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Skill upgrading in Europe

SKILLSNET TECHNICAL WORKSHOP
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Arnaud Dupuy & Jan Sauermann

**Research Centre for Education and the Labour Market,
Maastricht University, The Netherlands**



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EMPLOYMENT RESEARCH



Overview

- Skill composition of the workforce has changed
- Attempt to measure the speed of skill upgrading
- Identify structural breaks in the speed of upgrading
- KLEM data (1970-2005) on 9 European countries within 11 sectors.

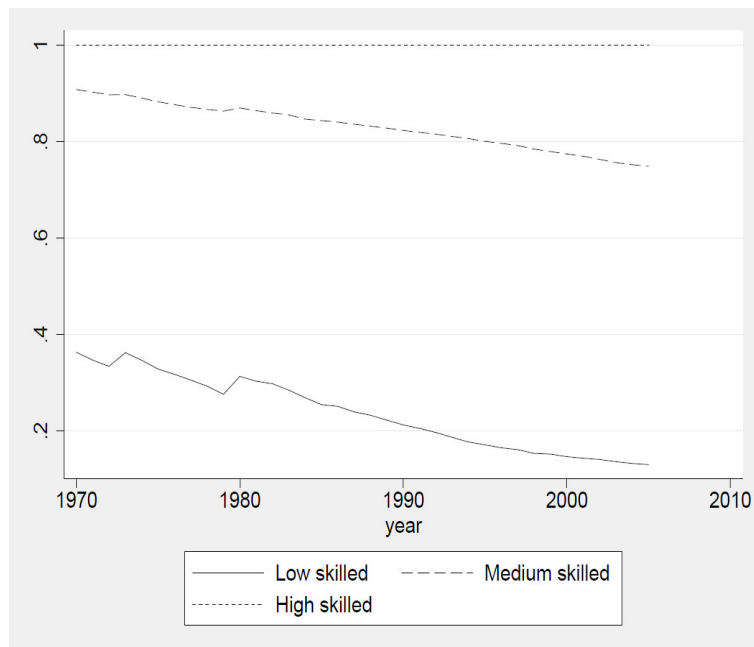
Related to:

- E3ME forecast by CE
- Substitution of factors (skill levels) within sectors: Imbalances.

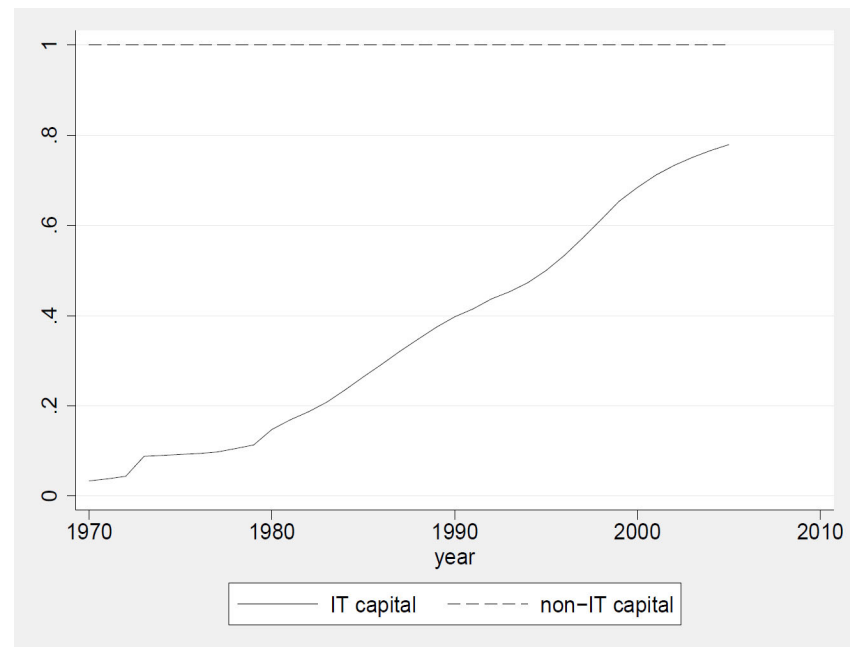
Overall trends

- Skill composition changed towards intermediate and high skilled labour in the last decades.
- Most important determinant of changes in skill composition is technological progress

Skill shares



Capital investment: IT / Non-IT



Outcomes

1. **Own-price elasticity:** how changes in wages or cost of capital translate into changes in demand for this factor.
2. **Cross-price elasticity:** how changes in the price of one input factor (e.g. wages for low-skilled labour) affect the demand for other input factors (e.g. IT-related capital investments).
3. **General trends** which cannot be accounted for by changes in input factor prices.

