Changes in workplace tasks in Germany

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evaluating skill and task measures

Daniela Rohrbach-Schmidt, Michael Tiemann
*Department of Sociology and Economics of Vocational Education and Training,
Federal Institute for Vocational Education and Training (BIBB)*

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Outline

1. What is meant by skills and job tasks?

2. How skills and tasks are measured over-time?

3. How tasks can be classified into task groups?

4. How do measures compare?

   1. Do changes in tasks groups implicate a pattern of routinization and polarization?

   2. Is there an increase in over-qualification related to task-change?

5. What do we conclude for analyses following the task-based approach with the data?

What is meant by skills and job tasks?

- Skills and tasks are characteristics of different units of analyses (e.g. Autor and Handel 2009): Whereas skills are characteristics of workers, tasks are characteristics of jobs

- Skill requirements / demand: job tasks ('application of that workers's skill endowment to a given set of activities' (Autor und Handel 2009, p. 7))

- Routine tasks: can be accomplished by machines following explicit programmed rules (ALM 2003, p. 1283)

- implications

  - Nonroutine cognitive tasks: analytic and interactive tasks:
    - testing hypotheses; medical diagnosis; complex communication tasks

  - Routine cognitive and manual tasks:
    - bookkeeping; clerical work; repetitive assembly tasks

  - Non-routine manual tasks:
    - truck-driving; cleaning

How skills and tasks are measured over time?

Year	Population	No. of cases
1979	German labour force (<u>not</u> included: apprentices and other people in qualification schemes, armed forces, foreign workers) age 15-65	28,828
	* active	992
	* unemployed	
1985/86	German active labour force age 15-65	26,361
1991/92	West-German active labour force	
	* German	23,476
	* German speaking foreign workers	614
	New Laender (east Germany)	7,851
	* active	1,880
	* unemployed	456
	* people in retraining schemes	
		34,277
1998/99	German active labour force (including German speaking foreign workers) age 15 and over, regular employment of 10 hrs/week	34,343
2005/06	German active labour force (including German speaking foreign workers) age 15 and over, regular employment of 10 hrs/week	20,000

How skills and tasks are measured over time?

- Sample selection
  - West-German employees, including West-Berlin
  - Between 15 an 65 years old
  - 10 to 168 hours per week („core-employment")

Year	N
1979	28,088
1985/86	25,933
1991/92	22,900
1998/99	25,513
2005/06	15,671
Total	118,105

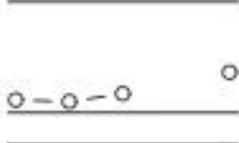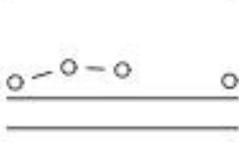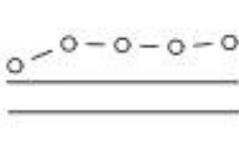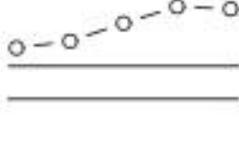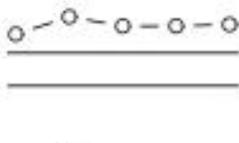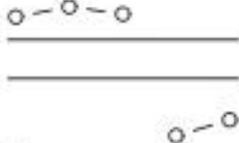# How skills and tasks are measured over time?

	Variable names	Content	Missing survey years
1	*investigating*	Gathering information, investigating, documenting	1979, 1985/86, 1991/92
2	*organizing*	Organizing, making plans, working out operations, decision making	-
3	*researching*	Researching, evaluating, developing, constructing	1998/99
4	*programming*	Working with computers, programming	1998/99
5	*applyinglaw*	Applying law, notarizing	1998/99, 2006
6	*teaching*	Teaching, training, educating	-
7	*consulting*	Consulting, advising	-
8	*buying*	Purchasing, procuring, selling	-
9	*promoting*	Promoting, marketing, public relations	-
10	*managing*	Managing personnel, leading, employing	1998/99, 2006
11	*negotiaing*	Negotiating, lobbying,	1985/86, 1991/92, 2006
12	*repairing*	Repairing, renovating, restoring	-
13	*accomodating*	Accommodating, preparing food, serving, (entertaining)	1998/99
14	*caring*	Taking care, healing	-
15	*cleaning*	Cleaning, recycling, waste disposal	1998/99
16	*protecting*	Protecting, guarding, observing, controlling traffic	1998/99
17	*measuring*	Measuring, testing, quality control	1985/86, 1991/92
18	*writing*	Clerical work	1998/99, 2006
19	*calculating*	Calculating, bookkeeping	1998/99, 2006
20	*operating*	Operating, controlling machines	-
21	*manufacturing*	Manufacturing of goods, planting	-
22	*storing*	Storing, transporting, shipping, stocking, posting	1998/99

