

Are Skills the Key to Economic Success?

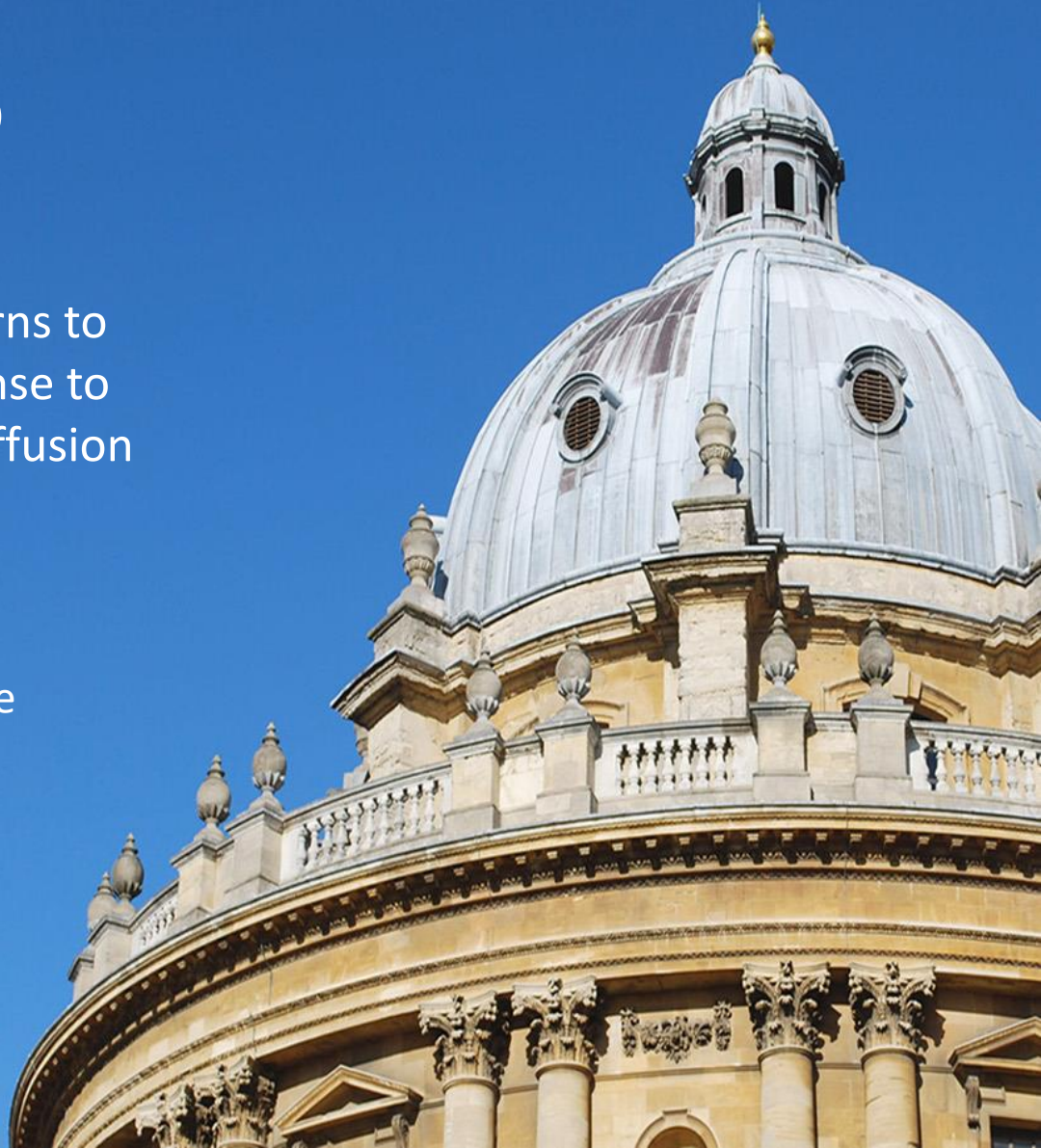
The heterogeneous economic returns to
high skills and credentials in response to
educational expansion and skills diffusion

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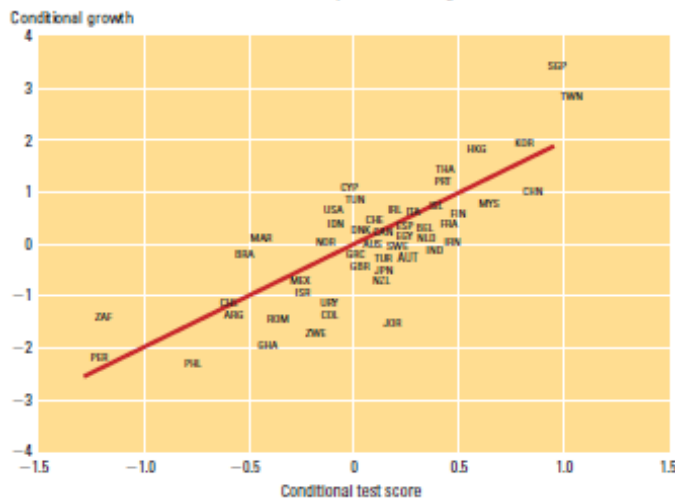
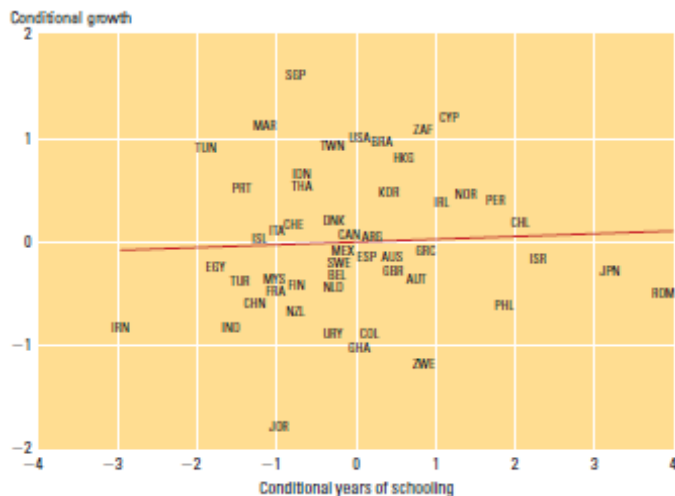
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Recent Research

Skills, rather than educational attainment, are the key to economic success of individuals and societies.



