



The Middle-Income Trap and Technology Policy in Southeast Asia

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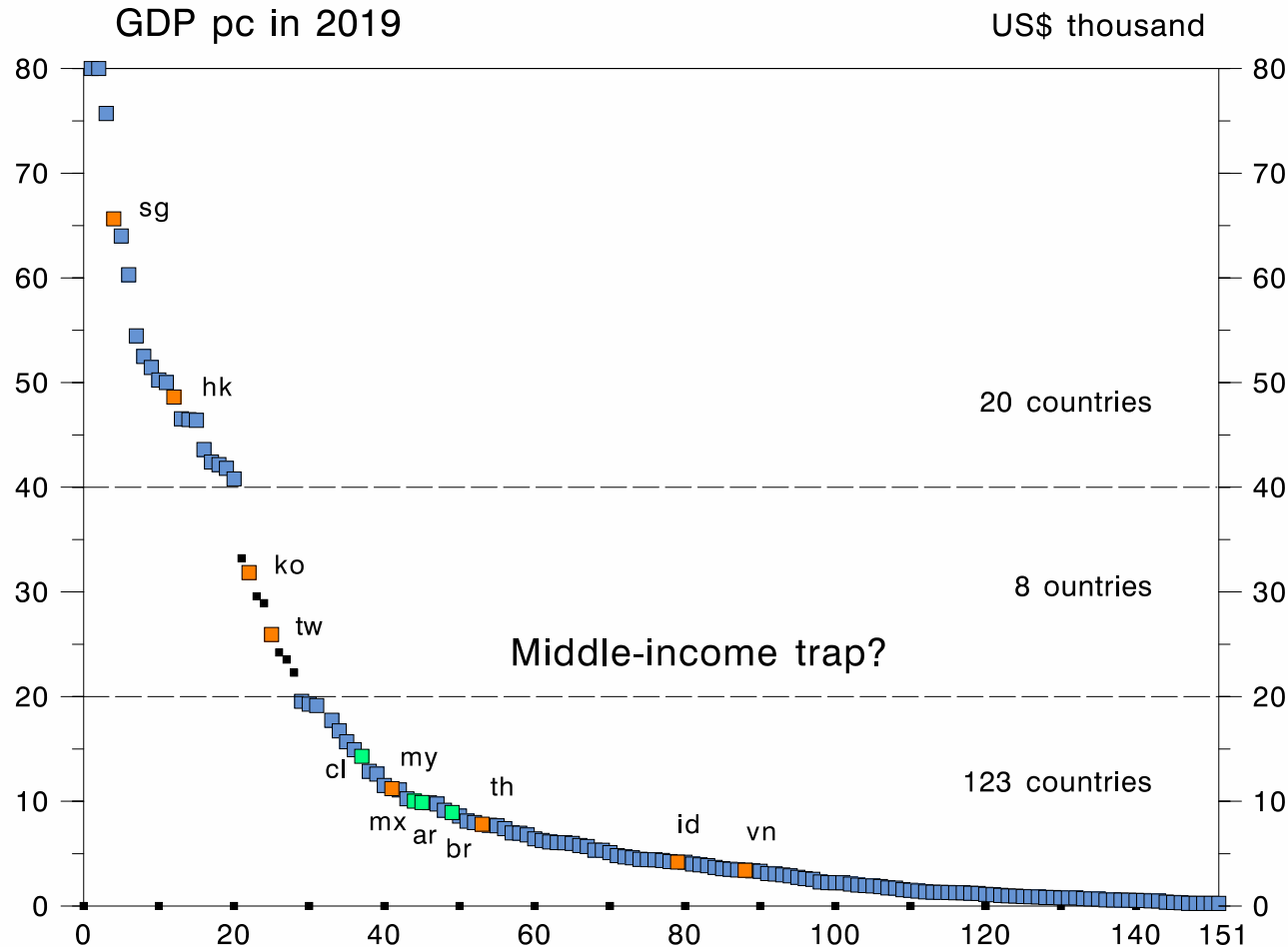
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Key takeaways



