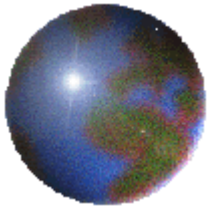

The evolution of skill premia over the past 60 years: A global perspective

(with David Kunst, TI)

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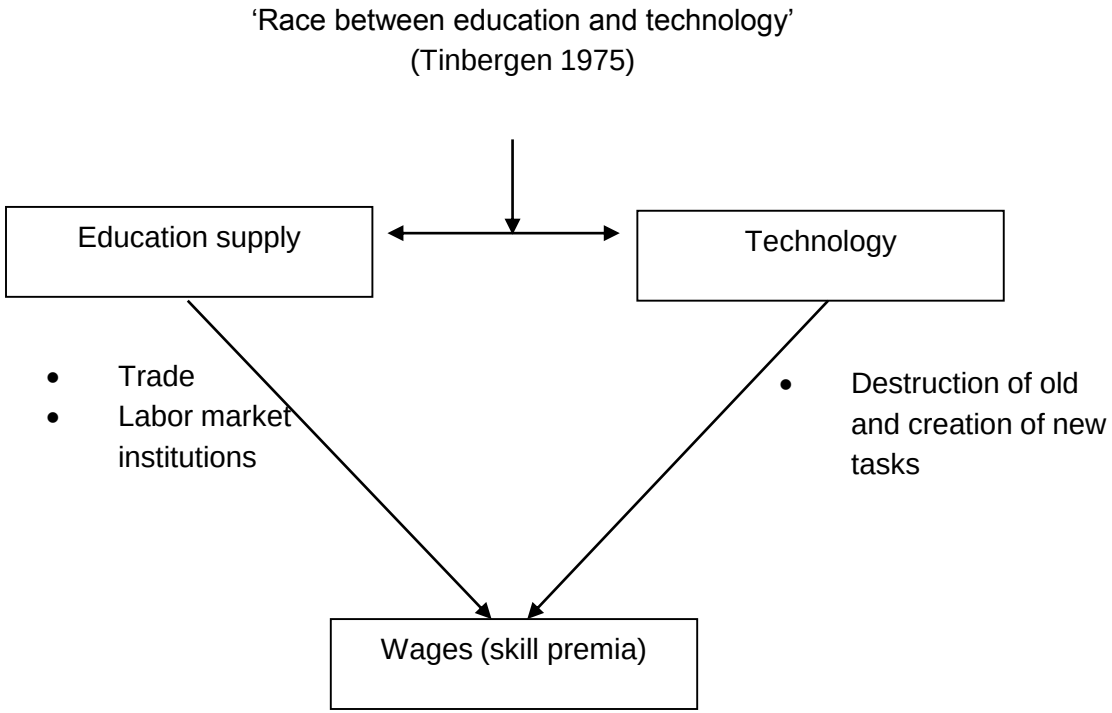
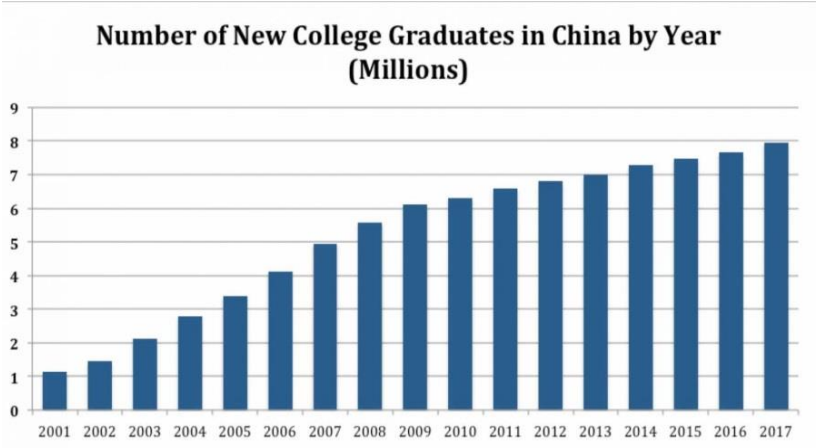
Introduction

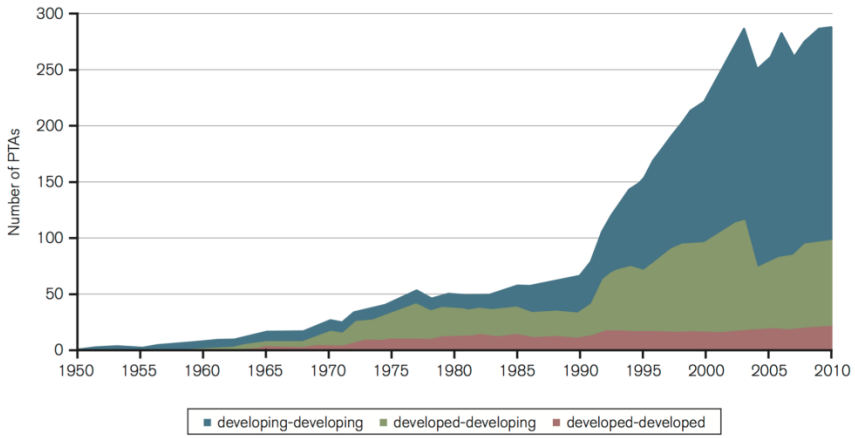
- Several (large) literatures on skill premia:
  - Labor literature (returns to investments in education)
  - Trade literature (factor price changes with changes in trade)
  - Technology literature (complementarity between technology, tasks, and skills)
  - Institutional economics literature (wage-setting processes)

