The US-Chinese technological rivalry

China in the World Economy, 2022

Questions from last time

- In which ways were Chinese economic reforms in in the 1990s distinct from the 1980s?

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- What happened with the renminbi‘s exchange rate in 1994?
- What does the phrase „triangular trade“ mean?

Today

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- The rise of Xi Jinping
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- End of neoliberal / Fukuyamist era of globalization?

Picking up the story

- Circa 2005 – apex of export-driven growth, everything seems fine…

Averting a middle-income trap

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- = it takes part in the production of sophisticated products organized by multinational companies, **who keep the most lucrative work elsewhere**
- For example, China makes electronics, but cannot produce top notch semiconductors

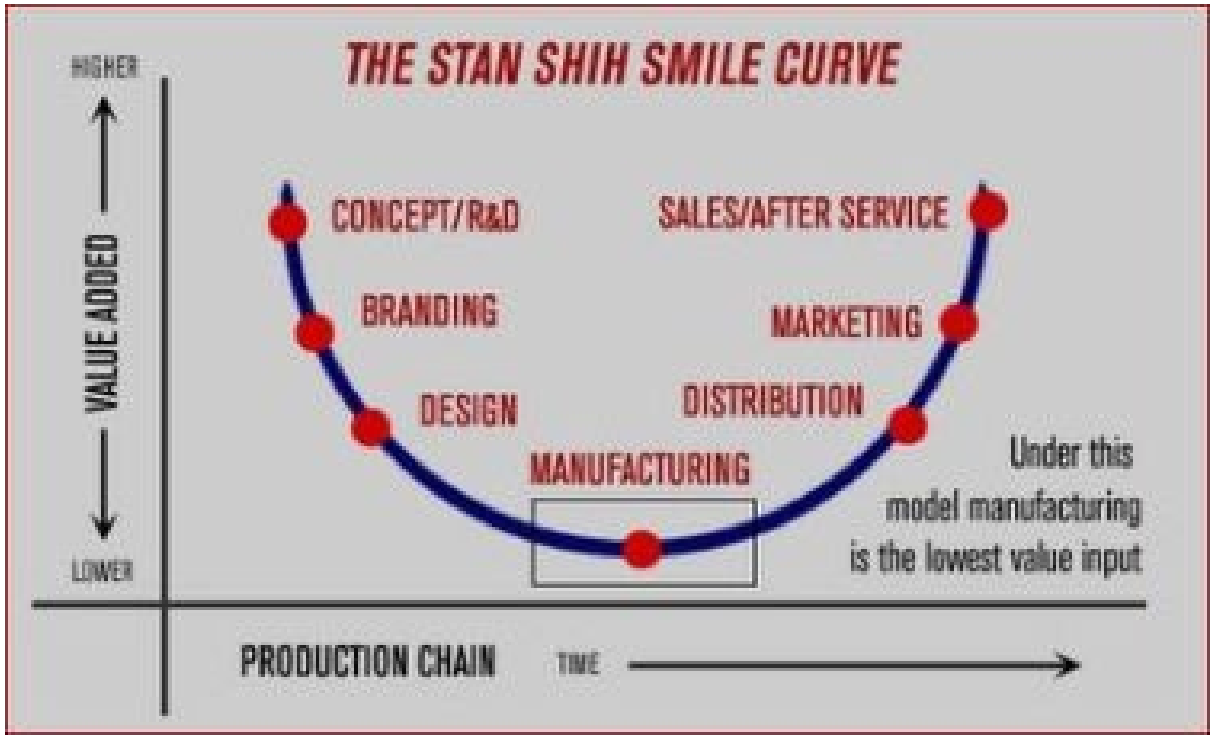
Averting a middle-income trap

- **Warning story – Japanese stagnation after 1990** – after wages grew, export moved to cheaper locations like China

Averting a middle-income trap

- Theory – the most value added processes are **at the start of production (research and development, design) and at the end (marketing, retailing)**
- The physical work in between can be done by anyone (= China)
- **Smiley curve**

Averting a middle-income trap



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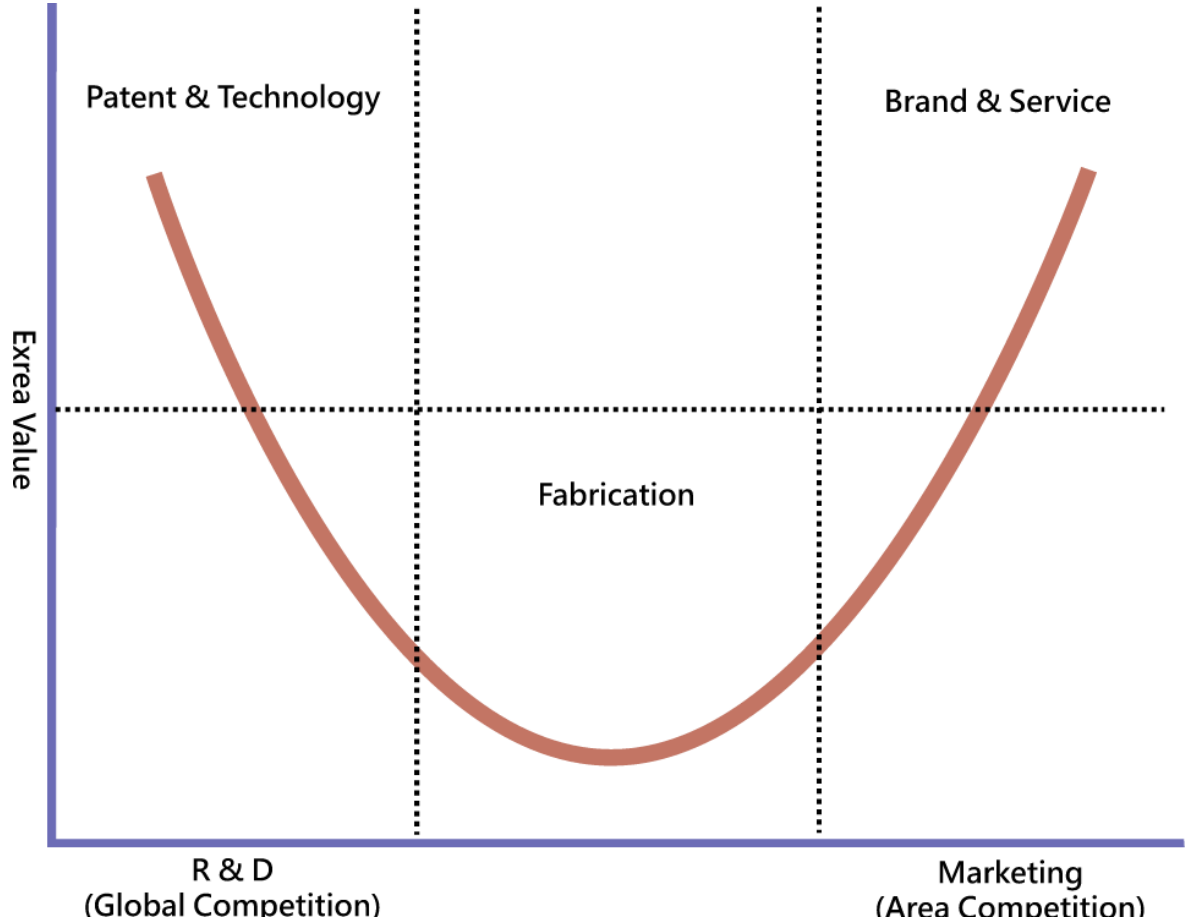

Triangular trade

Table 16.3
China's largest trading partners, 2015 (billions of US$).

	Exports	Imports	Total trade	Surplus
United States	502.6	150.5	653.2	352.1
Japan	160.6	143.1	303.7	17.5
Hong Kong	261.1	12.8	273.9	248.3
Republic of Korea	90.2	174.6	264.8	–84.3
Germany	103.3	87.7	191.0	15.7
Taiwan	44.9	143.3	188.2	–98.4
Australia	46.3	73.9	120.2	–27.6
Malaysia	33.2	53.3	86.5	–20.0
United Kingdom	63.0	18.9	81.9	44.1
Thailand	40.9	37.2	78.1	3.7
Brazil	30.7	44.3	75.1	–13.6
India	61.6	13.4	75.0	48.2
Viet Nam	49.4	25.1	74.6	24.3
Singapore	42.1	27.6	69.7	14.6
Netherlands	38.4	8.8	47.2	29.6

Source: *SYC* (2016, table 11-6).

Triangular trade

Table 16.2
Top import and export categories, 2016 (billions of US$).

	Imports	% of total		Exports	% of total
Semiconductors	227.0	14.3	Computers, components, LCDs	163.2	7.8
Petroleum and products	144.1	9.1			
Autos and auto parts	74.4	4.7	Clothing	157.8	7.5
Agricultural products except grain	69.1	4.4	Telephone handsets	117.1	5.6
			Textiles	105.0	5.0
Computer components, LCDs	59.2	3.7	Agricultural products	72.6	3.5
Iron ore	57.7	3.6	Semiconductors	61.0	2.9
Copper and copper ore	47.1	3.0	Finished steel	54.5	2.6
Grain	41.5	2.6	Furniture	47.8	2.3
Plastic raw materials	41.3	2.6	Shoes	47.2	2.3
Coal	24.5	1.5	Automobile parts	45.6	2.2

Source: General Administration of Customs.

