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# Higher education and regional engagement: Taiwan and Southeast Asia

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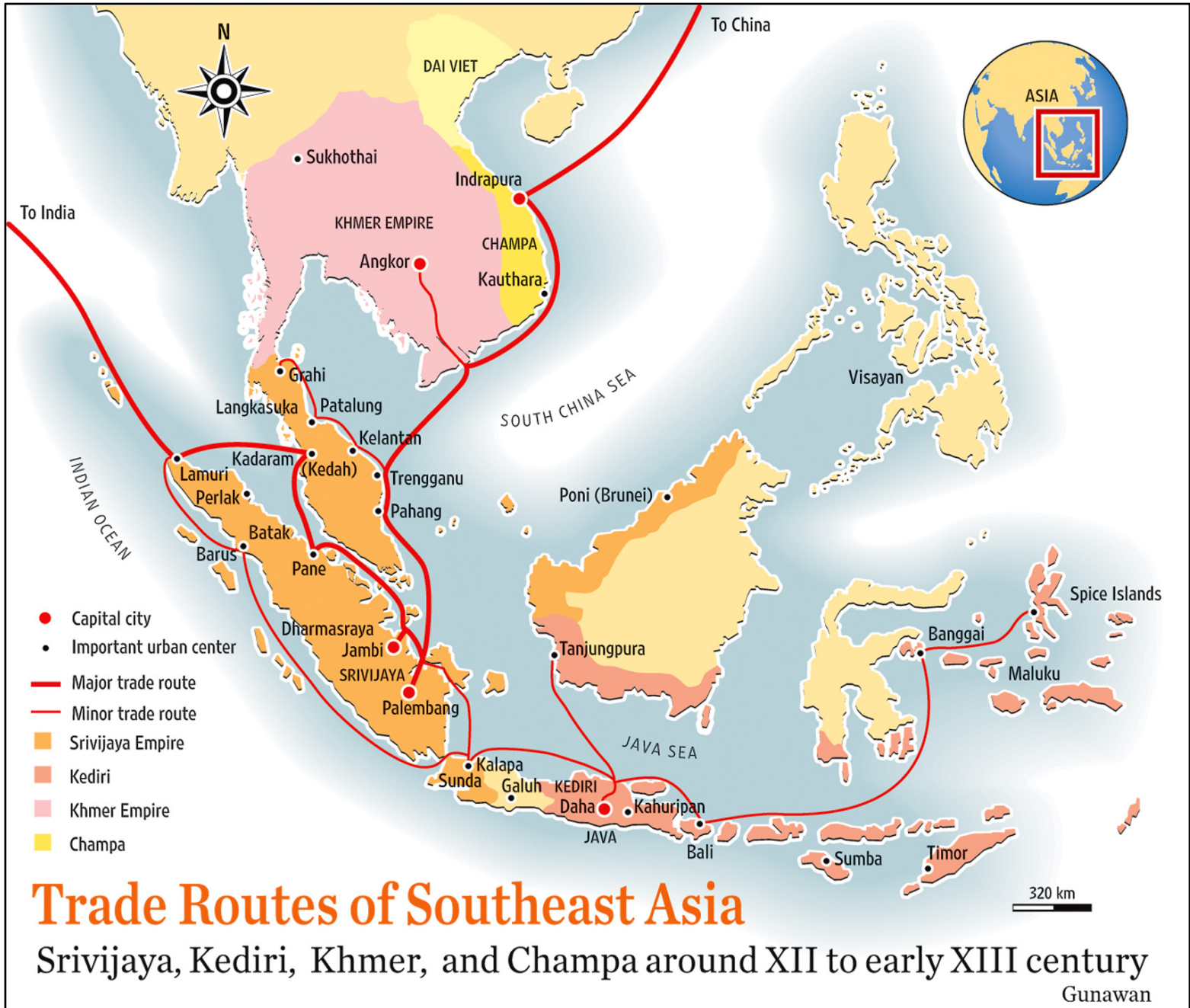
# Rapid growth of both research output and tertiary enrolment 1995-2011

UNESCO 2015, United States NSF 2014

System	Annual growth rate of tertiary enrolments	Annual growth rate of science papers
Iran	9.9%	23.5%
China	11.8%	15.4%
Tunisia	8.2%	13.0%
Thailand	4.8%	12.7%
Malaysia	10.5%	11.5%
Turkey	7.7%	10.4%
Singapore	6.7%	9.0%
Brazil	8.8%	8.7%

# International and PRC degree students in higher education in Taiwan, 2014

Country of origin	Number of students	Proportion (%) of all international and PRC students in Taiwan
China	5881	29.5%
Malaysia	3671	18.4%
Vietnam	2450	12.3%
Indonesia	1374	6.9%
Japan	698	3.5%
India	646	3.2%
Mongolia	571	2.9%
Thailand	548	2.7%
South Korea	511	2.6%
United States	419	2.1%
<b>all Southeast Asia</b>	<b>8043</b>	<b>40.3%</b>
<b>all international/ PRC</b>	<b>19,944</b>	<b>100.0%</b>



# Higher education and regional engagement: Taiwan and Southeast Asia

- Introduction
- Economy and population in East and Southeast Asia
- Growth of participation in tertiary education
- Growth of science and research
- World-Class Universities



# ECONOMY AND POPULATION IN EAST AND SOUTHEAST ASIA

# Economy and population, ASEAN nations

World Bank data for 2013 (2016)

Country	Population (millions)	GDP PPP (2011 USD) \$s billion	GDP per head (2011 USD) \$s
Singapore	5.4	419.6	77,721
Brunei Darussalam	0.4	29.0	70,535
Malaysia	29.5	690.0	23,419
Thailand	67.5	1008.0	14,943
Indonesia	251.3	2430.9	9675
Philippines	97.6	621.0	6365
Vietnam	89.8	459.7	5122
Lao PDR	6.6	31.6	4800
Cambodia	15.1	44.6	2955
Myanmar	53.0	n.a.	n.a.

n.a. = data not available.

# Economy and population, other Asia-Pacific

World Bank data for 2013 (2016), Taiwan data from CIA Factbook

Country	Population (millions)	GDP PPP (2011 USD) \$s billion	GDP per head (2011 USD) \$s
Hong Kong SAR	7.2	371.3	51,656
Taiwan	23.5	999.2	42,632
Japan	127.3	4535.1	35,614
South Korea	50.2	1641.4	32,684
China	1357.4	16024.0	11,805
Iran	77.2	1236.2	16,023
Sri Lanka	20.6	210.8	10,242
India	1279.5	6566.2	5132
Australia	23.1	990.5	42,845
New Zealand	4.4	148.2	33,360

n.a. = data not available.



