Goldman Sachs | Equity Research

12 September 2018 | 5:23AM EDT

Americas Technology: Semiconductor Capital Equipment

Semi Cap coverage view down to Neutral; LRCX down to Neutral and ENTG removed from the Conviction List

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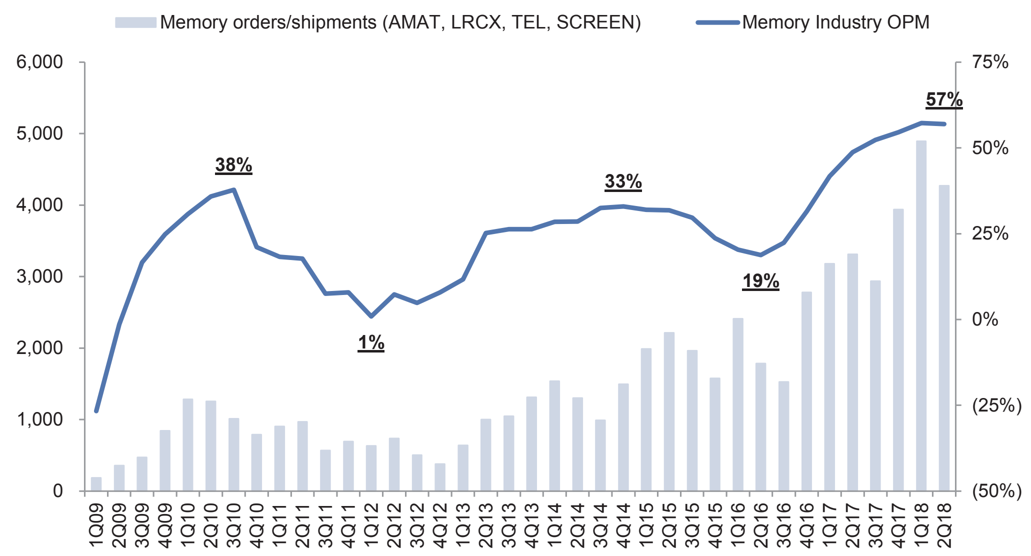
We lower our coverage view on the Semiconductor Capital Equipment space from Attractive to Neutral as we reduce our 2018/2019 memory capex expectations following early signs of excess supply in DRAM combined with further weakness in NAND pricing. The group (AMAT, LRCX and KLAC) has underperformed the SPX/SOX by 2080bps/2150bps YTD, but the stocks are still up ~140% on average, off the lows in September of 2015 and have outperformed the broader market by ~90% during this timeframe. While there was initially hope that Samsung's decision to push out DRAM spending was specific to the company and was related to node transition issues as opposed to supply/demand issues, **we now envision a more broad-based correction in memory capex in 2019**, as memory manufacturers digest what we perceive to be excess capacity in NAND and to a lesser extent DRAM. In single stock, **we downgrade LRCX to Neutral from Buy** as our updated CY19/20 EPS estimates sit 15%/23% below Street consensus. We continue to view LRCX as one of the best managed companies in our coverage universe and a long-term share gainer in the growing Etch/Deposition product markets; the stock, however, is unlikely to outperform our broader coverage group in the face of negative estimate revisions. **We also remove ENTG from the Conviction List**; although we remain Buy-rated given ENTG's disproportionate (i.e. ~70%) revenue exposure to wafer starts (as opposed to capex) and our view that ENTG is a long-term beneficiary of materials-enabled scaling and growing purity requirements. Find inside details on the rationale of the sector downgrade as well as our updated investment theses on individual stocks. **We would also highlight that we are making a concerted call with our global colleagues here as we downgrade Micron, Hynix and Tokyo Electron from Buy to Neutral and remove Buy-rated Samsung Electronics and SUMCO from the Conviction List.** Since we added Entegris to the Conviction List on May 22, 2017, the shares are up 29.6% vs. +24.8% for the Russell 2000.

Why now?

We are lowering our coverage view and making select rating changes as we account for the deterioration in memory pricing (and thus margins) and potential implications for future memory capex - note the two have historically been highly correlated

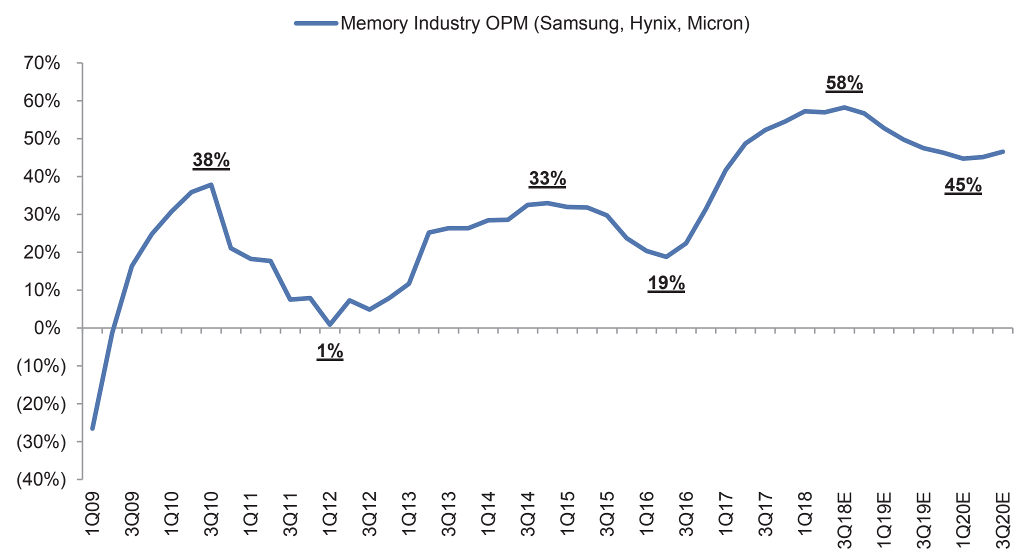
(Exhibit 1). Specifically, in NAND we now forecast low-teens sequential price declines in CY3Q and a further decline in CY4Q (from -12% and -10% prior), while we now expect DRAM pricing to peak in CY3Q and to trend lower through 3Q20. Based on updated estimates for Micron, Samsung Electronics and Hynix, we now expect memory industry margins to peak in CY18 and move lower for 6 quarters before ultimately bottoming in 1Q20.

Exhibit 1: Memory company profit margins and equipment spending are highly correlated



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 2: We expect memory industry margins to contract through 2019 and into 2020

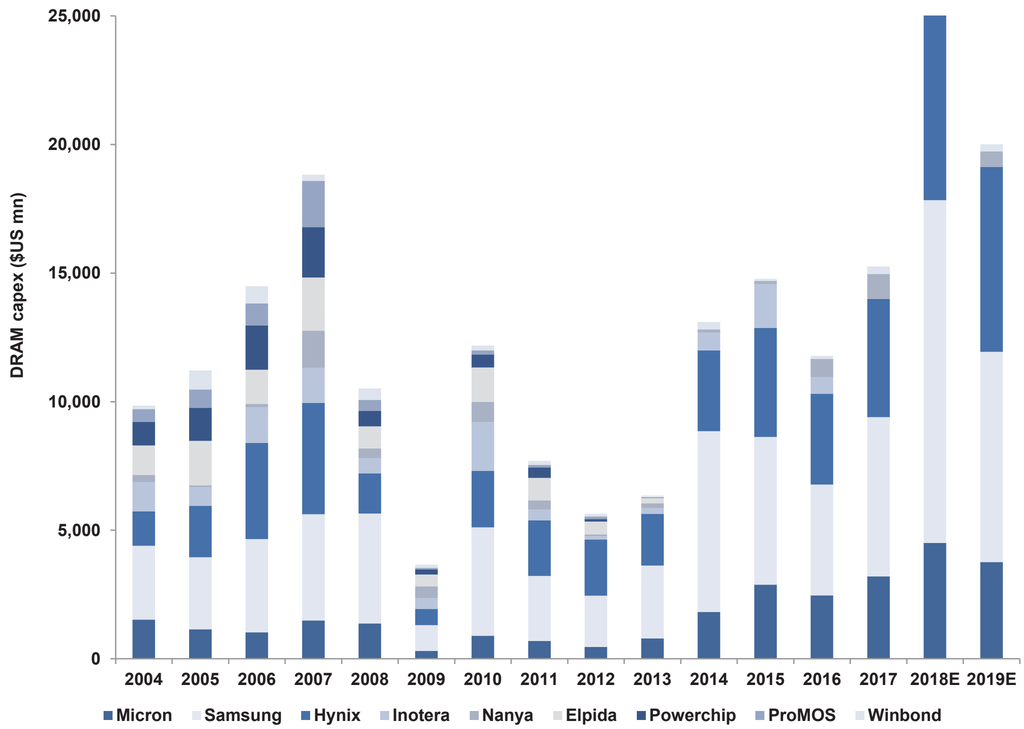


Source: Company data, Goldman Sachs Global Investment Research

In conjunction with the above changes, we have recalibrated our bottom-up Semiconductor capex model. As a result of the weaker pricing outlook, we now forecast