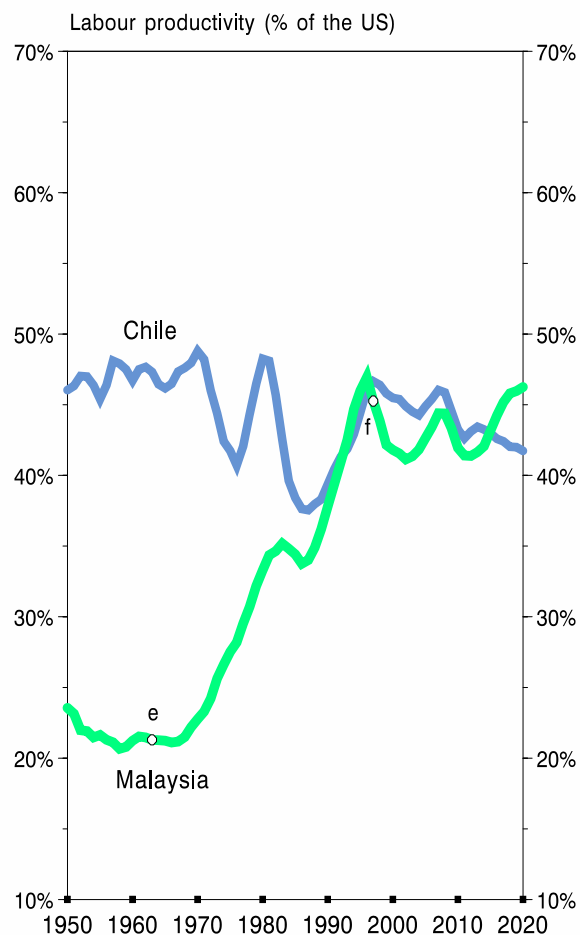
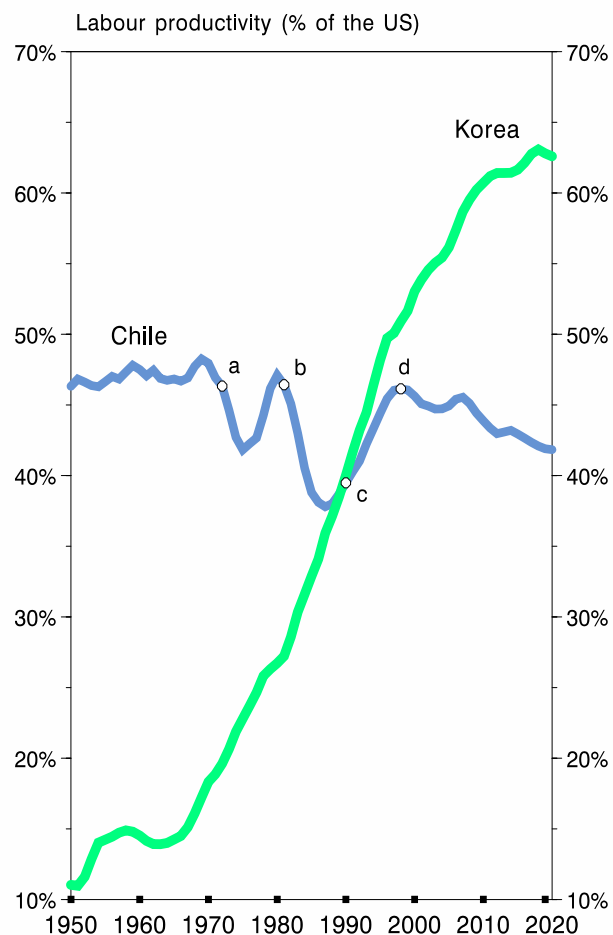
- Few countries have escaped the middle-income trap: productivity growth has tended to slow down or go into reverse at 50% of US labor productivity
- Sustaining productivity growth requires technological upgrading and investing in R&D, infrastructure and direct subsidization of capital-intensive activities that can realize economies of scale.
- Strong downstream relationships with manufacturers, and upstream relationships with fabs, drive the semiconductor industry.

