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Global Supply Chains

Supply Chain Chokepoint Tracker and Inflection Monitor – Bullwhip Effects Broadening

Supply dynamics are improving, while weaker demand is accelerating the healing and leading segments like memory, apparel and tech hardware to de-stock in a traditional bullwhip pattern. However, European gas and energy-intensive goods remain scarce, affecting growth and margins.

From supply anxiety to inventory overhang: We update our regular tracker of key bottleneck products/services as part of our Blue Paper series on [Global Supply Chains – Repair, Restructuring, and Investment Implications](#). In our research, we noted that investors should mind the bullwhip effects, which can occur given "orders had surged amid anxiety about sourcing product, thus inflating backlogs and setting the scene for a sharper-than-expected short-term unwind, particularly for consumer electronics and segments facing demand destruction risk."

Tech/Consumer at sharp end of adjustment: This effect is evident in the sharp change of order momentum since June, with de-stocking observed by our analysts in segments like PC/smartphone and associated components (memory, display). Previously favoured tech segments like [MLCC](#), [ABF substrate](#) and [cloud semis](#) have also underperformed as backlogs ease and investment growth becomes more uncertain.

But bottlenecks remain in energy and specialist components: However, conditions remain stressed in European gas markets and inflation in energy-intensive goods (such as glass) is affecting margins and exacerbating recessionary conditions. While our commodity strategists have trimmed their oil price forecasts, they see little respite for European winter gas prices without a de-escalation in the Russia-Ukraine conflict (see [European Gas Manual: Industrial Demand Under Pressure](#)). Separately, Auto and Industrial supply chains are still facing shortfalls in supply of components such as analog semis and PMICs, which are preventing a full volume recovery.

Recommendations: We remain cautious on the semis/hardware cycle, now including segments that investors have seen as secular growth, including cloud/HPC/semi cap. Upstream energy remains preferred across our global equity strategy teams, given ongoing restructuring of supply lines.

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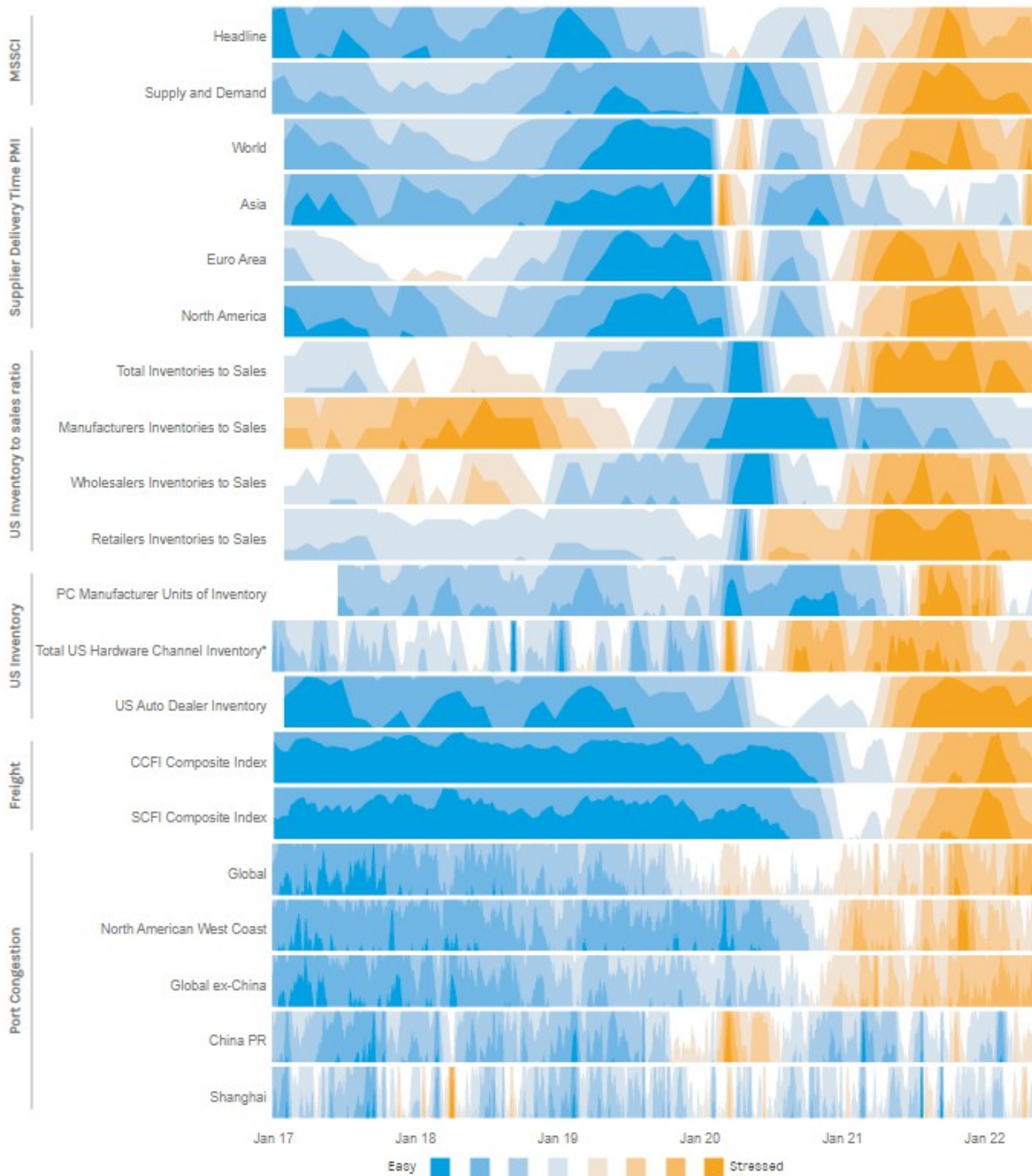
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Primary Chokepoint Dashboard

Exhibit 1: Supply Chain Conditions Gallery Summary (Blue = Easy, Orange = Stressed)

Indicators showing easy or stressed supply chain conditions.



Source: Various sources, Morgan Stanley Research. Note: *Total US Hardware Channel Inventory ex-PCs Units. MSSCI = Morgan Stanley Supply Chain Index; CCFI = China Containerized Freight Index; SCFI = Shanghai Containerized Freight Index. Please see [Supply Chain Conditions Gallery](#) for more.

Identifying inflections in supply-chain dynamics requires a global perspective and deep industry knowledge to separate the primary causes and the secondary effects in the highly interconnected global trading system. As part of our Blue Paper series on supply chains, we worked with our global research team to identify the primary chokepoints in the global economy and revisit these in this periodic tracker.

We also provide a [Supply Chain Conditions Gallery](#) and summarise them in [Exhibit 1](#) above, ranging from most benign/easy in blue to most backlogged/stressed in orange (based on their own historical range from 2017-current). This "horizon" chart shows some easing of port congestion (lower panel) and US PC and tech hardware inventory has loosened. Aggregate delivery times are improving slightly, but remain far longer than usual.

Revisiting Our Morgan Stanley Chokepoint Dashboard

On the primary chokepoints, we provide a global dashboard outlining our industry analysts' view on the severity (1-10 scale based on quarterly supply/demand imbalance) on a quarterly basis out to 4Q22, with their assessments of highly disrupted conditions in 3Q21 available as a reference point.

A score of 10/10 reflects a severe shortfall of production relative to orders; for instance, as seen during the lockdowns imposed across Southeast Asia on semiconductor assembly/testing (back-end foundry). Scores around 5/10 are consistent with balanced supply/demand conditions.

In this dashboard, our analysts have also outlined their outlooks for industry pricing vs. pre-Covid average levels over 2022, identifying key listed producers of products/services in these categories that would be affected by these pricing dynamics.

In this update, our analysts have lowered their perspectives on tightness of the ABF substrate and US trucking market, and while the TransPacific shipping lanes were seen to be healthier in 2Q, China's production recovery after the most extensive Covid lockdowns is expected to see a little more congestion on Far East-EU and intra-Asia lanes.

Exhibit 2: Morgan Stanley Chokepoint Dashboard

As of June 28, 2022		Estimated Bottleneck Severity (1-10)						Pricing vs pre-Covid Average (%)						Key Listed
Segment	End Markets	3Q21	4Q21E	1Q22E	2Q22E	3Q22E	4Q22E	3Q21	4Q21E	1Q22E	2Q22E	3Q22E	4Q22E	Producers
Semiconductors														
Mobile Controller Units (MCU)	Auto	10	9	8	7	6	5	20%	25%	25%	25%	23%	23%	4919.TW, STM.PA, IFXGn.DE, 6723.T, NXPI.O, MCHP.O, TXN.O
Power Management Integrated Circuits (PMIC)	Industrial / Auto / HPC / Consumer Elec.	10	9	8	7	6	5	55%	60%	60%	55%	30%	20%	6415.TW, NXPI.O, MCHP.O, TXN.O, ADI.O, ON.O
Leading Edge Foundry	Industrial / Auto / HPC / Consumer Elec.	9	9	8	8	8	8	15%	20%	22%	22%	20%	18%	2330.TW
Legacy Foundry	Industrial / Auto / HPC / Consumer Elec.	10	10	8	7	6	6	40%	45%	50%	45%	40%	20%	2303.TW, 5347.TWO, 6770.TW, 1347.TW, GFS.O
Outsourced Semiconductor Assembly and Testing (OSAT)	Industrial / Auto / HPC / Consumer Elec.	9	8	7	6	5	5	10%	10%	9%	8%	7%	6%	3711.TW, 600584.SS, 2449.TW
ABF Substrate	PC / HPC / Cloud / Auto	10	10	10	9	6	5	60%	65%	70%	75%	80%	80%	8046.TW, 3037.TW, 3189.TW, 4062.T, 6967.T, 009150.KS, AT&S (NC)
Transport / Logistics														
TransPacific	Consumer / Industrial	9	10	6	6	7	6	180%	210%	230%	240%	220%	170%	1919.HK, 9104.T, 9107.T, 9101.T, MAERSKb.CO, HLAG.DE
Far East-EU (Suez)	Consumer / Industrial	9	10	5	5	6	4	410%	430%	450%	410%	280%	270%	1919.HK, 9104.T, 9107.T, 9101.T, MAERSKb.CO, HLAG.DE
Intra-Asia (Malacca)	Consumer / Industrial	4	6	5	5	6	5	80%	120%	160%	160%	120%	100%	1308.HK
Air Freight	Consumer / Industrial	10	10	9	8	5	2	250%	200%	150%	100%	50%	20%	UPS.N, FDX.N, CHR.W.O, EXPD.O
US Trucking	Consumer / Industrial	10	10	9	7	6	5	135%	140%	135%	135%	130%	125%	KNX.N, WERN.O, SNDR.N, ODFL.O

E = Morgan Stanley Research estimates Source: Morgan Stanley Research. Note pricing trends are indicative and reflect our expectation of aggregate trends across the sector, with further detail available in stock/industry research. Shipping prices are for spot prices, which account for about 50% of the market; Air freight pricing represents those for peak routes; US trucking prices represent blended spot and contract rates.

Exhibit 3: Recent Changes to Our Analysts' Estimates of Bottleneck Severity for the Remainder of 2022



Source: Morgan Stanley Research (E) estimates

Chokepoint Company Valuation and Performance Trends

Here we summarise the valuations and aggregate performance trends of companies that produce goods and services in segments that we identify as bottlenecks in global supply chains.