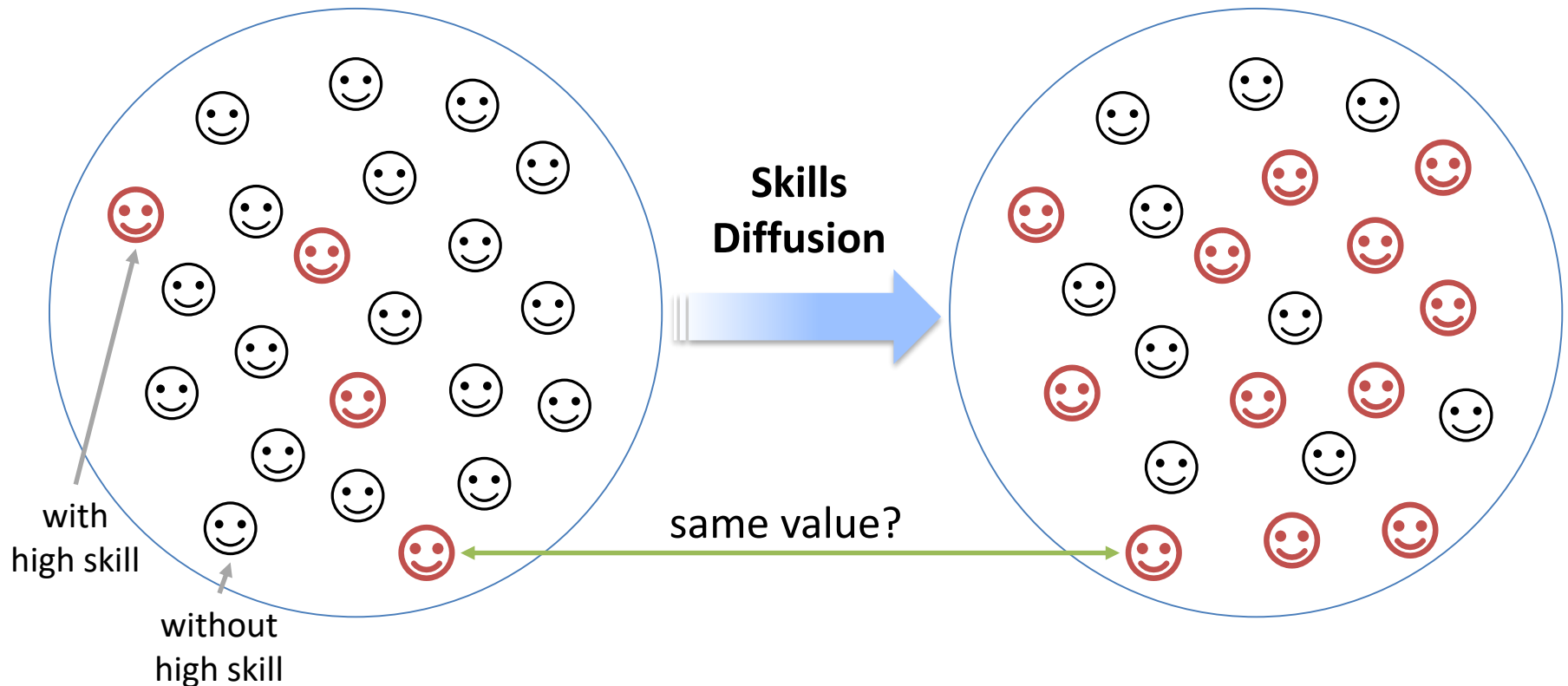
	Pooled	Australia	Austria	Belgium	Canada	Cyprus	Czech R.	Denmark	Estonia	Finland	France	Germany
Numeracy	.102*** (.003)	.128*** (.014)	.120*** (.010)	.089*** (.010)	.129*** (.008)	.057*** (.018)	.074*** (.020)	.085*** (.009)	.116*** (.014)	.079*** (.011)	.094*** (.009)	.148*** (.014)
Years schooling	.059*** (.001)	.061*** (.005)	.058*** (.004)	.045*** (.004)	.057*** (.003)	.082*** (.007)	.045*** (.010)	.043*** (.003)	.055*** (.005)	.057*** (.003)	.041*** (.003)	.064*** (.005)
Experience	.022*** (.001)	.010 (.008)	.016** (.007)	.011* (.006)	.020*** (.004)	.020** (.008)	.015* (.008)	.007* (.004)	.024*** (.009)	.014*** (.005)	.018*** (.005)	.009 (.008)
Experience ²	-.031*** (.003)	-.008 (.016)	-.019 (.013)	-.006 (.013)	-.024*** (.008)	-.009 (.019)	-.029 (.019)	-.006 (.008)	-.069*** (.020)	-.014 (.012)	-.018* (.010)	-.004 (.017)
Female	-.175*** (.005)	-.144*** (.024)	-.119*** (.022)	-.050*** (.017)	-.131*** (.014)	-.193*** (.034)	-.196*** (.033)	-.116*** (.013)	-.442*** (.024)	-.205*** (.015)	-.118*** (.015)	-.125*** (.024)
R ²	.307	.293	.370	.286	.303	.315	.262	.282	.310	.414	.331	.338
Observations	35,854	1,432	1,115	1,219	7,155	938	1,065	1,875	1,767	1,478	1,707	1,296
	Ireland	Italy	Japan	Korea	Netherl.	Norway	Poland	Slovak R.	Spain	Sweden	U.K.	U.S.
Numeracy	.151*** (.021)	.057*** (.016)	.114*** (.015)	.102*** (.015)	.111*** (.012)	.082*** (.008)	.071*** (.015)	.086*** (.018)	.104*** (.018)	.089*** (.010)	.173*** (.016)	.138*** (.022)
Years schooling	.060*** (.007)	.046*** (.004)	.067*** (.006)	.076*** (.005)	.063*** (.006)	.042*** (.003)	.090*** (.006)	.084*** (.006)	.066*** (.004)	.026*** (.004)	.061*** (.007)	.081*** (.007)
Experience	.030*** (.011)	.011 (.007)	.022*** (.007)	.025*** (.005)	.027*** (.006)	.023*** (.005)	.027*** (.007)	.013 (.012)	.021*** (.007)	.017*** (.004)	.009 (.009)	.015* (.008)
Experience ²	-.040 (.024)	.007 (.017)	-.009 (.018)	-.019 (.015)	-.044*** (.014)	-.042*** (.011)	-.044** (.017)	-.023 (.026)	-.024 (.015)	-.028*** (.010)	-.009 (.019)	-.028* (.016)
Female	-.029 (.033)	-.168*** (.026)	-.308*** (.026)	-.314*** (.028)	-.022 (.022)	-.137*** (.014)	-.216*** (.028)	-.282*** (.027)	-.111*** (.025)	-.109*** (.014)	-.107*** (.026)	-.228*** (.032)
R ²	.286	.278	.381	.438	.337	.297	.410	.323	.392	.252	.301	.420
Observations	1,031	1,018	1,322	1,441	1,013	1,519	816	1,198	1,190	1,316	1,671	983

Source:

Hanushek, Eric A. and Ludger Woessmann. 2007. *Education Quality and Economic Growth*. Washington, D.C.: World Bank.
 Hanushek, Eric A., Guido Schwerdt, Simon Wiederhold, and Ludger Woessmann. 2015. "Returns to Skills around the World: Evidence from PIAAC." *European Economic Review* 73:103–30.

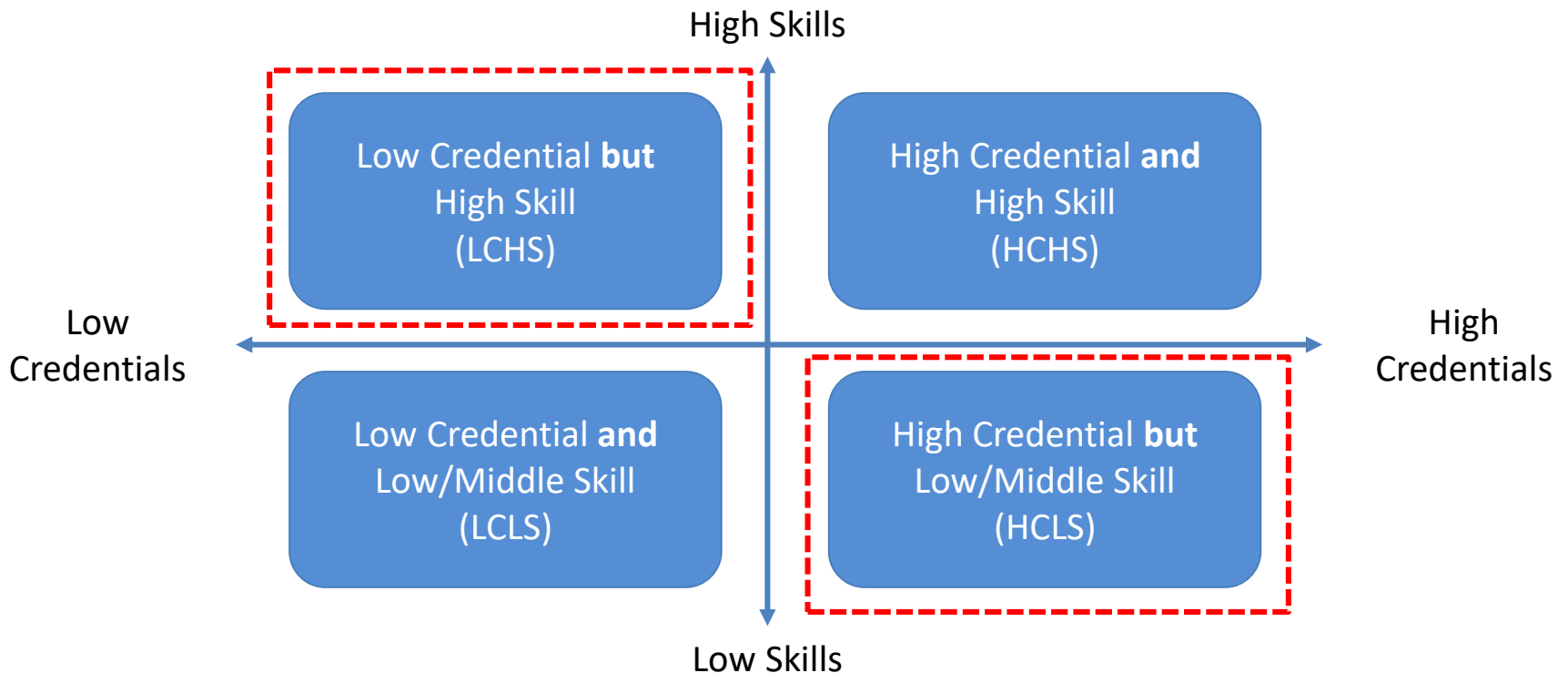
The economic values of skills might vary depending on their relativity/positionality within wider societal contexts.

