

International Differences in Job Mobility: A Schumpeterian Perspective

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In a nutshell...

Study of how the diffusion of ICT and the associated economic growth relate to turnover in the labor market.

Hypothesis: Growth predominantly raises the job mobility of skilled workers in the early adoption stages but the differential impact fades in the later stages.

Using a survey that directly assess cognitive skills, I document systematic differences in the effect of skills on job mobility across 37 countries.

While economic growth is associated with relatively higher job mobility among skilled workers, the prevalence of ICT in the workplace is associated with relatively lower mobility.

Summary

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Skills

Hypothesis

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Results

Conclusion

Trends

Size Premia

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Schumpeterian Growth Theory

New innovations replace older technologies (Grossman & Helpman, 1991; Aghion & Howitt, 1992; Klette & Kortum, 2004).

The reallocation of resources is an integral part of this process of creative destruction (Lentz & Mortensen, 2008).

There is a rich set of distinct predictions, which have been tested in numerous studies (Aghion *et al.*, 2014).

Faster innovation-led growth is generally associated with higher turnover rates.

Labor Market: Indirect Job Mobility

Schumpeterian models incorporating search models of unemployment à la Pissarides (2000) (Aghion & Howitt, 1994; Mortensen & Pissarides, 1998).

- Focus on indirect job mobility, i.e., job changes with intervening unemployment spells.
- Workers search for new jobs only once they become unemployed.

Creative destruction leads to displacement:

Jobs whose technology is fixed eventually become unprofitable, forcing the workers into unemployment until they find a new job.

Labor Market: Direct Job Mobility

Schumpeterian models incorporating on-the-job search models (Michau, 2013).

- Prominent role of direct job mobility or job-to-job mobility, i.e., job changes without intervening unemployment spells.
- Workers have the option to directly reallocate from low to high productivity jobs without intervening unemployment spells.

Creative destruction does not necessarily lead to displacement:

Rather a process of increasing job opportunities that workers have to seize, than a process of displacement and recurrent unemployment.

Labor Market: Reallocation to New-Technology Jobs

Creative destruction can be associated with vastly different experiences of increasing job opportunities or of displacement and recurrent unemployment.

A related question is to what extent job mobility reflects the reallocation from jobs with outdated technologies to jobs with new technologies.

Job mobility that is associated with recurrent displacement and protracted unemployment spells is less likely to be directional.

(see, e.g., Autor *et al.*, 2014, 2016)

General-Purpose Technology

General-purpose technologies are typically Schumpeterian.

- The technology diffuses to all sectors and firms eventually.
- The technology induces an economy-wide abandonment of older technologies.

General-purpose technologies typically lead to major transformations.

- In the early adoption stages, the use of the technology is characterized by uncertainty and novelties.
- In the later stages with widespread adoption, the use of the technology is characterized by familiar routines.

Skills and Adaptability

The key idea underlying the empirical study:

Skilled workers have an advantage in coping with the uncertainty and the novelties that are associated with a new technology in the early adoption stages (dates back to Nelson & Phelps, 1966).

An alternative related concept is versatility (a broader set of skills):

Entorf *et al.* (1999) document that computer users enjoy a wage premium of 15–20 percent, but that an individual worker's wage increases by less than 2 percent when entering a new-technology job.

Theoretical Background

Hypothesis

Main Hypothesis for Empirical Study

Faster economic growth...

- raises predominantly the job mobility of skilled workers in the early stages of the general-purpose technology adoption,
- but the differential impact of economic growth fades in the later stages.

Survey of Adult Skills

Programme for the International Assessment of Adult Competencies (PIAAC)

OECD large-scale initiative to provide internationally comparable data on skills of the adult population in 2011–2017 in more than 37 countries:

- OECD countries like USA, Germany and Japan
- non-OECD countries like Peru, Ecuador and Indonesia

PIAAC achievement tests:

- general knowledge attainable in schools and through life experiences
- conceptually different from IQ and (stable) traits
- 3 domains: literacy, numeracy, problem solving in tech-rich environments

Penn World Table version 9.1 (Feenstra et al., 2015)

PWT version 9.1 is a database with information on relative levels of income, output, input and productivity, covering 182 countries between 1950 and 2017.

Economic growth:

- measured by the annual growth rate of real GDP per capita from 1990 to the year of data collection
- based on real GDP at constant national prices, obtained from national accounts data for each country (rgdpna)

Economic advancement:

- measured by GDP per capita in 2011–2017
- based on expenditure-side real GDP at chained PPPs (rgdpe)

Sample

Sample selection:

- survey participants with 5–30 years of experience, i.e., potential experience: $\text{age} - \text{years of schooling} - 6$
- survey participants without protracted non-employment spells, i.e., individuals who have worked at least six months in each year
- male survey participants only

The final sample encompasses 22,895 individuals with 180–3,516 observations per country.

