Pivot to innovation? GVCs since the global trade collapse and the case of mobile handsets in China

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Pivot to innovation?
GVCs since the global trade collapse and the case of mobile handsets in China

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What are GVCs?

Modes of International Engagement Have Changed

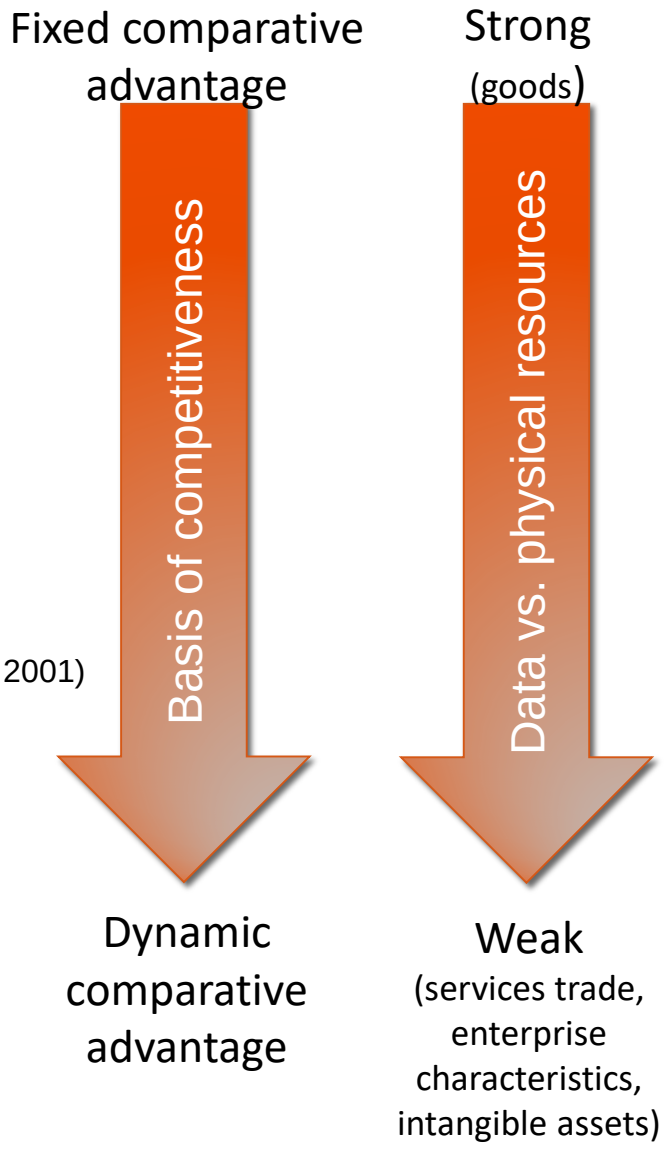
- Trade (from antiquity, from Silk Road to Wool for Wine)
  - Imports
  - Exports

  Tariffs and protection of infant industry to drive development

- FDI (from early 20th Century – e.g. Ford Model T)
  - Inward
  - Outward

  Local content requirements to drive development

- Global Value Chains (from late 1980s, especially after 2001)
  - Vertical specialization in trade and FDI (intermediate and final goods and services)
  - Sequentiality (from buyer to suppliers)
  - Rising importance of trade in services (software and other ICT-enabled services, e.g. BPO)
  - Knowledge and innovation networks (global fragmentation of R&D)



GVCs are

Complex production systems made of **multiple firms** located in different countries linked together by **multi-layered sourcing** networks and **fast-evolving, technology-enabled, business models**.

A firm's engagement in global value chains **combines** engagement in a context of "**arm's length transactions**" with features typical of **intragroup investment and trade**"

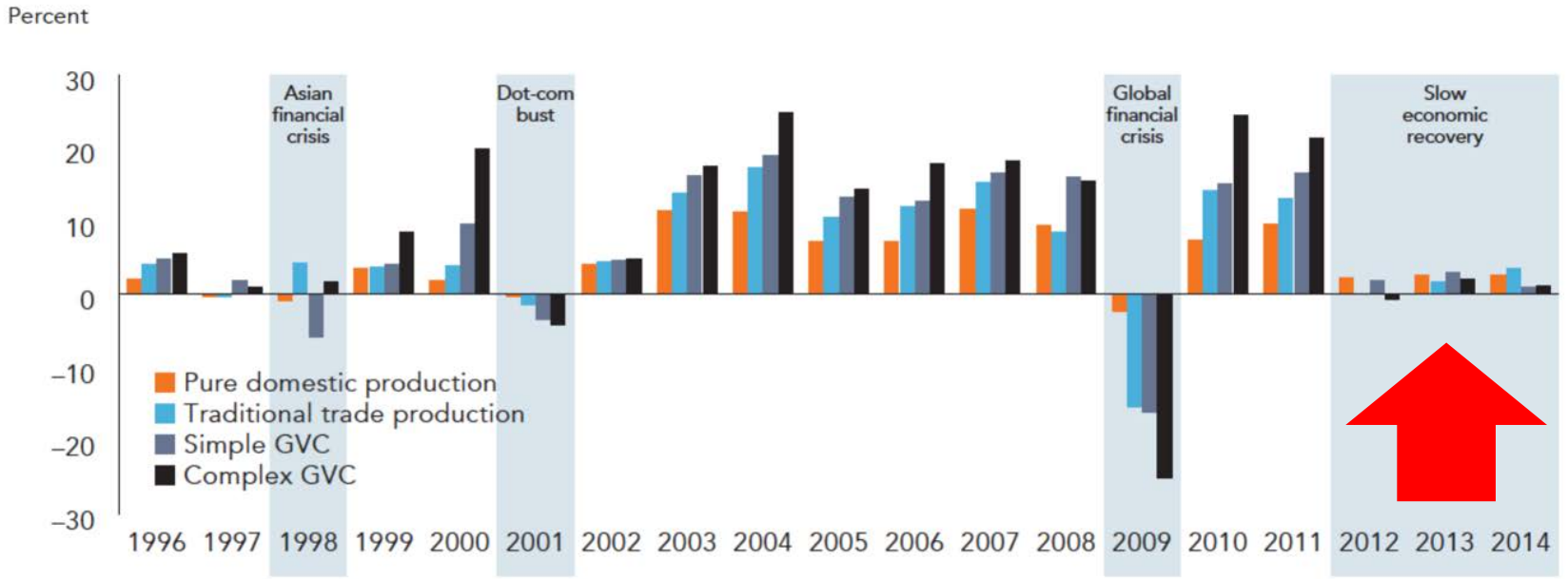
Gereffi, Humphrey, and Sturgeon, 2005

Wither GVCs?

Wither GVCs?

Why is this a question?

Worldwide nominal growth rates of different value-added creation activities, 1996–2014



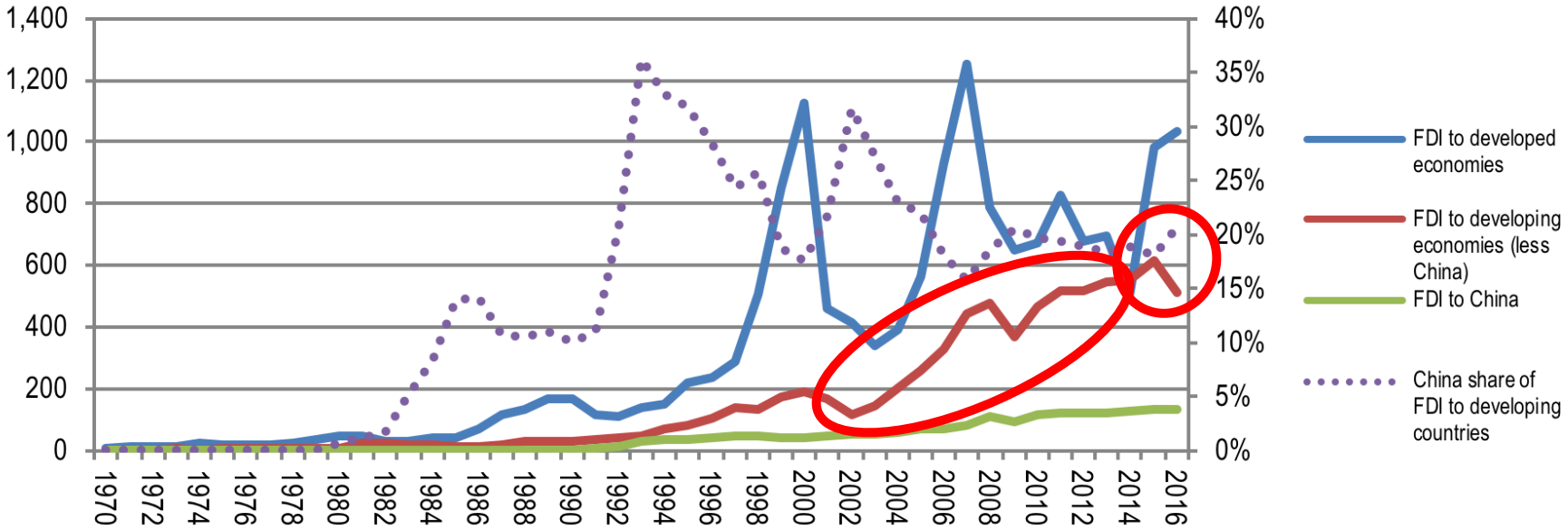
Source: Dollar, 2017, p. 3, drawn from University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

- Trade slowdown after 2011 characterized by weak recovery of “GVC trade”
- Work by Constantinescu, Mattoo, and Ruta (2015/IMF) showing rising local content in China

Wither GVCs?