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- **Ideally to create its own brands which keep the best jobs in China**
- Outsource cheap labor to poorer countries – Southeast Asia

Averting a middle-income trap

- **Technology will compensate for growing wages** – China will remain a competitive exporter

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Return of industrial policy

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- There were provincial programs + support for some SOEs and large corporations, **but no central coordinated plan**

MLP

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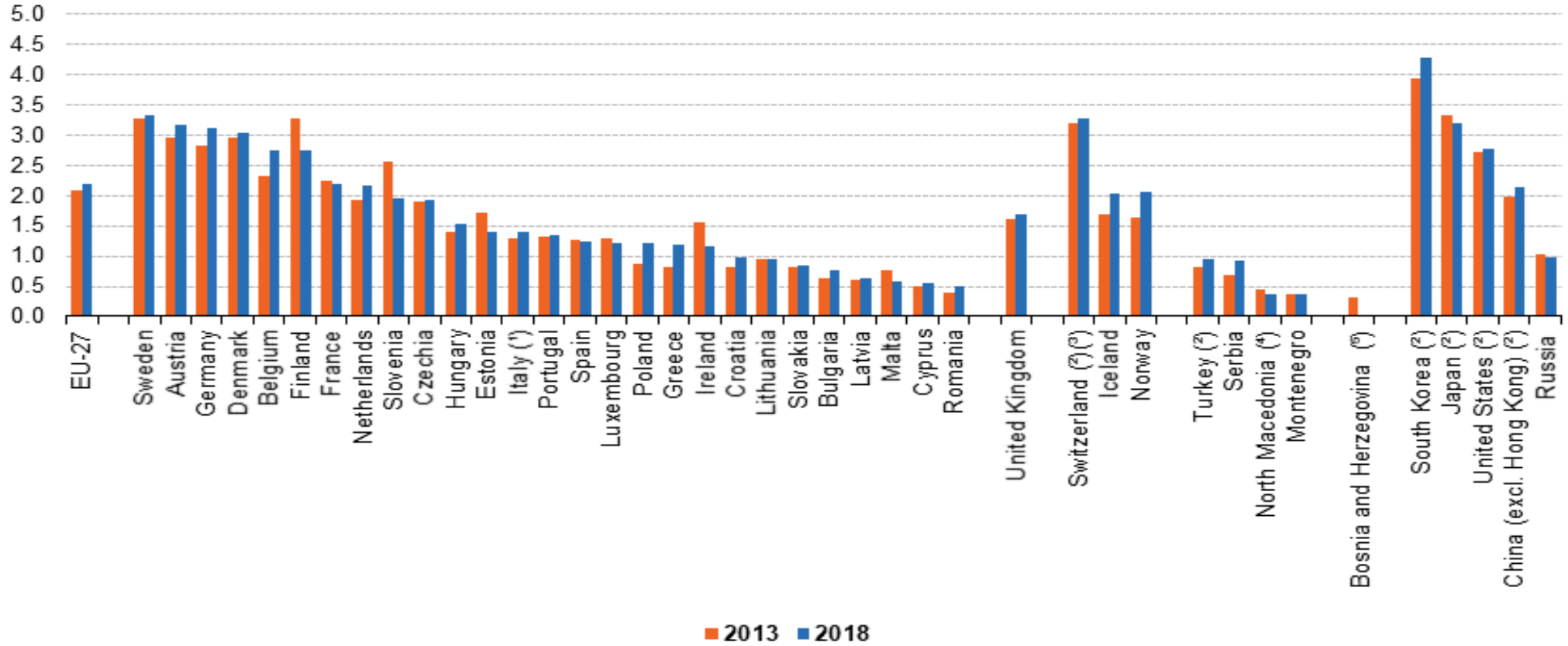
- - aircraft, semiconductors, intelligent computers, GMOs, novel drugs

MLP

- Ambition **to invest 2,5% of GDP** into research and development by **2020**
- **Almost achieved, RaD expenditures continue to grow quickly**

Gross domestic expenditure on R&D, by country, 2013 and 2018

(% of GDP)



Source: Eurostat (online data codes: sdg_09_10 and rd_e_gerdtot)

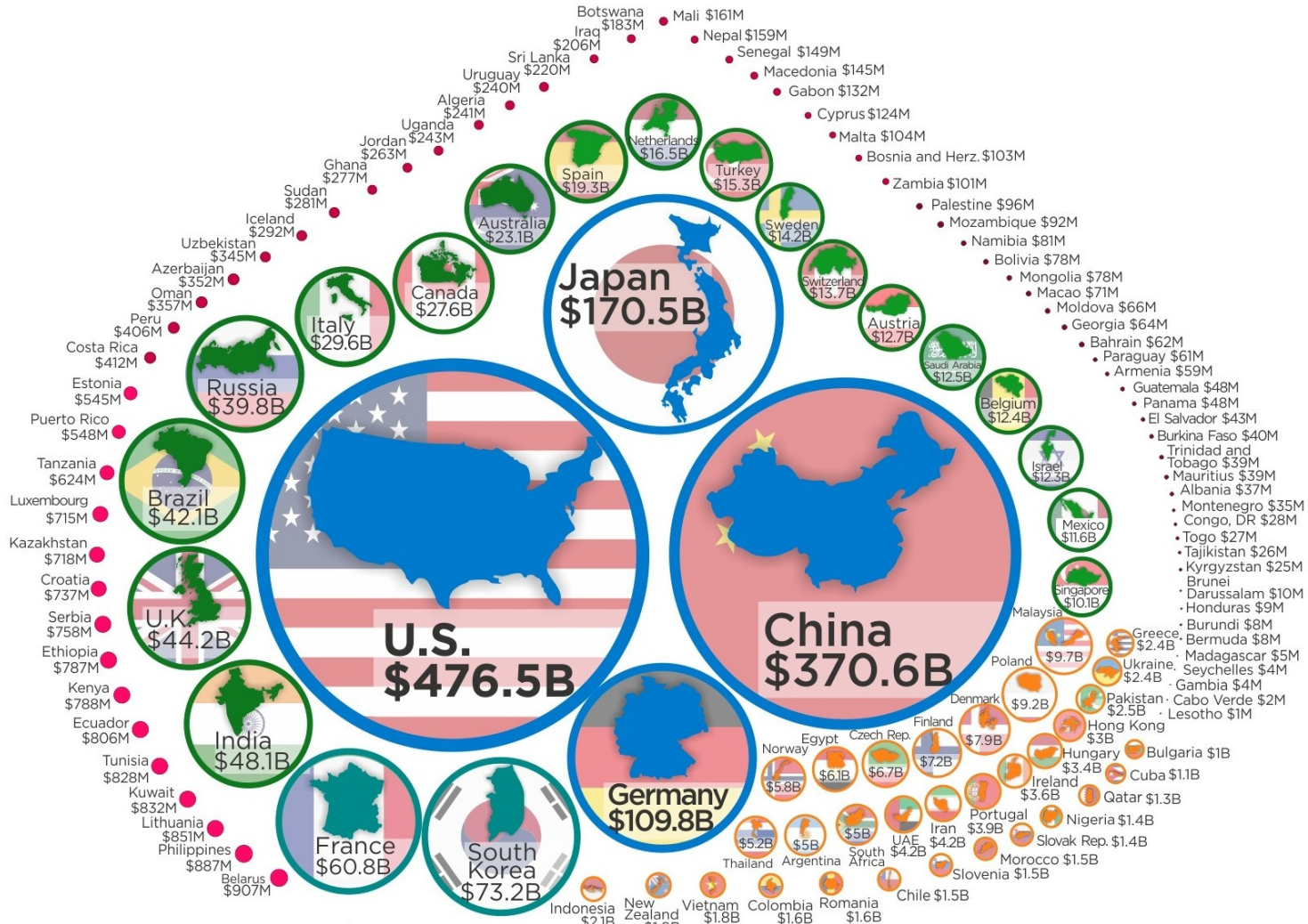
(1) Break(s) in time series between the two years shown.

(2) 2017 data (instead of 2018).

(3) 2012 data (instead of 2013).

(4) 2015 data (instead of 2013).

(5) No data for 2018.



Article & Sources:
https://howmuch.net/articles/research-development-spending-by-country
http://uis.unesco.org

howmuch.net

MLP

- MLP – **investments into science and research, not support for specifically chosen companies**

MLP

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- **=** typical goal of industrial policy – use governmental incentives to **learn and adopt foreign technologies**
- = similar to policies of other countries

2008 Financial crisis

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- **Use of state banks and SOEs!**

2008 Financial crisis

- > huge injections of state capital into the economy
- Use of state banks and SOEs!
- Successful – **return to growth as early as 2010**
- = **positive experience** with a large state intervention

2008 Financial crisis

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2008 Financial crisis

- > perception that the **Western model of capitalism has failed**
- > China should **use the advantages of its state capitalist model more often** and more forcefully

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- “Seize the commanding heights of the new technological revolution”

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- 2010 – **new and more ambitious policy**
- Ambition to not just catch up with **but to overtake leading countries and firms (=5G etc.)**

- = qualitative new goal, distinct from „normal“ industrial policy

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- More direct – **cooperation with specific firms**

The Xi Jinping era

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- Conservative, authoritarian turn

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- Ethnic nationalism, clampdown on minorities, upholding of traditional gender norms (ban on sissy boys etc.)

The Xi Jinping era

- Economically – **strengthening the role of the state/Party**

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- In the preceding era – **the private sector grew faster than the public sector** (in spite of policy!) and gradually overshadowed it

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- > the Party must lead to **overcome this coordination problem**

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- > **even greater obfuscation of the already blurry line** between the public and private sector!

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- **1978-2012** – Reform and Opening – **attempt to build up wealth** and strength at the cost of diverting from preferred values
- **2012 -?** – **New Era** – **dialectical synthesis** – now China has the means to go back to a much more statist economy and to do so efficiently = **correct principles with capacity to implement them**

Artificial intelligence

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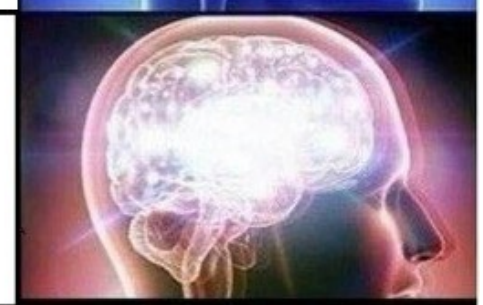
- > „AI is the new groundbreaking technology we are looking for!“
- A new economic era is beginning, China must take the lead

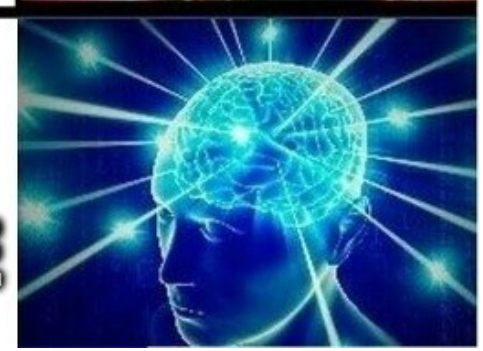
MELT DOWN TOOLS TO MAKE STEEL

LET LOCAL FARMERS DO THEIR THING

SUPPORT FDI



DEVELOP ARTIFICIAL INTELLIGENCE



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- „**Digital central planning**“?

Industrial revolutions

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- **4th – AI** – **autonomous robots and machines, smart manufacturing etc.**

- China should seize the opportunity and become the leader in the 4th industrial revolution
- > **take a shortcut**, bypass some stages of development and go to the top
- > **leapfrog advanced countries**

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- > **the West is weak and decadent, and cannot possibly withstand China‘s ability to mobilize resources** and make sacrifices for its common future

- **China rediscovered its confidence after 40 years of basically uninterrupted growth and success**

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- > „We will focus on things that are actually valuable and useful“ = high tech

- **„techno-nationalism“**

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- Smith - would be useful in a war???