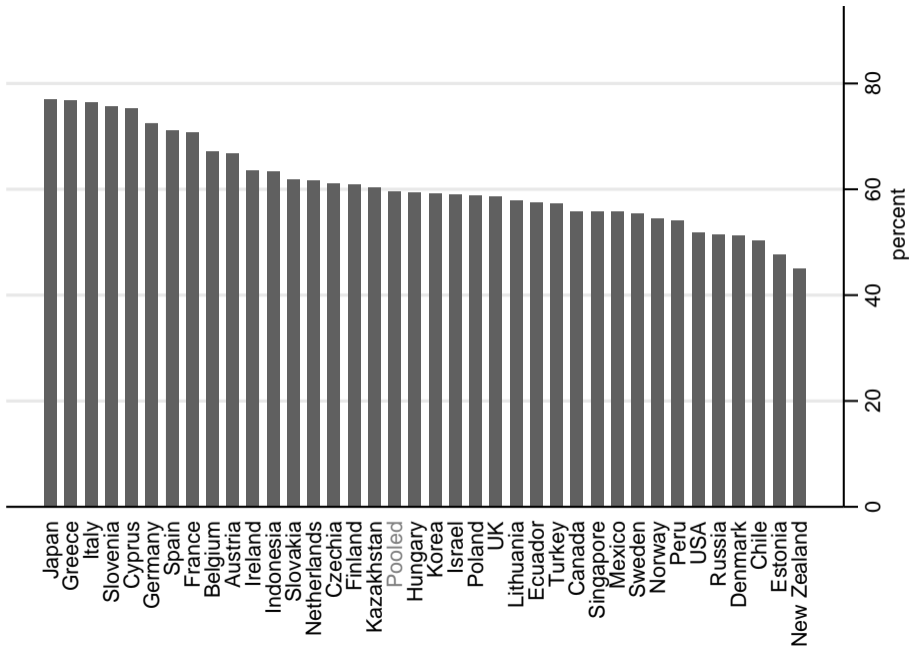
Job Mobility

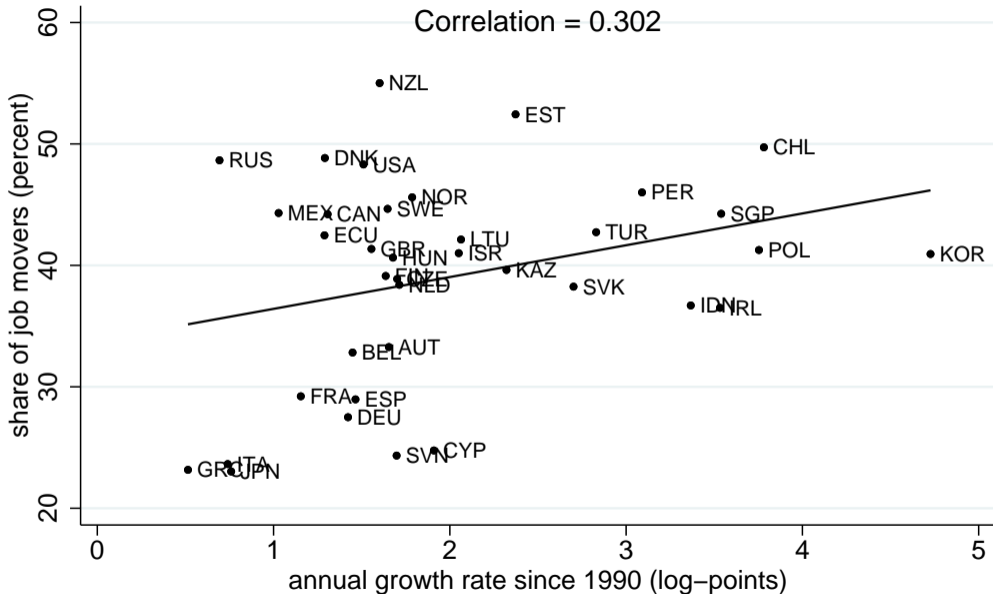
Survey participants report the number of different firms or organizations in which they worked during the five years preceding the interview.

Note:

- There is a sizable share of multiple-job holders: 9.9 percent in the pooled international sample.
- I adjust the reported cumulative number of jobs of multiple-job holders by subtracting 1.

share with 1 job





Use of ICT in the Workplace: Question

Survey participants report how often they usually...

- “use email”, “use the internet in order to better understand issues related to [their] work”, “conduct transactions on the internet, for example buying or selling products or services, or banking”,
- “use spreadsheet software, for example Excel”, “use a word processor, for example Word”, “use a programming language to program or write computer code”, or “participate in real-time discussion on the internet, for example online conference, or chat groups.”

Use of ICT in the Workplace: Measure

The scale for ICT use is constructed using item response theory:

- item parameters are estimated with the generalized partial credit model
- person-specific levels of ICT use are estimated with the weighted-likelihood method

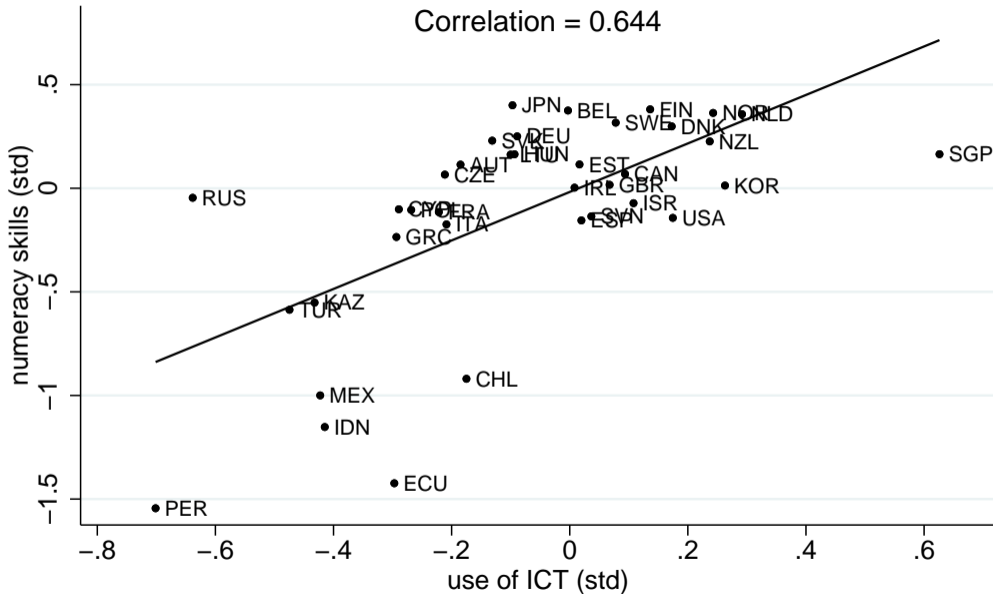
I set ICT use to 0 if a person indicates never pursuing any of the stated activities or not using a computer on the job.