The Middle-Income Trap



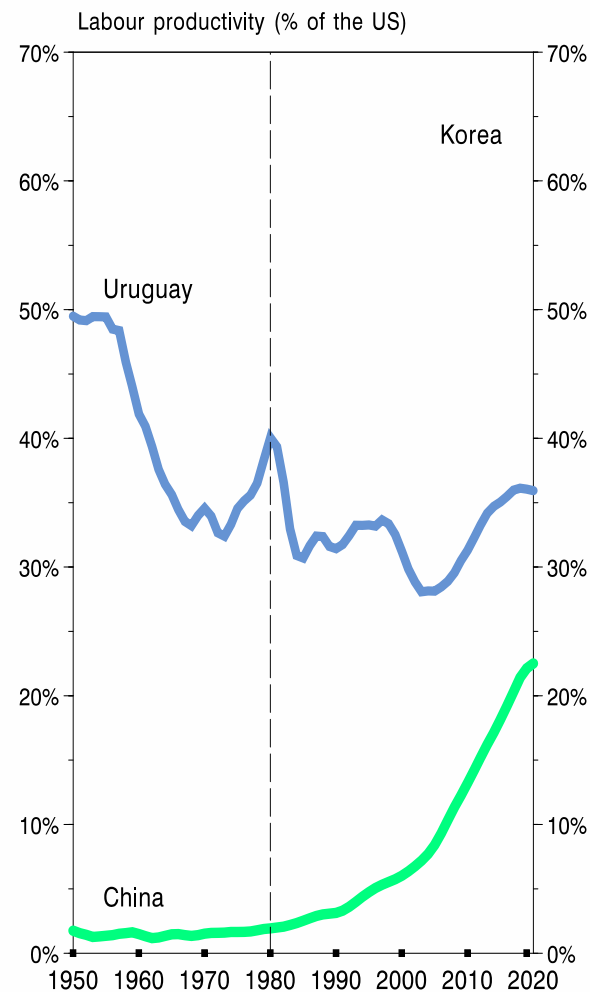
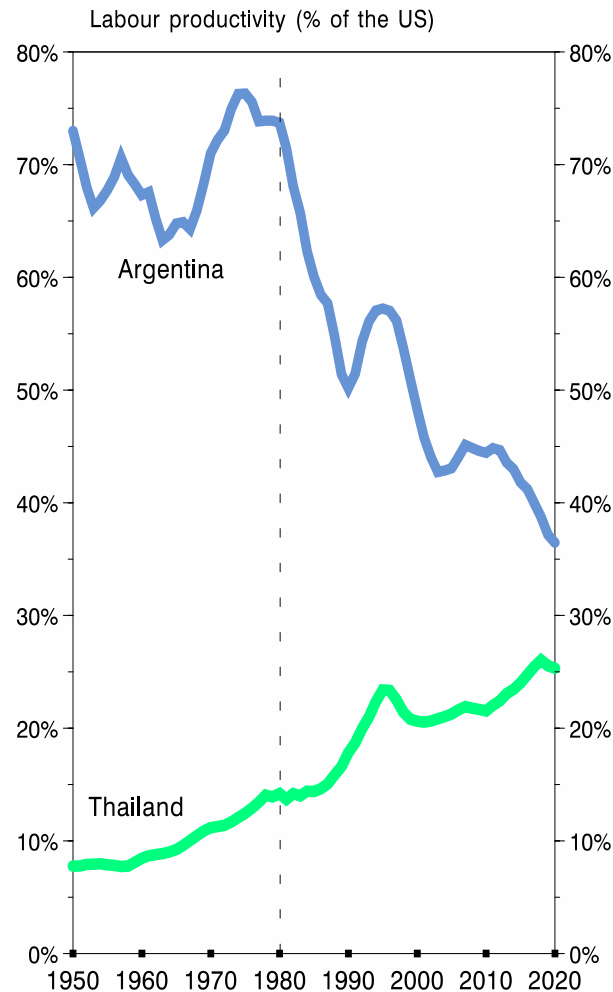
- Few countries have broken into the high-income group since WWII.
- Only 10 of 151 non-oil exporting countries have reached the \$20,000 mark → the 4 Asian NICs and 6 EU countries.
- Many countries have achieved high growth rates, but few have sustained them long enough to close the gap with the US (\$65,000 per capita in 2019).

