The US-China trade and technological war

China in the World Economy, autumn 2024

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- In what way was the Strategic Emerging Industry project different from its predecessor?

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- **Growing technological ambitions** – to overtake the US and become the leading economy

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- 2006: Medium-to-Long-Term Plan for the Development of Science and Technology
- 2010: Strategic Emerging Industry
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- Increasingly: **more money, higher ambitions, more direct cooperation with industry**
- Creeping return of central planning?

Where we also pick up the story:

2012:

The West finds out that China is not going to go liberal after all

- An undertone of this story – China **decided not to converge to liberal, free-market economies in terms of its economic model**

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- > **clash of different economic systems**
- > **ideological clash** – the West previously believed in Fukuyama‘s thesis and expected China to liberalize

Artificial intelligence

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- „**AI gap**“ – like the missile gap during the Cold War

- Prime minister Wen – it is during periods of crisis when **great technological revolutions take place**
- > this time, China is not going to miss it!
- “Seize the commanding heights of the new technological revolution”

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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**

AI

- - provided a **central idea to China‘s technological ambitions**

- **> general-purpose technology which is going to be at the heart of everything**

Industrial revolutions

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

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- > **take a shortcut**, bypass some stages of development and go to the top
- > **leapfrog advanced countries**

The AI triad

- 1) **Collection of data** – sensors, cameras with facial recognition etc.
- 2) **Quick transfer of data** – next generation Internet
- 3) **Processing od data** – algorithms, advanced hardware

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- „**Digital central planning**“? – doing what the USSR could not with AI?

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- **All three stages require hardware – advanced microchips**

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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

- „…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.“

Return of industrial policy

- **Bigger** (even relatively) than policies of Japan, Taiwan, South Korea etc. in the post-war period
- **A qualitatively different goal** – leadership

- Highly provocative – Naughton – **breaking of unwritten international rules**

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- > **backlash -** end of Western complacency about China – **US-China trade war**

- Biggest target of support – **semiconductors**
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- **China continues to be surprisingly weak and aims to improve its position**

Chips

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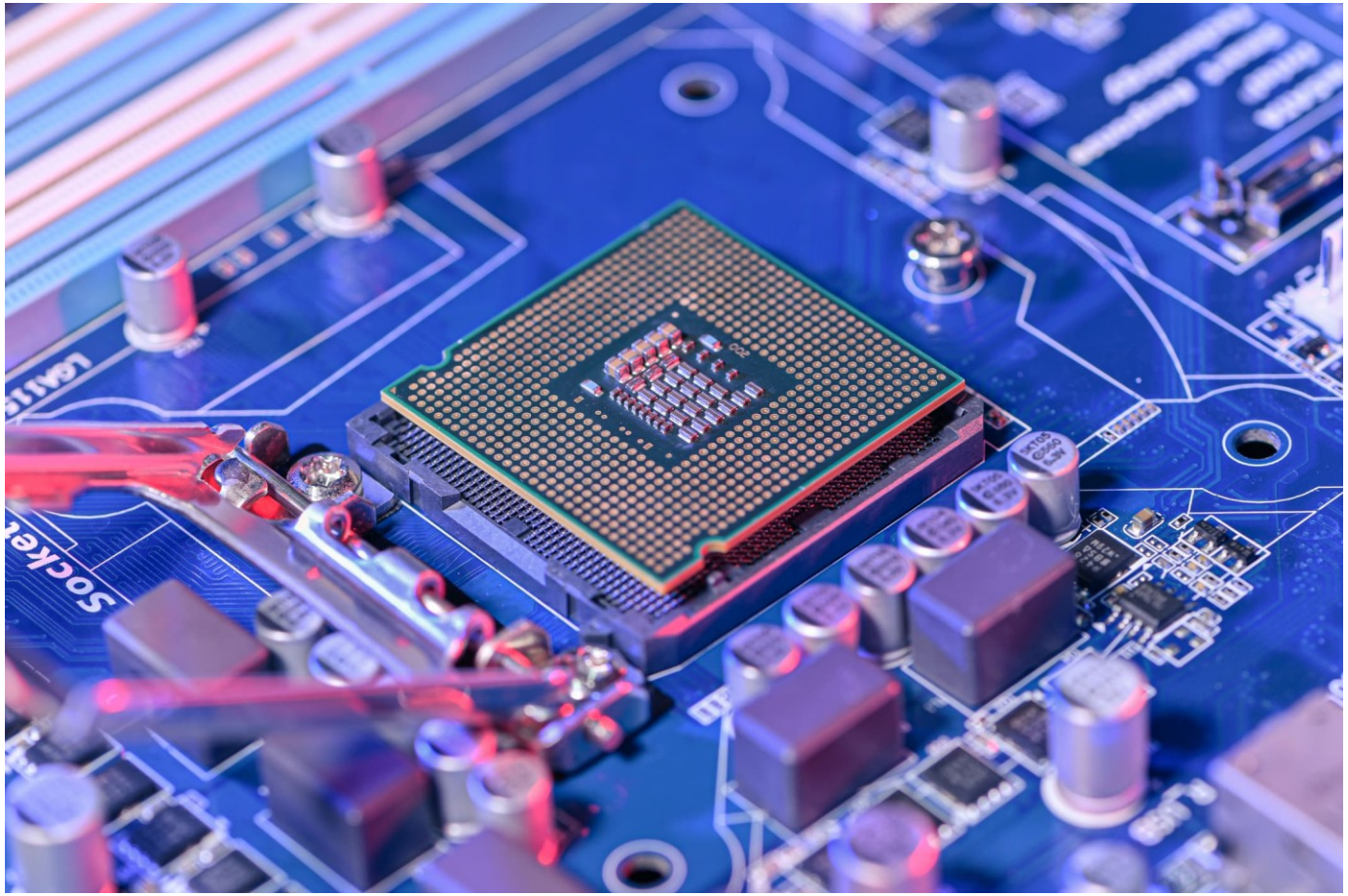

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- Invented – Bell labs, late 1950s

