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Asia Technology

Ice Age – End In Sight

In the late stage of a downturn, risks become discounted in magnitude and duration. Although it is early to be outright positive, we believe the underperformance has come to an end. We upgrade Korea Tech/Greater China Tech Semis to Attractive and distill our insight on navigating inflections.



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Ice Age – End In Sight

Upgrade from Cautious to Attractive: No one knows exactly when this downturn will end and we find it difficult to get ahead of macro events, but we see signals that suggest we should no longer be overly pessimistic: (1) the cyclical sell-off has already been punitive in an historical context; (2) the magnitude of the valuation correction (YoY) is approaching extremes relative to the last two decades; (3) earnings risks are now well understood and it is surprising that will drive stocks from here; (4) green shoots are emerging while some consumer parts of tech are close to bottoming; (5) we are [upgrading our top down EM strategy view on IT, Korea, and Taiwan](#); these are set-up for a reversal in returns in the coming weeks. What is not understood is cycle turns and the market's willingness to increasingly look through this late stage of the downturn and, hence, our focus on the other side of the cycle.

INDUSTRY VIEW

**S. Korea
Technology | Asia
Pacific**
Attractive

An inflection is near and we see reasons to be constructive on a 2H23 recovery. (1)

Macro headwinds are fading with the bulk of the Fed's heavy lifting likely to be done by year-end and benefits from China's reopening; (2) demand elasticity and replacement cycles will be driven by the sharp fall in pricing, especially consumer products; and (3) supply adjustment is accelerating via significant production and capex cuts that are underway. We have clearly worked through the slowdown in the consumer and are most positive on 'first-in, first out' exposure in LCD panels bottoming now, followed by memory in 4Q22, while the trough for foundry, auto and semicap should come with a lag in 1H23.

WHAT'S CHANGED

	From	To
S. Korea Technology Industry View	Cautious	Attractive
Greater China Technology Semiconductors Industry View	Cautious	Attractive

Preferences – Asia over US: Our positive bias in Asia reflects early cycle exposures relative to a cautious US, which has lagged in the downturn. **Key OWs:** memory, LCD panels and passive components. **Key UWs:** IC design, semi materials and equipment, and substrates.

Highest conviction in Hynix, TSMC and display sector: We make several upgrades at the stock level in consumer related cyclical stocks ([SK hynix](#), [LG Display](#), [Innolux](#), [AUO](#), [Parade](#)). We are most bullish on LCD panels and memory stocks. **Hynix** is now our top pick with **TSMC** offering c.60% potential upside to our price target. From a quant perspective, the global selloff in September shared increasing characteristics of market capitulation and favors an initial risk rally that is driven by price reversal vs. fundamental factors that come with a lag.

Asia Technology Hardware

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Passing through the storm

Upgrading Korea Tech/Greater China Tech Semis from Cautious to Attractive: We have been cautious on the tech sector since 3Q 2021 because it fitted our framework of a cyclical derating coincident with a semiconductor cycle peak. However, we are well advanced in the current cyclical downturn with global semiconductor shipment units having declined for nearly five quarters (historically 4-6 quarters of downturn) from the September 2021 peak. In terms of financial markets, the Philadelphia Semiconductor Index (SOX) has fallen to multi-decade lows and the Asia tech sector has seen its trading multiples compress back to cycle trough levels from a NTMPE of 21x to 12x and an EV/Sales of 1.7x to 1.1x. The reset in earnings revision breadth is the reason why meaningful downside risk to 2023 consensus estimates has likely become a lagging indicator now.

At this stage, we think earnings growth will not matter, but it is surprises that will drive stocks. We should not wait and expect a flow of good news to mark the bottom in stocks – this almost never happens – but rather, 'buy the bad news' when stocks positively respond to negative events will mark the inflection. It is hard to imagine a sector rebound at the height of a demand disfunction, and while downturns are never the same, we have seen this movie before and can learn how to position – stocks start the next leg up well before the cycle bottom is apparent to the general investing public – once again.

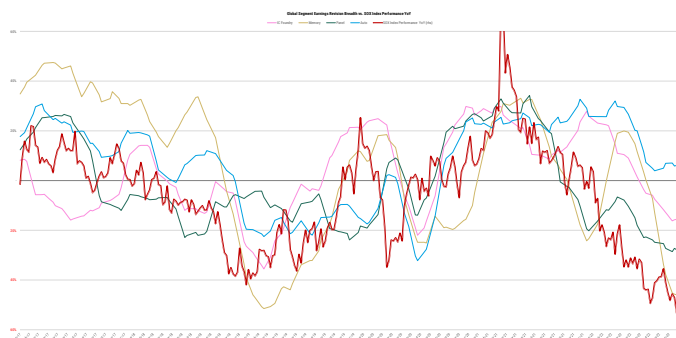
The weakness in tech could be overdone: Exhibit 2 suggests we should no longer be overly pessimistic, and that we should increasingly prepare for a reversal in returns in the coming weeks. Assuming valuation always leads first and fundamentals follow with a 2-3 quarters lag, we see early signs that the weakness in tech could be reversing: (1) inventory and shipments for some consumer parts of tech such as TV sets have normalized recently; (2) recent production cuts in memory typically signal a bottom for stocks as would help normalize inventory levels; (3) earnings revision breadth has fallen to cycle trough levels for many early beneficiaries of 'stay at home'; (4) peak-to-trough magnitude and duration is now within previous down cycles; and (4) valuation multiples are moving closer to recessionary cyclical bottoms. Reversals in trends are abrupt and despite further downside risks to earnings, we think the market will start to discount a recovery 2-3 quarters out, as inventory begins to peak and revenue rate of change begins to trough. Sector performance is likely to be entirely due to multiple expansion once an inflection narrative is established, and earnings a considerable lagging indicator.

Exhibit 1: Time to look through the trough once again – SOX Index performance in 11 cyclical downturns

Peak	Trough	Days to Trough	Fall from Peak	Next Peak	Days to Next Peak	Gain from Trough to Next Peak
20-Aug-97	7-Oct-98	413	-52%	10-Mar-00	520	594%
10-Mar-00	9-Oct-02	943	-84%	12-Jan-04	460	162%
12-Jan-04	8-Sep-04	240	-37%	8-Feb-06	518	56%
8-Feb-06	21-Jul-06	163	-30%	17-Jul-07	361	42%
17-Jul-07	20-Nov-08	492	-69%	17-Feb-11	819	177%
17-Feb-11	3-Oct-11	228	-31%	27-Mar-12	176	36%
27-Mar-12	17-Jul-12	112	-21%	1-Jun-15	1049	113%
1-Jun-15	11-Feb-16	255	-25%	12-Mar-18	760	159%
12-Mar-18	24-Dec-18	287	-26%	19-Feb-20	422	85%
19-Feb-20	18-Mar-20	28	-35%	3-Jan-22	656	213%
3-Jan-22	30-Sep-22	270	-43%	?	?	?
Average 1997-2020		316	-41%		574	164%

Source: Refinitiv, Morgan Stanley Research

Exhibit 2: Risk is lowest when the market perceives it to be the highest – Earnings revision breadth vs. SOX Index performance YoY



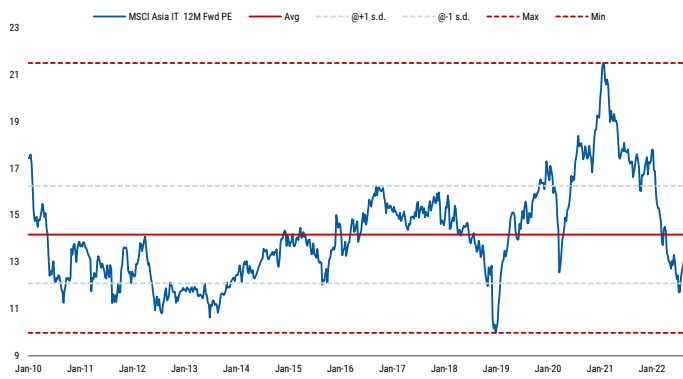
Source: Refinitiv, Morgan Stanley Research

The final capitulation? Capitulation has no definition but typically occurs during a period of continual stock price downtrend, and caused either by poor earnings prospects or negative company/market headlines – both apply to the current tech sell-off. It sets in when even the most bullish and long-term oriented investors after buying into successive dips, either get tired of further losses or run out of cash and simply stop buying and waiting.

- **A selling climax.** Historically, the end of a bear market does not go out with a whimper – it is truly an event. A lot of the losses in a bear market occur within the period when it ends, and we are at a point marked by deep pessimism in the market, which frequently accompanies major troughs.
- **Risk is lowest when investors perceive risk to be highest,** and while difficult to identify, the risk of further decline due to the widely debated recession risk is likely already being priced into the market. By definition, there are few sellers left to sell tech stocks near trough valuations, and the risk of trying to time the bottom at this stage is in missing it and failing to participate in the cyclical rebound that follows.

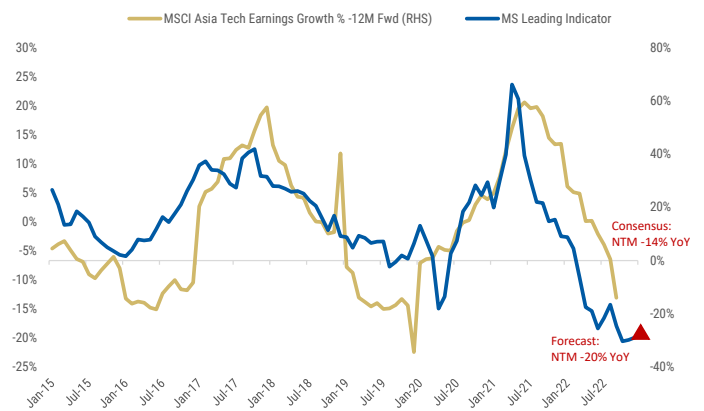
- **There is no magical soft-landing expectation from companies or investors anymore,** despite the Fed raising rates in an historic way into a system is levered to generational highs with rising inventory and slackening demand, and the market is beginning to discount a recession, which was not the case at the August peak.
- We now have **an increasingly large number of companies worried about the future,** and we are starting to get the feeling that the recession is finally beginning to be priced-in. Companies in general don't want to be negative and they also don't have the tools to forecast the macro environment – that is not what they do – but we are getting to 'bad news is bad news', driving very sharp negative earnings revisions.
- The CBOE Volatility Index (VIX) is one element in judging capitulation (also known as the 'fear index') and can be an indicator when closer to 40 vs. 30 now suggest some level of anxiety above the long-run average read of 20, but not at a moment of extreme fear. However, sentiment can unravel rather quickly as the market's attention has turned to earnings slowing at a higher pace in recent weeks.

Exhibit 3: Asia Tech NTM P/E at 12x



Source: Refinitiv, Morgan Stanley Research.

Exhibit 4: Top-down model implies further declines in NTM EPS



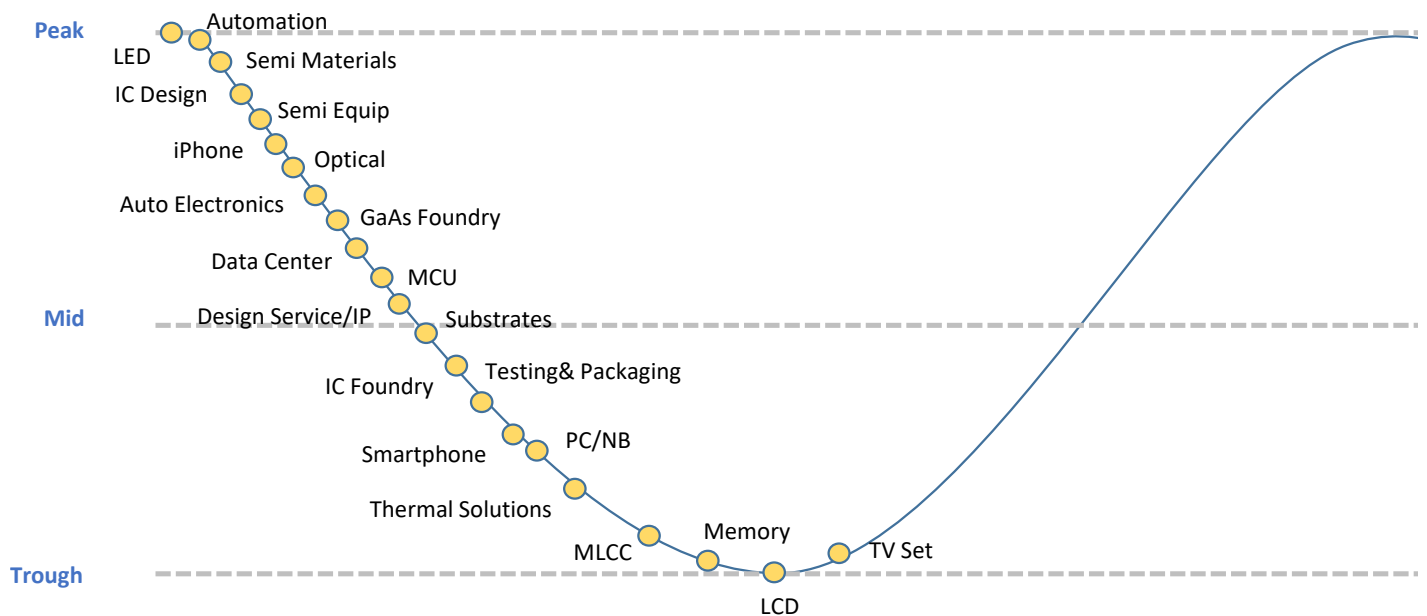
Source: Refinitiv, Morgan Stanley Research.

Don't try to time the market. It is impossible to know the perfect times to get in and out of the market, but we think a cyclical inflection in the technology sector will be the main debate in the coming months. History has shown down cycles are never that different, and when they have occurred stocks have eventually recovered and gone on to new highs. We believe that will be the case this time and we look for great companies at currently great prices (not good prices) that may flourish in a subsequent cyclical rebound. Rules to call the stocks' bottom from here will be when: (1) companies talk about weakness first (this is broadly happening already and peaks most likely in the October earnings reporting season); (2) expectations reset early so that by 4Q, when they miss, it may be better than feared; and (3) a '2H23 demand recovery' narrative follows, leading to

a rally. Ultimately, much depends on the rate of change in inflation/rates in the near term, with a lot of the macro headwinds likely behind us entering 1Q23.


When will industry growth resume? Not all chip and hardware growth curves are deteriorating at the same pace; some appear to be nearing the bottom, as illustrated on [Exhibit 5](#). Once again we are reminded that the best time to buy tech stocks is when (1) inventory peaks, (2) pricing bottom on a YoY basis as production levels fall to sustainable levels – both likely in 4Q22 for many cyclical commodity parts of tech, and (3) pessimism in the market is high. Some of these are beginning to materialize in areas like LCD panels, TV demand, and soon memory or MLCC in 4Q22, and then more segments of tech likely entering 1H23.

Exhibit 5: Sequencing the cycle – End Market Order Preference



Source: Company data, Morgan Stanley Research

Exhibit 6: First-in, First-out – Segment Order of Preference



	Last Peak	Expected Trough	Where are we different from what's priced in	Most Preferred Stocks	Least Preferred Stocks
TV Set	1Q21	3Q22	TV set inventory for Samsung and LG improved to normal levels (7-weeks) and YoY shipment likely flat from 4Q22 vs. double digit declines in Q2	LG Electronics	
LCD	2Q21	4Q22	TV/IT panel pricing to see signs of bottoming likely from October	LG Display E Ink BOE Innolux	
Memory	2Q21	4Q22	Memory pricing is likely to trough in 4Q22, and we prefer industry leaders with better cost competitiveness; while there should be no growth in Nanya Tech's bit output, and the pricing environment is facing pressure	Samsung Electronics SK hynix	Winbond Macronix
MLCC	1Q21	4Q22/1Q23	Low end MLCC inventory remains very high with pricing at a low point and will take more time for digestion to happen	Yageo Murata	
Thermal Solutions	1Q21	1Q23	We expect server platform upgrades to offset PC demand weakness next year	AVC	Auras
PC/NB Hardware	1Q21	1Q23	We are more bearish on demand than consensus and think there is more earnings downside		Acer Asus
Smartphone Hardware	1Q21	2Q23	We expect recovery to start from 2Q23 thanks to the low base in 2022 and accumulated replacement demand	Hirose Electric Transsion	OFILM
Testing & Packaging	4Q21	2Q23	JCET suffers from significant pricing pressure in the wire-bonding business, and weak consumer and smartphone markets		JCET
IC Foundry	2Q22	2Q23	TSMC's long-term earnings growth still looks promising given breakthroughs of N3e and N2 GAA, while second-tier foundries with large consumer electronics exposure and aggressive pricing strategy will continue to face headwinds	TSMC	PSMC
Substrates	2Q22	2Q23	ABF is starting to see some cuts in 4Q and we expect pricing to normalize in 1H23.		Shinko Ibiden
Design Service/IP	2Q21	2Q23	We prefer Andes as it enjoys global AI ASIC, auto HPC and China localization opportunities GUC has limited contributions from leading edge turnkey projects, and is more conservative on whether it could translate the NRE business into volume production Andes is the RISC-V IP leader in Asia, and aerospace and automotive are the two markets that will enlarge the TAM for RISC-V in the coming years.	Andes Alchip	GUC
MCU	3Q22	2Q23	We believe Nuvoton could benefit from China's MCU localization and enjoy synergy from the acquisition of Panasonic's semiconductor business	Nuvoton Sino Wealth	
Data Center Hardware/Semi	2Q22	2Q23	We expect server platform upgrades to drive content increase for data center components next year, while potential slowdown of cloud adoption in China could significantly impact Montage	Wiwynn Delta Fii	Montage
GaAs Foundry	2Q21	3Q23	Both WIN Semi and AWSC have cut 2022 capex plans, and it might take another 12-18 months for the segment to recover, and thus it is still too early to get involved		WIN Semi AWSC
Auto Electronics	1Q22	3Q23	We expect rising EV penetration to drive content increase for power related components	Delta SDI	
iPhone	3Q22	3Q23	We expect iPhone build to be skewed to iPhone Pro/Pro Max models in 2H22-1H23	Hon Hai Luxshare Genius	Largan
Optical	2Q21	3Q23	Optical: We expect iPhone 3D sensing design change to benefit InP laser providers	LandMark	
Semi Equipment	3Q22	3Q23	We expect WFE to decline 20% or more in 2023, given the outlook for memory oversupply and decline of non-memory fab utilization rates, vs. the current consensus that expects WFE to decline 5-15%	ACMR AMEC	TEL SCREEN DISCO
IC Design	4Q21	4Q23	Companies that are highly correlated to consumer tech, which raised prices during the shortages and face fierce competition, are those we least prefer	MediaTek Parade Will Semi	Silergy Novatek uPI
Semi Materials	2Q22	4Q23	We are positive on the raw wafer cycle because it typically lags the logic/memory cycle, and raw wafer demand should follow fab capacity expansion Raw wafer inventory remains healthy, while new capacity may arrive later than expected given the long equipment lead time	GlobalWafers Wafer Works	
Automation	2Q21	1Q24	We are at the late stage of this upcycle and the risk reward is more skewed to the downside in the coming few quarters	Chroma Advantech	Airtac Hiwin
LED	1Q22	1Q24	Pricing pressure to intensify in the coming few quarters amid the oversupply situation and the more conservative outlook for mini LED applications		Ennostar

Source: Company data, Morgan Stanley Research

What's Changed?

We upgrade our industry view for Korea Technology from **Cautious to Attractive** and see value emerging in certain companies. We see the highest upside in commodity consumer-related stocks, which have capitulated and are near cycle bottom, but we're less positive on upstream logic and crowded areas such as networking, cloud or auto semis that carry higher earnings risks and, or high valuations. Based on the late stage in the cycle, we think investors should reduce expensive Quality exposure and selectively add to Cyclical. We upgrade **SK Hynix** (OW from EW) and **LG Display** (OW from UW) to reflect commodity-driven stabilization and scope for YoY growth bottoming into Q4. Other preferred OWs: **Samsung Electronics** and **LG Electronics**.