Korea Catches up, Malaysia stalls



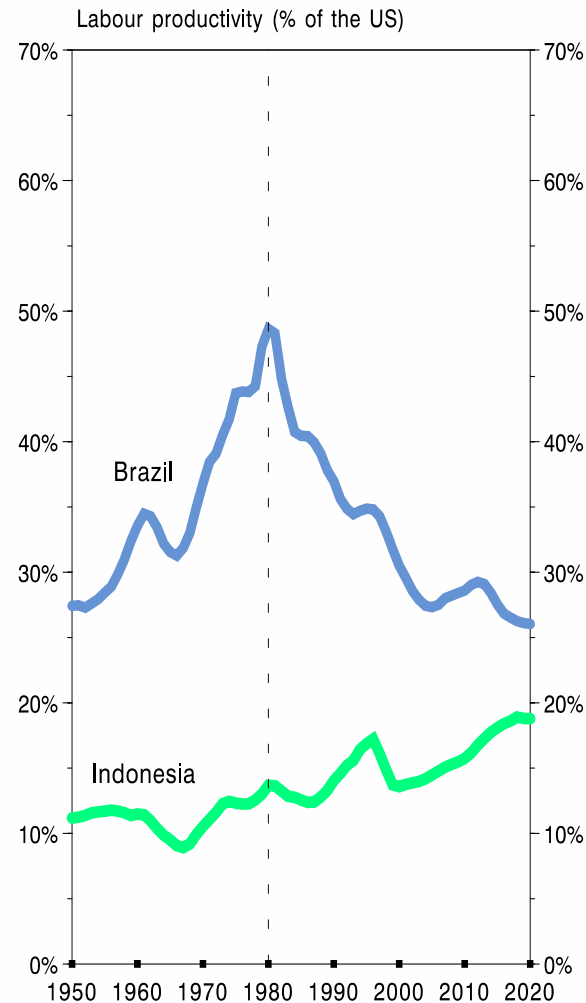
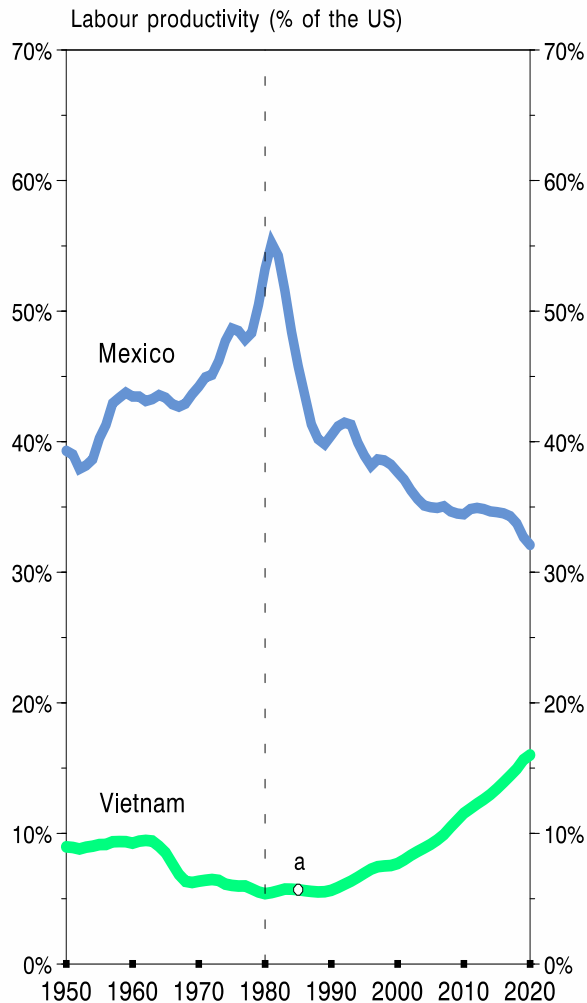
- Republic of Korea is catching up to the global productivity leader, achieving 63% of US labor productivity by 2020
- Malaysia performed well until the East Asian Financial Crisis in 1998, and then growth of productivity stagnated.
- Chile, widely regarded as a Latin American success story, has seen productivity growth fall relative to the US since the 1970s.