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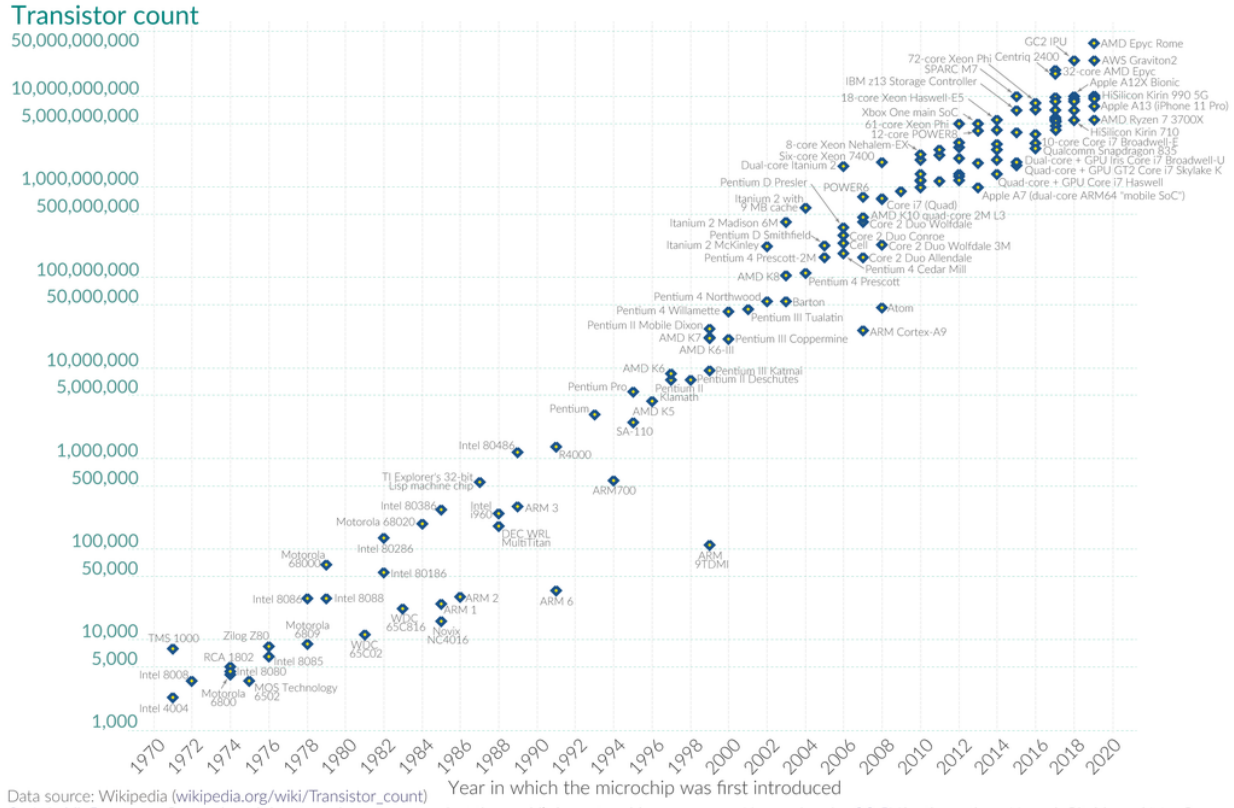
Moore's Law: The number of transistors on microchips doubles every two years

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)

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

Chips

- China **imports the vast majority of its chips**

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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- 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 **7 nm in size, they are attempting to move to 5nm**
- The TSMC‘s most advanced chips use 3nm chips, with the next goal being 1,4nm

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- **China is not far behind the global cutting edge, a bigger problem being the scale of production**

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

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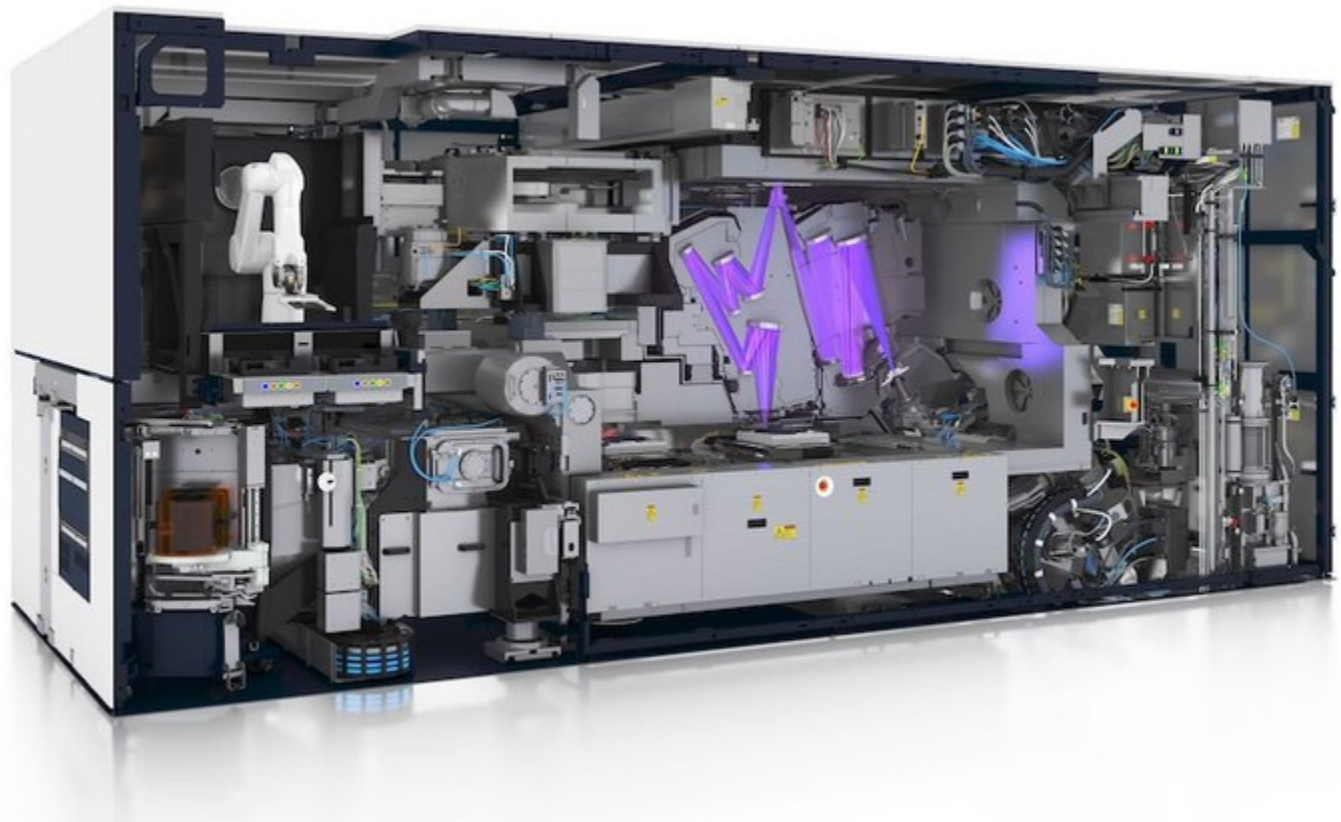

