

SEMI & MATRADE Webinar

Semiconductor Market Outlook - Semiconductors, Equipment and Materials Market Outlook

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October 28 2020



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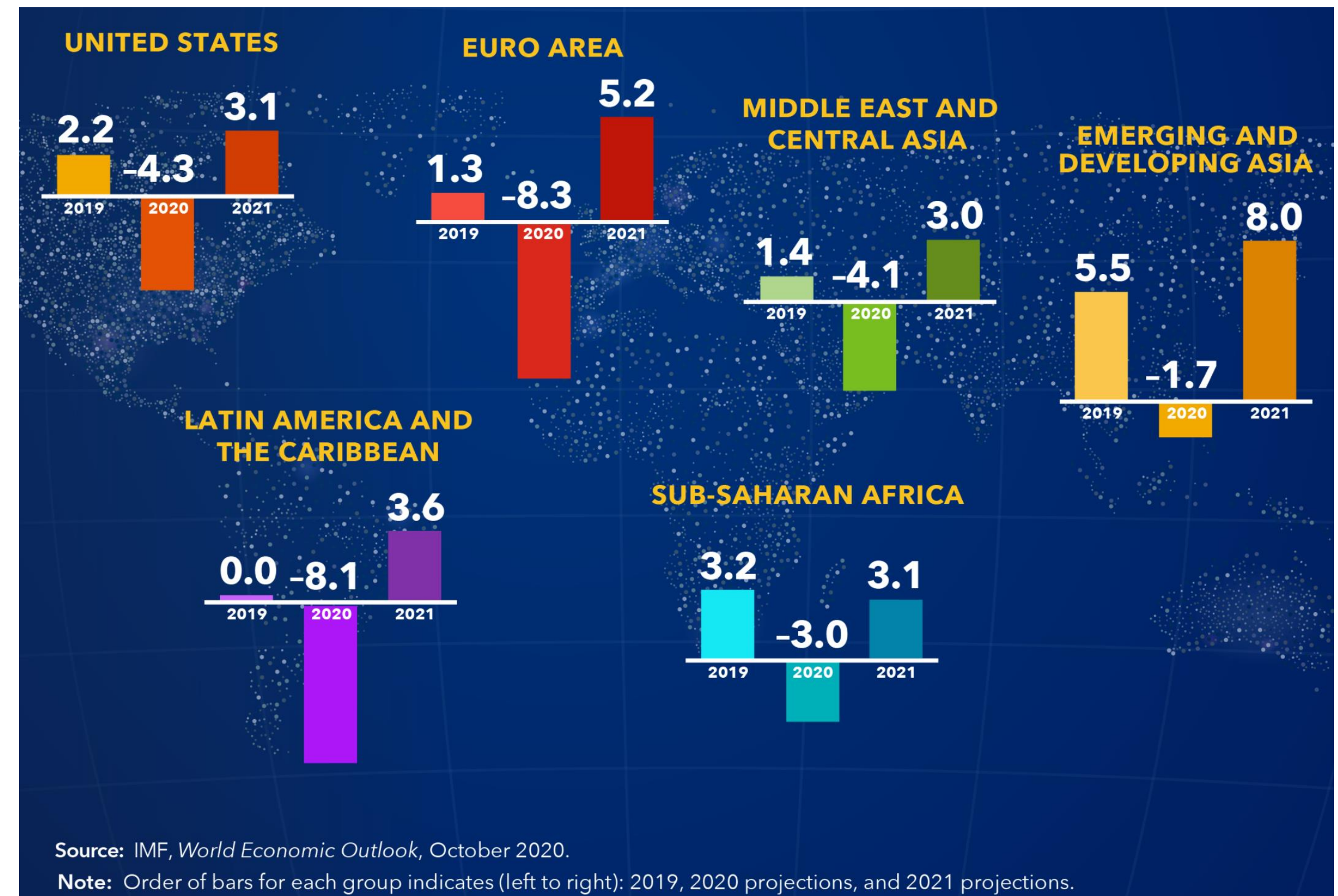
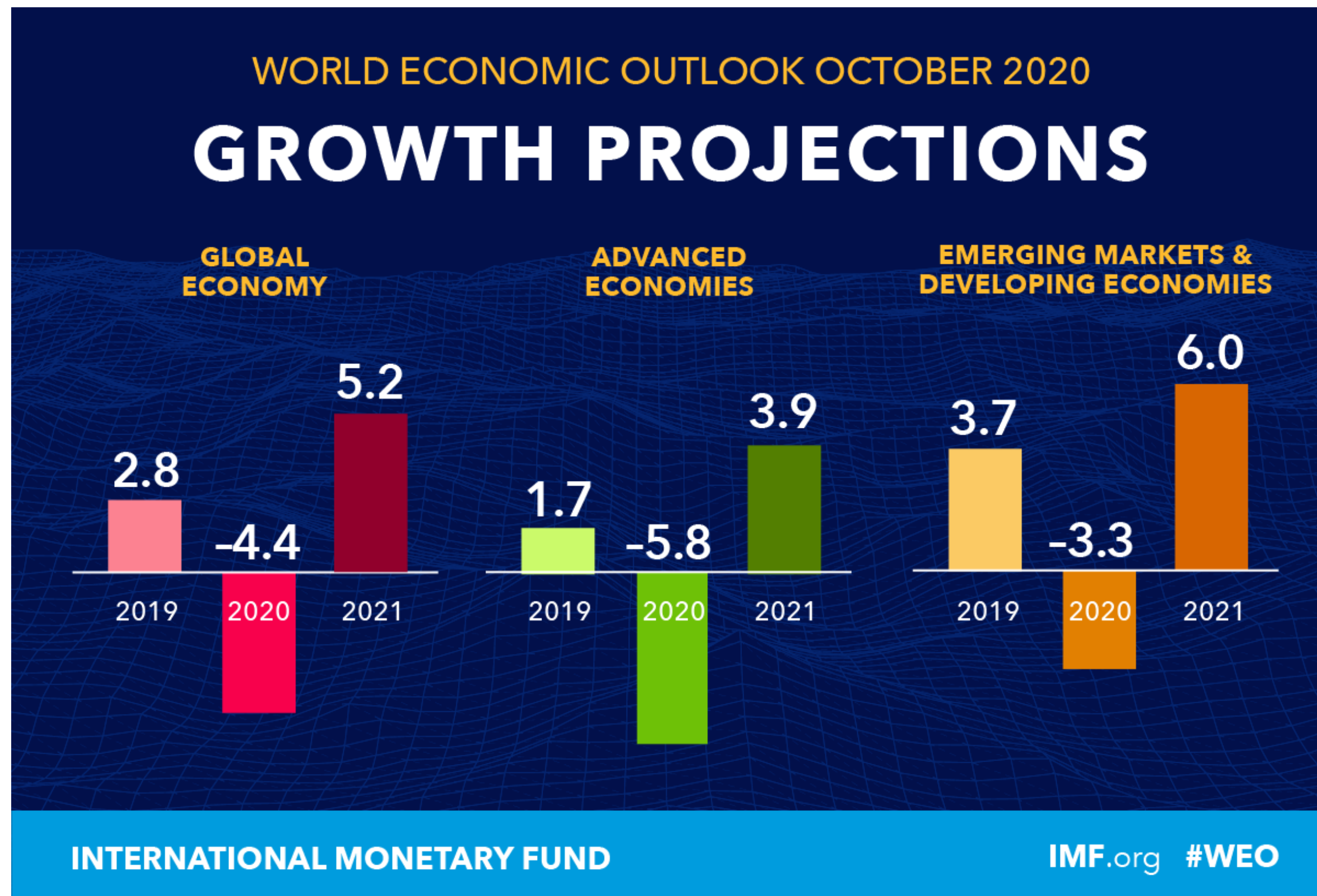
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Outline

