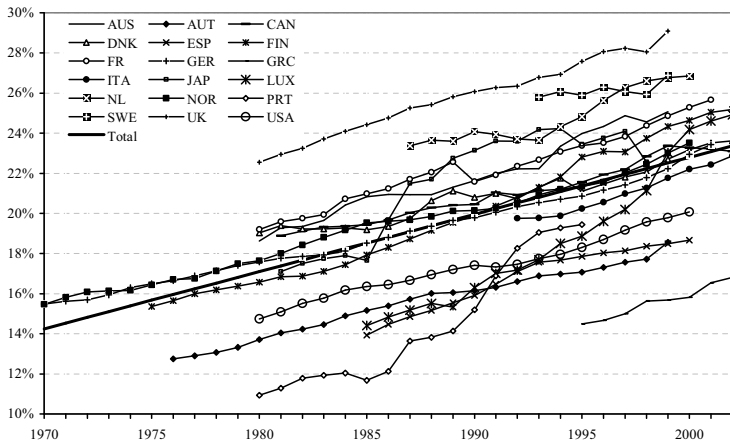




### *Most-similar system* design and a *variable-oriented* approach: 19 OECD countries from 1970 to 2002

- ▶ Aggregate trend: knowledge sector expansion (Rohrbach 2007)
- ▶ Aggregate relation: knowledge sector effects on (Gini) income inequality, controlling for skill supply change, globalization and institutional change (Rohrbach 2008)
- ▶ Cross-level interaction: Knowledge sector effects on the association between education and income

# Knowledge sector expansion



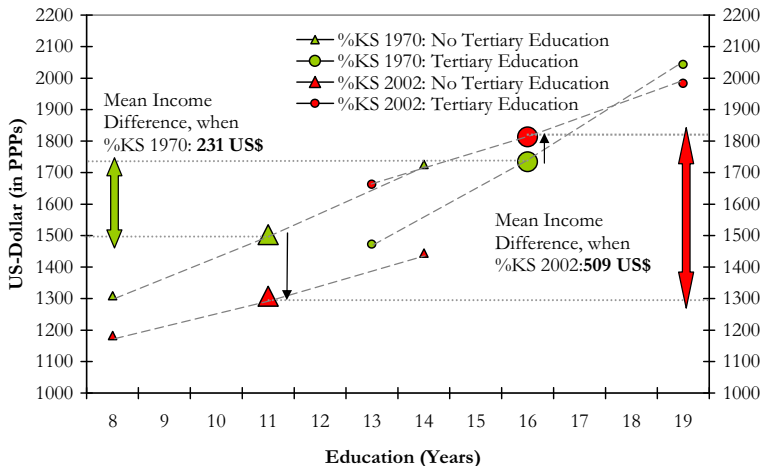
**Notes:** AUT, CAN, JAP, UK: Number of jobs; UK: Number of Employees. **Source:** OECD 2003, 2001; own calculations. *The figure is first appearing in Rohrbach (2007, Social Science Information © SAGE Publication Ltd & Foundation of the Maison des Science de l'Homme).*

# Sector bias and inequality

	Empty Intercept-only Model	Model 0	Model 2	Model 3	Model 4	Model 5	Model 6
Time (in years)		0.12***	0.07**	0.05*	0.05*	0.06*	0.03
[R: 1970 - 1999; M: 1986] <sup>a</sup> .....		(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Average Years of Schooling			-3.49***	-3.58***	-3.72***	-3.47***	-3.78***
[R: 2.4 - 12.3; M: 8.3] <sup>a</sup> .....			(0.84)	(0.87)	(0.75)	(0.85)	(0.81)
Average Years of Schooling (squared).....			0.19***	0.20***	0.21***	0.19***	0.22***
			(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
Sector Bias: %Employed in the Knowledge Sector [R: 10.9 - 29.1; M: 19.8] <sup>a</sup> .....			<b>0.29***</b>	<b>0.30***</b>	<b>0.27***</b>	<b>0.30***</b>	<b>0.29***</b>
			(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Sectorialism: % Knowledge Sector Wage Differential [R: -2.3 - 0.8; M: 0.2] <sup>a</sup> .....			<b>-0.51</b>	<b>-0.51</b>	<b>-0.53*</b>	<b>-0.49</b>	<b>-0.53*</b>
			(0.27)	(0.27)	(0.26)	(0.27)	(0.26)
% Natural Rate of Population Increase				-0.08			-0.12*
[R: -2.7 - 14.1; M: 3.9] <sup>a</sup> .....				(0.06)			(0.06)
% Union Density					-0.06***		-0.06***
[R: 7.4 - 85.2; M: 42.4] <sup>a</sup> .....					(0.01)		(0.01)
Total Trade as a % of GDP (constant prices)						-0.003	-0.003
[R: 10.8 - 266.9; M: 54.5] <sup>a</sup> .....						(0.01)	(0.01)
Intercept.....	35.03***	32.76***	43.30***	43.84***	46.98***	43.02***	47.41***
	(0.60)	(0.63)	(3.62)	(3.81)	(3.21)	(3.66)	(3.53)
Intraclass-correlation $\rho$	0.81	0.85	0.81	0.84	0.74	0.82	0.80
R <sup>2</sup> total		8.0	31.5	23.3	52.0	28.9	44.3

