

UBS Global I/O

Tech Hardware & Semis

1Q20 UBS APAC Tech Tour: Key takeaways

COVID-19 overrides discussions; China improving, more uncertainty elsewhere

We "virtually" met with over 25 companies in the tech supply chain in China, Taiwan, Korea and Japan. COVID-19 dominated the discussions. 1/ Overall production in China looks to be slowly getting back on track, with EMS/downstream production back to c. 85-100% of expected seasonal levels (pre demand adjustments) by end March. 2/ end-demand in China is starting to recover in March after a dismal February. 3/ end-demand uncertainty outside of China is evidently growing by the day, with the supply chain and OEMs struggling to assess it at this stage.

Smartphones & PC demand downside, hyperscale servers demand holding firm

We lower our smartphone industry unit estimates to -5% YoY in 2020 (was +1%), whilst keeping 2021 units largely unchanged. We also revise down our 5G smartphone units forecast for 2020 to 223mil from 275mil before. The China domestic smartphones market is improving from a very low base as offline retail re-opens & channel inventories slowly come down. We would expect the iPhone SE2 ramp schedule to be pushed out into April (still c. 30mil procurement target). However, while travel ban poses additional difficulties for Apple in getting the components qualified, we do not think this is enough for now to change the product launch schedule for iPhone 12 series in Sep '20. PC demand is also impacted, although lowered production means Intel CPU bottleneck is at this point not an issue anymore. Hyperscale servers demand is the one bright spot, with continuing strength from most large US customers, and some recent acceleration from Chinese customers.

Lag in semis orders adjustment, upside to memory pricing continues though

Feedback from the foundries and fabless companies are that demand forecasts have not come down. With that said, our view is customers were unwilling to cut given the foundry tightness, but with a significant change in end demand, the cuts are a matter of time. We are therefore pre-emptively lowering our estimates on TSMC ([link](#)) and MediaTek ([link](#)). Post re-assessing memory supply / demand though ([link](#)), we increase our memory pricing forecasts. We forecast 2Q20 DRAM contract pricing to increase 10% QoQ (server DRAM >20%) and NAND flash 3% QoQ.

Risk/reward for tech improving post correction

For full Most/ Least Prefs globally see Page 2.

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Figure 1: UBS Tech Most/Least preferred list

Company	Ticker	Rating	Price	PT	'20E PE	'21E PE	'20E PB	'21E PB	'20E EV/Sales	'21E EV/Sales
<i>Most preferred</i>										
Apple	AAPL.O	Buy	US\$277.97	US\$335	21.1	17.6	20.66	35.19	3.98	3.60
Catcher	2474.TW	Buy	NT\$187	NT\$255	8.2	6.9	0.92	0.85	1.78	1.61
GUC	3443.TW	Buy	NT\$181.5	NT\$300	18.5	14.2	4.84	4.27	1.67	1.38
Infineon	IFXGn.DE	Buy	€14.084	€24.5	16.0	13.8	1.90	1.74	1.89	1.66
Intel	INTC.O	Buy	US\$54.43	US\$75	11.0	10.7	2.92	2.70	3.66	3.57
Lens Tech	300433.SZ	Buy	Rmb16.02	Rmb23.5	23.9	19.4	2.87	2.55	2.09	1.75
Marvell	MRVL.O	Buy	US\$20.78	US\$28	35.8	22.7	1.84	1.59	4.76	3.63
MediaTek	2454.TW	Buy	NT\$320	NT\$430	18.3	15.7	1.64	1.58	1.29	1.13
Murata Mfg.	6981.T	Buy	¥4817	¥7000	14.0	12.4	1.70	1.55	1.85	1.65
NVIDIA	NVDA.O	Buy	US\$240.84	US\$320	31.0	27.3	9.10	10.82	9.50	9.99
Samsung Electronics	005930.KS	Buy	Won48900	Won74000	11.5	8.3	1.25	1.13	0.91	0.83
Samsung SDI	006400.KS	Buy	Won253000	Won330000	20.5	14.1	1.35	1.23	1.02	0.86
SEMCO	009150.KS	Buy	Won103000	Won140000	15.6	9.6	1.37	1.21	1.07	0.89
Sony	6758.T	Buy	¥5633	¥9100	11.3	10.2	1.44	1.27	-0.69	-0.73
TDK	6762.T	Buy	¥7810	¥13200	9.6	7.7	1.01	0.91	0.70	0.62
TSMC	2330.TW	Buy	NT\$276.5	NT\$380	16.9	14.4	4.10	3.65	5.58	4.84
Universal Scientific	601231.SS	Buy	Rmb18.09	Rmb23	23.1	16.2	3.61	3.07	0.84	0.66
<i>Least preferred</i>										
Applied Materials	AMAT.O	Sell (CBE)	US\$50.89	US\$51	12.9	12.3	5.24	5.31	3.35	3.16
Chipbond	6147.TWO	Sell	NT\$53.6	NT\$51	9.8	10.3	1.13	1.07	1.42	1.36
GoerTeK	002241.SZ	Sell	Rmb17.23	Rmb12	36.2	29.5	3.51	3.18	1.08	0.81
Hirose Electric	6806.T	Sell	¥9190	¥11500	19.4	18.4	1.09	1.06	0.98	0.94
LG Display	034220.KS	Neutral	Won10800	Won11500	-11.4	10.9	0.37	0.36	0.54	0.54
O-Film Tech	002456.SZ	Sell	Rmb14.59	Rmb11.7	35.1	23.7	4.23	3.65	1.14	1.00
Pegatron	4938.TW	Sell	NT\$52.6	NT\$50	13.2	12.6	0.90	0.86	0.09	0.08
Sanan Opto	600703.SS	Sell	Rmb22.8	Rmb14.5	50.3	40.8	4.23	3.92	11.46	9.92
Sharp	6753.T	Sell	¥958	¥910	9.0	9.3	1.50	1.32	0.33	0.32
SMIC	0981.HK	Sell (CBE)	US\$12	US\$10	-94.5	430.9	0.98	0.97	2.65	2.59
Texas Instruments	TXN.O	Sell (UR)	US\$106.04	US\$117	19.7	16.6	11.19	10.66	6.99	6.27
Wistron	3231.TW	Sell	NT\$22.15	NT\$17	13.5	13.4	0.74	0.71	0.10	0.10

Source: UBS estimates, price as of 16th March 2020 for Asia stocks, 13th March 2020 for US and Europe stocks.