- Improving 2020, Promising 2021
- Semiconductor Equipment Forecast
- Semiconductor Material Forecast
- Recent Development & Summary

World Economy Outlook

Improving 2020, Promising 2021



Global Manufacturing PMI Rebound Continued in September

J.P.Morgan Global Manufacturing PMI™

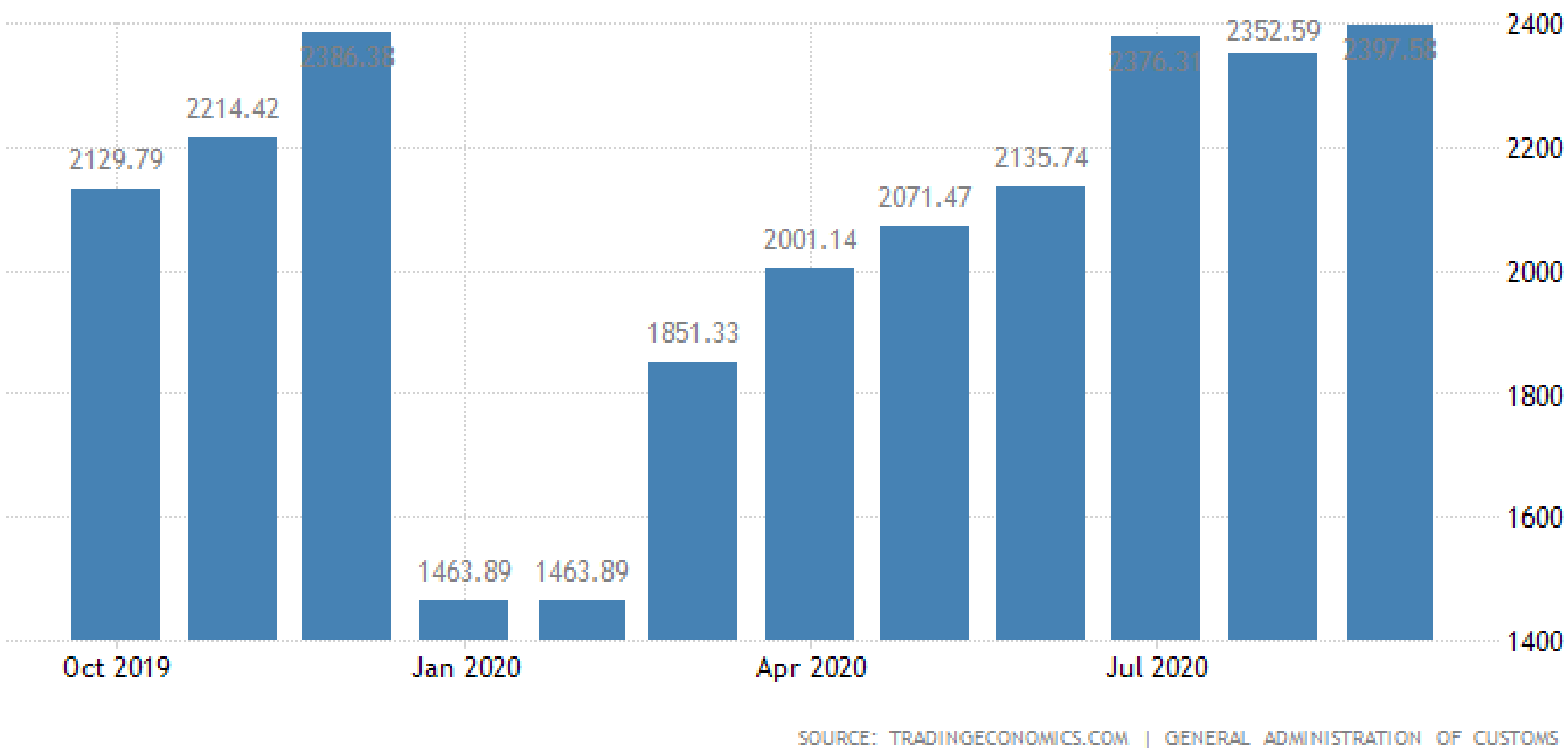
sa, >50 = improvement since previous month



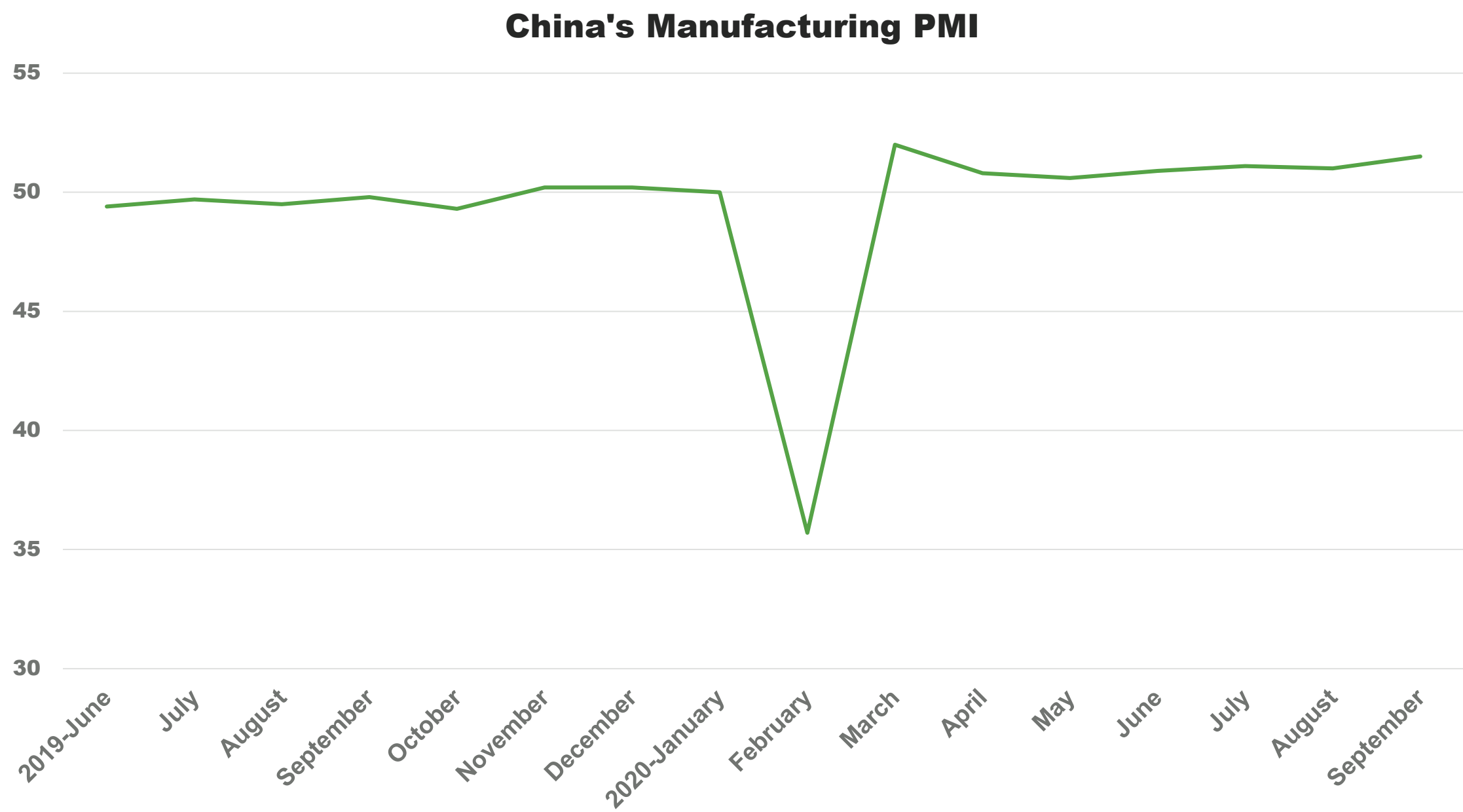
Sources: J.P.Morgan, IHS Markit.

