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● Topic of the week: Semiconductors: shortages, tech leadership and geopolitics

- Global chip sales fetch half a billion dollars;
- Shortages of semiconductors may extend into 2022, affecting supply chains across many industries;
- The semiconductor industry is concentrated around two major players (TSMC, Samsung);
- The sector has become a major geopolitical issue, key to technological leadership and economic policy in the US and China

● Market review: Entrenched volatility

- FOMC minutes unveils tapering talks
- The Fed could launch a permanent repo facility
- Sovereign spreads come in, BTP spreads within 120bp
- Volatility and swift sector rotations within equity markets

● Chart of the week



Building permits remain extremely dynamic in the United States, a testimony of the very high demand for housing. But it seems that the supply can't keep up with the pace. The number of houses awaiting construction has rebounded sharply to a record high in over 40 years.

This is one more example of supply-side constraints and bottlenecks. Firms are finding it difficult to find labour and the cost of raw materials (especially timber) has increased considerably.

This could limit the extent of the economic rebound but also maintain inflationary pressures.

● Figure of the week

22/05/2013

The first time Bernanke mentioned the tapering. At a Congressional hearing "If we see continued improvement, [...] we could take a step down in our pace of asset purchases."



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• **Topic of the week**

Semiconductors: shortages, tech leadership and geopolitics

Semiconductors are used in a wide range of industries. Global semi sales add up to half a trillion dollars. The outbreak of Covid caused unexpected surge in demand disrupting supply chains amid longer lead times and price pressures. The semiconductor industry is at the heart of the race for global technology leadership between the US and China.

Overview of the global semiconductor market

Global annual sales near \$ 500 billion

Semiconductors are in short supply after an unexpected surge in demand following the outbreak of the Covid crisis. Global chip sales reached \$ 41 billion in March 2021 matching the previous peak in October 2018. After a 12% decline in 2019 and a relapse in the first quarter of 2020, annual semiconductor sales recovered to \$ 435 billion in 2020. Turnover may fetch \$ 500 billion in 2021.

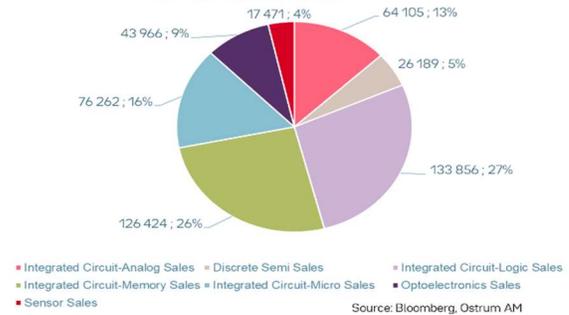
China is the main buyer of semiconductors accounting for 85% of world demand in 2020. In turn, Americas, Asia ex-China and Europe account for about a third each of the remaining 15% of global sales.



Semiconductors encompass various kinds of integrated circuits, sensors and optoelectronic items. Memory chips,

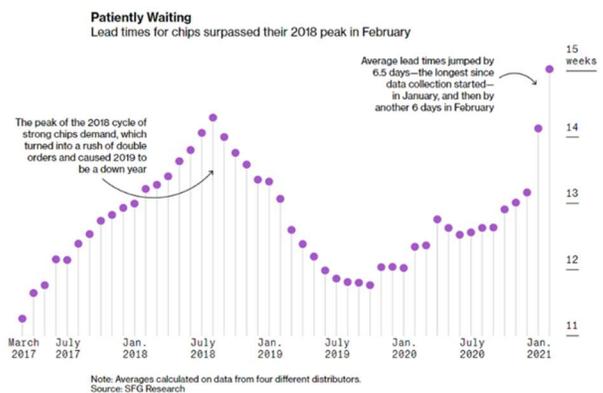
used to store data, are relatively simple and have become commodified. However, logic chips, which run programs, are quite complex and hence more expensive. Integrated circuits (logic) represent 27% of the market or about \$ 126 billion annually, with memory sales at 26%.