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1Q20 APAC Tech Tour takeaways

COVID19 update from the supply chain

Coronavirus impact to the supply dominated the discussions throughout all the meetings. **1/ Overall production in China looks to be slowly getting back on track.** **2/ end-demand in China is starting to recover in March after a dismal February.** **3/ end-demand uncertainty outside of China is evidently growing by the day, with the supply chain and OEMs struggling to assess it at this stage.**

Supply impact: slowly recovering from the disruption

Post Chinese New Year we started to see the Coronavirus impact to China production materializing meaningfully, with some of the key challenges coming from disruptions in logistics, labour resources, as well as the inspection capacity from the government for production resumption. At the current stage we believe most of the supply chain is in the process of normalizing, but the pace varying depending mainly on 1) labour intensity and 2) priority in getting the government approval to resume (largely determined by the scale of the business).

- **Upstream:** So far we think the impact for overall semis manufacturing looks very limited, with the processes being more automated and the fabs typically operating in a more controlled environment. Accordingly, we believe there has been limited disruption to semis production for existing capacity. Samsung is facing some delays in installing new capacity in Xi'an (NAND) but this appears limited to 3-4 weeks. SK Hynix has some delays in bringing engineers on site to calibrate equipment in both Wuxi (DRAM) and its Korean sites, but we believe the impact is fairly limited. YMTC (NAND) being in Wuhan is facing the airport shutdown with equipment stranded in airport and not moving in, until of course the situation normalises. Display production overall has seen a relatively more direct impact, mainly due to some of the production sites being located within Wuhan (Tianma, CSOT, BOE B17) and bottlenecks from the module side. While overall order adjustments for 1Q20 so far have been minimal, a shared concern from the upstream suppliers is the demand downside which could start to fully materialize into 2Q20.
- **Downstream:** Impact has been more visible for EMS and ODM companies, with the nature of the business being more labour intensive and the utilization rate having come down sharply due to shortage in labours post CNY. Labour bottlenecks are slowly starting to be resolved, and Hon Hai targets to return to full production recovery by end of March. Similarly, while resumption in progress, server rack assembly presents bottleneck for server production for the OEM/ODMs. The effort to normalize the labour shortage in urgency will likely incur additional costs such as additional incentives paid and logistics and transportation support provided to the returning workers, some of which to be partially shared with the customers and the government. There are still some pending issues to be resolved, such as components sourcing from smaller suppliers (or suppliers of suppliers), some of which are still pending government inspection and approval for production resumption.

Figure 2: COVID-19 production recovery status overview

Company	UBS view on the production status
ASPEED	ODMs labour looks fine; CPU remains tight; foundry capacity also tight
Catcher	3 production sites in China back to operating, but labour challenging; trying to recover UR
Foxconn Industrial	Production 50% end-Feb and to be normalized by end-Mar
Hon Hai	Labour recovery 50% early-Mar and full recovery by end-Mar; potential shortage in components
Lenovo	Overall UR 85% but production lower due to supply chain bottlenecks; smartphone production site in Wuhan partially open but UR very low
LG Display	Limited operational impact; potential shortages in components; seeing delays for China OLED fab ramp due to engineers
LG Electronics	China production resuming operation at 80-90% capacity; presents limited impact to overall production
Mediatek	No bottleneck for production so far
Partron	No impact and no issues in sourcing materials/components, supply chain mostly in Vietnam
Samsung	No impact to production; seeing some delays in new capacity additions due to equipment installation (c. 3-4 weeks for Xi'an – NAND)
SK Hynix	No impact to production; potential issues could be China logistics; delays in capacity additions due to equipment installation
Telling	40% of its offline stores open in Feb; >90% of its stores open in Mar
Tokyo Electron	Logistics disrupted for YMTC orders delivery and installation; some difficulties in sending engineers for other China production sites but minor
TSMC	No impact to production; downstream supply chain disrupted in Feb and recovering
Win Semi	No impact to production; Win Semi's supply chain concentrated to Taiwan
Xiaomi	Smartphone assembly has come back to normal level; CMOS image sensors remain tight

Source: UBS

Demand impact: likely inevitable with growing concerns

We see the end-demand impact as being inevitable and presenting a bigger concern for the supply chain. While we think the demand loss could lead to more pent-up demand and to be recouped later on for enterprise-related products, we believe that for consumer products this will extend the product cycle and lead to demand loss for the full year. Demand in China evidently took a hit in February, but has now started to recover. The biggest issue is that OEMs and the supply chain struggle to be ahead of / quantify possible demand downside outside of China for 2H March and 2Q20 at least.

- **China smartphones OEMs:** More than 50% of the offline distribution stores in China were closed in Feb; this is now coming back in Mar and planning for full recovery by April. However, a growing concern is demand for overseas market.
- **Apple:** Apple suspended its guidance for 1CQ20 ([link](#)), iPhone China units in Feb were down 61% YoY ([link](#)), and we think risk still persists with demand potentially at risk beyond China. We also think the production disruptions observed suggest that the upcoming iPhone SE2 ramp schedule will likely be pushed out into April. However, while travel ban poses additional difficulties for Apple in getting the components qualified, with the supply chain slowly recovering and there being enough time still, we do not think this is enough to change the product launch schedule for iPhone 12 series in Sep 2020.
- **PCs:** Production disruption in China has hindered the ability for PC OEM/ODM to deliver shipment to their customers. Lenovo notes China PCs market likely being down 30% YoY for 1Q20. Based on our supply chain analysis, we estimate Taiwan NB ODM shipment to decline by 45%

QoQ in Q1, lower than historical range of 14%-23% QoQ decline over the past 5 years. While the production challenges should gradually alleviate into 2Q, end-demand remains the key uncertainty ahead as consumption and corporate spending might not recover to previous levels in the short-term.

- **Servers:** Despite some bottlenecks in the production supply chain, server demand so far looks relatively unscathed from COVID impact compared to other segments of the market, with some upsides even from select customers. Enterprise demand is seeing negative impact due to COVID disruptions, especially for China enterprise. On the other hand, hyperscale-related demand is largely unchanged into 2Q20 as well as for the full year, with some upside from some of the tier 2 China hyperscale customers.