Notes: N<sub>i</sub> Measurements=255; N<sub>j</sub> Countries=19; <sup>a</sup>R = Range, M = Mean (arithmetic). Robust standard errors in parentheses. \*: p<0.05, \*\*: p<0.01; \*\*\*: p<0.001  
Sources: see text.

# Skill premium moderation



Notes: Based on weighted data.

Source: ISSP 1985-2002, OECD STAN (OECD 2003), OECD "Services: Statistics on Value Added and Employment" (OECD 2001), Barro and Lee (2001); own calculations.



- ▶ **Skill supply:** sustained increase in enrollment rates and time spent in the education system in the OECD population since the 1970s (Hadjar, Hadjar-Becker, 2007; OECD, 2007).
- ▶ **Skill demand:** increase in the average skill level of jobs, but:
  - ▶ *Upgrading:* demand is monotonously rising in skills (Morris, Western 1999; Acemoglu 2002), *SBTC* version
  - ▶ *Polarisation:* demand rises for non-routine labour and shrinks for routine labour (Autor et al. 2006, 2003; Goos, Manning 2007), *ALM* version

## SBTC

Job Category	Typical Skills	Demand	Ineq.
1 Well-paid skilled jobs	Non-manual	+	+
2 Low-paid least skilled jobs	manual	-	

## ALM [Autor, Levy and Murnane, 2003]

Job Category	Typical Skills	Demand	Ineq.
1 Well-paid skilled jobs	Non-routine cognitive skills	++	+
2 Middling jobs	Routine cognitive or manual skills	-	
3 Low-paid least skilled jobs	Non-routine manual skills	0/+	



### BIBB-/BAuA-Survey of the Working Population on Qualification and Working Conditions in Germany 2006

- ▶ Population: German active labour force (including German speaking foreign workers) age 15 and over, regular employment of 10 hrs/week
- ▶ Sampling: Random-Digit-Dialling (Gabler-Häder) and Kish
- ▶ Collection mode: CATI
- ▶ Sample size: 20,000

For details on BIBB-BAuA 2006 content, methods and data access also see [www.bibb-fdz.de](http://www.bibb-fdz.de)

## Individual-level variables $X$ , $Y$

- ▶ Standard Mincer and controls
- ▶ Skill requirements in respondents' job
- ▶ Decomposition of attained education in RE, OE, UE (Korpi, Tåhlin 2009)
- ▶ Log hourly wages (Alda, Rohrbach 2009)

## Firm- / industry - level variables (NACE) $Z$

- ▶ Firms affiliation to the knowledge sector (KS)
- ▶ Average skill level
- ▶ (Firm size)

1. Descriptives statistics: skills, requirements and matching by sectors (demographic and sampling weighting)
2. IV-Regression: matching (endogenous v.) by skill requirements in the KS (exogenous v.)
3. **Two-level hierarchical linear model (mixed, random coeff. model): Individuals ( $N_i=19,092$ ) nested within industries ( $N_j=55$ ):**

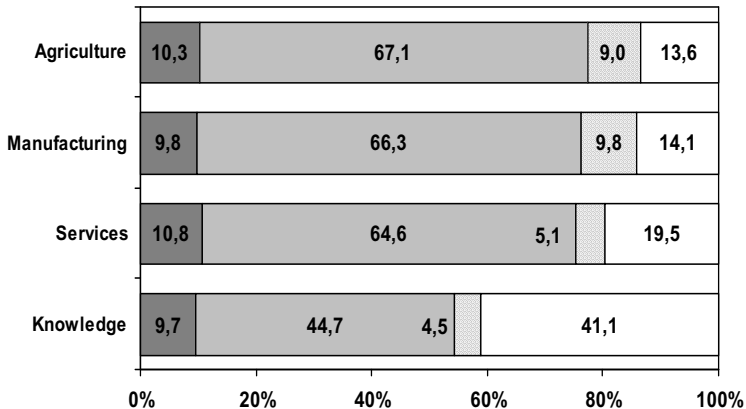
$$Y_{ij} = \gamma_{00} + u_{0j} + \epsilon_{ij} \quad (1)$$

Random slope model with cross-level interaction: KS effects on RE and OE (AE: apprenticeship no sig. variation!)