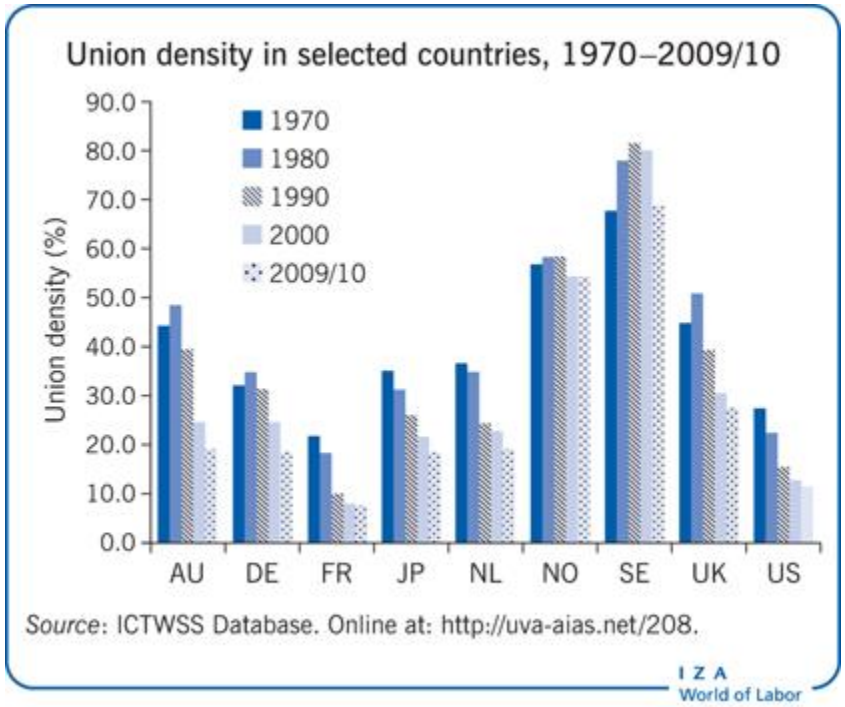
Main drivers of skill premia



Massive policy interventions







Source: WTO Secretariat.

- Longer term evidence is critical to study the broader drivers of global patterns
- But because of scarcity of internationally comparable wage data ➔ most studies on skill premia have been limited in terms of country and/or time coverage

This paper addresses these questions:

- How have skill premia changed globally since the 1950s?
- What has been the impact of the global surge in education on skill premia?
- Who has won the race between education and technology?
- Are your wages increasingly "set in Beijing"?

The data

- ILO October Inquiry on occupational wages
  - Annual survey since 1924
  - Increasing number of occupations are covered (1924: 18; 1953: 48; 1983: 162)
  - Occupations are narrowly defined (4-digit ISCO-88 and 08)
  - Wages are reported in varying formats (reporting period, averaging concept, pay concept, gender)
  - Standardized wages have been calculated by Freeman and Oostendorp (2000), Oostendorp (2005, 2012), and Freeman *et al*. (2011). Here we use an improved version of Freeman *et al*. (2011) covering 1953-2008.
  - Standardization format: hourly wage rates for males in current US dollars

Table 1: Overview of OWW data file

	Full sample	Panel sample
First year	1953	1953
Last year	2008	2008
Occupations	162	45
- primary	15	8
- secondary	112	35
- tertiary	35	2
Industries	49	18
All countries	188	187
- high income	73	73
- upper middle income	47	46
- low and lower middle income	68	68
- sovereign	166	165
Wage reports	198,502	112,866
No. of years with reports		
- average across countries	21.51	21.31
- standard deviation	14.77	14.71
No. of occupations per report		
- average	76.07	32.86
- standard deviation	44.20	9.38

How have skill premia changed globally since the 1950s?

- Literature:
  - Long-run increase in human capital has not led to a decline in the skill premia – 'New Kaldor Fact' of 'long-run stability of relative wages' (Jones and Romer 2010)
  - But Mincer returns have declined since 1970 (Montenegro and Patrinos 2014) or even since 1958 (Psacharopoulos 1994, Psacharopoulos and Patrinos 2004)