The recent trade rebound was lead by FDI, which drive GVC integration

Annual foreign direct investment inflows, China's position, 1970-2016, US$B



- Investment is found to be intensive in imports (e.g. Bussière et al, 2013), i.e., FDI drives GVC integration
- FDI to developing economies never collapsed
- FDI may be growing in China at the expense of other developing countries

Wither GVCs?

The trade slowdown in three typical "GVC Industries" was muted

World GDP, merchandise exports, and exports by "GVC industry" and value chain stage, 1988-2014 (US$ millions)

	1988	2011	2014	CAGR 1988-2011	CAGR 2011-2014	CAGR 1988-2014
World GDP	18,041,563,499	68,008,771,270	72,680,058,089	5.9%	2.2%	5.5%
World Merchandise Exports	627,466,530	16,472,352,676	16,910,190,294	15.3%	0.9%	13.5%
Total Exports in 3 "GVC Industries"	151,008,788	4,484,509,009	4,863,644,630	15.9%	2.7%	14.3%
Electronic Hardware	69,365,398	2,486,845,657	2,690,468,230	16.8%	2.7%	15.1%
Motor Vehicles	36,702,999	1,309,322,669	1,449,121,322	16.8%	3.4%	15.2%
Textile, Apparel, and Footwear	44,940,391	688,340,683	724,055,078	12.6%	1.7%	11.3%
World Merchandise Exports Less 3 Industries	476,457,741	11,987,843,667	12,046,545,664	15.1%	0.2%	13.2%

Sources:

- 1988-2014 world GDP, World Bank World Development Indicators http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators
- World merchandise exports: World Bank World integrated Trade Solution, https://wits.worldbank.org/WITS;
- Exports in "GVC Industries: World Bank MC-GVC database, includes balanced panel of 175 countries representing 93% of world trade for final and intermediates in three "GVC industries": electronics, automotive, and apparel and footwear

- The trade collapse was more pronounced than GDP
- Trade in the "GVC industries" slowed during the trade collapse, but less than overall trade
- Trade in motor vehicles and electronics were especially robust

Wither GVCs?

China's position is consolidating, led by electronic hardware

China electronic hardware exports by value chain stage, 1988-2015 (US$ millions)

Exports by Value Chain Stage	1988	2011	2015	CAGR 1988-2011	CAGR 2011-2015	CAGR 1988-2015
Electronic Hardware Final Goods	41,151,832	1,291,191,048	1,263,240,042	16.20%	0.50%	13.50%
China	294,281	453,316,448	520,192,992	37.60%	-3.40%	31.90%
China share	1%	35%	41%			
Electronic Hardware Intermediates	28,213,566	1,195,654,609	1,162,084,718	17.70%	0.70%	14.80%
China	16,625	315,589,536	331,651,712	53.50%	-1.20%	44.30%
China share	0%	26%	29%			
Imports by Value Chain Stage						
Electronic Hardware Final Goods	86,866,215	1,207,667,328	1,184,154,591	12.10%	0.50%	10.20%
China	1,621,470	89,607,104	64,121,784	19.10%	8.70%	14.60%
China share	2%	7%	5%			
Electronic Hardware Intermediates	43,467,296	1,051,138,505	1,015,291,169	14.90%	0.90%	12.40%
China	680,097	229,371,808	245,368,576	28.80%	-1.70%	24.40%
China share	2%	22%	24%			

Source: World Bank MC-GVC database, includes balanced panel of 175 countries representing 93% of world trade for final and intermediates in three "GVC industries": electronics, automotive, and apparel and footwear

- China's share of world final electronics goods exports rose to 41% by 2015…
- …while intermediate goods imports rose to 24%...
- …and intermediate goods exports rose to 29%

Wither GVCs?

Takeaways

- Slowdown was muted in GVC exporters and trade is rebounding
- The FDI slowdown was more pronounced between developed countries, and most likely related to the lingering effects of the financial crisis, from which Europe was slow to recover
- FDI into China (and developing countries in general) has continued to rise, most recently at the expense of other developing countries.
- While “GVC- trade” trade was stagnant for several years after 2011, it remained well above pre-crisis levels (i.e. very high).
- “GVC trade”, that is, trade in the three manufacturing sectors (electronic hardware, autos, and apparel) that are almost exclusively produced via GVCs, continued to grow while the rest of merchandise trade did not
- In these industries exports from — and intermediate goods imports to — China continue to grow.
- So even with rising costs, China appears to be strengthening its position as the "world’s workshop.”
- Local content and consumption is rising in China, which is to be expected, and this fact may explain why the measure (“parts and components”) used by Constantinescu, Mattoo, and Ruta (2015/IMF) is not industry specific enough, too narrow, and covering a period too short (until 2008) to be a good indicator of GVC-linked local sourcing in the recent years.

Wither GVCs?

Has nothing changed?

- If China is adding more value to exports, we need to ask:
  - How much new value is being added?
  - In what inputs and services is value being added?
  - Is new value being added by foreign invested enterprises (FIEs) or fully domestic firms?
- Value added: to what end?
  - Employment?
  - Links to domestic innovation capabilities? (Techno-nationalism)
  - Shift of export profile from FIEs to domestic firms?
- Industrial policies
  - What tools are being used?
  - What are their costs?
  - Are they effective?
  - Are there unintended consequences?
  - Are key policy goals being met by other means?

A pivot to innovation?

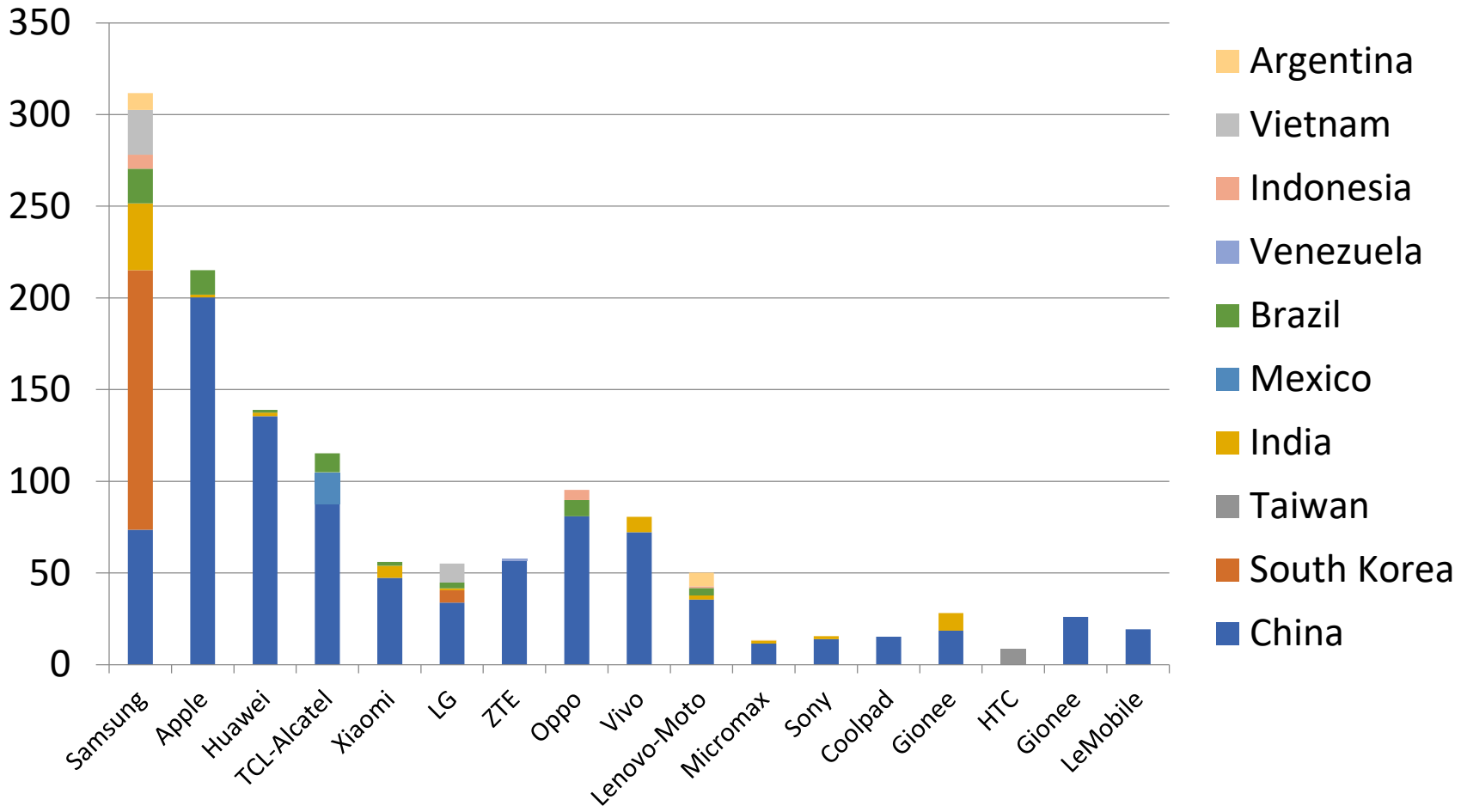
Shifting value added in China’s mobile phone handset industry

How can we best understand the evolving role of China in the global handset industry?