Modelling skill upgrading

- Estimating the demand for skill

Parameterized cost function: translog cost function with six types of inputs (low, intermediate and high skilled labour, IT and non-IT capital, intermediate inputs):

$$S_{IT} = \alpha_{IT} + \gamma_{IIT} \ln\left(\frac{P_{IT}}{P_{II}}\right) + \gamma_{IIN} \ln\left(\frac{P_N}{P_{II}}\right) + \gamma_{IILS} \ln\left(\frac{P_{LS}}{P_{II}}\right) + \gamma_{IIMS} \ln\left(\frac{P_{MS}}{P_{II}}\right) + \gamma_{IIHS} \ln\left(\frac{P_{HS}}{P_{II}}\right) + \gamma_{IIT} \ln Y + \gamma_{IIT} TR$$

Estimated using SUR technique (Zellner, 1962)

KLEM Data

- First, we can measure in how far input demand for one factor depends on its own price, i.e. how changes in wages or cost of capital translate into changes in demand for this factor.
- Second, we can measure how changes in the price of one input factor (e.g. wages for low-skilled labour) affect the demand for other input factors (e.g. IT-related capital investments), i.e. whether IT-related capital is a substitute or complement of different skill levels.
- Third, we measure general trends which cannot be accounted for by changes in input factor prices.

KLEM data: countries used

COUNTRY	Description	Period
AUT *	Austria	1980-2005
BEL *	Belgium	1980-2005
DNK *	Denmark	1980-2005
ESP *	Spain	1980-2005
FIN *	Finland	1970-2005
FRA *	France	1980-2005
ITA *	Italy	1970-2005
NLD *	Netherlands	1979-2005
UK *	United Kingdom	1970-2005
AUS *	Australia	1982-2005
JPN *	Japan	1973-2005
USA *	United States of America	1970-2005

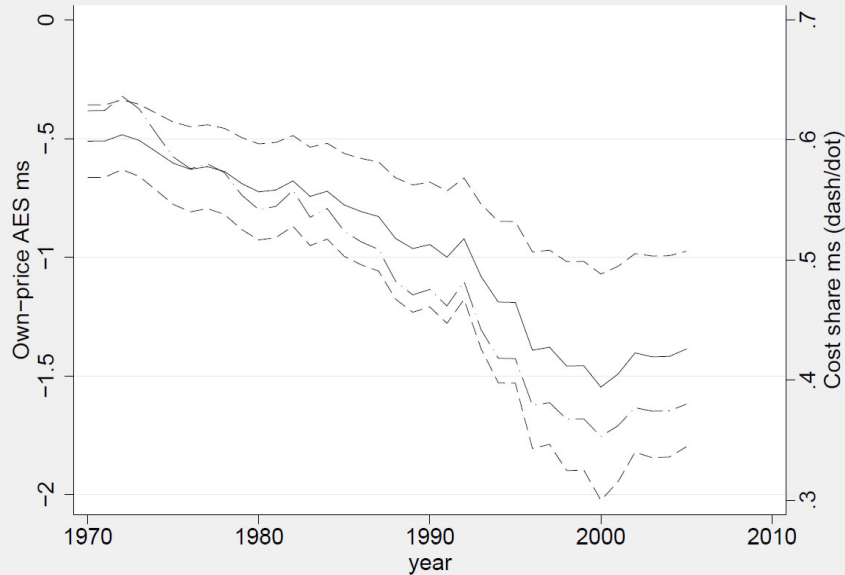
KLEM data: Sectors used

Industry	Description
AtB	Agriculture, hunting, forestry and fishing
C	Mining and quarrying
D	Total manufacturing
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade
H	Hotels and restaurants
I	Transport and storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
LtQ	Community social and personal services