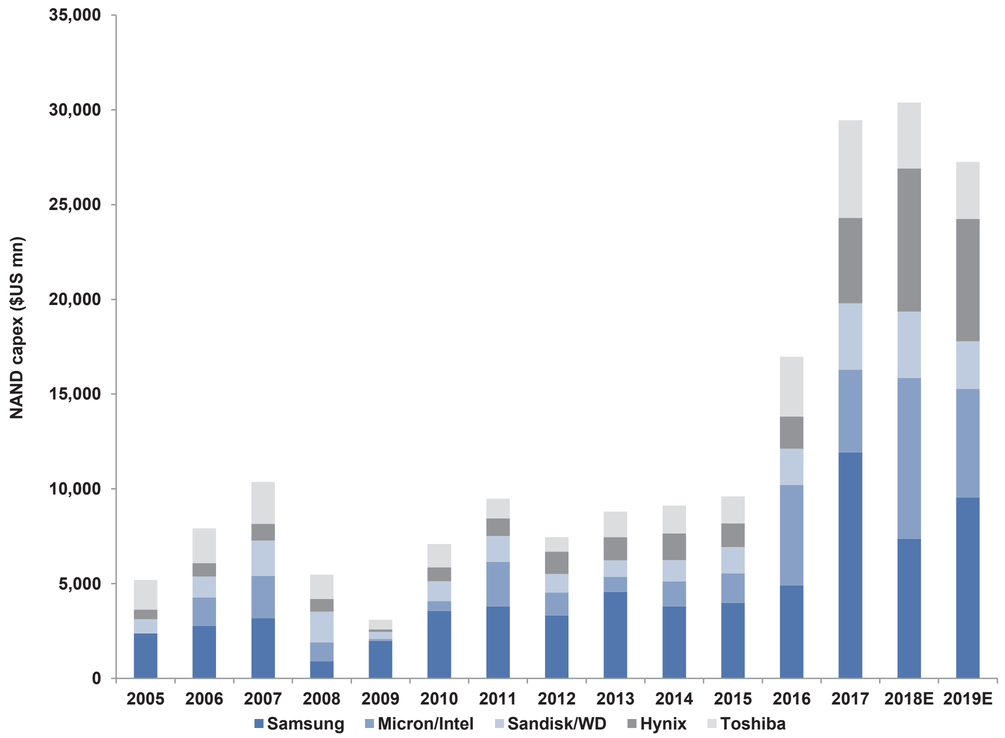
DRAM and NAND capex to decline 26% and 10% yoy in 2019 down from -18% and +7% prior (Exhibits 3-4), and for total Semiconductor capex to decline 6% yoy in 2019 vs +1% yoy prior (Exhibit 5). Note, all else equal, the reduction in memory capex will likely have an outsized impact on Lam's fundamentals given its disproportionate exposure to DRAM and NAND.

Exhibit 3: We expect DRAM capex to decline 26% in 2019



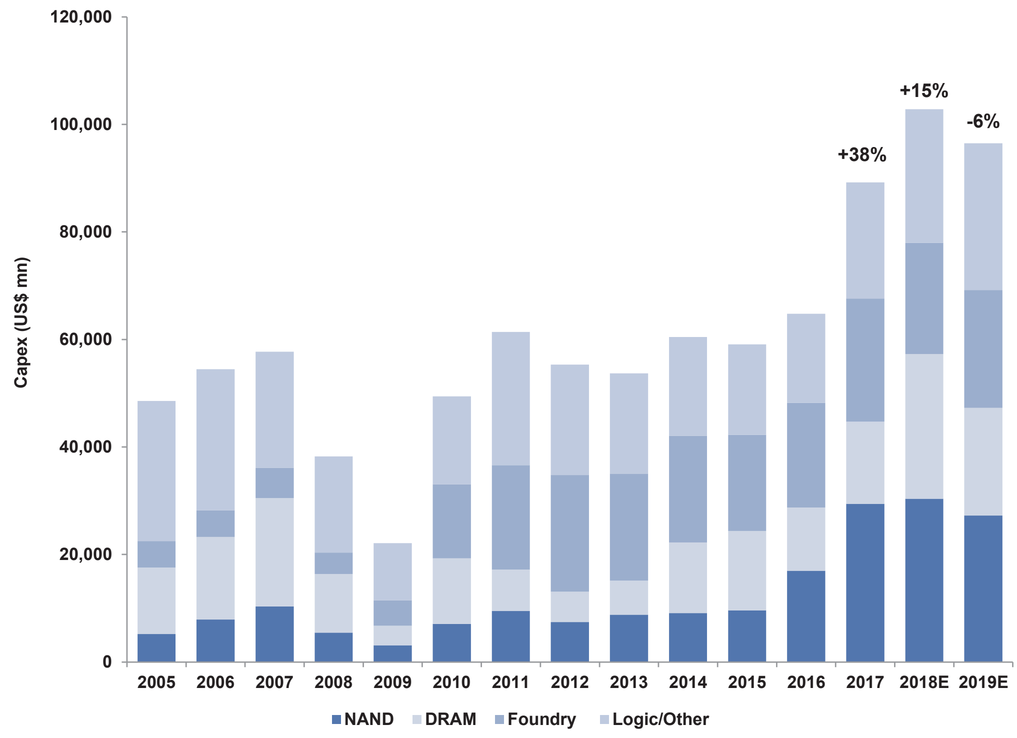
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 4: We expect NAND capex to decline 10% in 2019



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 5: We expect total Semiconductor capex to decline 6% in 2019

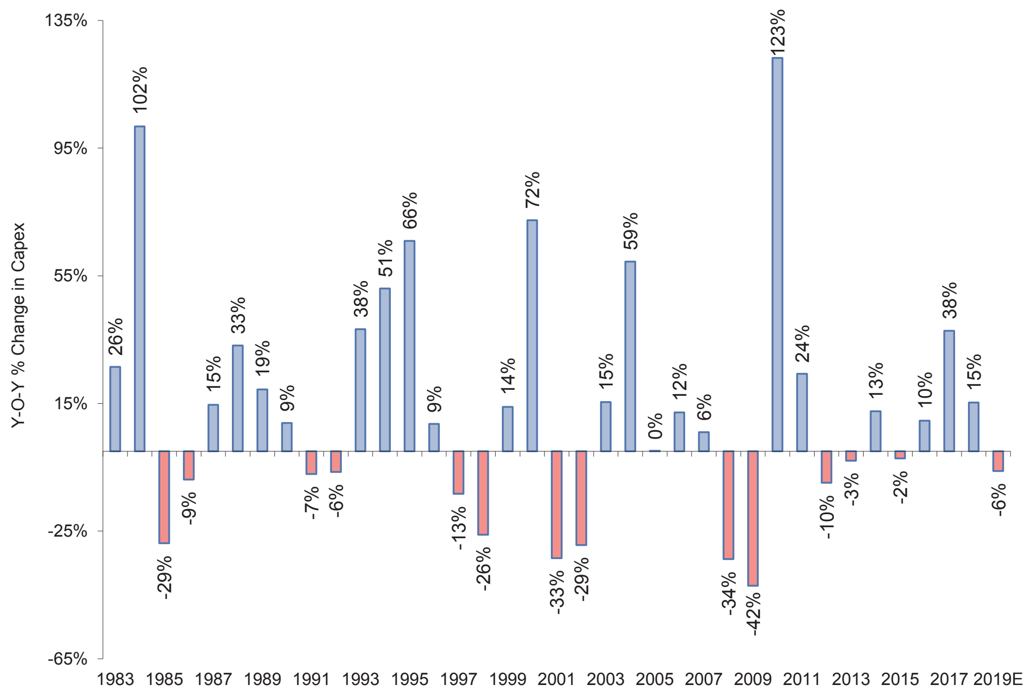


Source: Company data, Goldman Sachs Global Investment Research

A look back at past memory downturns

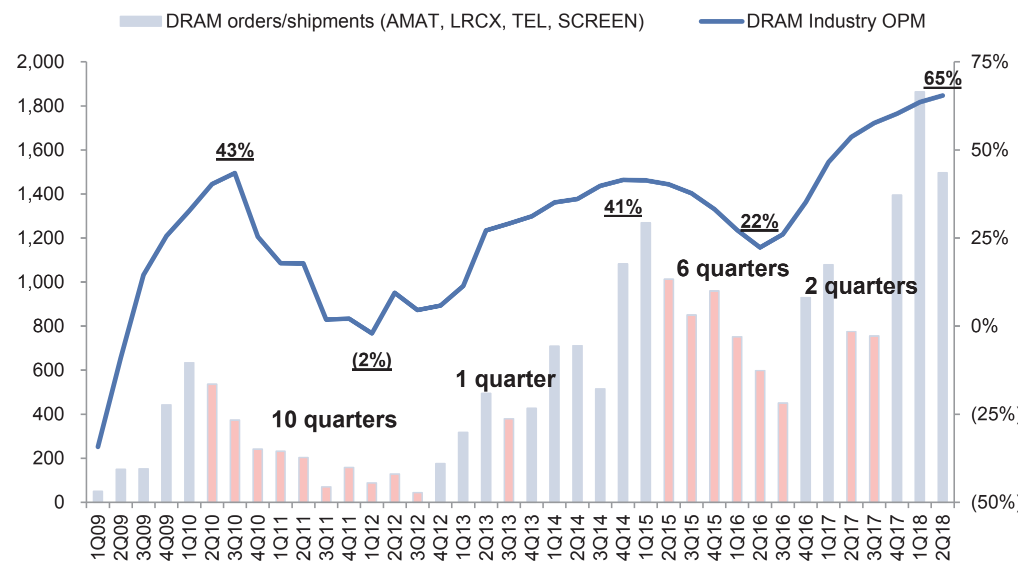
Semi capex downturns have historically lasted around two years (Exhibit 6), with year 1 declines ranging from -2% to -34% and year 2 declines ranging from -3% to -42%. In DRAM, capacity investment has historically contracted when profit margins have compressed (Exhibit 8) with the average operating margin downturn lasting 7 quarters. Peak-to-trough downturns for DRAM equipment spending/orders have lasted on average 5 quarters (Exhibit 7). However, when companies have reduced spending when margins were flat-to-up, equipment downturns have lasted 1-2 quarters.