- An overview of China's role in the global industry
- Understanding China's role
  - Micro-level approach
  - Macro-level approach
  - Meso-level approach
- Implications for policy

China is the largest handset producer…

Mobile phone handset production by brand and country, 2016, millions of units



Source: IHS Markit

…and the largest handset exporter…

Top 20 mobile handset exporters in 2016

value (US$M), units (M), and unit value

	Value (US$M)	Units (M)	Unit value	Share of top 20 (value)	Share of top 20 (units)
China	$116,091	1,295.5	$81	63.50%	78.90%
China, Hong Kong	$23,731	423.2	$165	11.40%	7.00%
Viet Nam*	$25,088	151.9	$162	4.50%	2.80%
USA	$9,897	61.0	$179	3.70%	2.10%
Rep. of Korea	$8,157	45.6	$179	2.90%	1.60%
Germany	$6,286	35.1	$182	2.40%	1.30%
Singapore	$5,222	28.7	$203	2.00%	1.00%
Austria	$4,425	21.8	$179	1.60%	0.90%
Slovakia	$3,523	19.7	$179	1.60%	0.90%
UAE	$3,480	19.5	$301	1.20%	0.40%
Czechia	$2,532	8.4	$179	0.90%	0.50%
Other Asia, nes	$1,877	10.5	$297	0.80%	0.30%
Sweden	$1,820	6.1	$150	0.80%	0.50%
Netherlands	$1,748	11.6	$241	0.80%	0.30%
United Kingdom	$1,729	7.2	$188	0.40%	0.20%
France	$989	5.3	$184	0.40%	0.20%
Italy	$973	5.3	$86	0.30%	0.40%
Mexico	$764	8.9	$340	0.30%	0.10%
Hungary	$639	1.9	$88	0.30%	0.30%
Malaysia	$606	6.9	$152	0.30%	0.20%
Total	$219,578	2,174	$101	100%	100%

Source: UN Comtrade, HS 851712 (Telephones for cellular networks or for other wireless networks)

- China plus Hong Kong account for 75% of world handset export value and 86% unit shipments
- Vietnam is a very distant second, where most phones are produced for export in several huge Samsung factories

...and unit prices of exports are rising…

China and Vietnam mobile handset exports and unit value, 2008-2016

Year	China			Vietnam		
	Export value (US$M)	% change	Unit value	Export value (US$M)	% change	Unit value
2007	$36,084	-	$70	NA	NA	NA
2008	$38,912	8%	$70	$8	-	139
2009	$39,794	2%	$66	$263	3031%	137
2010	$47,062	18%	$61	$1,587	504%	142
2011	$63,194	34%	$71	$5,698	259%	152
2012	$81,454	29%	$79	$10,093	77%	NA
2013	$95,626	17%	$79	$19,326	91%	174
2014	$115,919	21%	$87	$21,333	10%	193
2015	$124,266	7%	$91	$25,088	18%	165
2016	$116,091	-7%	$90	NA	NA	NA

Source: UN Comtrade, HS 851712 (Telephones for cellular networks or for other wireless networks)

- China's export growth has slowed in recent years
- Vietnam exports higher value phones, mainly current model Samsung Galaxy S-series

…the importance of the domestic market is increasing…

China's mobile phone handset domestic shipments, exports, and world shipments, 2011-2016, millions of units

	China shipments*		China Exports**		World shipments*		China Share of world mkt*
		yr/yr GR		yr/yr GR		yr/yr GR	
2011	90.6	-	893.4	-	494.5		18%
2012	204.2	125%	1,034.2	16%	725.3	47%	28%
2013	351.3	72%	1,206.3	17%	1,018.7	40%	34%
2014	392.8	12%	1,334.5	11%	1,301.7	28%	30%
2015	385.3	10%	1,365.7	2%	1,437.2	10%	27%
2016	448.5	16%	1,295.5	-5%	1,473.4	3%	30%

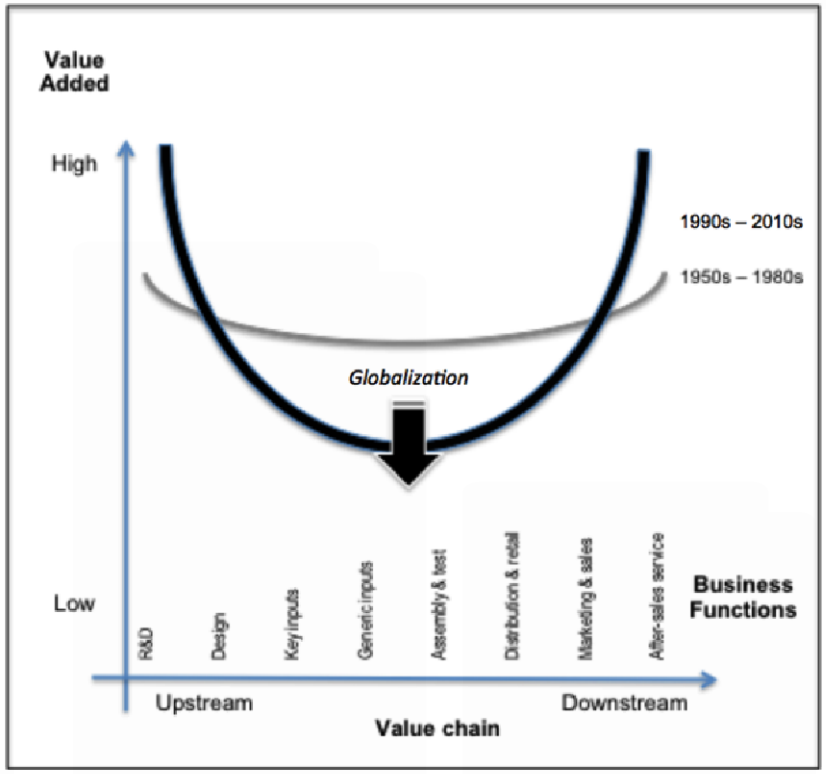
* smart phones only; **all mobile handsets

Sources: China shipments: IDC cited in Routley (2017); Exports: UN Comtrade, HS 851712 (Telephones for cellular networks or for other wireless networks); World shipments: Gartner

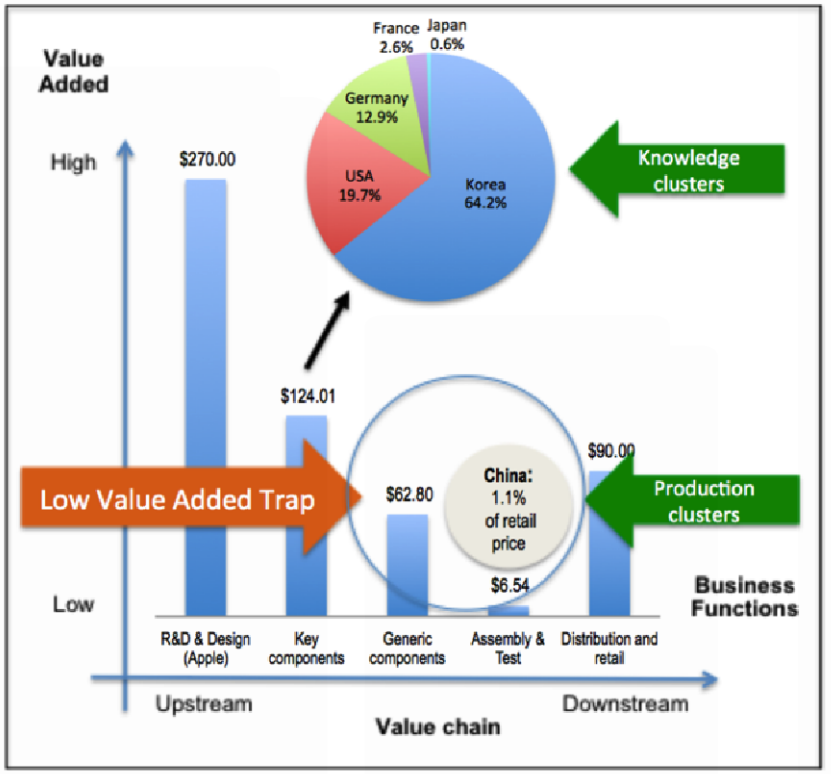
- Export growth has slowed
- China's handset market accounts for about 30% of world consumption, from 18% in 2011
- Production growth has slowed, but mainly because of a slowdown in the world market
- China's market growth has slowed, but is still strong
- Overall, the result is rising importance of the domestic market for China

GVCs and the "smiling" curve of value added

$600 iPhone 4 example (OECD, 2011)



Cost differentials lower the share of value added for routine business functions, which are shifted to developing countries.



Functions become geographically segmented between knowledge clusters, for higher value-added functions, and production clusters, which pool lower value-added functions, creating low value-added traps (China, the exporter of record, contributes only 1.1% of a $600 iPhone's value)

What the micro approach reveals

The iPhone case illustrates key features of GVCs:

1. The geographic separation of innovation from production
   - Can lead to “thin” industrialization: growth in output without innovation-related spillovers: technology development, leadership in standard-setting, marketing, branding, supply chain management, etc.
   - Dearth of Chinese ”lead firms” (brands) are emerging in many global industries

2. High import content of exports
   - Overstates export performance
   - Distorts analysis of trade structure and impact (trade imbalances, etc.)
   - Corrected for by TiVA-type estimates

Updated data reveals little improvement

Components of value added for the 2010 and 2017 Apple iPhone

Item	iPhone4 (2010)	% of retail	iPhone7 (2017)	% of retail
Key components	$124.46	20.7%	$153.48	23.6%
Generic components	$62.80	10.5%	$78.01	12.0%
Total direct material	$187.26	31.2%	$231.49	35.7%
Assembly	$6.54	1.1%	$5.96	0.9%
Total material and assembly (factory gate price)	*$193.80*	*32.3%*	*$237.45*	*36.6%*
Distribution	$90.00	15.0%	unknown	UA
R&D, overhead, royalty payments	$45.95	7.7%	unknown	UA
Apple margin	$270.00	45.0%	unknown	UA
Total distribution, R&D, royalty payments, overhead, and margin	*$405.95*	*67.7%*	*$411.55*	*63.4%*
Retail price	*$600.00*	*100.0%*	*$649.00*	*100.0%*