Results: Development of own price elasticity

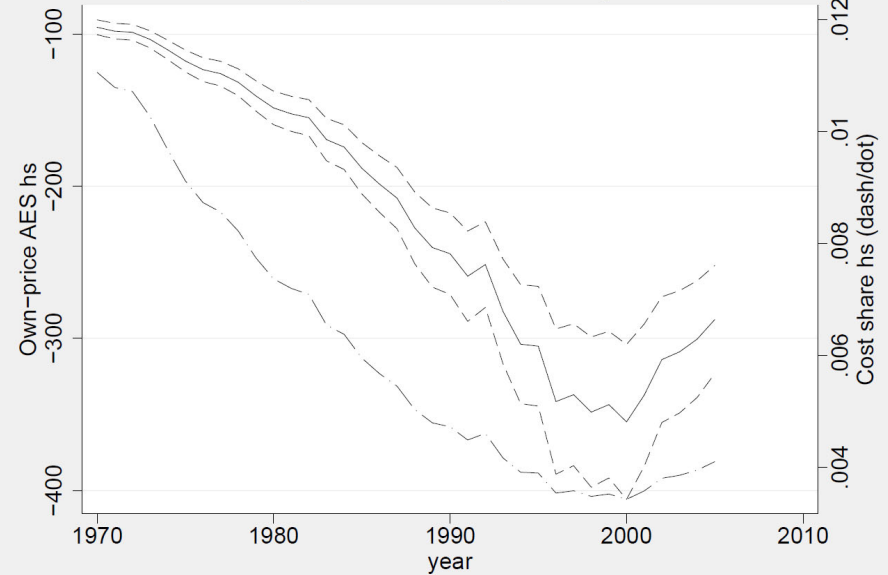
Medium skilled labour

Country=ITA; industry=H; input=ms



High skilled labour

Country=ITA; industry=H; input=hs



Note: The solid line shows the own-price AES over time; short dashes denote the 95%-confidence interval. The long-dashed line shows the development of the cost share

Source: EU-KLEMS, calculations by ROA

Results: Own price elasticities by sector

industry	Low skilled	Medium skilled	High skilled	IT	Non-IT	Inter-mediate
AtB	-2.44	-0.76	-6.41	-408.63	-0.65	-0.28
C	-8.10	-2.90	-7.24	-145.00	-0.27	-0.37
D	-5.16	-1.54	-10.96	-90.35	-2.09	-0.08
E	9.30	-1.46	-18.14	-88.18	-0.37	-0.18
F	-4.83	-1.63	-3.27	-200.59	-2.09	-0.29
G	-3.95	-0.92	-3.32	-42.61	-0.97	-0.63
H	-3.87	-1.39	-6.56	-152.11	-1.35	-0.59
I	-5.60	-1.28	-10.46	-27.15	-0.36	-0.13
J	-18.00	-2.63	-5.14	-20.22	-0.84	-0.80
K	-4.33	-2.77	-2.00	-52.93	-0.32	-0.68
LtQ	-4.40	-1.07	-2.08	-95.76	-1.02	-1.30
Average	-4.67	-1.67	-6.87	-120.32	-0.94	-0.49

Note: Own price elasticity across all countries. Sectors are Agriculture, hunting, forestry and fishing (AtB), Mining and quarrying (C), Total manufacturing (D), Electricity, gas and water supply (E), Construction (F), Wholesale and retail trade (G), Hotels and restaurants (H), Transport and storage and communication (I), Financial intermediation (J), Real estate, renting and business activities (K), Community social and personal services (LtQ)

