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Greater China Technology Semiconductors | Asia Pacific

Foundry Capacity Getting Sold Out; Upgrade Industry View to Attractive

We've started to see order overflows from TSMC to second-tier foundries given the strong logic semi demand. We double upgrade UMC and Vanguard to OW, and reiterate OW on Chipbond given attractive valuation.

Upgrade industry view another notch to Attractive heading into 2020: China's semi localization was the main reason we [upgraded the industry to In-Line](#) back in early September. Since then, we've also seen more upside in smartphone semis, driven by Apple [iPhone's increased orders](#) and [MediaTek's share gain in 5G SOC](#). Previously, our focus stocks were industry leaders such as TSMC. However, recently we've started to see growing demand in trailing-edge semiconductors, and believe it is time to diversify into some second-tier foundries, such as UMC, Vanguard, and Chipbond. We believe the logic semi upcycle will continue into 2020, as semi foundries in Asia are getting full.

What has triggered the recent 8-inch foundry demand surge? Could there be a wafer price hike? In Daniel Yen's [display semis report](#), we projected secular growth of TDDI, AMOLED, and super-slim fingerprint sensors. The trends in these new products – in particular, super-slim fingerprint sensors – have led to tight capacity for 8-inch foundry at TSMC, given 4x larger die size. Other 8-inch orders, such as LCD driver ICs, have overflowed to UMC (second source) and then to Vanguard (third source). Given the 8-inch foundry capacity shortage, we expect UMC to hike foundry prices in 1Q20.

12-inch trailing-edge foundry getting full too: The strong TDDI and AMOLED driver IC demand has filled TSMC and UMC's 80nm and 28nm nodes. Among all, Novatek has received the best foundry capacity and price support; hence, we raise our price target to NT\$272. Chipbond is our contrarian OW idea. We believe that next year iPhone SE2 will continue to use an LCD display. We forecast Chipbond's EPS to grow in 2020 vs. the Street's forecast of a Y/Y decline. We remain EW on SMIC at 1.4x 2020e P/B vs. 3.7% ROE, which is not as attractive as UMC's 0.8x P/B vs. 8.8% ROE.

Where are risks? Inventory pre-build, trade uncertainty: However, we also find end demand healthy overall. It's hard to predict whether/when Huawei would cut forecasts, given weak overseas smartphone sales, but that could be an entry point. Our key UWs are stocks with structural issues: Nanya Tech (Chinese DRAM competition) and ASMedia (AMD in-sourcing chipset).

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What's Changed FROM TO

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Industry View In-Line **Attractive**

Exhibit 1: Companies Featured Table

What's Changed Summary									
Ticker	Company	Rating		Price Target		Revision	EPS Change		
		New	Old	New	Old		19E	20E	21E
2303.TW	UMC	O	U	18.0	11.5	57%	12%	38%	50%
5347.TWO	Vanguard	O	U	82	55	49%	1%	13%	24%
6147.TWO	Chipbond	O	O	77	70	10%	1%	16%	11%
3034.TW	Novatek	O	O	272	260	5%	0%	4%	4%

Companies Featured					
Ticker	Company	Rating	Nov-29 Price	Price Target	Upside/Downside
6147.TWO	Chipbond	OW	62.8	77	23%
3034.TW	Novatek	OW	223.5	272	22%
2303.TW	UMC	OW	14.95	18	20%
6488.TWO	GlobalWafers	OW	331	389	18%
2454.TW	MediaTek	OW	421.5	490	16%
5347.TWO	Vanguard	OW	71.6	82	15%
2330.TW	TSMC	OW	305.0	339	11%
0981.HK	SMIC	EW	9.98	8.90	-11%
2408.TW	Nanya Tech	UW	71.2	63	-12%
5269.TW	ASMedia	UW	567	399	-30%

Source: Refinitiv, Morgan Stanley Research estimates

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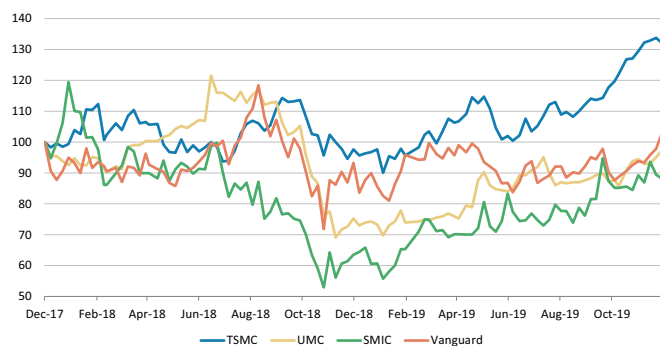
Investment Case: Demand Flowing Out to Second-tier Wafer Foundries as Logic Semi Cycle Boom Continues

Upgrading our Greater China Semis industry view to Attractive; time to diversify to laggards

We think second-tier stocks should have priced in the trend of China's semi localization – in particular SMIC. Recently Vanguard and UMC stocks have started to move, given market expectations regarding LCD driver IC demand recovery. However, we think this is still early innings if we compare their valuation and share price performance to industry leaders. Let's take a look at the two-year share price performance (the previous upcycle was around 2018):

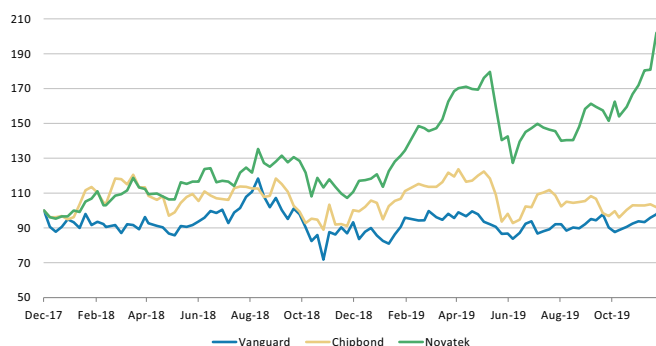
- TSMC significantly outperformed second-tier stocks such as UMC, SMIC, and Vanguard in the past cycle.
- In the display semis supply chain, Novatek (the leader) outperformed Chipbond and Vanguard (foundry subcontractors).

Exhibit 2: Semi foundry cycle share price performance comparison; TSMC outperformed UMC, SMIC, and Vanguard



Source: Refinitiv, Morgan Stanley Research

Exhibit 3: Display semis cycle share price performance comparison; Novatek outperformed Chipbond and Vanguard



Source: Refinitiv, Morgan Stanley Research

At present, we think some second-tier foundry stocks are offering even more attractive total return potential than industry leaders. In general, Taiwanese stocks are offering better dividend yields as well – e.g., GlobalWafers, WPG, and Chipbond.

UMC (double upgrade to OW, raising price target 57%): For example, UMC is trading at only 0.8x 2020e P/B and offering 4.1% dividend yield. We expect a price hike to be the key re-rating catalyst.

Vanguard (double upgrade to OW, raising price target 49%): Structural 8-inch wafer demand is prompting capacity tightness across the board, and semi inventory is stabilizing. Vanguard is trading at 3.8x our 2020e P/B with a 21% ROE, and we see more upside since it has previously traded at well above 4x forward P/B when ROE has been sustained above 20%.

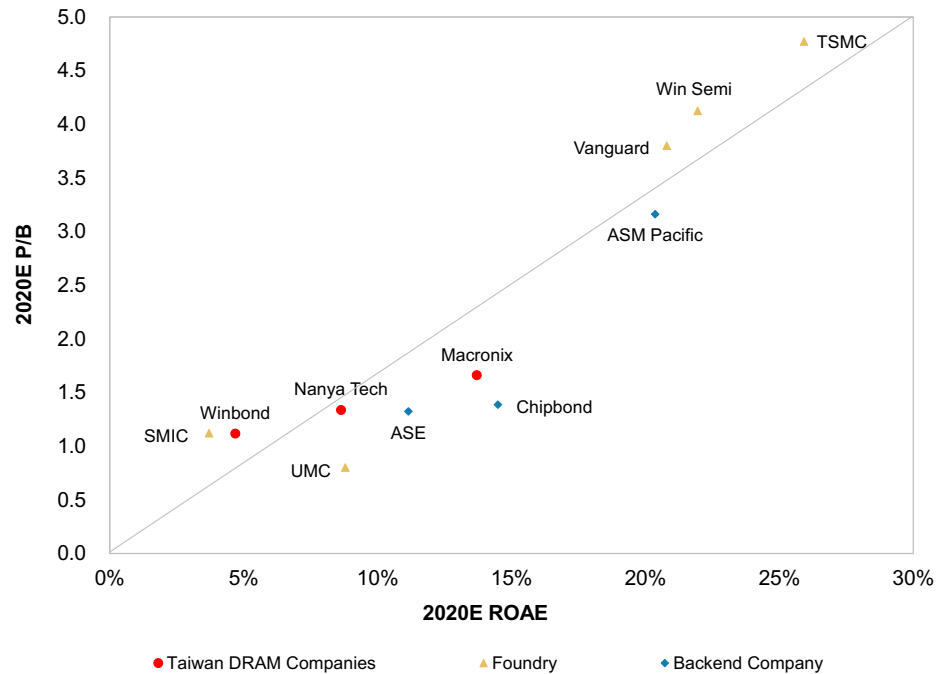
Chipbond (OW, raising price target 10%): We also think there's a misconception from the Street about Chipbond stock. Bears are arguing for a revenue shortfall from LCD iPhones in 2020, and some technology migration hiccups from Chip on Film (COF) migrating to Chip on Plastic (COP). For our contrarian view, please see [Chipbond: OLED iPhone Loss should not Shadow Overall Business Strength; OW](#). The recent correction makes the stock attractive, with a 2020e P/E of just 9.5x at our Street-high EPS forecast of NT\$6.57.

Novatek (OW, raising price target 5%): We believe the foundry tightness will help Novatek to expand its market share and GM profile for TDDI in 2020. We thus raise our price target to a Street-high NT\$272, implying >20% upside potential. Our earnings estimates are 15% higher than consensus for 2020 and 2021. Our bull case value of NT\$306 bakes in higher OLED shipments from an Apple project order win or lower OLED panel module yield from COP migration.

TSMC (OW): We see upside to our 1H20 revenue forecast. Besides full 7nm capacity, trailing edge demand is also recovering. 2020e P/B is 4.8x with 24% ROE, and we find the premium justified given its dominant position in logic foundries.

GlobalWafers (OW): Spot prices for wafers are still at a 10%-15% discount to long-term agreement (LTA) prices. However, we have started to see recovery for raw wafer demand in both 8-inch and 12-inch. We believe the 12-inch raw wafer inventory will return to healthy levels in 1Q20, and 8-inch should follow around 2Q20. In addition, GlobalWafers offers >8% dividend yield.

SMIC (maintain EW): SMIC's capacity should also benefit from the demand recovery thanks to emerging applications. However, we find valuation less attractive – 2020e P/B is already 1.4x vs. 3.7% ROE. This is not as attractive as UMC's 0.8x P/B vs. 8.8% ROE.

Exhibit 4: P/B vs. ROE: semi foundries

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

China's semi localization and 5G SoC triggered the logic semi cycle turn

China's semi localization remains the main growth driver of Greater China semis. This secular trend prompted us to upgrade our industry view to In-Line in September, although we viewed the timing of a recovery in the logic semi cycle as unclear.

- [Greater China Technology Semiconductors: Trend towards localization creates new opportunities; upgrade TSMC to OW \(4 Sep 2019\).](#)

Then, China's 5G infrastructure chip design showed itself to be more viable than expected, thanks to its collaboration with Taiwanese foundries. In September, we initiated coverage of KYEC at OW:

- [King Yuan Electronics Co Ltd: Beneficiary of China semi localization in 5G infra; OW \(23 Sep 2019\)](#)

In an accompanying report, we reiterated our OW ratings on TSMC and WIN Semi:

- [China's Industrial Evolution: How China will Chip In – Semi Localization for 5G Infrastructure \(23 Sep 2019\)](#)

We again reiterate those OW ratings.

More recently, we singled out Alchip, TSMC and KYEC as the best ways to play China's localization of CPUs and AI chips into 2020.

- [China's Localization: How will China chip in? Developing CPU and AI semi designs for the local market \(8 Nov 2019\)](#)

In this report, we present our case for upgrading our industry view another notch, to Attractive.

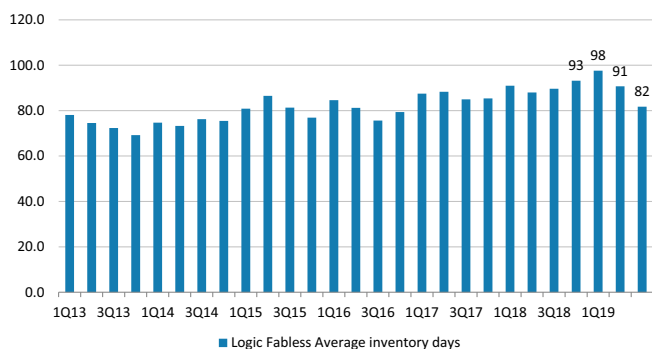
We are still in the middle of a logic semi upcycle

5G smartphone SoCs are another key leg for us to remain bullish on TSMC and MediaTek. Meanwhile, Apple iPhone sell-through appears to be better than expected – Y/Y growth in iPhone shipments have turned positive in 4Q19.

Our US semi analyst, Joe Moore, also [turned more bullish recently on NVIDIA](#). In general, we are still positive on the main logic semis (smartphone chipsets, CPUs, GPUs), which have filled TSMC's 7nm and 5nm leading-edge capacity.

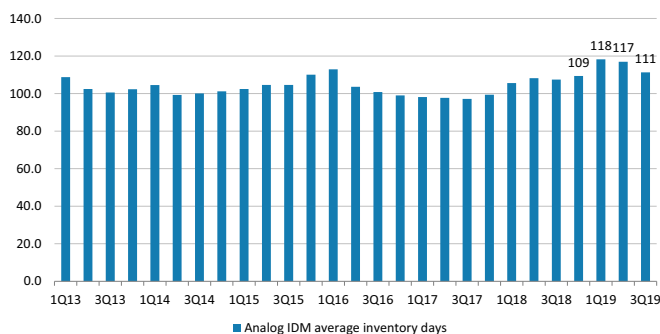
Meanwhile, logic semi inventories have gone down further after 3Q19 results, and so have analog IDM inventories.

Exhibit 5: Logic fabless – average inventory days trend



Source: Refinitiv, Morgan Stanley Research

Exhibit 6: Analog IDM – average inventory days trend



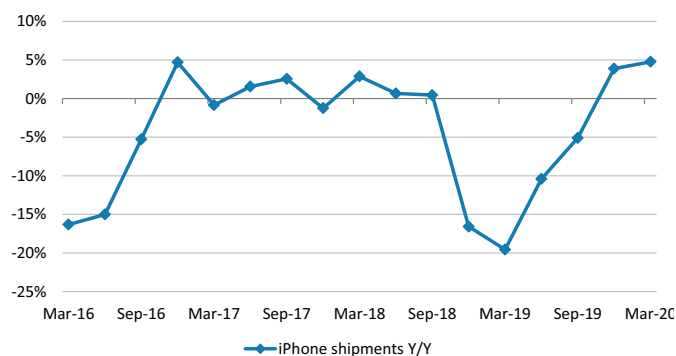
Source: Refinitiv, Morgan Stanley Research

Exhibit 7: Logic foundry fab utilization rate has been recovering



Source: Company data, Morgan Stanley Research estimates

Exhibit 8: iPhone shipments Y/Y trend



Source: Company data, Morgan Stanley Research estimates

Now, trailing edge foundry demand is also surging

We are seeing demand improvement and some structural content increase for trailing-edge logic semis. The trends in these new products – in particular super-slim fingerprint sensors – have led to tight capacity for 8-inch foundry at TSMC, given 4x larger die size. Other commodities such as LCD driver ICs have finished their inventory correction; CMOS image sensors benefit from phone camera resolution upgrades.