Sources: iPhone4: OECD (2011), based on iSupply; iPhone7: IHS Markit.
Note: Blue font is likely to be China value added

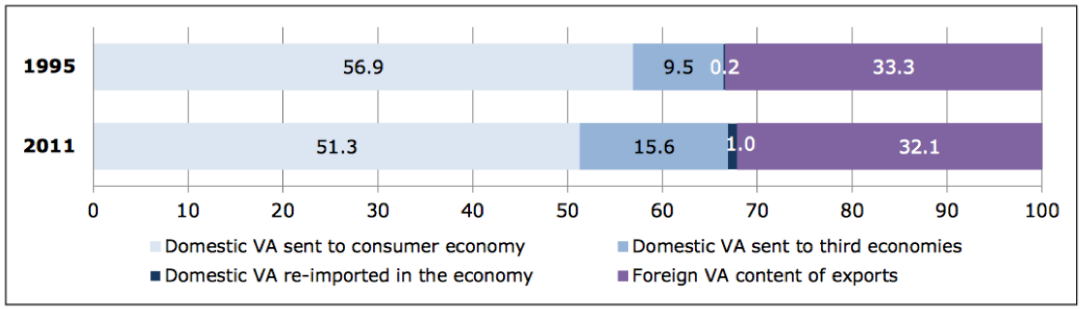
But, for China, more than a decade of export growth has generated vast reserves of cash at the central, provincial, and city government levels for aggressive state-led industrialization efforts.

What the macro approach reveals

- About 50% of the gross value of total Chinese exports in 2006 was derived from imported inputs (Koopman *et al,* 2009)
- This figure rose to 80% for technology-intensive sectors such as electronics, and to 82% for export processing production as a whole (p. 19)
- TiVA put China's foreign value-added at 55% of gross trade and 13% of total gross exports for the computer and electronic sector, China's largest export sector:

The value added (VA) components of gross exports,1995 and 2011

(% share in total gross exports)



Top export industries - Domestic and foreign VA content of exports, 2011

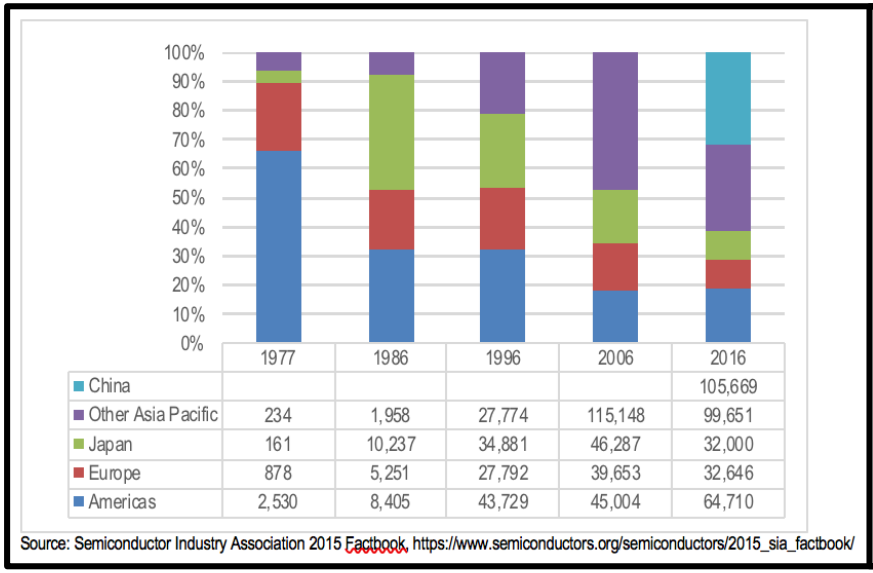
	(% share in industry total gross exports)			(% share in economy total gross exports)	
	Domestic VA	Foreign VA	Total	Domestic VA	Foreign VA
1. Computer and electronic	45.0	55.0	100.0	10.7	13.1
2. Wholesale and retail trade	95.9	4.1	100.0	12.6	0.5
3. Textiles	73.5	26.5	100.0	7.5	2.7

Source: WTO, "Trade in value-added and global value chains: statistical profiles", web access: https://www.wto.org/english/res_e/statis_e/miwi_e/countryprofiles_e.htm

China's drive to increase ICT: example of semiconductors

The delinking of production and consumption

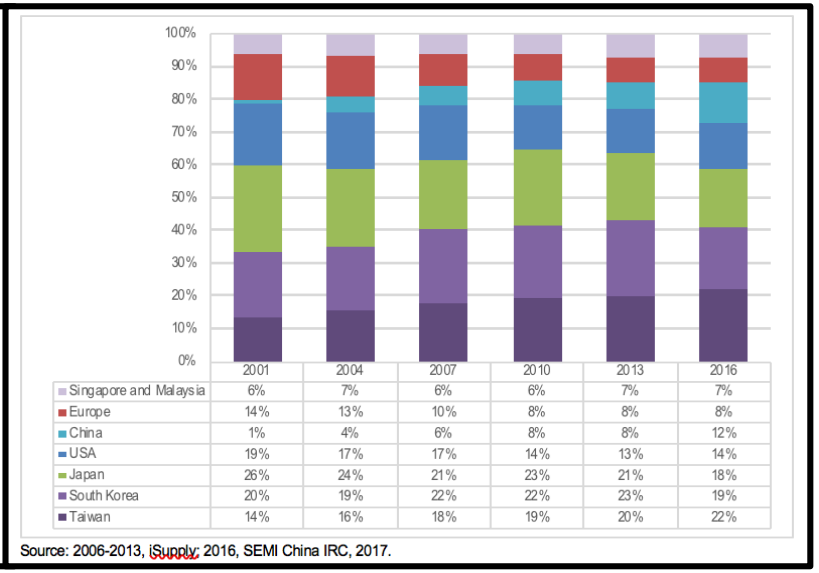
World semiconductor consumption by country & region, 1977-2016, shares and US$B



	1977	1986	1996	2006	2016
China					105,669
Other Asia Pacific	234	1,958	27,774	115,148	99,651
Japan	161	10,237	34,881	46,287	32,000
Europe	878	5,251	27,792	39,653	32,646
Americas	2,530	8,405	43,729	45,004	64,710

Source: Semiconductor Industry Association 2015 Factbook, https://www.semiconductors.org/semiconductors/2015_sia_factbook/

World semiconductor manufacturing capacity by country or region, 2006-2016



	2001	2004	2007	2010	2013	2016
Singapore and Malaysia	6%	7%	6%	6%	7%	7%
Europe	14%	13%	10%	8%	8%	8%
China	1%	4%	6%	8%	8%	12%
USA	19%	17%	17%	14%	13%	14%
Japan	26%	24%	21%	23%	21%	18%
South Korea	20%	19%	22%	22%	23%	19%
Taiwan	14%	16%	18%	19%	20%	22%

Source: 2006-2013, iSuppli; 2016, SEMI China IRC, 2017.

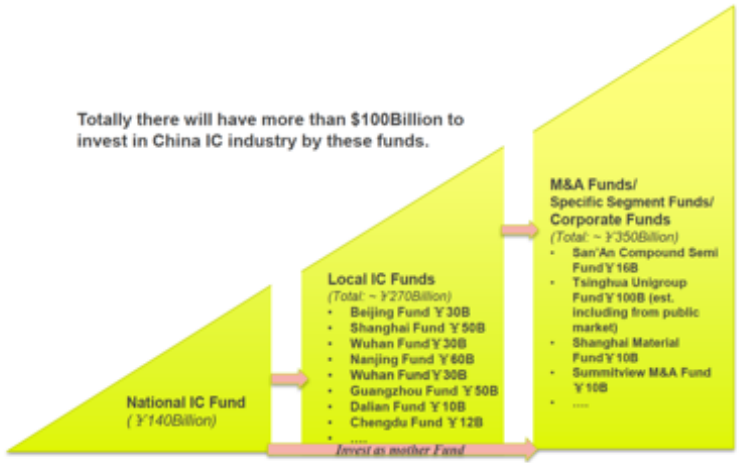
- Semiconductor production used to be co-located with consumption, but advent of the "foundry model" (separation of fabrication from chip design) and the continued export strength of American and European Integrated Device Manufacturers (IDMs) delinked production and consumption.
- China is the world's largest consumer of semiconductors (33%) and exporter of final ICT goods (41%), but the country only produced 12% of the world's semiconductors in 2016. This has created to a gap between consumption and production that has thus far been mainly filled by imports

Policy implication? State-led localization effort

Example of semiconductor fabrication for integrated circuits (IC) industry

China's IC revenue growth, 2001-2013, projections 2014-2020

State-led investments in China's IC manufacturing



Source: CSIA, SEMI IRC, March 2017

- Made in China 2025: increase self-sufficiency in semiconductor production to 40% by 2020 and 70% by 2025. The fund is currently valued at more than US$ 52 billion.
- China does not have globally competitive IDMs, so focus is on foundries. According to McKinsey, meeting these goals would mean that China would account for 100% of all expected incremental investment in foundry capacity through 2025.