Development of single tasks

Variable	1979	1985/86	1991/92	1998/99	2005/06	
promoting	2.7	8.4	17.4	11.9	12.0	
caring	3.9	6.6	7.0	7.3	8.1	
applying law	4.5	12.7	11.5	NaN	NaN	
accomodating	4.9	3.4	3.8	NaN	8.1	
negotiating	5.1	NaN	NaN	23.1	NaN	
programming	5.1	9.8	19.5	NaN	64.1	
teaching	7.0	17.0	14.8	17.6	21.0	
protecting	7.1	4.3	4.0	NaN	21.0	

Development of single tasks

Variable	1979	1985/86	1991/92	1998/99	2005/06	
cleaning	8.1	7.0	12.0	NaN	25.6	
researching	10.1	19.7	18.0	NaN	11.1	
operating	10.5	24.3	23.5	22.3	25.2	
organizing	11.5	15.8	27.1	37.6	36.1	
repairing	11.8	22.8	16.9	17.0	17.9	
managing	14.4	20.8	16.2	NaN	NaN	
measuring	18.9	NaN	NaN	33.9	43.9	

Development of single tasks

Variable	1979	1985/86	1991/92	1998/99	2005/06	
calculating	20.5	19.9	20.6	NaN	NaN	
buying	21.1	27.7	24.6	25.3	22.9	
consulting	21.1	18.8	17.2	53.6	58.2	
storing	23.2	18.1	46.3	NaN	25.7	
manufacturing	34.0	20.4	16.7	15.3	17.7	
writing	34.3	37.2	37.1	NaN	NaN	
investigating	NaN	NaN	NaN	28.8	49.6	

How tasks can be classified into task groups?

Validation strategy:

1. Competing classifications
a) the statistical classification (using factor analysis),
b) classification based on literature review
c) classification by criterion validation of items by external variables: *manual*, *routine*, *computer*

2. Index computation: non-additive, additive

3. Measures in comparison

Statistical classification

Variable	Factor 1 "nonroutine-analytic"	Factor 2 "routine-cognitive"	Factor 3 "nonroutine-interactive"	Factor 4 "routine-manual"	Factor 5 "nonroutine-manual"	Uniqueness
teaching	0,7593	0,1272	-0,0946	-0,0144	0,2432	0,3390
consulting	0,7589	0,1656	0,2303	-0,0896	0,2087	0,2920
measuring	0,2587	0,3506	0,0197	0,7335	0,2101	0,2276
operating	-0,0003	-0,0875	-0,1147	0,7698	-0,0197	0,3862
repairing	-0,0841	-0,2791	-0,0131	0,7703	-0,1244	0,3060
buying	0,0261	0,1695	0,7985	-0,0457	0,1379	0,3118
negotiating	0,6127	0,2200	0,6253	0,0405	0,0026	0,1836
promoting	0,2739	0,0626	0,8457	-0,0730	0,0011	0,2005
investigating	0,7281	0,0053	0,3248	-0,0944	-0,1732	0,3254
organizing	0,6653	0,2963	0,3706	0,1176	0,0852	0,3111
Researching	0,5255	0,1225	0,0719	0,3061	-0,1689	0,5814
manufacturing	-0,2000	-0,4538	-0,0250	0,5854	-0,0094	0,4107
accomodating	0,0458	-0,0566	0,1795	-0,0383	0,8610	0,2197
Caring	0,2484	-0,0440	-0,1672	-0,1584	0,8025	0,2393
managing	0,6311	0,2630	0,2721	0,1990	0,0617	0,4151
Storing	-0,2889	0,5798	0,3584	0,2348	0,1823	0,3635
protecting	0,3938	0,3520	-0,1514	0,4262	0,3316	0,4064
programming	0,4024	0,5370	0,1016	-0,0478	-0,1950	0,4992
Cleaning	-0,1052	0,0005	0,0805	0,3080	0,7713	0,2927
Writing	0,2180	0,8285	0,2542	-0,1695	-0,0760	0,1669
calculating	0,2040	0,5858	0,4879	-0,1025	-0,1747	0,3362
Applying law	0,4904	0,6408	-0,1247	0,0314	0,0015	0,3324

Notes: Sample is restricted to people from the western part of Germany belonging to the labor force (defined as having a paid work) aged 15 to 65, with a regular working time of at least ten hours per week. *Source*: BIBB/IAB – BIBB/BAuA Employment Surveys 1979-2006, weighted values, own calculations.

