BERNSTEIN

30 March 2021
Coverage Initiation

U.S. Semiconductor Capital Equipment

U.S. Semiconductor Capital Equipment: End of the bullwhip to tip of the spear - Initiating Coverage on LRCX & AMAT at Outperform

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We are initiating coverage on the US Semiconductor Capital Equipment Industry with a positive long-term structural stance. We are initiating coverage on Lam Research (LRCX, $700 TP) and Applied Materials (AMAT, $160 TP) both at Outperform.

Whereas semiconductors are difficult to forecast, semicap has historically tended to be at the end of the bullwhip, with the rapid expansion/deflation seen in past years in semiconductors magnified into wild cyclical swings in the equipment space. And yet, the industry managed to eke out robust returns over those cycles, even with 40pp+ swings in peak-to-trough economics and cycle bottoms that would approach break-even (or worse). While not a game for the faint of heart, semicap companies overall tended to do a decent job navigating a virtually unknowable environment.

But the cyclical environment for semicap has become more supportive. While still subject to swings, underlying semiconductor volatility has dampened as the industry has grown (and approached the $500B mark), with volatility correspondingly reduced in the semicap industry that feeds it. Economics across the cycle are vastly better, with trough margins well above prior peaks, structurally higher levels of FCF, and sustained capital return. And the "end of Moore's Law," far from being a harbinger of doom, has rather made the technological offerings of the semicap vendors more mission critical than ever as new materials and structures become more important to drive value for customers.

Over the longer term we believe semiconductor capital equipment is likely to be extremely structurally advantaged, with growth trends in the underlying semi market likely to remain positive over the long term, and with a strong case to be made for semiconductor capital intensity to continue evolving higher over time as the industry moves from the end of the bullwhip, to the tip of the spear.

Our view on WFE growth over the next several years is very positive; we see 2021 WFE spending at ~$75B, up ~19% YoY, and growing further through 2023 with foundry/logic spending set to inflect materially and go structurally higher, industry supply constraints complementing strong demand, memory spending recovery a matter of when vs if, and increasing potential for governmental incentives, supporting the stocks even after the run.

While a structurally positive WFE view is by itself likely enough to like the stocks, we believe both LRCX and AMAT have a number of attractive additional components to create value and support multiples, including a burgeoning services story, increasing SAM opportunities, solid (and potentially underappreciated) capital return, analyst day catalysts (AMAT holds their meeting on April 6, and LRCX's recent long-term analyst day model suggests a good amount of upside from here), and multiples that still appear attractive compared to the overall semi sector especially taking into account the industry's structural improvements.

We initiate coverage on Lam Research (LRCX) with an Outperform rating and $700 TP, and Applied Materials (AMAT) with an Outperform rating and $160 TP.

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BERNSTEIN TICKER TABLE

Ticker	Rating		29 Mar 2021 Closing Price	Target Price	TTM Rel. Perf.		EPS Adjusted 2020A	EPS Adjusted 2021E	EPS Adjusted 2022E	P/E Adjusted 2020A	P/E Adjusted 2021E	P/E Adjusted 2022E
AMAT	O	USD	125.71	160.00	122.8%	USD	4.17	6.05	6.92	30.18	20.77	18.17
LRCX	O	USD	570.29	700.00	80.2%	USD	15.96	25.07	27.79	35.74	22.74	20.52
SPX			3,971.09				136.96	172.45	198.42	28.99	23.03	20.01

COVERAGE INITIATION

O - Outperform, M - Market-Perform, U - Underperform, N – Not Rated

INVESTMENT IMPLICATIONS

We rate LRCX Outperform with a $700 target price.

We rate AMAT Outperform with a $160 target price.

DETAILS

For a primer on the Semiconductor Capital Equipment Industry please click here.

EXECUTIVE SUMMARY

We are initiating coverage on the US Semiconductor Capital Equipment Industry with a positive long-term structural stance. We are initiating coverage on Lam Research (LRCX, $700 TP) and Applied Materials (AMAT, $160 TP) both at Outperform.

Whereas semiconductors are difficult to forecast, semicap has historically tended to be at the end of the bullwhip, with the rapid expansion/deflation seen in past years in semiconductors magnified into wild cyclical swings in the equipment space.

And yet, the industry still managed to eke out robust returns over those cycles, even with 40pp+ swings in peak-to-trough economics and cycle bottoms that would approach break-even (or worse). While not a game for faint of heart, semicap players overall tended to do a decent job navigating a virtually unknowable environment.

Over the last several years, the cyclical environment for semicap has become more supportive. While still subject to swings, underlying semiconductor volatility has dampened as that industry has grown (and approached the $500B mark), with volatility correspondingly reduced in the semicap industry that feeds it. Consolidation within the space has helped to improve returns. And the "end of Moore's Law," far from being a harbinger of doom, has rather made the technological offerings of the semicap vendors more mission critical than ever as new materials and structures become more important to drive value for customers. In that light the industry is in far better shape than it used to be, with vastly improved economics around the cycle, trough margins in the current cycle at or above where prior peak margins used to be, judicious capital allocation and returns over the cycle, and an increasing contribution from a more recurring services element, all of which can help improve through-cycle valuations.

And over the longer term we believe semicap is likely to be an extremely structurally advantaged space, with growth trends in the underlying semiconductor market likely to remain positive over the long term, and with semiconductor capital intensity likely to continue evolving higher over time as the industry moves from the end of the bullwhip, to the tip of the spear.

We are positive on WFE growth over the next several years as foundry and logic spend appear set to inflect materially, and structurally, higher amid industry supply constraints and strong demand, with a recovery in memory spending appearing to be a matter of when rather than if, and increasing potential for governmental incentives. We believe overall WFE spend is set to inflect materially higher in 2021 to ~$75B, up 19% YoY, and reaching $87B by CY2023, driving semicap revenues higher and supporting the stocks even after the recent run.

While a structurally positive view on WFE is by itself likely enough to support a positive outlook on the stocks, beyond this we believe both LRCX and AMAT have a number of attractive additional components to create value and support multiples, including a burgeoning services story, increasing SAM opportunities, solid capital return, and analyst day catalysts (AMAT holds their meeting on April 6, and LRCX's recent long-term analyst day model suggests a good amount of upside from here). And while cognizant of the ever-present fear of cyclical risks, current multiples, even after the run, still appear attractive to us when compared to the overall semi sector, the overall market, and broader tech especially after taking into account the structural improvement of the semicap players and industry.

We initiate coverage Lam Research (LRCX) with an Outperform rating and $700TP, and Applied Materials (AMAT) with an Outperform rating and $160 TP.

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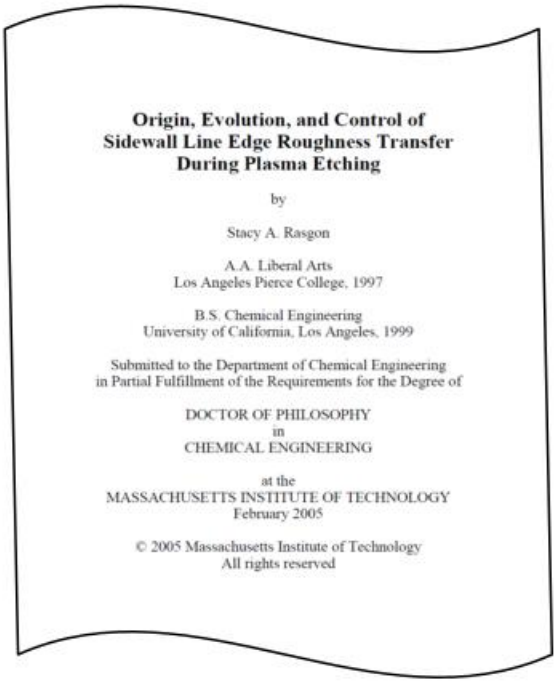
WHAT IS SEMICONDUCTOR CAPITAL EQUIPMENT AND WHY DOES IT MATTER?

Semiconductor capital equipment – end of the bullwhip, tip of the spear...

As some of you may know, we started our semiconductor life as equipment engineers (we built plasma etchers at MIT (**Exhibit 1**), studied how etch transfers line edge roughness down feature sidewalls at IBM Research, and in some Everettian alternate timeline likely have a doppelganger working at one the equipment companies).

EXHIBIT 1: **The semicap industry has long held a place near and dear to our heart**



Origin, Evolution, and Control of Sidewall Line Edge Roughness Transfer During Plasma Etching

by

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February 2005

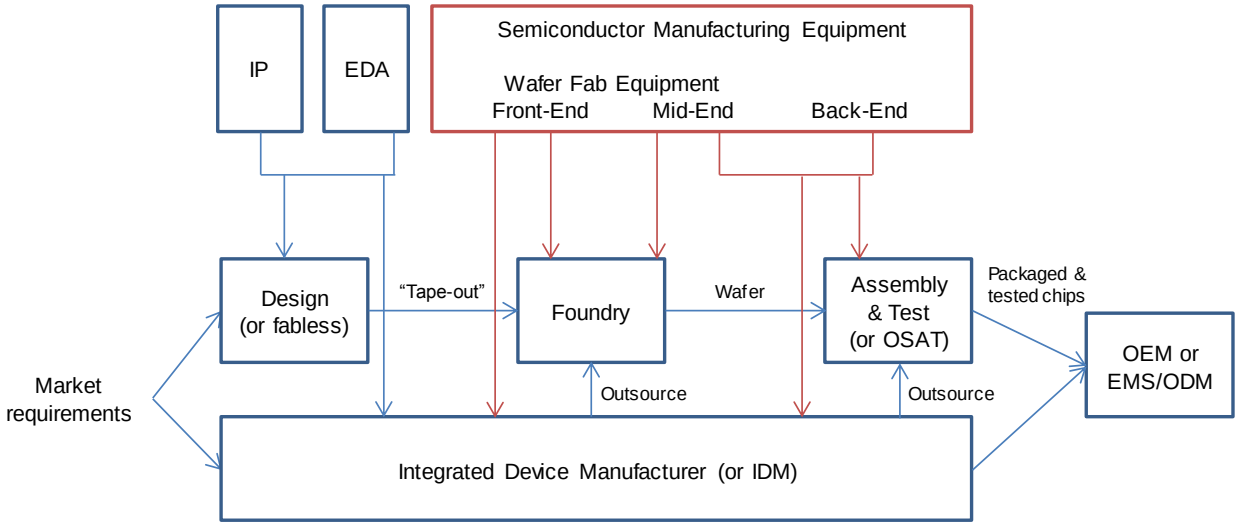
Source: Massachusetts Institute of Technology, Bernstein analysis

Hence the semiconductor capital equipment industry has always held a place near and dear to our heart, as the innovations developed have enabled the realizations of Gordon Moore's seminal 1965 paper[1] and allowed the fabrication of the most complex physical objects humanity has ever managed to conceive (as we have said many times, we are astonished that any of this stuff works at all).

This foundation has led to a robust daughter industry growing orders of magnitude from those early days a critical part of the supply chain (**Exhibit 2)**, with semiconductors pervading every aspect of modern life, and today a wafer fabrication equipment industry somewhere in the ballpark of ~$60B supports a semiconductor industry that is getting ever closer to $500B (**Exhibit 3, Exhibit 4**). And of course, semiconductors are crucial to support a $5 Trillion tech industry (there is no technology without semiconductors, and no semiconductors without semicap) (**Exhibit 5.**)

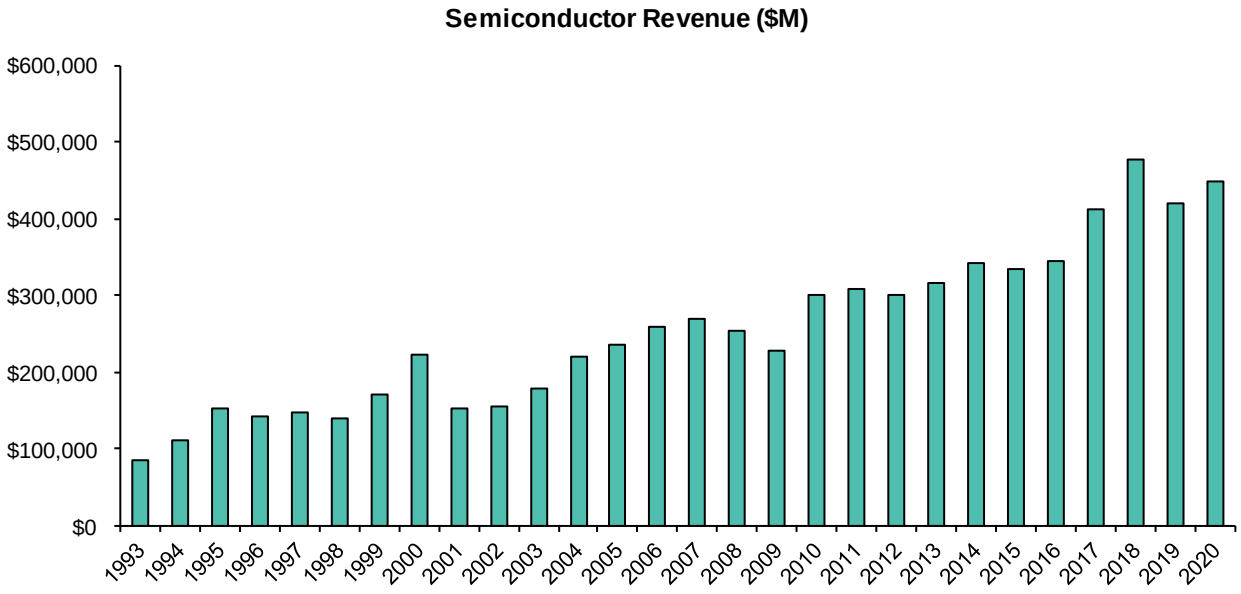
[1] The delightfully-titled "Cramming more components onto integrated circuits" published in *Electronics*. If you haven't read it, Intel has helpfully archived it here: https://newsroom.intel.com/wp-content/uploads/sites/11/2018/05/moores-law-electronics.pdf

EXHIBIT 2: **Semiconductor equipment is a critical part of the semi supply chain**



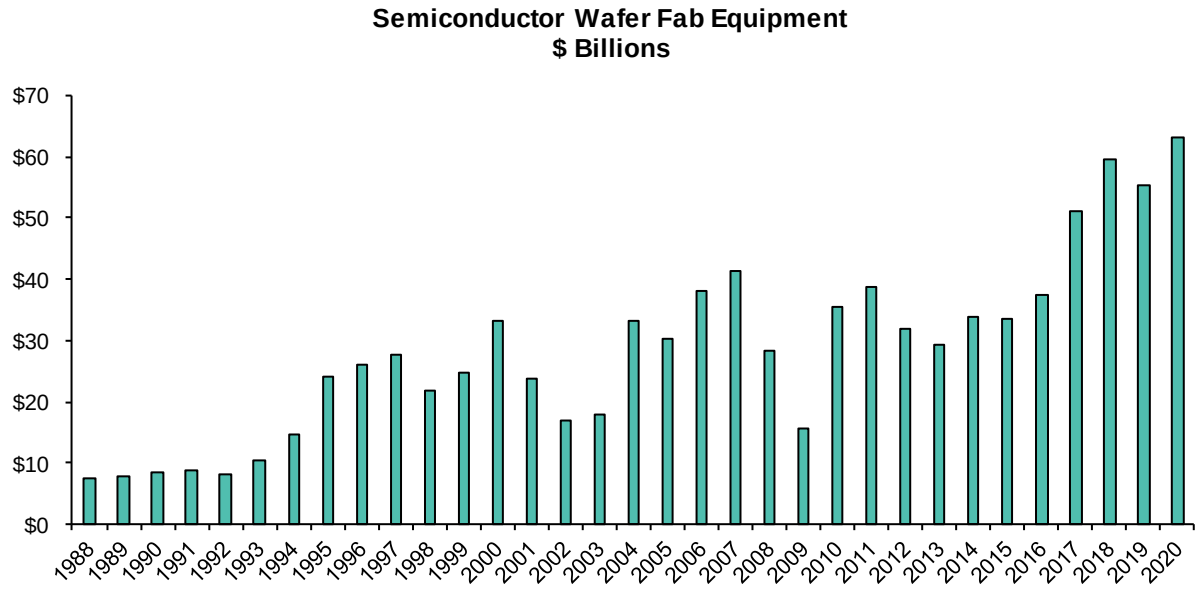
Source: Bernstein analysis

EXHIBIT 3: **Semiconductor capital equipment has enabled semiconductors to pervade every aspect of modern life**



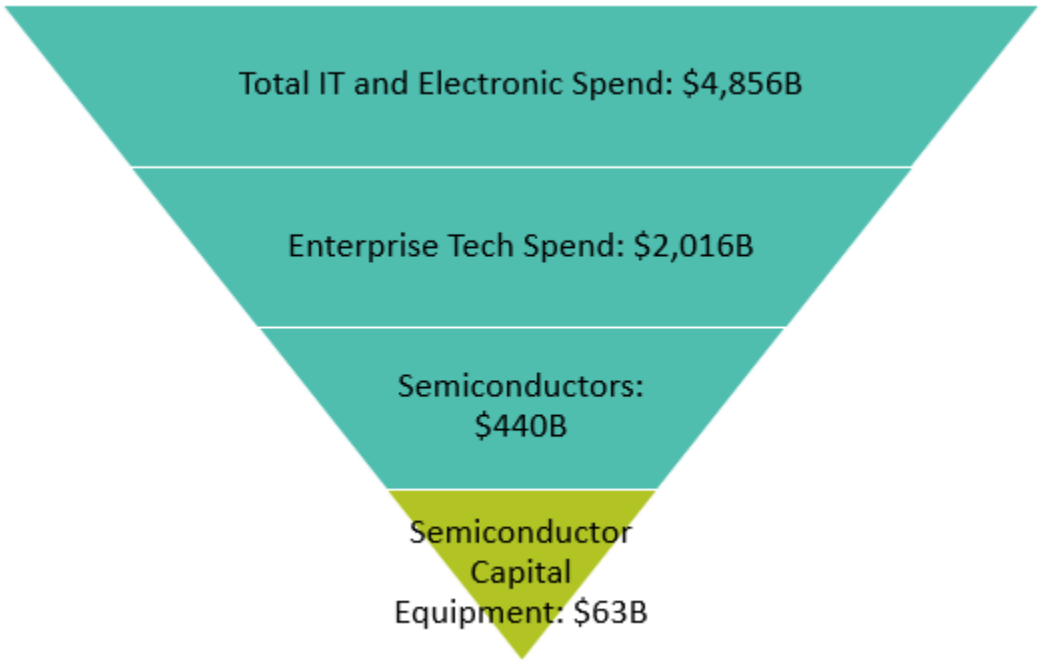
Source: World Semiconductor Trade Statistics, Bernstein analysis

EXHIBIT 4: **The wafer fabrication equipment (WFE) market recently crossed the $60B mark**



Source: Gartner, Bernstein analysis

EXHIBIT 5: **Semiconductor Capital Equipment underpins the entirety of the ~$5T global technology industry**



Source: WSTS, Gartner, Bernstein analysis

Semiconductors are a capital-intensive industry, with overall capex exceeding $100B annually. Manufacturing equipment is the largest portion of this spend, with semiconductor wafer fabrication equipment (WFE) accounting for close to 60% of total semiconductor capital spending (**Exhibit 6**).

Normalized levels for WFE have increased over the years as the underlying semiconductor industry has grown. The WFE market was ~$10B or so in the early 90's, jumping to the $20-$30B range in the years leading up to the tech bubble. From 2004 to 2016, the WFE market fluctuated between ~$30B and $40B (excluding the financial crisis). More recently, 2017-20 WFE spending leaped into the $50-$60B range, primarily on the back of a very strong memory cycle and the move from 2D to 3D NAND flash (**Exhibit 4**).

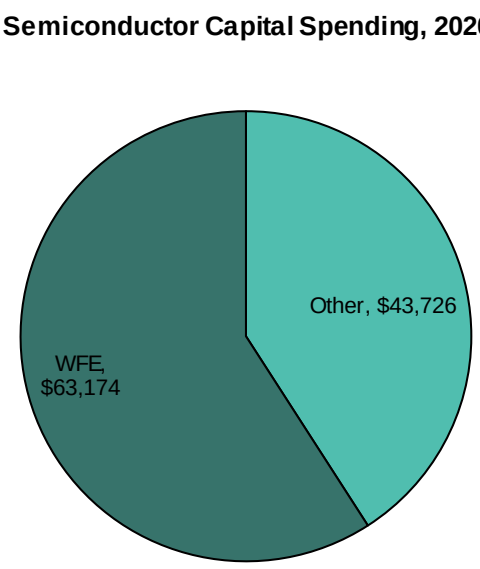
Underneath the banner of "WFE" there are a number of primary process steps and types used to manufacture semiconductor chips, processes that are highly complex in practice (**Exhibit 7**). But conceptually, what is going on is not all that hard to understand. Simplistically, to make a semiconductor chip one typically does one of three things. One either deposits material onto a wafer, patterns that material, or takes material away, as well as monitor and inspect the process throughout (**Exhibit 8**). These basic steps (in various flavors and forms) are repeated over and over again (with cleaning steps in between), building up the structure of the chip circuitry (**Exhibit 9**).

The various processes have contributed differing amounts to the market over the years, but etch and deposition have been taking material amounts of share, mostly at the expense of lithography, primarily due to the move from 2D-NAND to 3D-NAND flash (the latter of which is much more dependent on etch and dep), though litho has made a resurgence recently as EUV lithography finally goes mainstream especially in the foundry space (**Exhibit 10**).

Today foundry/logic spending makes up roughly 60% of WFE spend, with memory (DRAM and NAND) around 40%, though these can fluctuate year to year depending on the strength of the memory cycle (**Exhibit 11**).

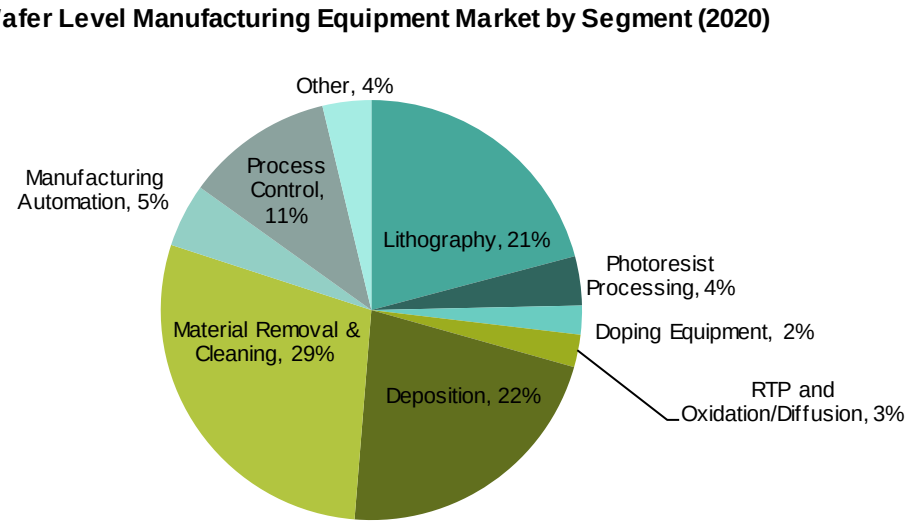
For a helpful primer on the overall market as well as various process steps please see Bernstein's Semiconductor Equipment Primer, 2020 Edition published by our colleague Mark Li.

EXHIBIT 6: **Wafer fabrication equipment accounts for close to 60% of semiconductor capital spending**



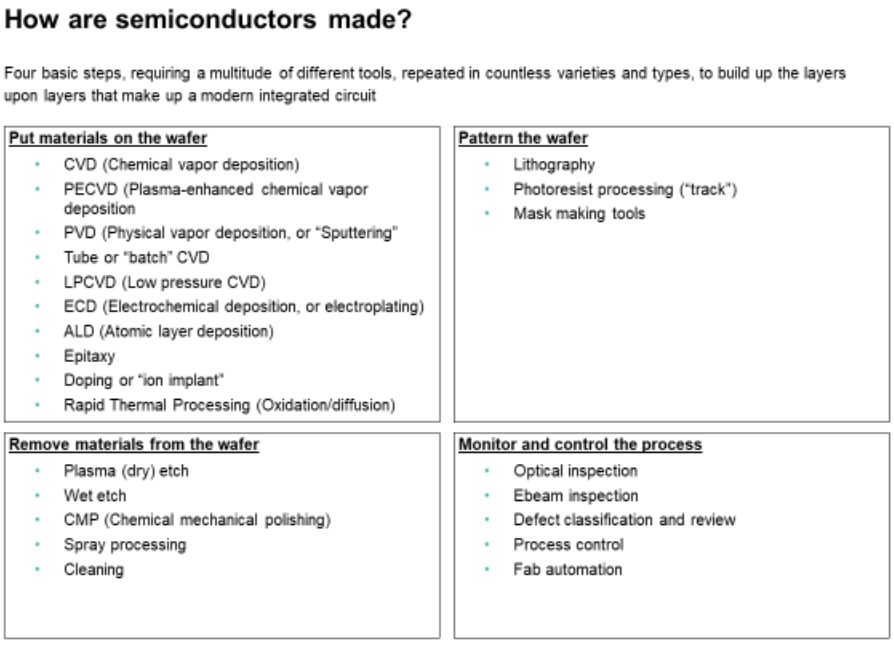
Source: Gartner, Bernstein analysis

EXHIBIT 7: **Semiconductor manufacturing utilizes a number of primary complex process steps**



Source: Gartner, Bernstein analysis

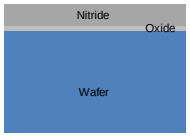
EXHIBIT 8: **Most semiconductor manufacturing process steps include either putting materials down on the wafer, patterning them, taking material away, or monitoring the process…**



Source: Bernstein analysis

EXHIBIT 9: **An illustration of the "front-end" semiconductor manufacturing process**

1. Start with raw wafer; deposit oxide and nitride

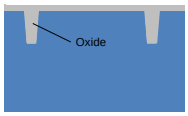


Layering
- Deposition

2. Form insulating trenches

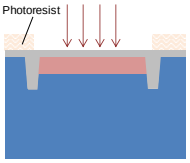
Patterning
- Photoresist processing
- Lithography
- Material removal & cleaning

3. Fill trenches with oxide, polish, remove nitride



Layering
- Deposition
- Material removal & cleaning

4. Well formation– ion implantation



Patterning
- Photoresist processing
- Lithography

Doping
- Doping equipment
- Material removal & cleaning

Thermal treatment
- Rapid thermal processing (RTP) & oxidation/diffusion

5. Gate stack formation

Layering
- Deposition

Patterning
- Photoresist processing
- Lithography
- Material removal & cleaning

6. Source/drain formation

Patterning
- Photoresist processing
- Lithography
- Material removal & cleaning

Layering
- Deposition

Doping
- Doping equipment

Thermal treatment
- Rapid thermal processing (RTP) & oxidation/diffusion

7. Contact via formation

Layering
- Deposition

Patterning
- Photoresist processing
- Lithography
- Material removal & cleaning

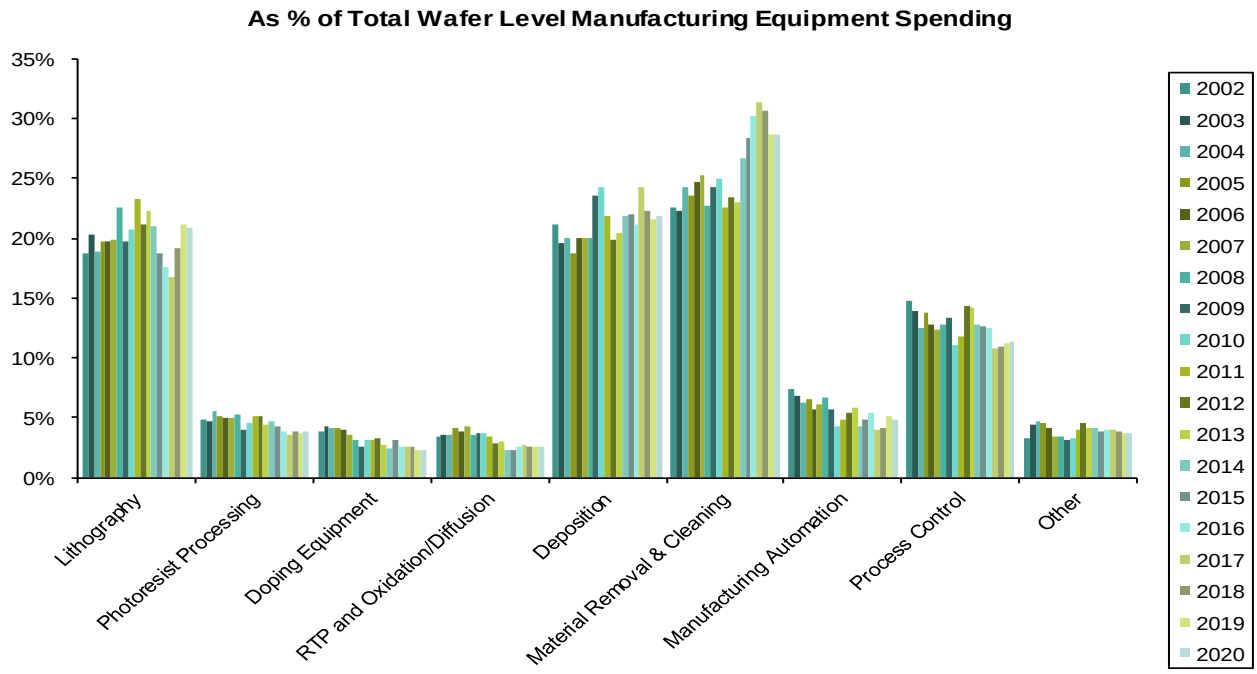
8. Metal interconnect formation

Layering
- Deposition

Patterning
- Photoresist processing
- Lithography
- Material removal & cleaning

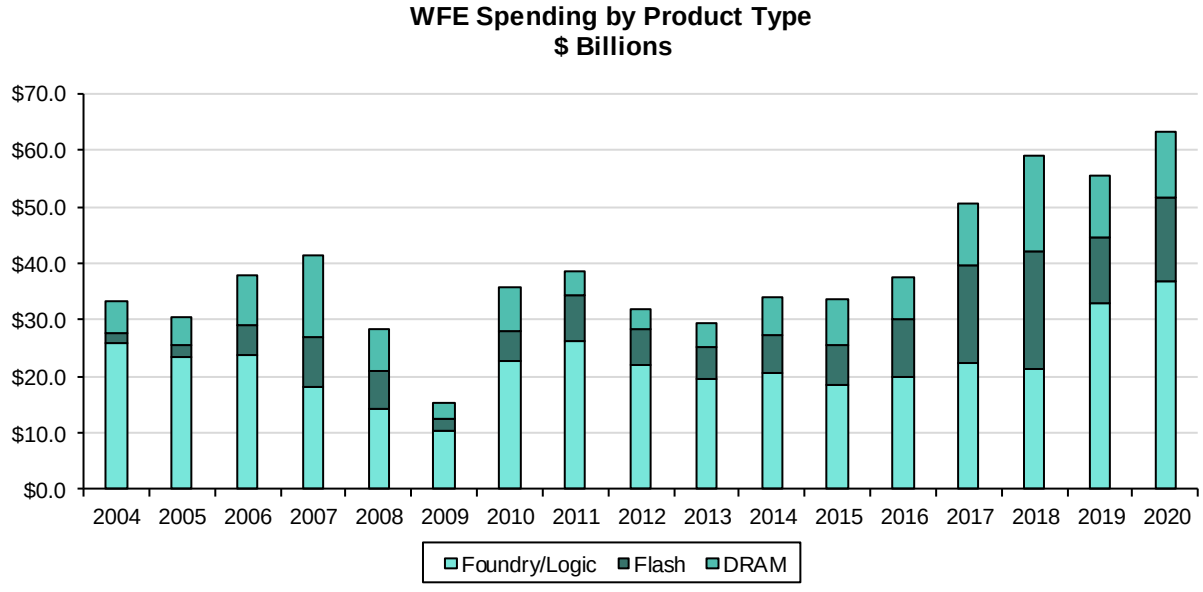
Source: Bernstein analysis

EXHIBIT 10: **Etch and lithography had grown faster than WFE over the past few years**



Source: Gartner, Bernstein analysis

EXHIBIT 11: **In 2020 roughly 40% of WFE spend went to memory (DRAM and flash); memory spending remains below the 2018 peak**



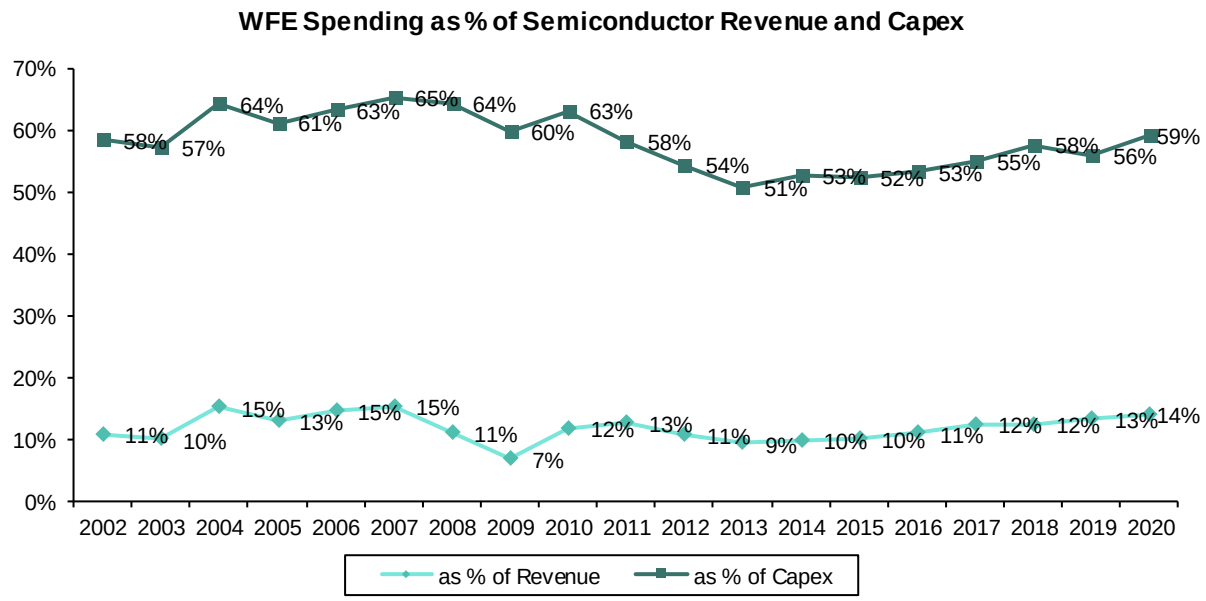
Source: Gartner, SEMI, Company reports, Bernstein estimates and analysis

But this industry is not one for the faint of heart.

Semiconductor manufacturing is hugely capital intensive, with major players spending a significant % of revenue on capex. And WFE equipment typically makes up a majority of this spend, industry-wide accounting for more than half of semiconductor capex spend every year, and a low teens % of total semiconductor revenue (**Exhibit 12**).

Volatility is a primary characteristic of the industry. While semiconductors on their own are challenging to forecast, and remain at the vagaries of macro events, product cycles, inventory fluctuations, competitive dynamics etc., volatility in semicap historically has been much worse; if there was ever any part of the sector where "playing the cycle" was imperative, semicap has been it.

EXHIBIT 12: **While WFE has grown considerably, it is pretty stable as a % of semi revenue and semi mfg capex**



Source: Gartner, Bernstein analysis

Overall normalized growth of semis and semicap have mostly tracked each other (with ~7-8% CAGR over the last 15-20 years. But semicap is effectively the "second derivative" of semiconductor demand (otherwise known as "the end of the bullwhip) and traditional semiconductor cyclicality has been greatly magnified in the equipment sector. In fact, it has not been uncommon to have revenue swings approaching (or exceeding)100% YoY on the upside, reaching 30-50% declines on the downside, in any given year).

While cycle investing is important in semiconductors in general, the "bullwhip" nature of semicap has historically made it much more important here. Stock prices have historically been extremely volatile, with price returns often surpassing 50% both positively and negatively.

Naturally WFE stocks are anticipatory, with share prices correlating best to WFE growth/shrink a quarter or two before they are reported. But as WFE sales tend to lead semiconductor sales, semicap stock performance anticipates changes in the broader semi cycle to a greater degree than semiconductors do. The stocks tend to be (unsurprisingly) correlated across the cycle. And forecasting under the best of circumstances is hard.

Concentrated market

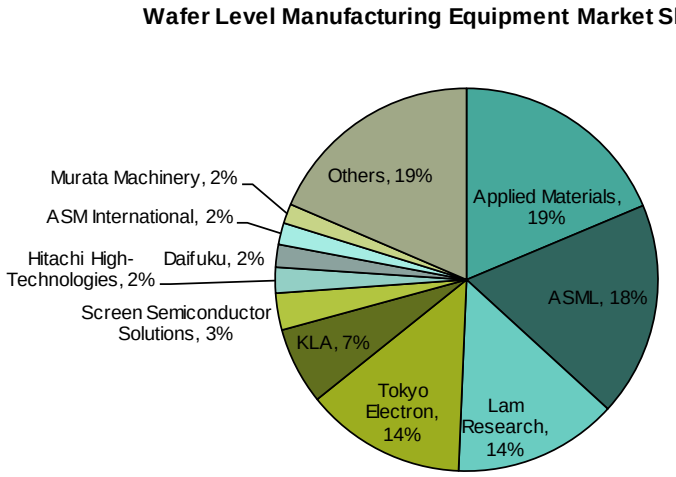
Semiconductor capital equipment share is concentrated at both the supplier, and customer levels, and concentration has increased over the years as the sheer weight of implementing Moore's Law has grown too heavy for most to bear.

Revenues from the five largest WFE players today comprise ~70% of the market on an all-in basis. Applied Materials is the largest supplier with ~20% overall market share, followed by ASML and LRCX (**Exhibits 13)** and concentration has increased over time due to market dynamics as well as (at least in the past) a few instances of large-scale M&A (which seems now to have reached its end) (**Exhibit 14**).

However, share within specific process steps tends to be far more concentrated; ASML effectively owns lithography, with TEL the primary player in resist processing / track. AMAT dominates in doping (from the Varian acquisition) and RTP, and KLA is the primary player in process control. LRCX, AMAT, and Tokyo Electron form a triumvirate in deposition and etch (AMAT always played in both, while LRCX was traditionally an etch player, gaining access to deposition as a result of their Novellus acquisition a number of years ago) (**Exhibit 15, Exhibit 16**).

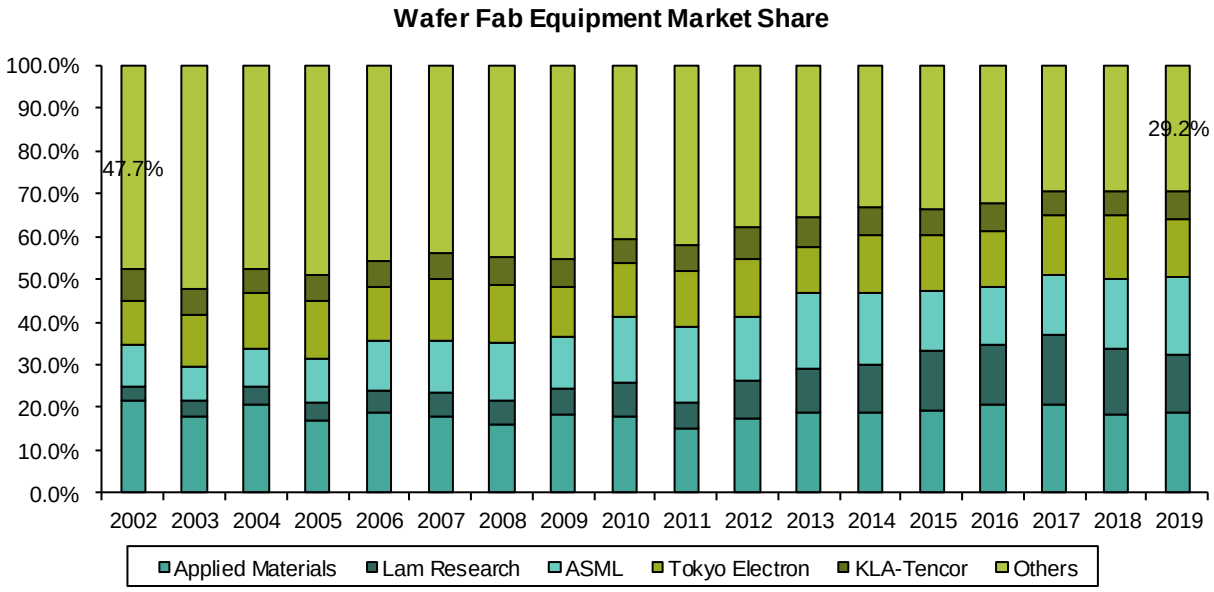
But we can decompose share even further which is useful in understanding the real moats these companies enjoy. For example conductor etch is dominated by LRCX (and to a lesser extent AMAT) while in dielectric etch AMAT has been largely shut out (with LRCX dominating, followed by Tokyo Electron) (**Exhibit 18, Exhibit 19**).

EXHIBIT 13: **Top 5 players control ~70% of the WFE market**



Source: Gartner, Bernstein analysis

EXHIBIT 14: **Larger players are slowing taking share**



Source: Gartner, Bernstein analysis

EXHIBIT 15: **2019 Market share by process is even more concentrated**

Segment	Deposition	Lithography	Photoresist Processing	Material Removal & Cleaning	Doping Equipment	RTP & Oxidation/ Diffusion	Process Control	Mfg Automation & Control	Others
Share of WFE	22%	21%	4%	29%	2%	3%	11%	5%	4%
Major Players of Each Segment	AMAT (44%)	ASML (83%)	TEL (91%)	LAM (34%)	AMAT (60%)	AMAT (40%)	KLA (54%)	Daifuku (37%)	
	LAM (19%)			TEL (24%)		TEL (20%)		Murata (32%)	
	TEL (10%)			AMAT (18%)	Axcelis (18%)	Kokusai (19%)	AMAT (11%)		
	ASM Intl (8%)						Hitachi HT (9%)	AMAT (5%)	
	Kokusai (5%)	Nikon (7%)		Screen Semi (10%)	SMIT (16%)	ASM (5%)	ASML (5%)	SEMES (3%)	
	Wonik IPS (2%)			Hitachi HT (4%)		Mattson (5%)	Lasertec (4%)		
	Others (12%)	Canon (5%)	Screen Semi (6%)	Others (10%)	Others (6%)	Others (10%)	Zeiss (3%)	Others (23%)	
		NuFlare (3%)	SEMES (2%)				Nova (3%)		
		Others (2%)					Nanometrics (3%)		
							Others (10%)		

Source: Gartner, Bernstein analysis

EXHIBIT 16: **2019 Market share by process is even more concentrated**

Material Removal & Cleaning Equipment Breakdown	Spray Processors	Dielectric Etch	Conductor Etch	CMP and Post-CMP Clean	Others
As % Total	14%	26%	41%	9%	9%
Major Players of Each Segment	Screen (45%)	TEL (61%)	Lam (51%)	AMAT (66%)	
	TEL (29%)	Lam (36%)	AMAT (30%)	Ebara (28%)	
	Lam (16%)	AMEC (3%)	Hitachi (9%)	Others (6%)	
	SEMES (6%)		TEL (7%)		
	ACM (4%)		Others (4%)		

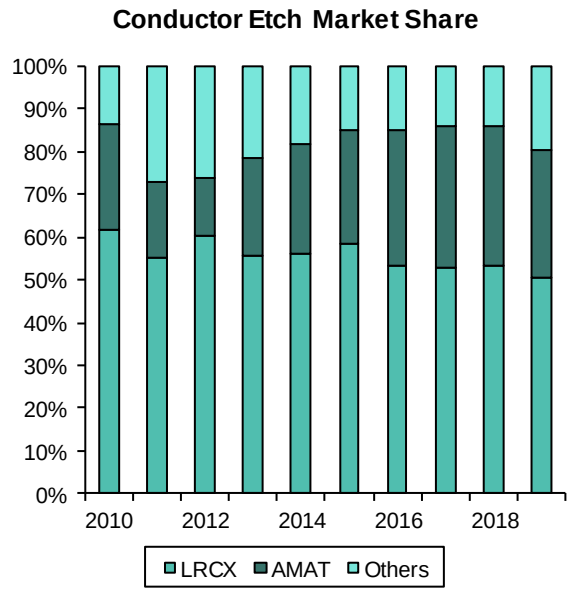
Source: Gartner, Bernstein analysis

EXHIBIT 17: **2019 Market share by process is even more concentrated**

Depostition Equipment Breakdown	Epitaxy	Tube CVD	ALD	Nontube LPCVD	Plasma CVD	Sputtering	Others
As % Total	8%	9%	12%	9%	31%	22%	9%
Major Players of Each Segment	AMAT (74%) ASM Intl (20%) Others (7%)	Kokusai (50%) TEL (46%) Others (4%)	ASM Intl (41%) TEL (28%) Lam (12%) Jusung (8%) Others (11%)	Lam (44%) TEL (33%) AMAT (15%) Others (8%)	AMAT (53%) Lam (34%) Wonik IPS (5%) Others (8%)	AMAT (85%) Ulvac (6%) Others (9%)	

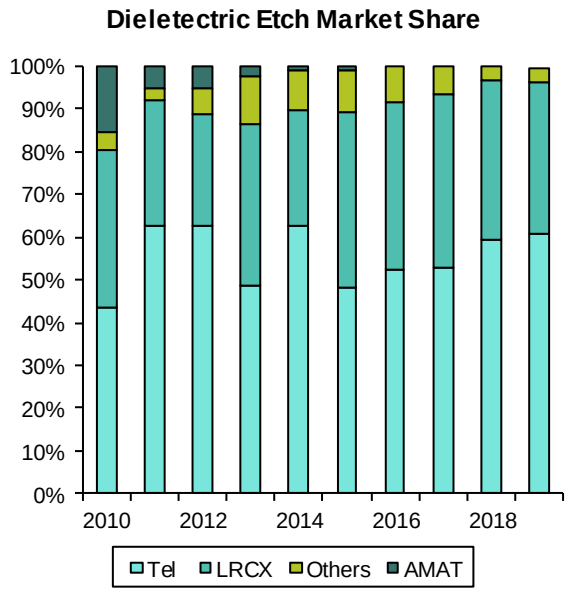
Source: Gartner, Bernstein analysis

EXHIBIT 18: **Share in conductor etch is dominated by LRCX followed by AMAT**



Source: Gartner, Bernstein estimates and analysis

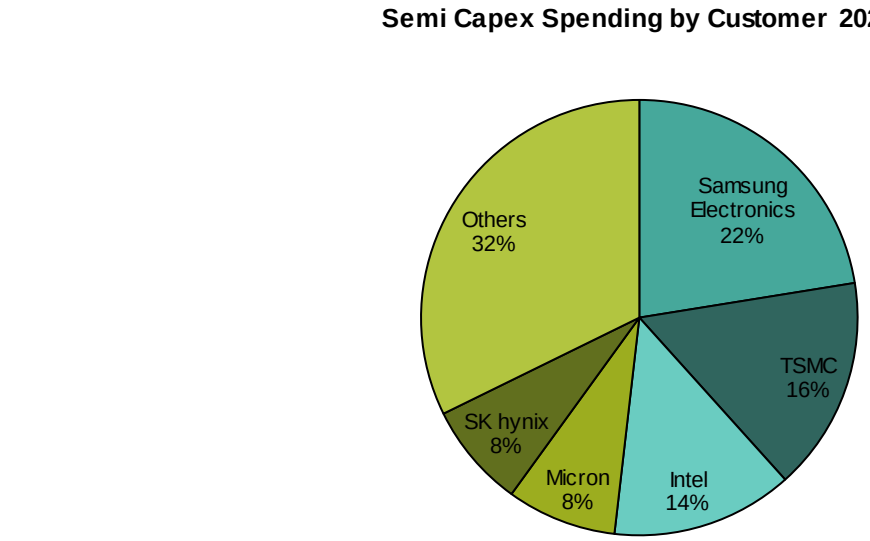
EXHIBIT 19: **Dielectric etch largely falls to TEL and then LRCX – with AMAT and others effectively out of the market**



Source: Gartner, Bernstein estimates and analysis

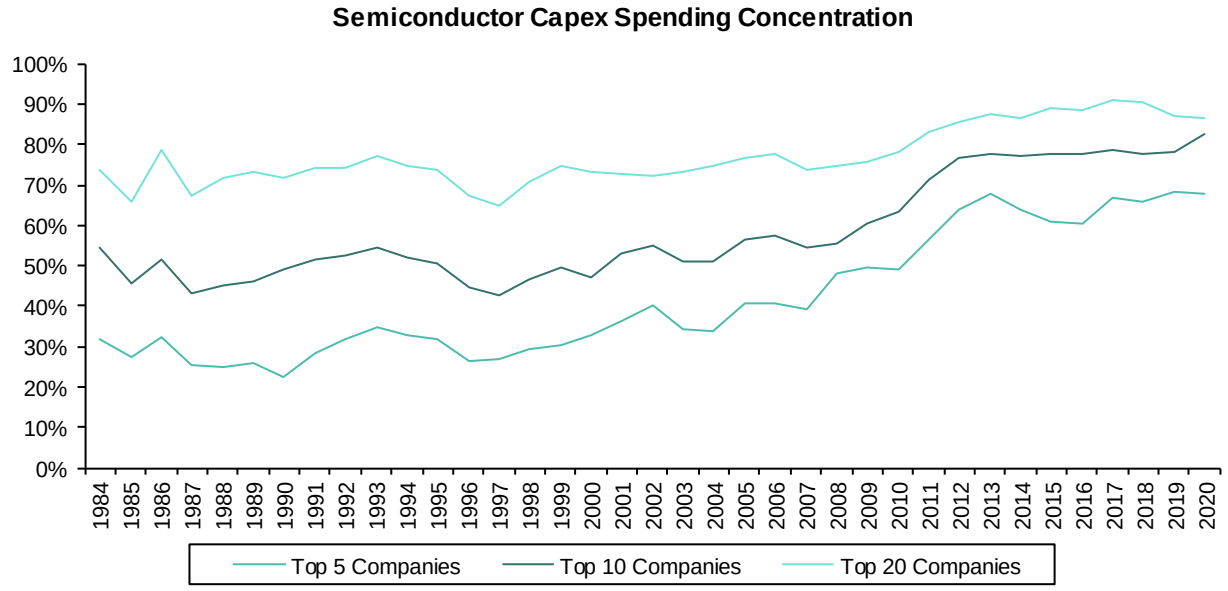
WFE customers are also quite concentrated with the three largest semiconductor manufacturers (Intel, Samsung, and TSMC) today collectively contributing more than 50% of all semiconductor capex (**Exhibit 20**). This trend has of course been increasing over time as semiconductor manufacturing becomes more complex and expensive, with the resulting scale economics pushing more and more players out of the leading edge game (**Exhibit 21**). We have yet to see this increased concentration hurt semi cap margins.