We expect 8-inch foundry utilization rates to be high in 1H20 (90%), and there may be a shortage in 2H20. 12-inch fab utilization should remain above 90% through 2020. In terms of profitability, trailing-edge foundries' margins are still not at their peak levels, suggesting that there is more upside to come if demand surges.

8-inch fab dynamics

- Super-slim fingerprint sensors consume 4x larger die size (meaning 4x wafer consumption assuming the same volume).
- Large panel LCD driver IC inventory replenishment has started in 4Q19. According to Chipbond, tTV driver IC foundry orders dropped 15%-20% Q/Q in 3Q19 given the pessimistic macro demand outlook. The driver IC inventory may have reached an insufficient level, and therefore Novatek has started to increase orders at 8-inch foundries recently.

12-inch trailing edge dynamics

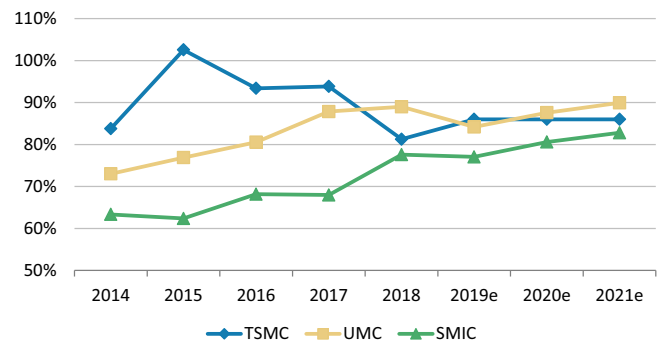
- AMOLED driver ICs are the key growth engine for 28nm. Samsung's 28nm foundry capacity is already full, so UMC becomes the major outsourcing foundry source for AMOLED driver ICs.
- NOR Flash has filled 55nm capacity at UMC and SMIC. We have seen price hikes for 55nm from SMIC.
- CMOS image sensors are a big fab filler. Smartphone camera resolution upgrades trigger strong demand for 40nm-65nm nodes. Sony's ISP has also filled TSMC's 22nm capacity.
- TWS controller ICs (28nm-40nm): TWS is probably the fastest-growing end market in 2019. The controller ICs inside also absorb additional 28nm/40nm capacity at TSMC, and we may start to see this semi chip migrating to 12nm in 2020.

Exhibit 9: Trailing edge wafer demand by application and nodes

Foundry node	Legacy demand	New demand driver	Capacity situation	Price hike?
0.18um/0.13um	larger panel DDI, optical fingerprint sensor	super-slim finger print sensor	full	Yes
90nm/80nm	discete smarphothe DDI	TDDI	getting full	
65nm/55nm	NOR Flash, CIS sensor	higher resolution CIS, NOR Flash in TWS	shortage	Yes
40nm	CIS	higher resolution CIS, TWS controller	90% utilization	
28nm/22nm	TV SoC, SSD controller IC	AMOLED, ISP	80% utilization	
16nm/12nm	4G smartphone, networking chip, Bitcoin ASIC	5G transceiver	90% utilization	

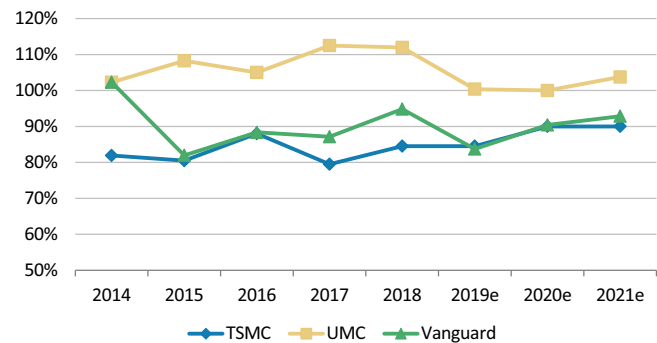
Source: Morgan Stanley Research estimates

Exhibit 10: TSMC, UMC, SMIC: 12-inch utilization rate trends



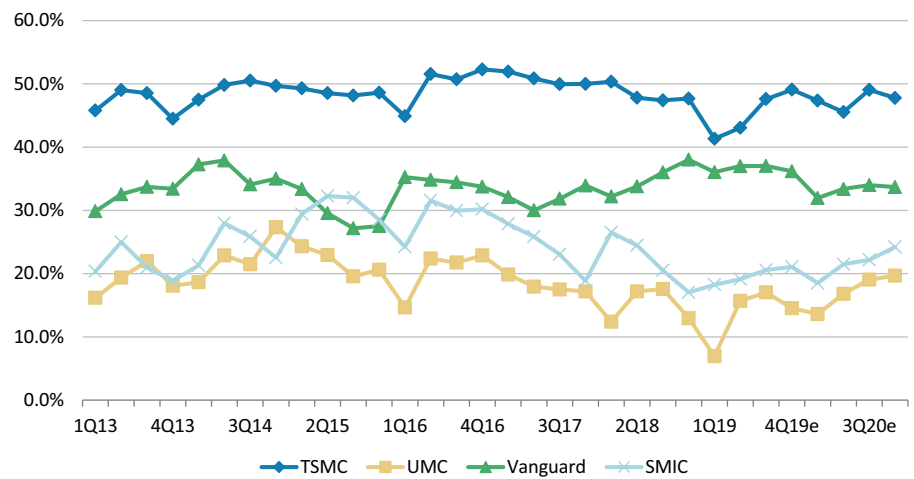
Source: Company Data, Morgan Stanley Research estimates

Exhibit 11: TSMC, UMC, Vanguard: 8-inch utilization rate trends



Source: Company Data, Morgan Stanley Research estimates

Exhibit 12: Foundries gross margin comparison



Source: Company Data, Morgan Stanley Research estimates

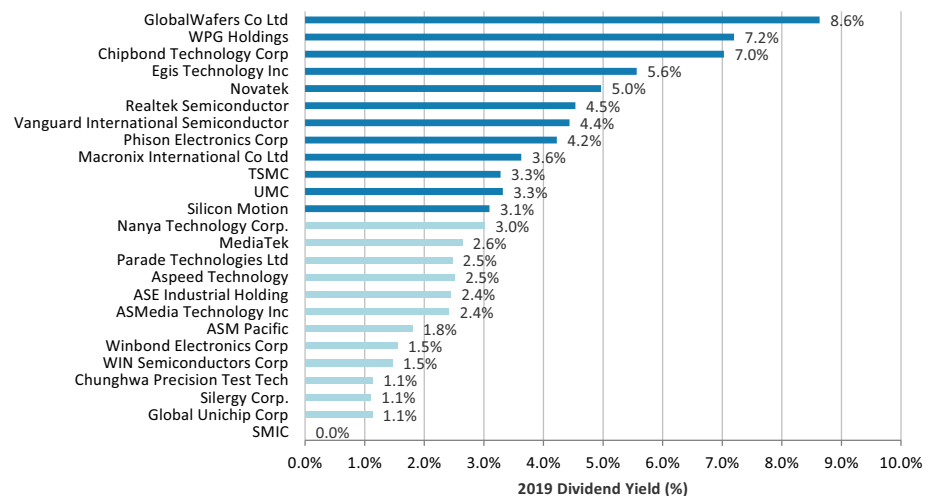
Globally, we haven't seen MCU and power semi recovery yet

On general purpose MCUs, Morgan Stanley analyst Craig Hettenbach pointed out in his [Microchip report](#) that the December quarter was much worse than Street estimates, as well as prevailing sentiment that business is stabilizing. Even management commented on the earnings call that it was a "false" bottom earlier in the year, as further deterioration in demand takes a toll into year-end.

According to our European semiconductor analyst, Dominik Olszewski, Infineon's revenue outlook is for 5% growth in 2020 vs. 2019 (September year-end) compared to c. 8-9% through-cycle growth. Infineon is more cautious on industrial end markets (e.g., see Asian machine tool order weakness). At present it is unclear whether that guidance is based on structural factors/data points it can see vs. expectations of cyclical recovery.

Infineon guided down for the December quarter and F20 guidance implies supra-seasonal 2H snapback. Recently for Infineon, c. 30% of EV-related product sales have been to China; it remains cautious about a short-term recovery in Chinese EVs. Chinese EV subsidies have been cut, affecting recent demand.

Exhibit 13: Greater China semis: dividend yield ranking



Source: Refinitiv, Morgan Stanley Research estimates

Exhibit 14: Greater China semis: Valuation comp table

Ticker	Company	Price 11/28/2019	Curr ency	Price Target	Rating	Market Cap. (US\$M)	Enterprise Value (US\$M)	3M Avg. Daily Trading (US\$M)	P/E Ratio (x)			EPS Growth			PEG (x)			ROAE			P/B Ratio (x)			EV/Sales (x)		
									2018	2019e	2020e	2018	2019e	2020e	2018	2019e	2020e	2018	2019e	2020e	2018	2019e	2020e	2018	2019e	2020e
Foundry																										
2330.TW	TSMC	309.5	TWD	339.0	O	263,130	245,340	305.0	22.9	23.6	19.6	2%	-3%	21%	9.8	(7.7)	1.0	22%	21%	26%	4.8	5.3	4.8	7.3	7.0	6.1
5347.TWO	Vanguard	71.1	TWD	82.0	O	3,821	3,213	8.8	19.0	20.4	20.8	37%	-7%	-2%	0.5	(3.0)	(13.3)	22%	19%	19%	4.0	3.9	3.8	3.4	3.5	3.1
2303.TW	UMC	15.1	TWD	18.0	O	5,797	5,159	18.5	28.8	27.7	18.7	-27%	4%	48%	(1.1)	6.9	0.4	3%	3%	5%	0.9	0.9	0.9	1.0	1.1	1.0
3105.TWO	WIN Semi	315.0	TWD	355.0	O	4,380	4,045	80.1	42.6	30.0	20.8	-21%	42%	44%	(2.0)	0.7	0.5	12%	17%	22%	5.3	4.9	4.3	7.1	5.8	4.8
0981.HK	SMC	10.3	HKD	8.9	E	6,679	1,546	35.3	48.3	66.7	31.9	-24%	-27%	109%	(2.0)	(2.4)	0.3	3%	2%	4%	1.2	1.2	1.2	3.6	3.8	3.3
Mean:									32.3	33.7	22.3	-7%	2%	44%	1.0	(1.1)	(2.2)	12%	13%	15%	3.2	3.2	3.0	4.5	4.2	3.7
Median:									28.8	27.7	20.8	-21%	-3%	44%	(1.1)	(2.4)	0.4	12%	17%	19%	4.0	3.9	3.8	3.6	3.8	3.3
Memory																										
2408.TW	Nanya Tech	71.7	TWD	63.0	U	7,177	5,264	40.5	5.6	18.0	15.9	-4%	-69%	13%	(1.6)	(0.3)	1.2	27%	8%	9%	1.3	1.4	1.3	1.9	3.0	2.6
2344.TW	Winbond	17.8	TWD	19.5	O	2,316	2,377	13.5	9.4	34.8	24.6	22%	-73%	42%	0.4	(0.5)	0.6	12%	3%	5%	1.1	1.2	1.1	1.4	1.5	1.3
2337.TW	Macronix	33.6	TWD	38.0	O	2,022	1,758	63.1	6.8	16.9	12.9	61%	-60%	31%	0.1	(0.3)	0.4	32%	11%	14%	2.0	1.9	1.7	1.5	1.5	1.4
8299.TWO	Phison	292.0	TWD	359.0	O	1,887	1,193	12.8	13.3	14.6	12.9	-25%	-9%	13%	(0.5)	(1.7)	1.0	16%	14%	15%	2.1	2.0	1.9	0.9	0.9	0.9
SIMO.O	Silicon Motion	NULL	USD	34.0	U	0	1,255	9.9	0.0	0.0	0.0	39%	-36%	25%	-	-	-	22%	12%	15%	2.4	2.9	2.7	2.4	3.0	2.5
603986.SS	Giga Device	166.8	CNY	208.0	O	6,679	6,719	190.4	116.9	81.4	46.1	-28%	44%	76%	(4.2)	1.9	0.6	21%	26%	36%	22.5	18.2	13.6	21.0	15.0	10.1
Mean:									25.3	27.6	18.7	11%	-34%	33%	(1.0)	(0.1)	0.6	22%	12%	15%	5.3	4.6	3.7	4.8	4.1	3.1
Median:									8.1	17.4	14.4	9%	-48%	28%	(0.3)	(0.3)	0.6	21%	12%	14%	2.1	2.0	1.8	1.7	2.3	2.0
Fabless																										
2379.TW	Realtek	239.0	TWD	260.0	O	3,981	2,921	32.8	27.9	18.6	17.4	28%	50%	7%	1.0	0.4	2.5	19%	25%	25%	4.9	4.4	4.1	1.9	1.5	1.4
5269.TW	ASMedia	581.0	TWD	399.0	U	1,144	1,065	11.1	36.5	32.0	25.5	118%	14%	25%	0.3	2.3	1.0	47%	43%	46%	15.0	12.9	10.7	8.7	8.2	6.9
2454.TW	MediaTek	431.5	TWD	490.0	O	22,406	18,099	115.0	32.7	29.4	17.3	-15%	11%	70%	(2.2)	2.6	0.2	8%	8%	13%	2.5	2.3	2.1	2.3	2.2	1.9
603160.SS	Goodix	195.6	CNY	240.0	O	12,455	12,411	127.6	120.8	42.7	39.9	-17%	183%	7%	(6.9)	0.2	5.7	20%	41%	34%	21.3	14.9	12.5	23.4	14.0	11.2
3034.TW	Novatek	223.5	TWD	272.0	O	4,459	3,819	57.4	21.3	16.9	13.6	27%	26%	25%	0.8	0.7	0.5	22%	25%	29%	4.5	4.1	3.7	2.1	1.8	1.6
5274.TWO	Aspeed	877.0	TWD	699.0	E	980	910	8.7	43.4	36.5	30.5	22%	19%	20%	1.9	1.9	1.5	31%	34%	37%	12.8	11.8	10.7	12.9	11.4	9.8
4966.TWO	Parade	608.0	TWD	688.0	O	1,565	1,375	9.9	24.6	20.6	18.1	-1%	19%	14%	(29.4)	1.1	1.3	22%	22%	22%	4.9	4.3	3.8	4.0	3.6	3.2
3443.TW	GUC	267.5	TWD	265.0	E	1,175	1,091	17.5	36.3	52.7	31.8	16%	-31%	66%	2.3	(1.7)	0.5	23%	15%	23%	8.2	7.8	6.8	2.5	3.1	2.5
6415.TW	Silergy	902.0	TWD	470.0	U	2,669	2,447	19.5	45.2	37.7	36.2	0%	20%	4%	NM	1.9	9.1	16%	16%	15%	6.3	5.6	5.1	7.9	7.3	6.5
6462.TWO	Egis	238.5	TWD	250.0	E	535	490	42.3	25.1	15.7	12.1	12%	59%	30%	2.0	0.3	0.4	29%	40%	44%	6.8	5.7	4.9	2.5	2.0	1.8
603501.SS	Will Semi	125.9	CNY	109.0	O	8,171	8,205	78.6	413.3	133.8	48.1	-10%	209%	178%	(39.5)	0.6	0.3	10%	8%	16%	34.9	4.3	3.7	14.5	6.8	2.9
3661.TW	Alchip	222.0	TWD	269.0	O	435	353	42.6	52.7	33.2	22.6	-17%	59%	47%	(3.1)	0.6	0.5	9%	13%	17%	4.5	4.1	3.6	3.1	2.7	2.1
Mean:									73.3	39.2	26.1	14%	53%	41%	(6.6)	0.9	2.0	21%	24%	27%	10.6	6.9	6.0	7.2	5.4	4.3
Median:									36.4	32.6	24.0	6%	23%	25%	0.3	0.6	0.8	21%	24%	24%	6.6	5.0	4.5	3.6	3.3	2.7
Backend																										
3711.TW	ASE	77.0	TWD	79.0	E	10,719	14,725	19.3	13.0	19.0	12.5	120%	-32%	52%	0.1	(0.6)	0.2	12%	8%	11%	1.5	1.4	1.3	1.2	1.1	1.0
601231.SS	USI	15.8	CNY	16.0	O	4,909	4,362	47.4	29.2	23.8	17.3	-10%	23%	37%	(2.9)	1.1	0.5	13%	15%	18%	3.7	3.3	2.9	0.9	0.8	0.7
6147.TWO	Chipbond	62.6	TWD	77.0	O	1,343	1,129	12.3	9.0	9.9	11.0	120%	-9%	-10%	0.1	(1.1)	(1.1)	17%	14%	13%	1.5	1.4	1.4	1.8	1.7	1.7
600584.SS	JCET	21.0	CNY	14.9	U	4,799	5,725	155.6	NM	NM	51.3	NM	NM	NM	NM	NM	NM	-9%	-3%	5%	2.7	2.8	2.7	1.7	1.9	1.5
0522.HK	ASM Pacific	103.4	HKD	105.0	O	5,374	4,797	17.3	20.1	39.5	16.0	-13%	-49%	146%	(1.6)	(0.8)	0.1	18%	9%	20%	3.5	3.4	3.2	1.9	2.2	1.9
6510.TWO	CHPT	918.0	TWD	890.0	E	987	777	30.6	42.0	47.5	34.2	-8%	-11%	39%	(5.1)	(4.2)	0.9	12%	10%	13%	4.9	4.7	4.5	7.2	7.0	5.2
2449.TW	KYEC	37.5	TWD	43.0	O	1,503	1,822	17.2	25.6	15.8	11.3	-22%	62%	40%	(1.2)	0.3	0.3	7%	12%	15%	1.9	1.8	1.7	2.7	2.2	1.9
Mean:									23.1	25.9	22.0	31%	-3%	51%	(1.8)	(0.9)	0.1	10%	9%	14%	2.8	2.7	2.5	2.5	2.4	2.0
Median:									22.8	21.4	16.0	-9%	-10%	39%	(1.4)	(0.7)	0.3	12%	10%	13%	2.7	2.8	2.7	1.8	1.9	1.7
Others																										
3702.TW	WPG	37.9	TWD	47.0	O	2,086	4,063	4.6	8.8	10.1	8.4	-3%	-13%	20%	(2.8)	(0.8)	0.4	14%	11%	13%	1.2	1.1	1.1	0.2	0.2	0.2
6488.TWO	GlobalWafers	341.0	TWD	389.0	O	4,866	3,764	57.1	10.9	10.8	11.2	146%	1%	-4%	0.1	7.2	(2.7)	35%	35%	36%	3.4	4.2	3.9	1.9	2.0	2.0
Mean:									9.9	10.4	9.8	71%	-6%	8%	(1.3)	3.2	(1.1)	25%	23%	24%	2.3	2.6	2.5	1.1	1.1	1.1
Median:									9.9	10.4	9.8	71%	-6%	8%	(1.3)	3.2	(1.1)	25%	23%	24%	2.3	2.6	2.5	1.1	1.1	1.1

