The Production of Cognitive and Non-cognitive Human Capital in the Global Economy

Chong Xiang, Purdue

Stephen Yeaple, Penn State and NBER

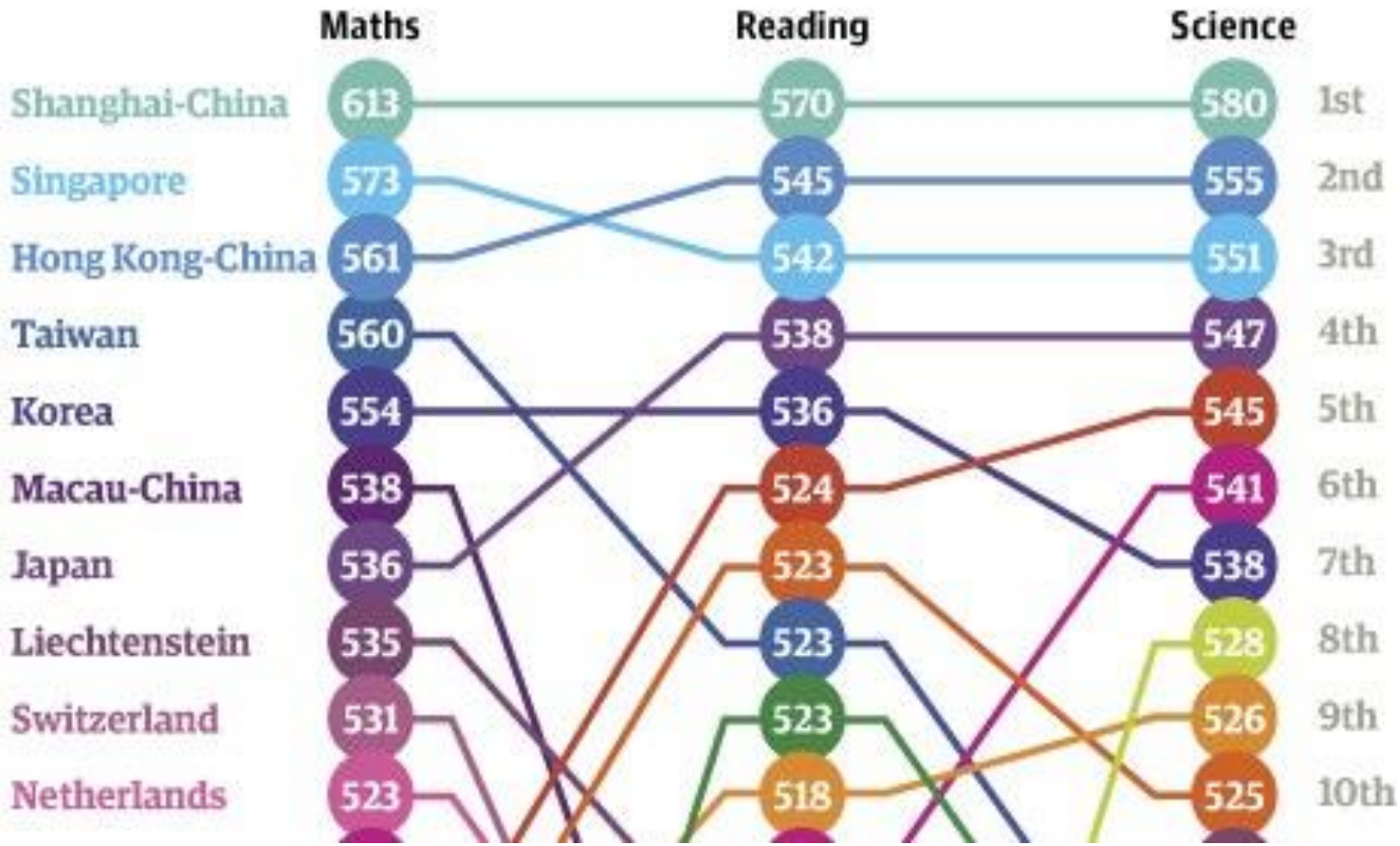
Human Capital <= Educational System

- How “good” is a country’s educational system?

Test Scores => Educational System?

- U.S. PISA math score ranks 31st out of 65 countries (2009)
- U.S. educational spending per capita = $3,139.28 (2004)
- President Obama: the nation that "out-educates us today will out-compete us tomorrow."
- U.S., U.K., Slovakia, Canada and Qatar …

Who Are the High-Achievers?



Educational System has Multiple Dimensions

- China: The Education Ministry announced a ban on homework for young children August 22, 2013.

- S. Korea: declared a 10 pm curfew on private tutoring

Educational System has Multiple Dimensions

- non-cognitive human capital is important (e.g. Heckman and Rubinstein 2001)

- Many of these non-cognitive skills do not show up in test scores (e.g Heckman and Kautz 2012)

- Hanushek and Woessmann (2011)

"The systematic measurement of such skills has yet to be possible in international comparisons"

We

- Production functions of cognitive & non-cognitive human capital => General equilibrium model
- Contribution 1 PISA score => cognitive productivity

We

- Contribution 1 PISA score => cognitive productivity
- Contribution 2 Occupational employment shares => comparative advantage & non-cognitive productivity

Why Does Anybody Care?

- U.K. education minister, Elizabeth Truss, visited Shanghai, Feb. 18, 2014, to “learn a lesson in math”

- Question: high PISA score => high cognitive and non-cognitive productivities?

We

- Contribution 1 PISA score => cognitive productivity
- Contribution 2 Occupational choices => comparative advantage, non-cognitive productivity
- Contribution 3 Quantify differences => effects on aggregate output

Why Does Anybody Care?

- U.S. education secretary Arne Duncan

"And the PISA results, to be brutally honest, show that a host of developed nations are out-educating us … Today, America has to study and learn from other nations once again."

- Question: higher PISA score => higher aggregate output?
- Cost-benefit analysis of policy?

Literature

- GE with worker heterogeneity (e.g. Ohsornge and Trefler, Hsieh, Hurst, Jones and Klenow 2016, Burnstein, Morales and Vogel 2016, and many others).
- Non-cognitive human capital (e.g. Neal and Johnson 1996, Kuhn and Weinberger 2005, Cunha, Heckman and Schennach 2010, and many others)
- Education policies (e.g. Figlio and Loeb 2011, and many others)
- Test scores (e.g. Hanushek and Woessman 2011, and many others)
- Comparative advantages in career choices (e.g. Roy 1951, Willis and Rosen 1979, and many others).
- Institutions (e.g. Hall and Jones, Acemoglu, Johnson and Robinson 2001, and many others)

Non-cognitive Skill = Leadership

- O*NET “Providing guidance and direction to subordinates ...” = Non-cog occupations
- Kuhn and Weinberger (2005)
- Wages in non-cognitive occupations are less responsive to test scores: Neal and Johnson (1996)

Details: Why Leadership

Examples of Occupations

- Non-cognitive: Business professionals (2410), managers of small enterprises (1310), Building frame and related trades workers (7120), Nursing and midwifery ... professionals (3230)

- Cognitive: Architects, engineers and related professionals (2140), Finance and sales … professionals (3410), Secretaries … (4110), Motor vehicle drivers (8320)

Data: Sum Stat

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor Force Size	28	12541.24	23132.62	156.43	120464.70
Non-cog. Emp. Share	28	0.2425	0.0514	0.1157	0.3775
Cognitive Emp. Share	28	0.7575	0.0514	0.6225	0.8843
Total Output ($000)	28	4.59E+08	1.18E+09	4130208	6.25E+09
Edu. Exp./Output	20	0.1255	0.0194	0.0985	0.1695
PISA Reading Score	28	498.96	18.30	468.93	539.34
PISA Math Score	28	503.73	22.17	455.80	553.40
PISA Science Score	28	506.81	19.70	470.07	554.28

Setting: Agg. Production

- K countries, indexed by k. Closed economy.
- Each country endowed with L^k units of heterogeneous labor

- Agg. production $y^k = \Theta^k [A_c (L_c^k)^{\frac{\alpha-1}{\alpha}} + A_n (L_n^k)^{\frac{\alpha-1}{\alpha}}]^{\frac{\alpha}{\alpha-1}}$

  Θ^k and α

  output is numeraire

Back to Property 2 Back to α equation

Setting: Worker Heterogeneity

- Workers are endowed with cognitive (c) and non-cognitive (n) talents, ε_c and ε_n

- Joint cdf is Frechet

$$\exp(-(T_c\varepsilon_c^{-\theta} + T_n\varepsilon_n^{-\theta})^{1-\rho}), \theta \equiv \frac{\tilde{\theta}}{1-\rho}.$$

$\theta > 1$

- Workers know ε_c and ε_n

Setting: H. Cap. Production

- Educational system => human capital production machine. 2 aspects of educational choices.
- Human capital accumulation $h_i(e) = h_i^k e^{\eta}, i = c, n$

  $\eta < 1$, h_c^k and h_n^k

- Motivations for h_c^k and h_n^k: deep historic roots (e.g. S. Korea, U.S.)