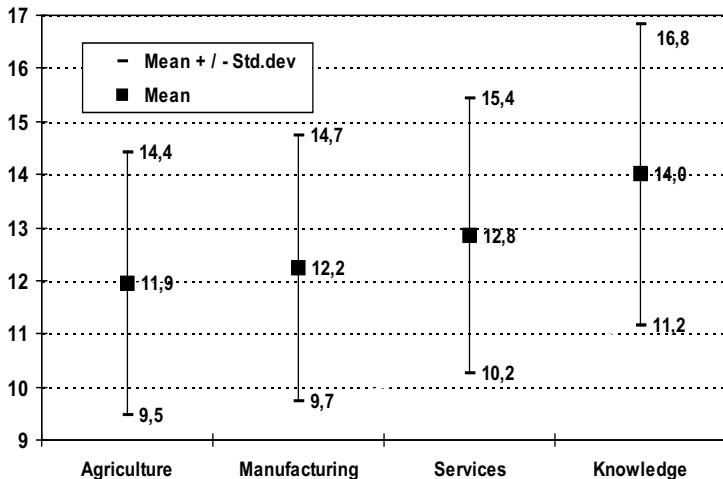
$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{ij} + \gamma_{11}Z_jX_{ij} + \gamma_{01}Z_j + u_{1j}X_{ij} + u_{0j} + \epsilon_{ij} \quad (2)$$

# Skill supply: Voc. educational attainment (degrees) by sectors

■ No qualifying degree ■ Apprenticeship ■ Master ■ University, Fachhochschule

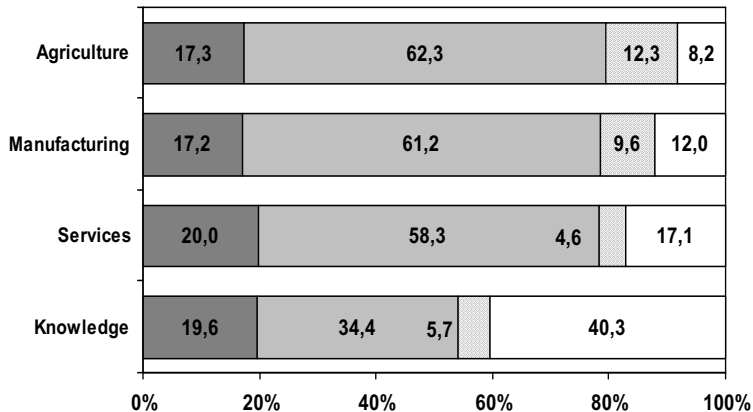


## Skill supply: Virt. years of educ. (school + VET) by sectors

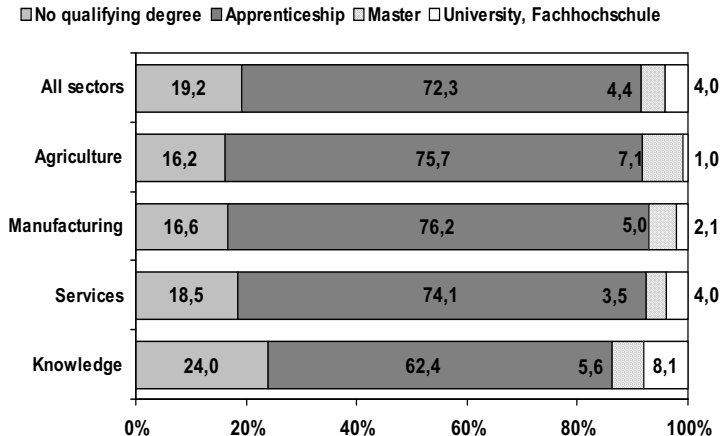


## Skill demand: Skill requirements (degrees) by sectors

■ No qualifying degree ■ Apprenticeship ■ Master ■ University, Fachhochschule



# Skill matching for people with apprenticeship degree<sup>1</sup>



<sup>1</sup> Apprenticeship=voc. training in the dual system, voc. qualifying Berufsfach-/Kollegd. [ISCED97 3C].





