Human capital, Information Technology and Productivity

or

The role played by IT intensive human capital in firm productivity

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Results in brief

Improvements in level of skilled human capital boost firm productivity in FIN, SWE and NOR

Effects strongest on total factor productivity

Type of human capital (IT intensive) important for labour productivity

Effects from human capital larger than from dissemination

Overview

Background

Purpose and expectations

Data availability

Methodology

Results

Conclusions

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Background

IT may impact firm productivity through

the inputs in real capital, human capital or intermediates

the dissemination of IT

the organisation and technology readiness

Few studies on productivity effects from real human capital

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Background
Orientation

Draca et al (2006), *IT affects productivity*

Doms et al (1997), and Galindo-Rueda and Haskel (2005), R*elationship high skills, IT, high wages, high productivity et cetera*

Ilmakunnas and Maliranta (2005), Gunnarsson et al (2001, 2004) and Iranzo (2006), *Type of education important for productivity, certain degree of indirect effect*

Rao et al (2002), *High level of university graduates positively related to productivity*

Abramovsky and Griffith (2005), *Organisation and IT, Europe slow in uptake*

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Purpose and expectations

Describe firm human capital characteristics

Firms high in IT also high in skilled human capital, wages and
productivity

Study impacts from real IT intensive human capital on productivity

Productivity bonuses from IT intensive human capital

Possibly indirect effects through IT usage

Compare effects from real human capital with alternative proxy wages

Wages suitable proxy for human capital

for Finland, Norway and Sweden

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Data availability

Cross country dataset from Eurostat ICT Impacts Project based on information from:

Production Surveys
Business registers
Firm ICT usage surveys
Education registers

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Methodology

Descriptive analysis

Regression analysis
Ordinary Least Squares production function estimations on pooled and unbalanced panels of firms 2001-2005 (Finland -2004)

Regressions programmed within a common code on groups of industries in each country

Dependent variables
Labour productivity (LP)
Total Factor Productivity (TFP)

Firm ICT usage the least common denominator in the Eurostat ICT impacts project

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Methodology

Explanatory variables

Hk   Firm share of employees with all kinds of post upper secondary education

Hkitpct   Firm share of employees with post upper secondary IT intensive education

Hknitpct   Firm share of employees with general post upper secondary education

K   Capital

W   Wages, alternative human capital variable

Age   Firm age

Age2   Firm age squared, non-linearity

DSLpct   Firm share of employees with access to fast broadband

ECpct   Firm share of selling and buying over the Internet

Hkdsl   Interaction between skilled human capital and broadband share

Wdsl   Interaction between wages and broadband share

Dummy variables controlling for time, industry, size and affiliation
Outlier control of extreme values

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Results (descriptive)

2005		Finland	Norway	Sweden
Proportion of employees	**All firms**	70	60	66
with PC access %	**Services**	76	68	73
	Manufacturing	56	51	60
Proportion of employees	**All firms**	62	54	55
with fast broadband access	**Services**	66	62	64
%	**Manufacturing**	43	46	43

2005		Finland*	Norway	Sweden
Proportion of employees with	**All firms**	10	17	4
IT intensive post upper	**Services**	11	19	5
secondary education %	**Manufacturing**	11	15	4
Proportion of employees with	**All firms**	17	6	11
general post upper secondary	**Services**	22	7	11
education %	**Manufacturing**	10	4	10

*Skills data for Finland refer to 2004
Sources: Statistics Finland, Statistics Norway and Statistics Sweden

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Results
IT intensive human capital on productivity

LnLpv	FIN* 1	3	SWE 1	3	NOR 1	3
Hkitpct	**0.767**	0.766	0.127	0.262	0.454	0.749
	(0.014)*	(0.039)***	(0.006)***	(0.045)***	(0.001)***	(0.137)***
Hknitpct	0.596	**0.610**	0.118	0.217	0.111	0.190
	(0.011)***	**(0.038)***	(0.004)***	(0.036)***	(0.021)***	(0.238)
DSLpct		0.085		0.194		**0.255**
		(0.018)***		(0.014)***		**(0.064)***
R-squared	0.21	0.27	0.14	0.28	0.27	0.43
Observations	59635	7746	776737	11398	38491	663