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- Krpec – a kilogram of integrated circuits vs. a kilogram of Parma ham

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- Supported sectors – advanced technology fields – **AI, machine learning, internet of things, new materials, aerospace, biotechnology**…

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- **> digitalization, smart cities, intelligent manufacturing**

Innovation Driven Development Strategy

- China now has a **whole system of programs** to develop new technologies and support their adoption

- Biggest target of support – **semiconductors**
- = **chips**
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- Necessary for China‘s technological goals
- **China continues to be surprisingly weak and aims to improve its position**

Return of industrial policy

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- Highly provocative – Naughton – **breaking of unwritten international rules**
- > **backlash -** end of Western complacency about China – **US-China trade war**

- „…in the IDDS, the opportunity to move directly to the technological frontier and surpass other economies is no longer a wished-for feature of a few random sectors, but rather **a fundamental feature of the current global moment**.“

- „Increasingly, Chinese industrial policy is based on the idea that China has a **once-in-a-lifetime opportunity** to get in on the ground floor of a technological revolution and vault into the leading ranks of economic and technological powers.“

China‘s industrial policy programs

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- 2010 – SEI - „let‘s development these X sectors **AND become the global leader in them**“

China‘s industrial policy programs

- 2006 – MLP – „**let‘s development these X sectors**“
- 2010 – SEI - „let‘s development these X sectors **AND become the global leader in them**“
- 2015 – MiC, IDDS - „let‘s development these X sectors AND become the global leader in them **AND implement these technologies in the entire economy**“

- How does China do this?

Industrial Guidance Funds

- Key **tool** of industrial policy
- The previous (MiC25 etc.) were programs laying out **goals**; this is about the **means**

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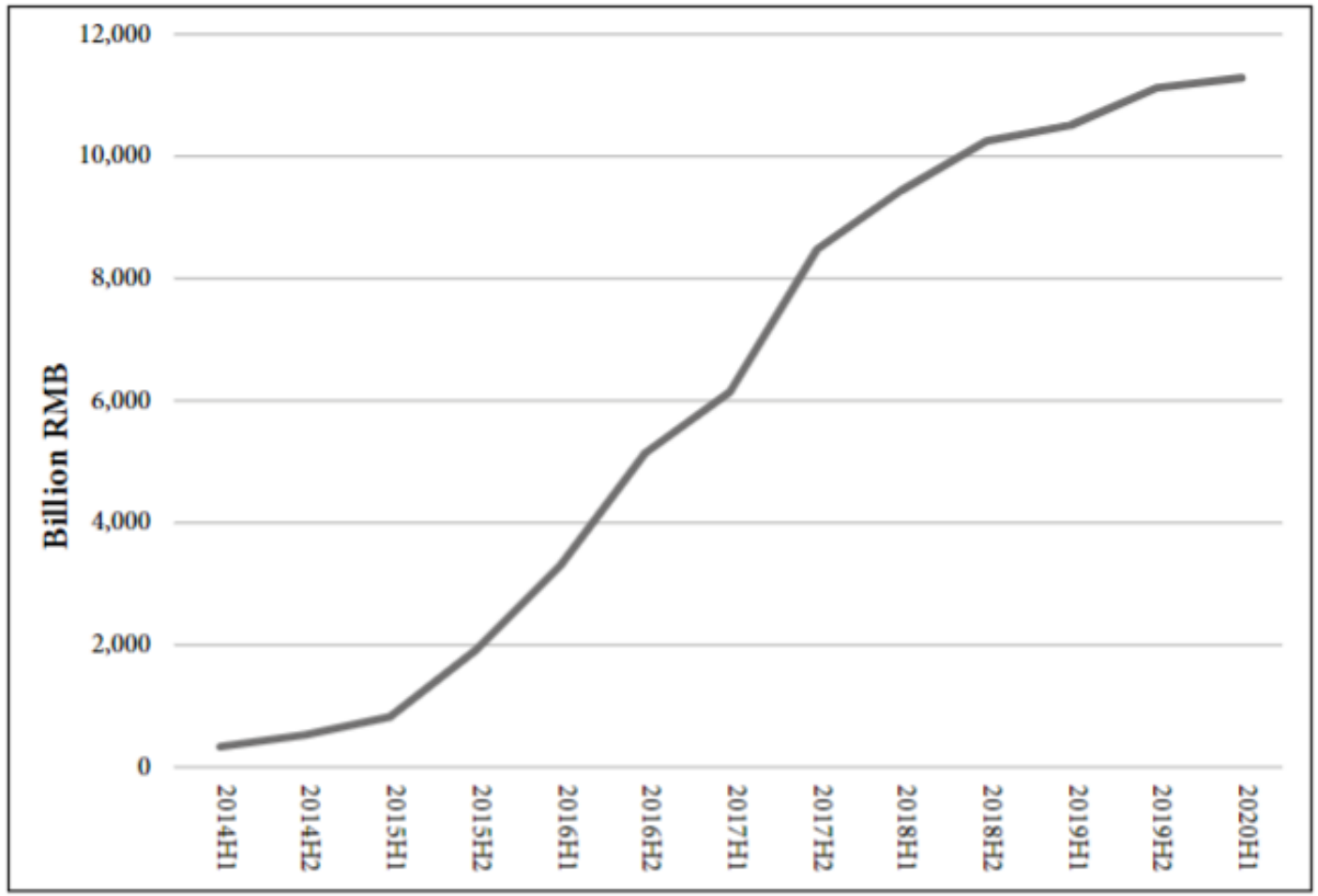
- **Investment** – both new startups and established firms
- 2019 – total commitment **1,6 trillion USD – 11 % of Chinese GDP**

Figure 4.1: Government Industrial Guidance Funds: Cumulative Fund-Raising Scope



5.1 Sectorial Orientation of Industrial Guidance Funds

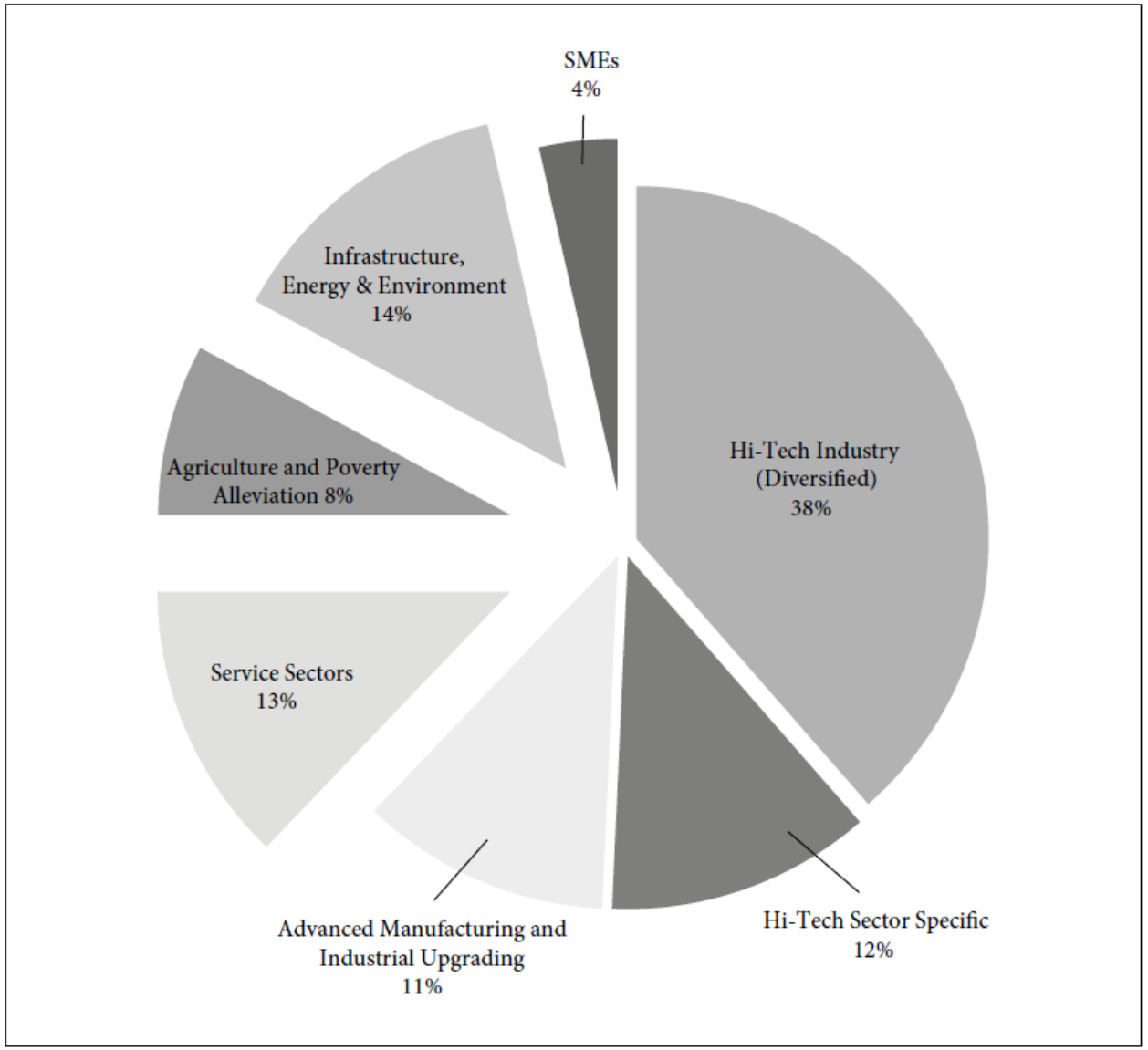


Table 5.1: Total Value of Industrial Guidance Funds (2020)

	Trillion RMB	Percent
National/Central	1.96	19%
Provincial	3.30	32%
Municipal	3.72	36%
County	1.34	13%
Total	10.32	100%

Sources: own elaboration compiled by the author from data supplied by Zero2IPO / Qingke Research Center (清科研究中心). Accessed at https://www.pedata.cn/. Some data may be behind paywalls.

Table 5.2: Largest Industrial Guidance Funds (2020)

Fund Name	Level	Scale (Billion RMB)
Integrated Circuit Fund (both rounds)	National	338.70
Optical Valley Fund (Wuhan)	Municipal	250.00
Government-Enterprise Cooperation Fund	National	180.00
Central SOE Innovation Fund	National	150.00
Kunpeng Fund (Shenzhen)	Municipal	150.00
National SOE Adjusment Fund	National	130.00
Shanxi Taihang Fund	Provincial	105.00
Jiangxi Development and Upgrading Fund	Provincial	100.01
Beijing Investment Guidance Fund	Provincial	100.01

Sources: own elaboration compiled by the author from data supplied by Zero2IPO / Qingke Research Center (清科研究中心). Accessed at https://www.pedata.cn/. Some data may be behind paywalls.

Social credit system(s)

- In the West – interpreted merely as a tool of social control

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- - by cheaper loans, access to public procurement contracts

„Wish list approach“

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- Next Generation Artificial Intelligence Plan – 2017

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- A brimful of **goals and targets – but no plan of how to acquire them**
- > „**let the local Party leaders figure this out, we will reward the successful ones**“
- = combination of **central plans with local initiative** – typical for China since the Great Leap Forward

„Wish list approach“

- „The central government isn’t issuing detailed marching orders to local officials for carrying out a master plan. Instead, it’s giving them **hundreds of ideas for “gifts” that it would like to receive, and saying, “surprise me.”**“

Examples from Sheehan‘s article

- Are you in charge of transportation for the new megacity of Xiong’an? Partner with Baidu’s self-driving project, Apollo, to demonstrate autonomous vehicles in the city.
- Head of the Changping branch of Beijing’s Public Security Bureau? Spend 2.75 million yuan ($437,000) procuring AI person-tracking software for security cameras.
- President of a mid-tier engineering university in Shandong? Open the province’s first AI research center focusing on medical and marine AI.
- Party chief of a Nanjing economic development zone? Pour 8 billion yuan ($1.3 billion) into an AI-focused venture capital fund and dole out 5 million yuan ($794,000) in R&D subsidies to each firm that sets up shop there.

