

# University of Nottingham UEB Global Engagement Workshop

Nottingham, 23 April 2018

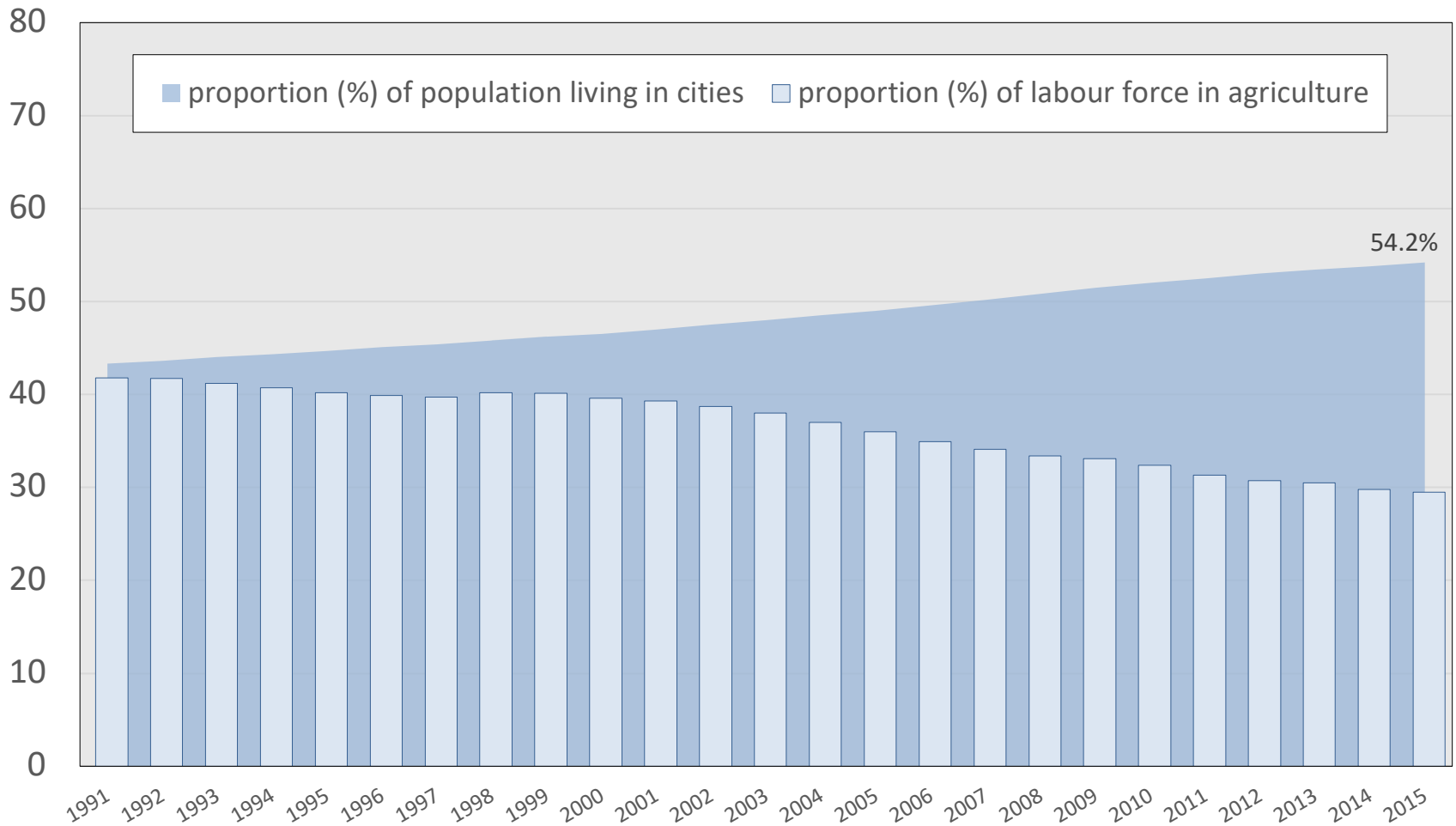
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ESRC Centre for Global Higher Education

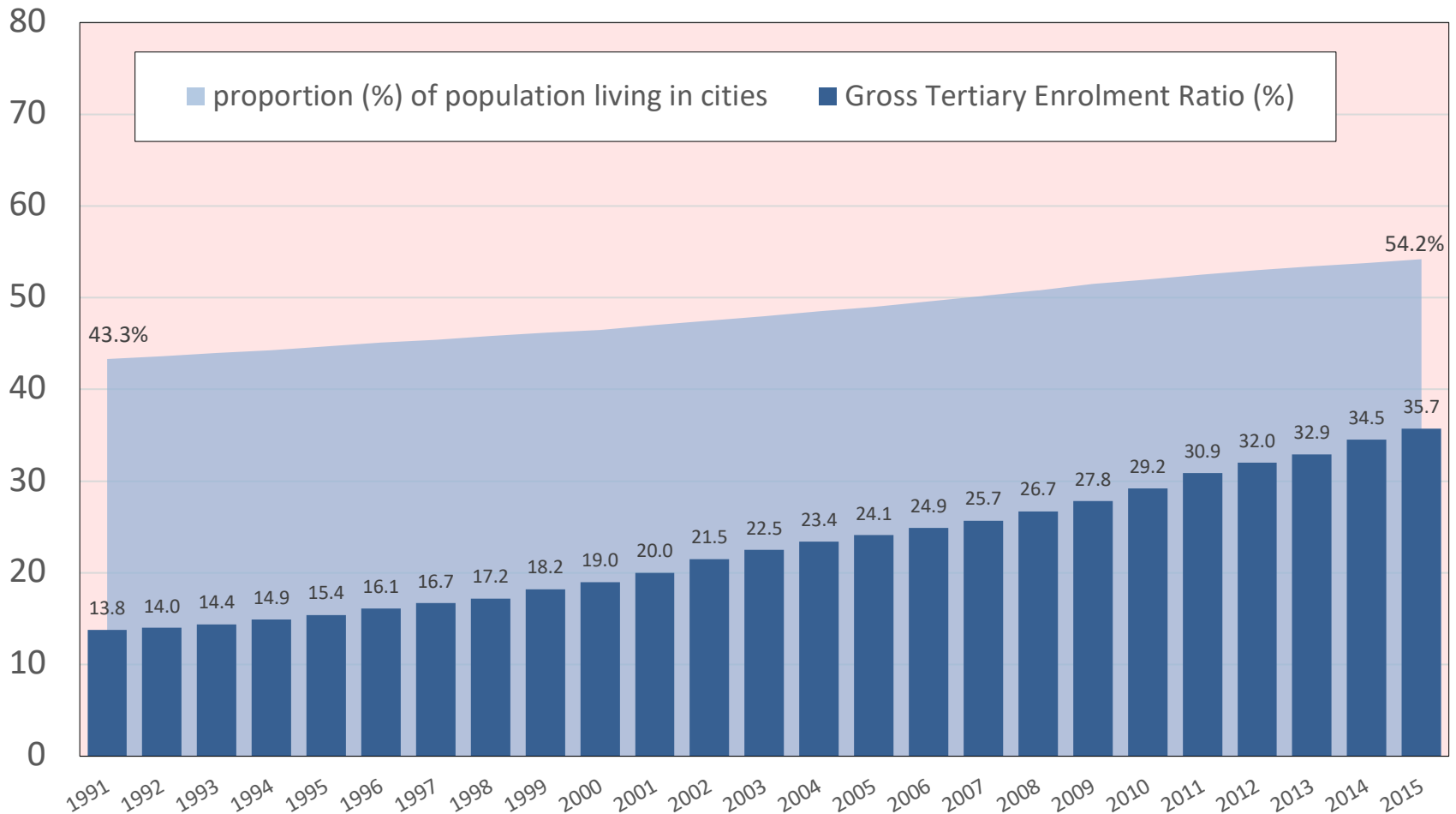
# Global HE: neither state nor market

- The logic of global higher education and science is more that of an open collaborative network than a vertical command system, a semi closed competitive oligopolistic market, or a national arms race in technological advantage
- There is no global state, and universities compete for prestige... but more so at national level than globally.
- In the space between and across nations there is a high degree of voluntary cooperation, not just in the collaboration between research groups but in the institutional relations between universities. This recalls the argument about voluntary cooperation in civil society by Nobel Laureate Elinor Ostrom, *Governing the commons* (Cambridge UP, 1990)