EXHIBIT 20: **Samsung, Intel and TSMC collectively contribute over 50% of total semiconductor capex spending…**



Source: Gartner, company reports, Bernstein analysis

EXHIBIT 21: **…and have historically outgrown smaller peers**



Source: Gartner, SEMI, Company reports, Bernstein analysis

HOW HAS THE SEMICONDUCTOR CAPITAL EQUIPMENT INDUSTRY IMPROVED VS HISTORY?

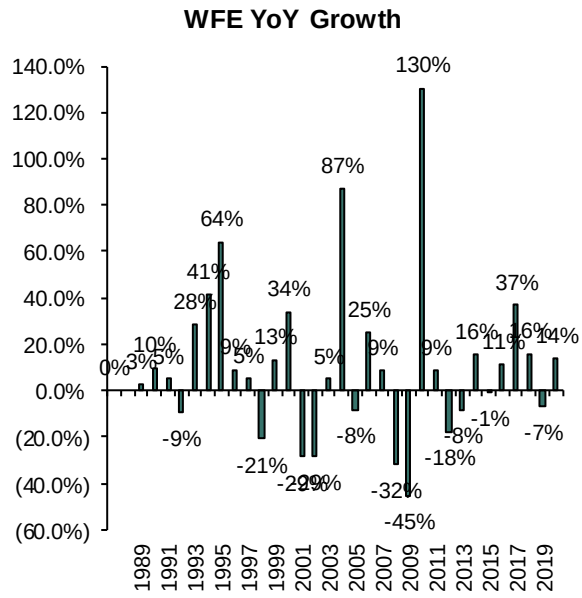
While still a challenging space to invest in, the fundamentals of the semicap industry (similar to the semiconductor industry) have improved markedly over time, as semis have both grown and matured.

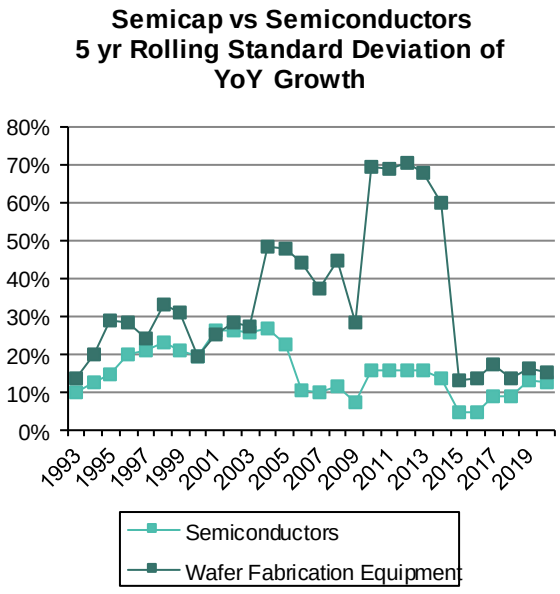
One might think that, as semiconductors have grown more complex, capital intensity (WFE as a percent of semi revenues) in the industry would have massively increased. This is, in fact, not the case; rather, capital intensity today, while higher than recent troughs, is actually lower than it was 15 years ago (**Exhibit 12**). But this has been OK; semicap has benefitted from overall (long-term) growth in the semi industry, and normalized WFE levels today are at a magnitude that well exceeds what was seen in prior cycles. And cyclicality, while still present, has been significantly reduced in recent years vs history (**Exhibit 22**).

Overall higher revenue levels, reduced volatility, consolidation etc. have yielded much healthier full-cycle industry economics than we have seen in the past. In prior cycles it was not uncommon to have trough operating margins for the sector in the low single digits, or even negative. The current cycle is therefore a huge outlier – WFE troughed in 2019, with industry margins in the mid-20's% range, above prior peak levels even with industry revenues down ~6%+ YoY (**Exhibit 23**), and with through-cycle economics vastly improved for the industry players (**Exhibit 24, Exhibit 25**).

And as financial performance has improved and FCF generation stabilized, cash return to shareholders has grown. Returns on capital have steadied and reached new highs, and total return to shareholders for many names has shown significant improvement in recent years (**Exhibit 26**)

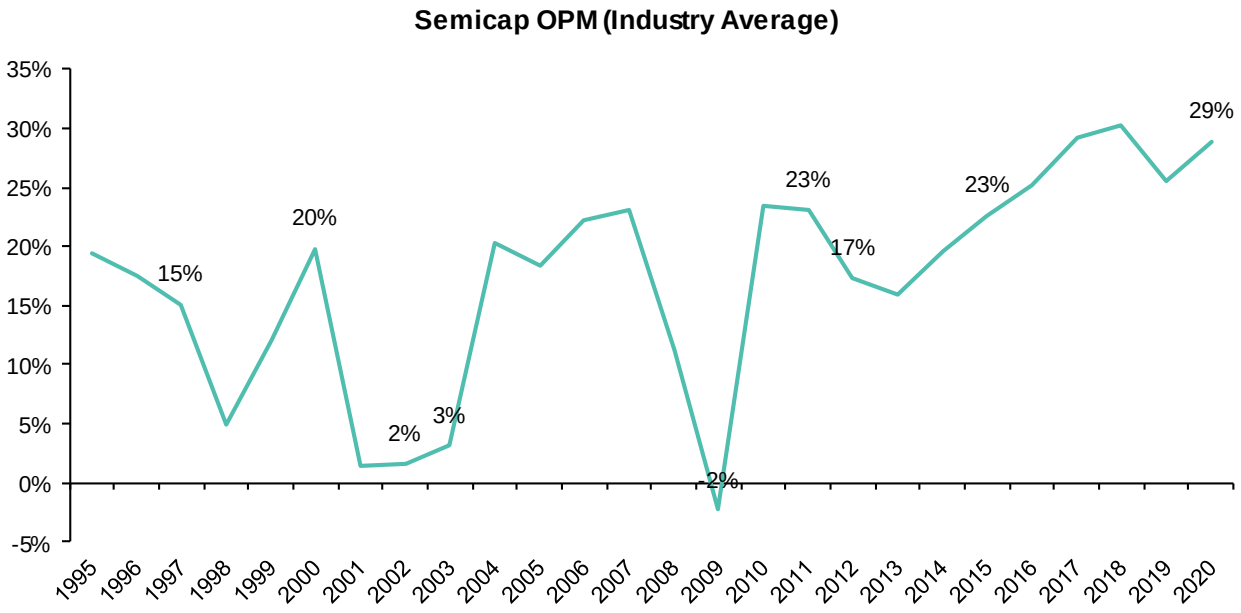
EXHIBIT 22: **Industry cyclicality has significantly reduced**





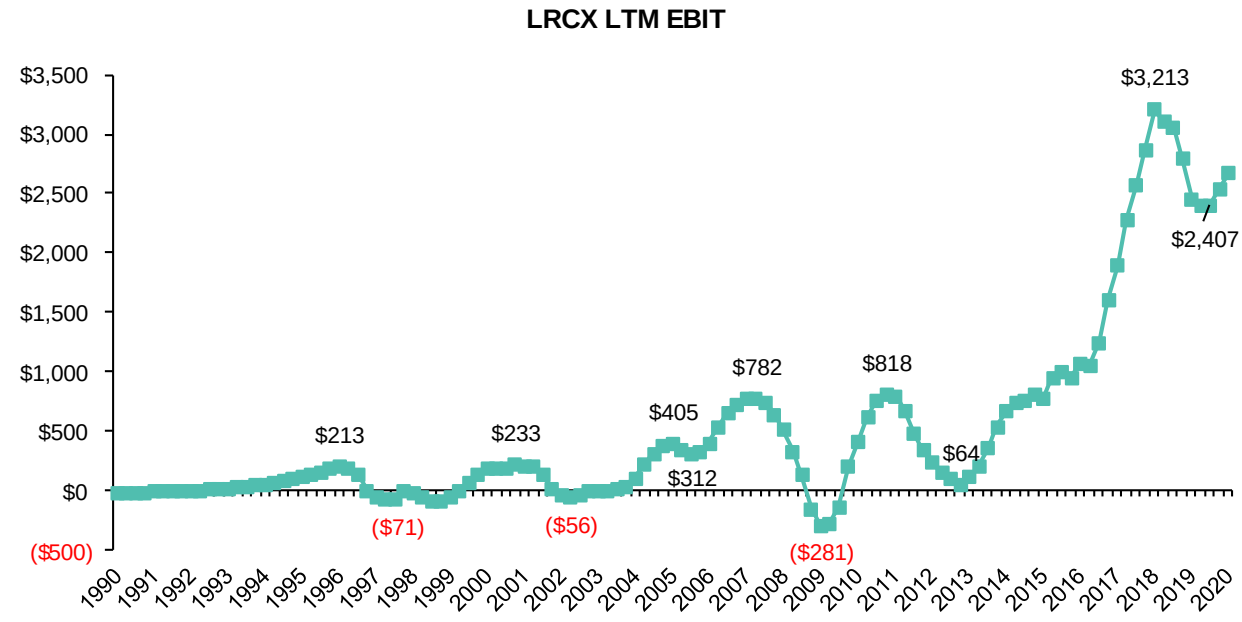
Source: Gartner, SEMI, Bernstein analysis

EXHIBIT 23: **...leading to better financial performance over the cycle**



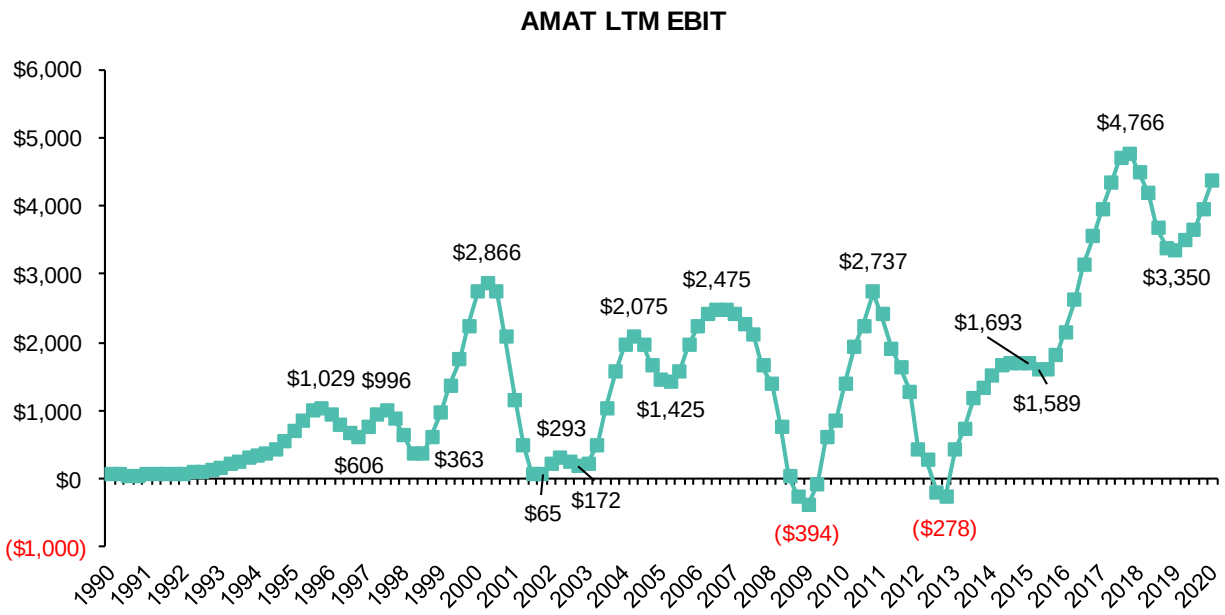
Source: Bloomberg, Bernstein analysis
Note: Numbers are proforma where available.

EXHIBIT 24: **Peaks and troughs are both higher**



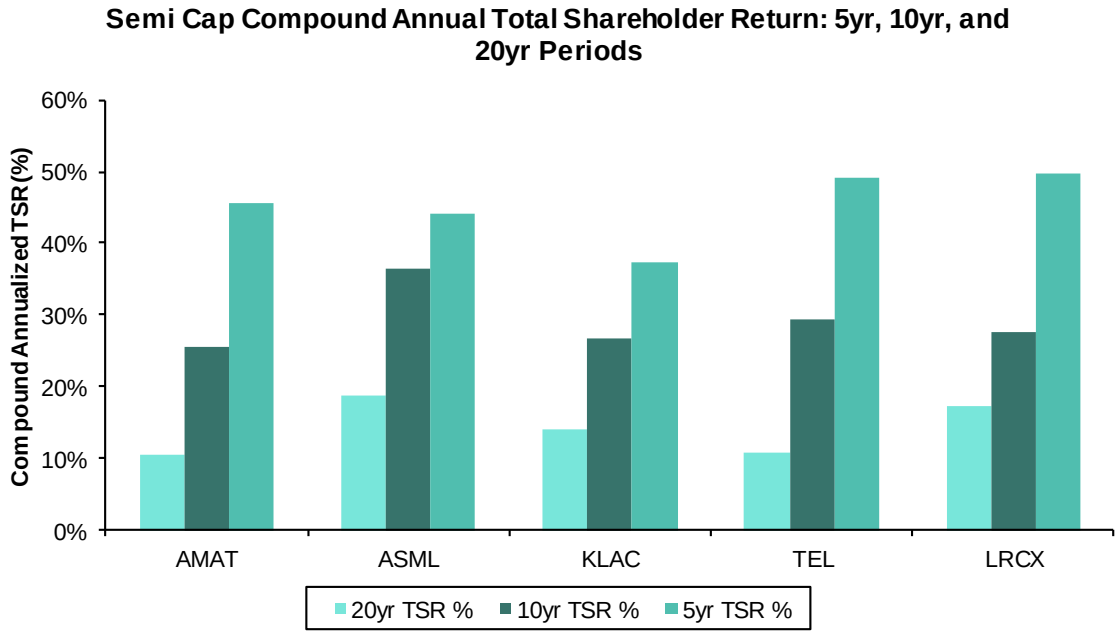
Source: Bloomberg, Bernstein analysis

EXHIBIT 25: **Peaks and troughs are higher**



Source: Bloomberg, Bernstein analysis

EXHIBIT 26: **Consequently, shareholder returns have gotten better for many players**



Source: Bloomberg, Bernstein analysis

WHY IS SEMCONDUCTOR CAPITAL EQUIPMENT STRUCTURALLY ATTRACTIVE FOR THE LONG TERM?

We believe semicap over the long term is likely to be an extremely structurally-advantaged space, with an underlying semiconductor industry that can continue to grow over the cycle coupled to semiconductor capital intensity, currently modest vs history, that we believe can structurally increase over time as the industry moves from the end of the bullwhip, to the tip of the spear.

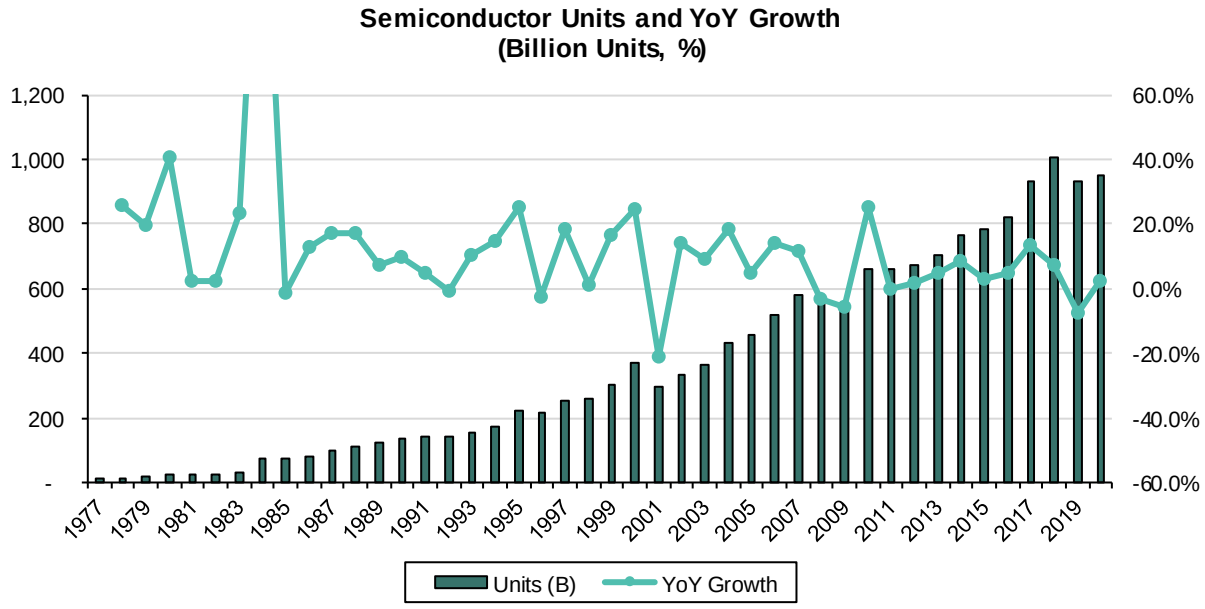
We believe the underlying semiconductor industry is, and can remain, a structural grower

Any discussion of semicap growth has to begin with a point of view on the underlying semiconductor market itself. Fortunately, betting on growth for semis has been, a winning proposition over the years. In particular, semiconductor units (ultimately the driver of wafer starts, and consequently manufacturing equipment purchases) have mostly grown steadily over the years, with the industry today shipping close to a trillion parts annually (**Exhibit 27**).

Obviously the industry has some cyclicality to it, with up years and down years, but overall the up years have won the day. Interestingly, the semiconductor industry has NEVER had a 5-year period in its history that did not demonstrate at least some amount of revenue growth; even periods containing the bursting of the tech bubble, or the global financial crisis, eventually generated a positive revenue CAGR over the timeframe. And units themselves have proven to be a better indicator than revenue (insulated from some of the pricing dynamics that have historically impacted memory in particular), with the industry never generating a 5-year CAGR of less than 3% unit growth at any time in its history. Over the last 10 years the average 5 year CAGR, whether units or revenue, has equaled ~5% (**Exhibit 28**).

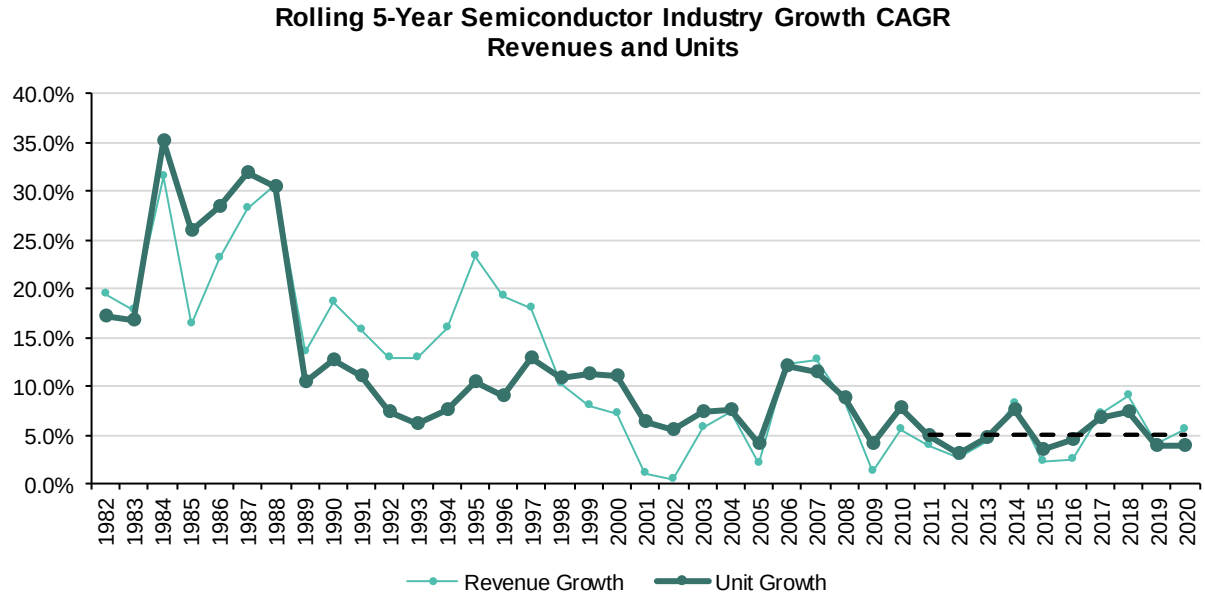
Given this and absent anything else, we would feel comfortable with the underlying semiconductor industry growing at a mid-single digit rate - whether units or revenues - over the cycle. However, there seems reason to believe that semiconductor growth could, in fact, even reaccelerate over time, given a number of powerful new end markets driving leading edge demand (whether AI, accelerated compute, autonomous driving, 5G, IoT, etc.), not to mention new models around remote stemming from the pandemic. And the current supply constraints in the industry are making it clear that even mature node volumes (industrial, automotive, etc.) can be structural growers as content increasingly pervades every aspect of modern life, and semis grow increasingly important.

EXHIBIT 27: **Semiconductor units have mostly grown steadily over the years**



Source: WSTS, Bernstein analysis

EXHIBIT 28: **Semiconductors have never had a 5-year period without at least some growth**

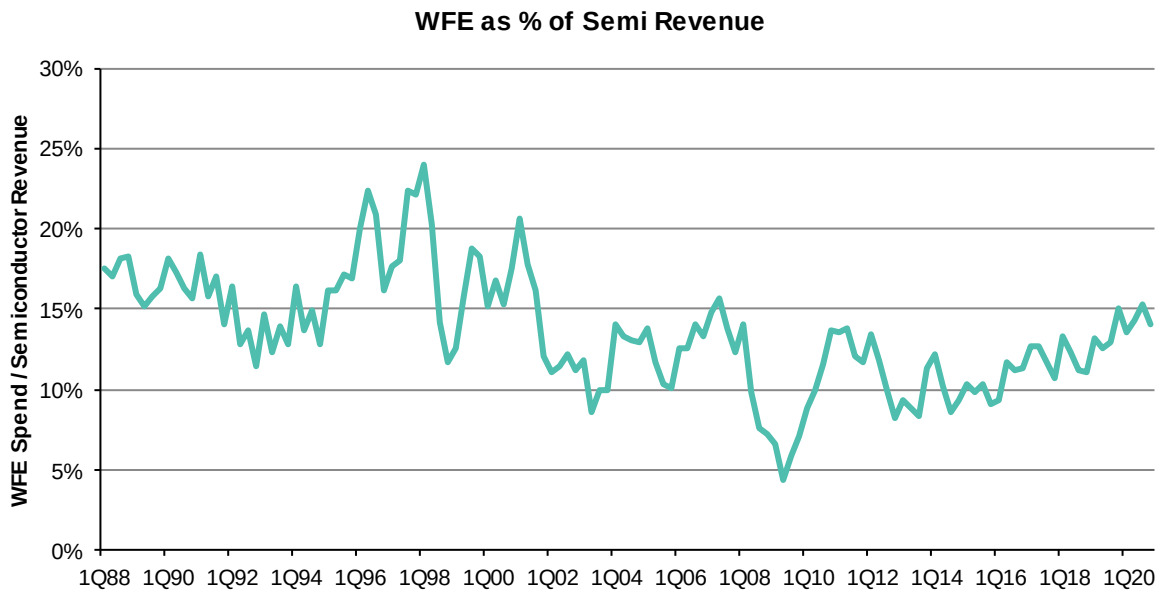


Source: WSTS, Bernstein analysis

Capital intensity overall remains modest by historical standards.

Semiconductor capital intensity (as measured by WFE as a % of semiconductor revenues) has varied over the years, as high as 25% in the late 90's, to a low of ~7% in the heart of the global financial crisis over a decade ago (**Exhibit 29**). Today 2020 semiconductor capital intensity sits at ~14%, up from the trough of 9-10% 5-6 years ago (an increase driven in part by structural changes in NAND flash), but below the ~15% level seen ~15+ years ago, and well below the 20—25% level seen 25+ years ago (so neither enormously depressed, nor elevated, vs history), and modest by historical standards, leaving headroom going forward.

EXHIBIT 29: **Semiconductor capital intensity today appears neither depressed nor elevated vs recent history, and depressed vs longer-term trends**



Source: Gartner, WSTS, Bernstein analysis

We believe there is a strong case to make for industry capital intensity to structurally increase from here.

We believe a number of drivers are lining up here that can continue to drive industry capital intensity structurally higher, including the end of wafer size transitions, a need for greater incremental wafer additions as die shrink slows, and increasing material and structural innovations required for those products that continue to need shrink.

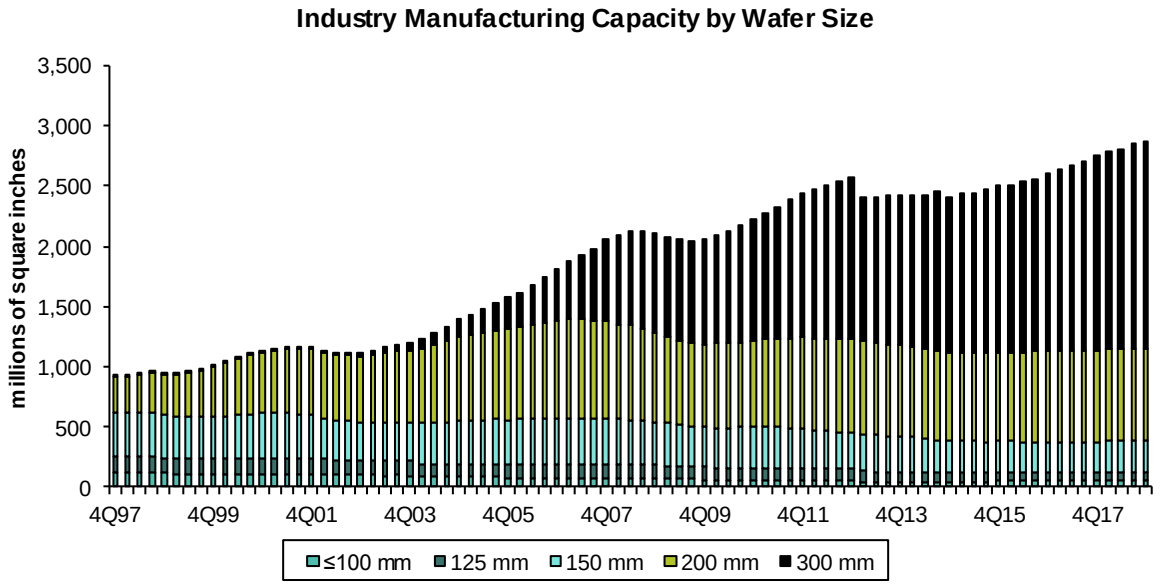
The industry can no longer count on larger wafers to help reduce cost

Historically the semiconductor industry underwent transitions to larger wafer sizes every ~10 years or so. Using larger wafers enabled more efficient manufacturing as the areal increase in wafer area (~2.25x for a 50% larger diameter) exceeded the increase in manufactured wafer cost (maybe ~1.5x), driving a structural decline in industry capital intensity (**Exhibit 30**).

However, while the benefits from the last transition (to 300mm wafers) worked their way through by the late '00's (just in time for the financial crisis), the industry can no longer count on moving to larger size wafers. The next move (to 450mm) was explored, and Intel even put some money to work on it through a partnership with ASML, but at the end of the day it proved abortive as almost no semi companies were large enough to support it, and frankly the semicap players had a rough time with the 300mm investment, an event they have proven mostly unwilling to repeat.

Today we are now more than 20 years past the introduction of 300mm wafers, and are unlikely to see the adoption of anything bigger, hence we cannot count on the tailwind of larger wafers to help reduce capital intensity going forward.

EXHIBIT 30: **Wafer size transitions have helped constrain cost increases**



Source: Gartner, Bernstein analysis

As shrink gets harder to come by with Moore's Law slowing, more significant incremental wafer additions will be required to drive incremental semiconductor revenues

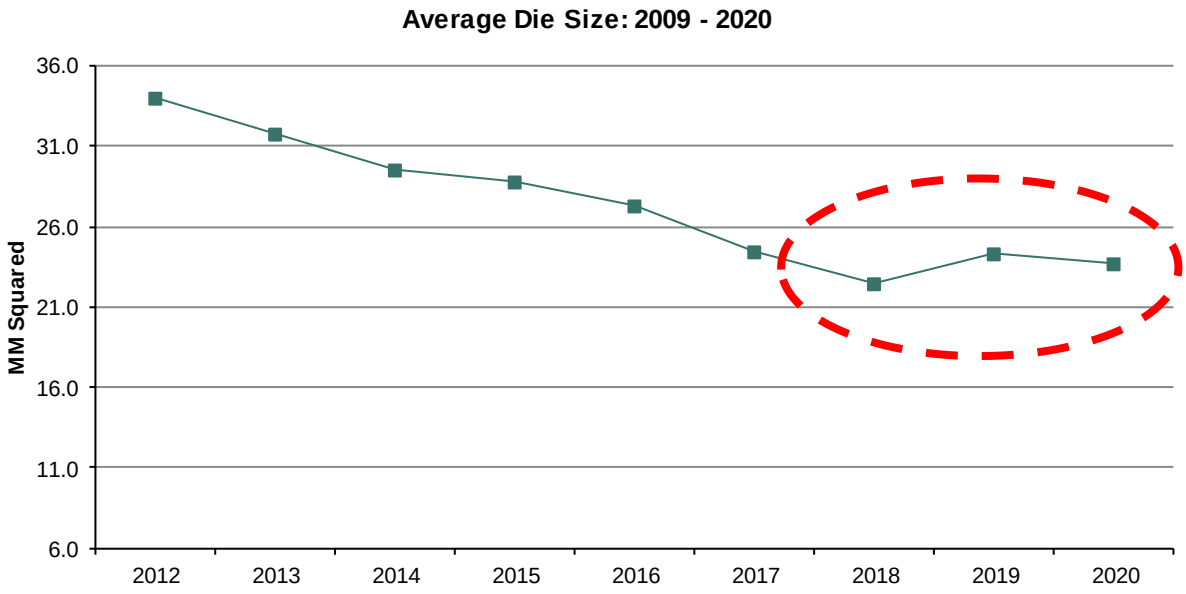
Historically, Moore's Law was a godsend to the semiconductor industry, driving not only performance and power improvements with every subsequent generation, but also gen-on-gen cost savings as transistor shrink led to die shrink, and drove significant increases in the number of chips manufacturable on a wafer, saving significant costs.

However, Moore's law is, today, coming to an end. But we do not believe this bodes negatively for the semicap industry; on the contrary a growing semiconductor market coupled to a slower rate of shrink is likely to be a godsend to industry wafer capacity addition.

Simplistically, a slowdown (or halt) to Moore's Law will slow (or stop) the pace of die shrink. But as long as the underlying semiconductor industry can grow (as we believe it can), the chips are going to be manufactured regardless, on whatever process node optimizes requirements around performance, power, and cost. And if dies are shrinking at a slower rate than in the past, the industry will require correspondingly more wafer starts to manufacture those dies, structurally increasing WFE spend.

In fact we are already seeing evidence of this trend. The industry-average effective die size has been in structural decline for years, but over the last 3-4 years has plateaued, and even increased, as Moore's Law has begun to reach its limit in the last several years (**Exhibit 31**).

EXHIBIT 31: **Because of Moore's law slowing, die sizes have begun to grow again**



* Excluded discretes
Source: Gartner, WSTS, Bernstein estimates and analysis

Where Moore's Law (or its analogues) is still required given performance or power needs, it will become more and more dependent on the tools semicap players provide

The "End of Moore's Law" is, in itself, not a statement on the ability of humanity to keep it going from a technical standpoint (engineers are smart, and if there is a business case to continue shrink they'll figure out a way to do it). The difference is that now if we want the performance and power benefits obtained by driving further shrink, we now have to pay for them (vs history when the chip designers got those improvements every year for free, piggybacking on the innovations of the process engineers).

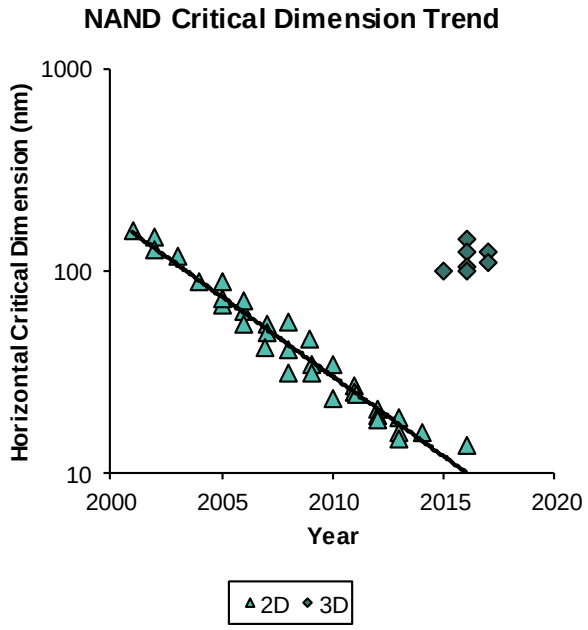
But there are now emerging numerous applications where the added value in terms of performance and power efficiency can still offset the additional cost of driving it, whether in high-ASP, high value areas like AI or high performance computing, or in high-volume markets like smartphones. Hence we believe there will still be demand for Moore's Law innovations, which will be beneficial to semicap as the industry's ability to innovate along those lines will fully depend upon the capital equipment players' ability to execute.

We have seen the push to achieve continued Moore's Law-like improvements drive a functional increase in capital intensity before, most notably in the NAND industry. Traditional 2D NAND used to be at the bleeding edge of Moore's Law as one of the primary mechanisms to improve density (and thus, cost) was to squeeze the memory cells closer together. However, this procedure became lithographically-limited (and NAND was first part of the semiconductor industry to hit a traditional "Moore's Law" limit).

Hence, the industry cast around for other methods to keep on a trajectory, ultimately settling on manufacturing NAND flash in a 3D structure, utilizing larger (and thus less-lithographically limited) memory cells, but adding additional complexity by constructing a stacked configuration to gain the requisite density improvements (**Exhibit 32, Exhibit 33**).

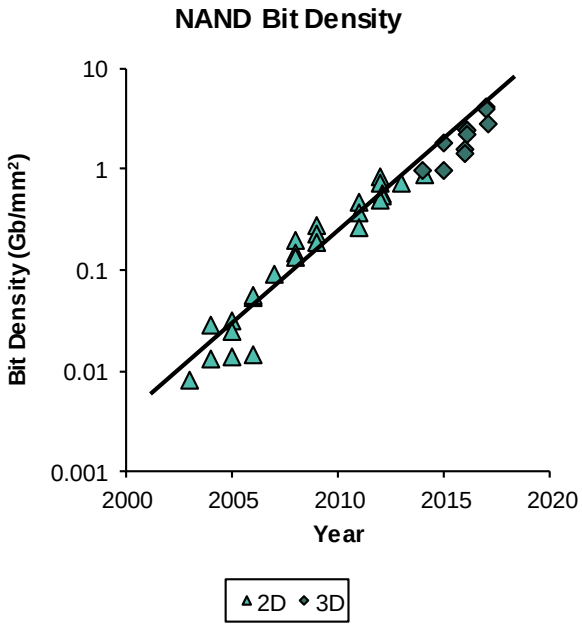
The resulting shift drove NAND capital intensity through the roof, as well as shifting the area of spend from lithography more toward the etch and deposition processes needed to create the layered structures (**Exhibit 10**). To that end, NAND capital intensity doubled over the last 5-10 years (**Exhibit 34**).

EXHIBIT 32: **3D NAND relaxed the lateral scaling requirements as lithographic limits were reached...**



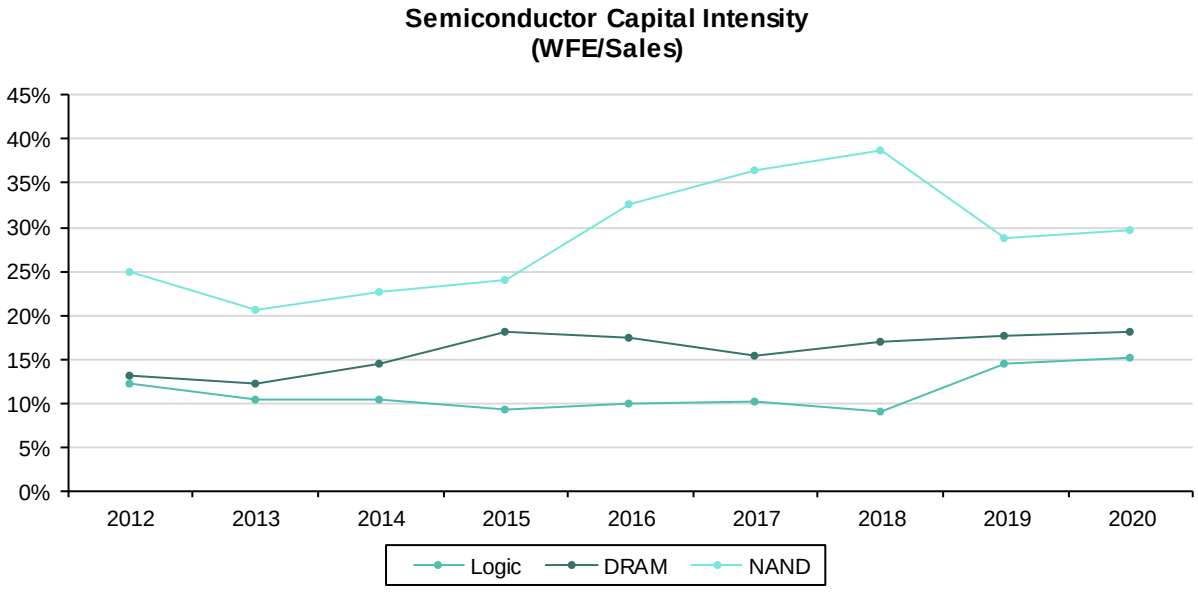
Note: Critical dimension here refers to contacted poly half pitch for 2D and channel hole diameter for 3D.
Source: IC Knowledge and Bernstein analysis.

EXHIBIT 33: **...but sustained areal density increases by utilizing vertical structures...**



Source: IC Knowledge and Bernstein analysis.

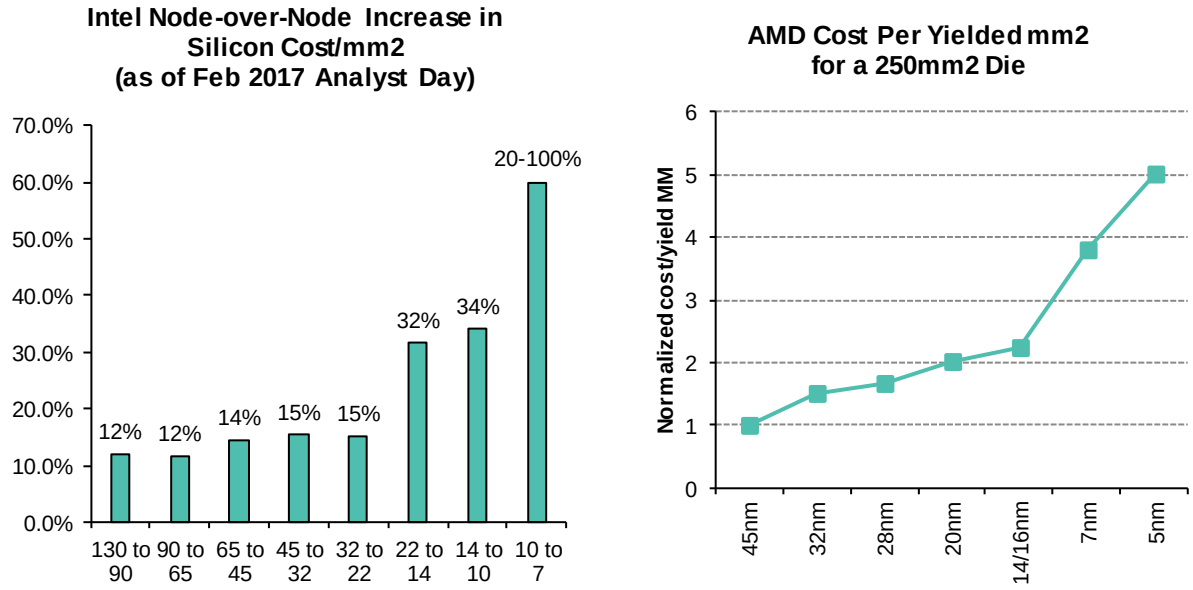
EXHIBIT 34: **...driving a considerable increase in NAND capital intensity over the last 5-10 years**



Source: Gartner, SEMI, WSTS, Bernstein estimates and analysis

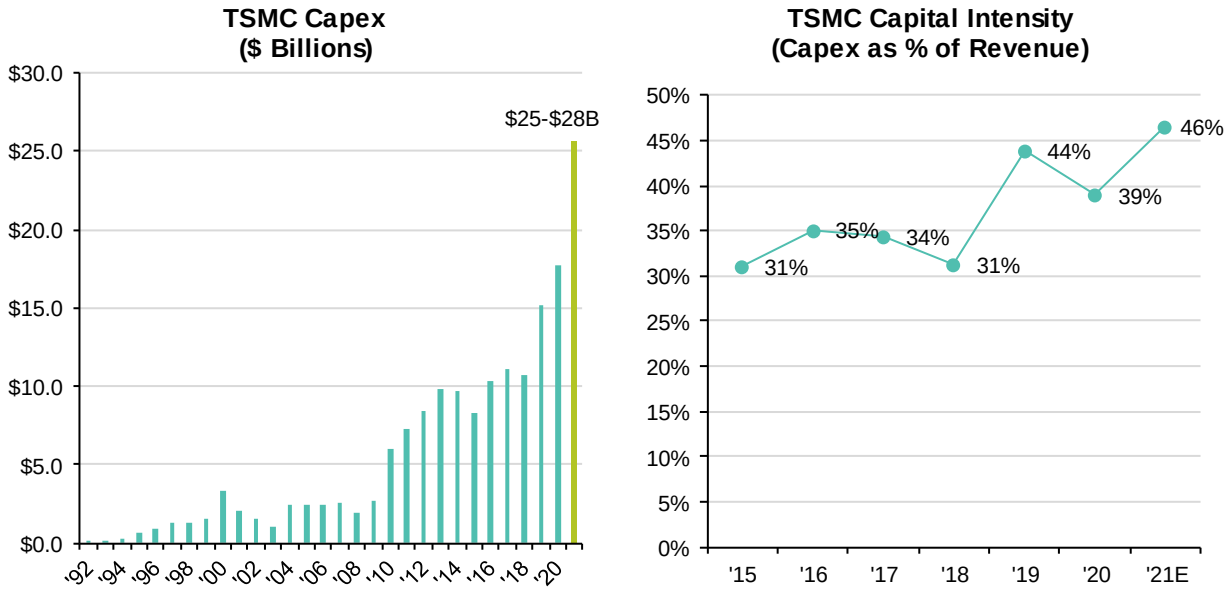
We are now beginning to see logic capital intensity increasing as well. The trend is obvious when examining leading edge manufacturers and customers. Intel's node-on-node areal cost increases have spiked with their last few node transitions and are getting worse with every one, and AMD began calling out cost increases some time ago (**Exhibit 35**). And of course no one could have missed TSMC's recent capex hike, currently calling for $25-$28B this year, a massive YoY increase to astoundingly high numbers, with capital intensity for 2021 likely approaching the 50% market, more reminiscent of years past (**Exhibit 36**).