Smartphones: lowering estimates

We revise down our global smartphone unit forecast to -5% YoY from +1% for 2020 as we reflect the downside to end-demand from COVID-19.

We are mainly lowering estimates for 1H20, and while we assume some of the lost demand to be partially made up in 2H, our view is that not of this will be recouped as we will see product refresh cycle being simply pushed out.

By OEMs, most of our downward revision comes from disruptions in China (for both production and end-demand) and therefore from China smartphone OEMs. We believe the China domestic smartphones market was already facing excess channel inventories, notably pre CNY. February demand then turned out to be particularly weak, with CAICT China smartphone shipment data for February indicating -55% YoY. Since then, our checks indicate an improvement in demand in the first week of March. One large distributor indicated smartphones inventories coming down vs prior 2 weeks, with more velocity so far for iPhone vs Android. We expect China smartphones demand to continue to recover from here.

Unfortunately the COVID-19 demand-related risks are now moving to Europe and shortly after the rest of the world. OEMs are therefore expecting downside into 2Q20 but obviously struggle to quantify those, hence why the supply chain is not yet identifying those in full.

- **Apple:** We adjusted our forecasts post initial supply chain disruption and February China sales ([link](#)). The supply chain is now calibrated for an April release of the SE2, and volumes still close to 30mil procurement in 2020. In spite of disruptions in the qualification process for the supply chain, we believe there is time for enough normalisation for the iPhone 12 to meet its initial 2H20 launch calendar.
- **Samsung:** We lower our Samsung smartphones unit Sell In ests further to 276m (-6.5% YoY) from 285mil prior. We believe 1Q20 is coming in close to 64mil (was 66.5mil) with some downside in GS20 units (9mil), although with a mix more biased towards the Ultra. The Flip could reach 250k Sell In in 1Q, but is slightly supply-constrained to the disruption in temporary production at Gumi post COVID-19. We have factored in some downside to global demand (notably Europe) in 2Q20 and forecast 67mil smartphones Sell In.
- **Huawei:** We revise down our procurement estimate to 210mil (-12.5% YoY) from 250mil for 2020. This comes from (1) initial excess channel inventories

entering CNY in the China domestic market (c. 10mil); (2) COVID-19 production and demand impact in China since; (2) possible further downside to Europe demand in 2Q20. We have not factored in yet risks related to possible changes in US Entity List rules ([link](#)). We also note that further downside to non-China demand could come from limitations in users experience imposed by no license for Google application services.

- **Xiaomi:** We recently tuned down our 2020 smartphones forecasts ([link](#)) and forecast 128mil units Sell In in 2020. Smartphones assembly is pretty much back to normal at this point. On the demand side, volumes are gradually coming back in China after a severe negative impact in February. So far demand overseas has held up but evidently uncertainty is building up, notably in Southern Europe where Xiaomi has solid market share.
- **Oppo/Vivo:** We forecast smartphones procurement close of 107/103mil for both respectively in 2020. Again this may not fully appreciate the downside to China demand into 2Q20.
- **LGE:** We lower our forecast further to 27.4mil (-5.5mil YoY) smartphones units Sell In in 2020 (was 28.1mil). LGE is over-indexed to Americas demand, and COVID-19 demand impact may take a bit longer to filter through.
- **Lenovo:** We could see further downside to our forecasts, notably due to supply. 50% of smartphones production is in China, and Wuhan is the main site.

Figure 3: UBS Global smartphone shipment forecast changes

	New			Old			% change		
	2019	2020E	2021E	2019E	2020E	2021E	2019E	2020E	2021E
Global smartphone units	1,371	1,303	1,355	1,345	1,359	1,372	1.9%	-4.1%	-1.3%
% YoY	-2.2%	-5.0%	4.0%	-2.0%	1.0%	1.0%			

Source: Company data, UBS estimates

Figure 4: UBS Global smartphone shipment by OEMs

(mil units)	2018	2019	1Q20E	2Q20E	3Q20E	4Q20E	2020E	1Q21E	2Q21E	3Q21E	4Q21E	2021E
Samsung	290.0	295.0	64.0	67.0	75.7	69.0	275.7	64.5	71.5	75.5	63.5	275.0
% of total	20.7%	21.5%	23.1%	23.3%	22.6%	17.1%	21.2%	21.0%	23.7%	22.1%	15.7%	20.3%
% YoY	-8.2%	1.7%	-11.1%	-11.8%	-3.0%	0.0%	-6.5%	0.8%	6.7%	-0.3%	-8.0%	-0.3%
Huawei*	206.0	240.8	48.0	50.0	57.0	55.0	210.0	55.0	55.0	62.0	58.0	230.0
% of total	14.7%	17.6%	17.3%	17.4%	17.0%	13.6%	16.1%	17.9%	18.2%	18.1%	14.4%	17.0%
% YoY	34.6%	16.9%	-18.8%	-14.8%	-14.7%	-2.1%	-12.8%	14.6%	10.0%	8.8%	5.5%	9.5%
Apple	204.4	193.0	40.0	37.0	44.0	74.0	195.0	49.0	41.0	46.0	74.7	210.7
% of total	14.6%	14.1%	14.4%	12.9%	13.1%	18.3%	15.0%	15.9%	13.6%	13.5%	18.5%	15.6%
% YoY	-5.3%	-5.6%	-8.0%	1.4%	2.3%	5.7%	1.0%	22.5%	10.8%	4.5%	1.0%	8.1%
Xiaomi	118.7	123.1	25.3	29.1	36.4	37.2	128.1	32.2	31.3	39.1	38.2	140.8
% of total	8.5%	9.0%	9.2%	10.1%	10.9%	9.2%	9.8%	10.5%	10.4%	11.4%	9.4%	10.4%
% YoY	29.9%	3.7%	-9.2%	-9.5%	13.5%	20.1%	4.0%	26.8%	7.8%	7.3%	2.6%	9.9%
OPPO*	113.3	112.8	20.0	25.0	32.0	30.0	107.0	26.0	28.0	30.0	28.0	112.0
% of total	8.1%	8.2%	7.2%	8.7%	9.6%	7.4%	8.2%	8.5%	9.3%	8.8%	6.9%	8.3%
% YoY	1.6%	-0.4%	-13.4%	-15.3%	2.6%	3.4%	-5.1%	30.0%	12.0%	-6.3%	-6.7%	4.7%
Vivo*	105.0	100.5	21.0	25.0	29.0	28.0	103.0	26.0	28.0	28.0	26.0	108.0
% of total	7.5%	7.3%	7.6%	8.7%	8.7%	6.9%	7.9%	8.5%	9.3%	8.2%	6.4%	8.0%
% YoY	5.4%	-4.3%	-9.5%	-12.0%	5.5%	30.8%	2.5%	23.8%	12.0%	-3.4%	-7.1%	4.9%
Lenovo	39.4	37.5	7.6	9.4	9.7	8.6	35.3	8.5	9.3	9.3	8.4	35.5
% of total	2.8%	2.7%	2.7%	3.3%	2.9%	2.1%	2.7%	0.7%	0.7%	0.7%	0.6%	2.7%
% YoY	-16.8%	-4.9%	-21.1%	-0.5%	-0.1%	-1.1%	-5.8%	11.8%	-1.1%	-4.1%	-2.3%	0.6%
LG Electronics	39.5	29.0	6.9	6.7	7.3	6.5	27.4	6.6	6.4	7.0	6.2	26.3
% of total	2.8%	2.1%	2.5%	2.3%	2.2%	1.6%	2.1%	2.2%	2.1%	2.1%	1.5%	1.9%
% YoY	-29.1%	-26.6%	-8.0%	-6.9%	-2.7%	-4.4%	-5.5%	-4.0%	-4.0%	-4.0%	-4.0%	-4.0%
Others	285.7	239.5	44.1	38.0	43.8	95.2	221.1	39.6	31.0	44.8	101.1	216.4
% of total	20.4%	17.5%	15.9%	13.2%	13.1%	23.6%	17.0%	12.9%	10.3%	13.1%	25.0%	16.0%
% YoY	-3.6%	-16.2%	-2.5%	-15.2%	-11.5%	-4.7%	-7.7%	-10.1%	-18.5%	2.1%	6.1%	-2.1%
Total volumes	1,402.0	1,371.2	276.9	287.2	335.0	403.6	1,302.6	307.4	301.6	341.7	404.1	1,354.7
% YoY	1.1%	-2.2%	-11.0%	-11.0%	-3.0%	2.9%	-5.0%	11.0%	5.0%	2.0%	0.1%	4.0%