# World proportion of labour force in agriculture (%) and people in cities (%): 1991-2015



# World urbanization (%) and Gross Tertiary Enrolment Ratio (%): 1991-2015

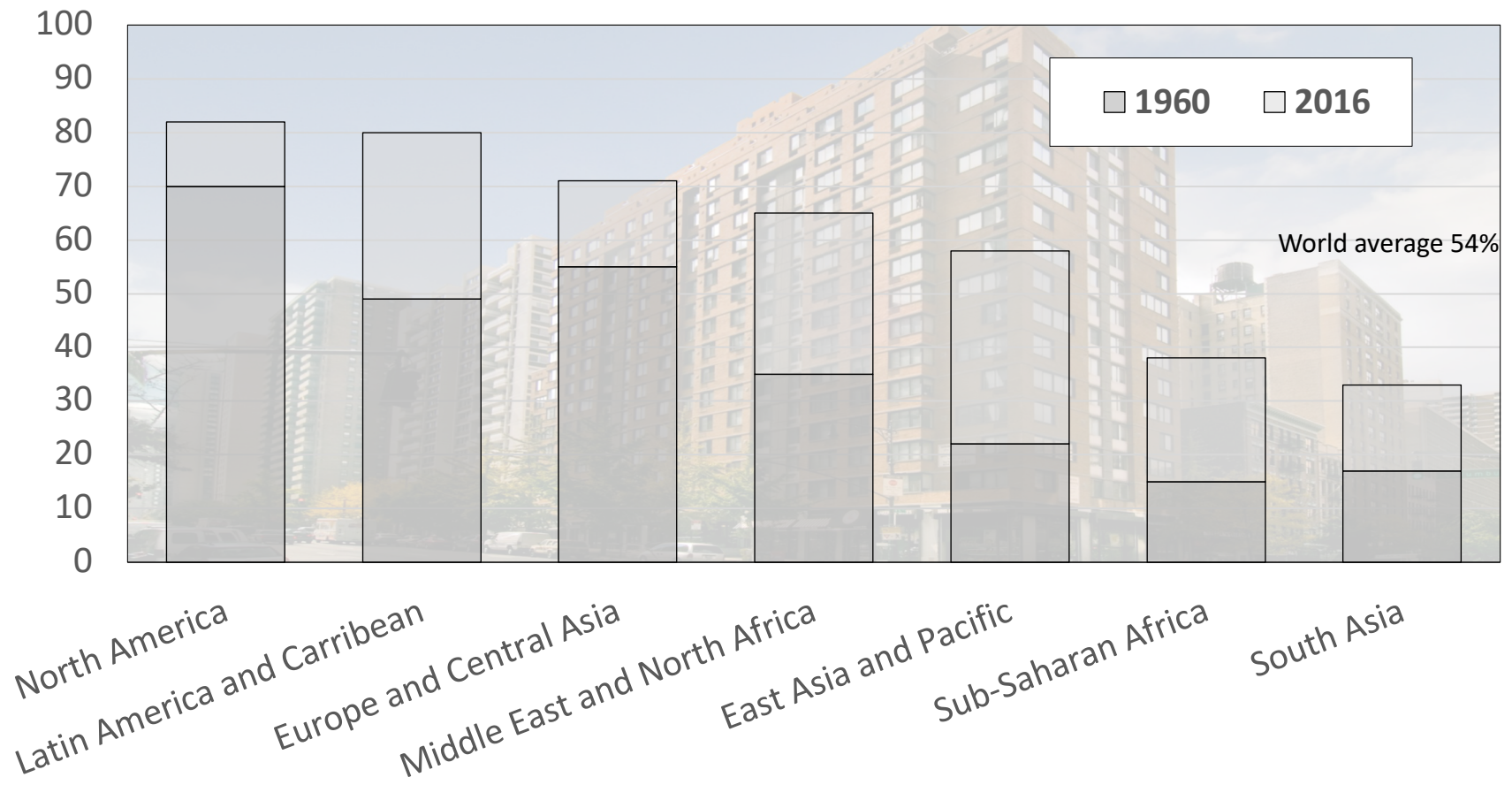


# Growth of the global middle class

- For Brookings, Homi Kharas (2017) states that the global middle class reached 3.2 billion persons in 2016, half a billion more than previously projected.
- The world middle class *doubled in size* between 2000 and 2016 which much of the growth in China and India
- ‘Within two or three years’ the majority of the world’s inhabitants will be middle class, with the growth of the global middle class concentrated at the lower income end.

[The middle class is defined as persons with incomes of \$10-100 American dollars a day in 2005 purchasing power parity values, \$14,600 to \$146,000 per year]

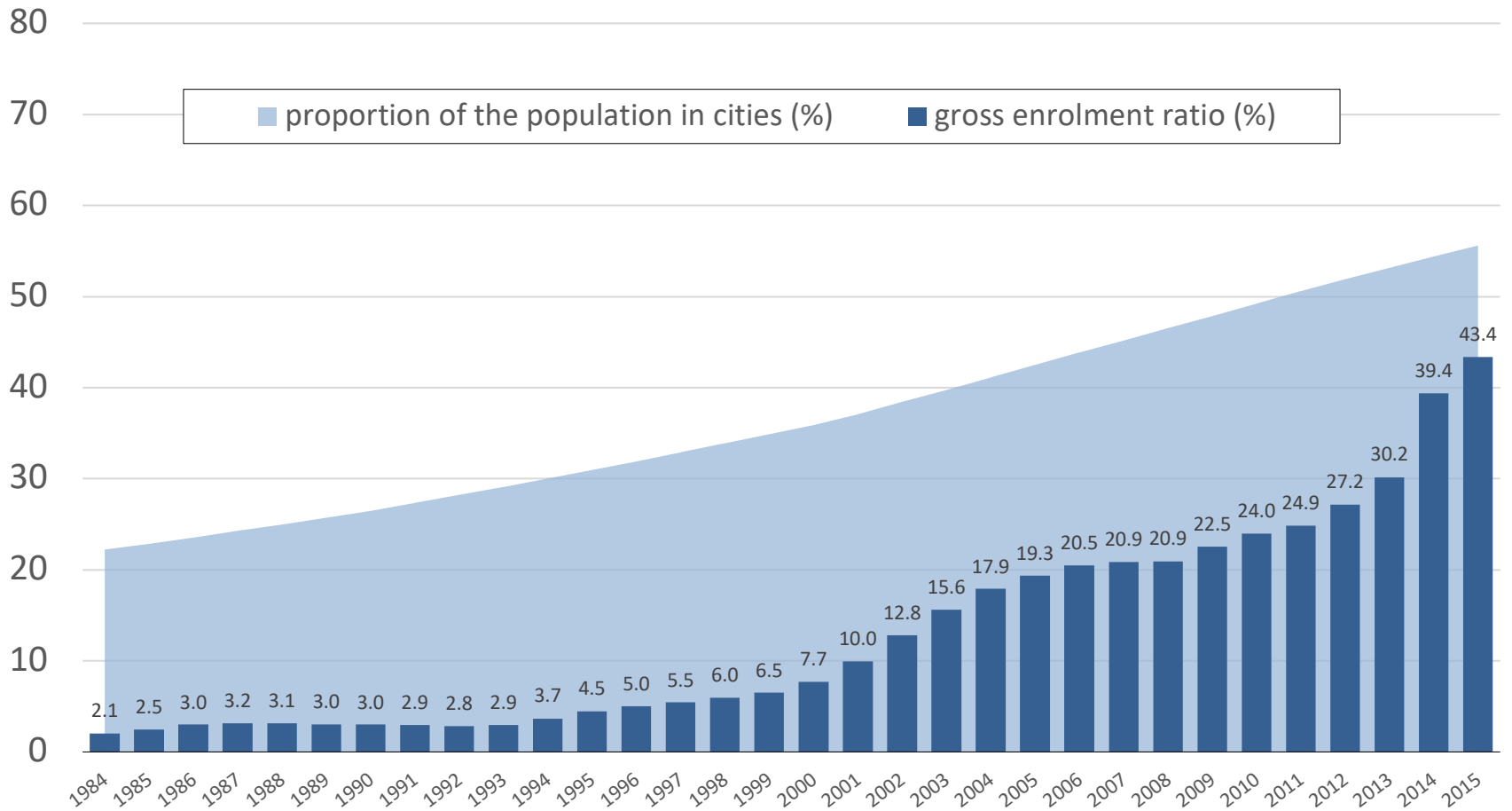
# Proportion of people living in cities (%), by world region: 2016