China & Asia Lead the Economic Recovery

China Export continues to expand in the 3Q20



China PMI has been above 50 in the past seven months

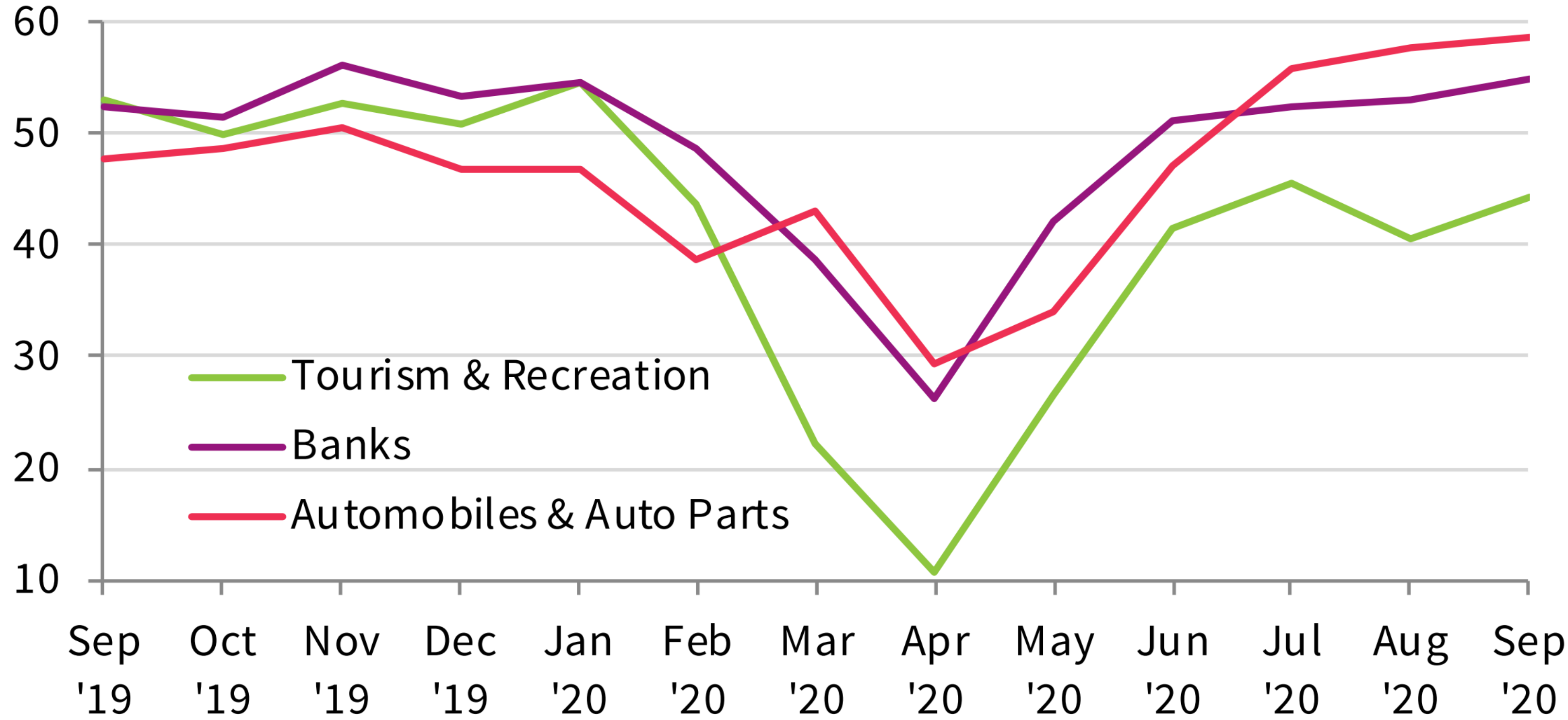


Source: National Bureau of Statistics of China, October 2020

Strong Rebound of Automotive Sector

Global Output / Business Activity Index

sa, >50 = growth since previous month

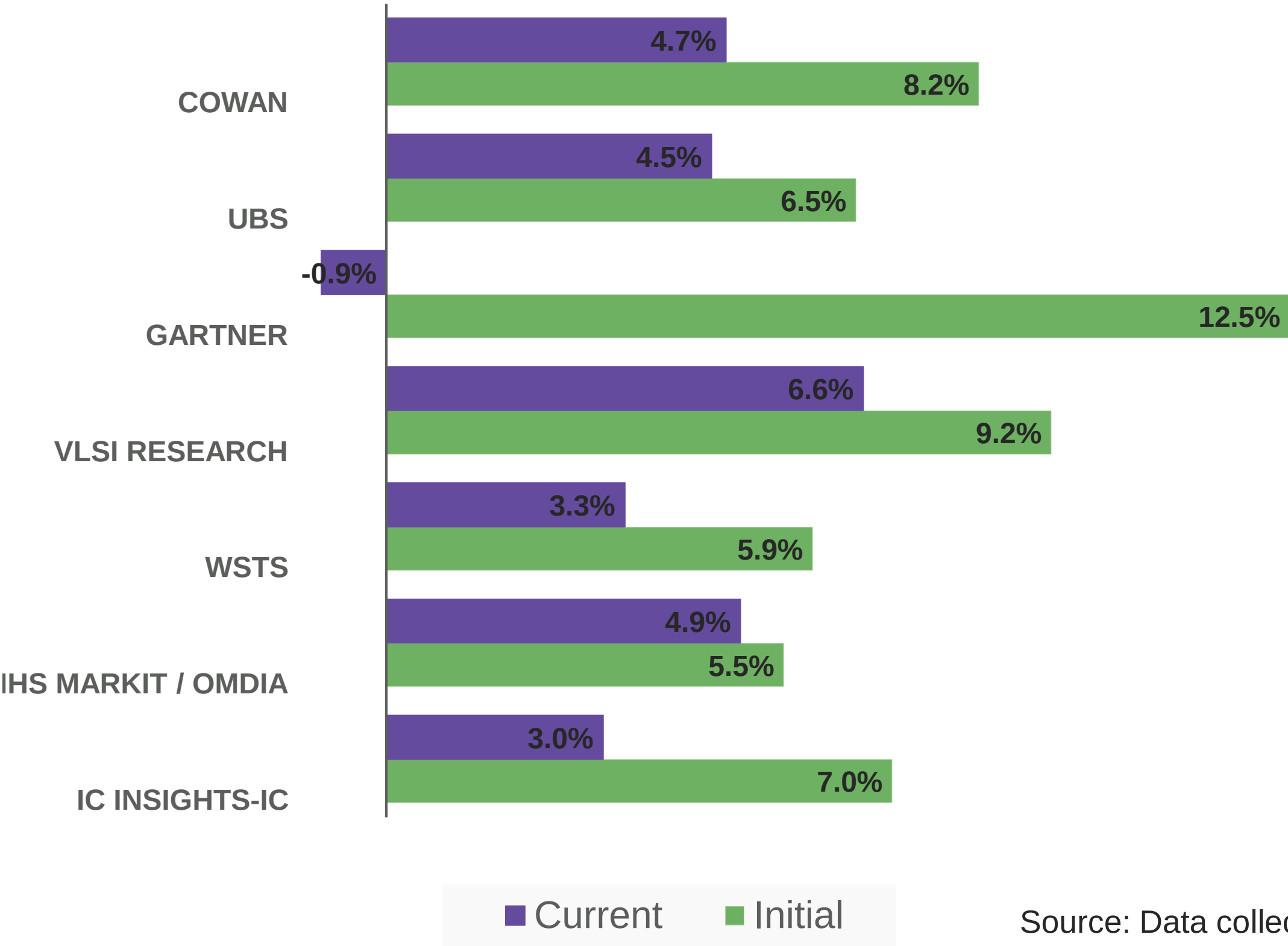


Source: IHS Markit.

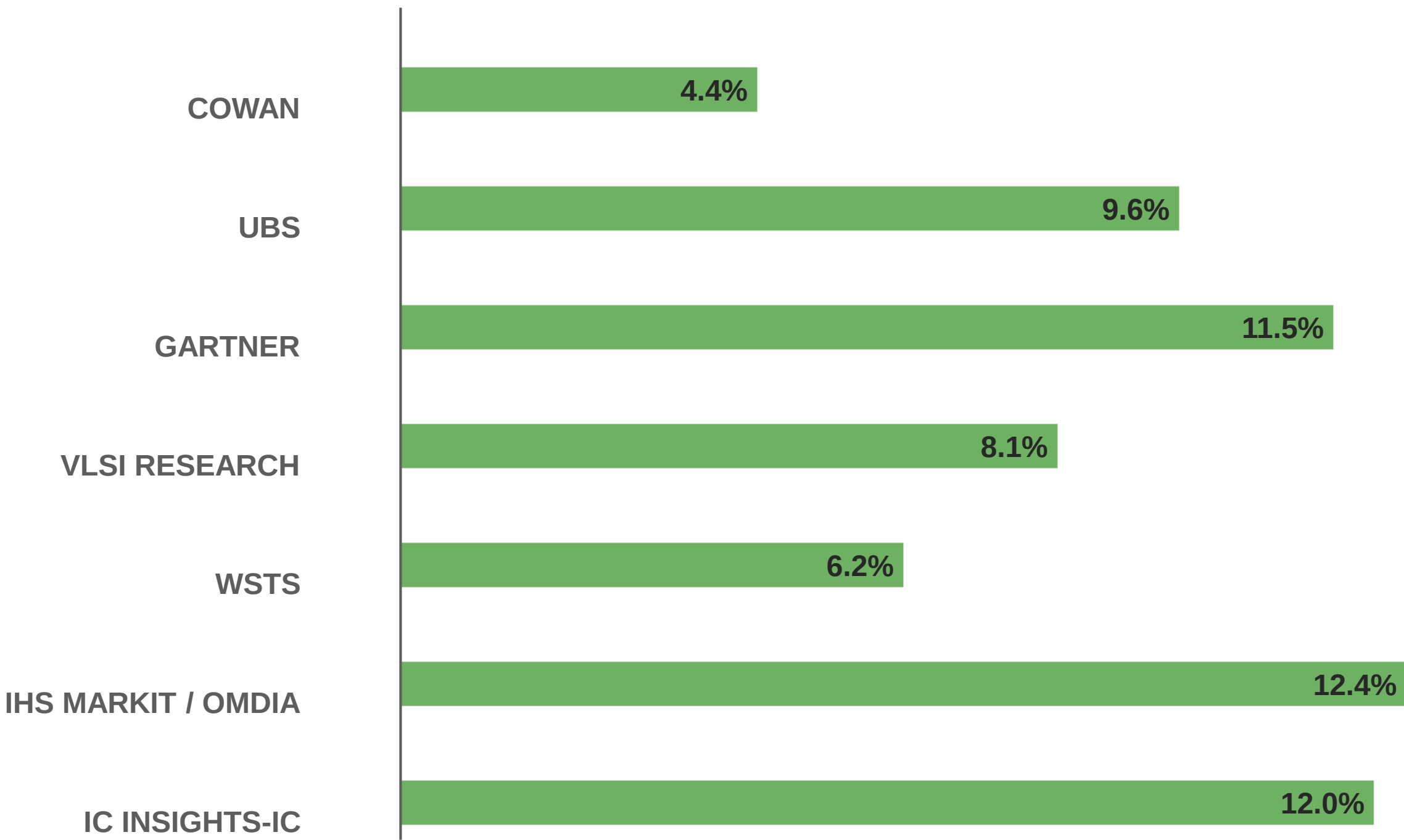


Semiconductor Market Forecasts – 2020 & 2021

Forecast for 2020 changed from avg. +8% to **+3.5%**



2021 Semiconductor forecast average **+9%**



Source: Data collection by SEMI, October 2020

Headwinds in 2020 may Continue into 2021

COVID-19

- COVID-19 Impact: Negative impact across most end-markets in 2Q20 and 3Q20, except for data center and PC.
- We still expect demand to improve in the coming quarters. However, as resurgence of cases continue to emerge, that could lead to economies partially closing again and impacting the pace of recovery.
- However, COVID-19 accelerates digital transformation of the many businesses and services throughout the world.
- Semiconductor is resilient to the pandemic and benefits from COVID-driven transformations