Solving the Model

- Step 1. Choose how much education
  - Returns are w_c^k and w_n^k
  - Individual worker output $h_i(e)\varepsilon_i = h_i^k e^{\eta}\varepsilon_i, i = c, n$
  - Maximize net income = $w_i^k h_i^k e^{\eta}\varepsilon_i - e$

- Step 2. Choose occupation

Solution: Employment Shares

- p_c^k and p_n^k = % of workers in occupations c and n

$$\frac{p_n^k}{p_c^k} = \frac{T_n}{T_c} \frac{(w_n^k h_n^k)^\theta}{(w_c^k h_c^k)^\theta}$$

Solution: RS and RD

- Relative supply (RS) is

$$\frac{L_n^k}{L_c^k} = \frac{T_n}{T_c}\frac{(h_n^k)^\theta}{(h_c^k)^\theta}\frac{(w_n^k)^{\theta-1}}{(w_c^k)^{\theta-1}}$$

- Relative demand (RD) is:

$$\frac{L_n^k}{L_c^k} = \left(\frac{A_c}{A_n}\frac{w_n^k}{w_c^k}\right)^{-\alpha}$$

Solution: Output per Worker

- Relative to benchmark country 0,

$$\frac{y^k / L^k}{y^0 / L^0} = \left(\frac{\Theta^k}{\Theta^0}\right)^{\frac{1}{1-\eta}} \left(\Omega^k\right)^{\frac{1}{1-\eta}},$$

$$\Omega^k = \left[p_c^0 \left(\frac{h_c^k}{h_c^0}\right)^a + p_n^0 \left(\frac{h_n^k}{h_n^0}\right)^a \right]^{\frac{1}{a}}$$

$$a = 1 / \left(\frac{1}{\theta} + \frac{1}{\alpha - 1}\right)$$

Detailed Steps

Solution: Comp. Advantage

- Recap

$$\frac{p_n^k}{p_c^k} = \frac{T_n}{T_c}\frac{(w_n^k h_n^k)^\theta}{(w_c^k h_c^k)^\theta}$$

- We can infer the comparative advantage of the education institution from employment-shares data!

$$\ln\frac{h_c^k}{h_n^k} = (\frac{1}{\theta} + \frac{1}{\alpha - 1})\ln\frac{p_c^k}{p_n^k} + \text{constant}$$

Why alpha - 1

Parameters: η

- Recap:

$$h_i(e) = h_i^k e^{\eta}, i = c, n$$

- Each country spends η of output on education

$$E^k L^k = \eta y^k$$

Variable	Obs	Mean	Std. Dev.	Min	Max
Edu. Exp./Output	20	0.1255	0.0194	0.0985	0.1695

Parameters: θ and h_c^k

- Assumption: PISA scores reflect cognitive human capital (e.g. Hanushek and Woessman 2011)

$$S^k = b\frac{L_c^k}{L^k}, b > 0$$

- Relative to benchmark country 0,

$$\frac{S^k}{S^0} = \left(\frac{E^k}{E^0}\right)^{\eta}\left(\frac{p_c^k}{p_0^k}\right)^{1-\frac{1}{\theta}}\frac{h_c^k}{h_0^k}$$

Parameters: θ and h_c^k

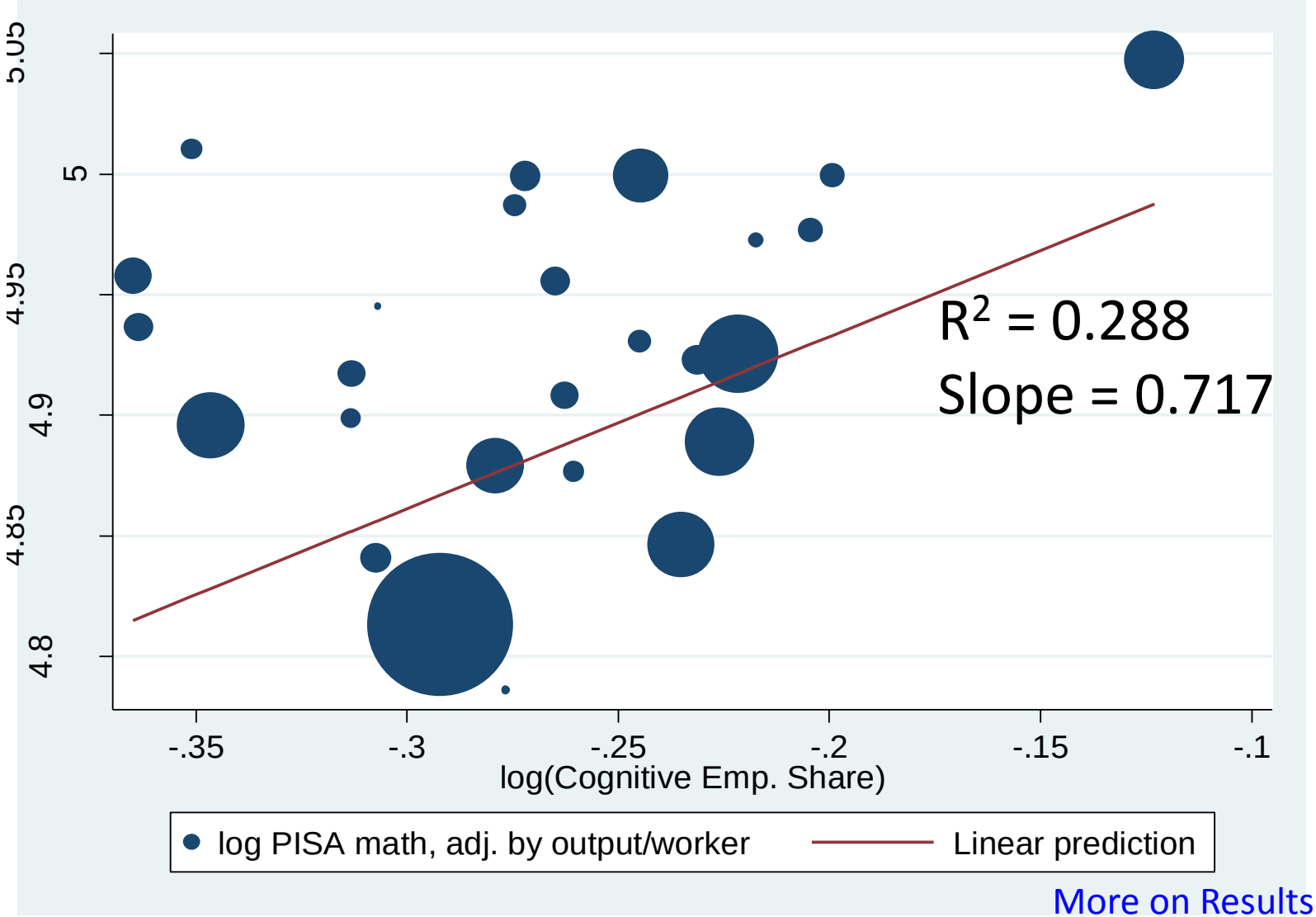
- Assumption: PISA scores reflect cognitive human capital (e.g. Hanushek and Woessman 2011)
- Relative to benchmark country 0,

$$\frac{S^k}{S^0} = \left(\frac{E^k}{E^0}\right)^{\eta} \left(\frac{p_c^k}{p_0^k}\right)^{1-\frac{1}{\theta}} \frac{h_c^k}{h_0^k}$$

- Re-arranging

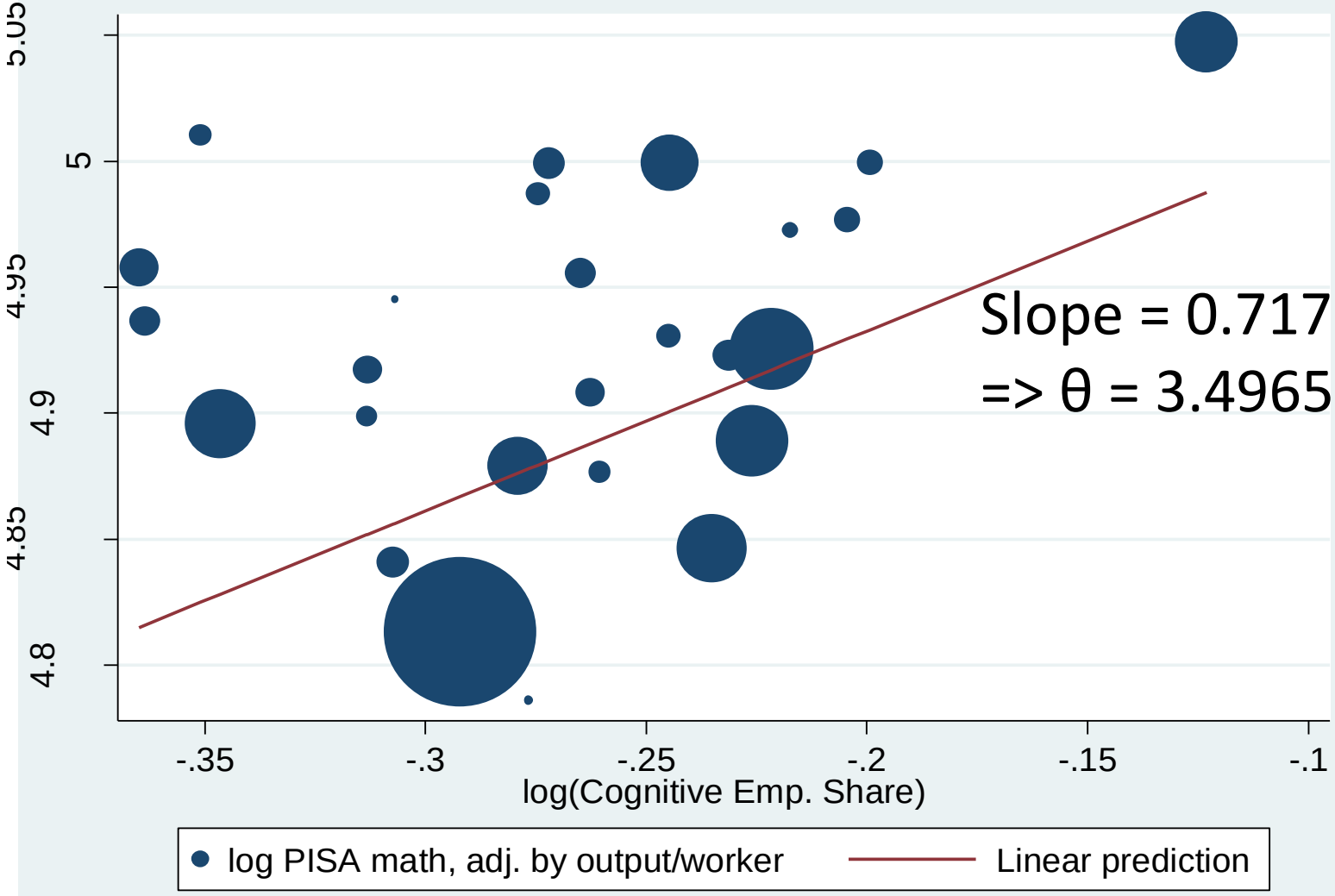
$$\ln \frac{S^k}{(y^k / L^k)^{\eta}} = \text{constant} + (1 - \frac{1}{\theta}) \ln p_c^k + \ln h_c^k$$