I standardize the measure of ICT use to obtain a mean of 0 and a standard deviation of 1 in the pooled international sample.

Numeracy Skills

The PIAAC defines numeracy as “the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life,” which is measured on a 500-point scale.

I standardize the score to obtain a mean of 0 and a standard deviation of 1 in the pooled international sample.



Readiness to Learn

Survey participants state to what extent the following statements apply:

- “When I hear or read about new ideas, I try to relate them to real life situations to which they might apply”, “I like learning new things”, “When I come across something new, I try to relate it to what I already know”,
- “I like to get to the bottom of difficult things”, “ I like to figure out how different ideas fit together” and “If I don’t understand something, I look for additional information to make it clearer.”

Item response theory is used to construct the readiness-to-learn scale, which I standardize to obtain a mean of 0 and a standard deviation of 1 in the pooled international sample.

Linear Probability Model

In order to study the international differences in the effect of skills on job mobility, I rely on a linear probability model that distinguishes two states:

- exactly one job over the preceding five years
- at least two jobs over the preceding five years

Focus on the ordinary least-squares estimates, but also replicate the main results with the maximum-likelihood probit model.

	OLS	
	(1)	
Numeracy (std)	-2.179***	(0.618)
Readiness to learn (std)	-	
Education (years)	-	
Experience (decades)	-24.416***	(3.107)
Experience ² (decades ²)	3.634***	(0.823)
Industry × occupation	-	

Table: Additional controls: country and interview year. Instruments for numeracy and readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS	
	(1)	(2)
Numeracy (std)	-2.179*** (0.618)	-
Readiness to learn (std)	-	2.372*** (0.402)
Education (years)	-	-
Experience (decades)	-24.416*** (3.107)	-24.463*** (3.059)
Experience ² (decades ²)	3.634*** (0.823)	3.775*** (0.828)
Industry × occupation	-	-

Table: Additional controls: country and interview year. Instruments for numeracy and readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS		
	(1)	(2)	(3)
Numeracy (std)	-2.179*** (0.618)	-	-
Readiness to learn (std)	-	2.372*** (0.402)	-
Education (years)	-	-	-0.910*** (0.190)
Experience (decades)	-24.416*** (3.107)	-24.463*** (3.059)	-24.668*** (3.054)
Experience ² (decades ²)	3.634*** (0.823)	3.775*** (0.828)	3.659*** (0.821)
Industry × occupation	-	-	-

Table: Additional controls: country and interview year. Instruments for numeracy and readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS			
	(1)	(2)	(3)	(4)
Numeracy (std)	-2.179*** (0.618)	-	-	-1.673** (0.708)
Readiness to learn (std)	-	2.372*** (0.402)	-	3.153*** (0.412)
Education (years)	-	-	-0.910*** (0.190)	-0.916*** (0.195)
Experience (decades)	-24.416*** (3.107)	-24.463*** (3.059)	-24.668*** (3.054)	-24.581*** (2.987)
Experience ² (decades ²)	3.634*** (0.823)	3.775*** (0.828)	3.659*** (0.821)	3.664*** (0.806)
Industry × occupation	-	-	-	-

Table: Additional controls: country and interview year. Instruments for numeracy and readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS				
	(1)	(2)	(3)	(4)	(5)
Numeracy (std)	-2.179*** (0.618)	-	-	-1.673** (0.708)	-0.930 (0.715)
Readiness to learn (std)	-	2.372*** (0.402)	-	3.153*** (0.412)	3.291*** (0.470)
Education (years)	-	-	-0.910*** (0.190)	-0.916*** (0.195)	-0.310 (0.193)
Experience (decades)	-24.416*** (3.107)	-24.463*** (3.059)	-24.668*** (3.054)	-24.581*** (2.987)	-24.896*** (2.729)
Experience ² (decades ²)	3.634*** (0.823)	3.775*** (0.828)	3.659*** (0.821)	3.664*** (0.806)	3.835*** (0.745)
Industry × occupation	-	-	-	-	x