Exhibit 4: Summary of Companies with Revenue Exposure to Chokepoint Segments

Company Name	Ticker	MS Rating	Market	Chokepoint Segment	Mkt Cap (US\$bn)	Last Price (LC)	Upside to TP (%)	P/E	P/BV	ROE	P/S	MS Analyst
								2022E	2022E	2022E	2022E	
Nuvoton Technology Corporation	4919.TW	OW	Taiwan	MCU (Mobile Controller Units)	2	130	29.2%	15.0x	3.7x	25.0%	1.1x	Yen, Daniel
STMicroelectronics	STM.PA	NC	Netherlands	MCU (Mobile Controller Units)	32	34	-	-	-	-	NA	-
Infineon Technologies	IFXGn.DE	NC	Germany	MCU (Mobile Controller Units)	33	25	-	-	-	-	NA	-
Renesas Electronics	6723.T	OW	Japan	MCU (Mobile Controller Units)	19	1353	47.8%	6.2x	1.9x	30.3%	1.8x	Yoshikawa, Kazuo
NXP Semiconductor NV	NXPI.O	EW	USA	MCU / PMIC	47	175	2.8%	12.7x	9.6x	75.2%	3.6x	Moore, Joseph
Microchip Technology Inc.	MCHP.O	OW	USA	MCU / PMIC	38	65	25.2%	12.7x	5.6x	44.1%	6.4x	Moore, Joseph
Texas Instruments	TXN.O	UW	USA	MCU / PMIC	155	164	-5.4%	19.0x	10.2x	53.5%	8.3x	Moore, Joseph
Silergy Corp.	6415.TW	UW	Taiwan	Power Management Integrated Circuits (PMIC)	2	615	-10.6%	30.6x	1.9x	6.3%	2.0x	Chan, Charlie
Analog Devices Inc.	ADI.O	EW	USA	Power Management Integrated Circuits (PMIC)	66	163	6.0%	17.7x	2.2x	12.7%	5.6x	Moore, Joseph
ON Semiconductor Corp.	ON.O	EW	USA	Power Management Integrated Circuits (PMIC)	27	59	-5.8%	12.4x	3.9x	31.3%	3.5x	Moore, Joseph
SMC	2330.TW	OW	Taiwan	Leading Edge Foundry	434	503	55.1%	13.4x	4.5x	34.0%	5.8x	Chan, Charlie
UMC	2303.TW	OW	Taiwan	Leading Edge Foundry, Legacy Foundry	17	42	36.6%	6.6x	1.7x	25.0%	1.9x	Chan, Charlie
Vanguard International Semiconductor	5347.TWO	EW	Taiwan	Legacy Foundry	4	75	6.4%	7.6x	2.8x	37.6%	2.1x	Chan, Charlie
Powerchip Semiconductor Manufacturing	6770.TW	UW	Taiwan	Legacy Foundry	4	42	-21.0%	6.5x	1.3x	26.9%	1.6x	Wu, Ray
Hua Hong Semiconductor Ltd	1347.HK	OW	China	Legacy Foundry	4	26	33.3%	12.9x	1.6x	12.1%	1.7x	Wu, Ray
GlobalFoundries Inc	GF5.O	OW	USA	Legacy Foundry	27	48	49.5%	20x	2.9x	14.1%	3.4x	Moore, Joseph
ASE Technology Holding Co. Ltd.	3711.TW	EW	Taiwan	Outsourced Semi Assembly and Testing (OSAT)	13	85	5.6%	7.5x	1.3x	16.9%	0.6x	Chan, Charlie
Jiangsu Changjiang Electronics Tech	600584.SS	UW	China	Outsourced Semi Assembly and Testing (OSAT)	6	25	-15.5%	17.4x	1.9x	11.0%	1.4x	Chan, Charlie
King Yuan Electronics Co Ltd	2449.TW	EW	Taiwan	Outsourced Semi Assembly and Testing (OSAT)	2	39	3.4%	7.1x	1.3x	17.8%	1.3x	Liu, Dylan
Nan Ya PCB	8046.TW	EW	Taiwan	ABF Substrate	6	279	50.8%	9.9x	3.5x	35.3%	2.7x	Kao, Howard
Unimicron	3037.TW	EW	Taiwan	ABF Substrate	9	177	35.6%	9.5x	3.0x	31.8%	1.9x	Kao, Howard
Kinsus Interconnect Tech.	3189.TW	EW	Taiwan	ABF Substrate	2	145	27.6%	9.2x	1.7x	18.7%	1.4x	Kao, Howard
Ibiden	4062.T	UW	Japan	ABF Substrate	4	4040	-23.3%	14.1x	1.4x	10.1%	2.1x	Sato, Shoji
Shinko Electric Industries	6967.T	UW	Japan	ABF Substrate	3	3505	-17.3%	9.3x	2.0x	21.8%	2.9x	Sato, Shoji
Samsung Electro-Mechanics	009150.KS	UW	S. Korea	ABF Substrate	8	143000	-2.1%	10.8x	1.5x	13.7%	1.1x	Kim, Shawn
COSCO Shipping Holdings Ltd	1919.HK	OW	China	TransPacific / Far-East-EU Transport	31	12	49.6%	1.6x	0.7x	46.8%	0.4x	Fan, Qianlei
Mitsui O.S.K. Lines	9104.T	OW	Japan	TransPacific / Far-East-EU Transport	9	3510	73.8%	1.4x	0.7x	47.7%	1.0x	Osaka, Takuya
Kawasaki Kisen	9107.T	OW	Japan	TransPacific / Far-East-EU Transport	7	9840	106.3%	1.0x	0.6x	57.1%	1.0x	Osaka, Takuya
Nippon Yusen	9101.T	OW	Japan	TransPacific / Far-East-EU Transport	13	10360	88.2%	1.4x	0.7x	51.9%	0.8x	Osaka, Takuya
AP Moller-Maersk	MAERSK.CC	OW	Denmark	TransPacific / Far-East-EU Transport	49	18195	31.9%	2.0x	0.8x	39.9%	0.6x	Dores, Carolina
Hapag Lloyd AG	HLA.G.DE	UW	Germany	TransPacific / Far-East-EU Transport	51	283	-22.4%	3.6x	2.3x	64.5%	1.7x	Thrum, Alexandra
SITC International Holdings Company	1308.HK	OW	China	Intra-Asia Transport	9	27	60.5%	5.0x	4.1x	82.9%	2.2x	Fan, Qianlei
United Parcel Service	UPS.N	UW	USA	Air Freight Transport	165	188	-21.3%	15.1x	8.2x	54.2%	1.6x	Shanker, Ravi
FedEx Corporation	FDX.N	EW	USA	Air Freight Transport	60	227	12.2%	11.0x	2.0x	17.8%	0.6x	Shanker, Ravi
C.H. Robinson Worldwide Inc.	CHRW.O	UW	USA	Air Freight Transport	14	102	-38.2%	16.7x	6.1x	36.4%	0.6x	Shanker, Ravi
Expeditors International of Washington	EXPD.O	UW	USA	Air Freight Transport	17	101	-7.1%	14.7x	4.4x	29.7%	1.1x	Shanker, Ravi
Knight-Swift Transportation Holdings Inc	KNX.N	OW	USA	US Trucking Transport	8	51	66.1%	9.4x	1.2x	12.4%	1.1x	Shanker, Ravi
Werner Enterprises	WERN.O	OW	USA	US Trucking Transport	3	41	76.4%	10.9x	1.8x	16.7%	0.9x	Shanker, Ravi
Schneider National Inc.	SNDR.N	OW	USA	US Trucking Transport	4	24	62.3%	9.0x	1.5x	16.6%	0.6x	Shanker, Ravi
Old Dominion Freight Line Inc	ODFLO	EW	USA	US Trucking Transport	32	279	11.1%	24.6x	7.5x	30.3%	5.0x	Shanker, Ravi

Source: RIMES, Factset, Morgan Stanley Research. Data as of July 22, 2022.

Exhibit 5: Performance of Equal-weighted Basket of Companies with Revenue Exposure to Chokepoint Segments vs. MSCI ACWI

US\$ Total Return Relative to MSCI ACWI, Rebased to 100 = Jan 2020



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Source: FactSet, RIMES, Morgan Stanley Research. Data as of July 22, 2022.

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Supply Chain Conditions Gallery

Supply Chain Indices

Our Global Economists recently developed an index to keep track of supply chain disruptions, the **Morgan Stanley Supply Chain Index (MSSCI)**. The MSSCI summarizes 33 series across shipping costs, delivery times, and backlogs using Principal Components Analysis (PCA). It builds on the structure the New York Fed Global Supply Chain Pressure Index (GSCPI), which uses shipping cost data and information from Purchase Manager Index (PMI) surveys, but adds global shipping cost measures that our equity analysts follow closely. Please see [Global Economics: Global Trade Monitor](#), January 12, 2022, for a brief description.

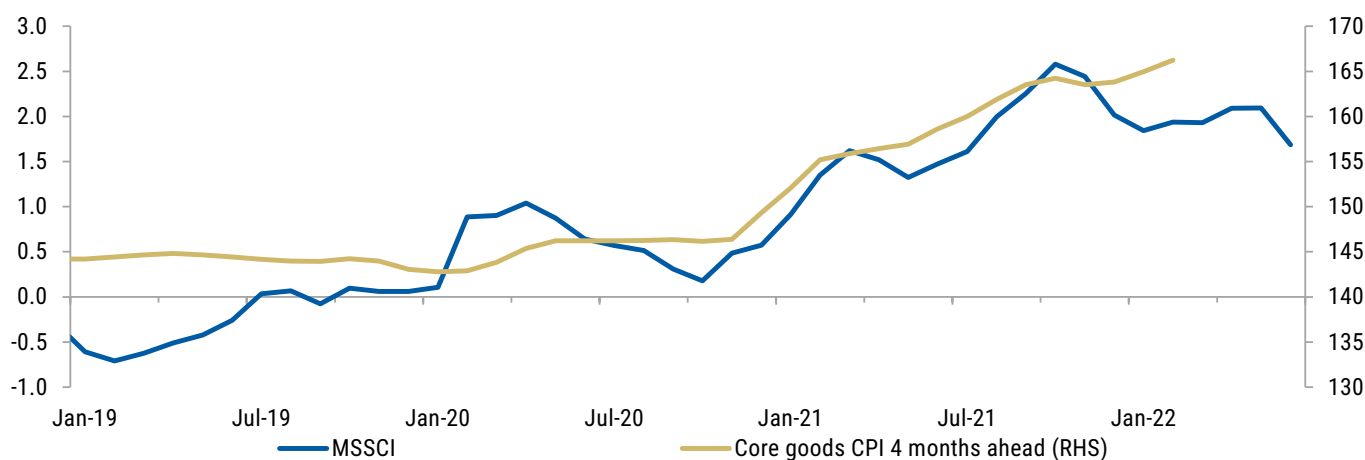
The Morgan Stanley Supply Chain Index (MSSCI) decreased for the first time this year.

The MSSCI dropped 20% MoM in June reflecting a meaningful reduction in supply-side bottlenecks. In particular, the decrease is explained by: (i) a noticeable improvement in the Baltic Exchange Dry Index, which measures the cost of transporting raw materials by sea; and (ii) a decrease in delivery times and backlogs in almost every country covered by the index, with China showing the largest improvement. Supply chains are still under stress, and the MSSCI is far above pre-Covid levels, but its recent print confirms a gradual decrease from its peak in Oct-21.

Supply-side easing also decreased "MSSCI supply and demand" which shows a smoother and more steady improvement due to global demand slowdown.

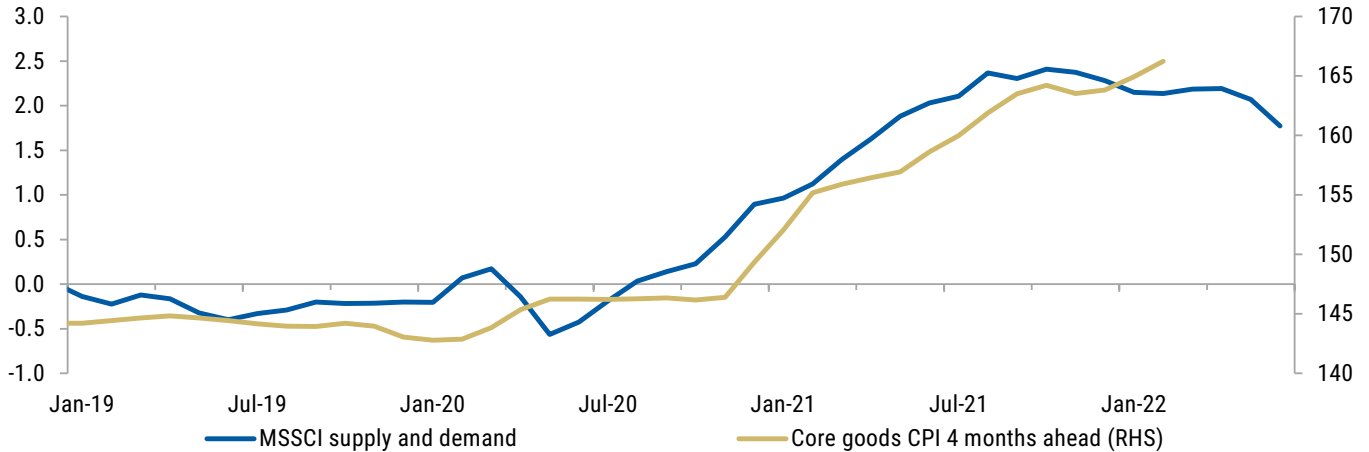
"MSSCI supply and demand" is affected by the interplay of supply and demand and, therefore, the gradual decrease in demand in the recent months explains the more persistent path without reversals. Global demand components, like PMI new orders and purchases, continue to show deceleration and will likely push the index downwards in the coming months. Please see [Global Economic Briefing: MSSCI: Significant supply-side improvement](#), July 18, 2022, for more detail.

Exhibit 6: Morgan Stanley Supply Chain Index (MSSCI): Dropped 20% MoM in June reflecting a meaningful reduction in supply-side bottlenecks



Source: Haver, Alphaliner, BLS, Morgan Stanley Research

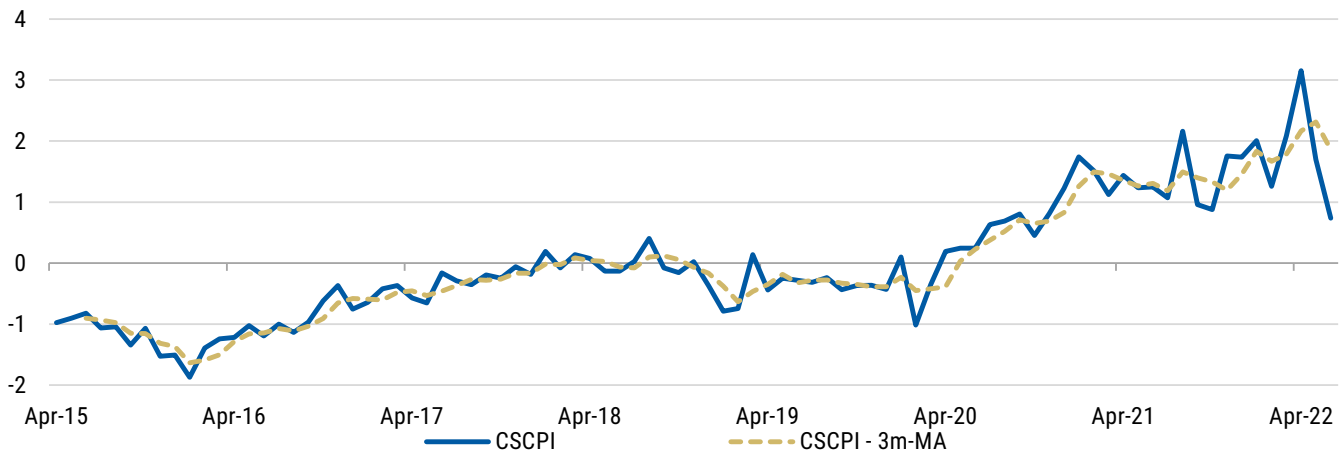
Exhibit 7: MSCI Supply Chain and Demand Index: A smoother and more steady improvement due to global demand slowdown



Source: Haver, Alphaliner, BLS, Morgan Stanley Research

Drawing on the work of the New York Fed as well as our global colleagues, our Asia Economics team constructed a China Supply Chain Pressure Index, allowing us to track the extent of supply chain disruptions. The index further eased in June which also supports the team's view that non-commodity PPI has already eased off its highs, and they expect the downward trend to continue, easing import prices elsewhere in the world, especially for the US. Please see [Asia Economics: The Viewpoint: Asia's Inflation Risks Have Peaked](#), Jul 6, 2022, for more.