$$\ln \frac{S^k}{(y^k / L^k)^\eta} = \text{constant} + (1 - \frac{1}{\theta}) \ln p_c^k + \ln h_c^k$$



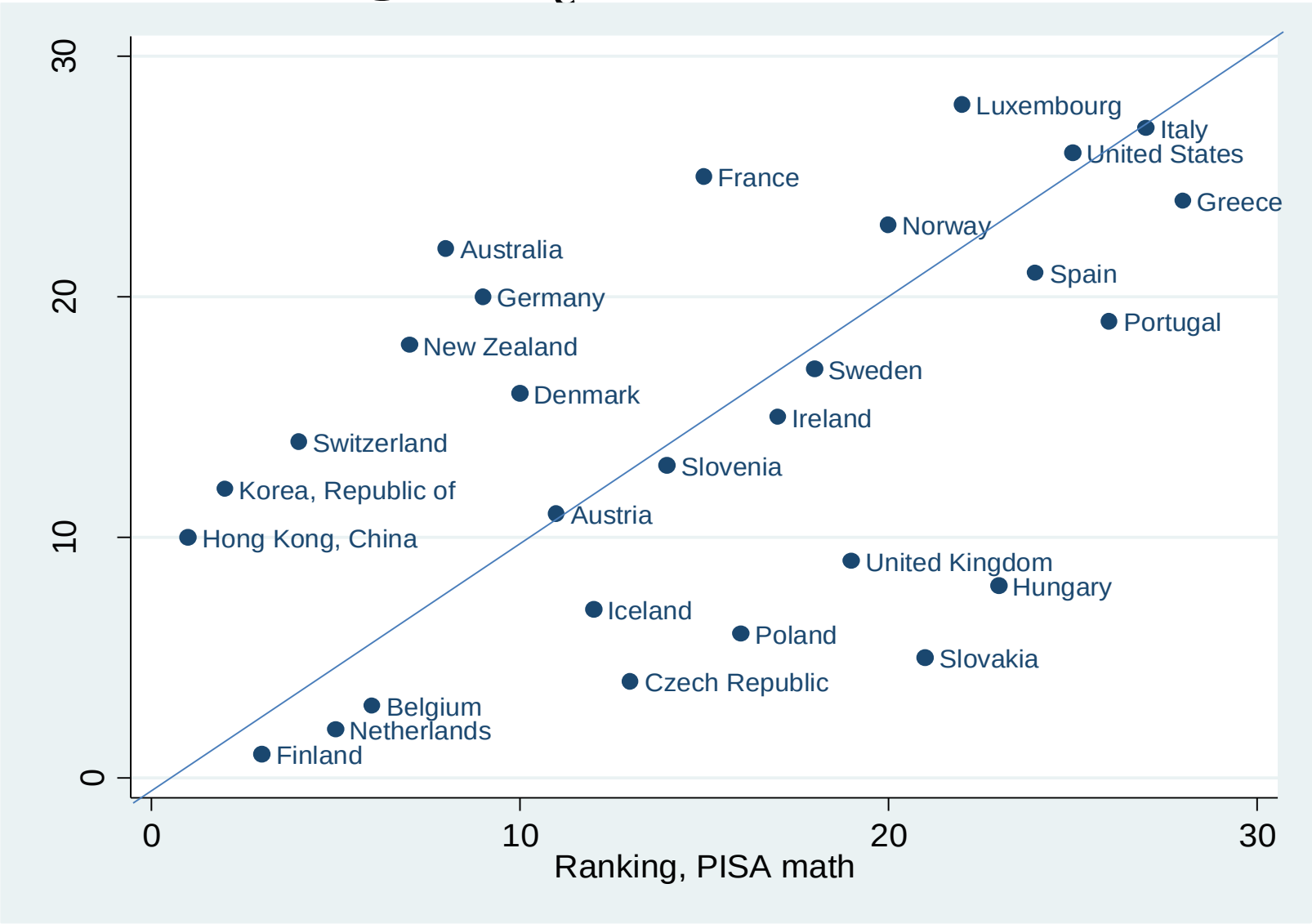
More on Results for θ

$$\ln \frac{S^k}{(y^k / L^k)^\eta} = \text{constant} + (1 - \frac{1}{\theta}) \ln p_c^k + \ln h_c^k$$



More on Results for θ

Rankings: h^k_c v. PISA math



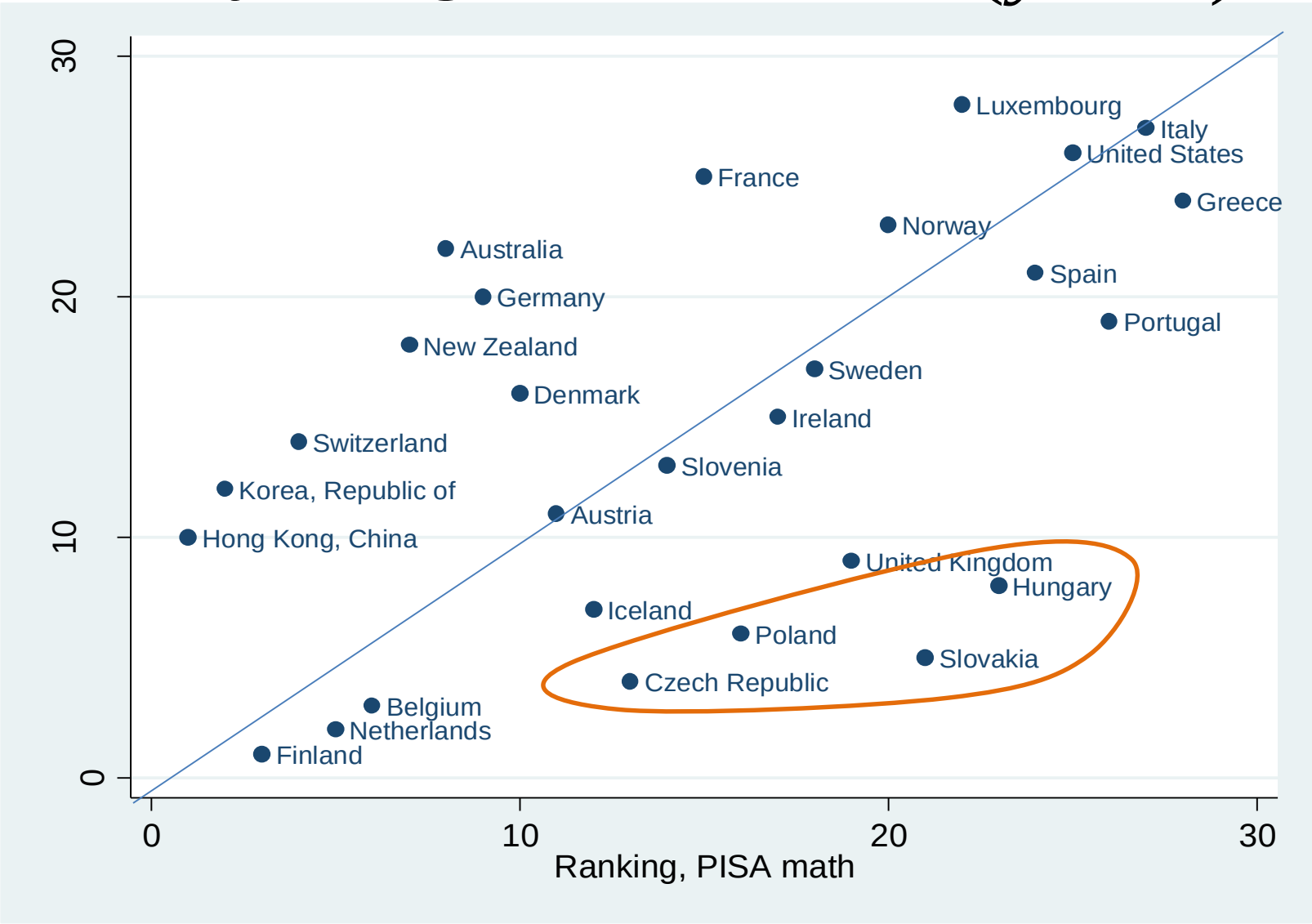
Recap: Test Score to Cog. Productivity

$$\ln \frac{S^k}{(y^k / L^k)^\eta} = \text{constant} + (1 - \frac{1}{\theta}) \ln p_c^k + \ln h_c^k$$