## Regional Gross Tertiary Enrolment Ratios (%): 1970, 1990, 2010 and 2014

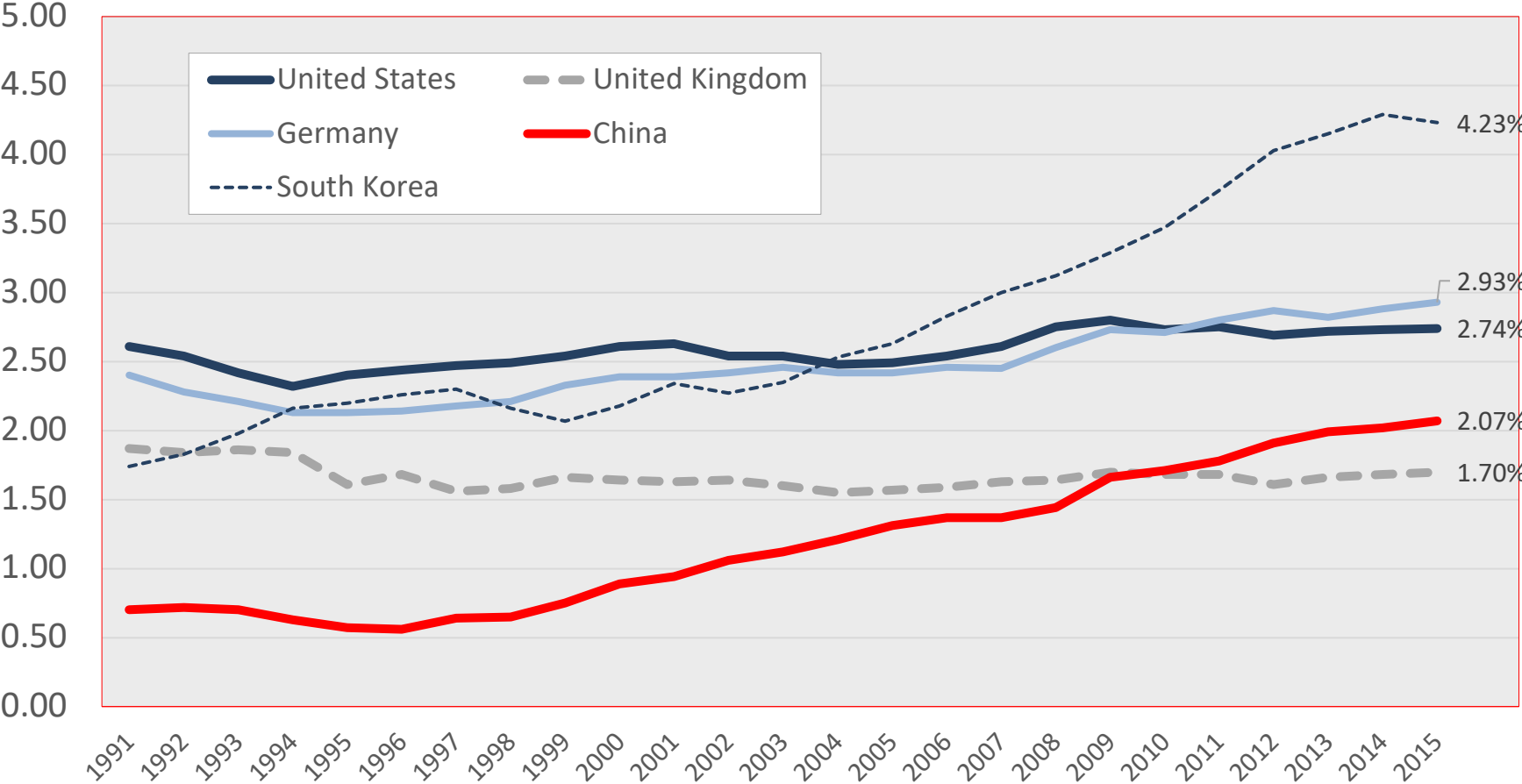
	1970	1990	2010	2014
World	10.0	13.6	29.3	34.5
North America/ W. Europe	30.6	48.6	76.9	76.4
Central and Eastern Europe	30.2	33.9	67.9	74.4
Latin America and Caribbean	6.9	16.9	40.9	44.7
East Asia and Pacific	2.9	7.3	27.3	39.1
Arab States	6.0	11.4	25.5	28.9
Central Asia	n.a.	25.3	26.7	25.7
South and West Asia	4.2	5.7	17.4	22.8
Sub-Saharan Africa	0.9	3.0	7.7	8.2