World Semiconductor Trade Statistics Annual
Semiconductor Sales



Shortages, longer lead times and price pressures everywhere

Higher demand — most notably from certain industries like smartphones and PCs which gained from the K-shaped recovery from the pandemic — has triggered an unprecedented global shortage. In February, lead times (duration between order and delivery) stretched beyond 15 weeks on average according to Susquehanna Financial Group. Broadcom — a major player in the industry across the supply chain — estimated that lead times jumped to 22.2 weeks, up from 12.2 weeks a year ago. At the previous cyclical peak in 2018, a rush to raise orders amid strong demand resulted in a slowdown the year after.



Despite running at capacity, production struggled to keep up with global demand for semiconductors. In South Korea, semiconductor output is up 25% from a year ago in March 2021 but shipments are up 30%. Inventories have thus been drawn down. The same is true in Japan where supply disruptions worsened the chip shortage. A Renesas Electronics plant was indeed damaged by fire in March. In the United States, elevated unfilled orders of electronic components only highlight supply-chain pressures. The Texas storm in February led to power outages that shut semiconductor plants including Samsung's; it took weeks for MyStratWeekly – 25/05/21 - 2

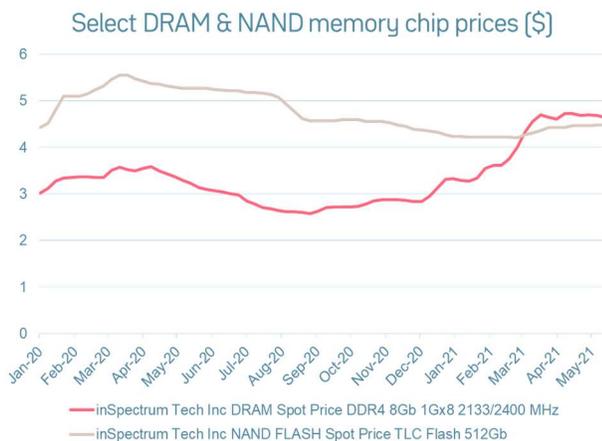
production to normalize. Taiwan electronics export orders are up 27% from a year ago, but the island suffered a drought that could affect semiconductor manufacturing.

Shortages result from a combination of factors. The stay-at-home orders underpinned chip orders beyond previous expectations. Sales of laptops exploded during lockdown as work-for-home and home-schooling became the norm spurring demand for monitors and networking gear. Given the unprecedented economic hit, corporations had a hard time assessing demand prospects.

The swift government response including income security measures underpinned consumer demand even for big-ticket items. The recovery in US auto sales for instance caught car manufacturers by surprise. Carmakers rushed to place semiconductor orders in late 2020, only to find out that technology companies (smartphone makers, computing firms) had secured high levels of semiconductor orders.

Other hardware producers including Chinese smartphone makers like Huawei had been forced to increase inventories out of fear of being deprived of US supplies as Donald Trump ignited a trade war on China. Chinese imports indeed climbed to \$ 380 billion in 2020 up 16% from a year ago. The supply shortage is most acute in so-called 200 millimeter wafers, from which low-end chips are made (used for display and power management in autos and consumer electronics for instance).