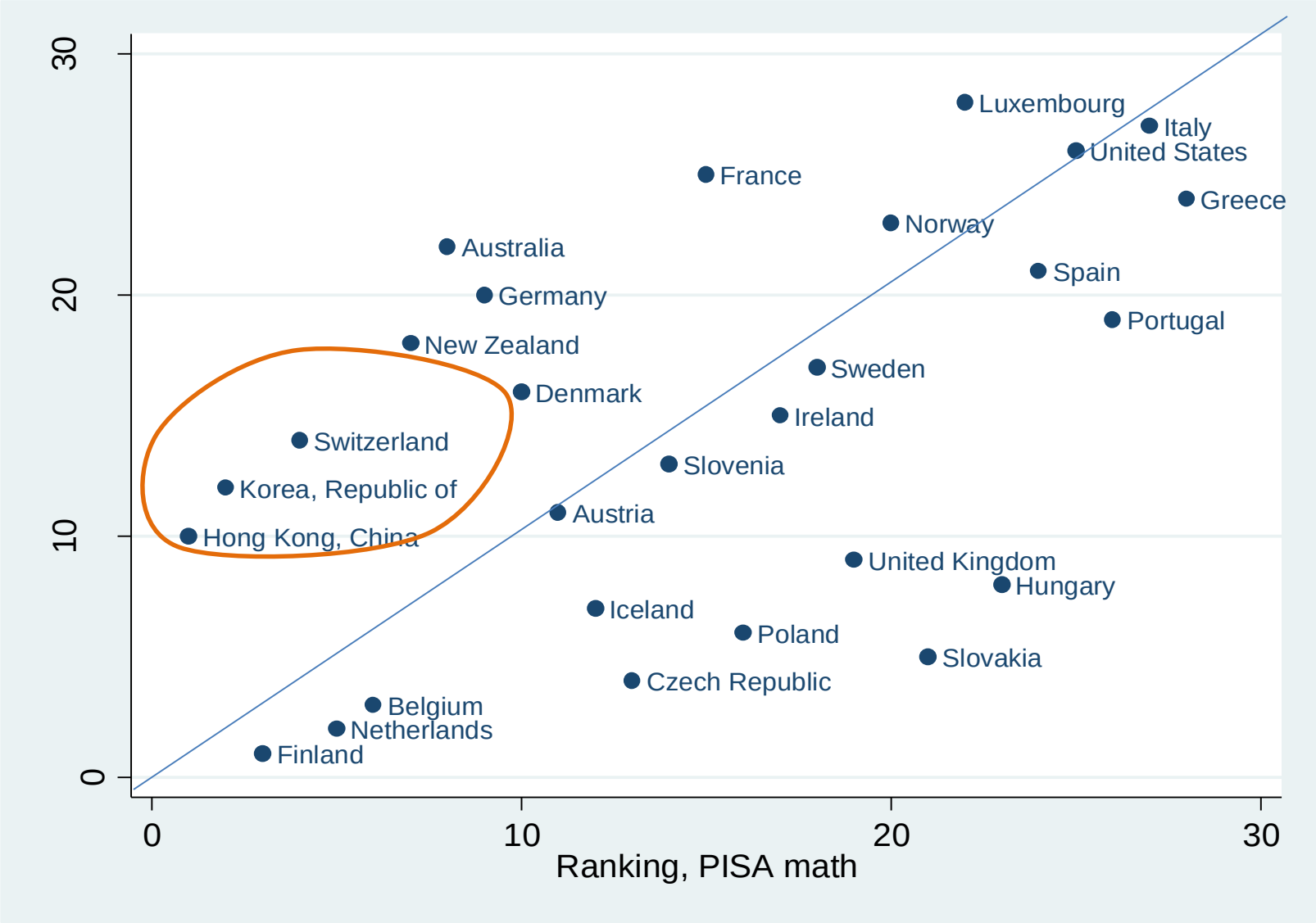
Educational Resources;

Incentives, minus selection

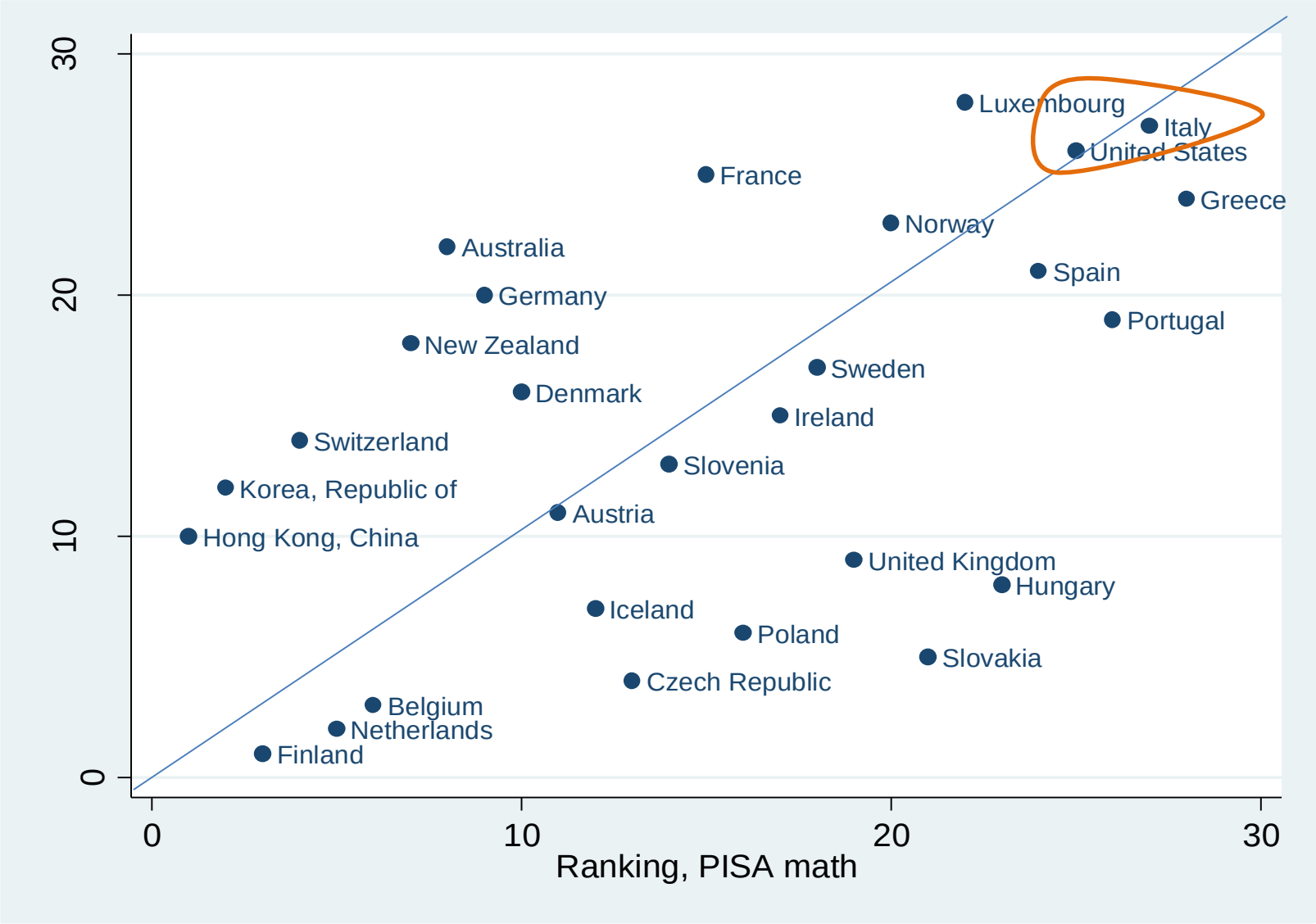
Adjusting for resources: $(y^k / L^k)^\eta$



Adjusting for incentives: $(1-\frac{1}{\theta})\ln p_c^k$



U.S. ranking: almost unchanged



Parameters: α and h_n^k

- Standard TFP estimation with twists

$$\ln \frac{y^k}{L^k S^k} = \text{constant} + \frac{\alpha}{\alpha - 1} \ln\left(1 + \frac{p_n^k}{p_c^k}\right) + \ln \Theta^k$$

Cognitive Human Cap.