„Wish list approach“

- “government-steered market economy”

Chips

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- **Basic unit – a transistor** – either allows electric current to pass through, or it does not

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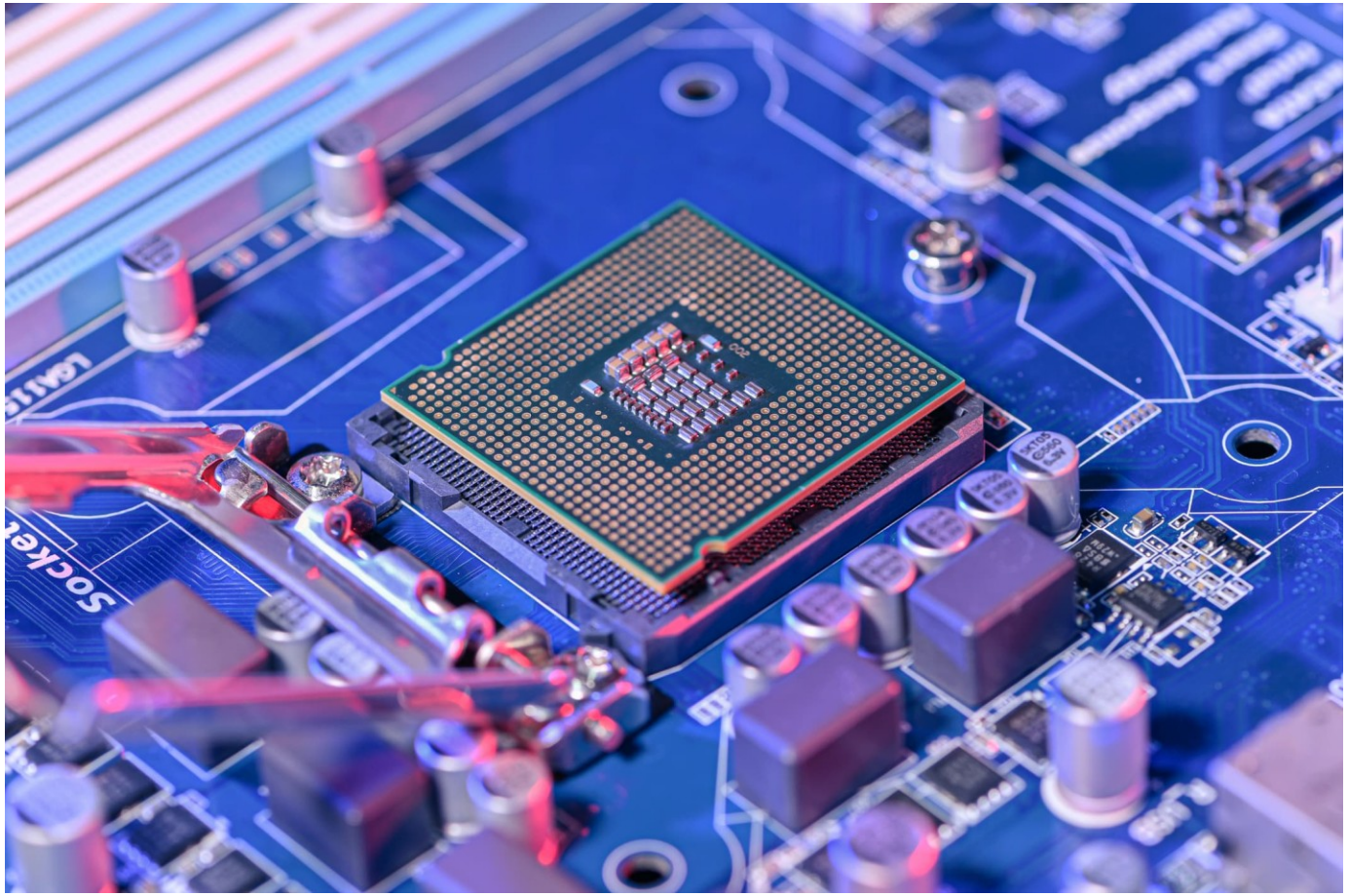

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- Invented – Bell labs, late 1950s

Chips

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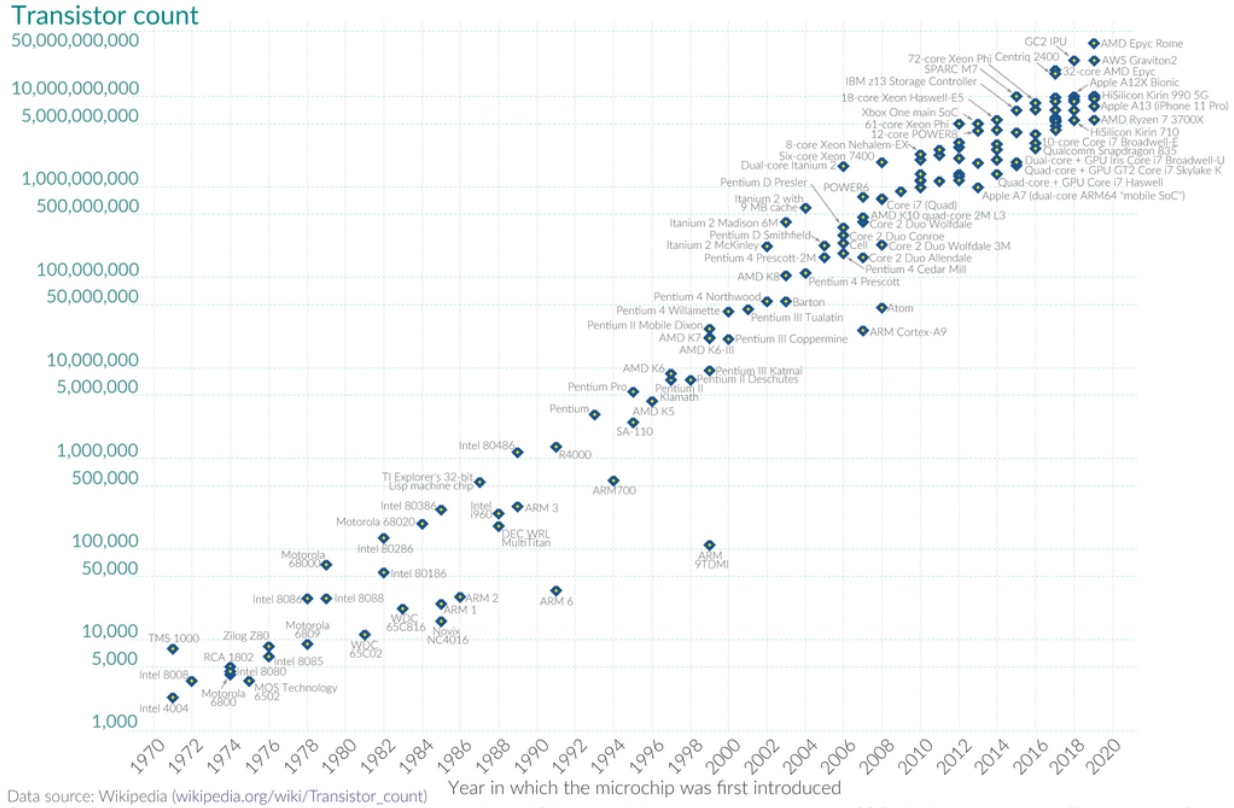
- > double brute computing force

Moore's Law: The number of transistors on microchips doubles every two years

Our World in Data

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.



Data source: Wikipedia (wikipedia.org/wiki/Transistor_count)

Chips

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- Or focus on specific types of rudimentary, trailing edge chips – **Europe!**

Chips

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Chips

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- Its national chip maker- **SMIC** – Semiconductor Manufacturing International Corporation
- **Quintessential national champion** on part with Huawei!
- Extremely high support - 50% of its revenue comes from state subsidies
- But **it is still far behind industry leaders and only has a small global market share**

Chips

- SMIC‘s smallest transistors are **14 nm in size**
- The smallest produced on a large scale globally are **7nm**, the cutting edge is moving to **5nm**

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- SMIC‘s smallest transistors are **14 nm in size**
- The smallest produced on a large scale globally are **7nm**, the cutting edge is moving to **5nm**
- Most of their production is even further from the frontier!

MOSFET scaling (process nodes)

10 µm – 1971
6 µm – 1974
3 µm – 1977
1.5 µm – 1981
1 µm – 1984
800 nm – 1987
600 nm – 1990
350 nm – 1993
250 nm – 1996
180 nm – 1999
130 nm – 2001
90 nm – 2003
65 nm – 2005
45 nm – 2007
32 nm – 2009
22 nm – 2012
14 nm – 2014
10 nm – 2016
7 nm – 2018
5 nm – 2020

Future

3 nm ~ 2022
2 nm ~ 2024

Chips

- China imports some 70 % of chips produced worldwide, half is then re-exported
- It only produces 16 % of world production, only 6 % comes from domestically owned firms

The semiconductor value chain

- **Perhaps the most sophisticated value chain in the world**

The semiconductor value chain

- **No country or company in the world is able to produce cutting edge chips on its own**

The semiconductor value chain

- Dominated by **USA + Taiwan, Korea, Japan**; Netherlands

The semiconductor value chain

- **EDA – software** (US firms)

