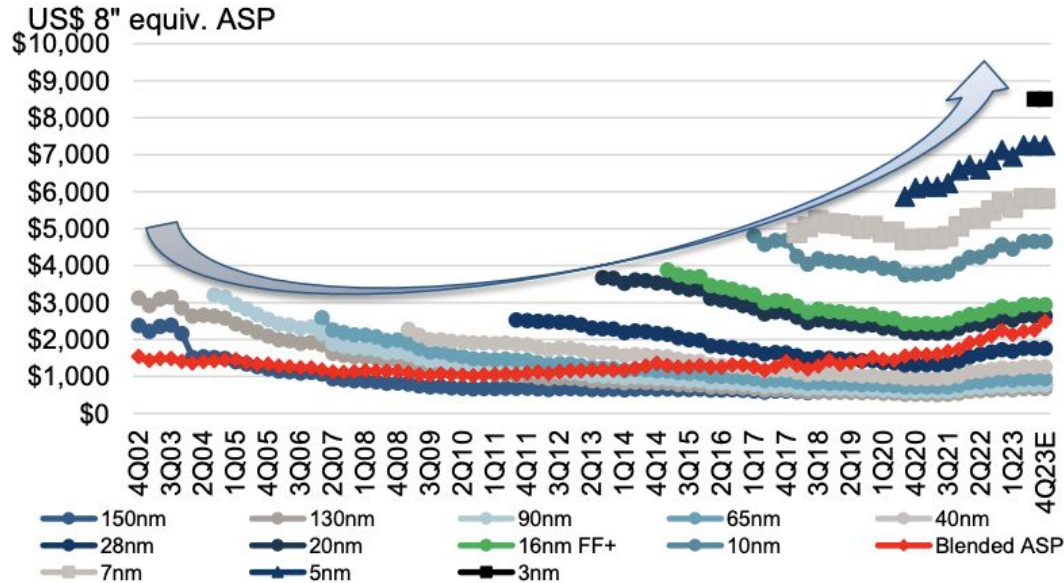


China's Lagging Edge Push

Disclaimer: This presentation is for informational purposes only and should not be considered as investment advice. The views expressed are the presenters' own and are subject to change.

2020 was a Price Inflection

Figure 11: TSMC lifts prices beyond higher leading node ASPs

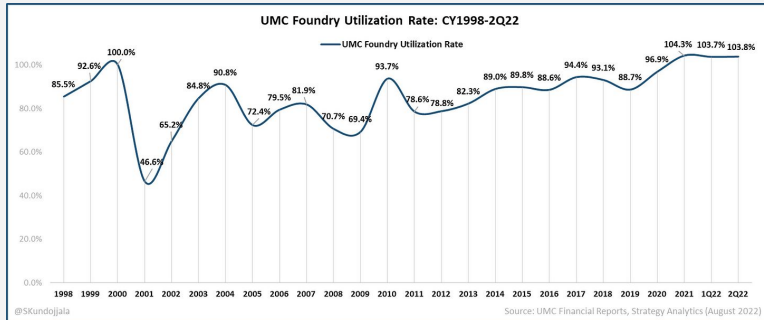


Source: Company data, Credit Suisse estimates

Why Did Price Increase?

Supply

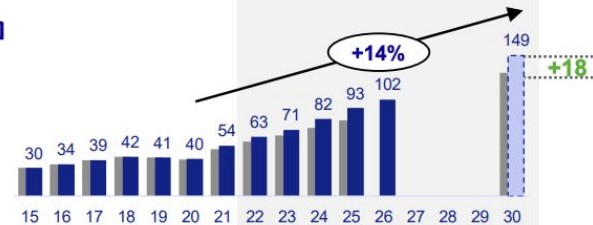
- Fully depreciated fabs
- Utilization above history



Demand

- Surge in lagging edge products from Automotive

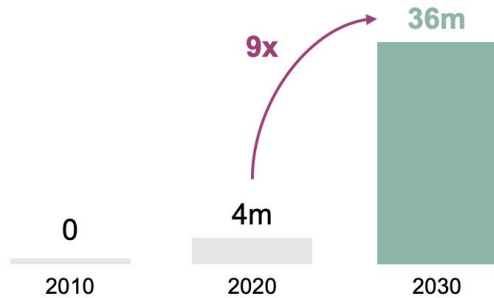
Automotive (\$bn)



Source: ASML Investor Day 2022

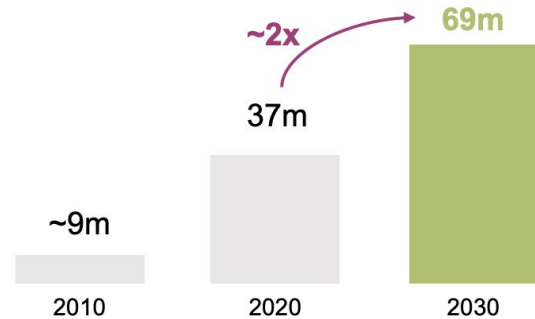
The Digital Transformation of Cars is a Big Wave (ADAS + EV)