Relative Quantity: Human Capital

Residual

- Recap: agg. Production function

$$y^k = \Theta^k [A_c (L_c^k)^{\frac{\alpha-1}{\alpha}} + A_n (L_n^k)^{\frac{\alpha-1}{\alpha}}]^{\frac{\alpha}{\alpha-1}}$$

Results for α

VARIABLES	Math Score	Drop AS NZ	Reading Score	Science Score
$\ln(1+\frac{p_n^k}{p_c^k})$	**3.125****	**3.112****	**2.932****	**2.923****
	(1.224)	**(1.259)**	**(1.170)**	**(1.210)**
ASNZ	-1.094**		-1.070**	-1.070**
	(0.423)		(0.404)	(0.418)
Observations	28	26	28	28
R-squared	0.282	0.203	0.283	0.269

- α = 3.125/(3.215-1)=1.4707 (math score),

More on Results for α

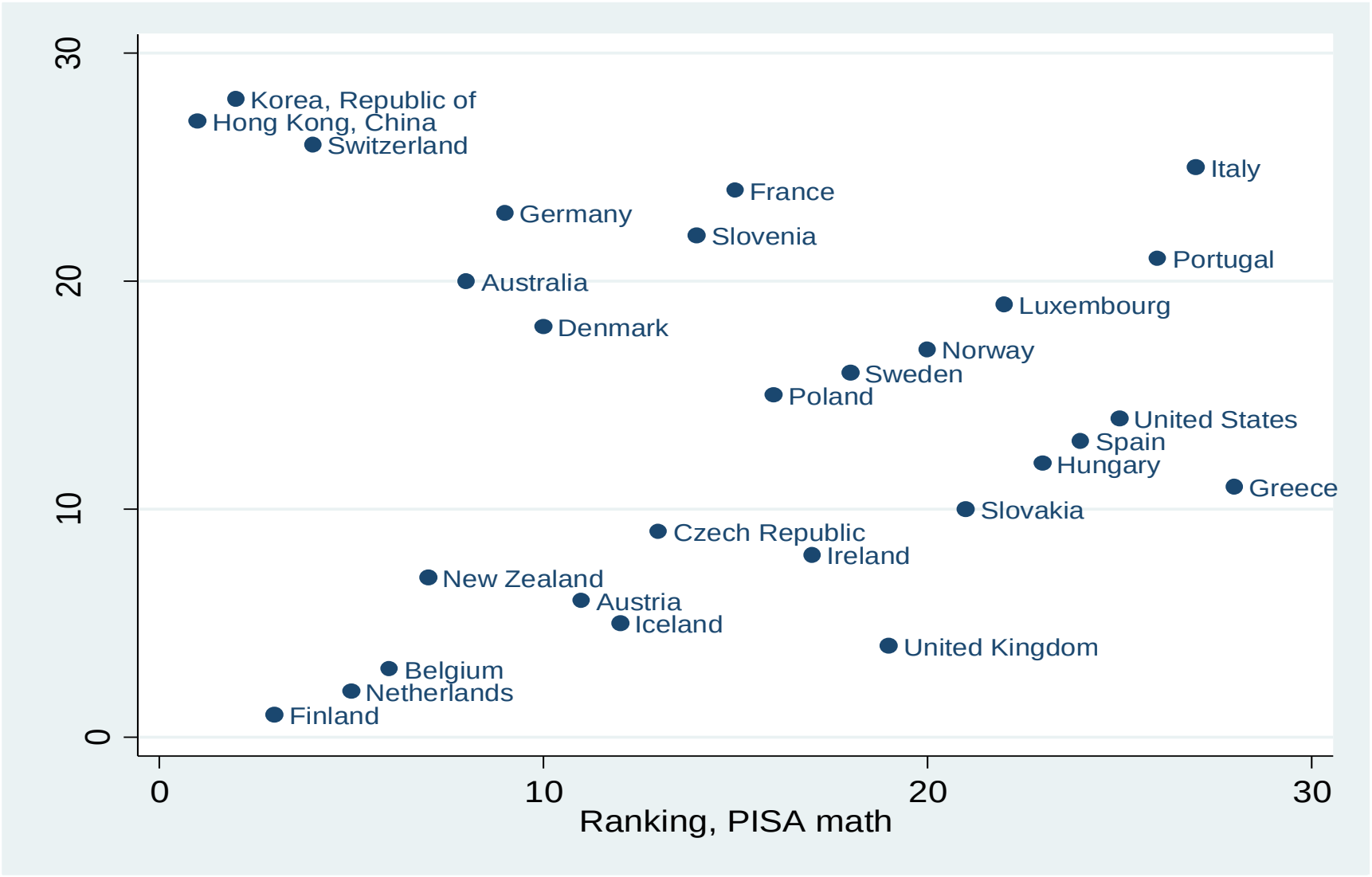
External Validation

- Our estimates for Θ^k are strongly correlated with the TFP estimates in the literature 0.4674 ~ 0.6377
- including PWT 8.0, Harrigan (1997), Eaton and Kortum (1996, 2002), Hall and Jones (1998) and Klenow and Rodriguez-Clare (1997).

Parameters: h_n^k

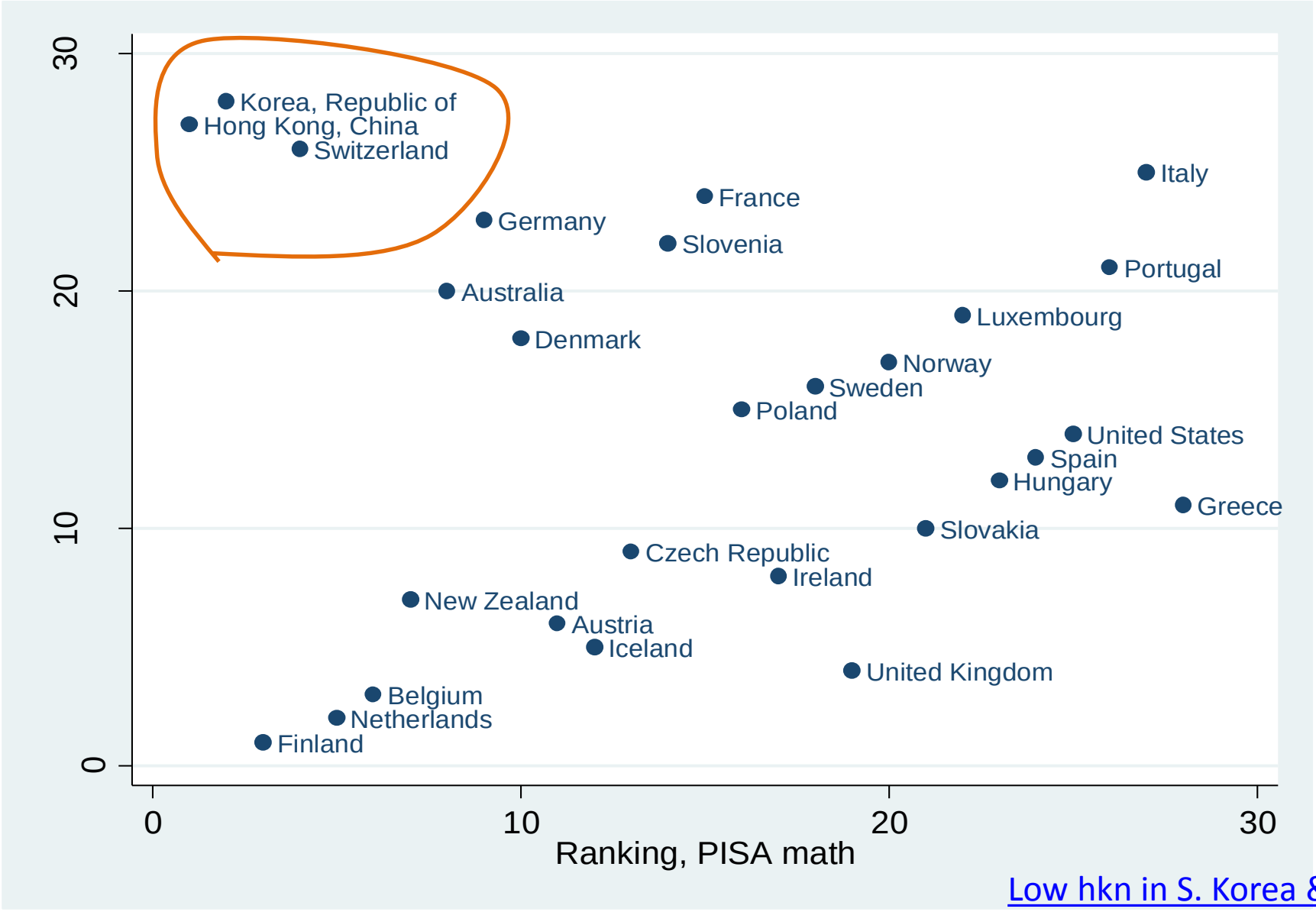
$$\ln \frac{h_c^k}{h_n^k} = \left(\frac{1}{\theta} + \frac{1}{\alpha - 1}\right) \ln \frac{p_c^k}{p_n^k} + \text{constant}$$

