Can a task-based approach explain the recent changes in the German wage structure?

Dirk Antonczyk, Bernd Fitzenberger, Ute Leuschner

Albert-Ludwigs-Universität Freiburg

9. Arbeitstreffen
DFG-Forschungsschwerpunktprogramm
'Flexibilisierungspotenziale bei heterogenen
Arbeitsmärkten'
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Motivation

- Rising Wage Dispersion, After All! (Kohn, 2006, Dustmann et al., 2007, Gernandt and Pfeiffer, 2007)
- 1980s: restricted to the upper part of the wage distribution (Fitzenberger, 1999)
- Since mid-1990s: rising wage inequality in the lower part
- In the US: 1980s overall rising inequality, 1990s: restricted to the upper part

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Motivation

- Skill-biased technical change (SBTC) (Katz and Autor, 1999)
- Task-based approach (Autor et al., 2003, Spitz-Oener, 2006)
- Polarization hypothesis (Goos and Manning, 2007)

- Can a task-based approach help to explain the recent changes in the German wage structure?

Outline

1. Motivation
2. Economic Background / Literature Review
3. Data
4. Econometric Approach
5. Results
6. Conclusions

Can a task-based approach explain the recent changes in the German wage structure?

Economic Review / Literature Review I

- SBTC (Katz and Autor, 1999), i.e. rising relative demand of skilled workers, leading to rising wage inequality over the entire wage distribution
- Task based approach (Autor et al., 2003) Operationalization of SBTC: Substitution of routine tasks, leads to falling share of routine-occupations, evidenced for the US
- Task-based approach for Germany (Spitz-Oener, 2006)

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Economic Review / Literature Review II

- Polarization (Goos and Manning, 2007) -> Growth of low wage jobs involving non-routine tasks
- Similar evidence for Germany (Spitz-Oener, 2006)
- Only scarce literture on job complexity, mostly used: DOT (e.g.: Autor et al., 2003). Job complexity seems to be positve correlated with wages (Grossberg and Sicilian, 1999)

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Data

- "Qualification and Occupational Career"-Survey by BIBB/IAB (1998/99) and "Working-Population-Survey" by BIBB/BAuA (2005/06)
- Contains personal characteristics and task characteristics

Data selection:

- Consider only German male citizens who work full-time in West Germany, aged between 25 and 55 years
- 9420 individuals for 1998/99
- 6348 individuals for 2005/06

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Variable Education

- Low-skilled: without a vocational training degree
- Medium-skilled: with a vocational training degree
- High-skilled: with a unicersity of applied sciences ("Fachhochschule") or a university degree

Skill-upgrading is obersvable

Categorie	**Tasks**
Non-routine analytic	developing, researching, designing and gathering information, investigating, documenting
Non-routine interactive	informing, advising and training, teaching, tutoring, educating and organizing, planning/preparing working processes and promoting, marketing, public relations and buying, providing, selling and to be supervisor
Routine cognitive	measuring, controlling, quality checks
Routine manual	fabricating, producing goods and supervising, controlling machines and transporting, stocking, posting
Non-routine manual	repairing, patching and nursing, serving, healing

$$Task_{ijt}(SO) = \frac{\text{number of activities in category } j \text{ performed by } i \text{ in cross section } t}{\text{total number of activities in category } j \text{ at time } t}$$

$$Task_{ijt}(AFL) = \frac{\text{number of activities in category } j \text{ performed by } i \text{ in cross section } t}{\text{total number of activities carried out by indiviudal } i \text{ at time } t}$$

$$NJC = \text{total number of activities carried out by indiviudal } i \text{ at time } t$$

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Questions regarding subjective job complexity

1. Are the procedures carried out in the job described in detail?
2. Are the procedures in the job very often of the same nature?
3. Does it happen regularly that new tasks are posed which have to be thought through beforehand?
4. Are existing procedures to be improved?
5. Are tasks demanded that the individual has not been trained in?
6. Are different tasks to be carried out at the same time?

$$SJC_i = (-1)jr_1 + (-1)jr_2 + jr_3 + jr_4 + jr_5 + jr_6$$

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	AFL		Spitz-Oener	
	98/99	05/06	98/99	05/06
Non-routine analytic	8.0	14.9	20.1	32.3
Non-routine interactive	38.7	39.4	32	31
Routine cognitive	9.8	12.4	45.6	54.4
Routine manual	29.7	23.3	36.2	30.8
Non-routine manual	13.8	9.9	29.1	21.2
NJC	4.39	4.5		
SJC	0.5	0.8		