China rises, Thailand slows



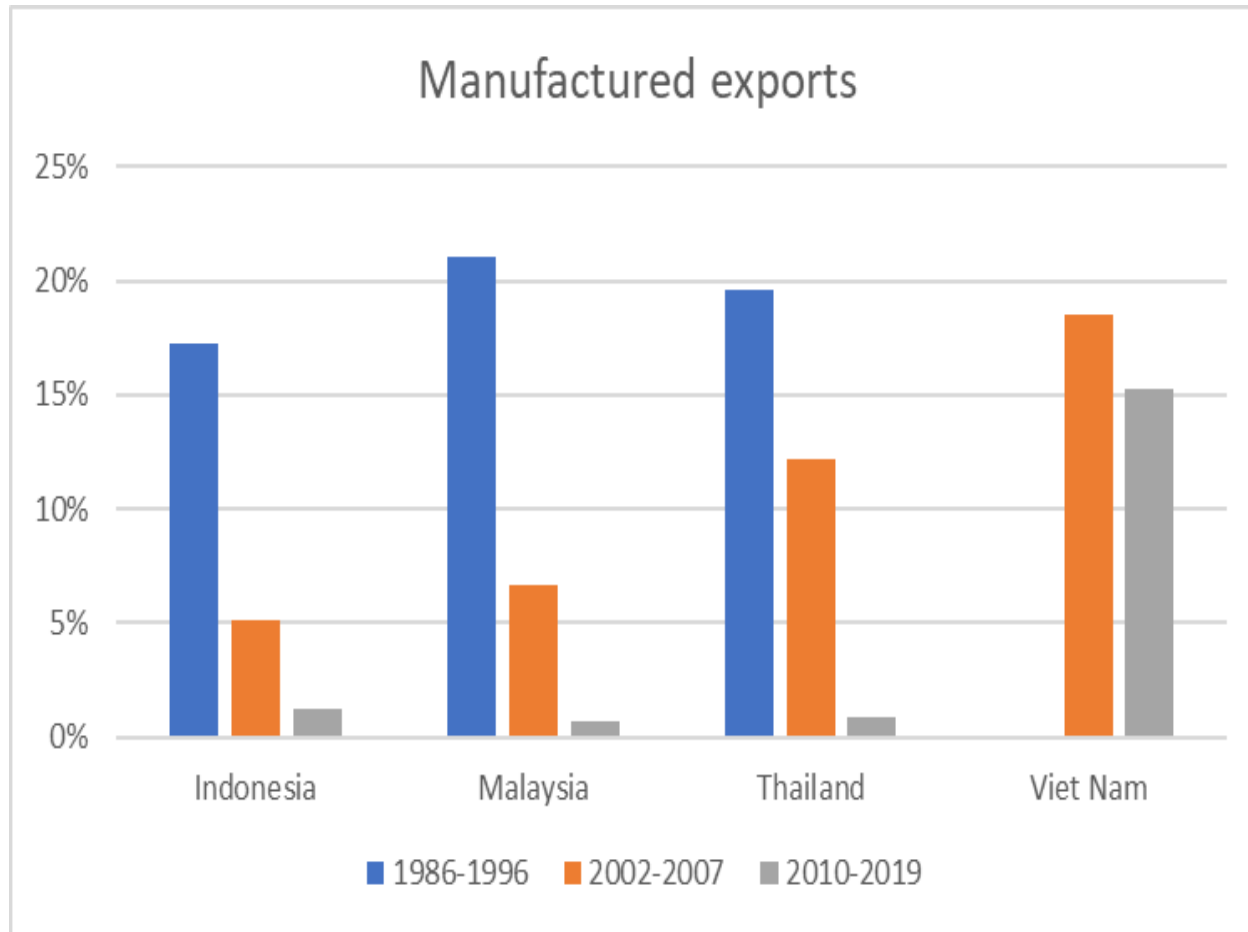
- From the Plaza Accords (1985) until 1998, Thailand made gains on US productivity.
- Recovery from the East Asia Financial Crisis was slow; progress after 2009 GFC uneven.
- China sustains progress but from a very low starting point, only achieving 22% of US productivity levels by 2020.
- Latin America falters especially since 1980 and the debt crisis.

Viet Nam and Indonesia sustain growth



- Viet Nam has sustained progress since 1990.
- Indonesia lost ground after the East Asian Financial Crisis but has since recovered, propelled by a resource-intensive strategy.
- Brazil and Mexico lost industrial capacity during the debt crisis and never recovered.