Measuring skill premia

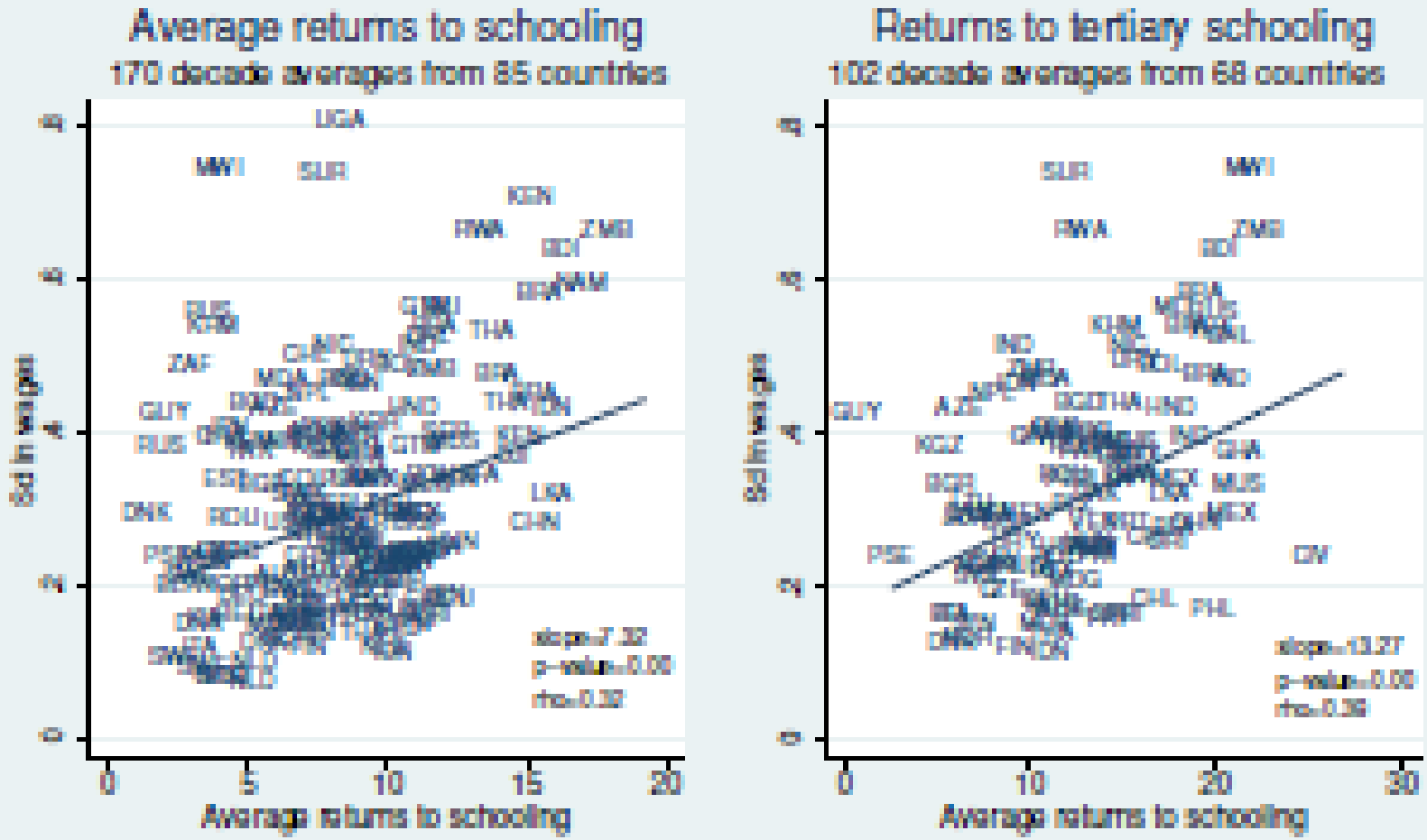
- Our proxy for skill premia: standard deviation of log occupational wages
- Strategies to improve balance in data:
  - Use decade-averages (constant US$)
  - Interpolate data if at most one intermediate decade-average wage is missing (→ fully balanced panel)
- *Two issues*
  - Do wage differentials reflect skill differentials?
  - How stable are occupational structures across countries and time?

Do wage differentials reflect return to education differentials?

- Mincer estimates
  - Control for non-education components of human capital and (often) for non-human capital factors
  - Cover all occupations
- On the other hand:
  - Mincer estimates impose (and are sensitive to) functional form assumptions (cf. Heckman *et al*. 2006)
  - Returns are often nonlinear (Montenegro and Patrinos 2014) and therefore singular estimates depend on educational population (and possibly sample) shares
  - Mincer estimates are available for fewer countries and periods

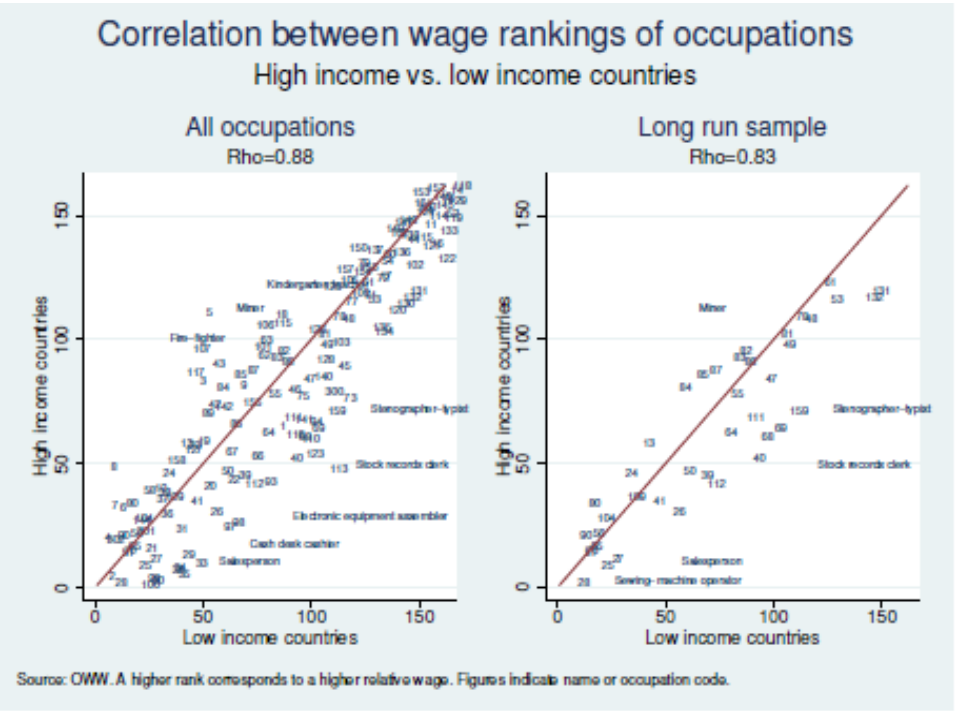
Correlation with Mincer–returns to schooling