Exhibit 6: Semiconductor capex downturns have historically lasted around 2 years



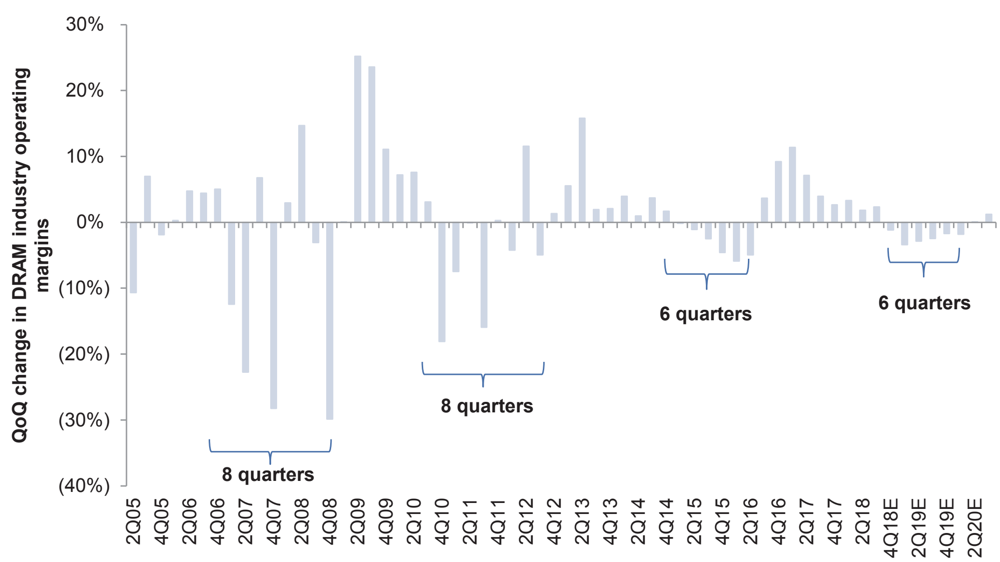
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 7: The average DRAM equipment downturn has lasted 5 quarters



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 8: The average DRAM operating margin downturn has lasted 7 quarters



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 9: Equipment downturns have generally been shorter when memory companies reduced capex ahead of a margin downturn

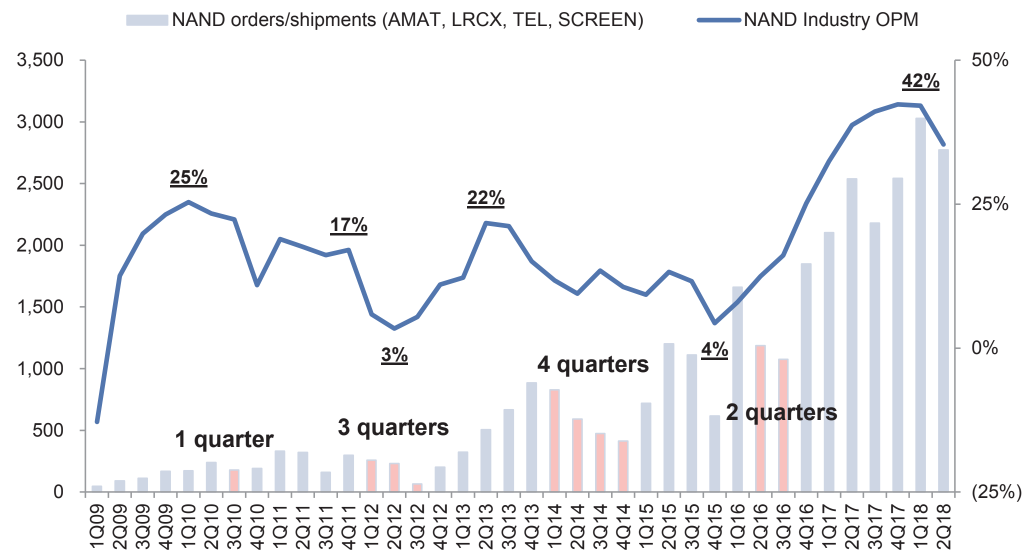
	Peak op. margin	Peak orders/shipments	First quarter of Semi Cap correction	Timing of equipment cut vs margin downturn	Equipment downturn duration
DRAM	3Q10	1Q10	2Q10	Before	10 quarters
	2Q13*	2Q13	3Q13	Before	1 quarter
	4Q14	1Q15	2Q15	After	6 quarters
	1Q17*	1Q17	2Q17	Before	2 quarters
	3Q18E	1Q18	2Q18	--	???

***Industry margin didn't contract**

Source: Goldman Sachs Global Investment Research

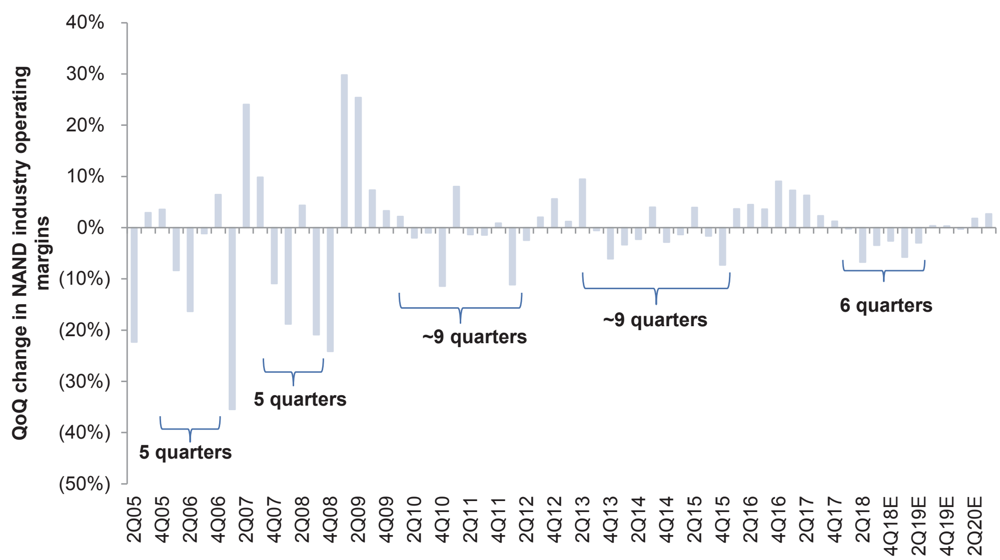
The same largely holds true for the NAND market, where the average operating margin downturn has lasted 7 quarters compared to the current downturn, which we expect to last for 6 quarters. Of the last 4 downturns from a front-end equipment perspective, the shortest was 1 quarter (3Q10), while the longest was 4 quarters (1Q14 - 4Q14). In both of these cases, NAND companies reduced orders/shipments after operating margins peaked. In the two cases where NAND companies reduced spending prior to a correction in operating margins, the equipment downturn lasted 2-3 quarters.

Exhibit 10: NAND equipment downturns have lasted 1-4 quarters



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 11: The average NAND operating margin correction has been 7 quarters



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 12: Equipment contractions have lasted 1-4 quarters

	Peak op. margin	Peak orders/shipments	First quarter of Semi Cap correction	Timing of equipment cut vs margin downturn	Equipment downturn duration
NAND	1Q10	2Q10	3Q10	After	1 quarter
	4Q11	4Q11	1Q12	Before	3 quarters
	2Q13	4Q13	1Q14	After	4 quarters
	1Q16*	1Q16	2Q16	Before	2 quarters
	2Q18	1Q18	2Q18	--	???

*Industry margin didn't contract

Source: Goldman Sachs Global Investment Research

Our base case suggests a relatively mild downturn relative to history…

We are currently modeling a mild downturn in 2019/2020 particularly in relation to downturns witnessed prior to 2010 (recall 2001/2002 Semi capex declined 34%/29% and 2008/2009 Semi capex declined 34%/42%). There are two key reasons why we believe the upcoming correction could be more shallow than in the past: **1) rational customer behavior:** for the first time in history, a DRAM manufacturer (i.e. Samsung) delayed a capex project in anticipation of a downturn as opposed to reacting to one. Recall, according to our checks, Samsung informed equipment OEMs in the April/May timeframe of its decision to postpone DRAM capex. We believe this preemptive move by Samsung indicates how consolidated the DRAM industry has become over the years and is a sign of rational behavior focused on profitability as opposed to market share. **2) shorter equipment lead times:** equipment lead times have generally come in thanks to improved supply chain operations over time; all else equal, this gives the customer (i.e. the semiconductor manufacturer) more flexibility when making capex decisions. When lead times are long, there is an incentive for a customer to 'stay in the queue' until it is absolutely certain the tool won't be needed, thereby driving last-minute cancellations. However, with shortened lead times, customers can hop out and/or hop back in the queue with relative ease which in turn enables behavior such as the one taken by Samsung in DRAM a several months ago.

… but what if we're wrong and this downturn is similar to ones in the past?