EXHIBIT 35: **Wafer costs in leading-edge logic are inflecting upward**



*We note that this Intel data is as of their February 2017 analyst day. Given the subsequent process delays on 10nm and 7nm we do not know how reality stacked up to these forecasts, but we would be shocked if these didn't represent a best-case
Source: Intel, AMD, Bernstein analysis

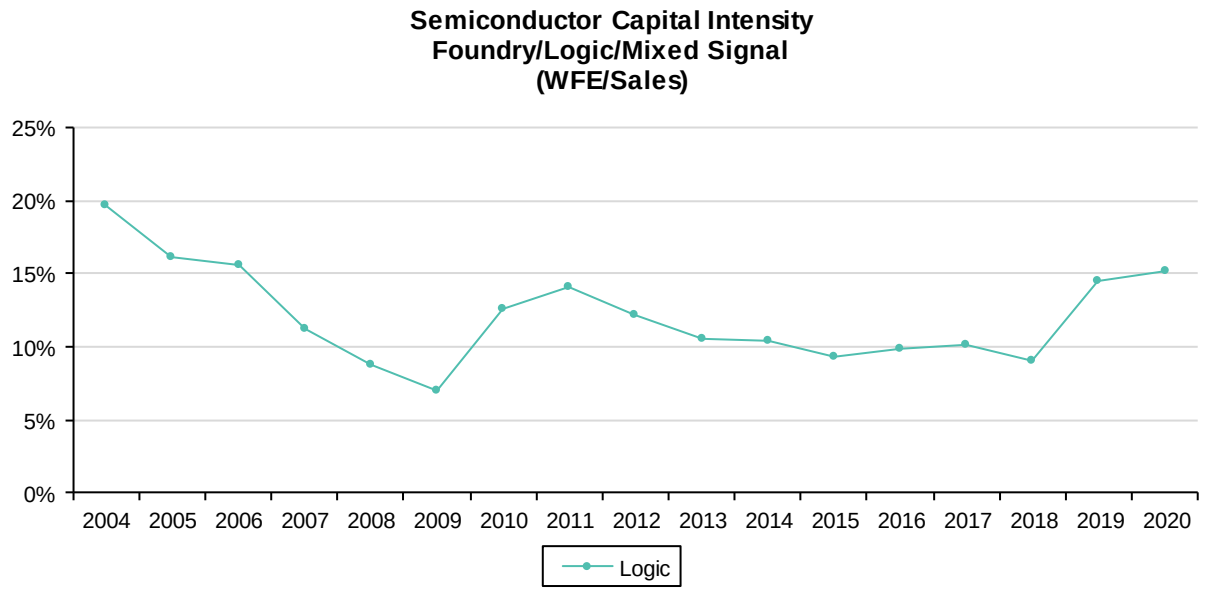
EXHIBIT 36: **Logic/foundry capex is on the rise on the back of higher intensity and strong demand**



Source: Bloomberg, Company reports, Bernstein estimates and analysis

Overall we have begun to see a corresponding inflection in logic capital intensity over the last several years (**Exhibit 37**). But we believe there is likely more to come.

EXHIBIT 37: **Logic capital intensity was flatter but has recently begun to rise**



Source: Gartner, SEMI, WSTS, Bernstein estimates and analysis

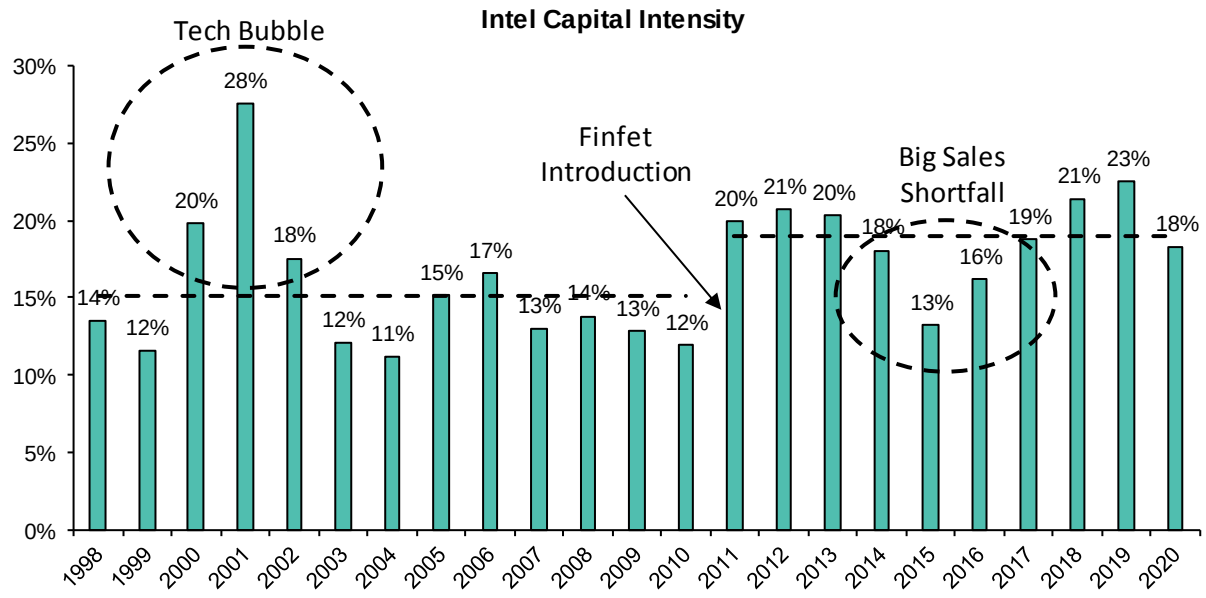
Innovation across structures and materials will become more and more necessary as lateral scaling for foundry/logic grows ever more challenging, also a positive driver for capital intensity

The foundry/logic industry is rapidly deploying EUV lithography in an attempt to keep pace with lateral scaling. However, EUV can only do so much, and innovations both in the structures and materials of logic transistors are becoming more and more necessary (similar to the transition that has impacted NAND). We believe these long-term shifts will be beneficial to foundry/logic capital intensity.

The logic industry has already gone through a number of materials-driven transitions in the past (strained silicon, high-k metal gate, SiGe channel, etc.) over the years. And about a decade ago, the structure of the transistor itself went through a shift as finfets became commercial reality.

A finfet essentially "lifts" the transistor source and drain out of the surface of the wafer, allowing the gate to surround them on three sides (Intel used to call these "tri-gate" transistors). Finfets allowed better control and performance than could be achieved by traditional planar transistors, and after Intel's introduction at 22nm were soon followed by TSMC (at what they called 16nm) and others, soon becoming standard across the industry. And in fact we saw a significant increase in capital intensity especially at Intel upon their introduction of finfets, moving from the low to mid-teens as a % of revenue to ~20%, (mostly) staying in that range since (**Exhibit 38**).

EXHIBIT 38: **Intel's capital intensity appears structurally higher after their finfet introduction at 22nm**



Source: company reports, Bernstein estimates and analysis

However, finfets are beginning to reach limits as well, with new innovations now required. Hence the industry is now moving toward the next step along these lines, to what is known, broadly, as a "gate-all-around" (or GAA) structures (also sometimes referred to as nanosheets, or nanowires), in which the transistor source and drain are essentially embedded in the gate, which (like the name says) surrounds them on all sides (**Exhibit 39**).

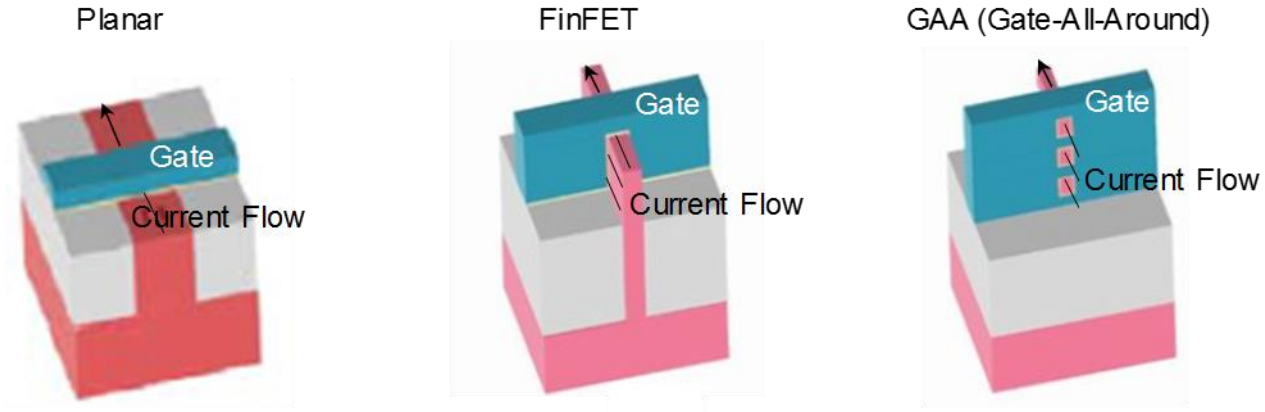
GAA structures have further advantages over finfets, namely better gate control, lower leakage currents and short channel effects, and higher drain currents. However, they bring new significant challenges in fabrication. Silicon nanowire formation requires epitaxial deposition of silicon and SiGe layers, with selective etching required to remove the SiGe layers without touching the Si wires. Atomic layer deposition (ALD) is used to deposit high quality, conformal gate metal coatings, which have to coat the underside of the wires as well as the top. And new materials (for example, gate metals) are used, all of which increases both the number of process steps and processing time. Samsung at least has already indicated plans to introduce a GAA structure at their 3nm node, set for production next year if all goes as planned.

It doesn't stop here either. As lateral scaling in logic gets even tougher the industry will need to discover new ways to keep it going. For example, IMEC has been pursuing a research into next-generation "forksheet" devices, which in theory would allow much tighter spacing between p and n components of the transistor (**Exhibit 40**).

And more broadly, over the longer term the IRDS believes that lateral scaling in logic will essentially come to a halt sometime in the middle of next decade (within 5-8 years) (**Exhibit 41, Exhibit 42**). As such, within 10 years it is likely that the third dimension will need to be utilized much more. One promising initial candidate is the complementary FET device, or "CFET" with stacks the n and p FETS of the transistor on top of one another rather than placing them side-by-side, providing more freedom and reducing cell area (**Exhibit 43**). And as we look out farther "true" 3-D structures (i.e. layers of transistors) will likely become needed (**Exhibit 44**) if scaling is to continue.

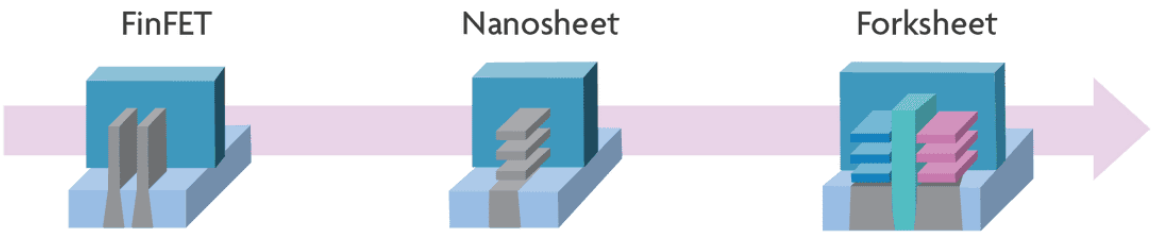
While much of this remains in the realm of the lab today (and hence hard to quantify precisely, the trends appear clear, and none of this will happen without the expertise and contributions of the tool vendors, with ever more complex and unique devices, structures, and materials acting as a tailwind toward capital intensity in the future.

EXHIBIT 39: **Innovative structure and material are another source of scaling.**



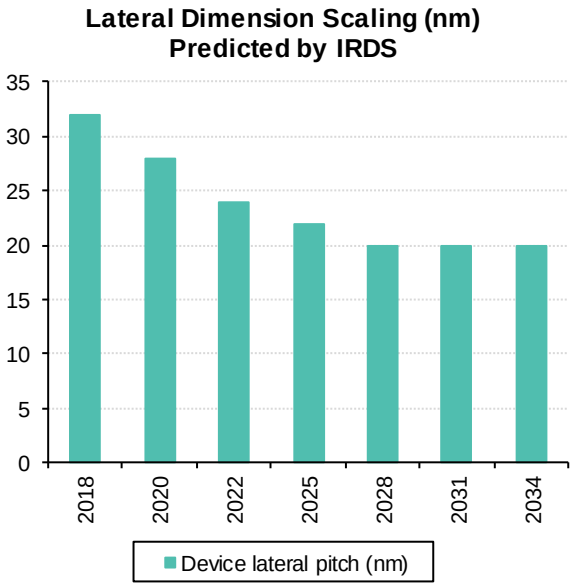
Source: Arm and Bernstein analysis.

EXHIBIT 40: **New mechanisms to improve density will be required in the future**



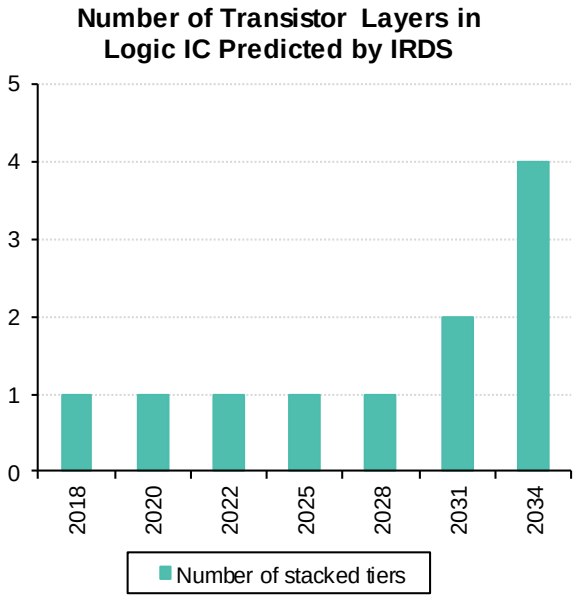
Source: IMEC, Bernstein analysis

EXHIBIT 41: **IRDS predicts that the lateral scaling will stop completely in by the end of next decade**



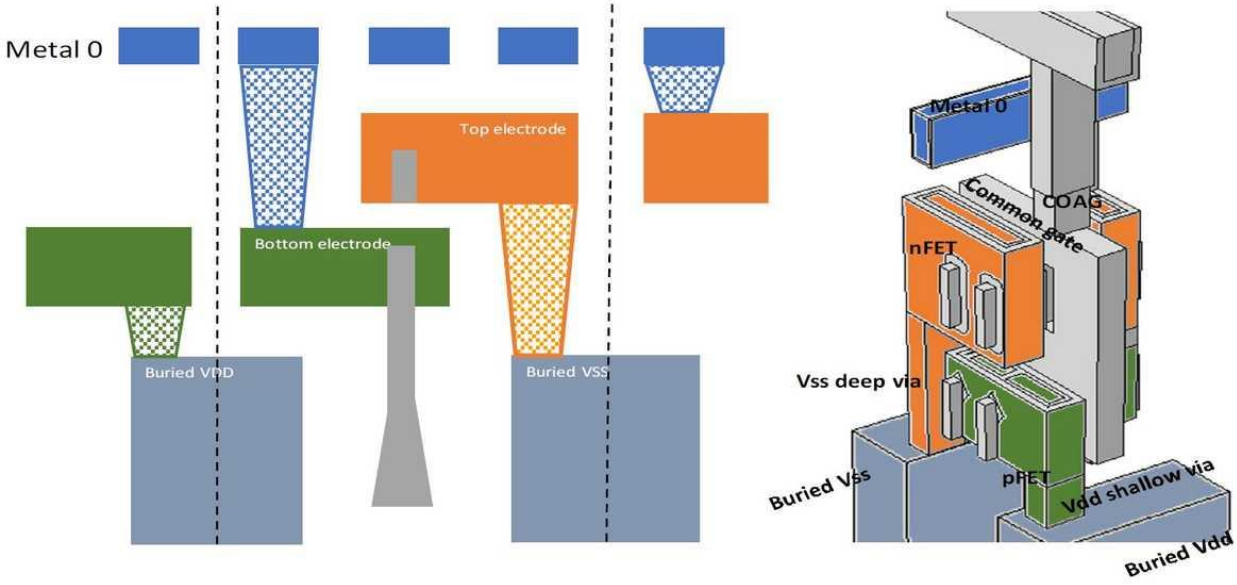
Source: IRDS and Bernstein analysis
Note: Data from 2019 and beyond are the forecast of IRDS

EXHIBIT 42: **From 2031 logic ICs are expected to have multiple layers of transistors vertically on a wafer.**



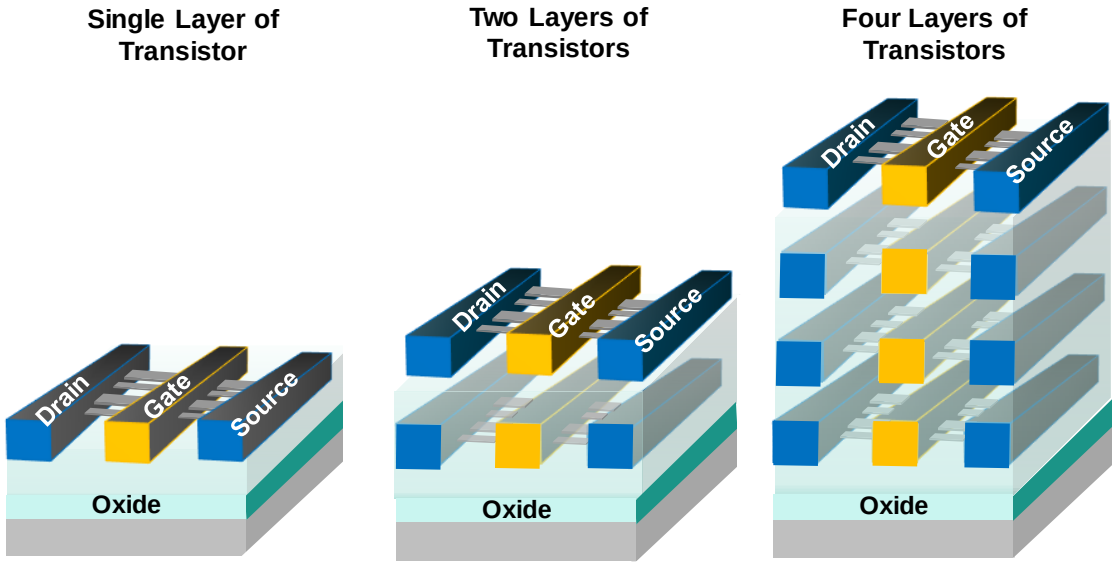
Source: IRDS and Bernstein analysis
Note: Data from 2019 and beyond are the forecast of IRDS

EXHIBIT 43: **CFETs may bring 3D logic scaling to reality**



Source: IMEC, Bernstein analysis

EXHIBIT 44: **Multiple vertical layers of transistors may be needed to continue logic IC scaling in the future.**



Source: Bernstein analysis

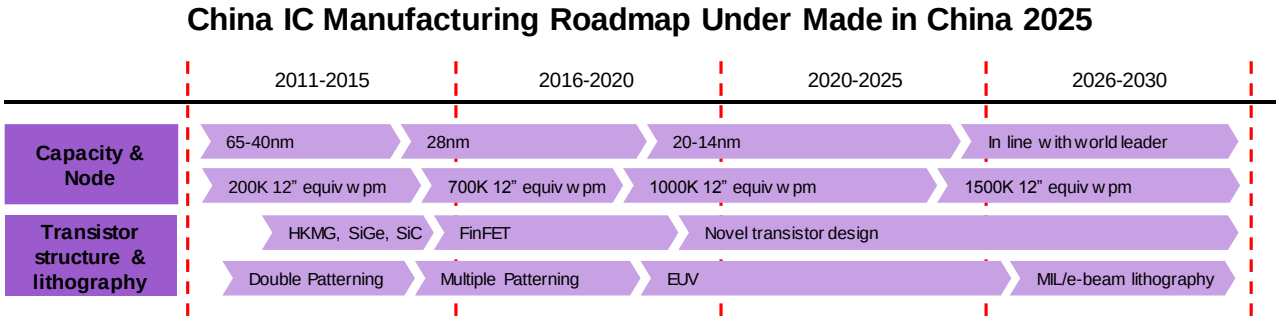
Tech decoupling could drive further semicap spend over time

China has been an area of growth in the semicap industry, with the Chinese government directing increasing investment towards its domestic semiconductor industry as well as multinational corporations increasingly building facilities in the region. Governmental policies have driven investments in Chinese chip makers attempting to build out local capabilities on a fairly aggressive timeline at least on paper (**Exhibit 45, Exhibit 46**), leveraging a high level of subsidization relative to other countries (**Exhibit 47**) and today has close to ~$100B currently earmarked across national and regional investments funds dedicated to semiconductors (**Exhibit 48, Exhibit 49**). They are currently attempting to build out incremental capacity, especially in memory, and relative share of WFE spent in China (albeit by both local and multinational players) has increased by 50% over the past few years (**Exhibit 50**).

However, under the Trump administration (and at this point continuing under Biden) the US has been taking steps to nip China's semiconductor aspirations in the bud, in particular banning sales of leading-edge equipment into the region. However, at this point it is looking like mature-node projects are still likely to proceed, and we believe WFE demand from indigenous Chinese projects can still grow with the market this year (**Exhibit 51**).

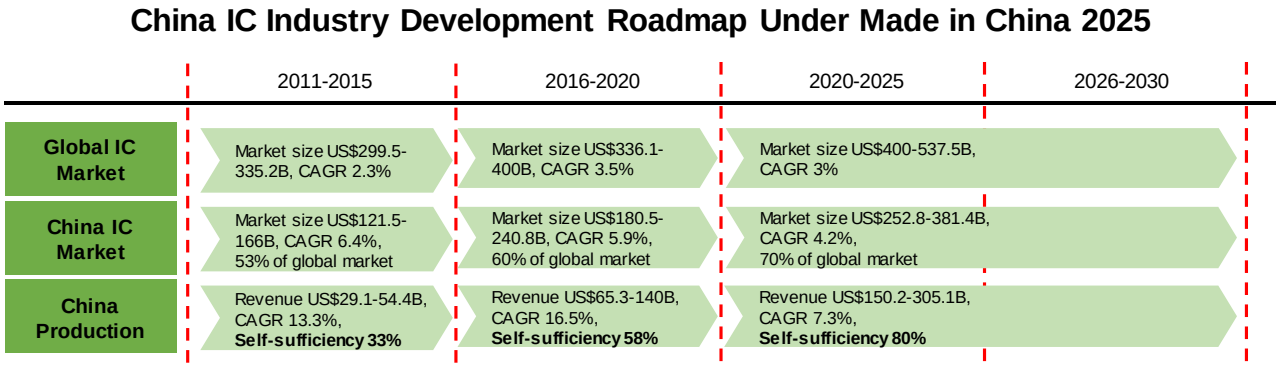
As far as leading edge, if parts are not being built in China they will still need to be built somewhere, hence we do not believe that China bans on leading edge equipment will have a structural impact on WFE demand over time. But off course, China is not the center of leading-edge semiconductor manufacturing in Asia; that crown belongs to Taiwan.

EXHIBIT 45: **China has set out semiconductor technology milestones**



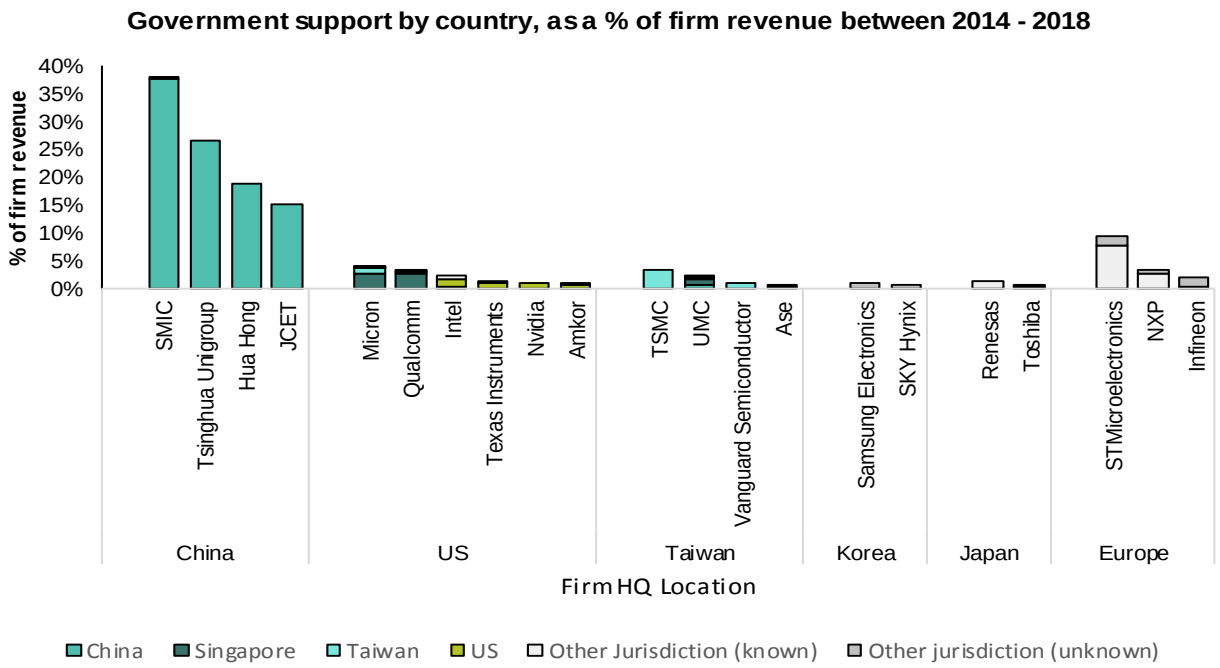
Source: Chinese Academy of Engineering, Bernstein analysis

EXHIBIT 46: **China's "Made in China 2025" plan targets 58% self-sufficiency rate by 2020**



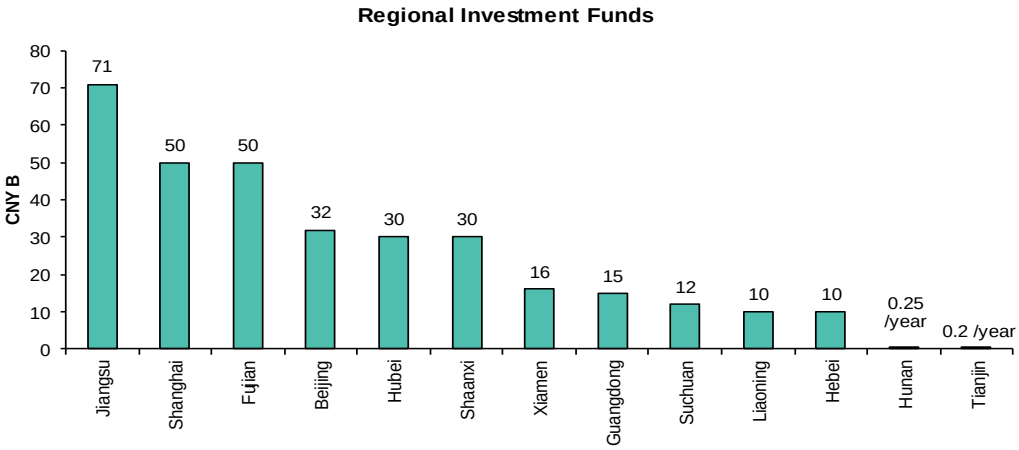
Source: Chinese Academy of Engineering, Bernstein analysis

EXHIBIT 47: **The majority of governmental support for Chinese companies came from China, while significant portions of governmental support for U.S. based companies came from Singapore and Taiwan**



Note: Other Jurisdiction (known) include Austria, France, Germany, Ireland, Israel, Japan, Malaysia, the Netherlands, the Philippines, the U.K.
Source: OECD, Bernstein analysis

EXHIBIT 48: **China has enabled numerous regional investment funds for semiconductors totaling ~325B CNY (~$50B USD)**



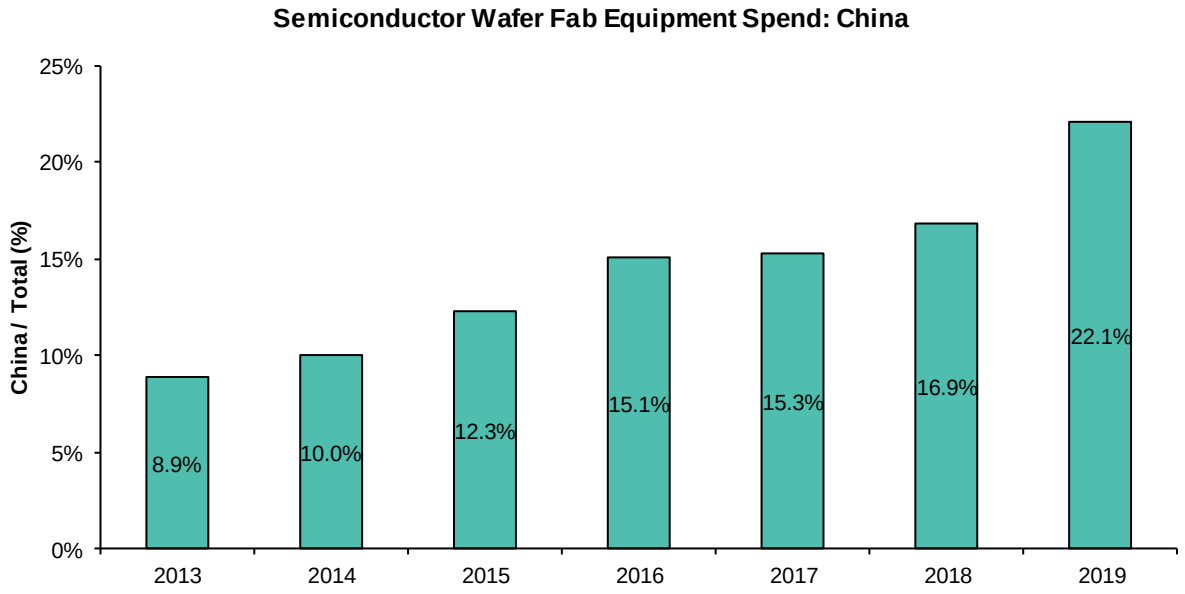
Source: Chinese Academy of Engineering, Bernstein analysis

EXHIBIT 49: **Direct "phase-1" and "phase-2" investments total another 335B CNY (~$50B USD)**

	Phase 1	Phase 2
	Fall 2014; 5 yr investment period	*Fall 2019; 5 yr investment period*
Capital Raised	CNY 139B (~US $21B)	CNY 204B (USD $28.9B)
Fund Use	●67% to semiconductor manufacturing ●17% to design ●10% to packaging & testing ●6% to material & equiptment	●SMIC (foundry), CXMT (DRAM), Payton (memory packaging & testing) & UNISOC, Smartchip, SmartSens (design) as of Dec, 2020 ●To continue to support equipment & critical components
Regional Investment Funds	*Representative Samples* **Jiangsu:** CNY 71B (~$11B) **Shanghai:** CNY 50B (~$7.5B) **Fujian:** CNY 50B (~$7.5B) **Bejing:** CNY 32B (~$5B)	**TBD**

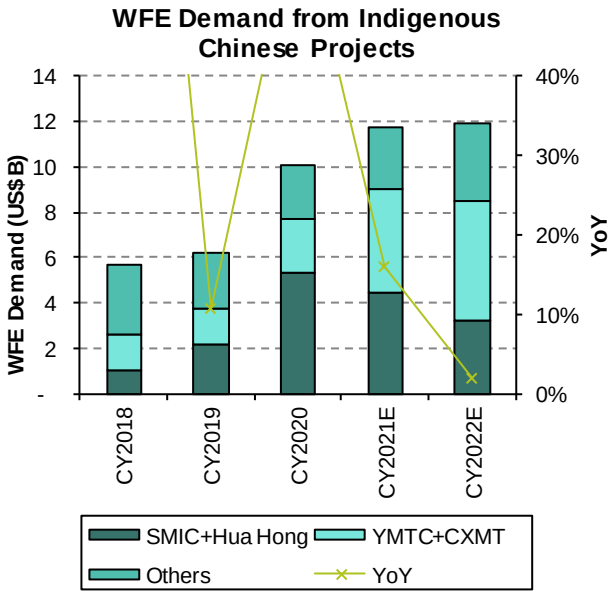
Source: CSIA, Bernstein analysis

EXHIBIT 50: **Chinese spend on WFE spend is outgrowing other geographies**



Source: Gartner, company reports, Bernstein analysis

EXHIBIT 51: **Despite the high base in CY2020, we expect the WFE demand from indigenous Chinese projects to grow in line with overall WFE market this year.**



Source: SEMI, Company reports, Bernstein analysis

The locus of leading-edge semiconductor manufacturing in Taiwan is becoming more and more of a geopolitical concern as the US and China continue along a colder path, and there have been strongly bipartisan calls in the US government to fund a greater base of semiconductor manufacturing in the US (**Exhibit 52**). And the current shortage situation, while not directly related to the broader issue of where semiconductor manufacturing is located, is helping to jump-start the conversation.

Currently the Biden administration has filed an executive order to review strategic supply chains including semiconductors, and there are calls to fund the chips acts (that were passed as part of the NDAA, but without funding currently allocated).

But recent events make it all but certain that funding for manufacturing will pass in likely non-trivial amount, encouraging further facility buildouts. And we are already beginning to see some of this. TSMC is currently building out a new facility in Arizona, and while the current size, as publicly disclosed, is small (~$12B investment, and ~20K WSPM) there has been recent newsflow that this could be upsized, potentially materially. Samsung is also reportedly exploring fab expansions in the US. And of course Intel's recent announcement that they, too, are entering the third-party foundry business is likely to be wholly enabled by governmental cash infusions.

And the US is not the only region that is strongly considering investments in semiconductor manufacturing, with the European Union, Japan, and India all now going down the path as well.

As these programs come to fruition the semicap players will benefit. And overall as supply chains decouple this will drive inefficiencies, which should be a net positive for WFE spend over the longer term as well.

EXHIBIT 52: **There has been a fair amount of recent bi-partisan legislation looking for ways to boost US domestic investment in semiconductors, with funding likely in the near future**

CHIPS for America Act	American Foundries Act of 2020	Fiscal Year 2021 National Defense Authorization Act (NDAA)
●$10B fed. grant program to incentivize new domestic semiconductor manufacturing facilities. ●$12B for R&D - US$5B: Advanced Packaging National Manufacturing Institute under DoC - US$3B: National Science Foundation - US$2B: DARPA - US$2B: DoE ●refundable ITC for qualified semi manufacturing equipment and facility investments.	●$15B federal grant program to incentivize new domestic semiconductor manufacturing and R&D facilities. ●$5B on the construction or modernization of fabs for national security, intelligence, and critical infrastructure. Likely will go to commerical facilities capable of producing secure chips. ●$5B for R&D - US$2B: DARPA - US$1.5B: National Science Foundation - US$1.25B: DoE - US$0.25B: National Institute of Standards & Technology ●mandates White House Office of Science and Technology develop plan to guide funding for advancing next-gen semiconductors.	●fed grant program to promote semi. manufacturing ●directs DoD to create programs with the private sector to encourage the development of advanced, secure microelectronics ●establishes Multilateral Microelectronics Security Fund the U.S., its allies and partners will use to reach agreements promoting consistency in their policies related to microelectronics, ●directs President to establish subcommittee on semiconductor technology and innovation within the National Science and Technology Council ●directs Secretary of Commerce to establish national semiconductor technology center and other important new programs. ●*House version:* $1.2 B for semiconductor research.

Endless Frontier Act	America LEADS Act
●US$100B over 5 years - US$2, 8, 20, 35, 35B from 2021 to 2025 - Initial key tech areas (i) AI and machine learning; (ii) high performance computing, **semiconductors**, & advanced computer hardware; (iii) quantum computing and information systems; (iv) robotics, automation, and advanced mfging; (v) natural or anthropogenic disaster prevention; (vi) advanced communications tech; (vii) biotech, genomics, and synthetic biology; (viii) cybersecurity, data storage, & data management tech; (ix) advanced energy; and (x) materials science, engineering, & exploration relevant to the other key areas above ●US$10B to set up 10 regional tech hubs by DoC	●Over US$350B in total to synchronize and mobilize all aspects of U.S. national power - US$100B for advanced R&D in critical tech over 5 years - US$10B to DoC to establish tech hubs over 5 years ●US$30.55B for **semiconductors** - US$15B: to set up a Semiconductor Incentive Grant program to support adv semi mfging & R&D - US$9.05B: to create National Semiconductor Technology Center for R&D - US$2B: DoE - US$2B: DARPA - US$1.5B: National Science Foundation - US$750M: to develop a secure microelectronics supply chain - US$250M: National Institute of Standards and Technology

Source: SEMI, SIA, press reports, US Senate, Bernstein analysis

HOW DO SEMICONDUCTOR CAPITAL EQUIPMENT STOCKS TRADE?

Semicap stocks tend to trade long term on revenue trends, and anticipate near-term changes to revenue expectations. And while still cyclical and subject to drawdowns, the long term secular trends have typically won the day

In semiconductors, anticipation of revenue growth is often the biggest driver of near-term stock performance, a trend (unsurprisingly) followed by semicap companies as well. Overall long term stock price increases generally follow long term trends in revenues, and in the nearer term stock price movements typically lead inflections in revenue expectations by 1-2 quarters (**Exhibit 53**).

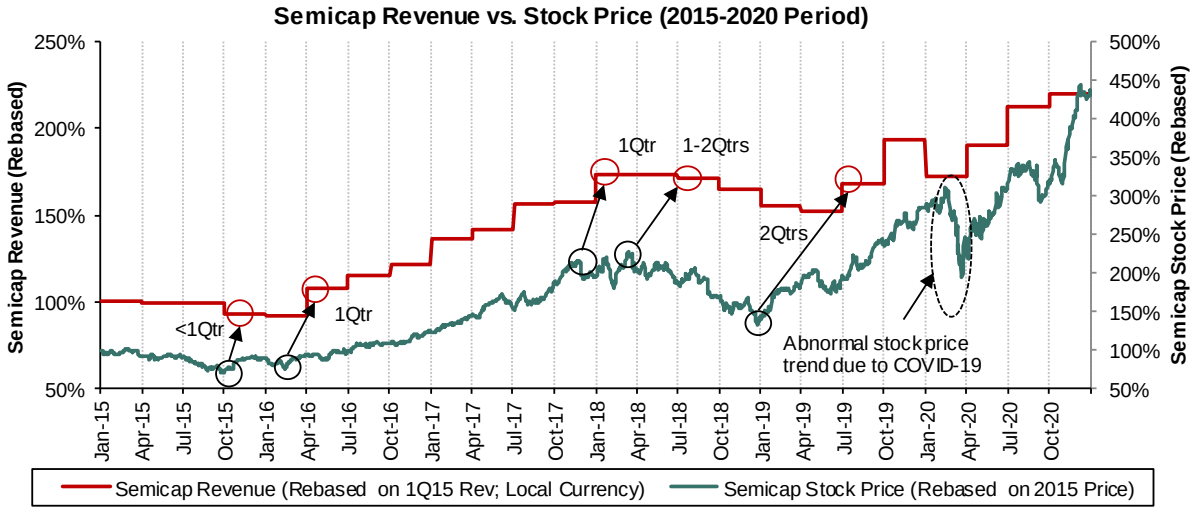
The trends are similar if we look farther back. For example, the 2009-2014 period demonstrates stock price stagnation as revenue growth expectations flatlined, and a similar anticipatory reaction to revenue upside (though the recovery from the financial crisis masks some trends earlier). Nevertheless, trading the stocks one to two quarters before actual revenue changes would have worked on five out of seven inflections in this period, and even if early on the other 2 examples, would still have been directionally correct (**Exhibit 54**).

What about long term holding through the cycle? Given the volatility most investors of course tend to look more at timing entry and exit points and trading around the cycles. For example, during the ~1.5 years downturn that spanned 1Q18 to 3Q19, the stocks lost as much as 42% peak to trough. Similarly, in the 2009-2014 period there was 2-year cycle (Q111-Q113) with a 35% drawdown. And of course we had the recent COVID dislocation in early 2020. That said, there is a clear secular long term trend in the industry, From 2009-2014 semicap stocks appreciated at a 25% CAGR even with the nasty drawdown; from 2015 to the end of 2020 the stocks on average appreciated 34% per year even with similar dynamics (**Exhibit 55, Exhibit 56**).

Thus in the 12-year period since the financial crisis, the secular won out in 8 of those years, and ultimately powered through the 4 years where cyclicality won the day. Now we fully recognize that it's tough for investors to hold through a 40% drawdown in the space, and we are not suggesting that they should. However, investors with a true long-term outlook on the space can probably feel good using the inevitable drawdowns as further entry points to build positions.

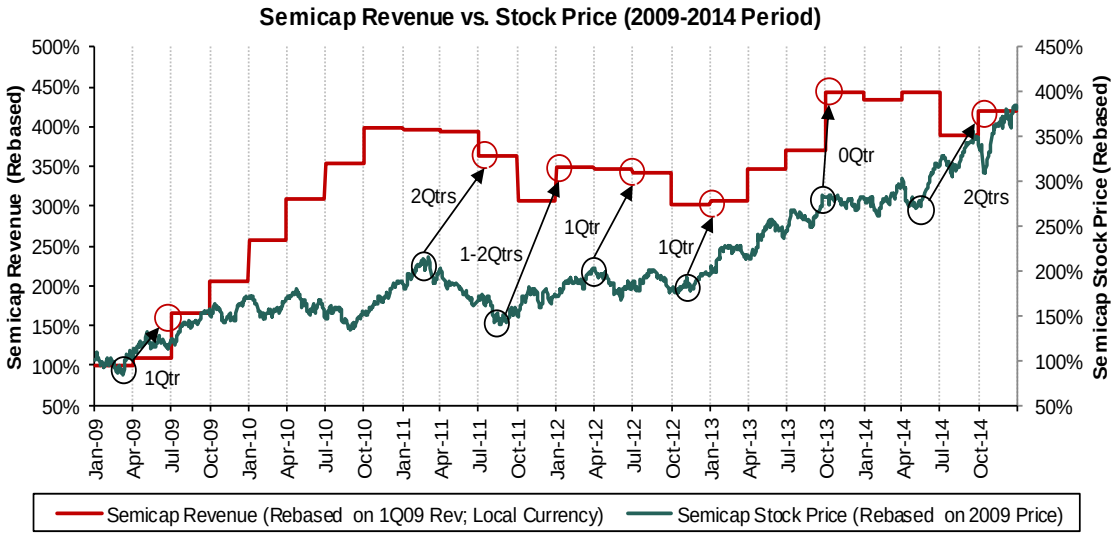
It should also be noted as well that, in general, semiconductor equipment companies have correlated stock prices. To some extent the market trends will drive almost anything in the space, and AMAT and LRCX demonstrate the most correlation to the broader semicap space of all the largest 5 players (a correlation coefficient of ~0.79 over the last 5 years; **Exhibit 57**). This makes some sense to us; KLA and ASML are both mostly focused on dominating single end markets (process inspection/control and lithography respectively), and Tokyo Electron is a Japanese stock, not traded in the US, while AMAT and LRCX both stretch across the bulk of the semicap space. But to some extent one could choose to buy (or sell) the basket of semicap stocks and play broader trends.

EXHIBIT 53: **Long term stock performance follows long term revenue trends; near-term stock performance tends to anticipate changes in revenue expectations by 1-2 quarters**



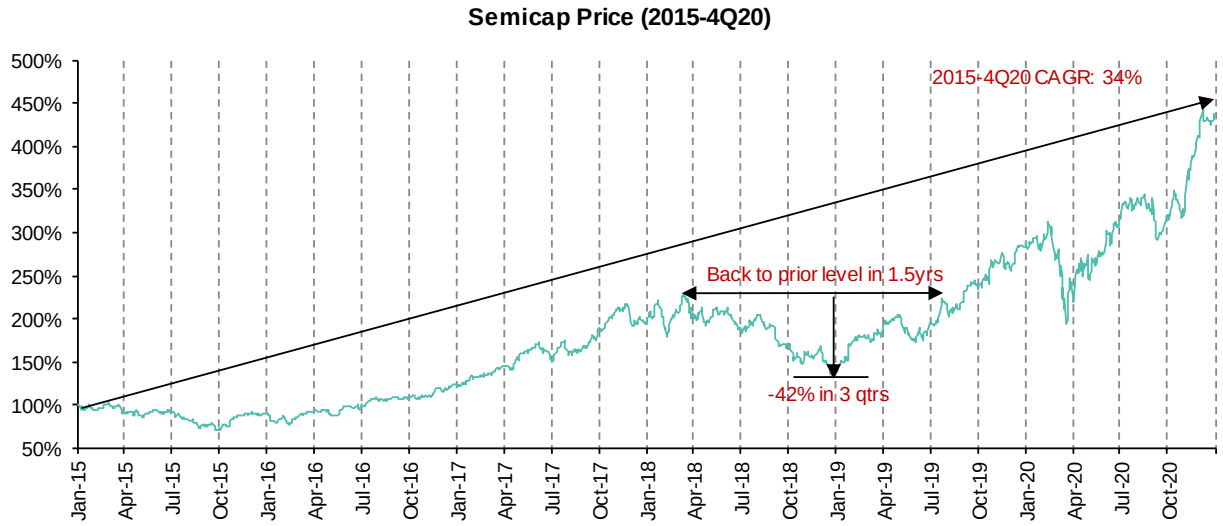
Source: Bloomberg, Bernstein analysis

EXHIBIT 54: **A similar pattern held in prior years**



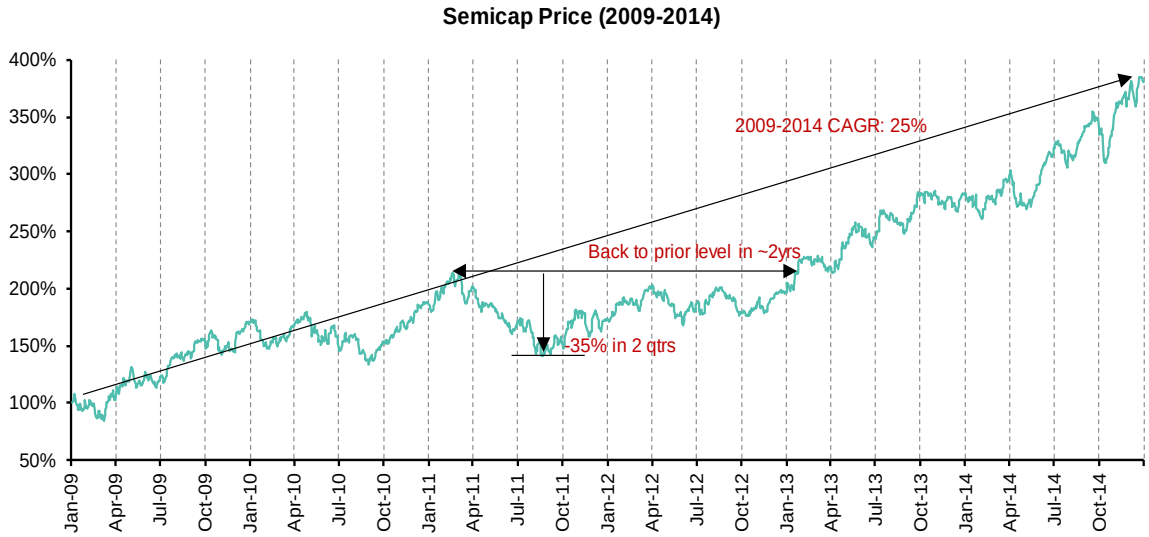
Source: Bloomberg, Bernstein analysis

EXHIBIT 55: **From2015-2020 the industry returned 34% annually even with a number of sharp corrections…**



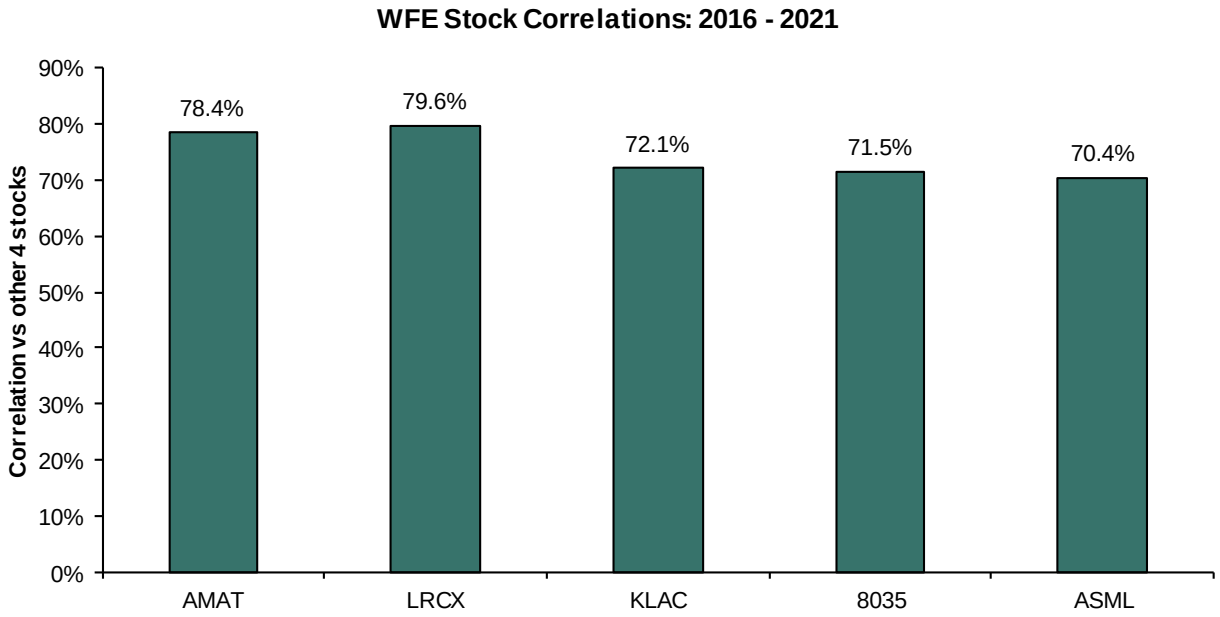
Source: Bloomberg, Bernstein analysis

EXHIBIT 56: **Form 2009-2014 the industry suffered a 35% drawdown, and still returned 25% annually on average**



Source: Bloomberg, Bernstein analysis

EXHIBIT 57: **Semicap share performance is highly correlated**



Source: Bloomberg, Bernstein analysis

WHAT IS OUR VIEW ON THE WAFER FABRICATION EQUIPMENT (WFE) MARKET?

