.013	0.234	0.180	0.077
M: Log of income	-0.098	0.047	-0.193	-0.007	—	
Log of hours	-0.354	0.081	-0.515	-0.195	-0.313	0.102
Further controls	yes				yes	
$\hat{\sigma}^2_{\mu(1)}$ (region)	0.042	0.007			fixed effects	
$\hat{\sigma}^2_{\mu(2)}$ (occ.)	0.015	0.005			fixed effects	
$\hat{\sigma}^2_{\nu}$ (individual)	1.184	0.028			fixed effects	
$\hat{\sigma}^2_{\epsilon}$	2.072	0.017				

Note: $n = 10213$, $nT = 41609$.
Source: SOEP 1992, 1994-2004.

Outline

5 Preferences for Inequality

6 Covariance structure

7 Further Estimation Results

8 Interpretation Example

Interpretation: Example Calculation
Decomposition of income effect

Reference group: region

| | Transitory effect | | Permanent effect | |
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.129	100%	0.109	100%
Absolute effect	0.052	40%	0.000	0%
Relative effect	0.077	60%	0.109	100%
Deprivations effect	0.054	42%	0.063	58%
Prestige effect	0.023	18%	0.046	42%

Reference group: occupation

| | Transitory effect | | Permanent effect | |
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.099	100%	0.078	100%
Absolute effect	0.109	110%	0.038	48%
Relative effect	-0.010	-10%	0.040	52%
Information effect	-0.028	-28%	-0.028	-35%
Prestige effect	0.018	18%	0.068	87%

Note: Calculations for the median position in the reference group.

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Reference group: occupation

	Transitory effect		Permanent effect	
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.099	100%	0.078	100%
Absolute effect	0.109	110%	0.038	48%
Relative effect	-0.010	-10%	0.040	52%
Information effect	-0.028	-28%	-0.028	-35%
Prestige effect	0.018	18%	0.068	87%

Note: Calculations for the median position in the reference group.

Interpretation: Example Calculation
Decomposition of income effect

Reference group: region

	Transitory effect		Permanent effect	
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.129	100%	0.109	100%
Absolute effect	0.052	40%	0.000	0%
Relative effect	0.077	60%	0.109	100%
Deprivations effect	0.054	42%	0.063	58%
Prestige effect	0.023	18%	0.046	42%

Reference group: occupation

	Transitory effect		Permanent effect	
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.099	100%	0.078	100%
Absolute effect	0.109	110%	0.038	48%
Relative effect	-0.010	-10%	0.040	52%
Information effect	-0.028	-28%	-0.028	-35%
Prestige effect	0.018	18%	0.068	87%

Note: Calculations for the median position in the reference group.

Interpretation: Example Calculation
Decomposition of income effect

Reference group: region

	Transitory effect		Permanent effect	
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.129	100%	0.109	100%
Absolute effect	0.052	40%	0.000	0%
Relative effect	0.077	60%	0.109	100%
Deprivations effect	0.054	42%	0.063	58%
Prestige effect	0.023	18%	0.046	42%

Reference group: occupation

	Transitory effect		Permanent effect	
	Marginal effect	% of total effect	Marginal effect	% of total effect
Total effect	0.099	100%	0.078	100%
Absolute effect	0.109	110%	0.038	48%
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