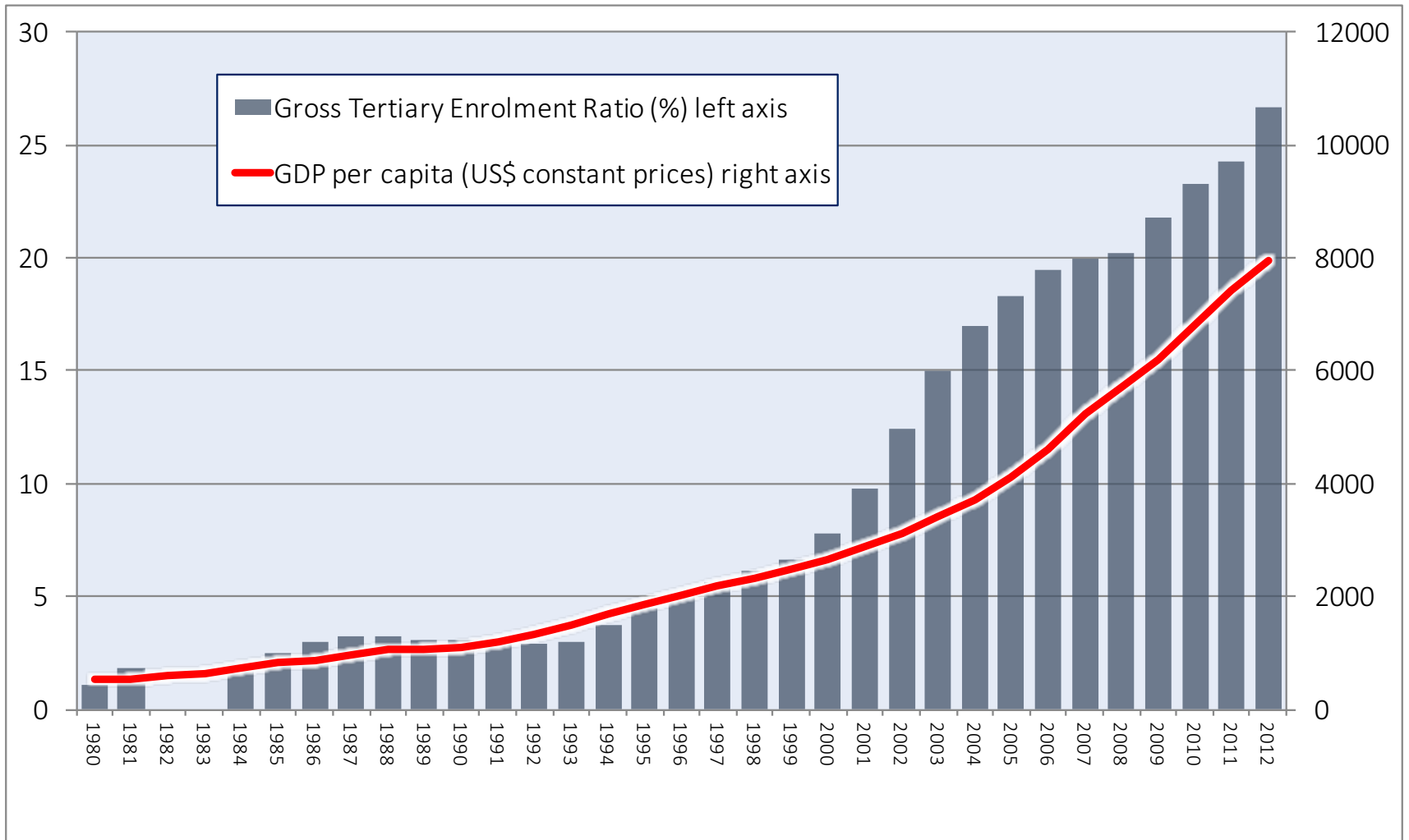
# GROWTH OF PARTICIPATION IN TERTIARY EDUCATION

# Regional growth in Gross Tertiary Enrolment Ratio (%), 1970-2013

UNESCO 2015 data

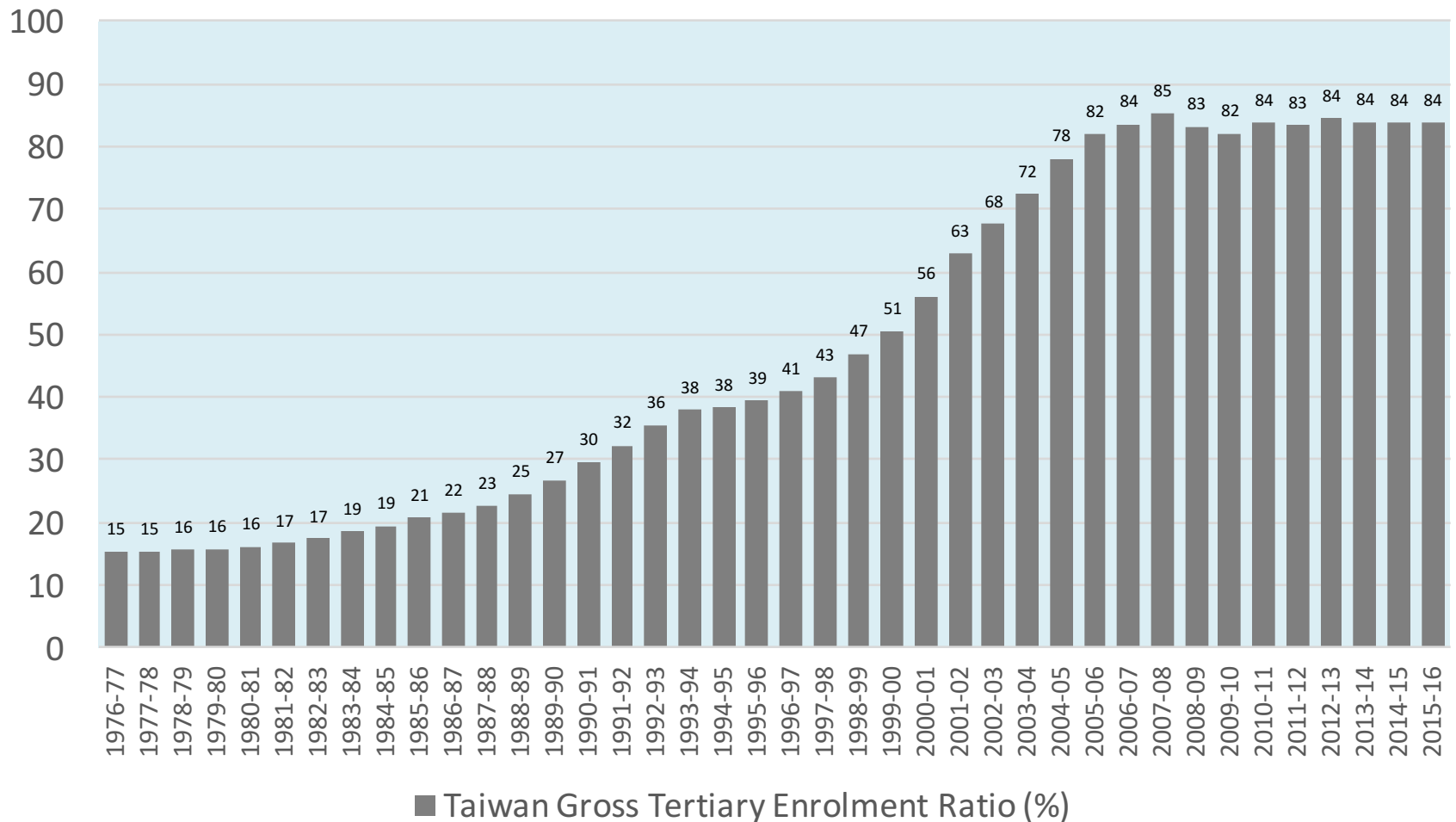
	1970	1990	2010	2013
World	10.0	13.6	29.3	32.9
North America/ W. Europe	30.6	48.6	76.9	76.6
Central and Eastern Europe	30.2	33.9	67.9	71.4
Latin America and Caribbean	6.9	16.9	40.9	43.9
<b>East Asia and Pacific</b>	<b>2.9</b>	<b>7.3</b>	<b>27.3</b>	<b>33.0</b>
Arab States	6.0	11.4	25.5	28.1
Central Asia	n.a.	25.3	26.7	26.1
South and West Asia	4.2	5.7	17.4	22.8
Sub-Saharan Africa	0.9	3.0	7.7	8.2