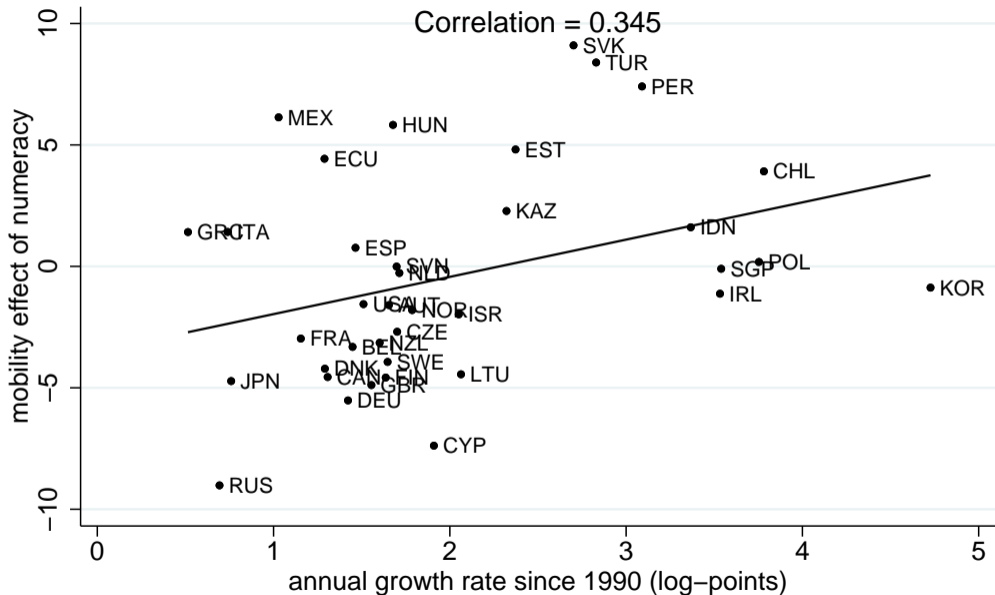
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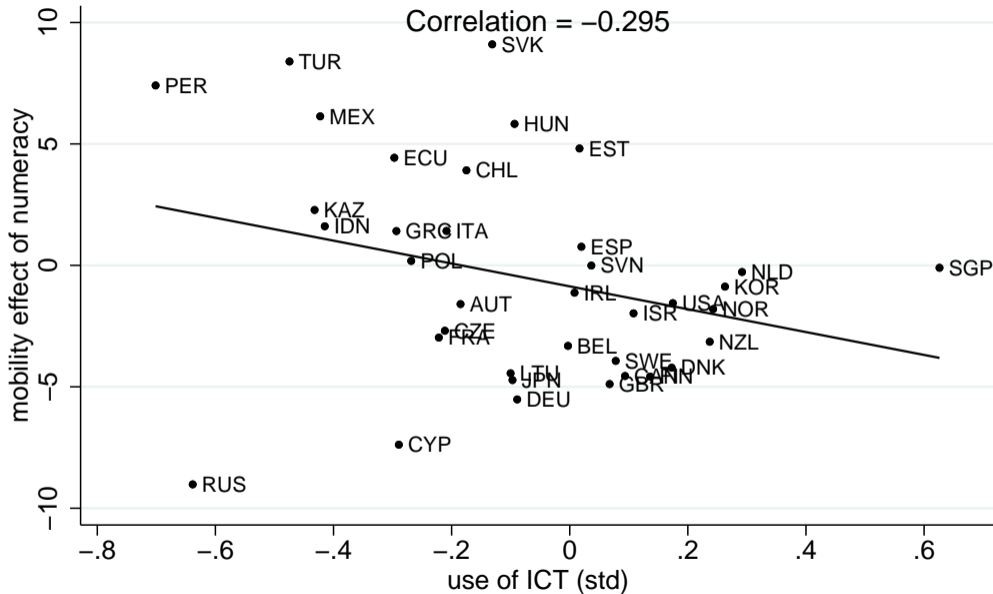
	OLS					2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Numeracy (std)	-2.179*** (0.618)	-	-	-1.673** (0.708)	-0.930 (0.715)	13.700*** (2.275)
Readiness to learn (std)	-	2.372*** (0.402)	-	3.153*** (0.412)	3.291*** (0.470)	6.571** (2.756)
Education (years)	-	-	-0.910*** (0.190)	-0.916*** (0.195)	-0.310 (0.193)	-3.319*** (0.405)
Experience (decades)	-24.416*** (3.107)	-24.463*** (3.059)	-24.668*** (3.054)	-24.581*** (2.987)	-24.896*** (2.729)	-26.098*** (3.467)
Experience ² (decades ²)	3.634*** (0.823)	3.775*** (0.828)	3.659*** (0.821)	3.664*** (0.806)	3.835*** (0.745)	4.333*** (0.984)
Industry × occupation	-	-	-	-	x	-