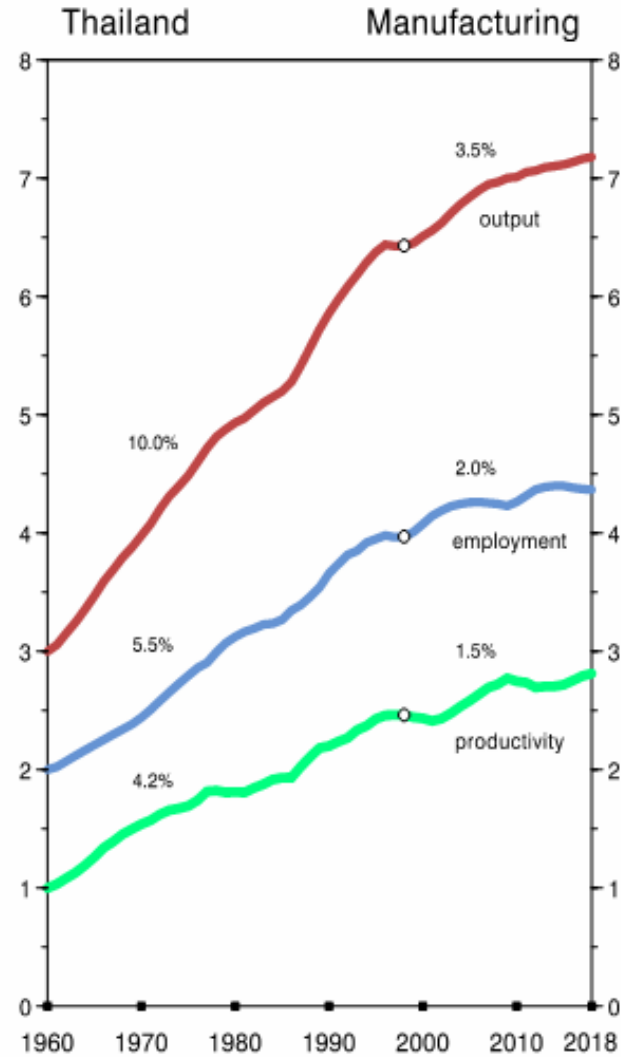
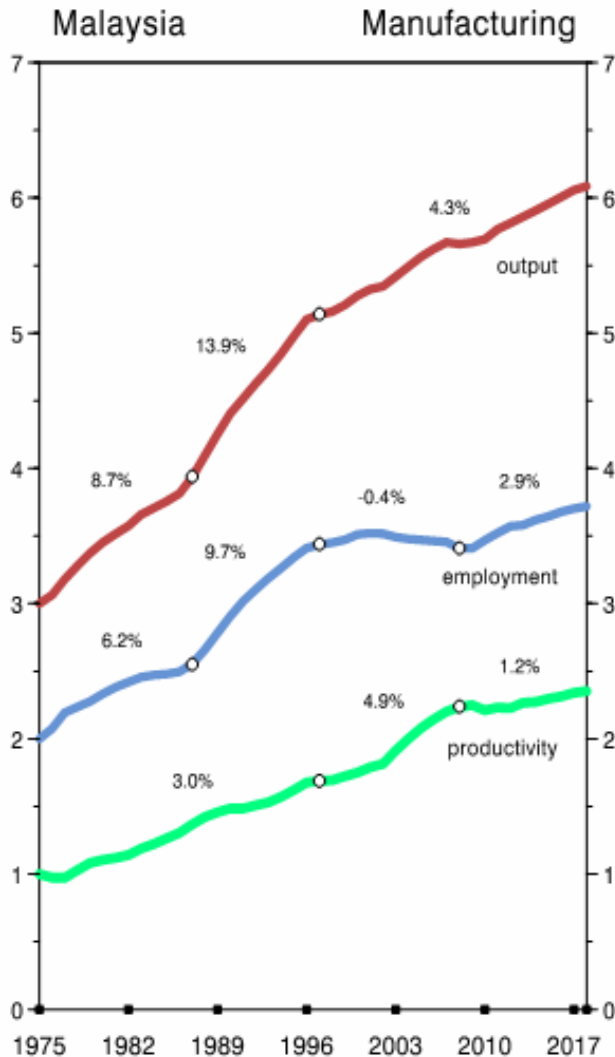
Growth of manufactured exports slows after East Asian Financial Crisis



- Productivity growth was driven by exports of manufactured goods
- These slowed after East Asian Financial Crisis and stagnated after Global Financial Crisis.
- Except in Viet Nam, which remained competitive in labor-intensive manufacturing

Source: World Development Indicators

Thai and Malaysian manufacturing output growth



- Employment in Malaysian manufacturing slows after EAFC
- Productivity growth slows after GFC
- Thai manufacturing employment and productivity growth slows after EAFC.
- Output slows in both countries after EAFC

Malaysia and Thailand: Exports gaining and losing global market share, 2010-2019



Malaysia

Commodity	% exports 2019
<u>Gaining Market Share</u>	
Crude oil	7.5
Natural gas	2.4
Measurement/control apparatus	1.4
Electrical equipment	1.3
<u>Losing Market Share</u>	
Transistors	13.1
Office equipment components	2.8
LNG	2.4
Computer equipment	2.2
Other telecoms equipment	1.5

Thailand

Commodity	% exports 2019
<u>Gaining Market Share</u>	
Passenger cars	4.6
Motor vehicle parts	4.2
Trucks	3.2
Computer equipment	3.1
<u>Losing Market Share</u>	
Transistors	2.4
Rice	2.2
Rubber	1.9
Electric circuit equipment	1.1
Office equipment components	1.0

Characteristics of semiconductor industry



- Research and development at the technological frontier (Samsung, TSMC and Intel)
- IC design: Fabless design firms of various sizes and technological capabilities but depends on relationships with manufacturers and fabs.
- Fabrication: Capital intensive, heavy infrastructure demands (energy, water, transport, communications, security) and large economies of scale.
- Assembly and test: Historically the most labor intensive, increasingly automated.