Source: Company data, UBS estimates; *procurement estimates for non-covered companies shown

Revising down 5G smartphone forecasts

Within our global smartphone unit revision, we also **revise down our global 5G smartphone unit forecast for 2020 to 223mil from 275mil before**, and for 2021 to 453mil from 500mil before. Most of the revision comes from Huawei and other China smartphone OEMs. We also adjust down our Samsung 5G units to 36mil from 45mil before, due to weaker than expected demand for Galaxy S20 series, and Galaxy Z Flip coming without 5G support. Our Apple iPhone forecast for 5G is unchanged as we do not think the disruptions so far is enough to change the product launch schedule for iPhone 12 series in Sep 2020.

Figure 5: UBS Global 5G smartphone shipment forecasts

(mil units)	2019	2020E	2021E
Apple	0	65	140
Samsung	7	36	93
Huawei	7	48	84
Xiaomi	1	15	35
LGE	1	3	7
Other Android	3	56	94
Total 5G smartphones	19	223	453
<i>% of total smartphones</i>	<i>1%</i>	<i>17%</i>	<i>33%</i>

Source: Company data, UBS estimates

PCs

Considering COVID-19 risks, we lower our global PC shipment forecast for 2020E to -4.2% YoY from -1.3% ([link](#)).

With the outbreak of COVID-19, the first impact to global PC industry is production disruption in China. This has hindered the ability for PC OEM/ODM to deliver shipment to their customers. For Q2, as workers gradually return to factories in China, we believe PC OEM/ODMs are in process of bringing their production back online. However, for production to resume to full capacity, we would still need all key segments within the supply chain to normalize, from raw material to components to assembly. Looking ahead, we expect production to eventually resume to full capacity and compensate for the production shortfall in Q1 and Q2.

One silver lining in reduced production rates is that the availability of Intel's CPUs – which turned into a more serious issue late 4Q19 – is now not a bottleneck for the larger PC OEMs. We believe those are offered incremental procurement volumes from CPU vendors.

Key uncertainty ahead is the impact of COVID-19 outbreak on PC end demand as consumption and corporate spending might not recover to previous levels in the short-term. This comes in addition to the Windows 10 replacement cycle on the corporate side slowing down post Win7 extended support termination last January.

Servers

Robust servers procurement from hyperscale customers has continued YTD.

We forecast servers unit procurement from hyperscale customers to grow 15.9% YoY in 2020 ('19E: -9.0%). We see continuing procurement strength from most US hyperscalers. Recently, we have seen some upside in orders from Chinese customers, including OEMs, although customers have been facing some logistical challenges with COVID-19 (assembly, but also installation on sites).

The supply chain expects strength from hyperscale procurement to continue in 2Q20. On the flipside, enterprise demand remains more anaemic for now. Intel's Ice Lake processors availability in volumes to customers continues to be expected by the supply chain for 1H21.

Memory Semis

We updated our supply / demand model post the Tour, indicating DRAM moderate undersupply til 3Q21 vs. NAND gradually coming back to some oversupply in 4Q20/2021 ([link](#)). We up our memory pricing forecasts & in the near term forecast blended DRAM contract prices up 10% QoQ (was +6%) in 2Q20 & NAND +3% (was flat).

We believe that the recovery in hyperscale server DRAM procurement has continued for most US large customers, and has recently accelerated across Chinese customers (although COVID-19 present logistical challenges). In the near term, we believe this is pushing server DRAM contract pricing up >20% QoQ in 2Q20 with 32GB server DRAM pricing towards US\$140-150. For NAND flash, solid state drive storage and flash arrays for servers is also robust.

Mobile DRAM and embedded NAND flash demand are seeing some modest downward adjustments in procurement and will ultimately be more negatively affected by COVID-19. On the flipside, this may set the stage for a robust recovery into 2021.

