

Asia Semiconductor Sector

US restrictions on Huawei's chip design and manufacturing a deeper supply chain impact

Semiconductor Devices | Forecast Change

Figure 1: CS semiconductor revisions following the additional Huawei restrictions

| Company | Ticker | New Rating | Old Rating | Mkt Cap (US\$mn) | Price 5/17/20 | New Target | Old Target | 2020 Sales YoY New | Change | 2021 Sales YoY New | Change | 2020 EPS New | Old | 2021 EPS New | Old |
|-----------------------------------|----------|------------|------------|------------------|---------------|------------|------------|--------------------|--------|--------------------|--------|--------------|---------|--------------|---------|
| Foundries | | | | | | | | | | | | | | | |
| TSMC | 2330.TW | N | OP | \$257.971 | \$298.0 | \$300.0 | \$350.0 | 9% | -3% | 6% | -6% | \$15.14 | \$16.00 | \$15.50 | \$17.25 |
| SMIC | 0981.HK | UP | N | \$13.119 | \$19.2 | \$16.0 | \$17.6 | 15% | -3% | 10% | -7% | \$0.31 | \$0.35 | \$0.39 | \$0.49 |
| Vanguard | 5347.TWO | N | N | \$3.832 | \$70.1 | \$66.5 | \$70.0 | 10% | -2% | 4% | -3% | \$3.19 | \$3.34 | \$3.48 | \$3.73 |
| Hua Hong | 1347.HK | N | N | \$2.748 | \$16.5 | \$17.5 | \$15.0 | 0% | -4% | 23% | -1% | \$0.50 | \$0.44 | \$0.42 | \$0.58 |
| Semiconductor Materials/Equipment | | | | | | | | | | | | | | | |
| CHPT | 6510.TWO | UP | UP | \$682 | \$623.0 | \$480.0 | \$510.0 | 10% | -4% | 0% | -5% | \$23.68 | \$24.69 | \$24.00 | \$25.56 |
| Back-end Companies | | | | | | | | | | | | | | | |
| ASE | 3711.TW | OP | OP | \$9.609 | \$66.4 | \$75.0 | \$84.0 | 5% | -1% | 5% | -1% | \$5.30 | \$5.50 | \$5.80 | \$6.00 |
| Asian Fabless | | | | | | | | | | | | | | | |
| Mediatek | 2454.TW | OP | OP | \$21.816 | \$411.0 | \$500.0 | \$430.0 | 9% | 4% | 18% | 12% | \$17.50 | \$16.00 | \$24.78 | \$19.77 |

Source: Company data, Credit Suisse estimates

- **Restrictions to further impact Huawei.** The US Commerce Department published Huawei restrictions Friday in line with our [original expectation](#) requiring a US equipment license to fab chips for Huawei or US EDA license for Huawei to design chips. Unless a license is granted or policy withdrawn, production would stop and impact the semi chain including TSMC (14% of 2019 sales), SMIC (19% of 2019 sales), ASE (8% of 2019 sales) and CHPT (20-25% of 2019 sales) but have upside opportunity for Mediatek.
- **5G infrastructure impacted more than smartphones.** Huawei's 60% share in China 5G infrastructure is more at risk with less viable non-US replacements for its infrastructure ASICs, impacting 5G builds after inventory is drawn in 2020 or requiring other supplier ramps. In smartphones, fabless supplying Huawei have no new restrictions so we maintain 20/21 industry units at -7%/+7% to 1.28 bn and 1.37 bn and only trim Huawei slightly from 196 mn/205 mn to 190 mn/180 mn. We see incremental US\$3 bn TAM for Mediatek to supply Huawei its processor and connectivity and factor 60% share by 2021.
- **Trade war broadening into a tech war.** Potential follow-on implications include: (1) A handicap to TSMC's goal to be everyone's foundry, (2) further efforts by China to step up import substitution and domestic subsidisation, (3) potential China retaliation on US business interests, (4) risk of reimposed tariffs or further equipment restrictions, and (5) further supply chain redundancy and localisation investments needed by the suppliers.
- **US-China trade and COVID-19 dual impacts.** The group has risk now both from COVID-19 semiconductor inventory build and demand risk, and now the escalating US-China tech war. We lower estimates for foundry/back-end suppliers unable to fully recoup the Huawei impact by other customers and impacted by net reduction on 5G deployments into 2020: (1) Downgrade TSMC from Outperform to NEUTRAL and TP from NT\$350 to NT\$300, (2) Downgrade SMIC from Neutral to UNDERPERFORM and TP from NT\$17.60 to NT\$16.00, (3) Maintain CHPT Underperform and lower our TP from NT\$510 to NT\$480, (4) Maintain ASE Outperform and lower our TP from NT\$78 to NT\$75, (5) Maintain Vanguard Neutral and lower our TP from NT\$70 to NT\$66.50. We also stay Outperform on Mediatek and lift our TP from NT\$430 to NT\$500 as they gain into Huawei.