The semiconductor value chain

- **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

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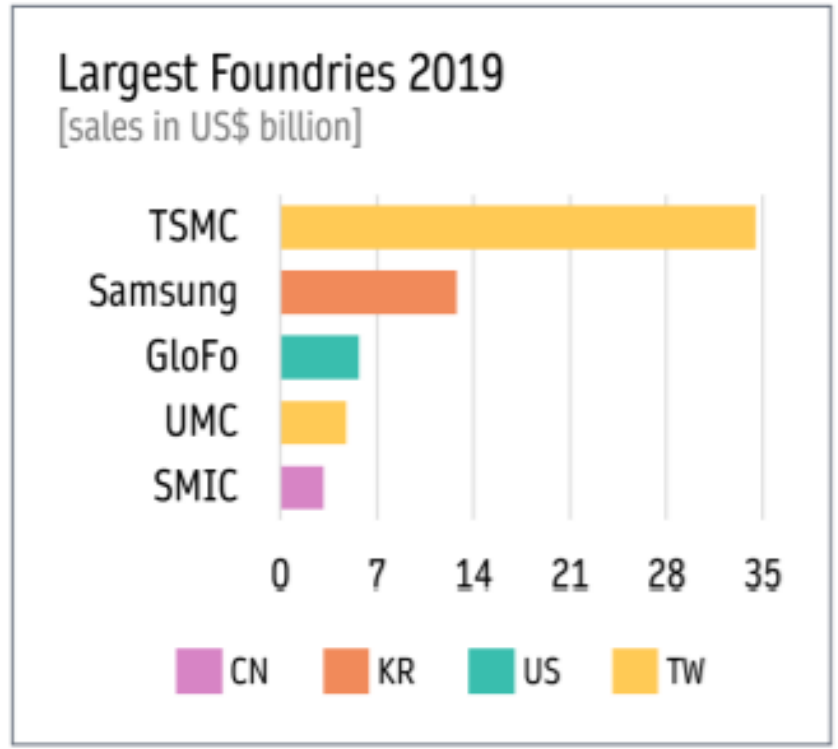
The semiconductor value chain

- **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!**

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

- How exactly does China pour money into microchips?
- Or into other industries?
- = how do programs such as Made in China 2025 actually work?

- **Very often, China does not work through the public budget, but takes advantage of government ownership of firms and banks**

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- = Chinese industrial policy is highly untransparent

Industrial Guidance Funds

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

Industrial Guidance Funds

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- „You have savings and profits? Give them to a designated fund!“
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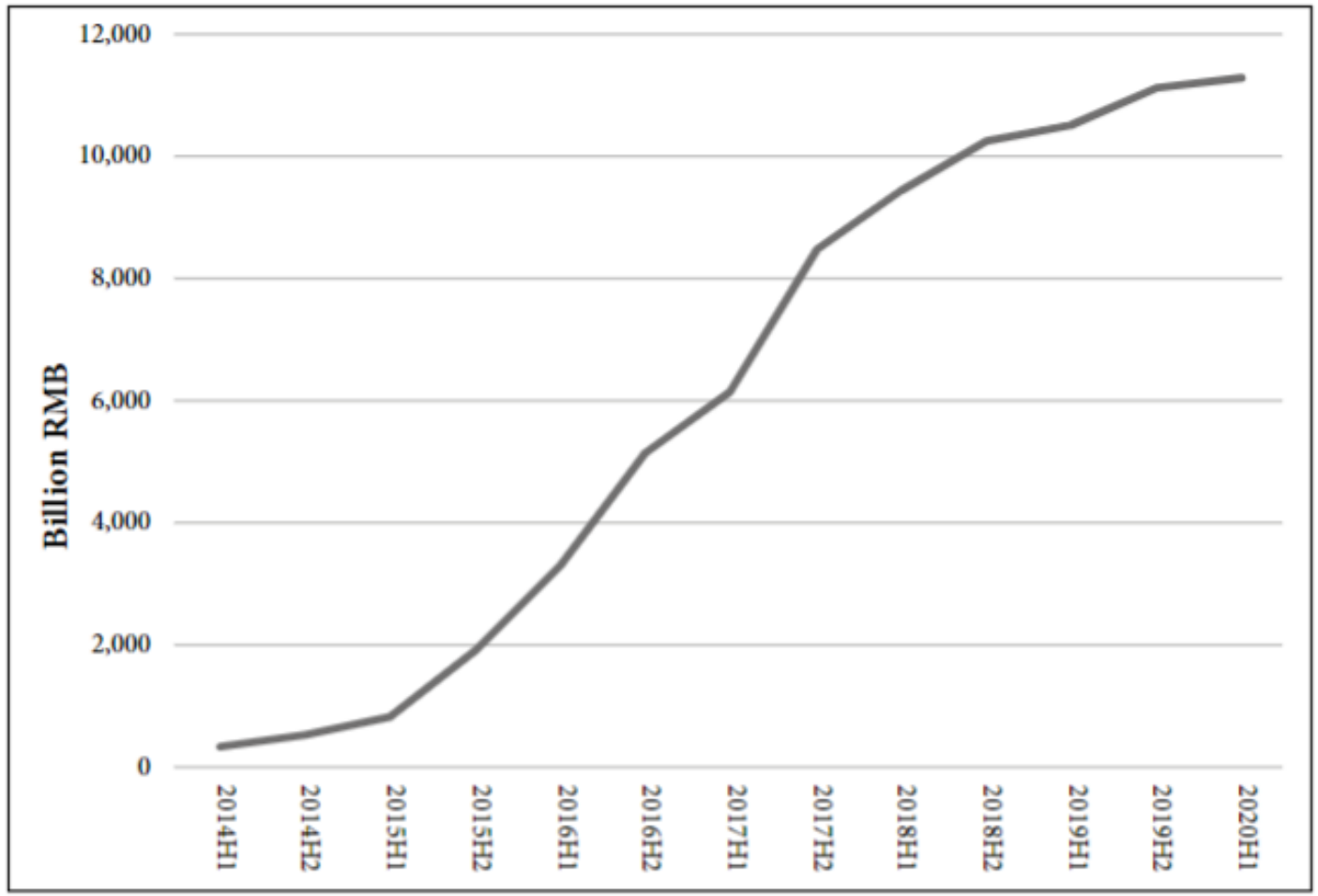
- 2019 – total commitment **1,6 trillion USD – 11 % of Chinese GDP**