1) Don't skills lose their returns as their scarcity diminishes due to skills diffusion?



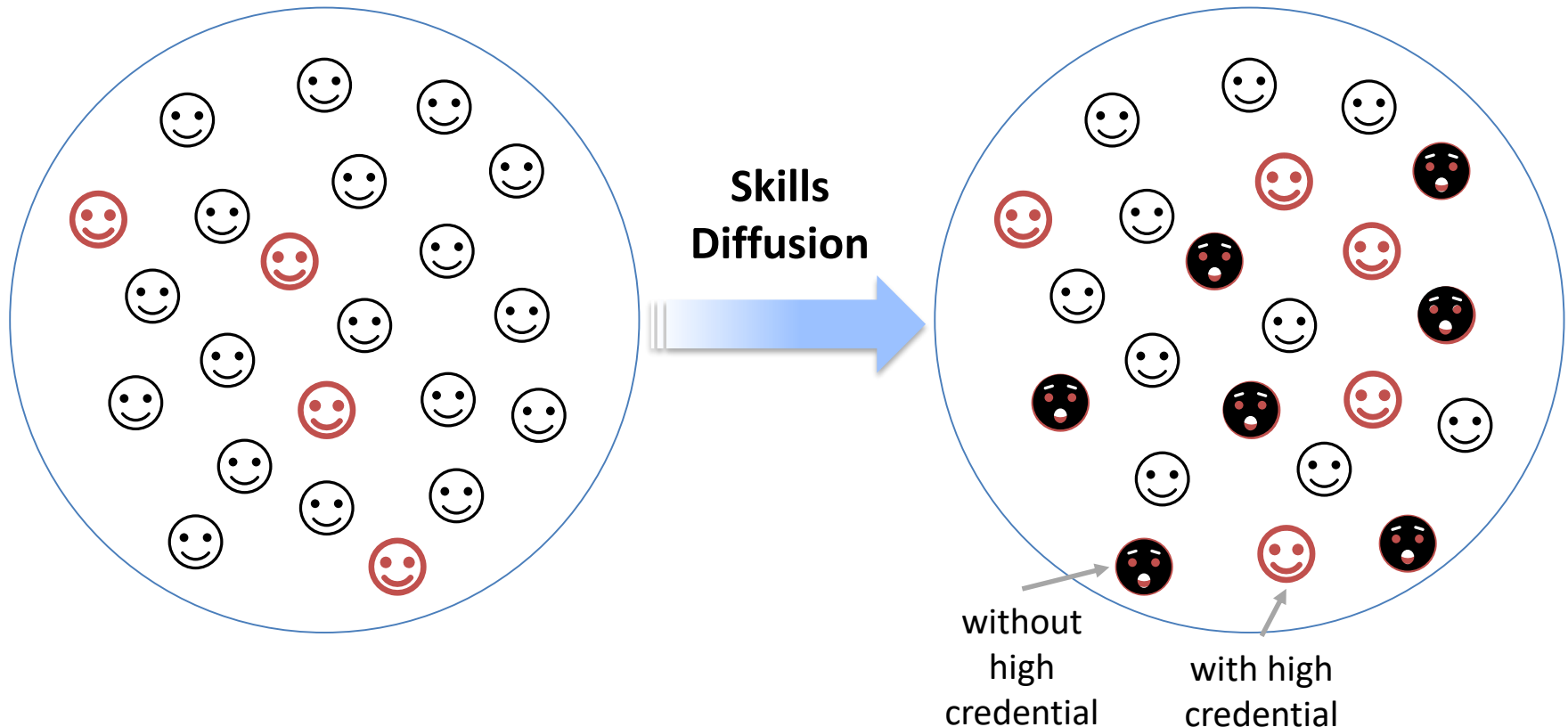
The economic values of skills might vary depending on their relativity/positionality within wider societal contexts.

- 2) Does the impact of skills outweigh that of educational credentials (not years of schooling)?

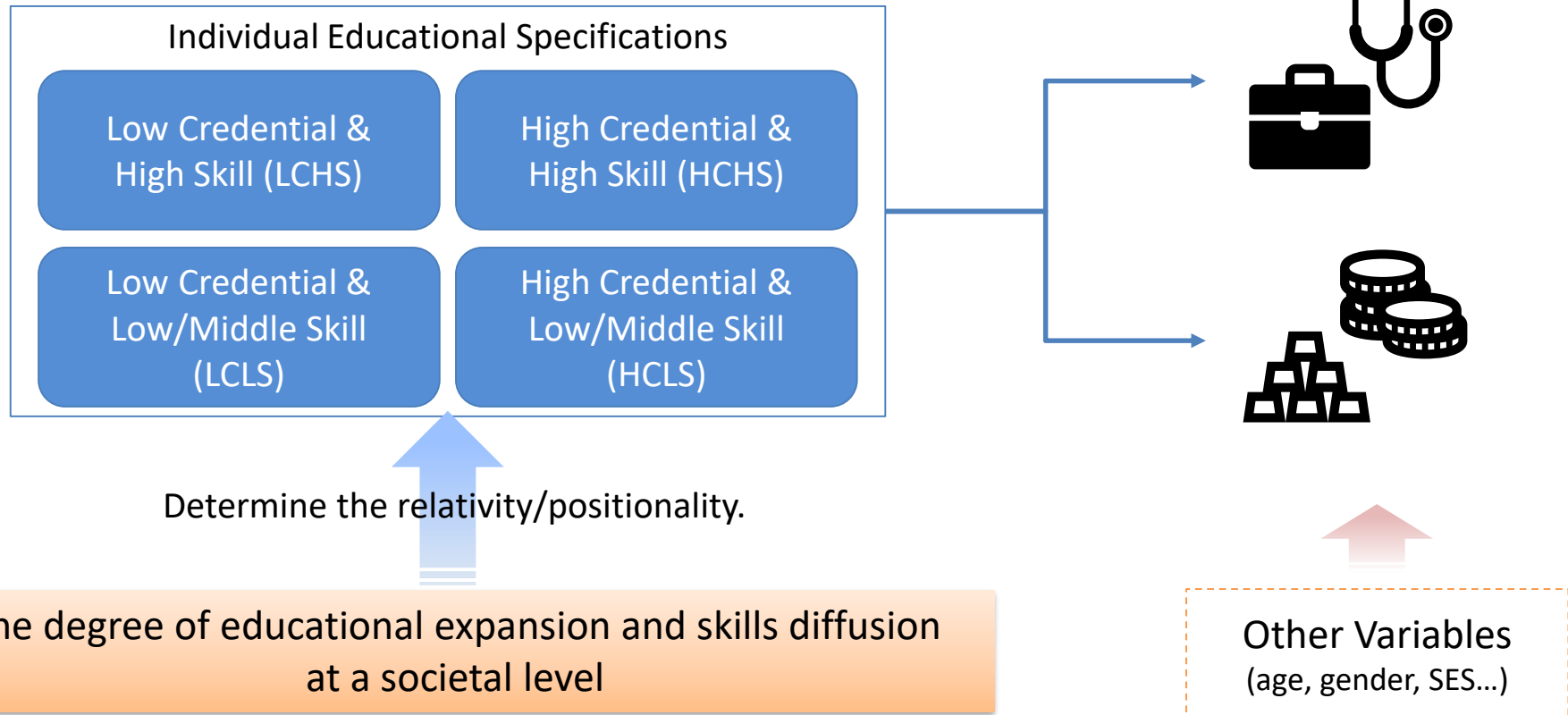


Missing Perspectives

If education policies merely aim to increase highly skilled people without attention to this relativity/positionality, individuals with high skills might be penalized, rather than rewarded, due to small/diminishing value of skills.



How do individual skills and credentials (educational specifications) affect economic rewards in association with societal educational expansion and skills diffusion?



Data

PIAAC: over 100,000 individuals in 26 countries.