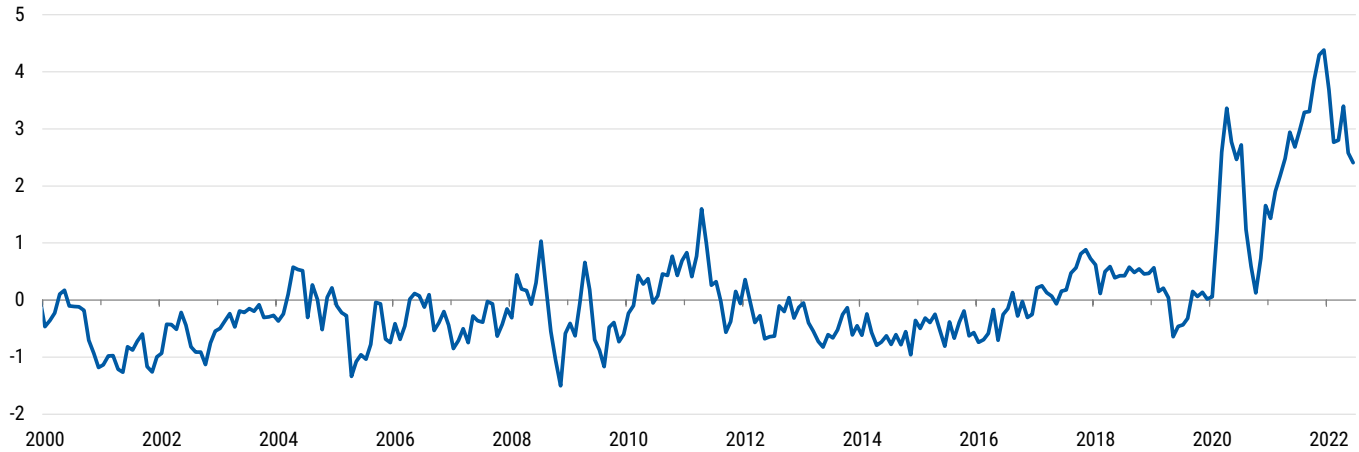
Exhibit 8: Morgan Stanley China Supply Chain Pressure Index: Supply chain pressures are easing



Source: Morgan Stanley Research. Note: We construct the MS China Supply Chain Pressure Index according to the NY Federal Reserve team index. This index was first published in our note: [Asia Economics: Spillovers from China's Strict Covid Management Approach](#), April 28, 2022.

We also look at the Global Supply Chain Pressure Index as computed by the New York Fed and see that Global supply chain pressures continued their decline in June. See [New York Fed Global Supply Chain Pressure Index](#) for more.

Exhibit 9: New York Fed Global Supply Chain Pressure Index

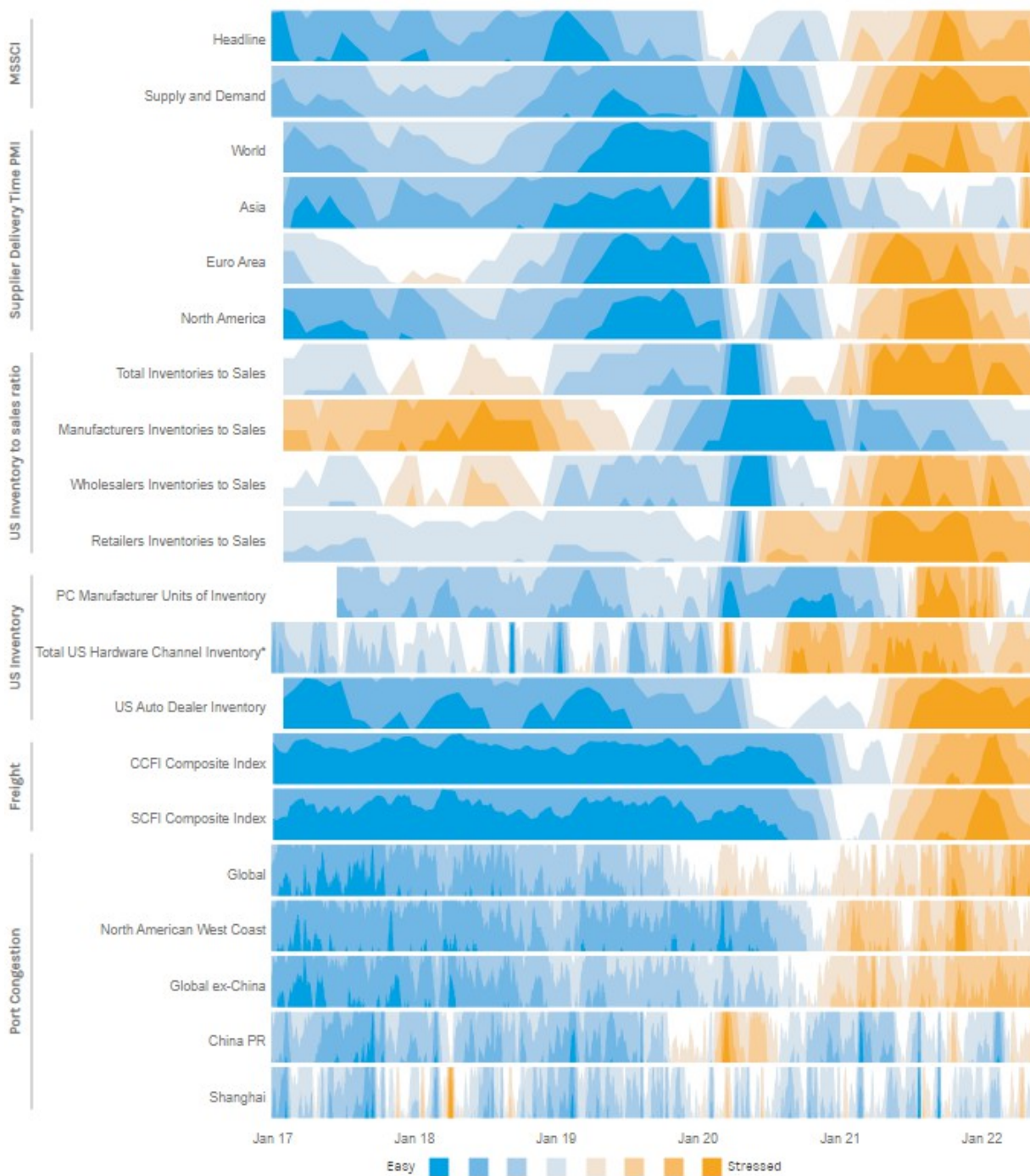


Source: Federal Reserve Bank of New York, Global Supply Chain Pressure Index. Data as of end-June 2022.

We also provide a [Supply Chain Conditions Gallery](#) and summarise them in [Exhibit 10](#), ranging from most benign/easy in blue to most backlogged/stressed in orange (based on their own historical ranges from 2017-current).

Exhibit 10: Supply Chain Conditions Gallery Summary (Blue = Easy, Orange = Stressed)

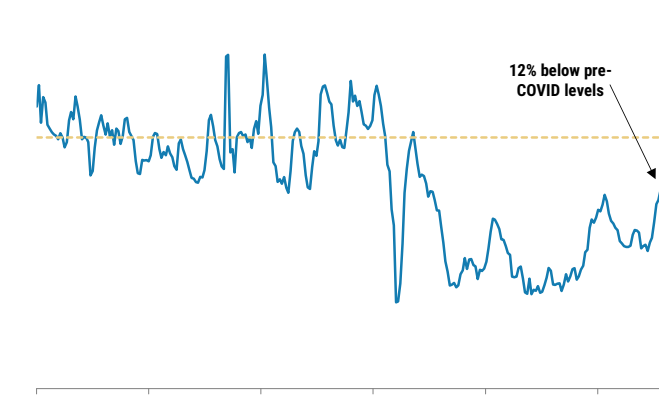
Indicators showing easy or stressed supply chain conditions.



Source: Various sources, Morgan Stanley Research. Note: *Total US Hardware Channel Inventory ex-PCs Units. MSCI = Morgan Stanley Supply Chain Index; CCFI = China Containerized Freight Index; SCFI = Shanghai Containerized Freight Index.

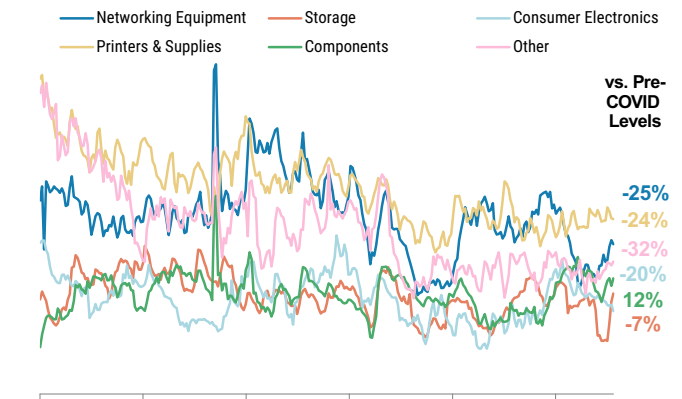
Inventory Conditions

Exhibit 11: Total US Hardware Channel Inventory ex-PCs (Units)



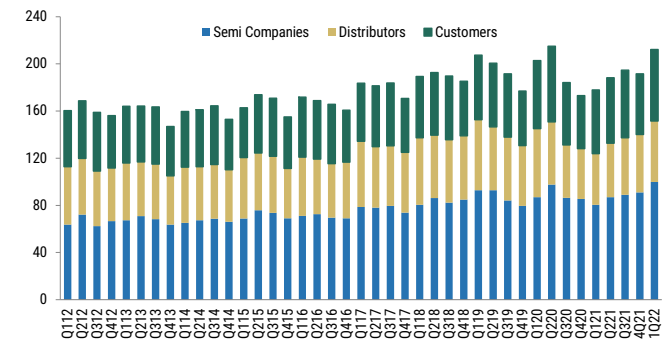
Source: Morgan Stanley Research. Proprietary to Morgan Stanley, reflects US channel inventory only.

Exhibit 12: Total US Hardware Channel Inventory ex-PCs (Units)



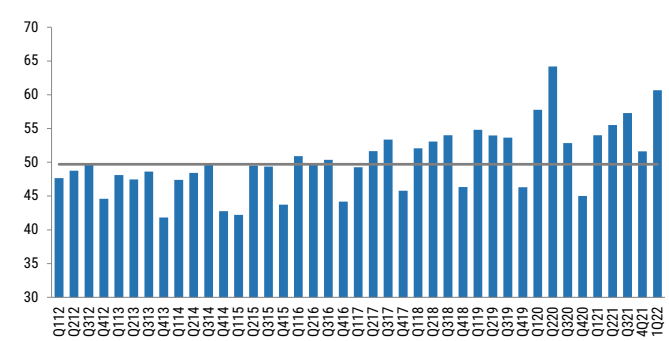
Source: Morgan Stanley Research. Proprietary to Morgan Stanley, reflects US channel inventory only.

Exhibit 13: Total Semiconductor Supply Chain Inventory



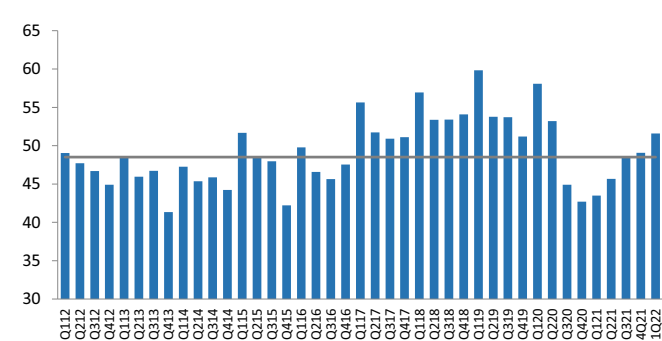
Source: Thomson Reuters, Company Data, Morgan Stanley Research. Note: Total Supply Chain Inventory refers to the total book value of inventory of major global companies in each segment in terms of days of COGS for the quarter.

Exhibit 14: Semiconductor Customers' Inventory (days)



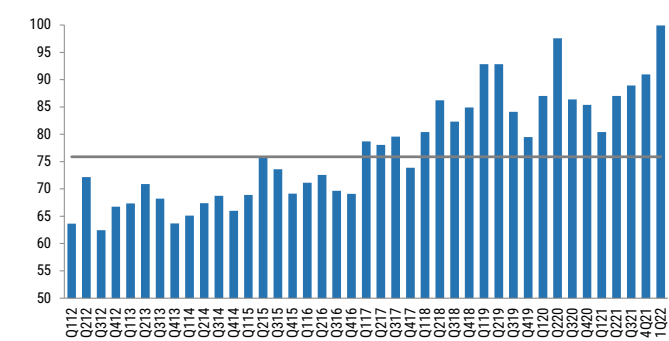
Source: Thomson Reuters, Company Data, Morgan Stanley Research. Note: Semi Customers include major global OEM/EMS/ODM. Days of inventory refers to the total book value of inventory to COGS for the quarter.

Exhibit 15: Semiconductor Distributors' Inventory (days)



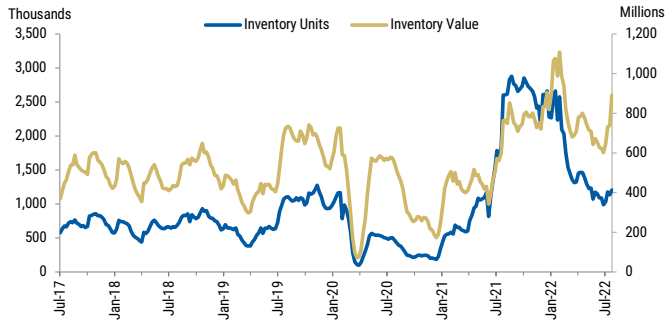
Source: Thomson Reuters, Company Data, Morgan Stanley Research. Note: Distributors include major global distributors of electronic components. Days of inventory refers to the total book value of inventory to COGS for the quarter.

Exhibit 16: Semiconductor Manufacturing Companies' Inventory (days)



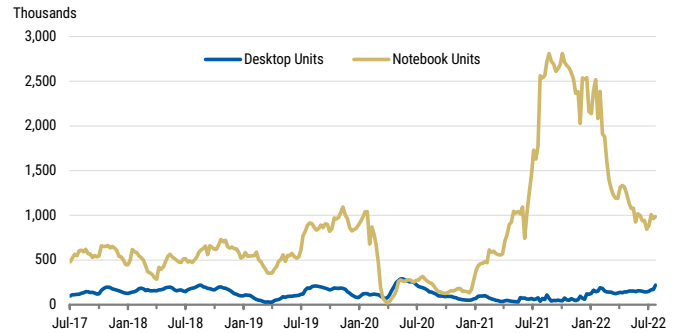
Source: Thomson Reuters, Company Data, Morgan Stanley Research. Note: Semiconductor manufacturing include major global manufacturers. Days of inventory refers to the total book value of inventory to COGS for the quarter.