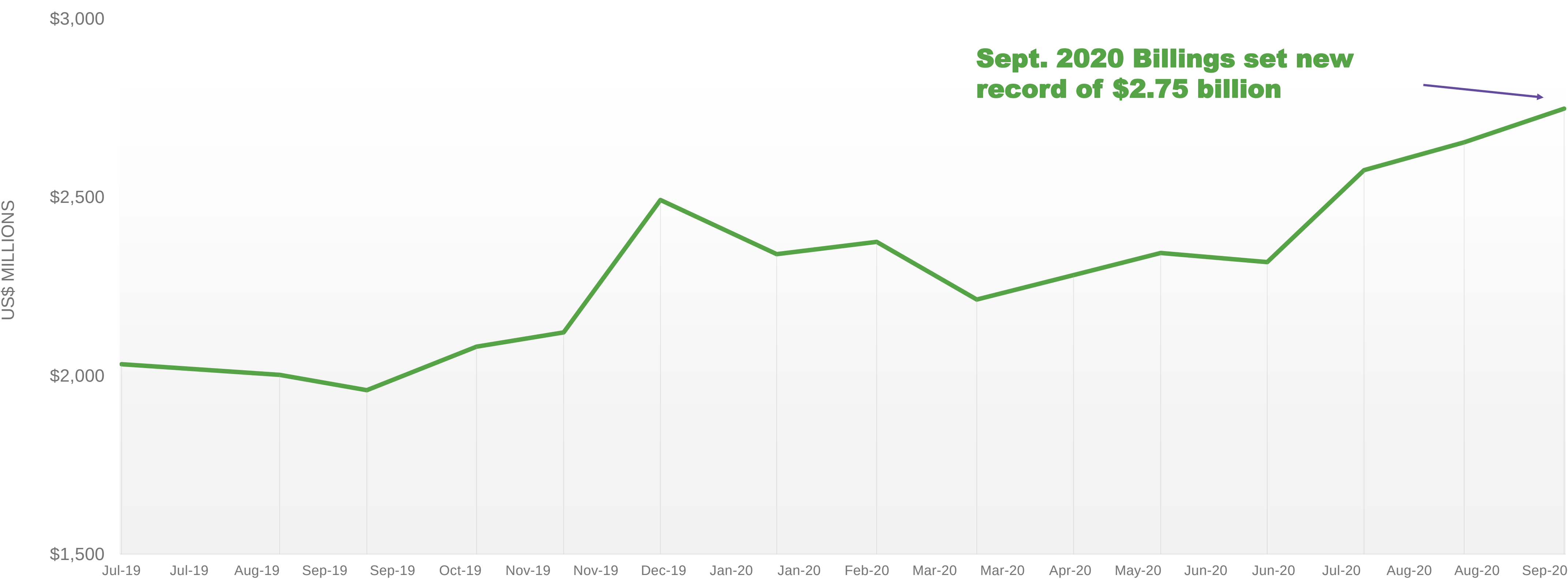
Geopolitical Tensions & Techno-Nationalism

- New U.S. export restrictions to China add substantial uncertainty to the semiconductor supply chain
- Restriction on Huawei will have a short-term impact to the supply chain. The market shall normalize in the next few quarters.
- The restrictions upon Huawei have accelerated the pace of localization for major Chinese OEMs
- The rise of techno-nationalism will accelerate the reshoring of the supply chain: Reshoring will not only happen to end-products but also extend upstream to semiconductor manufacturing.

Semiconductor Equipment Market

Monthly Billing Trend – *NA Billings Strength Continue into 3Q 2020*

Billings of North American Equipment Suppliers



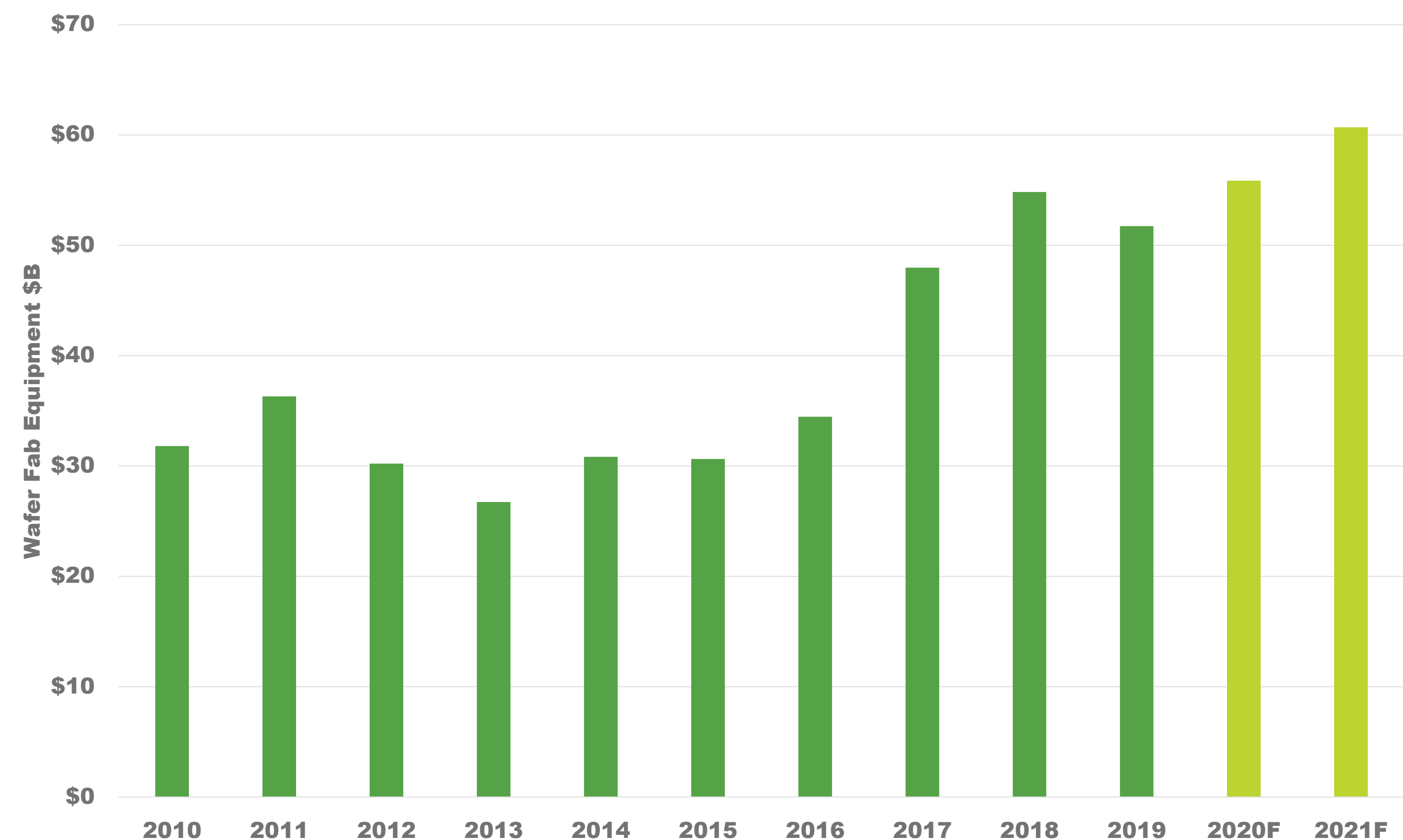
Source: SEMI Equipment Market Data Subscription, September 2020

Wafer Fab Equipment Market

Wafer fab equipment market size has expanded from ~\$30B in the first half of 2010s to ~\$50B in the past three years

Equipment billings in 2020 will be higher than current forecast supported by advanced logic and foundry investment.