# Growth of tertiary participation faster than change in GDP per capita, China 1980-2012

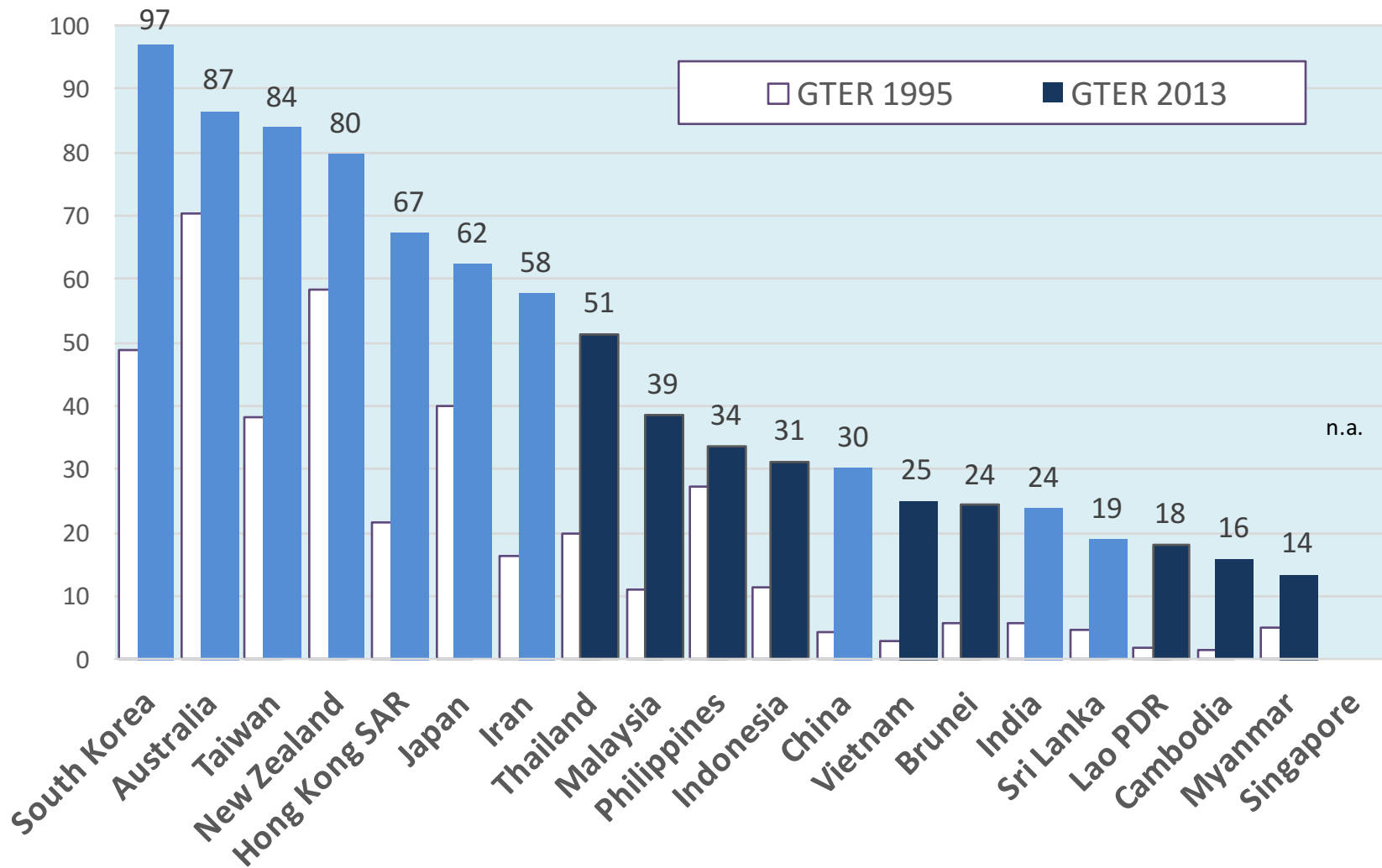


# Gross Tertiary Enrolment Ratio (%), Taiwan

1976-77 to 2015-16, Taiwan government data