Exhibit 17: PC Inventory Units and Value of Major Global PC Manufacturers



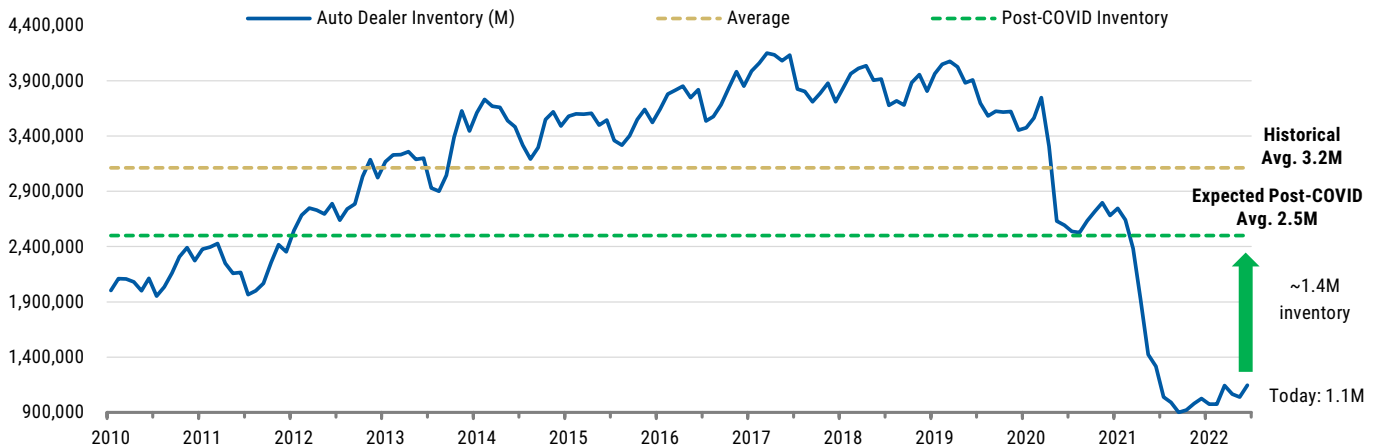
Source: Morgan Stanley Research. Proprietary to Morgan Stanley, reflects US channel inventory only.

Exhibit 18: Desktop and Notebook Inventory Units of Major Global Manufacturers



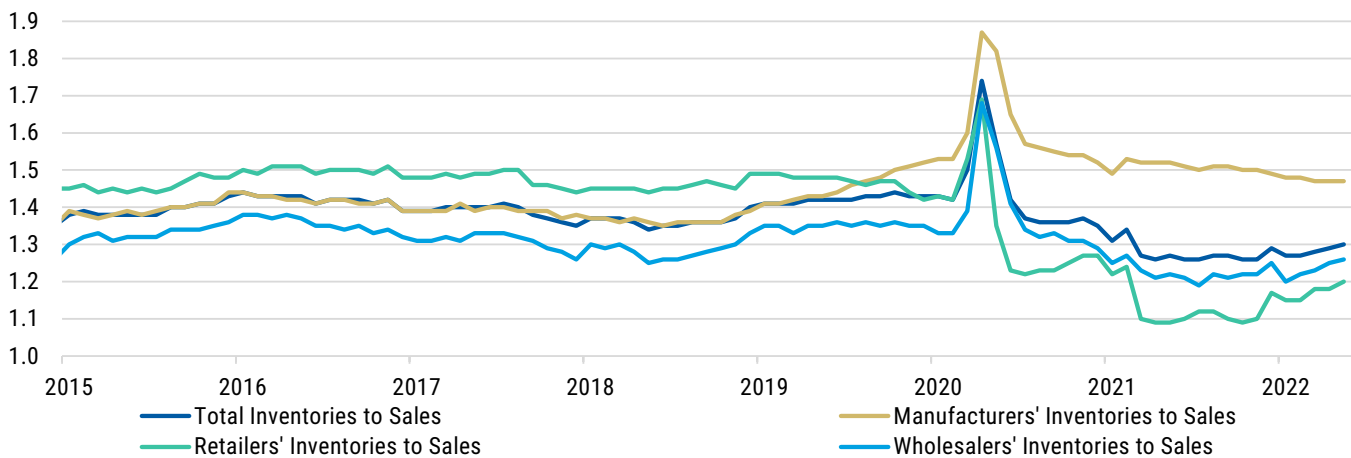
Source: Morgan Stanley Research. Proprietary to Morgan Stanley, reflects US channel inventory only.

Exhibit 19: US Auto Dealer Inventory Has Improved Modestly since Sep-21 Lows, Consistent with Gradual Improvement in Auto Supply Chain



Source: Motor Intelligence, Morgan Stanley Research

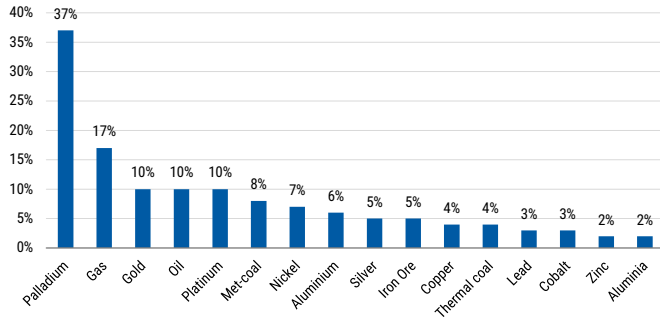
Exhibit 20: US Aggregate Inventory to Sales Ratio by Production Stage



Source: US Census Bureau, Haver Analytics, Morgan Stanley Research

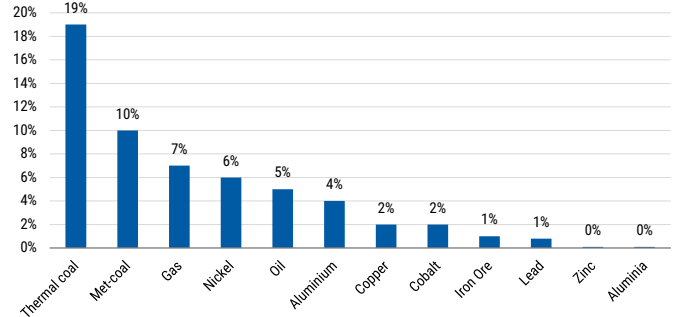
Russia's Commodity Exposure

Exhibit 21: Russia's Commodity Exposure – Russia's Share of Global Production by Commodity



Source: WBMS, IEA, Woodmac, Morgan Stanley Research. See: [Commodity Matters: Russia's Commodity Exposure](#), Jan 20, 2022.

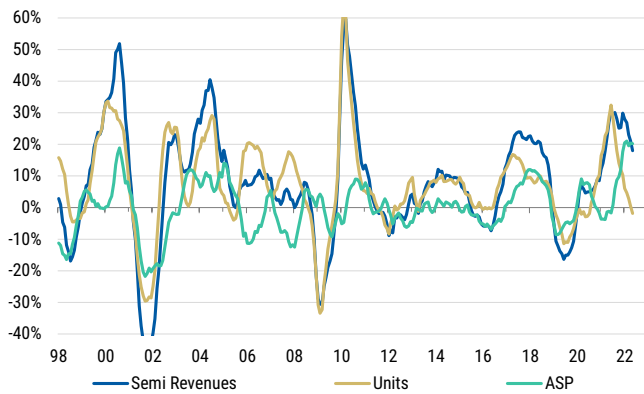
Exhibit 22: Russia's Commodity Exposure – Russia's Share of Global Exports in Key Commodities



Source: WBMS, IEA, Woodmac, Morgan Stanley Research. Note: Exports of thermal coal, met-coal and iron ore are shown as % of seaborne demand. See: [Commodity Matters: Russia's Commodity Exposure](#), Jan 20, 2022.

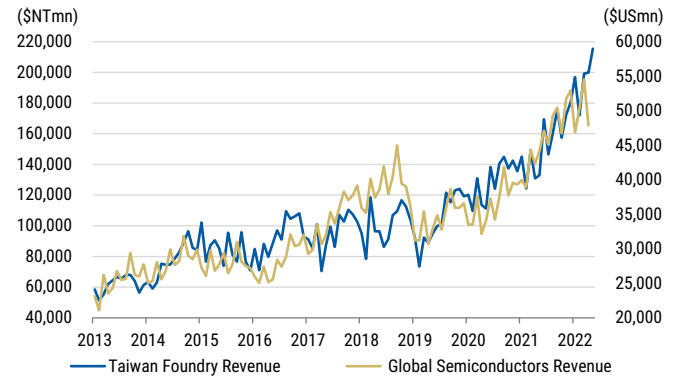
Semiconductor Revenues

Exhibit 23: Semiconductor Sales (three-month average)



Source: Worldwide Semiconductor Trading Statistics (WSTS), Morgan Stanley Research

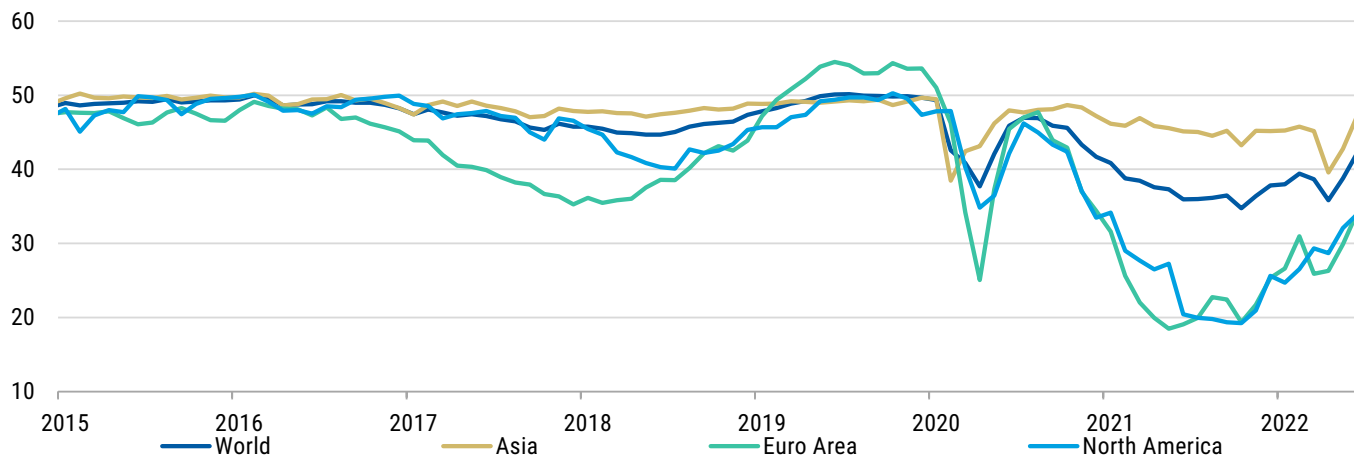
Exhibit 24: Taiwan Foundry Sales and Global Semiconductor Revenue



Source: Refinitiv, Morgan Stanley Research

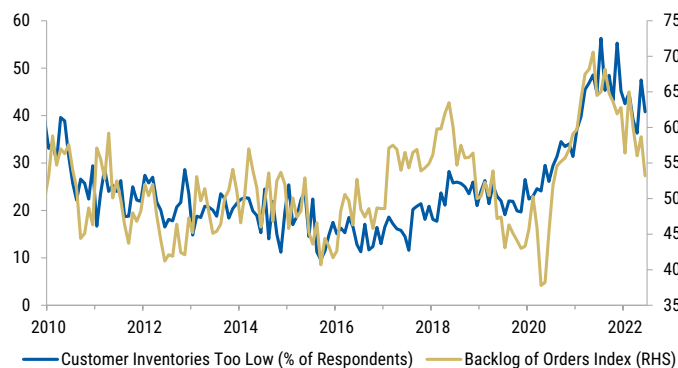
Manufacturing Survey Trends

Exhibit 25: IHS Markit Manufacturing Suppliers' Delivery Times (>50 =Faster, <50 = Slower)



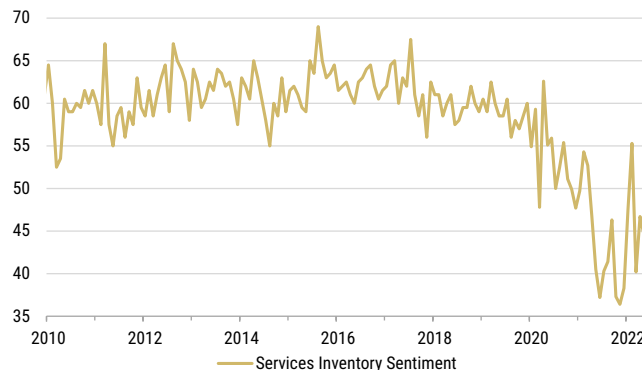
Source: IHS Markit, JP Morgan, Haver Analytics, Morgan Stanley Research

Exhibit 26: ISM Manufacturing: Customer Inventories & Backlog of Orders



Source: ISM, Haver, Morgan Stanley Research

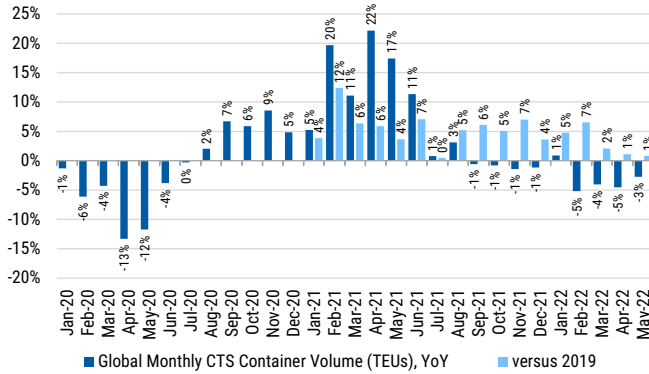
Exhibit 27: ISM Services Inventory Sentiment



Source: ISM, Haver, Morgan Stanley Research

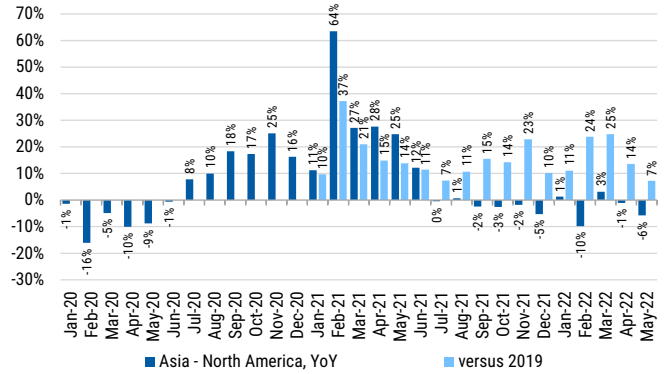
Port Congestion

Exhibit 28: Global Monthly Container Volumes Were up 1% in May 2022 vs. 2019 and Down 3% yoy