Source: Refinitiv, Morgan Stanley Research estimates

Stocks to avoid

China's memory localization also results in some negative impact on stocks such as Nanya Tech. China has further developed DRAM/NAND technology based on previously acquired foreign technologies. We think investors may underestimate China's capability in memory production. CXMT has sourced its DRAM technology from Qimonda. The company may improve its 19nm DRAM production yield to 60% in 1H20, and add more capacity. Specialty DRAM market players like Nanya Tech face the early impact.

On ASMedia, we remain cautious in view of AMD's in-house threat in 2020. The company has continued to miss on earnings this year, yet its share price has still held up quite well, given expectations that the 500 series chipset would ramp up in 4Q, as well as the shortage of Intel CPUs recently. But we don't think this is sustainable – 2020e P/E is now 26x, and we view AMD's in-house threat a greater risk in 2020. The CPU shortage gap is around 5% for PCs currently, but should ease heading into the slow season in 1Q20.

Where we could be wrong

1. Smartphone semis remain a big chunk of demand. Risks include disappointing 5G smartphone sell-through and/or Huawei order cuts given overseas smartphone demand weakness.
2. China's localization is less successful. For example, deficiency of locally designed/made semi components results in market share loss of Chinese system companies.
3. Inventory pre-build for 5G smartphones, but sell-through remains uncertain.
4. Prolonged downcycle of automobile and industrial demand, which are also major end markets for trailing edge foundry demand (MCUs and power semis.)

Background charts: foundry process roadmap

Trailing-edge process refers to 28nm and above nodes. Currently, 90nm nodes or below are fabricated by 12-inch wafers, with 0.13um nodes or above by 8-inch wafers.

Exhibit 15: Leading-edge foundry process roadmap

Advanced Logic / Foundry											
CY	2011	2012	2013	2014	2015	2016	2017	2018	2019e	2020e	2021 Onward
Intel		22nm FinFET		14nm FinFET					10nm FinFET		7nm
TSMC	28nm			20nm	16nm FinFET	16nm+ FinFET	10nm FinFET	7nm	7nm+	5nm	3nm
							12nm	22nm		6nm	
Samsung	32nm	28nm			14nm FinFET		10nm FinFET	8nm LPP	7nm LPP	5nm	3nm GAA
						28FDS		14nm LPU	28FDS-eMRAM	18FDS	

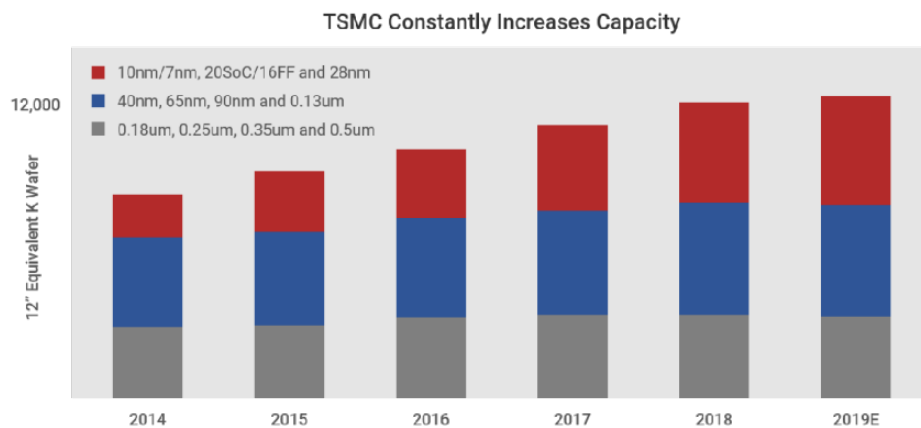
Source: Company Data, Morgan Stanley Research (e) estimates

Exhibit 16: Trailing-edge foundry process roadmap

Legacy Logic / Foundry											
CY	2011	2012	2013	2014	2015	2016	2017	2018	2019e	2020e	2021 Onward
SMIC		40nm			28nm		28nm HKC	28nm HKC+	14nm FinFET	7nm FinFET	
GF					14LPP		12LP				
							22FDX			12FDX	
UMC			28nm HLP	28nm HPC	28nm HPC+		14nm FinFE				

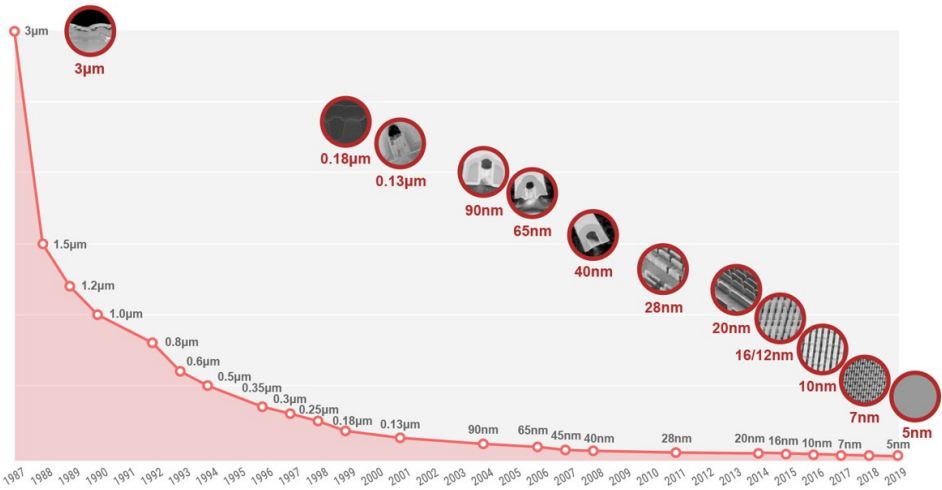
Source: Company Data, Morgan Stanley Research (e) estimates

Exhibit 17: TSMC capacity breakdown



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

Exhibit 18: TSMC logic semi node migration history



Source: Company Data, Morgan Stanley Research estimates

UMC: Trailing-edge Capacity Tightness In Sight; Double Upgrade to OW

Trailing-edge 12-inch wafer capacity getting busy, and 28nm could be full soon: Logic wafer foundries have started to recover since late 2Q in response to China's semiconductor localization efforts, and now we see this demand flowing into UMC. In addition, key competitor Samsung's 28nm capacity has started to be filled by its in-house demand for OLED driver ICs and image sensor ISPs, causing 28nm demand outflow into UMC's fab. We believe the faster-than-expected recovery in UMC's utilization rates is structural, driven by applications such as TDDI and OLED driver ICs for Novatek, higher resolution image sensors, and increasing shipment of TWS earbuds for Realtek. We now forecast that UMC's utilization rate can reach nearly 90%, and its revenue growth could exceed 15% in 2020.

8-inch wafer price hike amid capacity shortage: Similar to Vanguard, we are also seeing capacity tightness in UMC's 8-inch fabs after TSMC's 8-inch fab turned busy a quarter ago. With limited supply increase in 8-inch capacity, we believe UMC will be able to hike its wafer prices given the capacity tightness for customers with smaller volume. Along with the higher utilization rate in 12-inch trailing edge, this price hike should help improve the company's margin profile and hence its earnings outlook.

Acquisition of USJC could allow UMC to capture demand upside: We have viewed UMC's acquisition of USJC as a positive, and we now turn even more positive as trailing edge 12-inch capacity turns tight. Even though the fab is currently running at below corporate average utilization rates and only at break-even levels, we believe synergies will start to materialize if automotive demand stabilizes. We think that UMC will gradually be able to transfer some of its excess orders to the USJC fab, thus bringing up the fab's utilization rates and profitability.

Lawsuit against Micron the key downside risk: Despite UMC's healthy fundamentals, uncertainties around charges from the US Department of Justice overhang the share price. We view potential fines as the key reason why UMC's stock trades at just 0.8x P/B today. The lawsuit could take time to finalize and UMC has not issued any comment on the situation.

Raising price target to NT\$18.0 and upgrading to OW: In view of a healthier demand outlook from 2020, we believe UMC's P/B should re-rate to at least 1x, which is what our price target implies. We believe the current valuation is attractive given the steady outlook for earnings and thus dividend payout.

UMC: Earnings Estimate Revisions

We raise our 2019, 2020, and 2021 EPS estimates 11.9%, 38.1% and 49.7%,

respectively: We see a mass recovery in UMC's wafer demand, mainly driven by rising demand for display semis and optical fingerprint sensors. In addition, the improved business outlook should allow UMC to raise its wafer pricing to enhance its profitability, and help fill the new capacity from the newly acquired Japanese fab, USJC, to help make it profitable rather than a burden. We therefore raise our revenue estimates 11.0% for 2020 and 15.6% for 2021. With higher revenue scale, we also raise our gross margin and operating margin assumptions.

Exhibit 19: UMC: Earnings estimate revisions

(NT\$ mn)	New 2019e	Old 2019e	Diff. %	New 2020e	Old 2020e	Diff. %	New 2021	Old 2021e	Diff. %
Net sales	147,170	144,129	2.1%	173,225	156,070	11.0%	181,607	157,103	15.6%
Gross profit	20,276	19,627	3.3%	30,197	24,793	21.8%	33,233	25,237	31.7%
Operating profit	4,597	4,162	10.5%	13,652	9,427	44.8%	16,040	10,243	56.6%
Pretax income	4,240	3,798	11.6%	12,330	8,239	49.7%	14,537	8,907	63.2%
Net income	8,007	7,156	11.9%	14,549	10,536	38.1%	16,701	11,159	49.7%
Basic EPS	0.68	0.60	11.7%	1.23	0.89	37.9%	1.41	0.94	49.7%
Diluted EPS	0.61	0.55	11.9%	1.11	0.81	38.1%	1.28	0.85	49.7%
Margins									
Gross margin	13.8%	12.8%		17.4%	17.2%		18.3%	16.5%	
Operating margin	3.1%	1.2%		7.9%	5.7%		8.8%	5.4%	
Pretax margin	2.9%	1.0%		7.1%	5.7%		8.0%	5.2%	
Net margin	5.4%	3.6%		8.4%	7.0%		9.2%	6.4%	