Tech upgrading in the semiconductor industry



- Japan, Korea and Taiwan began with licensing technology from the US but launched national R&D and investment programs
- By the late 1970s Japanese firms were competitive with the US; Korea and Taiwan by late 1980s.
- SMIC acquired Motorola plant and built new plants with government support; launched joint venture with Huawei in 2015 to produce advanced integrated circuits.
- Made in China 2025 program (2015):
 - Direct state funding for R&D; 40 new R&D centers with specific targets
 - State support for semiconductor, green tech, robotics
 - Acquisition and mergers with foreign companies with tech assets.

Semiconductor production by stage, 2020

	Frontier R&D		Fabrication		Assembly and testing	
	National	FDI	National	FDI	National	FDI
Japan	7	0	27	6	18	7
Taiwan	5	0	15	2	29	7
Korea	4	0	5	0	8	4
China	2	0	16	8	88	19
Singapore	0	0	2	6	2	20
Malaysia	0	0	2	5	5	26
Thailand	0	0	0	1	3	16
Viet Nam	0	0	0	0	0	7

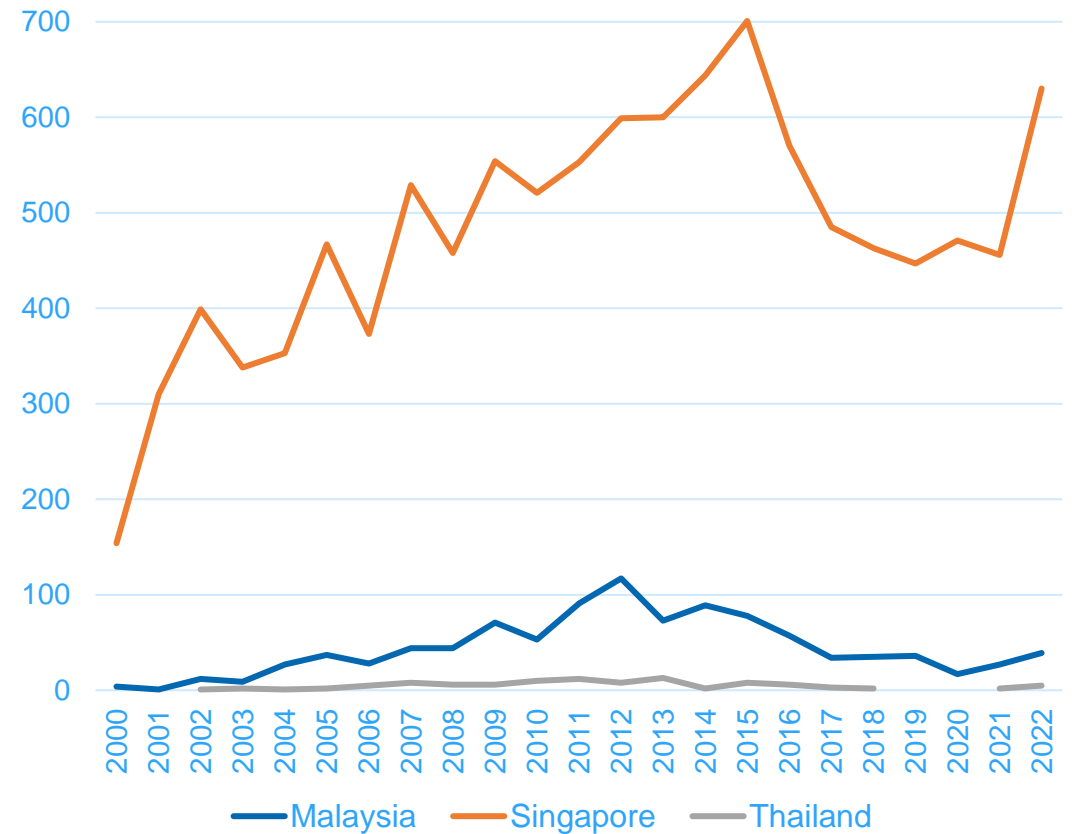
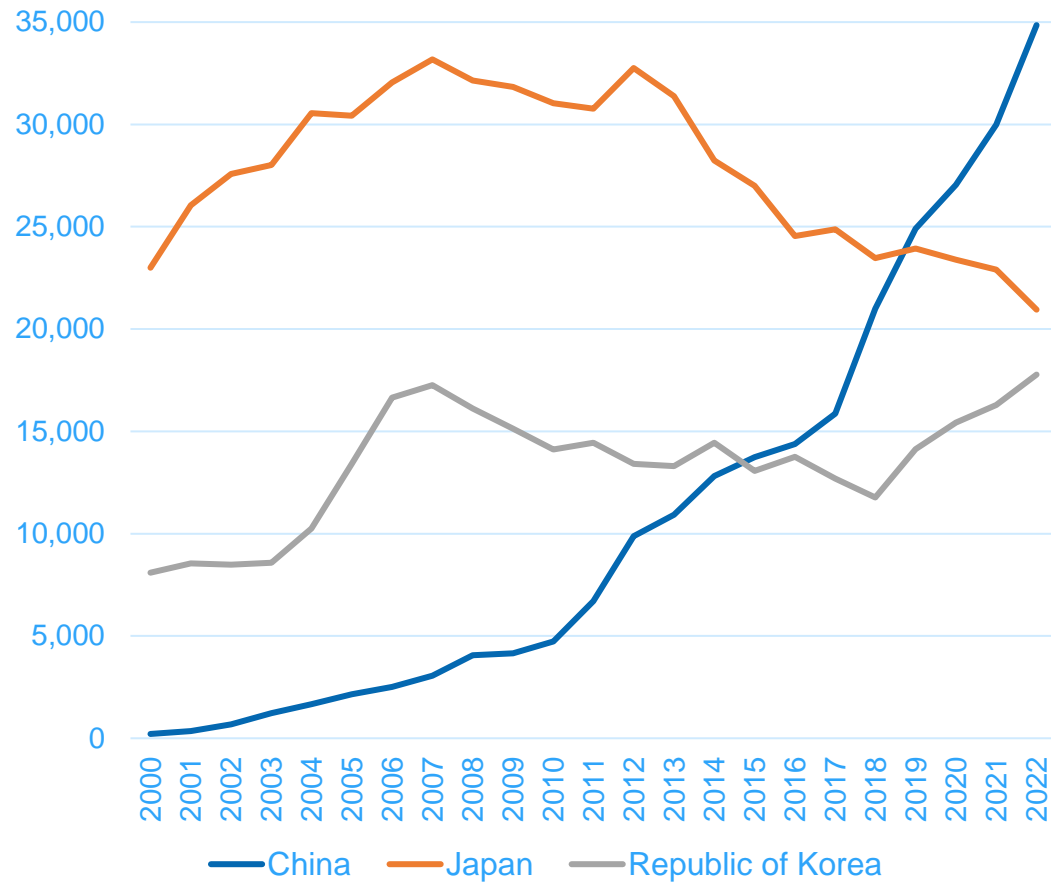
Source: Rasiah and Wong 2021