Source: EU-KLEMS, calculations by ROA

Results: Own price elasticity by country

country	Low skilled	Medium skilled	High skilled	IT	Non-IT	Inter-mediate
AUS	-1.07	-4.57	-6.87	-65.13	-0.13	-0.64
AUT	5.52	-0.21	-6.37	-39.74	0.01	-0.36
BEL	-10.42	-1.51	-1.50	-92.88	-0.89	0.30
DNK	-8.24	-3.88	-2.14	-48.25	-0.23	-0.28
ESP	-0.74	-8.80	-5.88	-61.96	-0.33	-0.65
FIN	-10.24	-5.81	-8.62	-90.05	-1.16	-0.08
FRA	0.26	0.85	-4.23	-99.64	-0.45	-0.17
ITA	-114.57	-0.69	-44.19	-96.84	-2.22	-0.48
JPN	-10.87	-1.13	-2.59	-72.96	-0.74	-0.46
NLD	-10.83	-1.76	-9.80	-64.90	-1.09	-0.53
UK	3.01	-1.12	-2.38	-102.01	-1.38	-0.63
USA	-5.21	-0.72	-1.34	-81.65	-0.57	-0.17
Average	-13.62	-2.44	-7.99	-76.33	-0.76	-0.35

Note: Own price elasticity across all sectors.

Source: EU-KLEMS, calculations by ROA

Results: Speed of Skill Upgrading (Trend)

industry	g_ls_tr	g_ms_tr	g_hs_tr	g_it_tr	g_ni_tr	g_ii_tr
AtB	-0.0062	0.0015	0.0008	0.0003	0.0001	0.0035
C	-0.0031	-0.0013	0.0002	0.0009	-0.0001	0.0034
D	-0.0028	-0.0007	0.0011	0.0006	0.0011	0.0007
E	-0.0016	-0.0015	0.0003	0.0009	0.0011	0.0009
F	-0.0030	0.0018	0.0005	0.0004	0.0011	-0.0007
G	-0.0022	-0.0008	0.0010	0.0005	0.0018	-0.0003
H	-0.0041	0.0028	0.0024	0.0000	0.0019	-0.0030
I	-0.0026	-0.0028	0.0009	0.0023	0.0013	0.0009
J	-0.0012	-0.0059	0.0009	0.0049	-0.0030	0.0044
K	-0.0005	-0.0028	0.0018	0.0010	0.0009	-0.0005
LtQ	-0.0014	-0.0031	0.0036	0.0010	0.0013	-0.0015
average	-0.0026	-0.0012	0.0012	0.0012	0.0007	0.0007

Note: Coefficient of the trend variable aggregated across all countries. ls refers to low-skilled, ms to medium skilled, hs to high-skilled labour, it to IT related capital, ni to non-IT related capital, ii to intermediate inputs. Sectors are Agriculture, hunting, forestry and fishing (AtB), Mining and quarrying (C), Total manufacturing (D), Electricity, gas and water supply (E), Construction (F), Wholesale and retail trade (G), Hotels and restaurants (H), Transport and storage and communication (I), Financial intermediation (J), Real estate, renting and business activities (K), Community social and personal services (LtQ)

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Average	-13.62	-2.44	-7.99	-76.33	-0.76	-0.35

Note: Coefficient of the trend variable aggregated across all sectors.

Source: EU-KLEMS, calculations by ROA

Preliminary results

- Between 1970 and 2005 the share of low skilled labour decreased from 35% to about 20% (in hours worked)
- The share of high skilled workers went from 9 to 16%.
- Estimated own price elasticity show two patterns:
 - Low and high-skilled labour show on average higher responsiveness to price changes than medium-skilled.
 - IT related inputs are more responsive to changes in prices than on-IT related inputs.
- Cross price elasticities show that
 - Increases in low-skilled wages leads to substitution by intermediate and high skilled.
 - Medium and high-skilled labour are complements rather than substitutes
- The trend variable shows that there is an upward trend for high-skilled labour, while low-skilled labour follows a downward trend, after controlling for price changes.

Next steps

- Low input shares: (1) impose separability; or (2) imposing structure across industries and/or countries.
- Tests on separability of inputs: now there are no restrictions on substitutability.
- Estimating structural breaks: using the core sample with sufficient time series, analyse whether degree of substitution and speed of skill upgrading changes structurally, e.g. due to the introduction of new technologies.
- Endogeneity (of prices in the share equations): use of instrumental variable techniques.

Contact Details

Research Centre for Education and the Labour Market

Maastricht University | ROA

P.O. Box 616, NL-6200 MD Maastricht

T +31 43 3883647 F +31 43 3884914

www.roa.nl

<Ben.Kriechel@maastrichtuniversity.nl>