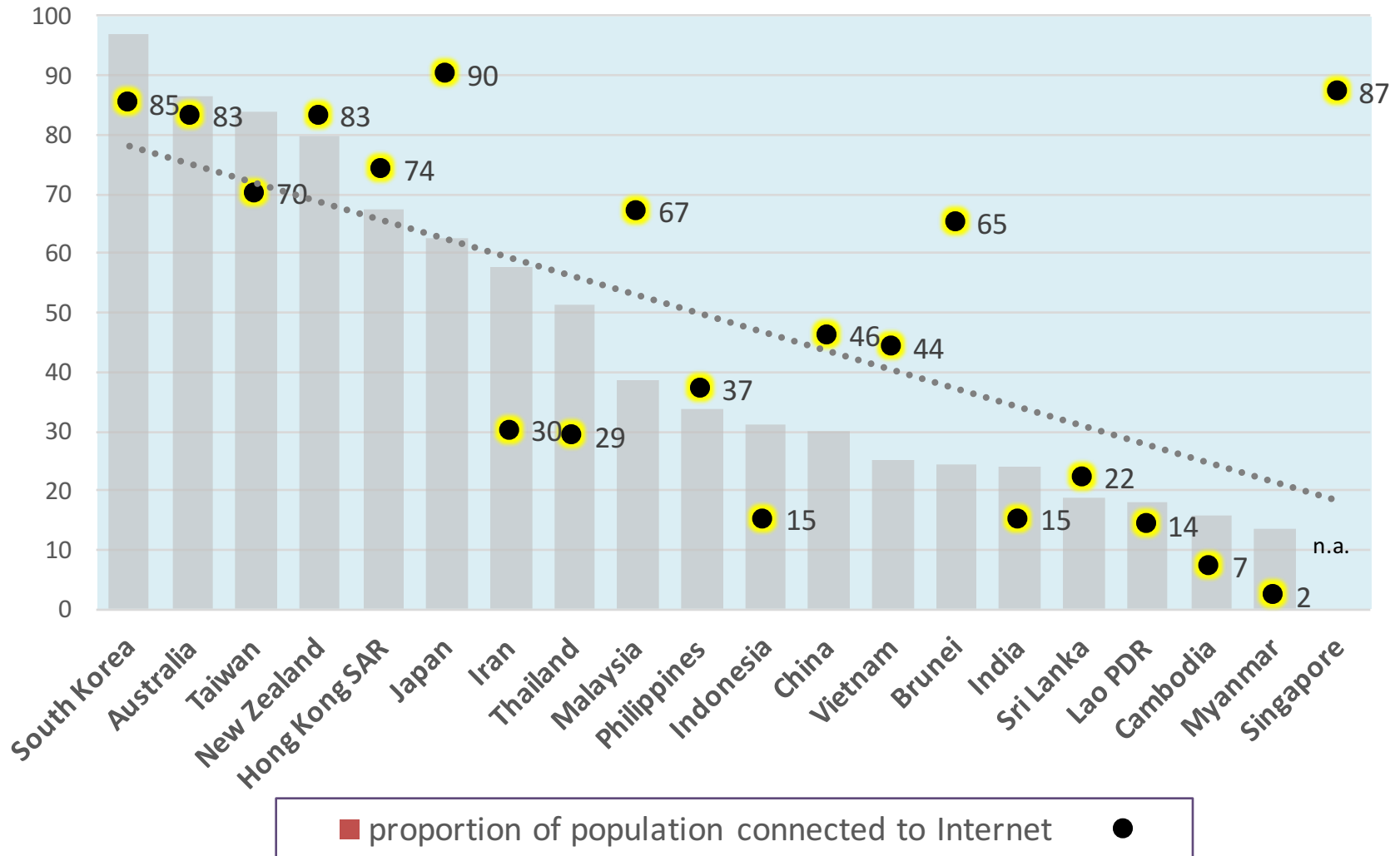


# Gross Enrolment Ratio (%) 1995 and 2013

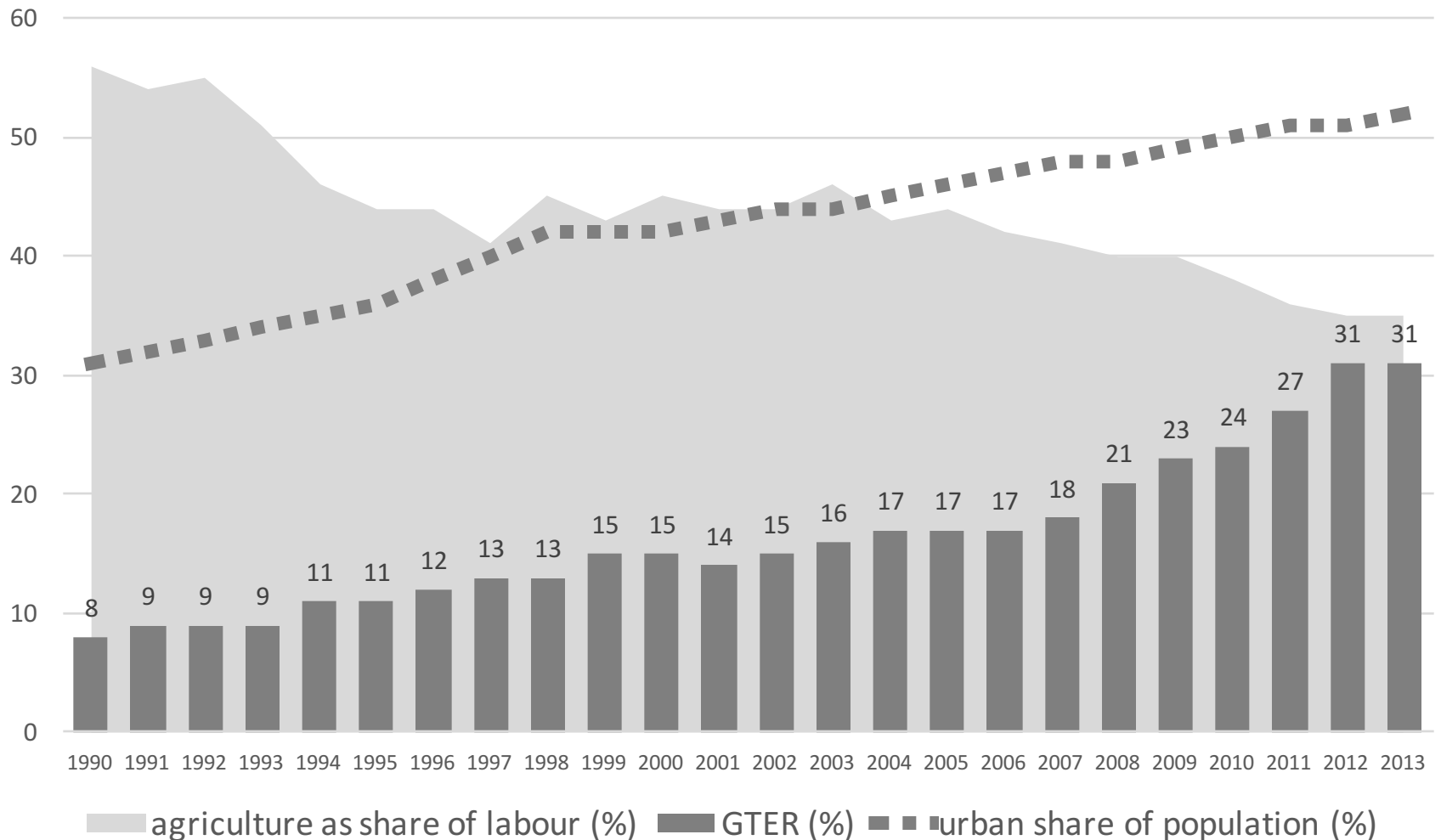


n.a. = data not available. 1994 not 1995 for Brunei, Hong Kong, Sri Lanka. 2011 for Cambodia. 2012 for Myanmar.