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Econometric model

Assume that $log(w_i)$ of individual i is normally distributed

$$\log(w_i) = \beta_0 + X_i'\beta_1 + \sigma_i \cdot \epsilon_i$$

Allow the conditional wage dispersion to vary with covariates X

$$\sqrt{Var(\log(w_i)|X_i)} \equiv \log(\sigma_i) = \gamma_0 + X_i'\gamma_1$$

Vector X_i contains personal characteristics and tasks variables

$$X_i = (P_i, T_i)$$

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Estimation approach

For some individuals we only have the information about the interval their personal wages lie in ($I_i = 1$), therefore we apply a heteroskedastic intervall regression approach. Individual contributions to the likelihood function are given by

$$L_i = \left[\frac{1}{\sigma_i}\varphi\left(\frac{\log(w_i) - \beta_0 - X_i'\beta}{\sigma_i}\right)\right]^{I_i=0}$$

$$\cdot \left[\Phi\left(\frac{\log(b_i) - \beta_0 - X_i'\beta}{\sigma_i}\right) - \Phi\left(\frac{\log(a_i) - \beta_0 - X_i'\beta}{\sigma_i}\right)\right]^{I_i=1}$$

Simulation of wage distributions

Simulated wage distribtutions for 1999 and 2006: quantile θ

$$q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{99}, \alpha_{1,P}^{99}, \alpha_{1,T}^{99})$$

$$q_\theta^{06}(P^{06}, T^{06}, \alpha_0^{06}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06})$$

$\alpha_0^j, \alpha_{1,P}^j, \alpha_{1,T}^j$ denote the sets of coefficients for the intercepts, the slope coefficients and for the personal characteristics, respectively. Covariates are defined as deviations from their 99 means.

Decomposition I

Changes in personal characteristics

$$\Delta_\theta^1 = q_\theta^{06}(P^{06}, T^{06}, \alpha_0^{06}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06}) - q_\theta^{99}(P^{99}, T^{06}, \alpha_0^{06}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06})$$

Changes in task assignment

$$\Delta_\theta^2 = q_\theta^{99}(P^{99}, T^{06}, \alpha_0^{06}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06}) - q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{06}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06})$$

Residual change (Unexplained)

$$\Delta_\theta^3 = q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{06}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06}) - q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{99}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06})$$

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Decomposition II

Change in coefficients of personal characteristics

$$\Delta_\theta^4 = q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{99}, \alpha_{1,P}^{06}, \alpha_{1,T}^{06}) - q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{99}, \alpha_{1,P}^{99}, \alpha_{1,T}^{06})$$

Change in coefficients of task characteristics

$$\Delta_\theta^5 = q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{99}, \alpha_{1,P}^{99}, \alpha_{1,T}^{06}) - q_\theta^{99}(P^{99}, T^{99}, \alpha_0^{99}, \alpha_{1,P}^{99}, \alpha_{1,T}^{99})$$

$$\Delta_\theta^{06/99} = \underbrace{\underbrace{\underbrace{\Delta_\theta^1}_{\textit{Personal}} + \underbrace{\Delta_\theta^2}_{\textit{Task}}}_{\textit{Characteristics}} + \underbrace{\Delta_\theta^3}_{\substack{\textit{Residual}\\ \textit{effect}}} + \underbrace{\underbrace{\Delta_\theta^4}_{\textit{Personal}} + \underbrace{\Delta_\theta^5}_{\textit{Task}}}_{\textit{Coefficients}}}$$

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Table 1: Estimated Model 1999: AFL measure without occupations

Parameter for heteroskedasticity	Estimate (Standard Error)
Constant	-1.0441 (.0076)
Age	-.0543 (.0095)
Age2	.0007 (.0001)
Lowskill	.1255 (.0286)
Highskill	.0026 (.0223)
AFLKA1	.1801 (.0774)
AFLKA2	.2907 (.0502)
AFLKA3	-.2868 (.0718)
AFLKA4	.0515 (.0473)
NJC	.03441 (.0039)
SJC2	-.0062 (.0060)
PC use	-.0269 (.0200)