COVID-19 is not having any impact on memory production so far. This is however leading to up c. 3-4 weeks delay in equipment installation at Samsung's Xi'an X2 (NAND flash), and YMTC (NAND) not being able to move in new equipment (as the fab is in Wuhan). More importantly though, we believe demand uncertainty related to COVID-19 is leading Samsung to put on pause possible plans for upsized capacity ramp for 2020 at both Xi'an (NAND) and P2 (DRAM). We hence maintain our prior forecasts of Samsung to add 55k wpm gross capacity in NAND in '20, 40k wpm in DRAM, and for SK Hynix, 20k wpm in NAND and 10k wpm in DRAM.

Foundry

We met with TSMC and also discussed foundry plans with Samsung. Overall the feedback is foundries have not seen any downside from COVID-19: No disruptions on the supply side, and although demand downside into Q2/Q3 seems likely to us, it is too early to quantify.

Our view is capex plans are likely on track, as both TSMC and Samsung are expanding 5nm and 7nm. However, we do believe TSMC's capex is front-end loaded. Geopolitical tension and the potential for additional CPU businesses are key issues raised by investors, and our view is eventually TSMC could build a U.S. fab: 1) geopolitical tension and U.S. customers' desire to increase U.S. content, 2) the desire to stay ahead of competitors on Moore's Law and therefore the need to recruit U.S. engineers, and 3) concerns about Taiwan's electricity and other utilities. In the near-term, our view on foundry competition is unchanged. We do see Samsung taking some share at 7nm this year (Qualcomm and NVIDIA), but we are not seeing any other customer movements.

Displays

Large panel LCD

We updated our supply / demand model ([link](#)) indicating some large panels LCD undersupply continuing, but fading down, for most of 2021. We now forecast LCD TV panels pricing to increase 10% QoQ in 1Q20, and 6% increase in 2Q.

With more production sites being located in China, LCD panel production has seen more disruptions due to Coronavirus than other upstream tech. While negative impact to end-consumption become more visible into 2Q, we think this is for now leading to tighter supply and LCD TV panel price increase accelerating. We think the persisting issues could be sourcing of some of the smaller components as well as labour resources for the back-end module processes.

So far the panel makers have seen relatively limited order adjustments for 1Q20, but considering China market being 23% of global TV units, we believe this is simply a matter of time. Furthermore we are increasingly more concerned on the demand risk potentially widening to other markets beyond China. Furthermore, once China production fully normalizes and new capacity ramps resume, we expect China supply growth to return its trajectory and lead to global area supply growth.

Large panel OLED

Following the initial challenges in 2H19 ([link](#)), we believe Coronavirus is further delaying LG Display's China Guangzhou OLED gen 9.5 (TV panels) fab ramp schedule, as engineers cannot come in back / forth from Korea. We believe the fab is now targeting final equipment tuning by end-Mar to start production ramp from Apr onward to reach 60k spm capacity by end of 2Q20. We think the further delay in ramp presents downside risks to the targeted OLED TV panel unit of ~6mil for 2020 and alongside possible COVID-19 demand impact, forecast 5.3mil OLED TV panel units shipments in 2020 ([link](#)).

We believe Samsung is so far on track for its ramp-up of QD Display (OLED TV panels) production. We estimate Samsung has closed down ~110k spm of its LCD capacity on Korea in 2H19, and has placed most of the equipment orders need to convert this into 30k spm QD Display capacity. Our expectation on the timeline for commercial QD Display TV product remains unchanged with early 2021 products announcements (CES 2021 very likely in our view). Beyond, we think Samsung remains committed to its plan to convert away all of its remaining LCD capacity in Korea (Line 8) over the next several years. So far we do not have any visibility on the timing of potential gen 10.5 QD Display capacity. Regarding the recent industry discussions on Samsung adopting "QNED" technology for its next generation TV products, our view is that this is still at its early stage and multiple years away from being a commercially viable solution.

Mobile OLED

Samsung: The supply chain's visibility on the timing of Samsung A5 investment remains low. However, we believe that the upcoming display changes for iPhones in 2021 will lead to capacity loss in A3, and this supplemented by demand increase will likely lead to Samsung A5 capacity addition. We expect iPhones to change its display technology to use LTPO OLED from 2021, which will enable ~10% power efficiency gain, a necessity for more 5G mmWave volumes ([link](#)). The shift of existing LTPS OLED lines to LTPO, combined with the ongoing changes to accommodate for Y-OCTA adoption this year, will lead to reduction in Samsung's existing capacity from the conversion. We believe the capacity reduction, paired with stable demand improvement, firms up the visibility for Samsung A5 investment, and we are more confident that Samsung will need to add capacity for output by 2H21, implying equipment orders should start from 2H20 (likely towards end-2020) ([link](#)).

LG Display: After finally getting into Apple OLED supply chain in 2H19, we expect LG Display to increase its OLED volume towards Apple meaningfully this year. In addition to the legacy model, we expect LG Display to supply one of the 2H20 new OLED models as well, and we estimate this could increase the company's full year iPhone OLED volume to ~15-20mil. From capacity perspective, so far LG Display has only been utilizing 1 line (15k spm) from its E6 fab, and from 2H20 expect the company to operate both lines (30k spm total) to support the volume increase.

China OLED: Some of the ongoing capacity ramp-up plans are seeing delays, due to difficulties in getting the engineers support for the final equipment installation. Separately for equipment orders though, after close to a year of quietness, we started to see OLED equipment orders from Chinese panel makers recover aggressively from 2H19 (with GVO, CSOT, and Tianma). For the nearer term this could be maintained until equipment orders for BOE B12 fully follow through within 1H20. Beyond this, however, we expect the Chinese panel makers to enter a digestion phase for all the capacity they have committed to installing so far, and order momentum to taper off. While there are still some new projects left in the longer term plan such as BOE B15 and CSOT T5, the numbers are coming down and these remain at a far too early stage.

- **BOE:** the latest B11 fab is close to being fully installed with total 48k capacity. The next project from BOE is the B12 fab, for which after some delays from the initial supply chain expectation, we recently started to see equipment purchase orders materializing from Feb for all three lines (delivery likely to be in sequence per line, 1 line each in 2H20/1Q21/2H21 respectively). Once B12 is fully equipped, BOE will then have in total 144k spm gen 6 OLED capacity installed. The next planned project would be B15 fab, but the current supply chain discussions suggest this might not be until 2021/22 at the earliest.
- **China Star (CSOT):** T4 fab capacity addition is ongoing - the last phase of equipment orders were finally placed in early Jan, with delivery scheduled for Oct 2020. We think the next fab T5 is present in the longer term company plan, but again still at a very initial stage and far out.
- **Visionox (GVO):** front end equipment orders were placed in Sep for 30k, with delivery scheduled for Nov 2020. Beyond this we do not see any new fab projects in sight. V2 fab still has one more production line to fill, but visibility in the supply chain remains low.
- **Tianma:** Wuhan fab is currently adding phase 2 (15k), with equipment orders starting from 4Q19. Initial stage discussions for a new production line in Xiamen are emerging, but with no expectation on timeline.