While US semis have largely come down sharply from late July/early August highs, we expect to see incremental weakness into the September earnings period. Over the past couple months, semiconductor company P/E multiples have contracted 24% on average across the group (based on MSe CY22 earnings), as the macro situation worsens and management teams begin to surrender to guide downs. Despite this dynamic, we have seen just roughly half the companies in our coverage see consensus earnings revisions come down for CY23, signaling further downside to numbers over the final two earnings report periods of 2022. Where we see the most risk specifically is in the computer stocks that have yet to cut CY22 guidance,

Exhibit 7: The average semiconductor company in our coverage has only seen a -1% EPS revision to CY22 consensus numbers, and a -7% EPS revision to CY23 consensus numbers. Only ½ of the companies have seen negative EPS revisions YTD at all.

Company	CY22 EPS Revisions YTD	CY23 EPS Revisions YTD
Advanced Micro Devices	31%	19%
Intel	-39%	-31%
NVIDIA	-33%	-29%
Lam Research	-3%	-2%
Applied Materials	-6%	-10%
KLA	7%	7%
Teradyne	-38%	-30%
Analog Devices	22%	12%
Texas Instruments	15%	1%
ON Semiconductor	57%	43%
NXP Semiconductor	17%	6%
Microchip Technology	12%	12%
Silicon Laboratories	93%	40%
Wolfspeed	-30%	-7%
Micron Technology	-34%	-66%
Western Digital	-43%	-62%
Broadcom	13%	12%
Marvell Technology	5%	0%
Skyworks Solutions	-6%	-10%
Qorvo	-29%	-33%
Ambarella	-42%	-41%
Qualcomm	16%	11%

Source: Morgan Stanley Research, Refinitiv

namely AMD and QCOM, as well as analog and broad-based companies who have still been describing robust demand conditions. Inventory builds, weakening macroeconomics conditions, and lessening severity of supply constraints (i.e. more inventoried vehicles on wheels, *golden screw* phenomenon) should place more of a damper on continued optimism we've seen from this group.

In summary, we still see a fundamentally challenging period ahead for US semiconductors, with greater headwinds still ahead. Companies are either missing numbers around headwinds that are already occurring – which is being well received, but doesn't signal an imminent bottom, either – or they have good numbers and good outlooks with well-understood potential for challenges, which isn't inspiring either at least until we can better calibrate where numbers will bottom.

When we do eventually see estimate cuts that reflect the challenging environment we see ahead, we turn our attention to the prior semiconductor down cycle for a more precise view of where we're headed. In the chart below, we show trough multiple on peak trailing 12 month EPS during the 2018/2019 semiconductor cycle. Though business conditions for several companies are structurally different this time around, this framework helps to backstop our view on when we are nearing fair valuation to discount the near-term deterioration of earnings growth, and could begin to get more constructive on certain stocks within the group.

Exhibit 8: US semiconductor cycle peak EPS vs. trough multiples

Company	Peak 2018 EPS	Trough Trailing Multiple
NVIDIA	\$1.89	16.9X
Lam Research	\$17.80	7.4X
Applied Materials	\$4.46	7.1X
KLA	\$9.14	9.4X
Analog Devices	\$5.96	13.6X
Texas Instruments	\$5.59	15.9X
Silicon Laboratories	\$3.75	19.8X
Micron Technology	\$12.48	2.5X
Western Digital	\$14.75	2.4X
Marvell Technology	\$1.26	12.6X
Skyworks Solutions	\$7.22	8.4X
Qualcomm	\$3.91	12.6X

Source: Morgan Stanley Research, Refinitiv

Exhibit 9: MS Asia Tech Key Overweight Calls

Korea	
005930.KS	Samsung Electronics
000660.KS	SK hynix
034220.KS	LG Display
Greater China	
2330.TW	TSMC
2454.TW	MediaTek
000725.SZ	BOE
002475.SZ	Luxshare
ACMR.O	ACMR
Japan	
6762.T	TDK
6702.T	Fujitsu

Source: Morgan Stanley Research

We upgrade our Industry View for Greater China Semiconductors from Cautious to Attractive:

Last December, we debated, [Semiconductors 2022 Outlook: Chip Shortage or Oversupply? \(8 Dec 2021\)](#), when the industry was still optimistic. Fast forwarding to this year, we entered a semi recession (revenue Y/Y decline) in July 2022. More than an inventory digestion, downstream customers wanted to correct inventory levels back to pre-COVID levels. Stay-at-home tech demand has faded (e.g., PC shipments to be down 17% Y/Y in 2022e), while inflation pressures weigh on consumer tech.

However, we now see three reasons to be constructive on a 2H23 recovery from an earnings perspective:

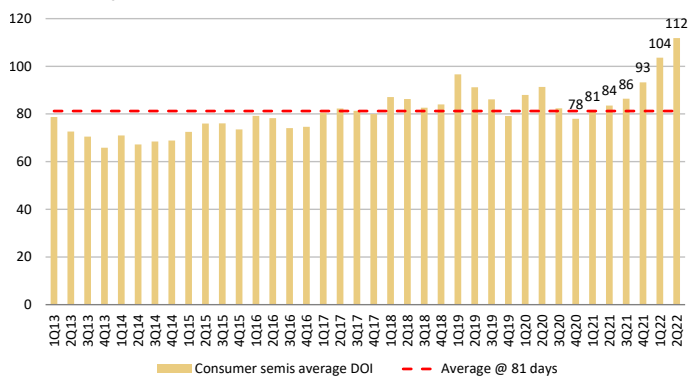
Exhibit 10: Industry View Changes and Ratings Changes

	Old	New
Industry		
Korea Technology	Cautious	Attractive
Greater China Semiconductors	Cautious	Attractive
Company		
SK hynix	EW	OW
LG Display	UW	OW
Innolux	UW	OW
AUO	UW	EW
Nanya Tech	UW	EW
Parade	EW	OW

Source: Morgan Stanley Research

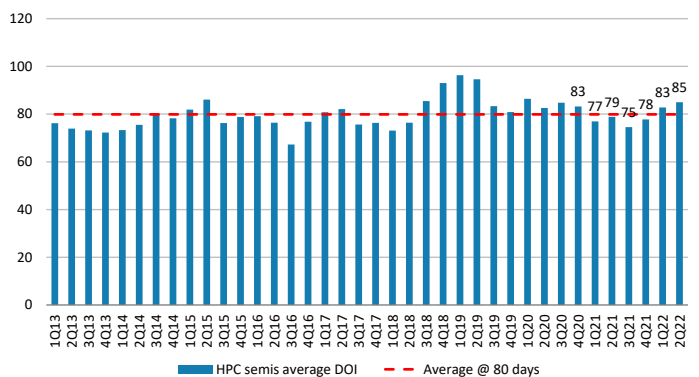
- Economies reopening:** the global economy is reopening, while the end to China's COVID-zero policy is hopefully a matter of time. Greater China semis have good exposure to China smartphone demand, which ties in to China's reopening.
- Cheaper tech products and logistics:** We expect Chip ASP and margins to see mean reversion, and consumer products (such as an Rmb999 5G smartphone) should be cheaper in 2023.
- Slower fab capacity increase:** 2nd tier foundries such as Powerchip and Vanguard started to cut capex in July, and TSMC also sees production cuts in 4Q22. We expect semi inventory days to start to decline in 1Q23.

Exhibit 11: While consumer semi days of inventory have reached historically high levels...



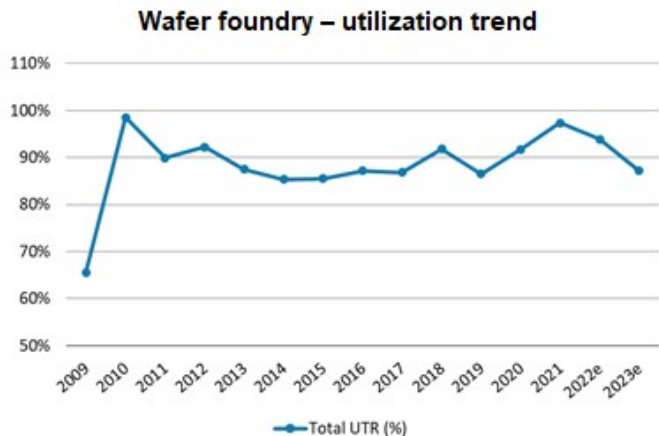
Source: Company data, Morgan Stanley Research

Exhibit 12: ...HPC semi inventory is still around the historical average



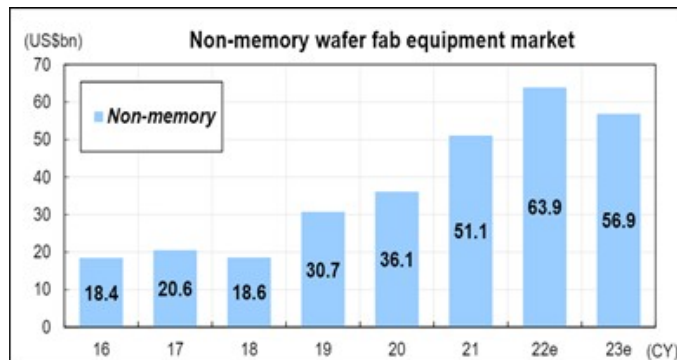
Source: Company data, Morgan Stanley Resear

Exhibit 13: Foundry output has slowed down with production cuts



Source: Company data, Morgan Stanley Research (e) estimates

Exhibit 14: We estimate foundry capex to decline 10%-20% Y/Y in 2023



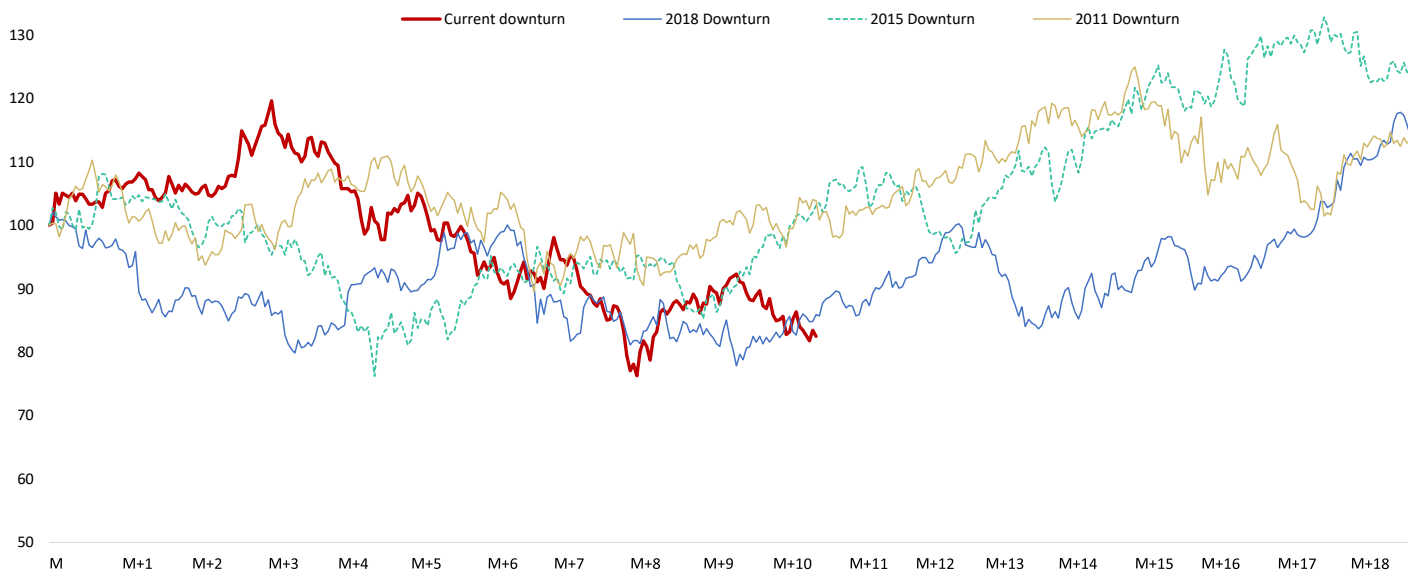
Source: Company data, Morgan Stanley Research (e) estimates

Indeed, stock valuations are attractive while expectations are now at trough levels. We see TSMC stock is approaching the bottom, and our price target of NT\$720 implies a 60% return in 12 months.

We rather stay selective for now, as it is hard to gauge the margin downside for commodity products such as LCD driver ICs, image sensors, RF semis, PMIC, and niche memory.

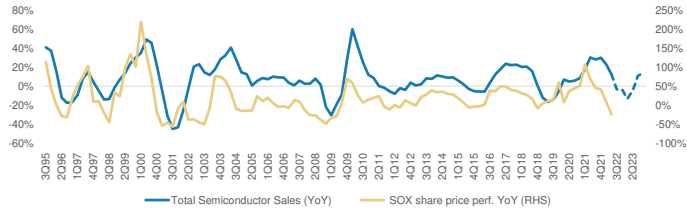
Pricing power and margin sustainability are still how we differentiate our stock ratings. We stay OW on TSMC, MediaTek and Will Semi, as their long-term industry positions remain solid. Otherwise, our top OW ideas for China's semi localization include Alchip, Andes, AMEC, and Starpower.

Exhibit 15: TSMC's market cap trends in recent semiconductors downturns



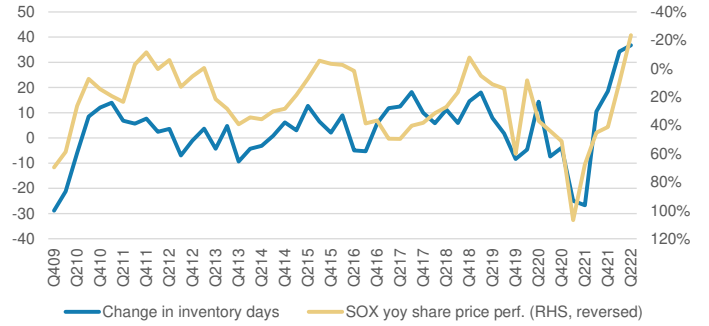
Source: Company data, Refinitiv, Morgan Stanley Research

Exhibit 16: Down-cycles last 4 quarters on average, while Y/Y stock performance leads fundamentals by 1-2 quarters



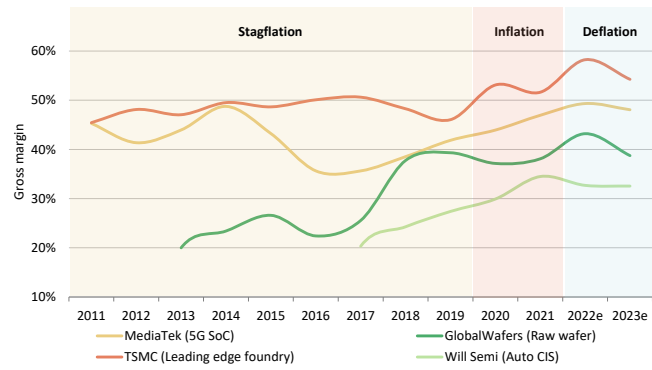
Source: Company data, Refinitiv, Morgan Stanley Research estimates

Exhibit 17: Y/Y stock performance inflection point has been almost concurrent with the change in inventory days



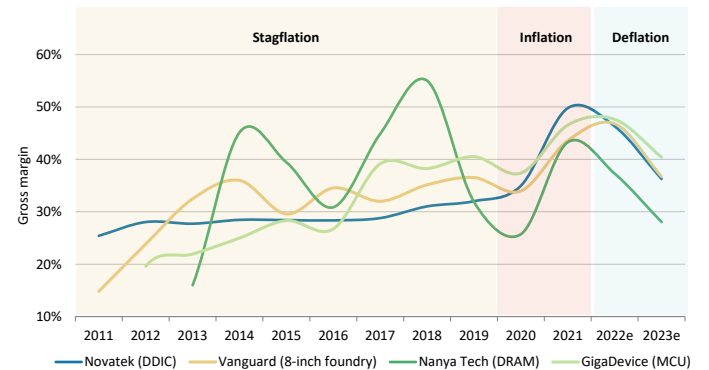
Source: Company data, Refinitiv, Morgan Stanley Research

Exhibit 18: Gross margins have improved structurally for the industry leaders



Source: Company data, Morgan Stanley Research (e) estimates

Exhibit 19: Gross margin trends for commodity semi players are cyclical



Source: Company data, Morgan Stanley Research (e) estimates

Our 'Least Preferred' list is focused on multiple and earnings risk:

We remain cautious on upstream IC design – all stocks are Underweight rated, as they carry earnings risks and, or high valuations. We are less positive than consensus on Equal-weight-rated **Phison Electronics**, while **Realtek** (Equal-weight) faces thematic headwinds from weak consumer end demand.

Navigating Tech Cycle Reversal (Upturn) Complexity With Quant

The magnitude of the valuation correction (YoY) is approaching extreme, relative to what we have seen in the last two decades. Concurrently, the valuation gap between the SOX index level and its underlying earnings growth has converged, which forms a better ground for long-term investors to explore intrinsic value. In the last 7 major market troughs (since Jan 1999), (1) the initial risk rally was highly price reversal driven, which has nothing to do with fundamentals, and (2) after the initial risk rally, fundamental factors started to generate alpha for Tech Hardware, while Semiconductors remained a Beta trade. We note that the alpha efficacy of momentum factors started to diverge from 50 trading days onward. Tech Hardware

names turned to be 6-12M momentum driven, but semiconductor names remained highly reversal driven. That means investors tended to look for bottom-up alpha only among Tech Hardware names, and continued taking Semiconductor names to gain market Beta exposures. Bottom-up factors, like consensus earnings revisions, only started adding value for Semiconductor names after 4 months from the bear market trough, historically.

A Final Word Of Advice

A perceived cyclical downturn creates maximum anxiety and fear in the market, and we believe it is important to lean the other way when sentiment moves to extremes. With maximum negativity, we think it is always a good strategy to try to allow for the possibility of positive surprises.

Most important, however, is not to lose sight of the long term. Consider a downturn as an opportunity to invest in some great companies at attractive prices.

Where Are We in the Cycle?

It is never different! There is always mean reversion, where the magnitude of the downturns tends to be proportional to the excesses created on the way up. We are well advanced in the current cyclical downturn from where global semiconductor shipment units peaked around September last year. Up until now, the consumer has seen a slowdown, but two thirds of the US economy is related to services to the consumer and when that starts to slow down then you start to see it affect enterprise demand – with a lag. And so that is the next phase of the slowdown that we expect reaches the peak rate of decline in 4Q22 and eventual recovery into positive growth from 2H23.

Semiconductor stocks typically lead the upturn in profitability by about 1-2 quarters. The trough occurs 5-6 months after the peak with an average sell-off of 30% (peak to trough). In the current downturn, SOX sold off by about 41% from its peak in January 2022 to lows in September 2022. SOX declined 40% in 2022 and underperformed the S&P 500 by 160bps. It is trading at near trough valuation of PE of 14x compared to its 10-year average of 17.5x. Most analysts expect additional downward revisions following 3Q22 earnings leading to another 6-15% sell-off. They also expect earnings to bottom in 1Q23 followed by marginal growth in Q2 and Q3 of 2023. Semiconductor revenue growth for 2023 is expected by consensus to decline -4% using MSCI Asia IT consensus as a proxy, below the +5% growth of 2022e.

Semiconductor industry cycles are typically less a function of demand drying up, but that may be the case in this downturn: Cycles tend to be supply driven as more often they arise from surges in inventory levels and excess fab capacity.