Policy implication? State-led localization effort

Example of flat panel displays

Company	City	Generation	Capacity	Status
Operational plants before 2013				
CEC-Panda	Nanjing	6	90	Operational
BOE	Beijing	6	90	Operational
BOE	Beijing	8.5	150	Operational
CSOT	Guangzhou	8.5	150	Operational
As of 2017				
BOE	Hefei	8.5	120	Operational
BOE	Chongqing	8.5	150	Operational
LGD	Guangzhou	8.5	210	Operational
China Star	Shenzhen	8.5	160	Operational
CEC-Panda	Nanjing	8.5	72	Operational
SDC	Suzhou	8.5	120	Operational
China Star	Shenzhen	8.5	145	Operational
CEC-Panda	Chendu	8.6	120	Under construction for Q1, 2018
CEC-IRICO	Xianyang	8.6	120	Under construction for Q2, 2018
HKC	Chongqing	8.6	70	Under construction for Q2, 2018
BOE	Fuqing	8.5	150	Under construction for Q2, 2018
BOE	Hefei	8.5	120	Under construction for Q3, 2018
Sharp (Foxconn)	Guangzhou	10	90-120	Planned
China Star	Shenzhen	11	90	Planned
			480	*Operational before 2013*
			1457	*Operational in 2017*
			580	*Under construction in 2017*
			180-210	*Planned as of 2017*
Total capacity installed, under construction, and planned			*2,217-2,247*	

Note: capacity is in thousands of panels per month.
Source: CSOT, 2017

Policy implication? State-led localization effort

Flat panel market share, 2010 and 2018 (est.), by producer and HQ nationality

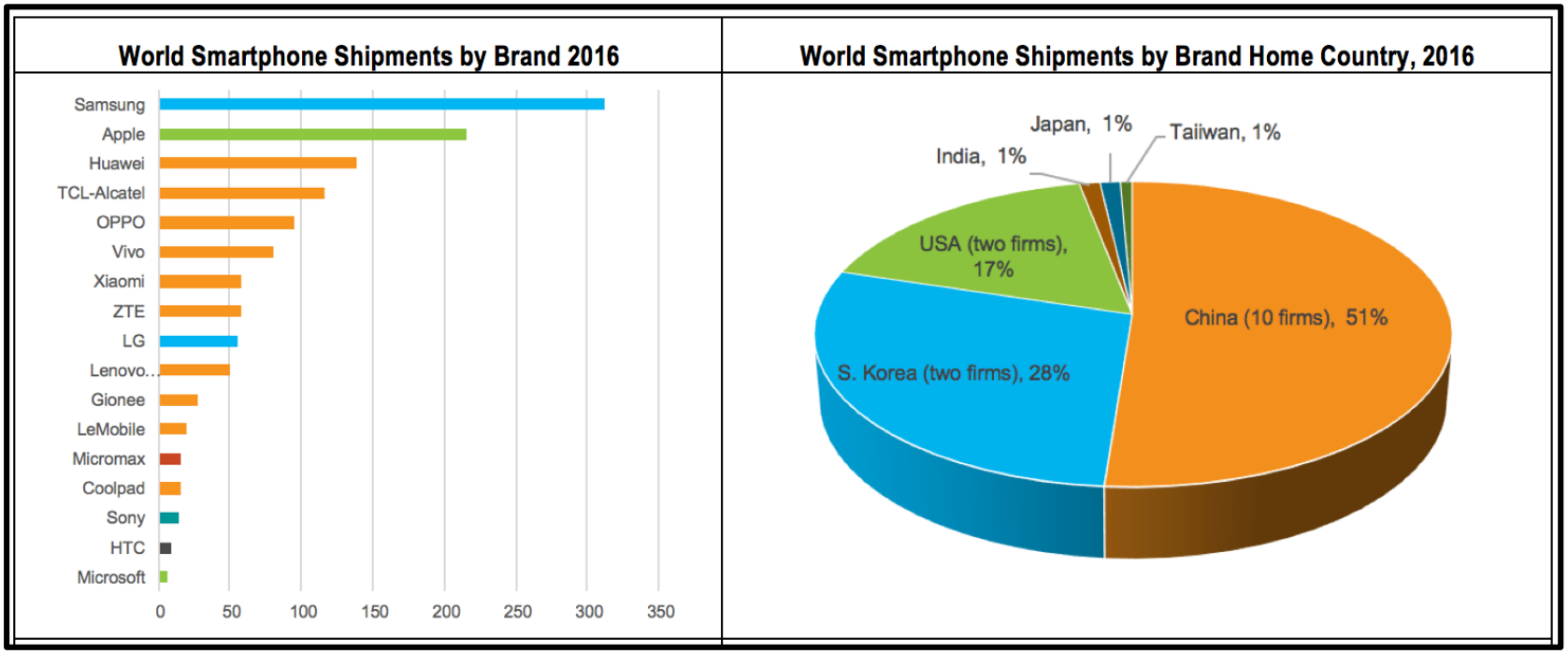
2010				2018			
Rank	Company	Nationality	Share	Rank	Company	Nationality	Share
1	Samsung	Korea	24%	1	Samsung	Korea	19%
2	LG	Korea	22%	2	LG	Korea	18%
3	Innolux	Taiwan	17%	3	BOE	China	14%
4	AUO	Taiwan	15%	4	Innolux	Taiwan	13%
5	Sharp	Japan	8%	5	AUO	Taiwan	11%
6	Chunghwa	Taiwan	3%	6	China Star	China	7%
7	Panasonic	Japan	3%	7	Sharp (Foxconn)	Taiwan	5%
	others		8%		others		12%
Share in top 7 by nationality		*Korea*	*46%*	*Share in top 7 by nationality*		*Korea*	*37%*
		Taiwan	*35%*			*Taiwan*	*29%*
		Japan	*11%*			*China*	*21%*
		China	*0%*			*Japan*	*0%*

Source: IHS, Web access: https://technology.ihs.com/551480/china-to-dominate-flat-panel-display-manufacturing-by-2018-ihs-says

- Domestic Chinese firms now supply 80% of domestic flat panel consumption for TVs, up from only 20% in 2008
- Within the industry, observers point to the closing of factories on the part of Samsung and LG as an acknowledgement that it will be difficult to compete with China in this sector in the future.
- As with planned investments in semiconductor fabrication, new capacity in China's flat panel industry may overshoot demand and could eventually tilt the industry toward the bottom of Shih's smile curve.

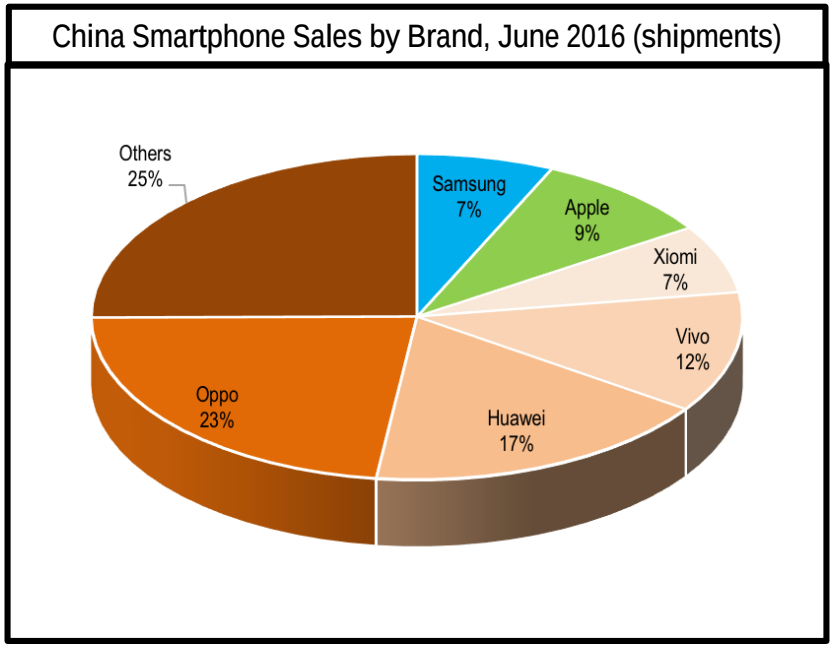
But is something missing from this analysis?

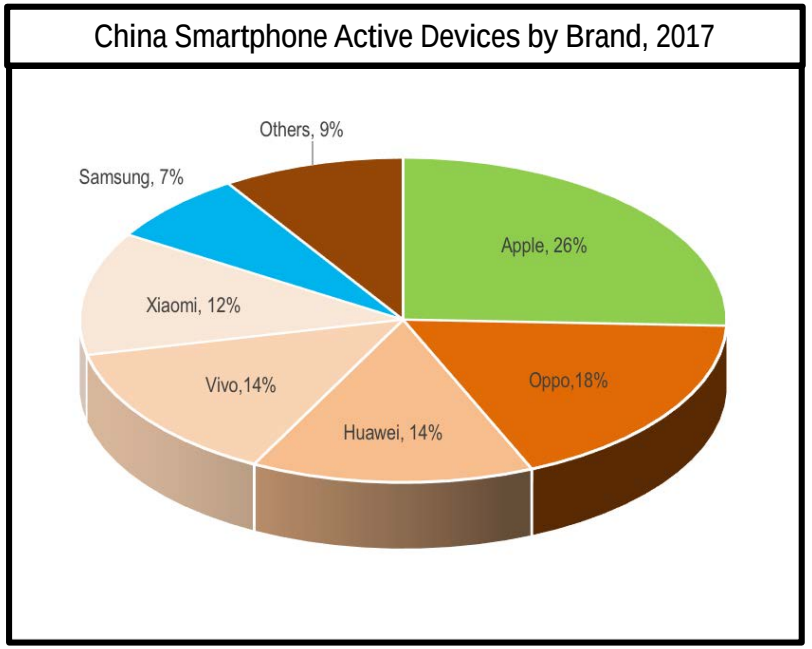
Chinese brands account for over 50% of world market…