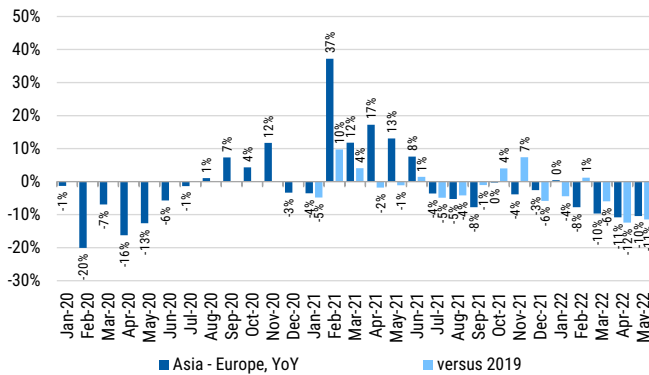
Source: CTS, Morgan Stanley Research

Exhibit 29: Asia - North America Volume Grew 7% in May 2022 vs. 2019 but Was Down 6% yoy



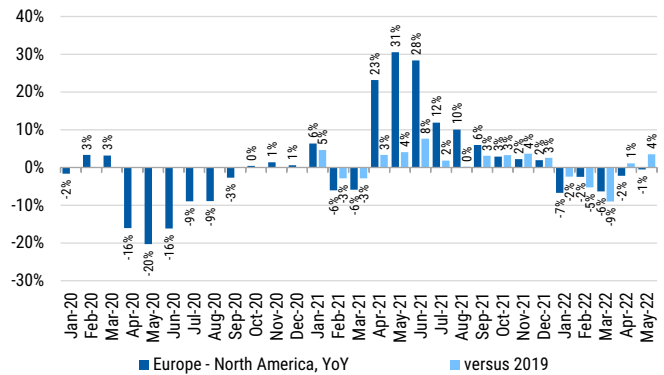
Source: CTS, Morgan Stanley Research

Exhibit 30: Asia - Europe Volumes Were Down 10% yoy in May 2022 and Down 11% vs. 2019



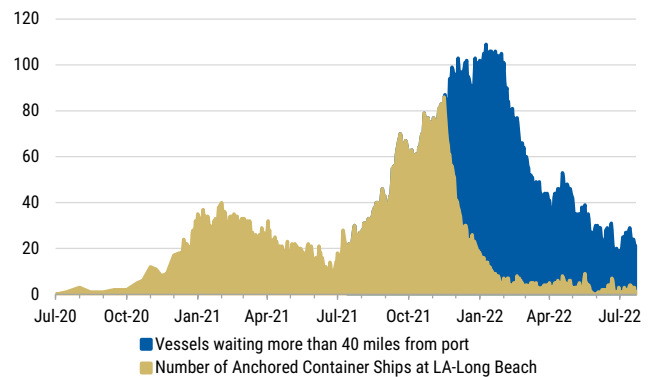
Source: CTS, Morgan Stanley Research

Exhibit 31: Europe - North America Volume Fell -1% yoy in May 2022 But Were Up 4% vs. 2019



Source: CTS, Morgan Stanley Research

Exhibit 32: Number of Anchored Container Ships at LA-Long Beach



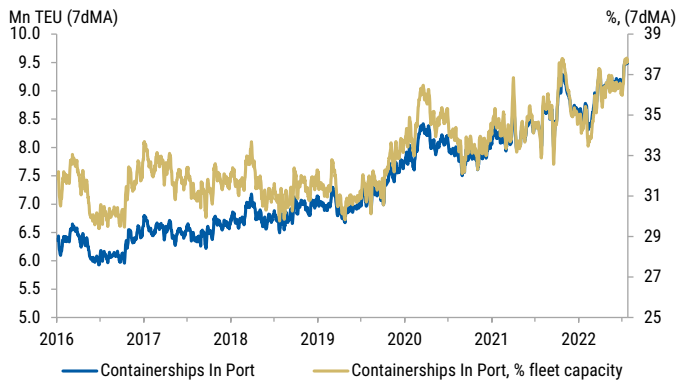
Source: Bloomberg Economics, Marine Exchange of Southern California & Vessel Traffic Service L.A./Long Beach, Morgan Stanley Research

Exhibit 33: Total Backlog of Ships at LA-Long Beach



Source: Bloomberg Economics, Marine Exchange of Southern California & Vessel Traffic Service L.A./Long Beach, Morgan Stanley Research

Exhibit 34: Port Congestion Index: Global Containerships in Port



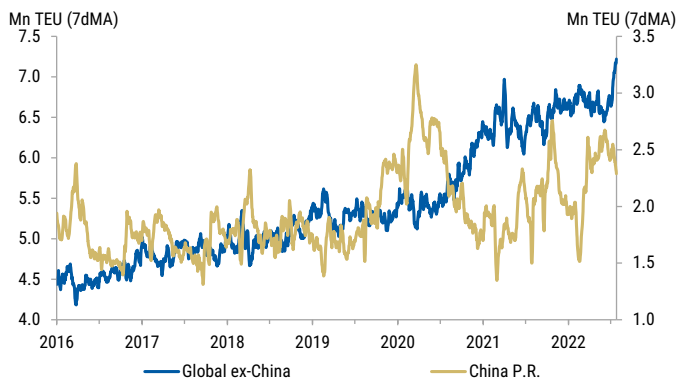
Source: Clarkson Research Services Limited, Morgan Stanley Research

Exhibit 35: Port Congestion Index: Containerships in Port – Global and North American West Coast



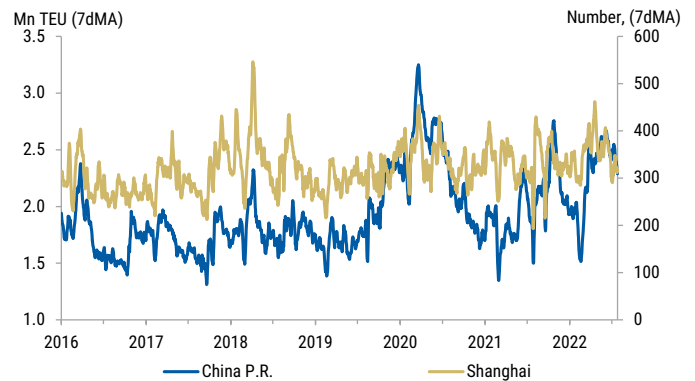
Source: Clarkson Research Services Limited, Morgan Stanley Research

Exhibit 36: Port Congestion Index: Containerships in Port - Global ex-China and China



Source: Clarkson Research Services Limited, Morgan Stanley Research

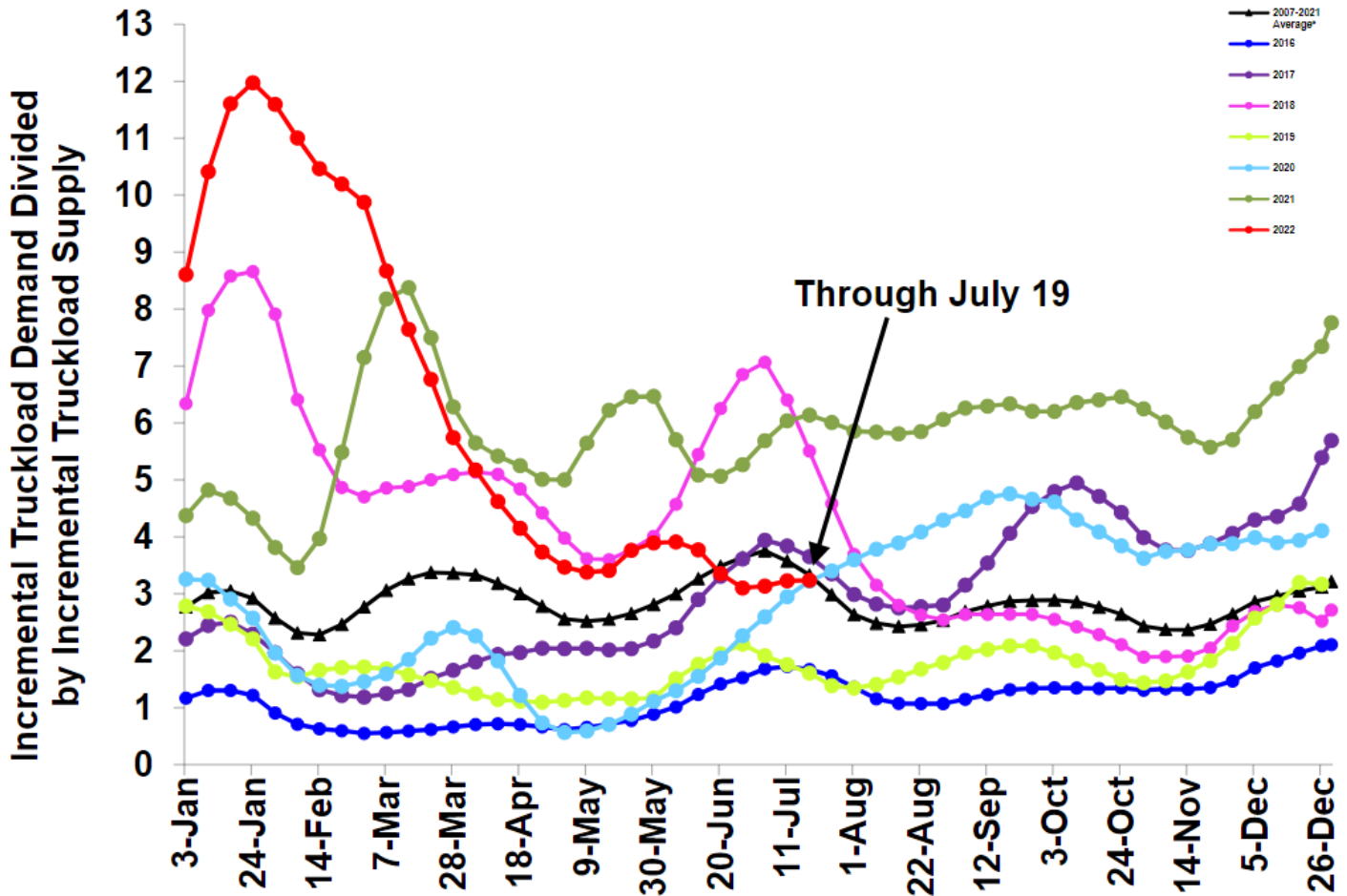
Exhibit 37: Port Congestion Index: Containerships in Port - China and Shanghai



Source: Clarkson Research Services Limited, Morgan Stanley Research

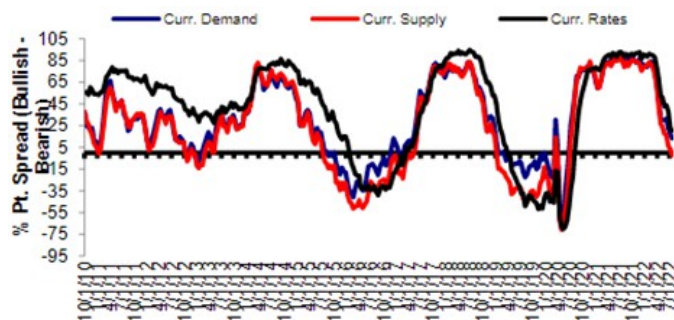
Freight Transportation

Exhibit 38: Morgan Stanley Dry Van Truckload Freight Index (TLFI) - Normalisation since March 2022 as Asia Export Volumes Weakened Amid China Covid Lockdowns



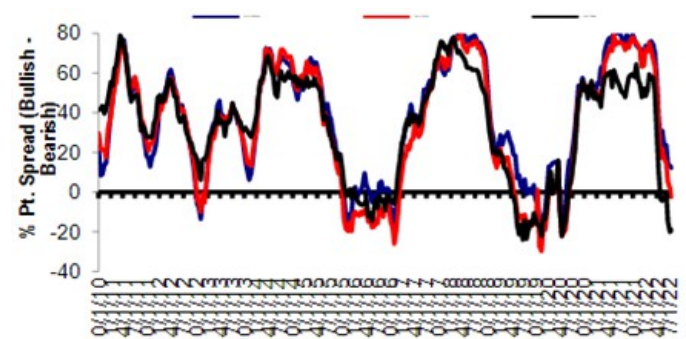
Source: Morgan Stanley Research. The index measures the demand for Dry-Van Truckload services compared to the supply. When a given reading is above prior years' level, it means there is more freight demand relative to available capacity. When a given reading is below prior years' level, it means there is less freight demand relative to capacity. *2007-2021 average trend line excludes financial crisis years of 2008 and 2009. Please see [Freight Transportation: Truck Stop/TLFI: Signs Of Sunshine](#) (20 Jul 2022), for the commentary on the latest update.