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



5.1 Sectorial Orientation of Industrial Guidance Funds

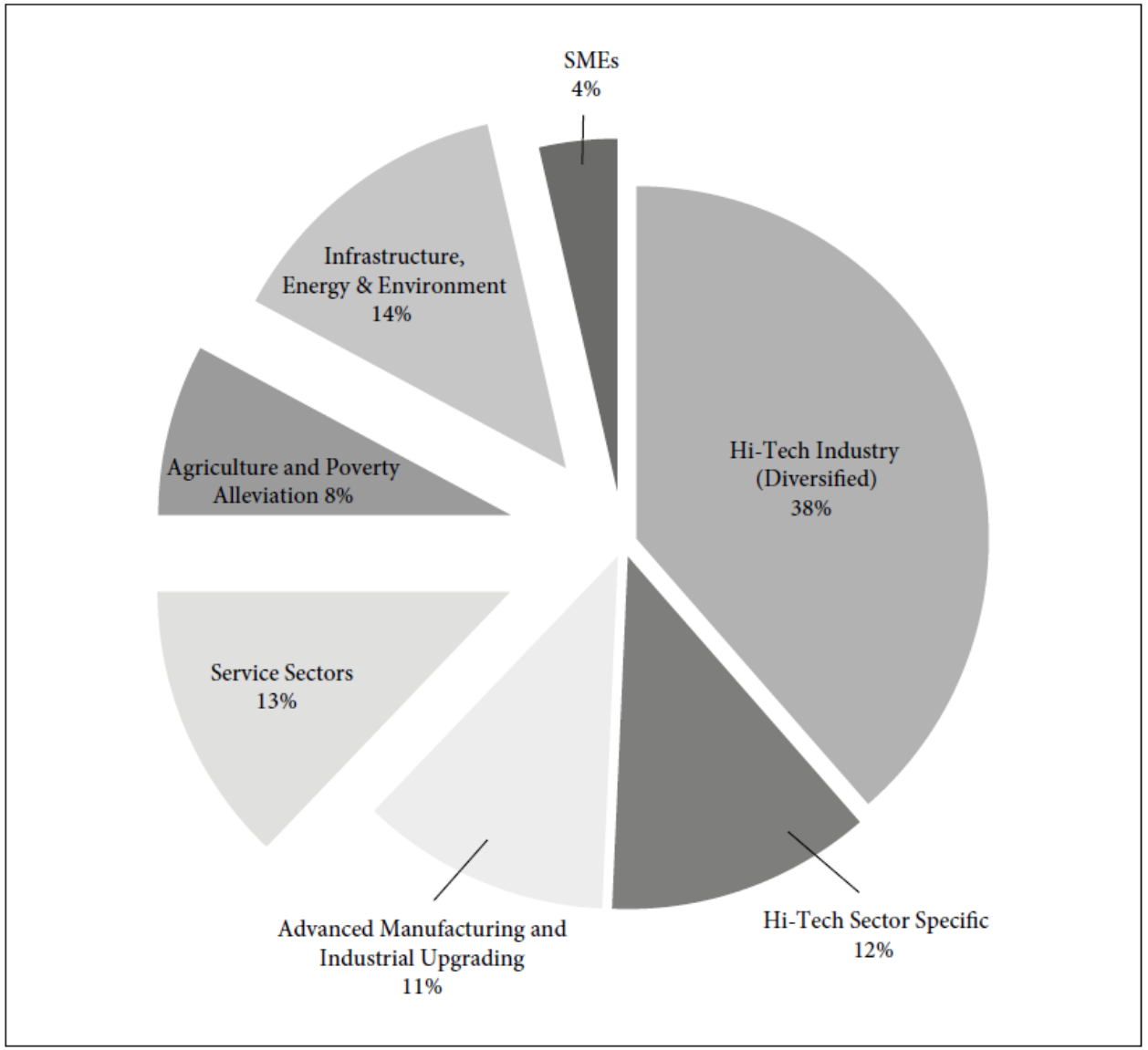


Table 5.1: Total Value of Industrial Guidance Funds (2020)

	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

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- - by cheaper loans, access to public procurement contracts

The semiconductor value chain

- **China‘s Achilles‘ heel!**

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

US-China rivalry

US-China rivalry

- Technological and military
- Geopolitical
- Ideological
- Trade and jobs

The semiconductor value chain

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

US – Chinese technological rivalry

- Khan and Flynn: *Maintaining China s Dependence on Democracies for Advanced Computer Chips*

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

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- **US strategy - in line with this approach**

Export controls

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

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- Affects US companies + pressure on foreign companies + pressure on allies to adopt equivalent measures (Netherlands, Japan)

Under Trump

- 2019 – export controls against **Huawei (**chips themselves) and **SMIC** (equipment)

Under Biden

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- **Ban on SME exports to China (mostly ASML products)**
- Ban on **US engineers working for Chinese semiconductor companies**
- **Ban on exporting specific advanced chips** to China – AI chips
- Deeper bans on specific companies

- This is the core of the technological component of the US-China rivalry = **US attempts to prevent China from producing cutting edge chips and overtaking the US in AI**

- **There also other US policies aimed at China**
- - usually less targeted = affect many sectors of the economy, not only microchips

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- 2014 – **controversial takeover of the German robotics firm Kuka**
- Backlash in the West – again seen as an intolerable intrusion into the free market by China