That said, what if our base case is wrong and the downturn is more prolonged and/or much deeper? How would such a scenario impact our estimates and our price targets? Below we illustrate a downside scenario analysis indicating: a) to what extent 2019/2020 earnings could deteriorate and b) how this would impact the stocks. Bottom line, we find there could be 4-47% potential downside to our LRCX CY20 EPS estimate, 3-40% potential downside to our AMAT CY20 EPS estimate, and 4-42% potential downside to our KLAC CY20 EPS estimate, when assuming a worse downturn. Note, based on the bear case scenario, LRCX would trade at 19.1x the implied CY20 EPS estimate (vs 10.41x today), AMAT would trade at 16.0x the implied CY20 EPS estimate (vs 9.x today), and KLAC would trade at 20.9x the implied CY20 EPS estimate (vs 12.1x today).

Our scenario analysis assumes the following. We acknowledge a range of outcomes exists outside of our analysis:

-CY19 and CY20 WFE declines 5-30% yoy (note our current estimates assume a 5% decline in CY19/20 equipment revenue).

-Note the CY19/20 WFE declines of 5-30% compare to downturns since 2000 that have ranged from down ~33-34% in year 1 and down ~30-40% in year 2.

-CY20 Services growth of 10% for LRCX, 6% for AMAT, and 8% for KLAC.

-CY20 Display revenue for AMAT that is consistent with our current estimate.

-Incremental/detrimental gross margins in line with our current assumptions

-Opex intensity of 19-25% for LRCX, 19-23% for AMAT, and 26-30% for KLAC, consistent with historical ranges.

-Interest and other expense, tax rate, and share count consistent with our current estimates.

Exhibit 13: We see 4-47% potential downside to our CY20 LRCX EPS estimate

Implied CY20 EPS

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	$15.41	$14.85	$14.30	$13.75	$13.19	$12.64
(10%)	$14.17	$13.67	$13.16	$12.66	$12.16	$11.66
(15%)	$12.98	$12.53	$12.08	$11.62	$11.17	$10.72
(20%)	$11.84	$11.44	$11.03	$10.63	$10.23	$9.82
(25%)	$10.76	$10.40	$10.04	$9.68	$9.32	$8.96
(30%)	$9.73	$9.41	$9.09	$8.77	$8.46	$8.14

vs current CY20 EPS GSE

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	0%	(4%)	(7%)	(11%)	(14%)	(18%)
(10%)	(8%)	(11%)	(15%)	(18%)	(21%)	(24%)
(15%)	(16%)	(19%)	(22%)	(25%)	(27%)	(30%)
(20%)	(23%)	(26%)	(28%)	(31%)	(34%)	(36%)
(25%)	(30%)	(33%)	(35%)	(37%)	(40%)	(42%)
(30%)	(37%)	(39%)	(41%)	(43%)	(45%)	(47%)

Implied CY20 P/E

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	10.1x	10.5x	10.9x	11.3x	11.8x	12.3x
(10%)	11.0x	11.4x	11.8x	12.3x	12.8x	13.3x
(15%)	12.0x	12.4x	12.9x	13.4x	13.9x	14.5x
(20%)	13.1x	13.6x	14.1x	14.6x	15.2x	15.8x
(25%)	14.4x	14.9x	15.5x	16.1x	16.7x	17.3x
(30%)	16.0x	16.5x	17.1x	17.7x	18.4x	19.1x

Source: Goldman Sachs Global Investment Research

Exhibit 14: We see 3-40% potential downside to our CY20 AMAT EPS estimate

Implied CY20 EPS

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	$4.12	$3.98	$3.84	$3.70	$3.56	$3.42
(10%)	$3.86	$3.74	$3.61	$3.48	$3.35	$3.22
(15%)	$3.61	$3.50	$3.38	$3.26	$3.14	$3.02
(20%)	$3.37	$3.26	$3.15	$3.04	$2.93	$2.82
(25%)	$3.13	$3.04	$2.94	$2.84	$2.74	$2.64
(30%)	$2.91	$2.82	$2.73	$2.64	$2.54	$2.45

vs current CY20 EPS GSE

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	0%	(3%)	(7%)	(10%)	(13%)	(17%)
(10%)	(6%)	(9%)	(12%)	(16%)	(19%)	(22%)
(15%)	(12%)	(15%)	(18%)	(21%)	(24%)	(27%)
(20%)	(18%)	(21%)	(23%)	(26%)	(29%)	(31%)
(25%)	(24%)	(26%)	(29%)	(31%)	(34%)	(36%)
(30%)	(29%)	(32%)	(34%)	(36%)	(38%)	(40%)

Implied CY20 P/E

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	9.5x	9.8x	10.2x	10.6x	11.0x	11.5x
(10%)	10.1x	10.5x	10.9x	11.3x	11.7x	12.2x
(15%)	10.8x	11.2x	11.6x	12.0x	12.5x	13.0x
(20%)	11.6x	12.0x	12.4x	12.9x	13.4x	13.9x
(25%)	12.5x	12.9x	13.3x	13.8x	14.3x	14.9x
(30%)	13.5x	13.9x	14.4x	14.9x	15.4x	16.0x

Source: Goldman Sachs Global Investment Research

Exhibit 15: We see 4-42% potential downside to our CY20 KLAC EPS estimate

Implied CY20 EPS

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	$8.74	$8.39	$8.05	$7.72	$7.38	$7.04
(10%)	$8.19	$7.87	$7.56	$7.25	$6.93	$6.62
(15%)	$7.67	$7.37	$7.08	$6.79	$6.50	$6.21
(20%)	$7.15	$6.88	$6.61	$6.35	$6.08	$5.81
(25%)	$6.65	$6.40	$6.16	$5.91	$5.67	$5.43
(30%)	$6.17	$5.94	$5.72	$5.50	$5.27	$5.05

vs current CY20 EPS GSE

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	(0%)	(4%)	(8%)	(12%)	(16%)	(19%)
(10%)	(6%)	(10%)	(14%)	(17%)	(21%)	(24%)
(15%)	(12%)	(16%)	(19%)	(22%)	(26%)	(29%)
(20%)	(18%)	(21%)	(24%)	(27%)	(30%)	(34%)
(25%)	(24%)	(27%)	(30%)	(32%)	(35%)	(38%)
(30%)	(29%)	(32%)	(35%)	(37%)	(40%)	(42%)

Implied CY20 P/E

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	12.1x	12.6x	13.1x	13.7x	14.3x	15.0x
(10%)	12.9x	13.4x	14.0x	14.6x	15.2x	16.0x
(15%)	13.8x	14.3x	14.9x	15.6x	16.2x	17.0x
(20%)	14.8x	15.4x	16.0x	16.6x	17.4x	18.2x
(25%)	15.9x	16.5x	17.2x	17.9x	18.6x	19.5x
(30%)	17.1x	17.8x	18.5x	19.2x	20.0x	20.9x

Source: Goldman Sachs Global Investment Research

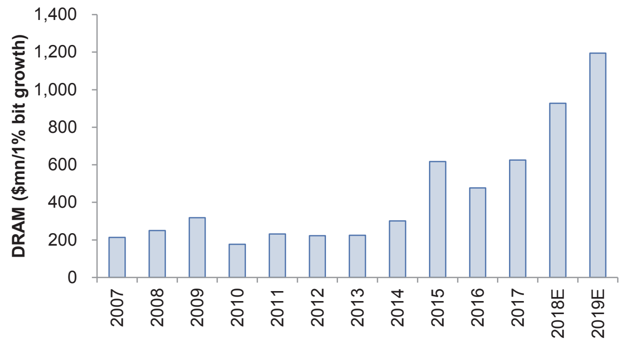
We remain constructive on the industry's long-term fundamental outlook

Despite the subdued 6-12 month industry outlook, we remain positive on the industry longer term for the following five reasons:

1) Growth in semiconductor content across a wider range of end-markets/applications: We believe the growth profile of the broader Semiconductor industry has improved over the past several years as new demand drivers have emerged. The industry is no longer reliant on the corporate PC refresh cycle or on the next iPhone; rather, it is exposed to a wider set of end-markets/applications that often have their respective/unique cycles. The growth inflection in Artificial Intelligence, in particular, has had a notable impact on the compute/processor manufacturers (i.e. Nvidia and to a lesser extent Intel, Xilinx, etc) as well as the memory manufacturers. In our AI Hardware report published on 3/11/18 (see here), we estimated that the proliferation of AI could drive ~$85bn in incremental revenue across compute, memory, storage and networking over the next 5 years.

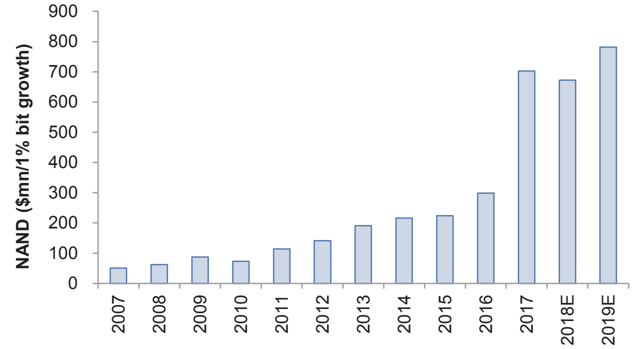
2) Growing capital intensity: We see upside bias to industry capital intensity. As evidenced in DRAM, node transitions are growing in difficulty and as a result wafer capacity is being added to address demand growth. Note the amount of capex required to grow DRAM bit supply 1% has increased from approximately $200mn in 2007 to ~$600mn in 2017 and we expect this to rise further, to ~$1.2bn by 2019 (Exhibit 16). In NAND, the increase has been more pronounced (Exhibit 17), with capex needed to achieve 1% bit growth growing from <$100mn in 2007 to ~$700mn in 2017. Longer term, we believe that these trends are likely to support elevated levels of DRAM and NAND capex going forward.