LnTfp	FIN* 1	3	SWE 1	3	NOR 1	3
Hkitpct	**1.095**	1.034	0.279	0.253	0.535	0.881
	(0.028)*	(0.089)***	(0.007)***	(0.056)***	(0.014)***	(0.140)***
Hknitpct	**1.110**	1.027	0.234	0.289	0.194	0.334
	(0.023)*	(0.087)***	(0.005)***	(0.045)***	(0.021)***	(0.244)
DSLpct		0.238		**0.316**		0.249
		(0.041)***		**(0.018)***		(0.066)***
R-squared	0.63	0.58	0.61	0.77	0.68	0.61
Observations	59634	7745	776675	11397	38490	662

1= Exhaustive dataset , **3= firm ICT**
Use survey linked to Production Survey

Sources: Statistics Finland, Statistics Sweden and Statistics Norway

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Results

Skilled human capital interacted with firm IT use

Variable	LnLpv			LnTfp		
	FIN*	SWE	NOR	FIN*	SWE	NOR
Lnkl				-0.383	-0.219	-0.249
				(0.008)***	(0.004)***	(0.005)***
Hkpct	0.712	0.116	0.932	1.129	-0.010	0.905
	(0.050)***	(0.052)*	(0.086)***	(0.109)***	(0.065)	(0.090)***
Dslpct	0.099	0.175	0.171	0.308	0.277	0.126
	(0.026)***	(0.016)***	(0.028)***	(0.056)***	(0.019)***	(0.030)***
Hkdsl	-0.047	**0.196**	-0.138	-0.188	**0.449**	0.047
	(0.064)	**(0.068)****	(0.100)	(0.140)	**(0.085)*****	(0.105)
R-squared	0.26	0.27	0.37	0.60	0.76	0.63
Observations	8791	11685	5139	8790	11684	5138

Sources: Statistics Finland, Statistics Sweden and Statistics Norway

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Results
IT intensive human capital on productivity

Improvements in level of IT intensive human capital boost firm productivity in FIN, SWE and NOR (FIN the most)

Effects strongest on total factor productivity, from all types of skilled human capital (except NOR , only IT intensive)

Type of human capital (IT intensive) crucial for labour productivity

Differences among industries more marked than among countries, services firms generally gain more than manufacturers

Effects from human capital larger than from firm IT usage

SWE only country where IT use interacts with skilled human capital

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Results
Wages on productivity

Equation 3	LnLpv			LnTfp		
	Lnw	Hkitpct	Hknitpct	Lnw	Hkitpct	Hknitpct
FIN	0.943	0.766	0.610	0.923	1.034	1.027
	(0.015)***	(0.039)***	(0.038)***	(0.039)***	(0.089)***	(0.087)***
NOR	0.965	0.749	0.190	1.019	0.881	0.334
	(0.084)***	(0.137)***	(0.238)	(0.104)***	(0.140)***	(0.244)
SWE	1.000	0.262	0.217	1.043	0.253	0.289
	(0.014)***	(0.045)***	(0.036)***	(0.019)***	(0.056)***	(0.045)***

Equation 4	LnLpv				LnTfp			
	Lnw	Hk	Lnwdsl	Hkdls	Lnw	Hk	Lnwdsl	Hkdls
FIN	0.983	0.712	**-0.083**	-0.047	0.917	1.129	-0.010	-0.188
	(0.023)***	(0.050)***	**(0.032)****	(0.064)	(0.055)***	(0.109)***	(0.075)	(0.140)
NOR	1.054	0.932	**-0.067**	-0.138	0.929	0.905	0.021	0.047
	(0.023)***	(0.086)***	**(0.030)****	(0.100)	(0.027)***	(0.090)***	(0.035)	(0.105)
SWE	0.998	0.116	0.008	**0.196**	0.983	-0.010	**0.126**	**0.449**
	(0.021)***	(0.052)*	(0.030)	**(0.068)****	(0.028)***	(0.065)	(0.041)***	(0.085)***

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Results
Wages on productivity

Wages differ in estimates from real human capital (higher, lower...)

Variation among types of productivity less obvious

FIN and NOR now affected by interaction, negatively, SWE not significant

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Conclusions

Firms high in IT also high in skilled human capital, wages and productivity

Productivity bonuses from IT intensive human capital, differences larger among firms than countries

Type of human capital (IT intensive) crucial for labour productivity, less so for total factor productivity

Services firms gain more

SWE surprisingly only country where IT operates through skilled human capital

Results may stress differences in industry structure and organisational readiness

Wages dubious proxy for human capital, estimates deviate from real human capital in a non systematic way

Employer-employee dataset including educational achievement desirable

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