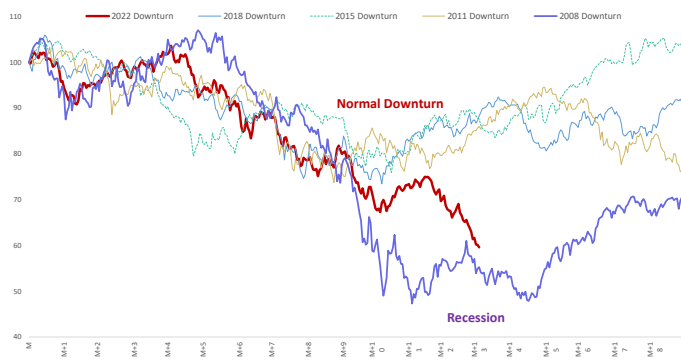
In short, excess supply is what leads to down cycles... Demand shocks from recessions are the rare exception and result in the eventual recovery being delayed, i.e., U-shaped vs. a typical V-shaped recovery.

...and the rate of change often dictates the start of a cyclical upturn: It is just the nature of the semiconductor business cycle that manufacturers build to overcapacity during boom times, and then the cycle collapses as demand returns to more normal levels.

Some key observations:

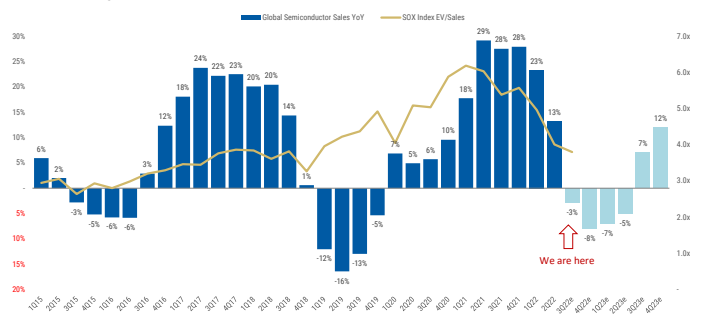
- **Cycle:** The semiconductor industry cannot change that fast. It has too much inertia on the way up and is unable to react to abrupt change in the macro environment. At cycle peak, companies typically overbuild and customers tend to order more chips than they need. That’s when the cycle reverses, leading to gluts and plunging prices.
- **Inventory:** A key factor influencing swings in the cycle is inventory. The ongoing weakening in the global economic

Exhibit 20: The market has priced-in a mild recession downturn



Source: Refinitiv, Morgan Stanley Research

Exhibit 21: Global semiconductor cycle – now 5 quarters into a 4-6 quarter cycle downturn



Source: Refinitiv, SIA, Morgan Stanley Research estimates

outlook with some participants calling for recession (typically the bear case) is one macro factor which will drive an earlier end to inventory builds given the expectation for lower shipments. There is a digestion period for inventory to be consumed and a resulting headwind to semiconductor revenues.

- **Duration:** Each complete cycle is made up of a contraction phase of about 4-6 quarters, followed by an expansion phase of roughly 6-11 quarters. We are entering the fifth quarter into the contraction phase. Macro uncertainty plays a big role in the duration of a downturn, and the impact of a recession being a U-shaped recovery rather than V-shaped normal cyclical downturn.
- **Share price:** We expect sales growth to continue its decline over the next few quarters before we start to see green shoots of recovery. Share prices, however, move on the rate of change in YoY sales with leading indicators being inventory and macro factors. While industry down-cycles affect share prices in the short term, they are never long-lasting. Overtime, share prices typically recover along with sales.
- **Tech proxy:** The memory industry is usually one of the first signs for the tech industry inflecting as the rate of change in price fall slows and inventory begins to come off peak levels. The question is, when do those 3 cylinders – DRAM, NAND & Display – start firing again?
- **Companies tend to be lagging:** Most tech companies will report worst earnings and guidance, and this makes it very difficult to talk about an up-cycle when profits are still declining. However, we are at the late stages of a down-cycle when everyone agrees, admits or recognizes a new reality.

Recent indicators of the tech cycle point to some signs that suggest a stabilization in the period ahead for certain parts of tech:

1. Investors are now facing late-cycle timing, late-cycle industry conditions, and late-cycle valuations, five quarters into in the down-cycle.

2. Markets are no longer having a hard time digesting an environment of decelerating earnings growth. It is largely expected by now.
3. Tech companies are usually slow to acknowledge what they are seeing on the way down. But investors and the market are ahead of that, and look for the decks to be cleared before moving in.
4. There is also the uncertainty of how much of tech demand is real, given component shortages (that lead to over-ordering or "double booking") and incoming data that is incrementally more bearish. However, stocks are less volatile as the market already assumes that things will get worse continuously.
5. Financial market expectations for tech (approximated by the Philadelphia Semiconductors Index) point towards some bottoming out later in the year, after falling for three consecutive quarters.
6. While the global PMI for new export orders in the manufacturing sector has remained below the expansion-contraction threshold of 50, the pace of its decline in recent months has been significantly less steep than in the first half of 2022. Although it covers a broader set of exported products, it also shows a fairly high correlation with sectorial stock prices and thus could provide some further evidence of stabilization in the global tech sector.
7. Korean exports of semiconductors – often used as another leading indicator of activity in the tech sector – have gone through a sharp deterioration and moving closer to previous cycle bottoms.
8. Broader indices of activity in the technology sector, which include utilization, book-to-bill, and global trade in electronic components also suggest an advanced stage in the weakening of the sector's growth momentum.

Overall, therefore, the turning of the global tech cycle seems partly to reflect a rather exceptionally strong period in 2020-21, related to substantial pull forward of consumer demand and investment in expanding capacities of data centres globally.

What Caused the 2018 Semiconductor Downturn?

The 2018 downturn was caused by commercial and consumer demand that started to slow in 3Q18 when over 50% of semiconductor manufacturers missed growth forecasts, triggering a downturn. Trade tariffs, imposed in mid-2018 between the US and China, exacerbated the downturn.

Key highlights:

1. Smartphone growth turned negative in 3Q18. This was reinforced by Apple when it reduced revenue guidance for the upcoming quarter due to weak demand for iPhones.
2. Automobile demand in the US, China and Europe slowed down.
3. Industrial demand was affected by continued economic slowdown in China as well as Europe.
4. Cloud infrastructure spending growth rate slowed as companies entered a period of digestion following strong growth in 2016-18 period.

How Did the 2019 Cycle Recover?

The cycle recovery began in the middle of 2019 with the decline in sales of data-center processors and non-memory products bottoming while inventories of memory chips began the fall. As prices of certain chips picked up, large semiconductor companies such as TSMC and Samsung, saw profits beginning to improve from 2H19.

What Happens in a Recovery?

We are not calling for the "beginning of a new cycle" but acknowledge that an inflection (bottom) is closer and therefore to prepare: Market disruptions are a fact of life for the technology sector and tech stocks swing from excessive enthusiasm to extreme pessimism (and vice versa), and momentum can change abruptly near cycle inflections. Buying the former and selling the latter can cause short-term pain but tends to pay off mostly during the early stages of market upturns, as pessimism quickly gives way to optimism as YoY growth rates begin to approach the cyclical bottom and in some cases have moved past already.

In previous upturns, Asian tech stocks' EV/Sales multiples have expanded ~89%. Earnings increase 97-137% in a typical up-cycle and revenues rise 5-74% in a span of four quarters. Dispersion within the sector is significant on the way up. Stocks rally 95% on average, with momentum reversal sectors (i.e., most out of favour) performing best, while crowded defensives underperform.

In the longer term, it is clear that semiconductor sales will recover to higher levels than before

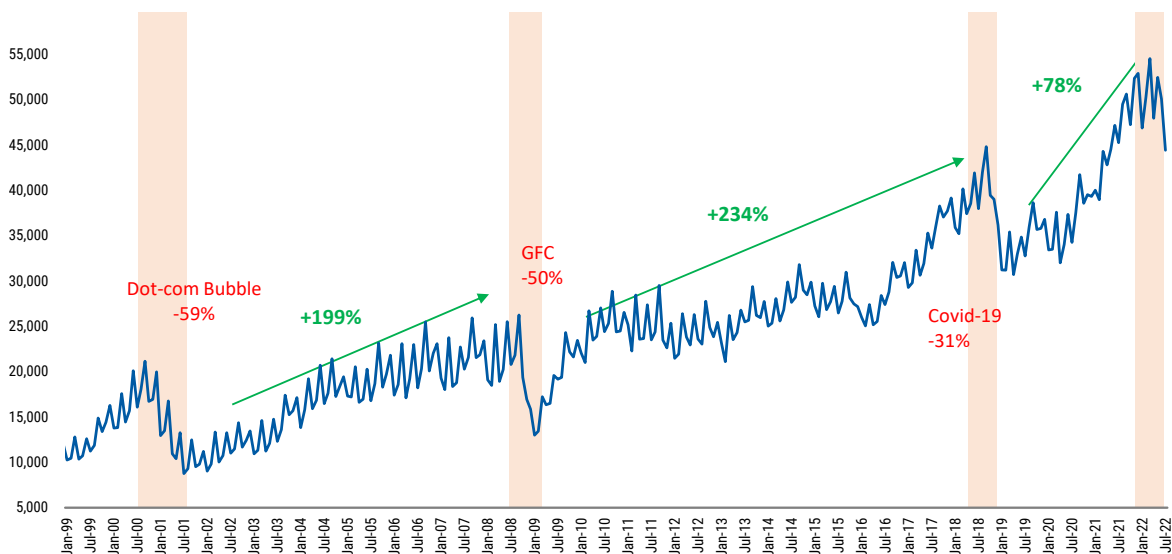
As such, while downturns tend to depress share prices, they also present attractive buying opportunities for long-term investors.

Counter intuitively, the increasing challenges of Moore's Law dynamic have led to a more favorable industry structure, with better pricing power for semiconductor suppliers and more stable margins. As incremental cost reductions are shrinking and the cost curve flattening, chipmakers' capital allocation has become more disciplined.

Furthermore, limited supply growth via technology migration (shrinking) because of Moore's Law challenges should result in reduced excess spending – and hence, cyclicity. R&D cycles span years, equipment lead times extend more than a year, the average fabrication plant takes two years to build, and manufacturing a chip takes 2-4 months.

In addition, semiconductor companies are rationally adjusting to lower long-term growth rates, which are leading to lower investment profiles and higher margins across the industry.

Exhibit 22: Semiconductor revenue recovers to higher levels following major demand shocks over the long term



Source: WSTS, Morgan Stanley Research

Every cycle is different, but certain patterns have tended to repeat over time

History tends to repeat in semiconductor cycles and can offer guidance as to how segments might perform during each phase. Understanding how those segments have performed historically at various points in the semi cycle may help investors evaluate and adjust their exposure and identify opportunities.

Volatility is greater because the group constantly has to deal with the effects of the broader economic cycle, ever-shortening product life cycles, and persistent peer competition.

Competition is intense, with product innovation, fueled by aggressive research & development (R&D), paving the way for increased profitability.

However, during economic downturns, revenues come under pressure, as corporate information technology budgets are pared and consumers hold off on purchasing the latest gadgets.

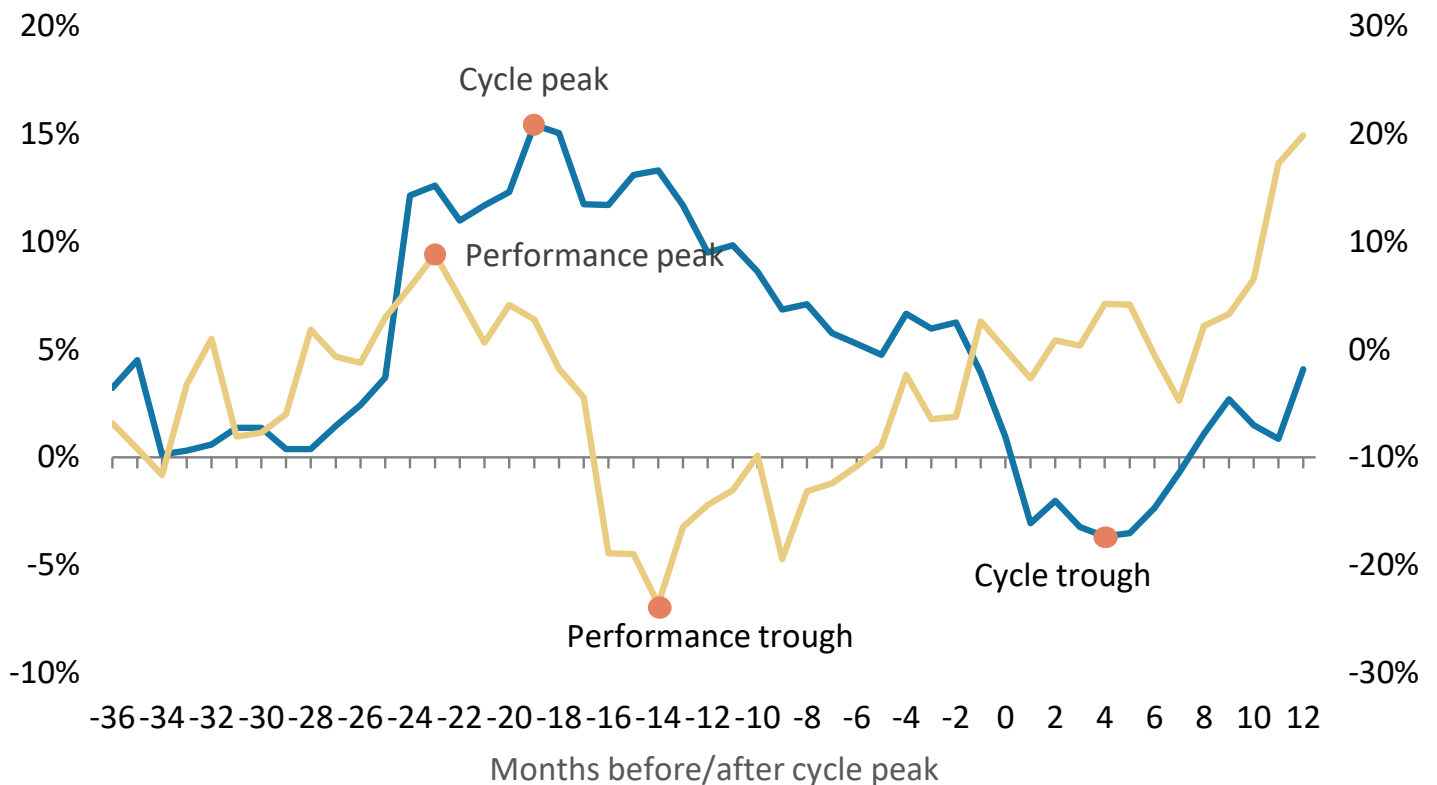
Companies in the industry see their earnings leverage increase sharply as they get into higher revenue numbers and spread depreciation, R&D and basic corporate G&A over a much larger revenue base. We have seen this upward acceleration and that same leverage works on the way down as well.

Cyclical tech that has corrected the most tends to outperform in the initial stage of recovery rally. Short squeezes tend to amplify the upside. Two and a half months after the initial rally, hardware stocks with strong earnings revisions and momentum tend to outperform the most. Quality stocks tend to perform well during sector corrections and volatile periods in recovery.

Aggressive market-timing moves, such as shifting an entire portfolio into cash, can backfire: Some of the strongest returns typically occur during the late stages of a cycle upturn or immediately after a market bottom.

- It is often better to stay invested to avoid missing out on the upswing.
- Performance trough has led the fundamental trough by 5-6 quarters in past cycles.
- The magnitude of recovery is proportional to the magnitude of correction.

Exhibit 23: Tech sector performance starts to bounce back 18 months before fundamentals turns

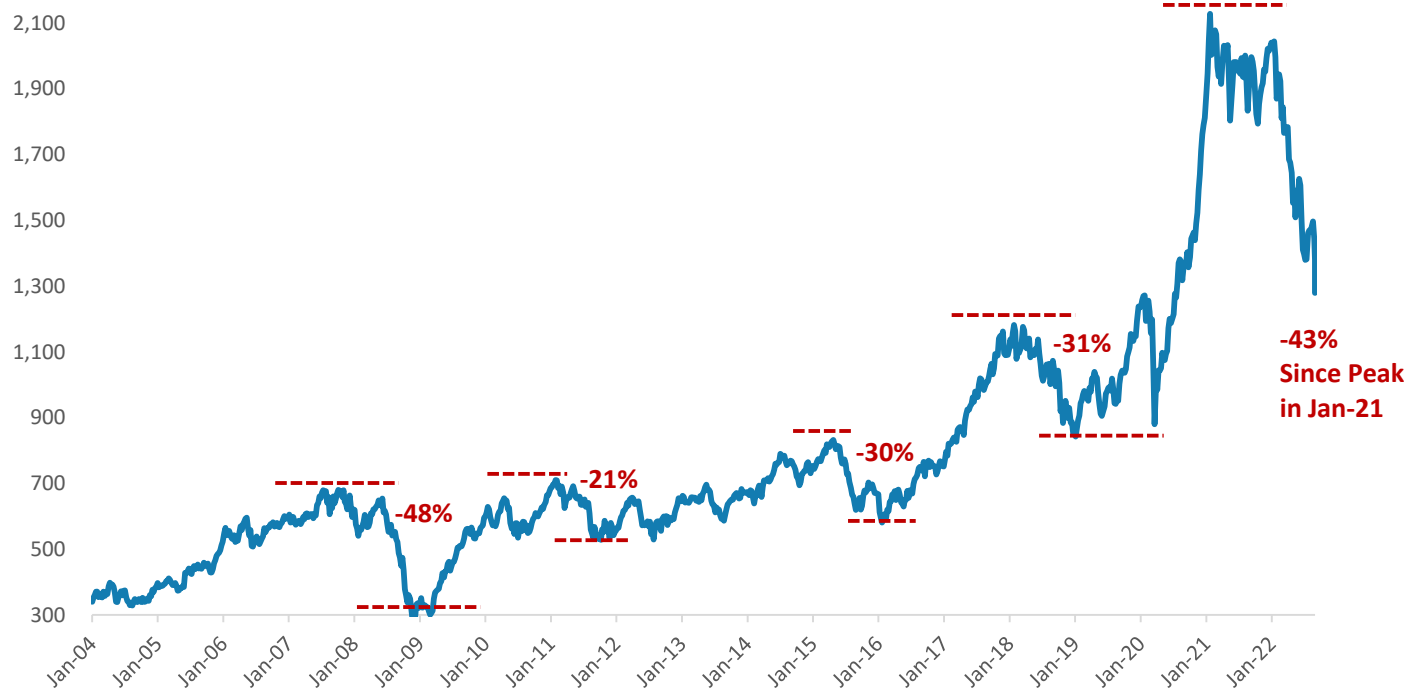


Source: Refinitiv, Morgan Stanley Research; Note: data from past three cycles since 2012.

Climbing a wall of worry is part of the bottoming process. In 2019, the SOX index rallied 57%, its strongest performance since 2009, when it was up 70%. This strong run occurred despite gloomy fundamentals and increasing macro uncertainty. That year, earnings and

revenue saw larger declines for most chip companies and the Semiconductor Industry Association industry revenues to fall 13% for the year, which would be the worst decline since the 2009 GFC. 2020 demand eventually picked up where 2018 left off despite the COVID effect in 2Q20.

Exhibit 24: MSCI AC Asia Tech market cap 40% draw-down is in-line with past recessionary down-cycles

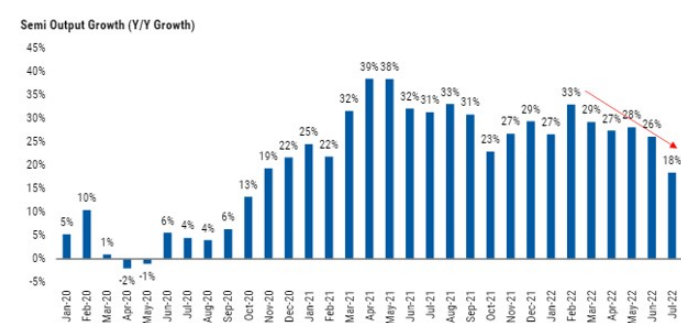


Source: Refinitiv, Morgan Stanley Research

What's different this time?