Number of BEV + PHEV sales¹



Source: Infineon CMD Day 2021

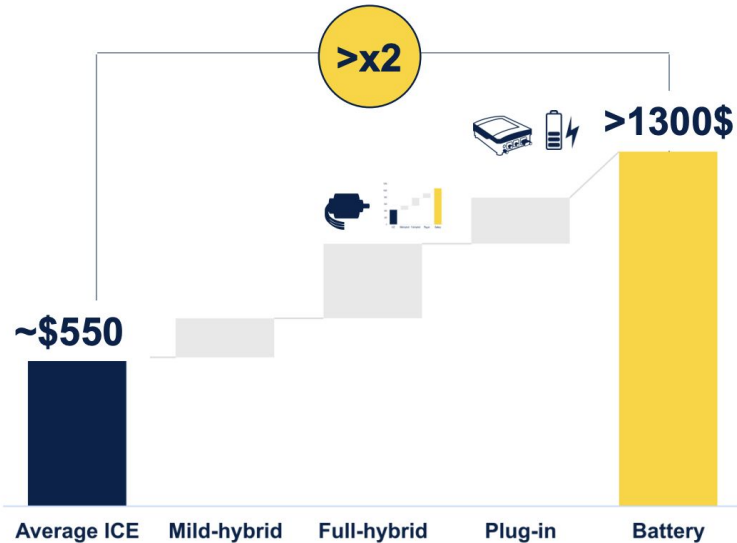
Sales of cars equipped with ADAS (L1 or higher)¹



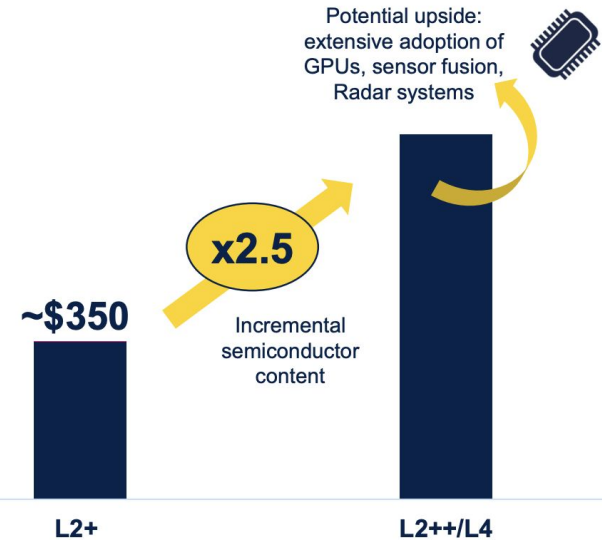
Source: Infineon CMD Day 2021

Big Waves Leads to Content Increases

Electrification significantly increases car silicon content



To increase autonomy additional silicon is needed in every car



Source: STMicroelectronics Investor Day 2022

China Will Ride the Wave

“China is now by far the largest market for EVs, accounting for 60 percent of new vehicle registrations last year and 40 percent of the global electric car stock. Most of the EVs sold in the country are produced there, as is a growing number of exported vehicles. China is also by far the main producer of lithium batteries globally, which are the main component in EVs. According to the International Energy Agency (IEA), the country accounts for 65 percent of battery production and 80 percent of cathode production, and the Department of Energy’s estimate is even higher.”

“There are cost advantages to producing EVs in China. Exact estimates are challenging because of differences in quality and size but as an example in 2022, 20 percent of electric car models on offer in China were priced at less than \$15,000. By comparison in 2022 in the United States and Europe there were no electric models on sale for less than \$20,000. According to some industry insiders, production in China may mean up to \$10,000 in savings.”

Overcapacity and Exports

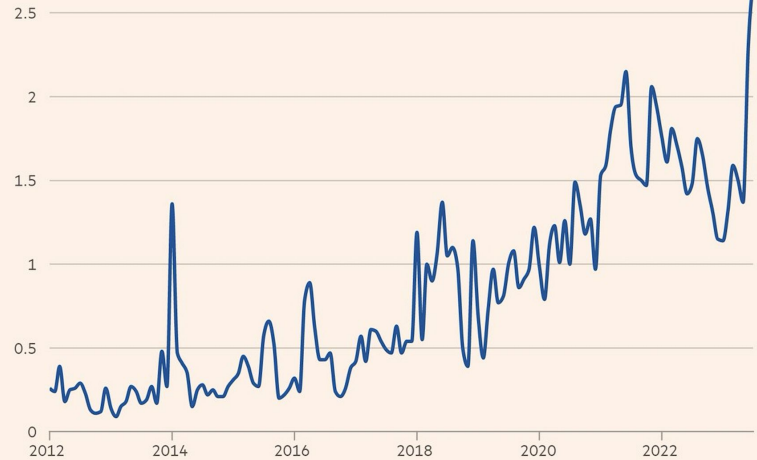
- China is more than happy to create a wave of export driven GDP growth
- Currently China has capacity for 40mn vehicles a year compared to a domestic market of just 20-25mn vehicles¹
- China is in economic rough spot, exporting at a loss is still likely GDP positive
- Chinese companies have been willing to pursue extremely uneconomic policies for long periods of time due to central planning, this seems like likely base case