Exhibit 39: Current Morgan Stanley Truckload Sentiment Survey (TLSS): Current Demand and Supply Decreased Sequentially



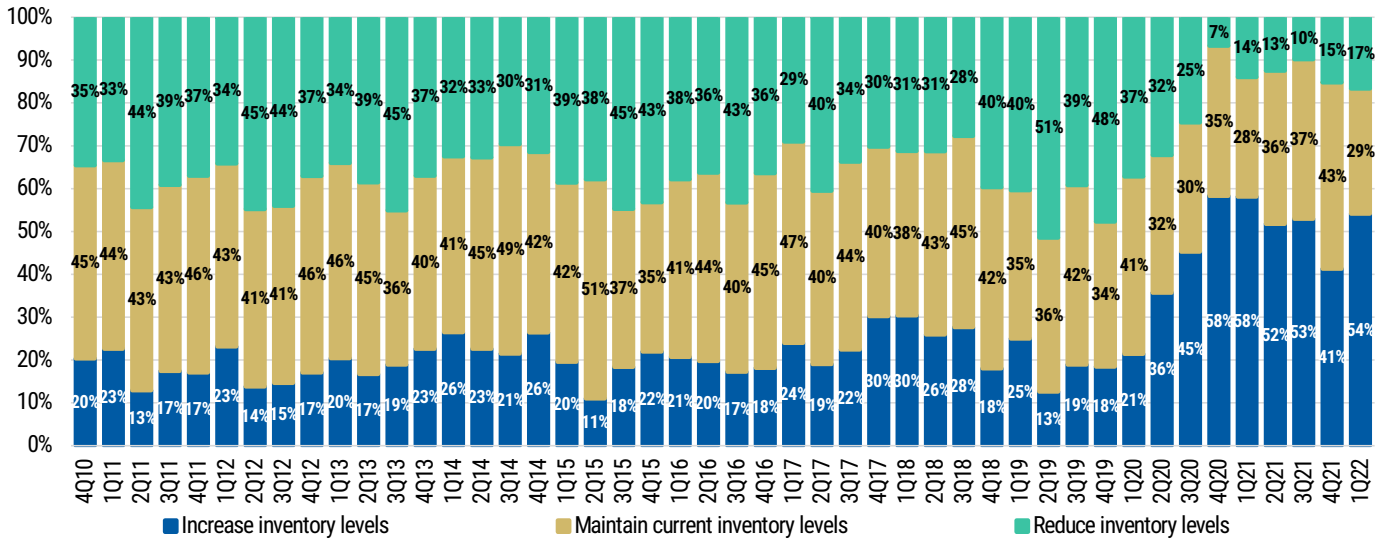
Source: Morgan Stanley Research. Response % Pt. Spread (Bullish - Bearish) for TL Demand, Supply and Rates defined as: TL Demand – the % of respondents describing demand as “strong” less the % describing demand as “weak”; TL Supply – the % of respondents describing supply as “tight” less the % describing supply as “abundant”; TL Rates – the % of respondents saying TL rates are “Higher” YoY less the % saying TL rates are “Lower” YoY. Please see [Freight Transportation: Truck Stop/TLSS: Mixed Messages](#) (27 Jul 2022), for the commentary on the latest update.

Exhibit 40: Three-month Forward Morgan Stanley Truckload Sentiment Survey (TLSS): 3-month Forward Demand and Supply Sentiment Decreased Sequentially



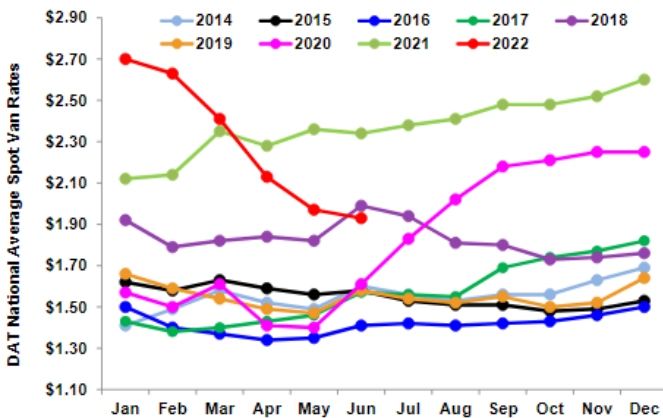
Source: Morgan Stanley Research. Response % Pt. Spread (Bullish - Bearish) for TL Demand, Supply and Rates defined as: TL Demand – the % of respondents describing demand as “strong” less the % describing demand as “weak”; TL Supply – the % of respondents describing supply as “tight” less the % describing supply as “abundant”; TL Rates – the % of respondents saying TL rates are “Higher” YoY less the % saying TL rates are “Lower” YoY. Please see [Freight Transportation: Truck Stop/TLSS: Mixed Messages](#) (27 Jul 2022), for the commentary on the latest update.

Exhibit 41: Freight: Shippers' Inventory Plans: Majority of Shippers Still Planning to Increase Inventories



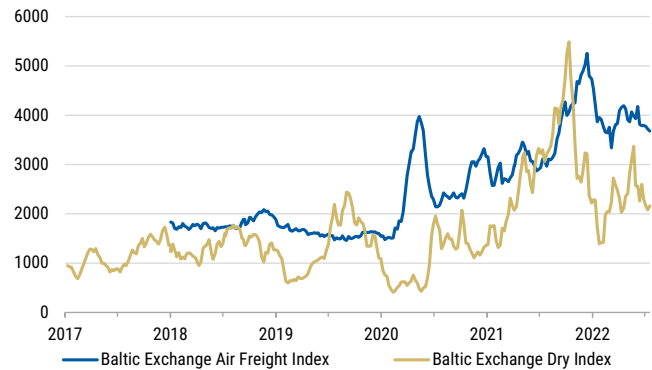
Source: Morgan Stanley Research

Exhibit 42: DAT Rates: National Average Spot Van Rates ex. Fuel Surcharge



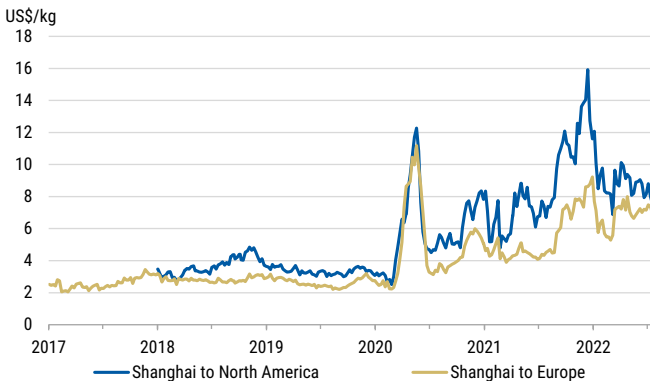
Source: DAT Solutions, Morgan Stanley Research

Exhibit 43: Baltic Exchange Freight Indices



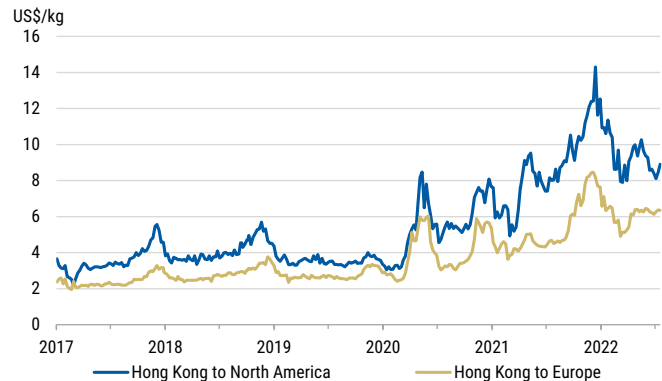
Source: The Baltic Exchange, The Air Freight Index Company, Refinitiv Eikon, Morgan Stanley Research

Exhibit 44: TAC Air Cargo Freight Index: Shanghai to North America and Europe



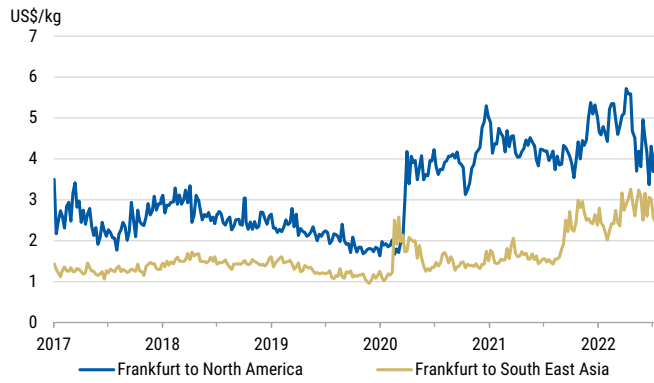
Source: The Air Freight Index Company, Refinitiv Eikon, Morgan Stanley Research

Exhibit 45: TAC Air Cargo Freight Index: Hong Kong to North America and Europe



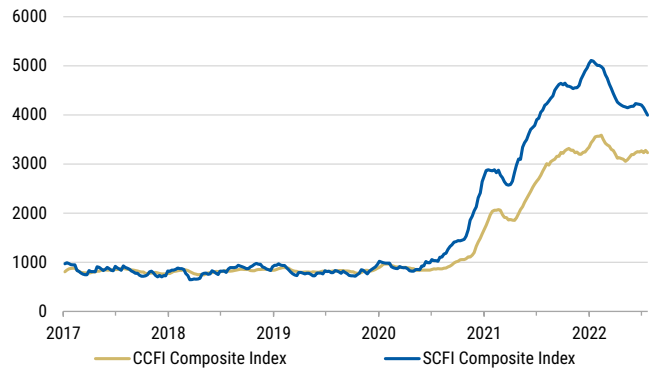
Source: The Air Freight Index Company, Refinitiv Eikon, Morgan Stanley Research

Exhibit 46: TAC Air Cargo Freight Index: Frankfurt to North America and Southeast Asia



Source: The Air Freight Index Company, Refinitiv Eikon, Morgan Stanley Research

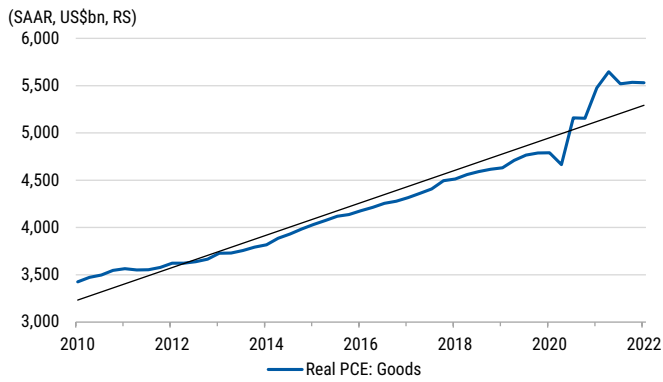
Exhibit 47: China and Shanghai Freight Composite Indices: Container Rates Continue to Steadily Decrease



Source: Shanghai Shipping Exchange, Refinitiv Eikon, Morgan Stanley Research

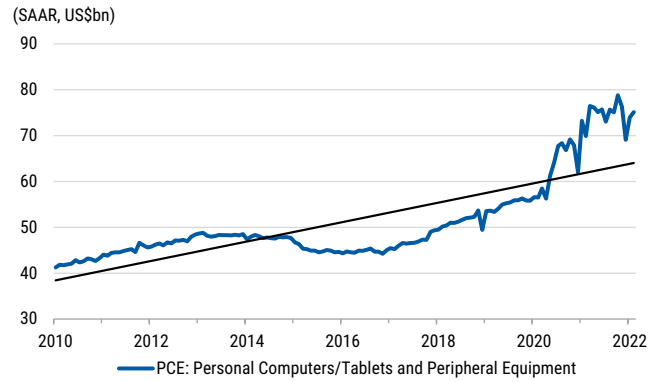
Personal Consumption Expenditures (PCE)

Exhibit 48: US Overall Real PCE



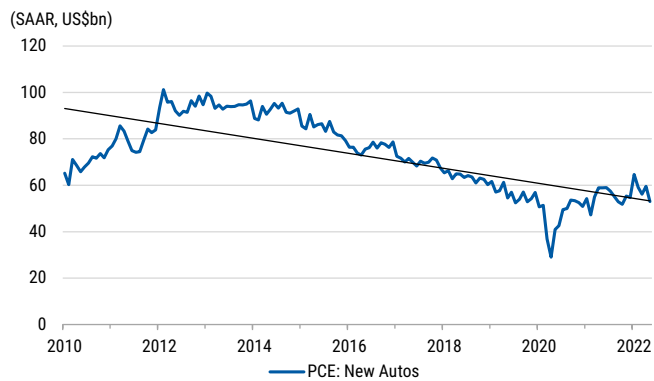
Source: Haver, Morgan Stanley Research

Exhibit 49: US Tech Hardware PCE



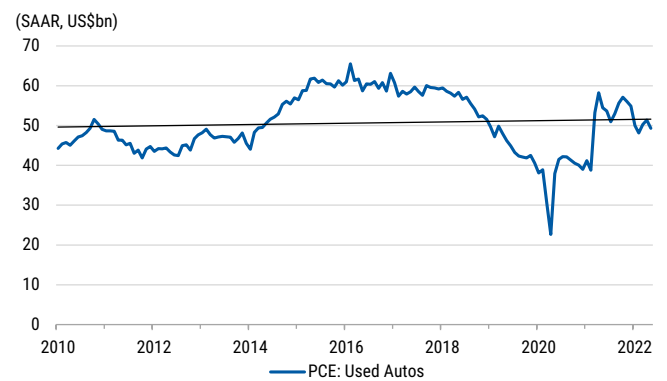
Source: Haver, Morgan Stanley Research

Exhibit 50: US New Autos PCE



Source: Haver, Morgan Stanley Research

Exhibit 51: US Used Autos PCE



Source: Haver, Morgan Stanley Research

Global Supply Chain Interactive Model

We have worked with our AlphaWise team to expand a set of interactive models that utilise a mix of FactSet Supply Chain and Geographic Revenue datasets along with Morgan Stanley's proprietary [Global Exposure Guide](#), providing readers a one-stop interactive dashboard that can be tailored to their interest.

Broadly, we divide the interactive models into two parts – revenue and supply chain – where users can look at supply-chain linkages and regional revenue flows by sector, company or specific chokepoint. To see the detailed user guide, please refer to [Appendix: Using the Global Supply Chain Interactive Model](#).

Revenue: This shows the 2019 and 2020 revenue distribution of companies – on both an individual and a sector level – across different regions. Users can toggle between different options to analyse revenue distribution across different regions. We also provide revenue exposure of firms in segments we have identified as global supply-chain chokepoints.

Supply Chain: This shows the revenue network of all suppliers and consumers – at both the sector and company levels – and how interconnected and exposed they are to different firms in the entire supply chain. We provide multiple filters like market capitalization, sector, year and region to narrow the scope of inquiry.

Global Supply Chain and Revenue Network

SUPPLY CHAIN
REVENUE

Supply chain network for all suppliers and customers in **Technology Hardware & Equipment**. Filter results by selecting a minimum MCAP value or by selecting regions of interest. Click on a company for a company view.

SECTOR: Technology Hardware & Eq... [BACK] [RESET]

COMPANY: [] CHOKE PTS: []

MCAP (bn): 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50

YEAR: 2019 2020 DIFF

REGION

- United States and C...
- LatAm
- EMEA
- China
- Japan
- Rest of Asia Pacific
- Offshore Financial C...