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

Exhibit 20: UMC: Quarterly financials

(NT\$ mn)	1Q19	2Q19	3Q19	4Q19e	1Q20e	2Q20e	3Q20e	4Q20e	2018	2019e	2020e	2021e
Total Revenues	32,583	36,031	37,738	40,818	39,216	42,357	46,266	45,386	151,253	147,170	173,225	181,607
Sequential Change	-8.3%	10.6%	4.7%	8.2%	-3.9%	8.0%	9.2%	-1.9%				
Change vs Year Ago	-13.1%	-7.3%	-4.2%	14.9%	20.4%	17.6%	22.6%	11.2%	1.3%	-2.7%	17.7%	4.8%
Cost of Sales	(30,321)	(30,379)	(31,306)	(34,888)	(33,875)	(35,246)	(37,447)	(36,461)	(128,413)	(126,894)	(143,028)	(148,375)
Gross Profit	2,262	5,652	6,433	5,930	5,341	7,112	8,819	8,925	22,840	20,276	30,197	33,233
Gross Margin	6.9%	15.7%	17.0%	14.5%	13.6%	16.8%	19.1%	19.7%	15.1%	13.8%	17.4%	18.3%
Total Opex	(3,860)	(3,891)	(3,924)	(4,005)	(3,991)	(4,098)	(4,225)	(4,230)	(17,043)	(15,679)	(16,545)	(17,193)
Percent of Revenues	11.8%	10.8%	10.4%	9.8%	10.2%	9.7%	9.7%	9.3%	11.3%	10.7%	9.6%	9.5%
R&D	(2,807)	(2,787)	(2,813)	(2,813)	(2,838)	(2,863)	(2,888)	(2,913)	(13,025)	(11,224)	(11,502)	(11,902)
Percent of Revenues	8.6%	7.7%	7.5%	6.9%	7.2%	6.8%	6.2%	6.4%	8.6%	7.6%	6.6%	6.6%
Sales and Marketing	(889)	(953)	(970)	(1,049)	(1,008)	(1,088)	(1,189)	(1,166)	(3,902)	(3,860)	(4,451)	(4,667)
Percent of Revenues	2.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
General and Admin	(164)	(151)	(141)	(143)	(145)	(147)	(149)	(151)	(116)	(599)	(582)	(624)
Percent of Revenues	0.5%	0.4%	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%	0.7%	0.4%	0.3%	0.3%
Operating Income	(1,597)	1,761	2,509	1,925	1,350	3,013	4,593	4,695	5,797	4,597	13,652	16,040
Percent of Revenues	-4.9%	4.9%	6.6%	4.7%	3.4%	7.1%	9.9%	10.3%	3.8%	3.1%	7.9%	8.8%
Total Non-operating Income(Loss)	1,247	(617)	(531)	(456)	(331)	(331)	(331)	(331)	(3,613)	(357)	(1,322)	(1,503)
Profit Before Taxes	(350)	1,144	1,977	1,469	1,020	2,683	4,263	4,364	2,184	4,240	12,330	14,537
Percent of Revenues	-1.1%	3.2%	5.2%	3.6%	2.6%	6.3%	9.2%	9.6%	1.4%	2.9%	7.1%	8.0%
Change vs Year Ago	-118.9%	-45.2%	138.7%	-156.8%	-397.3%	134.9%	115.6%	197.2%				
Taxes	443	(202)	(39)	(148)	(103)	(271)	(431)	(441)	499	54	(1,245)	(1,468)
Tax Rate	126.0%	17.6%	2.0%	10.1%	10.1%	10.1%	10.1%	10.1%	-21.0%	-1.3%	10.1%	10.1%
Net Income, Cont Ops	93	942	1,938	1,320	917	2,412	3,832	3,924	2,643	4,294	11,084	13,068
Percent of Revenues	0.3%	2.6%	5.1%	3.2%	2.3%	5.7%	8.3%	8.6%	1.7%	2.9%	6.4%	7.2%
Minority Interest	1,109	798	950	816	764	847	925	908	4,430	3,714	3,465	3,632
Reported Income (TW GAAP)	1,201	1,740	2,929	2,137	1,701	3,259	4,757	4,831	7,073	8,007	14,549	16,701
Percent of Revenues	3.7%	4.8%	7.8%	5.2%	4.3%	7.7%	10.3%	10.6%	4.7%	5.4%	8.4%	9.2%
Change vs Year Ago	-64.7%	-52.4%	70.2%	-225.2%	41.6%	87.2%	62.4%	126.1%	-26.5%	13.2%	81.7%	14.8%
Reported diluted EPS (NT\$, TW GAAP)	0.09	0.13	0.22	0.16	0.13	0.25	0.36	0.37	0.52	0.61	1.11	1.28
Reported Basic EPS (NT\$, GAAP)	0.10	0.15	0.25	0.18	0.14	0.28	0.40	0.41	0.58	0.68	1.23	1.41

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

UMC: Valuation Methodology

We raise our price target to NT\$18.0 from NT\$11.5: This mainly reflects our higher earnings estimates thanks to the stronger outlook given demand in trailing edge. We continue to derive our price target from our residual income model framework, where we keep all of our key assumptions unchanged, including a cost of equity of 9.2%, an intermediate growth rate of 6.0%, a terminal growth rate of 3.0%, and a cash dividend payout ratio of 90%.

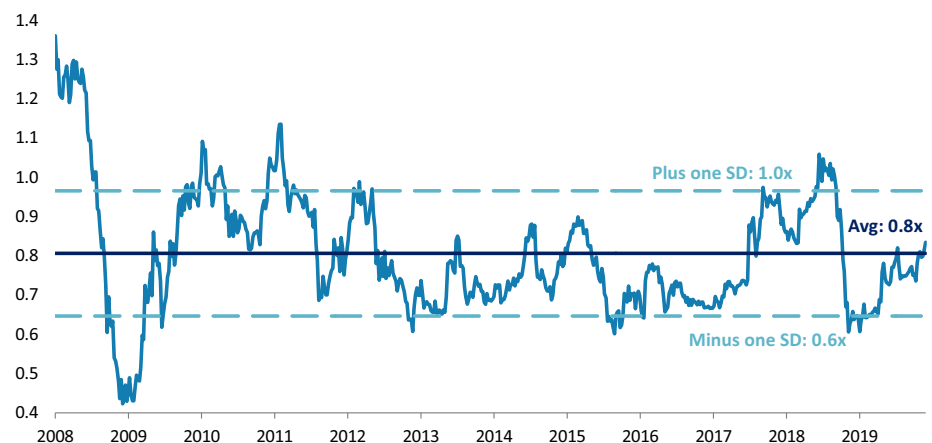
Exhibit 21: UMC: RI model

(NT\$ mn)	2019e	2020e	2021e	2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e
Total Equity	206,597	210,266	210,240	213,662	217,164	220,938	224,936	229,172	233,661	238,416	243,455	248,793
Net Profit	8,239	14,549	16,701	17,694	18,747	19,862	21,044	22,296	23,623	25,029	26,518	28,096
ROAE	4.0%	7.0%	7.9%	8.3%	8.7%	9.1%	9.4%	9.8%	10.2%	10.6%	11.0%	11.4%
Residual Income	(10,825)	(4,648)	(2,706)	(1,851)	(1,123)	(353)	463	1,327	2,241	3,210	4,235	5,320
Spread	-5.2%	-2.2%	-1.3%	-0.9%	-0.5%	-0.2%	0.2%	0.6%	1.0%	1.4%	1.8%	2.2%
Ending Equity Capital	206,597											
PV of Forecast Period	(3,665)											
PV of Continuing Value	33,023											
Equity Value	235,955											
No. of Shares	13,119											
Projected Price (NT\$)	18.0											

Source: Company Data, Morgan Stanley Research estimates

In terms of relative valuation, we prefer to use price to book ratio given its higher earnings volatility. UMC is trading at 0.8x one-year forward P/B, roughly in line with its 10-year historical average, and at a discount when compared to peers like SMIC (1.4x P/B). In addition, UMC could trade well above 1.0x P/B when trailing-edge demand is strong. Our price target implies 1.0x 2020e P/B.

Exhibit 22: UMC one-year forward P/B



Source: TEJ, Morgan Stanley Research estimates

UMC: Financial Summary

Income Statement, 2015-2018e, Year End Dec

(NT\$ mn)	2018	2019e	2020e	2021e
Turnover	151,253	147,170	173,225	181,607
YoY Growth	1.3%	-2.7%	17.7%	4.8%
Less: COGS	(128,413)	(126,894)	(143,028)	(148,375)
Variable costs	(82,682)	(82,877)	(99,468)	(104,814)
Depreciation & amort	(45,731)	(44,017)	(43,561)	(43,561)
Gross profit	22,840	20,276	30,197	33,233
YoY Growth	-15.6%	-11.2%	48.9%	10.1%
% margin	15.1%	13.8%	17.4%	18.3%
Operating Expenses:	(17,043)	(15,679)	(16,545)	(17,193)
R&D	(13,025)	(11,220)	(11,502)	(11,902)
Sales and Marketing	(3,902)	(3,860)	(4,451)	(4,667)
General and Admin	(116)	(599)	(592)	(624)
Operating Profit	5,797	4,597	13,652	16,040
YoY Growth	-11.7%	-20.7%	197.0%	17.5%
% margin	3.8%	3.1%	7.9%	8.8%
Total Non-op	(3,613)	(357)	(1,322)	(1,503)
Pretax Profit	2,184	4,240	12,330	14,537
YoY Growth	-72.0%	94.1%	190.8%	17.9%
% margin	1.4%	2.9%	7.1%	8.0%
Tax	459	54	(1,245)	(1,468)
Reported Net Income	7,073	8,007	14,549	16,701
ModelWare EPS (NT\$)	0.52	0.61	1.11	1.28
Key Ratios				
	2018	2019e	2020e	2021e
Return (%)				
ROAA	1.9%	2.2%	3.9%	4.5%
ROAE	3.4%	3.9%	7.0%	7.9%
OP. ATO	58.4%	55.9%	63.1%	72.1%
Gearing (x)				
Net Debt/ Equity	(0.1x)	(0.2x)	(0.1x)	#DIV/0!
Current Ratio	2.8x	2.4x	2.6x	#DIV/0!
Quick Ratio	2.2x	1.6x	1.7x	#DIV/0!
Operating Cycle				
AR/NR Turnover (days)	53	63	60	61
Inventory Turnover (days)	51	55	53	53
AP Turnover (days)	19	21	20	20
Cash Conversion (days)	86	97	94	95

Balance sheet

(NT\$ mn)	2018	2019e	2020e	2021e
Assets				
Cash & Equivalent	83,662	87,603	84,093	107,722
Marketable Security	528	634	634	634
A/R & N/R	23,875	27,438	30,509	31,301
Inventories	18,295	20,646	21,576	22,169
Other Current Ass.	3,608	19,279	19,279	19,279
Total current assets	141,193	168,907	169,399	194,413
LT Investment	33,505	40,338	40,338	40,338
Total Fixed Assets	172,847	145,877	143,608	118,789
Total Other Assets	17,060	21,270	21,270	21,270
Total Assets	364,605	376,392	374,615	374,809
Liabilities				
A/P & N/P	6,802	7,655	8,000	8,219
Accrued Expenses	0	0	0	0
Other Payable	16,464	15,033	15,033	15,033
Total Current Liab.	49,899	71,352	65,697	65,917
L-T Liabilities	67,083	55,229	55,229	55,229
Total Other L-T Liab	41,086	43,446	43,446	43,446
Total Liabilities	158,068	170,027	164,372	164,592
Equity				
Common Stocks	124,243	117,243	117,243	117,243
Preferred Stocks				
Capital Reserve	40,399	39,360	39,360	39,360
Retained earnings	47,075	49,476	53,354	53,328
Treasury Stock	(5,647)	(120)	(120)	(120)
Total Equity	206,536	206,365	210,242	210,217
Cash Flow Statement				
(NT\$ mn)	2018	2019e	2020e	2021e
Net Income	2,643	4,294	11,084	13,068
Depreciation	52,049	48,582	47,348	47,348
Net Investment Losses (Gains)	(137)	10	0	0
Others	(5,775)	(25,758)	(3,656)	(1,166)
Cash Flow-Operating	50,935	27,117	54,777	59,251
(Purchase) of FA	(19,590)	(21,915)	(45,079)	(22,529)
Sale of Fix Asset	201	23	0	0
(Purchase)L-T Inv.	(843)	(15)	0	0
Sale of L-T Inv.	62	2	0	0
Sale(Pur.)S-T Inv.	(593)	31	0	0
Cash Flow-Investing	(15,500)	(22,736)	(45,079)	(22,529)
Inc(Dec)-S-T Debt	(1,339)	8,850	0	0
Dividend Paid	(8,558)	(6,914)	(7,206)	(13,094)
Dir.&Emp.Bonus	0	0	0	0
Proceed from New Issue	0	0	0	0
Dec/Inc-TreasureSt	(3,944)	(2,972)	0	0
Others	(19,644)	885	(6,000)	0
Cash Flow-Financing	(33,485)	(151)	(13,206)	(13,094)
Change in Cash	1,987	3,941	(3,509)	23,628
Net cash/(debt), b/f	81,674	83,661	87,602	84,093
Net cash/(debt), c/f	83,661	87,602	84,093	107,721

e = Morgan Stanley Research Estimates

Source: Company Data, Morgan Stanley Research

UMC: Risk-Reward

Healthy 12-inch and 8-inch demand; OW



Source: Refinitiv, Morgan Stanley Research estimates

Price Target NT\$18

Base case, residual income model.

Bull NT\$22.40**1.2x 2020e BVPS**

Healthy semi growth; better-than-expected 8-inch and trailing-edge 12-inch demand: 1) Global semi sales grow strongly in 2020, and foundry industry growth is >15%; 2) strong 8-inch demand and 12-inch demand thanks to better-than-expected adoption of new display semis; 3) USJC fab turns profitable faster-than-expected after synergies are realized.

Base NT\$18.00**1.0x 2020e BVPS**

Healthy semi growth; solid 8-inch demand; increased demand for trailing-edge 12-inch: 1) Global semi sales grow steadily in 2020 and foundry industry growth reaches double digits; 2) robust 8-inch demand and 12-inch demand thanks to display semis; 3) USJC fab slowly turns profitable after synergies are realized.

Bear NT\$9.90**0.6x 2020e BVPS**

Stagnant semi growth; 8-inch and trailing-edge 12-inch face weakening demand: 1) Global semi sales stay flattish in 2020, and foundry industry growth is in low single digits; 2) display semis adoption slows down, hurting UMC's demand; 3) USJC fab turns loss-making given lack of realized synergies.

Why Overweight

- We expect UMC will benefit from the growing demand in legacy foundry nodes, including trailing-edge 12-inch and 8-inch.
- UMC's profitability is currently constrained by the acquisition of USJC, but more synergies will come as we expect a healthy demand environment in 2020. Competition from Chinese fabs and TSMC, should also ease.
- UMC's capex has become more strategic, with solid demand from higher-margin 8" business.
- Valuation looks attractive at 0.8x 2020e BVPS given the company's steady earnings outlook.

Key Value Drivers

- Global semiconductor growth.
- 8-inch demand.
- 28nm design wins coupled with yield rate improvement.
- Capacity discipline, hence, high utilization rate/sustainable margin.

Potential Catalysts

- Wafer price hikes.
- Strong monthly sales.
- Rush orders from key customers.

Risks to Achieving Price Target

- **Downside:**
 - Softer-than-expected global economic and semiconductor growth.
 - Increasing pricing competition could reduce the margin and utilization rate.
 - Unfavorable customer mix changes.

Vanguard: A Better 2020 Outlook; Double Upgrade to OW

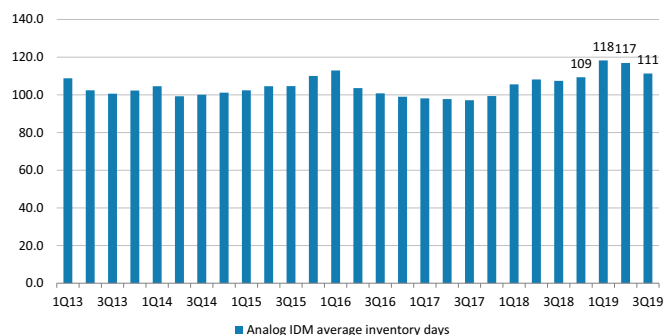
Structural 8-inch wafer demand prompts capacity tightness across the board: After industry bellwether TSMC signaled a recovery in foundry demand during its 2Q earnings call, we now see signs of stronger wafer demand for 8-inch foundries. Customers' inventory days continued to fall after three quarters of depletion, and inventory replenishment – especially for large display driver ICs – should help drive a demand upturn from 1H20. Meanwhile, increased 8-inch wafer demand from emerging applications such as fingerprint sensors and power semis for 5G continues to eat up 8-inch wafer supply. With industry supply growing only at 2-3% next year, we thus believe 8-inch foundry capacity should result in a shortage once again in 2H20.