Method

Multilevel logistic regression analysis
(skilled occupations: binary)
(earnings quintiles: ordered)

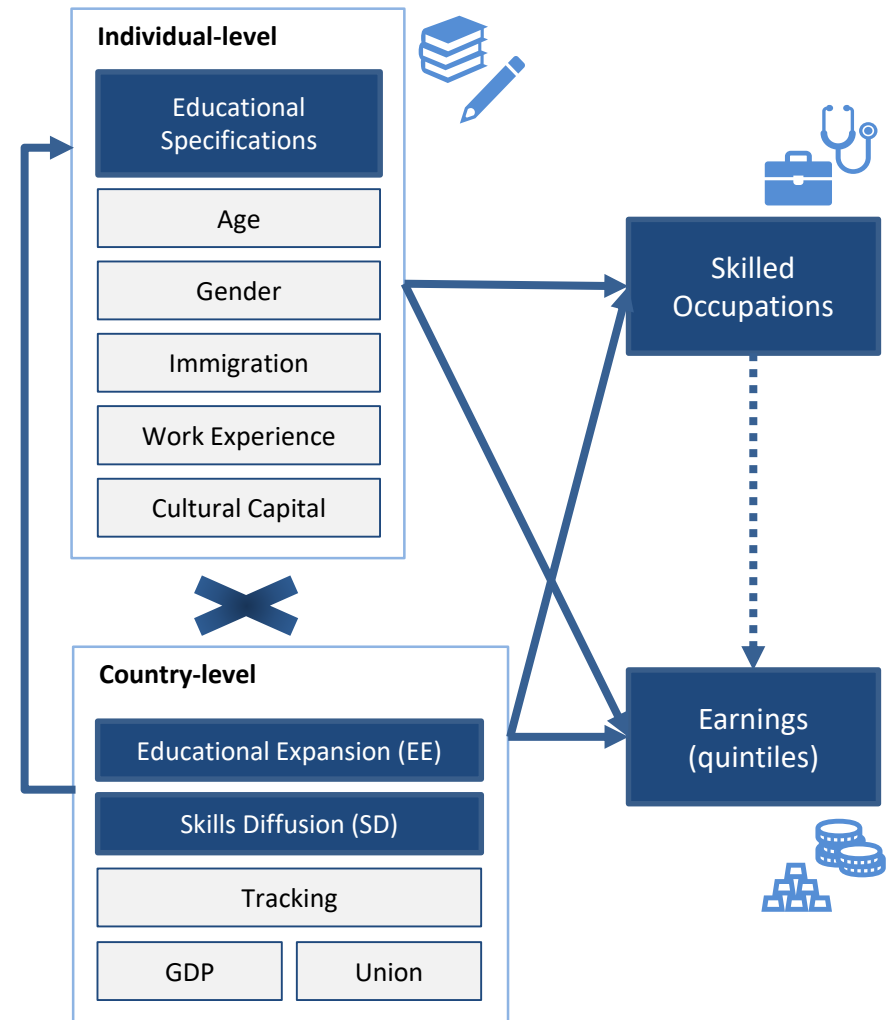
Variables

[Individual-level]

High Skill: PIAAC proficiency level 4 or 5
High Credential: ISCED 2011 Level 5 and above
Age: 5 cohort dummies, Gender: male dummy
Immigration: first generation immigrant dummy
Work Experience: years of paid work
Cultural capital: parental education and books

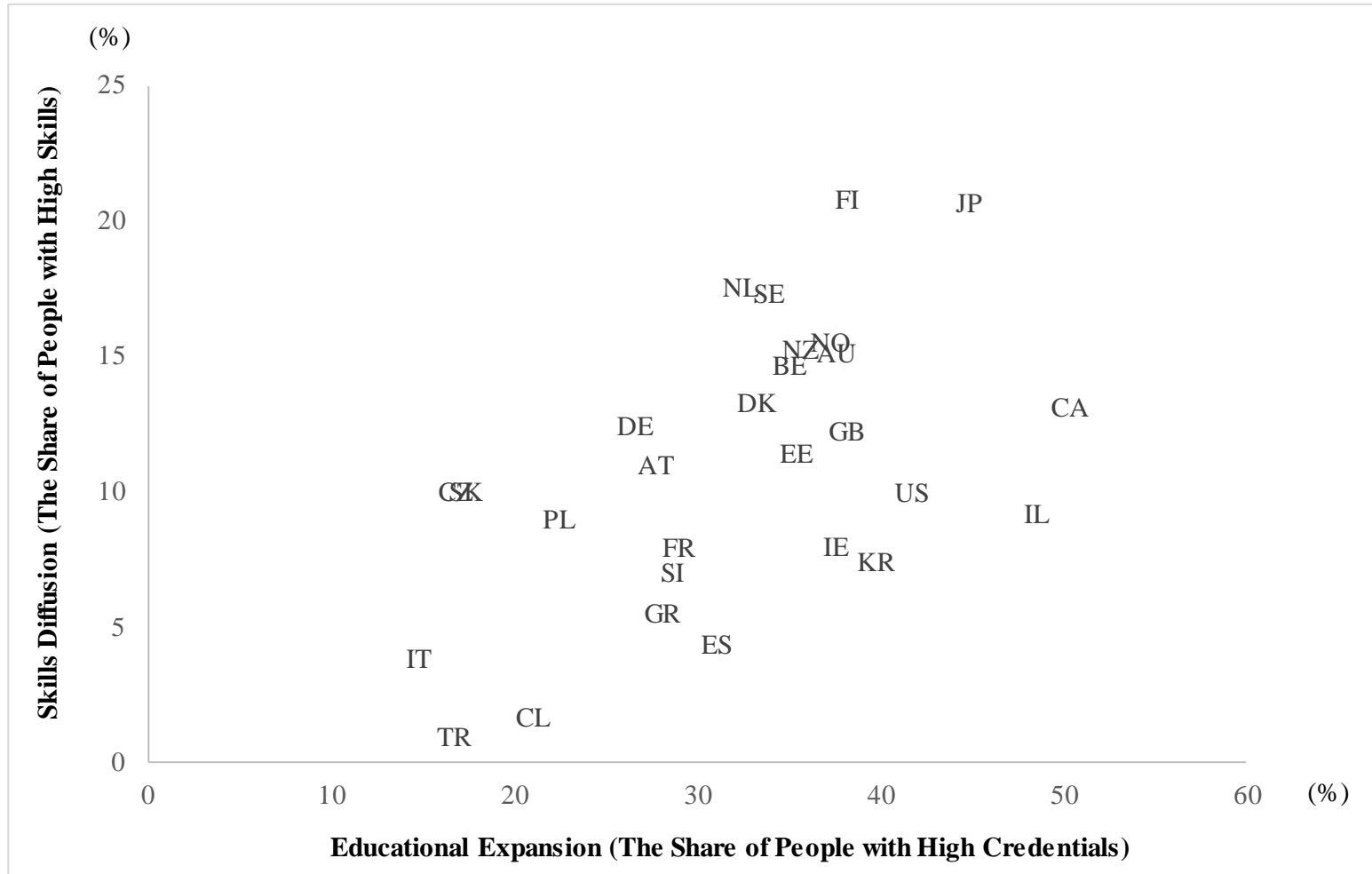
[Country-level]

Educational Expansion/Skills Diffusion:
the share of population with high credential/skill
Tracking: index of the strength of tracking*
GDP: per capita (PPP), Union: union density



*Bol, Thijs and Herman G. van de Werfhorst. 2013. "Educational Systems and the Trade-Off between Labor Market Allocation and Equality of Educational Opportunity." *Comparative Education Review* 57(2):285-308.

The Degree of Educational Expansion and Skills Diffusion in OECD Countries



Source: OECD.Stat (<http://stats.oecd.org/>) [Accessed: 1 August 2018] and OECD (2016) *Skills Matter: Further Results from the Survey of Adult Skills*. Paris: OECD Publishing.

Skilled Occupations:
Multilevel Binary
Logistic Regression
(Model 3)

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = b_{0j} + b_1M_{ij} + b_2A_{(over\ 55)ij} + b_3A_{(45-54)ij} + b_4A_{(35-44)ij} + b_5A_{(25-34)ij} + b_6I_{ij} + b_7C_{ij} + b_8W_{ij} + b_9HCHS_{ij} + b_{10}HCLS_{ij} + b_{11}LCHS_{ij} \dots (1)$$

where i = level one (individual), j = level two (country),

p_{ij} = the probability of doing skilled occupations for individual i in country j

b_n = coefficient of individual level independent variables

M_{ij} = male dummy, $A_{(n)ij}$ = cohort dummy (age categories),

I_{ij} = first generation immigrant dummy, C_{ij} = cultural capital, W_{ij} = years of paid work,

$HCHS_{ij}$ = HCHS dummy, $HCLS_{ij}$ = HCLS dummy, $LCHS_{ij}$ = LCHS dummy,

$$b_{0j} = \gamma_{00} + \gamma_{01}E_j + \gamma_{02}S_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + u_{0j} \dots (2)$$

where γ_{00} = average intercept,

γ_{0n} = coefficient of country level independent variables,

E_j = the degree of educational expansion, S_j = the degree of skills diffusion,

T_j = index of tracking, G_j = GDP per capita, U_j = union density, u_{0j} = country (j) dependent deviation

Substitute Equation (2) into Equation (1), and denote b_n by γ_{n0} .