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- **Rare tool in rich countries** – de facto a capital control limiting foreign investment

US investment screenings

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- **2018**‘s Foreign Investment Risk Review Modernization Act (**FIRRMA**) – strengthened CFIUS and enhanced its powers

EU

- A tighter regime of export controls and investment screenings **is being created in the EU as well!**
- **– two new EU regulations in 2021 – invite member states to create national-level investment screenings**

Investment screening

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- Implementation – problematic
- **- what if China acts through a local proxy firm?**
- = they give money to a company seated in California which makes the purchase

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- Sanctions are generally difficult to enforce – busting them is profitable and the private sector is usually one step ahead of the government

The US-China trade war

The US-China trade war

- Trump – 2017 and 2018, kept under Biden
- Old-school protectionism > **trade war**

The US-China trade war

- **„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

The US-China trade war

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- Branko Milanovic - **paradox**ically – rich urban American are on the same side as the poor from the Global South – in favor of (US) free trade
- Poor people in the West are against free trade due to the China Shock

The US-China trade war

- **Political conflict** – winners vs. losers of globalization
- Branko Milanovic - paradoxically – rich urban American are on the same side as the poor from the Global South – in favor of (US) free trade
- Poor people in the West are against free trade due to the China Shock > Donald Trump

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- 2018-2019 – **4 waves of tariffs on Chinese goods**

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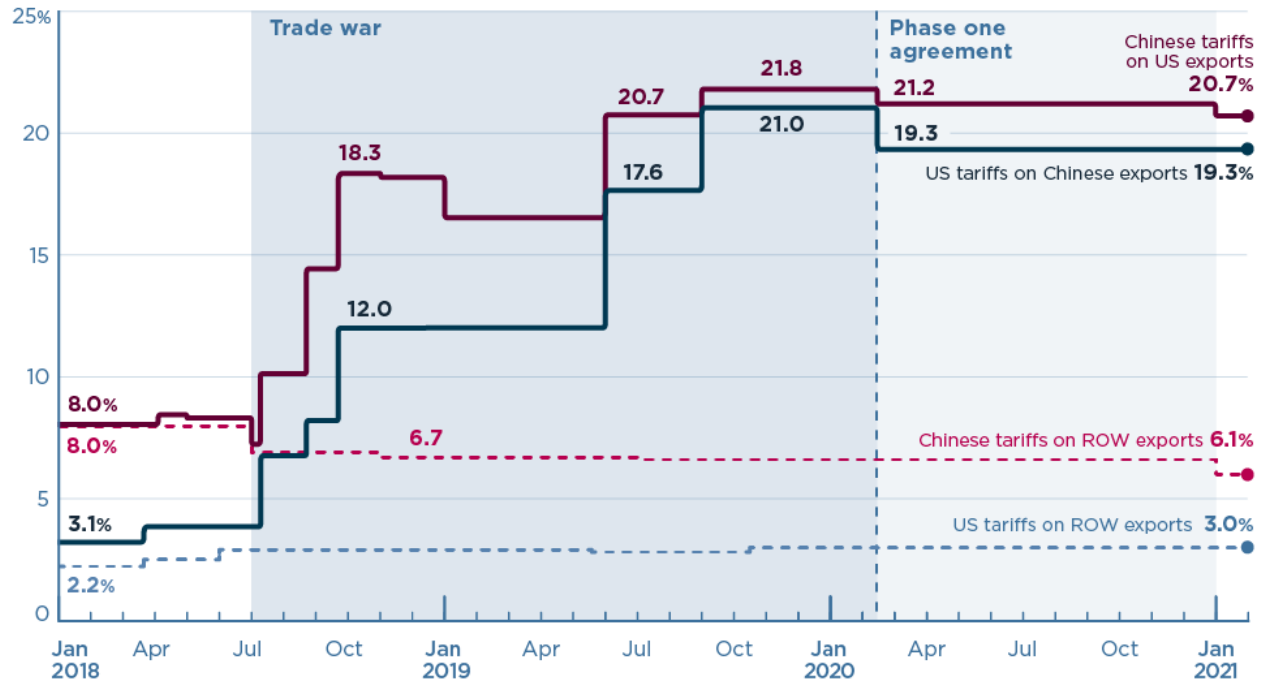
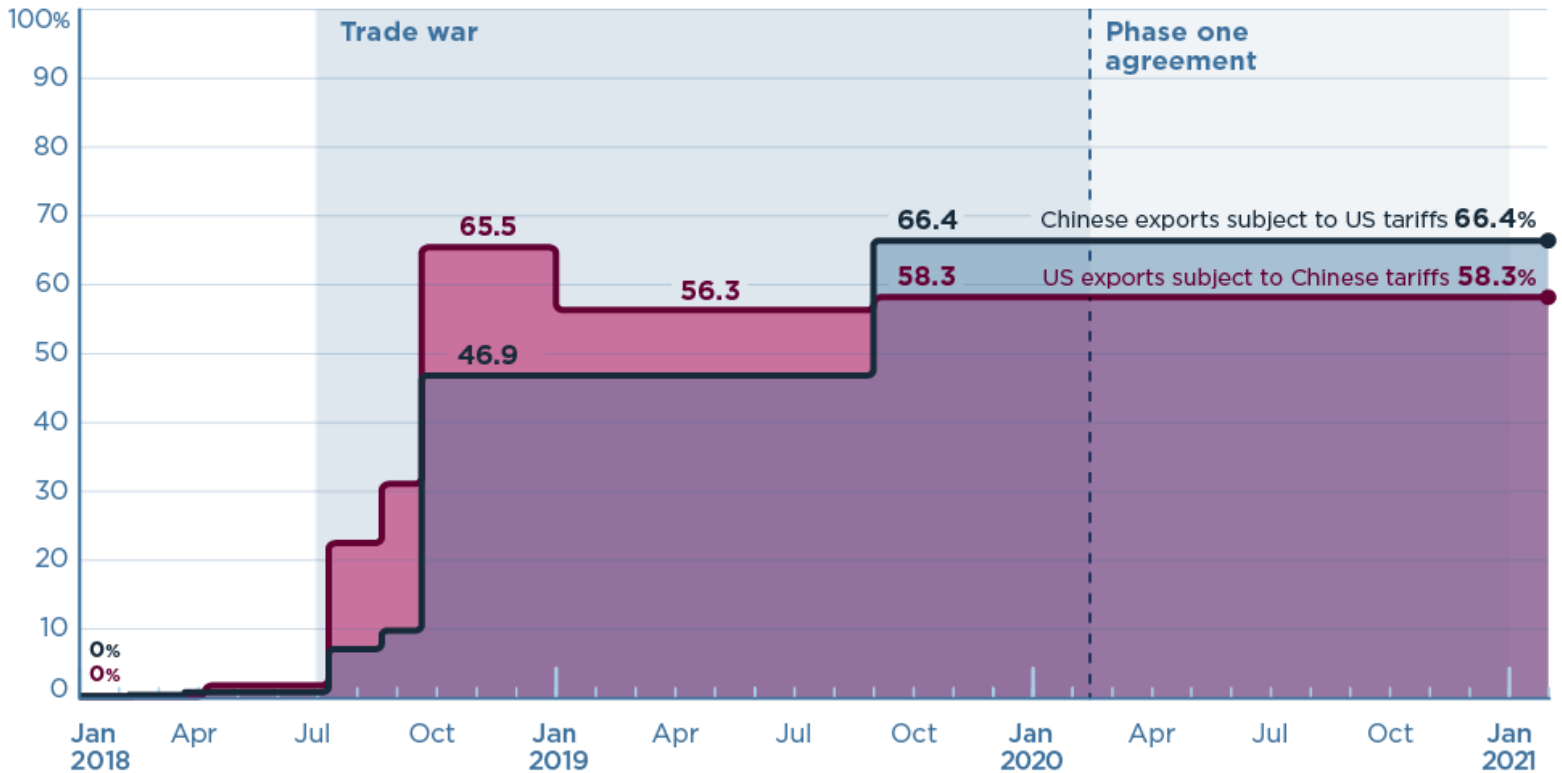
- Chinese retaliation