Singapore fab still a key swing factor, but we think Vanguard can fill the fab thanks to increased outsourcing: Our UW thesis was mainly based on the additional depreciation burden from the Singapore fab that Vanguard has to bear from 2020. Our proprietary analysis also suggests a break-even utilization rate as high as 82% for the SG fab. Yet, since Vanguard can benefit directly from the increased outsourcing from TSMC and the healthier industry outlook, we think it can surpass that threshold and generate 2020 EPS growth of 11%.

Power semi demand still slow in the near term, but stabilizing: Vanguard has guided for revenue from power semis to decline Q/Q in 4Q19, and key customer Infineon (covered by Dominik Olszewski) continues to sound wary on the outlook given its cautious view on industrial end markets and recovery in Chinese EVs in the near term. However, average inventory of analog IDMs also fell another six days in 3Q19, so we think demand for Vanguard could stabilize from here. If auto and industrial demand were to recover also, outsourcing from key customers should resume, and Vanguard's power business could grow strongly off a low base in 2019.

Double upgrade to OW: With the healthier demand outlook and the Singapore fab no longer a drag, we expect the company will achieve an earnings CAGR of over 20% in the next few years with healthy free cash flow. We raise our price target to NT\$82.

Exhibit 23: Analog IDM average inventory declined another 6 days in 3Q



Source: Refinitiv, Morgan Stanley Research

Exhibit 24: Vanguard's Fab 3E breakeven utilization rate

Fixed Cost (US\$mn)	
Fab 3E Acquisition Cost	236
Depreciable assets	236
Dereciation year	6
Depreciation per year (US\$mn)	39.3
Variable Cost	
Blended wafer ASP (US\$ k)	0.6
Revenue per year (US\$mn)	252
Utilization rate	81.9%
Variable Cost (%)	62%
Variable Cost (US\$mn)	128.0
Others	
OPEX ratio	15.5%
OPEX (US\$mn)	39.1
Breakeven UT rate	
Total Cost (US\$mn)	206
Breakeven UT rate	81.9%

Source: Company Data, Morgan Stanley Research estimates

Vanguard: Earnings Estimate Revisions

We raise our 2019, 2020, and 2021 EPS estimates 1%, 13%, and 24%, respectively: As one of the key outsourcing partners for 8-inch wafer foundries, we think Vanguard will enjoy some short term tailwinds in view of the inventory replenishment. In addition, the improving business outlook should also 1) increase the pace of IDM outsourcing, and 2) increase orders transferred from key partner TSMC. This should help Vanguard fill its new capacity from the Singapore fab and make it profitable rather than a burden. We therefore raise our revenue estimates 7% for 2020 and 12% for 2021. With higher revenue scale to help offset the margin dilution from the new Singapore fab, we also raise our gross margin and operating margin assumptions.

Exhibit 25: Vanguard: Earnings estimate revisions

(NT\$ mn)	New 2019e	Old 2019e	Diff.%	New 2020e	Old 2020e	Diff.%	New 2021e	Old 2021e	Diff.%
Net sales	27,953	27,912	0%	34,195	31,879	7%	38,650	34,618	12%
Gross profit	10,220	10,203	0%	11,388	10,431	9%	13,121	11,343	16%
Operating profit	6,799	6,766	0%	7,648	6,717	14%	9,122	7,307	25%
Pretax income	7,277	7,244	0%	7,960	7,033	13%	9,444	7,627	24%
Net income	5,770	5,744	0%	6,408	5,662	13%	7,603	6,140	24%
EPS (NT\$)	3.50	3.48	1%	3.89	3.42	13%	4.61	3.71	24%
Margins									
Gross margin	36.6%	36.6%		33.3%	32.7%		33.9%	32.8%	
Operating margin	24.3%	24.2%		22.4%	21.1%		23.6%	21.1%	
Pretax margin	26.0%	26.0%		23.3%	22.1%		24.4%	22.0%	
Net margin	20.6%	20.6%		18.7%	17.8%		19.7%	17.7%	

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

Exhibit 26: Vanguard: Quarterly financials

(NT\$ mn)	1Q19	2Q19	3Q19p	4Q19e	1Q20e	2Q20e	3Q20e	4Q20e	2018	2019e	2020e	2021e
Total Revenues	6,907	6,918	7,127	7,001	7,647	8,523	9,164	8,860	28,928	27,953	34,195	38,650
Sequential Change	-10.4%	0.2%	3.0%	-1.8%	9.2%	11.5%	7.5%	-3.3%				
Change vs Year Ago	7.5%	-1.9%	-8.0%	-9.1%	10.7%	23.2%	28.6%	26.5%	16.1%	-3.4%	22.3%	13.0%
Cost of Sales	(4,417)	(4,359)	(4,489)	(4,489)	(5,203)	(5,678)	(6,049)	(5,877)	(18,760)	(17,733)	(22,806)	(25,529)
Percent of Revenues	63.9%	63.0%	63.0%	63.8%	68.0%	66.0%	66.0%	66.3%	64.8%	63.4%	66.7%	66.1%
Gross Profit	2,490	2,559	2,638	2,533	2,443	2,846	3,116	2,983	10,168	10,220	11,388	13,121
Percent of Revenues	36.1%	37.0%	37.0%	36.2%	32.0%	33.4%	34.0%	33.7%	35.2%	36.6%	33.3%	33.9%
Total Opex	(832)	(882)	(849)	(857)	(901)	(926)	(949)	(965)	(3,014)	(3,421)	(3,740)	(3,989)
Percent of Revenues	12.1%	12.8%	11.9%	12.2%	11.8%	10.9%	10.4%	10.9%	10.4%	12.2%	10.9%	10.3%
R&D	(424)	(474)	(420)	(425)	(450)	(460)	(470)	(480)	(1,494)	(1,742)	(1,860)	(1,930)
Percent of Revenues	6.1%	6.9%	5.9%	6.1%	5.9%	5.4%	5.1%	5.4%	5.2%	6.2%	5.4%	5.1%
Sales and Marketing	(82)	(88)	(75)	(74)	(92)	(102)	(110)	(106)	(341)	(318)	(410)	(464)
Percent of Revenues	1.2%	1.3%	1.1%	1.1%	1.2%	1.2%	1.2%	1.2%	1.2%	1.1%	1.2%	1.2%
General and Admin	(327)	(320)	(355)	(359)	(364)	(369)	(379)	(379)	(1,179)	(1,361)	(1,470)	(1,545)
Percent of Revenues	4.7%	4.6%	5.0%	5.1%	4.7%	4.3%	4.0%	4.3%	4.1%	4.9%	4.3%	4.0%
Operating Income	1,658	1,677	1,789	1,676	1,543	1,919	2,167	2,018	7,155	6,799	7,648	9,122
Percent of Revenues	24.0%	24.2%	25.1%	23.9%	20.2%	22.5%	23.6%	22.8%	24.7%	24.3%	22.4%	23.6%
Total Non-operating Income(Loss)	92	216	98	71	75	79	77	81	317	478	312	322
Profit Before Taxes	1,749	1,893	1,887	1,747	1,618	1,998	2,244	2,099	7,472	7,277	7,960	9,444
Percent of Revenues	25.3%	27.4%	26.5%	25.0%	21.2%	23.4%	24.5%	23.7%	25.8%	26.0%	23.3%	24.4%
Change vs Year Ago	21.1%	7.2%	-9.0%	-20.2%	-7.5%	5.5%	18.9%	20.1%				
Taxes	(362)	(413)	(391)	(341)	(315)	(360)	(438)	(409)	(1,306)	(1,507)	(1,552)	(1,841)
Tax Rate	20.7%	21.8%	20.7%	19.5%	19.5%	19.5%	19.5%	19.5%	17.5%	20.7%	19.5%	19.5%
Reported Income (TW GAAP)	1,388	1,480	1,496	1,406	1,303	1,638	1,807	1,690	6,166	5,770	6,408	7,603
Percent of Revenues	20.1%	21.4%	21.0%	20.1%	17.0%	18.9%	19.7%	19.1%	21.3%	20.6%	18.7%	19.7%
Change vs Year Ago	20.9%	4.1%	-10.4%	-27.1%	-6.1%	8.7%	20.8%	20.1%	36.5%	-6.4%	11.1%	18.6%
EPS (NT\$)	0.84	0.90	0.91	0.85	0.79	0.98	1.10	1.02	3.73	3.50	3.89	4.61
Change vs Year Ago	20.9%	4.1%	-10.3%	-26.6%	-6.1%	8.7%	20.8%	20.1%	36.6%	-6.3%	11.1%	18.6%

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

Vanguard: Valuation Methodology

We raise our price target to NT\$82 from NT\$55: In addition to our higher earnings estimates for 2019-21, we lift our intermediate growth rate from 5.0% to 7.5% given the better business outlook resulting from emerging applications in 8-inch wafer foundries. We continue to derive our price target from our residual income model framework, where we keep all other assumptions unchanged, including a cost of equity of 9.0%, a terminal growth rate of 4.0%, and a cash dividend payout ratio of 75%.

Exhibit 27: Vanguard: RI model

(NT\$ mn)	2019e	2020e	2021e	2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e
Total Equity	29,964	31,127	33,485	36,142	39,000	42,073	45,378	48,931	52,753	56,863	61,283	66,037
Net Profit	5,770	6,408	7,603	8,176	8,793	9,455	10,168	10,935	11,760	12,646	13,600	14,625
ROAE	19.4%	21.0%	23.5%	23.5%	23.4%	23.3%	23.3%	23.2%	23.1%	23.1%	23.0%	23.0%
Residual Income	3,070	3,590	4,525	4,852	5,207	5,589	5,999	6,441	6,916	7,426	7,976	8,566
Spread	10.4%	12.0%	14.5%	14.5%	14.4%	14.3%	14.3%	14.2%	14.1%	14.1%	14.0%	14.0%
Ending Equity Capital	29,964											
PV of Forecast Period	35,536											
PV of Continuing Value	69,132											
Equity Value	134,633											
No. of Shares	1,649											
Projected Price (NT\$)	82											

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

In terms of relative valuation, despite Vanguard's P/B ratio of 3.8x looking fairly expensive compared to its historical average, we don't find it particularly stretched given its 20% 2020e ROE. The stock was able to trade above 4x forward P/B in 2018 when the company benefited from strong 8-inch demand and capacity tightness, and we believe this time around Vanguard's share price could reach that valuation level again.

Exhibit 28: Vanguard one-year forward P/B



Source: TEJ, Morgan Stanley Research estimates

Vanguard: Financial Summary

Income Statement

NT\$ mn (Years End Dec)	2018	2019e	2020e	2021e
Net sales	28,928	27,953	34,195	38,650
COGS	(18,760)	(17,733)	(22,806)	(25,529)
Gross profit	10,168	10,220	11,388	13,121
Operating expenses	(3,014)	(3,421)	(3,740)	(3,999)
R&D	(1,494)	(1,742)	(1,860)	(1,990)
SG&A	(1,519)	(1,679)	(1,880)	(2,009)
Operating income	7,155	6,799	7,648	9,122
Non-operating income	317	478	312	322
Pre-tax income	7,472	7,277	7,960	9,444
Income tax	(1,306)	(1,507)	(1,552)	(1,841)
Net income	6,166	5,770	6,408	7,603
Adj.wtd.avg.shrs (mn)	1,652	1,649	1,649	1,649
Reported EPS (NT\$)	3.73	3.50	3.89	4.61
Modelware EPS (NT\$)	3.73	3.50	3.89	4.61

Cash Flow Statement

NT\$mnn (Years End Dec)	2018	2019e	2020e	2021e
Cash flow from Operations	7,460	9,258	8,809	10,564
Net profits	6,166	5,770	6,408	7,603
Depreciation	1,823	2,147	3,594	3,789
Equity investment losses (income)	24	0	0	0
Other adjustments	(553)	1,341	(1,193)	(828)
Cash flow from Investing	(3,903)	(10,687)	(2,905)	(3,491)
Capex	(1,919)	(10,687)	(2,905)	(3,491)
Change of LT Investment	(1,871)	0	0	0
Change of ST Investment	(105)	0	0	0
Other adjustments	(8)	0	0	0
Cash flow from financing	(4,903)	(5,245)	(5,245)	(5,245)
Increase in L/T debt	0	0	0	0
Increase in S/T debt	0	0	0	0
Cash Dividend Paid	(4,917)	(5,245)	(5,245)	(5,245)
Dir& Emp Bonus Paid	0	0	0	0
Issuance of stock	0	0	0	0
Dec/Inc-TreasureSt	0	0	0	0
Other Adjustments	14	0	0	0
Net change in cash	(1,346)	(6,673)	659	1,828

Balance Sheet

NT\$mnn (Years End Dec)	2018	2019e	2020e	2021e
Cash	14,607	7,934	8,593	10,421
Mkt Securities	1,602	1,602	1,602	1,602
AR/NR	5,728	4,736	5,793	6,548
Inventory	3,416	2,933	3,773	4,223
Other	450	450	450	450
Current Assets	25,803	17,655	20,211	23,244
Long-term investments	4,747	4,747	4,747	4,747
Fixed assets	6,444	14,983	14,294	13,996
Other assets	659	659	659	659
Total Assets	37,653	38,044	39,911	42,646
S/T borrowings	0	0	0	0
AP/NP	1,293	1,230	1,582	1,771
Other ST liabilities	5,897	5,825	6,177	6,365
LT debt	0	0	0	0
Other LT liabilities	1,025	1,025	1,025	1,025
Total Liabilities	8,214	8,080	8,784	9,161
Common shares	16,390	16,390	16,390	16,390
Retained earning	12,193	12,718	13,881	16,239
Other shareholders' equity	857	857	857	857
Total Equity	29,439	29,964	31,127	33,485
Total Liab. & Shrhldr's Equity	37,653	38,044	39,911	42,646

Financial Ratios

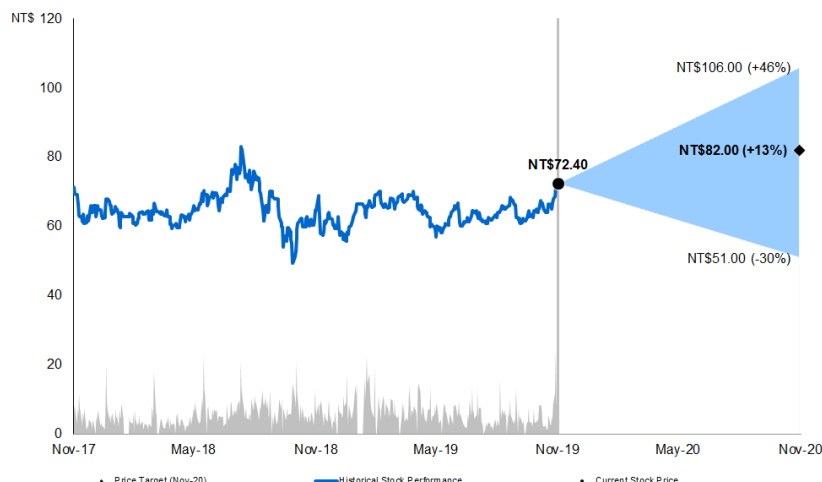
	2018	2019e	2020e	2021e
Growth(%)				
Turnover	16.1	(3.4)	22.3	13.0
Operating profits	36.8	(5.0)	12.5	19.3
Pretax profits	41.5	(2.6)	9.4	18.6
Net profits	36.9	(6.4)	11.1	18.6
EPS	36.6	(6.3)	11.1	18.6
Margins (%)				
Gross Margin	35.2	36.6	33.3	33.9
Operating Margin	24.7	24.3	22.4	23.6
Pretax Margin	25.8	26.0	23.3	24.4
Net Profit	21.3	20.6	18.7	19.7
Return (%)				
ROAA	17.3	15.2	16.4	18.4
ROAE	21.7	19.4	21.0	23.5
Gearing (%)				
Net Debt/Equity	(49.6)	(26.5)	(27.6)	(31.1)
Liabilities/Equity	27.9	27.0	28.2	27.4
Ratios (X)				
Current ratio	3.6	2.5	2.6	2.9
Quick ratio	3.1	2.0	2.1	2.3
Others				
AR/NR Turnover (days)	61.8	61.8	61.8	61.8
Inventory Turnover (days)	60.4	60.4	60.4	60.4
AP Turnover (days)	25.3	25.3	25.3	25.3
Cash Conversion (days)	96.9	96.9	96.9	96.9

E = Morgan Stanley Research Estimates

Source: Morgan Stanley Research, Company Data

Vanguard: Risk-Reward

8" wafer demand recovering, while power semis could provide more upside if auto/industrial demand rebounds



Source: Refinitiv, Morgan Stanley Research estimates

Price Target NT\$82

Base case, residual income model.