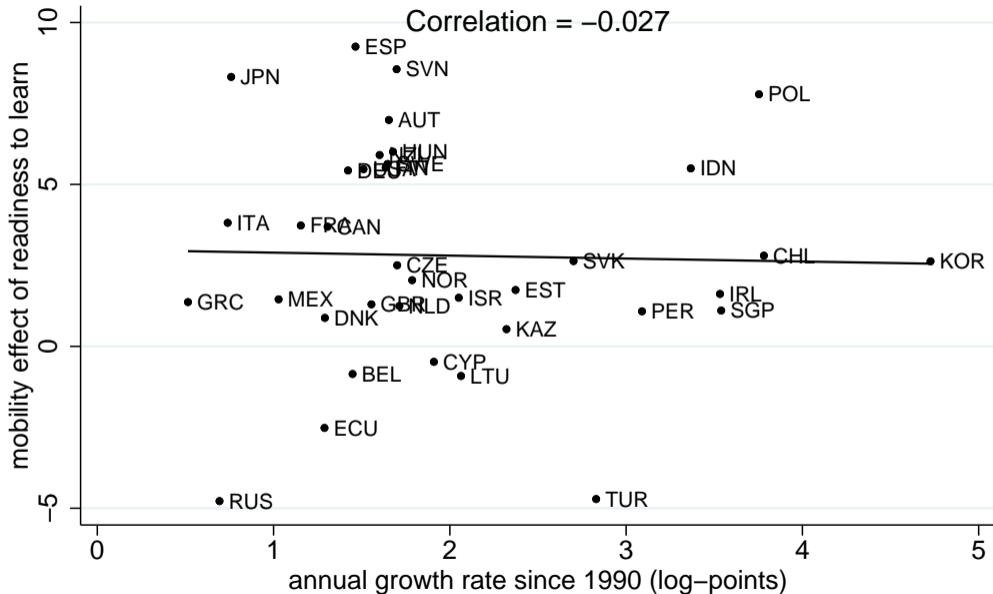
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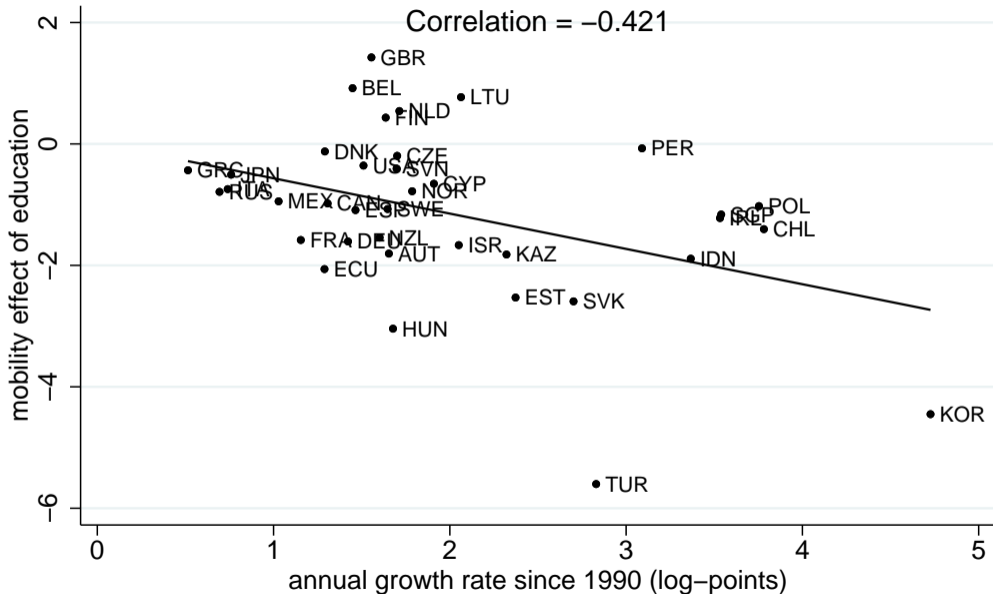
	OLS					2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Numeracy (std)	-2.179*** (0.618)	-	-	-1.673** (0.708)	-0.930 (0.715)	13.700*** (2.275)	16.639*** (2.398)
Readiness to learn (std)	-	2.372*** (0.402)	-	3.153*** (0.412)	3.291*** (0.470)	6.571** (2.756)	7.388*** (2.644)
Education (years)	-	-	-0.910*** (0.190)	-0.916*** (0.195)	-0.310 (0.193)	-3.319*** (0.405)	-2.197*** (0.323)
Experience (decades)	-24.416*** (3.107)	-24.463*** (3.059)	-24.668*** (3.054)	-24.581*** (2.987)	-24.896*** (2.729)	-26.098*** (3.467)	-26.169*** (3.060)
Experience ² (decades ²)	3.634*** (0.823)	3.775*** (0.828)	3.659*** (0.821)	3.664*** (0.806)	3.835*** (0.745)	4.333*** (0.984)	4.503*** (0.888)
Industry × occupation	-	-	-	-	x	-	x

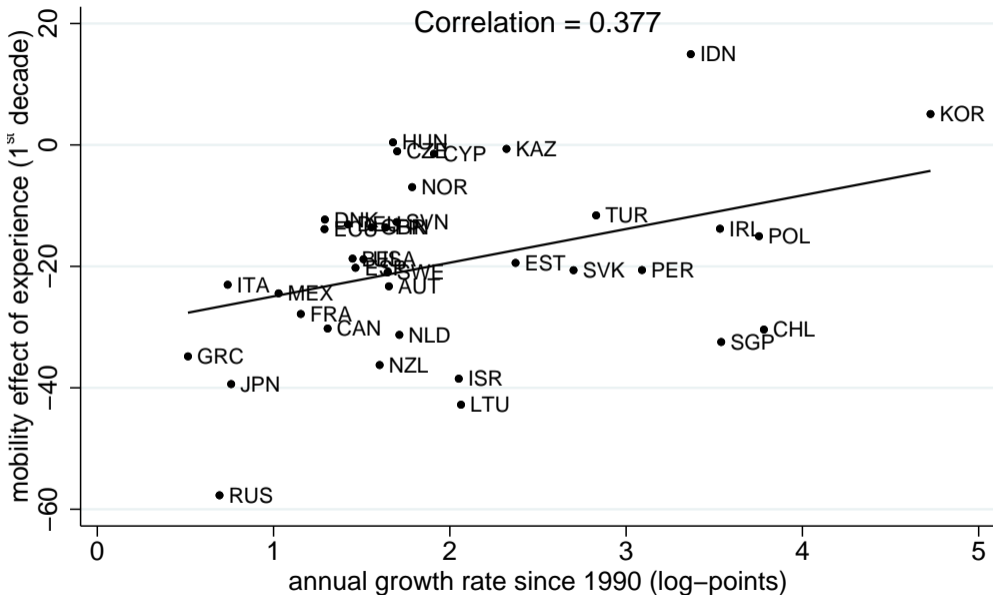
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(1)