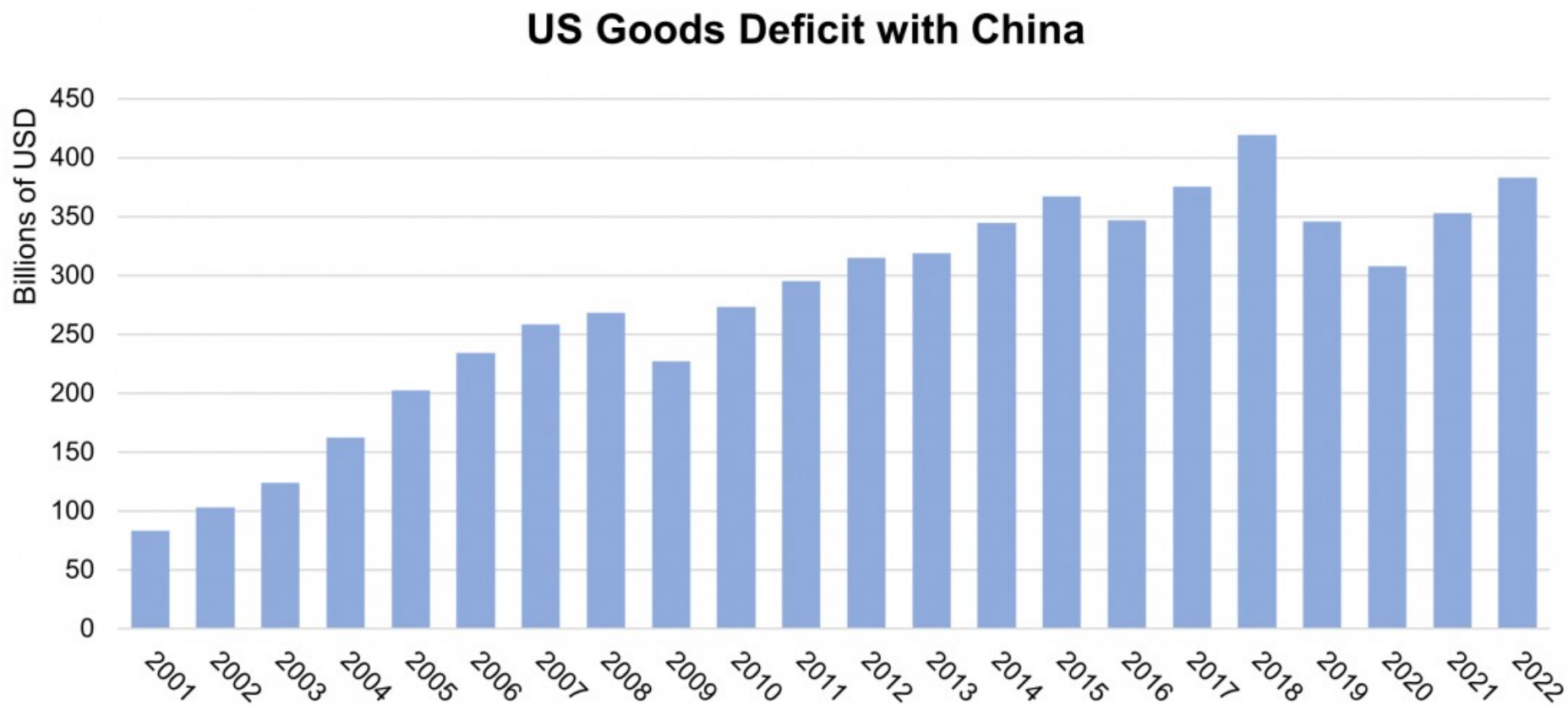
US-China trade war tariffs: An up-to-date chart

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



b. Percent of US–China trade subject to tariffs




US Goods Deficit with China
Billions of USD
450
400
350
300
250
200
150
100
50
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

The US-China trade war

- **Much worse for China** – far more dependent on exports, has more to loose

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The US-China trade war

- **Much worse for China** – far more dependent on exports, has more to loose
- **Also not great for US customers**
- Winners – **US workers in import-competing industries; third countries – EU!**