Figure 6: Mobile OLED capacity forecasts

(k spm)	Gen	2016	2017	2018	2019	2020E	2021E
Samsung Display							
SDI A1	4	55	55	55	55	55	55
A2	5.5	158	178	190	190	190	190
A3	6	26	98	135	135	124	109
A4	6	--	4	30	30	30	30
A5	6			--	--	--	19
LG Display							
E2	4	14	14	14	14	14	14
E5	6	--	11	15	15	15	15
E6	6		--	8	20	30	30
BOE							
Chengdu B7	6	--	8	16	48	48	48
Mianyang B11	6		--	--	20	44	48
Chongqing B12	6			--	--	4	32
Fuzhou B15	6			--	--	--	4
Visionox							
Kunshan V1	5.5	4	4	4	4	4	4
Gu'an V2	6		--	4	15	15	15
Hefei V3	6		--	--	--	4	30
Tianma							
TNM Shanghai AMOLED 2	5.5	2	4	4	4	4	4
TNM Zouling Wuhan AMOLED	6		--	15	15	15	30
CSOT							
Wuhan T4 OLED	6		--	--	8	23	45
Others							
Ever Display Shanghai 1	4	8	9	10	11	12	12
Ever Display Shanghai 2 LTPS	6			--	--	8	15
Truly Huizhui B AMOLED	4.5	5	15	15	15	15	15
Royole OLED	5.5		--	1	5	15	15
JDI Mobera J1 AMOLED	4.5				8	8	8
Sharp AMOLED Sakai MP+Pilot	4.5			8	8	8	8
AUO L4B AMOLED	H4	8	8	8	8	8	8
Total installed OLED capacity (gen 6 eq, k spm)		162	274	388	476	536	647
% YoY			69.1%	41.6%	22.6%	12.7%	20.8%

Source: Company data, IHS, UBS estimates

APPENDIX

Figure 7: UBS Global PC shipment forecasts

(mil units)	2014	2015	2016	2017	2018	2019	2020E	2021E
<i>By product segment</i>								
Desktops	133.6	118.2	108	102.3	99.8	100.3	96.2	95.5
% YoY	-1.7%	-11.5%	-8.7%	-5.3%	-2.4%	0.5%	-4.1%	-0.7%
Notebooks	180.1	169.5	162.2	160.4	160	162.3	154	155.7
% YoY	-0.2%	-5.9%	-4.3%	-1.1%	-0.2%	1.4%	-5.1%	1.2%
Total PC	313.7	287.7	270.1	262.7	259.8	262.6	250.2	251.2
% YoY	-0.8%	-8.3%	-6.1%	-2.7%	-1.1%	1.1%	-4.7%	0.4%
Chromebooks	5.7	6.8	9.4	12.8	14.9	16	16.6	16.9
% YoY	111.9%	18.8%	38.2%	35.7%	16.7%	7.4%	3.9%	1.4%
Total Units	319.4	294.5	279.5	275.4	274.7	278.6	266.8	268.1
% YoY	0.1%	-7.8%	-5.1%	-1.5%	-0.3%	1.4%	-4.2%	0.5%
<i>By end-application</i>								
Commercial PC	165.3	156.1	156.2	164.3	168.8	180.2	173.9	175.7
% YoY	-2.5%	-5.6%	0.1%	5.2%	2.7%	6.7%	-3.5%	1.0%
Consumer PC	154.2	138.4	123.3	111.1	105.9	98.4	92.9	92.4
% YoY	3.2%	-10.2%	-10.9%	-9.9%	-4.7%	-7.0%	-5.7%	-0.5%
Total Units	319.4	294.5	279.5	275.4	274.7	278.6	266.8	268.1
% YoY	0.1%	-7.8%	-5.1%	-1.5%	-0.3%	1.4%	-4.2%	0.5%

Source: Gartner, UBS estimates

Figure 8: What are companies saying about the supply chain?

Corporates are extremely uncertain about the impact

Adelaide Brighton (25 Feb): "It's too early to really judge the impacts"
ASE Technology (7 Feb): "Supply chain risk is also troublesome and extremely difficult for us to evaluate"
Balkrishna Industries (17 Feb): "It's too early to say"
Caltex (24 Feb): "It is still too early to assess the full impact of the coronavirus"
City Development (25 Feb): "The full impact on businesses, operations and supply chains is still unknown"
Hitachi (31 Jan): "if the supply chain is cut then it will have an impact. We are concerned about this impact but we cannot quantify or incorporate this in our forecast yet"
Honda Motor (7 Feb): "we cannot say when the production stops"
Hua Hong Semis (14 Feb): "it's going to eventually affect us, okay, in the supply chain. I don't know when this is going to happen"
Inari Ameritron (25 Feb): "The impact of COVID-19 on global growth and global supply chain is hard to assess at this stage"
LG Display (31 Jan): "it should have an impact, both on the supply and the demand. However, given the uncertainties surrounding this issue, I believe that the uncertainties are greater on the supply side"
Nissan Motor (13 Feb): "supply chain disruptions... still uncertain at this time"
Olympus (6 Feb): "the impact of the coronavirus outbreak is very hard to predict"
Siam Cement (29 Jan): "Negative impact from Coronavirus outbreak is needed to be monitored"
Sime Darby (26 Feb): "The impact of the coronavirus outbreak cannot be accurately estimated at this juncture"
Tata Chemicals (3 Feb): "We haven't yet assessed the supply chain knock-on impacts of the Chinese coronavirus"
Tata Motors (30 Jan): "not able to get visibility of what the situation on the ground is with respect to not just the demand, but also the extended supply chain"
Yamaha Motor (13 Feb): "still uncertain at this time"