Bull NT\$106

5.6x base case 2020e BVPS

Healthy semi demand: Power and auto semi demand are exceptionally strong; inventory level is digested quickly and DDI for smartphones and large panels shows growth. Easing competition from peers. We assume (1) global semi sales growth of >10% in 2020 and foundry industry growth of high single digits; (2) better-than-expected demand for 8" capacity; (3) power demand for 5G tracks ahead of schedule.

Base NT\$82

4.3x base case 2020e BVPS

Healthy semi demand with some competition: Power and auto semi demand grows steadily, and inventory level stabilizing. 8-inch wafer demand increasing from 5G and optical fingerprint, helping Vanguard's new Singapore fab ramp up. We assume: (1) global semi sales rebound to growth in 2020 of 5-10%; (2) strong foundry industry growth in 2020.

Bear NT\$51

3.8x base case 2020e BVPS

Semi growth slowdown: Semi growth slowdown; power and auto semi demand weakens; elevated power semi inventory level. Smartphone DDI shows a worse-than-expected decline. Intensified competition and new Chinese capacity dampen the overall pricing environment. We assume: (1) overall semi industry falls in 2020 and foundry growth is also stagnant; (2) weaker-than-expected demand for 8" capacity due to faster product migration in 2020.

Why Overweight

- Vanguard's exposure to power components should make it a key beneficiary of structural trends such as EV and 5G, and its new Singapore fab acquisition could allow it to capture more growth amid a healthy demand environment
- 8" wafer demand along with strong demand in auto for legacy nodes has held up its blended wafer ASP well, thus margins and earnings.
- Inventory correction issue appears to be coming to an end, while competition from other 8-inch vendors should ease given overall strength in demand.
- Vanguard is trading at 3.8x 2020e BVPS with 20% ROE, and we find it inexpensive compared to the stock's previous trading record when fundamentals were healthy.

Key Value Drivers

- Global semiconductor growth.
- Foundry demand from display driver ICs and power management ICs.
- Healthy global 8-inch foundry demand.
- 8-inch expansion plan to capture industry growth.

Potential Catalysts

- Stronger smartphone/TV demand
- Analog IDMs' inventory continues to fall
- Easing competition in 8-inch foundry business with pricing rebound

Risks to Achieving Price Target

- **Downside:**
- Weaker-than-expected LCD driver IC demand.
- Intensified competition in power semi business.
- Slower than expected EV penetration.
- IDMs customers starting to move production in-house

Chipbond: OLED iPhone Loss should not Overshadow Overall Business Strength; OW

Negatives from iPhone and COP impact overstated: Chipbond's share price has been a laggard YTD (+7.7% vs. TAIEX +20.3%). The key concern has been that the iPhone would drop all LCD models in 2020, and that Chipbond would have a difficult time filling the revenue shortfall. We disagree, and think this negative is overstated. New iPhones account for only 4-5% of Chipbond's revenue this year, so it has already de-risked the potential hit from iPhone's decision on switching to OLED. Meanwhile, Chipbond could still provide testing services for the iPhone SE2 model in 1H20, and we believe component volume could reach as high as 30mn units. Last, Chipbond could still stay in the OLED iPhone supply chain even if LG Display and BOE were to gain some share in the 2H20 iPhones, not to mention the possibility that there could be another LCD iPhone model in 2H20.

COF capacity still tight: Another key investor concern is that rising adoption from COP would cannibalize the market for COF and hence Chipbond's earnings. For COP, we remind investors that it could be adopted only in flexible OLED, not rigid OLED or LCD panels. That said, Chipbond's COF demand should not disappear, and COF could still make up a large portion of the display market, mainly thanks to increased TDDI outsourcing from driver IC players. Key customer Novatek's OLED driver IC shipments should also take off in 2020, and Chipbond, as the major back-end partner, should therefore benefit from the increased shipments.

RF share gain provides further upside: According to the company, Chipbond has gained share with one key vendor radio frequency (RF) components, thus making it more a beneficiary of 5G. With contributions from this new client and additional RF content for 5G smartphones, we believe Chipbond could generate RF revenue growth of 30-40% in 2020. Coupled with strength from display driver ICs, we are forecasting top-line growth of 7.1%, and EPS could exceed NT\$6.5 in 2020.

Near-term outlook better than feared: The company guided for 4Q19 revenue to decline 5-10% amid seasonality, but that should be followed by a 5-10% Q/Q increase in 1Q20 (vs. the current Street expectation of +2.2% Q/Q). That's thanks to inventory replenishment, mainly of large display driver ICs.

Raising price target to NT\$77: We believe Chipbond's fundamentals remain intact, and the stock has been overlooked given exaggerated concerns. P/E is just 9.6x on our increased 2020 EPS forecast (vs. the 10-year historical average of 11.7x), and its healthy free cash flow in the next few years should sustain its dividend yield at above 6.5%. We believe the stock should perform better from here. Thus, we keep our OW rating.

Chipbond: Earnings Estimate Revisions

We raise our EPS estimates 1% for 2019, 16% for 2020, and 11% for 2021: Our higher revenue assumptions are mainly based on better-than expected COF demand, share gains at a new RF customer, and incremental orders from iPhone SE2 model. Furthermore, we think key customer Novatek's increased OLED driver IC penetration should also benefit Chipbond, offsetting the potential content loss on COP. With larger revenue scale, we also raise our gross margin and operating margin assumptions.

Exhibit 29: Chipbond: Earnings estimate revision summary

(NT\$ mn)	New '19E	Old '19E	Diff.	New '20E	Old '20E	Diff.	New '21E	Old '21E	Diff.
Net sales	20,176	20,467	-1%	21,613	20,051	8%	22,849	21,565	6%
Gross profit	6,609	6,557	1%	6,799	6,032	13%	7,102	6,544	9%
Operating profit	5,260	5,066	4%	5,481	4,465	23%	5,788	4,978	16%
Pretax Income	5,367	5,342	0%	5,479	4,764	15%	5,786	5,278	10%
Net income	4,147	4,094	1%	4,266	3,681	16%	4,546	4,113	11%
Reported EPS	6.39	6.31	1%	6.57	5.67	16%	7.00	6.33	11%
Margins									
Gross margin	32.8%	32.0%		31.5%	30.1%		31.1%	30.3%	
Operating margin	26.1%	24.8%		25.4%	22.3%		25.3%	23.1%	
Pretax margin	26.6%	26.1%		25.3%	23.8%		25.3%	24.5%	
Net margin	20.6%	20.0%		19.7%	18.4%		19.9%	19.1%	

Source: Morgan Stanley Research (E) estimates

Exhibit 30: Chipbond: Quarterly financial statement

NT\$ in million	1Q19	2Q19	3Q19	4Q19E	1Q20E	2Q20E	3Q20E	4Q20E	2018	2019E	2020E	2021E
Total Revenues	4,671	5,043	5,449	5,013	5,046	5,314	5,575	5,678	18,725	20,176	21,613	22,849
Sequential Change	-12.0%	8.0%	8.0%	-8.0%	0.7%	5.3%	4.9%	1.8%				
Change vs Year Ago	21.3%	18.6%	2.5%	-5.5%	8.0%	5.4%	2.3%	13.3%	1.6%	7.7%	7.1%	5.7%
Cost of Sales	3,174	3,411	3,519	3,465	3,534	3,661	3,779	3,841	13,360	13,568	14,815	15,747
Percent of Revenues	68%	68%	65%	69%	70%	69%	68%	68%	71%	67%	69%	69%
Variable costs	2,502	2,733	2,840	2,782	2,851	2,976	3,094	3,151	10,702	10,857	12,072	12,963
as a % of revenue	54%	54%	52%	56%	57%	56%	56%	56%	57%	54%	56%	57%
Depreciation & Amortization expense	672	678	678	683	683	685	685	689	2,658	2,711	2,742	2,784
as a % of COGS	21%	20%	19%	20%	19%	19%	18%	18%	20%	20%	19%	18%
as a % of revenue	14%	13%	12%	14%	14%	13%	12%	12%	14%	13%	13%	12%
Gross Margin	1,498	1,633	1,930	1,548	1,512	1,653	1,796	1,837	5,365	6,609	6,799	7,102
Percent of Revenues	32.1%	32.4%	35.4%	30.9%	30.0%	31.1%	32.2%	32.4%	28.7%	32.8%	31.5%	31.1%
Incremental Margin	NM	36%	73%	NM	-111%	53%	55%	40%	337%	86%	13%	25%
Total Opex	316	334	369	330	269	329	373	346	1,466	1,349	1,318	1,313
Percent of Revenues	6.8%	6.6%	6.8%	6.6%	5.3%	6.2%	6.7%	6.1%	7.8%	6.7%	6.1%	5.7%
R&D	117	121	132	136	136	156	158	160	440	506	610	612
Percent of Revenues	2.5%	2.4%	2.4%	2.7%	2.7%	2.9%	2.8%	2.8%	2.4%	2.5%	2.8%	2.7%
General & administrative	164	175	198	158	88	128	168	138	869	693	520	510
Percent of Revenues	3.5%	3.5%	3.6%	3.1%	1.7%	2.4%	3.0%	2.4%	4.6%	3.4%	2.4%	2.2%
Selling & marketing	36	38	39	36	45	46	48	49	156	149	188	192
Percent of Revenues	0.8%	0.7%	0.7%	0.7%	0.9%	0.9%	0.9%	0.9%	0.8%	0.7%	0.9%	0.8%
Operating Income	1,182	1,298	1,561	1,218	1,243	1,324	1,423	1,491	3,900	5,260	5,481	5,788
Percent of Revenues	25.3%	25.7%	28.7%	24.3%	24.6%	24.9%	25.5%	26.3%	20.8%	26.1%	25.4%	25.3%
Change vs Year Ago	110.9%	95.9%	23.4%	-13.0%	5.2%	2.0%	-8.9%	22.4%	26%	35%	4%	6%
EBITDA	1,854	1,976	2,239	1,901	1,926	2,009	2,108	2,181	6,558	7,970	8,223	8,573
EBITDA margin	39.7%	39.2%	41.1%	37.9%	38.2%	37.8%	37.8%	38.4%	35.0%	39.5%	38.0%	37.5%
Total Non-operating Income(Loss)	54	73	(19)	(0)	(0)	(0)	(0)	(0)	(334)	107	(2)	(2)
Profit Before Taxes	1,235	1,372	1,542	1,218	1,242	1,324	1,423	1,491	3,566	5,367	5,479	5,786
Percent of Revenues	26%	27%	28%	24%	25%	25%	26%	26%	19%	27%	25%	25%
Taxes	260	368	342	250	259	329	304	321	879	1,220	1,213	1,241
Tax Rate	21.0%	26.8%	22.2%	20.5%	20.8%	24.8%	21.4%	21.5%	25%	23%	22%	21%
Reported Income (TW GAAP)	975	1,004	1,200	968	983	995	1,118	1,170	4,515	4,147	4,266	4,546
Percent of Revenues	21%	20%	22%	19%	19%	19%	20%	21%	24%	21%	20%	20%
Change vs Year Ago	0%	0%	0%	0%	0%	0%	0%	0%	120%	-8%	3%	7%
Reported EPS (NT\$, TW GAAP)	1.50	1.55	1.85	1.49	1.51	1.53	1.72	1.80	6.95	6.39	6.57	7.00
Change vs Year Ago	160%	34%	-56%	42%	1%	-1%	-7%	21%	120%	-8%	3%	7%

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

Chipbond: Valuation Methodology

We raise our price target from NT\$70 to NT\$77: The raised price target is mainly to reflect our raised earnings estimates. Our price target is our base case scenario value, derived from a residual income model. Our key assumptions (all unchanged) are a cost of equity of 9.8% (2.0% risk-free rate, 6% risk premium, beta of 1.3); a medium-term growth rate of 5.0%, and a long-term growth rate of 3.0%.

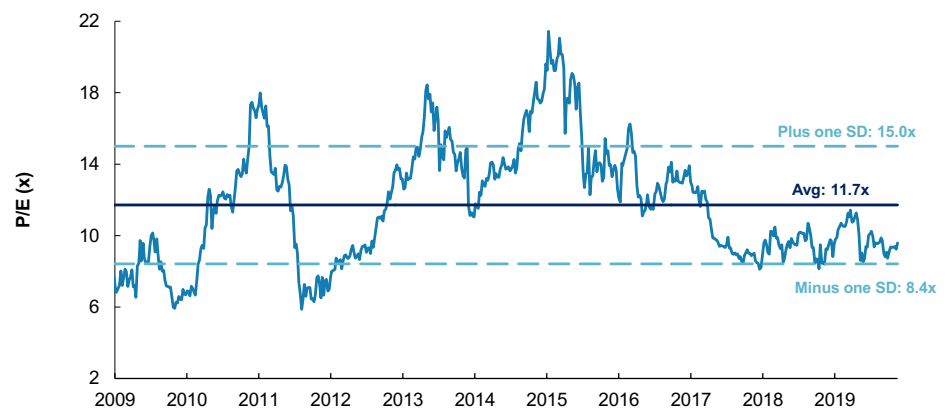
Exhibit 31: Chipbond: RI model

(NT\$ mn)	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Total Equity	28,835	30,176	31,712	33,478	35,333	37,280	39,324	41,470	43,724	46,091	48,576	51,185
Net Profit	4,147	4,266	4,546	4,773	5,012	5,262	5,525	5,801	6,092	6,396	6,716	7,052
ROAE	14.6%	14.5%	14.7%	14.6%	14.6%	14.5%	14.4%	14.4%	14.3%	14.2%	14.2%	14.1%
Residual Income	1,345	1,343	1,476	1,536	1,596	1,658	1,724	1,794	1,866	1,943	2,023	2,107
Spread	4.8%	4.7%	4.9%	4.8%	4.8%	4.7%	4.6%	4.6%	4.5%	4.4%	4.4%	4.3%
Ending Equity Capital	28,835											
PV of Forecast Period	10,176											
PV of Continuing Value	11,411											
Equity Value	50,422											
No. of Shares	651											
Projected Price (NT\$)	77											

Source: Morgan Stanley Research (E) estimates

On relative valuation, Chipbond's one-year forward P/E is close to one standard deviation below historical average levels. Coupled with dividend yield of 7%, we find this valuation attractive in view of the steady revenue and earnings growth we project in the next two years. We believe Chipbond deserves a valuation at least similar to the historical average of 11.7x, as implied by our price target of NT\$77.