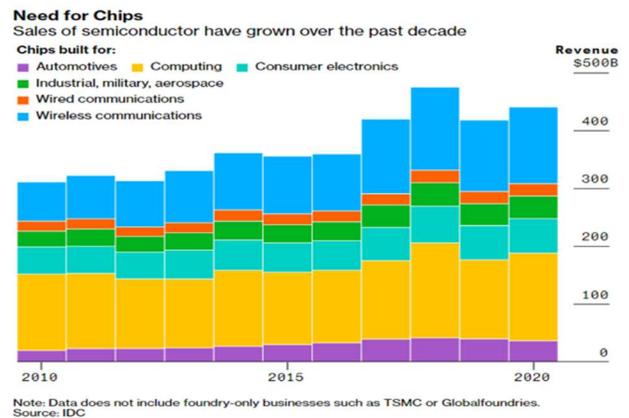
Unsurprisingly prices for DRAM, memory chips that depends upon an applied voltage to keep the stored data, are on the rise. High-end DRAM prices have increased by 40-50% in the past year whilst cheaper DRAM prices doubled. In turn, NAND, the most common type of flash memory used in storage devices including SSD, USB or SD cards, were in high demand during the first quarter of last year. NAND prices fell through the remainder of 2020 but rebounded early on in 2021.



Autos among the worst affected industries

Major semiconductor manufacturers, including Samsung and TSMC, foresee a supply shortfall extending into 2022. The shortages will affect several industries, chief amongst them autos. Likewise, the development of 5G in Europe and elsewhere may face delays. Gaming devices and smartphones will also be affected.

As concerns the automotive industry, it is estimated that production of up to million vehicles will be delayed by the lack of available chips. HIS and Deloitte estimate that electronics that use semiconductors account for 40% of total car manufacturing costs, up from 27% a decade ago and just 18% in year 2000. The rise of EV will raise that cost by a further 5% by 2030. Anecdotally, a severe shortage of \$ 1 chips disrupted production at a US truck manufacturer in February. Lost revenue for carmakers could add up to \$ 60 billion.



Hardware is hard

Not rocket science... just more much complicated

The manufacturing of advanced chips requires unparalleled precision, and significant investments in a rapidly changing technology. Facilities may cost billions in sunk costs including building and equipment and there are large operational risks to deal with. In the manufacturing process, water and electricity consumption are enormous and safety and hygiene requirements are even more stringent than surgery rooms.

In recent years, the costs of chip manufacturing have grown exponentially. Multi-year investment plans fetch tens of billions of dollars. For this reason, there are only a few global players left in the foundry business. TSMC and Samsung are the most prominent names. TSMC dominates the so-called foundry activity dedicated to manufacturing logic chips for others Samsung is a leader in memory chips but wishes to

expand into the foundry business to serve chip designers including Nvidia for instance. Samsung has been improving its production technology and winning new orders lately. Intel is the largest US company manufacturing chips but, for the time being, operates only for its own name (for PC and laptops). Smaller manufacturers from the US, China, and Taiwan, try to catch up with TSMC's technology but technological and financial barriers to entry are significant in the foundry business. Texas Instruments for instance chose to exit manufacturing business of the most advanced chips.

Other semiconductor companies supply equipment used in parts of the manufacturing process. ASML has a monopoly on photolithography equipment required to print patterns of cutting-edge chips onto the wafer. A handful of Japanese companies supply the chemicals used in semiconductor manufacturing. Cadence Design Systems and Synopsys are key suppliers of design automation software, without which no manufacturing can be done.

The geopolitics of semiconductors

Given the cost and difficulty in producing semiconductors, there is a global dependence on the two major Asian foundries, TSMC and Samsung. It is only natural that economic powers including China, the US and Europe would want to reduce their exposure to foreign chip supply. The semiconductor industry has been at the heart of the U.S.-China trade tensions in the past years.

The US wants to encourage companies to expand advanced factories domestically to address supply chain and security issues. President Biden recently put forward a proposal to spend \$50 billion to support semiconductor manufacturing and research as part of an infrastructure bill. The administration may use tax incentives to promote chip production capacity expansion. Projects include a \$12 billion investment for a TSMC plant in Arizona and a \$17 billion facility by Samsung, possibly in Texas. In turn, Intel Corp., may invest \$20 billion to set up its own foundry business to produce chips for other companies. The European Union will make a similar offer to the two Asian producers in a bid to double production by 2030. Meanwhile cross-border deals are closely watched by governments.