Lagging Edge Calculus

- China has been banned from pursuing leading edge development, still has managed a 7nm SMIC chip
- Completely focused on the lagging edge
- Year to date semiconductor capacity additions have accelerated, driven mostly by lagging edge

China's chip equipment imports hit record for two consecutive months

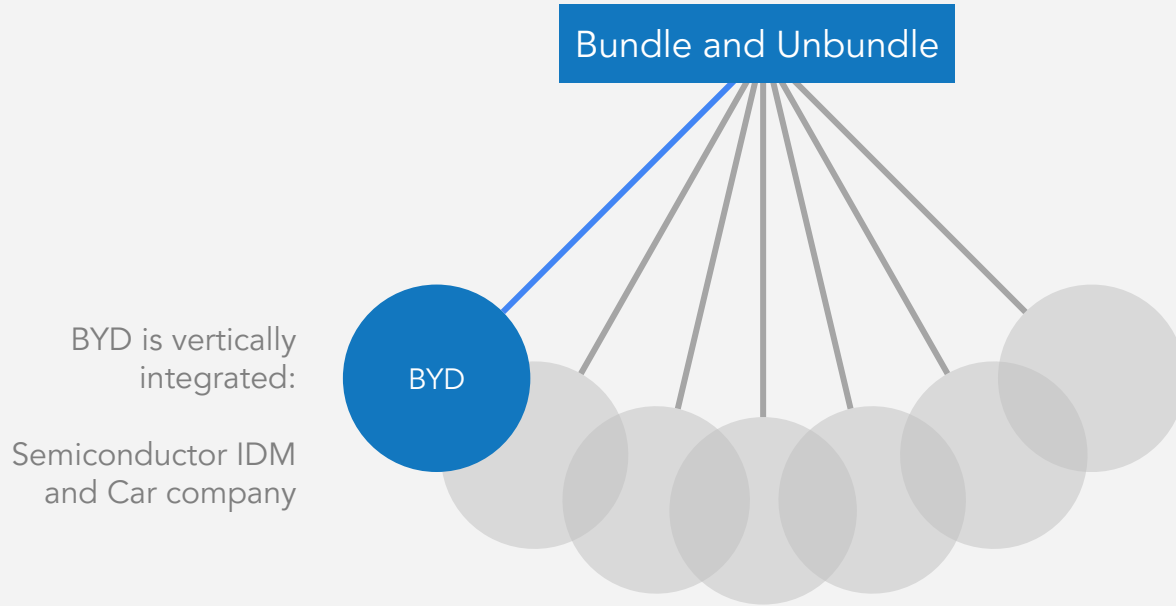
Imports of equipment for manufacturing semiconductor devices (\$bn)



FINANCIAL TIMES

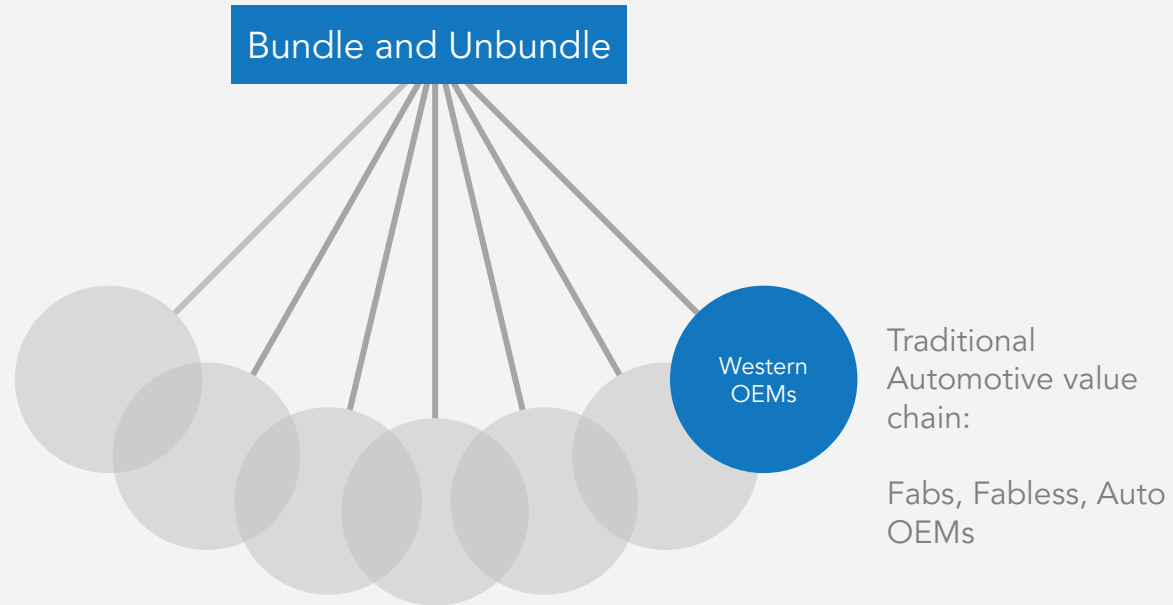
Source: China's General Administration of Customs