Over the near to medium term we believe current supply-demand has tightened significantly, foundry will be a tailwind, and memory recovery is a matter of when, not if. Overall we are positive on WFE growth; we forecast WFE spending of ~$75B this year (up ~19% YoY), growing to $87B by CY2023.

The supply-demand situation has tightened; foundry spending appears set to grow

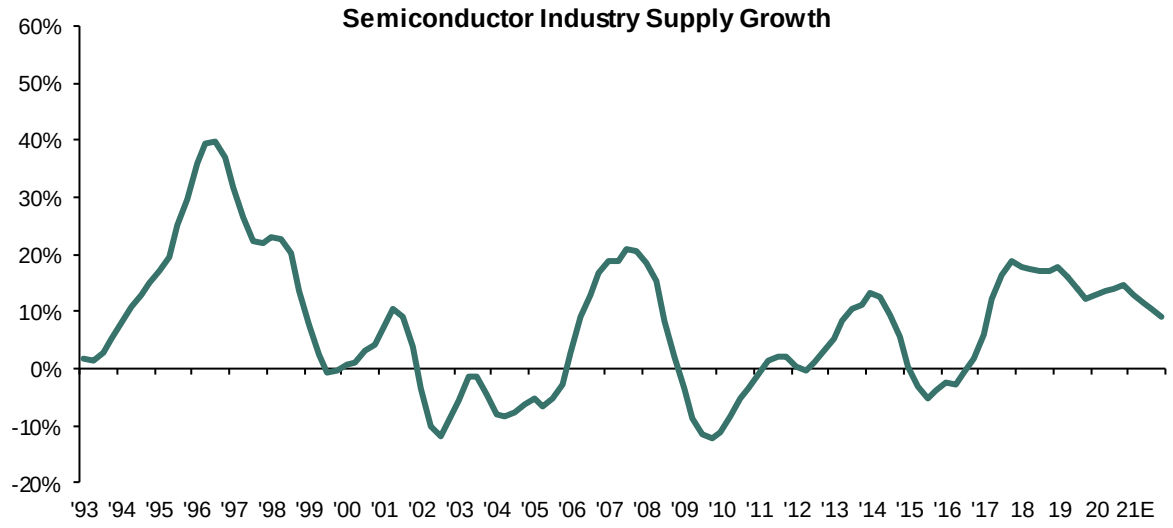
Over the years we have found a good measure of growth in overall industry supply can be found by simply taking WFE, building a 4 year depreciation cycle out of it, and then taking the YoY growth in that metric (plotted in **Exhibit 58**). An equally simple measure of industry demand growth can be found by simply taking YoY growth in semiconductor revenue or units (**Exhibit 59**). Comparing the two and looking for divergences provides a good measure of the current relative industry supply-demand situation.

While industry supply growth has remained relatively steady recently, demand has been a bit more volatile, with a downturn in 2019 followed by COVID volatility in 2020 (with a sharp correction in the 1H, and a rapid demand snapback in the 2H). Given the recent sharp demand increase demand growth has recently overtaken supply growth (**Exhibit 60**), driving a supply-demand environment characterized by shortages in many end markets.

Currently industry capacity utilization is very high. At foundries mature node utilization exceeds 90%, and leading-edge capacity is essentially sold out (**Exhibit 61**). And historically periods of high utilization are correlated with, and have been a reliable leading indicator of, incremental capacity additions (**Exhibit 62**).

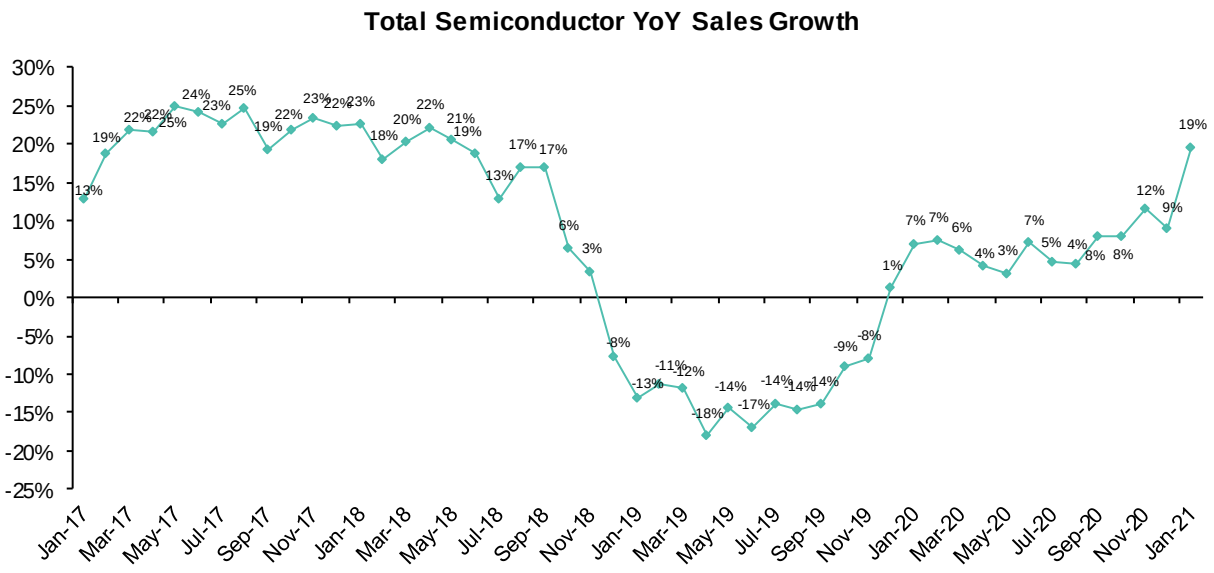
Hence in this context TSMC's record capex guidance ($25-$28B, up 50-65% YoY) is perhaps not a surprise, and of course should drive significant WFE growth this year. Going forward however, for all the reasons mentioned above we believe much of this growth is structural (frankly we would be surprised if TSMC's capex guide ever started with a number lower than "2" again), and overall we believe foundry spending can act as a tailwind.

EXHIBIT 58: **The pace of industry supply growth fell a bit over the last year or two**



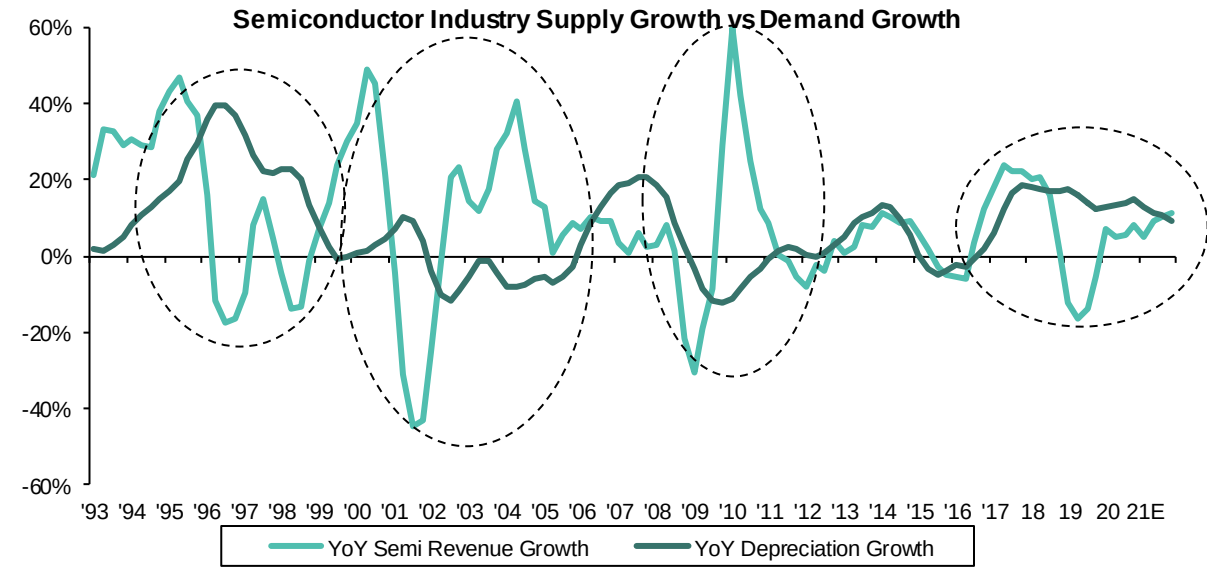
Source: SEMI, Gartner, Bernstein estimates and analysis
Note: Forward estimates are from Gartner's 4Q20 forecast

EXHIBIT 59: **However we are now in the midst of a sharp demand cycle**



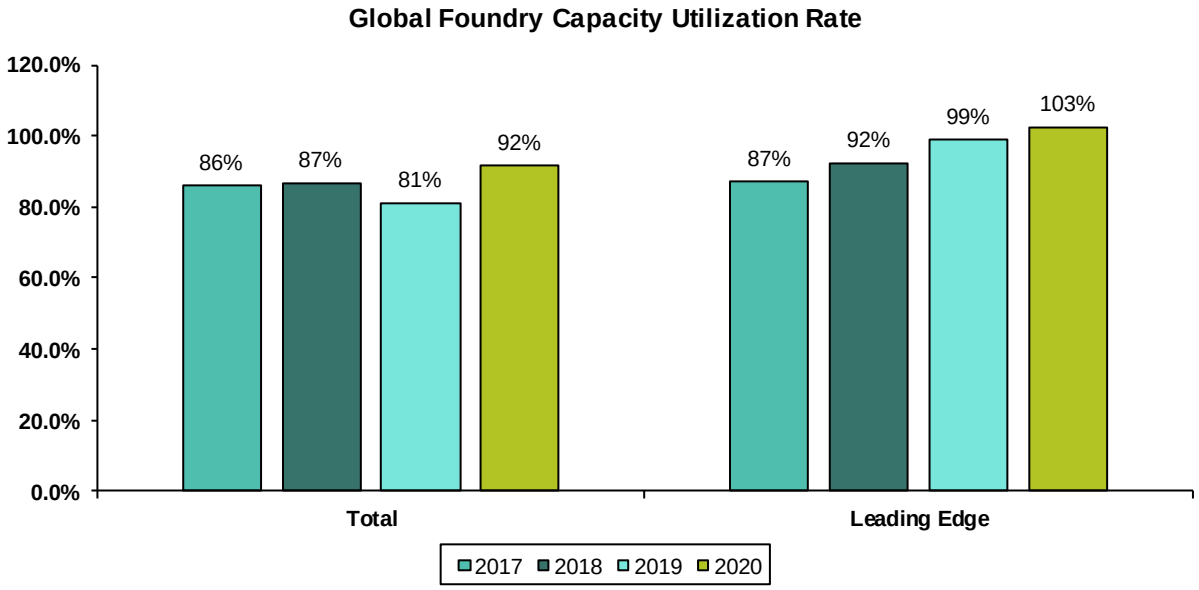
Source: WSTS, Bernstein Analysis

EXHIBIT 60: **Demand growth has recently caught up with and exceeded supply growth, yielding a tight capacity environment**



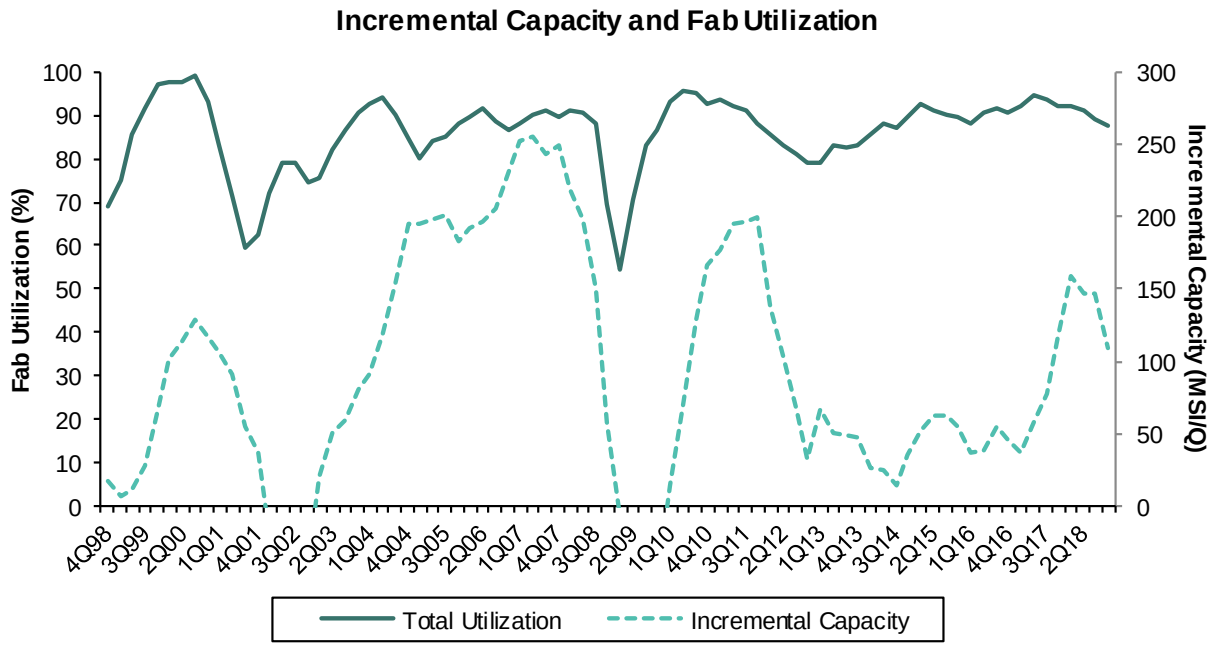
Note: 2021 Forecasts are Gartner
Source: SEMI, Gartner, Bernstein estimates and analysis

EXHIBIT 61: **Overall foundry capacity utilization is high, and leading-edge capacity appears sold-out**



Source: Gartner, Bernstein analysis

EXHIBIT 62: **Fab utilization has been a reliable leading indicator of incremental capacity additions in the past**



Source: Gartner, Bernstein analysis
Note: Gartner stopped publishing quarterly capacity and utilization estimates after 4Q18.

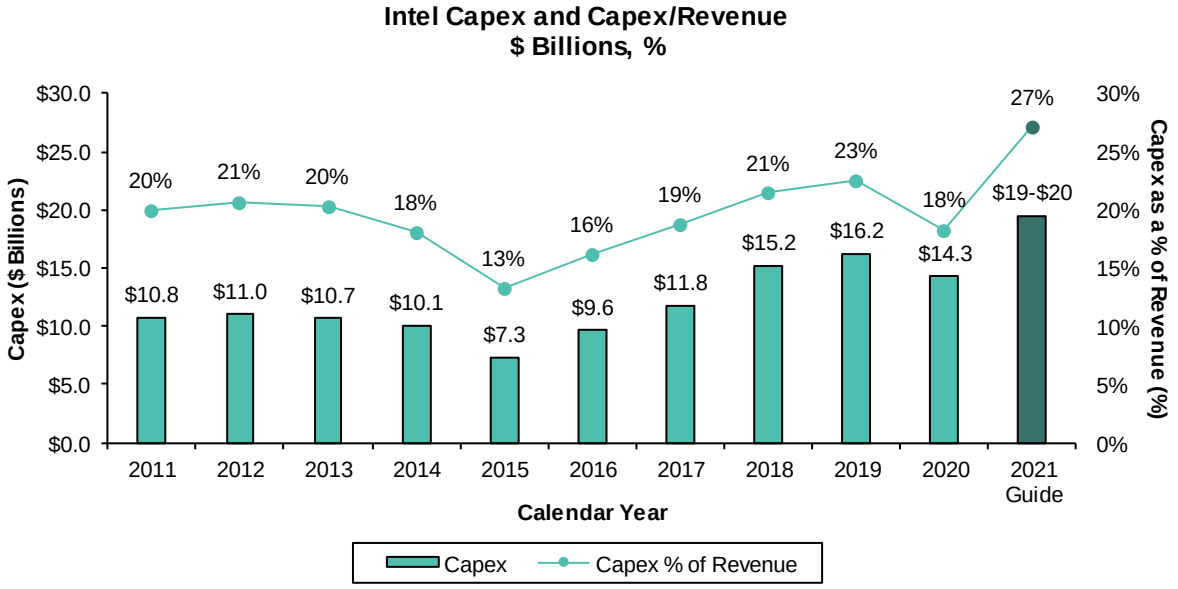
Logic spending looks set to structurally grow as well given Intel's new plans

While many have thought that Intel might choose to move away from their historical focus on process technology, the company put that thesis to rest recently, calling for a doubling down on internal manufacturing with a staggering 2021 capex guide ($19-$20B, a ~27% capital intensity; **Exhibit 63**) as well as plans to invest $20B in Arizona in a bid to restart their foundry aspirations.

We note that the 2021 capex guide and the $20B Arizona investment mostly do not overlap; hence it seems likely that the significant 2021 increase in capex is representative of the requirements of their core business as they introduce 7nm with a larger EUV contribution, and is one more indicator of structurally increasing capital intensity in the industry. And it seems likely to us that the bulk of the Arizona investment, at least at first, will likely be for Intel's internal capacity as well as it will take significant time to build out meaningful foundry volume, if indeed they can do it at all.

And if Intel can actually make a name for themselves in 3rd party foundry, this would likely be a positive for WFE as well as TSMC is a (far) more efficient manufacturer than Intel is (**Exhibit 64**); in fact our math suggests that TSMC historically spends ~30-35% less for a given increment of fab capacity (**Exhibit 65**) with a 10-40% lower WFE intensity (**Exhibit 66**). Hence if Intel can capture any sort of meaningful foundry volume, it is likely they will require a higher WFE spend to produce an equivalent amount of wafer output that TSMC could.

EXHIBIT 63: **Intel guided 2021 capex to $19-$20B, with capital intensity of ~27%, well above history**



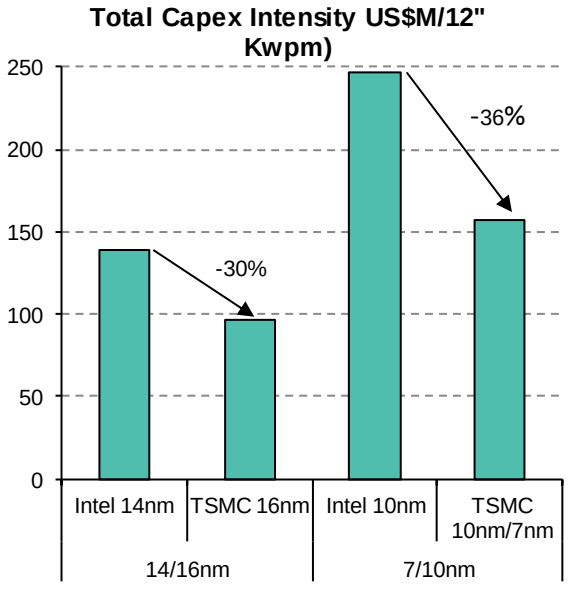
Source: Company reports, Bernstein analysis

EXHIBIT 64: **Though Intel's capacity is mostly built from upgrading prior capacity, a few fabs for 14 & 10nm were built greenfield and can be compared to TSMC's fabs for the equivalent nodes.**

Fabs	Total Capex US$M	WFE US$M	Capacity 12" Kwpm	Total Capex Intensity US$M/12" Kwpm	WFE Intensity US$M/12" Kwpm
TSMC					
10/7nm					
Fab 12 Phase 7	5,640	4,600	35	161	131
Fab 15 Phase 5	5,300	4,450	35	151	127
Fab 15 Phase 6	5,600	4,700	35	160	134
Fab 15 Phase 7	5,450	4,400	35	156	126
TOTAL	**21,990**	**18,150**	**140**	**157**	**130**
16nm					
Fab 14 Phase 7	3,375	3,050	35	96	87
TOTAL	**3,375**	**3,050**	**35**	**96**	**87**
Intel					
10nm					
Fab 42	8,135	7,285	33	247	221
TOTAL	**8,135**	**7,285**	**33**	**247**	**221**
14nm					
D1C-Expansion	1,345	1,070	12	112	89
D1X Module 1	3,975	2,475	20	199	124
Fab 24	5,639	4,039	47	120	86
TOTAL	**10,959**	**7,584**	**79**	**139**	**96**

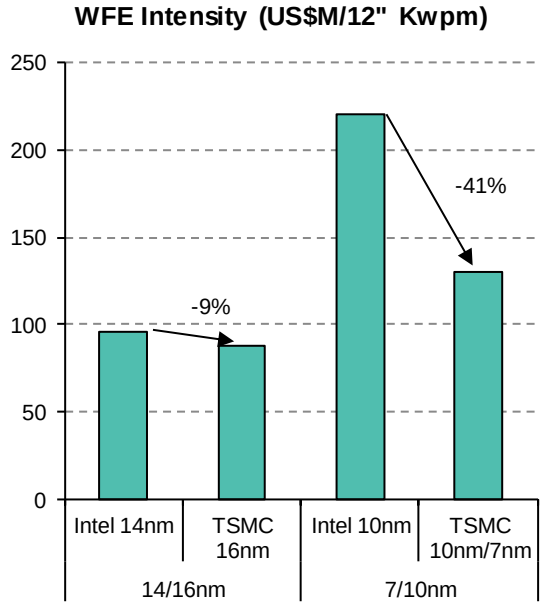
Source: SEMI and Bernstein analysis

EXHIBIT 65: **To build same amounts of capacity, TSMC historically spent 30-35% less total capex than Intel ...**



Source: SEMI and Bernstein analysis
Note: we don't include capex for maintenance & conversion after each node reach its peak capacity.

EXHIBIT 66: **...and ~10-40% less specifically for WFE.**



Source: SEMI and Bernstein analysis
Note: we don't include capex for maintenance & conversion after each node reach its peak capacity.

Memory spending recovery is a matter of when, not if

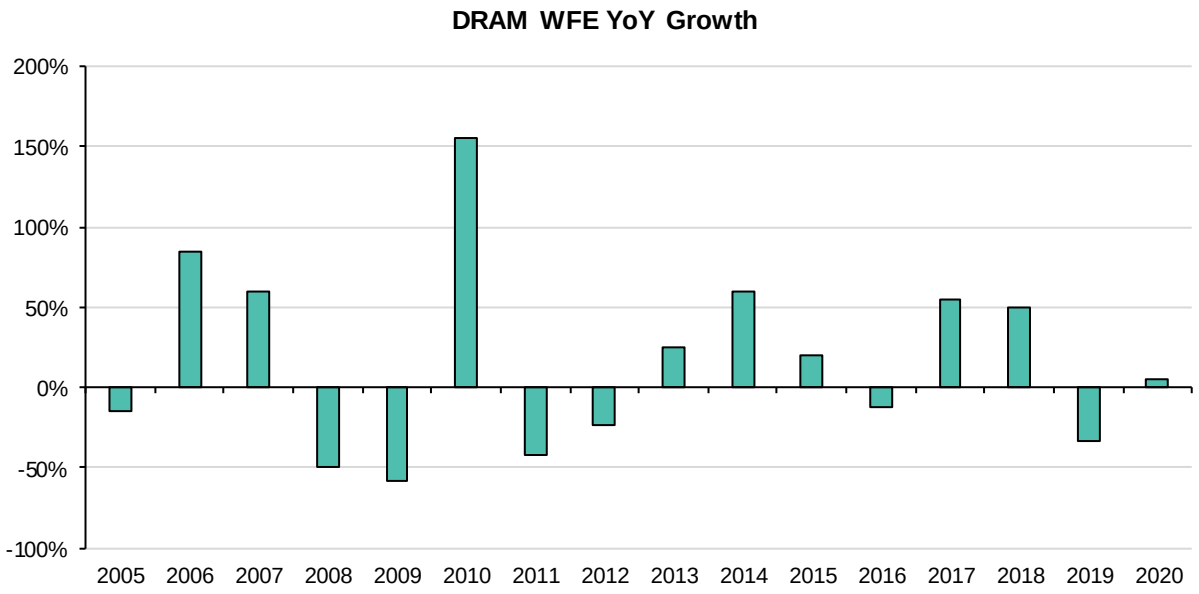
As memory surged in 2017 and 2018, capex spending was an enormous tailwind. However, for the last few years memory spend has been more muted as the underlying industry experienced both a 2019 downturn and the 2020 COVID pandemic, with capex for memory suffering somewhat over the last couple of years especially in DRAM (**Exhibit 67**).

Most industry participants are expecting memory capex to begin recovering this year, especially in DRAM where the somewhat muted supply growth has been met by strong demand drivers (for example, PCs) that have proven surprisingly resilient amid COVID, and which are continuing recovery into 2021 (**Exhibit 68**). And in fact we have begun to see DRAM prices normalize as strong demand and muted supply growth bring supply and demand closer to balance (**Exhibit 70**).

NAND capex spending came under pressure in 2019, but grew somewhat in 2020 (though off the low 2019 base) (**Exhibit 69**), and unlike DRAM we have not seen the same level of underlying demand driver strength. Hence supply and demand are more mismatched currently, with NAND ASPs rolling over in the second half of 2020 and into 2021 (**Exhibit 71**). However, we expect recovery here too at some point (more a question of when, rather than if) as inventory works off and underlying demand picks up, and we move to higher layer counts as we go through 2021.

Overall for the long term memory remains a growth market in our opinion, with bit growth over time typically robust over the cycle (**Exhibit 72**) and with strong secular drivers (AI, 5G, and other advanced drivers are all drivers of increased memory content as well).

EXHIBIT 67: **DRAM capex growth has been muted for the last year or two**



Source: Gartner, SEMI, Bernstein estimates and analysis

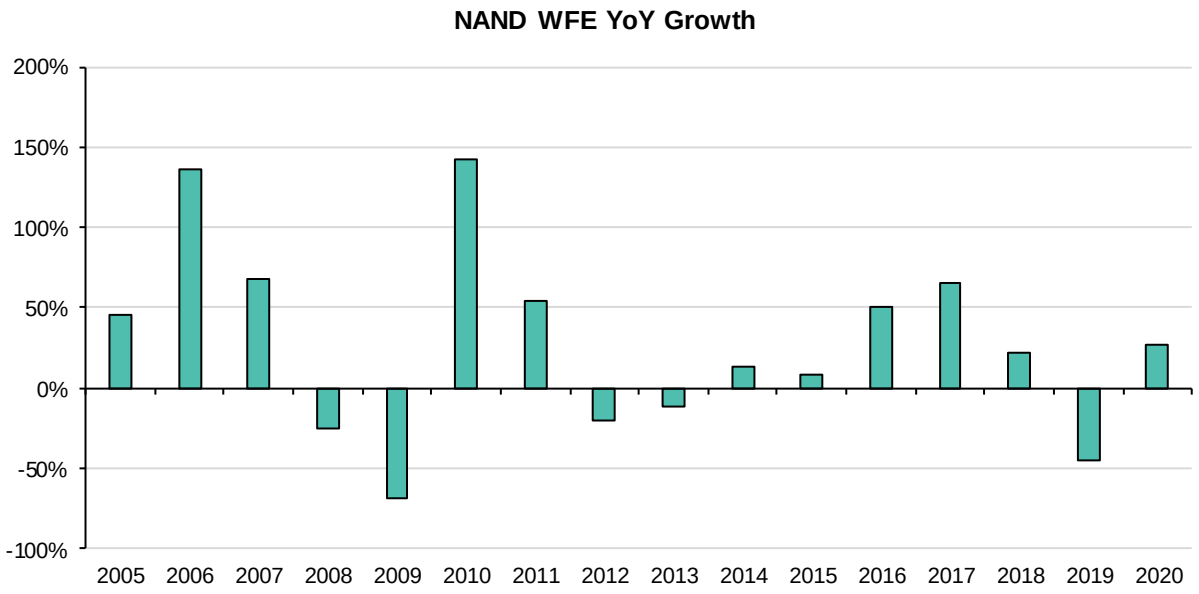
EXHIBIT 68: **Participants are currently positive on DRAM in the near term, and see NAND recovery coming later**

Company	Event	Commentary
MU	MS, 2021	So on the DRAM side, volume is definitely better than we anticipated coming into the quarter. In addition, ASPs are better than we anticipated coming into the quarter. So those 2 are certainly driving upside on the DRAM front. On the NAND front, I would say volume is definitely running more positively than we expected. AsPs are generally somewhat in line with our expectations coming into the quarter.
Samsung	4Q20	For Memory, we expect business conditions to improve in the first half based on continued demand from mobile and server. However, global macro uncertainties including currency movements are likely to continue to influence the business environment. We will enhance cost competitiveness and market leadership by accelerating migration to 1z nano DRAM and 6th-generation V NAND while also expanding application of EUV technology.
SK Hynix	4Q20	More specifically, we expect the server DRAM demand growth to be above 30% this year, as key hyperscale customers resume new data center investments, new server CPUs with eight DRAM support channels instead of six will be launched, leading to new server replacement cycle.
Nanya	4Q20	On the other hand, as the generally high inventory level across the industry eases off in the first half of this year, the NAND market environment is expected to gradually recover as we enter the second half. or the market outlook, we are seeing that DRAM demand is stabilizing in first half 2021 and the industry is entering a new upcycle
AMAT	MS, 2021	We see DRAM from a growth standpoint firing this year. NAND, we see some investments early in the year, but being a bit more muted from a growth profile standpoint but still a healthy level.
KLAC	MS, 2021	So certainly, if you look at that type of growth, we expect the foundry/logic part of our business to be mostly in line with the market after a faster-than-market growth year last year, DRAM to be faster than the overall market performance and then flash to be a little bit less.
LRCX	MS, 2021	So I'm very optimistic about where DRAM is headed. We've got some new things coming in as EUV begins to be introduced in process flows, the (inaudible) that we announced about a year ago, and we talked about at SPIE last week. The demand in the poll for that is very strong. We're very excited about that in DRAM and foundry and logic.
TEL	3Q20	For NAND, along with inventory adjustments, memory price has bounced back to the upward trend. Investment is expected to start again gradually. For this year, investment for the transition from 9X layers to 12X layers will increase. For DRAM, as memory prices bottomed out, and in early 2020 inventories will be normalized, restart of investment is expected.
ASML	GS, 2021	So that means that, yes, we have a very strong and not only bullish, but I would say, as a logic industry that is under -- that's in undercapacity, clearly, we have -- as a DRAM industry that is set to order more throughout the rest of the year for shipment throughout 2020. And I think somewhere down the line that 3D NAND will also follow, which is not at the same level of, I would say, utilization as we have seen with DRAM towards the end of the year, early this year.

Source: Bernstein analysis

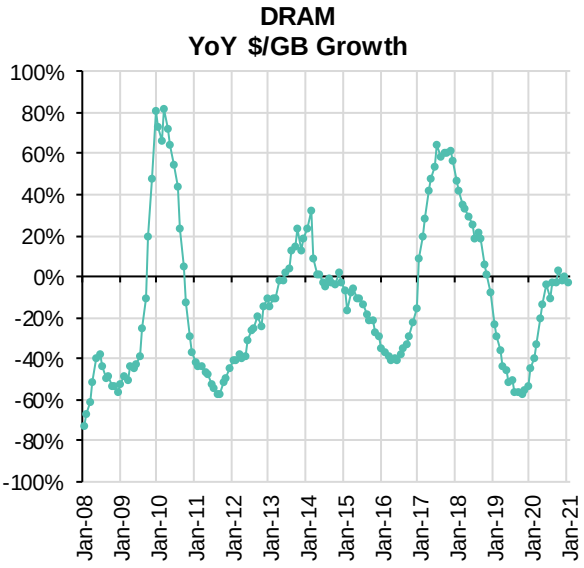
Source: DRAM Exchange, Gartner, Strategy Analytics, Bernstein Global Memory Team (Newman) estimates and analysis

EXHIBIT 69: **NAND supply growth picked up more in 2020 (off a low 2019 base)**



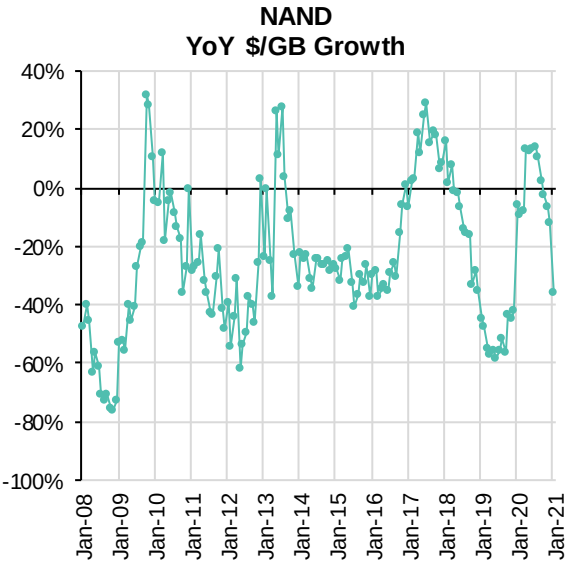
Source: Gartner, SEMI, Bernstein estimates and analysis

EXHIBIT 70: **DRAM ASPs are now recovering...**



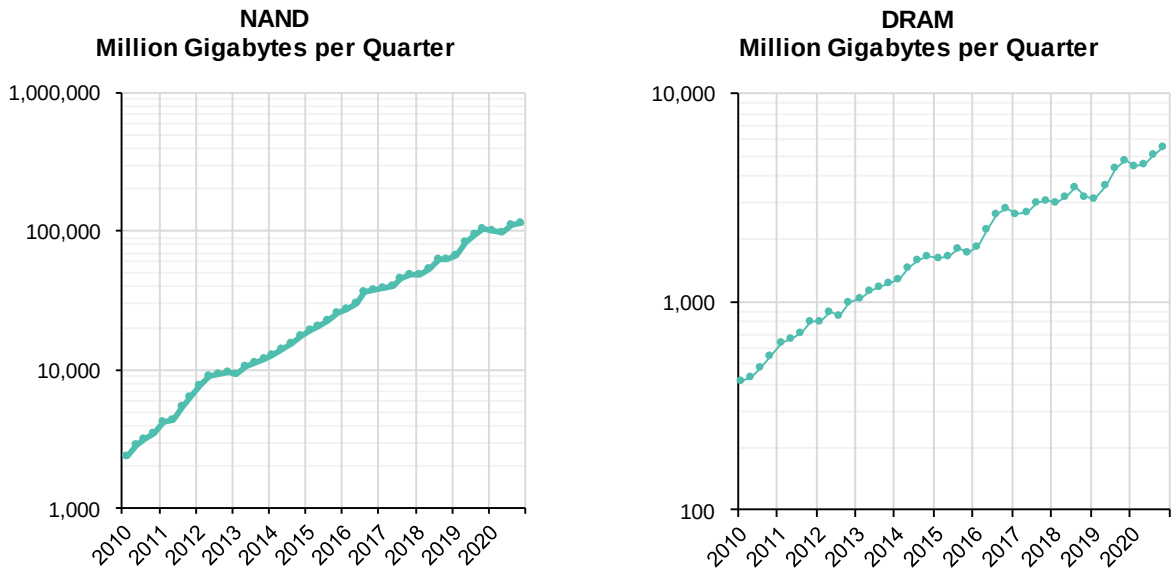
Source: WSTS, Bernstein analysis

EXHIBIT 71: **...while NAND ASPs have rolled**



Source: WSTS, Bernstein analysis

EXHIBIT 72: **Demand for memory bits has rarely degraded**

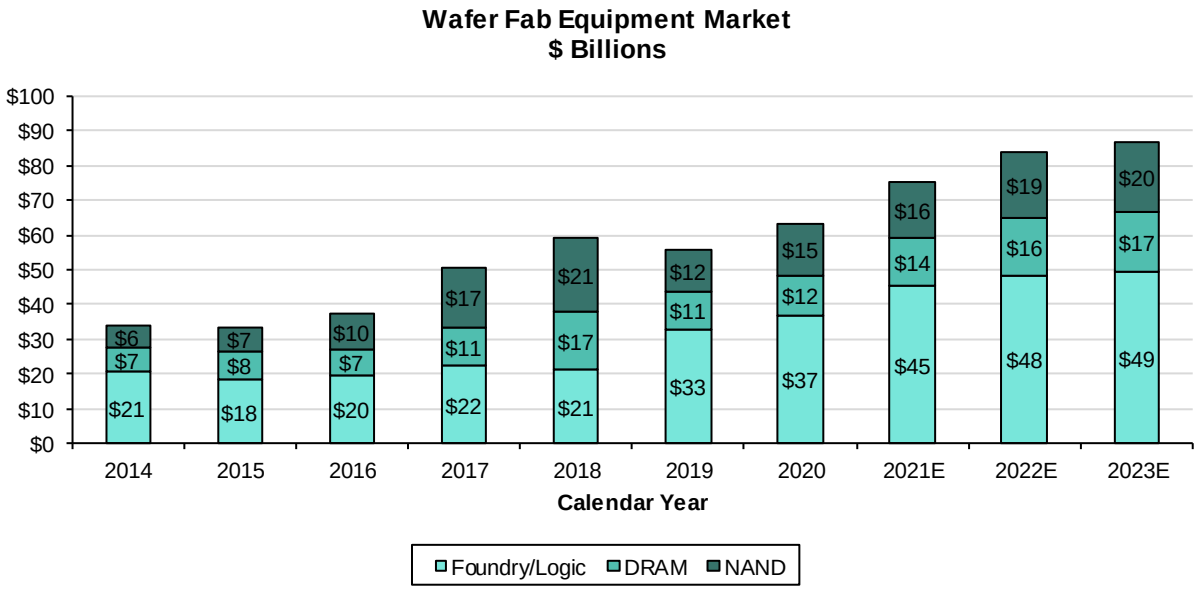


Source: WSTS, Bernstein analysis

Overall we believe WFE is set to have a strong 2021, likely up ~19% YoY to ~$75B, with further growth in 2022

Overall we believe strong foundry/logic outlook, coupled to memory recovery, bode well for WFE spend this year and beyond. We model total equipment spending in 2021 of $75B, up ~19% YoY. We model foundry/logic at $45, up 22%, with DRAM spending at $14, up 20% YoY, and NAND at $16, up 9% YoY, with further growth beyond, reaching $87B by CY2023 (**Exhibit 73**).

EXHIBIT 73: **We model WFE at ~$75B in CY2021, with further growth in 2022**



Source: Company reports, Gartner, SEMI, Bernstein estimates and analysis

HOW CAN WE COMPARE AND CONTRAST LAM RESEARCH AND APPLIED MATERIALS?

AMAT and LRCX have a number of similarities. Both play in a variety of sub-markets (as opposed to, say, KLAC or ASML who maintain much more focus in their specialties). Both have grown over the years through acquisitions; AMAT acquired Varian (obtaining a presence in doping as well as much of their current senior management team), while LRCX bought Novellus (which brought the virtually pure-play etch company into the deposition space). Both have had failed acquisitions as well (AMAT's purchase of Tokyo Electron and, more recently, Kokusai, and LRCX's purchase of KLAC both failed on regulatory grounds).

AMAT is bigger and more diversified (and makes equipment for display manufacturing as well as semiconductors), whereas LRCX plays primarily in etch and deposition. The two companies overlap within deposition in the CVD (chemical vapor deposition) space, and in conductor etch. AMAT has significant additional presence within deposition in epitaxy and sputtering, as well as strong presence in areas like rapid thermal processing, doping and ion implant, and Ebeam inspection and defect review (none of which LRCX really play in). LRCX has additional strength in dielectric etch (where AMAT is completely absent), ECD (electrochemical deposition, essentially electroplating), and some presence in ALD (atomic layer deposition) (AMAT plays a little bit in these two, but nowhere near LRCX's scale).

AMAT has higher share in foundry/logic than LRCX (AMAT captures ~20 cents of an incremental foundry/logic WFE dollar vs ~10 cents for LRCX). Both companies have similar overall memory WFE share but LRCX is more heavily weighted in NAND flash (LRCX captures more than 20 cents of a NAND WFE dollar vs AMAT at ~15 cents; for DRAM however AMAT captures ~20 cents of a WFE dollar vs ~12 cents for LRCX).

At the company level LRCX has significantly more memory exposure (currently ~60% of revenue, rising to ~80% in a strong memory year); AMAT currently has ~40% memory exposure rising to ~60% in a strong memory year; LRCX's memory exposure is also much more heavily weighted to NAND flash with AMAT's NAND vs DRAM exposure more balanced.

A summary of key business differences can be found in **Exhibit 74.**

EXHIBIT 74: **How do LRCX and AMAT compare with each other?**

	LRCX	AMAT
Share by End Market	More NAND, less Foundry/Logic	More Foundry/Logic and DRAM, less NAND
End Market Exposure	Equipment business 60-80% Memory, 40-20% Foundry/Logic	Equipment business 40-60% memory, 60-40% Foundry/Logic
Business Mix	~2/3 Semi equipment, ~1/3 services	~2/3 semi equipment; ~1/4 services, ~1/10 display
Process Exposure	Deposition and Removal only	Deposition, Removal, RTP, Doping, Process Control, Automation, as well as Display
Process Strengths	CVD, PECVD, ECD, Dielectric and Conductor Etch	PECVD, CVD, Sputtering, Epitaxy, Conductor Etch, CMP, RTP, Doping, Ebeam, and Epitaxy
Geographic Exposure	China, Korea, Taiwan	China, Taiwan, Korea

Source: company reports, Bloomberg, Bernstein analysis

AMAT has more exposure to foundry/logic; LRCX is more heavily exposed to NAND flash

A dollar of incremental WFE spend does not necessarily flow to the different semicaps equally. But we can take a rough stab at outlining who benefits most as the various parts of the WFE market grow.

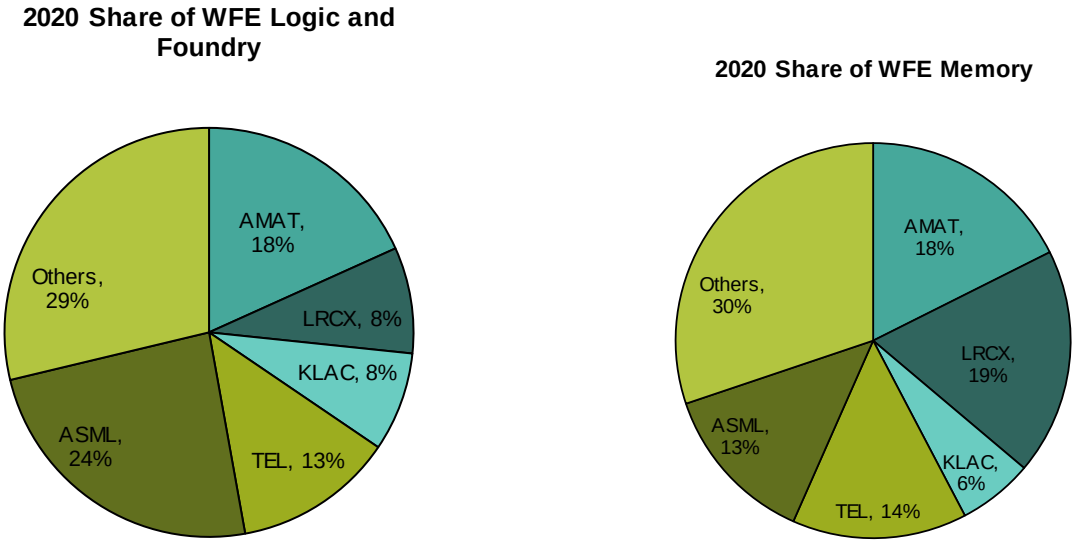
For example, AMAT captures close to 20 cents of every foundry/logic WFE dollar spent, with about 9 cents going to LRCX (**Exhibit 75**) with shares relatively constant over time overall (**Exhibit 76**). In contrast, both AMAT and LRCX capture close to 20 cents of every memory WFE dollar spent, though even here there are differences, with LRCX benefitting more from NAND spending, and AMAT from DRAM (**Exhibit 77**). Exposures to memory overall have bounced around over the years but been fairly constant over time for AMAT; LRCX has picked up a bit of share over the years given NAND exposure (**Exhibit 78**).

In terms of the company exposures themselves, semiconductor equipment systems make up ~2/3 of revenues for both AMAT and LRCX. Services makes up the remaining revenues (~1/3) for LRCX, and about 1/4 of revenues for AMAT (with the remaining 10% from display products) (**Exhibit 79, Exhibit 80**).

Within the ~2/3 of revenues taken up by systems, both AMAT and LRCX have high exposure to logic and memory, but memory makes up more of LRCX's systems sales than AMAT who has a bit more structural foundry/logic exposure.

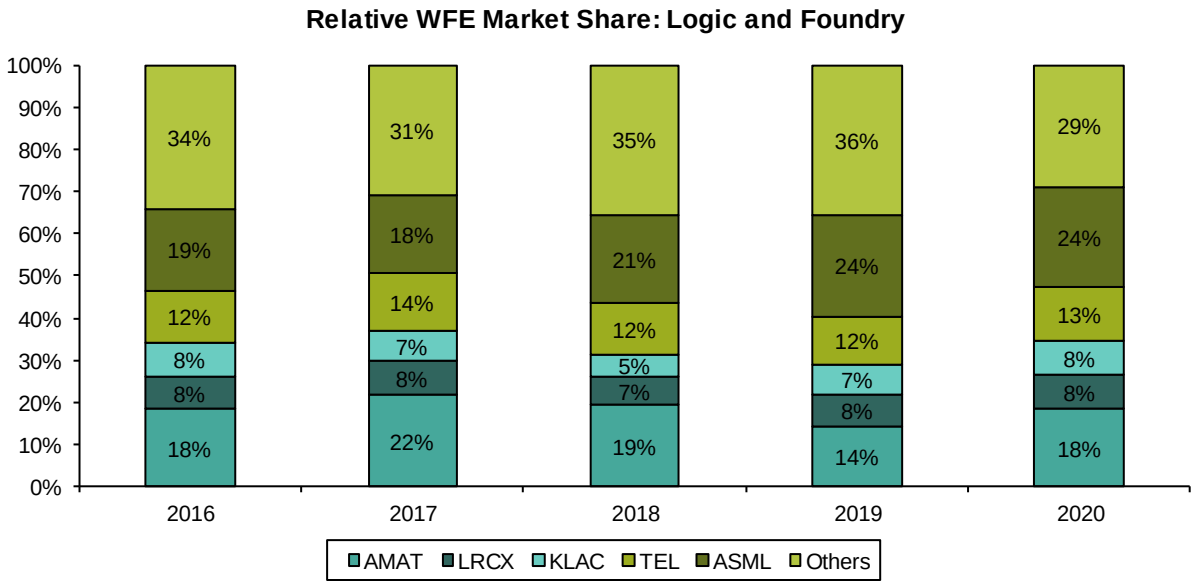
About 60% of LRCX's system sales are currently to memory, a number that can go as high as 80% in a strong memory (especially flash) spend year (**Exhibit 81**). In contrast AMAT's system sales are currently ~60% logic and ~40% memory which can reverse in a strong memory spend year, but AMAT will still typically have more foundry/logic exposure than LRCX (**Exhibit 82**).