Numeracy (std)	-2.175*** (0.509)
× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)
× Mean of ICT use (std)	-
Readiness to learn (std)	-
× growth rate since 1990 (log-points, demeaned)	-
× Mean of ICT use (std)	-
Education (years)	-
× growth rate since 1990 (log-points, demeaned)	-
× Mean of ICT use (std)	-
Industry × occupation	-

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS	
	(1)	(2)
Numeracy (std)	-2.175*** (0.509)	-2.159*** (0.559)
× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)	—
× Mean of ICT use (std)	—	-4.376* (2.580)
Readiness to learn (std)	—	—
× growth rate since 1990 (log-points, demeaned)	—	—
× Mean of ICT use (std)	—	—
Education (years)	—	—
× growth rate since 1990 (log-points, demeaned)	—	—
× Mean of ICT use (std)	—	—
Industry × occupation	—	—

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS		
	(1)	(2)	(3)
Numeracy (std)	-2.175*** (0.509)	-2.159*** (0.559)	-2.155*** (0.456)
× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)	—	1.378*** (0.485)
× Mean of ICT use (std)	—	-4.376* (2.580)	-4.315** (2.051)
Readiness to learn (std)	—	—	—
× growth rate since 1990 (log-points, demeaned)	—	—	—
× Mean of ICT use (std)	—	—	—
Education (years)	—	—	—
× growth rate since 1990 (log-points, demeaned)	—	—	—
× Mean of ICT use (std)	—	—	—
Industry × occupation	—	—	—

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS			
	(1)	(2)	(3)	(4)
Numeracy (std)	-2.175*** (0.509)	-2.159*** (0.559)	-2.155*** (0.456)	-1.594*** (0.491)
× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)	-	1.378*** (0.485)	1.846*** (0.490)
× Mean of ICT use (std)	-	-4.376* (2.580)	-4.315** (2.051)	-5.825*** (1.730)
Readiness to learn (std)	-	-	-	3.153*** (0.402)
× growth rate since 1990 (log-points, demeaned)	-	-	-	-0.360 (0.482)
× Mean of ICT use (std)	-	-	-	2.201 (1.724)
Education (years)	-	-	-	-0.936*** (0.182)
× growth rate since 1990 (log-points, demeaned)	-	-	-	-0.352* (0.204)
× Mean of ICT use (std)	-	-	-	0.157 (0.832)
Industry × occupation	-	-	-	-

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS				
	(1)	(2)	(3)	(4)	(5)
Numeracy (std)	-2.175*** (0.509)	-2.159*** (0.559)	-2.155*** (0.456)	-1.594*** (0.491)	-0.869 (0.536)
× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)	–	1.378*** (0.485)	1.846*** (0.490)	1.628*** (0.439)
× Mean of ICT use (std)	–	-4.376* (2.580)	-4.315** (2.051)	-5.825*** (1.730)	-4.992*** (1.658)
Readiness to learn (std)	–	–	–	3.153*** (0.402)	3.283*** (0.455)
× growth rate since 1990 (log-points, demeaned)	–	–	–	-0.360 (0.482)	-0.315 (0.517)
× Mean of ICT use (std)	–	–	–	2.201 (1.724)	2.219 (1.843)
Education (years)	–	–	–	-0.936*** (0.182)	-0.352* (0.207)
× growth rate since 1990 (log-points, demeaned)	–	–	–	-0.352* (0.204)	-0.311* (0.181)
× Mean of ICT use (std)	–	–	–	0.157 (0.832)	-0.001 (0.678)
Industry × occupation	–	–	–	–	x

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS					2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Summary						
Numeracy (std)	-2.175*** (0.509)	-2.159*** (0.559)	-2.155*** (0.456)	-1.594*** (0.491)	-0.869 (0.536)	12.092*** (2.554)
Theory						
Data						
× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)	-	1.378*** (0.485)	1.846*** (0.490)	1.628*** (0.439)	5.393*** (1.973)
Results						
× Mean of ICT use (std)	-	-4.376* (2.580)	-4.315** (2.051)	-5.825*** (1.730)	-4.992*** (1.658)	-38.801*** (8.977)
Conclusion						
Readiness to learn (std)	-	-	-	3.153*** (0.402)	3.283*** (0.455)	11.946*** (3.634)
Trends						
× growth rate since 1990 (log-points, demeaned)	-	-	-	-0.360 (0.482)	-0.315 (0.517)	-9.759** (3.934)
Size Premia						
× Mean of ICT use (std)	-	-	-	2.201 (1.724)	2.219 (1.843)	17.850** (8.272)
References						
Education (years)	-	-	-	-0.936*** (0.182)	-0.352* (0.207)	-3.474*** (0.374)
× growth rate since 1990 (log-points, demeaned)	-	-	-	-0.352* (0.204)	-0.311* (0.181)	-0.082 (0.284)
× Mean of ICT use (std)	-	-	-	0.157 (0.832)	-0.001 (0.678)	2.170 (1.499)
Industry × occupation	-	-	-	-	x	-