2021 WFE market is projected to grow mid single digit % to set a record of \$61B driven by memory spending recovery, leading-edge foundry and logic investments



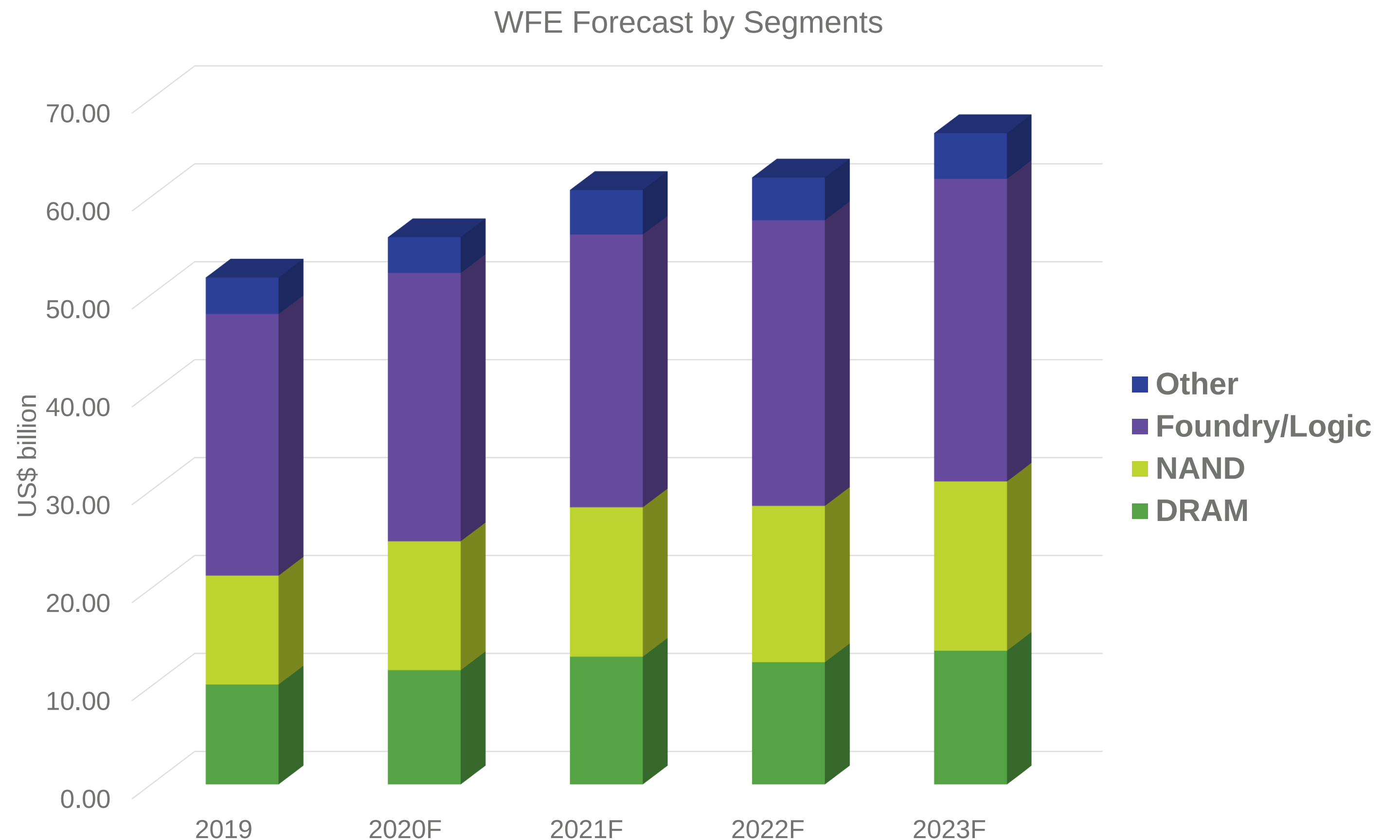
Source: SEMI Equipment Market Data Subscription, September 2020

Wafer Fab Equipment Market by Product Segment

Overall WPE market is expected to show healthy growth in the next few years. 2021/2022 WPE market size will surpass \$60B and is projected to exceed **\$65B in 2023**

Both **DRAM** and **NAND** spending are expected **to increase mid-teen% in 2021** and remain robust in the following years.

Foundry and Logic spending is expected to reach **~\$30B** in 2022 and 2023.



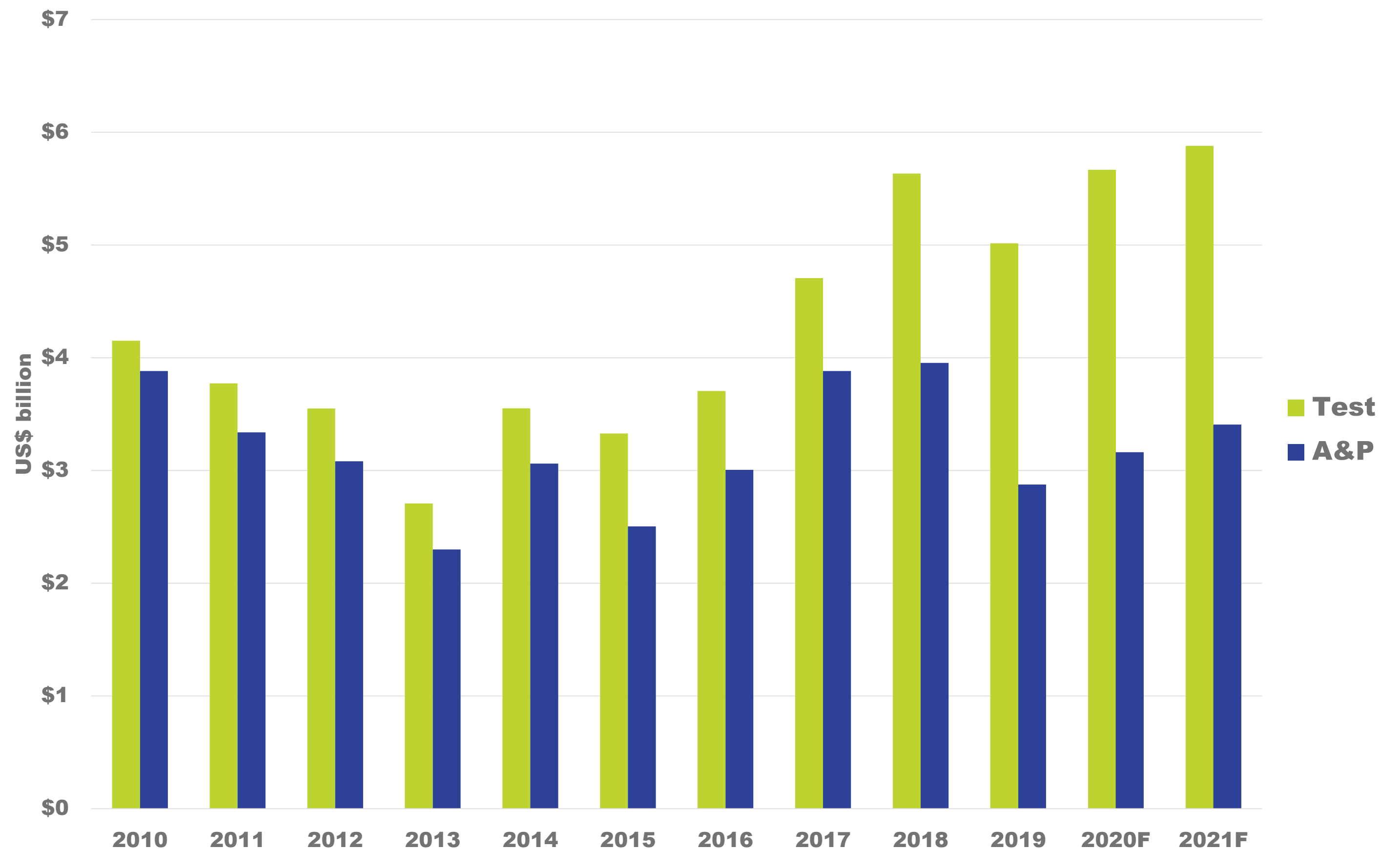
Source: SEMI WFE Forecast, September 2020