Some evidence of supply chain issues is already apparent / expected imminently

Alumina (24 Feb): "there are supply chain disruptions in China affecting bauxite, alumina, aluminium and other raw material flows. This has resulted in a spike in the API as China imports more alumina to satisfy smelter production needs"
Appen (25 Feb): "Some of our US customers rely on China for their hardware supply chain and have signaled supply challenges"
Bluescope Steel (23 Feb): "you just can't get trucks to deliver your products. So I suspect there's going to be a backlog in the supply chain for a period of time that it is really difficult for us to forecast... it is expected that February and March business performance will be heavily impacted"
Hap Seng (26 Feb): "the COVID-19 outbreak could negatively impact [the Trading division's] supply chain. Building Materials Division's operations via MMSB and Hafaryare expected to be affected by supply disruptions"
Honda (7 Feb): "the impact to Automobile business is much higher... usually, we have 3 days inventory"
Minebea Mitsumi (5 Feb): "We cannot imagine any fan products without any components from China. So we believe there will be some impact"
Motherson Sumi (10 Feb): "some suppliers have issued force majeure letters in North America and in some other regions"
Olympus (6 Feb): "supply chain would be constrained as well, obviously. So we don't know to what extent we can actually deliver the product"
Sembcorp Marine (20 Feb): "Challenges remain, in particular supply chain disruptions due to the COVID-19 virus outbreak, which could affect execution of Marine projects"
Shen Siong (20 Feb): "There appear to be some disruptions to the supply chain...and this will raise input prices and may affect the Group's gross margin if these increases cannot be passed on to the customers"
Sime Darby (26 Feb): "the disruptions to vehicle and equipment supply chains may also affect sales in other countries"
Singapore Technologies Engineering (23 Feb): "customer demand reduction, supply chain and workforce redistribution. For example, if airlines continue to scale back their flight schedule, it will affect our aerospace MRO business as more airline customers adjust or delay maintenance cycle"

But most believe that issues will only become apparent if supply chain disruptions continue

Bharat Forge (10 Feb): "30% of the global supply chain for manufactured goods comes out of China and about 20% of manufacturers goods are purchased by China. So if you put a stop on it for 30 to 45 days, it's quite a big impact"
Blue Star (31 Jan): "We have sufficient raw material and finished goods to cater to the overall supplies that are needed to fulfil sales for quarter 4"
Glenmark Pharma (17 Feb): "This quarter, we are covered. Q4, we are covered, and part of Q1, we are covered. After that, it will all depend on how things evolve in China"
IPCA Laboratories (13 Feb): "supply has to start coming somewhere between mid-March, so that your main production is not hampered"
Lenovo (20 Feb): "I think we have enough components to ensure a couple of weeks production"
Lupin (6 Feb): "Based on the inventories and what we have in WIP, we don't see a disruption in this quarter. If the situation sorts out in the next few weeks... we don't see an issue"
Mahindra & Mahindra (11 Feb): "We have 1 component coming from China, and that affects approximately 3,000 to 3,500 vehicles of BS IV, total effect. We are hoping that it will open up in a week to 10 days. If that happens, then we'll be able to still manage, time-wise. If it goes beyond, let's say, February end, it will become very difficult"
Natco Pharma (13 Feb): "this phenomenon will have an impact on the earnings, if the supply chain problems continue in the near term"
Nikon Corp (6 Feb): "if the problem is to continue a lot longer, we particularly have to pay attention to our FPD Systems Business and Imaging Business"
Rio Tinto (26 Feb): "prepared for some short-term impacts, such as supply-chain issues. Our products are currently reaching our customers"
Softbank (7 Feb): "both handsets and base stations, I think we have enough inventory built up to be able to deal with the situation, at least for the short term. But if this prolongs for 3 months, 6 months, then there may be some impact one way or another. I think it'd be the handsets. Perhaps that will be the case when there's that big March sales season, we could be impacted"
Viva Energy (23 Feb): "this has not yet had a material impact on operations or financial results, however could do so in the event of substantial expansion of the issue"
Voltas (10 Feb): "While we are adequately covered for the quarter 4, certain alternate sources of supply can and will be pressed into action"
Wesfarmers (19 Feb): "Longer term into the first half of next year, if it drags on, there would be some stuff we'd have to look at around some of the seasonal products"

Efforts are being made to try to minimise the impact

Adelaide Brighton (25 Feb): "Our strategy is to keep our stock levels high at this point in time... There is an ability, albeit less efficient, to increase the capacity of production in some of our aged plants should we fall into a situation where importation is a challenge"

Bluescope Steel (23 Feb): "shipping products around or finding other suppliers"

Delta (17 Feb) "will take the necessary measures to ensure that our supply chain remains resilient, including the close collaboration between our procurement department and its suppliers"

Honda Motor (7 Feb): "we may change the order of the production so that we can continue the operation of the production line"

Hyundai Motors (7 Feb): "Countermeasures for work stoppage include increasing supply from domestic and SE Asian suppliers, and minimising supply lead time when vendors located in China resume their operation."

Nippon Yusen (31 Jan): "agilely responding through adjustments to the capacity supply"

Nissan Motor (13 Feb) "the alternative parts and supplementary parts and components, we have a plan and we have put into implementation"

Reliance Worldwide Corp (23 Feb): "The company is working actively with its supply partners to prioritise production to restock products that have lower inventory levels"

Shen Siong (20 Feb): "The Group is increasing its level of inventory in view of the uncertainties in the supply chain"

Voltas (10 Feb): "While we are adequately covered for the quarter 4, certain alternate sources of supply can and will be pressed into action"

Some businesses (or parts of businesses) believe they are well placed to withstand the challenges

Breville (12 Feb): "for unrelated reasons, Breville is holding finished goods inventory above our normal equilibrium levels"

Fonterra (26 Feb): "already contracted a high percentage of our 2020 financial year's milk supply and this is helping us manage the impact of coronavirus"

Honda Motor (7 Feb): "for the motorcycle and power products, we have very high level of inventory. So even if the production stops... the sales will not stop"

Mitsubishi Chemical (12 Feb): "there are no signs of further decline either even in the face of this coronavirus outbreak"

SATS (13 Feb): "We haven't suffered from any serious disruptions in our raw material supply chain for food"

Stockland (19 Feb): "staying very close to our retailers to understand from them... at the moment is that stocks for the following season is already landed in Australia"

Symphony (7 Feb): "most of our supplies for the coming... couple of months or 2, 3 months have already been received"

Woolworths (25 Feb): "A lot of those long-life goods, we can swing production elsewhere if we need to. And really, the fixtures are the same. So we don't feel in a bad place"

Source: AlphaSense, UBS

Valuation Method and Risk Statement

Investing in the technology sector involves a high degree of risk. Rapid technological changes, increasing competition and exposure to macroeconomic cycles are among the many risks faced by investors in technology stocks. Moreover, it is extremely difficult to project the financial results of tech companies since their operating models are highly volatile and unpredictable. Finally, valuing technology stocks can prove challenging, as neither traditional nor non-traditional valuation measures have provided much insight into how these stocks trade.