# Urbanization (%) and Gross Tertiary Enrolment Ratio (%) in China: 1984-2015





# Investment in R&D as a proportion (%) of GDP, USA UK, Germany, China, South Korea: 1991-2015

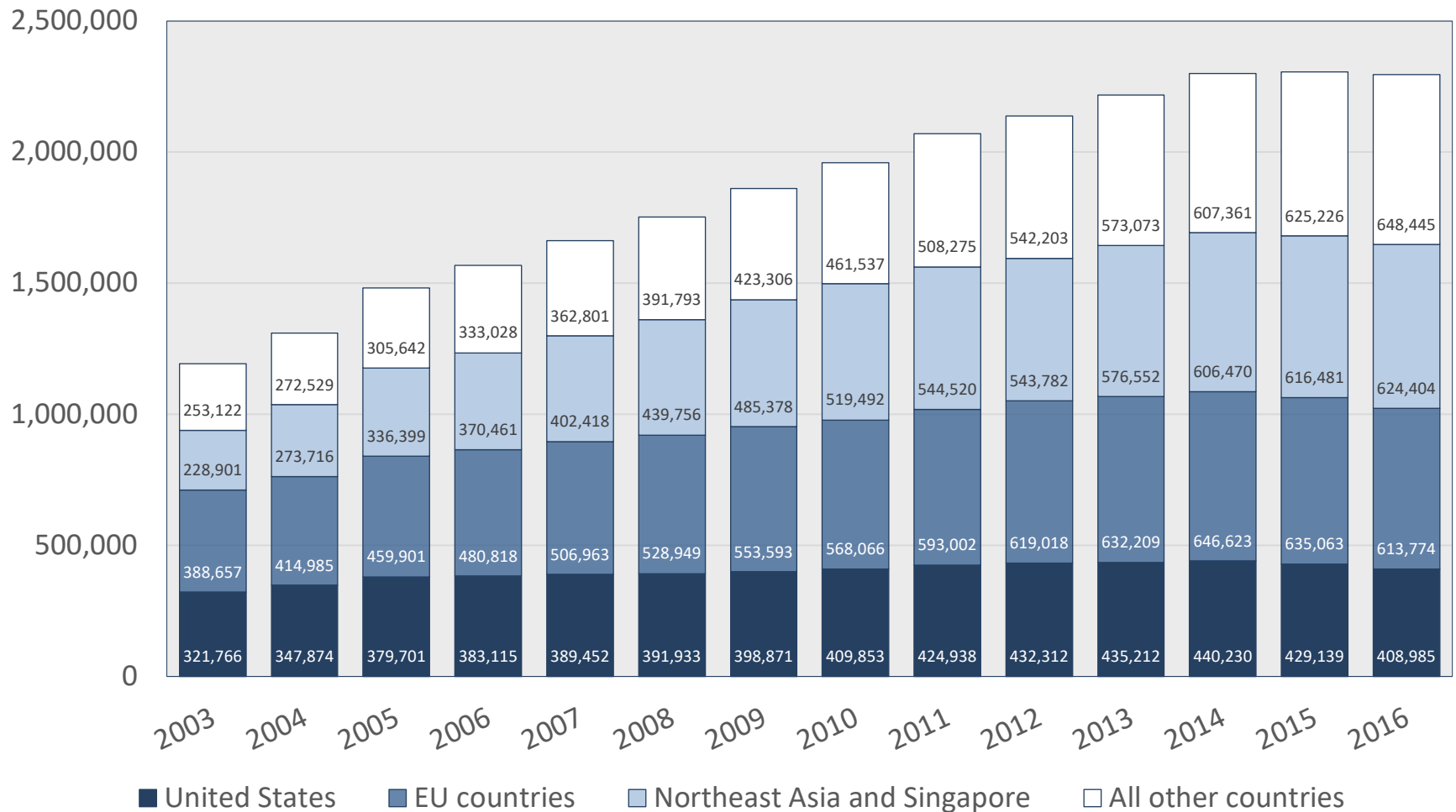


# Internationally mobile/ foreign[\*] doctoral students as proportion (%) of all doctoral students, 2015

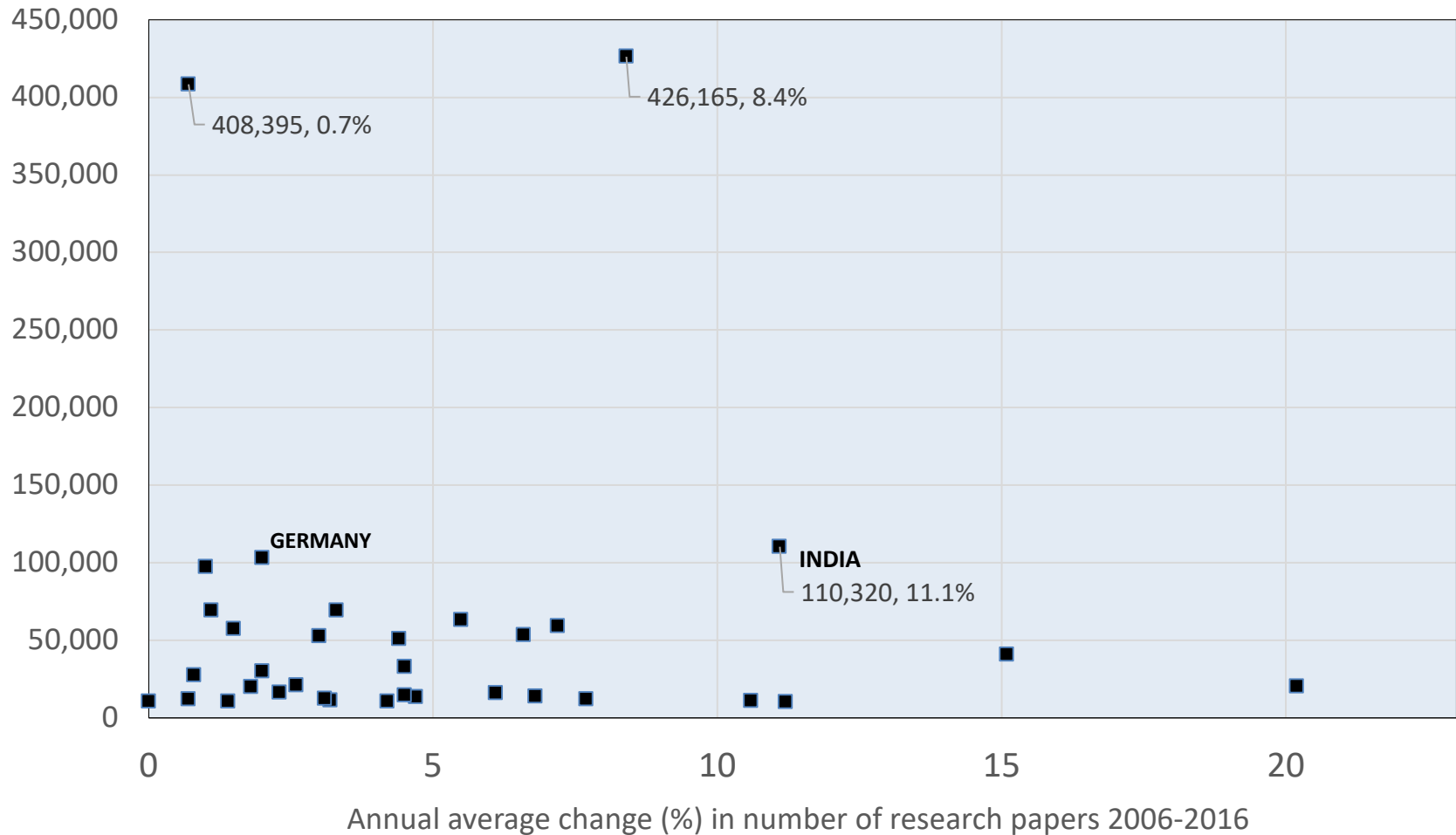
Numbers in brackets = number of top 500 universities, ARWU 2017

Luxembourg (0)	87.0%	Austria (6)	27.0%	Slovak Rep.* (0)	9.1%
Switzerland (7)	54.3%	<b>OECD average</b>	<b>25.7%</b>	Latvia (0)	8.8%
New Zealand (2)	46.2%	Ireland (3)	25.4%	South Korea* (12)	8.7%
UK (37)	42.9%	Canada (20)	24.4%	Slovenia (1)	8.5%
Belgium (7)	42.3%	Brazil* (6)	22.4%	Chile (2)	8.4%
France (22)	40.1%	Portugal (3)	21.2%	Hungary (2)	7.2%
USA (146)	37.8%	Norway (3)	20.5%	Turkey* (1)	6.5%
Netherlands (12)	36.2%	Finland (6)	19.9%	Israel* (6)	5.5%
Sweden (11)	34.0%	Japan (18)	18.2%	Russian Fed.* (2)	4.5%
Australia (20)	33.8%	Czech Rep.* (1)	14.8%	Mexico (1)	2.6%
Denmark (5)	32.1%	Estonia (0)	10.7%	Poland (2)	1.9%
Iceland (0)	31.6%	Germany (39)	9.1%		

# Annual number of science papers, USA, Europe, East Asia and Singapore, rest of world: 2003-2014



# Number of papers (2016), and annual rate of growth (2006-2016), national research systems



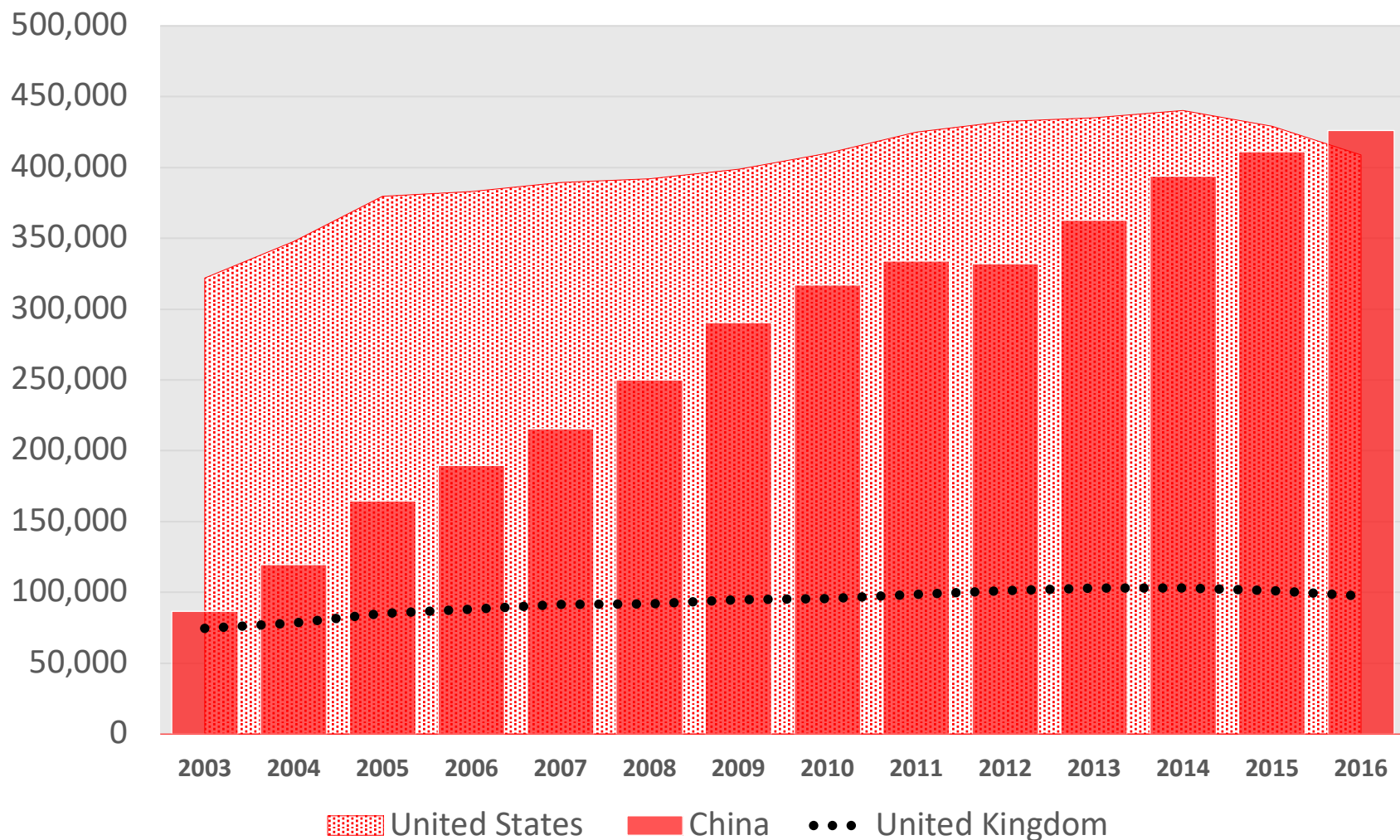
# Research universities with 1000+ high citation (top 10%) papers in 2006-09 (unshaded) and 2012-15