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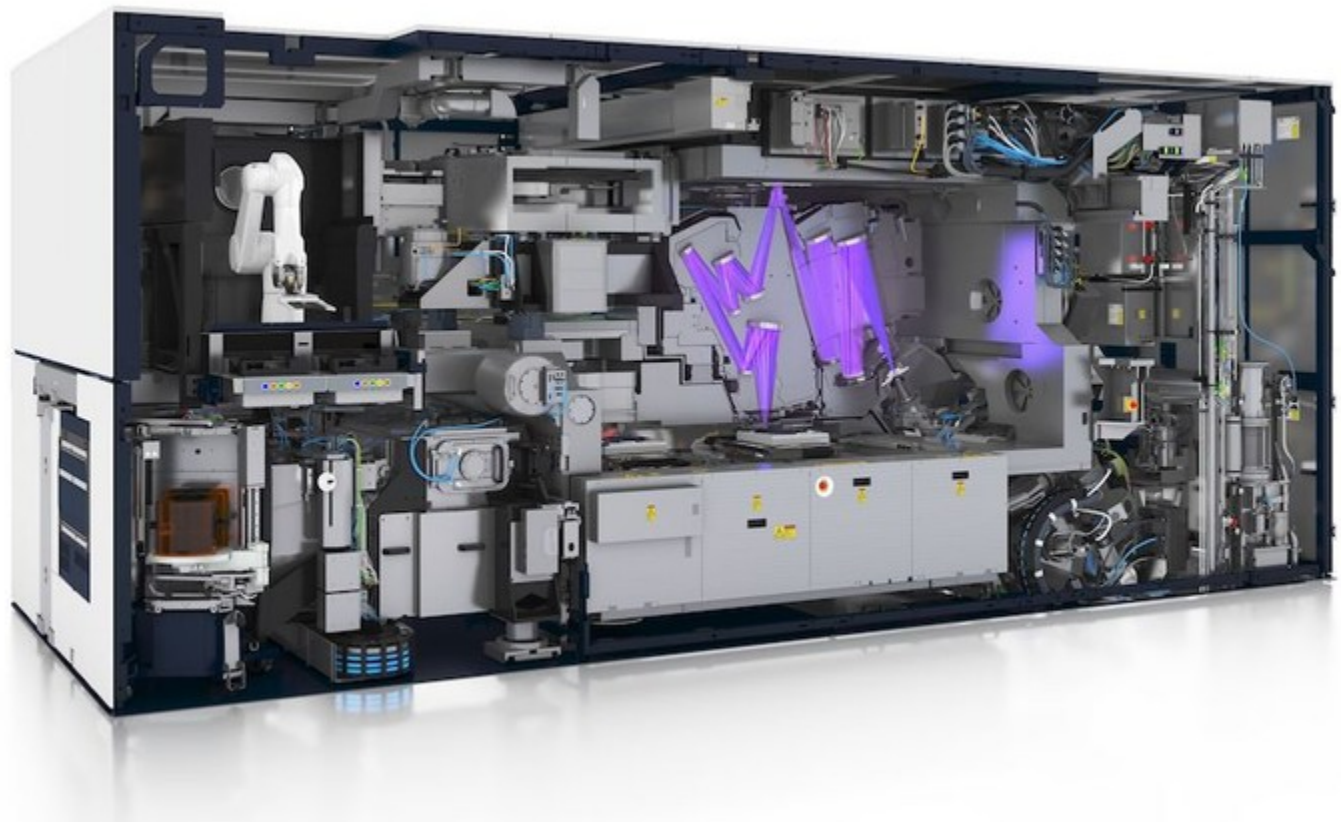

The semiconductor value chain

- **EDA – software** (US firms)
- **Design** – smartphone manufacturers etc.
- **SME – equipment** – US + Japan + **Netherlands (ASML)**
- - extreme-ultraviolet lithography – largest bumps on their mirrors are **smaller than one atom!**

The semiconductor value chain

- Together – **„fabs“** – most expensive factories in the world – circa 20 billion dollars to create a production link

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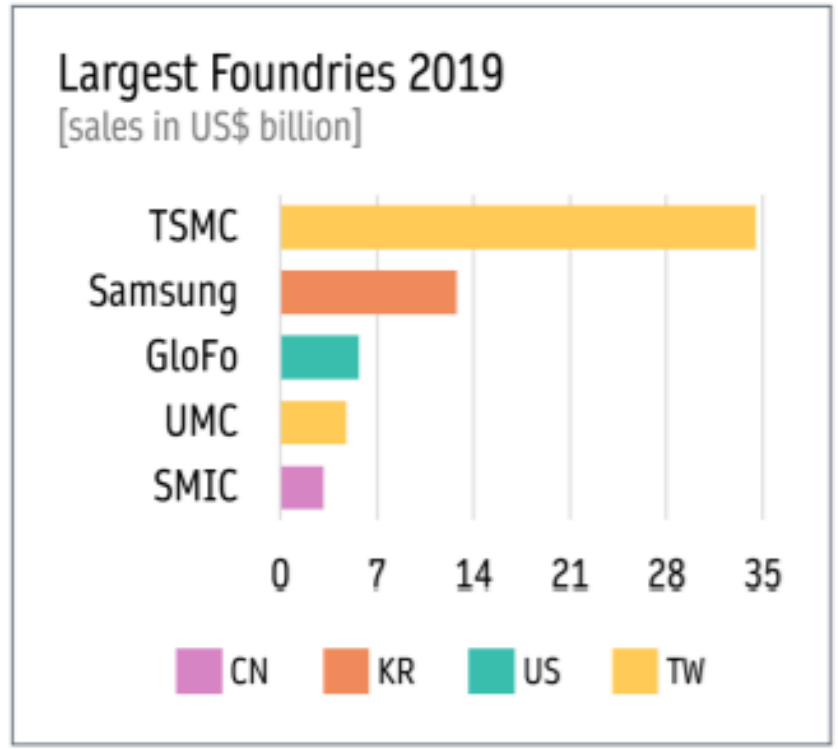
- **Non-monetary inputs – need for engineers with experience**, which is extremely rare

The semiconductor value chain

- **Most important producer of chips in the world – TSMC – Taiwan** Semiconductor Manufacturing Company

The semiconductor value chain

- **Most important producer of chips in the world** – **TSMC – Taiwan** Semiconductor Manufacturing Company
- - **50% of global production** or so, even stronger on the cutting edge


Largest Foundries 2019
[sales in US$ billion]
TSMC
Samsung
GloFo
UMC
SMIC
0
7
14
21
28
35
CN
KR
US
TW

The semiconductor value chain

- China – no **EDA or SME**, few experiences engineers

The semiconductor value chain

- **China‘s Achilles‘ heel!**

The semiconductor value chain

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- **> huge resources are being invested into redressing it**

The semiconductor value chain

- **China‘s Achilles‘ heel!**
- **> huge resources are being invested into redressing it**
- **> US pressure is concentrated in this area**

US – Chinese technological rivalry

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- **This embargo must include US allies** (Korea, Japan, Taiwan, Netherlands)

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- Biden‘s strategy - in line with this approach – last week‘s restrictions!

Biden‘s sanctions on China

- Wide **ban on SME exports to China** – mostly ASML – achieved because ASML uses US technologies
- Ban on **US engineers working for Chinese semiconductor companies**
- **Ban on exporting specific advanced chips** to China – AI chips
- Deeper bans on specific companies

- Trump only targeted Huawei and SMIC

Export controls

- Cold War-era legislation – it is possible for the US government to **ban the export of products which can be used for military purposes**

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- **Exterritorial** – falls on foreign companies using US inputs or IP

Investment screenings

- Since circa 2014, China ramped up **strategic purchases of foreign technological companies**

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- > **a screening mechanism, which allows US authorities to stop the sale**
- If the owner still wants to sell, he must find a different buyer, if he can‘t one, the government will temporarily purchase it

- A tighter regime of export controls and investment screenings **is being created in the EU as well!**
- **– two new EU regulations in 2021!**

The US-China trade war

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- **„China shock“** – contrary to expectations of economists, the post-2000 surge of imports had negative impacts on many parts of US society

The US-China trade war

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- > de-industrialization, followed by **permanently decreased wages and employment**

The US-China trade war

- **Political conflict** – winners vs. losers of globalization

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- > Donald Trump

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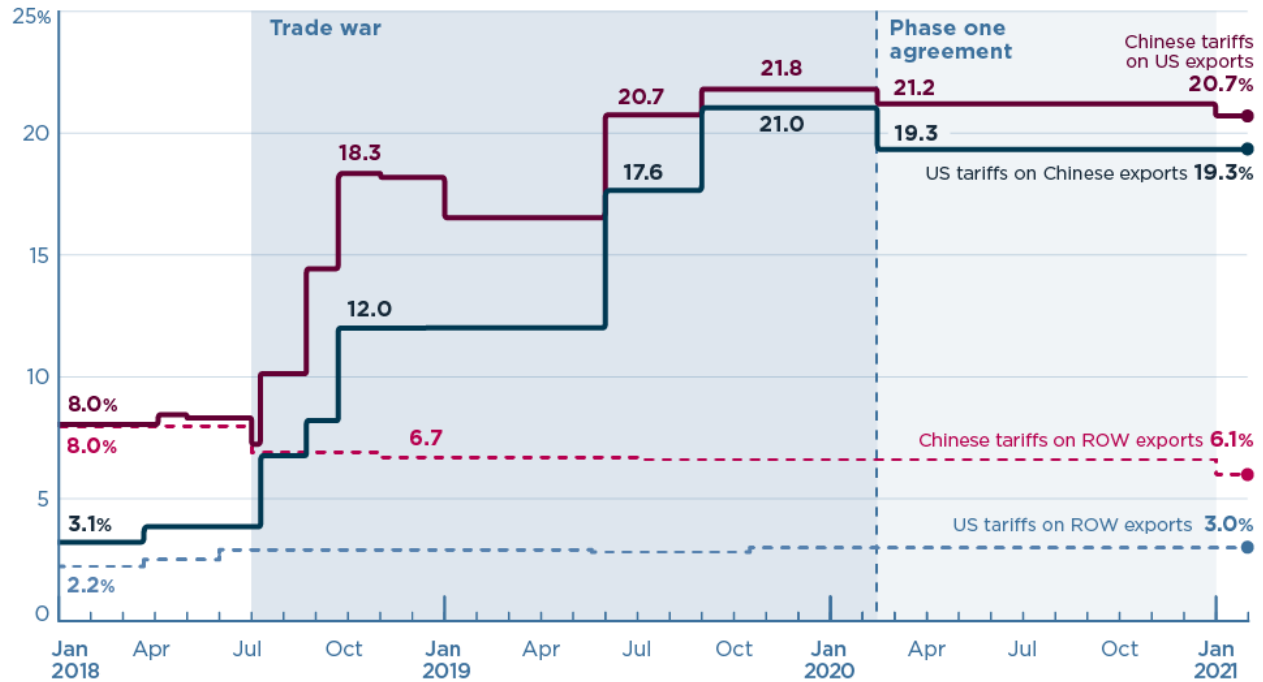
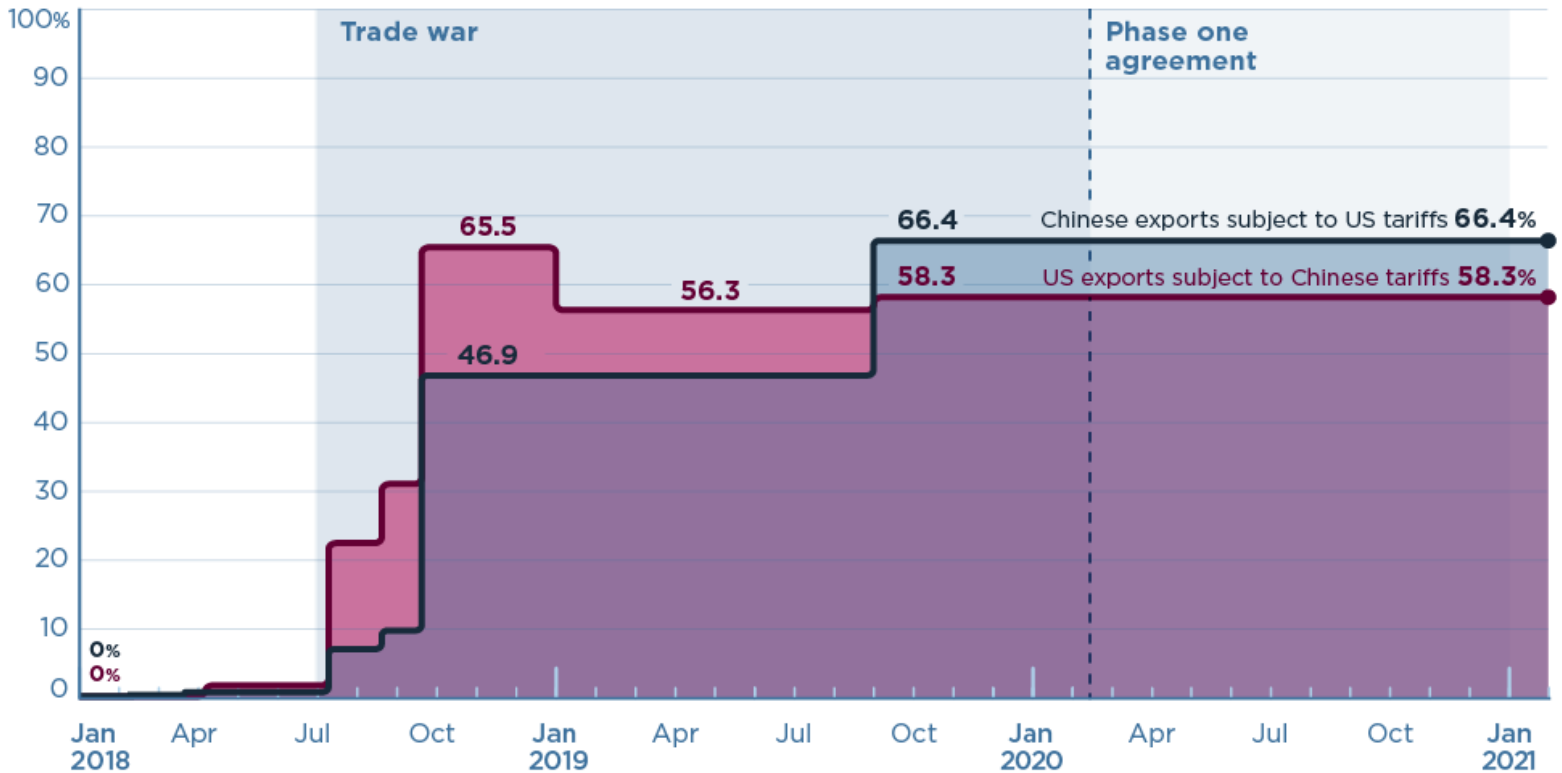
- Chinese retaliation