Source: IHS Markit, 2016

… 84% of Chinese sales, and approximately 60% of active devices…

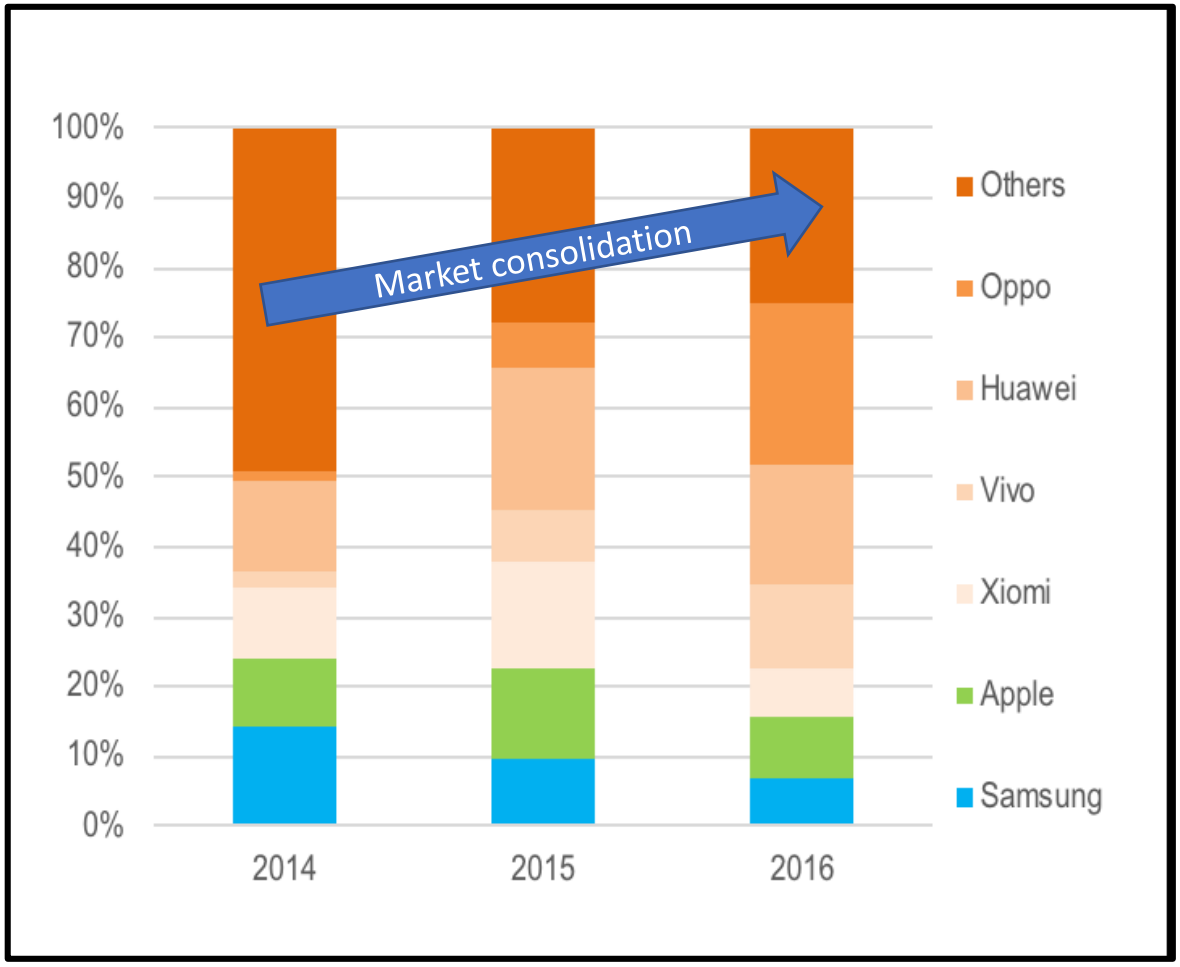




Source: China shipments by brand: IDC cited in Routley, 2017; Active devices: Newzoo cited in Hollander, 2018.

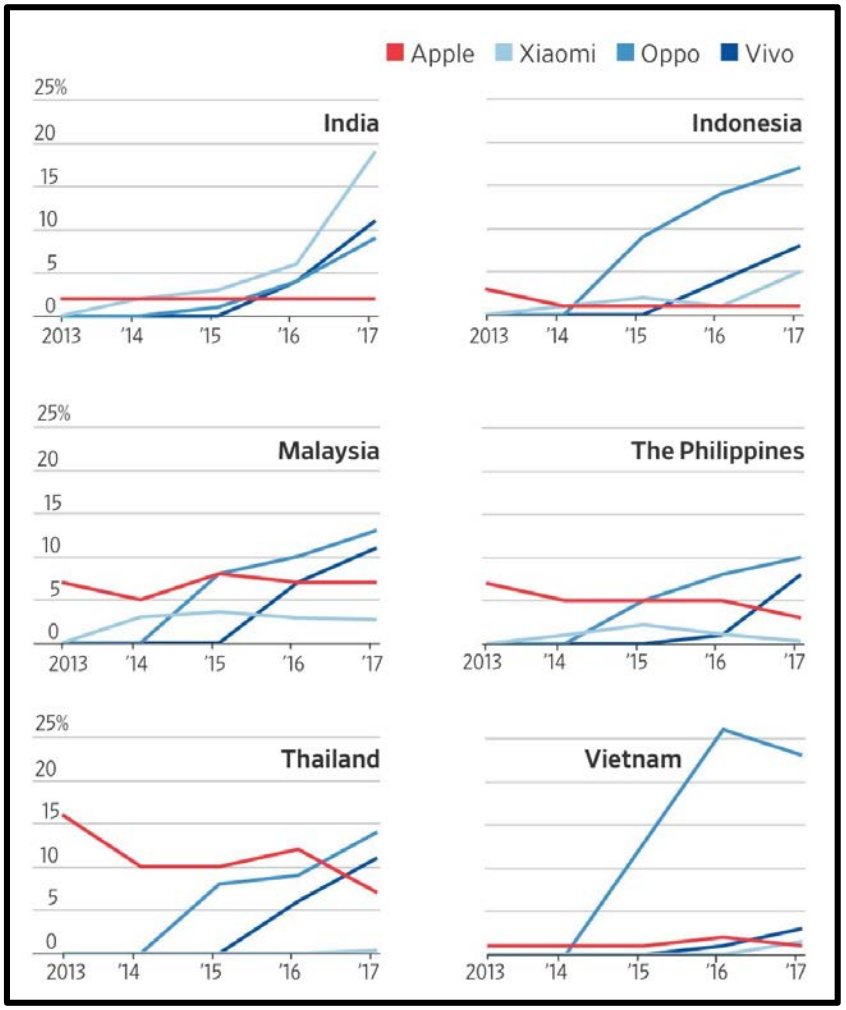
…and have been consolidating market share…

China Smartphone Sales by Brand, June 2014 – June 2016



Source: IDC cited in Routley, 2017

…and are increasingly successful outside of China.

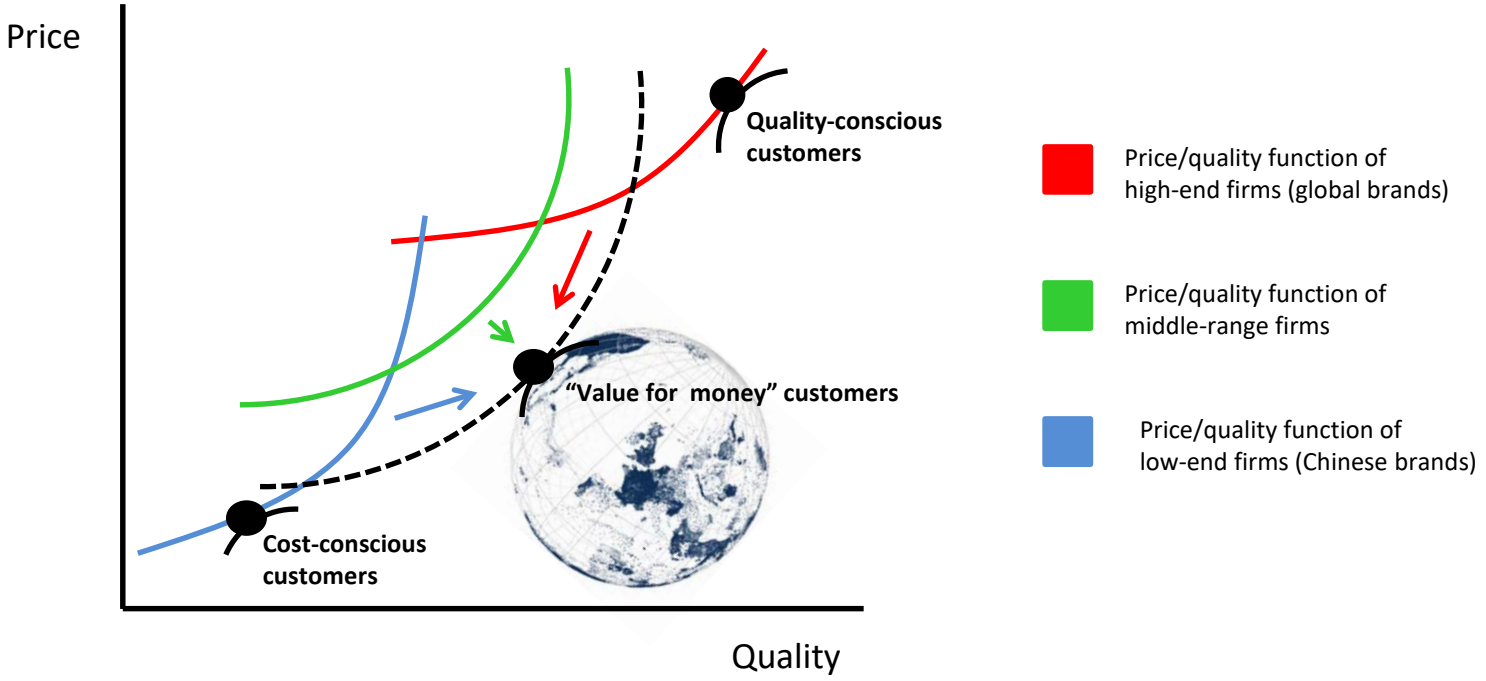


- Does not include world market leader Samsung
- Oppo and Vivo are both owned by BBK electronics of Dongguan
- According to the XDA Developers blog, Xiaomi plans to sell smartphones in the U.S. soon. "We've always been considering entering the US market," Xiaomi Chairman Lei Jun reportedly said during China's annual legislative session in Beijing, "We plan to start entering the market by end 2018, or by early 2019."
- However, the US government has thus far banned the sales of Huawei and ZTE equipment and devices to government agencies

Source: Purnell, Newley. 2018. "Why the iPhone Is Losing Out to Chinese Devices in Asia: Apple's market share is stagnant or declining in Asia, paving the way for other smartphone makers." Wall Street Journal Tech, Feb 19. Web access: https://www.wsj.com/articles/why-customers-from-india-to-indonesia-prefer-chinese-devices-to-iphones-1519036203

How are Chinese firms upgrading?