university	Papers 2012-15	
Harvard U	USA	7134
Stanford U	USA	3372
U Michigan	USA	2798
Johns Hopkins U	USA	2649
UC Berkeley	USA	2628
Massachusetts IT	USA	2565
U Washington, Seattle	USA	2436
UC Los Angeles	USA	2398
U Pennsylvania	USA	2247
UC San Diego	USA	2217
Columbia U	USA	2168
Yale U	USA	2130
UC San Francisco	USA	1967
Duke U	USA	1828
Northwestern U	USA	1813
U Wisconsin-Madison	USA	1766
U Minnesota, T. Cities	USA	1649
U Pittsburg	USA	1629
U North Carolina, C.H.	USA	1543
UC Davis	USA	1493
Cornell U	USA	1468
Washington U, St L.	USA	1467
U Texas, Austin	USA	1451
New York U	USA	1450
Ohio State U	USA	1425
U Chicago	USA	1393

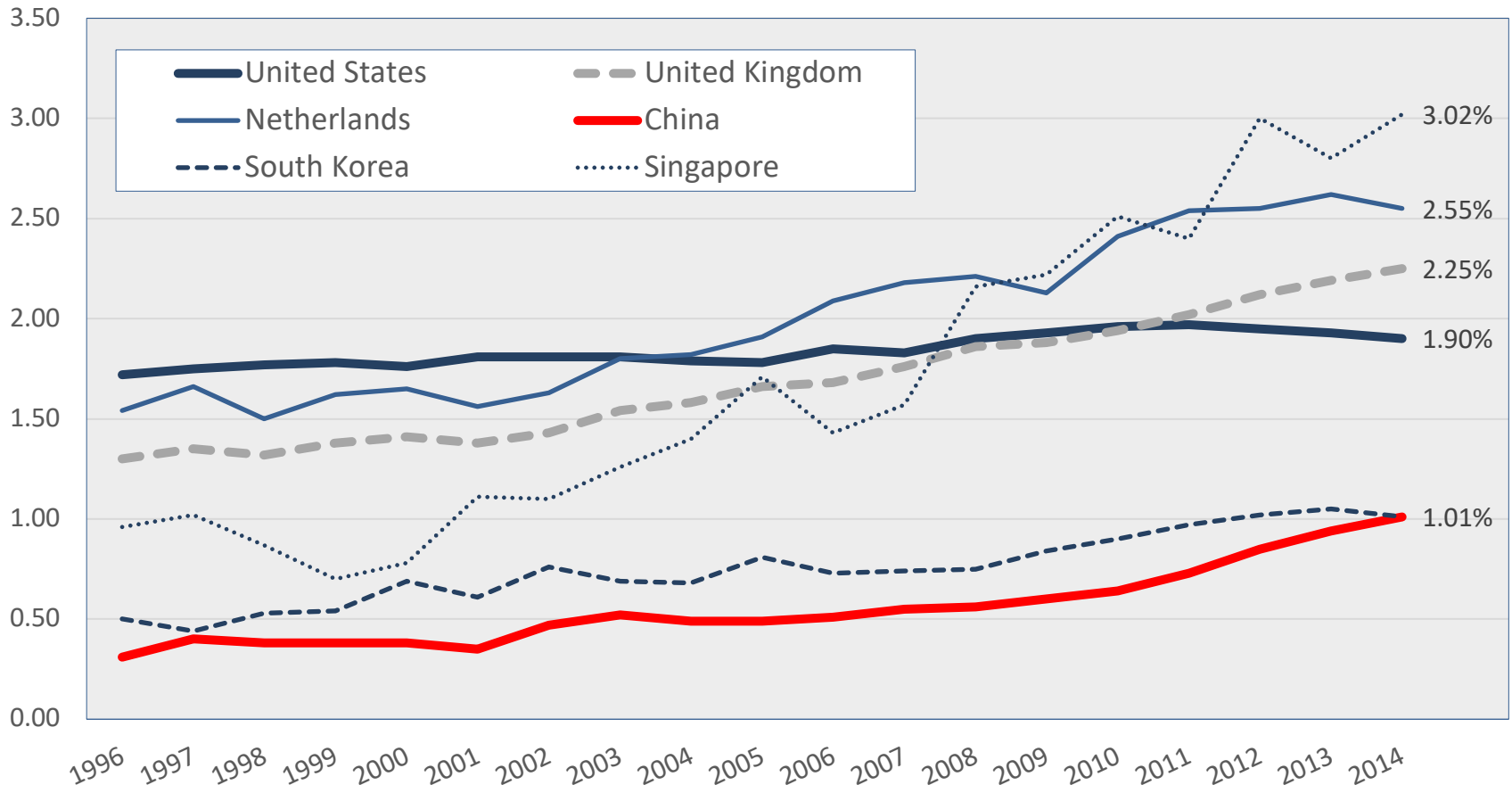
university	Papers 2012-15	
Pennsylvania State U	USA	1363
U Illinois Urbana-C.	USA	1319
U Texas HSC, Houston	USA	1307
U Florida	USA	1206
U Southern California	USA	1171
Princeton U	USA	1170
Vanderbilt U	USA	1159
Caltech	USA	1119
Emory U	USA	1076
Rutgers U	USA	1008
U Maryland, College Park	USA	1000
<b>OTHER ANGLO-SPHERE [Nottingham 801, 9th in UK]</b>		
U Toronto	CANADA	2980
U British Columbia	CANADA	1730
McGill U	CANADA	1407
U Alberta	CANADA	1097
U Oxford	UK	2570
U College London	UK	2357
U Cambridge	UK	2274
Imperial College London	UK	1871
U Manchester	UK	1273
King's College London	UK	1231
U Edinburgh	UK	1078
U Melbourne	AUSTRALIA	1518
U Queensland	AUSTRALIA	1443
U Sydney	AUSTRALIA	1416

university	Papers 2012-15	
Monash U	AUSTRALIA	1109
U New South Wales	AUSTRALIA	1080
<b>EAST ASIA</b>		
Tsinghua U	CHINA	1768
Zhejiang U	CHINA	1762
Shanghai Jiao Tong U	CHINA	1538
Peking U	CHINA	1403
Fudan U	CHINA	1224
Huazhong U S&T	CHINA	1045
Sun Yat-sen U	CHINA	1006
National U Singapore	SINGAPORE	1597
Nanyang Technological U	SINGAPORE	1413
U Tokyo	JAPAN	1333
Seoul National U	STH KOREA	1182
<b>EUROPE</b>		
ETH Zurich	SWITZERLAND	1596
U Zurich	SWITZERLAND	1106
Ecole P.F. Lausanne	SWITZERLAND	1013
Katholieke U, Leuven	BELGIUM	1459
Ghent U	BELGIUM	1207
U Copenhagen	DENMARK	1432
U Utrecht	NETHERLANDS	1382
U Amsterdam	NETHERLANDS	1234
Karolinska Institute	SWEDEN	1056
Ludwig Maximillians U	GERMANY	1005
U Paris VI P&M Curie	FRANCE	1005

# US National Science Board data on number of research papers, USA, China, UK: 2003-2016



# Proportion of all papers that were in top 1 per cent of field by cite rate: USA, UK, Netherlands, China, South Korea, Singapore: 1996-2014