US industrial policy

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US industrial policy

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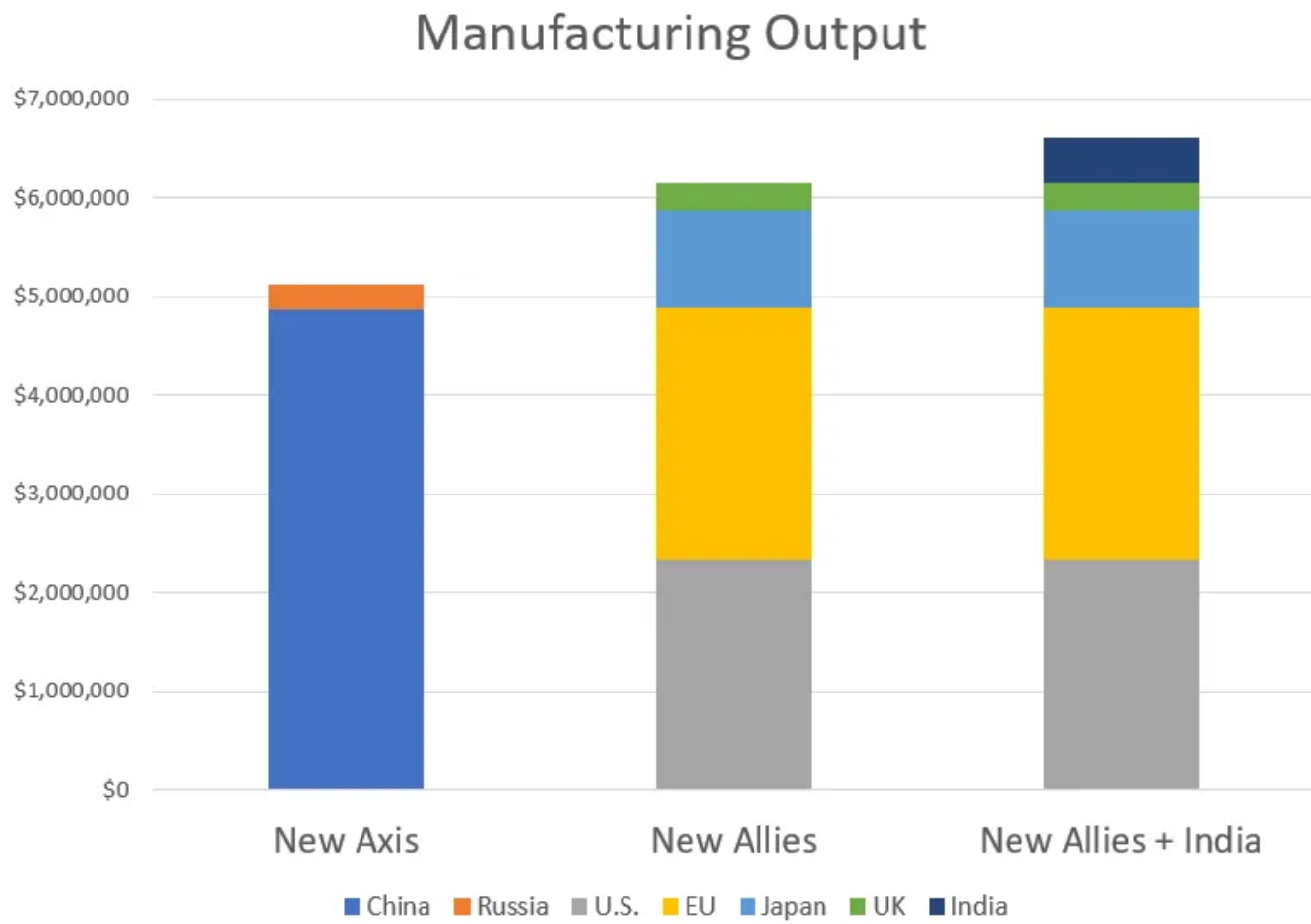
- **- competition against China‘s industrial policy**
- - preparation for potential war (?)


Manufacturing Output
$7,000,000
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
New Axis
New Allies
New Allies + India
China
Russia
U.S.
EU
Japan
UK
India

US industrial policy

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US industrial policy

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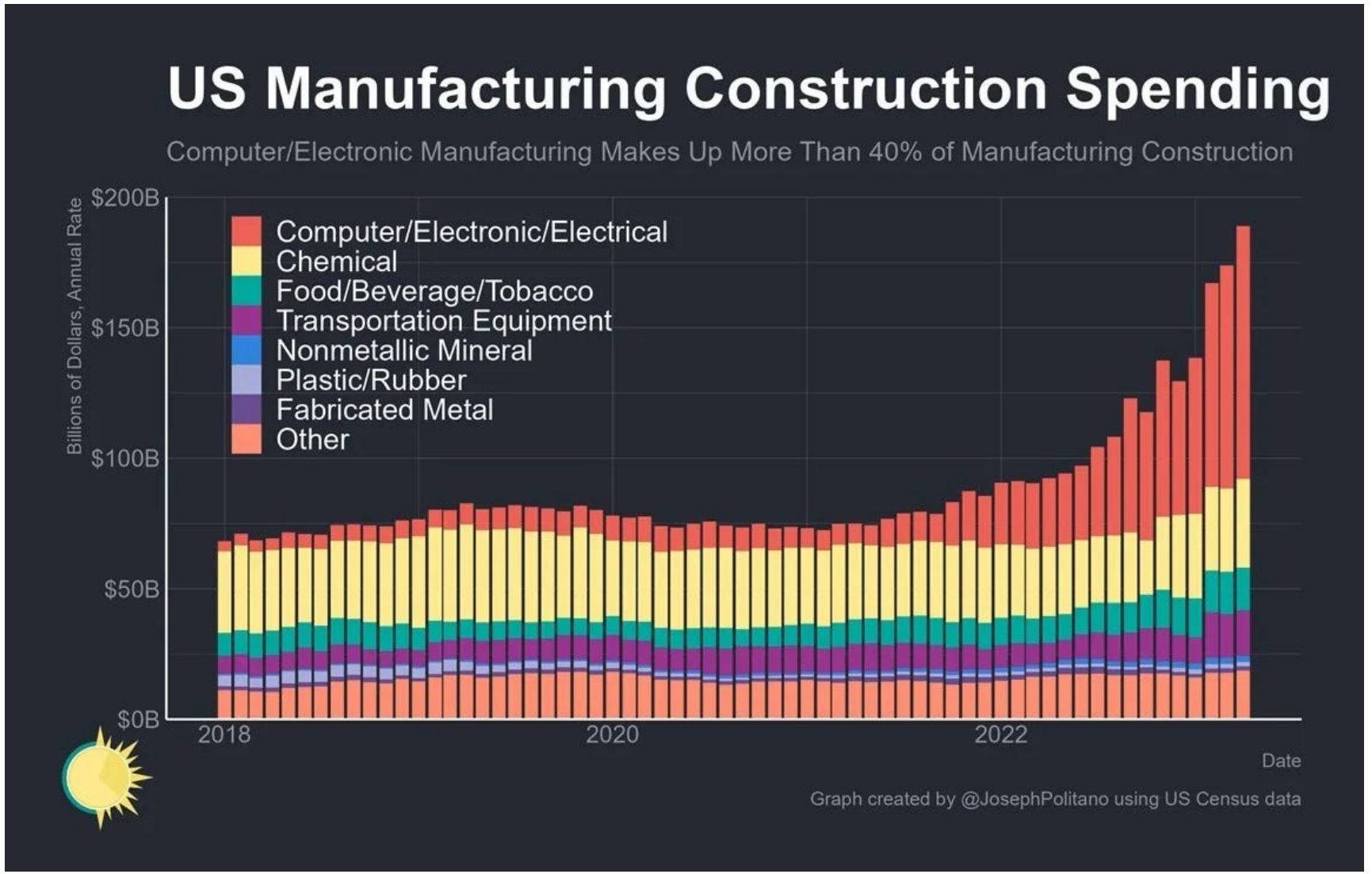
- **CHIPS for America Act – semiconductors**
- **- TSMC‘s new factory in Arizona**