US-China trade war tariffs: An up-to-date chart

a. US–China tariff rates toward each other and rest of world (ROW)



b. Percent of US–China trade subject to tariffs



The US-China trade war

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- Winners – **US workers in import-competing industries; third countries – EU!**
- Popular in the US – Biden continues the same policy

The US-China trade war

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- = decoupling?

The US-China trade war

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- **Returns on investment** in China are higher than anywhere else in the world

The US-China trade war

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- **Far less successful** – China remains paramount for large multinational companies
- - a giant market
- **Returns on investment** in China are higher than anywhere else in the world
- Sometimes – **feigned moves abroad** – products are completed in another country, so they avoid US tariffs etc.

The US-China trade war

- How has China‘s role changed from the perspective of a multinational corporation between 2000 to 2020?

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The US-China trade war

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- **From a source of cheap labor to a market** – the Chinese are rich enough to consume

- This goes hand in hand with China‘s drive to decrease its dependence on exports – **promotion of domestic consumption**
- Trade war = another incentive to make China less dependent on exports

Threats to China‘s success story

Threats to China‘s success story

- **1) Backlash from industrialized countries**
- Even EU, CANZ, Japan etc. are starting to turn against China

Threats to China‘s success story

- 2) **An uncertain wager on digital technologies**

Threats to China‘s success story

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Threats to China‘s success story

- 2) **An uncertain wager on digital technologies**
- Normally, industrial policy **is about catching-up**
- There are existing technologies to be copied – **it is faster to copy something than to develop it**
- Even if you decide for domestic innovations, **it is still clear that the technology is viable and can work**

Threats to China‘s success story

- 2) **An uncertain wager on digital technologies**
- As you get near the frontier, it is **more and more hard to say which way to go**

Threats to China‘s success story

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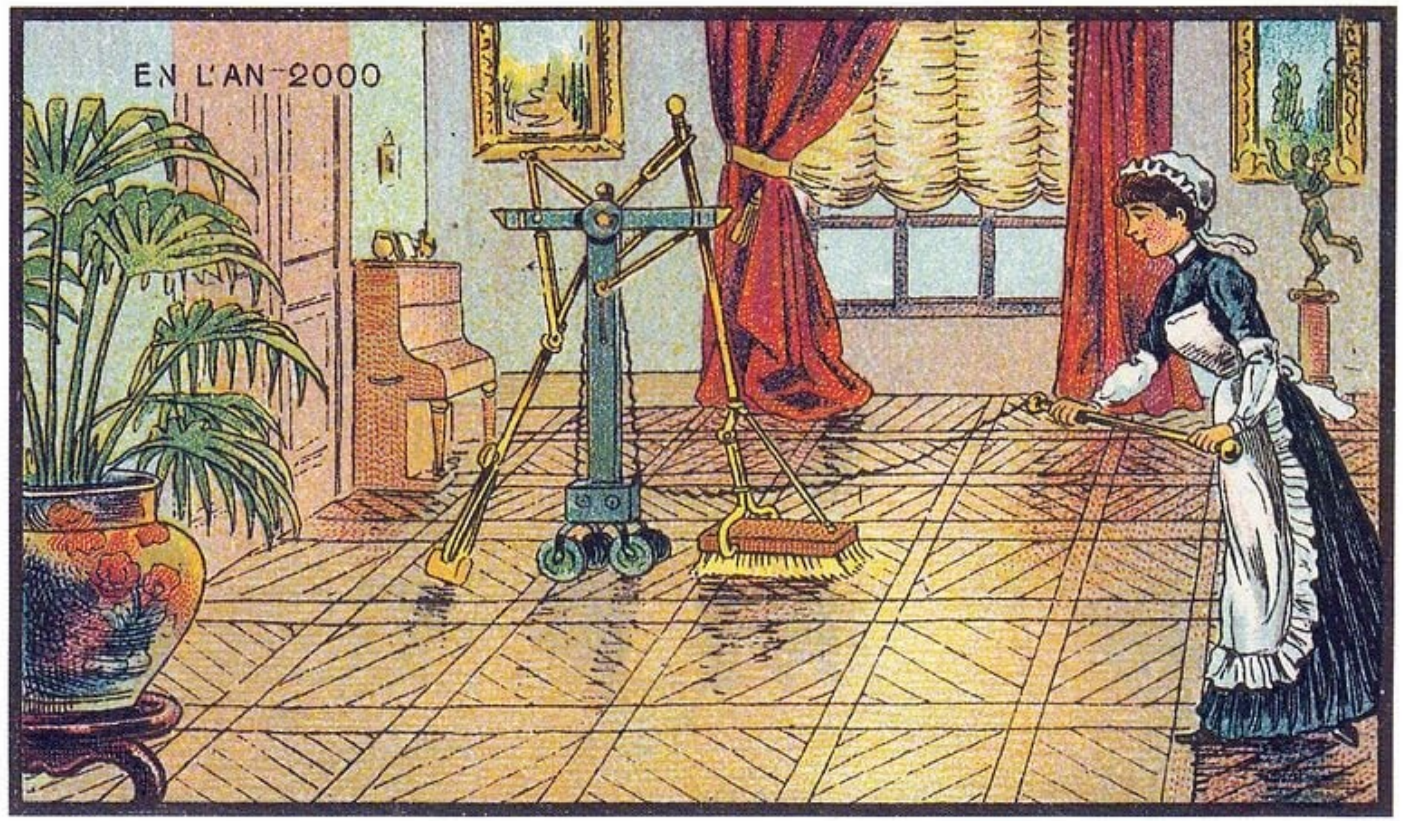
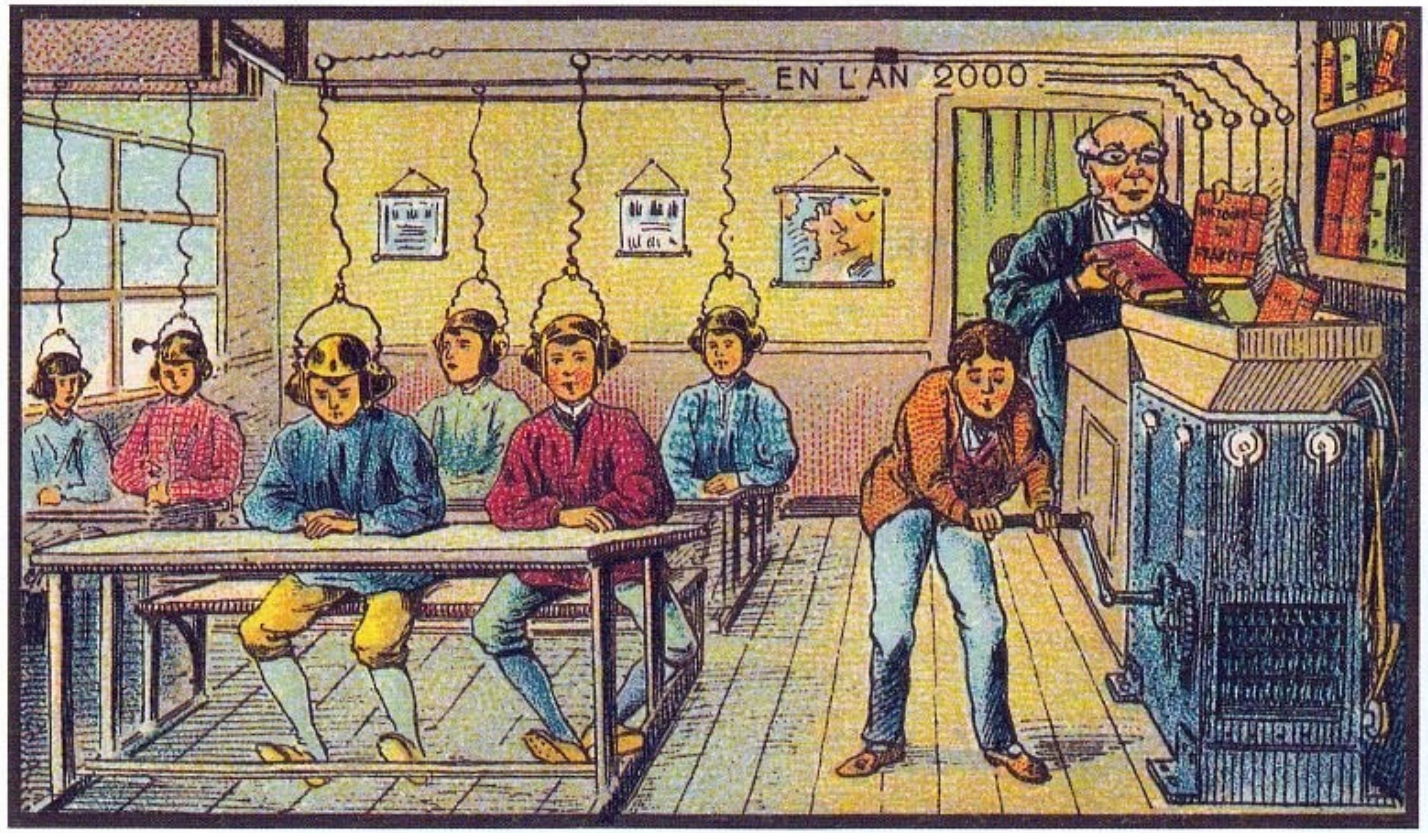
- Most countries (J, K, T) **liberalize at this point** > so that markets can experiment and find the way
- **China has decided to bet huge resources on a technological revolution that is yet to emerge**
- > What if the future doesn‘t work the way Beijing imagines?