Table 2: Estimated Model 2006: AFL–Task–Index without occupations

Parameter for heteroskedasticity	Estimate (Standard Error)
Constant	-.9042 (.0111)
Age	-.0098 (.0122)
Age2	.0001 (.0001)
Lowskill	.1825 (.0445)
Highskill	.2784 (.0268)
AFLKA1	-.1715 (.0791)
AFLKA2	-.2813 (.0670)
AFLKA3	-.5324 (.0797)
AFLKA4	-.2327 (.0677)
NJC	.0391 (.0047)
SJC	-.0130 (.0076)
PC use	-.0920 (.0251)

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Table 3: Estimated Model 1999: AFL–Task–Index with occupations

Parameter for cond. expectation	Estimate (Standard Error)
Constant	3.2363 (.0037)
Lowskill	.0946 (.3269)
Highskill	-1.6854 (.2810)
Age	.0335 (.0050)
Age2	-.0003 (.0001)
Lowskill*Age	-.0117 (.0169)
Lowskill*Age2	.0002 (.0002)
Highskill*Age	.0820 (.0140)
Highskill*Age2	-.0009 (.0002)
AFLKA1	.2694 (.0346)
AFLKA2	.2145 (.0234)
AFLKA3	.1775 (.0297)
AFLKA4	.0869 (.0217)
NJC	.0097 (.0019)
SJC	.0113 (.0028)
PC use	.0791 (.0096)

Table 4: Estimated Model 2006: AFL–Task–Index with occupations

Parameter for cond. expectation	Estimate (Standard Error)
Constant	3.271 (.0065)
Lowskill	.0622 (.6611)
Highskill	-1.2227 (.4028)
Age	.0509 (.0068)
Age2	-.0005 (.0001)
Lowskill*Age	-.0124 (.0332)
Lowskill*Age2	.0002 (.0004)
Highskill*Age	.0602 (.0199)
Highskill*Age2	-.0006 (.0002)
AFLKA1	.1711 (.0475)
AFLKA2	.1108 (.0391)
AFLKA3	-.0877 (.0451)
AFLKA4	.0103 (.0400)
NJC	-.0027 (.0027)
SJC	.0129 (.0042)
PC use	.1042 (.0137)

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Table 5: AFL with occupations

	80-20	80-50	50-20
Overall: 06-99	0.085 (0.011)	0.039 (0.007)	0.046 (0.007)
Char.P	0.024 (0.007)	0.015 (0.005)	0.009 (0.005)
Char.T	-0.026 (0.004)	-0.012 (0.003)	-0.013 (0.003)
Coef.P	0.02 (0.007)	0.015 (0.004)	0.005 (0.004)
Coef.T	-0.003 (0.007)	-0.013 (0.005)	0.01 (0.004)
Unexplained	0.07 (0.008)	0.034 (0.004)	0.036 (0.004)