The Bundling and Unbundling Pendulum



History has precedent:
Infineon spun from Siemens in 1999, NXPI from Phillips in 2006, On Semi from Motorola in 1999

The Bundling and Unbundling Pendulum



We live in the unbundled world of semiconductors. From Fabs to fabless, there is a huge incremental profit pool from vertical integration of semiconductors into cars

The Pendulum Swings: BYD the Vertical Giant

- BYD is the clear leader in vertical integration
- BYD supplies their own PMICs, looking to become full stack automotive IDM
- They are even buying Auto Transport ships for exports
- BYD had proposed a spin-off of BYD semiconductor, now that's scrapped and being kept in-house

Industry Margins: Vertical Integration

Semiconductor Fabs

- TSMC
- Samsung
- Intel (IDM)
- UMC
- GlobalFoundries
- SMIC
- Micron
- SK Hynix

Foundries

Segment Economics

(% of annual revenue, 2016-2019)

• Gross Margin:	40%
• R&D:	9%
• Capex:	34%
• Operating Cash Flow:	15%

Source: BCG x SIA

Fabless Semiconductor

- Nvidia
- Broadcom
- Qualcomm
- AMD
- Infineon
- Marvel

Fabless

Segment Economics

(% of annual revenue, 2016-2019)

• Gross Margin:	50%
• R&D:	20%
• Capex:	4%
• Operating Cash Flow:	20%

Source: BCG x SIA

Auto OEMs

- Honda
- BMW
- Mercedes
- Toyota
- Hyundai
- Volkswagon
- Nissan
- Ford
- General Motors

Auto

Segment Economics

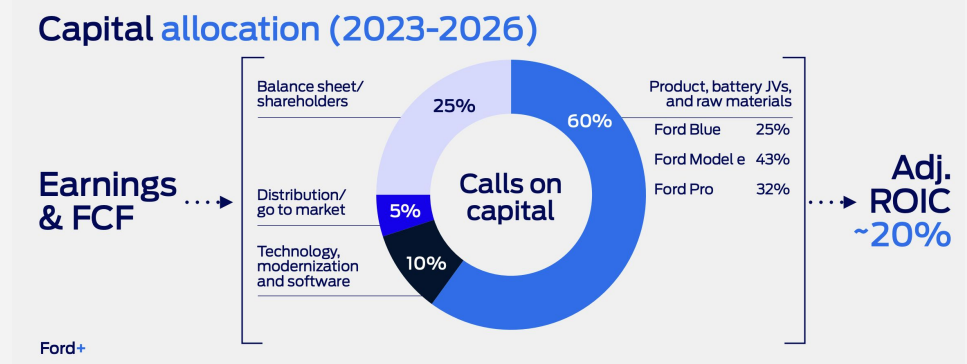
(% of annual revenue, 2016-2019)

• Gross Margin:	18%
• R&D:	3%
• Capex:	7%
• Operating Cash Flow:	7%

Source: Fabricated Knowledge

Traditional OEMs are in Dire Straits

- Ford's recent investor day is promising the majority of investment to be in EVs
- Large traditional OEMs also are all investing in EVs
- No one except for Tesla and BYD makes much profits in EV
- Diseconomies of scale for ICE value chain



Already Seeing the Consequences

- TSMC is rumored to be cutting prices for trailing edge wafer costs
- Texas Instruments is cutting prices in lagging edge in China to defend prices
 - Texas Instruments has aggressive capacity expansion plan predicated on the CHIPS act
- The lagging edge is driving towards a massive supply glut

Conclusions

China is increasingly focused on lagging edge production for Automotive

Vertical integration will lead to price dumping, Western OEMs likely can't compete

The West must respond, leading to further split in East-West supply chains

East-West Split will be taxing for Automotive Semis