Test and Assembly/Packaging Equipment Market

2020 **Test equipment** market is expected to **grow over 10%** and the momentum will continue in 2021

Test equipment growth is primarily driven by **5G and HPC**, which are the multi-year drivers of the industry

Assembly & Packaging equipment is forecasted to **grow over 10% in 2020** and +8% in 2021 driven by **advanced packaging** and **wire-bonding** capacity build



Source: SEMI Equipment Market Data Subscription, July 2020

Semiconductor Materials Market

Silicon Wafer Shipment Trend



Source: SEMI SMG, October 2020

- Year-to-date through 3Q20 wafer shipment increased **2.7%** Year-over-Year
- **2Q 2020** shipment **rebounded 8% QoQ**, driven by various demands pick-up and partially for the safety stock build-up
- **3Q 2020** shipment **declined 0.5% QoQ** as demand for memory (polished wafer) was weaker than expected
- Overall pricing pressure could continue into early part of 2021 except for 300mm epi-wafers

Total Semiconductor Materials Market

Stable 2020 and Record 2021

Materials market exceeded \$50B since 2018 driven by shipment growth and advanced process requirements in both wafer fab and packaging facilities

Overall Materials market flat in 2020 with wafer fab material expected to **decline 0.5%** while packaging materials to **grow 2%**

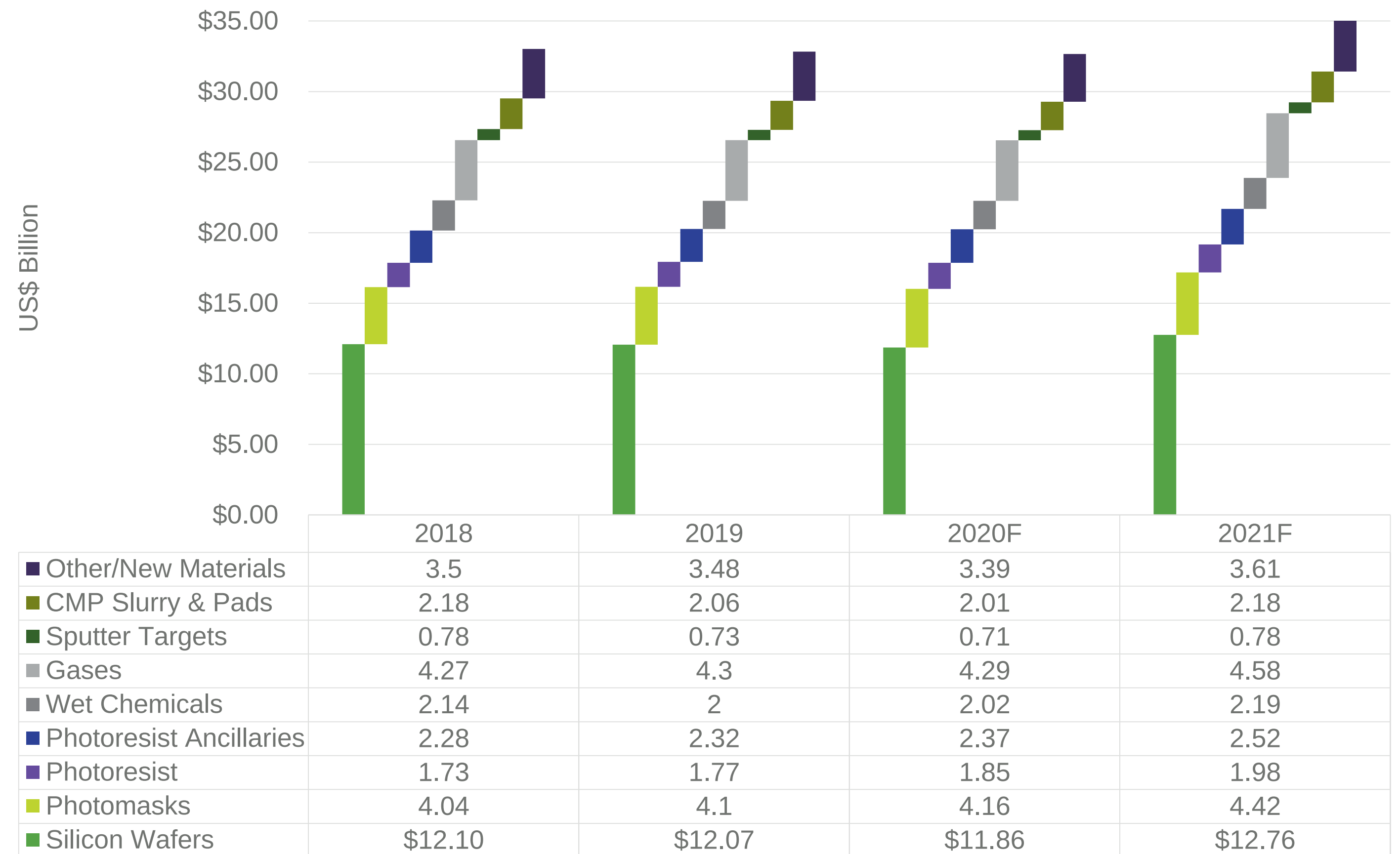
Expect **~6% growth** to set a record high in **2021** surpassing **\$55B**