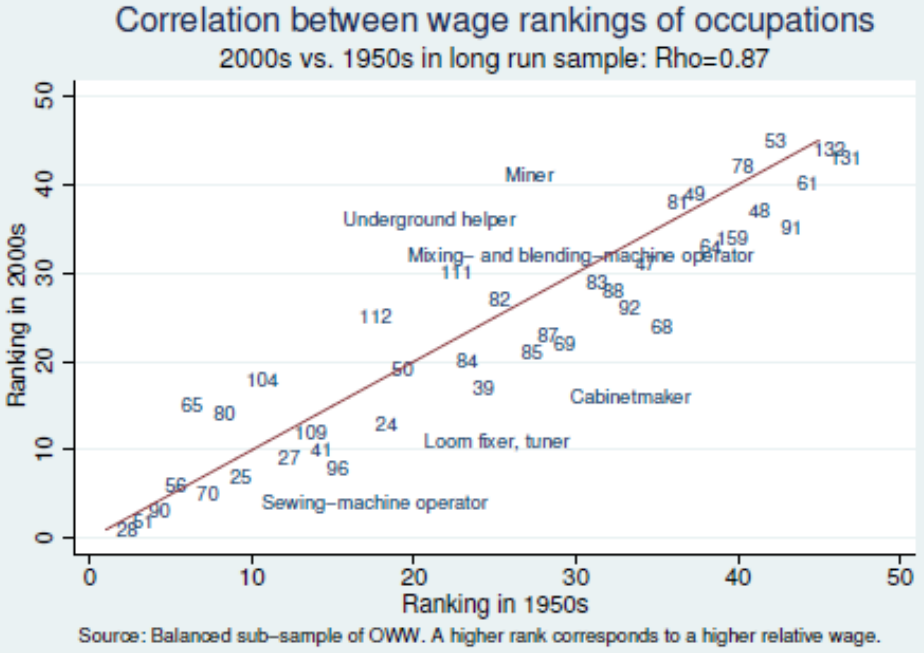
Panel sample



Mincer returns from Psacharopoulos (2004) and Montenegro & Patrinos (2014).

How stable are occupational structures across countries and time?