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Hypothetical and statistical classification

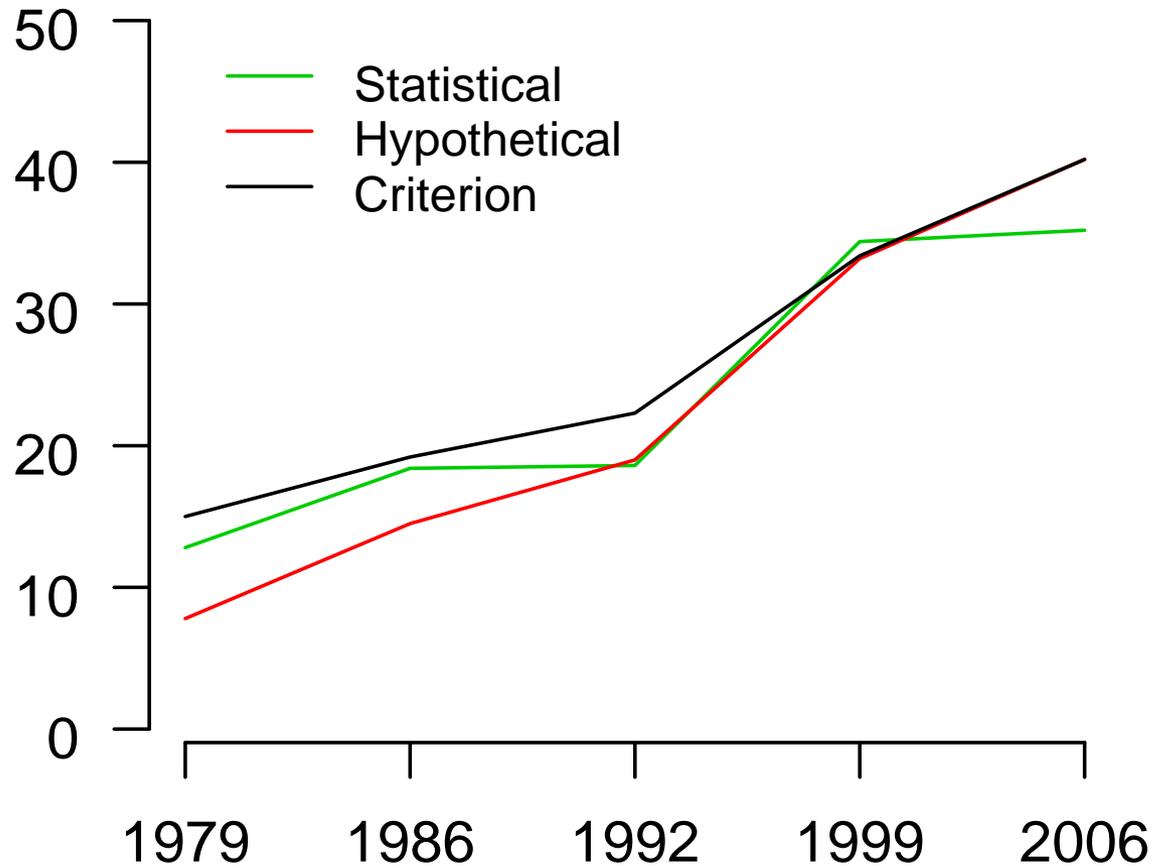| Task items BIBB/IAB/BAUA 1979-2006		Task categorization	
No.	Content	Theory / research practice	Statistical classification
1	*investigating*	Analytic	Analytic
2	*organizing*	Analytic	Analytic
3	*researching*	Analytic	Analytic
4	*programming*	Analytic	Routine cognitive
5	*applyinglaw*	Analytic	Routine cognitive
6	*teaching*	Interactive	Analytic
7	*consulting*	Interactive	Analytic
8	*buying*	Interactive	Interactive
9	*promoting*	Interactive	Interactive
10	*managing*	Interactive	Analytic
11	*negotiaing*	Interactive	Interactive
12	*repairing*	Non-rout. manual	Routine manual
13	*accomodating*	Non-rout. manual	Non-rout. manual
14	*caring*	Non-rout. manual	Non-rout. manual
15	*cleaning*	Non-rout. manual	Non-rout. manual
16	*protecting*	Non-rout. manual	Routine manual
17	*measuring*	Routine cognitive	Routine manual
18	*writing*	Routine cognitive	Routine cognitive
19	*calculating*	Routine cognitive	Routine cognitive
20	*operating*	Routine manual	Routine manual
21	*manufacturing*	Routine manual	Routine manual
22	*storing*	Routine manual	Routine cognitive