1. IV-Reg: Observed match (RE, OE, UE) is endogenous to sectoral skill requirements  $\Rightarrow$  HLM with individuals nested in industries, CLI
2. Empty model: ICC=13.2, i.e. 13.2 percent of variance in log hourly wages is due to differences between industries
3. Random intercept model with L1- and L2-predictors: RE, OE  $>0$ , UE  $<0$ ;  $|UE| < RE > OE$   
(Controls: age (+sq.), Sex, experience (+sq.), tenure (+sq.), supervisor status, dummies for school education, sector dummies, mean(firmsize), mean(education))

- ▶ Returns for VET qualification vary between industries:
  - ▶  $u_{1j}^*RE = .007$  (.003)  $\rightarrow \{.39 - (.48) - .56\}$
  - ▶  $u_{1j}^*OE = .023$  (.008)  $\rightarrow \{.03 - (.18) - .33\}$
- ▶ If ALM, KS interaction on: returns for *correctly matched workers* with 3C degree **0/+**; returns for *overqualified workers* with 3C degree -
  - ▶  $\gamma_{11} (RE*KS) = .071$  (.037), no decrease in  $u_{1j} \rightarrow$  wage premium for RE(apprenticeship) is not moderated by KS
  - ▶  $\gamma_{11} (OE*KS) = -.179$  (.307), clear decline (-23%) in  $u_{1j} \rightarrow$  wage premium for OE(appr.) is lower in the KS (.047) than in the remaining economy (.226)

- ▶ A substantial part of the variance in wages results from differences between industries
- ▶ Random coefficient models (RCM) show common pattern:  $RE, OE > 0, UE < 0; |UE| < RE > OE$
- ▶ Exploting RCM with cross-level interaction, polarisation hypothesis can't be rejected with German data:
  - ▶ Falling returns for people with medium level voc. degree within jobs not requiring any voc. education
  - ▶ Stable returns for correctly matched people with medium level voc. degree



The classification of the KS, i.e. the knowledge industries, separated by functional groups (expressed in terms of ISIC Rev.3):

1. **Knowledge creation:** Research and development
2. **Knowledge infrastructure:** Manufacture of paper and paper products; Manufacture and renting of computer machinery, radio, television and communication equipment and other electrical machinery and instruments; Computer and related activities; Post and Telecommunications
3. **Knowledge management:** Legal, accounting, book-keeping and auditing activities, Tax consultancy, market research and public opinion polling, business and management consultancy; Advertising
4. **Knowledge mediation:** Education; Publishing, printing and reproduction of recorded media; Motion picture, radio, television and other entertainment activities; News agency activities; Library, archives, museums and other cultural activities

# Application of ISCED-97 to the German education qualifications

This table is taken from Schneider 2008 (p. 98, table 6, columns 1 2, 4, and 7).

National categories	ISCED-97 (OECD)	Microcensus 2004 <sup>1</sup>
<b>No formal qualification</b>	0/1	<b>2.08</b>
<b>Volks-/Hauptschulabschluss</b>		<b>10.16</b>
<b>Anlernausbildung; internship; pre-vocaitonal training year</b>		<b>1.12</b>
<b>Realschulabschluss / Mittlere Reife</b>	<b>2A</b>	<b>2.36</b>
<b>Polytechnisch Oberschule (GDR)</b>		<b>0.55</b>
<b>Vocational training in the dual system, training for intermediate public services</b>		<b>47.29</b>
<b>Vocationally qualifying Berufsfach-/Kollegschulabschluss; one-year health sector school</b>	3C	<b>3.00</b>
<b>Fachhochschulreife</b>		<b>0.42</b>
<b>Abitur / allgemeine or fachgebundene Hochschulreife</b>	<b>3A</b>	<b>2.43</b>
<b>3B + 3A or 3A + 3B</b>	4A	<b>5.58</b>
<b>Meister/Techniker; equivalent Fachschulabschluss; two-to three-year health sector school; Fach-/Berufsakademie</b>		<b>7.69</b>
<b>Fachschulabschluss (GDR)</b>	<b>5B</b>	<b>1.76</b>
<b>College of public administration</b>		<b>0.86</b>
<b>Fachhochschulabschluss</b>	5A(med)	<b>5.20</b>
<b>Universitätsabschluss</b>	5A(long)	<b>7.93</b>
<b>Doctorate</b>	6	<b>1.58</b>

Notes: <sup>1</sup> One per cent sample of the German population, Individuals aged 25-64 (in per cent).