Exhibit 16: DRAM capital intensity has risen significantly over the last decade...
Capex needed to achieve 1% bit growth



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 17: ...a similar trend has emerged in NAND as well
Capex needed to achieve 1% bit growth

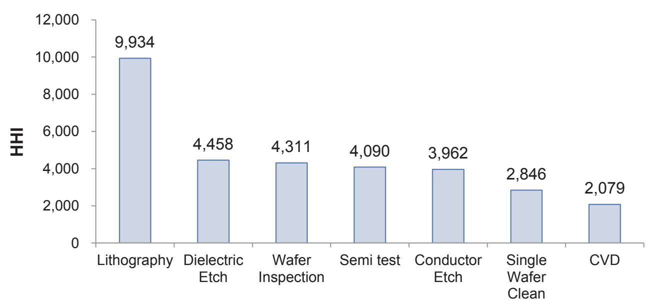


Source: Company data, Goldman Sachs Global Investment Research

3) Semi Cap = 'picks and shovels': Semi Cap companies manufacture/supply the 'picks and shovels' to the semiconductor industry. Without an Applied Materials CMP tool or a Lam Research Conductor Etch tool, there wouldn't be any Intel CPUs or Nvidia GPUs. Put another way, as long as a Semi Cap company is well positioned across the top 5-10 capex spenders, it will most likely grow in line with the overall Semiconductor market independent of share shifts across its customer base.

4) Consolidated market share: While the overall Wafer Fab Equipment (WFE) market remains fragmented with an HHI index of 1,139 (note an HHI of 1,500-2,500 is considered 'moderately concentrated'), when examined individually, most product groups could be categorized as 'highly concentrated' (Exhibit 18). We believe the consolidated nature of these markets bode well for our companies' ability to sustain/improve margins and returns through cycle.

Exhibit 18: Most sub-segments of the equipment industry would be classified as "highly concentrated'
Based on CY17



Source: Gartner, Goldman Sachs Global Investment Research

5) Still cyclical but less cyclical, in our view: Semi Cap Equipment will always remain a cyclical industry, in our view, given a) the amount of time it takes for a customer to add capacity and b) the possibility of the demand landscape changing during that timeframe. While Semi Cap companies have done a great job in shortening lead times over the past decade (LRCX management noted in a recent meeting that lead times are down from ~9 months 10 years ago to ~90 days today), we believe there will always be supply driven booms and busts in the industry. That said, the fact is that a) equipment lead times are shorter than any time before in the industry's history and b) the Semiconductor industry has matured and the participants are more rational (note Samsung's recent preemptive DRAM push out was arguably the first time it made such a move ahead of DRAM price/margin declines).

What we would need to see to turn bullish again

In order to turn bullish again on the group, we would need to signs of a cyclical trough in memory pricing/margins/capex which in turn would signal a potential bottom in Semi Cap Street estimates. For context, as illustrated in the analysis above in Exhibit 8, DRAM downturns (the definition of a 'downturn' being periods where margins declined qoq) have historically lasted for 7 quarters on average and NAND downturns have typically lasted for 7 quarters. Note, in the current cycle, we are in the third quarter of the NAND downturn, while we haven't even entered the downturn in DRAM.

In DRAM, yield issues at leading-edge nodes could provide a tailwind to Semi Cap companies as memory customers would be required to add wafer capacity, assuming a stable demand environment.

In NAND, an acceleration in bit/demand growth stemming from price elasticity combined with a slowdown in supply growth could create a more balanced supply/demand environment and in turn drive a recovery in capex.

Single stock investment theses

Lam Research (Neutral, $155.40): We downgrade LRCX to Neutral from Buy as our updated CY19/20 EPS estimates of $15.38/$15.41 sit 15%/23% below FactSet consensus, respectively. We continue to view LRCX as one of the best managed companies in our coverage universe and a long-term share gainer in the growing Etch/Deposition product markets; we believe the stock, however, is unlikely to outperform our broader Semiconductor/Semi Cap Equipment coverage group in the face of negative estimate revisions. Our updated 12-month price target of $180 (down from $224) is based on 12x (down from 13x on reduced growth) normalized EPS of $15.00 (down from $17.25 on lower go-forward estimates).

Applied Materials (Neutral, $39.18): We maintain our Neutral rating but cut CY19/20 EPS estimates by 14%/20% to $4.00/$4.12, respectively, as we reflect our updated outlook on memory capex. (Our FY18/19/20 EPS estimates change by 0%/-10%/-19% to $4.46/$3.87/$4.11.) Our updated 12-month price target of $47 (down from $52) is based on 12x (down from 13x on reduced growth) normalized EPS of $3.90 (down from $4.00 on lower go-forward estimates). On AMAT specifically, we would await signs of improved share growth in WFE and a recovery in Display capex before turning more constructive on the stock. Risks include 1) changes in the memory supply-demand outlook, 2) changes in the competitive landscape, and 3) changes in the Display capex outlook.

KLA-Tencor (NR, $105.62): We reduce CY19/20 EPS estimates by 11%/12% to $8.88/$8.74, respectively. (Our FY19/20 EPS estimates change by -7%/-11% to $8.63/$9.17 and we introduce FY21 of $8.86). The magnitude of the revision is marginal in relation to LRCX/AMAT and is a function of a) the difference in customer exposure (recall KLAC is more exposed to logic/foundry vs memory) and b) investments in Process Control are more tied to node transitions as opposed to capacity buys. We are Not Rated on KLAC.

Teradyne (Buy; $38.56): We trim CY19/20 EPS estimates by 8%/7% to $2.81/$3.57, respectively, as we make minor changes to our Semi Test segment revenue outlook (mostly Memory Test). We, however, remain constructive on the stock given the positive 2019 outlook in Mobile Semi Test (albeit off a low base in 2018) and the company's continued expansion in Industrial Automation. Our updated 12-month price target of $48 (from $52 prior) is based on 17x (unchanged) normalized EPS of $2.80 (down from $3.05 on lower go-forward estimates) and implies 24% potential upside. Risks include, 1) a broad Semiconductor industry downturn, 2) changes in the competitive landscape in Semi Test as well as in the collaborative robot business, 3) new product execution, and 4) M&A.

Entegris (Buy; $31.50): We remove ENTG from the Conviction List as our updated CY19/20 EPS estimates of $2.19/$2.56 are effectively in line with Street consensus. That said, we maintain the Buy rating as the 70:30 business mix (i.e. ~70% of revenue is tied to wafer starts or semiconductor production as opposed to capex) as well as its idiosyncratic product cycles will support continued earnings outperformance relative to the equipment OEMs. Our updated 12-month price target of $38 (from $43) is based 85% on a fundamental component of $38 (18x [down from 19x on lower growth] normalized EPS of $2.10 [down from $2.25 on lower estimates]) and 15% on an M&A component of $41 (12x 2019E EBITDA).

Versum (Neutral, $37.68): Similar to ENTG, we reflect the reduced memory spending outlook to parts of VSM's business that are exposed to industry capex, and cut CY19/20 EPS estimates by 11%/18% to $2.30/$2.28, respectively. (Our FY18E/19E/20E EPS estimates change by 0%/-8%/-16% to $2.35/$2.32/$2.29.) While we like VSM's advanced materials product portfolio, we remain Neutral-rated given limited potential upside to the stock. Our updated 12-month price target of $38 (from $40) is based 85% on a fundamental component of $37 (15x [down from 16x on lower growth] normalized EPS of $2.45 [unchanged]) and 15% on an M&A component of $44 (12x 2018E EBITDA). Risks include a broad semiconductor industry downturn, supply/demand in commodity gases and implications for pricing/margins, and M&A.

Keysight Technologies (Neutral, $66.50): As KEYS has relatively low exposure to broader semiconductor capex, our investment thesis and estimates are unchanged. Our unchanged 12-month price target of $66 is based on 18x our normalized EPS forecast of $3.70. Risks include timing of 5G ramp and 4G decline, changes in the competitive landscape, China trade impacts and cadence of A&D spend.