Criterion validation

No.	Content	Hypoth.	Manual	Routine	Computer	Task category
1	*investigating*	analytic	-	-	+	Non-rout. cognitive
2	*organizing*	analytic	-	-	+	Non-rout. cognitive
3	*researching*	analytic	-	-	+	Non-rout. cognitive
4	*programming*	analytic	-	-	+	Non-rout. cognitive
5	*applyinglaw*	analytic	-	-	+	Non-rout. cognitive
6	*teaching*	analytic	-	-	+	Non-rout. cognitive
7	*consulting*	analytic	-	-	+	Non-rout. cognitive
8	*buying*	interactive	-	-	+ (06 -)	Non-rout. cognitive
9	*promoting*	interactive	-	-	+	Non-rout. cognitive
10	*managing*	interactive	-	-	+	Non-rout. cognitive
11	*negotiaing*	interactive	-	-	+	Non-rout. cognitive
12	*repairing*	Non-rout. manual	+	-	-	Non-rout. manual
13	*accomodating*	Non-rout. manual	+*	- (06 +)	-	Non-rout. manual
14	*caring*	Non-rout. manual	+*	- (06 +)	-	Non-rout. manual
15	*cleaning*	Non-rout. manual	+	+	-	Routine manual
16	*protecting*	Non-rout. manual	+	-	79 +; 06 -	Non-routine manual
17	*measuring*	Routine cognitive	+	-(06 n.s.)	79+, 99 n.s., 06 -	Non-rout. cognitive
18	*writing*	Routine cognitive	-	-	+	Non-rout. cognitive
19	*calculating*	Routine cognitive	-	-	+	Non-rout. cognitive
20	*operating*	Routine manual	+	+(79 n.s.)	-(79, 85/6 +)	Routine manual
21	*manufacturing*	Routine manual	+	+	-	Routine manual
22	*storing*	Routine manual	+ (92 -)	+ (92 -)	-(92 +)	Routine manual