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(over\ 55)ij} + \gamma_{30}A_{(45-54)ij} + \gamma_{40}A_{(35-44)ij} + \gamma_{50}A_{(25-34)ij} + \gamma_{60}I_{ij} + \gamma_{70}C_{ij} + \gamma_{80}W_{ij} + \gamma_{90}HCHS_{ij} + \gamma_{100}HCLS_{ij} + \gamma_{110}LCHS_{ij} + \gamma_{01}E_j + \gamma_{02}S_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + u_{0j} \dots (3)$$

Add cross-level interaction terms to Equation (3).

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(over\ 55)ij} + \gamma_{30}A_{(45-54)ij} + \gamma_{40}A_{(35-44)ij} + \gamma_{50}A_{(25-34)ij} + \gamma_{60}I_{ij} + \gamma_{70}C_{ij} + \gamma_{80}W_{ij} + \gamma_{90}HCHS_{ij} + \gamma_{100}HCLS_{ij} + \gamma_{110}LCHS_{ij} + \gamma_{01}E_j + \gamma_{02}S_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + \gamma_{91}HCHS_{ij}E_j + \gamma_{101}HCLS_{ij}E_j + \gamma_{111}LCHS_{ij}E_j + \gamma_{92}HCHS_{ij}S_j + \gamma_{102}HCLS_{ij}S_j + \gamma_{112}LCHS_{ij}S_j + u_{0j}$$

Main effects of individual educational specifications

Change in effects of individual educational specifications in association with societal educational expansion

Change in effects of individual educational specifications in association with societal skills diffusion

Earnings Quintiles: Multilevel Ordered Logistic Regression (Model 3)

$$Y_{ij}^* = \beta_0j + \beta_1M_{ij} + \beta_2A_{(over\ 55)ij} + \beta_3A_{(45-54)ij} + \beta_4A_{(35-44)ij} + \beta_5A_{(25-34)ij} + \beta_6I_{ij} + \beta_7C_{ij} + \beta_8W_{ij} + \beta_9HCHS_{ij} + \beta_{10}HCLS_{ij} + \beta_{11}LCHS_{ij} + \varepsilon_{ij} \quad \dots \quad (1)$$

where i = level one (individual), j = level two (country),

Y_{ij}^* = latent response for individual i in country j ,

and an observed response Y_{ij} (earnings quintiles) can be determined by thresholds (τ_n):

$$Y_{ij} = \begin{cases} 1 & \text{if } Y_{ij}^* \leq \tau_1 \\ 2 & \text{if } \tau_1 < Y_{ij}^* \leq \tau_2 \\ 3 & \text{if } \tau_2 < Y_{ij}^* \leq \tau_3 \\ 4 & \text{if } \tau_3 < Y_{ij}^* \leq \tau_4 \\ 5 & \text{if } \tau_4 < Y_{ij}^* \end{cases}$$

β_n = coefficient of individual level independent variables

M_{ij} = male dummy, $A_{(n)ij}$ = cohort dummy (age categories),

I_{ij} = first generation immigrant dummy, C_{ij} = cultural capital, W_{ij} = years of paid work,

$HCHS_{ij}$ = HCHS dummy, $HCLS_{ij}$ = HCLS dummy, $LCHS_{ij}$ = LCHS dummy,

ε_{ij} = residual for individual i in country j

$$\beta_0j = \gamma_{00} + \gamma_{01}E_j + \gamma_{02}S_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + u_{0j} \quad \dots \quad (2)$$

where γ_{00} = average intercept

γ_{0n} = coefficient of country level independent variables

E_j = the degree of educational expansion, S_j = the degree of skills diffusion,

T_j = index of tracking, G_j = GDP per capita, U_j = union density, u_{0j} = country (j) dependent deviation

Substitute Equation (2) into Equation (1), and denote β_n by γ_{0n} .

$$Y_{ij}^* = \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(over\ 55)ij} + \gamma_{30}A_{(45-54)ij} + \gamma_{40}A_{(35-44)ij} + \gamma_{50}A_{(25-34)ij} + \gamma_{60}I_{ij} + \gamma_{70}C_{ij} + \gamma_{80}W_{ij} + \gamma_{90}HCHS_{ij} + \gamma_{100}HCLS_{ij} + \gamma_{110}LCHS_{ij} + \gamma_{01}E_j + \gamma_{02}S_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + u_{0j} + \varepsilon_{ij} \quad \dots \quad (3)$$

Add cross-level interaction terms to Equation (3).

$$Y_{ij}^* = \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(over\ 55)ij} + \gamma_{30}A_{(45-54)ij} + \gamma_{40}A_{(35-44)ij} + \gamma_{50}A_{(25-34)ij} + \gamma_{60}I_{ij} + \gamma_{70}C_{ij} + \gamma_{80}W_{ij} + \gamma_{90}HCHS_{ij} + \gamma_{100}HCLS_{ij} + \gamma_{110}LCHS_{ij} + \gamma_{01}E_j + \gamma_{02}S_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + \gamma_{91}HCHS_{ij}E_j + \gamma_{101}HCLS_{ij}E_j + \gamma_{111}LCHS_{ij}E_j + \gamma_{92}HCHS_{ij}S_j + \gamma_{102}HCLS_{ij}S_j + \gamma_{112}LCHS_{ij}S_j + u_{0j} + \varepsilon_{ij}$$

Main effects of individual educational specifications

Change in effects of individual educational specifications in association with societal educational expansion

Change in effects of individual educational specifications in association with societal skills diffusion

Target Countries and the Number of Respondents

Country	Round	Respondents		Country	Round	Respondents	
		Occupation	Earning			Occupation	Earning
Austria	1	4,300	3,280	Japan	1	4,102	3,601
Belgium	1	3,848	2,949	South Korea	1	5,236	4,198
Canada	1	23,349	18,011	Netherlands	1	4,440	3,550
Chile	2	4,237	3,054	New Zealand	2	5,376	4,187
Czech Republic	1	4,841	2,996	Norway	1	4,026	3,412
Denmark	1	6,585	4,959	Poland	1	6,659	4,261
Finland	1	4,839	3,633	Slovak Republic	1	4,186	2,876
France	1	5,454	3,985	Slovenia	2	3,728	2,324
Germany	1	4,583	3,682	Spain	1	4,612	2,780
Greece	2	3,344	1,670	Sweden	1	3,973	3,133
Ireland	1	4,840	3,274	Turkey	2	2,881	1,914
Israel	2	3,951	2,785	United Kingdom	1	7,049	5,420
Italy	1	3,411	2,237	United States	1	4,313	3,225

Total Number of Respondents: Occupation Analysis=138,163. Earnings Analysis=101,396

Note: Samples are limited to valid cases for the analysis of skilled occupations and that of earnings quintiles respectively. Some participating countries, for which country-level data are unavailable, are excluded.