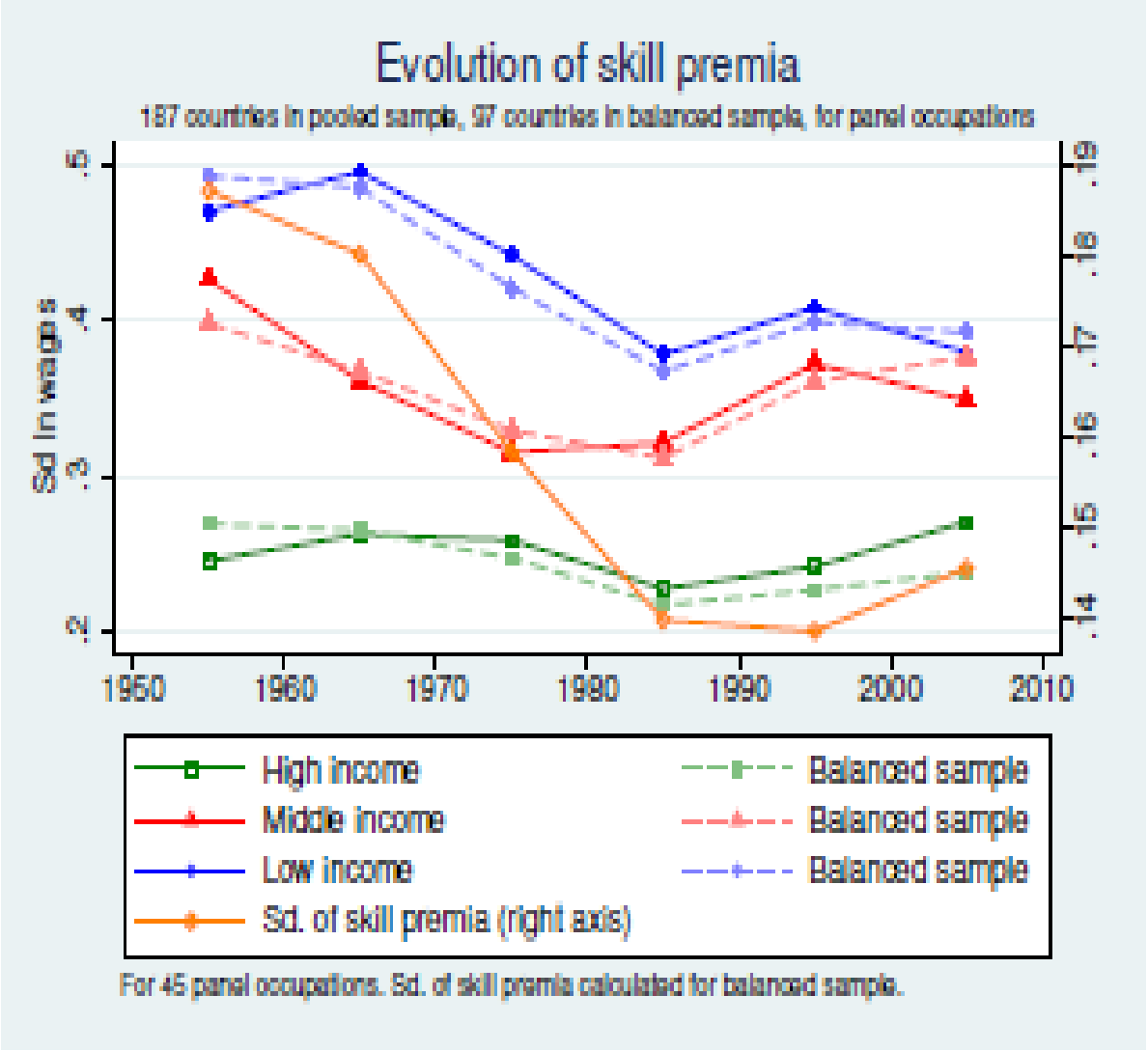




Global changes in skill premia: findings

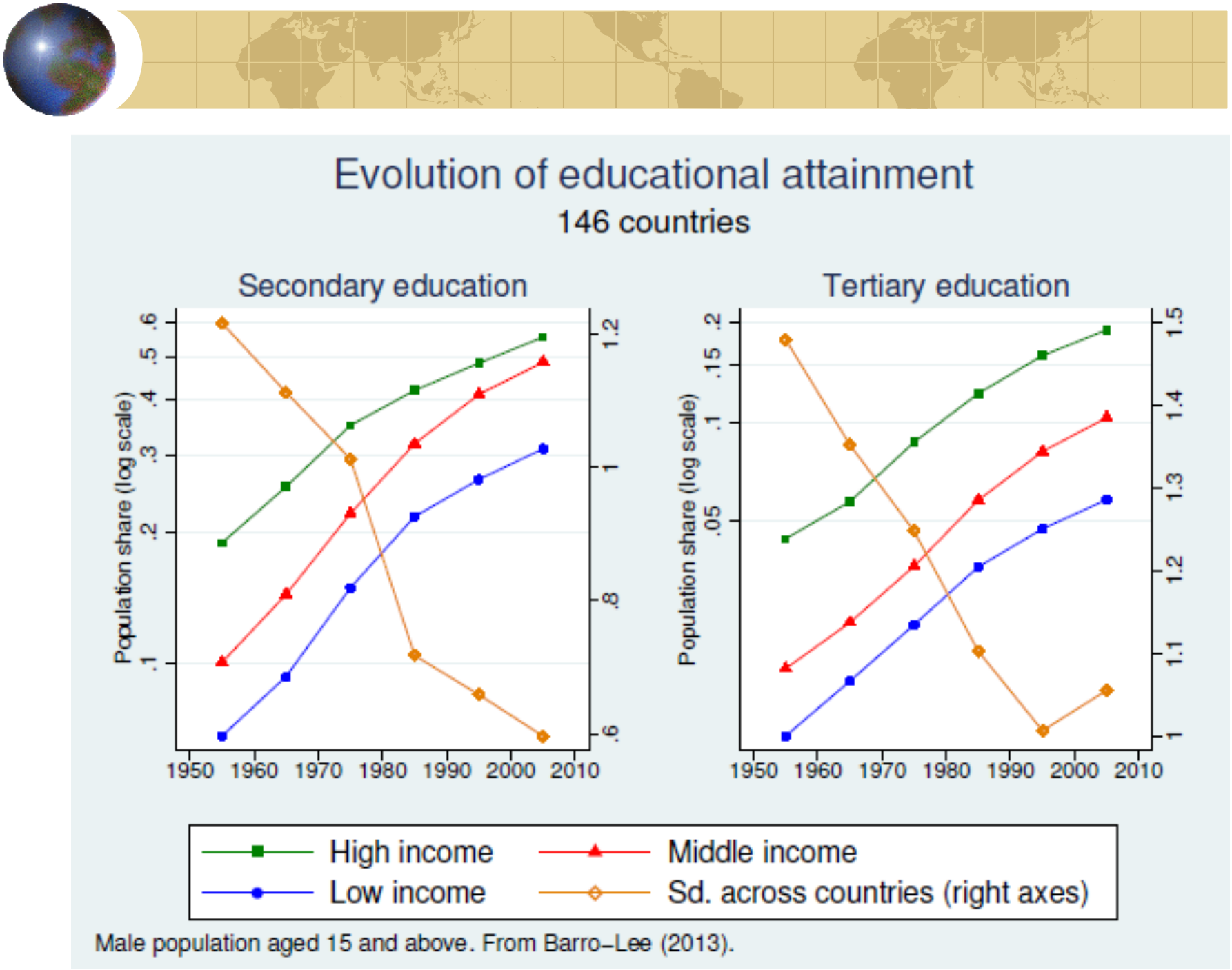
- Skill premia much higher in poorer countries
- Declining skill premia in the 1950s-1980s (23%) and 1950s-2000s (15%)
- Increasing skill premia since the 1980s
- Global convergence of skill premia