EN L'AN 2000



Electric Scrubbing

A Tailor of the Latest Fashion



At School

- „The future will be just like the present, only more so“

Threats to China‘s success story

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- At the expense of the actually promising sectors

Threats to China‘s success story

- 2) **An uncertain wager on digital technologies**
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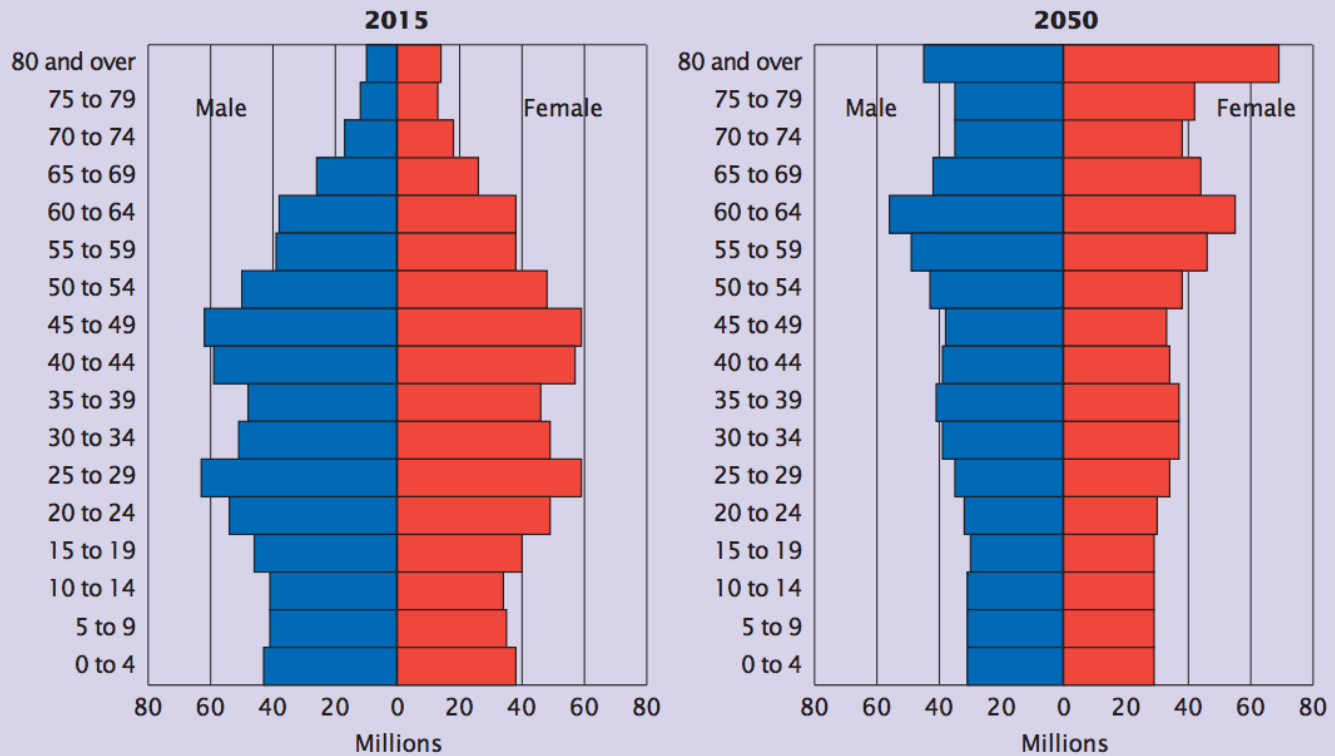
- At the expense of the actually promising sectors
- **Bursting of a bubble x permanent support for an entrenched interest**

Threats to China‘s success story

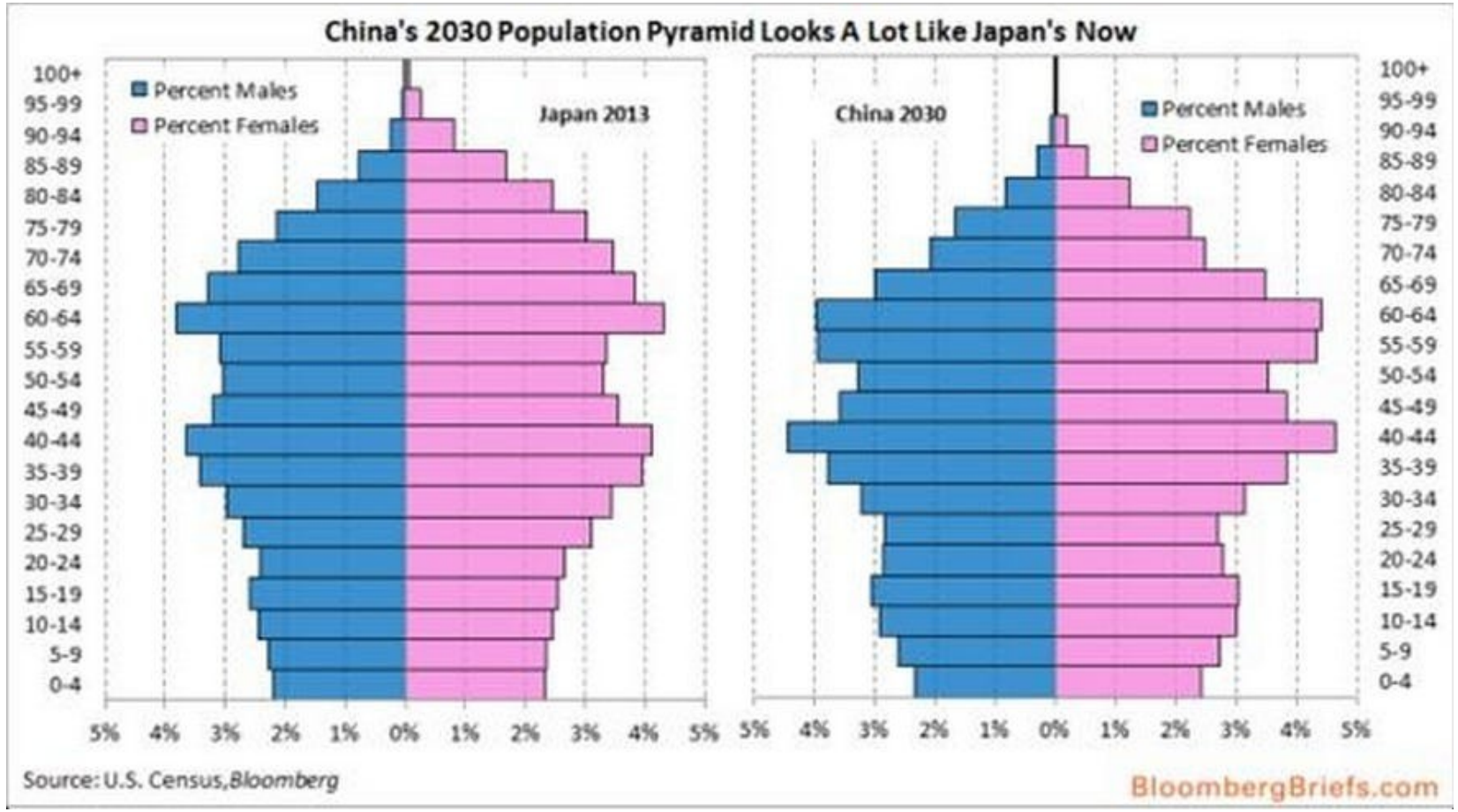
- **3) Ageing population**

Figure 3-2.

Population by Age and Sex for China: 2015 and 2050



Source: U.S. Census Bureau, 2013; International Data Base.


China's 2030 Population Pyramid Looks A Lot Like Japan's Now
Percent Males
Percent Females
Japan 2013
China 2030
100+
95-99
90-94
85-89
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
5% 4% 3% 2% 1% 0% 1% 2% 3% 4% 5%
Source: U.S. Census, Bloomberg
BloombergBriefs.com

Threats to China‘s success story

- **3) Ageing population**
- > need for far greater spending on **pensions, healthcare spending**