Descriptive Statistics

Variables	Skilled Occupations				Earnings Quintiles			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Individual Level								
High Credential and High Skills	0.08	0.27	0.00	1.00	0.09	0.29	0.00	1.00
High Credential without High Skills	0.29	0.45	0.00	1.00	0.31	0.46	0.00	1.00
High Skills without High Credential	0.04	0.18	0.00	1.00	0.04	0.18	0.00	1.00
Neither High Credential nor High Skills	0.60	0.49	0.00	1.00	0.56	0.50	0.00	1.00
Gender (male dummy)	0.50	0.50	0.00	1.00	0.51	0.50	0.00	1.00
Cohort: 16-24 years old	0.15	0.36	0.00	1.00	0.13	0.34	0.00	1.00
Cohort: 25-34 years old	0.21	0.41	0.00	1.00	0.22	0.42	0.00	1.00
Cohort: 35-44 years old	0.23	0.42	0.00	1.00	0.25	0.43	0.00	1.00
Cohort: 45-54 years old	0.22	0.41	0.00	1.00	0.24	0.43	0.00	1.00
Cohort: 55-65 years old	0.19	0.39	0.00	1.00	0.16	0.37	0.00	1.00
First Generation Immigrant	0.11	0.31	0.00	1.00	0.11	0.31	0.00	1.00
Cultural Capital	0.05	2.29	-3.30	17.10	0.08	2.29	-3.30	17.10
Years of Paid Work	18.23	13.03	0.00	55.00	18.51	12.34	0.00	55.00
Skilled Occupation	0.41	0.49	0.00	1.00	0.44	0.50	0.00	1.00
Semi-skilled White Collar	-	-	-	-	0.29	0.45	0.00	1.00
Semi-skilled Blue Collar	-	-	-	-	0.19	0.39	0.00	1.00
Elementary Occupation	-	-	-	-	0.08	0.27	0.00	1.00
Earnings Quintiles	-	-	-	-	2.98	1.42	1.00	5.00
Country Level								
Educational Expansion	31.44	9.58	13.12	50.31	31.44	9.58	13.12	50.31
Skills Diffusion	10.75	5.20	0.99	20.81	10.75	5.20	0.99	20.81
Index of Tracking	-0.01	0.97	-1.31	1.79	-0.01	0.97	-1.31	1.79
GDP per capita (USD, PPP)	35080.98	9065.94	20562.26	57998.85	35080.98	9065.94	20562.26	57998.85
Union Density	28.48	17.96	7.74	68.61	28.48	17.96	7.74	68.61
Observations	Individuals=138,163 Countries=26				Individuals=101,396 Countries=26			

Note: The reference years of “GDP per capita” are 2010 for PIAAC round 1 countries and 2013 or 2014 for PIAAC round 2 countries. “Educational Expansion” and “Union Density” are based on the data in 2010, while “Skills Diffusion” and individual-level variables refers to years in which each country participated in PIAAC. For “Index of Tracking,” see Bol and van de Werfhorst (2013).

Limitation/Further Development

- A cross-country multilevel modelling is employed.
 - Country-specific analyses using longitudinal data are meaningful.
- The scope of high credentials is broad.
 - Variation across types of tertiary degrees (vocational orientation, prestige, fields of study etc.) should be investigated further.
- The scope of high skills is limited to general information-processing skills.
 - Occupation-specific skills and non-cognitive skills should be accounted for further. Continuous variables, instead of categorical ones, could be worth investigating.
- The scope of skilled occupations is broad.
 - Variation across occupations should be investigated (especially by country).
- Earnings are quantified by quintiles.
 - Absolute values (logarithm) of earnings could be analysed for comparison.
- Individual backgrounds are used just as control variables.
 - Detailed analyses by gender, cohort, etc. are meaningful.
- Causality is not necessarily tested.
 - Reverse causation as well as path should be investigated using longitudinal data.

Extracts from the final model (occupation analysis)

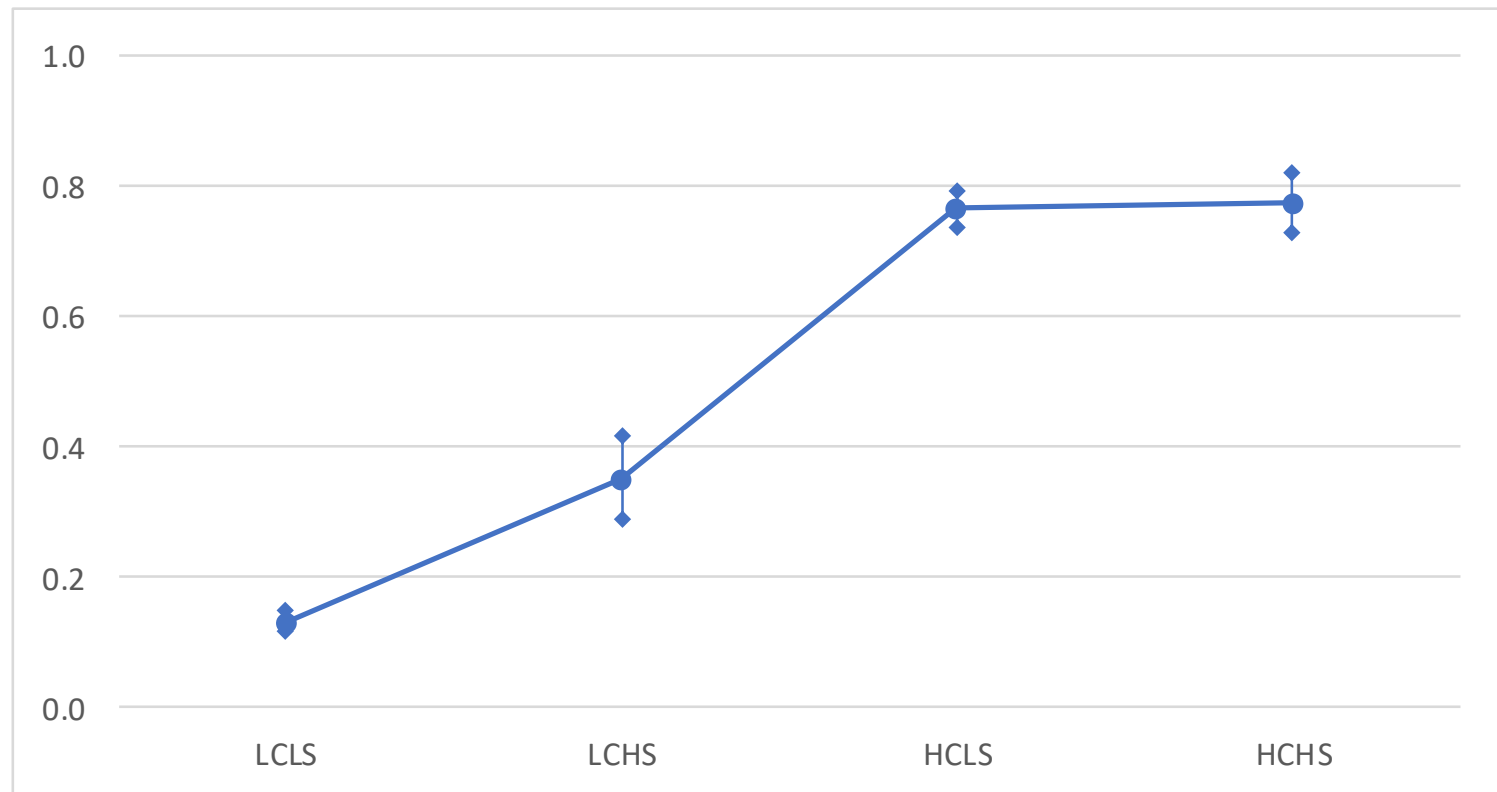
Independent Variable		Skilled Occupation (Model 3)		
		B		S.E.
Level One (Individual)	Educational Specifications: Reference = Neither High Credentials nor High Skills			
	High Credentials & High Skills (HCHS)	3.128	***	0.126
	Only High Credentials without High Skills (HCLS)	3.074	***	0.056
	Only High Skills without High Credentials (LCHS)	1.266	***	0.130
Cross-Level Interactions	Educational Expansion * HCHS	-0.020	***	0.003
	Educational Expansion * HCLS	-0.032	***	0.002
	Educational Expansion * LCHS	-0.006		0.004
	Skills Diffusion * HCHS	0.017	*	0.007
	Skills Diffusion * HCLS	0.009	*	0.004
	Skills Diffusion * LCHS	-0.013		0.009
Level Two (Country)	Educational Expansion	-0.001		0.011
	Skills Diffusion	0.003		0.018
	Index of Tracking	0.093		0.092
	GDP per capita (USD, PPP)/10,000	0.242	*	0.098
	Union Density	-0.001		0.004
Control Variables (Individual)	Gender		Yes	
	Age (Cohorts)		Yes	
	Immigrant Background		Yes	
	Cultural Capital		Yes	
	Years of Paid Work		Yes	
Variance	Random Effect Covariance Structure (Intercept)	0.121	**	
Model Fit	-2LL	646339.345		
	AIC	646341.345		

Both HC & HS contribute to occupational attainment.

But the impact of credentials far outweighs that of skills.

Marginal Effects of Educational Specifications (occupation analysis)

- Tertiary graduates enjoy a high probability of obtaining skilled occupations regardless of skills level (i.e. both HCHS and HCLS).
- High skills per se modestly enhance occupational rewards only when individuals do not possess high credentials (i.e. LCHS).