Geopolitics and the semiconductor industry

Global leadership in technology has shaped the recent trade conflict between the US and China. The Biden administration has signaled it will continue Trump's efforts to restrict China's access to high-end US technology — including that used in Taiwan's foundries. The US Senate bill currently under consideration includes measures to

protect intellectual property. US lawmakers aim at sanctioning companies that have engaged in intellectual property theft or coerced technology transfer.

Taiwan became a dominant player as its government promoted the electronics industry in the 1970s benefitting from US technology transfers. Catching up with Taiwanese expertise in chipmaking would take years and require massive financial commitment possibly a trillion dollars over a decade. Chinese President Xi Jinping is very aware of the need to be independent from foreign chip supplies. Chinese semiconductor firms are actively recruiting engineers from Taiwan powerhouses and the government investment effort in key technologies will be scaled up to \$1.4 trillion by 2025. In addition, Beijing may waive taxes on imported semiconductor materials and parts until 2030 if the equipment cannot be manufactured domestically. Chinese chip makers (top among them SMIC) still rely heavily on foreign technologies.

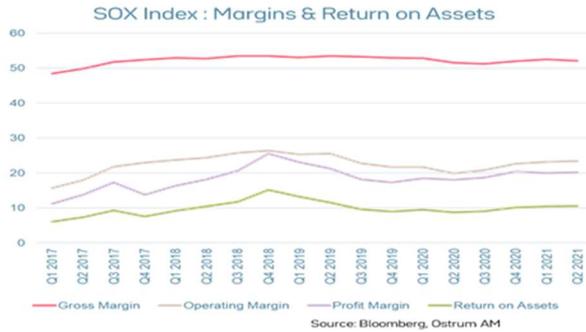
Semis losing out to broader market in 2021

The semiconductor stock index has massively outperformed in 2020, as stay-at-home orders raise demand for electronic devices and other durable goods. The SOX index representative of the global semiconductor industry gained 50% last year beating the S&P 500 gauge handsomely by about 35%. The performance of semis has since rolled over in early 2021 and into the second quarter in part due to the reopening and reflation trades. As for other growth stocks, the valuations of semiconductor companies are sensitive to long-term interest rates.



The stellar performance came disproportionately from multiple expansion. Price-earnings ratios hover about 33x at present compared with a 5-year average of 23x. Other valuation metrics including price-to-sales (6.9x) and price-to-book (7.5x) are now significantly above their respective long-term averages. With the benefit of hindsight, valuation

realignment was indeed overdue. Margins went down slightly through the past two years. Gross margins are off some 145pp from their peak in the second quarter of 2019. Gross margins are forecast at 52.04% in the second quarter. Operating margins are down as sales could not keep up with employee costs. Net debt (0.6x net debt to EBITDA) has turned positive for the sector in aggregate as R&D spending grew.



Return on Equity remains in the low 20s. High RoE is partly a by-product of extensive use of share buybacks as a way of returning cash to shareholders. SOX index members spent \$ 51.5 billion on share buybacks in the second half of 2018 whilst dishing out dividends worth \$ 16.7 billion. Since then, payouts have been reduced as R&D spending needs picked up (+13.4% in 2019).

SOX Index: Buyback and Dividend Policy



Conclusion

Manufacturing semiconductor is not rocket science... it is much harder. Barriers to entry are high. The global semiconductor industry is concentrated in a handful of key players. Two foundries (TSMC, Samsung) manufacture most chips for global designers. Chip shortages have caused supply disruptions amid stronger-than-expected demand for computing, automobiles and consumer electronics through the pandemic period. As both the US and China are dependent upon foreign supplies from South Korea and Taiwan, global economic leadership requires securing chip supplies. Beijing and Washington will battle fiercely to attract talent and develop domestic chip manufacturing. As concerns equity markets, semi stocks outperformed last year but high valuations and required R&D spending may weigh on prospective equity returns.