Notes: -=stat. sig. negative association with criterion variable +=stat. sig. positive association with criterion variable. *Manual='working standing'.
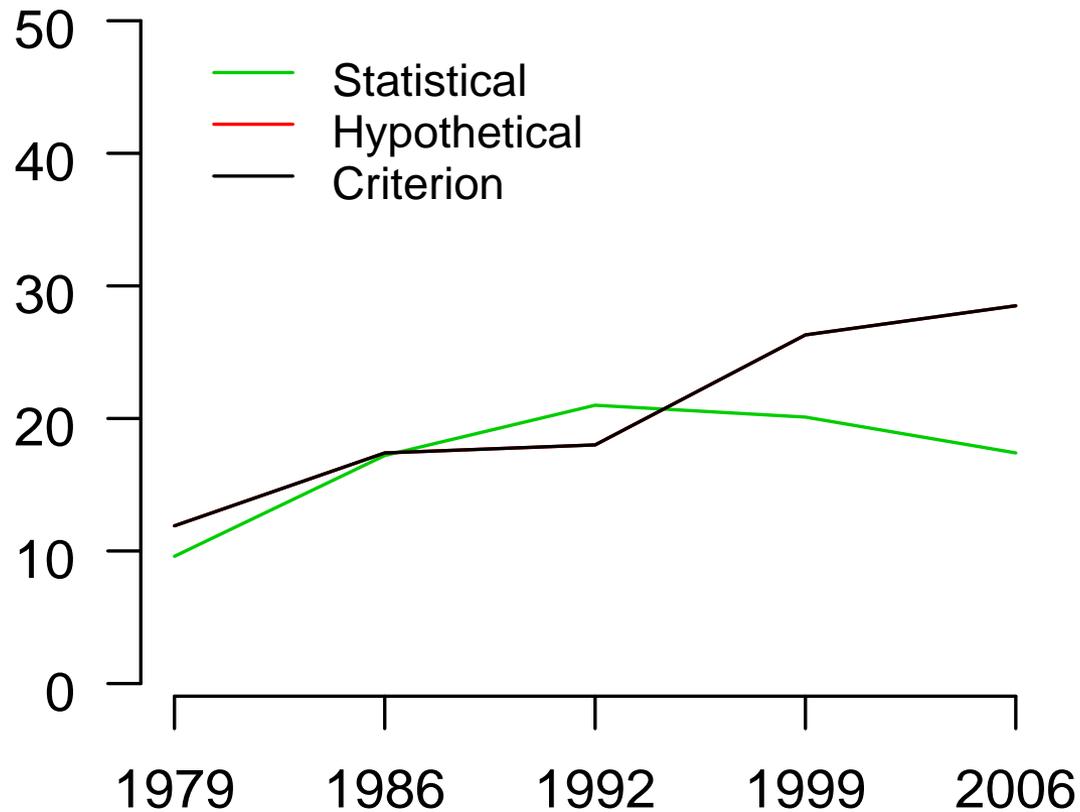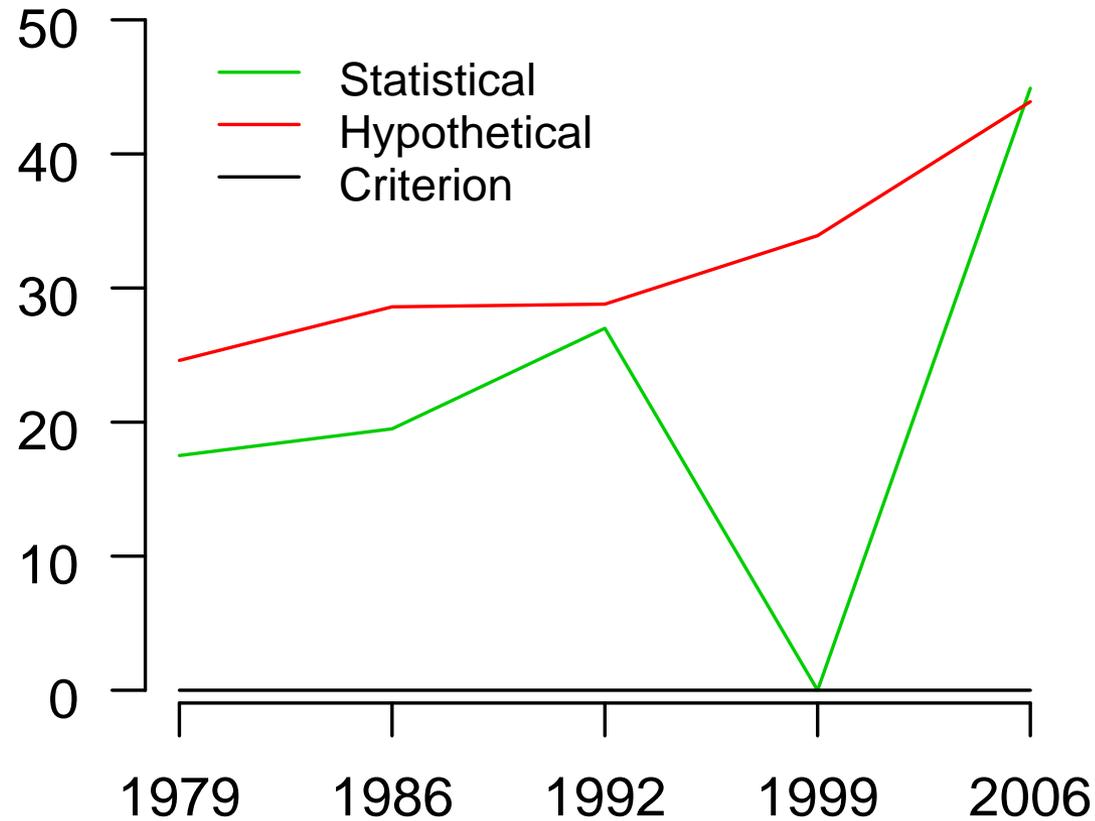
Routinization?