# Growth in the number of high citation (top 10%) papers, selected Asian universities: 2006-09 to 2012-15

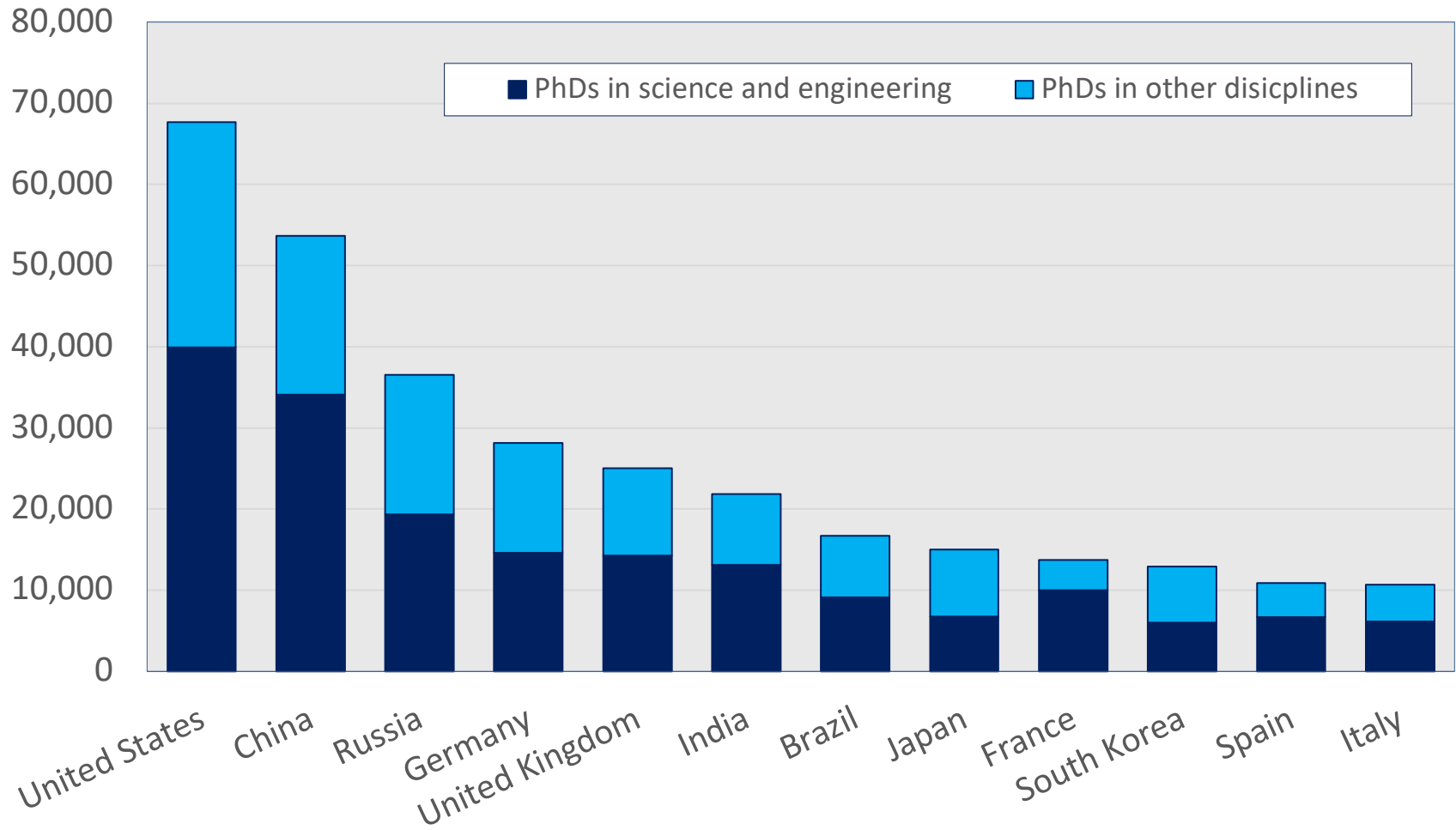
University		Top 10% papers 2006-2009	Top 10% papers 2012-2015	Growth 2006-09 to 2012-15 2006-09 = 1.00
Tsinghua U	CHINA	819	1768	2.15
Zhejiang U	CHINA	730	1762	2.42
Peking U	CHINA	622	1538	2.47
Shanghai Jiao Tong U	CHINA	644	1403	2.11
Fudan U	CHINA	469	1224	2.61
Huazhong UST	CHINA	241	1045	4.37
National U Singapore	SINGAPORE	1042	1597	1.53
Nanyang Technological U	SINGAPORE	568	1413	2.49
Tokyo U	JAPAN	1323	1333	1.01
Kyoto U	JAPAN	968	932	0.96
U Hong Kong	HONG KONG SAR	558	741	1.33
Seoul National U	STH. KOREA	742	1182	1.59
National Taiwan U	TAIWAN	604	786	1.30
MIT	USA	2091	2565	1.23
U Cambridge	UK	1796	2274	1.27



# World's leading universities in high citation (top 10%) papers in Physical Sciences STEM, 2012-15

University	System	Top 10% papers in Physical Sciences & Engineering	University	System	Top 10% papers in Mathematics & Computing
UC Berkeley	USA	1176	Tsinghua U	CHINA	367
Massachusetts IT	USA	1175	Nanyang TU	SINGAPORE	259
Tsinghua U	CHINA	1054	Zhejiang U	CHINA	256
Stanford U	USA	976	Huazhong USA	CHINA	250
Nanyang TU	SINGAPORE	931	Massachusetts IT	USA	245
Harvard U	USA	875	Harbin IT	CHINA	236
Zhejiang U	CHINA	857	NU Singapore	SINGAPORE	226
U Cambridge	UK	801	Stanford U	USA	208
NU Singapore	SINGAPORE	749	Xidian U	CHINA	205
U S & T	CHINA	720	Shanghai Jiao T U	CHINA	196
ETH Zurich	SWITZERLAND	678	City U Hong Kong	HONG K SAR	188
U Tokyo	JAPAN	649	U Texas, Austin	USA	187
Shanghai JT U	CHINA	638	South East U	CHINA	184
Peking U	CHINA	636	UC Berkeley	USA	184
Caltech	USA	635	Beihang U	CHINA	177

# Doctoral degrees by country: 2014



# Global network logic

... the international and national networks may be shaping each other in a process of co-evolution between the national institutional structure and the global network. The relative influences of national and international networks appear to vary among nations. Globalization and internationalization can first be considered as a tendency, but in more than half of the countries, the international network has become the better predictor of the national participation at the global level than vice versa. In other cases, national patterns of collaboration still prevail.

... international cooperation is particularly advantageous for less advanced countries; network participation should enhance that advantage because it enables efficient collective search... The active and robust global network is proof of its own usefulness. Researchers gain enough benefit from it that they are willing to extend the extra time and effort to maintain long-distance communications. Should capacity continue to grow in more places around the globe, one can expect to see more 'nodes' join the network. The global network is arguably now a more stable system that serves as a source of vitality and direction to R&D at all lower levels...

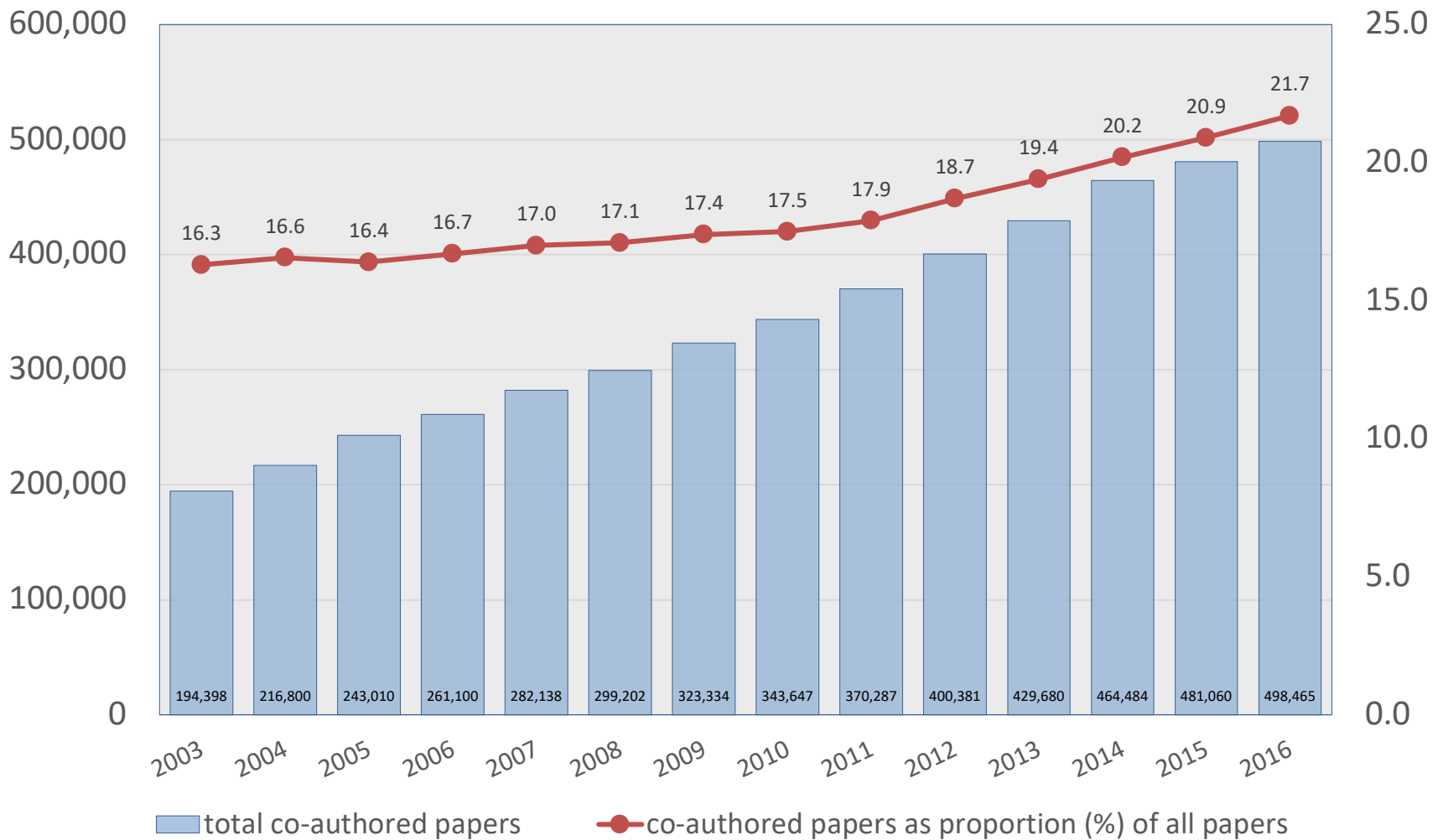
- Wagner, C., Park H. and Leydesdorff, L. (2015). The continuing growth of global cooperation networks in research: A conundrum for national governments. *PLoS ONE* 10(7): e0131816. doi:10.1371/journal.pone.0131816