Figure 2: The evolution of skill premia in the panel sample



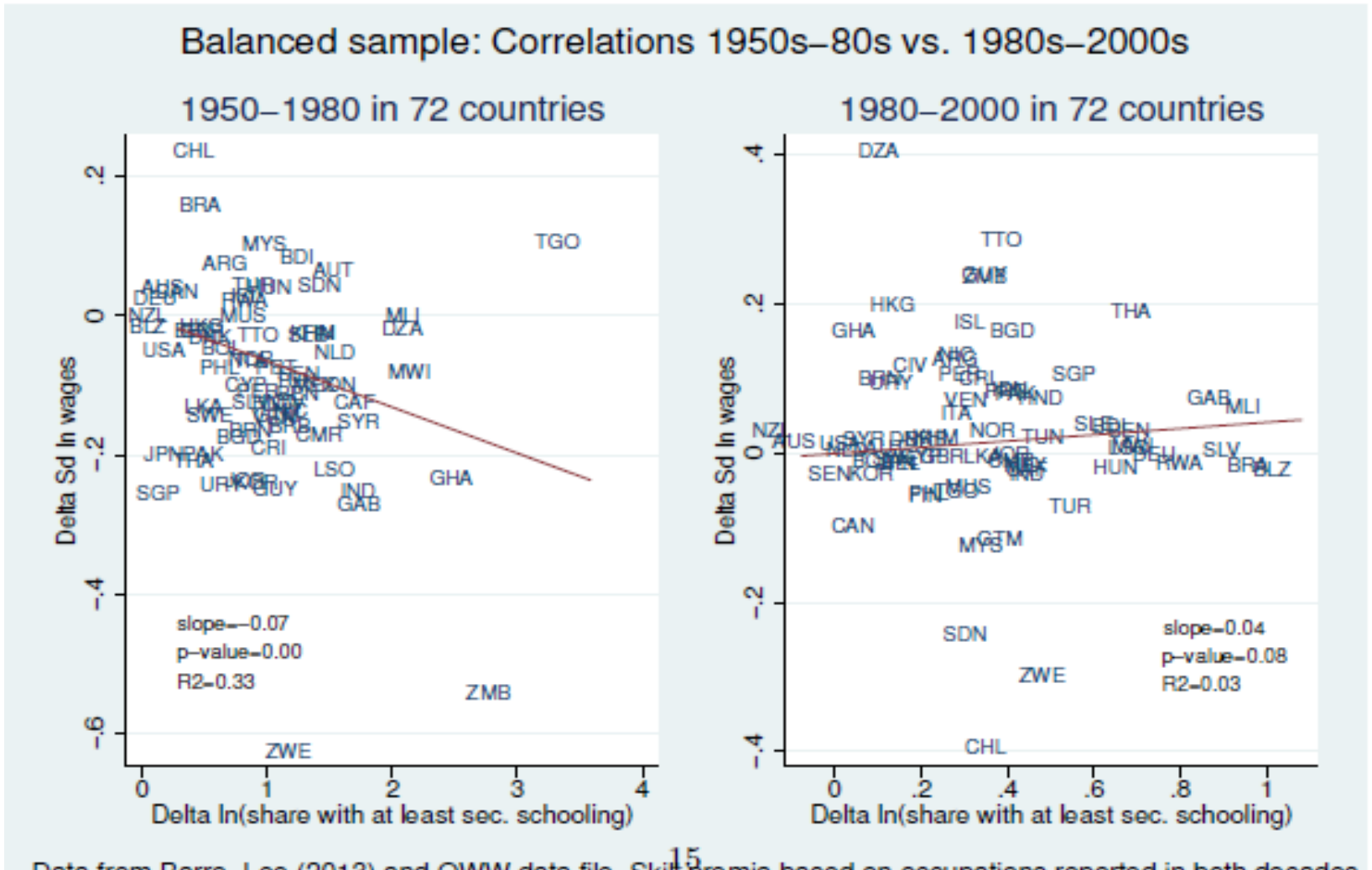
What has been the impact of the global surge in education on skill premia?

- For the US, fluctuations in the growth rate of the share of college graduates can account for much of the evolution of the US college wage premium throughout the 20th century (Katz and Murphy (1992) and Goldin and Katz (2008))
- Can the (enormous) changes in global education supplies also explain the global patterns in skill premia over the past 60 years?



Male population aged 15 and above. From Barro–Lee (2013).