# Gross Enrolment Ratio (% , grey) and persons connected to Internet (%), 2013



# GTER and urbanization in Indonesia 1990-2013



# Cities in East/South/Southeast Asia over 10 million people in size, 2010

city	millions
Tokyo JAPAN	37.7
Chongqing CHINA	28.8
Shanghai CHINA	25.5
Karachi PAKISTAN	25.2
Beijing CHINA	25.0
Guangzhou CHINA	24.9
Seoul KOREA	22.7
Mumbai INDIA	21.9
Delhi INDIA	21.8
Manila PHILIPPINES	20.7

city	millions
Wuhan CHINA	19.0
Osaka JAPAN	17.4
Tianjin CHINA	15.8
Kolkata INDIA	15.6
Dhaka BANGLADESH	14.3
Jakarta INDONESIA	13.2
Tehran IRAN	13.2
Shenyang CHINA	12.6
Shenzhen CHINA	12.3
Bangkok THAILAND	10.1



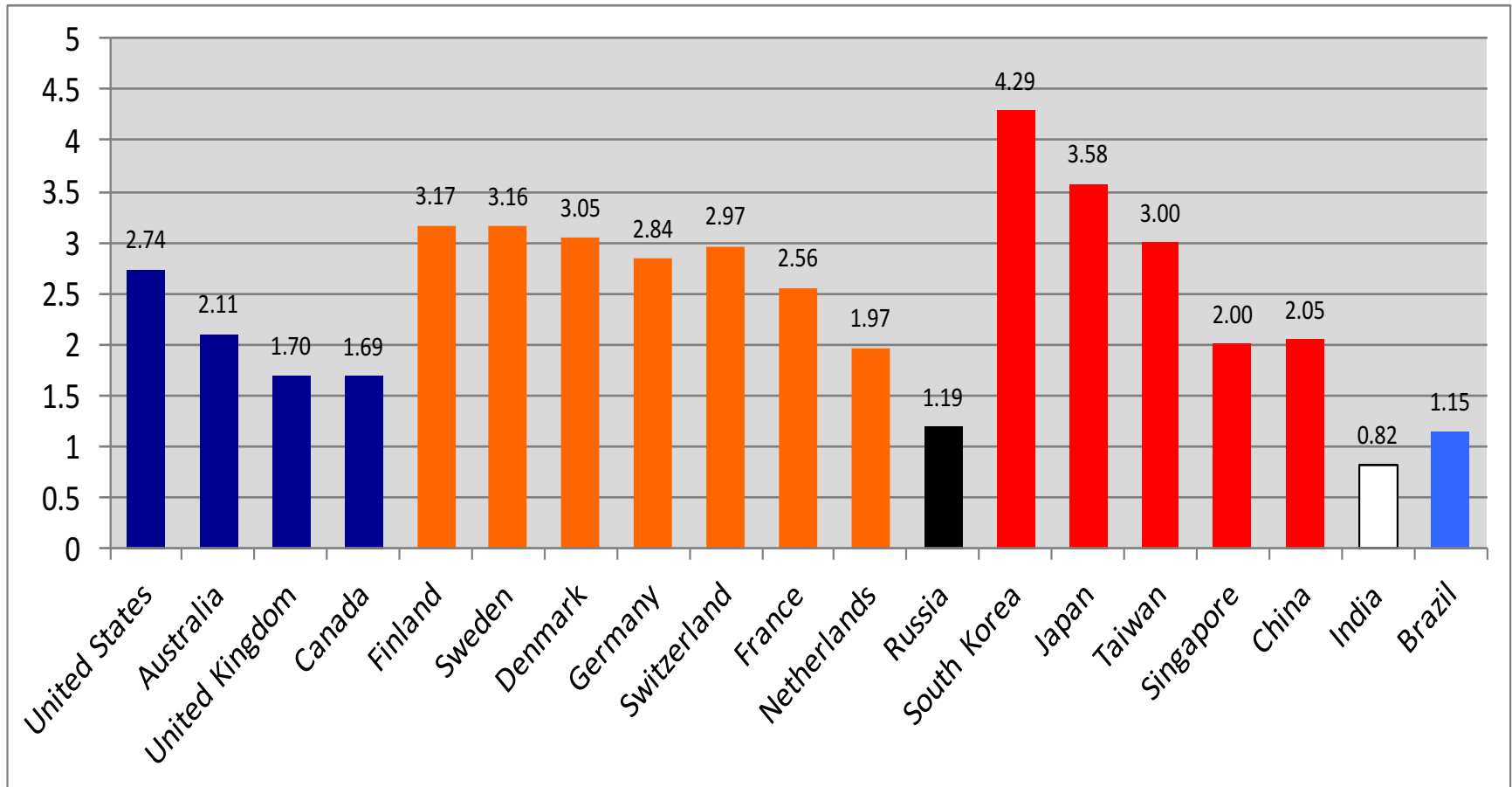
# GROWTH OF SCIENCE AND RESEARCH

# Components of a national innovation system

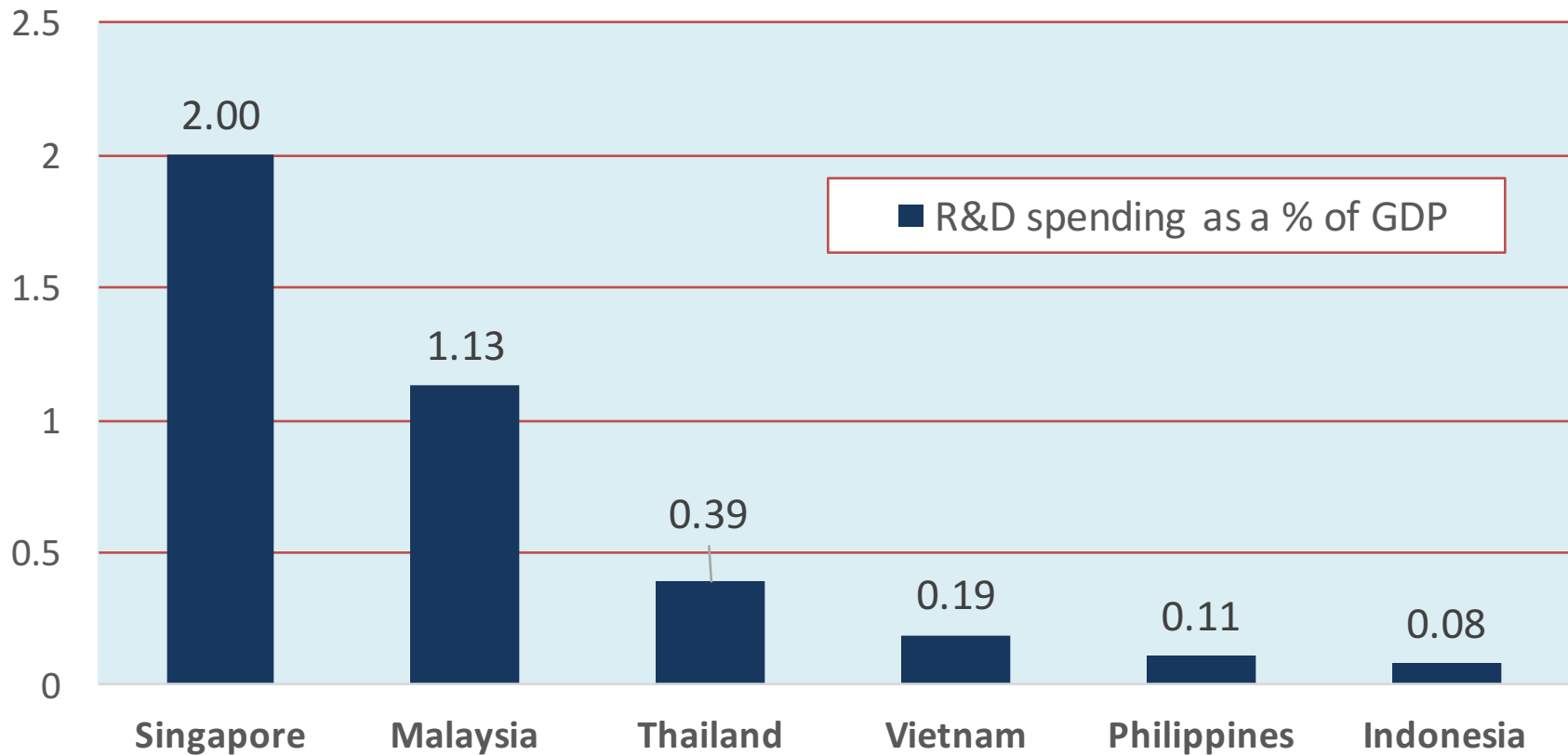


# R&D as a % of GDP 2014, selected countries

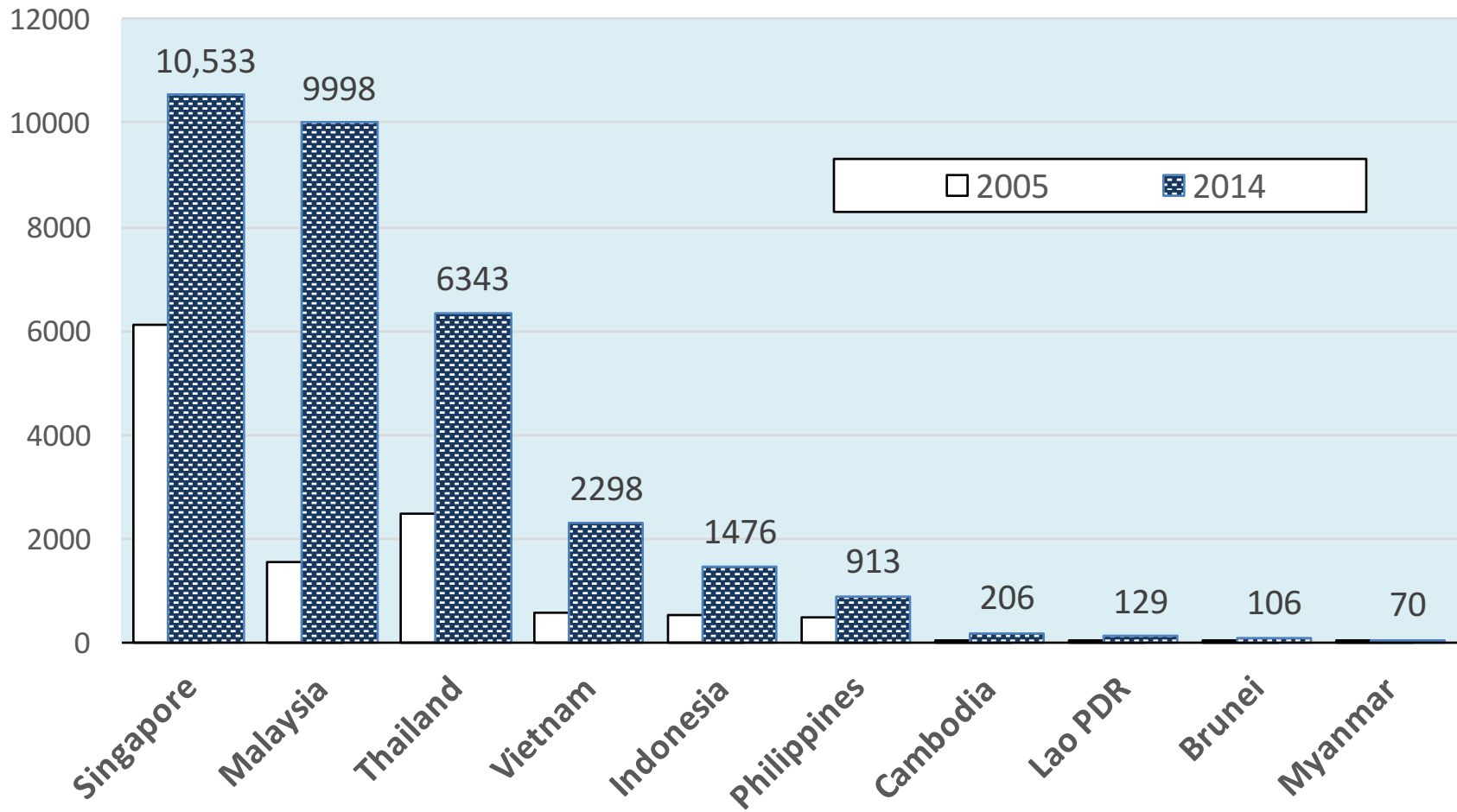
Investment in R&D as a proportion of GDP in 2014 (OECD data 2016). Data for USA, Australia and Singapore 2013, data for Switzerland and Brazil 2012, data for India 2011