Exhibit 32: Chipbond: one-year forward P/E band



Source: TEJ, company data, Morgan Stanley Research estimate

Chipbond: Financial Summary

Income Statement

NT\$m (Years End Dec)	2018	2019E	2020E	2021E
Net sales	18,725	20,176	21,613	22,849
COGS	(13,360)	(13,568)	(14,815)	(15,747)
Gross profit	5,365	6,609	6,799	7,102
Operating expenses	(1,466)	(1,349)	(1,318)	(1,313)
Operating income	3,900	5,260	5,481	5,788
Non-operating income	(334)	107	(2)	(2)
Pre-tax income	3,566	5,367	5,479	5,786
Income tax	879	1,220	1,213	1,241
Minority Interest	(1,828)	0	0	0
MW Net Income	4,515	4,147	4,266	4,546
Adj. wtd. avg. shrs(m)	649	651	651	651
Reported EPS (NT\$)	6.95	6.39	6.57	7.00
Modelware EPS (NT\$)	6.95	6.39	6.57	7.00

Balance Sheet

NT\$m (Years End Dec)	2018	2019E	2020E	2021E
Cash	6,058	6,465	7,177	8,179
Mkt Securities	0	0	0	0
AR/NR	5,664	4,947	5,299	5,602
Inventory	750	968	1,057	1,124
Other	664	664	664	664
Current Assets	13,137	13,044	14,197	15,569
Long-term investments	4,723	4,723	4,723	4,723
Fixed assets	16,188	15,977	15,735	15,450
Deferred assets	182	182	182	182
Other assets	5,379	5,379	5,379	5,379
Total Assets	39,609	39,306	40,216	41,304
S/T borrowings	1,576	1,376	1,176	976
AP/NP	815	750	819	870
Other ST liabilities	5,897	5,897	5,897	5,897
LT debt	2,650	1,650	1,350	1,050
Other LT liabilities	798	798	798	798
Common shares	6,543	6,543	6,543	6,543
Total Liabilities	11,736	10,471	10,040	9,592
Additional capital	9,440	9,440	9,440	9,440
Retained earning	435	1,397	2,738	4,275
Other shareholders' equity	11,455	11,455	11,455	11,455
Total Equity	27,873	28,835	30,176	31,712
Total Liab. & Shrhldr's Equity	39,609	39,306	40,216	41,304

Cash Flow Statement

NT\$m (Years End Dec)	2018	2019E	2020E	2021E
Cashflow from Operations	6,126	7,292	6,636	7,012
Reported net profits	4,515	4,147	4,266	4,546
Depreciation	2,510	2,711	2,742	2,784
Working Capital Change	(329)	434	(372)	(318)
Other adjustments	(570)	0	0	0
Cashflow from Investing	(4,771)	(2,500)	(2,500)	(2,500)
Capex	(6,510)	(2,500)	(2,500)	(2,500)
Change of LT Investment	1,063	0	0	0
Change of ST Investment	0	0	0	0
Other adjustments	676	0	0	0
Cashflow from financing	(1,378)	(4,384)	(3,425)	(3,509)
Increase in L/T debt	450	(1,000)	(300)	(300)
Increase in S/T debt	(1,146)	(200)	(200)	(200)
Cash Dividend Paid	(1,855)	(3,184)	(2,925)	(3,009)
Dir & Emp Bonus Paid	0	0	0	0
Issuance of stock	0	0	0	0
Other adjustments	1,173	0	0	0
Exchange rate adjustment	13	0	0	0
Net change in cash	-11	407	711	1,003

Financial Ratios

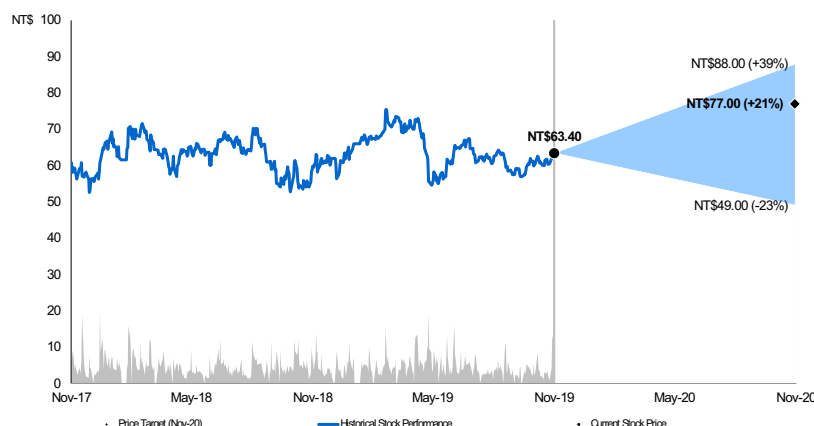
	2018	2019E	2020E	2021E
Growth(%)				
Turnover	1.6	7.7	7.1	5.7
Operating profits	28.1	34.9	4.2	5.6
Pretax profits	29.9	50.5	2.1	5.6
Net profits	119.7	-8.1	2.9	6.5
EPS	119.7	-8.1	2.9	6.5
Margins (%)				
Gross Margin	28.7	32.8	31.5	31.1
Operating Margin	20.8	26.1	25.4	25.3
Pretax Margin	19.0	26.6	25.3	25.3
Net Profit	24.1	20.6	19.7	19.9
Return (%)				
ROAE	17.0	14.6	14.5	14.7
ROAA	12.0	10.5	10.7	11.2
Gearing (%)				
Net Debt/Equity	(5.9)	(11.9)	(15.4)	(19.4)
Liabilities/Equity	42.1	36.3	33.3	30.2
Ratios (X)				
Current ratio	1.6	1.6	1.8	2.0
Quick ratio	1.4	1.4	1.6	1.8
Others				
AR/NR Turnover (days)	89	89	89	89
Inventory Turnover (days)	26	26	26	26
AP Turnover (days)	20	20	20	20
Cash Conversion (days)	95	95	95	95

E = Morgan Stanley Research Estimates

Source: Morgan Stanley Research, Company Data

Chipbond: Risk-Reward

Healthy 12-inch bumping market demand with attractive valuation; OW



Source: Refinitiv, Morgan Stanley Research estimates

Price Target **NT\$77**

Base case, residual income model.

Bull **NT\$88****13.3x 2020e EPS**

Stronger-than-expected 4K2K and 8K4K TV; Android driver IC business continues to expand; stronger-than-expected TDDI demand: 1) 4K2K TV penetration rate rises significantly in 2020, thanks to price elasticity; 2) price hikes continue for LCD driver IC back end in 2020, given limited supply; 3) COF contributes >40% of sales in 2020; and (4) RF business continues to grow substantially.

Base **NT\$77****11.7x 2020e EPS**

4K2K TV demand increases gradually; healthy 12-inch bumping market; TDDI demand remains healthy: 1) 4K2K TV demand grows gradually in 2020 in view of the Summer Olympics; 2) COF contributes 30% of sales in 2020; and 3) RF business contributes ~20% revenue by end-2020 thanks to customer's share gain.

Bear **NT\$49****7.5x 2020e EPS**

Disappointing 4K2K TV sell-through; large market share loss given competition; TDDI demand remains sluggish: 1) 4K2K penetration rate stagnant in 2020; 2) Chipbond's market share falls to below 60% in 2020 amid stiff competition from ChipMOS and LB Semicon; and 3) lack of COF demand in 2020 given accelerated adoption of flexible OLED.

Why Overweight

- Chipbond's COF capacity remains healthy, as iPhone SE2 and TDDI will jointly help fill the capacity shortfall from transition into flexible OLED.
- The healthy film capacity in late 2019 and 2020 could lead to more aggressive COF adoption.
- Chipbond has gained share with RF customers, giving it higher exposure to benefit from 5G
- We view P/E at 9.6x revised 2020e EPS as undemanding, still at a discount to the historical average. We think risk-reward still looks favorable.

Key Value Drivers

- Full-screen LCD display penetration rate.
- Smartphone sell-through.
- Gold bumping market share gains.
- TDDI penetration.

Potential Catalysts

- Further price hikes on the entire process given tightness in testers.
- Chinese smartphone makers adopting COF to enable true full screens.
- Rush orders or order wins from PA customers.

Risks to Achieving Price Target

- **Downside:**
 - Smartphones could move to Korean OLED aggressively with bundle sales of display ICs, shrinking the TAM for Chipbond.
 - Weaker-than-expected 4K2K TV demand.
 - More losses from COF substrate business.
 - Industry peers announce significant capacity expansion.

Novatek: Earnings Growth Could Accelerate Further in 2020; Raising Price Target to NT\$272

Reiterate OW – we see further share price upside: Novatek's share price has appreciated 18.9% vs. the TaieX up 5.1% since October 1. The strong share price performance was driven by the company's brighter outlook in 2020, mainly from TDDI and AMOLED DDI growth opportunities. Now, investors' questions regard how much upside the stock has left. We expect the competitive landscape to be more favorable for Novatek, given its superior chip design capability and further foundry constraint for peers on TDDI. We thus raise our TDDI ASP and GM assumptions. Our earnings forecasts are 13% and 15% higher than consensus for 2020 and 2021. Based on our new estimates, 2020e P/E is 13x. The stock also offers 6-7% dividend yield.

TDDI – getting even tighter on foundry capacity... We believe the legacy 12-inch foundry capacity is getting even tighter into the end of 2019, which has caused foundry capacity constraints for the TDDI design houses. Amid this constraint, we believe the foundries will be selective on customers and will only support those with larger order wins or longer visibility. For the low-tier/small customers, there could be price negotiations, implying potential price hikes from foundries into 2020. Judging from the project pipeline, Novatek remains the only vendor that could secure sufficient support from UMC, since it has already obtained large orders from the end customers thanks to its superior chip design. We thus don't think the cost hike will be significant for Novatek, but other TDDI vendors could face greater cost adjustment.

...which could drive GM recovery: One of the key downside factors for Novatek in 3Q19 was the price erosion in TDDI. This caused the company's gross margin to erode in 3Q. However, if peers' capacity is facing greater constraint, we believe peers will also need to hike prices by the same magnitude to reflect the cost hike. For Novatek, we expect the company could also take the chance to adjust pricing back in line with that of peers. But its costs are not rising that much from the foundry side, so Novatek's GM for TDDI could further expand on top of the larger scale.

The bull case is greater AMOLED DDI shipments: Novatek mentioned during its 3Q19 earnings call that Chinese panel customers could switch DDI packaging to COP from COF. This could increase the driver IC volume for Novatek if the Chinese panel makers' module yield is not high. Thus, the bull case scenario is that Chinese panel makers experience lower yields after switching to COP from COF. Another scenario is that BOE successfully penetrates the iPhone supply chain in 2020 and switches the DDI vendor to Novatek from Siliconworks. We estimate this would cause DDI shipments to be greater than 100mn vs. our current forecast of 80mn.

Novatek: Earnings Estimate Revisions

We raise our 2020 and 2021 earnings forecasts 4% each: The better pricing for TDDI has prompted us to raise sales and GM assumptions.

Exhibit 33: Novatek: Earnings estimate revisions

NT\$ mn	Current 2019E	Previous 2019E	Diff.	Current 2020E	Previous 2020E	Diff.	Current 2021E	Previous 2021E	Diff.
Net sales	63,921	63,921	0%	73,836	72,715	2%	79,524	78,134	2%
COGS	43,597	43,597		49,539	48,940		53,154	52,461	
Gross profit	20,324	20,324	0%	24,296	23,776	2%	26,370	25,673	3%
Operating expenses	10,566	10,566		11,267	11,261		11,945	11,798	
Operating profit	9,758	9,758	0%	13,030	12,515	4%	14,425	13,875	4%
Non-op. income (exp.)	219	219		43	43		43	43	
Pretax Income	9,977	9,977	0%	13,072	12,558	4%	14,467	13,917	4%
Taxes	1,937	1,937		2,630	2,526		2,911	2,800	
Net income	8,040	8,040	0%	10,443	10,032	4%	11,557	11,117	4%
Reported EPS (NT\$)	13.21	13.21	0%	17.16	16.49	4%	18.99	18.27	4%
Margins									
Gross margin	31.8%	31.8%	0 ppt	32.9%	32.7%	0 ppt	33.2%	32.9%	0 ppt
Operating margin	15.3%	15.3%	0 ppt	17.6%	17.2%	0 ppt	18.1%	17.8%	0 ppt
Pretax margin	15.6%	15.6%	0 ppt	17.7%	17.3%	0 ppt	18.2%	17.8%	0 ppt
Net margin	12.6%	12.6%	0 ppt	14.1%	13.8%	0 ppt	14.5%	14.2%	0 ppt