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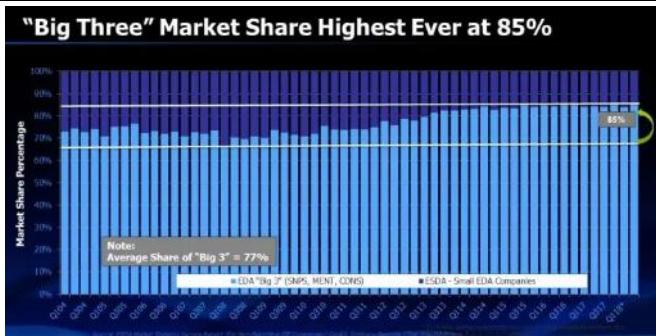
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Focus chart and tables

Figure 2: The US EDA leaders Cadence, Synopsys and Mentor (now part of Siemens) control 85% share of design software



Source: Semi Wiki

Figure 4: US suppliers aside from Huawei lead in wired ICs

| Company Name | Country | 2018 | 2019 |
|-------------------------------|--------------|------------|--------------|
| Broadcom | US | 5,552 | 5,468 |
| Intel | US | 1,386 | 1,441 |
| Texas Instruments | US | 1,510 | 1,339 |
| HiSilicon Technologies | China | 930 | 1,020 |
| Marvell Technology Group | US | 846 | 936 |
| Micron Technology | US | 1,264 | 797 |
| Xilinx | US | 503 | 604 |
| Realtek Semiconductor | Taiwan | 308 | 418 |
| Analog Devices | US | 376 | 406 |
| Mellanox Technologies | US | 280 | 364 |

Source: Gartner

Figure 6: Huawei a US\$3 bn TAM for Mediatek to address

| Huawei Smartphone Application Processor TAM | 4G | | 5G | | Total | |
|---|--------------|--------------|--------------|----------------|----------------|-----------------|
| | 2020 | 2021 | 2020 | 2021 | 2020 | 2021 |
| Units (mn) | 132.9 | 83.9 | 56.5 | 98.1 | 189.5 | 180.0 |
| ASPs (US\$) | \$7.9 | \$7.1 | \$34.3 | \$25.3 | \$15.8 | \$16.8 |
| Huawei Sales TAM (US\$mn) | \$1,053 | \$600 | \$1,941 | \$2,430 | \$2,994 | \$3,030 |
| Mediatek Huawei Share | 30% | 60% | 20% | 60% | 27% | 60% |
| Mediatek Huawei sales (US\$mn) | \$316 | \$360 | \$388 | \$1,458 | \$809 | \$1,818 |
| Mediatek Smartphone sales (US\$mn) | \$2,520 | \$2,202 | \$1,327 | \$3,009 | \$3,880 | \$5,230 |
| Huawei % of Mediatek Smartphones | 13% | 16% | 29% | 48% | 21% | 35% |
| Mediatek Total sales (US\$mn) | | | | | \$8,964 | \$10,611 |
| Huawei % of Mediatek total sales | | | | | 9% | 17% |

Source: Company data, Credit Suisse estimates

Figure 8: SMIC generated 18.9% of sales from Huawei in 2019

| Top customers | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Hi-Silicon | | | | \$324 | \$610 | \$538 | \$582 | \$590 |
| % of sales | | | | 14.5% | 20.9% | 17.4% | 17.3% | 18.9% |
| Qualcomm | \$283 | \$474 | \$483 | \$367 | \$383 | \$637 | \$528 | \$398 |
| % of sales | 16.6% | 22.9% | 24.5% | 16.4% | 13.1% | 20.5% | 15.7% | 12.8% |
| Broadcom | \$384 | \$270 | \$178 | \$216 | | | | |
| % of sales | 22.5% | 13.1% | 9.0% | 9.6% | | | | |
| Top 5 customers | \$953 | \$1,082 | \$1,007 | \$1,181 | \$1,591 | \$1,594 | \$1,552 | \$1,514 |
| % of sales | 56% | 52% | 51% | 53% | 55% | 51% | 48% | 49% |
| Top 5 YoY | 46% | 14% | -7% | 17% | 35% | 0% | -3% | -2% |
| Rest of SMIC | \$749 | \$987 | \$963 | \$1,056 | \$1,323 | \$1,507 | \$1,808 | \$1,601 |
| Rest YoY | 12% | 32% | -2% | 10% | 25% | 14% | 20% | -11% |
| SMIC Total | \$1,702 | \$2,069 | \$1,970 | \$2,236 | \$2,914 | \$3,101 | \$3,360 | \$3,116 |
| SMIC YoY | 29% | 22% | -5% | 14% | 30% | 6% | 8% | -7% |