The “fight for the middle” (both domestic and global)



Source: Brandt and Thun 2011, 2016; Thun 2018

Successful Chinese brands depend on global technology

Technology comparison for two mobile phone handsets, 2016

Huawei (China) P6	Vendor (HQ)	Item
Operating system	Google (USA)	Android Marshmallow
Processor	Huawei (China)***	Kirin 955 Octa-core CPU
Modem	Skyworks (USA)	WCDMA/LTE and FDD/TDD LTE modem
Memory products	SK Hynix (Korea)	24 Gb (3 GB) RAM
	Samsung (Korea)	32 GB eMMC flash memory (2)
Various functional ICs	Texas Instruments (USA)	Fast charging IC
	HiSilicon (China)	Audio codec
	Broadcom (USA)**	5G Wi-Fi and Bluetooth module
	Broadcom (USA)**	GPS controller
	NXP (Netherlands)*	Near field communications controller
	Vivante (USA)	Graphics processor

* NXP is the former Philips semiconductor division
** Broadcom was recently acquired by Avago Technologies (Singapore)
*** Designed by HISilicon (China), a Huawei subsidiary, based on ARM (UK) technology: CPU: ARMv8-A; GPU: ARM Mali-T880 MP4

Samsung (Korea) Galaxy Note 7	Vendor (HQ)	Item
Operating system	Google (USA)	Android Marshmallow
Processor	Qualcomm (USA)	Snapdragon 820
Modem	Qualcomm (USA)	X12 LTE modem (integrated in processor)
Memory products	Samsung (Korea)	4 GB SDRAM
	Samsung (Korea)	64 GB Universal Flash Storage 2.0
Various functional ICs	Broadcom (USA)	Multiband multimode module
	NXP (Netherlands)*	Near field communications controller
	Qorvo (USA)	High band RF fusion and diversity receive module
	Qualcomm (USA)	Audio codec and DSP audio/voice processor
	Murata (Japan)	Front-end module
	Samsung (Korea)**	Wi-Fi module
	Wacom (Japan)	Touch control IC
	Qualcomm (USA)	Power Management IC
	Qualcomm (USA)	Envelope tracker
	Qualcomm (USA)	RF transceiver (2)
	IDT (Japan)	Wireless power receiver and power ICs

* NXP is the former Philips semiconductor division
** Probably contains a Broadcom Wi-Fi SoC

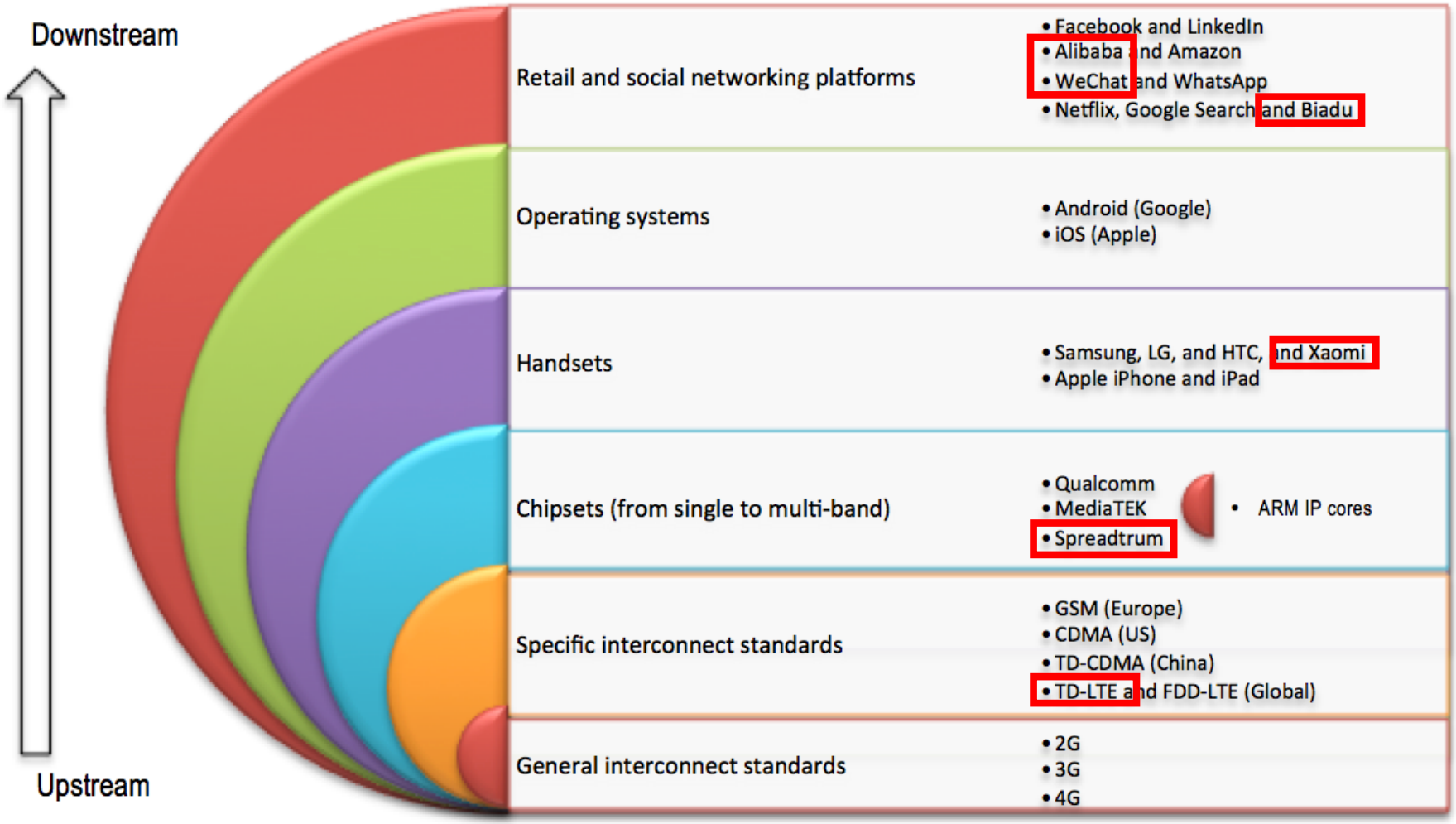
Source: Thun and Sturgeon, 2017 derived from iFixit.com teardowns

Key technology suppliers include:

- Google (Android OS)
- Samsung (memory)
- ARM (low power radio code)
- Qualcomm (processors and various)
- Broadcom (WiFi, GPS, various)
- NXP (near field communications)

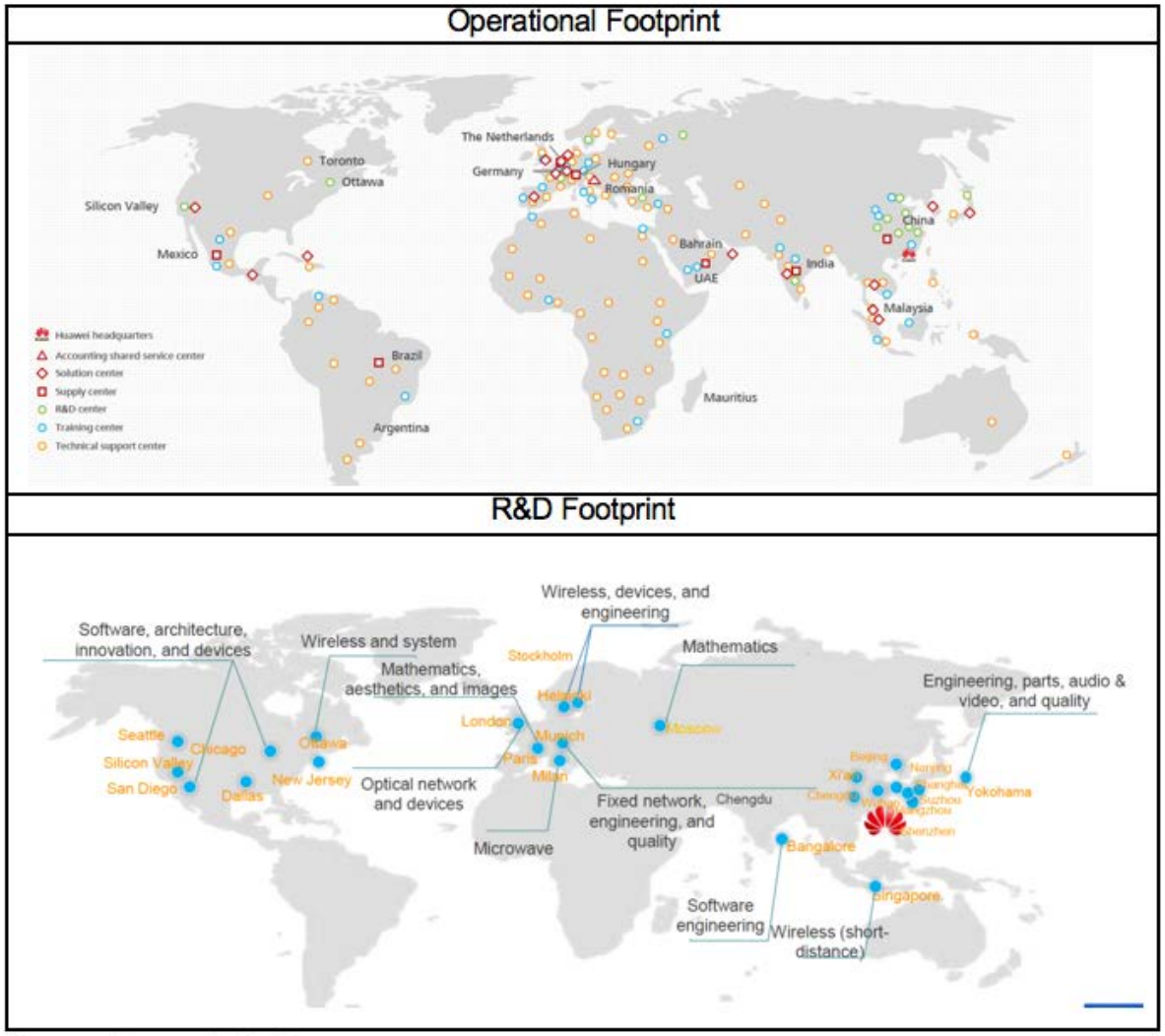
Chinese firms participate in global platform ecosystems