Source: SEMI Materials Market Data Subscription, September 2020

Wafer Fab Materials Forecast

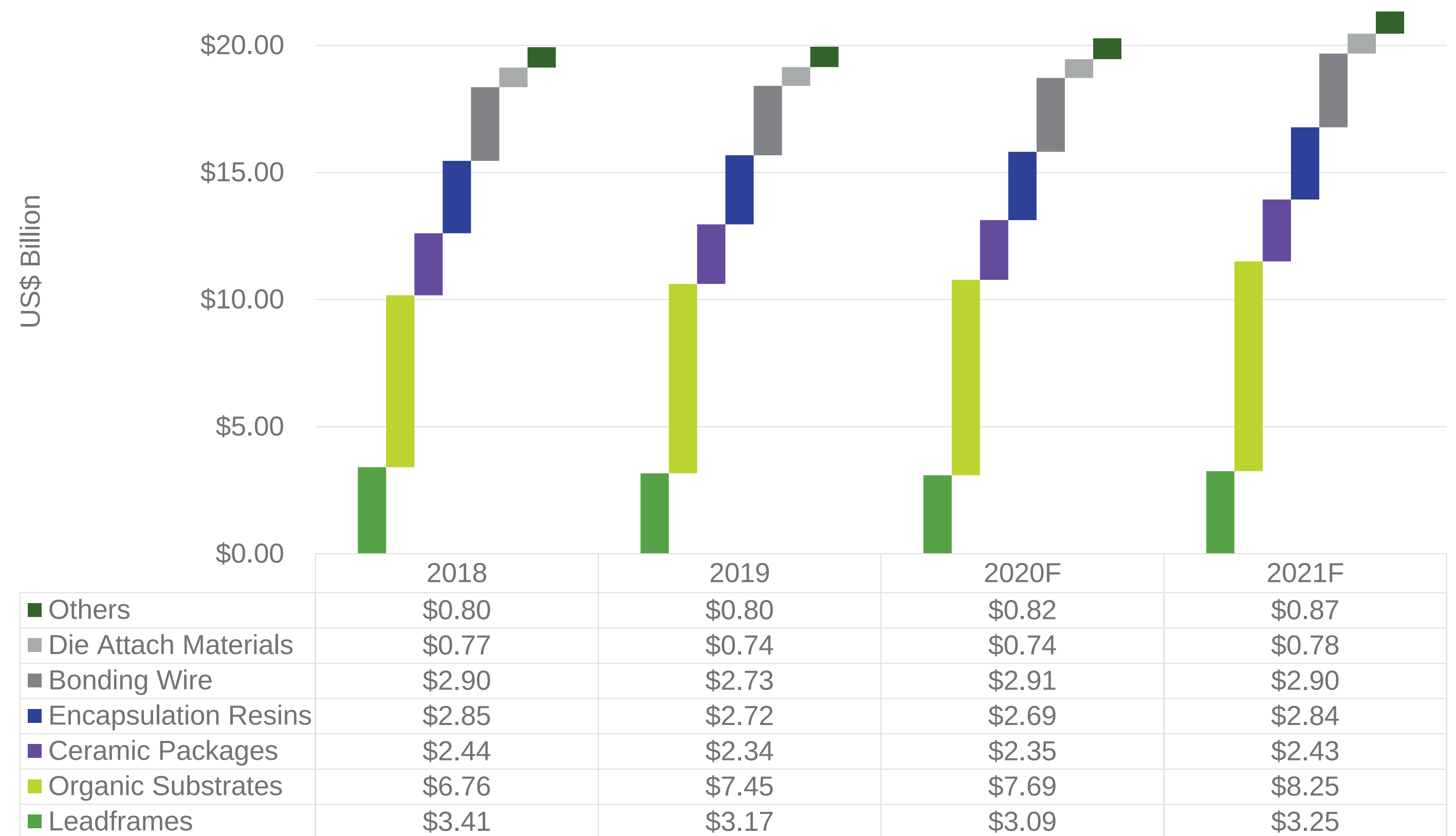
- Wafer Fab Materials is projected to decline 0.5% in 2020 but **rebound 7% in 2021**
- Silicon wafer market are under pressure this year and shall see improvement in both shipment and revenue in 2021
- Most other materials are seeing growth this year with stronger growth expected in 2021 from **Photomask, Wet Chemicals, Photoresist and Ancillaries**



Source: SEMI Materials Market Data Subscription, September 2020

Packaging Materials Forecast

- Packaging Materials will grow **2%** in 2020 and **5%** in 2021
- **Substrate** continues to show strength driven advanced packaging adoption in HPC and 5G
- **Leadframe** is forecast to decline 3% this year but rebound 5% in 2021
- Ceramic Packages and Encapsulation Resins will also see soft 2020 and recovery in 2021



Source: SEMI Materials Market Data Subscription, September 2020

Recent Development & Summary

Recent Development

Restriction to SMIC

- SMIC accounts for about 7.5% of worldwide foundry capacity and even a higher % in mature nodes; SMIC accounts for about 7.5% of WFE market in 2020
- Real impact is still under evaluation. Existing capacity may not be affected
- It may impact new tools orders and SMIC's leading-edge expansion (though, SMIC just announce its N+1 tape-out)
- We expect significant decline of SMIC's fab spending in 2021
- However, opportunities emerge for non-U.S. tool suppliers

SK Hynix's Acquisition of Intel NAND Flash

- No immediate impact to supply/demand
- The acquisition provides SK Hynix access to enterprise SSD market
- Dalian fab provides instant capacity addition (>80K), economy of scale and room for future expansion
- Big plus for Korean equipment suppliers in the long run for future capacity expansion and technology migration
- Maybe related to U.S.-China tension as Tsinghua Unigroup was considered the forerunner of Intel's NAND flash business

Foundry and DRAM Markets

Foundry

- Foundry industry is expected to see 20% growth in 2020 driven by digital transformation and WFH/LFH.
- All technology nodes are seeing strong demand, except for 28nm.
- As SMIC customers explore alternative foundry sources, we've seen sudden foundry demand spike in recent months.
- 200mm capacity are especially in tight supply with demand from PMIC, DDI, MCU, Sensors (SMIC has about 9% of global 200mm foundry capacity)

DRAM

- DRAM price decline to continue into 4Q20 (~10%) due to elevated inventory
- Though there is a pause of server-related (memory) procurement in 2H20, cloud/server demand is poised to improve in the coming quarters from U.S. and China customers.
- Mobile DRAM demand a tad better than server. Higher 5G phone penetration provides some upside in 2021
- PC DRAM is better than expected as laptop/chromebook demand strength will continue into 1Q21.
- DRAM price is expected to bottom out and recover in 1Q21

Summary

Near Term Concerns

- Industry Headwinds
 - The resurgence of COVID-19 cases will greatly slow down the reopening of economies
 - The ongoing trade & geopolitical tensions (U.S.-China, China-India) and the U.S. elections will contribute to regulatory uncertainty that could persist for years to come
- Macro uncertainty impacting 2021 demand
- After Huawei's stockpiling, an elevated inventory level seems to become a norm, which is a risk
- Further trade restrictions will have negative impact to the capital equipment and material industries

Market Drivers

- We remain positive on 2021 forecasts for Electronics and IC sales
- Datacenters, HPC and AI are still the key industry drivers
- Laptop/Server demand strength is expected to continue into 2021
- 5G adoption may be slower than expected this year. Long-term growth prospective remain solid
- Massive government stimulus packages will continue to boost the recovery
- Both semiconductor equipment and material markets are expected to grow next year

Q & A