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12-Month Rating	Definition	Coverage ¹	IB Services ²
Buy	FSR is > 6% above the MRA.	44%	32%
Neutral	FSR is between -6% and 6% of the MRA.	41%	29%
Sell	FSR is > 6% below the MRA.	15%	20%
Short-Term Rating	Definition	Coverage ³	IB Services ⁴
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 31 December 2019.

1:Percentage of companies under coverage globally within the 12-month rating category.

2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.

3:Percentage of companies under coverage globally within the Short-Term rating category.

4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

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Company Disclosures

Company Name	Reuters	12-month rating	Short-term rating	Price	Price date
Advanced Process Systems Corporation	265520.KQ	Neutral	N/A	Won23,200	16 Mar 2020
Apple Inc. ^{7, 16b, 22}	AAPL.O	Buy	N/A	US\$277.97	13 Mar 2020
Applied Materials Inc ^{16b, 20}	AMAT.O	Sell (CBE)	N/A	US\$50.89	13 Mar 2020
ASML ^{16b}	ASML.AS	Buy	N/A	€216.10	13 Mar 2020
Catcher Technology	2474.TW	Buy	N/A	NT\$187.00	16 Mar 2020
Chipbond Technology	6147.TWO	Sell	N/A	NT\$53.60	16 Mar 2020
Fingerprint Cards AB ²⁰	FINGb.ST	Sell (CBE)	N/A	SKr10.95	13 Mar 2020
Global Unichip	3443.TW	Buy	N/A	NT\$181.50	16 Mar 2020
GlobalWafers	6488.TWO	Neutral	N/A	NT\$322.00	16 Mar 2020
GoerTek	002241.SZ	Sell	N/A	Rmb17.23	16 Mar 2020
Hirose Electric	6806.T	Sell	N/A	¥9,190	16 Mar 2020
Hitachi ³	6501.T	Buy	N/A	¥2,903.5	16 Mar 2020
Hon Hai Precision	2317.TW	Neutral	N/A	NT\$71.10	16 Mar 2020
Infineon Technologies AG ¹⁸	IFXGn.DE	Buy	N/A	€14.08	13 Mar 2020
INNOLUX Corporation ^{1, 4, 5, 7}	3481.TW	Neutral	N/A	NT\$6.02	16 Mar 2020
Intel Corp. ^{4, 6a, 6b, 6c, 7, 16b, 22}	INTC.O	Buy	N/A	US\$54.43	13 Mar 2020
KLA Corporation ^{16b}	KLAC.O	Sell (UR)	N/A	US\$145.37	13 Mar 2020
Lens Technology	300433.SZ	Buy	N/A	Rmb16.02	16 Mar 2020
LG Display ^{16b}	034220.KS	Neutral	N/A	Won10,800	16 Mar 2020
LG Innotek	011070.KS	Neutral	N/A	Won96,500	16 Mar 2020
Marvell Technology Group ^{16b}	MRVL.O	Buy	N/A	US\$20.78	13 Mar 2020
MediaTek Inc.	2454.TW	Buy	N/A	NT\$320.00	16 Mar 2020
Murata Manufacturing	6981.T	Buy	N/A	¥4,817	16 Mar 2020
NVIDIA Corp ^{16b, 22}	NVDA.O	Buy	N/A	US\$240.84	13 Mar 2020
O-Film Tech	002456.SZ	Sell	N/A	Rmb14.59	16 Mar 2020

Company Name	Reuters	12-month rating	Short-term rating	Price	Price date
Pegatron	4938.TW	Sell	N/A	NT\$52.60	16 Mar 2020
Samsung Electro-Mechanics	009150.KS	Buy	N/A	Won103,000	16 Mar 2020
Samsung Electronics²²	005930.KS	Buy	N/A	Won48,900	16 Mar 2020
Samsung SDI	006400.KS	Buy	N/A	Won253,000	16 Mar 2020
Sanan Optoelectronics	600703.SS	Sell	N/A	Rmb22.80	16 Mar 2020
Semiconductor Manufacturing Intl Corp^{2, 4, 5, 13, 16a, 20}	0981.HK	Sell (CBE)	N/A	HK\$12.00	16 Mar 2020
Sharp	6753.T	Sell	N/A	¥958	16 Mar 2020
Siltronic AG¹⁸	WAFGn.DE	Neutral	N/A	€58.36	13 Mar 2020
SK Hynix	000660.KS	Neutral	N/A	Won80,600	16 Mar 2020
Sony^{7, 16b, 22}	6758.T	Buy	N/A	¥5,633	16 Mar 2020
Sunny Optical Technology^{4, 16a}	2382.HK	Buy	N/A	HK\$103.30	16 Mar 2020
Taiwan Semiconductor Manufacturing^{16b, 22}	2330.TW	Buy	N/A	NT\$276.50	16 Mar 2020
Taiyo Yuden	6976.T	Buy	N/A	¥2,377	16 Mar 2020
TDK	6762.T	Buy	N/A	¥7,810	16 Mar 2020
Texas Instruments Inc^{16b}	TXN.O	Sell (UR)	N/A	US\$106.04	13 Mar 2020
Universal Scientific Industrial	601231.SS	Buy	N/A	Rmb18.09	16 Mar 2020
Wistron Corporation	3231.TW	Sell	N/A	NT\$22.15	16 Mar 2020
Wonik IPS	240810.KQ	Neutral	N/A	Won25,850	16 Mar 2020

Source: UBS. All prices as of local market close.

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Additional Prices: SUMCO, ¥1,226 (16 Mar 2020); Shin-Etsu Chemical, ¥9,139 (16 Mar 2020); Source: UBS. All prices as of local market close.

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