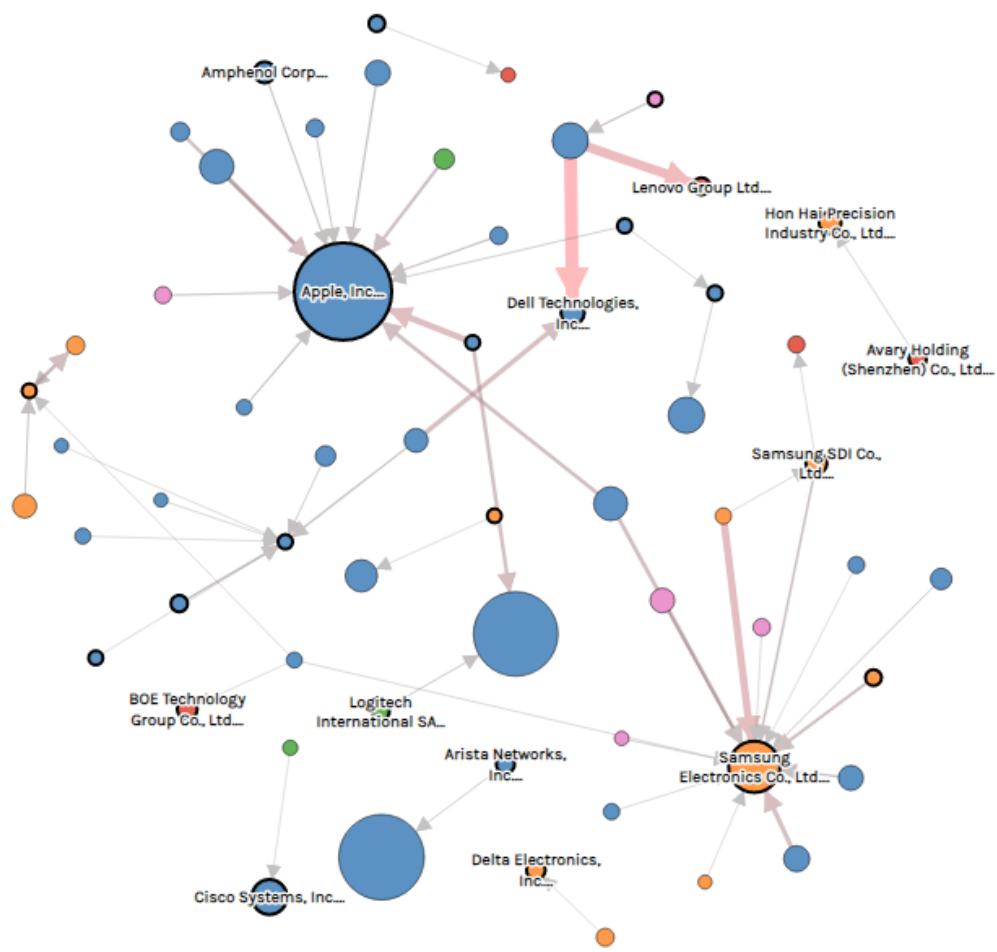
CIRCLE SIZE (US\$)

22.5B 2.25T

SALES LINE (US\$)

3.37M 13.2B

Arrow shows supply dirn.

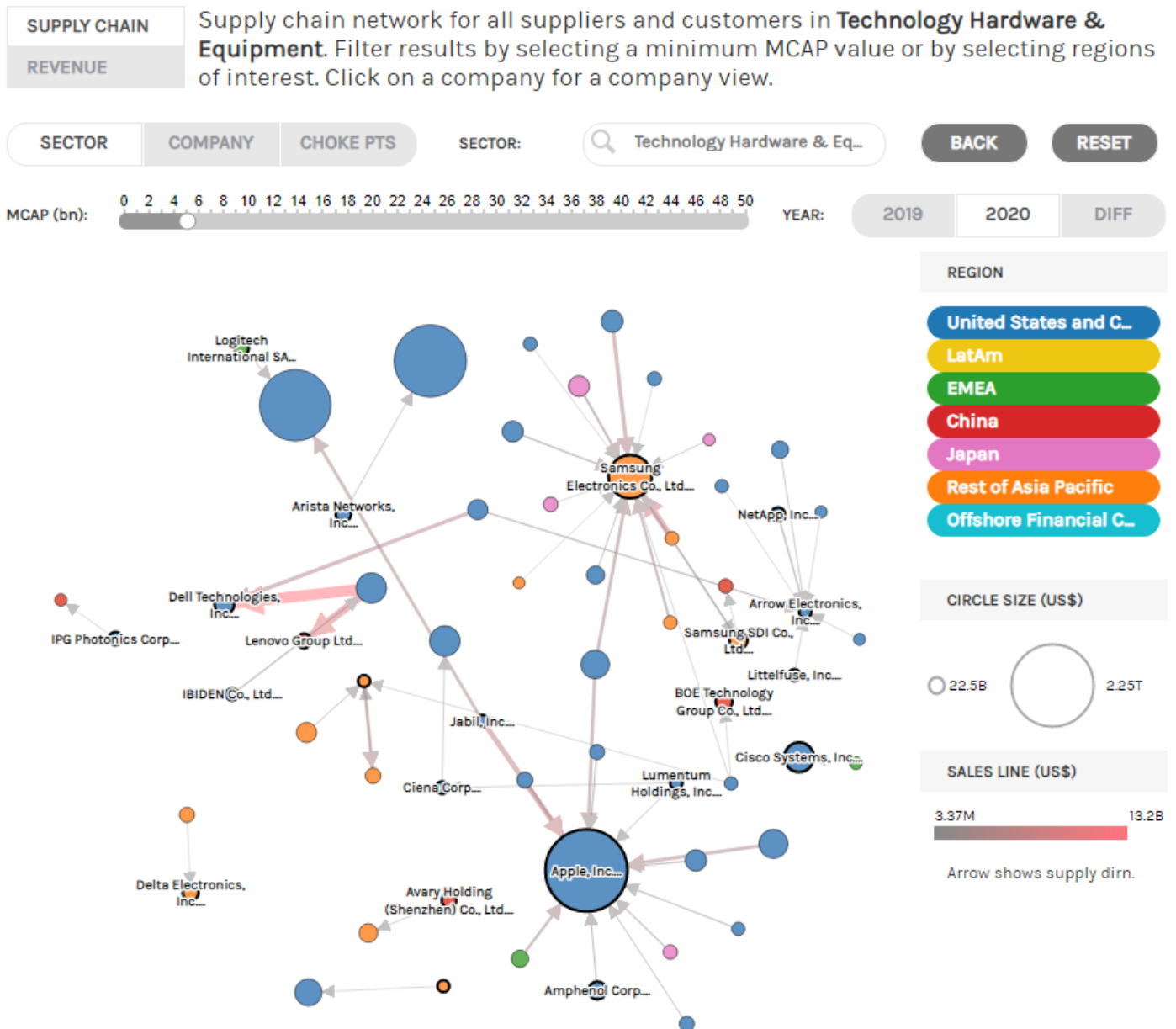


Source: AlphaWise, FactSet, Morgan Stanley Research

Appendix: Using the Global Supply Chain Interactive Model

Broadly, we divide the interactive into two parts – revenue and supply chain – where users can look at supply-chain linkages and regional revenue flows by sector, company or specific chokepoint (see top left toggle).

Global Supply Chain and Revenue Network



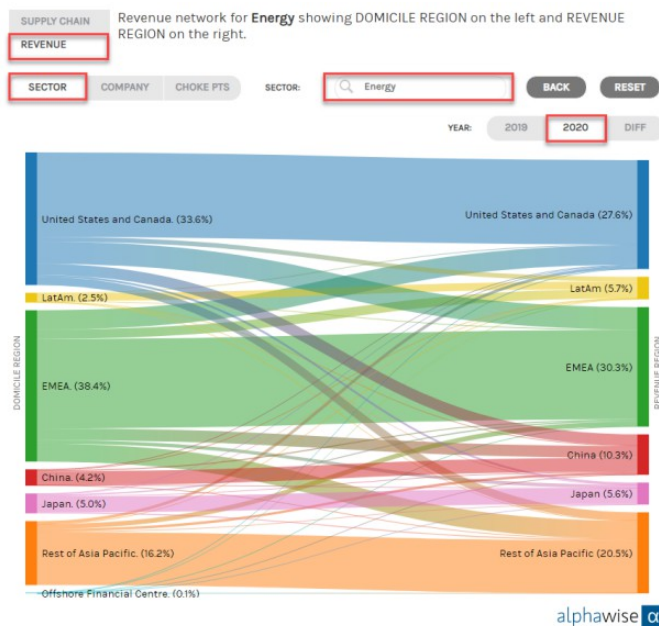
Source: AlphaWise, FactSet, Morgan Stanley Research

Revenue: This shows the 2019 and 2020 revenue distribution of companies – on both

individual and sector levels across different regions. To analyse revenue distribution by sector in different geographies, users should select the "Sector" toggle in the top left and search for the sector of interest in the search bar provided adjacent to the toggle. Users can also select relevant year of interest in the top right and can analyze how revenue distribution changed between 2019 vs. 2020 using the "DIFF" toggle.

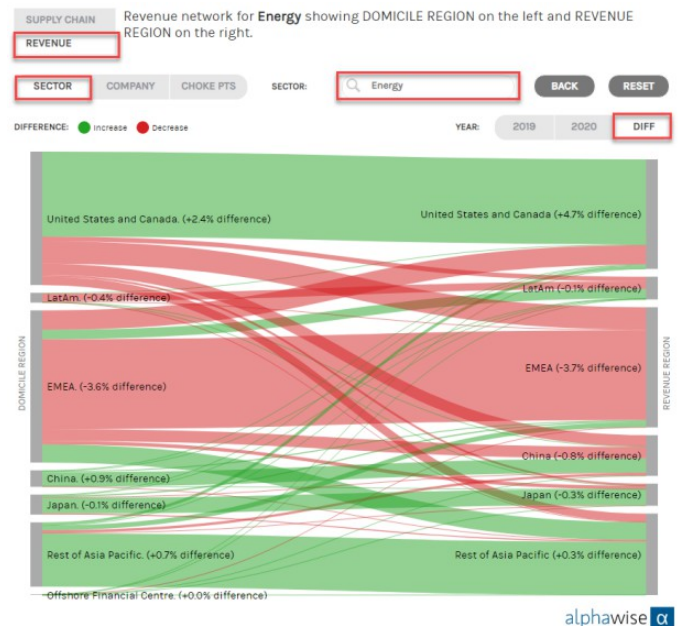
For example, [Exhibit 52](#) shows "Energy" companies' geographic revenue distribution. The domicile regions of the companies are shown on the left side, while their end users are shown on the right. Companies that are domiciled in the US constitute about 11.9% by revenue globally, while Japan represents 27.3% and China only 5.3%. In terms of end users, US/Canada constitute of 14.4%, Japan 23.1% and China 7.2%. Switching to the "DIFF" toggle ([Exhibit 53](#)) shows that Energy companies among the US companies showed revenue increasing in 2020 vs. 2019 (highlighted by green), while companies in LatAm and China showed declining revenues during the same period.

Exhibit 52: Revenue – Geographic Revenue Distribution of Energy Sector Companies in 2020



Source: Factset, RIMES, Morgan Stanley Research

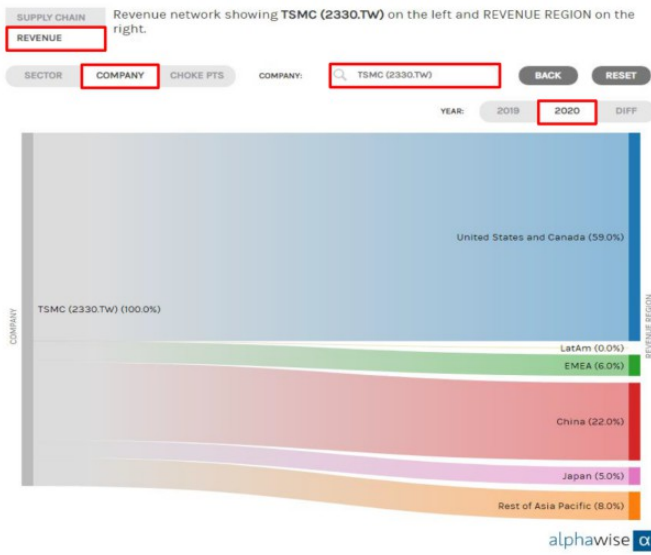
Exhibit 53: Revenue – Change in the Geographic Revenue Distribution of Energy Sector Companies in 2020 vs. 2019



Source: Factset, RIMES, Morgan Stanley Research

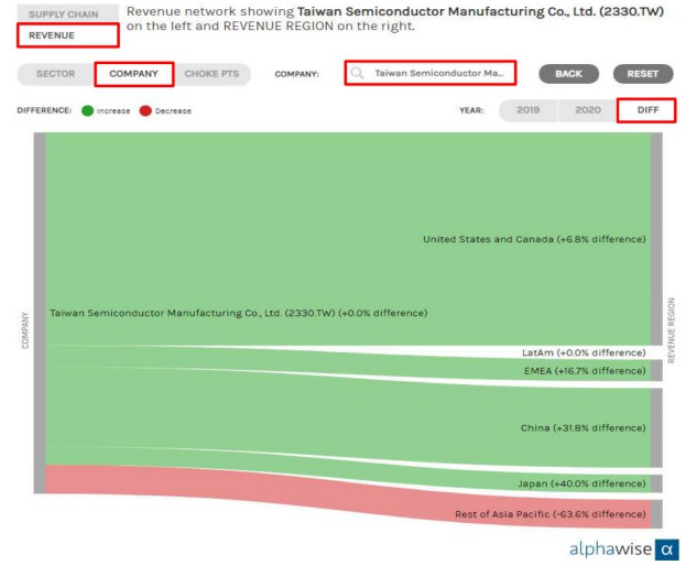
To analyze revenue exposure at the company level, users can search for a particular company by its name or by ticker in the search bar provided after selecting the "Company" toggle. For example, [Exhibit 54](#) shows that in 2020, TSMC (2330.TW) generated 59% of its revenue from the US, 22% from China and about 8% from Rest of Asia Pacific. It also generated 6% of its revenue from EMEA and 5% from Japan. Further, [Exhibit 55](#) shows TSMC registered an increase in revenue (highlighted in green) from almost all regions except from Asia Pacific-ex-China-ex-Japan in 2020 vs. 2019.