Results: Non-cognitive Productivities



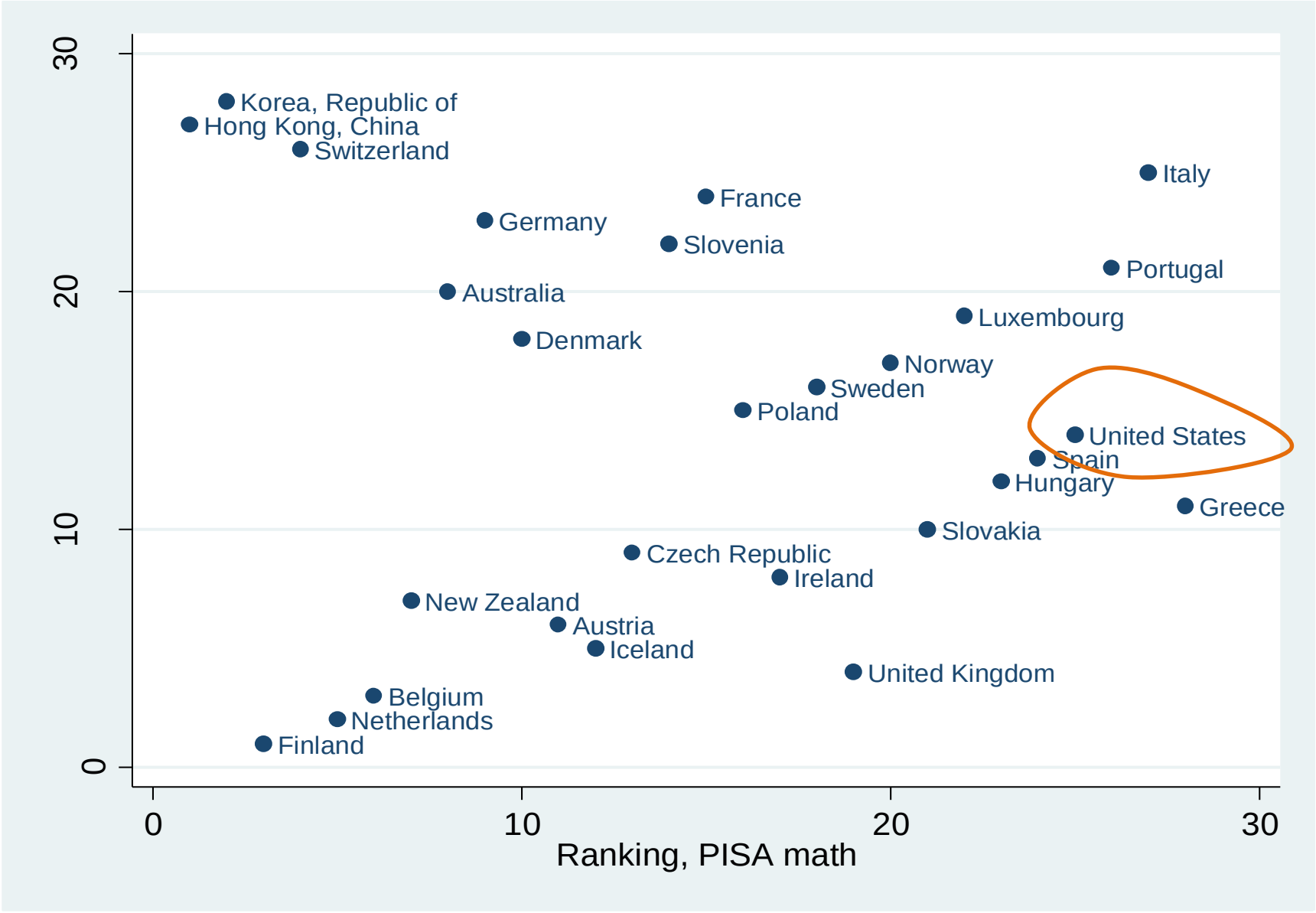
- U.S. level = 1. Correlation = -0.0602

Results: Non-cognitive Productivities

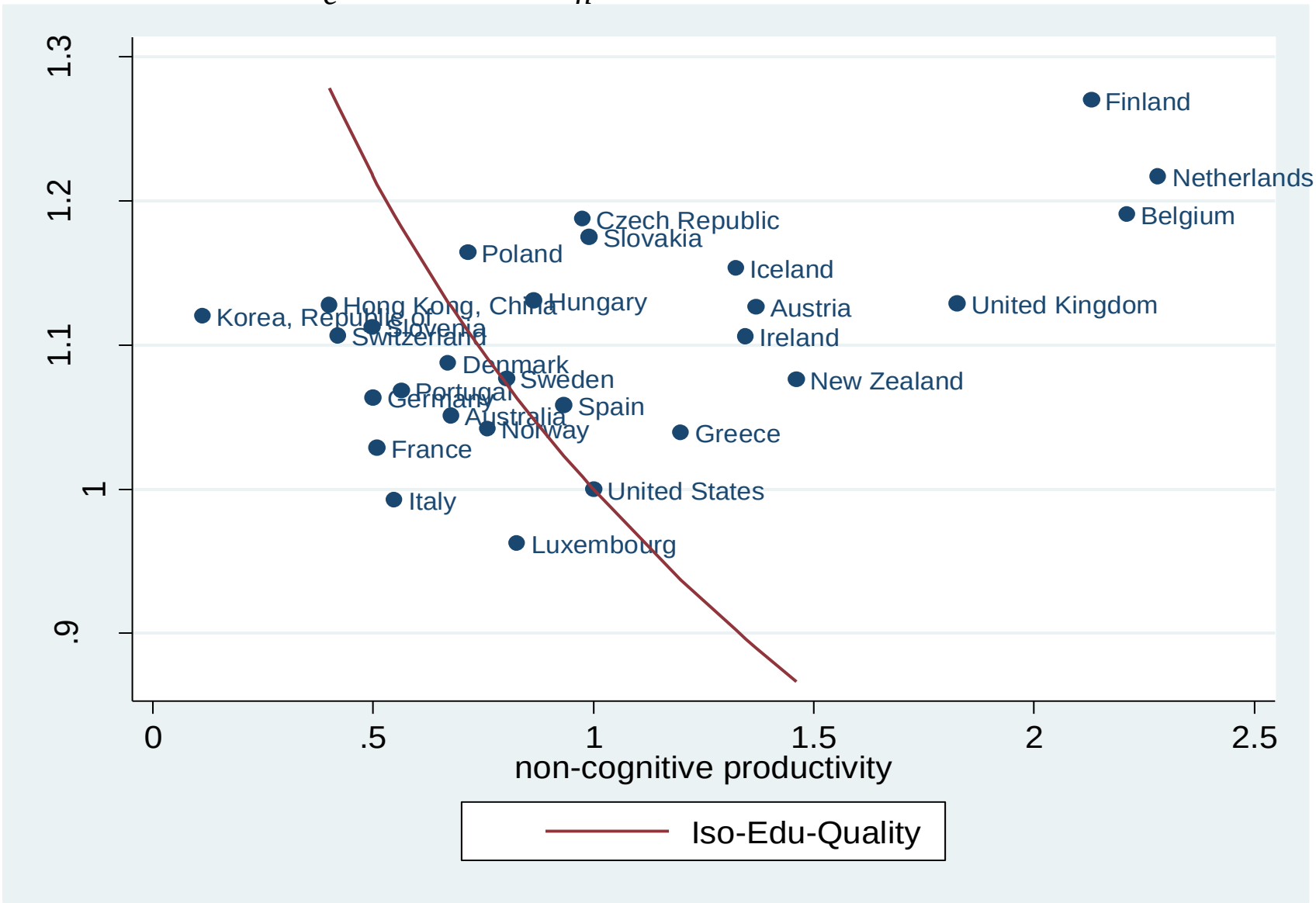


Low hkn in S. Korea & H.K.

Implications for the U.S.



$$\Omega^k = [p_c^0(\frac{h_c^k}{h_c^0})^a + p_n^0(\frac{h_n^k}{h_n^0})^a]^{\frac{1}{a}} = 1, a = 1/(\frac{1}{\theta} + \frac{1}{\alpha - 1})$$



$$\frac{y^k / L^k}{y^0 / L^0} = [\frac{\Theta^k}{\Theta^0}]^{\frac{1}{1-\eta}} [\Omega^k]^{\frac{1}{1-\eta}}$$

Countries	y/L	Output TFP	Edu Quality
Austria	0.6434	0.5297	1.2147
Belgium	0.6892	0.4636	1.4867
Czech Republic	0.3293	0.2860	1.1513
Denmark	0.5979	0.6187	0.9664
Finland	0.5037	0.3259	1.5458
France	0.7329	0.8517	0.8606
Germany	0.6296	0.7126	0.8834
Greece	0.5190	0.4761	1.0901
Hong Kong	0.6864	0.7724	0.8887
Hungary	0.3517	0.3292	1.0684
Iceland	0.5110	0.4168	1.2261
Ireland	0.6642	0.5583	1.1896
Italy	0.6761	0.7977	0.8476
S. Korea	0.4304	0.6027	0.7142
Luxembourg	1.4376	1.5674	0.9172
Netherlands	0.6712	0.4387	1.5300
Norway	0.7289	0.7589	0.9605
Poland	0.3045	0.2917	1.0438
Portugal	0.3845	0.4216	0.9121
Slovakia	0.2979	0.2600	1.1459
Slovenia	0.3929	0.4275	0.9191
Spain	0.6087	0.5913	1.0293
Sweden	0.5937	0.5917	1.0034
Switzerland	0.5855	0.6641	0.8816
United Kingdom	0.6349	0.4758	1.3345
U.S.	1.0000	1.0000	1.0000

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Policy Implications

- Which countries to emulate?
- What is the payoff of education policy?
- What is the objective of education policy?

Policy Implications

- Is an increase in test score always good news?

$$(1-\eta)d\ln S^k = (1+Bp_c^k)d\ln h_c^k - (Bp_n^k)d\ln h_n^k, B>0$$

Policy Implications

- Is an increase in test score always good news?

$$(1-\eta)d\ln S^k = (1+Bp_c^k)d\ln h_c^k - (Bp_n^k)d\ln h_n^k,$$

$$B = \frac{(\theta-1)(\alpha-1)-\alpha\eta}{\theta+\alpha-1} = 0.2496$$

- Policy = U.S. copies everything from H.K.: U.S. test score increases by 22.50%

What if U.S. Gets H.K.'s Edu. System?