Axel Botte

• **Market review**

Entrenched volatility

Pockets of volatility indicate heightened market nervousness

Equity markets have entered a form of horizontal consolidation with increased volatility and violent sector rotations linked to changes in long-term rates. The main question remains the Fed's monetary policy outlook, as a monetary turning point has already taken place in several regions facing inflationary pressures. The markets thus appear trapped in a cycle initiated by the increase in inflation expectations pushing US long-term rates higher followed by a correction in stock market indices. The ensuing adjustment in large-cap growth stocks in turn limits the pressure on rates to the detriment, ultimately, of the US dollar. The fall in the greenback then resuscitates a rebound in risky assets. This investor sentiment cycle determines a sideways price drift characterized by high volatility. VIX regularly trades above the 20% threshold.

The cryptocurrency market continues to grab the headlines. Tesla's decision to stop accepting Bitcoin payments arguably proves that the token is not a currency. China is banning its use. Its elevated volatility prevents it from being a store of value, one of the essential attributes of a currency. Conversely, one can be surprised by the lack of volatility in the credit markets. CDS indices barely respond to equity volatility and bond spreads move within a quite narrow range.

The outcome of this episode of market nervousness will depend on the future monetary policy of the Fed. The minutes of the April FOMC meeting indicate that the tapering discussion is underway, regardless of what some FOMC members may say publicly. Jackson Hole, at the end of August, will be an important rendezvous to communicate before a formal announcement in September. The risk for the Fed is that the US economy will hit supply constraints prematurely. The lowest sustainable level for the unemployment rate is probably higher than the 3.5% that prevailed before the pandemic. Labor participation is picking up very slowly and recent income transfers to households are reviving ideological opposition between Democrats and Republicans as infrastructure programs are debated in Congress. Uncertainty also stems from the trend in budget deficits and the ability of the US bond markets to absorb Treasuries issues. The inflation-adjusted 5-year bond yield (-1.80%) has declined by 140bp over the past year. At these levels, tensions around Treasury bond auctions cannot be ruled out. Bottlenecks in the primary markets would risk impacting the repo market on which the primary dealers refinance their holdings. It is for this reason that the Fed is studying the possibility of keeping a permanent repo facility open to US banks and international financial institutions. The

experience of tensions in repo markets in September 2019 and March 2020 argues for caution. The mention of tapering in the FOMC minutes nonetheless already initiated a limited correction in real bond yields, reducing breakeven inflation rates somewhat. In turn, the 10-year T-note is looking for direction oscillating between 1.60 and 1.70%.

In the euro zone, the much-advertised acceleration of the PEPP scheme remains elusive as the ECB seemed to let the Bund drift higher for a time. The German Bund approached -0.07%. A comment by Philip Lane dismissing the risk of inflation, with public support from Mario Draghi, eventually reversed the uptrend to push the Bund yield back down towards -0.13% at the weekly close. Sovereign spreads were well behaved, with Italian BTP spreads falling back below the 120bp threshold. The level of 1% on 30-year OATs continues to attract significant institutional interest. The EU's SURE issues have weighed on supranational debt markets, whose spreads have been rising for several weeks. The € 14bn SURE double tranche borrowing (8 and 25 years) was met with high demand of about € 90bn. Duration hedging around EU bond issuance likely contributed to the narrowing in swap spreads. The 10-year swap spread is trading at 30bp.

As concerns European credit markets, euro IG spreads (84bp against Bund) widened slightly over the past week. The primary market remains quite active with nearly 20 billion worth of bond issuance last week. The primary market deals no longer offer a premium compared to a secondary market which is suffering from an apparent lack of investor appetite for risk. The BBB group however benefits from the economic outlook and improving rating revisions. High beta market segments tend to widen out, especially hybrid debt or bank subordinated securities. Real estate companies were also under pressure. Meanwhile, European high yield is stable at 304bp above the German bond. Primary activity has finally slowed down after the deluge of bond issues since the start of the year. CDS index spreads remain inert despite tentative signs of widening on the iTraxx Crossover index (259bp). In Asia, the setbacks of Huarong, a systemic entity supported by the Chinese state, may affect the perception of the regional credit asset class.