Extracts from the final model (occupation analysis)

Independent Variable		Skilled Occupation (Model 3)		
		B		S.E.
Level One (Individual)	Educational Specifications: Reference = Neither High Credentials nor High Skills			
	High Credentials & High Skills (HCHS)	3.128	***	0.126
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	Only High Skills without High Credentials (LCHS)	1.266	***	0.130
Cross-Level Interactions	Educational Expansion * HCHS	-0.020	***	0.003
	Educational Expansion * HCLS	-0.032	***	0.002
	Educational Expansion * LCHS	-0.006		0.004
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	Union Density	-0.001		0.004
Control Variables (Individual)	Gender		Yes	
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	Immigrant Background		Yes	
	Cultural Capital		Yes	
	Years of Paid Work		Yes	
Variance	Random Effect Covariance Structure (Intercept)	0.121	**	
Model Fit	-2LL	646339.345		
	AIC	646341.345		

Impact of credentials becomes smaller due to EE.

Impact of credentials becomes larger due to SD.

Impact of skills per se is not significantly influenced by SD.

Extracts from the final model (earnings quintiles)

Independent Variable		Earnings Quintiles (Model 4)		
		β		S.E.
Level One (Individual)	Educational Specifications: Reference = Neither High Credentials nor High Skills			
	High Credentials & High Skills (HCHS)	1.700	***	0.100
	Only High Credentials without High Skills (HCLS)	1.289	***	0.050
	Only High Skills without High Credentials (LCHS)	0.925	***	0.133
Cross-Level Interactions	Educational Expansion * HCHS	-0.003		0.002
	Educational Expansion * HCLS	-0.006	***	0.001
	Educational Expansion * LCHS	-0.015	***	0.004
	Skills Diffusion * HCHS	-0.027	***	0.005
	Skills Diffusion * HCLS	-0.025	***	0.003
	Skills Diffusion * LCHS	-0.011		0.008
Level Two (Country)	Educational Expansion	0.000		0.005
	Skills Diffusion	-0.014		0.007
	Index of Tracking	0.001		0.038
	GDP per capita (USD, PPP)/10,000	-0.012		0.040
	Union Density	-0.001		0.002
Control Variables (Individual)	Gender			Yes
	Age (Cohorts)			Yes
	Immigrant Background			Yes
	Cultural Capital			Yes
	Years of Paid Work			Yes
	Occupations			Yes
Variance	Random Effect Covariance Structure (Intercept)	0.019	**	
Model Fit	-2LL	1360074.137		
	AIC	1360076.137		

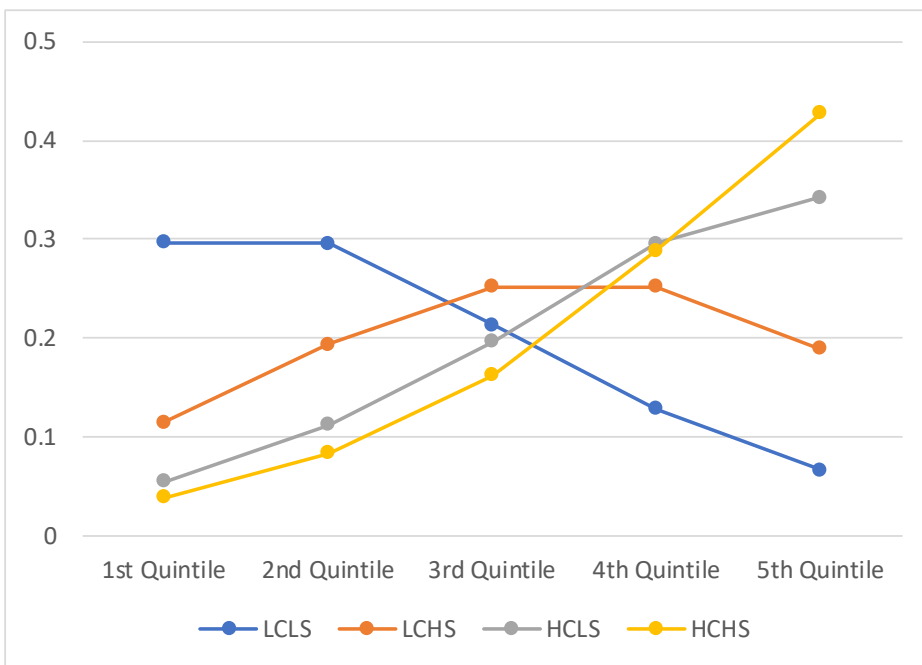
Both HC & HS contribute to better earnings.

But the impact of credentials outweighs that of skills.

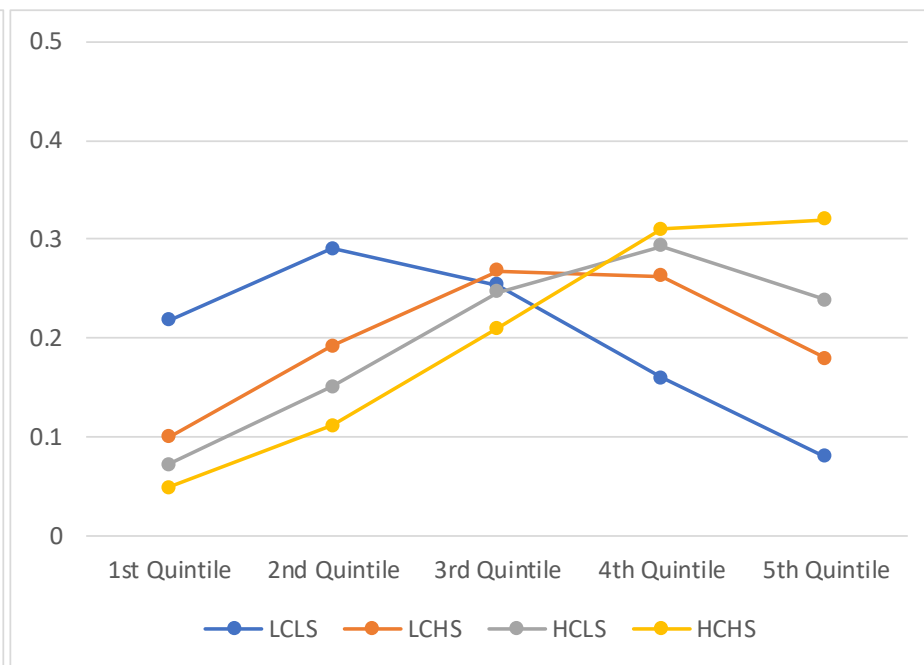
Marginal Effects of Educational Specifications (earnings analysis)

- Tertiary graduates (especially HCHS) enjoy a high probability of falling into higher earnings quintiles.
- The contribution of high skills per se (i.e. LCHS) starts diminishing in line with LCLS after passing the third quintile.

Model 3 (exclude occupations)



Model 4 (include occupations)



Extracts from the final model (earnings quintiles)

Independent Variable		Earnings Quintiles (Model 4)			Impact of mere credentials and skills becomes smaller due to EE.
		β		S.E.	
Level One (Individual)	Educational Specifications: Reference = Neither High Credentials nor High Skills				
	High Credentials & High Skills (HCHS)	1.700	***	0.100	
	Only High Credentials without High Skills (HCLS)	1.289	***	0.050	
	Only High Skills without High Credentials (LCHS)	0.925	***	0.133	
Cross-Level Interactions	Educational Expansion * HCHS	-0.003		0.002	
	Educational Expansion * HCLS	-0.006	***	0.001	Impact of credentials becomes smaller due to SD.
	Educational Expansion * LCHS	-0.015	***	0.004	
	Skills Diffusion * HCHS	-0.027	***	0.005	
	Skills Diffusion * HCLS	-0.025	***	0.003	
	Skills Diffusion * LCHS	-0.011		0.008	
Level Two (Country)	Educational Expansion	0.000		0.005	Impact of skills per se is not significantly influenced by SD.
	Skills Diffusion	-0.014		0.007	
	Index of Tracking	0.001		0.038	
	GDP per capita (USD, PPP)/10,000	-0.012		0.040	
	Union Density	-0.001		0.002	
Control Variables (Individual)	Gender			Yes	
	Age (Cohorts)			Yes	
	Immigrant Background			Yes	
	Cultural Capital			Yes	
	Years of Paid Work			Yes	
	Occupations			Yes	
Variance	Random Effect Covariance Structure (Intercept)			0.019 **	
Model Fit	-2LL			1360074.137	
	AIC			1360076.137	

(*** p<0.001, ** p<0.01, * p<0.05) [two tailed] [N: Individual=101,396, Country=26]

Main Findings

1. Both high skills and high credentials contribute to obtaining prestigious jobs and better earnings, regardless of their combination.
2. In particular, the impact of high credentials far outweighs that of high skills. This means that, if individuals attempt to acquire high skills *instead of* high credentials, they would be penalized rather than rewarded.
3. As the scarcity of high credentials decreases in response to educational expansion, returns to high credentials diminish.
4. High skills do not lose their rewards even though their scarcity declines due to skills diffusion. This suggests that high skills operate as absolute goods.
5. From a comparative perspective, in association with skills diffusion, the effect of high credentials on occupational attainment is intensified whereas that on earnings is undermined. What does this inconsistency imply?