Platform Layering in Mobile Telecom



Successful Chinese brands create global footprints

Example of Huawei

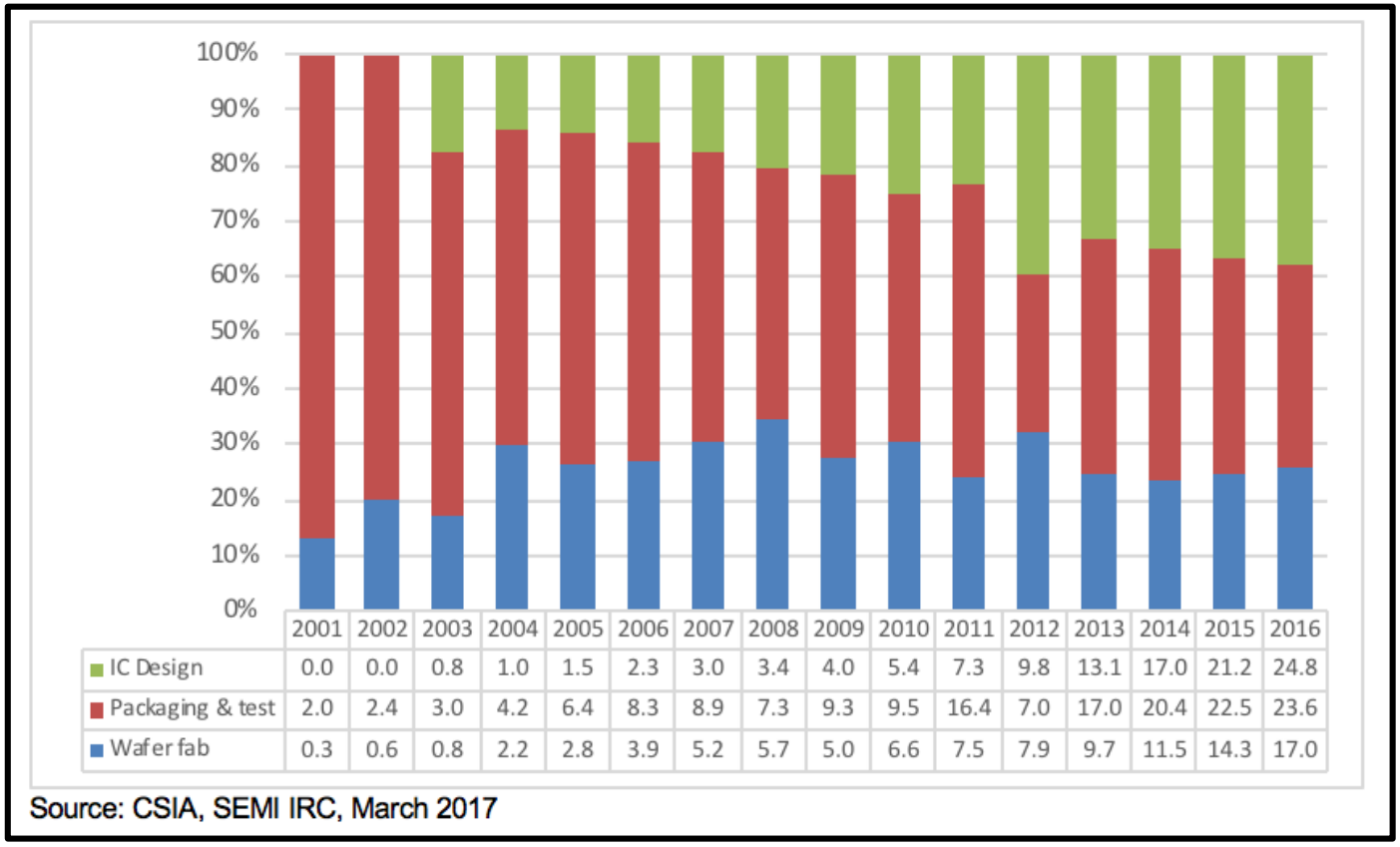


Source: Huawei, 2017

In what GVC segments are Chinese firms succeeding?

Example of IC design

Revenues in China for IC design, packaging and test, and wafer fabrication, 2001-2016, US$B



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
IC Design	0.0	0.0	0.8	1.0	1.5	2.3	3.0	3.4	4.0	5.4	7.3	9.8	13.1	17.0	21.2	24.8
Packaging & test	2.0	2.4	3.0	4.2	6.4	8.3	8.9	7.3	9.3	9.5	16.4	7.0	17.0	20.4	22.5	23.6
Wafer fab	0.3	0.6	0.8	2.2	2.8	3.9	5.2	5.7	5.0	6.6	7.5	7.9	9.7	11.5	14.3	17.0

Source: CSIA, SEMI IRC, March 2017

- IC design is more difficult to commodify than fabrication and closely tied to product innovation.
- IC design has grown faster than fabrication in China, despite weak government support
- Allwinner and Rockchip are examples of successful Chinese IC design firms

Is more handset-related R&D and innovation happening in China?

Dynamic domestic market and unique ecosystems in certain industrial clusters draw global R&D

Samsung's Global R&D footprint, 2016

Location	Headcount	Focus
Dallas, TX, USA	unknown	Advanced software solutions for wireless terminal devices Next generation network technologies - Advanced Technology Laboratory (ATL) Advanced wireless technologies and product - Wireless Solutions Laboratory (WSL)
San Jose, CA, USA	unknown	Hard-disk drive (HDD), digital TV products, printer architecture, home networking as well as other new and emerging technologies; strategic parts and components, and core technologies
Beijing, China	800	GSM, TD-SCDMA technology Next-generation mobile communications.
Nanjing, China	300	Software
Shanghai, China	500	unknown
Suzhou, China	300	Semiconductor, DRAM, NAND, etc.
Wuhan, China	unknown	WiBro (broadband wireless)
Bangalore, India	2,000	Product customization for the Indian mobile phone market Wireless terminals and infrastructure, networking, system on chip (SoC), digital printing, and other multimedia/digital media as well as application software System software for digital products, protocols for wired/wireless networks, and handsets.
Gumi, Korea	5,000	Mobiles handsets (all major and next generation technologies), communication systems and printers
Seoul, Korea	5,200	Digital TVs
Suwon, Korea	500	CTV, DTV, DVDP, monitors, and CD-ROM, HDD, etc.
Yokohama, Japan	200	Optical equipment, plasma display, next-generation wireless handsets, lithium-ion (li-on) batteries, etc.
London, UK	75	Mobile phones and digital TV software
Moscow, Russia	50	Optics, software algorithms. and other new technologies
Yakum, Israel	90	Hebrew software for mobile phones

Sources: IHS Markit and Samsung

Summary

- Core competitive “resource” of domestic Chinese handset firms is not hardware; it is ability to respond fast to consumer demand
- Effective firm strategy in fast-moving technology-intensive industries dictates building a business model that maximizes competitive advantage (and outsources everything else)
- Chinese handset firms are beginning to succeed at the edges of the smile curve
- Though profitability remains a question, consolidation provides domestic producers with the stability and scale to invest in design capabilities
- Dynamic domestic market, the build up of unique ecosystems of production, and growing skills and connectivity lure global technology to Chinese centers
- Government policy often focuses on the bottom of the smile curve (e.g. semiconductor and flat panel display fabrication) and their policies have a further dampening effect.

Key policy questions

- What is the “right” level of local content?
  - Successful firms depend on access to constantly evolving global technology ecosystems and knowledge-intensive intermediates …
- What type of local content is most important?
  - Successful firms dominate the connection with customer and are focused in growing their design and marketing capabilities…
- What policies will enable Chinese firms to compete internationally?
  - Successful firms develop products that depend on interoperability and compatibility with global markets…
- Is this a model that applies to Agri GVCs as well?
  - Leveraging local demand, driven by income growth
  - Focus on building scale, brands, and connectivity
  - Building up of clusters with a highly competitive environment