The current recovery will follow a "first-in, first-out" sequence, in our view. Covid and supply chain issues have disrupted the current cycle and caused cycles within tech to be out of sync. Taiwan August sales indicated that the foundry sector is holding up due to TSMC and second tier foundries coming off their peak since 1H22, while memory continued its correction and LCD was near trough (**Exhibit 27**). This means significant divergence is likely on the way up.

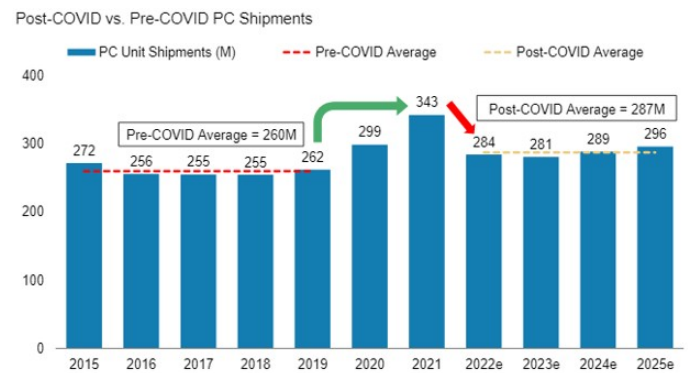
Exhibit 25: Semiconductor output growth is slowing as end-market demand weakens & semi inventory corrects



Source: Refinitiv, Morgan Stanley Research

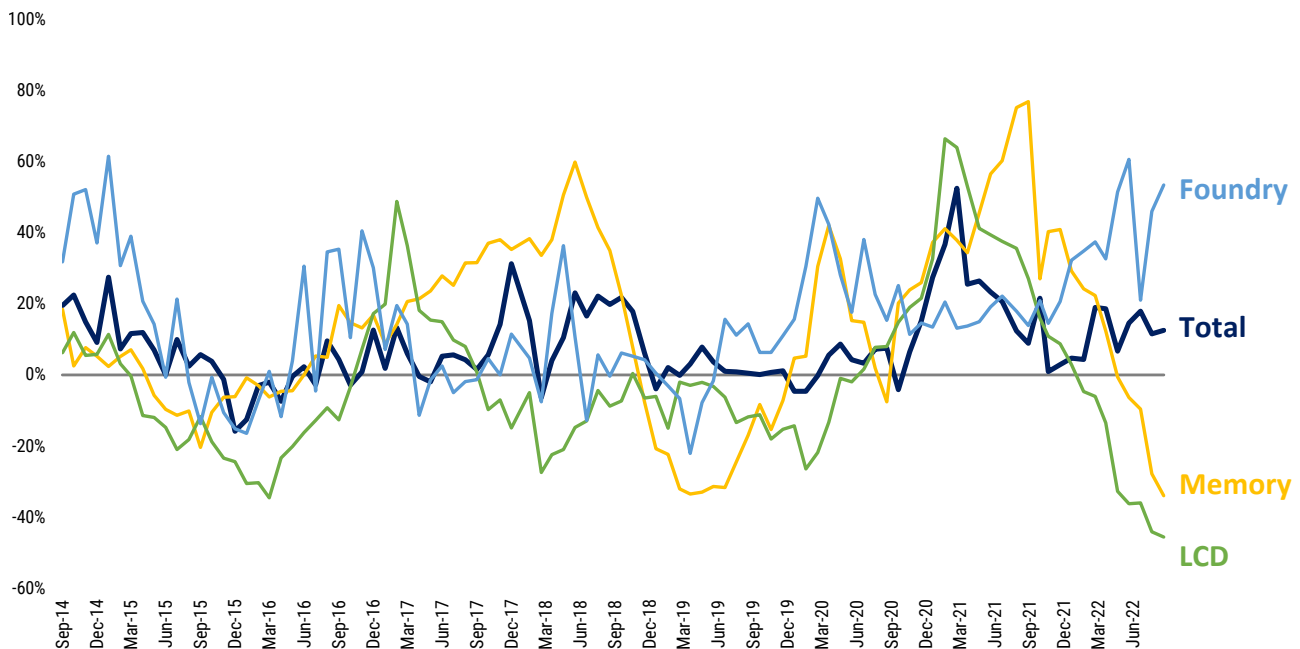
Unlike past cycles, the current cycle saw smartphone demand weaken first, followed by PC and more recently cloud. Component shortages in auto, industrial and networking end markets, along with logistic disruptions have triggered some segments of tech to over-earn during the past a two years. In terms of earnings revision breadth, panels have reached their 2018 trough while commodities such as memory and MLCC are still approaching trough, with the revision of previously loved segments such as auto and semi-equipment just starting.

Exhibit 26: PC market shipments took a significant step function higher during COVID, but we model that normalizing as purchases are digested



Source: FactSet, Morgan Stanley Research (e) estimates

Exhibit 27: Taiwan monthly sales YoY



Source: Company data, Morgan Stanley Research

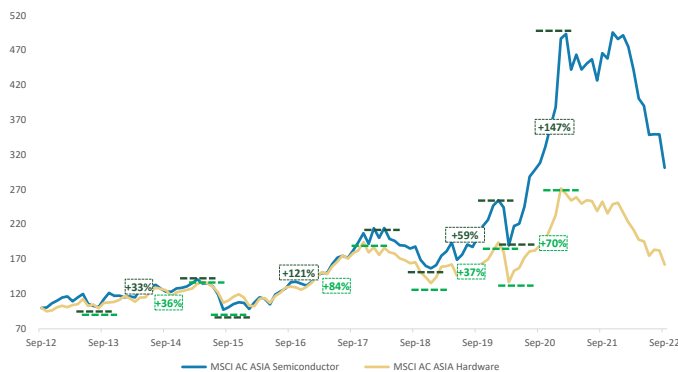
Tech leadership often changes in a new cycle

What used to work for stock picking won't work in the same way.

The past cycle's looser monetary and fiscal policy, low cost of capital and stock price inflation is giving way to de-globalization and decarbonization, which means lower margins (from cost pressures) and lower multiples. This means staying away from winners of the previous cycle and focusing on low priced companies with strong cash flow generation – and staying clear of popular fast growers without regard to profits, such as metaverse.

Within the Tech segment, semiconductor stocks tend to outperform hardware in recovery while the magnitude of correction is similar. By reviewing the long/short alpha of Quality and Reversal factors over various horizons in the past 6 cycles since 1999, we found that reversal factors work better than quality in the initial stage of a recovery. In particular, the stocks that are most shorted/sold in the past month give the best performance in the following month, while the three month reversals indicate the winners in the following quarter.

Exhibit 28: Semiconductor outperforms Hardware in recovery



Source: Refinitiv, Morgan Stanley Research

Exhibit 29: Reversal Factor outperforms Quality in the initial rally

	Average forward monthly return		
	1	3	6
Quality	0.7%	-1.6%	-1.0%
1M reversal	2.9%	1.9%	1.9%
3M reversal	2.1%	3.2%	1.8%
6M reversal	2.4%	1.4%	0.3%
9M reversal	1.5%	3.3%	0.8%
12M reversal	2.7%	3.6%	0.8%

Source: FactSet, Morgan Stanley Research

Exhibit 30: 2018 Cycle – Sequence to Recovery with PC first then Cloud

Date	Months from MSCI Asia IT Trough	Sector	Peak to Recovery Durations (Months)
Jul-18	-6	PC/NB Hardware Recovery	14
Oct-18	-3	IC Design Recovery	1
Oct-18	-3	IC Foundry Recovery	8
Oct-18	-3	Datacenter Hardware Recovery	3
Jan-19	0	Memory Recovery	7
Jan-19	0	Testing & Packaging Recovery	10
Jan-19	0	Smartphone Hardware Recovery	17
May-19	4	Automation Recovery	13
May-19	4	LED/Optical Recovery	18
Jun-19	5	Semi Equipment Recovery	19
Aug-19	7	Semi Materials Recovery	15
Aug-19	7	MLCC Recovery	14
Nov-19	10	LCD Recovery	22

Source: Refinitiv, Morgan Stanley Research

Exhibit 31: 2022 Cycle – Mobile First, then PC and Cloud

Date	Months from MSCI Asia IT Peak	Sector	Peak to Current Trough (Months)
Jul-20	-6	Smartphone Hardware Peak	24
Jan-21	0	Automation Peak	21
Jan-21	0	MLCC Peak	20
Feb-21	1	Memory Peak	19
Apr-21	3	Testing & Packaging Peak	17
Apr-21	3	LCD Peak	17
Apr-21	3	IC Design Peak	17
May-21	4	PC/NB Hardware Peak	14
Jul-21	6	Semi Materials Peak	14
Sep-21	8	IC Foundry Peak	13
Jul-21	6	Data center Hardware Peak	12
Nov-21	10	LED Optical Peak	10
Jan-22	12	Semi Equipment Peak	9

Source: Refinitiv, Morgan Stanley Research

Five Signposts To Watch

Several indicators anticipate future market directions, empowering investors to predict price movements before they happen. By using past data, leading indicators give signals before the new trend occurs. Despite the impossibility of pinpointing the inflection or exact start of a recovery, there are some generally reliable signals worth watching closely in a late-cycle phase of the semiconductor market. The current environment is influenced by deteriorating end-demand caused by post-Covid mean reversion and macro concerns. Therefore, it is helpful to look at several different aspects of supply and demand to better assess where we are in the cycle. Keep in mind that any indicator should be viewed more as a milestone than a destination sign.

Macro Factors – Still Hostage to Macroeconomic News

Macro matters a lot for tech and inflation matters more – for example, inflation acts as a triple threat for tech companies: (1) it increases input costs, (2) it reduces purchasing power from the consumer, and (3) higher inflation means higher rates and higher de-rating on the multiple.

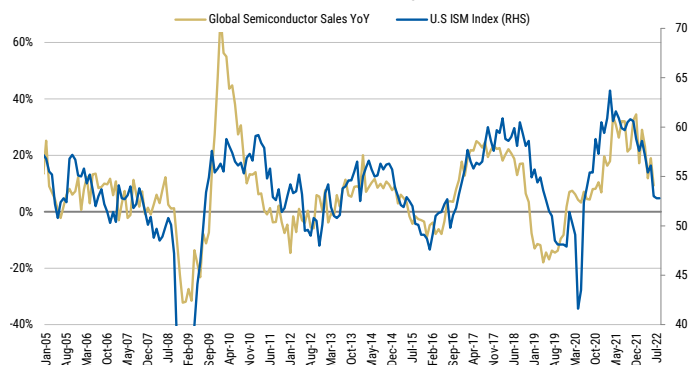
On the demand side, four examples of economic indicators that can warn of a recession include the yield curve, corporate profits, the unemployment rate and housing starts. Overall, these factors point to increasing concerns over economic growth in 2H22 as we enter the late tech cycle.

US PMI data is indicative of semiconductor industry demand and historically has been highly correlated with MSCI Asia Tech performance ([Exhibit 32](#)).

A demand slowdown creates similar results to overcapacity, where producers cut prices to try and stimulate demand but instead cause a downward price spiral.

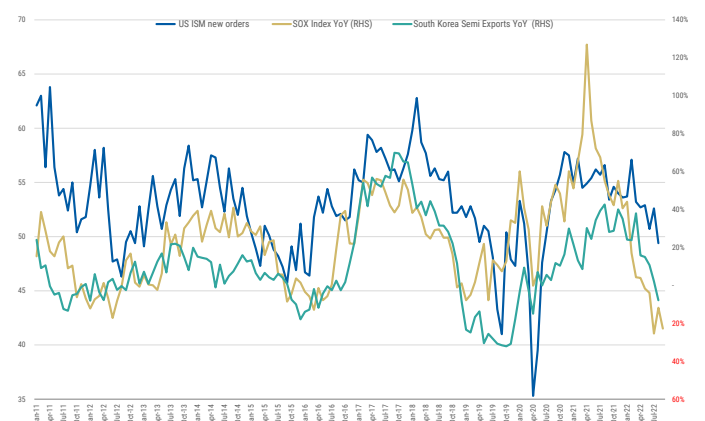
Our PMI tracking indicates that US PMI still has further downside risk in the coming months. We expect global semiconductor sales growth to decelerate to previous trough levels in the fundamental cycle, but the share price typically moves way ahead of it ([Exhibit 33](#)).

Exhibit 32: Global Semi Revenue highly correlates with US ISM



Source: Haver, Refinitiv, Morgan Stanley Research

Exhibit 33: US PMI and South Korea Export data continues to deteriorate



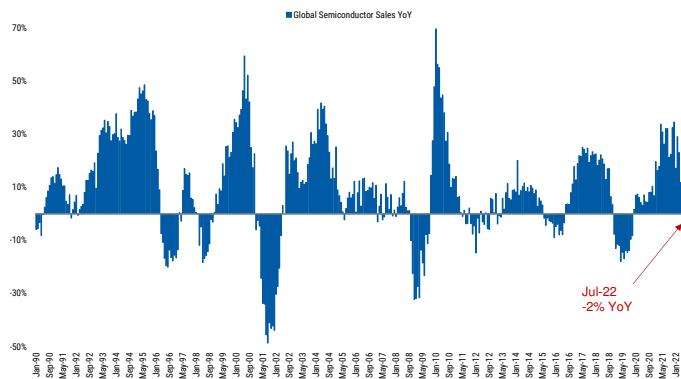
Source: Haver, CEIC, Refinitiv, Morgan Stanley Research

Rate of Change – Sequential Cyclical Inflection

We expect the rate of change to inflect at a different period in the current cycle led by consumer driven parts of tech, which peaked much earlier than enterprise or component constrained parts of tech. We have already begun a YoY recovery for the TV supply chain, including LCD TV panels, and are likely to reach bottom in 4Q22 for commodity areas such as memory, MLCC, IT panels, PCs and most likely follow a 'First-in First-out' sequence to the recovery.

With the average duration on the way down at about 14 months, based on seven past cycles since 1996, each complete cycle is made up of a contraction phase of about 4-6 quarters, followed by an expansion phase of roughly 6-11 quarters.

Exhibit 34: Performance trough leads fundamentals by 2-3 quarters on average



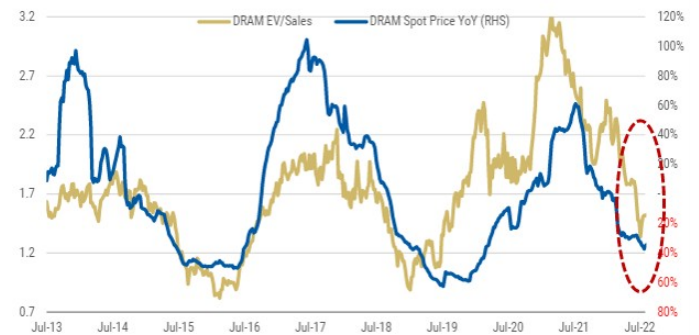
Source: SIA, Refinitiv, Morgan Stanley Research

Tech stocks are sensitive to rate of change. Foundry stocks (particularly TSMC) are most forward-looking (1-3 months), while memory and MLCC stocks moves 1-2 months before the sales growth rate inflects.

We find that stocks tend to sell off into a YoY peak and rally into a YoY trough (which was 4Q20). The performance flattens out 6-12 months after but still yields positive returns. However, stocks start to struggle 12 months after cycle troughs.

The sales growth rate has decelerated for 4 quarters since the peak in 2Q21; although pull-in demand in late 2021 has disrupted the cycle, it quickly deteriorated again into 2022. SOX Index EV/Sales valuation has corrected 45% since 1Q21, with 5% further downside to 2018 trough level.

Exhibit 35: The YoY rate of change defines troughs



Source: SIA, Refinitiv, Morgan Stanley Research

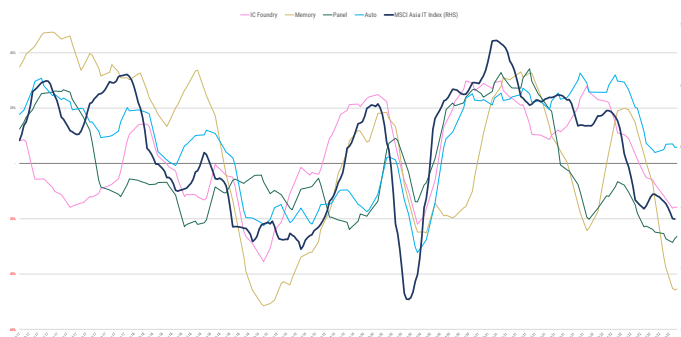
Earnings Revision Breadth – No Longer Synchronized

Earnings revision breadth has already inflected for LCD panels and memory, while still in positive territory for component constrained areas like auto semis, as illustrated in Exhibit 54. As a result, the broader reading continues to deteriorate, but at different stages by sub-groups, and likely to bottom in 1H23.

While stock performance prices in the downward trends one/two quarters before the actual EPS turn, earnings revision breadth signals the peak of indices' performance 1-2 months in advance.

In the current cycle, the improvement continued into 2Q22, driven partly by the order backlog and hope for a 2H recovery, which looks increasingly unlikely now.

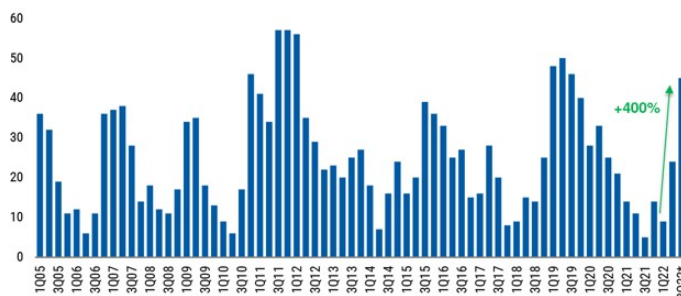
Exhibit 36: Earnings revision breadth inflecting at different stages by sub-group



Source: Refinitiv, Morgan Stanley Research

Exhibit 38: Tech company transcript references to "inventory correction" and similar terms are up 400% since 1Q22

of Transcripts Where Technology Companies Reference Inventory Correction



*3Q22 reflects QTD. Includes references to "inventory correction", "inventory digestion", or "elevated inventory" or "inventory workdown"

Source: Refinitiv, Morgan Stanley Research

Inventory Cycles – Approaching Peak

An improvement in inventory adjustment often leads a recovery into an upturn in the tech cycle. Inventory plays an important role in causing swings in customer purchase behavior and often accelerates the rate of decline as the value of holding inventory declines sharply with prices falling, and vice versa on the way up.

Inventory buildup can occur either because of increased supply or slowing demand. For the industry fundamentals to recover, excessive inventories have to be digested first. In periods of high demand, profitability of semiconductor manufacturers is high and invested to increase capacity.

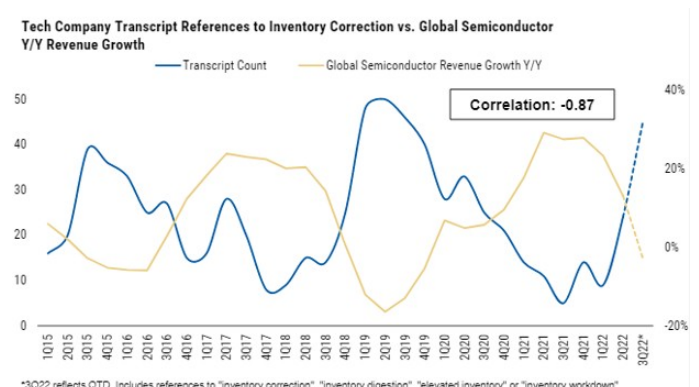
We may be approaching an inventory peak into year-end and 1Q23 for the broader industry, but similar to the rate of change, we note that the TV set market is already back to normal inventory levels – and soon in many parts of tech, benefitting from substantial production cuts such as capacitors and display panels.