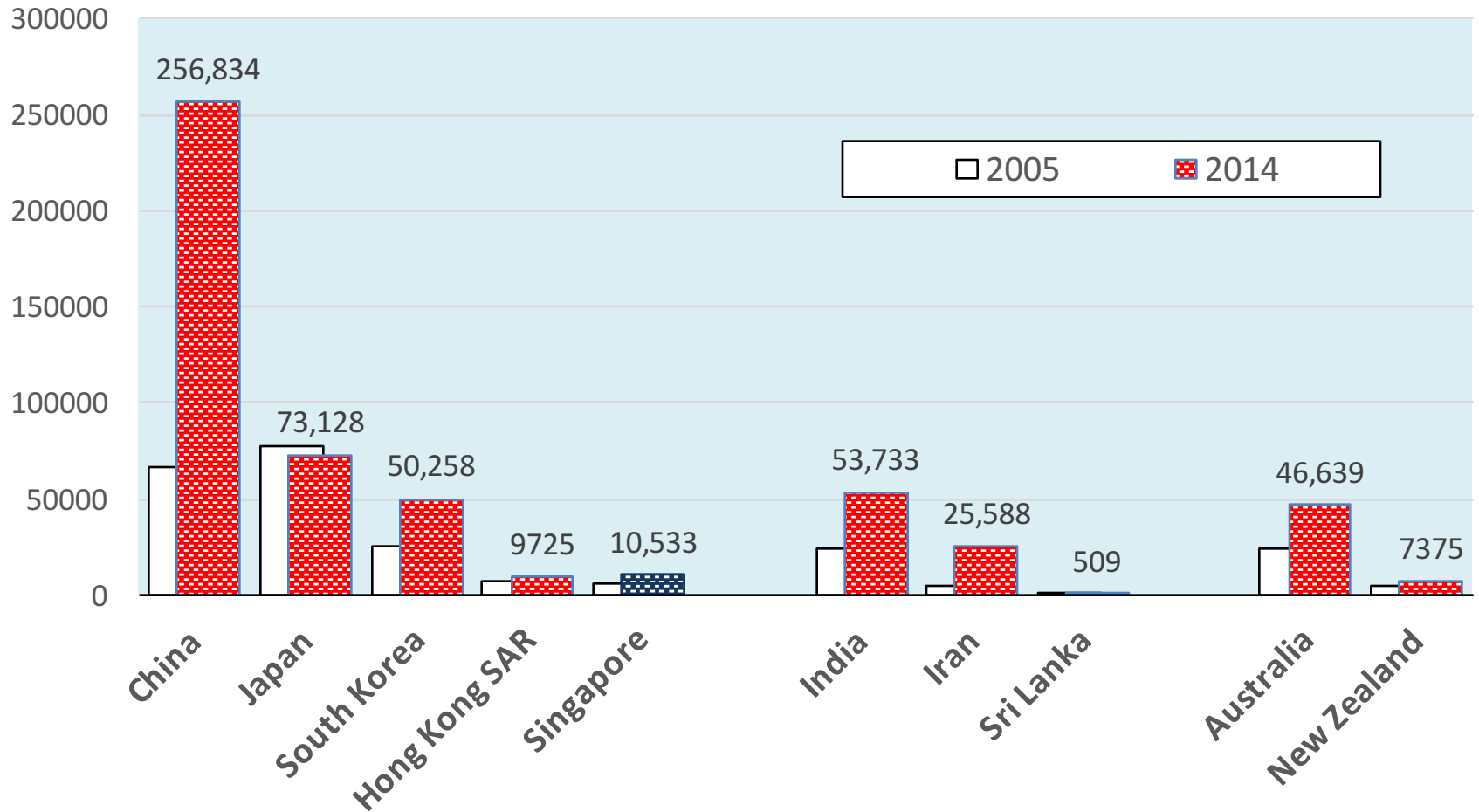
# R&D spending as a proportion (%) of GDP: six ASEAN nations, 2014