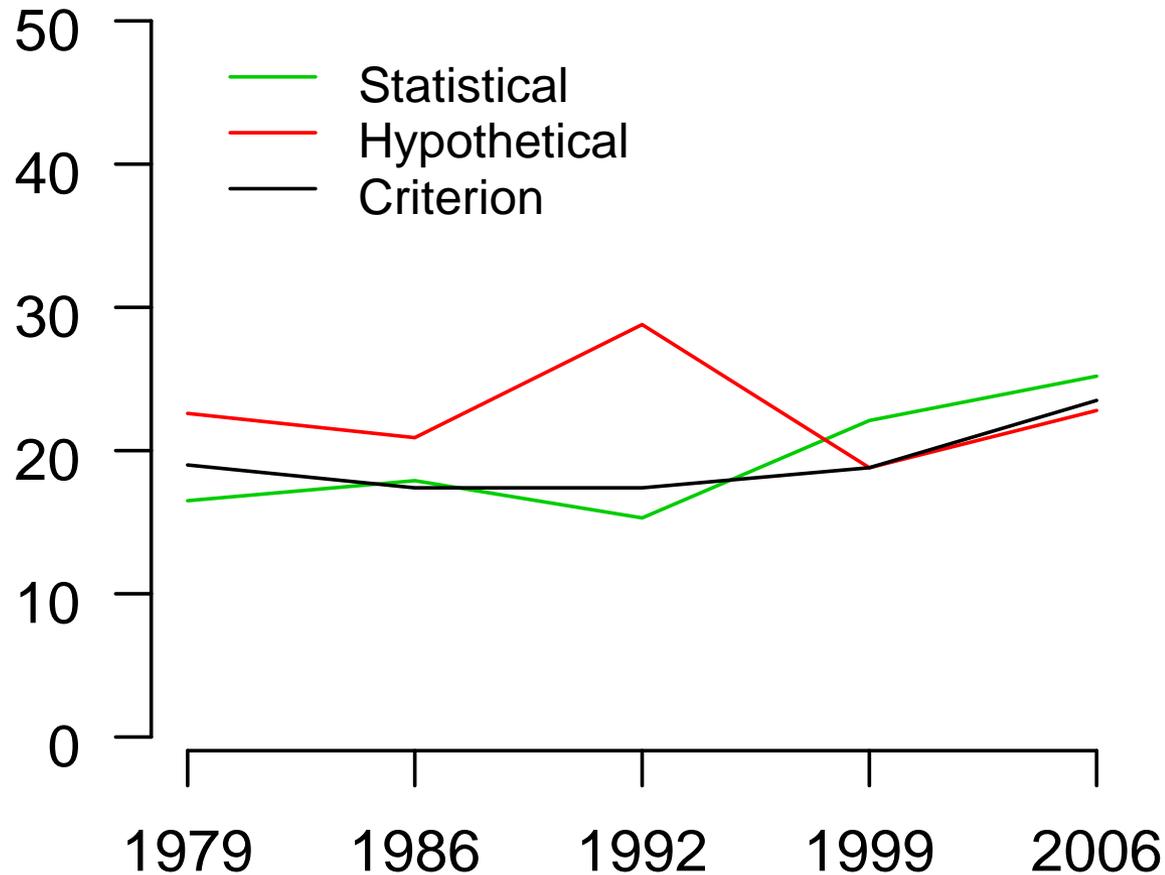Analytic

Routinization?

Interactive

Routinization?

Routine-Cognitive

Legend: Statistical (green), Hypothetical (red), Criterion (black)

X-axis: 1979, 1986, 1992, 1999, 2006
Y-axis: 0, 10, 20, 30, 40, 50

Routinization?

Routine-Manual

Legend:
- Statistical (green)
- Hypothetical (red)
- Criterion (black)