Exhibit 37: Earnings revision breadth distance to trough by segment

	Earnings Revision Breadth		
	2018 Trough	Current	Distance to Trough
PC/NB Hardware	-31%	6%	-38%
Semi-Equipment	-39%	-11%	-29%
Auto	-23%	6%	-29%
Automation	-28%	-7%	-21%
Smartphone Hardware	-24%	-3%	-21%
LED/ Optical	-43%	-23%	-20%
IC Foundry	-36%	-16%	-20%
Memory	-51%	-38%	-19%
Semi Materials	-21%	-13%	-9%
Data center Hardware	-2%	4%	-6%
MLCC	-27%	-22%	-5%
Testing & Packaging	-8%	-11%	2%
TFT-LCD	-23%	-28%	5%
IC Design	-10%	-28%	18%
Global	-13%	-2%	-12%
Asia	-22%	-8%	-15%

Source: Refinitiv, Morgan Stanley Research

Exhibit 39: Tech company transcript references to "inventory correction" has a highly negative (-0.9) correlation to global semiconductor revenue growth



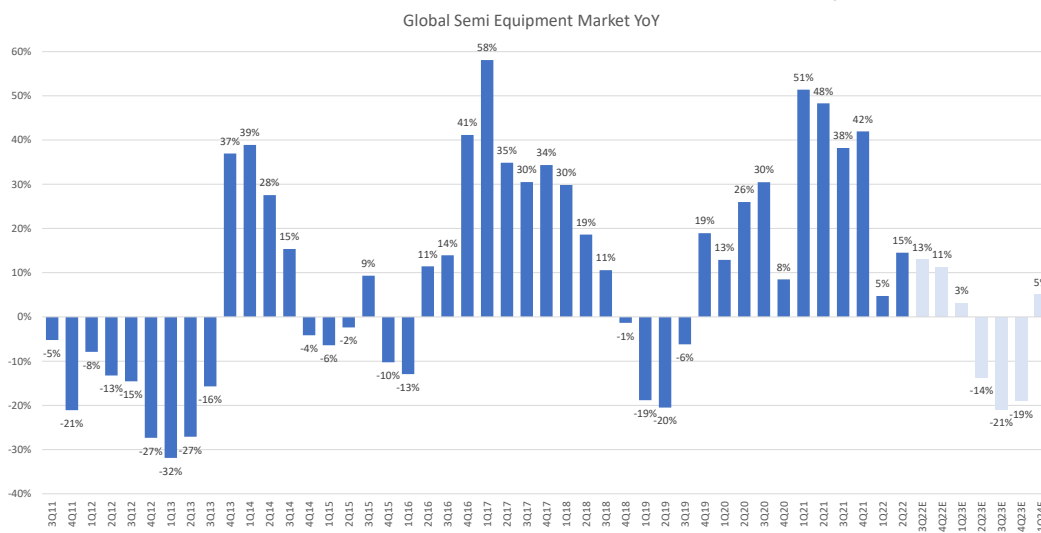
Source: Refinitiv, Morgan Stanley Research

Capex

This can be seen as a leading indicator of growth in the semiconductor industry: It is a predictable sequence – when profitable semiconductor makers tend to invest in new manufacturing capacity as returns on investments are justified. This new capacity ramps in about two years to full output, causing an oversupply which unravels pricing. We forecast the wafer fab equipment (WFE) market in 2023 to decline 13% YoY.

However, capex in itself is not a leading indicator of future stock gains. Rather, companies that are increasing their capital spending levels are more likely building off past performance. Capex growth should not be looked at in isolation. Absolute levels of capex relative to the semiconductor market give an indication whether capex is too high.

Exhibit 40: Capex is a leading indicator of growth in the semiconductor industry



Source: SIA, Morgan Stanley Research

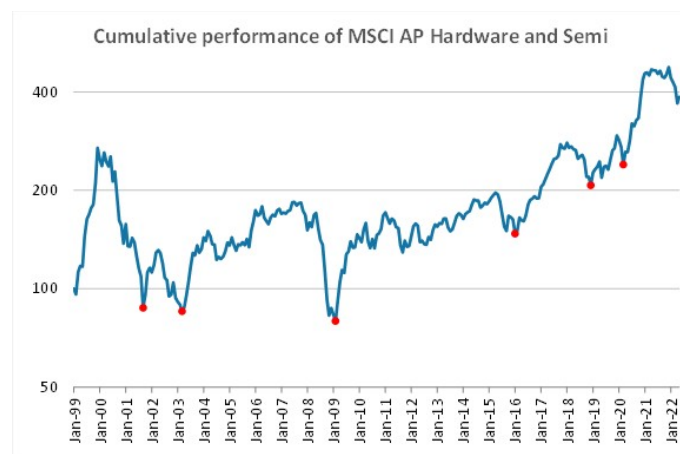
Where to Invest During Recovery?

New market leadership has often emerged at the end of a bear market. Many companies have benefited from globalization and the low cost of capital but we are transitioning to a new world that is de-globalizing and de-carbonizing. Conditions are shifting from asset price inflation to goods inflation, as the past cycle was about deleveraging, free money and low cost of capital. For example, the fastest growers may no longer work without regard to profits, and intangible assets (like metaverse, block chain) may no longer be valued in the same way as tangible goods – indeed, the key challenge for cyclical investors may well be in navigating a transition from owning expensive 'quality' or secular growth back towards more plain vanilla 'value' cyclical investing. Opportunities are very stock/end-market specific

and these should lead to a wide dispersion in equity valuations as well as dispersion in fundamentals.

When 'bad becomes good'. We reviewed factors driving tech stocks over various horizons in the past 6 cycles and tracked respective forward performance over the next 1, 3 and 6 months coming off the bottom of the cycle. In the initial rally, stocks that are shorted the most on the way down outperform the most (Reversal factor effect). In particular, 1M reversal gives the best performance in the following month while 3M reversal indicates the winners in the following quarter.

Exhibit 41: Reversal factor outperforms in initial rally



Source: Refinitiv, Morgan Stanley Research

Exhibit 42: Reversal vs. Quality

	Average forward monthly return		
	1	3	6
Quality	0.7%	-1.6%	-1.0%
1M reversal	2.9%	1.9%	1.9%
3M reversal	2.1%	3.2%	1.8%
6M reversal	2.4%	1.4%	0.3%
9M reversal	1.5%	3.3%	0.8%
12M reversal	2.7%	3.6%	0.8%

Source: Refinitiv, Morgan Stanley Research

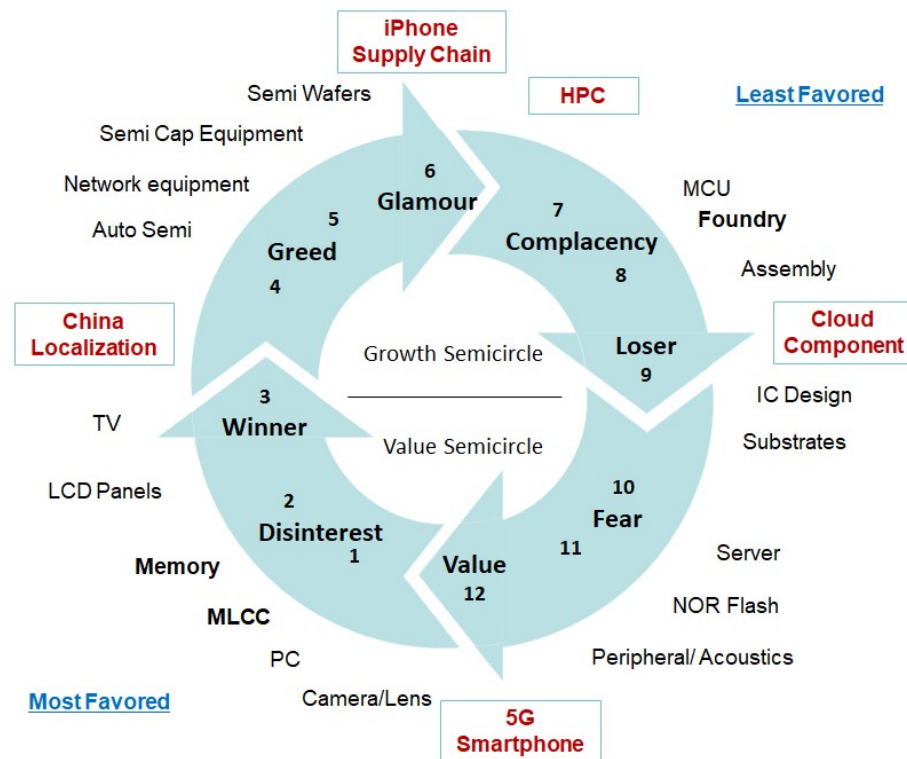
How does one position for a cyclical upturn?

Exploiting market extremes – when troubled periods spell opportunity. While there are green shoots emerging for the first time (TV market), we are not driven as to when that inflection takes place (the more we wait the more the economic data deteriorates, and cuts are going to continue), but it is more about what's priced-in and risk vs. reward. In positioning for an eventual cyclical upturn, we sequence supply chains and stocks in our coverage on the investment clock, and take advantage of the momentum life cycle. Market irregularities do occur and rational investors are certainly able to capture those opportunities, in our view. Our aim is not to use clock investing as the

major basis for investment decisions, but rather as a supplementary tool to guide investors to more attractive entry points for often complicated tech supply chains and companies.

Our first goal is to make sound fundamental recommendations by valuing stocks correctly based on unbiased estimates of future returns and cash flows. With the sense of intrinsic value on the one hand, we then try to disassociate ourselves from market sentiment, and instead observe and anticipate market behavior. Of course, this is easier said than done, and we would be the first to admit that it is impossible to disassociate ourselves completely from market sentiment.

Exhibit 43: First-in, First-out: Tech Investment Clock – Follow the Sequence



Source: Morgan Stanley Research

Not all tech stocks have fallen in the same way. We have termed the investing technique utilizing this cycle "clock investing" because the cycle circulates around a hypothetical investment clock. This cycle is driven by two factors: the earnings cycle and human psychology, such as:

- *Herd instinct:* amplifies the cycles, resulting in overshooting on both the upside and downside.
- *Availability heuristics:* bias investors with repetitive noises in one direction.
- *Representative heuristics:* prevent investors from seeing the true underlying probabilities.

We transfer the momentum cycle into a 12-hour (reversed) hypothetical investment clock (Exhibit 25):

- The clock starts at 6 o'clock (Glamour stage) when a stock is at its peak in performance, and the market is complacent on the stock.
- The Losing stage commences at 9 o'clock...
- ...and the Winning stage at 3 o'clock.
- 12 o'clock is the bottom of the momentum cycle, or the Value stage.

Hardware stocks in general fall within the Leader to the Glamour stage, anticipating a leg of outperformance:

- TV and the related supply chain are leading the way, positioned at 3 o'clock – our best idea is LG Display which we upgrade to OW from UW.
- Logic semiconductor, foundry, enterprise IC design are positioned at 7 o'clock where we favor large cap secular growth over pure cyclical exposure.
- iPhone supply chain is positioned at the crowded Glamour stage.
- Because of inventory adjustment and a weak pricing environment (although temporary), memory and MLCC have been de-rated, moving past a value trap at 2 o'clock. We see a compelling risk-reward with Samsung and Hynix given valuations back to decade lows and the late stage of the memory downturn.

Semiconductor stocks are generally positioned somewhere between 9 and the 11 o'clock fear stage at this point...

...while cloud component stocks are still at the Losing stage (9 o'clock): The part of semis driven by IC design has recently shown weaker performance than foundry with more balanced portfolios. We stay EW on Aspeed.

China's localization supply chain is placed at 3 o'clock... Our top OW ideas for China's semi localization include **Alchip, Andes, AMEC,** and **Starpower.**

...while the Chinese smartphone supply chain and Samsung stand at 12 o'clock: We believe that the auto semis performance will quickly move to the losing stage once component bottlenecks are out of the way as supply meets real demand. Pricing power and margin sustainability are still how we differentiate our stock ratings. We stay OW on **TSMC, MediaTek** and **Will Semi**, as their long-term industry positions remain solid. We reiterate OW on **USI** as it benefits from iPhone sales and Apple Watch SiP content increase. But we also reiterate UW on **Win Semi, Maxscend, AWSC** and **Novatek**, given their structural issues (e.g., China's local competition) are more than just cyclical headwinds.

Switch back toward Cyclical: We have analyzed sector performance in seven tech cycle recoveries since 1996.

- Normally, there is a trade-off between multiple expansion and EPS estimate revision – our analysis shows that after three, six, and nine months, multiple expansion wins.
- After a year, these effects basically even out.
- For semiconductors, the degree of re-rating is mid-teens after the revenue YoY trough: however, it is noticeably more acute in semi materials, approaching >50% and less in IC design.

Exhibit 44: MS Most Preferred Recommendations List

Ticker	Company	One-Liner	Coverage Analyst
Conviction Overweights			
Semiconductors			
005930.KS	Samsung Electronics	Trough multiple near trough cycle	Shawn Kim
000660.KS	SK hynix	Trough multiple near trough cycle	Shawn Kim
034220.KS	LG Display	LCD TV Panel cycle inflected and trough valuations	Shawn Kim
2330.TW	TSMC	Long-term earnings growth looks promising given further breakthrough of N3e and N2 GAA	Charlie Chan
6533.TW	Andes	Andes is well-positioned to capture the RISC-V share gain opportunity with 17 years of CPU IP experience, while its reaccelerating China business in 2H22 act as a strong near-term catalyst	Charlie Chan
3661.TW	Alchip	We believe Alchip's revenue momentum will pick up in 2H22 thanks to improving ABF substrate supply, followed by a strong 2023 outlook underpinned by robust HPC clients' demand	Charlie Chan
ACMR.O	ACMR	Strong China capex offsets cycle headwinds. New tools for the next-generation semiconductor opportunity, strong China capex trend, and further PBCOA progress are the reasons we continue to rate the stock Overweight	Charlie Chan
688012.SS	AMEC	Outgrowing global semi equipment market. Along with China's localization trend, we believe AMEC will continue to enjoy strong growth momentum. Advanced nodes need more etching equipment, and AMEC supplies that to TSMC's new 3nm production line	Charlie Chan
300327.SZ	Sino Wealth	A great proxy to play in auto market, and we also spot its structural margin expansion thanks to solid execution in acquisition and multiple new products	Daniel Yen
4919.TW	Nuvoton	We believe Sino Wealth plays an important role in MCU and AMOLED TDDI localization in China, and think its BMIC business could enjoy high growth in the next 3-5 years	Daniel Yen
1385.HK	Shanghai Fudan	We believe Shanghai Fudan could benefit from China's specialty FPGA localization and the company can outperform during the semi down-cycle in view of limited consumer exposure	Daisy Dai
6762.T	TDK	ROE improvement to continue as the firm shifts from sole reliance on rechargeable batteries to a balanced earnings structure	Shoji Sato
6806.T	Hirose Electric	The strength of sales to general industrial machinery is already priced in, but we think the increase in sales in new fields such as sales to automotive and wearable devices is not factored in. Furthermore, an increase in ROE will also be a catalyst	Ryo Sasaki
6702.T	Fujitsu	Profitability is improving steadily thanks to offshore options and the concentration of domestic services to select sites	Hiroto Segawa
Tech Hardware			
002475.SZ	Luxshare	We like Luxshare for its increasing supply share within Apple hardware devices and we believe this will drive a meaningful YoY profit recovery in 2H22 onward	Sharon Shih
2308.TW	Delta Electronics	We see steady operating margin expansion in 2H22 despite macro headwinds as well as potential re-rating opportunity from increasing EV exposure	Sharon Shih
3406.TW	Genius	Key beneficiary of good iPhone14 momentum + upcoming pancake VR launching	Andy Meng
6669.TW	Wiwynn	Secular cloud demand; better positioned vs. other ODMs	Howard Kao
2327.TW	Yageo	Transforming into a global total solutions provider; better positioned vs. peers thanks to its high end product offerings	Howard Kao
8069.TWO	E Ink	Secular ESL trend driving e-paper demand	Derrick Yang
000725.SZ	BOE	Value emerging on trough valuation for mid to long term investors	Derrick Yang

Source: Morgan Stanley Research

Exhibit 45: MS Least Preferred Recommendations List

Ticker	Company	One-Liner	Coverage Analyst
Conviction Underweights			
Semiconductors			
6415.TW	Silergy	Gross margin erosion given higher foundry costs and competition from global peers (e.g., TI)	Charlie Chan
3105.TWO	WIN Semi	Low fab UTR and inventory pile-up at design house customers lead to pricing pressure	Charlie Chan
3034.TW	Novatek	Gross margin pressure with higher foundry costs and DDI pricing erosion	Daniel Yen
688008.SS	Montage	Demand uncertainty, high market expectation on DDR5 penetration and fierce competition may cap its revenue growth and gross margin profiles	Daniel Yen
6770.TW	PSMC	We see further downside for PSMC's business and multiple. Valuation remains rich, given its low earnings quality into 2023. PSMC is still our high-conviction UW call	Ray Wu
4704.T	Trend Micro	We see the fall in market share in N.Am enterprise security as a structural issue	Hiroto Segawa
6967.T	Shinko Electric	Earnings will be weaker than market expectation due mainly to weaker than expected ABF package sales	Shoji Sato
4062.T	Ibiden	Earnings will be weaker than market expectation due mainly to weaker than expected ABF package sales	Shoji Sato
Tech Hardware			
002373.SZ	Transinfo	Continuous demand weakness and market share pressures	Andy Meng
2353.TW	Acer	Weakening PC outlook leading to contracting margins	Howard Kao
2357.TW	Asus	Weakening PC outlook along with gloom GPU demand dragging earnings outlook	Howard Kao
3714.TW	Ennostar	Mini LED opportunities peaking out and traditional LED to see more pricing pressure	Derrick Yang