The global network presents opportunities for science policy-makers to seek efficiencies that were not available when a few nations dominated science. With improved scanning of research and more effective communications, it may be possible to leverage foreign research, data, equipment, and know-how ... it may be possible to ask grant seekers to identify possibilities for efficiency gains through international collaboration, and then provide the financial and policy supports to integrate knowledge from abroad.

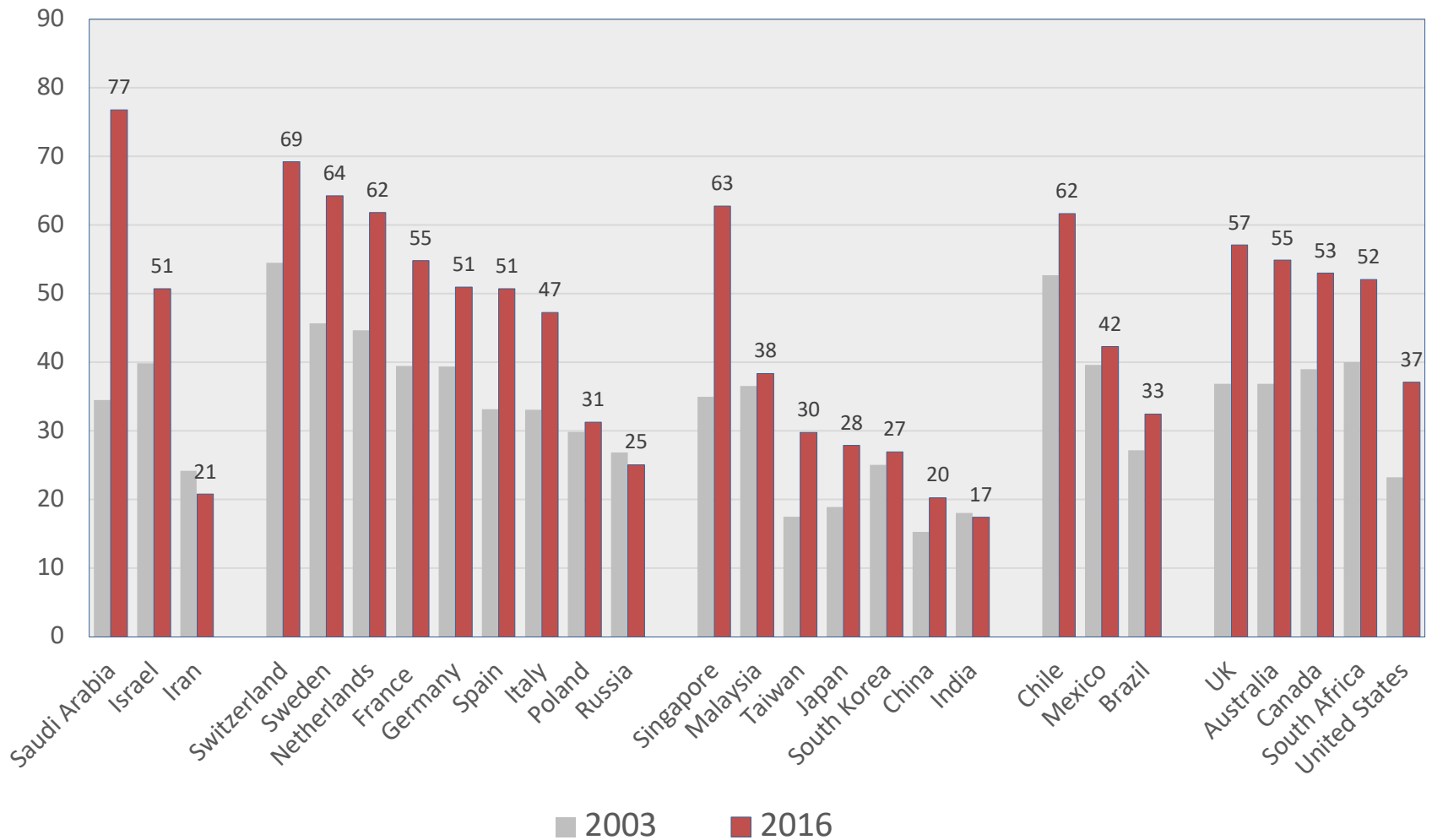
This dynamic system, operating orthogonally to national systems, is increasingly difficult to influence and even less amenable to governance as it grows. This does not mean that nations must build an international governance mechanism, but that they must learn to manage and benefit from a network. Networks operate by reciprocity, exchange, incentives, trust, and openness...

-Wagner, C., Park H. and Leydesdorff, L. (2015). The continuing growth of global cooperation networks in research: A conundrum for national governments. *PLoS ONE* 10(7): e0131816.  
doi:10.1371/journal.pone.0131816