Source: Morgan Stanley Research (E) estimates

Exhibit 34: Novatek: Quarterly financial statements

NT\$ in million	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19E	2016	2017	2018	2019E	2020E	2021E
Total Revenues	10,466	13,265	15,757	15,346	14,946	16,305	16,595	16,074	45,651	47,074	54,834	63,921	73,836	79,524
Sequential Change	-12.4%	26.7%	18.8%	-2.6%	-2.6%	9.1%	1.8%	-3.1%						
Change vs Year Ago	-4.1%	12.4%	27.1%	28.4%	42.8%	22.9%	5.3%	4.7%	-10.3%	3.1%	16.5%	16.6%	15.5%	7.7%
Cost of Sales	7,385	9,258	10,846	10,330	10,043	11,079	11,439	11,035	32,705	33,518	37,818	43,597	49,539	53,154
Percent of Revenues	71%	70%	69%	67%	67%	68%	69%	69%	72%	71%	69%	68%	67%	67%
Gross Margin	3,081	4,007	4,911	5,017	4,903	5,226	5,156	5,039	12,946	13,556	17,015	20,324	24,296	26,370
Percent of Revenues	29.4%	30.2%	31.2%	32.7%	32.8%	32.1%	31.1%	31.3%	28.4%	28.8%	31.0%	31.8%	32.9%	33.2%
Incremental Margin	NM	33%	36%	NM	NM	24%	-24%	NM	NM	43%	45%	36%	40%	36%
Total Opex	1,926	2,253	2,638	2,583	2,498	2,663	2,709	2,696	7,302	7,800	9,400	10,566	11,267	11,945
Percent of Revenues	18.4%	17.0%	16.7%	16.8%	16.7%	16.3%	16.3%	16.8%	16.0%	16.6%	17.1%	16.5%	15.3%	15.0%
R&D	1,580	1,838	2,182	2,141	2,050	2,194	2,232	2,232	6,020	6,459	7,741	8,708	9,338	10,019
Percent of Revenues	15.1%	13.9%	13.8%	14.0%	13.7%	13.5%	13.4%	13.9%	13.2%	13.7%	14.1%	13.6%	12.6%	12.6%
General & administrative	288	336	365	360	372	390	383	373	1,063	1,146	1,349	1,517	1,512	1,528
Percent of Revenues	2.8%	2.5%	2.3%	2.3%	2.5%	2.4%	2.3%	2.3%	2.3%	2.4%	2.5%	2.4%	2.0%	1.9%
Selling & marketing	58	79	91	82	76	80	94	91	219	195	310	341	417	398
Percent of Revenues	0.6%	0.6%	0.6%	0.5%	0.5%	0.5%	0.6%	0.6%	0.5%	0.4%	0.6%	0.5%	0.6%	0.5%
Operating Income	1,156	1,754	2,272	2,433	2,405	2,562	2,448	2,343	5,644	5,755	7,615	9,758	13,030	14,425
Percent of Revenues	11.0%	13.2%	14.4%	15.9%	16.1%	15.7%	14.7%	14.6%	12.4%	12.2%	13.9%	15.3%	17.6%	18.1%
Change vs Year Ago	-4.2%	26.7%	42.4%	55.1%	108.1%	46.1%	7.7%	-3.7%	-19%	2%	32%	28%	34%	11%
Total Non-operating Income(Loss)	(44)	223	7	103	31	66	71	51	141	182	290	219	43	43
Profit Before Taxes	1,112	1,977	2,280	2,536	2,436	2,628	2,518	2,394	5,785	5,937	7,906	9,977	13,072	14,467
Percent of Revenues	11%	15%	14%	17%	16%	16%	15%	15%	13%	13%	14%	16%	18%	18%
Taxes	195	395	441	483	469	501	488	479	781	913	1,515	1,937	2,630	2,911
Tax Rate	17.6%	20.0%	19.3%	19.1%	19.2%	19.1%	19.4%	20.0%	13.5%	15.4%	19.2%	19.4%	20.1%	20.1%
Reported Income (TW GAAP)	917	1,582	1,839	2,053	1,968	2,127	2,031	1,915	5,004	5,024	6,391	8,040	10,443	11,557
Percent of Revenues	9%	12%	12%	13%	13%	13%	12%	12%	11%	11%	12%	13%	14%	15%
Change vs Year Ago	0%	0%	0%	0%	0%	0%	0%	0%	-22%	0%	27%	26%	30%	11%
Reported EPS (NT\$, TW GAAP)	1.51	2.60	3.02	3.37	3.23	3.50	3.34	3.15	8.22	8.26	10.50	13.21	17.16	18.99
Change vs Year Ago	-1%	29%	18%	56%	115%	34%	10%	-7%	-22%	0%	27%	26%	30%	11%

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

Novatek: Valuation Methodology

Our price target of NT\$272 (up from NT\$260) is based on a residual income model using our base case forecasts. We raise our price target to reflect the rise in our earnings estimates and medium-term growth rate. We continue to assume that cost of equity is constant at 9.8% (2.0% risk-free rate, 6% risk premium, 1.30 beta). Our medium-term growth rate assumption rises to 6.0% from 5.7%. Our terminal growth rate remains 3.2%.

Our price target implies 15-16x 2020e EPS, at the high end of the historical range (10-15x) since 2005.

Exhibit 35: Novatek: RI model

NT\$million	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E	2031E
Total Equity	36,678	39,463	42,519	45,757	49,190	52,829	56,686	60,774	65,108	69,702	74,571	79,733
Net Profit	10,443	11,557	12,250	12,985	13,764	14,590	15,465	16,393	17,377	18,420	19,525	20,696
ROAE	30.0%	30.4%	29.9%	29.4%	29.0%	28.6%	28.2%	27.9%	27.6%	27.3%	27.1%	26.8%
Residual Income	6,663	7,546	7,934	8,350	8,791	9,258	9,753	10,278	10,834	11,423	12,048	12,710
Spread	20.2%	20.6%	20.1%	19.6%	19.2%	18.8%	18.5%	18.1%	17.8%	17.5%	17.3%	17.0%
Ending Equity Capital	36,678											
PV of Forecast Period	57,352											
PV of Continuing Value	71,398											
Equity Value	165,428											
No. of Shares	609											
Projected Price (NT\$)	272											

Source: Morgan Stanley Research estimates

Exhibit 36: Novatek: P/E band



Source: Company data

Novatek: Financial Summary

Income Statement

NT\$m (Years End Dec)	2018	2019E	2020E	2021E
Net sales	54,834	63,921	73,836	79,524
COGS	(37,818)	(43,597)	(49,539)	(53,154)
Gross profit	17,015	20,324	24,296	26,370
Operating expenses	(9,400)	(10,566)	(11,267)	(11,945)
Operating income	7,615	9,758	13,030	14,425
Non-operating income	290	219	43	43
Pre-tax income	7,906	9,977	13,072	14,467
Income tax	1,515	1,937	2,630	2,911
Reported net income	6,391	8,040	10,443	11,557
Adj.wtd.avg.shrs(m)	609	609	609	609
Reported EPS (NT\$)	10.50	13.21	17.16	18.99

Balance Sheet

NT\$m (Years End Dec)	2018	2019E	2020E	2021E
Cash	20,498	21,497	23,171	24,728
Mkt Securities	0	0	0	0
AR/NR	13,172	14,080	16,264	17,517
Inventory	6,948	6,896	7,836	8,407
Other	414	414	414	414
Current Assets	41,031	42,887	47,685	51,066
Long-term investments	1,196	1,196	1,196	1,196
Fixed assets	2,611	2,811	3,011	3,211
Deferred assets	469	469	469	469
Other assets	2,762	2,762	2,762	2,762
Total Assets	48,070	50,125	55,123	58,704
S/T borrowings	2,181	2,181	2,181	2,181
AP/NP	10,220	9,603	10,913	11,709
Other ST liabilities	4,564	4,564	4,564	4,564
LT debt	0	0	0	0
Other LT liabilities	787	787	787	787
Common shares	6,085	6,085	6,085	6,085
Total Liabilities	17,752	17,136	18,445	19,241
Additional capital	11,084	11,084	11,084	11,084
Retained earning	13,613	16,285	19,973	22,758
Other shareholders' equity	(464)	(464)	(464)	(464)
Total Equity	30,318	32,990	36,678	39,463
Total Liab. & Shrhldr's Equity	48,070	50,125	55,123	58,704

Cash Flow Statement

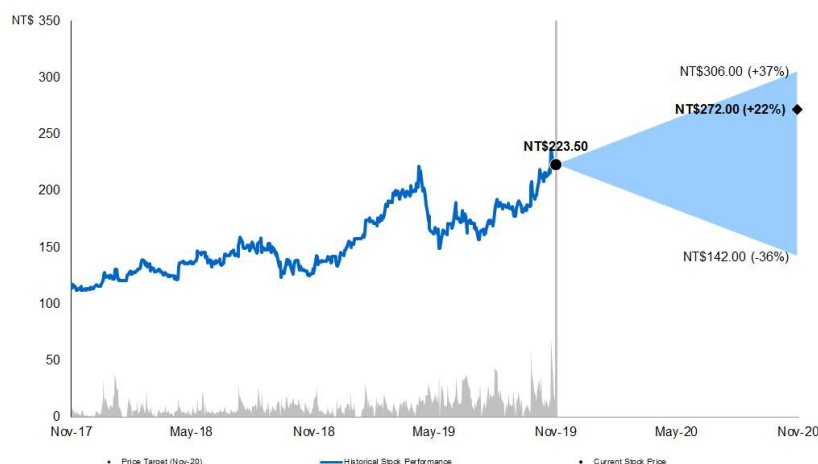
NT\$m (Years End Dec)	2018	2019E	2020E	2021E
Cashflow from Operations	8,011	6,916	8,983	10,891
Net profits	7,829	8,040	10,443	11,557
Depreciation	317	348	355	362
Working Capital Change	(90)	(1,473)	(1,815)	(1,028)
Other adjustments	(44)	0	0	0
Cashflow from Investing	(1,371)	(548)	(555)	(562)
Capex	(1,027)	(548)	(555)	(562)
Change of LT Investment	0	0	0	0
Change of ST Investment	(129)	0	0	0
Other adjustments	(215)	0	0	0
Cashflow from financing	(4,255)	(5,368)	(6,754)	(8,772)
Increase in L/T debt	0	0	0	0
Increase in S/T debt	(170)	0	0	0
Cash Dividend Paid	(4,320)	(5,368)	(6,754)	(8,772)
Dir& Emp Bonus Paid	0	0	0	0
Issuance of stock	0	0	0	0
Other adjustments	235	0	0	0
Exchange rate adjustment	1	0	0	0
Net change in cash	2,386	1,000	1,674	1,556

Financial Ratios

	2018	2019E	2020E	2021E
Growth(%)				
Turnover	16.5	16.6	15.5	7.7
Operating profits	32.3	28.1	33.5	10.7
EPS	27.2	25.8	29.9	10.7
Margins (%)				
Gross Margin	31.0	31.8	32.9	33.2
Operating Margin	13.9	15.3	17.6	18.1
Pretax Margin	14.4	15.6	17.7	18.2
Net Margin	11.7	12.6	14.1	14.5
Return (%)				
ROAE	21.7	25.4	30.0	30.4
ROAA	14.4	16.4	19.8	20.3
Gearing (%)				
Net Debt/Equity	(59.9)	(58.6)	(57.2)	(57.1)
Liabilities/Equity	58.6	51.9	50.3	48.8
Ratios (X)				
Current ratio	2.4	2.6	2.7	2.8
Quick ratio	2.0	2.2	2.2	2.3
Others				
AR/NR Turnover (days)	80	80	80	80
Inventory Turnover (days)	58	58	58	58
AP Turnover (days)	80	80	80	80
Cash Conversion (days)	58	58	58	58

E = Morgan Stanley Research Estimates

Source: Morgan Stanley Research, Company Data

Novatek: Risk-Reward**Stronger growth from TDDI and AMOLED DDI in 2020**

Source: Refinitiv, Morgan Stanley Research estimates

Price Target NT\$272

Base case, residual income (RI) model.

Bull NT\$306**18x 2020e EPS**

4K2K TV penetration rises; faster smartphone resolution upgrade; new product ramps up; margins improve: 1) Worldwide 4K2K TV penetration reaches 70% in 2020 because of increased availability of 4K2K content. 2) Smartphone resolution upgrade accelerates given launch of faster and more mobile VR-related devices in 2020. 3) Novatek ramps up CMOS image sensor business in 2020. 4) TV SoC margin improves to 40% with larger scale in 2020.

Base NT\$272**16x 2020e EPS**

4K2K TV receives positive consumer feedback; high-end smartphone resolution upgrade begins: 1) 4K2K TV penetration reaches 60% in 2020, thanks to price elasticity. 2) Smartphone resolution upgrades continue in 2020, given higher requirements for better user experience in VR. 3) Overall gross margin is maintained at around 32% in 2020.

Bear NT\$142**8x 2020e EPS**

4K2K TV remains a niche market; smartphone driver IC faces price competition: 1) Consumers opt for less-expensive TVs given a weaker economy and 4K2K TV penetration stays flattish at 50% in 2020. 2) Smartphone driver IC price competition intensifies globally in 2020, given saturated smartphone markets. 3) Novatek's gross margin declines to 26% in 2020.

Why Overweight

- Despite the slowdown in smartphone semis, we believe that Novatek's earnings can still increase over 25% in 2020, thanks to strong growth in TDDI and AMOLED.
- We believe an acceleration of AMOLED adoption will drive up the company's business from 2021 onward.
- The company is trading at 13x our 2020 EPS.
- Cash yield is a healthy 6-7%.

Key Value Drivers

- Global 4K2K TV penetration rate.
- Smartphone resolution panel upgrades.
- TV SoC profitability.
- AMOLED driver IC shipments.

Potential Catalysts

- Faster-than-expected proliferation of 4K2K TVs worldwide.
- Easing competition in smartphone driver ICs.
- Higher earnings contribution from TDDI.
- Faster-than-expected progress in AMOLED LCD driver IC.

Risks to Achieving Price Target

- **Downside:** 1) Competition in TDDI – price competition could intensify and drive Novatek's gross margin below its corporate average; 2) 4K2K TV growth could be slower than we expect amid international sports events.

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(as of November 30, 2019)

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Equal-weight/Hold	1452	46%	317	47%	22%	692	48%
Not-Rated/Hold	1	0%	0	0%	0%	1	0%
Underweight/Sell	563	18%	73	11%	13%	222	16%
TOTAL	3,166		677			1430	

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INDUSTRY COVERAGE: Greater China Technology Semiconductors

COMPANY (TICKER)	RATING (AS OF)	PRICE* (12/03/2019)
Charlie Chan		
Achip Technologies Ltd (3661.TW)	O (11/08/2019)	NT\$214.00
ASE Technology Holding Co. Ltd. (3711.TW)	E (09/24/2019)	NT\$75.50
ASM Pacific (0522.HK)	O (09/05/2019)	HK\$101.90
Chipbond Technology Corp (6147.TWO)	O (04/24/2019)	NT\$62.50
Chunghwa Precision Test Tech (6510.TWO)	E (11/08/2019)	NT\$900.00
Global Unichip Corp (3443.TW)	E (11/08/2019)	NT\$260.50
GlobalWafers Co Ltd (6488.TWO)	O (08/16/2019)	NT\$341.00
Jiangsu Changjiang Electronics Tech (600584.SS)	U (09/22/2015)	Rmb21.83
King Yuan Electronics Co Ltd (2449.TW)	O (09/24/2019)	NT\$36.05
MediaTek (2454.TW)	O (09/12/2019)	NT\$418.00
Nanya Technology Corp. (2408.TW)	U (10/08/2019)	NT\$73.30
Phison Electronics Corp (8299.TWO)	O (05/21/2019)	NT\$287.00
Silergy Corp. (6415.TW)	U (08/16/2018)	NT\$893.00
Silicon Motion (SIMO.O)	U (04/23/2019)	US\$43.98
SMC (0981.HK)	E (09/05/2019)	HK\$10.10
TSMC (2330.TW)	O (09/05/2019)	NT\$307.00
UMC (2303.TW)	O (12/03/2019)	NT\$15.35
Universal Scientific Ind. (Shanghai) (601231.SS)	O (08/04/2015)	Rmb16.59
Vanguard International Semiconductor (5347.TWO)	O (12/03/2019)	NT\$73.10
Will Semiconductor Co Ltd Shanghai (603501.SS)	O (09/01/2019)	Rmb146.00
WIN Semiconductors Corp (3105.TWO)	O (04/18/2019)	NT\$291.00
Daniel Yen, CFA		
ASMedia Technology Inc (5269.TW)	U (02/25/2019)	NT\$606.00
Aspeed Technology (5274.TWO)	E (07/05/2019)	NT\$878.00
Egis Technology Inc (6462.TWO)	E (11/07/2019)	NT\$232.00
GigaDevice Semiconductor Beijing Inc (603986.SS)	O (04/24/2019)	Rmb179.55
Macronix International Co Ltd (2337.TW)	O (04/24/2019)	NT\$35.75
Novatek (3034.TW)	O (09/06/2019)	NT\$219.50
Parade Technologies Ltd (4966.TWO)	O (03/03/2019)	NT\$592.00
Realtek Semiconductor (2379.TW)	O (08/03/2018)	NT\$227.00
Shenzhen Goodix Technology Co Ltd (603160.SS)	O (09/06/2019)	Rmb200.91
Winbond Electronics Corp (2344.TW)	O (07/26/2019)	NT\$17.70
WPG Holdings (3702.TW)	O (07/31/2017)	NT\$37.75

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* Historical prices are not split adjusted.

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