Source: Morgan Stanley Research

Exhibit 46: MS Most Preferred Recommendation List – Valuation

Company name	Ticker	MS Rating	Share Price (Local Curr)	Price Target (Local Curr)	Upside (%)	Mkt Cap (\$ mn)	P/E		P/B		EV/EBITDA		ROE		Div Yield		Coverage Analyst
							2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	
Conviction Overweights																	
Samsung Electronics	005930.KS	OW	53,100.00	68,000.00	28%	220,659	8.2	10.6	1.0	0.9	2.2	2.2	13%	9%	3%	5%	Kim, Shawn
SK hynix	000660.KS	OW	83,100.00	130,000.00	56%	42,013	8.8	31.8	0.9	0.9	2.5	3.1	11%	3%	2%	2%	Kim, Shawn
LG Display	034220.KS	OW	12,000.00	17,000.00	42%	2,982	NM	19.5	0.4	0.3	3.0	2.1	-6%	2%	0%	1%	Kim, Shawn
TSMC	2330.TW	OW	422.00	720.00	71%	344,075	11.2	11.7	3.8	3.2	6.9	6.3	45%	32%	4%	4%	Chan, Charlie
Andes Technology Corp	6533.TW	OW	394.50	450.00	14%	591	43.3	41.5	3.7	3.6	64.6	28.0	10%	9%	1%	2%	Chan, Charlie
Alchip Technologies Ltd	3661.TW	OW	867.00	1,420.00	64%	2,032	30.1	19.8	5.6	4.8	15.8	11.4	21%	28%	2%	2%	Chan, Charlie
ACM Research Inc	ACMR.O	OW	12.46	28.00	125%	736	20.1	13.5	1.7	1.3	14.2	9.4	27%	33%	1%	0%	Chan, Charlie
Advanced Micro-Fabrication Equipment Inc	688012.SS	OW	107.87	175.00	62%	9,345	66.8	58.2	10.4	8.8	86.8	69.7	19%	18%	0%	0%	Chan, Charlie
Sino Wealth Electronic	300327.SZ	OW	33.32	43.00	29%	1,566	26.2	24.8	7.0	5.9	23.4	21.6	32%	28%	1%	1%	Yen, Daniel
Nuvoton Technology Corporation	4919.TW	OW	108.00	168.00	56%	1,361	11.3	11.5	3.1	2.8	5.2	5.0	26%	27%	6%	6%	Yen, Daniel
Shanghai Fudan Microelectronics	1385.HK	OW	35.90	39.30	9%	3,725	26.2	26.1	6.5	5.3	17.7	16.6	32%	25%	0%	0%	Dai, Daisy
Wiyynn Corp	6669.TW	OW	808.00	950.00	18%	4,304	11.4	10.5	4.0	3.3	8.3	7.3	45%	38%	3%	4%	Kao, Howard
Yageo Corp.	2327.TW	OW	269.00	460.00	71%	4,178	6.2	5.6	1.5	1.3	3.9	3.0	30%	27%	4%	5%	Kao, Howard
Genius Electronic Optical Co. Ltd.	3406.TW	OW	345.50	600.00	74%	1,216	13.4	12.3	2.1	1.9	6.0	5.4	17%	17%	4%	4%	Meng, Andy
TDK	6762.T	OW	4,455.00	6,000.00	35%	11,665	11.0	9.4	1.2	1.1	4.5	3.9	12%	13%	2%	3%	Sato, Shoji
Hirose Electric	6806.T	OW	18,980.00	23,000.00	21%	4,635	18.8	18.1	1.9	1.9	6.3	5.8	10%	11%	3%	3%	Sasaki, Ryo
Fujitsu	6702.T	OW	15,785.00	23,000.00	46%	21,459	12.6	11.5	1.9	1.8	5.1	4.5	16%	16%	2%	2%	Segawa, Hiroto
Luxshare Precision Industry Co., Ltd.	002475.SZ	OW	29.40	45.60	55%	28,933	18.8	14.7	3.7	3.0	15.0	12.9	24%	25%	0%	0%	Shih, Sharon
Delta Electronics Inc.	2308.TW	OW	253.00	326.00	29%	20,664	21.4	19.3	3.0	2.8	10.9	9.8	16%	17%	3%	3%	Shih, Sharon
E Ink Holdings Inc.	8069.TWO	OW	212.00	280.00	32%	7,582	30.4	20.6	6.0	5.2	27.0	17.3	22%	29%	2%	3%	Yang, Derrick
BOE Technology	000725.SZ	OW	3.27	4.80	47%	15,996	14.7	11.7	0.9	0.8	7.6	6.2	6%	8%	6%	2%	Yang, Derrick

Source: Company data, Morgan Stanley Research (E) estimates

Exhibit 47: MS Least Preferred Recommendation List – Valuation

Company name	Ticker	MS Rating	Share Price (Local Curr)	Price Target (Local Curr)	Upside (%)	Mkt Cap (\$ mn)	P/E		P/B		EV/EBITDA		ROE		Div Yield		Coverage Analyst
							2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	
Conviction Underweights																	
Powerchip Semiconductor Manufacturing Co	6770.TW	UW	28.50	27.00	-5%	2,933	4.6	11.5	1.2	1.2	1.8	4.2	34%	10%	5%	7%	Wu, Ray
Silergy Corp.	6415.TW	UW	421.00	430.00	2%	5,074	24.6	24.8	1.4	1.3	19.7	18.4	28%	24%	2%	0%	Chan, Charlie
WIN Semiconductors Corp	3105.TWO	UW	123.50	110.00	-11%	1,646	28.4	20.1	1.8	1.7	9.2	6.5	5%	9%	7%	2%	Chan, Charlie
Novatek	3034.TW	UW	219.00	161.00	-26%	4,190	4.7	9.1	2.0	2.1	1.9	3.5	40%	22%	14%	7%	Yen, Daniel
Montage Technology Co Ltd	688008.SS	UW	52.33	44.00	-16%	7,704	50.8	42.1	5.7	5.4	51.7	37.7	14%	15%	2%	2%	Yen, Daniel
Acer Inc.	2353.TW	UW	21.90	17.00	-22%	2,123	9.9	11.9	1.0	0.9	2.8	2.3	10%	8%	7%	6%	Kao, Howard
Asustek Computer Inc.	2357.TW	UW	234.00	185.00	-21%	5,465	7.8	9.1	0.7	0.7	2.6	2.6	10%	8%	8%	8%	Kao, Howard
China TransInfo Technology Co Ltd	002373.SZ	UW	8.31	6.80	-18%	1,847	47.0	17.0	1.0	0.9	9.7	5.7	2%	6%	0%	1%	Meng, Andy
Shinko Electric Industries	6967.T	UW	3,115.00	2,900.00	-7%	2,907	7.0	8.9	1.7	1.4	2.8	2.9	30%	18%	2%	2%	Sato, Shoji
Ibiden	4062.T	UW	3,960.00	3,100.00	-22%	3,819	12.4	13.1	1.4	1.3	3.9	3.9	12%	10%	1%	1%	Sato, Shoji
Trend Micro Incorporated	4704.T	UW	7,820.00	5,700.00	-27%	7,565	35.7	32.9	4.8	4.6	12.9	11.6	14%	14%	2%	2%	Segawa, Hiroto
Ennosar Inc	3714.TW	UW	41.45	38.50	-7%	893	21.8	23.4	0.6	0.6	2.6	2.3	3%	3%	4%	2%	Yang, Derrick

Source: Company data, Morgan Stanley Research (E) estimates

Our Quant Approach

Using math for both return enhancement and risk mitigation:

Investment opportunities often arise from various sources:

- Challenges in understanding changing technologies (as is the case today),
- Rapid cycle times for innovation and production,
- Variations in the huge volume of global data points, and/or
- The constant global noise from one region to another.

By using quant strategies, we can better identify emerging trends, inflections, and potential investments: We focus on fundamental research first, but then apply model-based, systematic quantitative

investment tools to our team's insights, adding an extra level to their research efforts in identifying the final investment recommendations.

Our approach is not intended to replace in any way the specific insights and knowledge of our fundamental analytical side. Instead, we seek only to present a rigorous analysis of the extent to which specific factors appear to be associated with future performance. If a stock looks attractive from both a fundamental and a quant perspective, then it may justify further attention.

We believe quant is a powerful tool to test fundamental ideas in the tech sector: In this report, we show that certain factors have historically been closely associated with stock outperformance and underperformance.

Further, the alpha of these factors has been empirically strong across time and countries globally, and can be explained by a combination of:

1. Behavioral inefficiencies,
2. Market structure, and
3. Risk premiums.

Biggest surprises from collaboration: Mathematically speaking, we have found that:

- The highest returns have appeared when entering around a trough and exiting six months before a peak.
- The market rewards free cash flow most but does not trust companies to deploy cash.
- EV/EBITDA, gross margins, and the top line are most rewarded while earnings are not.

Exhibit 48: Quant Screening Reversal Factor Top

Company name	Ticker	MS Rating	Share Price (Local Curr)	Price Target (Local Curr)	Upside (%)	Mkt Cap (\$ mn)	P/E		P/B		EV/EBITDA		ROE		Div Yield		Coverage Analyst
							2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	
Top																	
Parade Technologies Ltd	4966.TWO	EW	618.00	717.00	16%	1,550	9.4	11.3	2.9	2.6	6.1	6.9	37%	26%	5%	4%	Yen, Daniel
Wingtech Technology Co Ltd	600745.SS	OW	47.67	80.00	68%	8,297	21.3	16.8	1.6	1.5	10.2	8.9	8%	9%	0%	0%	Meng, Andy
ASMedia Technology Inc	5269.TW	OW	665.00	1,000.00	50%	1,447	16.2	13.0	2.8	2.5	17.3	10.5	18%	21%	4%	4%	Yen, Daniel
Sunny Optical	2382.HK	OW	74.90	150.00	100%	10,425	26.1	19.1	3.2	2.8	13.1	10.2	14%	17%	1%	1%	Meng, Andy
WIN Semiconductors Corp	3105.TWO	UW	123.50	110.00	-11%	1,646	28.4	20.1	1.8	1.7	9.2	6.5	5%	9%	7%	2%	Chan, Charlie
Iljin Materials	020150.KS	OW	50,800.00	120,000.00	136%	1,627	20.8	16.0	2.2	1.9	16.0	12.1	11%	13%	1%	0%	Kim, Ryan
Nan Ya PCB	8046.TW	EW	188.50	275.00	46%	3,826	6.7	6.2	2.4	2.0	4.4	3.7	45%	38%	5%	9%	Kao, Howard
Hangzhou Silan Microelectronics Co. Ltd.	600460.SS	EW	32.05	46.00	44%	6,380	36.6	28.7	5.5	4.7	20.7	16.0	17%	19%	0%	0%	Dai, Daisy
Hua Hong Semiconductor Ltd	1347.HK	OW	18.00	35.00	94%	3,036	8.0	15.0	1.1	1.0	6.0	7.3	15%	7%	2%	3%	Wu, Ray
GigaDevice Semiconductor Beijing Inc	603986.SS	EW	93.75	105.00	12%	8,797	25.9	28.6	4.2	3.9	19.3	21.2	18%	15%	2%	2%	Yen, Daniel
Will Semiconductor Co Ltd Shanghai	603501.SS	OW	80.13	120.00	50%	13,315	26.7	29.3	5.6	5.3	25.3	21.7	23%	21%	2%	2%	Chan, Charlie
Flat Glass Group Co Ltd	6865.HK	OW	18.96	33.40	76%	8,884	17.8	10.6	2.7	2.1	20.5	12.4	18%	25%	0%	0%	Yang, Hannah
Xiaomi Corp	1810.HK	OW	8.79	13.40	52%	28,565	48.4	21.2	1.4	1.3	28.2	18.2	3%	7%	0%	0%	Meng, Andy
Silergy Corp.	6415.TW	UW	424.50	430.00	1%	5,116	24.8	25.0	1.5	1.3	19.9	18.6	28%	24%	2%	0%	Chan, Charlie
Shenzhen Transsion Holdings Co Ltd	688036.SS	OW	58.16	91.00	56%	6,550	14.9	10.7	2.9	2.4	8.0	5.2	22%	27%	3%	2%	Meng, Andy
Maxscend Microelectronics Co Ltd	300782.SZ	UW	88.41	85.00	-4%	4,146	33.9	30.8	8.5	6.8	17.4	13.4	27%	27%	1%	0%	Chan, Charlie
Unimicron	3037.TW	EW	117.50	180.00	53%	5,502	5.9	5.9	2.0	1.6	5.0	4.4	45%	33%	3%	7%	Kao, Howard
Yangjie Technology	300373.SZ	OW	49.39	90.00	82%	3,558	20.9	18.6	4.0	3.4	13.2	11.6	23%	22%	0%	1%	Dai, Daisy
Powship Semiconductor Manufacturing Co	6770.TW	UW	28.80	27.00	-6%	2,964	4.7	11.7	1.2	1.2	1.8	4.2	34%	10%	5%	7%	Wu, Ray
GlobalWafers Co Ltd	6488.TWO	OW	359.00	580.00	62%	4,936	9.7	8.4	2.9	2.5	3.0	2.3	35%	34%	7%	6%	Chan, Charlie
LG Innotek	011070.KS	EW	273,500.00	360,000.00	32%	4,495	5.6	7.1	1.5	1.3	3.3	3.5	35%	22%	5%	4%	Kim, Shawn
LG Display	034220.KS	UW	12,000.00	13,000.00	8%	2,982	NM	19.5	0.4	0.3	3.0	2.1	-6%	2%	0%	1%	Kim, Shawn
Shengyi Technology Co Ltd.	600183.SS	EW	13.10	18.50	41%	4,192	15.8	13.0	2.0	1.8	10.2	8.2	13%	15%	5%	4%	Kao, Howard

Source: Company data, Morgan Stanley Research (E) estimates

Exhibit 49: Quant Screening Reversal Factor Bottom

Company name	Ticker	MS Rating	Share Price (Local Curr)	Price Target (Local Curr)	Upside (%)	Mkt Cap (\$ mn)	P/E		P/B		EV/EBITDA		ROE		Div Yield		Coverage Analyst
							2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	2022E	2023E	
Bottom																	
Wiwynn Corp	6669.TW	OW	805.00	950.00	18%	4,288	11.3	10.5	4.0	3.3	8.2	7.3	45%	38%	3%	4%	Kao, Howard
Accton Technology Corporation	2345.TW	EW	266.50	275.00	3%	4,672	19.5	16.7	8.6	7.7	14.1	12.2	49%	51%	4%	5%	Kao, Howard
Delta Electronics Inc.	2308.TW	OW	252.00	326.00	29%	20,582	21.4	19.2	3.0	2.8	10.8	9.7	16%	17%	3%	3%	Shih, Sharon
Lite-On Technology	2301.TW	EW	63.20	65.00	3%	4,592	9.9	9.0	1.9	1.8	4.2	3.8	20%	21%	8%	9%	Shih, Sharon
Catcher Technology	2474.TW	UW	169.00	113.00	-33%	4,029	12.5	14.6	0.8	0.8	12.7	11.9	7%	6%	6%	7%	Shih, Sharon
Hirose Electric	6806.T	OW	19,410.00	23,000.00	18%	4,740	19.2	18.5	2.0	1.9	6.6	6.1	10%	11%	3%	3%	Sasaki, Ryo
E Ink Holdings Inc.	8069.TWO	OW	212.00	280.00	32%	7,582	30.4	20.6	6.0	5.2	27.0	17.3	22%	29%	2%	3%	Yang, Derrick
Quanta Computer Inc.	2382.TW	EW	74.20	82.50	11%	9,010	11.7	10.2	1.6	1.6	8.4	6.7	15%	16%	7%	7%	Kao, Howard
Acer Inc.	2353.TW	UW	21.85	17.00	-22%	2,118	9.9	11.9	1.0	0.9	2.8	2.3	10%	8%	7%	6%	Kao, Howard
TDK	6762.T	OW	4,580.00	6,000.00	31%	11,993	11.3	9.7	1.2	1.1	4.6	4.0	12%	13%	2%	3%	Sato, Shoji
Ricoh	7752.TW	EW	1,042.00	1,100.00	6%	4,586	11.6	9.4	0.7	0.7	4.2	3.7	6%	8%	4%	5%	Ono, Masahiro
Unigroup Guoxin Microelectronics Co Ltd	002049.SZ	OW	144.00	194.00	35%	12,284	37.9	26.8	13.5	8.3	23.1	15.8	44%	43%	0%	0%	Dai, Daisy
ASE Technology Holding Co. Ltd.	3711.TW	EW	77.10	98.00	27%	10,800	5.9	8.4	1.1	1.1	3.1	3.6	21%	13%	10%	7%	Chan, Charlie
Canon	7751.T	OW	3,179.00	3,800.00	20%	29,292	11.9	10.6	1.1	1.0	4.9	4.4	10%	10%	4%	4%	Ono, Masahiro
Kyocera	6971.T	EW	7,413.00	7,800.00	5%	18,380	15.7	15.0	0.9	0.9	4.9	4.7	6%	6%	3%	3%	Sato, Shoji
Zhen Ding	4958.TW	EW	102.50	124.00	21%	3,046	7.0	6.7	0.8	0.7	3.0	2.6	12%	12%	5%	7%	Kao, Howard
Seiko Epson	6724.T	UW	2,000.00	1,800.00	-10%	4,781	11.3	12.0	1.0	0.9	4.9	4.8	9%	8%	3%	3%	Ono, Masahiro
Pegatron Corporation	4938.TW	EW	57.50	68.00	18%	4,726	8.6	7.5	0.7	0.7	3.8	3.5	9%	10%	9%	9%	Kao, Howard

Source: Company data, Morgan Stanley Research estimates

Quantech Takeaways on the Latest Semis Cycle

Macro challenges have bought a significant valuation correction YTD, and the global selloff in September shared increasing characteristics of market capitulation. We explore how Tech Hardware and Semiconductor names have behaved in the early stage of market recovery, if a bear market trough in Asia/EM is to be seen at some point in October.

In addition, we also leverage a quantitative approach to systemize the global semiconductor sales momentum and DRAM contract price behavior (*SK Hynix: Short-term Fear Provide Attractive Entry Point – Upgrade to OW*) to evaluate where we are in the industry cycle. We note that the YTD industry selloff might have front ran the deteriorating demand and earnings forecasts, while our model also forecasts a stabilization of DRAM contract pricing in 4Q2022, and anticipates a cyclical pick up in 1H2023.

We believe the industry, as a whole, does not justify a cautious view at this stage.

Exploring Opportunities After Historical Market Troughs

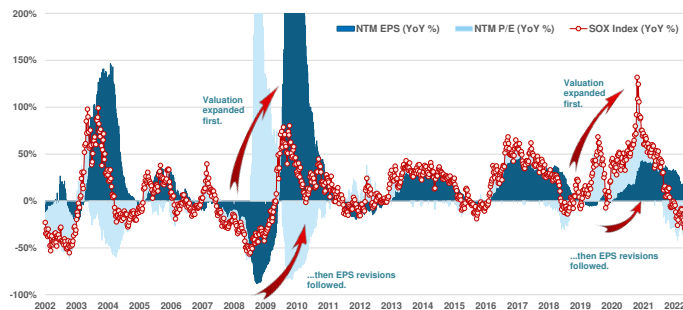
Latest market dynamics: There are growing signs of market capitulation, per the views of our Asia Equity Strategy and Quant Research team. The team expects a trough in this bear market will be formed in a matter of weeks rather than months from now. Given the cyclical nature of Tech Hardware and Semiconductor industries, we explore the investment implications of a market trough in the analysis below.

In 2022 YTD, both Tech Hardware and Semiconductor industries in Asia Pacific have recorded drawdowns of 35-40%, which underper-

formed the standard MSCI Asia Pacific index. "Inflation surprise" and "rates shock" have been adding pressure to the industry valuation globally, while moderation of earnings growth have also been a drag ([Exhibit 50](#)), but it is not yet a detractor.

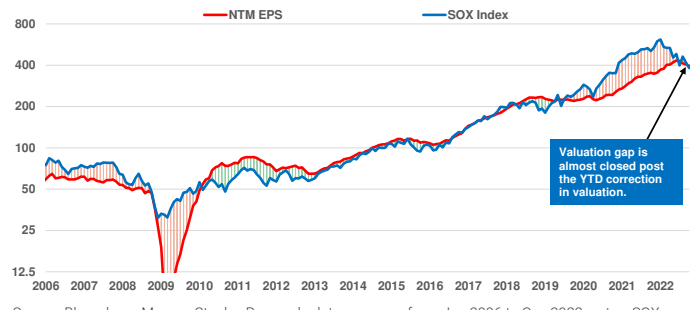
The magnitude of the valuation correction (YoY) is approaching extreme, relative to what we have seen in the last two decades. Concurrently, the valuation gap between the SOX index level and its underlying earnings growth has converged, which forms a better ground for long-term investors to explore intrinsic value ([Exhibit 51](#)).

Exhibit 50: Return breakdown of SOX index by forward P/E changes vs. NTM EPS changes – YoY basis.



Source: Bloomberg, Morgan Stanley Research; data coverage from Jan 2002 to Sep 2022.

Exhibit 51: Historical indexed changes of SOX index and its NTM EPS.



Source: Bloomberg, Morgan Stanley Research; data coverage from Jan 2006 to Sep 2022; notes: SOX index and its NTM EPS are both indexed to 100 as of Jun 30, 2014.