Economies of scale and agglomeration



- Basic research and fabrication are capital intensive and only feasible on a large scale
 - Development has depended on government for large capital grants
 - Research activities require government support for universities and institutes and merit-based hiring, promotion and compensation
 - Japan, Korea, Taiwan helped national firms acquire basic technology and advance toward tech frontier
- IC design entails close relationships with customers (manufacturers) and suppliers (fabs)
 - China is largest market for semiconductors (>50%); but most still imported.
 - Agglomeration economies (clustering) in manufacturing important in Japan, Korea and China
 - Flow of tacit information, trust

Semiconductor patents by country, 2000-2022



Source: World Intellectual Property Organization

- Malaysia Institute of Microelectronic Systems (MIMOS) founded in 1985 by technical universities; later relaunched as SOE
 - First national IC design 1994
 - Established first national wafer fabrication plant 2002
- Despite state support, industry has remained concentrated in assembly and testing with heavy reliance on FDI
- Weak relationships with manufacturers; skilled labor migrates to Singapore for higher wages.
- Absence of frontier research at research universities.
- Weaker diaspora of international engineers and scientists than China, Korea and Taiwan

Thailand



- Thailand mostly limited to assembly and testing by foreign companies
- One Japanese wafer fabrication facility catering to large domestic automobile assembly industry.
- Focused on providing basic infrastructure, security and trade liberalization rather than domestic capacity.
- Lacks research capacity in universities.

Policy implications



- Most countries experience a productivity slowdown when they face competition both in labor-intensive and knowledge-intensive manufacturing (squeezed by poorer and richer countries).
- Successful countries have started with FDI and licensing technology but have invested heavily in domestic universities, research institutes and firms.
- Relationships with downstream manufacturing firms is important: Viet Nam's potential comparative advantage .
- Viet Nam's scientific diaspora also a comparative advantage.