EXHIBIT 75: **AMAT captures almost 20 cents of every dollar spent on logic/foundry and memory; LRCX captures less on logic/foundry**



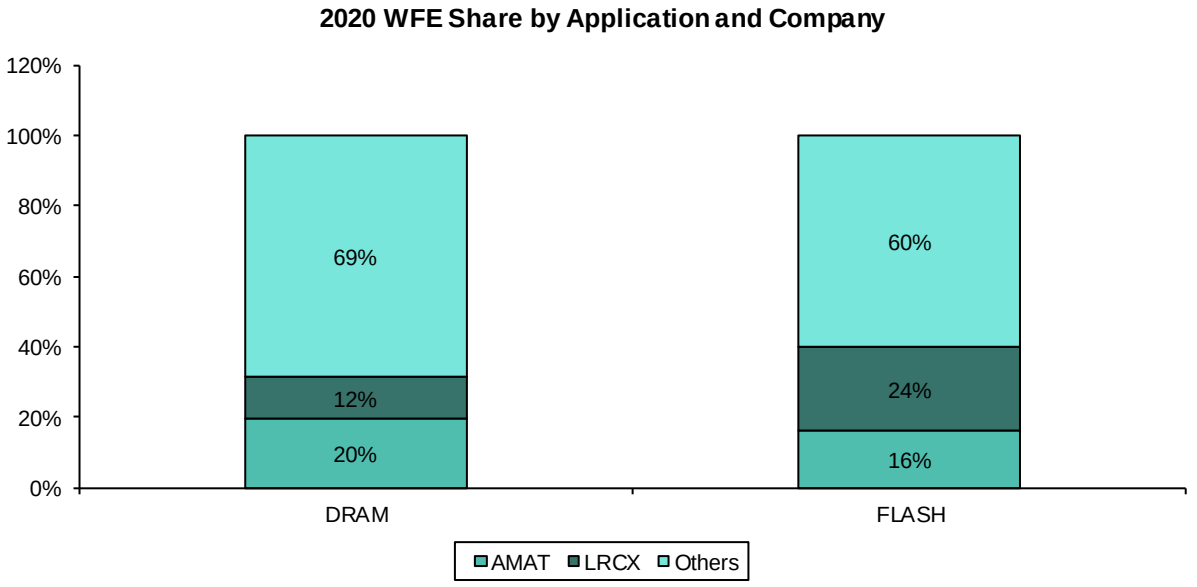
Source: Gartner, SEMI, company reports, Bernstein estimates and analysis

EXHIBIT 76: **Overall shares within foundry/logic have been fairly constant over time**



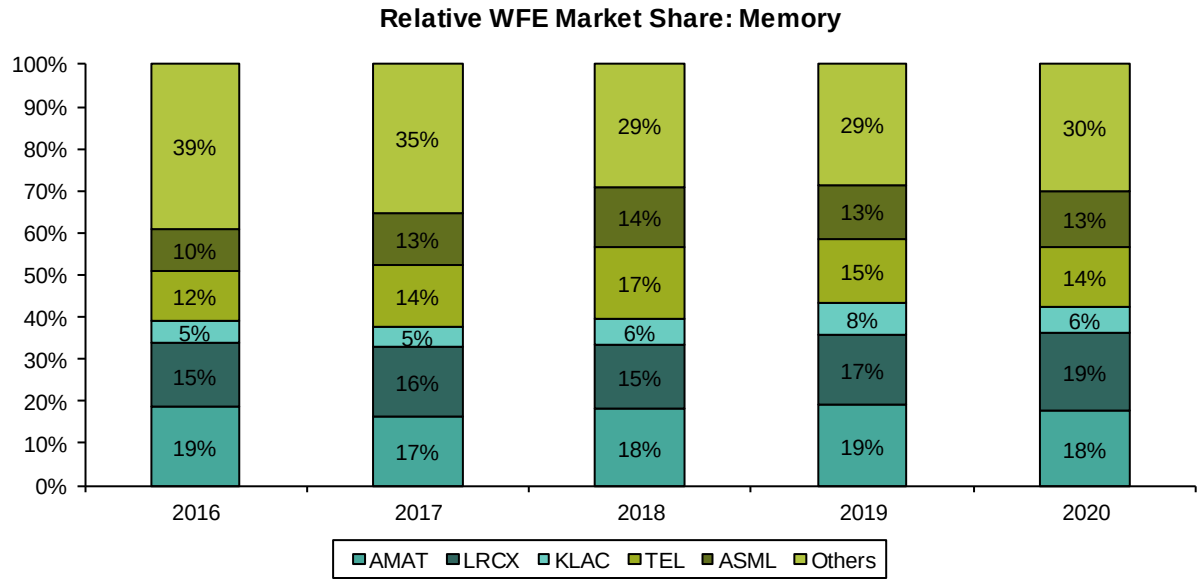
Source: Gartner, SEMI, company reports, Bernstein estimates and analysis

EXHIBIT 77: **Within memory LRCX benefits more from NAND, with AMAT more from DRAM**



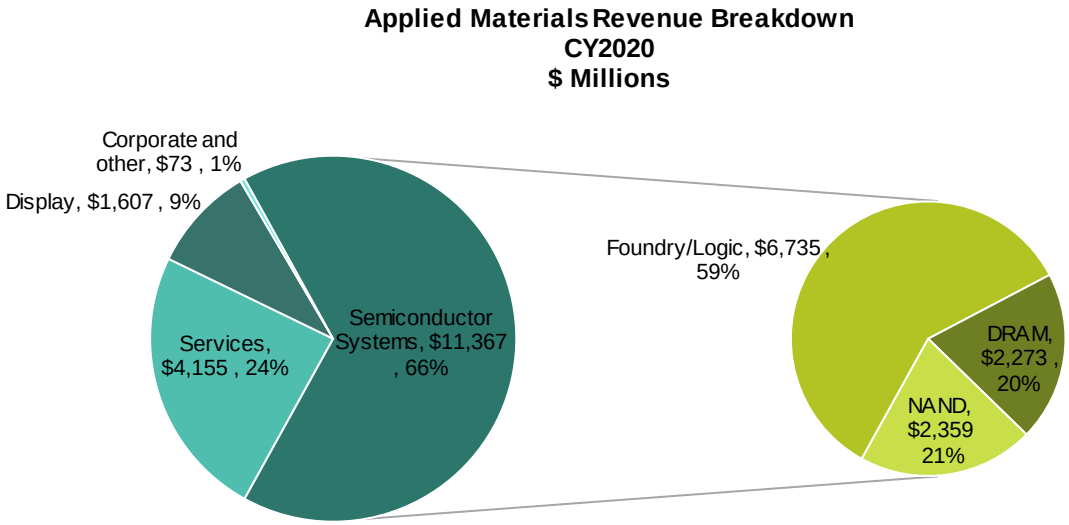
Source: Gartner, SEMI, company reports, Bernstein estimates and analysis

EXHIBIT 78: **Share of memory spend for both AMAT and LRCX has bounced around a bit, AMAT share has been fairly constant, while LRCX has picked up a bit given NAND exposure**



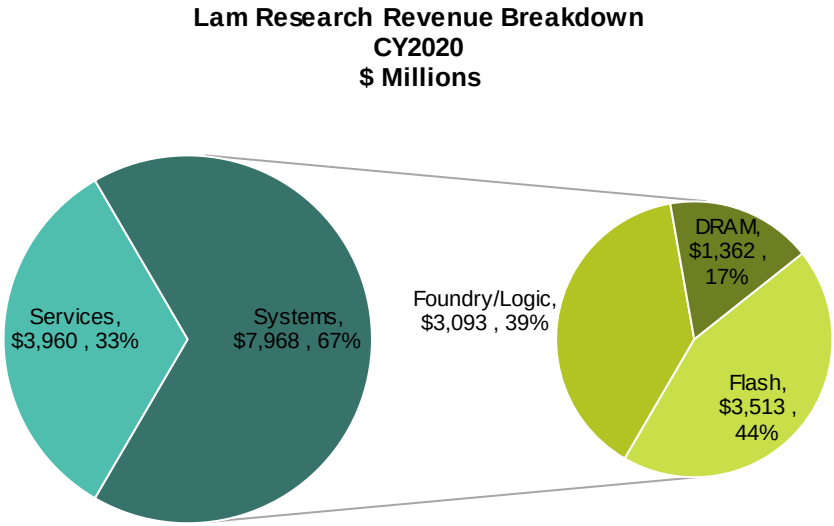
Source: Gartner, SEMI, company reports, Bernstein estimates and analysis

EXHIBIT 79: **Semiconductor systems make up ~2/3 of AMAT's revenue; services are about ¼, with display ~10%**



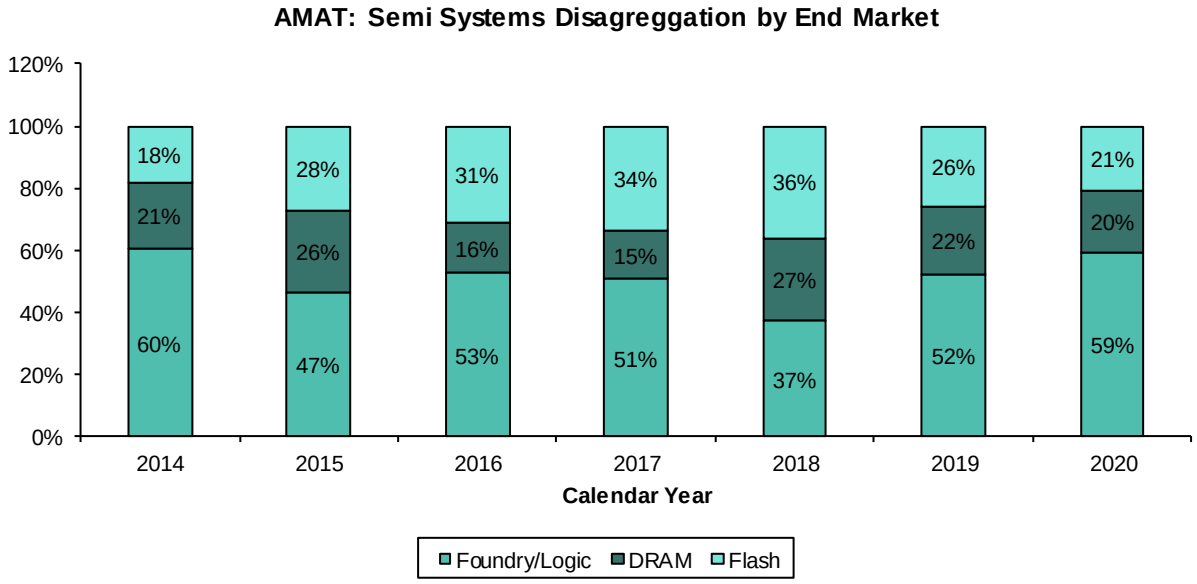
Source: Company reports, Bernstein analysis

EXHIBIT 80: **Systems make up ~2/3 of LRCX's revenues as well, with services ~1/3**



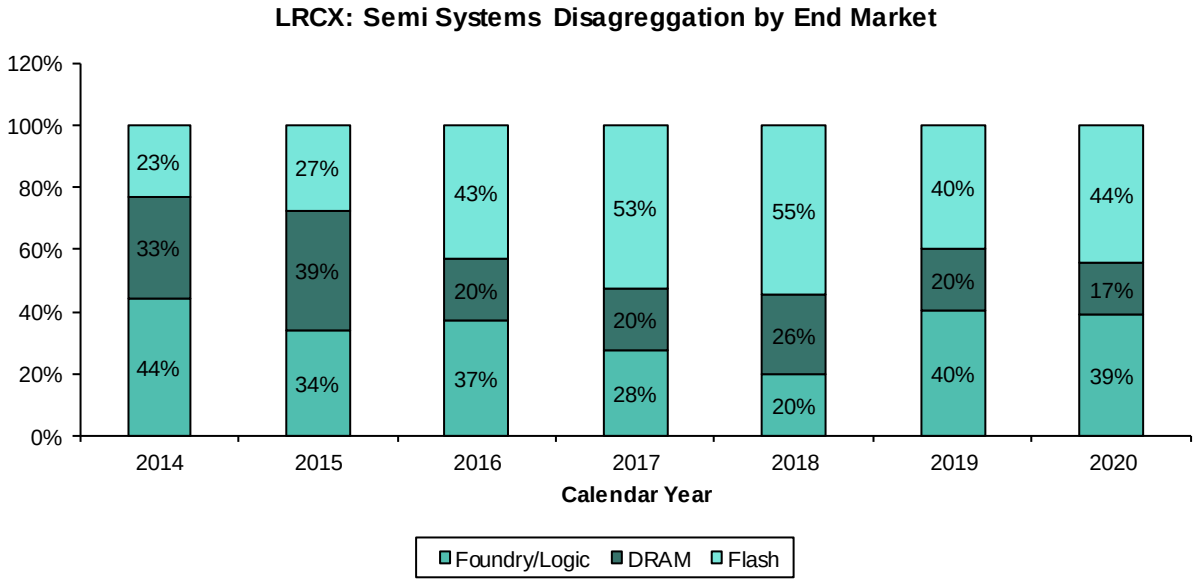
Source: Company reports, Bernstein analysis

EXHIBIT 81: **About 60% of AMAT's system revenues currently are logic, with ~40% memory; mix can go to 50-60% memory in strong memory years**



Source: Company reports, Bernstein analysis

EXHIBIT 82: **About 60% of LRCX's semiconductor systems revenue is memory, which can go to 80% in a strong memory year**



Source: Company reports, Bernstein analysis

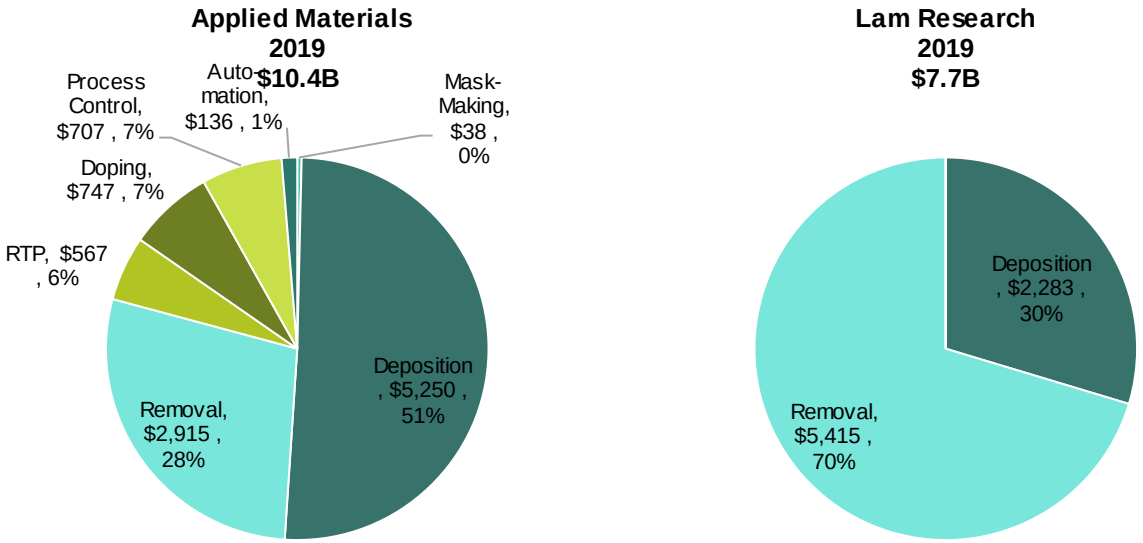
While AMAT has a broader span across processes than LRCX; the two companies overlap primarily in CVD and conductor etch

Applied Materials has a broader span across the various process regimes. About half their semiconductor system revenues come from deposition of various types (primarily plasma CVD, low-pressure CVD, sputtering, and epitaxy), with close to 30% from removal technologies (mostly conductor etch and chemical mechanical polishing, or CMP). 20% of their system revenues come from other processes however like doping (acquired from the Varian merger), rapid thermal processing, and process control.

Lam's roots however are primarily in etch, and removal technologies (mostly conductor and dielectric etch) make up ~70% of their system sales. They acquired a deposition franchise through their acquisition of Novellus; deposition (mostly CVD, ECD (plating) and atomic layer deposition, or ALD) makes up the other ~30% of their revenues (**Exhibit 83**).

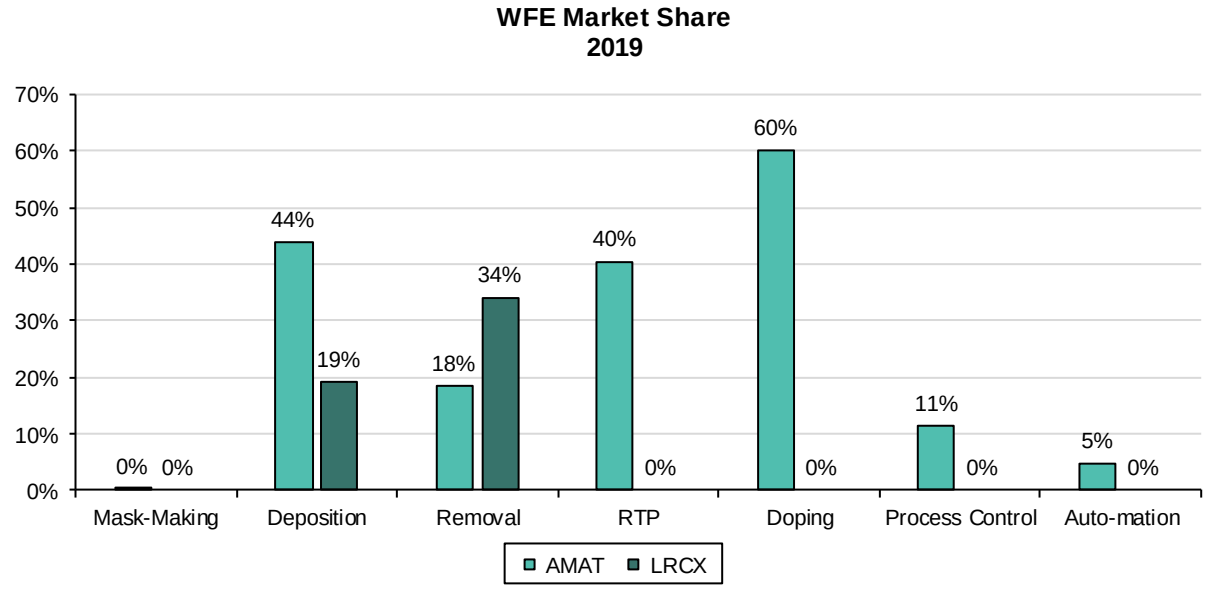
Overall, AMAT has higher total share in deposition (~44%, more than 2x LRCX) while the latter is stronger in removal (~34%, almost 2x AMAT) (**Exhibit 84**). However, one has to dig down deeper to draw real conclusions. The two companies really overlap within deposition in CVD; AMAT also has strong positions in epitaxy and sputtering where LRCX does not really play, while LRCX dominates in ECD where AMAT is absent. Within removal AMAT really only plays in conductor etch and that is the only area where the two companies overlap (AMAT has ~30% of that market, and LRCX ~50%); LRCX plays much broader in the removal market across dielectric etch, strip, etc. (**Exhibit 85, Exhibit 86, Exhibit 87**).

EXHIBIT 83: **AMAT has a broader span of products across the various process regimes, while Lam focuses primarily on deposition and removal**



Source: Gartner, Bernstein analysis

EXHIBIT 84: **AMAT's deposition share is higher (a function of strong PECVD and sputtering presence) while LRCX's roots lie in etch**



Source: Gartner, Bernstein analysis

EXHIBIT 85: **AMAT and LRCX overlap primarily in CVD (chemical vapor deposition) and conductor etch. Within Deposition AMAT also dominates in epitaxy and sputtering; LRCX dominates in ECD (electroplate). In other areas within removal AMAT is strong in CMP, while LRCX plays in dielectric etch**

WFE Sales and Market Share by Process Type (2019)		Sales ($M)		Market Share (%)	
		AMAT	LRCX	AMAT	LRCX
Lithography	Optical Mask-Making Lithography	$38		100%	
Deposition	Epitaxy	$729		74%	
	Atomic Layer Deposition	$42	$166	4%	16%
	Nontube LPCVD	$158	$445	15%	44%
	Plasma CVD	$1,980	$1,273	53%	34%
	Sputtering (PVD)	$2,271		85%	
	ECD (plating)	$71	$399	14%	81%
Removal	Bevel Edge Removal		$138		100%
	Single Wafer Spray Processors		$361		16%
	Strip		$83		18%
	Dielectric Etch		$1,503		36%
	Conductor Etch	$1,958	$3,330	30%	51%
	Chemical Mechanical Polishing (CMP)	$957		66%	
RTP/Oxidation/Diffusion	RTP	$446		70%	
	Gate Stack	$121		100%	
Doping	Medium Current Implanter	$219		58%	
	High-Current Implanter	$497		83%	
	Ultra-High-Dose Doping Equipment	$30		100%	
Process Control	CD-SEM	$159		30%	
	Mask Inspection and Review	$51		7%	
	Optical Wafer Inspection	$192		14%	
	E-Beam Wafer Inspection	$93		37%	
	SEM Defect Review	$211		60%	
Automation	Other Fab Automation	$136		17%	
Total		**$10,360**	**$7,698**	**19%**	**14%**

Source: Gartner, Bernstein analysis

EXHIBIT 86: **AMAT equipment product platform lineup**

Product Family	Model	Functionality	Process
Olympia	Olympia	ALD/CVD	ALD
Centura	iSprint	Tungsten gap fill	ALD/CVD
	DXZ	TEOS, oxide, low-k deposition	CVD
	Ultima	Plasma CVD	PECVD
	RP EPI	Epitaxy	Epitaxy
	EP 200mmm	Epitaxy (200mm eafers)	Epitaxy
	Centura / Centura AP	Single wafer etch (150/200/300mm)	Etch
	SILVIA	TSV Etch	Etch
	Tetra Z	Photomask Etch	Photomask
	TETRA EUV	EUV Mask Etch	Photomask
	DPN HD	Nitridation / post-nitridation anneal	RTP
Endura	Volta	Cobalt Deposition	CVD
	Volta	Selective tungsten deposition	CVD
	ALPS	Cobalt Deposition	Sputtering/PVD
	Amber	Copper fill	Sputtering/PVD
	Avenir	high-k/metal gate deposition	Sputtering/PVD
	Cirrus HT CO	Cobalt silicide deposition	Sputtering/PVD
	Cirrus HTX	TiN film deposition	Sputtering/PVD
	Clover MRAM	MRAM stack material deposition	Sputtering/PVD
	CUBS RV XT	Copper barrier / seed TaN depolition	Sputtering/PVD
	ILB	TiN contact barrier deposition	Sputtering / PVD / ALD
	Impulse	Phase-change / ReRAM film deposition	Sputtering/PVD
	Underbump	Back end metallization	Sputtering/PVD
	Ventura	TSV Metallization	Sputtering/PVD
	Versa	Tungsteen deposition	Sputtering/PVD
Producer	AVILA	TSV fill	PECVD
	BLOK	low-k deposition	PECVD
	Black	porous low-k deposition	PECVD
	Celera	high-stress SiN deposition	PECVD
	DARC	Anti-reflective coating deposition	PECVD
	Precision APF	Amorphous carbon hard mask deposition	PECVD
	HARP	high aspect ratio CVD of oxides	CVD
	INVIA	Conformal dielectric deposition	CVD
	XP Precision	Hard mask deposition	CVD
	Producer	Etching	Etch
	Selectra	Selectrive Etching	Etch
	PYRA	Low/mid temperature annealing	RTP
Nokota	Nokota	ECD for packaging applications	ECD
Raider	Raider	Electroplating	ECD
Reflexon	LK	Chemical mechanical planarization	CMP
Reflexon	LK Prime	Chemical mechanical planarization	CMP
Mirra	Mesa	CMP for 200mm wafers	CMP
Centris	SYM3	High-uniformity etch	Etch
	SYM3 Y	High-uniformity etch	Etch
Vista	3000XP	Medium-current implant	Ion Implant / Doping
	900 3D	Medium-current implant	Ion Implant / Doping
	900XP	Medium-current implant	Ion Implant / Doping
	HCP	High-current implant	Ion Implant / Doping
	PLAD	Plasma-based doping	Ion Implant / Doping
	TRIDENT	High-current implant	Ion Implant / Doping
Enlight	Enlight	Optical wafer inspection	Inspection / Metrology
Uvisoin	8 Inspection	Optical wafer inspection	Inspection / Metrology
Provisoin	2E Beam	ebeam wafer inspectioon	Inspection / Metrology
Semvison	G7 Defect	ebeam defect analysis	Inspection / Metrology
VeritySEM	5i Metroloty	Critical dimension ebeam inspection	Inspection / Metrology
AERA4	Mask Inspection	Photomask inspection	Inspection / Metrology
Vantage	Astra DSA	millisecond anneal	RTP
	Radiance Plus	High volume atmospheric anneal	RTP
	RADOX	oxide film growth	RTP
	Vulcan	Uniform annealing	RTP
SigmaMeltec	SigmaMeltec	Mask Clean	Photomask
	CTS	Mask Coat	Photomask
	SFB	Mask post-exposure bake	Photomask
	SFD	Mask development	Photomask
ALTA	4700DP	Mask Writing	Photomask
AKT	PX, 55KS	Display deposition (CVD)	Display
	ARISTO, PIVOT, TOUCH	Display deposition PVD)	Display
	EBEAM Review	Display defect review	Display
	EBEAM array test	Display ebeam array test	Display

Source: company reports, Bernstein analysis

EXHIBIT 87: **LRCX product groupings and their functions**

Product Family	Functionality	Process
Altus	Tungsten ALD, CVD for advanced memory and logic	Deposition
SABRE 3D	ECD for TSVs	Deposition
SABRE	ECD for Copper and Damascene (logic and memory interconnect)	Deposition
SOLA	UVTP for insulating materials used in conjunction with dielectric etc	Deposition
Speed	High Volume HDP-CVD for high qual gap fill related to dielectric etch	Deposition
Striker	ALD for dielectric films in logic, memory, and imaging	Deposition
VECTOR	PECVD for dielectric film deposition	Deposition
Reliant Deposition	Value/sometimes refurbished machines for CVD, HDP-CVD, PECVD	Deposition
DSIE	Deep Reactive Ion Etch for MEMS, power, sensors, and transducers	Etch
Flex	ALE, RIE for dielectric etch	Etch
Kiyo	Advanced ASLE, RIE for conductor etch in FinFET, tri-gate, and 3D NAN	Etch
SENSE.I	ALE, DRIE for advanced conductor and dielectric etch	Etch
SYNDION	DRIE, RIE for deep silicon etch	Etch
VANTEX	RIE for 3D NAND	Etch
VERSYS	RIE for BEOL etch	Etch
Reliant Etch	Value/sometimes refurbished machines for DRIE, RIE	Etch
Coronus	Plasma Bevel Clean	Strip & Clean
DV-Prime and Da Vinci	Wet Clean/Strip/Etch for removing particles, polymers and residues	Strip & Clean
EOS	Advanced Wet Clean/Strip/Etch for leading edge	Strip & Clean
Gamma	Dry Strip for downstream processing	Strip & Clean
SP Series	Wet Clean/Strip/Etch related to wafer level packaging	Strip & Clean
Reliant Clean	Value/sometimes refurbished machines for Wet Clean/Strip/Etch	Strip & Clean
Metryx	Mass Metrology	Metrology

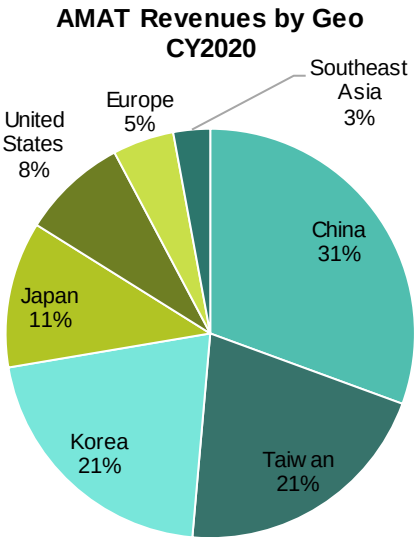
Source: company reports, Bernstein analysis

China, Taiwan, and Korea make up the bulk of sales for both AMAT and LRCX

China, Taiwan, and Korea make up the bulk of sales for both AMAT and LRCX (close to ¾ of total revenues for both companies; **Exhibit 88, Exhibit 89**). AMAT's Taiwan exposure is higher given a greater exposure toward foundry; LRCX has more china and Korea exposure.

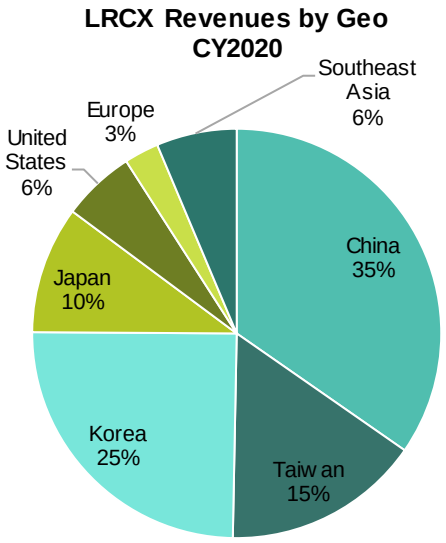
China exposure for both companies, and for the industry at large, has increased markedly over the years, from ~10-15% in 2014 to more than 30% today (though we note that some of AMAT's china exposure is due to display) (**Exhibit 91**) as capacity has grown in the country, both from local as well as multinational players. Going forward it may be more challenging to build out especially leading-edge facilities in China; hence we may see exposure come down somewhat as capacity is increasingly built in other regions (including, potentially, the US).

EXHIBIT 88: **China, Taiwan, and Kora make up the bulk of sales for both AMAT...**



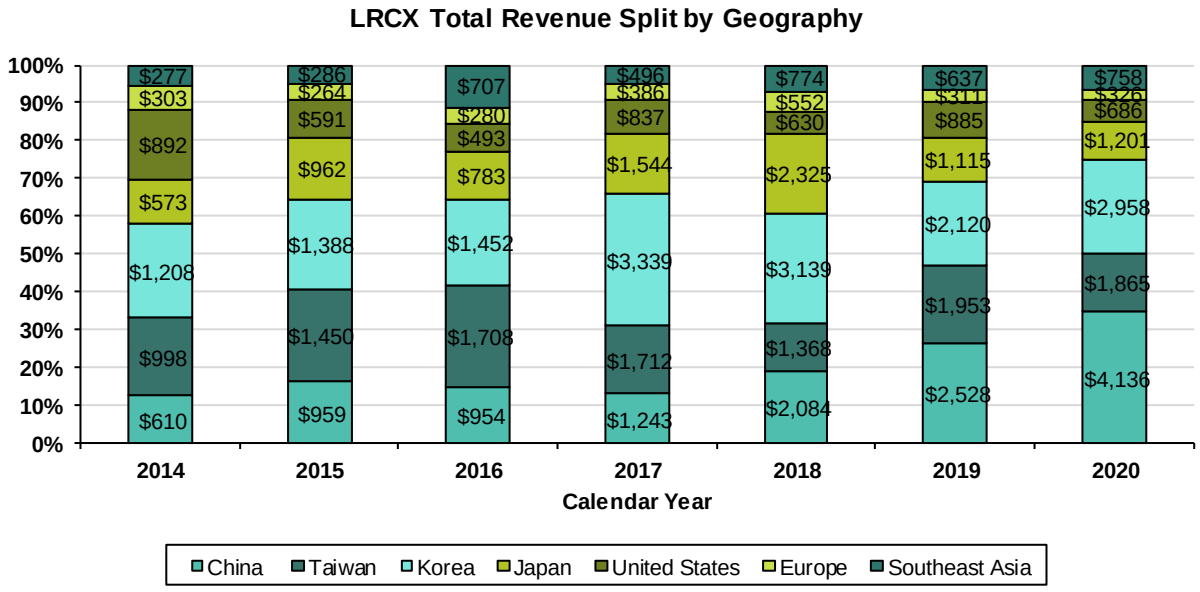
Source: Company reports, Bernstein analysis

EXHIBIT 89: **...and LRCX**



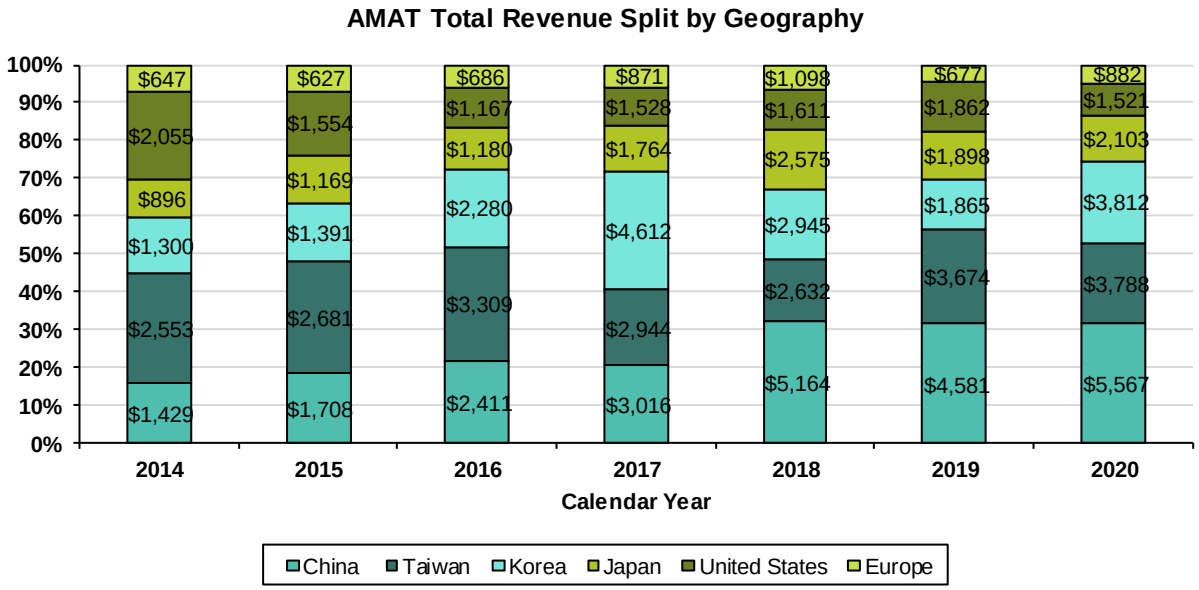
Source: Company reports, Bernstein analysis

EXHIBIT 90: **LRCX's China exposure has grown over the years; Korea exposure is also high given memory positioning**



Source: Company reports, Bernstein analysis

EXHIBIT 91: **AMAT's China exposure has also grown; Taiwan exposure is a bit higher than LRCX's given foundry positioning**



Source: Company reports, Bernstein analysis

WHAT IS THE STORY BEHIND THE STOCKS?

Initiating coverage on LRCX and AMAT at Outperform (LRCX OP, $700 TP; AMAT OP, $160 TP)

We are initiating coverage on Lam Research (LRCX) with an Outperform rating and a $700 target price. We are initiating coverage on Applied Materials (AMAT) with an Outperform rating and a $160 target price.

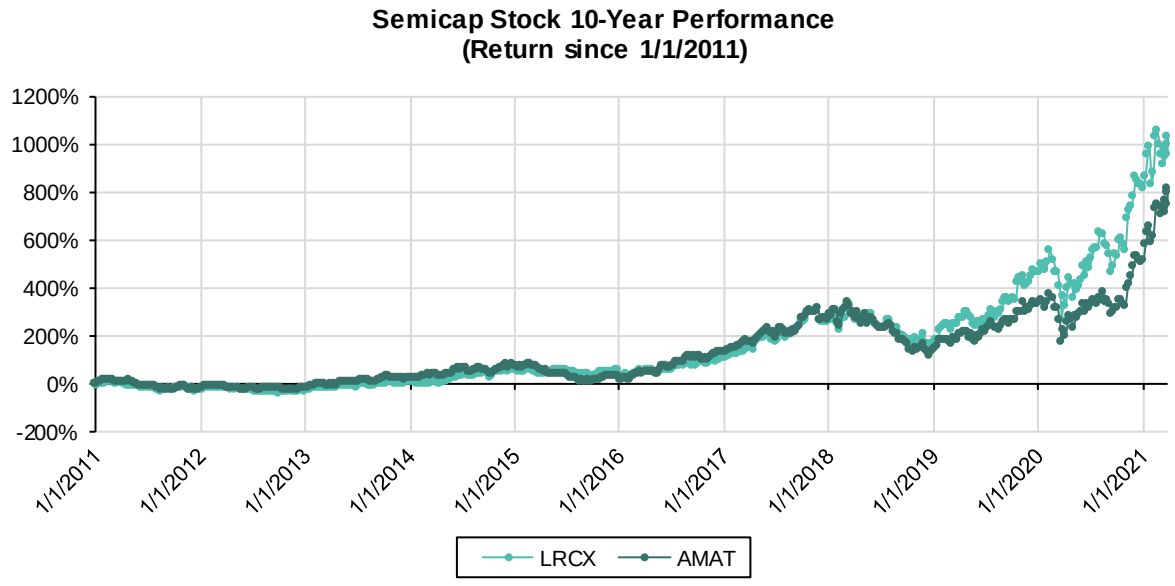
Both stocks have been stellar performers, benefitting from industry growth, structural improvements in semicap, as well as a shift in NAND dynamics as that industry shifted from 2D to 3D structures, driving significantly more etch and deposition and playing into the company's wheelhouse. Through both organic and inorganic means LRCX's revenues increased by ~5x over the last 10 years or so, and AMAT's sales have almost doubled. And the stocks have been (for those holding through the cycles) a home run, with LRCX returning 1000%, and AMAT up ~800% over the same timeframe as a result (**Exhibit 92**).

And we are cognizant that the current cycle, from a stock perspective, feels like it's getting a bit mature, with very strong recent performance. In 2020 a basket of the 5 biggest semicap stocks returned ~52% on average (LRCX the most at 62%, with AMAT the least at 41%), roughly inline with the SOX index (itself up 51%). So far YTD in 2021 however semicap has outperformed the broader semi market, with the same 5 stocks returning an average of ~27% (AMAT the best performer at 46%, with Tokyo Electron at 19%), above the SOX (9% YTD) and the S&P500 (6% YTD) (**Exhibit 93, Exhibit 94**).

Thus we suspect one of the first questions we are going to get with a bullish initiation here will be some variation of "Where the heck have you been until now?" But given the cyclical and secular changes that we believe are continuing, it still is not difficult for us to see the potential for more upside from here especially when taking a through-the-cycle perspective, and even after the run, we think there is still room to go.

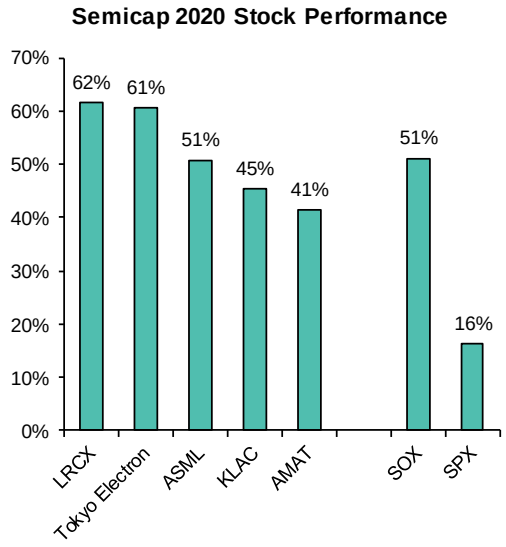
A structurally positive view on WFE is by itself likely enough to support a positive outlook on the stocks. But beyond this we believe both companies have a number of attractive additional components to create value and support multiples, including a burgeoning services story, increasing SAM opportunities, solid capital return, and analyst day catalysts (AMAT holds their meeting on April 6, and LRCX's recent long-term analyst day model suggests a good amount of upside from here).

EXHIBIT 92: **LRCX has 1000% over the last 10 years; AMAT has returned 800%**



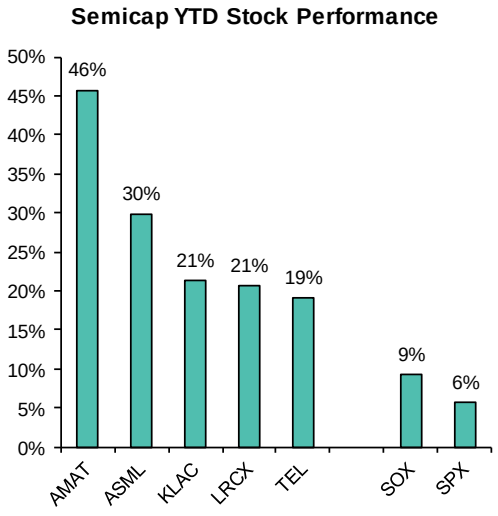
Source: Bloomberg, Bernstein analysis

EXHIBIT 93: **Semicap stocks on average performed strongly, but in-line with the SOX last year…**



Source: Bloomberg, Bernstein analysis

EXHIBIT 94: **…and have outperformed the SOX YTD, up an average of 27% vs 9% for the SOX and 6% for the S&P**



Source: Bloomberg, Bernstein analysis

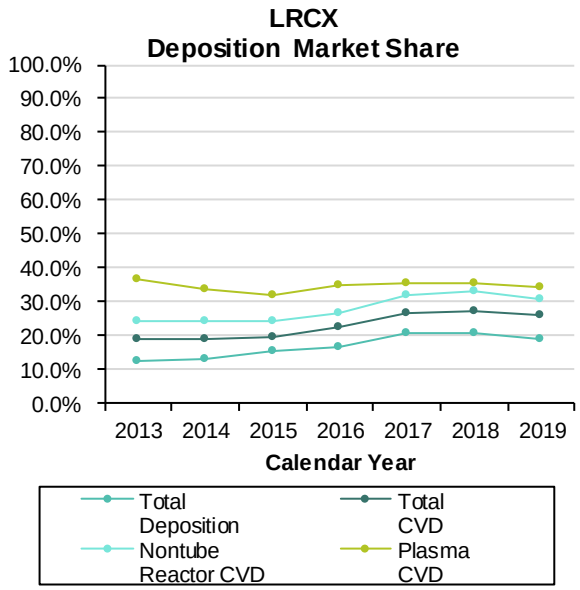
While each thinks they are/will be taking share, evidence is mixed; however SAM growth is very real both in core markets as well as a number of greenfield opportunities

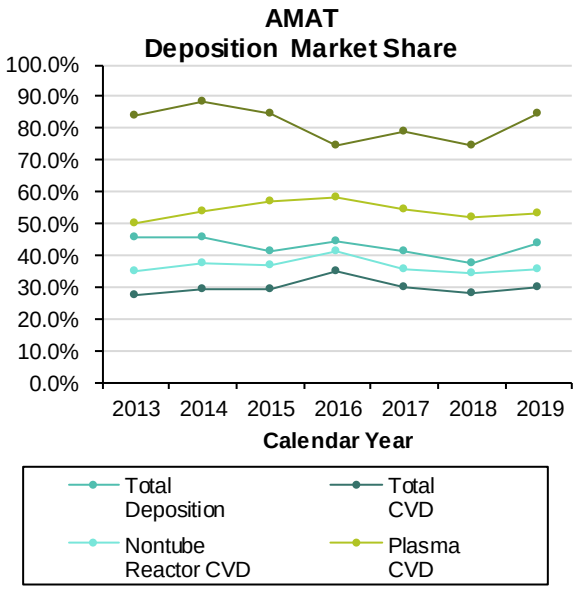
We have yet to run into a company, in any industry, that does not believe they are, or will be, taking share from competitors, and semicap is no exception, with share gains naturally forming a piece of everyone's forward strategy. For example, LRCX believes they can take ~3 points of etch share over the next several years, and ~2-4 points of deposition share; AMAT has talked about similar things in the past as well.

An examination at the surface level for evidence of sustainable share shifts between companies is, however, somewhat mixed. Over the years a cursory examination of market data suggests LRCX has in fact taken share in deposition, particularly CVD, whereas AMAT share has bumped around a bit year to year but not changed all that much (**Exhibit 95**). Conversely, within etch AMAT has taken share in conductor etch (while essentially exiting dielectric etch), with LRCX share in both conductor and dielectric flat to a bit down over the last several years (**Exhibit 96**). Of course, these share numbers taken at face value don't necessarily mean all that much, as they will be driven in any given year by relative strength in end markets (logic vs foundry vs DRAM vs NAND) and specific customer actions given different exposures.

But putting share aside, there is strong evidence that the SAM for both companies is growing as industry shifts more toward the deposition and etch processes that make up much of LRCX and AMAT's wheelhouse as increasing layer counts, more complex new structures, and new materials require more from the semicap players. In fact, since 2013 deposition itself has picked up more than 200bps of WFE share; etch has picked up more than 600 bps, driven by increasing complexity in logic and the shift from 2D NAND to 3D NAND (**Exhibit 97**), all within the context of a strongly growing WFE market over the cycle, and driven solid through-cycle growth for both companies (**Exhibit 98**).