Countries	y/L		Output TFP	Edu Quality
Austria	0.6434		0.5297	1.2147
Belgium	0.6892		0.4636	1.4867
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Luxembourg	1.4376		1.5674	0.9172
Netherlands	0.6712		0.4387	1.5300
Norway	0.7289		0.7589	0.9605
Poland	0.3045		0.2917	1.0438
Portugal	0.3845		0.4216	0.9121
Slovakia	0.2979		0.2600	1.1459
Slovenia	0.3929		0.4275	0.9191
Spain	0.6087		0.5913	1.0293
Sweden	0.5937		0.5917	1.0034
Switzerland	0.5855		0.6641	0.8816
United Kingdom	0.6349		0.4758	1.3345
U.S.	1.0000		1.0000	1.0000

Policy Implications

- Both dimensions of the educational system matter

- Our framework: quantify both dimensions => net effects on aggregate output

Open Economy: Setting

- "Talent trade": 1 unit of human capital => 1 unit of intermediate inputs, freely traded
- This implies that w_c and w_n are equalized

- Final goods remain non-tradable.
- Final goods used to produce human capital

Open Economy: Validation

	Dep. Var. = Revealed Comp Advantage		
	(1)	(2)	(3)
Non-cog abundance x non-cog intensity	15.989	15.979	10.615
	(2.92)	(2.92)	(2.02)
Cap abundance x cap intensity		0.000	0.000
		(0.10)	(0.22)
Skill abundance x skill intensity			9.173
			(4.71)
constant	-1.108	-1.113	1.976
	(-3.30)	(-3.28)	(2.77)
industry FE	yes	yes	yes
country FE	yes	yes	yes
R^2	0.369	0.369	0.401
# obs.	1103	1103	1103

Open Economy: Solution

- Effects of educational quality on output per worker

$$\frac{y^k / L^k}{y^0 / L^0} = \left(\frac{\Theta^k}{\Theta^0}\right)^{\frac{1}{1-\eta}} \left(\Omega^k\right)^{\frac{1}{1-\eta}},$$

$$\Omega^k = \left[p_c^0 \left(\frac{h_c^k}{h_c^0}\right)^a + p_n^0 \left(\frac{h_n^k}{h_n^0}\right)^a\right]^{\frac{1}{a}}$$

$a = \theta$

- Recap: closed-economy, $a = 1/\left(\frac{1}{\theta} + \frac{1}{\alpha - 1}\right)$

Open Economy: Parameter Values

- The identification of η, θ, and h^k_c is the same as in closed economy
- For h^k_n

$$\ln \frac{h_c^k}{h_n^k} = \frac{1}{\theta} \ln \frac{p_c^k}{p_n^k} + \text{constant}$$

	Cog Productivity			Non-cog Productivity			Overall Edu Quality	
	Value	Ranking		Value	Ranking		Value	Ranking
open-economy: free trade								
	Identical	Identical		0.9160	0.8577		0.8365	0.7757

Detailed Steps

Overall Edu Quality

Countries	Closed-Econ	Free Trade
Austria	1.2147	1.1539
Belgium	1.4867	1.2496
Czech Republic	1.1513	1.2090
Denmark	0.9664	1.0837
Finland	1.5458	1.3398
France	0.8606	1.0109
Germany	0.8834	1.0487
Greece	1.0901	1.0501
Hong Kong	0.8887	1.1132
Hungary	1.0684	1.1411
Iceland	1.2261	1.1827
Ireland	1.1896	1.1298
Italy	0.8476	0.9733
S. Korea	0.7142	1.0772
Luxembourg	0.9172	0.9526
Netherlands	1.5300	1.2822
Norway	0.9605	1.0371
Poland	1.0438	1.1715
Portugal	0.9121	1.0573
Slovakia	1.1459	1.1957
Slovenia	0.9191	1.1020
Spain	1.0293	1.0623
Sweden	1.0034	1.0779
Switzerland	0.8816	1.0908
United Kingdom	1.3345	1.1694
U.S.	1.0000	1.0000

Conclusion

- Diff. countries produce human capital in very diff. ways
- We can quantify these differences: ≠ Test scores
- These diff. have very large implications for output/worker: trade matters
- New perspectives on payoffs & objectives of edu. policies: trade matters
  - E.g. Test score & agg. output move in opposite directions => exacerbated in open economy

Why Leadership?

	Replicate	Leadership	Not Leadership
Black	-0.0537***	-0.0937**	-0.0381*
	(0.0196)	(0.0365)	(0.0228)
Hispanic	0.0425**	0.0164	0.0482*
	(0.0211)	(0.0378)	(0.0251)
Age	0.0349***	0.0483***	0.0285***
	(0.00708)	(0.0129)	(0.00833)
AFTQ	**0.183*** **	**0.157*** **	**0.183*** **
	(0.00964)	**(0.0182)**	**(0.0113)**
AFTQ2	-0.0130	-0.0199	-0.00717
	(0.00802)	(0.0143)	(0.00961)
Constant	6.233***	6.148***	6.281***
	(0.112)	(0.205)	(0.132)
Observations	3,210	951	2,259
R-squared	0.168	0.151	0.163

Why Leadership?

	Replicate	Interactions
Black	-0.0537***	-0.0661***
	(0.0196)	(0.0191)
Hispanic	0.0425**	0.0413**
	(0.0211)	(0.0206)
Age	0.0349***	0.0323***
	(0.00708)	(0.00689)
Leadership		0.121***
		(0.0163)
college		0.187***
		(0.0264)
aftq	0.183***	0.137***
	(0.00964)	(0.0115)
aftq2	-0.0130	-0.0369***
	(0.00802)	(0.00950)
AFTQ x LDSHP		**-0.0345****
		(0.0159)
AFTQ x College		0.0525**
		(0.0245)
Observations	3,210	3,210
R-squared	0.168	0.214

Back to Data

Why Leadership?

	Replicate	Interactions	Alt. LDSHP
Black	-0.0537***	-0.0661***	-0.0641***
	(0.0196)	(0.0191)	(0.0192)
Hispanic	0.0425**	0.0413**	0.0414**
	(0.0211)	(0.0206)	(0.0206)
Age	0.0349***	0.0323***	0.0316***
	(0.00708)	(0.00689)	(0.00690)
Leadership		0.121***	0.127***
		(0.0163)	(0.0186)
college		0.187***	0.195***
		(0.0264)	(0.0263)
aftq	0.183***	0.137***	0.125***
	(0.00964)	(0.0115)	(0.0113)
aftq2	-0.0130	-0.0369***	-0.0358***
	(0.00802)	(0.00950)	(0.00956)
AFTQ x LDSHP		**-0.0345****	**-0.00749**
		(0.0159)	**(0.0182)**
AFTQ x College		0.0525**	0.0495**
		(0.0245)	(0.0244)
Observations	3,210	3,210	3,210
R-squared	0.168	0.214	0.211

Why Leadership?

	artistic	Not artistic	social	Not social
Black	-1.490*	-0.0533***	0.0238	-0.0515**
	(0.799)	(0.0195)	(0.0683)	(0.0202)
Hispanic	-0.586*	0.0422**	0.119	0.0364*
	(0.331)	(0.0212)	(0.0788)	(0.0215)
Age	0.0752	0.0345***	0.0557**	0.0325***
	(0.0844)	(0.00710)	(0.0254)	(0.00722)
AFTQ	**-0.713****	**0.184*****	**0.204*****	**0.185*****
	(0.333)	**(0.00965)**	**(0.0370)**	**(0.00979)**
AFTQ2	0.299*	-0.0120	-0.00483	-0.0172**
	(0.150)	(0.00809)	(0.0341)	(0.00807)
Observations	**30**	3,180	382	2,828
R-squared	0.188	0.170	0.127	0.181

Detailed Steps: Closed Econ

- Agg. Supply of human capital

$$L_i^k = L^k p_i^k E(h_i^k e^{\eta} \varepsilon_i \mid \text{occ. } i) = \gamma L^k p_i^k [h_i^k (\eta w_i^k)^{\eta} (\frac{T_i}{p_i^k})^{\frac{1}{\theta}}]^{\frac{1}{1-\eta}}$$

- Output identity $y^k = w_n^k L_n^k + w_c^k L_c^k$

- Returns to human capital

$$w_i^k = \Theta^k (p_i^k)^{-\frac{1}{\alpha-1}} (A_i)^{\frac{\alpha}{\alpha-1}}$$

Back to Output/worker

Relative Quantity

- In terms of observables

$$\frac{L_n^k}{L_c^k} = \left(\frac{A_c p_n^k}{A_n p_c^k}\right)^{\frac{\alpha}{\alpha-1}}$$

Back to Comp. Adv.

More Results for θ

VARIABLES	Math Score	Drop AS NZ	Reading Score	Science Score	Alt. Ldshp.
$\ln(p_c^k)$	**0.714*** **	**0.717*** **	**0.521*** **	**0.512** **	**0.677***
	(0.224)	(0.230)	(0.165)	(0.201)	(0.357)
ASNZ	0.213**		0.189***	0.189**	0.175**
	(0.0773)		(0.0570)	(0.0695)	(0.0842)
Constant	5.075***	5.076***	5.032***	5.040***	5.032***
	(0.0607)	(0.0624)	(0.0448)	(0.0546)	(0.0784)
Observations	28	26	28	28	28
R-squared	0.347	0.288	0.384	0.292	0.196

- θ = 1/(1-0.714)=3.4965 (math),
- or 1/(1-0.521) =2.0877 (reading)

Back

More Results for θ

VARIABLES	Leadership	social	artistic
$\ln(p_c^k)$	**0.714*** **	**1.112*** **	**-0.466**
	(0.224)	**(0.298)**	**(2.747)**
ASNZ	0.213**	0.0778	0.130
	(0.0773)	(0.0703)	(0.0874)
Constant	5.075***	5.033***	4.880***
	(0.0607)	(0.0412)	(0.0356)
Observations	28	28	28
R-squared	0.347	0.409	0.082

- θ = 1/(1-0.714)=3.4965 (math),
- or 1/(1-0.521) =2.0877 (reading)

Back

More Results for α

VARIABLES	Leadership	social	artistic
$\ln(1+\frac{p_n^k}{p_c^k})$	**3.125****	**6.564*****	**-2.078**
	(1.224)	**(1.412)**	**(14.23)**
ASNZ	-1.094**	-0.426	-0.733
	(0.423)	(0.332)	(0.453)
Observations	28	3.426***	4.321***
R-squared	0.282	(0.195)	(0.184)

- α = 3.125/(3.215-1)=1.4707 (math score),

Back to Results for α

Why is hkn low in S. Korea and H.K.?