Exhibit 54: Revenue – Geographic Revenue Distribution of TSMC in 2020



Source: Factset, RIMES, Morgan Stanley Research

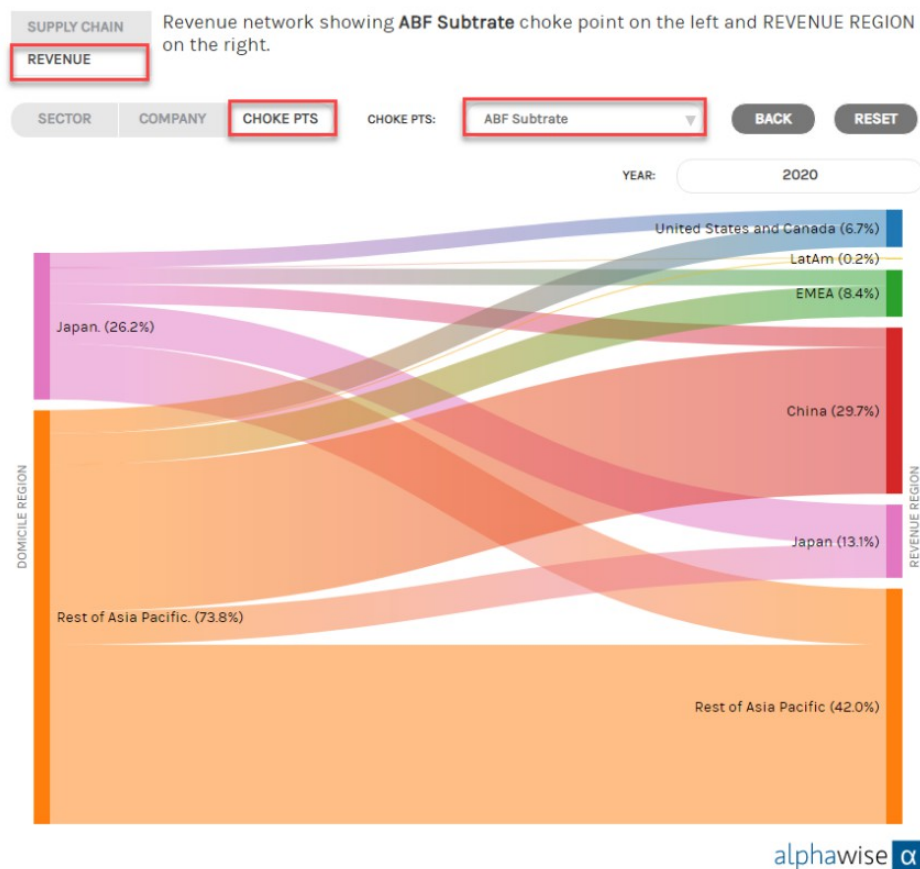
Exhibit 55: Revenue – Change in the Geographic Revenue Distribution of TSMC in 2020 vs 2019



Source: Factset, RIMES, Morgan Stanley Research

Finally, [Exhibit 56](#) shows the aggregate revenue distribution of "Chokepoint" firms – those that we have identified as key producers in the associated segments of our Global Supply Chain Chokepoint Dashboard. For example, most of the companies who are operating in the tight ABF Substrates segment belongs to Rest of Asia-Pacific (58.5%), followed by in Japan (41.5%) per our analysts, while the end-users are primarily in the Rest of Asia Pacific (42.7%), followed by China (26.4%), Japan (14.5%) and US/Canada (9.4%). Moreover, the individual strand in the interactive shows revenue distribution by region.

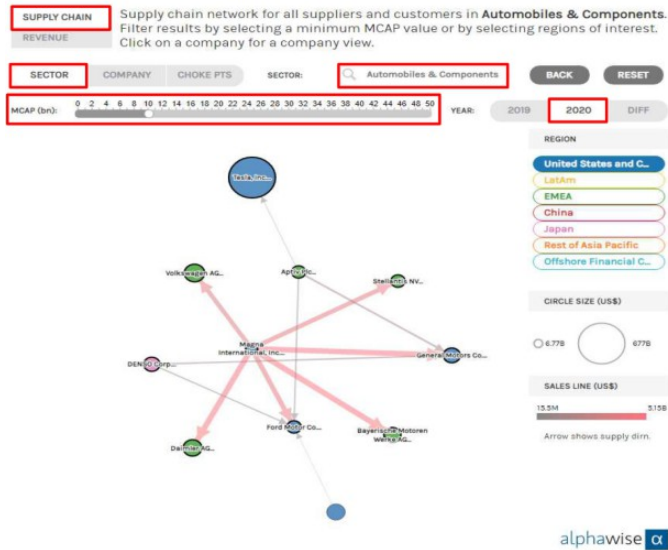
Exhibit 56: Revenue – The Geographic Revenue Distribution of Choquepoint Stocks in ABF Substrate industry



Source: Factset, RIMES, Morgan Stanley Research

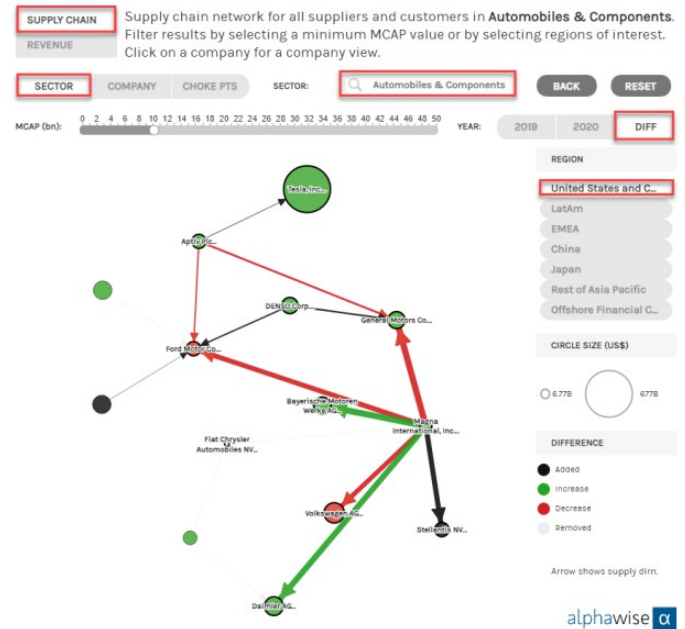
Supply chain: This shows the network of all suppliers and customers – either at the sector or company level – and how interconnected and exposed they are to different firms in the entire supply chain. We provide several filters like market cap, sector, year and region for easy manipulation of the interactive. One can select single/multiple regions shown on the left side and can adjust the MCAP slider to filter out companies that are below the threshold. The direction of the arrow represents the flow of goods/services from producer to customer, with the width representing magnitude of revenue exposure. As an illustration, [Exhibit 57](#) shows the supply-chain network of companies in Automobiles and Components, having a market capitalization over US\$10bn, domiciled in the US/Canada. Moreover, clicking on the "DIFF" toggle shows how the network has changed vs. 2019 ([Exhibit 58](#)).

Exhibit 57: Supply Chain: Automobiles & Components Supply-chain Network for US Domiciled Firms in 2020 Having MCAP Greater than US\$10bn



Source: Factset, RIMES, Morgan Stanley Research

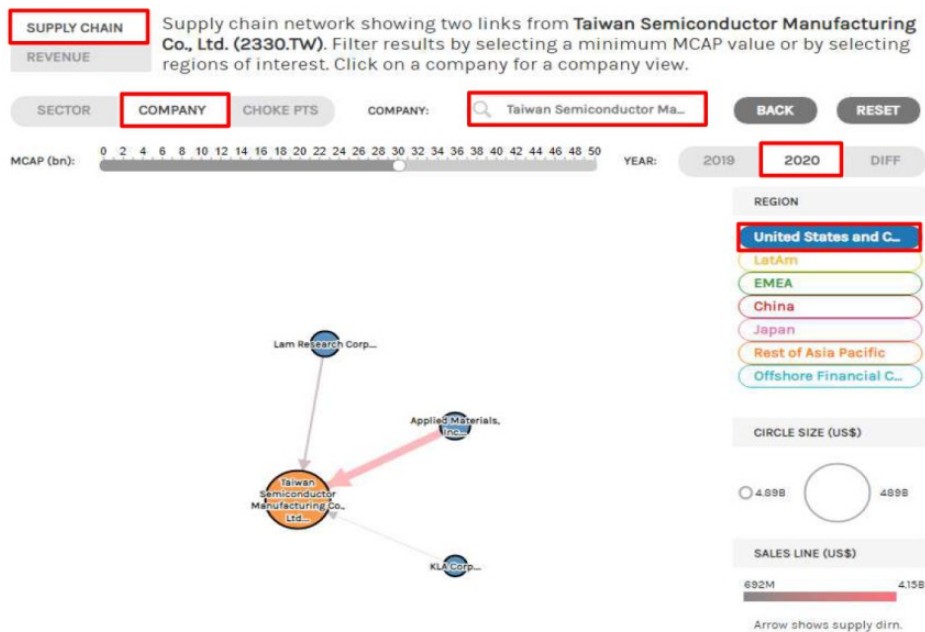
Exhibit 58: Supply Chain: Change in Revenue Supply Networks for Automobiles & Components firms (>=US\$10bn) in 2020 vs. 2019



Source: Factset, RIMES, Morgan Stanley Research

Similarly, we also provide company-level details where users can search for companies of interest in the search bar and slide the MCAP filter to look for relevant suppliers from the regions of interest. [Exhibit 59](#) shows American firms larger than US\$50bn that are suppliers to TSMC, with the width of arrow representing the size of revenue exposure. Further, the "DIFF" toggle shows if there is any change in the revenue linkages in 2020 vs. 2019.

Exhibit 59: Supply Chain: TSMC Supply-chain Linkages with Firms Having Greater than US\$bn of MCap and Domiciled in US/Canada in 2020

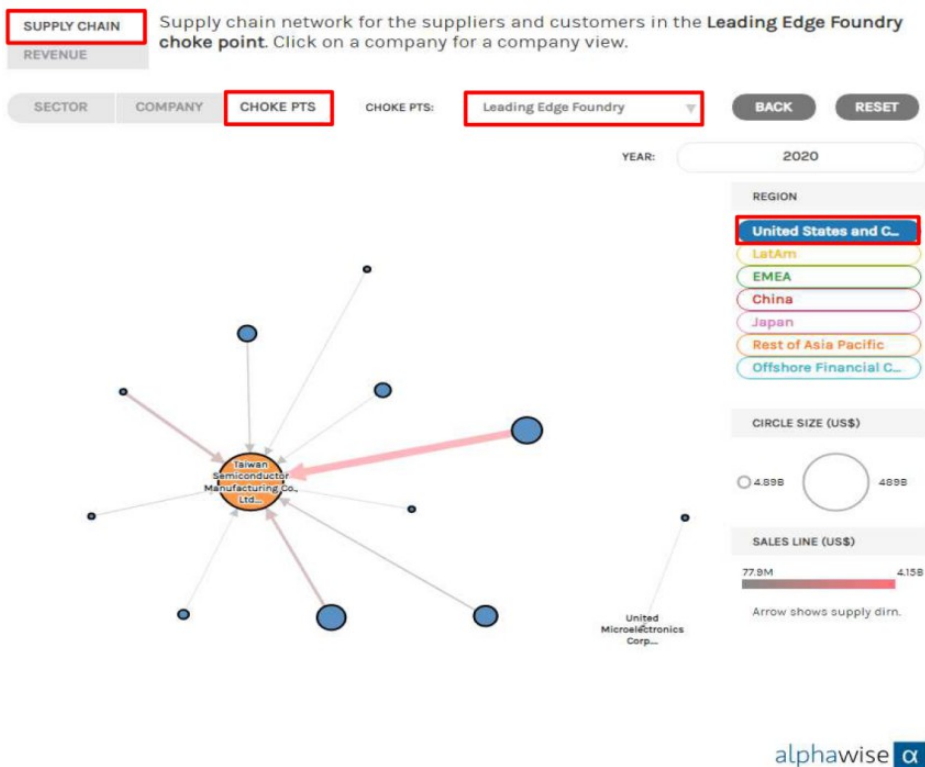


alphawise α

Source: Factset, RIMES, Morgan Stanley Research

Finally, the "Chokepoint" category shows supply-chain networks of companies that our analysts believe are facing significant friction on multiple fronts, and that is expected to affect their supply-chain networks in a significant way. The list of sectors can be accessed using the drop down menu. [Exhibit 60](#) shows the supply-chain networks of firms that are "Chokepoints" in the Leading Edge Foundry industry and are domiciled in US/Canada.

Exhibit 60: Supply Chain: Network of Suppliers and Customers for Firms Who Are Chokepoints in Leading Edge Foundry Industry



Source: Factset, RIMES, Morgan Stanley Research

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(as of July 31, 2022)

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STOCK RATING CATEGORY	COVERAGE UNIVERSE		INVESTMENT BANKING CLIENTS (IBC)			OTHER MATERIAL INVESTMENT SERVICES CLIENTS (MISC)	
	COUNT	% OF TOTAL	COUNT	% OF TOTAL IBC	% OF RATING CATEGORY	COUNT	% OF TOTAL OTHER MISC
Overweight/Buy	1366	39%	318	42%	23%	593	39%
Equal-weight/Hold	1559	44%	357	47%	23%	708	46%
Not-Rated/Hold	0	0%	0	0%	0%	0	0%
Underweight/Sell	613	17%	91	12%	15%	226	15%
TOTAL	3,538		766			1527	

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Stock Price, Price Target and Rating History (See Rating Definitions)

Samsung Electro-Mechanics (009150.KS) - As of 8/2/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 8/1/17 : O/I; 11/26/17 : O/C; 11/21/18 : E/C; 7/30/19 : E/I; 10/6/19 : O/I; 11/18/19 : O/A; 5/12/21 : E/A; 7/19/21 : E/I; 8/12/21 : E/C; 6/1/22 : U/C

Price Target History: 7/7/17 : 127000; 10/19/17 : 130000; 1/22/18 : 120000; 5/20/18 : 170000; 8/1/18 : 200000; 11/1/18 : 170000; 11/21/18 : 115000; 12/17/18 : 109000; 1/22/19 : 100000; 4/16/19 : 115000; 7/4/19 : 100000; 7/24/19 : 92000; 10/6/19 : 140000; 1/29/20 : 150000; 2/20/20 : 165000; 3/19/20 : 130000; 4/1/20 : 120000; 5/28/20 : 150000; 9/3/20 : 170000; 12/1/20 : 180000; 1/19/21 : 240000; 3/1/21 : 250000; 5/12/21 : 180000; 10/19/21 : 170000; 10/27/21 : 160000; 1/24/22 : 180000; 3/18/22 : 170000; 6/1/22 : 140000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
 Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst) —
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