European equity markets are up 0.2% (Euro Stoxx 50) amid high volatility. From a sector perspective, profit taking on commodity-related cyclicals contrasted with the rebound in consumer staples. The hypothesis of a return of Iranian supply weighed on crude prices towards the end of last week, resulting in a drop in oil stocks. Flows continue to feed the value theme while European growth funds record net outflows. Inflation expectations and the reopening of the economy, confirmed by the upbeat May service PMI, sparked a rebound in tourism-related stocks.

Axel Botte
Global strategist

● Main market indicators

G4 Government Bonds	25-May-21	-1wk (bp)	-1m (bp)	YTD (bp)
EUR Bunds 2y	-0.66 %	-1	+3	+4
EUR Bunds 10y	-0.16%	-5	+10	+41
EUR Bunds 2s10s	50 bp	-4	+7	+37
USD Treasuries 2y	0.15 %	+0	-1	+3
USD Treasuries 10y	1.59 %	-5	+3	+68
USD Treasuries 2s10s	144 bp	-5	+4	+65
GBP Gilt 10y	0.8 %	-7	+6	+60
JPY JGB 10y	0.08 %	-1	+1	+6
€ Sovereign Spreads (10y)	25-May-21	-1wk (bp)	-1m (bp)	YTD (bp)
France	37 bp	-3	+3	+14
Italy	113 bp	-8	+9	+2
Spain	67 bp	-4	+1	+5
Inflation Break-evens (10y)	25-May-21	-1wk (bp)	-1m (bp)	YTD (bp)
EUR OATi (9y)	135 bp	-12	+3	-
USD TIPS	247 bp	-8	+13	+48
GBP Gilt Index-Linked	358 bp	+3	+12	+58
EUR Credit Indices	25-May-21	-1wk (bp)	-1m (bp)	YTD (bp)
EUR Corporate Credit OAS	86 bp	+2	+1	-6
EUR Agencies OAS	38 bp	-1	-1	-3
EUR Securitized - Covered OAS	29 bp	+2	-2	-3
EUR Pan-European High Yield OAS	303 bp	+3	-2	-55
EUR/USD CDS Indices 5y	25-May-21	-1wk (bp)	-1m (bp)	YTD (bp)
iTraxx IG	51 bp	0	+1	+3
iTraxx Crossover	254 bp	-2	+4	+12
CDX IG	51 bp	-1	0	+1
CDX High Yield	289 bp	-7	-2	-5
Emerging Markets	25-May-21	-1wk (bp)	-1m (bp)	YTD (bp)
JPM EMBI Global Div. Spread	337 bp	+4	-3	-15
Currencies	25-May-21	-1wk (%)	-1m (%)	YTD (%)
EUR/USD	\$1.226	+0.37	+1.43	+0.3
GBP/USD	\$1.417	-0.18	+2.02	+3.78
USD/JPY	¥108.86	+0.07	-0.67	-5.11
Commodity Futures	25-May-21	-1wk (\$)	-1m (\$)	YTD (\$)
Crude Brent	\$68.3	-\$0.4	\$2.9	\$16.8
Gold	\$1 883.3	\$15.9	\$104.5	-\$11.0
Equity Market Indices	25-May-21	-1wk (%)	-1m (%)	YTD (%)
S&P 500	4 197	0.81	0.40	11.74
EuroStoxx 50	4 054	1.21	1.00	14.10
CAC 40	6 417	0.99	2.54	15.59
Nikkei 225	28 554	0.52	-1.96	4.04
Shanghai Composite	3 581	1.48	4.07	3.12
VIX - Implied Volatility Index	18.34	-14.06	5.83	-19.38

Source: Bloomberg, Ostrum Asset Management

Additional notes

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