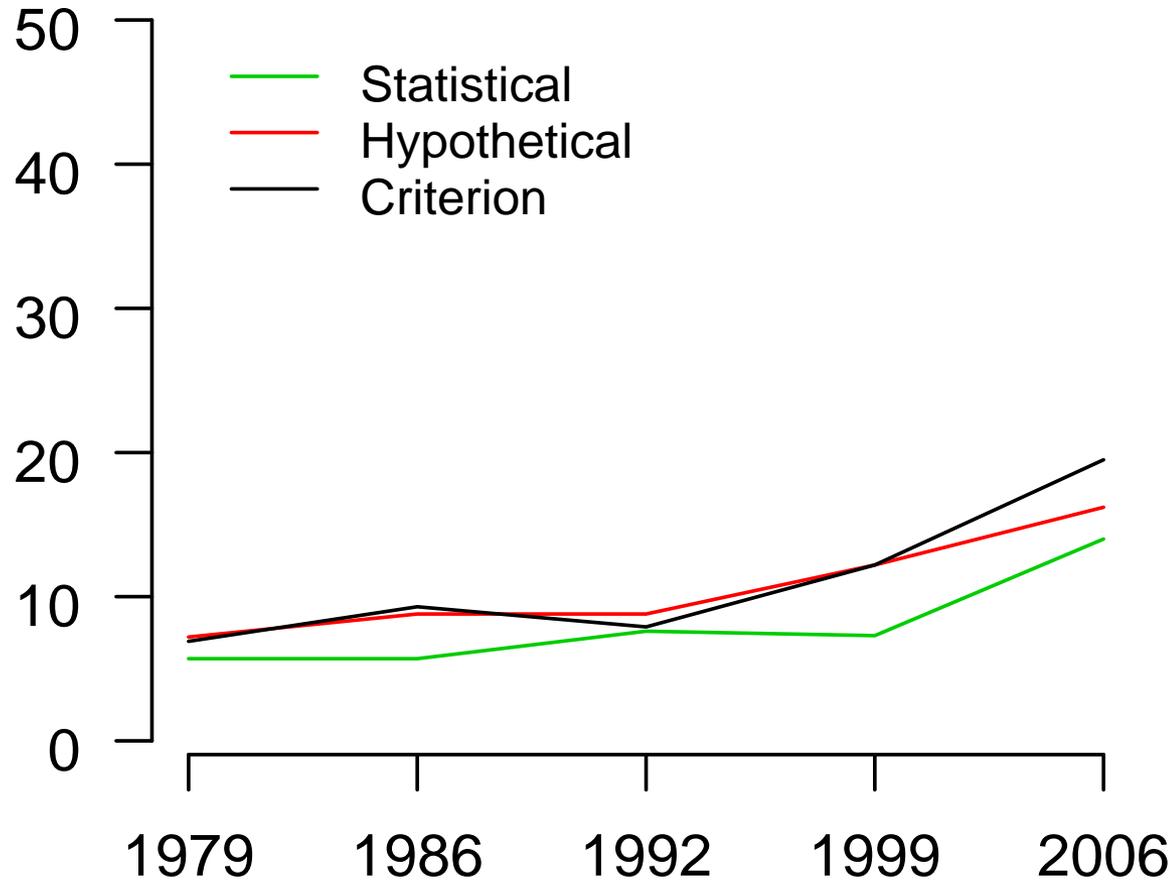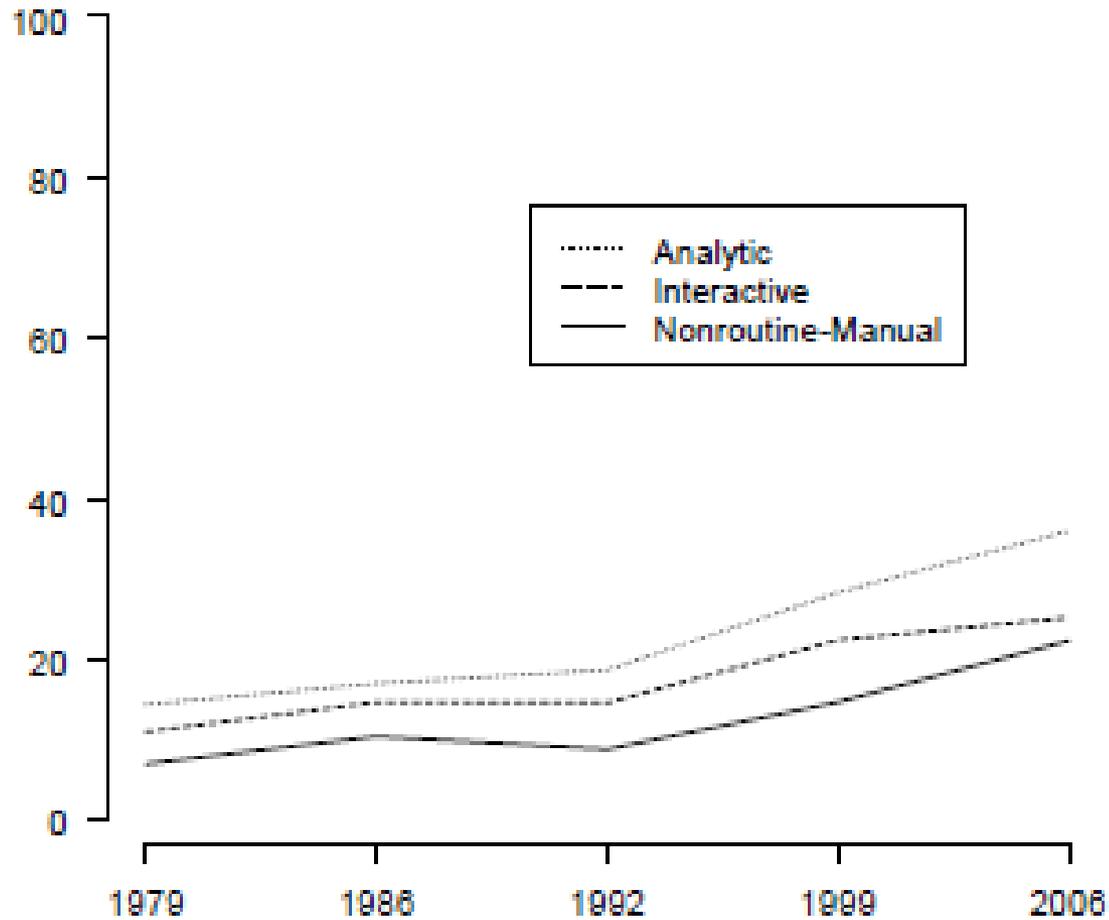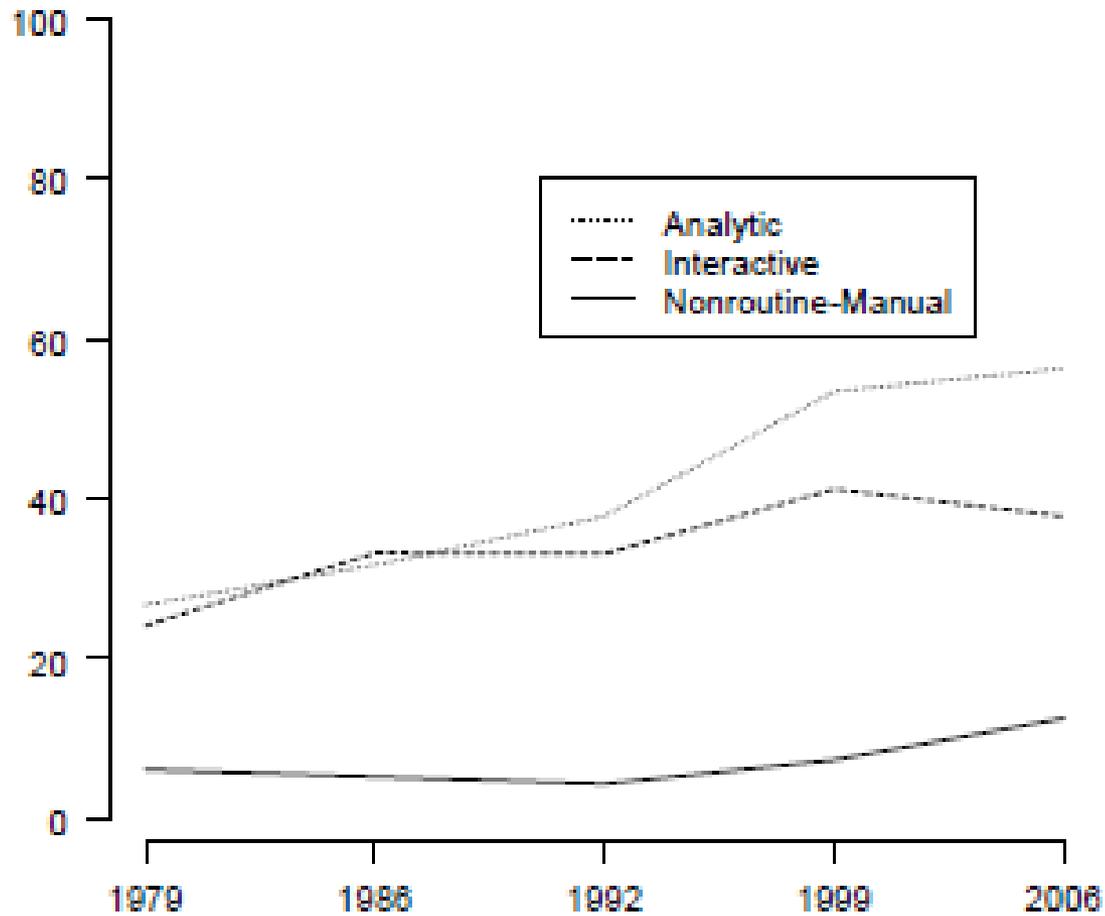# Routinization?