Skill supply and premia: Bivariate evidence



Supply-demand framework

- Aggregate production function $Y_t = A_t S_t^{\alpha_t} U_t^{1-\alpha_t}$

  where S_t, U_t are skilled, unskilled workers, A_t captures all production factors except labor

- Competitive equilibrium:

$$\ln w_{S,t} = ln\alpha_t + \ln A_t - (1-\alpha_t)\ln\left(\frac{S_t}{U_t}\right)$$

$$\ln w_{U,t} = ln(1-\alpha_t) + \ln A_t + \alpha_t \ln\left(\frac{S_t}{U_t}\right)$$

- Estimating equation:

$$\ln w_{c,o,t} = c + \beta_1 lnA_{c,t} + \beta_2 \ln(school_{c,t}) + \sum_i \beta_i^2 D^i \ln(school_{c,t}) + \{D_c\} + \{D_o\} + \{D_t\} + \sum_i \beta_i^3 D^i t + X_{c,t}\gamma + \sum_i D^i X_{c,t}\gamma + \varepsilon_{c,o,t}$$

  where $\ln(school_{c,t})$ is a proxy of relative skill supply, D^i a dummy for skill categories requiring $school_{c,t}$, D_c, D_o, D_t are country, occupation, time dummies

- Hypotheses: $\beta_1 > 0, \beta_2 > 0, \beta_i^2 < 0, \beta_i^3 > 0$

- Variables:
  - $w_{c,o,t}$: real OWW occupational wages (price levels from Penn World Table 9.0)
  - $A_{c,t}$: real GDP per capita (Penn World Table)
  - $school_{c,t}$: share of male population aged 15 and above with at least some secondary education (Barro-Lee)
  - D^i: 2nd and 3rd tercile of global occupational ranking
  - $\varepsilon_{c,o,t}$: clustered at country level
  - t: 5-year periods

		By income		1953-79	1980-08	
	(1) Pooled	(2) High	(3) Other	(4) Panel	(5) Panel	(6) Pooled
ln A	0.682**	0.555**	0.567**	0.592**	0.626**	0.629**
	(0.070)	(0.071)	(0.096)	(0.123)	(0.117)	(0.111)
ln school	-0.194+	0.156	-0.146	0.002	-0.429	-0.257
	(0.104)	(0.116)	(0.159)	(0.080)	(0.342)	(0.280)
x *medium skilled*	-0.067**	-0.016	-0.056*	-0.088**	-0.052*	-0.037
	(0.016)	(0.031)	(0.024)	(0.018)	(0.024)	(0.024)
x *high skilled*	-0.198**	-0.303**	-0.142**	-0.231**	-0.227**	-0.190**
	(0.033)	(0.074)	(0.044)	(0.030)	(0.041)	(0.046)
trend med. skilled	0.000	-0.000	-0.019	0.004	0.001	0.014
	(0.007)	(0.009)	(0.015)	(0.015)	(0.013)	(0.011)
trend high skilled	0.039*	0.076**	0.003	0.050*	0.081**	0.044
	(0.017)	(0.022)	(0.030)	(0.024)	(0.026)	(0.031)
Constant	-6.646**	-6.988**	-2.325	-4.810*	-6.803**	-7.916**
	(1.389)	(1.514)	(2.414)	(1.996)	(1.743)	(2.608)
Observations	53692	23234	30458	15321	13075	37439
R^2	0.783	0.838	0.610	0.771	0.840	0.824
Countries	129	48	81	106	121	122
Intervals	5 year	5 year	5 year	5 year	5 year	5 year
Country FE	✓	✓	✓	✓	✓	✓
Occupation FE	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓

Trend variables are divided by 10. Panel sample consists of 45 occupations reported throughout. Standard errors in parentheses, clustered at the country level. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

	Trade by income					
	(1) Benchmark	(2) GDP	(3) High	(4) Other	(5) Union d.	(6) Combined
ln A	0.682**	0.680**	0.574**	0.498**	0.712**	0.726**
	(0.070)	(0.072)	(0.096)	(0.106)	(0.110)	(0.108)
x *medium skilled*		0.008				-0.011
		(0.011)				(0.020)
x *high skilled*		-0.002				-0.060
		(0.027)				(0.047)
ln school	-0.194+	-0.192+	0.320*	-0.033	0.136	0.162
	(0.104)	(0.104)	(0.157)	(0.138)	(0.202)	(0.232)
x *medium skilled*	-0.067**	-0.075**	-0.029	-0.061*	-0.045	0.004
	(0.016)	(0.019)	(0.038)	(0.024)	(0.040)	(0.031)
x *high skilled*	-0.198**	-0.195**	-0.368**	-0.138**	-0.389**	-0.362**
	(0.033)	(0.039)	(0.092)	(0.052)	(0.087)	(0.092)
trend med. skilled	0.000	0.001	-0.002	-0.017	-0.002	-0.006
	(0.007)	(0.007)	(0.011)	(0.016)	(0.012)	(0.012)
trend high skilled	0.039*	0.038*	0.067*	-0.001	0.060*	0.061*
	(0.017)	(0.017)	(0.026)	(0.036)	(0.025)	(0.028)
ln (trade/GDP)			-0.142	-0.109		-0.212
			(0.112)	(0.135)		(0.183)
x *medium skilled*			0.025	0.055*		-0.004
			(0.027)	(0.024)		(0.020)
x *high skilled*			0.070	0.029		-0.016
			(0.046)	(0.066)		(0.062)
union density					0.124	0.275
					(0.253)	(0.298)
x *medium skilled*					-0.128**	-0.119*
					(0.046)	(0.047)
x *high skilled*					-0.455**	-0.450**
					(0.091)	(0.103)
Constant	-6.646**	-6.685**	-6.924**	-1.211	-8.382**	-8.463**
	(1.389)	(1.369)	(2.133)	(2.876)	(2.220)	(2.402)
Observations	53692	53692	19970	27102	19197	18632
R^2	0.783	0.783	0.830	0.651	0.850	0.852
Countries	129	129	47	78	50	50
Intervals	5 year	5 year	5 year	5 year	5 year	5 year
Country FE	✓	✓	✓	✓	✓	✓
Occupation FE	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓