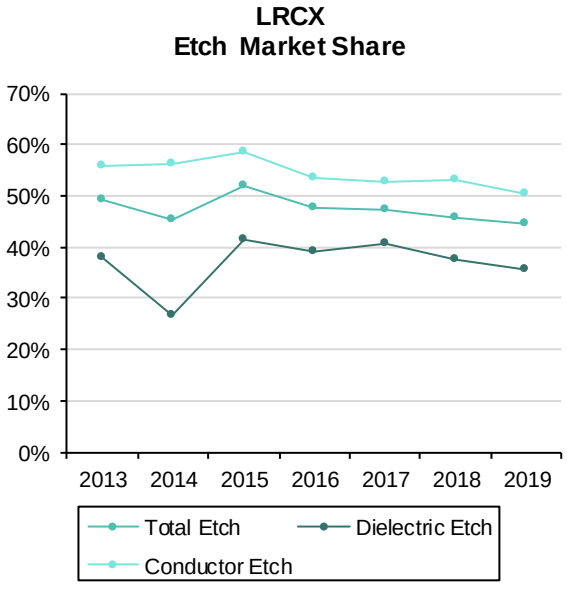
EXHIBIT 95: **LRCX has picked up "headline" deposition share over the last several years, whereas AMD share performance has been flatter**

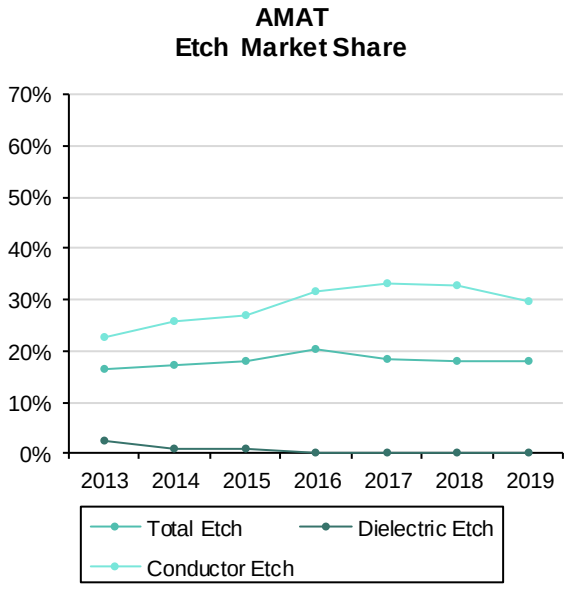




*LRCX share adjusted for Novellus acquisition
Source: Gartner, Bernstein analysis

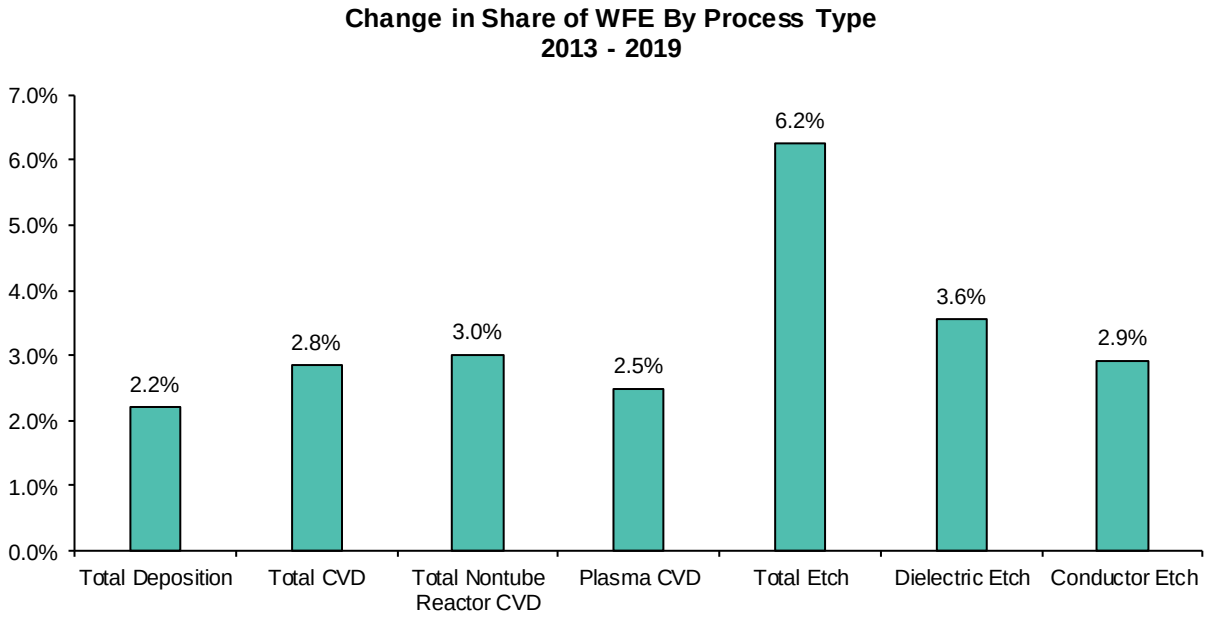
EXHIBIT 96: **LRCX has lost some "headline" etch share over the last several years; AMAT picked up some conductor etch share but effectively exited dielectric**





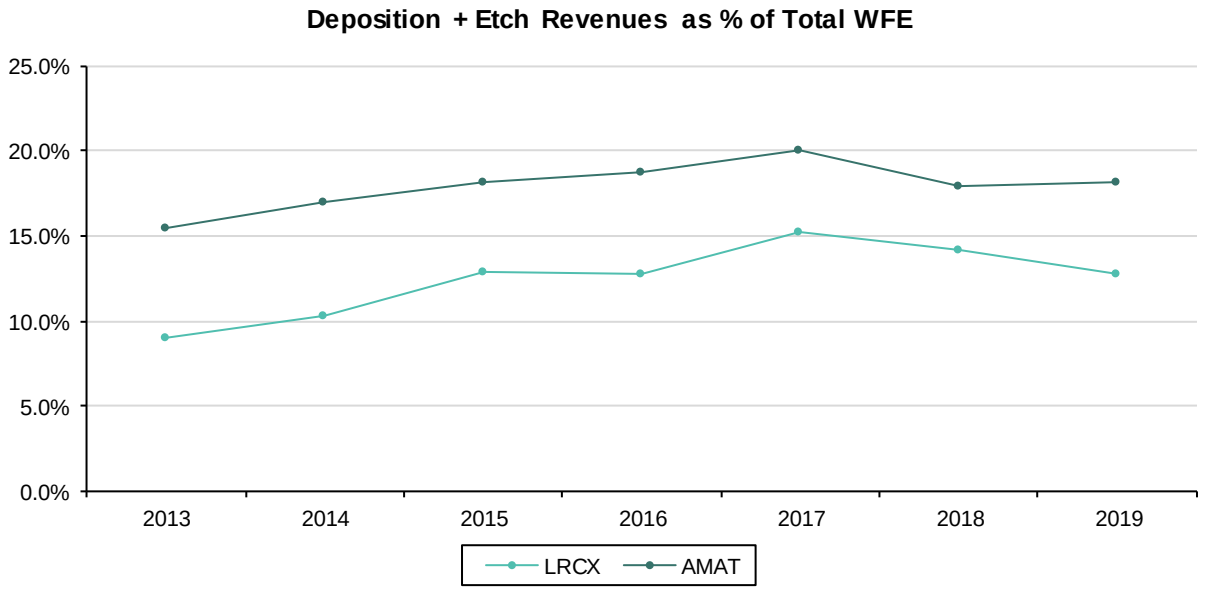
Source: Gartner, Bernstein analysis

EXHIBIT 97: **But deposition and etch have increasingly taken share of the overall WFE market...**



*LRCX deposition process shares adjusted for Novellus acquisition
Source: Gartner, Bernstein analysis

EXHIBIT 98: **...and driven growth for both LRCX and AMAT**



Source: Gartner, Bernstein analysis

We expect this trend to continue as layer counts increase and structures grow increasing complex across both logic and memory markets. Logic is moving to increasing 3D structures with more complex processing and increased layer counts (recall our earlier discussion of GAA transistors, CFETs, etc; which will increase the roles of epitaxy and ALD as well as more traditional product markets). NAND flash is continuing to push on layer counts (**Exhibit 99**), with both companies improving tools (and developing new ones) to enable it. And DRAM is running into scaling problems today, necessitating the initiation of EUV to print smaller features, but DRAM over time will eventually likely require 3D structures of its own, further increasing deposition/etch intensity.

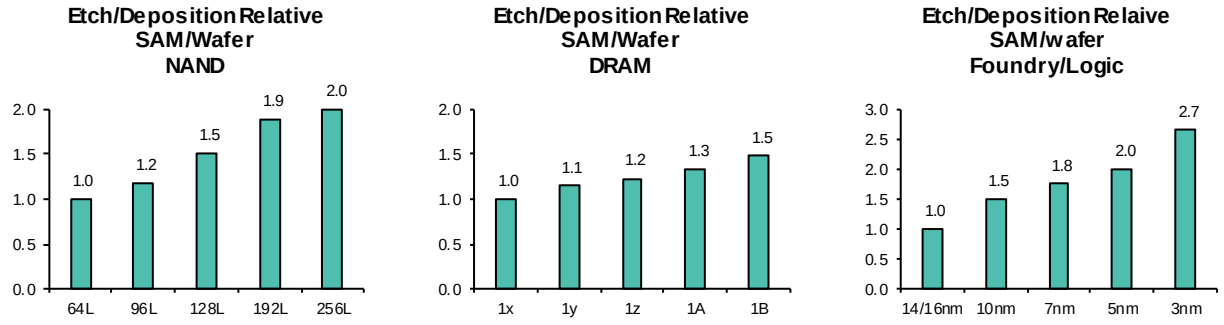
EXHIBIT 99: **Memory players continue to scale NAND through layer addition**

	MS%	2013	2014	2015	2016	2017	2018	2019	2020	2021E	2022E	2023E
Samsung	*38%*		24L	32L	48L	64L		92L		128L	176L	2XXL
Kioxia/WDC	*27%*				48L	64L		96L		112L	160L	2XXL
Micron/Intel**	*22%*				32L	64L		96L		128L	176L	2XXL
SK Hynix	*12%*					48L	72L		96L	128L	176L	2XXL
YMTC	*0%*							32L	64L	128L		192L

*Note that Intel has sold their NAND business to Hynix; Micron/Intel roadmap represents Micron only after 96L
Source: Press searches, company reports, Techinsights, Bernstein estimate and analysis

In fact LRCX has given some color on their own view for SAM/wafer growth across all their key markets as these trends develop and they introduce new products to capture them (**Exhibit 100**), numbers that seem eminently reasonable to us. Additionally, both companies have a number of new initiatives that than potentially carry them beyond their current purview into new markets.

EXHIBIT 100: **Technology advancement should be good for LRCX SAM growth**



Source: Company reports, Bernstein analysis

Both companies are looking at some new greenfield opportunities to grow share into new, previously under-served markets as well. For example, Applied Materials plays in inspection and process control, and has significant market share especially in Ebeam (~30-40% share in Ebeam inspection and CD-SEM, and ~60% in Ebeam defect review). However, their optical share has been smaller, ~15% in a market where KLAC dominates. But, the company recently spoke of new products to marry both their Ebeam inspection expertise with their recent optical platform ("Enlight") together with AI analysis to quickly zero in on wafer defects that are more likely to be real, while rejecting the massive amounts of false defects / noise that would be otherwise identified. The company believes they have a 3x lower cost per wafer scan than the competition (presumably KLA) (**Exhibit 101-Exhibit 102**).The Enlight platform has seen ~$400M in cumulative revenue over the last 5 quarters with adoption by every leading edge customer, with market share in the >$1B optical patterned wafer inspection market jumping in 2019 upon introduction of the Enlight tool (**Exhibit 103**).

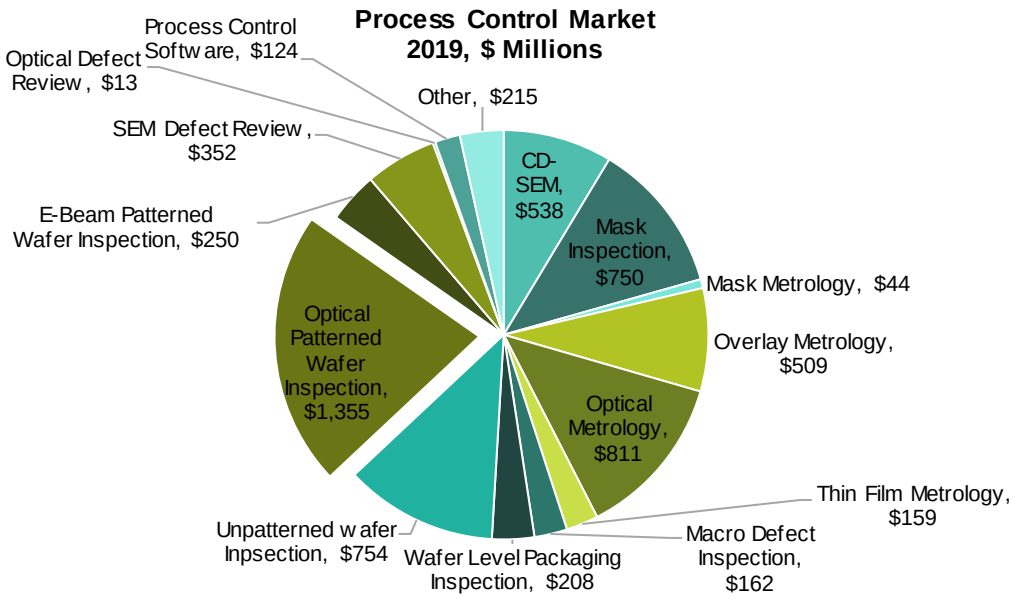
For LRCX, one interesting greenfield opportunity is dry photoresist, which the company is working on together with ASML and IMEC. As features get smaller (and for EUV lithography in particular) traditional liquid photoresist processing has a number of disadvantages including pattern collapse (where surface tension from liquid developer solution pulls features over on the wafer), challenging control resist thickness during spin processing, resist decay, and time-consuming experimentation when evaluating new resist materials.

In a dry resist process however, a photoresist is deposited on the wafer using a CVD (chemical vapor deposition) process, with the thickness controlled primarily by the deposition time vs having to play off spin speed and viscosity effects. The resist is exposed similarly as normal resists, with exposure changing the etch selectivity of the material. The exposed wafer is then baked, and then "dry-developed" in what is essentially an etching step, with the remaining material used to pattern the underlying layers.

As compared to traditional wet photoresist processing, dry resists, while still in development, could be quite beneficial. The process can be tuned much easier using knobs right on the tool (gas flows, temperature, pressure, etc.) vs having to develop new resists and developers in an external lab. There are significant potential environmental savings with substantially lower chemical and water usage (important from an ESG consideration). And most importantly, dry resists have the potential to improve throughput as they require a lower dose (a major potential cost improvement especially for EUV where throughput is difficult to increase) which could help make EUV more economical (hence the interest from ASML, as well as IMEC, on the technology).

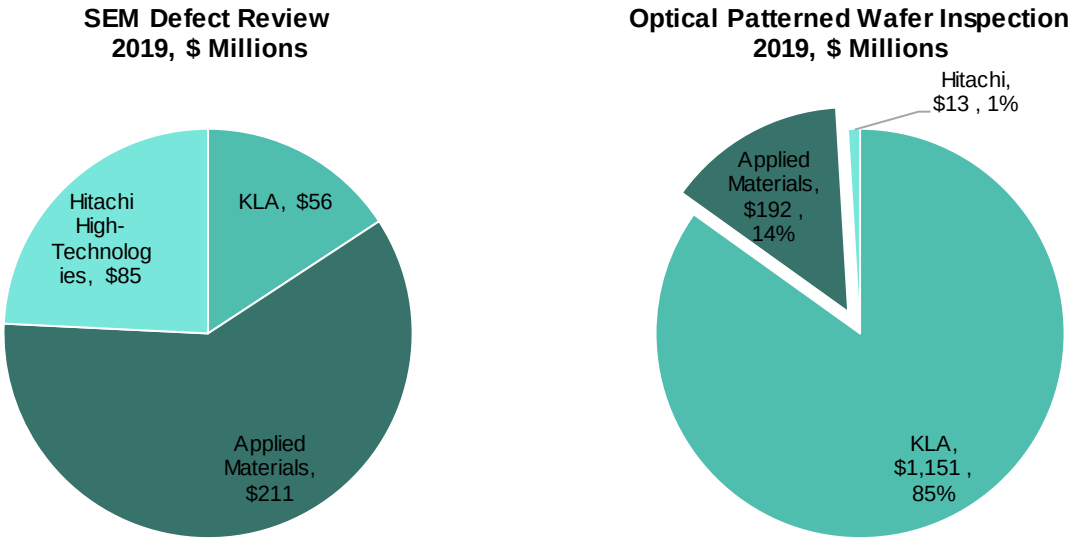
The process would open up some of the resist processing (track) market, currently ~$2B, to LRCX (**Exhibit 104**), as well as conceivably some of the photoresist market also (itself ~$1.5B, **Exhibit 105**). While uptake will take time, LRCX sees their available EUV SAM/wafer doubling by the 3nm node (as an aside helping to cast away worries that widespread adoption of EUV will be a detriment to the LRCX's and AMATs of the industry), with dry resist making up a portion of it (**Exhibit 106**) and is targeting ~$1.5B in cumulative revenue from the technology over the next 5 years, which seems reasonable given the size of the available markets it could potentially replace.

EXHIBIT 101: **AMAT is looking to disrupt the ~>$1B optical inspection market...**



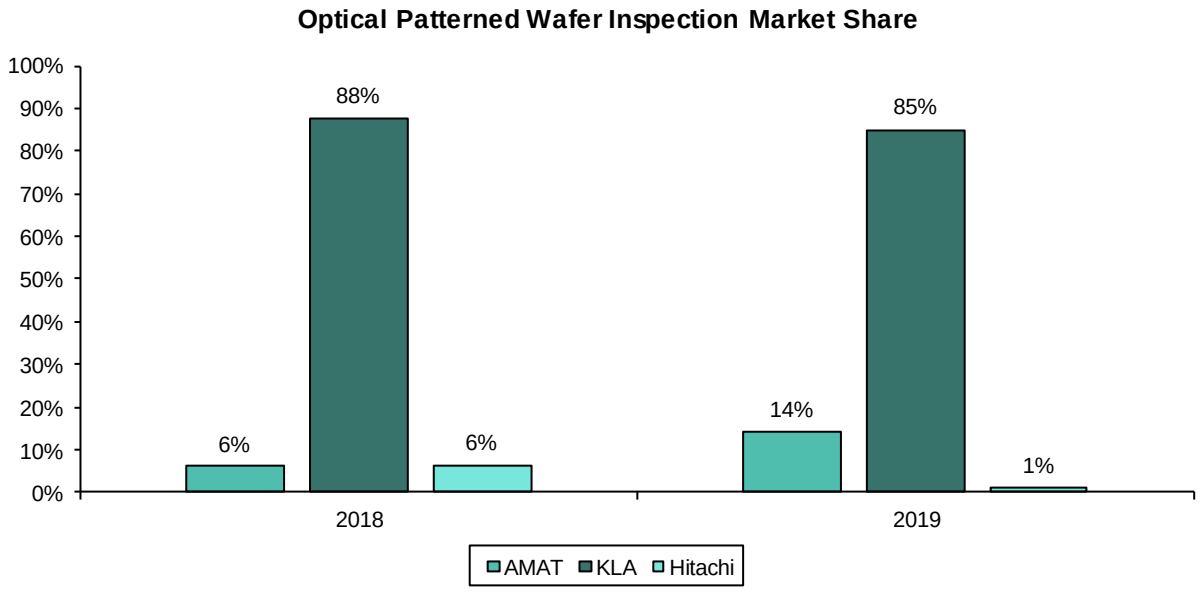
Source: Gartner, Bernstein analysis

EXHIBIT 102: **...leveraging a dominant position in E-beam review, a new high-throughput optical platform, and AI data to significantly reduce customer cost for inspection**



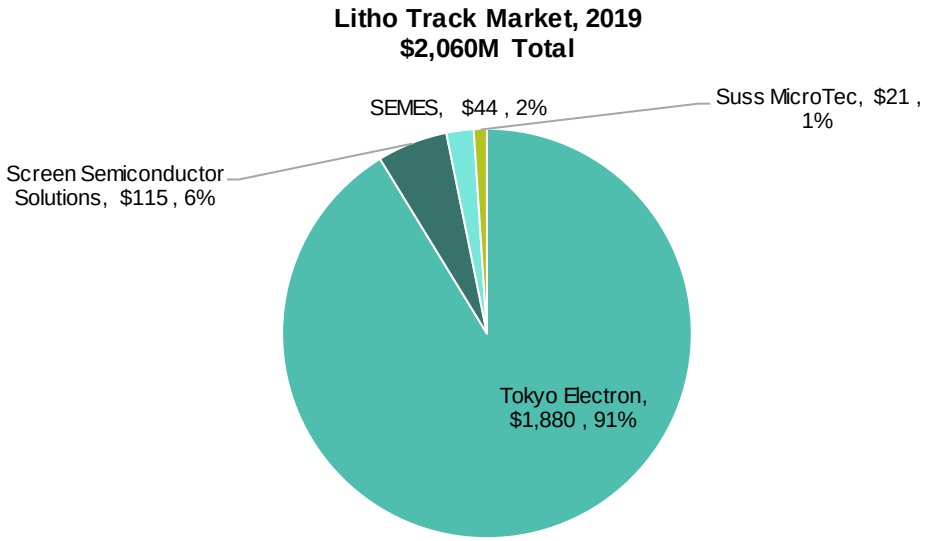
Source: Gartner, Bernstein analysis

EXHIBIT 103: **AMAT has begun to take more share in inspection**



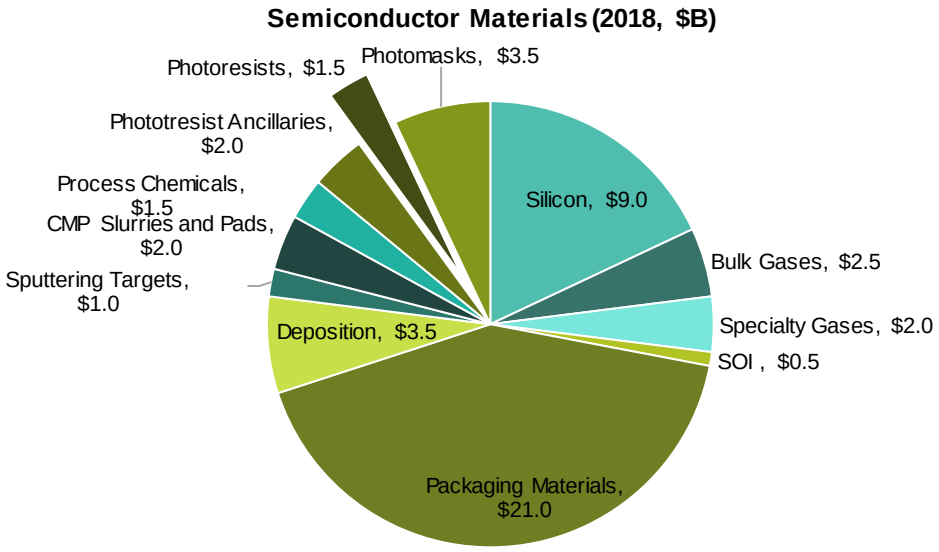
Source: Gartner, Bernstein analysis

EXHIBIT 104: **Lithography processing equipment (track) is a ~$2B market**



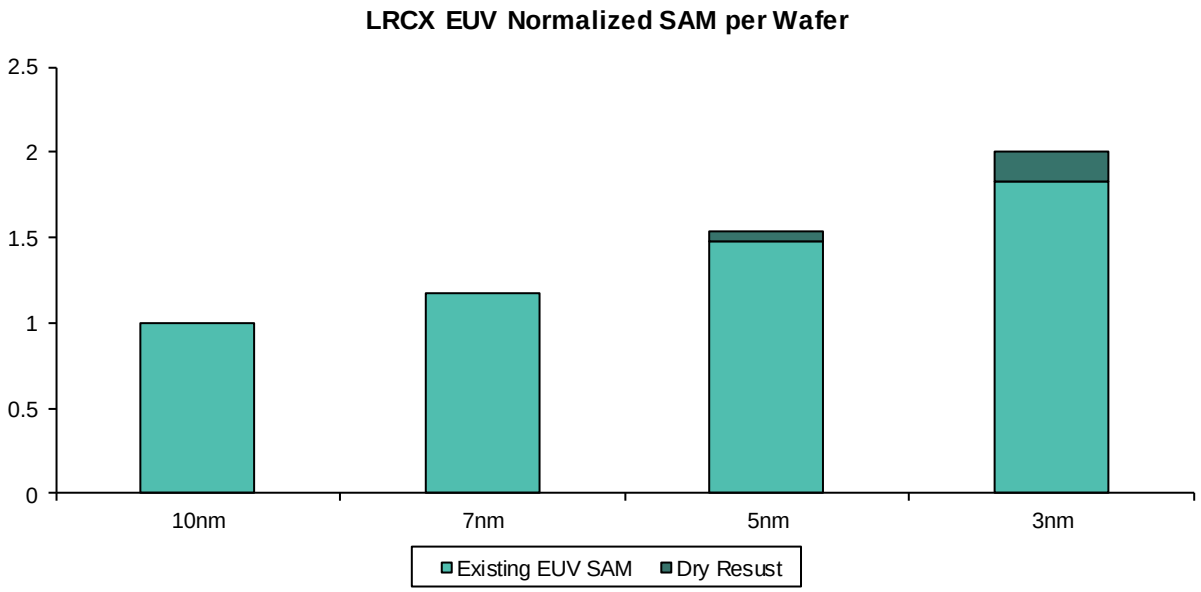
Source: Gartner, Bernstein analysis

EXHIBIT 105: **Photoresists themselves are a ~$1.5B market**



Source: Versum materials Industry Strategy Symposium 2018 presentation, Bernstein analysis

EXHIBIT 106: **LRCX sees their EUV SAM doubling by 3nm, with some further upside from the dry resist opportunity**



Source: Company reports, Bernstein estimates and analysis

Services are becoming an increasingly stabilizing force with continued strong growth potential; we believe both LRCX and AMAT can add $1.5B+ in incremental services revenues over the next several years and grow the business in the double digits

Semiconductor manufacturing tools don't operate on their own forever. They require regular maintenance and servicing, spare parts, etc. Hence semicap companies also make money by providing service and support to their installed base of tools, which typically numbers in the 10's of thousands.

Traditional services businesses include providing spare parts (consumables and non-consumables), repair and refurbishing, reconditioning of parts, chamber maintenance, and preventive maintenance. Additionally, some semicap companies include their sales of used and refurbished tools, as well as (sometimes) lagging edge (200mm and below) equipment in the segment. Between the two companies, LRCX has higher services exposure than AMAT given a more focused product offering and larger installed base (**Exhibit 107**).

Over a long period of time service revenues, at least for players like LRCX and AMAT, have grown in-line to a bit above equipment revenues, and in any given year could undergrow or outgrow relevant equipment sales. However, in recent years we have begun to see services act as a significant stabilizer for semicap companies, with growth rates on a 7, 5, and 3 year basis much more stable, and at an increasingly large premium vs the much more volatile underlying equipment growth (**Exhibit 108**). In fact, service revenues for both LRCX and AMAT continued to grow even in 2019 (when both companies saw equipment revenues fall close to 20%; **Exhibit 109**), and neither company has seen services decline YoY at least since 2013.

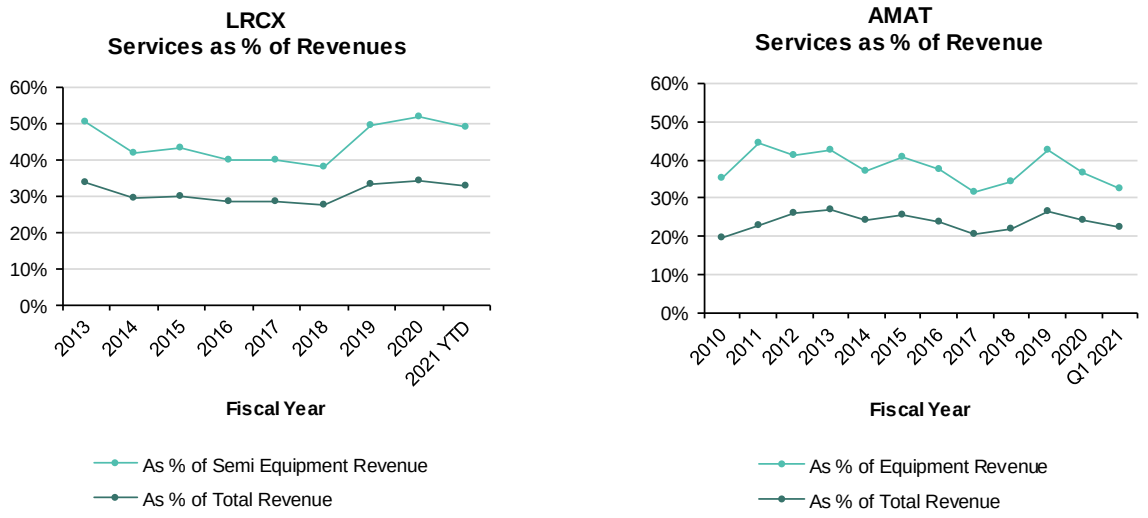
Ultimately services revenues are a function of installed base growth and services spend per tool. But the installed base is always growing as tools tend to be used for many years. For example LRCX's installed base has grown fairly consistently at ~10% annually, and currently stands at around ~66K tools, while AMAT's installed base (which includes some display) stands at ~46K tools, growing historically around 5% annually (**Exhibit 110**).

As processing gets more complex, there is an increasing opportunity to increase spend through a number of levers. Most semicap companies have been successful at increasing their attach rate of long-term contracts vs relying on transactional interactions. They are increasingly providing new data-enabled service, using increasing amounts of data collection at the tool itself to optimize processes, enable predictive maintenance (resulting in taking the tool down for maintenance only as needed, saving uptime), and reduce/eliminate variability. Consequently we have seen a significant increase in realized service revenues per tool, up on the order of 50% since 2013 for both LRCX and AMAT (**Exhibit 111**), with services revenues consistently outgrowing the installed base on almost any timeframe (**Exhibit 112**). And there is likely more room to go (for example, LRCX

believes by 2023 they will be earning ~1.7x as much service revenue per tool vs 10 years before, which would put it at ~$61K, almost 20% higher than current levels).

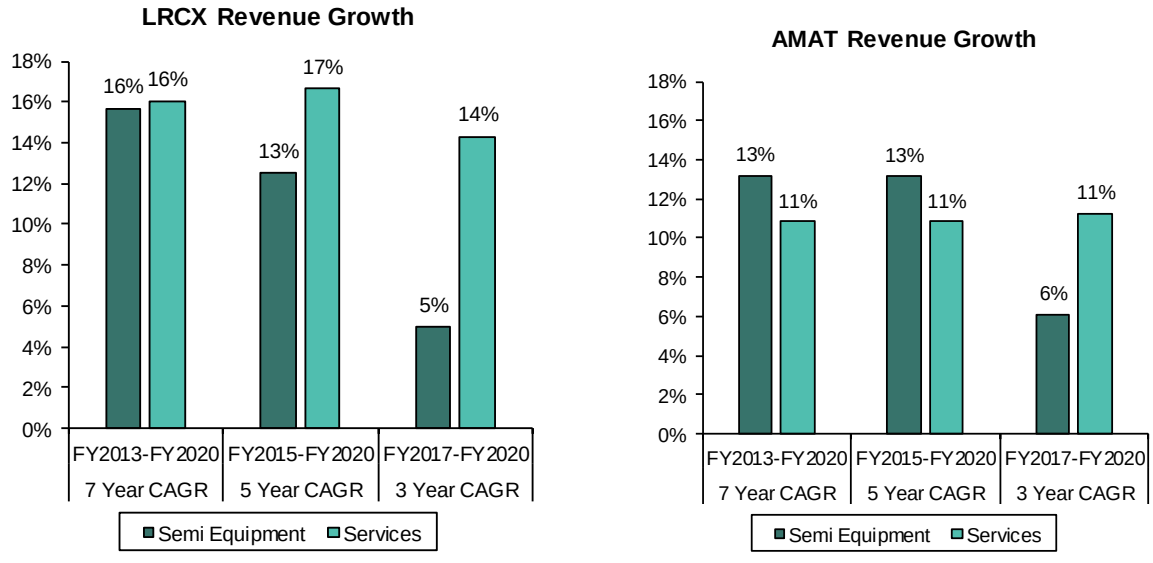
For LRCX, this plausibly suggests the company can maintain continued double-digit services growth over the next cycle, likely racing $5B+ level by FY2023, adding $1.5B or more in additional revenues over the next three years (**Exhibit 113**). We see similar dynamics for AMAT if they can continue (as they have historically) on a similar revenue/tool trends as LRCX, also adding in excess of $1.5B by FY2023 reaching services revenues in the high $5B to $6B over the next 3 years (**Exhibit 114**).

EXHIBIT 107: **LRCX has higher services exposure than AMAT**



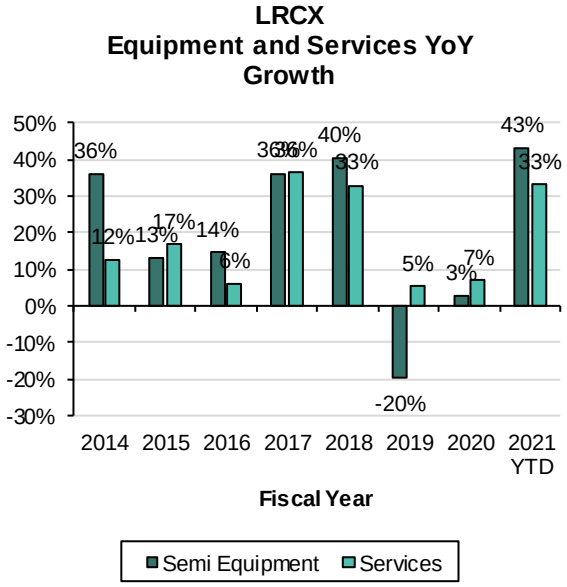
Note that AMAT services revenues also include display
Source: Company reports, Bernstein estimates and analysis

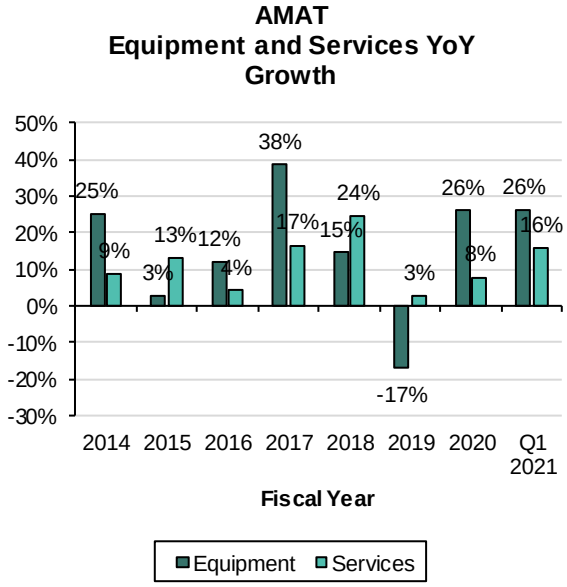
EXHIBIT 108: **Services revenue have proved to be a stabilizing force in recent years...**



Note that AMAT services revenues also include display
Source: Company reports, Bernstein estimates and analysis

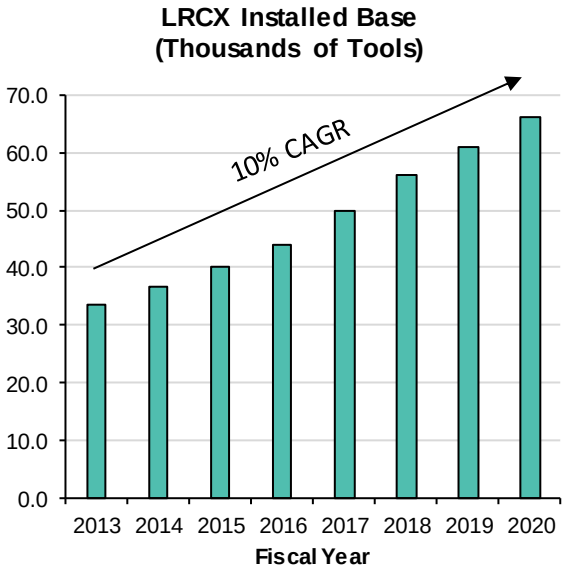
EXHIBIT 109: **...growing YoY even through recent downturns**

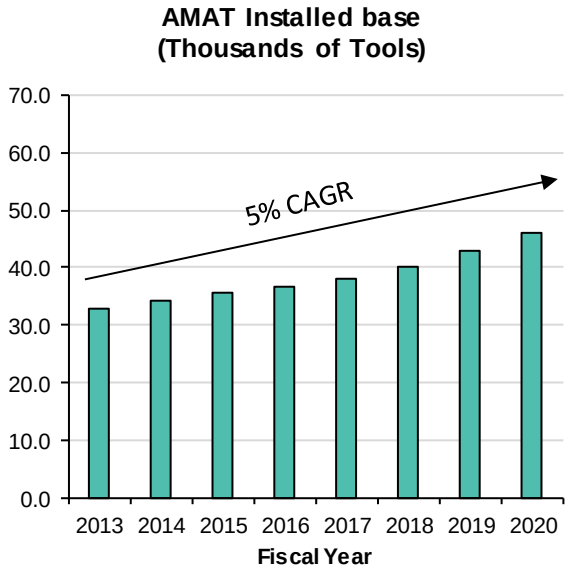




Note that AMAT services revenues also include display
Source: Company reports, Bernstein estimates and analysis

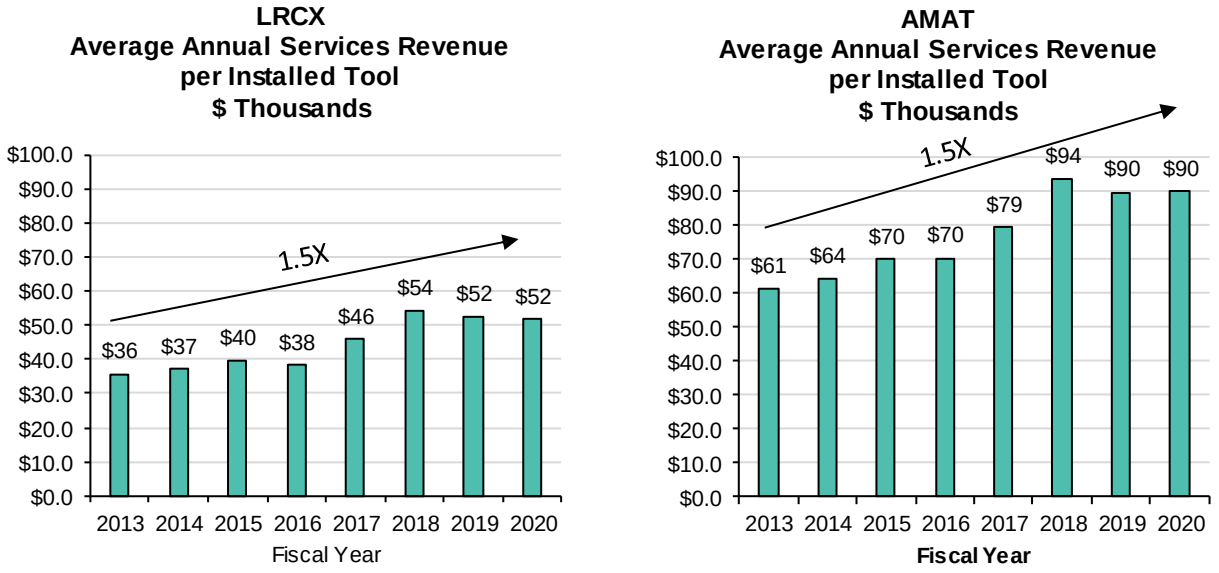
EXHIBIT 110: **Semicap tool installed bases have grown consistently over time**





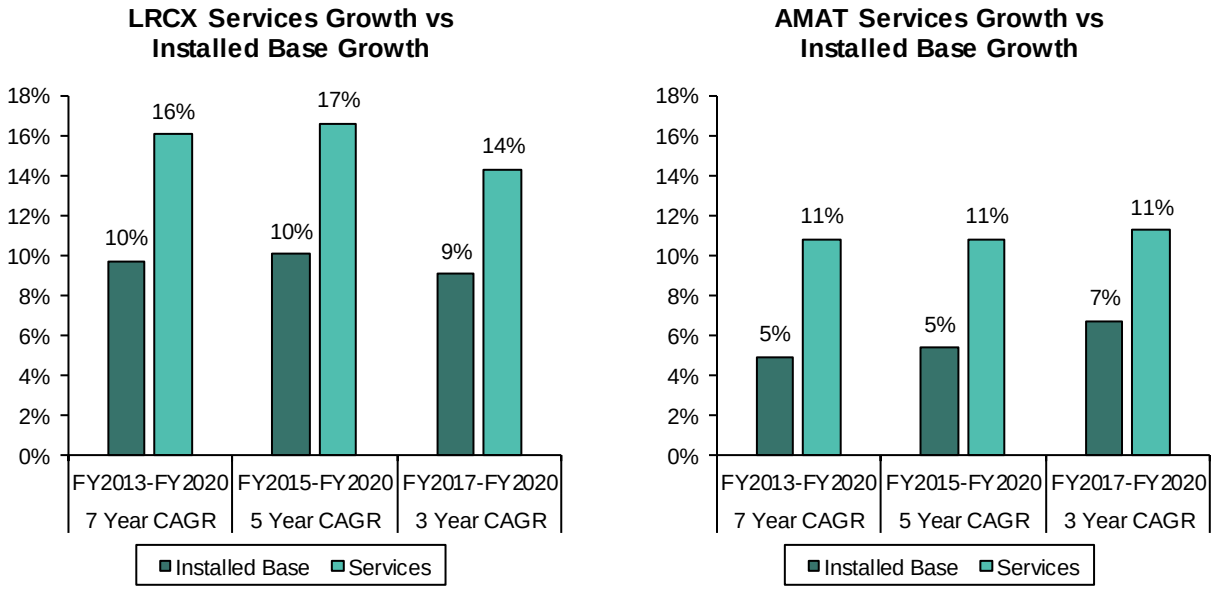
Note that AMAT installed base also include display
Source: Company reports, Bernstein estimates and analysis

EXHIBIT 111: **Average services revenue per tool has been increasing over time as a result of higher attach and greater value-add**



Note that AMAT services revenues and installed base also include display. Also note that 2019 was a downturn year, and 2020 was impacted by COVID
Source: Company reports, Bernstein estimates and analysis

EXHIBIT 112: **Hence services revenues have consistently outgrown the installed base**



Note that AMAT services revenues and installed base also include display
Source: Bernstein analysis

EXHIBIT 113: **We believe LRCX can continue growing their services business in the double digits, likely adding ~$1.5B and reaching in excess of $5B by FY2023**

LRCX FY2023 Services Revenues, $ Billions ($3.4B in 2020)

		Installed Base Growth 2020-2023					
		5%	6%	7%	8%	9%	10%
2023 Services Revenue per Installed chamber Relative to 2013	1.5	$4.1	$4.2	$4.3	$4.5	$4.6	$4.7
	1.6	$4.4	$4.5	$4.6	$4.8	$4.9	$5.0
	1.7	$4.6	$4.8	$4.9	$5.1	$5.2	$5.3
	1.8	$4.9	$5.1	$5.2	$5.4	$5.5	$5.7
	1.9	$5.2	$5.3	$5.5	$5.7	$5.8	$6.0

LRCX Services Revenue CAGR, FY2020-FY2023

		Installed Base Growth 2020-2023					
		5%	6%	7%	8%	9%	10%
2023 Services Revenue per Installed chamber Relative to 2013	1.5	6%	7%	8%	9%	10%	11%
	1.6	9%	10%	11%	12%	13%	14%
	1.7	11%	12%	13%	14%	15%	16%
	1.8	13%	14%	15%	16%	17%	18%
	1.9	15%	16%	17%	18%	19%	20%

Source: Company reports, Bernstein estimates and analysis

EXHIBIT 114: **We believe AMAT can see similar dynamics, adding $1.5B (or more) in services revenues by FY2023 and reaching high $5B to $6B**

AMAT FY2023 Services Revenues, $ Billions ($4.2B in 2020)

		Installed Base Growth 2020-2023					
		4%	5%	6%	7%	8%	9%
2023 Services Revenue per Installed chamber Relative to 2013	1.5	$4.8	$4.9	$5.1	$5.2	$5.4	$5.5
	1.6	$5.1	$5.2	$5.4	$5.6	$5.7	$5.9
	1.7	$5.4	$5.6	$5.7	$5.9	$6.1	$6.2
	1.8	$5.7	$5.9	$6.1	$6.2	$6.4	$6.6
	1.9	$6.1	$6.2	$6.4	$6.6	$6.8	$7.0

AMAT Services Revenue CAGR, FY2020-FY2023

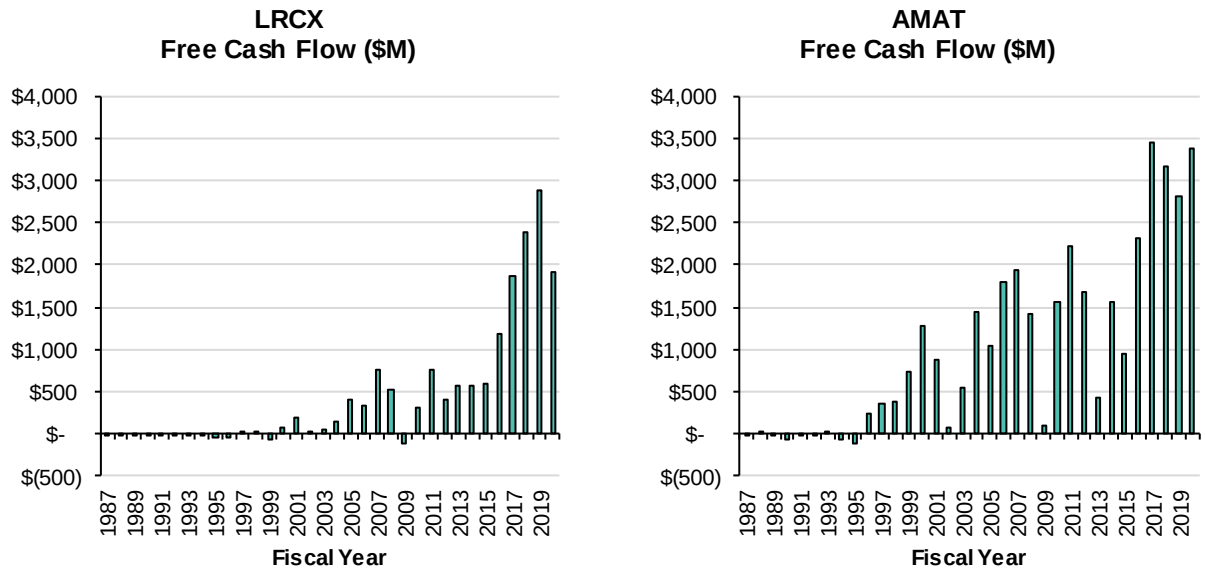
		Installed Base Growth 2020-2023					
		5%	6%	7%	8%	9%	10%
2023 Services Revenue per Installed chamber Relative to 2013	1.5	5%	6%	7%	8%	9%	10%
	1.6	7%	8%	9%	10%	11%	12%
	1.7	9%	10%	11%	12%	13%	14%
	1.8	11%	12%	13%	15%	16%	17%
	1.9	13%	14%	16%	17%	18%	19%

Source: Bernstein analysis

Capital return can act as a further value driver for both stocks and help support multiples

While still somewhat volatile over the cycle, free cash flow generation for LRCX and AMAT has increased by leaps and bounds as the WFE market, and consequently, revenues, have grown over the years (**Exhibit 115**). And as the companies have gained scale profitability has followed, with free cash flow margins structurally increasing over time, today sitting in the 20-30% range for both (**Exhibit 116**)

EXHIBIT 115: **Free cash flow has grown by leaps and bounds over the year**

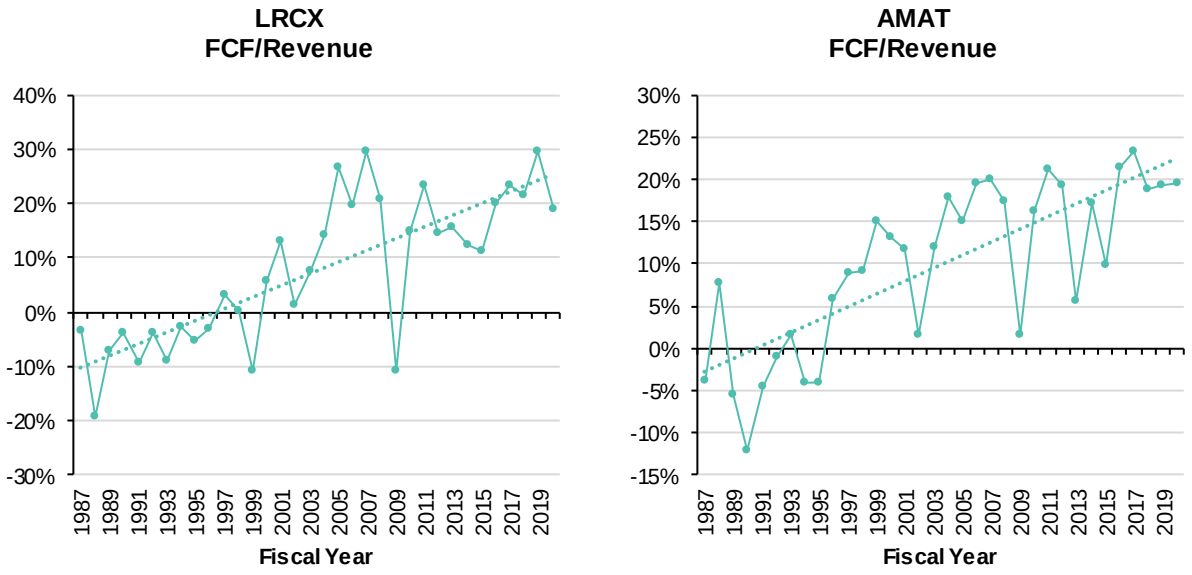


Source: Bloomberg, Bernstein analysis

And as cyclicality has lessened and FCF has grown, the companies have shown increasing willingness to return cash. AMAT instituted a dividend in 2005; LRCX in 2015, and the pace of cash return has accelerated over the years. And while it can vary significantly in any individual year, on average both LRCX and AMAT return ~100% of FCF in the form of dividends and buybacks to shareholders (**Exhibit 117**) with a substantial reduction in outstanding shares for both companies (down ~12% since FY2013 for LRCX, and down ~25% for AMAT) (**Exhibit 118**).