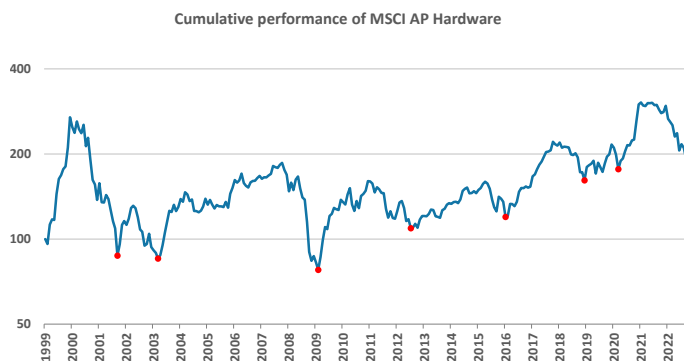
Looking into the historical troughs: Since Jan. 1999, there have been 7 major market troughs in MSCI Asia Pacific that could be identified. We label them by red dots in [Exhibit 52](#) and [Exhibit 53](#). Our analysis is based on these historical market troughs to summarize the market dynamics before and after them. We aim to discover what characteristics of industry players tended to outperform and underperform during the early stage of market recovery, which is usually composed of two phases - (i) initial risk rally, and (ii) transition to fundamentals driven. We summarize two key takeaways in the discussion below.

1) Initial risk rally is highly price reversal driven, which has nothing to do with fundamentals. It is indeed common to see that short covering and buy-the-dip inflows are the key drivers for market valuation to expand in the initial risk rally phase, while consensus earnings

growth might continue to be revised down. Such a market backdrop is normally driven by macro policy stimulus, or resolutions of systematic events. Looking at where we are today, a Fed pivot post a moderation of high inflation might help improve the risk sentiment, triggering short covering and fund flows to favor risk-on trades.

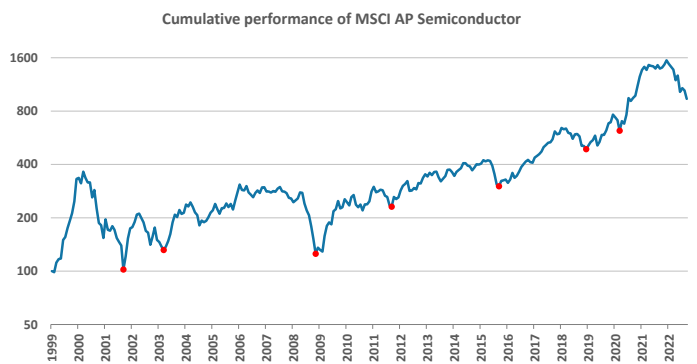
According to our historical analysis, an initial risk rally on average would last for 50 trading days, i.e., 2.5 months. During the period, underperformers in late-stage bear markets tended to outperform in the rally, while stocks with high momentum tended to underperform. Both Tech Hardware and Semiconductor names shared the same trading pattern. This price reversal effect was significant and highly consistent. Consensus revisions did not add meaningful value on average, because corporate guidance might have been lagging to reflect the macro factor improvement.

Exhibit 52: Historical troughs of MSCI Asia Pacific Tech Hardware index



Source: Bloomberg, Morgan Stanley Research; data as of Sep 21, 2022

Exhibit 53: Historical troughs of MSCI Asia Pacific Semiconductor index

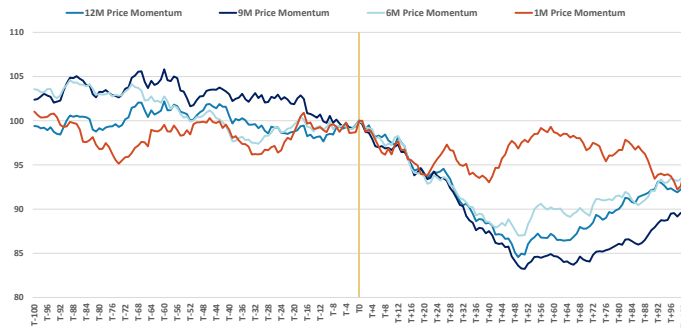


Source: Bloomberg, Morgan Stanley Research; data as of Sep 21, 2022

2) After an initial risk rally, fundamental factors started to generate alpha for Tech Hardware, while Semiconductor remained a Beta trade. We note that the alpha efficacy of momentum factors started to diverge from 50 trading days onward. Tech Hardware names became 6-12M momentum driven, but semiconductor names remained highly reversal driven. This means investors tended to look

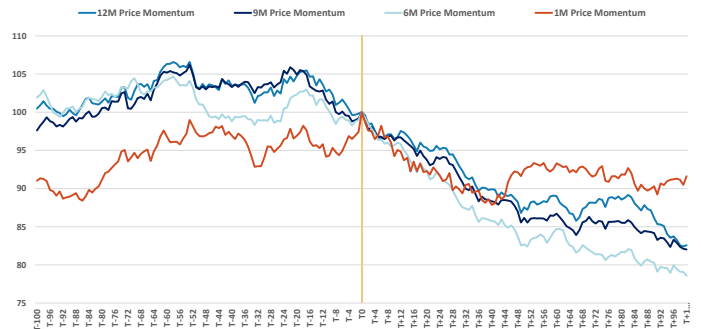
for bottom-up alpha only among Tech Hardware names, and continued taking semiconductor names to gain market Beta exposure. Bottom-up factors like consensus earnings revisions only started adding value for Semiconductor names after 4 months from the bear market trough, historically.

Exhibit 54: L/S factor performance of price momentum before and after historical market troughs – Tech Hardware



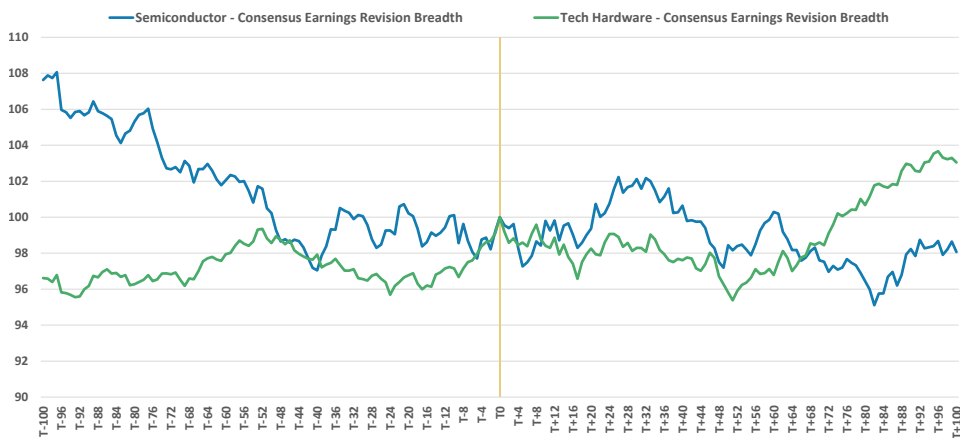
Source: FactSet, Morgan Stanley Research

Exhibit 55: L/S factor performance of price momentum before and after historical market troughs – Semiconductor



Source: FactSet, Morgan Stanley Research

Exhibit 56: L/S factor performance of consensus earnings revisions breadth before and after historical market troughs – Tech Hardware vs. Semiconductor



Source: FactSet, Morgan Stanley Research

Modeling Industry Cycle via a Quantech Framework

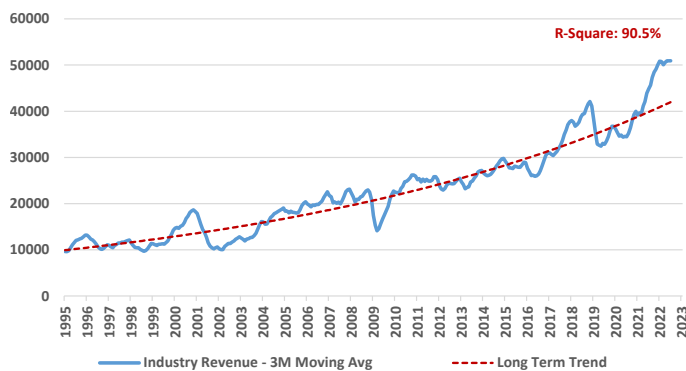
Besides evaluating market trading dynamics around the trough of historical bear markets, we also look at the industry cycle from a quant perspective. We rely on our Quantech framework to model global semiconductor sales momentum, gauge we are now in the industry, and provide insight into the alpha opportunities to which we think investors should pay attention.

Global Semiconductor Sales Momentum and its Implications on sector performance.

Methodology Recap: What we did in July 2021 was to take two steps to classify the sales cycle of semiconductor industry:

1. Take the logarithm of the monthly sales number, and run a linear time-series regression to sort out the sales level of long-term structural growth trend.

Exhibit 57: Step 1 – sorting out the sales level of the long-term structural growth trend



Source: WSTS, Morgan Stanley Research; note: data is smoothed by taking 3-month moving average

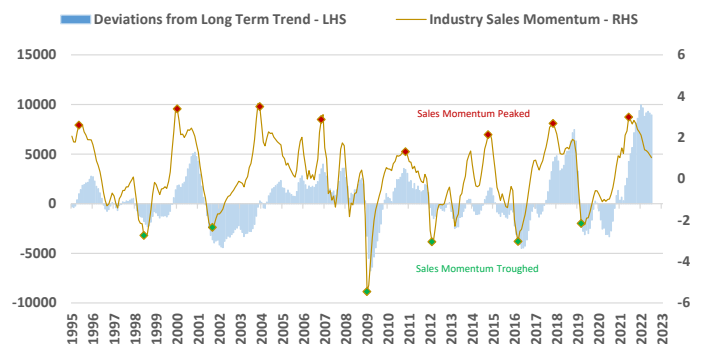
2. Measure the delta of the reported monthly sales vs. the sales level of long-term structural growth trend, and calculate its z-score relative to its past rolling two-year history.

From a quant perspective, we found the market tends to price assets based on industry fundamentals, that being forward looking sales momentum. This phenomenon could be intuitively understood in that assets with poor but improving fundamentals would be more likely to outperform assets with good but deteriorating fundamentals.

- In other words, it is the change in expectations that matters.

We model the expectation changes by tracking the deviations of industry global sales from its long-term trend (Exhibit 57). Accordingly, we translate the deviation into a z-score to gauge the industry sales momentum, i.e., the yellow line in Exhibit 58.

Exhibit 58: Step 2 – measuring the monthly delta of industry sales vs. long-term structural growth trend



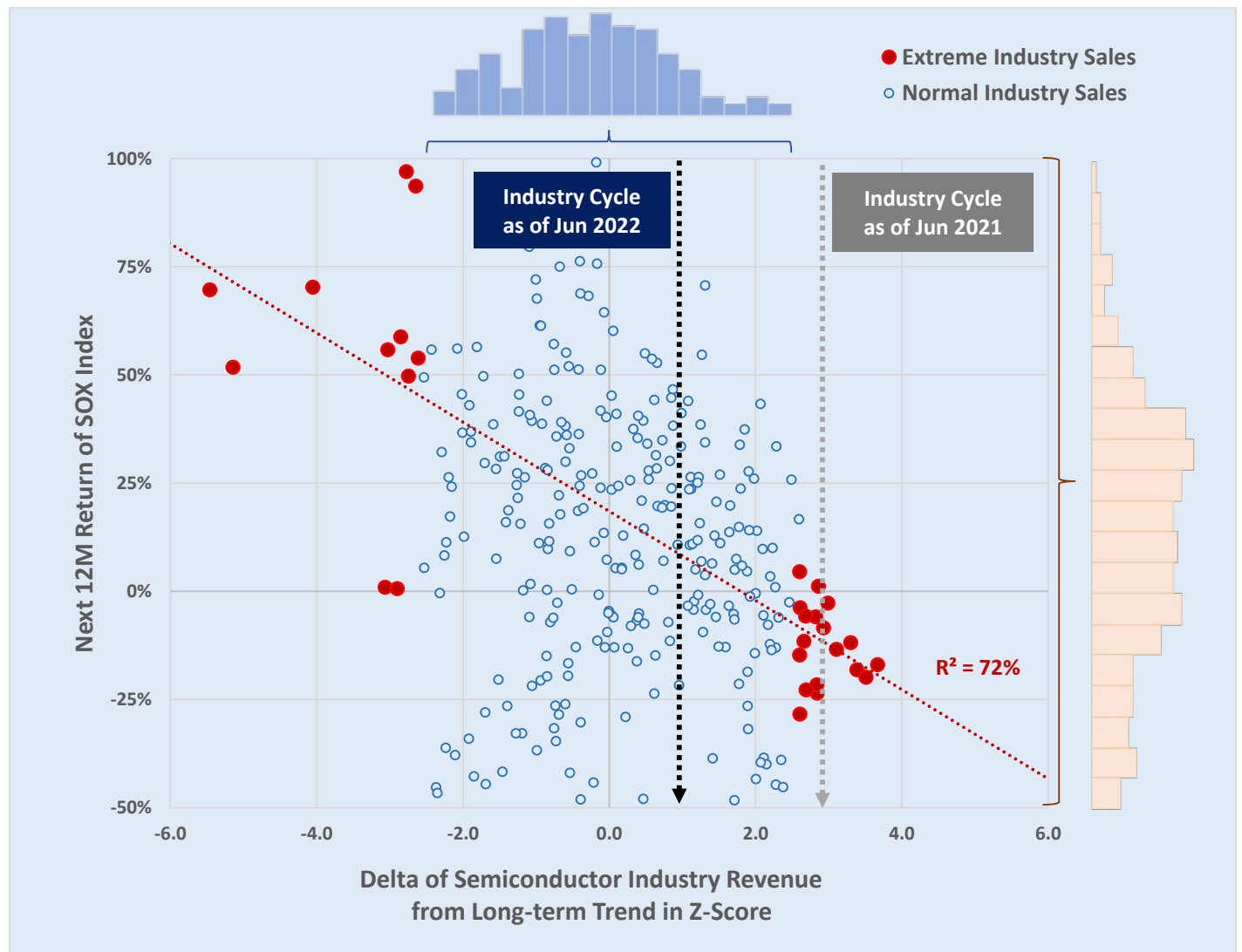
Source: WSTS, Morgan Stanley Research

Investment Implications: Based on this framework, industry sales remains above the long-term trend, but the sales momentum has been decreasing quickly in 1H2022. There is no sign of sales momentum picking up in the near term, and we believe it might mean industry sales fall below the long-term trend at some point in 2023. Herein, we flag two important investment implications:

i) The absolute return of the global semiconductor industry will depend more on the industry outlook than macro factors. In July

2021, we flagged a cautious view on industry performance ahead because we believed the strong industry sales momentum was too extreme to be sustainable from that point onward. A year later, sales momentum has moderated to a neutral level where there is no obvious reversal relationship between sales momentum and industry performance. Thus, the "red flag" of this signal has eased for now (Exhibit 59).

Exhibit 59: Empirical relationship between next-12-months returns for the SOX and semiconductor industry total sales delta from long-term trend in z-score



Source: WSTS, FactSet, Morgan Stanley Research; data as of Aug 2022.

ii) Price actions YTD appear to have front run industry sales momentum: The historical returns of the MSCI Asia Pacific Semiconductor Index and Tech Hardware Index tend to return negatively after the industry sales momentum drops below the long term trend.

In July 2021, we expected both Semiconductor and Tech Hardware players to continue lackluster performance in 2H2021, and the draw-down risk to emerge in 1H2022. This has played out in 2022 so far, but

industry sales momentum looks more resilient than what market price action is implying. Thus, we think the probability of both industries running into a tactical relief rally will get higher at some point in 4Q2022.

However, whether a risk rally would be prolonged or not would be highly depended on (i) the timing of industry sales momentum improvement, and (ii) the degree of capitulation and thus how far asset prices have been sold beyond their fundamentals.

Exhibit 60: MSCI Industry indices performance by semiconductor sales cycles

Average Monthly Performance by Semiconductor Sales Cycles	Above Trend		Below Trend	
	Rising	Declining	Declining	Rising
Absolute Performance				
MSCI Asia Pacific Semiconductor & Equipment	1.2%	0.5%	-0.4%	2.8%
MSCI Asia Pacific Tech Hardware	1.2%	0.7%	-0.5%	1.3%
Relative Performance vs. MSCI Asia Pacific				
MSCI Asia Pacific Semiconductor & Equipment	0.2%	-0.7%	-0.1%	2.0%
MSCI Asia Pacific Tech Hardware	0.2%	-0.5%	-0.2%	0.5%

Source: FactSet, MSCI, Morgan Stanley Research; data coverage: July 2001 to Jun 2021 - 20 years of MSCI industry indices history (the longest available history).

Exhibit 61: Information Ratio of L/S alpha by stock characteristics – analysis of index constituents in MSCI Asia Pacific Semiconductor & Equipment Index and MSCI Asia Pacific Technology Hardware Index.

Factor Performance Along Semiconductor Sales Cycle				
Description	Above Trend & Rising	Above Trend & Declining	Below Trend & Declining	Below Trend & Rising
Cheap P/B	0.16	-0.59	-0.01	0.08
Cheap P/S	-0.17	0.31	0.03	-0.50
Cheap P/E	0.43	0.68	0.86	0.52
High Total Yield	-0.05	0.86	0.47	0.10
Cheap Fwd P/E	0.61	1.28	0.65	0.40
High FCF Yield	0.11	1.40	1.60	0.92
Value Composite	0.19	0.86	1.16	0.59
Low Accruals	-0.11	-0.26	0.38	0.17
High Earnings Stability	-0.12	0.93	0.75	0.01
High Profitability	0.75	1.29	0.34	0.41
Low Leverage	0.22	1.03	0.94	0.64
High Operating Efficiency	0.19	0.87	0.36	-0.08
Quality Composite	0.40	1.18	1.30	0.54
High Internal Growth	0.53	0.52	-0.06	-0.12
High Dividend Growth	-0.06	-0.28	0.01	0.60
High Earning Growth	0.53	0.52	0.74	0.47
High Long Term Growth f/c	-0.10	0.34	0.58	0.36
Growth Composite	0.02	0.33	0.57	0.88
1M Loser	0.17	-0.09	0.03	0.96
12M-1M Residual	0.44	0.87	0.91	0.29
Earning Revision	0.61	0.73	0.55	0.53
Sales Revision	0.56	0.59	1.14	0.41
Sentiment Composite	0.91	0.92	1.34	0.69
12M Price Momentum	0.32	1.00	0.59	0.07
Small Cap	0.02	-0.69	0.52	-0.58
Low Volatility	0.32	0.66	-0.14	-0.23
Low Beta	-0.17	0.97	-0.16	-0.45

Source: FactSet, MSCI, Morgan Stanley Research; data coverage: July 2001 to Jun 2021 - 20 years of MSCI industry indices history (the longest available history).

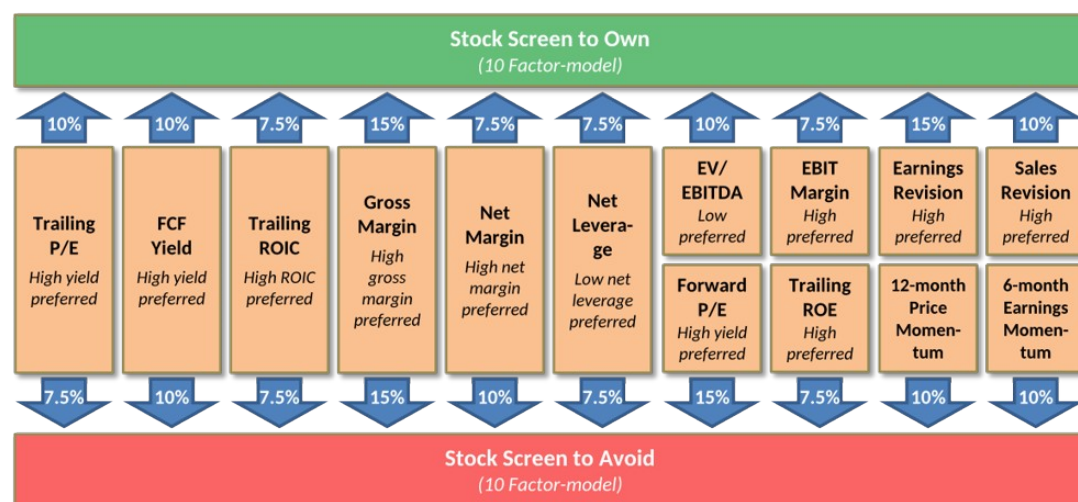
QUANTECH – Stock Screening & Criteria

Exhibit 62: QuanTech Stock Screen – Names that are exposed the most to long-term outperforming characteristics in Tech Hardware and Semiconductor industry.