US Manufacturing Construction Spending
Computer/Electronic Manufacturing Makes Up More Than 40% of Manufacturing Construction
Billions of Dollars, Annual Rate
$200B
$150B
$100B
$50B
$0B
Computer/Electronic/Electrical
Chemical
Food/Beverage/Tobacco
Transportation Equipment
Nonmetallic Mineral
Plastic/Rubber
Fabricated Metal
Other
2018
2020
2022
Date
Graph created by @JosephPolitano using US Census data

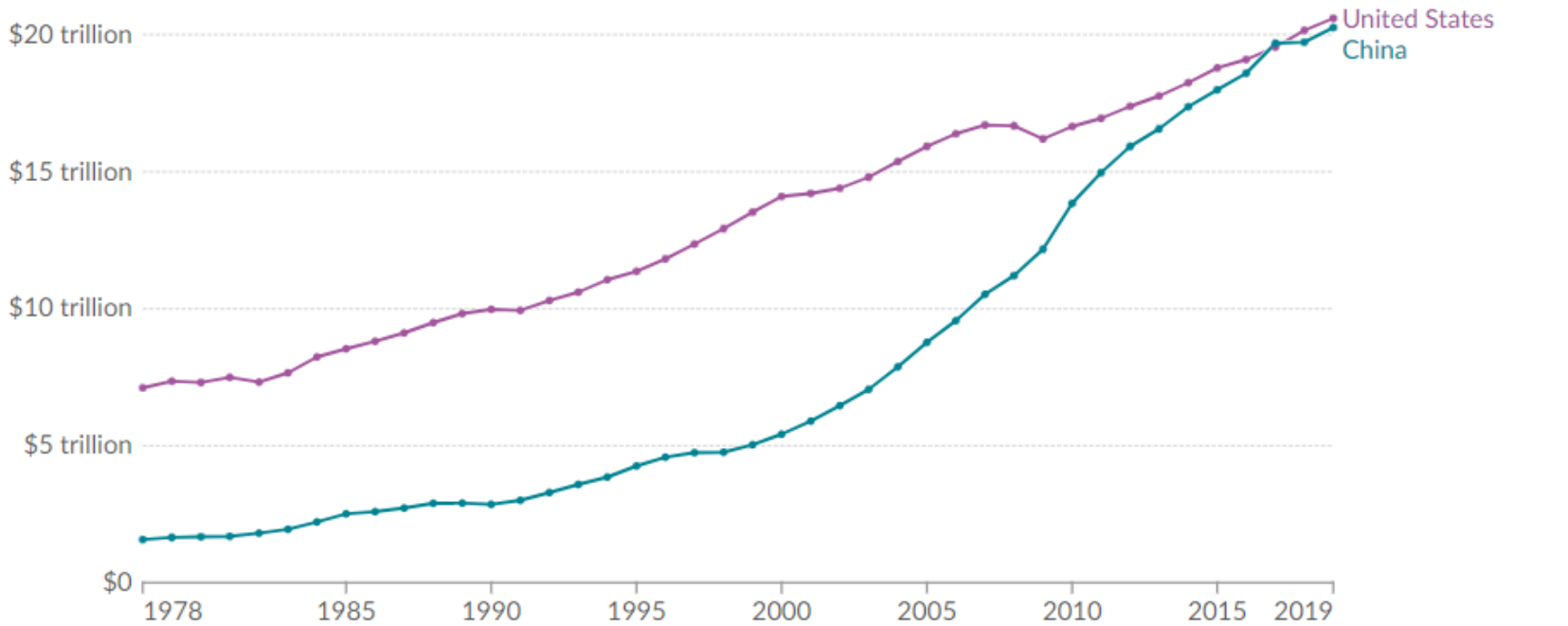
Gross domestic product (GDP), 1978 to 2019

This data is adjusted for inflation and differences in the cost of living between countries.

Our World in Data

Table | Map | Chart

Edit countries and regions | Settings



1950 — 2019

Data source: Feenstra et al. (2015), Penn World Table (2021) – Learn more about this data

Note: This data is expressed in international-$ at 2017 prices, using multiple benchmark years to adjust for differences in the cost of living between countries over time.

The Economist

Four principal economic US policies aimed at China

- Four principal economic US policies aimed at China:
- 1) Tariffs
- 2) Domestic industrial policy
- 3) Investment screenings
- 4) Export controls

Next time

- **China in the World Trade Organization**

Next time

- **China in the World Trade Organization**
- - insights into the international economic rules and whether or not the US and China violate them