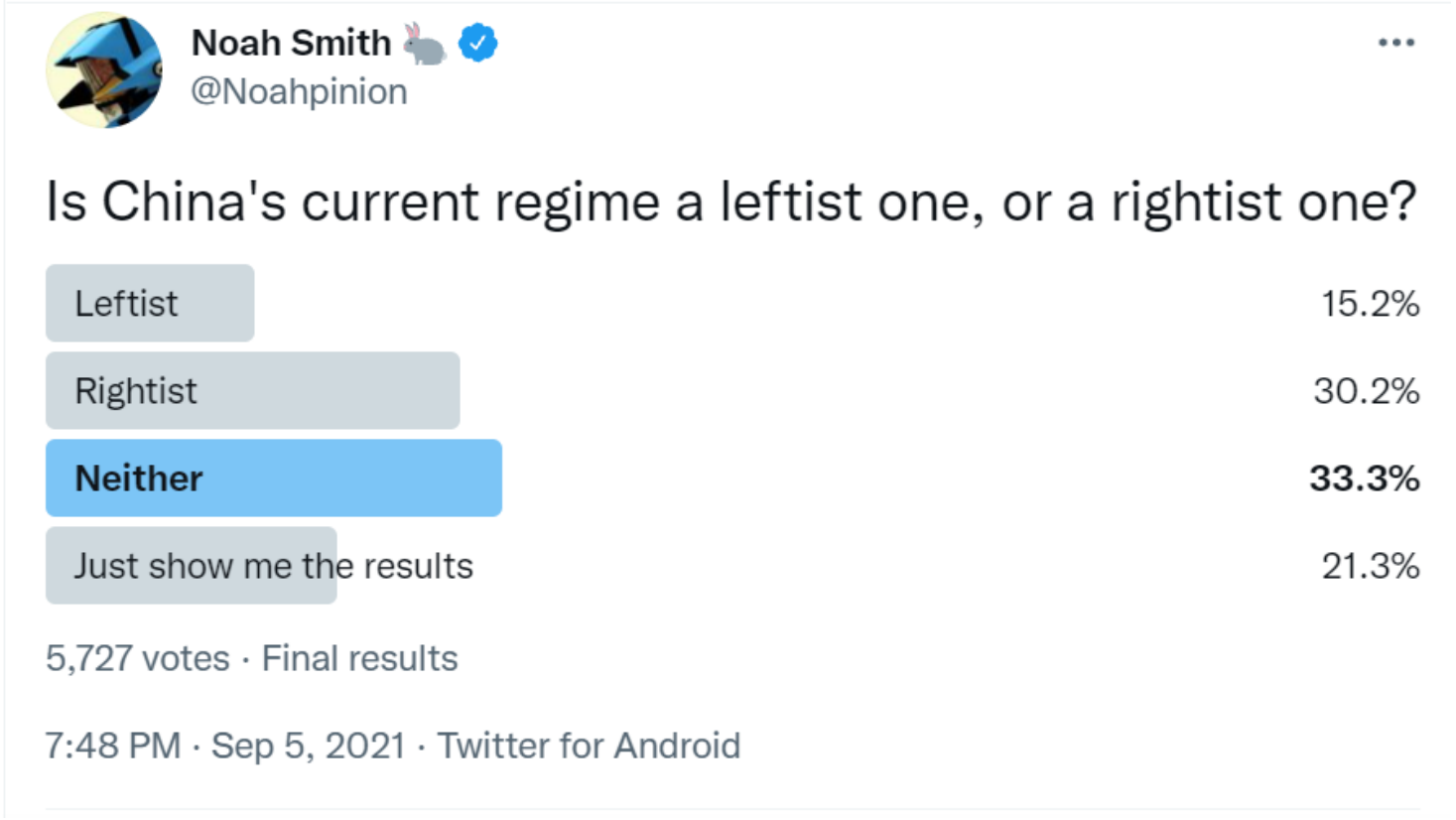
Threats to China‘s success story

- **3) Ageing population**
- > need for far greater spending on **pensions, healthcare spending**
- China currently only has a tiny welfare state
- Because „it promotes laziness“

Poll

- Is China right-wing or left-wing?

Poll


Noah Smith
@Noahpinion
Is China's current regime a leftist one, or a rightist one?
Leftist
15.2%
Rightist
30.2%
Neither
33.3%
Just show me the results
21.3%
5,727 votes · Final results
7:48 PM · Sep 5, 2021 · Twitter for Android

Threats to China‘s success story

- **4) A real-estate bubble**

Threats to China‘s success story

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- **Huge build up of real estate since 1990**

Threats to China‘s success story

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- Also infrastructure

Threats to China‘s success story

- **4) A real-estate bubble**
- **Huge build up of real estate since 1990**
- Also infrastructure
- **Financed by state banks, built by SOEs**

Threats to China‘s success story

- **4) A real-estate bubble**
- **During every crisis > financial injection > even more build up**

Threats to China‘s success story

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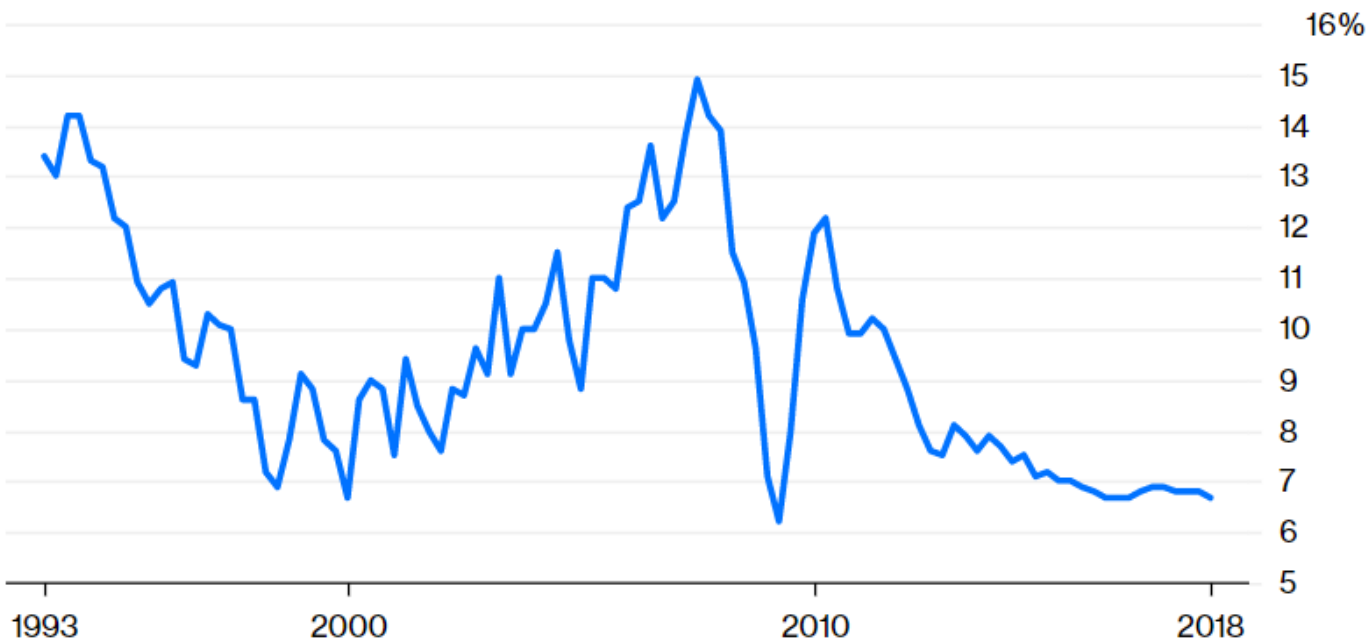
Threats to China‘s success story

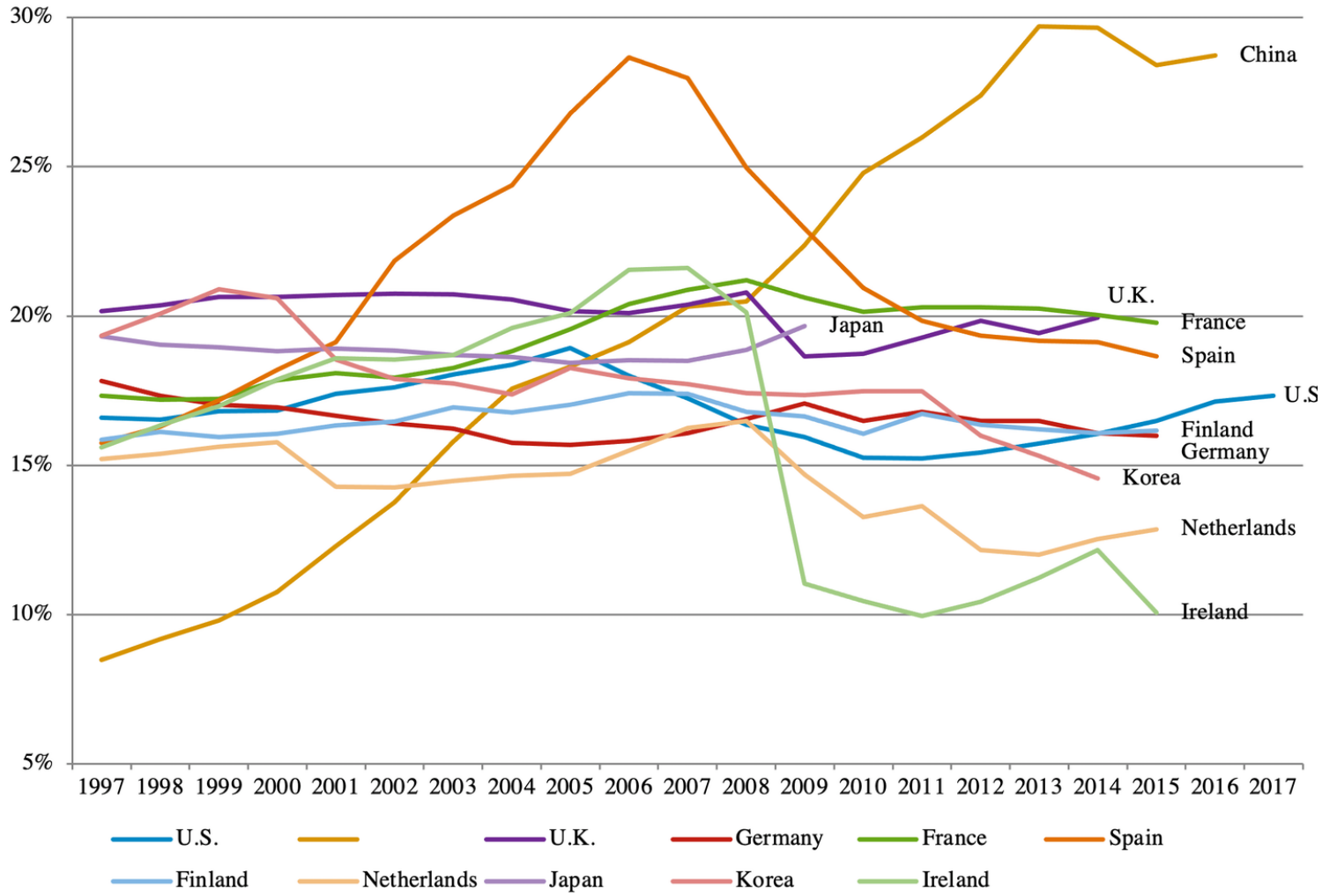
- **4) A real-estate bubble**
- **During every crisis > financial injection > even more build up**
- „Keynesianism with Chinese characteristics“ was based around real-estate
- > **near miraculous ability to escape recessions**

No Recession Here

China real quarterly annualized gross domestic product growth



Source: Bloomberg


30%
25%
20%
15%
10%
5%
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
China
U.K.
France
Spain
Japan
U.S
Finland
Germany
Korea
Netherlands
Ireland
U.S.
U.K.
Germany
France
Spain
Finland
Netherlands
Japan
Korea
Ireland

Threats to China‘s success story

- **4) A real-estate bubble**
- 2008 – the biggest injection of them all > **overproduction, redundant capacity**

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- Empty suburbs of investment flats

Threats to China‘s success story

- **4) A real-estate bubble**
- The Xi leadership – **lets switch resources to manufacturing!**

Threats to China‘s success story

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- But:
- What if the manufacturing strategy fails?

Threats to China‘s success story

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- Local governments get income from selling land > **will they have to switch to higher taxes?**
- **What about the middle class and their savings**?

- Do we still have time?

- Do we still have time?
- Probably not…

Next time

- **China in the World Trade Organization**