Trend variables are divided by 10. Varying sample coverage according to data availability.
Standard errors in parentheses, clustered at the country level. + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

Historical impact of changes in skill supply and technology on global skill premia

Table 4: Skill premia simulations

Actual vs. counterfactual skill premia

		With 1950-values for:				With 1980-values for:			
	Actual	School	Δ(%)	Trend	Δ(%)	School	Δ(%)	Trend	Δ(%)
All countries:									
1950 Mean	0.38								
1980 Mean	0.29	0.35	19.01	0.30	0.86*				
2000 Mean	0.33	0.41	22.75	0.32	-3.83*				
2000 Mean	0.33					0.35	5.98	0.32	-5.09
1950 Sd	0.20								
1980 Sd	0.14	0.16	11.32	0.14	-1.81*				
2000 Sd	0.15	0.18	13.52	0.15	-2.68*				
2000 Sd	0.15					0.16	5.10	0.15	-1.12

Are your wages increasingly "set in Beijing"?

- Trade impacts skill premia in two ways in standard trade theory:
  - Increased demand for abundant factors
  - FPE
- Literature provides clear evidence that:
  - Trade does not always increase the demand for scarce factors
  - FPE does not hold

- A weaker version of FPE is "Factor Price Adjustment" (FPA):

The initial factor price response to an increase in a factor supply is reduced over time as the economy shifts its output mix towards sectors that employ this factor most intensively. The more open a country is to international commerce, the greater will be the opportunities for adjustment in the output mix and the less will be the factor price response at any point in time. (Leamer and Levinsohn 1995)

- Some (scarce) evidence supporting FPA at country level (e.g. Hanson and Slaughter 2002, for US) and country-level (Rotunno and Wood 2016, for 40, mostly high income, countries in WIOD)

	WIOD, 1995-2008			Extensions		
	(1) Adj.	(2) Non-adj.	(3) Level	(4) Periods	(5) Countries	(6) Pooled
ln A	0.402^{+}	0.402^{+}	0.392^{+}	0.691**	0.573**	0.649**
	(0.228)	(0.222)	(0.216)	(0.106)	(0.094)	(0.078)
ln school	0.126	-0.059	0.501	0.108	0.343*	-0.180
	(0.301)	(0.390)	(0.316)	(0.176)	(0.163)	(0.112)
x *medium skilled*	-0.053	-0.024	-0.113	-0.013	-0.047	-0.067**
	(0.063)	(0.092)	(0.133)	(0.038)	(0.034)	(0.019)
x *high skilled*	-0.491**	0.134	-1.490**	-0.329**	-0.480**	-0.212**
	(0.140)	(0.207)	(0.223)	(0.079)	(0.108)	(0.042)
openness	0.134	0.145	0.105	-0.155	-0.121	-0.145
	(0.141)	(0.124)	(0.157)	(0.210)	(0.141)	(0.134)
x *medium skilled*	0.006	-0.004	0.018	-0.074^{+}	-0.027	0.028
	(0.047)	(0.039)	(0.059)	(0.039)	(0.048)	(0.037)
x *high skilled*	0.083	0.054	0.252^{+}	-0.075	-0.036	-0.022
	(0.114)	(0.091)	(0.141)	(0.073)	(0.069)	(0.069)
ln school x openness	-0.238	-0.208	-0.712	0.409*	0.055	0.012
	(0.222)	(0.158)	(0.733)	(0.190)	(0.086)	(0.053)
x *medium skilled*	0.086	0.035	0.112	-0.066	-0.076^{+}	-0.011
	(0.123)	(0.093)	(0.227)	(0.040)	(0.040)	(0.027)
x *high skilled*	0.885**	0.724**	2.099**	0.097	-0.132	-0.061
	(0.237)	(0.154)	(0.391)	(0.122)	(0.106)	(0.046)
trend med. skilled	0.038*	0.041*	0.039*	0.010	0.009	-0.000
	(0.017)	(0.015)	(0.016)	(0.011)	(0.010)	(0.009)
trend high skilled	0.104**	0.117**	0.097**	0.101**	0.105**	0.035
	(0.032)	(0.031)	(0.033)	(0.029)	(0.027)	(0.023)
Constant	-10.639**	-11.544**	-10.306**	-10.756**	-9.628**	-6.085**
	(3.599)	(3.399)	(3.275)	(2.138)	(1.943)	(1.810)
Observations	9652	9652	9652	18616	22175	47072
R^2	0.908	0.909	0.909	0.872	0.849	0.807
Countries	34	34	34	39	56	125
Intervals	5 year	5 year	5 year	5 year	5 year	5 year
Country FE	✓	✓	✓	✓	✓	✓
Occupation FE	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓

Trend variables are divided by 10. Except for columns (2) and (3), openness is proxied as log trade/GDP ratio, adjusted for log population size. Standard errors in parentheses, clustered at the country level.

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

Summary

- How have skill premia changed globally since the 1950s?
  - Strong decline, especially until the 1980s
- What has been the impact of the global surge in education on skill premia?
  - Strong decline in global skill premia
  - Compression in global skill premia
- Who has won the race between education and technology?
  - Education over the entire period – big time
  - But technology tying since 1980s
- Are your wages increasingly "set in Beijing"?
  - Yes, if you live in a WIOD country