* Although the skills-based earnings distribution can be realized even in a society where the degree of skills diffusion is limited, the amount of HS is not adequate for employers to stop rewarding high credentials (and shift its earnings distribution mechanism).

* This explanation is based on the assumption of the flow from education to monetary rewards via occupations. However, it is important to note that these elements interact with each other in reality and that earnings can be generated without obtaining occupational outcomes.

- The meritocratic earnings distribution may be intensified as skills diffusion progresses in a society.
- The accumulation of high skills within a society would benefit not only highly skilled people themselves but also the whole society in a way to promote an efficient job allocation and a fair earnings distribution.

Further Exploration (with continuous implementation/development of PIAAC)

1. Detailed country-specific analyses using longitudinal data.
(by using this cross-country analysis as reference)
2. Elaboration of variables.
(credentials, skills, dependent variables)
3. Detailed analyses by sub-groups.
(gender, cohort, immigrant status, etc.)
4. Social inequality and mobility.
5. Reverse causation and path.
6. Non-economic outcomes including subjective well-being.
7. Combination of educational expansion and skills diffusion.
8. Societal-level impact.

Full Results: Skilled Occupations

Independent Variable		Model 1		Model 2		Model 3		
		B	S.E.	B	S.E.	B	S.E.	
Intercept		-2.198 ***	0.076	-3.119 ***	0.347	-3.071 ***	0.369	
Level One (Individual)	Gender: Reference = Female							
		Male	-0.079 ***	0.013	-0.078 ***	0.013	-0.078 ***	0.013
	Age: Reference = 16-24 years old							
		55 years and over	0.430 ***	0.043	0.421 ***	0.043	0.415 ***	0.043
		45-54 years old	0.586 ***	0.035	0.589 ***	0.035	0.584 ***	0.035
		35-44 years old	0.725 ***	0.029	0.738 ***	0.029	0.735 ***	0.029
		25-34 years old	0.692 ***	0.025	0.695 ***	0.026	0.694 ***	0.026
	Immigrant: Reference = Not First Generation Immigrant							
		First Generation Immigrant	-0.434 ***	0.022	-0.381 ***	0.022	-0.381 ***	0.022
		Cultural Capital	0.142 ***	0.003	0.141 ***	0.003	0.141 ***	0.003
		Years of Paid Work	0.025 ***	0.001	0.026 ***	0.001	0.026 ***	0.001
	Educational Specifications:							
	Reference = Neither High Credential nor High Skills							
	High Credential & High Skills (HCHS)	2.656 ***	0.029	3.238 ***	0.119	3.128 ***	0.126	
	Only High Credential without High Skills (HCLS)	2.021 ***	0.015	3.109 ***	0.054	3.074 ***	0.056	
	Only High Skills without High Credential (LCHS)	0.871 ***	0.032	1.172 ***	0.115	1.266 ***	0.130	
Cross-Level Interactions	Educational Expansion * HCHS			-0.017 ***	0.003	-0.020 ***	0.003	
	Educational Expansion * HCLS			-0.030 ***	0.001	-0.032 ***	0.002	
	Educational Expansion * LCHS			-0.009 **	0.003	-0.006	0.004	
	Skills Diffusion * HCHS					0.017 *	0.007	
	Skills Diffusion * HCLS					0.009 *	0.004	
	Skills Diffusion * LCHS					-0.013	0.009	
	Level Two (Country)	Educational Expansion			-0.000	0.010	-0.001	0.011
Skills Diffusion					0.003	0.018		
Index of Tracking			0.098	0.088	0.093	0.092		
GDP per capita (USD, PPP)/10,000			0.255 **	0.087	0.242 *	0.098		
Union Density			-0.001	0.004	-0.001	0.004		
Variance	Random Effect Covariance Structure (Intercept)		0.139 ***	0.115 ***	0.121 **			
Model Fit	-2LL		644947.813	646363.995	646339.345			
	AIC		644949.813	646365.995	646341.345			

Full Results: Earnings Quintiles

Independent Variable		Model 1		Model 2		Model 3		Model 4		
		β	S.E.	β	S.E.	β	S.E.	β	S.E.	
Threshold	Cut point 1	0.949 ***	0.035	0.809 ***	0.143	0.935 ***	0.130	1.463 ***	0.154	
	Cut point 2	2.177 ***	0.036	2.048 ***	0.143	2.173 ***	0.130	2.777 ***	0.154	
	Cut point 3	3.220 ***	0.036	3.099 ***	0.144	3.225 ***	0.130	3.907 ***	0.155	
	Cut point 4	4.430 ***	0.037	4.319 ***	0.144	4.446 ***	0.131	5.199 ***	0.155	
Level One (Individual)	Gender: Reference = Female									
	Male	1.073 ***	0.012	1.063 ***	0.012	1.064 ***	0.012	1.085 ***	0.013	
	Age: Reference = 16-24 years old									
	55 years and over	-0.039	0.038	-0.043	0.039	-0.027	0.039	-0.031	0.039	
	45-54 years old	0.687 ***	0.030	0.694 ***	0.031	0.707 ***	0.031	0.674 ***	0.031	
	35-44 years old	1.027 ***	0.025	1.035 ***	0.026	1.041 ***	0.026	0.964 ***	0.026	
	25-34 years old	1.039 ***	0.022	1.039 ***	0.022	1.041 ***	0.022	0.945 ***	0.023	
	Immigrant: Reference = Not First Generation Immigrant									
	First Generation Immigrant	-0.430 ***	0.019	-0.378 ***	0.019	-0.380 ***	0.019	-0.274 ***	0.020	
	Cultural Capital (Parents' education and books)	0.053 ***	0.003	0.048 ***	0.003	0.047 ***	0.003	0.021 ***	0.003	
	Years of Paid Work	0.053 ***	0.001	0.056 ***	0.001	0.055 ***	0.001	0.050 ***	0.001	
	Educational Specifications:									
	Reference = Neither High Credential nor High Skills									
	High Credential & High Skills (HCHS)	1.829 ***	0.022	2.193 ***	0.090	2.356 ***	0.099	1.700 ***	0.100	
	Only High Credential without High Skills (HCLS)	1.260 ***	0.014	1.899 ***	0.048	1.991 ***	0.049	1.289 ***	0.050	
	Only High Skills without High Credential (LCHS)	0.445 ***	0.031	1.089 ***	0.118	1.188 ***	0.132	0.925 ***	0.133	
	Occupations: Reference = Elementary Occupation									
Skilled Occupation							1.841 ***	0.025		
Semi-skilled White Collar							0.596 ***	0.025		
Semi-skilled Blue Collar							0.856 ***	0.026		
Cross-Level Interactions	Educational Expansion * HCHS			-0.009 ***	0.002	-0.005 *	0.002	-0.003	0.002	
	Educational Expansion * HCLS			-0.017 ***	0.001	-0.012 ***	0.001	-0.006 ***	0.001	
	Educational Expansion * LCHS			-0.018 ***	0.003	-0.015 ***	0.004	-0.015 ***	0.004	
	Skills Diffusion * HCHS					-0.024 ***	0.005	-0.027 ***	0.005	
	Skills Diffusion * HCLS					-0.023 ***	0.003	-0.025 ***	0.003	
Skills Diffusion * LCHS					-0.016	0.008	-0.011	0.008		
Level Two (Country)	Educational Expansion			-0.004	0.004	-0.002	0.004	0.000	0.005	
	Skills Diffusion					-0.009	0.006	-0.014	0.007	
	Index of Tracking			0.005	0.036	0.019	0.032	0.001	0.038	
	GDP per capita (USD, PPP)/10,000			-0.004	0.036	0.034	0.034	-0.012	0.040	
	Union Density			-0.002	0.002	-0.001	0.001	-0.001	0.002	
Variance	Random Effect Covariance Structure (Intercept)									
		0.023 ***		0.018 **		0.014 **		0.019 **		
Model Fit	-2LL		1345306.443		1298352.589		1299092.108		1360074.137	
	AIC		1345308.443		1298354.589		1299094.108		1360076.137	

Thank You !

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