Exhibit 19: We reduce our CY19/20 EPS estimates by 11%/14% on average

$ millions, except per share data

	New vs Old			
	Revenue		EPS (Non-GAAP)	
	CY19E	CY20E	CY19E	CY20E
LRCX				
New	9,948	9,817	$15.38	$15.41
Old	11,386	11,462	$18.05	$18.52
Difference	**(12.6%)**	**(14.4%)**	**(14.8%)**	**(16.8%)**
AMAT				
New	15,701	15,478	$4.00	$4.12
Old	17,164	17,683	$4.66	$5.17
Difference	**(8.5%)**	**(12.5%)**	**(14.2%)**	**(20.4%)**
KLAC				
New	4,220	4,140	$8.88	$8.74
Old	4,510	4,445	$9.96	$9.88
Difference	**(6.4%)**	**(6.9%)**	**(10.8%)**	**(11.5%)**
ENTG				
New	1,659	1,764	$2.19	$2.56
Old	1,735	1,847	$2.44	$2.84
Difference	**(4.4%)**	**(4.5%)**	**(10.1%)**	**(9.8%)**
VSM				
New	1,313	1,312	$2.30	$2.28
Old	1,396	1,458	$2.60	$2.79
Difference	**(5.9%)**	**(10.0%)**	**(11.4%)**	**(18.3%)**
TER				
New	2,283	2,514	$2.81	$3.57
Old	2,365	2,600	$3.04	$3.82
Difference	**(3.5%)**	**(3.3%)**	**(7.5%)**	**(6.7%)**
Median	**(6.9%)**	**(8.6%)**	**(11.5%)**	**(13.9%)**

	GS vs Street			
	Revenue		EPS (Non-GAAP)	
	CY19E	CY20E	CY19E	CY20E
LRCX				
GS	9,948	9,817	$15.38	$15.41
Street	11,539	12,245	$18.10	$20.12
Difference	**(13.8%)**	**(19.8%)**	**(15.1%)**	**(23.4%)**
AMAT				
GS	15,701	15,478	$4.00	$4.12
Street	17,767	19,358	$4.63	$5.19
Difference	**(11.6%)**	**(20.0%)**	**(13.6%)**	**(20.7%)**
KLAC				
GS	4,220	4,140	$8.88	$8.74
Street	4,532	4,764	$9.52	$10.37
Difference	**(6.9%)**	**(13.1%)**	**(6.7%)**	**(15.7%)**
ENTG				
GS	1,659	1,764	$2.19	$2.56
Street	1,719	1,833	$2.28	$2.61
Difference	**(3.5%)**	**(3.8%)**	**(3.9%)**	**(1.7%)**
VSM				
GS	1,313	1,312	$2.30	$2.28
Street	1,440	--	$2.38	--
Difference	**(8.8%)**	**--**	**(3.3%)**	**--**
TER				
GS	2,283	2,514	$2.81	$3.57
Street	2,330	2,637	$2.68	$2.75
Difference	**(2.0%)**	**(4.7%)**	**4.8%**	**29.7%**
Median	**(7.8%)**	**(12.3%)**	**(6.3%)**	**(6.4%)**

Source: FactSet, Goldman Sachs Global Investment Research

LRCX: Downgrade to Neutral on reduced memory outlook

We cut CY19/20 EPS by 15%/17%, respectively, as we reflect the deteriorating memory capex outlook, and downgrade the stock to Neutral from Buy. Although we remain constructive on Lam's ability to capture higher share within the growing Deposition/Etch product markets as well as management's operational capabilities and its willingness to return cash to shareholders, we believe the stock will struggle to outperform our broader coverage group given further potential downside to Street estimates (note our updated CY19/20 EPS estimates are 15%/23% below Street consensus). We model a relatively mild downturn for the industry for reasons we outlined above, but would note that there could be up to 47% downside to our CY20 EPS estimate (i.e. from $15.41 to ~$8.14) if this downturn were to mirror those witnessed prior to 2010. We would await early signs of memory price (and therefore capex) stabilization before turning constructive on the Semi Cap Equipment group as well as LRCX. Since we added Lam Research to the Buy List on December 19, 2016, the shares are up 45.2% vs. +27.6% for the S&P 500.

LRCX	12m Price Target: $180	Price: $155.4	Upside: 15.8%

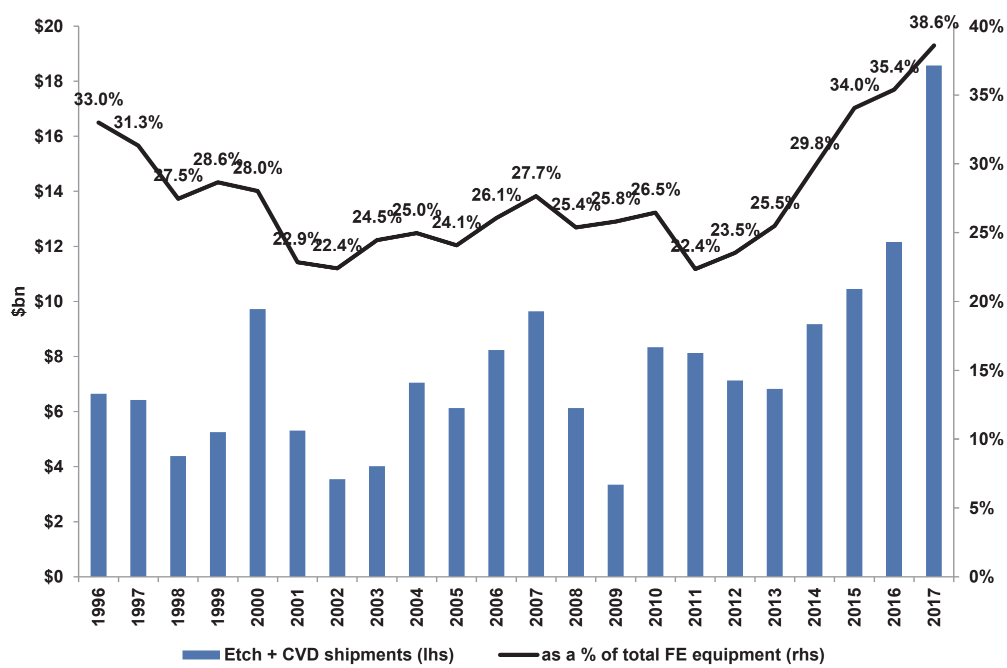
Neutral	GS Forecast				
		6/18	6/19E	6/20E	6/21E
Market cap: $25.0bn	**Revenue ($ mn) New**	**11,077.0**	**9,437.1**	**10,064.1**	**10,429.9**
Enterprise value: $22.2bn	Revenue ($ mn) Old	11,077.0	10,396.3	11,397.7	--
3m ADTV :$510.9mn	EBITDA ($ mn)	3,699.9	2,922.1	3,223.5	3,358.8
United States	EBIT ($ mn)	3,373.5	2,581.6	2,883.0	3,018.3
America-Semiconductor Capital Equipment: Neutral	**EPS ($) New**	**17.90**	**13.74**	**15.78**	**16.84**
	EPS ($) Old	17.90	15.56	18.24	--
M&A Rank: 3	P/E (X)	10.5	11.3	9.8	9.2
	Dividend yield (%)	1.4	3.0	3.4	3.5
	Net debt/EBITDA (X)	(0.8)	(1.0)	(1.1)	(1.3)
		6/18	**9/18E**	**12/18E**	**3/19E**
	EPS ($)	5.31	3.16	3.56	3.48

Source: Company data, Goldman Sachs Research estimates, FactSet. Price as of 11 Sep 2018 close.

The long-term fundamental outlook is still positive...

SAM expansion: LRCX primarily competes in Etch and Deposition - i.e. two of the fastest growing product groups in the Wafer Fab Equipment (WFE) market. As shown in Exhibit 20, the Etch and Deposition markets combined have grown from 22% of the front-end equipment market (a good proxy for the Wafer Fab Equipment market) to 39% in 2017 - driven by the planar to 3D transition in NAND and increased adoption of materials-enabled scaling techniques in leading-edge logic/foundry. While the insertion of EUV may dampen the pace of relative SAM expansion in the foundry space, we see the positive trajectory sustaining into 2019/2020 as NAND manufacturers transition to higher layer counts (which requires additional Etch/Deposition tools).

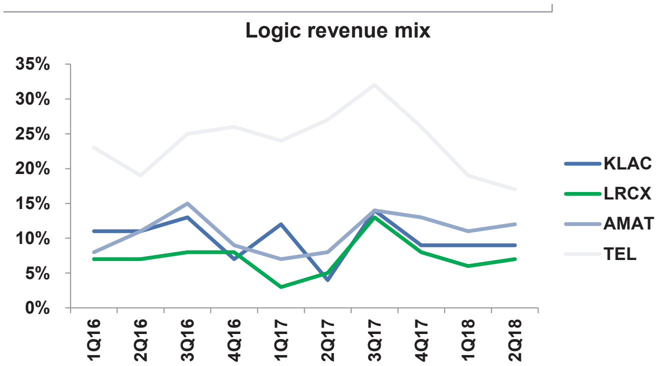
Exhibit 20: Etch and Deposition have been growing as a % of total front end equipment spending



Source: SEMI

Share gain potential: Furthermore, we expect LRCX to execute to its long-term share gain goals thereby driving above-industry growth. Recall, at its 2018 Analyst Day, management indicated share gain targets of +4-8% points in Etch/Deposition, respectively, by 2021. While slower spend in the memory complex could lead to a deterioration in share (note near-term share shifts are typically driven more by differences in customer mix), we believe LRCX is well positioned to elevate its position in leading edge logic and foundry longer term. Particularly in the logic market - where Intel remains by far the key driver of capex - the introduction/ramp of 10nm in 2019/2020 will drive share higher, in our view, as LRCX has won ~5x the number of applications in 10nm relative to 14nm, per management. Note that Lam's presence in the logic space had been minimal (Exhibit 21) following the transition to 300mm wafers; however, the company's position began to improve at the 14nm node. Importantly, not only do we expect Lam's competitive position to improve at the 10nm node, but 7nm is likely to bring about an even opportunity for the company.