Nonroutine-Manual

Polarization?

ISCED 3B

Polarization?

ISCED 5A

Under-utilization of skills from polarization?

Table 7: Job tasks by over-qualification and over-skilling

	Over-qualification		Over-skilling	
	Over-qualified (n_{ij}=24,671-96)	Not over-qualified (n_{ij}=61,342	Over-skilled (n_{ij}=4,012-8)	Not over-skilled (n_{ij}=36,974)
Analytic	15.7	25.3	31.8	36.6
Interactive	13.9	20.2	23.6	27.5
Non-routine manual	7.0	9.7	14.5	14.8

Notes: Sample is restricted to people from the western part of Germany belonging to the labor force (defined as having a paid work) aged 15 to 65, with a regular working time of at least ten hours per week. *Source*: BIBB/IAB – BIBB/BAuA Employment Surveys 1979-2006, weighted values, own calculations.

What do we conclude for analyses following the task-based approach with the data?

- focus on the increase in non-routine tasks

- If routine, focus on manual routine tasks (routine cognitive tasks are not sufficiently measured over time) or use other measures of routinization

- additive and non-additive measures: consider the number of items within each cross-section as well as the availability of items between waves

What do we conclude for analyses following the task-based approach with the data?

- with some limitations and careful data handling the German worker-level cross-sections on tasks can be fruitfully used for analyses following a task-based approach.

- Task change as predicted by the routinization hypothesis is pervasive in Germany and might be an explanandum for rising over-qualification or other labor market changes to be studied.

Thank you!

Please send comments and nquestions to
tiemann@bibb.de / rohrbach@bibb.de