- Seth (2002), "Education Fever …"
  - "A great air of tension hovered throughout South Korea on 17 November 1999 … All nonessential government workers would report to work only later in the morning, as would employees of major firms … thirteen thousand police had been mobilized in Seoul alone … Flights at all the nation's airports had been restricted …"
- Historically, Chinese imperial exam 605 AD, Korea 958 AD

Why is hkn low in S. Korea and H.K.?

- WSJ, 02/29/2012, “Asian Education’s Failing Grade”
  - “A typical East Asian high school student often must follow a 5 a.m. to midnight compressed schedule … for up to six days a week..”
- WSJ, 11/10/2011, “Stress Test …”
  - “Many students prepare for these entrance exams from an early age, often studying up to 16 hours a day for years …”

Back to Non-cog Ranking Picture

Detailed Steps: Open Econ

- Exact price index

$$P^k = \frac{1}{\Theta^k}[(A_c)^{\alpha}(w_c)^{1-\alpha} + (A_n)^{\alpha}(w_n)^{1-\alpha}]^{\frac{1}{1-\alpha}}$$

- Normalization: $P^k = 1/\Theta^k$

- To max net income: $w_i^k h_i^k e^{\eta} \varepsilon_i - P^k e$

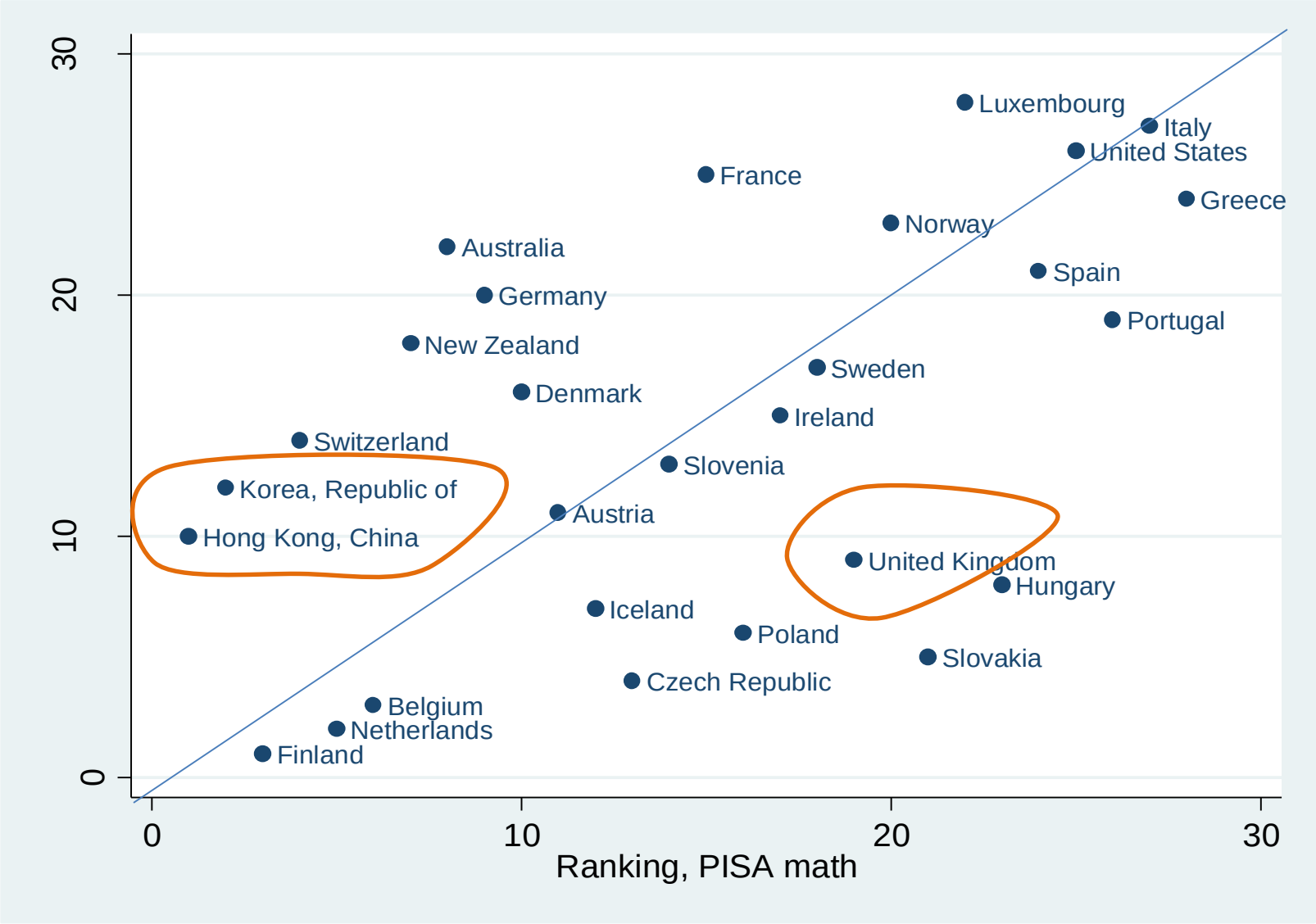
- The price index affects the levels of edu. spending, output, and agg. supplies of human capital

Back to Open Econ

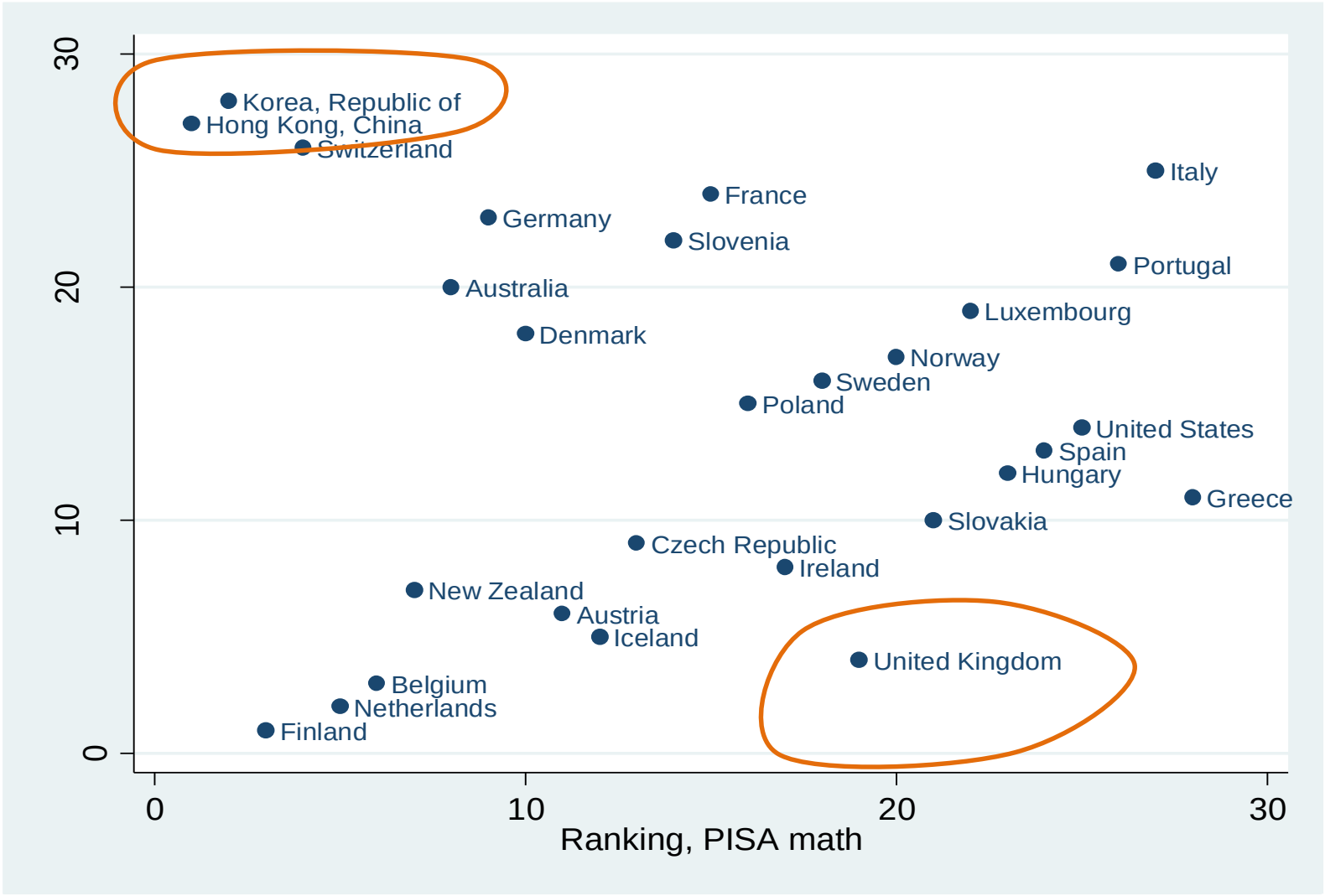
Implications for the U.K.

- U.K. education minister, Elizabeth Truss, visited Shanghai, Feb. 18, 2014, to “learn a lesson in math”

U.K. Cognitive Productivity



U.K. Non-cognitive Productivity



- High test score ≠ superior educational system