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

	OLS					2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Summary								
	Numeracy (std)	-2.175*** (0.509)	-2.159*** (0.559)	-2.155*** (0.456)	-1.594*** (0.491)	-0.869 (0.536)	12.092*** (2.554)	15.252*** (2.332)
Theory	× growth rate since 1990 (log-points, demeaned)	1.392** (0.595)	-	1.378*** (0.485)	1.846*** (0.490)	1.628*** (0.439)	5.393*** (1.973)	4.211*** (1.634)
Data								
Results	× Mean of ICT use (std)	-	-4.376* (2.580)	-4.315** (2.051)	-5.825*** (1.730)	-4.992*** (1.658)	-38.801*** (8.977)	-35.914*** (8.053)
Conclusion								
	Readiness to learn (std)	-	-	-	3.153*** (0.402)	3.283*** (0.455)	11.946*** (3.634)	11.409*** (3.443)
Trends	× growth rate since 1990 (log-points, demeaned)	-	-	-	-0.360 (0.482)	-0.315 (0.517)	-9.759** (3.934)	-6.897** (3.402)
Size Premia								
References	× Mean of ICT use (std)	-	-	-	2.201 (1.724)	2.219 (1.843)	17.850** (8.272)	10.770* (6.321)
	Education (years)	-	-	-	-0.936*** (0.182)	-0.352* (0.207)	-3.474*** (0.374)	-2.289*** (0.334)
	× growth rate since 1990 (log-points, demeaned)	-	-	-	-0.352* (0.204)	-0.311* (0.181)	-0.082 (0.284)	-0.126 (0.277)
	× Mean of ICT use (std)	-	-	-	0.157 (0.832)	-0.001 (0.678)	2.170 (1.499)	2.542* (1.409)
	Industry × occupation	-	-	-	-	x	-	x

Table: Additional controls: experience, experience², country and interview year. Instruments for numeracy skills and the readiness to learn: parental education and uncompleted qualification programs by country. Robust standard errors in parentheses, adjusted for clustering at the country level. Statistical significance at the 10, 5, and 1 percent level denoted by *, **, and ***, respectively.

Sensitivity Analysis

The negative relation between the mobility effect of skills and ICT use loses its statistical significance if...

- the least advanced economies according to GDP or mean level of skills are excluded: Indonesia, Ecuador, Peru, Mexico, Kazakhstan, Chile, Turkey.
- it is controlled for cross-country differences in the mobility effect of skills and traits by GDP and by the mean level of skills.

The main findings are robust to controlling for cross-country differences in the mobility effect of skills and traits by trade-union density and public employment and to alternative specifications of the growth rate (1990–2007 or 20 years preceding the interview).

Conclusion

Study of how the diffusion of ICT and the associated economic growth relate to turnover in the labor market.

Hypothesis: Growth predominantly raises the job mobility of skilled workers in the early adoption stages but the differential impact fades in the later stages.

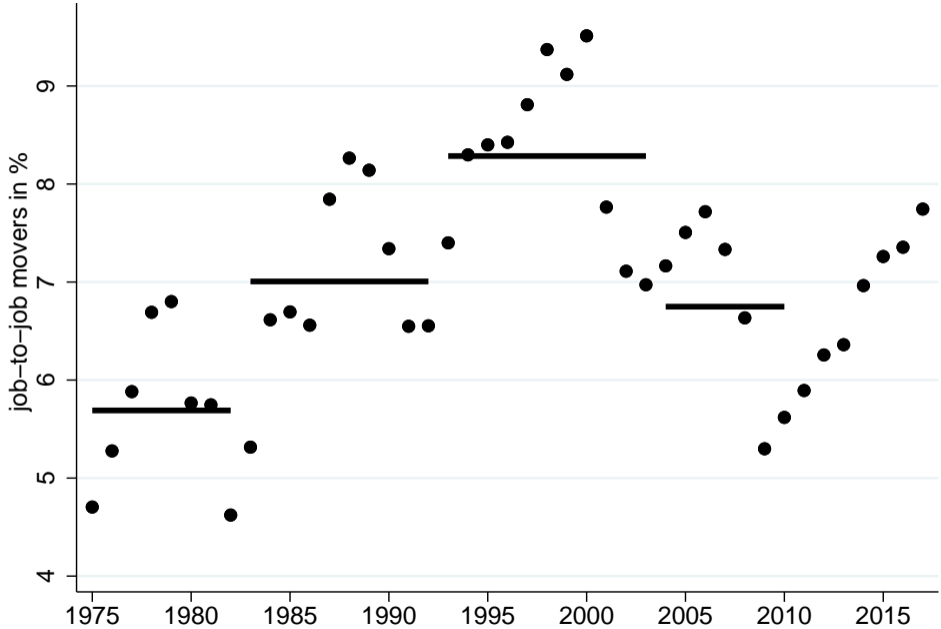
Using a survey that directly assess cognitive skills, I document systematic differences in the effect of skills on job mobility across 37 countries.