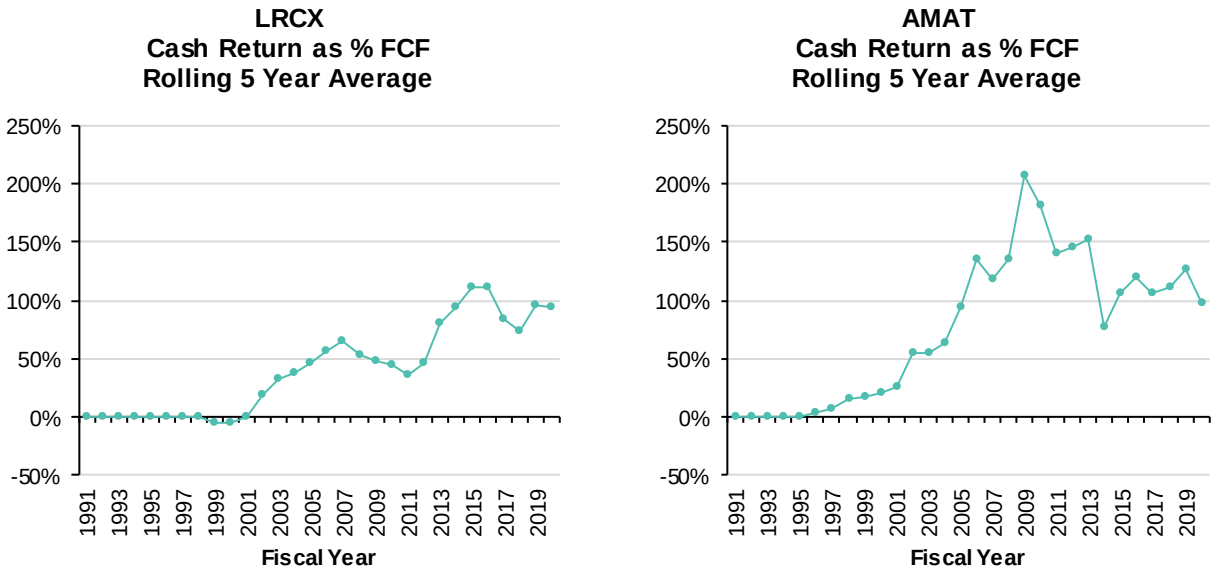
LRCX currently has ~$5B in buyback authorization outstanding. And AMAT has just upped their buyback authorization, allocating a new $7.5B for buybacks following the termination of the Kokusai deal. We will hear more on AMAT's capital return policy at their forthcoming analyst day, but we expect it to be positive.

EXHIBIT 116: **Free cash flow margins have structurally grown over time**



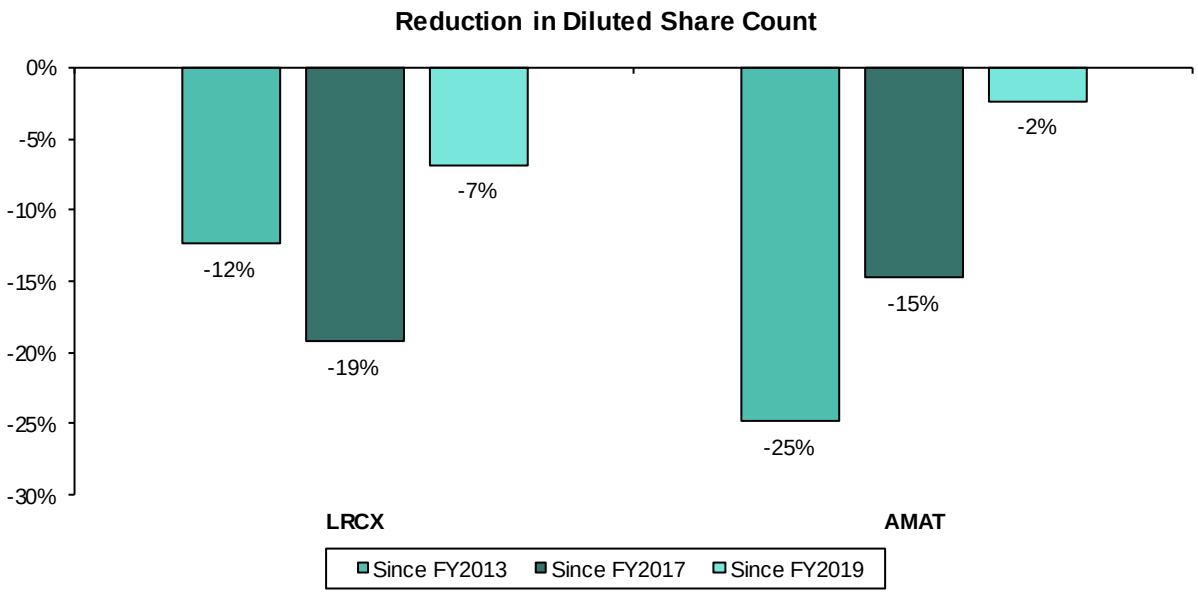
Source: Bernstein analysis

EXHIBIT 117: **While the pace is a bit lumpy, on average both LRCX and AMAT have returned close to 100% of FCF to shareholders over the last 5 years**



Source: Bloomberg, Bernstein analysis

EXHIBIT 118: **Both LRCX and AMAT have substantially reduced outstanding shares**



Source: Bloomberg, Bernstein analysis

LRCX's recently-shared analyst-day model suggests upside…

LRCX has made it a habit to give some color on their longer-term expectations at their analyst days. For example, back in 2018 the company guided to a 2021 model implying ~$15B in revenues and ~$24 in EPS on WFE expectations in mid-50's (**Exhibit 119**). And overall the operating numbers may eventually come in close to it; we note that consensus currently has expectations for CY2021 revenues a bit above $14B, with EPS of ~$26, though of course memory WFE in particular in recent years has been tougher.

At the most recent analyst day Lam management gave a point of view on a CY2023/24 model that, at least from an operating perspective, looks quite similar to the prior 2021 model at least at the low end (~$15B in revenue and ~32.5% operating margin), though EPS is far higher (in the low 30's) given share buybacks and consequent reduction in outstanding shares. However, we note that the CY2020 WFE environment is already sitting roughly at the low end of the CY2023 model, with lower revenues (~$12B). Hence it would seem that LRCX management expects considerable upside from here even in a roughly stagnant WFE environment, and more if WFE grows (**Exhibit 120**).

EXHIBIT 119: **The low end of LRCX's CY2023/24 model looks similar to the 2021 model presented at the 2018 analyst day from an operating perspective, with significantly higher EPS on lower share count**

	CY2021 Model Given in 2018	CY2023/24 Model		
WFE ($B)	$55	$60	$65	$70
Revenue ($B)	$15.5	$15.0	$16.0	$17.0
PF OPM (%)	33.0%	32.5%	33.0%	33.5%
PF OP ($B)	$5.1	$4.9	$5.3	$5.7
PF EPS	$25.0	$31.0	$33.5	$36.0

Source: Company reports, Bernstein estimates and analysis

EXHIBIT 120: **The CY2023 model suggests significant upside in a WFE environment similar to current levels**

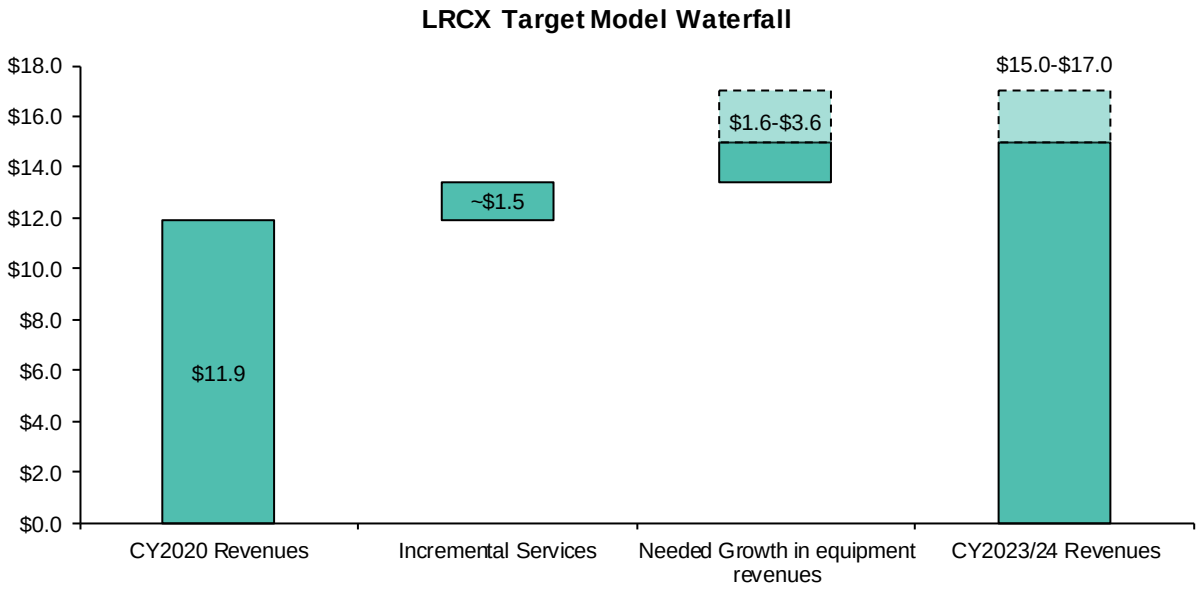
	CY19	CY20	CY2023/24 Model		
WFE ($B)	$56	$63	$60	$65	$70
Revenue ($B)	$9.6	$11.9	$15.0	$16.0	$17.0
PF OPM (%)	27.8%	29.4%	32.5%	33.0%	33.5%
PF OP ($B)	$2.7	$3.5	$4.9	$5.3	$5.7
PF EPS	$13.70	$20.47	$31.0	$33.5	$36.0
DSO (M)	182	147	152	153	154

Source: Company reports, Bernstein estimates and Bernstein analysis

Roughly speaking, the company appears to expect ~$3B in incremental revenues over the next 3-4 years in a flattish WFE environment, and more if WFE grows. And digging in here suggests it seems doable; given our belief that the company could see an incremental ~$1.5B or so in services revenues over that sort of a timeframe, LRCX would need ~$1.5B in incremental equipment sales to hit the low end of their guidance, and ~$2.5B to hit the higher end (**Exhibit 121**), which would imply some share gains. But their model also tops out at WFE spending of ~$70B, a number we believe the industry is likely to solidly exceed this year, let alone waiting for CY2023 or 24.

Hence, we do not believe growth numbers like this are a stretch, with a number of levers available (whether through market growth, relative memory strength, SAM growth, share gains, or any combination of them). And the stock is today trading at a mid-teens multiple on the likely earnings power such a revenue profile could bring, with EPS in the low to mid 30's probable at that point.

EXHIBIT 121: **Given likely services growth LRCX only needs ~$1.6B in incremental equipment revenues to enter their CY2023 model, implying a low 30's to mid-30's EPS**



Source: Company reports, Bernstein estimates and analysis

…and AMAT holds their own analyst day next week, where we believe we could get a new long-term model that could leave further room for numbers to move up.

Applied Materials is actually holding an analyst day next week on Tuesday, at which point we expect to get further color on product roadmap and strategy, capital allocation, and a new long-term model.

As the old saying goes, predicting is hard, especially about the future. But performance against prior long-term models from the company have been, at least from an operating perspective, good; while market share forecasts were not always spot on given growth of WFE in areas where the company did not play (like EUV or dielectric etch), overall the company outperformed on the 2018 and 2019 models by a good amount (**Exhibit 122**). And while the 2020 model ultimately missed, this was mostly due to display; the company came close on the semi side (not bad in an industry where predicting 2 quarters out is difficult, let alone 3 years ahead) (**Exhibit 123**).

EXHIBIT 122: **AMAT's historical performance against their long-term models has been decent**

$ in Billions	2018 Model (Given in 2015)	2018A	Δ
WFE	$33.5	$58.9	
Sales	$11.6	$17.3	$5.7
Semi Systems	$7.3	$10.9	$3.6
Services	$2.9	$3.8	$0.9
Display + New	$1.4	$2.6	$1.2
GM %	44.6%	46.3%	1.7%
GP	$5.17	$8.0	$2.8
OPEX	$2.40	$3.0	$0.6
OP%	23.9%	29.0%	5.1%
Tax %	17.5%	6.2%	-11.3%
DSO	1,100	1,025	-75
EPS	$2.00	$4.45	$2.45

$ in Billions	2019 Model (Given in 2016)	2019A	Δ
WFE	$34.5	$55.5	
Sales	$11.6	$14.6	$3.0
Semi Systems	$8.5	$9.0	$0.5
Services	$3.2	$3.9	$0.7
Display + New	$1.8	$1.7	($0.1)
GM %	44.6%	44.0%	(0.6%)
GP	$5.17	$6.4	$1.2
OPEX	$2.65	$3.0	$0.3
OP%	25.1%	23.5%	-1.6%
Tax %	11.0%	13.1%	2.1%
DSO	1,044	946	-98
EPS	$2.80	$3.04	$0.24

Source: Company reports Gartner, Bernstein analysis

EXHIBIT 123: **Even the 2020 model was close on semis, though display missed**

$ in Billions	2020 Model (Given in 2017)	2020A	Δ
WFE	$45.0	$63.2	
Sales	$19.6	$17.2	($2.4)
Semi Systems	$11.6	$11.4	($0.2)
Services	$4.5	$4.2	($0.3)
Display + New	$3.5	$1.7	($1.8)
GM %	47.0%	45.1%	(1.9%)
GP	$9.21	$7.8	($1.5)
OPEX	$3.40	$3.2	($0.2)
OP%	29.6%	26.3%	-3.3%
Tax %	10.0%	11.7%	1.7%
DSO	1,024	923	-101
EPS	$5.08	$4.17	-$0.91

Source: Company reports, Bernstein analysis

We would expect to get a new three-year model (presumably out to 2023) at the analyst day, and given the company's current outlook for 2021 WFE of at least $70B, it will probably start from that point. But it's an interesting exercise to play with some potential models for what we might hear from them, with a reasonable semi market share, services growth (we believe ~$1.5B incremental revenues over the period are plausible) and maybe some display recovery. At a $70B WFE we think we could see earnings power in the mid $6 (the Street is about there right now anyway). But we believe WFE can likely be higher than this; an $80B WFE could take earnings power into the mid to upper $7's, while a $90B WFE could drive earnings in the mid $8's to $9 (**Exhibit 124**). Hence in this environment we think there is room for numbers to continue to move up

EXHIBIT 124: **We believe AMAT could give a new long-term model that could leave room for further upside to numbers**

$ in Billions	Possible 2023 Models?		
WFE	$70.0	$80.0	$90.0
Sales	$23.1	$25.6	$28.0
Semi Systems	$15.4	$17.6	$19.8
Services	$5.7	$5.7	$5.7
Display + New	$2.0	$2.3	$2.5
GM %	45.0%	46.0%	47.0%
GP	$10.40	$11.75	$13.16
OPEX	$3.60	$3.70	$3.80
OP%	29.4%	31.5%	33.4%
Tax %	13.0%	13.0%	13.0%
DSO	900	900	900
EPS	$6.40	$7.62	$8.88

Source: Company reports, Bernstein estimates and analysis

Both LRCX and AMAT have comprehensive ongoing ESG efforts and initiatives

We believe the semiconductor and semi equipment industries generally offering a positive influence on the world, with the space today sitting as the fundament of all technological progress, driving ever further advances in the human condition, and creating (on the surface at least) a world increasingly benefitting from it. Hence we do believe the space is be relevant from an ESG perspective for investors.

ESG metrics relevant to semis and semicap from the likes of the SASB have primarily focused on topics such as energy and waste management, employee health and engagement, materials sourcing, and competitive behavior (while the Sustainability Accounting Standards Board (SASB) does not call out semicap specifically, their materiality matrix for ESG issues in the semiconductors can be found in **Exhibit 125**). And the topics pursued by AMAT and LRCX tend to map well to these, understandable as these types of topics are important in the industry, as well as being (mostly) things that management can affect to some degree (**Exhibit 126**), and both of them map their supported initiatives to categories consistent with the UN Sustainability Goals as well (**Exhibit 127**).

+ **Environmental goals:** Environmental topics tend to loom large in most internal company ESG efforts, understandable as the semiconductor industry involves high tech manufacturing, is resource intensive, relies on the use of potentially hazardous chemicals, and can produce potentially hazardous emissions, and hence can have a definitive environmental impact. Semiconductor manufacturing also requires significant amounts of electricity (our own ballpark estimate is somewhere between 500 kWh and 1 MWh per finished wafer) uses significant amounts of water, and resource usage is going up as complexity increases (**Exhibit 128**), putting the burden on the semicap players to help their customers find ways to cope.

+ **Supplier and sourcing management**: Almost all semiconductor / semicap companies further audit and survey their suppliers across a number of metrics which can include targets related to environmental issues, diversity, and responsible sourcing. In particular, semiconductor manufacturing can involve the use of some rather esoteric material inputs, for which there are often no substitutes, which when hailing from some of the seedier areas of the world are often referred to as "conflict minerals." Both LRCX and AMAT have plans and strategies in place to avoid the use of conflict minerals in their production, working to ensure that all necessary minerals are responsibly obtained from known sources.
+ **Employee well-being**: The semiconductor industry requires a highly-skilled, often globally-based collection of talent. Competition for the best engineering talent is fierce. And yet the industry (and much of tech in general) has historically been seen as less diverse (with lower % of under-represented minorities and women). This is problematic not only on the surface (i.e. it's not fair) but also practically; given talent is randomly distributed, companies who do not pursue diverse workplaces risk leaving much-needed talent by the wayside (or worse, allowing more-enlightened competitors to pick it off), though on the whole employees seem generally happy at LRCX (they boast a 91% retention rate with an average employee tenure of ~8 years). LRCX and AMAT also pursue diversity and inclusion as part of their corporate efforts. Other areas like workplace health and safety, employee engagement, and talent management more broadly tend to appear prominently as well.
+ **Community**: Both LRCX have community engagement and charitable giving as a focus area.

Both Lam and AMAT have well developed corporate responsibility and ESG efforts. Lam has a cross functional CSR team led by a fulltime CSR manager, comprised of members of the various business units, and has input from the CEO as well as contact with the BoD. And while AMAT has been publishing CSRs since 2005, it conducted its "first comprehensive [ESG] Materiality Assessment" in 2019 to help set new targets for the company relating to sustainability (energy efficiency and carbon footprint reduction), fostering an environment of inclusion amongst employees, more closely examining the operations of suppliers (to hold them to the same standards as their internal operations), as well as increased transparency and disclosure to the public regarding its efforts; in 2020 AMAT also created a new position: Director of ESG, Corporate Sustainability, and Reporting, currently filled by Chris Librie[2].

For completeness, we show a variety of third party ESG metrics for LRCX and AMAT, as well as other semicap companies, in **Exhibit 129**. While interpretation of these is always a bit up in the air, both LRCX and AMAT screen favorably (at least average or above) vs peers, and better than the broader S&P. They also screen as "AA" (ESG leaders) in the MSCI ESG ratings.

[2] For AMAT ESG related blog posts: Chris Librie's blog posts, accessed Mar. 23rd, 2021.

EXHIBIT 125:

SASB Materiality Matrix for Semiconductors

Material for > 50% of industries in sector
Material for < 50% of industries in sector

Dimension	General Issue Category	Semiconductors
Environment	GHG Emissions	■
	Air Quality	
	Energy Management	■
	Water & Wastewater Management	■
	Waste & Hazardous Materials Management	■
	Ecological Impacts	
Social Capital	Human Rights & Community Relations	
	Customer Privacy	
	Data Security	
	Access & Affordability	
	Product Quality & Safety	
	Customer Welfare	
	Selling Practices & Product Labeling	
Human Capital	Labor Practices	
	Employee Health & Safety	■
	Employee Engagement, Diversity & Inclusion	■
Business Model & Innovation	Product Design & Lifecycle Management	■
	Business Model Resilience	
	Supply Chain Management	
	Materials Sourcing & Efficiency	■
	Physical Impacts of Climate Change	
Leadership & Governance	Business Ethics	
	Competitive Behavior	■
	Management of the Legal & Regulatory Environment	
	Critical Incident Risk Management	
	Systemic Risk Management	

Source: SASB, Bernstein analysis

EXHIBIT 126: **Both LRCX and AMAT focus on a variety of relevant ESG topics around product and worker safety, energy efficiency, supply chain, waste, and community engagement**

LRCX ESG Priorities

Category	Material Topics	Sustainable Develoment Goals
Buisness and Governance	Leadership Participation in ESG	3,4,8,10,13
Products and Customers	Regulatory Compliance and Emerging Regulations Product Safety Product Compliance New Product Pipeline	8,13
Our Workplace	Employee Wellness and Professional Growth Health and Safety Inclusion and Diversity	3,4,8,10
Responsible Supply Chain	Supplier Screening Managing Negative Impacts Within the Supply Chain	3,4,10,13
Sustainable Operations	Energy Efficiency Waste and Recycling Greenhouse Gas Emissions	13
Our Communities	Community Engagement Charitable Giving	3,4,10

AMAT ESG Priorities

Category	Material Topics	Sustainable Develoment Goals
Energy and Emissions	Maximize energy efficiency Reduce enviormental impact through conservatoin and renewables	7,13
Health and Safety	Establish and implement EHS policies to protect worker health/safety	3,8
Design for Sustainability	Design resusable/recyclable products	9,12
Waste	Reduce resource consumption and packaging waste	12
Supply Chain Responsibility	Increase supplier diversity Hold suppliers to higher standard Commit to responsible sourcing of materials Commit to protecting human rights and conducting ethical business	8,12
Diversity	Establish culture of inclusion, diversity, and engagement	5,10
Learning and Development	Fostor personal and professional development for all workforce	4,8
Charitable Giving and Community	Make financial and human investments in communities	5,10,17
Ethics and Compliance	Broaden ESG disclosures to increase transparency and outreach	16

Source: Company reports, United Nations, Bernstein analysis

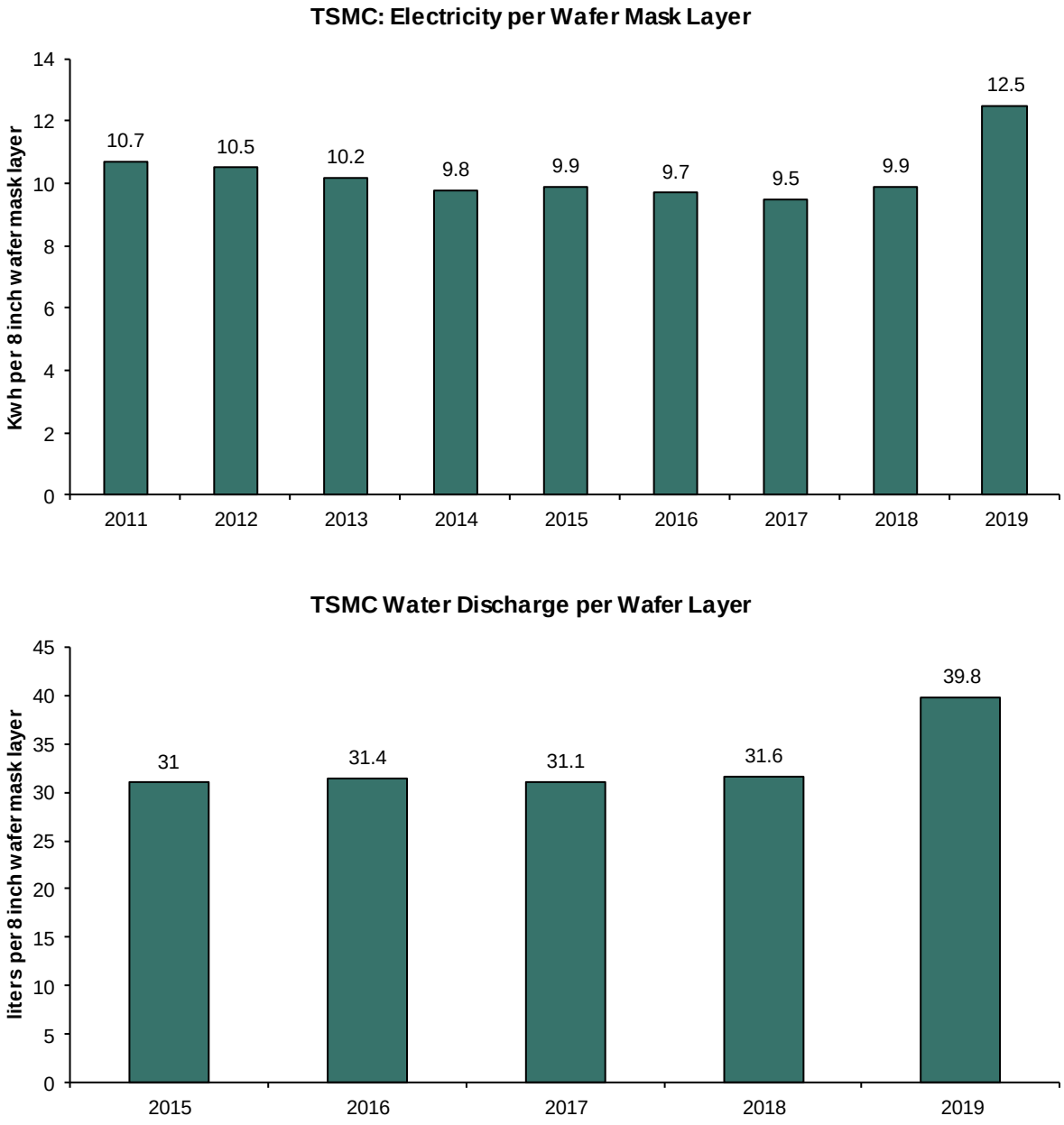
EXHIBIT 127: **LRCX and AMAT both target a number of the US sustainable development goals**

LRCX and AMAT Alignment with UN Sustainable Development Goals

		LRCX	AMAT
1	No Poverty		
2	Zero Hunger		
3	Good Health and Well-Being		
4	Quality Education		
5	Gender Equality		
6	Clean Water and Sanitation		
7	Affordable and Clean Energy		
8	Decent work and Economic Growth		
9	Industry, Innovation, and Infrastrcture		
10	Reduced Inequalties		
11	Sustainable Cicties and Communities		
12	Responsible Consumption and Production		
13	Climate Actoin		
14	Life Below Water		
15	Life on Land		
16	Peace, Justice, and Strong Institutions		
17	Partnerships for the Goals		

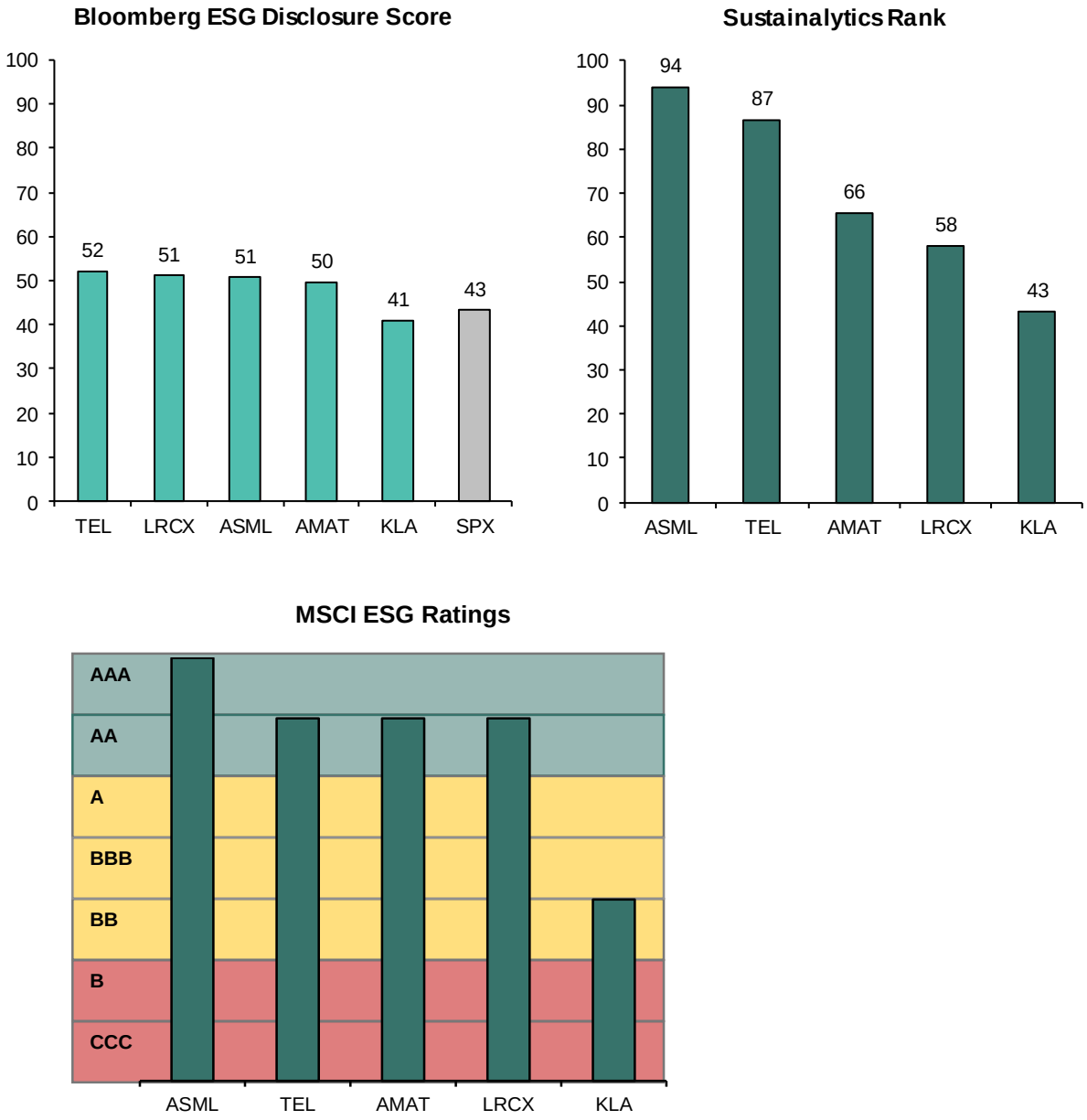
Source: Company reports, United Nations, Bernstein analysis

EXHIBIT 128: **Resource usage in semiconductor manufacturing is rising as complexity increases**



Source: Company reports, Bernstein analysis

EXHIBIT 129: **Both LRCX and AMAT are rated AA ("leader") in resilience to long term ESG risks by MSCI**



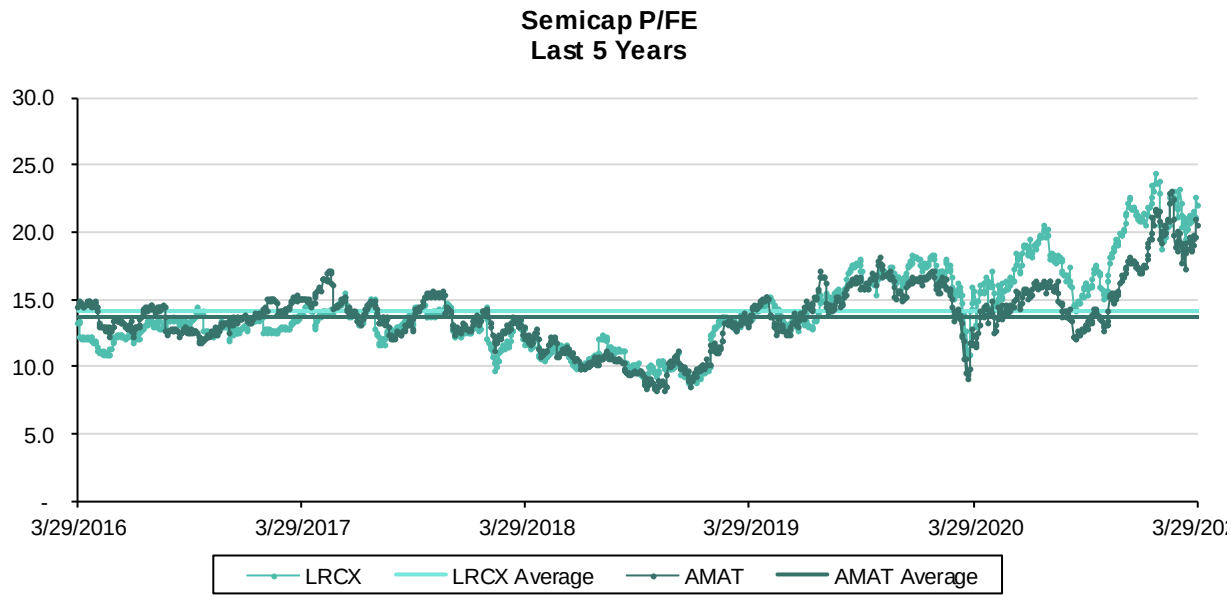
Source: Bloomberg, Bernstein analysis

LRCX and AMAT valuations are somewhat elevated vs history on an absolute basis, but appear reasonable vs semis, the market, and broader tech especially given the fundamental improvements in the industry; of the two AMAT has run more YTD, but remains a touch cheaper

Given the sharp run in the shares investors are naturally growing somewhat more interested in valuations in semicap (and, frankly, semis as a whole). And yes, it is true that current valuations are at a fairly sharp premium vs history on an absolute basis (**Exhibit 130**).

However, a good amount of this is due to the sector overall given the rise in semiconductor valuations broadly, and vs the SOX neither company appears particularly egregious, with LRCX at a slight discount to the SOX, and AMAT at a bigger one; both stocks also trade at a discount to the S&P, and at a sharp discount to the NASDAQ (**Exhibit 131**).

EXHIBIT 130: **LRCX and AMAT are currently trading at a decent premium vs history on an absolute basis**

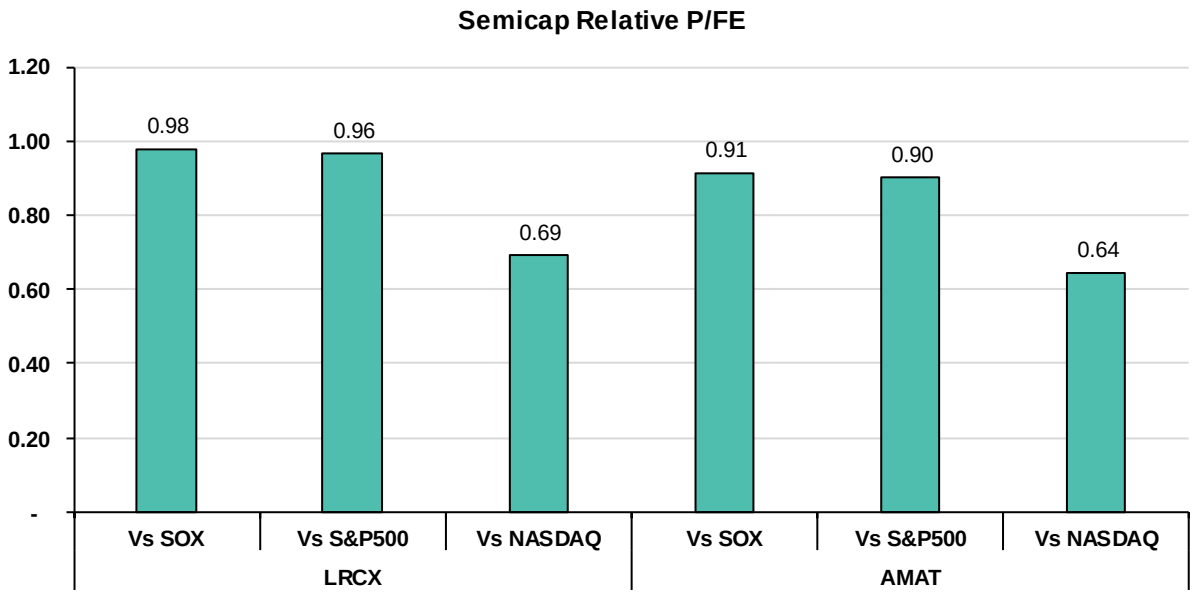


Source: Bloomberg, Bernstein analysis

And relative valuations are actually lower than they have been at some points in the past as well; in fact relative to various markets (whether semis, the broader S&P, or broader tech) relative valuation was actually higher 5 years ago (**Exhibit 132, Exhibit 133, Exhibit 134**), which seems incongruous to us given the structural changes in the industry, massively improved economics over the cycle (amid lower overall cyclicality) both in terms of peak to trough variability as well as significantly higher EPS growth (**Exhibit 135**) and FCF generation, and numerous secular drivers. Hence current valuations seem fine to us; Parity or below vs the SOX doesn't seem like a stretch at all (and we believe we could argue for even more). And of course we believe numbers can be higher than what is current implied by consensus.

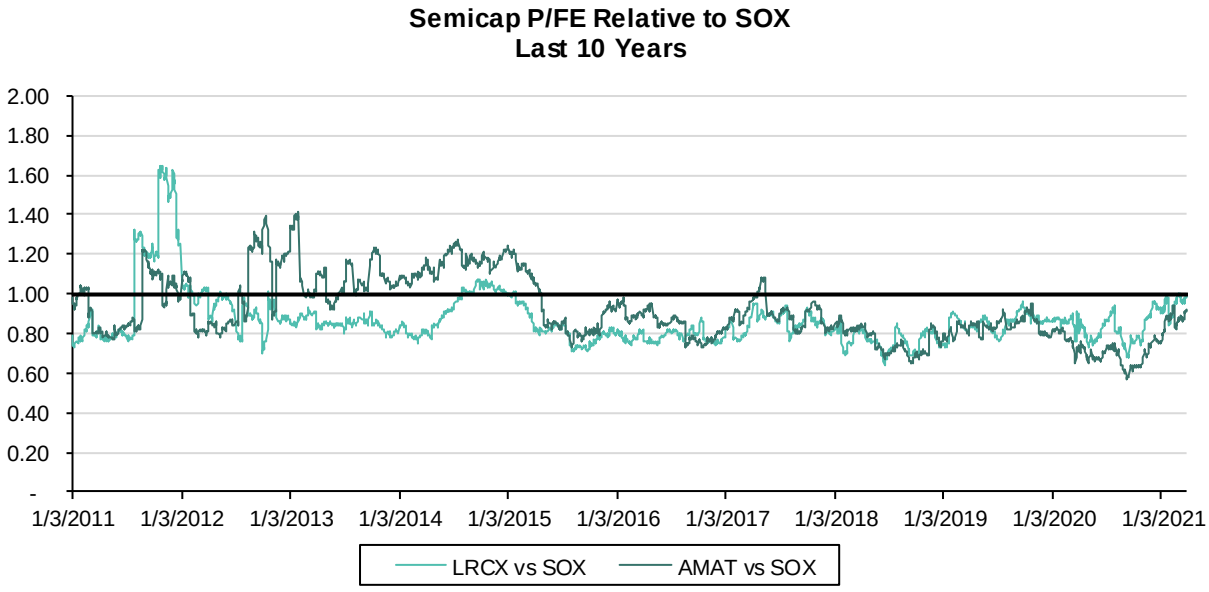
Of the two stocks, AMAT has run more YTD, but remains a touch cheaper.

EXHIBIT 131: **But they both currently trade at discounts to the SOX, S&P500, and NASDAQ**



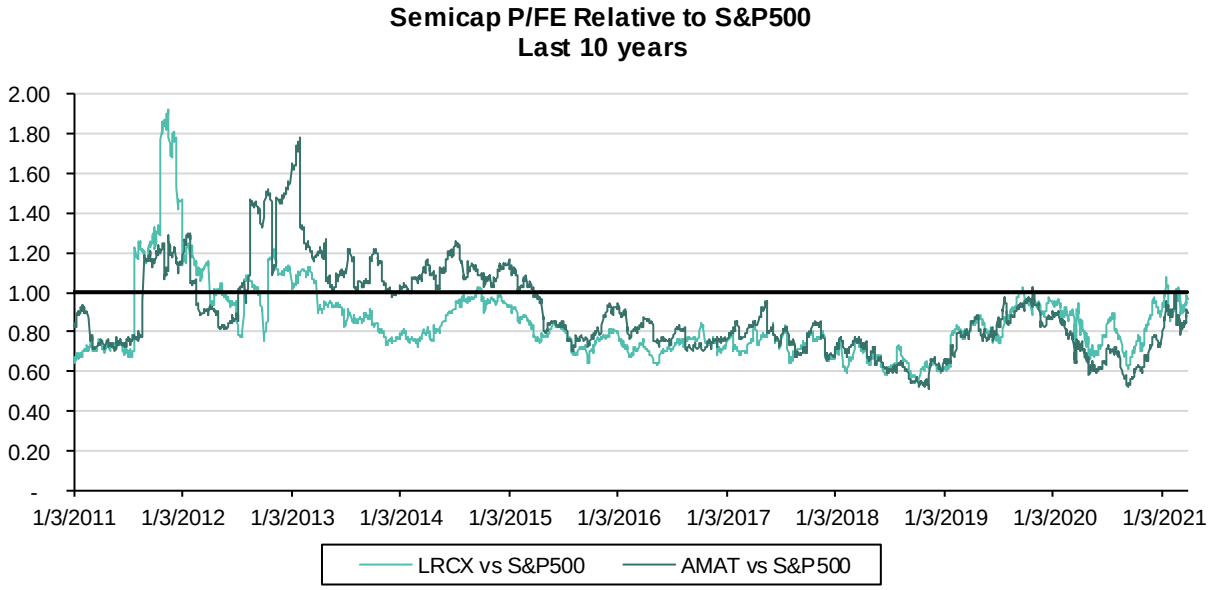
Source: Bloomberg, Bernstein analysis

EXHIBIT 132: **Valuations do not look egregious vs history relative to the SOX...**



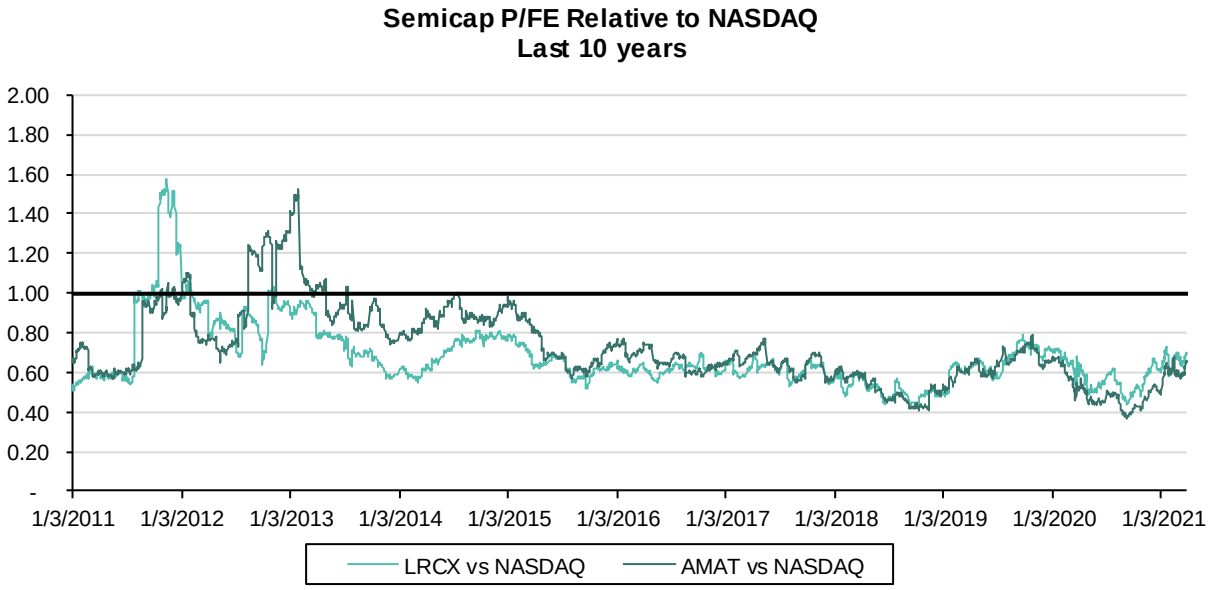
Source: Bloomberg, Bernstein analysis

EXHIBIT 133: **...the S&P500...**



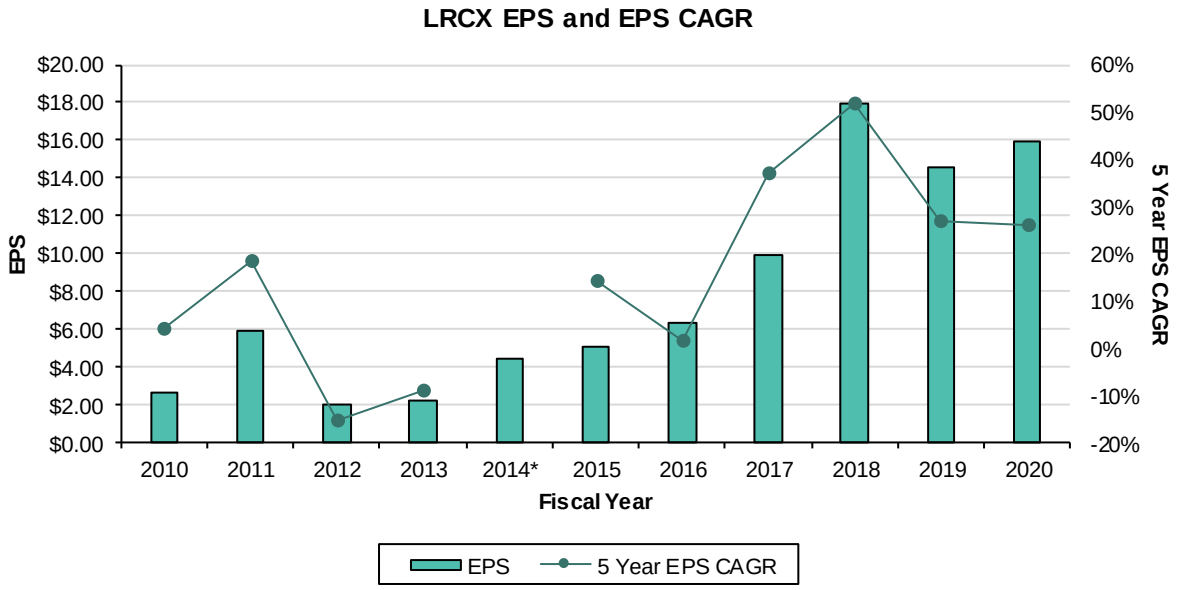
Source: Bloomberg, Bernstein analysis

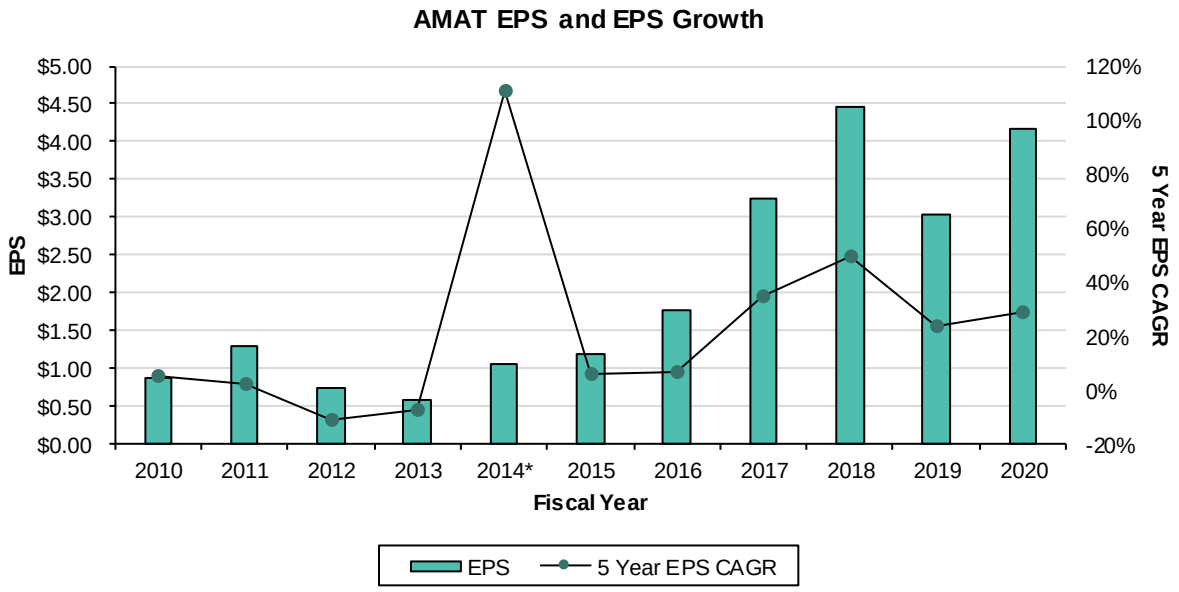
EXHIBIT 134: **...or broader tech**



Source: Bloomberg, Bernstein analysis

EXHIBIT 135: **EPS growth rates are much higher today vs history**





*LRCX FY2014 EPS CAGR builds off of FY 2009 where EPS was negative; FY2014 AMAT EPS CAGR builds off of FY2009 where EPS was very small (3 cents)
Source: Bloomberg, Bernstein analysis

We believe numbers still have room to move up, and are above consensus over the next several years for both stocks.