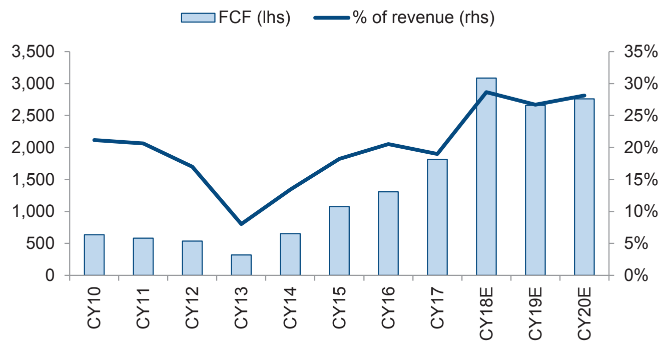
Exhibit 21: LRCX has less logic exposure relative to peers



Source: Company data

Capital return: Supported by its ability to generate high levels of FCF (Exhibit 22) and management's commitment towards capital return (recall Lam's target is to return at least 50% of FCF to shareholders), we forecast elevated levels of total shareholder return through 2019/2020. On the dividend, CFO Doug Bettinger indicated during a recent NDR (see here for our takeaways note) that cash generated from the installed base business would more than cover the dividend and that there was bias to grow the dividend over time even in the face of a minor revenue correction. On repurchases, a) recall Lam was ~60% of the way through its $4bn repurchase authorization (which was increased from $2bn in March) as of June, b) management expects to exhaust the authorization over the next 3 quarters, and c) in the absence of large-scale M&A (which is our base case), we see high likelihood of management renewing its authorization as soon as the current one is exhausted.

Exhibit 22: LRCX has a strong FCF generation profile



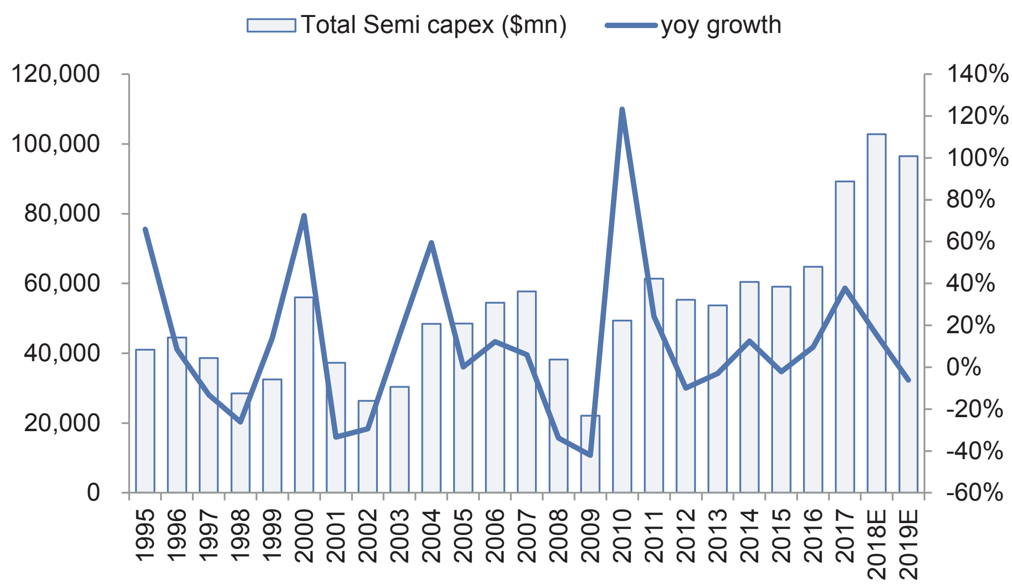
Source: Company data, Goldman Sachs Global Investment Research

... but hard to stay positive in the face of a negative EPS revision cycle

That said, we believe the stock will struggle to outperform our broader coverage group given potential downside to Street estimates. Note our updated CY19/20 EPS estimates of $15.38/$15.41 are 15%/23% below FactSet consensus. As NAND price declines accelerate in 2H18 and DRAM pricing reverts lower starting in CY4Q, we believe more capex cuts/push outs will emerge in the memory complex which will in turn lead to more cautious commentary from Semi Cap management teams, and ultimately drive down consensus numbers.

We model a relatively mild downturn in 2019/2020 for reasons we outlined above in the report (i.e. more rational customer behavior, shortened lead times), but would note that there could be up to 47% downside to our CY20 LRCX EPS estimate (i.e. from $15.41 to ~$8.14) if this downturn were to mirror those witnessed prior to 2010 (Exhibit 24).

Exhibit 23: We expect the correction in 2019 to be more muted compared to cycles prior to 2010



Source: Goldman Sachs Global Investment Research

Exhibit 24: We see 4-47% potential downside to our CY20 EPS estimate

Implied CY20 EPS

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	$15.41	$14.85	$14.30	$13.75	$13.19	$12.64
(10%)	$14.17	$13.67	$13.16	$12.66	$12.16	$11.66
(15%)	$12.98	$12.53	$12.08	$11.62	$11.17	$10.72
(20%)	$11.84	$11.44	$11.03	$10.63	$10.23	$9.82
(25%)	$10.76	$10.40	$10.04	$9.68	$9.32	$8.96
(30%)	$9.73	$9.41	$9.09	$8.77	$8.46	$8.14

vs current CY20 EPS GSE

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	0%	(4%)	(7%)	(11%)	(14%)	(18%)
(10%)	(8%)	(11%)	(15%)	(18%)	(21%)	(24%)
(15%)	(16%)	(19%)	(22%)	(25%)	(27%)	(30%)
(20%)	(23%)	(26%)	(28%)	(31%)	(34%)	(36%)
(25%)	(30%)	(33%)	(35%)	(37%)	(40%)	(42%)
(30%)	(37%)	(39%)	(41%)	(43%)	(45%)	(47%)

Implied CY20 P/E

CY20 WFE yoy \ CY19 WFE yoy	(5%)	(10%)	(15%)	(20%)	(25%)	(30%)
(5%)	10.1x	10.5x	10.9x	11.3x	11.8x	12.3x
(10%)	11.0x	11.4x	11.8x	12.3x	12.8x	13.3x
(15%)	12.0x	12.4x	12.9x	13.4x	13.9x	14.5x
(20%)	13.1x	13.6x	14.1x	14.6x	15.2x	15.8x
(25%)	14.4x	14.9x	15.5x	16.1x	16.7x	17.3x
(30%)	16.0x	16.5x	17.1x	17.7x	18.4x	19.1x

Source: Goldman Sachs Global Investment Research

In order to turn more constructive on the Semi Cap Equipment group as well as LRCX, we would need to see more capex cuts (i.e. not just at Samsung) and early signs of memory price stabilization. For context, DRAM equipment downturns have historically lasted 1-10 quarters, NAND downturns 1-4 quarters, and memory-led Semi Cap downturns 1-11 quarters, while in the current September quarter, we are in the second quarters of the NAND/Semi Cap downturns, respectively, and haven't even entered one in DRAM.

Price target methodology and risks

Our updated 12-month price target of $180 (down from $224 prior) is based on 12x (down from 13x on reduced growth and increased cyclical risk) normalized EPS of $15.00 (down from $17.25 on lower go-forward estimates). Risks include, magnitude/longevity of the memory downturn, strength/weakness in logic/foundry spend, and any changes to the competitive landscape.

Removing ENTG from the CL - maintain Buy on business mix

We remove ENTG from the Conviction List as our updated CY19/20 earnings estimates are effectively in line with Street consensus. That said, we remain Buy-rated on the stock relative to the rest of our coverage group for the following 4 reasons: **1) Defensive business mix:** we see ENTG weathering the current capex correction better than its Semi Cap Equipment peers given ~70% revenue exposure to unit-driven, as opposed to capex-driven products. **2) Growing purity requirements:** in both leading-edge logic/foundry and memory, we expect growing purity requirements to drive increased adoption of filtration/purification devices (~35% of total revenue) as well as higher replacement rates. **3) Materials-enabled scaling:** we believe the stalling of Moore's Law will continue to incentivize semiconductor companies to innovate and improve chip performance by leveraging new/more materials. **4) Capital allocation optionality:** ENTG has completed four transactions in the past year and half and indicated the potential for more; we believe the company's deep industry knowledge and ability to integrate assets into its platform are differentiating factors in driving value through M&A. Our updated 12-month price target of $38 implies 20% potential upside from current levels. Since we added Entegris to the Conviction List on May 22, 2017, the shares are up 29.6% vs. +24.8% for the Russell 2000.

ENTG	12m Price Target: $38	Price: $31.5	Upside: 20.6%

Buy	GS Forecast				
		12/17	12/18E	12/19E	12/20E
Market cap: $4.5bn	**Revenue ($ mn) New**	**1,342.5**	**1,565.1**	**1,658.8**	**1,763.9**
Enterprise value: $4.9bn	Revenue ($ mn) Old	1,342.5	1,569.8	1,735.1	1,847.3
3m ADTV :$34.5mn	EBITDA ($ mn)	357.1	444.2	503.8	553.3
United States	EBIT ($ mn)	216.4	310.4	363.9	411.2
America-Semiconductor Capital Equipment: Neutral	**EPS ($) New**	**1.44**	**2.00**	**2.19**	**2.56**
	EPS ($) Old	1.44	2.02	2.44	2.84
M&A Rank: 2	P/E (X)	17.5	15.7	14.4	12.3
	Dividend yield (%)	0.3	0.9	1.1	1.2
	Net debt/EBITDA (X)	(0.1)	0.9	0.7	0.5
		6/18	**9/18E**	**12/18E**	**3/19E**
	EPS ($)	0.49	0.53	0.52	0.51

Source: Company data, Goldman Sachs Research estimates, FactSet. Price as of 11 Sep 2018 close.