# Research paper output, ASEAN group 2014 and 2005

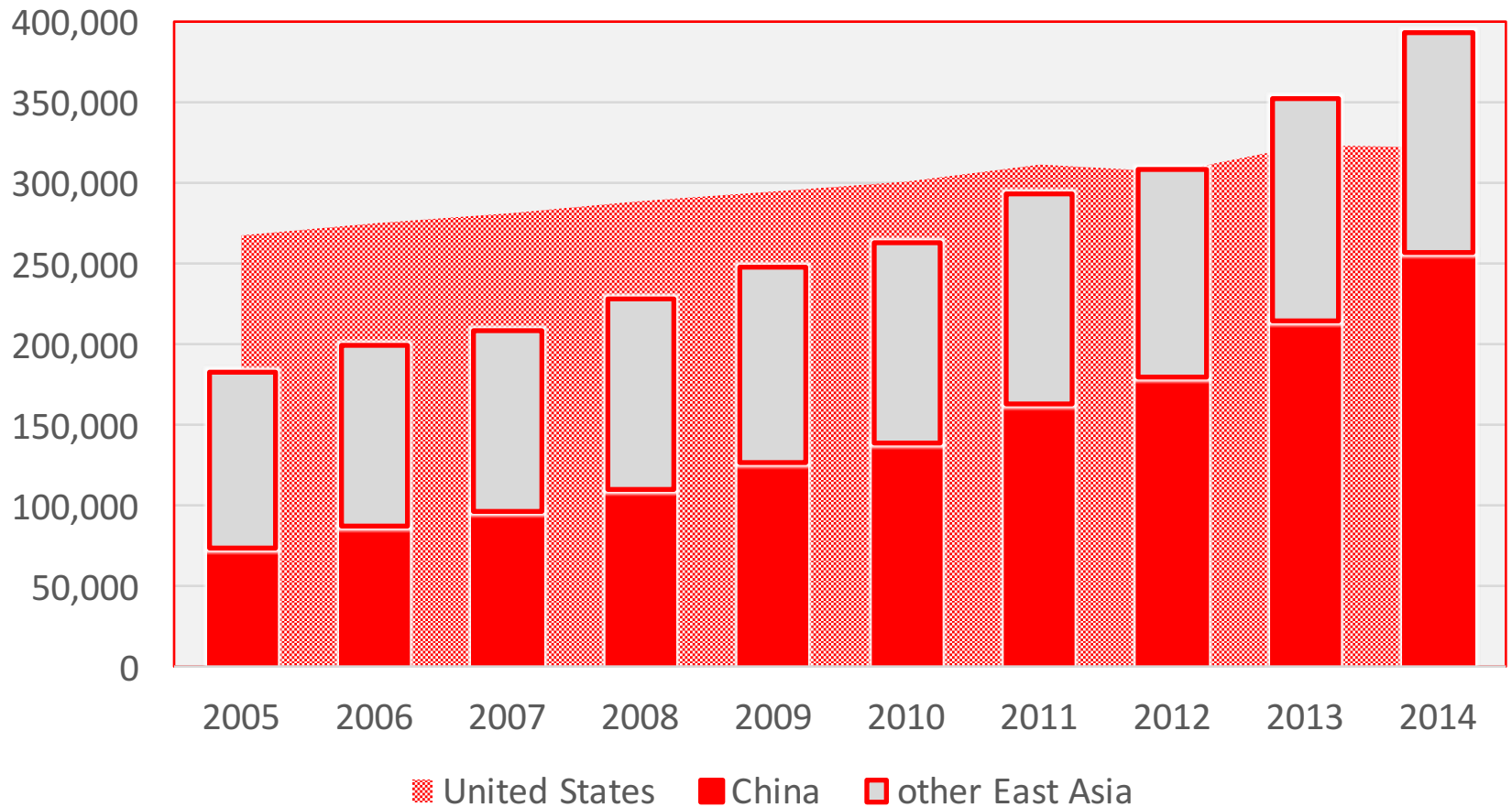


# Research papers, other Asia-Pacific 2014 and 2005



# Research papers 2005-2014: USA, China, other East Asia

Thomson-Reuters/UNESCO data. Papers include reviews and notes. Other East Asia = Japan, Korea, Singapore, Vietnam (Taiwan absent from UNESCO data)



# WORLD-CLASS UNIVERSITIES



# Top 13 WCUs by number of high citation papers

Data from Leiden University CWTS ranking 2016

Universities		Papers 2011-2014	% of these papers in top 10% of field	Number of top 10% papers
1 Harvard U	USA	32,253	21.9	7060
2 Stanford U	USA	14,615	22.1	3223
3 U Toronto	Canada	21,544	13.7	2956
4 U Michigan	USA	17,867	15.4	2756
5 U California, Berkeley	USA	12,764	20.9	2669
6 MIT	USA	10,439	25.0	2606
7 Johns Hopkins U	USA	15,631	16.2	2539
8 U California, Los Angeles	USA	13,994	17.3	2424
9 U Oxford	UK	13,300	18.1	2414
10 U Washington, Seattle	USA	14,018	16.6	2321
11 U Pennsylvania	USA	13,037	17.3	2253
12 U Cambridge	UK	12,506	17.3	2169
13 U College London	UK	13,032	16.6	2126

# World-Class Universities, Chinese systems

Shanghai ARWU top 500 universities, 2004 & 2015

	2004	2015
China mainland	8	32
Hong Kong SAR	5	5
Taiwan	3	7
Singapore	2	2
Total	18	46

# Universities in ARWU 500, 2015

Country	In top 200	In top 500	Universities in top 200
Australia	8	20	U Melbourne, Australian National U, U Queensland, U Western Australia, Monash U, U New South Wales, U Sydney
China	7	32	Peking U, Shanghai Jiao Tong U, Tsinghua U, Zhejiang U, Fudan U, Sun Yat-sen U, U Science & Technology
Hong Kong SAR	2	5	Chinese U Hong Kong, U Hong Kong
India	--	1	
Iran	--	2	
Japan	7	18	U Tokyo, Kyoto U, Osaka U, Nagoya U, Tohoku U, Hokkaido U, Tokyo IT
Malaysia	--	2	
New Zealand	--	2	
Singapore	2	2	National U of Singapore, Nanyang U Technology
South Korea	1	12	Seoul National U
Taiwan	1	7	National Taiwan U

# Leading Asian research universities:

Growth of papers in top 10% of their research field, 2006-09 to 2011-14

university	system	Papers published 2006-09 (cites by 2011)	Papers published 2011-14 (cites up to 2016)	World rank 2011-14	growth
NU Singapore	SINGAPORE	1042	1489	28	+ 42.9%
Nanyang TU	SINGAPORE	568	1253	46	+ 120.6%
Tsinghua U	CHINA	819	1453	31	+ 77.4%
Zhejiang U	CHINA	730	1431	33	+ 96.0%
Shanghai JT U	CHINA	664	1232	48	+ 85.5%
Peking U	CHINA	622	1192	50	+ 91.6%
Fudan U	CHINA	469	1059	60	+ 125.8%
U Tokyo	JAPAN	1318	1315	44	- 0.2%
Kyoto U	JAPAN	951	915	81	- 3.8%
U Hong Kong	HONG KONG	558	730	110	+ 30.8%
National Taiwan U	TAIWAN	604	736	108	+ 21.9%
Seoul National U	KOREA	742	1099	57	+ 48.1%
U Melbourne	AUSTRALIA	1005	1442	32	+ 43.5%
U Cambridge	UK	1820	2169	12	+ 19.2%

# Leading universities Taiwan, Thailand, Malaysia by number of high citation papers

University		Total number of journal papers	Proportion (%) of all papers in top 10% of their field	Number of papers in top 10% of their field
		2011-2014	2011-2014	2011-2014
N. Taiwan U	TAIWAN	10,245	7.2%	736
N. Cheng Kung U	TAIWAN	6291	6.4%	403
N. Tsing Hua U	TAIWAN	3574	9.0%	323
N. Chiao Tung U	TAIWAN	4028	7.4%	299
Chang Gung U	TAIWAN	4398	6.1%	269
N. Yang Ming U	TAIWAN	2993	6.2%	186
N. Chung Hsing U	TAIWAN	2289	6.6%	152
China Medical U - Taiwan	TAIWAN	2331	6.5%	150
U Malaya	MALAYSIA	5004	8.3%	417
U Sains Malaysia	MALAYSIA	3672	7.8%	285
U Teknologi Malaysia	MALAYSIA	2091	9.1%	191
Mahidol U	THAILAND	2318	6.0%	139
Chulalongkorn U	THAILAND	2373	5.0%	118
Prince Songkla U	THAILAND	1027	6.3%	65

# Internationally coauthored scientific articles, Taiwan, 1997 and 2012 (*1997=1.0*)

country	1997	2012	growth (1997=1.0)
USA	768	2438	3.2
China	89	1228	13.8
Japan	115	780	6.9
UK	57	613	10.8
Germany	47	586	12.5
France	35	450	12.9
Australia	28	415	14.8
Canada	72	410	5.7
Italy	36	407	11.3
Russia	18	407	22.6
South Korea	20	391	19.6
Spain	9	382	42.4
Switzerland	31	360	11.6

country	1997	2012	growth (1997=1.0)
India	17	324	19.1
Poland	3	287	95.7
Greece	1	280	280.0
Czech Rep.	1	267	267.0
Austria	0	256	--
Brazil	8	245	30.6
Netherlands	10	234	23.4
Portugal	2	228	114.0
Turkey	1	216	216.0
Hungary	4	215	53.8
Finland	6	207	34.5
Sweden	8	194	24.3
Chile	0	185	--