At their last earnings in January both AMAT and LRCX suggested we might see WFE spend of $60-$70B this year; we are above that (at ~$75B), and see growth continuing beyond 2021. Hence we are above consensus for both stocks over the next several years (**Exhibit 136**).

We initiate coverage on both LRCX and AMAT at Outperform.

We initiate coverage on Lam Research (LRCX) at Outperform, with a target price of $700 (~21x our FY2023 EPS of 32.57) and initiate coverage on Applied Materials (AMAT) at Outperform, with a target price of $160 (~21x our VY2023 EPS of 7.55).

EXHIBIT 136: **We are above consensus for both LRCX and AMAT over the next several years**

LRCX								
Quarter	Q221	Q321E	Q421E	Q122E	2020	2021E	2022E	2023E
Sales								
Bern	$3,456	$3,707	$3,721	$3,587	$10,045	$14,061	$15,011	$16,694
Cons		$3,719	$3,696	$3,529		$14,049	$14,686	$15,993
Variance		-$12	$25	$58		$12	$326	$701
OPM								
Bern	30.3%	30.5%	31.0%	30.6%	27.1%	30.7%	31.1%	31.8%
Cons		30.3%	30.8%	30.7%		30.5%	30.6%	31.0%
Variance		0.2%	0.2%	-0.1%		0.2%	0.5%	0.8%
EPS								
Bern	$6.03	$6.59	$6.78	$6.47	$15.96	$25.07	$27.79	$32.57
Cons		$6.59	$6.72	$6.41		$25.08	$26.78	$29.82
Variance		$0.00	$0.05	$0.06		($0.01)	$1.01	$2.75
AMAT								
Quarter	Q121	Q221E	Q321E	Q421E	2020	2021E	2022E	2023E
Sales								
Bern	$5,162	$5,393	$5,547	$5,621	$17,202	$21,724	$23,909	$25,082
Cons		$5,407	$5,514	$5,576		$21,660	$23,145	$23,761
Variance		-$14	$33	$46		$64	$764	$1,321
OPM								
Bern	29.0%	30.5%	30.4%	30.4%	26.3%	30.1%	30.7%	31.3%
Cons		30.4%	30.6%	30.5%		30.1%	30.4%	27.2%
Variance		0.1%	-0.2%	-0.1%		0.0%	0.3%	4.1%
EPS								
Bern	$1.39	$1.51	$1.56	$1.59	$4.17	$6.05	$6.92	$7.55
Cons		$1.51	$1.55	$1.57		$5.99	$6.50	$6.71
Variance		$0.00	$0.02	$0.02		$0.06	$0.42	$0.84

Source: Company reports, Bloomberg, Bernstein estimates and analysis

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EXHIBIT 137: **Bernstein LRCX Income Statement**

INCOME STATEMENT																
Fiscal Period	**2020**	**2021E**	**2022E**	**2023E**	**Q120**	**Q220**	**Q320**	**Q420**	**Q121**	**Q221**	**Q321E**	**Q421E**	**Q122E**	**Q222E**	**Q322E**	**Q422E**
Non-GAAP Revenue	$10,045	$14,061	$15,011	$16,694	$2,166	$2,584	$2,504	$2,792	$3,177	$3,456	$3,707	$3,721	$3,587	$3,587	$3,811	$4,026
Non-GAAP COGS	$5,432	$7,504	$7,981	$8,789	$1,182	$1,402	$1,344	$1,504	$1,666	$1,845	$2,002	$1,991	$1,919	$1,908	$2,024	$2,130
Non-GAAP Gross Profit	$4,613	$6,557	$7,030	$7,904	$983	$1,181	$1,160	$1,288	$1,511	$1,611	$1,705	$1,730	$1,668	$1,679	$1,787	$1,896
Non-GAAP Operating Expenses	$1,891	$2,238	$2,369	$2,590	$431	$481	$486	$493	$523	$563	$575	$577	$570	$588	$598	$612
Non-GAAP R&D	$1,257	$1,471	$1,586	$1,719	$287	$319	$323	$327	$350	$364	$378	$380	$380	$395	$400	$411
Non-GAAP SG&A	$635	$766	$783	$871	$144	$162	$163	$166	$174	$199	$196	$197	$190	$194	$198	$201
Non-GAAP Operating Income	$2,722	$4,319	$4,662	$5,314	$552	$700	$673	$795	$988	$1,048	$1,131	$1,153	$1,098	$1,090	$1,189	$1,284
Non-GAAP Other expense, net	($87)	($189)	($174)	($173)	($11)	($13)	($30)	($33)	($51)	($53)	($41)	($44)	($44)	($44)	($43)	($43)
Non-GAAP Pre-tax Income	$2,635	$4,130	$4,488	$5,141	$541	$688	$644	$762	$937	$995	$1,089	$1,110	$1,054	$1,047	$1,146	$1,241
Non-GAAP Provision for Income taxes	($259)	($474)	($516)	($591)	($61)	($86)	($53)	($58)	($102)	($114)	($131)	($128)	($121)	($120)	($132)	($143)
Non-GAAP Net Income	$2,376	$3,656	$3,972	$4,550	$480	$602	$590	$704	$835	$880	$959	$982	$932	$926	$1,015	$1,098
GAAP Basic Share Outstanding	145	144	141	138	145	144	145	145	145	144	143	143	142	141	141	140
GAAP Basic EPS	$15.54	$25.07	$28.04	$32.88	$3.22	$3.57	$3.96	$4.79	$5.67	$6.04	$6.59	$6.77	$6.46	$6.54	$7.20	$7.84
GAAP Diluted Share Outstanding	149	146	143	140	151	150	148	147	147	146	145	145	144	143	143	142
GAAP Diluted EPS	$15.12	$24.72	$27.64	$32.41	$3.09	$3.43	$3.88	$4.73	$5.59	$5.96	$6.49	$6.68	$6.37	$6.45	$7.10	$7.73
Non-GAAP Diluted Share Outstanding	149	146	143	140	151	150	148	147	147	146	145	145	144	143	143	142
Non-GAAP Diluted EPS	$15.96	$25.07	$27.79	$32.57	$3.18	$4.01	$3.98	$4.78	$5.67	$6.03	$6.59	$6.78	$6.47	$6.46	$7.11	$7.74
Pro-Forma Reconciliation																
GAAP Revenue	$10,045	$14,061	$15,011	$16,694	$2,166	$2,584	$2,504	$2,792	$3,177	$3,456	$3,707	$3,721	$3,587	$3,587	$3,811	$4,026
GAAP Gross Profit	$4,609	$6,543	$7,025	$7,899	$982	$1,180	$1,167	$1,280	$1,506	$1,604	$1,704	$1,729	$1,667	$1,677	$1,786	$1,895
GAAP Operating Income	$2,674	$4,228	$4,644	$5,297	$537	$687	$694	$756	$961	$1,010	$1,117	$1,140	$1,084	$1,089	$1,188	$1,283
GAAP Net Income	$2,252	$3,604	$3,950	$4,529	$466	$515	$575	$697	$823	$869	$944	$967	$918	$924	$1,012	$1,096
Margins and Growth Rates																
PF Gross Margins	45.9%	46.6%	46.8%	47.3%	45.4%	45.7%	46.3%	46.1%	47.5%	46.6%	46.0%	46.5%	46.5%	46.8%	46.9%	47.1%
R&D as % of Sales	12.5%	10.5%	10.6%	10.3%	13.2%	12.3%	12.9%	11.7%	11.0%	10.5%	10.2%	10.2%	10.6%	11.0%	10.5%	10.2%
SG&A as % of Sales	6.3%	5.5%	5.2%	5.2%	6.7%	6.3%	6.5%	5.9%	5.5%	5.8%	5.3%	5.3%	5.3%	5.4%	5.2%	5.0%
PF Opex as % of Sales	18.8%	15.9%	15.8%	15.5%	19.9%	18.6%	19.4%	17.7%	16.5%	16.3%	15.5%	15.5%	15.9%	16.4%	15.7%	15.2%
PF OPM	27.1%	30.7%	31.1%	31.8%	25.5%	27.1%	26.9%	28.5%	31.1%	30.3%	30.5%	31.0%	30.6%	30.4%	31.2%	31.9%
Tax Rate	(9.8%)	(11.5%)	(11.5%)	(11.5%)	(11.4%)	(12.5%)	(8.3%)	(7.6%)	(10.9%)	(11.5%)	(12.0%)	(11.5%)	(11.5%)	(11.5%)	(11.5%)	(11.5%)
Net Margin	23.7%	26.0%	26.5%	27.3%	22.1%	23.3%	23.6%	25.2%	26.3%	25.5%	25.9%	26.4%	26.0%	25.8%	26.6%	27.3%
QoQ																
Sales					(8.3%)	19.3%	(3.1%)	11.5%	13.8%	8.8%	7.3%	0.4%	(3.6%)	0.0%	6.3%	5.6%
Gross Profit					(9.4%)	20.1%	(1.8%)	11.1%	17.3%	6.7%	5.8%	1.5%	(3.6%)	0.6%	6.5%	6.1%
R&D					(2.9%)	11.2%	1.5%	1.2%	6.8%	4.2%	3.8%	0.4%	0.2%	3.8%	1.4%	2.6%
SGA					(7.0%)	12.4%	0.7%	1.7%	4.7%	14.8%	(1.4%)	0.4%	(3.6%)	1.9%	2.3%	1.6%
Operating Profit					(13.0%)	26.8%	(3.9%)	18.1%	24.2%	6.1%	7.9%	2.0%	(4.8%)	(0.7%)	9.1%	8.0%
Tax Rate					-31 bps	-114 bps	421 bps	67 bps	-326 bps	-63 bps	-50 bps	50 bps	00 bps	00 bps	00 bps	00 bps
Net Income					(14.2%)	25.5%	(1.9%)	19.3%	18.5%	5.4%	8.9%	2.4%	(5.0%)	(0.6%)	9.5%	8.3%
DSO					(2.5%)	(0.4%)	(1.3%)	(0.5%)	(0.1%)	(0.9%)	(0.3%)	(0.3%)	(0.5%)	(0.5%)	(0.5%)	(0.5%)
EPS					(12.0%)	26.0%	(0.6%)	19.9%	18.7%	6.4%	9.3%	2.8%	(4.5%)	(0.1%)	10.1%	8.8%
YoY																
Sales	4.1%	40.0%	6.8%	11.2%	(7.1%)	2.4%	2.6%	18.2%	46.7%	33.8%	48.1%	33.3%	12.9%	3.8%	2.8%	8.2%
Gross Profit	4.1%	42.1%	7.2%	12.4%	(9.0%)	1.2%	5.5%	18.8%	53.6%	36.4%	47.0%	34.3%	10.4%	4.2%	4.8%	9.6%
R&D	5.9%	17.1%	7.8%	8.4%	(1.7%)	11.7%	3.1%	10.8%	21.9%	14.2%	16.9%	16.0%	8.8%	8.3%	5.8%	8.2%
SGA	(1.2%)	20.7%	2.2%	11.3%	(9.3%)	5.0%	(6.6%)	7.1%	20.5%	23.0%	20.5%	19.0%	9.6%	(2.8%)	0.9%	2.1%
Operating Profit	4.5%	58.7%	7.9%	14.0%	(12.3%)	(3.7%)	10.2%	25.3%	78.8%	49.6%	67.9%	45.1%	11.1%	4.1%	5.2%	11.4%
Tax Rate	32 bps	-167 bps	-01 bps	00 bps	55 bps	-252 bps	-64 bps	344 bps	49 bps	100 bps	-372 bps	-389 bps	-63 bps	00 bps	50 bps	00 bps
Net Income	2.1%	53.9%	8.6%	14.6%	(13.7%)	(4.2%)	1.0%	26.1%	74.1%	46.3%	62.4%	39.4%	11.7%	5.2%	5.8%	11.9%
DSO	(6.9%)	(2.1%)	(2.0%)	(2.3%)	(8.9%)	(7.4%)	(6.1%)	(4.6%)	(2.3%)	(2.8%)	(1.9%)	(1.7%)	(2.1%)	(1.7%)	(1.9%)	(2.1%)
EPS	9.6%	57.2%	10.8%	17.2%	(5.3%)	3.5%	7.6%	32.1%	78.2%	50.5%	65.5%	41.8%	14.1%	7.1%	7.9%	14.3%

Source: company reports, Bernstein estimates and analysis

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EXHIBIT 138: **Bernstein LRCX Balance Sheet**

BALANCE SHEET																
Fiscal Period	**2020**	**2021E**	**2022E**	**2023E**		**Q120**	**Q220**	**Q320**	**Q420**	**Q121**	**Q221**	**Q321E**	**Q421E**	**Q122E**	**Q222E**	**Q322E**	**Q422E**
Assets																	
Current Assets:																	
Cash and cash equivalents	$4,915	$4,257	$4,404	$4,706		$4,607	$3,036	$3,962	$4,915	$4,129	$3,687	$3,958	$4,257	$4,369	$4,392	$4,350	$4,404
Investments	$1,795	$2,355	$2,355	$2,355		$984	$1,648	$1,432	$1,795	$2,529	$2,355	$2,355	$2,355	$2,355	$2,355	$2,355	$2,355
Accounts receivable, net	$2,097	$2,839	$3,096	$3,145		$1,636	$2,030	$2,191	$2,097	$2,318	$2,900	$2,911	$2,839	$2,747	$2,779	$2,943	$3,096
Inventories	$1,900	$2,499	$2,666	$2,680		$1,483	$1,529	$1,675	$1,900	$2,138	$2,349	$2,509	$2,499	$2,405	$2,377	$2,534	$2,666
Prepaid expenses and other current assets	$146	$205	$225	$229		$125	$212	$150	$146	$161	$176	$208	$205	$200	$205	$213	$225
Non-cash current assets	$4,143	$5,542	$5,987	$6,055		$3,244	$3,771	$4,016	$4,143	$4,617	$5,426	$5,628	$5,542	$5,352	$5,361	$5,690	$5,987
Total current assets	$10,854	$12,154	$12,746	$13,116		$8,835	$8,455	$9,409	$10,854	$11,275	$11,468	$11,941	$12,154	$12,075	$12,108	$12,395	$12,746
PP&E, net	$1,071	$1,235	$1,295	$1,376		$1,030	$1,047	$1,049	$1,071	$1,134	$1,208	$1,222	$1,235	$1,247	$1,261	$1,276	$1,295
Restricted cash and investments	$254	$253	$253	$253		$255	$254	$254	$254	$253	$253	$253	$253	$253	$253	$253	$253
Goodwill and intangible assets	$1,653	$1,614	$1,559	$1,505		$1,691	$1,678	$1,667	$1,653	$1,646	$1,641	$1,628	$1,614	$1,600	$1,587	$1,573	$1,559
Other assets	$727	$898	$959	$971		$533	$480	$560	$727	$749	$800	$882	$898	$849	$850	$908	$959
Total assets	$14,559	$16,154	$16,812	$17,220		$12,344	$11,914	$12,939	$14,559	$15,057	$15,370	$15,925	$16,154	$16,024	$16,058	$16,404	$16,812
Liabilities and Stockholders' Equity																	
Non-debt current liabilities	$2,323	$3,035	$3,275	$3,319		$1,813	$1,933	$2,063	$2,323	$2,573	$2,758	$3,030	$3,035	$2,911	$2,913	$3,103	$3,275
Current portion of convertible notes and capital leases	$840	$833	$833	$833		$645	$632	$42	$840	$834	$833	$833	$833	$833	$833	$833	$833
Total current liabilities	$3,162	$3,868	$4,108	$4,152		$2,458	$2,566	$2,106	$3,162	$3,407	$3,591	$3,863	$3,868	$3,744	$3,745	$3,936	$4,108
Senior notes, convertible notes, and capital leases, less current por	$4,971	$4,964	$4,964	$4,964		$3,788	$3,786	$5,044	$4,971	$4,993	$4,992	$4,992	$4,964	$4,964	$4,964	$4,964	$4,964
Income taxes payable	$910	$902	$902	$902		$857	$873	$889	$910	$880	$902	$902	$902	$902	$902	$902	$902
Other long-term liabilities	$333	$455	$475	$477		$262	$272	$351	$333	$351	$376	$444	$455	$423	$421	$451	$475
Total liabilities	$9,376	$10,189	$10,449	$10,494		$7,365	$7,496	$8,389	$9,376	$9,632	$9,862	$10,201	$10,189	$10,033	$10,032	$10,252	$10,449
Total stockholders' equity	$5,172	$5,959	$6,358	$6,720		$4,936	$4,379	$4,538	$5,172	$5,419	$5,503	$5,719	$5,959	$5,986	$6,020	$6,146	$6,358
Total liabilities and stockholders' equity	$14,559	$16,154	$16,812	$17,220		$12,344	$11,914	$12,939	$14,559	$15,057	$15,370	$15,925	$16,154	$16,024	$16,058	$16,404	$16,812

Source: company reports, Bernstein estimates and analysis

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EXHIBIT 139: **Bernstein LRCX Cash Flow Statement**

CASH FLOW STATEMENT																
Fiscal Period	**2020**	**2021E**	**2022E**	**2023E**		**Q120**	**Q220**	**Q320**	**Q420**	**Q121**	**Q221**	**Q321E**	**Q421E**	**Q122E**	**Q222E**	**Q322E**	**Q422E**
Cash flows from operating activities:																	
Net income	$2,252	$3,604	$3,950	$4,529		$466	$515	$575	$697	$823	$869	$944	$967	$918	$924	$1,012	$1,096
Depreciation and amortization	$269	$309	$329	$345		$65	$66	$67	$71	$73	$76	$79	$81	$81	$82	$82	$83
Other changes to operatiing cash flows	($394)	($597)	($8)	$227		($66)	($272)	($101)	$45	($254)	($601)	$113	$145	$142	$47	($106)	($91)
Cash provided by operating activities	$2,126	$3,316	$4,271	$5,101		$464	$308	$541	$813	$643	$345	$1,136	$1,192	$1,141	$1,053	$988	$1,089
Cash flows from investing activities:																	
Capital expenditures and intangible assets	($203)	($313)	($335)	($372)		($39)	($62)	($51)	($51)	($63)	($92)	($79)	($80)	($80)	($82)	($84)	($89)
Business acquisition, net of cash acquired	$0	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net sales from available-for-sale investments	($15)	($569)	$0	$0		$790	($662)	$211	($354)	($737)	$168	$0	$0	$0	$0	$0	$0
Transfers of restricted cash and investments	$0	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	($26)	($8)	$0	$0		($1)	($10)	$10	($25)	($2)	($6)	$0	$0	$0	$0	$0	$0
Cash used in investing activities	($244)	($890)	($335)	($372)		$751	($734)	$170	($430)	($802)	$70	($79)	($80)	($80)	($82)	($84)	($89)
Cash flows from financing activities:																	
Debt repayments	($1,915)	($53)	$0	$0		($29)	($18)	($618)	($1,250)	($19)	($5)	$0	($29)	$0	$0	$0	$0
Debt issuance	$3,222	$0	$0	$0		$0	$0	$1,250	$1,972	$0	$0	$0	$0	$0	$0	$0	$0
Excess tax benefit on share-based compensation	$0	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Treasury stock purchases	($1,370)	($2,372)	($3,000)	($3,600)		($78)	($1,005)	($245)	($41)	($449)	($723)	($600)	($600)	($750)	($750)	($750)	($750)
Dividends paid	($657)	($727)	($789)	($826)		($159)	($167)	($164)	($168)	($167)	($188)	($186)	($186)	($199)	($198)	($197)	($196)
Reissuance of treasury stock related to employee stock purchase p	$85	$41	$0	$0		$0	$38	$0	$47	$0	$41	$0	$0	$0	$0	$0	$0
Proceeds from issuance of common stock	$8	$14	$0	$0		$4	$1	$2	$2	$6	$8	$0	$0	$0	$0	$0	$0
Other	$2	($1)	$0	$0		$0	$0	$0	$2	($2)	$1	$0	$0	$0	$0	$0	$0
Cash used in financing activities	($624)	($3,098)	($3,789)	($4,426)		($262)	($1,151)	$225	$563	($631)	($865)	($786)	($815)	($949)	($948)	($947)	($946)
Free Cash Flow	$1,923	$3,003	$3,936	$4,729		$425	$246	$490	$762	$580	$253	$1,058	$1,113	$1,061	$971	$905	$1,000

Source: company reports, Bernstein estimates and analysis

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EXHIBIT 140: **Bernstein AMAT Income Statement**

INCOME STATEMENT Fiscal Period	2020	2021E	2022E	2023E	Q120	Q220	Q320	Q420	Q121	Q221E	Q321E	Q421E	Q122E	Q222E	Q322E	Q422E
Net Sales	$17,202	$21,724	$23,909	$25,082	$4,162	$3,957	$4,395	$4,688	$5,162	$5,393	$5,547	$5,621	$5,675	$5,882	$6,074	$6,278
COGS	$9,450	$11,571	$12,672	$13,168	$2,295	$2,192	$2,417	$2,546	$2,793	$2,858	$2,940	$2,979	$3,008	$3,118	$3,219	$3,327
Non-GAAP Gross Profit	$7,752	$10,153	$11,237	$11,914	$1,867	$1,765	$1,978	$2,142	$2,369	$2,535	$2,607	$2,642	$2,667	$2,765	$2,855	$2,951
Non-GAAP Operating Expenses	$3,223	$3,617	$3,887	$4,064	$799	$789	$818	$817	$873	$890	$920	$933	$942	$960	$980	$1,004
R&D	$2,234	$2,477	$2,634	$2,759	$552	$550	$572	$560	$606	$609	$627	$635	$641	$653	$662	$678
Marketing and Selling	$526	$607	$669	$702	$135	$130	$130	$131	$147	$147	$155	$157	$159	$165	$170	$176
General and administrative	$567	$658	$696	$715	$129	$137	$145	$156	$161	$162	$166	$169	$170	$171	$176	$179
Other	$0	$152	$0	$0	$0	$0	$0	$0	$152	$0	$0	$0	$0	$0	$0	$0
Non-GAAP adjustment	($104)	($278)	($113)	($112)	($17)	($28)	($29)	($30)	($193)	($28)	($28)	($28)	($28)	($28)	($28)	($28)
Non-GAAP Operating Income	$4,529	$6,537	$7,351	$7,850	$1,068	$976	$1,160	$1,325	$1,496	$1,645	$1,687	$1,709	$1,725	$1,805	$1,875	$1,946
Interest Expenses	($240)	($215)	($206)	($206)	($59)	($61)	($61)	($59)	($61)	($51)	($51)	($51)	($51)	($51)	($51)	($51)
Interest and other Income, net	$41	$64	$76	$86	$22	$7	($7)	$19	$18	$10	$18	$18	$17	$20	$19	$20
Others	$24	($8)	$0	$0	$4	$7	$20	($7)	($8)	$0	$0	$0	$0	$0	$0	$0
Non-GAAP Pre-tax Income	$4,354	$6,377	$7,220	$7,730	$1,035	$929	$1,112	$1,278	$1,445	$1,603	$1,654	$1,675	$1,691	$1,773	$1,842	$1,914
Provision for Income taxes	$509	$780	$939	$1,043	$131	$112	$136	$130	$163	$200	$207	$209	$220	$230	$240	$249
Non-GAAP Net Income	$3,845	$5,598	$6,282	$6,686	$904	$817	$976	$1,148	$1,282	$1,403	$1,447	$1,466	$1,471	$1,542	$1,603	$1,665
GAAP Basic Share Outstanding	915	915	898	876	916	917	915	914	915	919	915	911	906	901	896	891
GAAP Basic EPS	$3.95	$5.83	$6.85	$7.50	$0.97	$0.82	$0.92	$1.24	$1.23	$1.49	$1.54	$1.57	$1.59	$1.68	$1.75	$1.83
GAAP Diluted Share Outstanding	923	925	908	886	927	923	922	921	925	929	925	921	916	911	906	901
GAAP Diluted EPS	$3.92	$5.77	$6.77	$7.42	$0.96	$0.82	$0.91	$1.23	$1.22	$1.47	$1.53	$1.55	$1.57	$1.66	$1.73	$1.81
Non-GAAP Diluted EPS	$4.17	$6.05	$6.92	$7.55	$0.98	$0.89	$1.06	$1.25	$1.39	$1.51	$1.56	$1.59	$1.61	$1.69	$1.77	$1.85
Pro-Forma Reconciliation																
GAAP Gross Profit	$7,692	$10,109	$11,221	$11,910	$1,858	$1,749	$1,955	$2,130	$2,349	$2,527	$2,599	$2,634	$2,663	$2,761	$2,851	$2,947
Total adjustment	$60	$44	$16	$4	$9	$16	$23	$12	$20	$8	$8	$8	$4	$4	$4	$4
Non-GAAP Gross Profit	$7,752	$10,153	$11,237	$11,914	$1,867	$1,765	$1,978	$2,142	$2,369	$2,535	$2,607	$2,642	$2,667	$2,765	$2,855	$2,951
GAAP Operating expenses	$3,327	$3,894	$4,000	$4,176	$816	$817	$847	$847	$1,066	$918	$949	$961	$970	$988	$1,008	$1,033
Total adjustment	($104)	($278)	($113)	($112)	($17)	($28)	($29)	($30)	($193)	($28)	($28)	($28)	($28)	($28)	($28)	($28)
Non-GAAP Operating expenses	$3,223	$3,617	$3,887	$4,064	$799	$789	$818	$817	$873	$890	$920	$933	$942	$960	$980	$1,004
GAAP Operating Income	$4,365	$6,215	$7,222	$7,734	$1,042	$932	$1,108	$1,283	$1,283	$1,608	$1,651	$1,673	$1,693	$1,772	$1,842	$1,914
Total adjustment	$164	$322	$129	$116	$26	$44	$52	$42	$213	$36	$36	$36	$32	$32	$32	$32
Non-GAAP Operating Income	$4,529	$6,537	$7,351	$7,850	$1,068	$976	$1,160	$1,325	$1,496	$1,645	$1,687	$1,709	$1,725	$1,805	$1,875	$1,946
GAAP Provision for income taxes	$547	$727	$939	$1,043	$113	$123	$199	$112	$110	$200	$207	$209	$220	$230	$240	$249
Total adjustment	($38)	$53	$0	$0	$18	($11)	($63)	$18	$53	$0	$0	$0	$0	$0	$0	$0
Non-GAAP adjusted provision for income taxes	$509	$780	$939	$1,043	$131	$112	$136	$130	$163	$200	$207	$209	$220	$230	$240	$249
GAAP Pre-tax income	$4,166	$6,063	$7,091	$7,614	$1,005	$878	$1,040	$1,243	$1,240	$1,567	$1,618	$1,639	$1,659	$1,741	$1,810	$1,882
Total adjustment	$188	$314	$129	$116	$30	$51	$72	$35	$205	$36	$36	$36	$32	$32	$32	$32
Non-GAAP Pre-tax income	$4,354	$6,377	$7,220	$7,730	$1,035	$929	$1,112	$1,278	$1,445	$1,603	$1,654	$1,675	$1,691	$1,773	$1,842	$1,914
GAAP Net Income	$3,619	$5,337	$6,153	$6,570	$892	$755	$841	$1,131	$1,130	$1,366	$1,411	$1,429	$1,439	$1,510	$1,571	$1,633
Total adjustment	$226	$261	$129	$116	$12	$62	$135	$17	$152	$36	$36	$36	$32	$32	$32	$32
Non-GAAP Net Income	$3,845	$5,598	$6,282	$6,686	$904	$817	$976	$1,148	$1,282	$1,403	$1,447	$1,466	$1,471	$1,542	$1,603	$1,665
Growth and Margins	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
QoQ Revenue Growth	0.0%	0.0%	0.0%	0.0%	10.9%	(4.9%)	11.1%	6.7%	10.1%	4.5%	2.9%	1.3%	1.0%	3.7%	3.3%	3.4%
YoY Revenue Growth	17.8%	26.3%	10.1%	4.9%	10.9%	11.8%	23.4%	24.9%	24.0%	36.3%	26.2%	19.9%	9.9%	9.1%	9.5%	11.7%
Non-GAAP Gross Margin	45.1%	46.7%	47.0%	47.5%	44.9%	44.6%	45.0%	45.7%	45.9%	47.0%	47.0%	47.0%	47.0%	47.0%	47.0%	47.0%
R&D as % of Sales	13.0%	11.4%	11.0%	11.0%	13.3%	13.9%	13.0%	11.9%	11.7%	11.3%	11.3%	11.3%	11.3%	11.1%	10.9%	10.8%
Marketing as % of Sales	3.1%	2.8%	2.8%	2.8%	3.2%	3.3%	3.0%	2.8%	2.8%	2.7%	2.8%	2.8%	2.8%	2.8%	2.8%	2.8%
G&A as % of Sales	3.3%	3.0%	2.9%	2.9%	3.1%	3.5%	3.3%	3.3%	3.1%	3.0%	3.0%	3.0%	3.0%	2.9%	2.9%	2.9%
Non-GAAP Opex as % of Sales	18.7%	16.6%	16.3%	16.2%	19.2%	19.9%	18.6%	17.4%	16.9%	16.5%	16.6%	16.6%	16.6%	16.3%	16.1%	16.0%
Opex YoY Growth	9.6%	12.5%	6.9%	4.4%	6.5%	5.9%	9.7%	8.2%	9.3%	12.8%	12.5%	14.2%	7.9%	7.8%	6.5%	7.7%
PF Operating Margin	26.3%	30.1%	30.7%	31.3%	25.7%	24.7%	26.4%	28.3%	29.0%	30.5%	30.4%	30.4%	30.4%	30.7%	30.9%	31.0%
Tax Rate	11.7%	12.2%	13.0%	13.5%	12.7%	12.1%	12.2%	10.2%	11.3%	12.5%	12.5%	12.5%	13.0%	13.0%	13.0%	13.0%
Net Margin	22.4%	25.8%	26.3%	26.7%	21.7%	20.6%	22.2%	24.5%	24.8%	26.0%	26.1%	26.1%	25.9%	26.2%	26.4%	26.5%

Source: company reports, Bernstein estimates and analysis

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EXHIBIT 141: **Bernstein AMAT Balance Sheet**

BALANCE SHEET **Fiscal Period**	**2020**	**2021E**	**2022E**	**2023E**	**Q120**	**Q220**	**Q320**	**Q420**	**Q121**	**Q221E**	**Q321E**	**Q421E**	**Q122E**	**Q222E**	**Q322E**	**Q422E**
Assets																
Current Assets:																
Cash and cash equivalents	$5,351.0	$7,889.5	$8,871.6	$9,845.4	$3,424.0	$5,281.0	$4,350.0	$5,351.0	$6,213.0	$6,925.4	$7,364.5	$7,889.5	$8,143.6	$8,279.5	$8,553.1	$8,871.6
Short-term investments	$387.0	$410.0	$410.0	$410.0	$536.0	$423.0	$406.0	$387.0	$410.0	$410.0	$410.0	$410.0	$410.0	$410.0	$410.0	$410.0
Accounts receivable, net	$2,963.0	$3,479.3	$3,886.7	$3,967.9	$2,679.0	$2,625.0	$2,806.0	$2,963.0	$3,045.0	$3,402.7	$3,455.0	$3,479.3	$3,493.8	$3,659.3	$3,765.1	$3,886.7
Inventories	$3,904.0	$4,500.7	$5,045.4	$5,087.0	$3,472.0	$3,725.0	$3,952.0	$3,904.0	$3,925.0	$4,482.6	$4,514.5	$4,500.7	$4,526.5	$4,769.4	$4,893.9	$5,045.4
Other current assets	$764.0	$853.0	$951.6	$956.1	$658.0	$681.0	$734.0	$764.0	$676.0	$853.5	$858.7	$853.0	$845.2	$902.5	$924.6	$951.6
Total current assets	$13,369.0	$17,132.5	$19,165.4	$20,266.3	$10,769.0	$12,735.0	$12,248.0	$13,369.0	$14,269.0	$16,074.2	$16,602.8	$17,132.5	$17,419.1	$18,020.7	$18,546.7	$19,165.4
Long-term investments	$1,538.0	$1,601.0	$1,601.0	$1,601.0	$1,713.0	$1,678.0	$1,538.0	$1,538.0	$1,601.0	$1,601.0	$1,601.0	$1,601.0	$1,601.0	$1,601.0	$1,601.0	$1,601.0
PP&E, net	$3,466.0	$1,838.8	$2,129.4	$2,402.7	$1,555.0	$1,534.0	$1,530.0	$3,466.0	$1,638.0	$1,693.4	$1,760.5	$1,838.8	$1,909.7	$1,978.1	$2,051.9	$2,129.4
Goodwill	$1,604.0	$3,479.0	$3,479.0	$3,479.0	$3,399.0	$3,426.0	$3,474.0	$1,604.0	$3,479.0	$3,479.0	$3,479.0	$3,479.0	$3,479.0	$3,479.0	$3,479.0	$3,479.0
Purchased technology and other intangible assets, net	$153.0	$103.3	$70.3	$50.3	$142.0	$132.0	$157.0	$153.0	$140.0	$127.8	$115.5	$103.3	$95.0	$86.8	$78.5	$70.3
Deferred income taxes and other assets	$2,223.0	$2,178.0	$2,178.0	$2,178.0	$2,189.0	$2,310.0	$2,224.0	$2,223.0	$2,178.0	$2,178.0	$2,178.0	$2,178.0	$2,178.0	$2,178.0	$2,178.0	$2,178.0
Total assets	$22,353.0	$26,332.5	$28,623.0	$29,977.3	$19,767.0	$21,815.0	$21,171.0	$22,353.0	$23,305.0	$25,153.4	$25,736.8	$26,332.5	$26,681.8	$27,343.5	$27,935.1	$28,623.0
Liabilities and Stockholders' Equity																
Current liabilitites:																
Short-term debt	$0.0	$0.0	$0.0	$0.0	$600.0	$600.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Acounts payable, notes payable and accrued expenses	$3,138.0	$3,458.6	$3,850.9	$3,901.7	$2,569.0	$2,831.0	$2,895.0	$3,138.0	$2,932.0	$3,409.6	$3,434.7	$3,458.6	$3,437.7	$3,635.8	$3,732.9	$3,850.9
Contract Liabilities	$1,321.0	$1,685.6	$1,901.2	$1,952.4	$1,400.0	$1,334.0	$1,390.0	$1,321.0	$1,572.0	$1,671.4	$1,681.5	$1,685.6	$1,727.2	$1,790.0	$1,839.9	$1,901.2
Total current liabilities	$4,459.0	$5,144.2	$5,752.1	$5,854.2	$4,569.0	$4,765.0	$4,285.0	$4,459.0	$4,504.0	$5,081.1	$5,116.3	$5,144.2	$5,165.0	$5,425.9	$5,572.7	$5,752.1
Long-term debt	$5,448.0	$5,449.0	$5,449.0	$5,449.0	$4,714.0	$6,215.0	$5,447.0	$5,448.0	$5,449.0	$5,449.0	$5,449.0	$5,449.0	$5,449.0	$5,449.0	$5,449.0	$5,449.0
Other liabilities + Income Taxes Payable	$1,868.0	$1,879.0	$1,879.0	$1,879.0	$1,824.0	$1,811.0	$1,870.0	$1,868.0	$1,879.0	$1,879.0	$1,879.0	$1,879.0	$1,879.0	$1,879.0	$1,879.0	$1,879.0
Total liabilities	$11,775.0	$12,472.2	$13,080.1	$13,182.2	$11,107.0	$12,791.0	$11,602.0	$11,775.0	$11,832.0	$12,409.1	$12,444.3	$12,472.2	$12,493.0	$12,753.9	$12,900.7	$13,080.1
Total stockholders' equity	$10,578.0	$13,860.4	$15,542.9	$16,795.1	$8,660.0	$9,024.0	$9,569.0	$10,578.0	$11,473.0	$12,744.3	$13,292.6	$13,860.4	$14,188.8	$14,589.6	$15,034.4	$15,542.9
Total liabilities and stockholders' equity	$22,353.0	$26,332.5	$28,623.0	$29,977.3	$19,767.0	$21,815.0	$21,171.0	$22,353.0	$23,305.0	$25,153.4	$25,736.8	$26,332.5	$26,681.8	$27,343.5	$27,935.1	$28,623.0

Source: company reports, Bernstein estimates and analysis

EXHIBIT 142: **Bernstein AMAT Cash Flow Statement**

CASH FLOW STATEMENT Fiscal Period	2020	2021E	2022E	2023E	Q120	Q220	Q320	Q420	Q121	Q221E	Q321E	Q421E	Q122E	Q222E	Q322E	Q422E
Cash flows from operating activities:																
Net income	$3,619.0	$5,336.8	$6,152.8	$6,570.0	$892.0	$755.0	$841.0	$1,131.0	$1,130.0	$1,366.5	$1,410.9	$1,429.4	$1,438.9	$1,510.0	$1,570.7	$1,633.2
Depreciation and amortization	$376.0	$351.0	$349.1	$385.6	$94.0	$91.0	$94.0	$97.0	$94.0	$85.9	$86.2	$84.9	$78.7	$88.6	$90.0	$91.8
share-based compensation	$307.0	$428.0	$428.0	$428.0	$93.0	$71.0	$70.0	$73.0	$107.0	$107.0	$107.0	$107.0	$107.0	$107.0	$107.0	$107.0
Excess tax banefits from share-based compensation	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Deferred income taxes	$80.0	$28.0	$0.0	$0.0	$30.0	($11.0)	$79.0	($18.0)	$28.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Other	$60.0	$148.0	$0.0	$0.0	$15.0	$7.0	$33.0	$5.0	$148.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Net change in operating assets and liabilities	($638.0)	($632.8)	($442.8)	($25.2)	($137.0)	($278.0)	($250.0)	$27.0	($86.0)	($515.7)	($54.3)	$23.2	($11.8)	($204.7)	($105.5)	($120.7)
Cash provided by operating activities	$3,804.0	$5,659.0	$6,487.2	$7,358.5	$987.0	$635.0	$867.0	$1,315.0	$1,421.0	$1,043.7	$1,549.8	$1,644.5	$1,612.8	$1,500.9	$1,662.1	$1,711.3
Cash flows from investing activities:																
Capital expenditures	($422.0)	($542.0)	($606.8)	($638.9)	($102.0)	($71.0)	($87.0)	($162.0)	($121.0)	($129.1)	($141.1)	($150.9)	($141.4)	($148.7)	($155.6)	($161.1)
Cash paid for acquisitions	($107.0)	($12.0)	$0.0	$0.0	$0.0	($27.0)	($80.0)	$0.0	($12.0)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Proceeds from sale of facility	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Proceeds from sales and maturities of investments	$1,754.0	$358.0	$0.0	$0.0	$368.0	$667.0	$353.0	$366.0	$358.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Purchases of investments	($1,355.0)	($441.0)	$0.0	$0.0	($428.0)	($404.0)	($178.0)	($345.0)	($441.0)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Cash used in investing activities	($130.0)	($637.0)	($606.8)	($638.9)	($162.0)	$165.0	$8.0	($141.0)	($216.0)	($129.1)	($141.1)	($150.9)	($141.4)	($148.7)	($155.6)	($161.1)
Cash flows from financing activities:																
Net Change in Debt	$97.0	$0.0	$0.0	$0.0	$0.0	$1,498.0	($1,401.0)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Proceeds from common stock issuances	$174.0	$0.0	$0.0	$0.0	$15.0	$76.0	$0.0	$83.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Common stock repurchases	($649.0)	($1,500.0)	($4,000.0)	($4,800.0)	($200.0)	($199.0)	($200.0)	($50.0)	$0.0	$0.0	($750.0)	($750.0)	($1,000.0)	($1,000.0)	($1,000.0)	($1,000.0)
Excess tax benefits from share-based compensation	($172.0)	($142.0)	$0.0	$0.0	($153.0)	($10.0)	($3.0)	($6.0)	($142.0)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Dividends	($787.0)	($841.4)	($898.3)	($945.8)	($192.0)	($193.0)	($202.0)	($200.0)	($201.0)	($202.2)	($219.6)	($218.6)	($217.4)	($216.2)	($233.0)	($231.7)
Other	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Cash used in financing activities	($1,337.0)	($2,483.4)	($4,898.3)	($5,745.8)	($530.0)	$1,172.0	($1,806.0)	($173.0)	($343.0)	($202.2)	($969.6)	($968.6)	($1,217.4)	($1,216.2)	($1,233.0)	($1,231.7)
FCF	$3,382.0	$5,116.9	$5,880.4	$6,719.6	$885.0	$564.0	$780.0	$1,153.0	$1,300.0	$914.6	$1,408.7	$1,493.6	$1,471.5	$1,352.2	$1,506.5	$1,550.2

Source: company reports, Bernstein estimates and analysis

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DISCLOSURE APPENDIX

VALUATION METHODOLOGY

U.S. Semiconductor Capital Equipment

We value companies in our coverage using a combination of Price to EPS, Enterprise Value to Sales, and Enterprise Value to EBITDA multiples.

Applied Materials Inc

For AMAT, we apply a ~21x multiple to our FY2023 non-GAAP EPS estimate ($7.55) equating to a $160 target price.

Lam Research Corp

For LRCX, we apply a ~21x multiple to our FY2023 non-GAAP EPS ($32.57) equating to a $700 target price.

RISKS

U.S. Semiconductor Capital Equipment

The greatest sector-wide risk that could affect all of the stocks in our coverage is the macroeconomic environment and resulting impact on revenues and sentiment. Upside risk to our targets exist if global GDP growth is quicker than we currently anticipate, which would result in stronger semiconductor / semicap industry growth than we currently forecast. Conversely, if GDP growth is slower than expected, this would result in slower growth for the industry and semiconductor / semicap companies. Recent increasingly negative rhetoric around trade and tariffs, and of course the coronavirus pandemic, represent further potential risks to our broad coverage.

Beyond the broader macro environment, several company-specific risks may influence the stocks in our coverage:

Applied Materials Inc

Downside risks to our target price on AMAT include the potential for an industry downturn, detrimental end market mix, share losses, and geopolitical risks.

Lam Research Corp

Downside risks to our target price on LRCX include the potential for an industry downturn, detrimental end market mix, NAND spending recovery that takes longer than expected, share losses, and geopolitical risks.

REQUIRED REGULATORY DISCLOSURES

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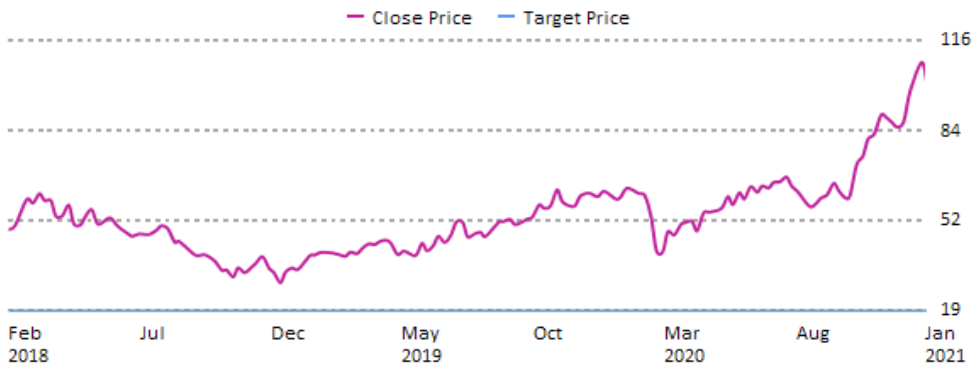
Ticker Rating Changes
AMAT
LRCX

Rating Guide: O - Outperform, M - Market-Perform, U - Underperform, N - Not Rated
Rating Actions: IC - Initiated Coverage, DC - Dropped Coverage, RC - Rating Change

AMAT / Applied Materials Inc (USD)

Date Rating Target

No coverage data

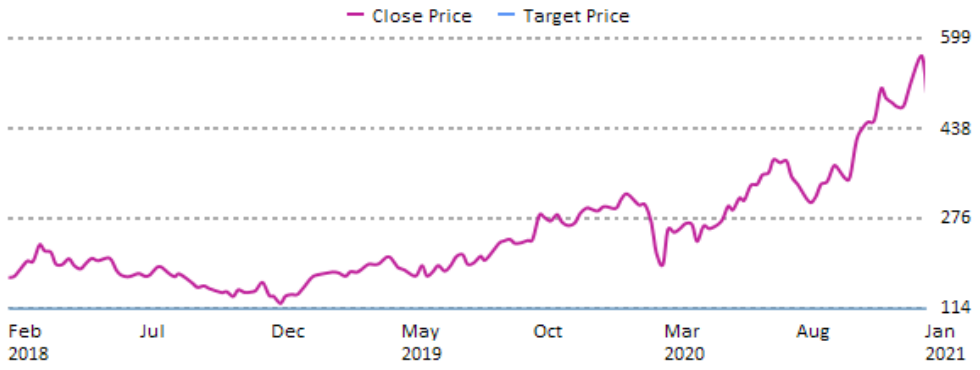


Source: Bernstein - As of 04-Feb-2021

LRCX / Lam Research Corp (USD)

Date Rating Target

No coverage data



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