Reasons for staying Buy-rated

1) Defensive business mix: While we take an incrementally more cautious view on Semiconductor capex, we maintain a positive outlook on semiconductor production as we believe there are structural/secular drivers that will result in increased production. Recall that ENTG's business mix is weighted towards production representing ~70% of revenues as opposed to other Semi Cap companies (namely the OEMs) who are disproportionately exposed to changes in capital spending. We would also note that while 90% of ENTG's revenues are related to semiconductors, their customer base is more diversified than other Semi Cap companies in our coverage with just two 10% customers (Exhibit 25).

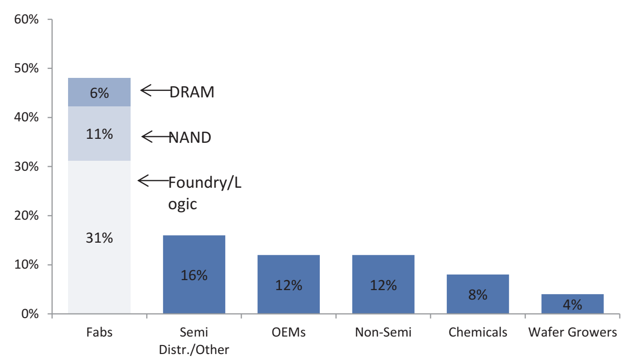
Exhibit 25: Entegris has a less concentrated customer base...

	KLAC	ENTG	AMAT	VSM	LRCX
10% customers	Samsung	TSMC Samsung	Samsung TSMC	INTC Samsung TSMC	Intel Micron Samsung SK Hynix Toshiba
Cumulative Revenues	21%	23%	38%	48%	78%

Source: Company data

Exhibit 26: ...with customers outside of fabs

Customer type based on 2017 sales



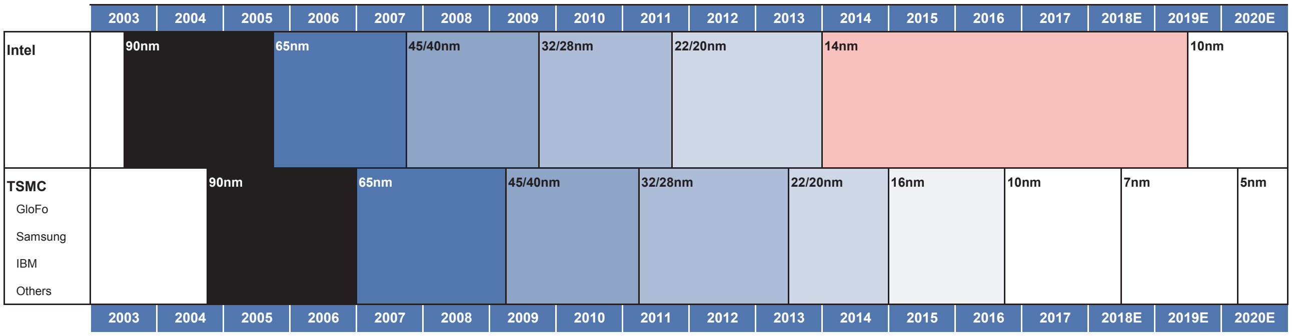
Source: Company data

2) Growing purity requirements: The increasingly complex device architectures and materials required to enable further improvements in semiconductor performance are raising purity requirements as smaller imperfections can impact yields, driving adoption and increasing the value of ENTG's filtration/purification products. We view the trend of increasing purity requirements as a secular change and increasingly important component of spending that should continue even with a weaker overall capex backdrop. According to ENTG, a 1% improvement in yields translates into $150mn/yr in net profit in a leading edge logic fab and $110mn/year in net profit for a 64 layer 3D NAND fab with 60K wafer starts per month, making ENTG's products a compelling investment given their importance and low cost relative to other fab-related capital expenditures, in our view.

3) Materials-enabled scaling: Historically, semiconductor companies have achieved performance improvements through horizontal scaling; however, as process nodes have shrunk to single-digit nanometer line-widths, shrinks have slowed (Exhibit 27). Entegris is positioned to benefit from continued increases in the importance and necessity of advanced materials in the semiconductors manufacturing process. Even in an incrementally weaker capex environment, companies will continue to spend on advancing their manufacturing processes as the financial reward for advantages in leading edge architectures is independent from cuts associated with near-term capacity concerns. According to the company, materials spending in a 7nm logic device is 2.2x that of a 28nm device and materials spending in 128L 3D NAND is 1.8x spending on a

64L 3D NAND device. Our view that spending on future/advanced architectures will continue is unchanged and the slowing of Moore's law will drive spending on materials-enable solutions.

Exhibit 27: The 14nm node has been INTC's longest since the early 2000's as it struggles to achieve volume 10nm production
Process node introduction timeline



Source: Company data, Goldman Sachs Global Investment Research

4) Capital allocation optionality: ENTG has a stated strategy of pursuing accretive shareholder return with M&A as a priority. Given ENTG's strong positioning with large/difficult to penetrate customers, deep industry knowledge and demonstrated ability to manage acquisitions, we view the company as well positioned to drive value through future deals. Recall that ENTG had been aware of the asset they recently acquired (SAES Pure Gas) for decades before acting when there was the opportunity to purchase it and has already indicated upside to the financial impact they outlined post-acquisition. While we take no view on specific future transactions, we believe the company is well-positioned to continue pursuing accretive M&A and has stated that it intends to do so.

Exhibit 28: ENTG presented a financial model at their March Analyst Day that included meaningful earnings upside with levered M&A

Year Three Operating EPS	Retain Cash; Build Liquidity	Buyback Shares	M&A	Levered M&A	Potential Total EPS
$2.00+	$0.00	$0.35	$0.50	$1.00	$2.35-$3.00+

Source: Company data

Estimate update

Given the reduced memory capex outlook, we cut revenue estimates for the Advanced Materials Handling (AMH) segment as well as the Microcontamination Control (MC) segment - i.e. two segments that have exposure to capex. We maintain revenue estimates for the Specialty Chemicals and Engineered Materials (SCEM) segment, on the other hand, where revenue is driven primarily by semiconductor units or production. All in, we reduce CY18/19/20 revenue estimates by 0.3%/4.4%/4.5%, respectively, and non-GAAP EPS from $2.02/$2.44/$2.84 to $2.00/$2.19/$2.56, respectively (Exhibit 29). Relative to FactSet consensus, our updated EPS estimates are modestly above in CY18, but 4% below in CY19 (Exhibit 30).

Exhibit 29: We lower our CY18/19 EPS estimates by 10%
$ millions, except per share data

	Absolute CY2018	Absolute CY2019	Absolute CY2020	yoy CY2018	yoy CY2019	yoy CY2020
Revenue						
New	1,565	1,659	1,764	16.6%	6.0%	6.3%
Old	1,570	1,735	1,847	16.9%	10.5%	6.5%
Change	**(0.3%)**	**(4.4%)**	**(4.5%)**	**(0.3%)**	**(4.5%)**	**(0.1%)**
SCEM						
New	540	593	653	11.3%	9.8%	10.0%
Old	540	593	653	11.3%	9.8%	10.0%
Change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
MC						
New	549	635	693	26.0%	15.6%	9.0%
Old	554	666	726	27.0%	20.2%	9.0%
Change	**(0.8%)**	**(4.6%)**	**(4.6%)**	**(1.1%)**	**(4.6%)**	**0.0%**
AMH						
New	475	430	418	12.9%	(9.5%)	(2.8%)
Old	475	476	468	0.0%	0.1%	(1.5%)
Change	**0.0%**	**(9.6%)**	**(10.7%)**	**12.9%**	**(9.6%)**	**(1.2%)**
EPS (Non-GAAP)						
New	$2.00	$2.19	$2.56	--	--	--
Old	$2.02	$2.44	$2.84	--	--	--
Change	**(0.7%)**	**(10.1%)**	**(9.8%)**	--	--	--

Source: Goldman Sachs Global Investment Research

Exhibit 30: We are 4% below Consensus on CY19 EPS
$ millions, except per share data

	CY2018	CY2019	CY2020
Revenue			
GS	1,565	1,659	1,764
Street	1,561	1,719	1833*
Difference	**0.3%**	**(3.5%)**	**(3.8%)**
EPS (Non-GAAP)			
GS	$2.00	$2.19	$2.56
Street	$1.98	$2.28	$2.61*
Difference	**1.2%**	**(3.9%)**	**(1.7%)**

*Based on 2-3 estimates included in FactSet Consensus

Source: FactSet, Goldman Sachs Global Investment Research

Price target methodology and risks

In conjunction with our estimate revision, we update our 12-month price target to $38 (down from $43 prior) which is based 85% on a fundamental component of $38 (18x [down from 19x on lower growth] our normalized EPS forecast of $2.10 [down from $2.25 on lower estimates]) and 15% on an M&A component of $41 (12x normalized EBTIDA). Risks to our Buy-thesis include, 1) a broad-based semiconductor downturn, 2) a deeper-than-expected correction in capex, 3) mis-execution on new products, and 4) failure to capture synergies from recent acquisitions.

Pricing information of other stocks mentioned

Micron Technology Inc. ($43.60), Samsung Electronics (W45,050), SK Hynix Inc. (W76,600), SUMCO (¥1,740) and Tokyo Electron (¥17,095)

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Reg AC

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