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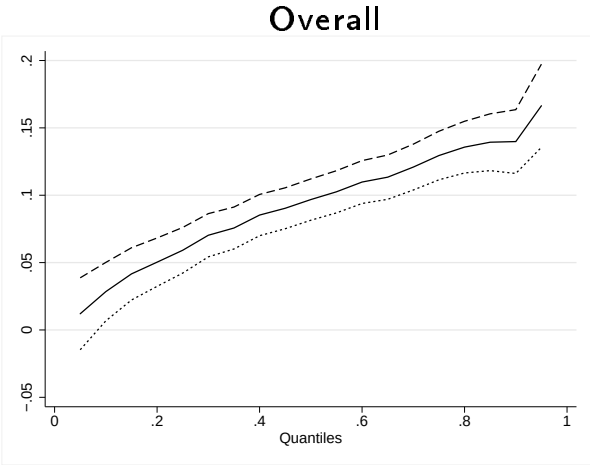
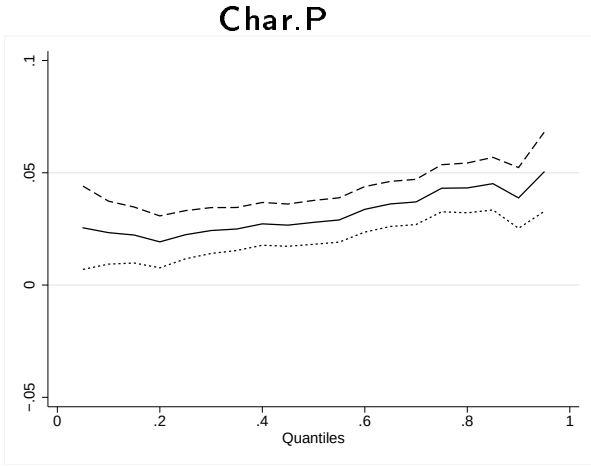
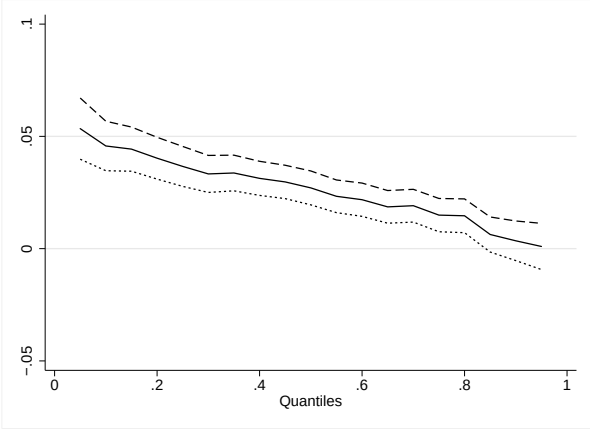
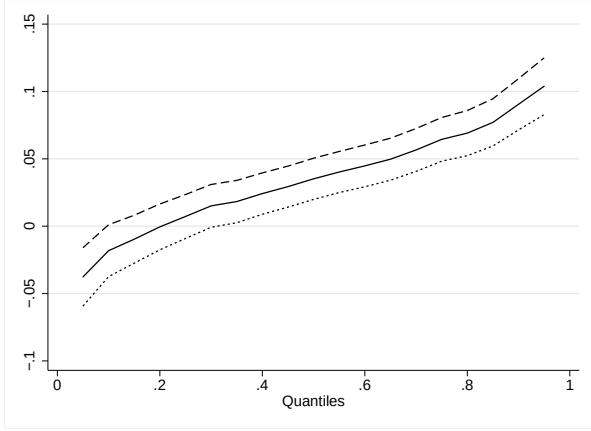
Results of decompostion I









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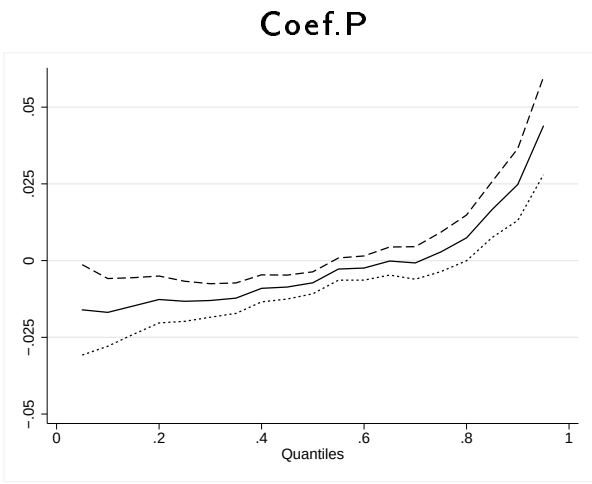
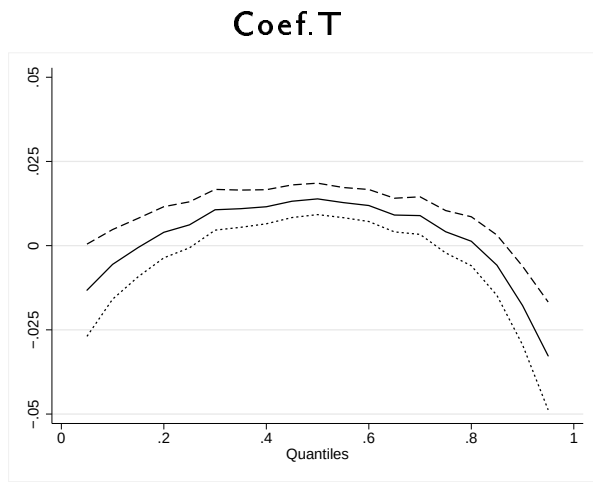
Results of decompostion II





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Contribution

- First study to analyze most recent changes in wage inequality using a task based approach
- Implementing two proxies for job complexity
- Implementing a decompostion of the entire wage distribution into tasks and personal characteristics

Main results

- We find a noticeable increase of wage inequality
- Personal characteristics help to explain rising inequality, task characteristics do not
- Personal coefficient effect works towards rising wage inequality in the upper part, task coefficient effect shows inverted U–shaped pattern
- We thus conclude that the task based approach cannot explain the recent changes and the search is still open for other explanations