# Growth in internationally co-authored papers, all countries: 2003-2016

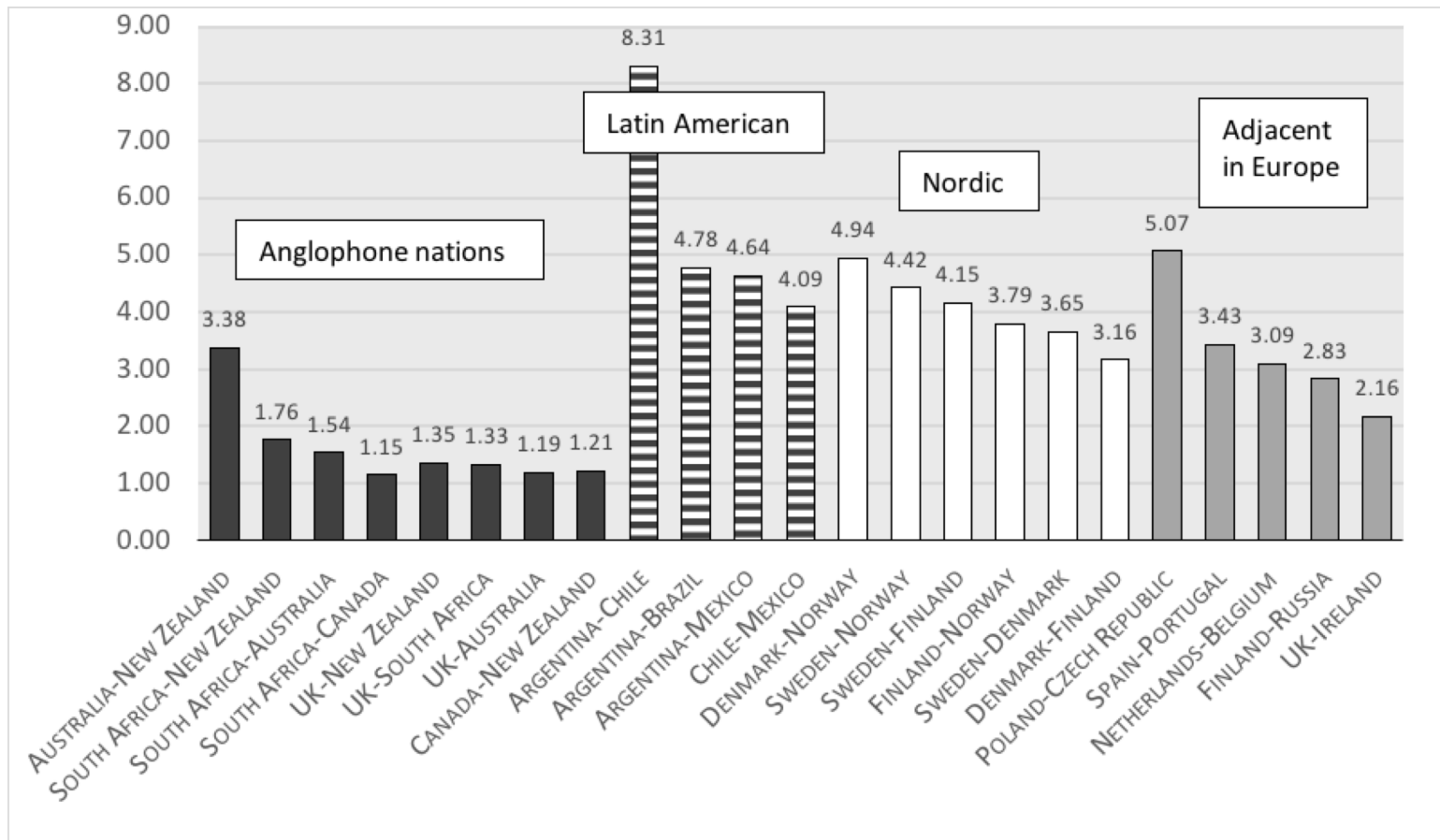


# Proportion (%) of all papers that are internationally co-authored, selected countries: 2003 and 2016



# Selected examples of intensive regional research collaboration: 2016

Rate of international co-authorship in science and engineering papers between named countries in the pair, relative to their overall rate of international co-authorship with all countries. **world average = 1.00**



# Above average intensity of research collaboration

UNITED STATES	
Israel	1.33
South Korea	1.23
China	1.19
Canada	1.13
Taiwan	1.05
Mexico	1.04

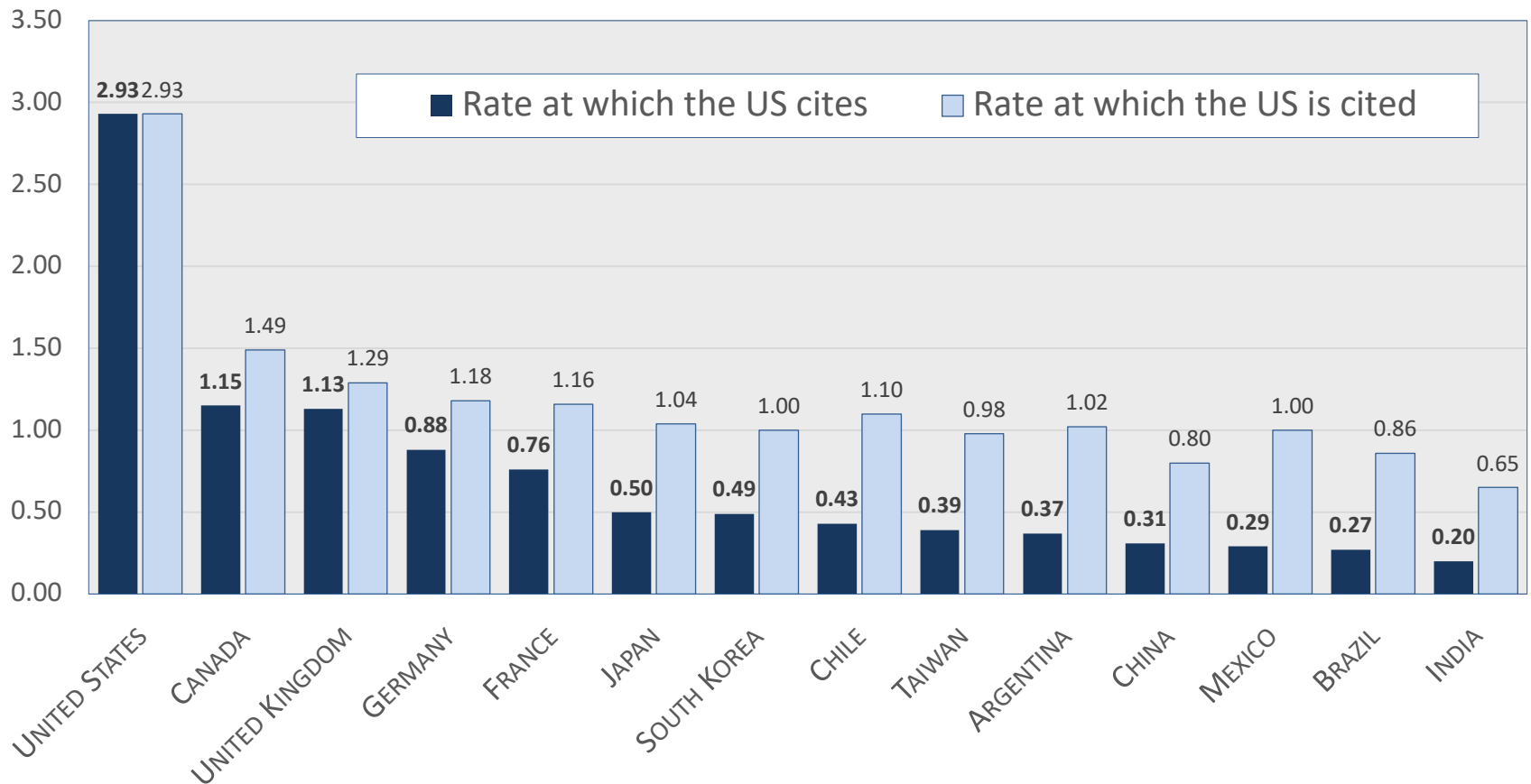
CHINA	
Singapore	2.03
Taiwan	1.73
Pakistan	1.23
United States	1.19
Australia	1.15
Japan	1.09

UNITED KINGDOM	
Ireland	2.16
Greece	1.74
Netherlands	1.50
Denmark	1.43
Hungary	1.43
Norway	1.40
Finland	1.28
Italy	1.27
Sweden	1.27
Belgium	1.26
Switzerland	1.21
Portugal	1.19
Spain	1.16
Poland	1.12
Germany	1.07
Austria	1.03
France	1.01
New Zealand	1.35
South Africa	1.33
Australia	1.19
Chile	1.01



# Who cites US papers and who is cited by US papers

The rate at which papers by authors from selected countries are cited by papers with authors from United States, compared to the rate that these countries cite United States authors, science and engineering papers, 2014. **world average = 1.00**



# Brexit and UK higher education: 5-10 year horizon

	Best case	Middle case	Worst case
<b>FINANCIAL FLOWS</b>			
<b>Horizon 2020 and other research</b>	No change (current net gain £3 billion)	UK stays in most, but pays what it takes	Rest of world access only
<b>ERDF, EIB and matching funds</b>	UK government replaces all funds	Some UK funds in lieu, politics decides	All funding disappears
<b>EU student revenues</b>	Net gain at higher fee, but differential	Modest decline affects many	Major income fall in many HEIs
<b>Other international student revenues</b>	Policy/regulation opens up: big growth	Slow return to modest growth	Absolute decline, differential effects
<b>TALENT FLOWS</b>			
<b>EU doctoral students</b>	No change, flow continues as before	Loss of some very bright students	‘Not welcome’: big fall in EU numbers
<b>EU-citizen academic staff</b>	Very broad High Skill Migration pathway	Some loss present and future staff	Sharp fall in EU-citizen numbers
<b>Study abroad by UK students</b>	Erasmus role is maintained	UK government mobility scheme	Sharp fall in outward mobility

# Monash University in the Shanghai ARWU ranking 2004-2017

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
202-301	203-300	201-300	203-304	201-302	201-302	151-200	151-200	101-150	101-150	101-150	101-150	79	78

- 73,807 students in 2016
- Four campuses in Melbourne, one in each of Malaysia, South Africa and China (with Southeast University), major partnerships with IIT Bombay and Warwick