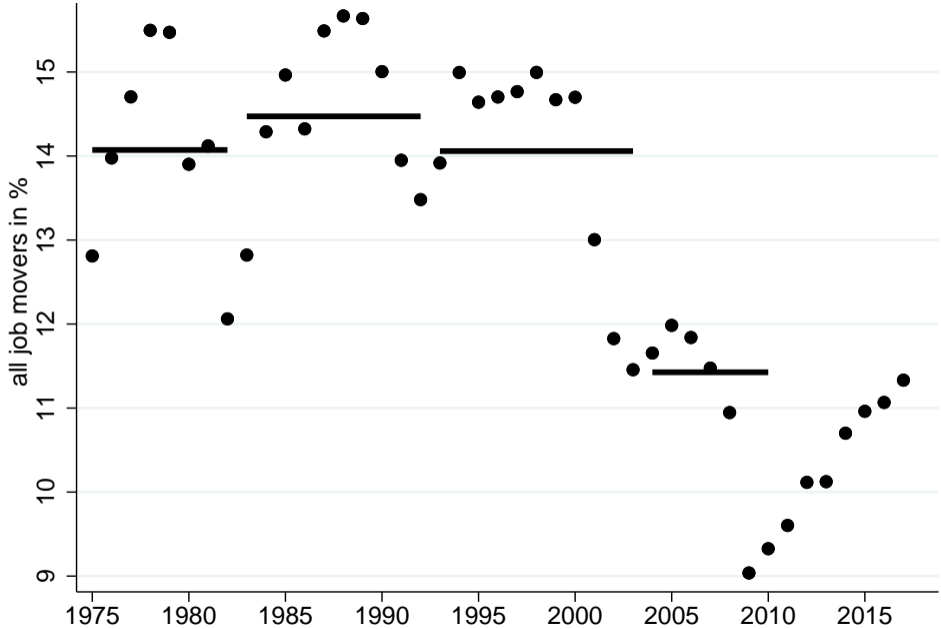
While economic growth is associated with relatively higher job mobility among skilled workers, the prevalence of ICT in the workplace is associated with relatively lower mobility.

Trends and Cycles in U.S. Job Mobility

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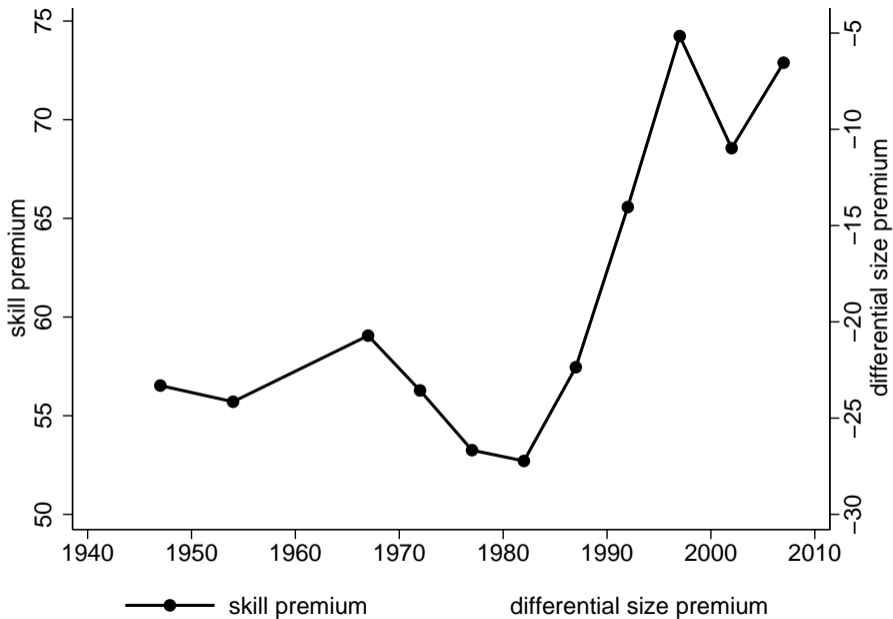


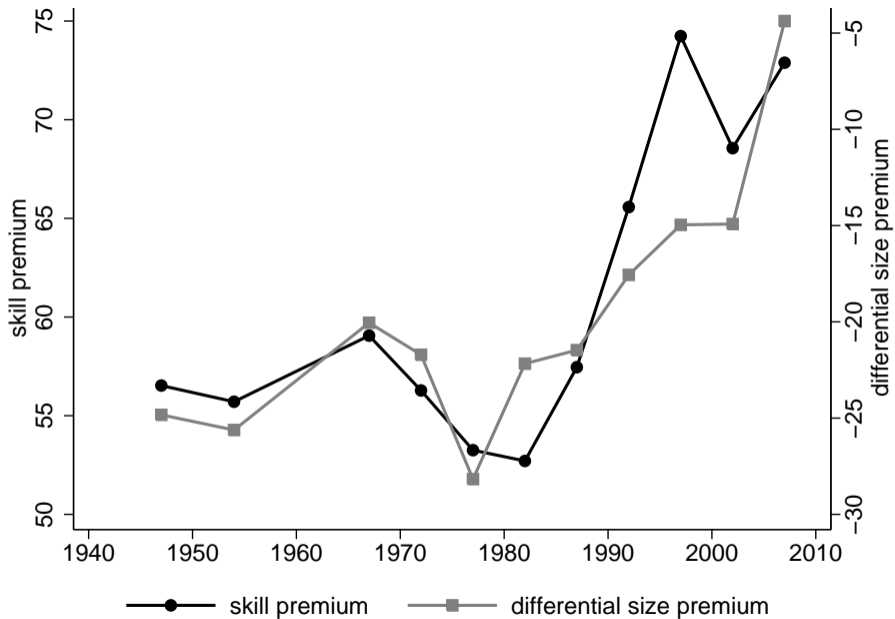


Small Employers, Large Employers and the Skill Premium

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Differential Size Premium

Summary

Theory

Data

Results

Conclusion

Trends

Size Premia

References

“There has been a recurrence of doubts and fears for the future—aroused in this case by the protracted slowdown in productivity growth since the late 1960’s, the seeming erosion of the competitiveness of U.S. industries in world markets, and the spectre of ‘deindustrialization’ and massive structural unemployment.”
(Baumol, 1986)

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