Ticker	Company	Country	MS Rating	Target Price Upside	Mkt Cap Min US\$	Price Last	Rank of Percentile in Quant Model
2330.TW	TSMC	Taiwan	OW	58%	377,076	455	4th pctl
CSCO.O	Cisco Systems Inc	United States of America	EW	17%	169,587	41.15	5th pctl
AMAT.O	Applied Materials Inc.	United States of America	EW	28%	74,327	85.04	23th pctl
LRCX.O	Lam Research Corp	United States of America	OW	40%	52,993	386.83	26th pctl
7974.T	Nintendo	Japan	OW	19%	50,341	61320	14th pctl
KLAC.O	KLA Corp	United States of America	EW	14%	47,434	313.07	5th pctl
000660.KS	SK Hynix	S. Korea	EW	26%	43,898	83500	29th pctl
7741.T	HOYA	Japan	OW	13%	35,721	14105	7th pctl
ANET.N	Arista Networks	United States of America	EW	11%	35,206	112.55	1th pctl
7751.T	Canon	Japan	OW	16%	30,584	3277	9th pctl
2454.TW	MediaTek	Taiwan	OW	38%	29,014	580	29th pctl
DELL.N	Dell Technologies Inc.	United States of America	EW	49%	27,137	36.28	17th pctl
000725.SZ	BOE Technology	China	OW	41%	17,001	3.41	19th pctl
2303.TW	UMC	Taiwan	OW	51%	15,453	38.3	14th pctl
NTAP.O	NetApp Inc	United States of America	EW	37%	14,191	64.23	12th pctl
6762.T	TDK	Japan	OW	22%	13,049	4920	27th pctl
WDC.O	Western Digital	United States of America	OW	92%	11,402	33.82	23th pctl
6857.T	Advantaset	Japan	EW	22%	9,821	7350	10th pctl
FFIV.O	F5 Networks Inc	United States of America	EW	41%	8,807	145.66	1th pctl
3008.TW	Largan Precision	Taiwan	EW	17%	8,081	1885	7th pctl
011070.KS	LG Innotek	S. Korea	EW	4%	5,888	344500	18th pctl
LITE.O	Lumentum Holdings Inc	United States of America	EW	38%	5,286	71.27	32th pctl
SLAB.O	Silicon Laboratories Inc.	United States of America	EW	31%	5,057	123.02	2th pctl
6806.T	Hirose Electric	Japan	OW	14%	4,979	20130	20th pctl
2379.TW	Realtek Semiconductor	Taiwan	EW	3%	4,774	303.5	24th pctl
5334.T	NGK Spark Plug	Japan	EW	(3%)	4,186	2943	10th pctl
4958.TW	Zhen Ding	Taiwan	EW	9%	3,428	113.5	18th pctl
VIAV.O	Viavi Solutions Inc	United States of America	EW	28%	3,167	13.29	21th pctl
COMM.O	CommScope Holding Company Inc	United States of America	EW	0%	2,719	10.98	21th pctl
2360.TW	Chroma Ate Inc.	Taiwan	OW	24%	2,494	186	15th pctl
SIMO.O	Silicon Motion	Taiwan	EW	28%	2,330	70.04	27th pctl
5274.TWO	Aspeed Technology	Taiwan	EW	(10%)	2,268	1890	8th pctl
SWON.S	Softwareone Holding AG	Switzerland	EW	61%	1,693	10.53	28th pctl
3189.TW	Kinsus Interconnect Tech.	Taiwan	EW	35%	1,412	98	32th pctl
6908.T	IRISO Electronics	Japan	EW	(13%)	664	4040	22th pctl

Source: FactSet, Morgan Stanley Research; screen as of Sep 23, 2022.

Exhibit 63: QUANTECH model factors summary: factors' weight based on optimal back-tested results



Source: Morgan Stanley Research

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Morgan Stanley & Co. LLC makes a market in the securities of Applied Materials Inc., Arista Networks, Canon, Cisco Systems Inc, CommScope Holding Company Inc, Dell Technologies Inc., KLA Corp, Lam Research Corp, LG Display, Lumentum Holdings Inc, NetApp Inc, Silicon Laboratories Inc., Silicon Motion, TSMC, UMC, Viavi Solutions Inc, Western Digital.

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Morgan Stanley uses a relative rating system using terms such as Overweight, Equal-weight, Not-Rated or Underweight (see definitions below). Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold and sell. Investors should carefully read the definitions of all ratings used in Morgan Stanley Research. In addition, since Morgan Stanley Research contains more complete information concerning the analyst's views, investors should carefully read Morgan Stanley Research, in its entirety, and not infer the contents from the rating alone. In any case, ratings (or research) should not be used or relied upon as investment advice. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations.

Global Stock Ratings Distribution

(as of September 30, 2022)

The Stock Ratings described below apply to Morgan Stanley's Fundamental Equity Research and do not apply to Debt Research produced by the Firm.

For disclosure purposes only (in accordance with FINRA requirements), we include the category headings of Buy, Hold, and Sell alongside our ratings of Overweight, Equal-weight, Not-Rated and Underweight. Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold, and sell but represent recommended relative weightings (see definitions below). To satisfy regulatory requirements, we correspond Overweight, our most positive stock rating, with a buy recommendation; we correspond Equal-weight and Not-Rated to hold and Underweight to sell recommendations, respectively.

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	1342	38%	295	41%	22%	590	39%
Equal-weight/Hold	1582	45%	335	47%	21%	702	46%
Not-Rated/Hold	0	0%	0	0%	0%	0	0%
Underweight/Sell	610	17%	84	12%	14%	219	14%
Total	3,534		714			1511	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

Analyst Stock Ratings

Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.

In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.

Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below. Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

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

L&F Co Ltd (066970.KQ) - As of 10/3/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 10/1/17 : /I; 11/26/17 : /C; 2/21/19 : U/C; 7/30/19 : U/I; 11/18/19 : U/A; 8/5/20 : E/A; 12/17/20 : O/A; 7/19/21 : O/I; 8/12/21 : O/C

Price Target History: 2/21/19 : 26991.69; 4/10/19 : 22171.75; 7/4/19 : 21207.76; 1/17/20 : 19279.78; 4/6/20 : 14459.83; 6/10/20 : 19000; 8/5/20 : 41000; 10/16/20 : 37000; 12/17/20 : 92000; 4/22/21 : 120000; 8/17/21 : 170000; 10/20/21 : 280000; 11/24/21 : 310000; 5/16/22 : 390000; 8/17/22 : 400000

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) ■
 Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
 Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
 Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

LG Display (034220.KS) - As of 10/3/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 10/1/17 : U/I; 11/26/17 : U/C; 1/24/18 : O/C; 6/18/18 : E/C; 7/30/19 : E/I; 11/18/19 : E/A; 12/9/19 : O/A; 3/19/20 : E/A; 7/19/21 : E/I; 8/12/21 : E/C; 4/27/22 : U/C

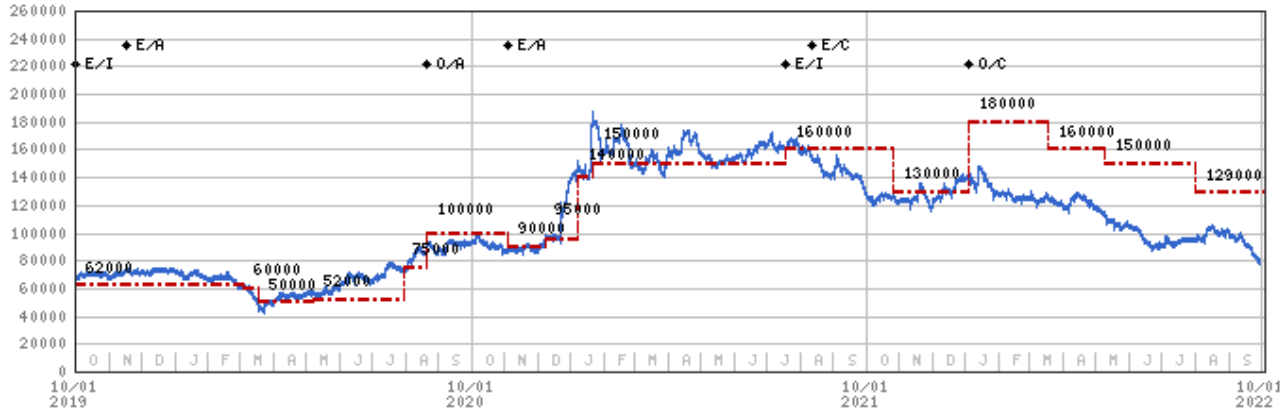
Price Target History: 8/9/17 : 26000; 1/24/18 : 40000; 4/4/18 : 34000; 4/25/18 : 31000; 6/18/18 : 23000; 7/23/18 : 22000; 10/24/18 : 20000; 1/22/19 : 19000; 7/4/19 : 18000; 7/23/19 : 17000; 8/16/19 : 14000; 12/9/19 : 19000; 3/4/20 : 17000; 3/19/20 : 11000; 7/23/20 : 12000; 8/27/20 : 13000; 10/16/20 : 16000; 10/22/20 : 17000; 12/21/20 : 18000; 1/22/21 : 26000; 3/29/21 : 24000; 4/28/21 : 25000; 9/29/21 : 19000; 1/24/22 : 22000; 3/18/22 : 18000; 4/27/22 : 15000; 7/11/22 : 14000; 7/27/22 : 13000

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) ■
 Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
 Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
 Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

LG Electronics (066570.KS) - As of 10/3/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 10/1/17 : U/I; 11/26/17 : U/C; 1/22/18 : E/C; 7/30/19 : E/I; 11/18/19 : E/A; 8/21/20 : O/A; 11/4/20 : E/A; 7/19/21 : E/I; 8/12/21 : E/C; 1/4/22 : O/C

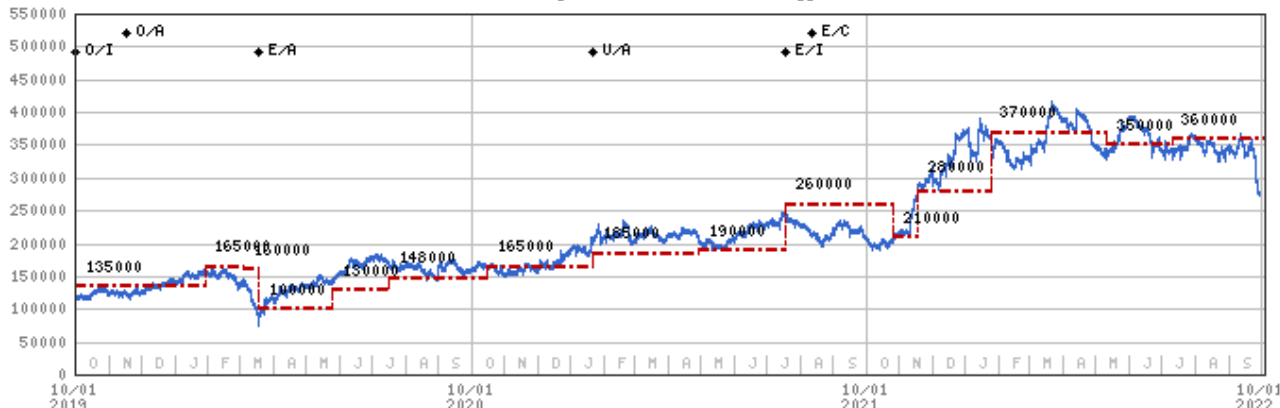
Price Target History: 9/6/17 : 70000; 10/24/17 : 74000; 1/22/18 : 106000; 7/23/18 : 92000; 9/10/18 : 85000; 12/18/18 : 68000; 4/1/19 : 72000; 7/4/19 : 80000; 7/30/19 : 70000; 8/16/19 : 62000; 3/4/20 : 60000; 3/19/20 : 50000; 5/8/20 : 52000; 7/30/20 : 75000; 8/21/20 : 100000; 11/4/20 : 90000; 12/8/20 : 95000; 1/8/21 : 140000; 1/22/21 : 150000; 7/19/21 : 160000; 10/26/21 : 130000; 1/4/22 : 180000; 3/18/22 : 160000; 5/10/22 : 150000; 8/1/22 : 129000

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) ■
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

LG Innotek (011070.KS) - As of 10/3/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 10/1/17 : E/I; 11/26/17 : E/C; 11/21/18 : U/C; 7/4/19 : O/C; 7/30/19 : O/I; 11/18/19 : O/A; 3/19/20 : E/A; 1/22/21 : U/A; 7/19/21 : E/I; 8/12/21 : E/C

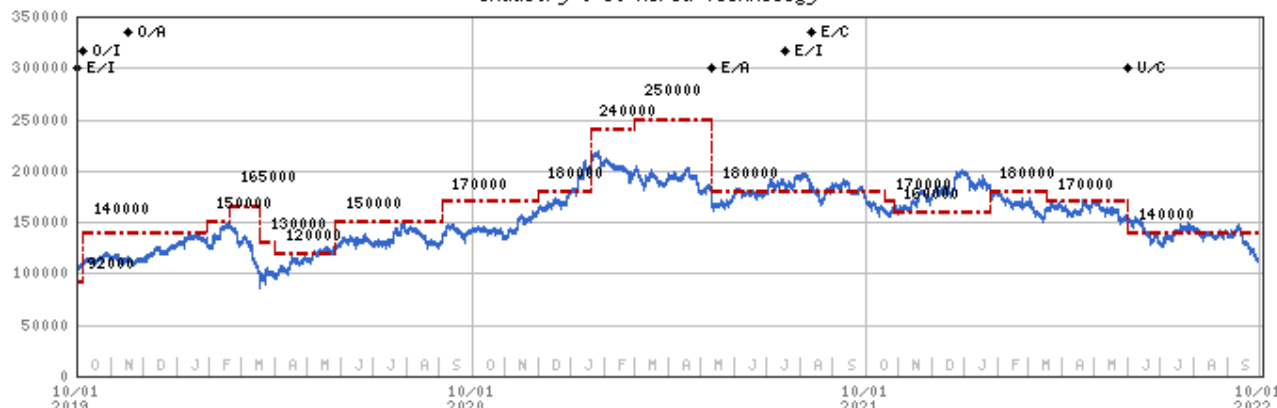
Price Target History: 8/9/17 : 160000; 1/22/18 : 140000; 1/30/18 : 130000; 3/26/18 : 125000; 6/19/18 : 150000; 11/21/18 : 95000; 1/22/19 : 92000; 4/1/19 : 90000; 7/4/19 : 150000; 8/16/19 : 135000; 1/29/20 : 165000; 3/4/20 : 160000; 3/19/20 : 100000; 5/26/20 : 130000; 7/17/20 : 148000; 10/16/20 : 165000; 1/22/21 : 185000; 4/29/21 : 190000; 7/19/21 : 260000; 10/26/21 : 210000; 11/18/21 : 280000; 1/24/22 : 370000; 5/12/22 : 350000; 7/11/22 : 360000

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) ■
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Samsung Electro-Mechanics (009150.KS) - As of 10/3/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 10/1/17 : 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) ■
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Samsung Electronics (005930.KS) - As of 10/3/22 in KRW
Industry : S. Korea Technology



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

Price Target History: 9/22/17 : 58000; 11/26/17 : 56000; 6/28/18 : 54000; 11/1/18 : 50000; 11/21/18 : 47000; 12/14/18 : 42000; 1/15/19 : 40000; 7/30/19 : 53000; 8/16/19 : 48000; 9/10/19 : 50000; 11/18/19 : 60000; 1/14/20 : 72000; 2/26/20 : 75000; 3/19/20 : 68000; 4/29/20 : 65000; 7/12/20 : 70000; 9/11/20 : 73000; 11/27/20 : 88000; 1/12/21 : 110000; 2/25/21 : 115000; 5/18/21 : 93000; 6/8/21 : 98000; 8/12/21 : 89000; 9/15/21 : 95000; 12/3/21 : 97000; 3/18/22 : 95000; 4/28/22 : 85000; 6/10/22 : 80000; 7/8/22 : 75000; 7/22/22 : 70000; 9/17/22 : 68000

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) ■
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

SK hynix (000660.KS) - As of 10/3/22 in KRW
Industry : S. Korea Technology



Stock Rating History: 10/1/17 : NA/I; 11/26/17 : NA/C; 8/5/18 : U/C; 7/30/19 : E/I; 11/18/19 : O/A; 7/19/21 : O/I; 8/12/21 : U/C; 12/3/21 : E/C; 2/11/22 : O/C; 7/22/22 : E/C

Price Target History: 9/20/17 : NA; 8/5/18 : 71000; 9/6/18 : 70000; 11/13/18 : 69000; 12/14/18 : 63000; 1/15/19 : 61000; 1/25/19 : 63000; 3/3/19 : 60000; 4/25/19 : 70000; 6/4/19 : 61000; 7/25/19 : 70000; 7/30/19 : 85000; 8/16/19 : 80000; 9/10/19 : 81000; 11/18/19 : 95000; 1/14/20 : 115000; 2/26/20 : 120000; 3/19/20 : 110000; 8/21/20 : 93000; 10/23/20 : 100000; 12/2/20 : 160000; 1/12/21 : 170000; 2/25/21 : 174000; 5/18/21 : 146000; 6/8/21 : 156000; 8/12/21 : 80000; 9/15/21 : 88000; 12/3/21 : 110000; 12/23/21 : 125000; 1/24/22 : 130000; 1/28/22 : 136000; 2/11/22 : 155000; 3/18/22 : 150000; 4/27/22 : 130000; 6/10/22 : 120000; 7/5/22 : 110000; 7/22/22 : 105000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target --- No Price Target Assigned (NA)
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 Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
 Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
 Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

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INDUSTRY COVERAGE: S. Korea Technology

COMPANY (TICKER)	RATING (AS OF)	PRICE* (09/30/2022)
Ryan Kim		
Advanced Process Systems Corp (265520.KQ)	E (03/18/2022)	W15,900
Duk San Neolux Co Ltd (213420.KQ)	O (04/09/2020)	W31,700
Ecopro BM (247540.KQ)	O (08/03/2021)	W88,100
Iljin Materials (020150.KS)	O (02/21/2019)	W50,800
L&F Co Ltd (066970.KQ)	O (12/17/2020)	W177,700
Posco Chemical Co Ltd. (003670.KS)	O (08/10/2022)	W150,000
SK IE Technology (361610.KS)	E (07/28/2022)	W52,400
Solus Advanced Materials Co Ltd (336370.KS)	O (05/11/2021)	W29,900
Wonik IPS Co Ltd (240810.KQ)	O (09/07/2020)	W22,250
Shawn Kim		
LG Display (034220.KS)	U (04/27/2022)	W12,000
LG Electronics (066570.KS)	O (01/04/2022)	W78,600
LG Innotek (011070.KS)	E (07/19/2021)	W273,500
Samsung Electro-Mechanics (009150.KS)	U (06/01/2022)	W112,000
Samsung Electronics (005935.KS)	O (11/18/2019)	W46,900
Samsung Electronics (005930.KS)	O (11/18/2019)	W53,100
Samsung SDI (006400.KS)	E (10/26/2021)	W546,000
Samsung SDS (018260.KS)	U (01/06/2022)	W115,000
Seoul Semiconductor (046890.KQ)	U (04/04/2018)	W10,150
SK hynix (000660.KS)	E (07/22/2022)	W83,100

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* Historical prices are not split adjusted.

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