Source: Company data, Credit Suisse estimates

Asia Semiconductor Sector

Figure 3: US has 40% market share in fab equipment

| Equipment supplier | 2018 sales | 2018 share | Country | Equipment supplier | 2018 sales | 2018 share | Country |
|--------------------------|------------|------------|---------|----------------------|---------------|------------|---------|
| Applied Materials | \$10,990 | 18.5% | U.S. | Ebara | \$487 | 0.8% | Japan |
| ASML | \$9,743 | 16.4% | Holland | Murata Machinery | \$441 | 0.7% | Japan |
| Lam Research | \$9,001 | 15.1% | U.S. | Tokyo Seimitsu | \$425 | 0.7% | Japan |
| Tokyo Electron | \$8,967 | 15.1% | Japan | Wonik IPS | \$384 | 0.6% | Korea |
| KLA | \$3,264 | 5.5% | U.S. | NovFlare Technology | \$364 | 0.6% | Japan |
| Screen Semi | \$1,799 | 3.0% | Japan | Veeco | \$359 | 0.6% | U.S. |
| Kokusai Electric | \$1,187 | 2.0% | Japan | Axcelis Technologies | \$292 | 0.5% | U.S. |
| Hitachi High-Tech | \$1,166 | 2.0% | Japan | Others | \$6,458 | 10.9% | U.S. |
| SEMES | \$1,129 | 1.9% | Korea | | | | |
| Daifuku | \$930 | 1.6% | Japan | | | | |
| ASM International | \$745 | 1.3% | Holland | | | | |
| Canon | \$695 | 1.2% | Japan | | | | |
| Nikon | \$618 | 1.0% | Japan | | | | |
| Total (US\$mn) | | | | \$59,442 | 100.0% | | |
| U.S. suppliers | | | | \$23,906 | 40.2% | | |
| Japan suppliers | | | | \$17,078 | 28.7% | | |
| Holland suppliers | | | | \$10,488 | 17.6% | | |
| Korea suppliers | | | | \$1,512 | 2.5% | | |

Source: Gartner, Credit Suisse estimates

Figure 5: Huawei the #3 semi buyer at US\$20.8bn in silicon



Source: Company data, Credit Suisse estimates

Figure 7: Removing Huawei from our 2021 TSMC estimate

| TSMC Revenue | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2020% 2019% | 2021% 2020% |
|-------------------------------|----------|----------|----------|----------|----------|----------|----------|----------------|----------------|
| Apple | \$4,230 | \$4,958 | \$7,283 | \$7,423 | \$8,000 | \$8,810 | \$10,918 | 22.7% | 26.4% |
| Qualcomm | \$4,232 | \$3,335 | \$2,211 | \$1,959 | \$2,483 | \$3,710 | \$2,827 | 9.8% | 6.8% |
| Broadcom | \$1,980 | \$2,750 | \$3,040 | \$3,314 | \$2,699 | \$3,089 | \$3,570 | 8.0% | 8.6% |
| Hi-Silicon | \$1,069 | \$1,261 | \$1,531 | \$2,781 | \$4,947 | \$3,463 | \$0 | 8.9% | 0.0% |
| AMD | \$1,138 | \$1,729 | \$1,491 | \$1,527 | \$1,929 | \$3,013 | \$3,841 | 7.8% | 9.3% |
| Mediatek | \$1,772 | \$2,693 | \$1,740 | \$1,424 | \$1,043 | \$1,914 | \$3,399 | 4.9% | 8.2% |
| NVIDIA | \$1,504 | \$1,934 | \$2,551 | \$2,817 | \$2,321 | \$2,368 | \$2,037 | 6.1% | 4.9% |
| TSMC sales from its top 30 | \$23,449 | \$25,340 | \$28,442 | \$30,706 | \$31,440 | \$35,629 | \$37,711 | 52% | 91% |
| TSMC YoY at its top 30 | 5% | 11% | 10% | 5% | 25% | 13% | 5% | | |
| TSMC's share of top customers | 39% | 40% | 39% | 38% | 38% | 41% | 40% | | |
| Rest of TSMC's inventory | \$3,157 | \$3,494 | \$3,863 | \$3,490 | \$3,193 | \$3,217 | \$3,609 | 8% | 9% |
| Rest of TSMC YoY | 14% | 11% | 5% | -5% | -5% | 1% | 12% | | |
| TSMC Sales (CS Estimate) | \$26,606 | \$29,434 | \$32,105 | \$34,196 | \$34,633 | \$38,846 | \$41,320 | 100% | 100% |
| TSMC Overall YoY | 6% | 11% | 9% | 7% | 1% | 12% | 6% | | |

Source: Company data, Credit Suisse estimates

Figure 9: Huawei has substitutes available for its smartphones

| Chipset | Supplier | Supplier region | Shipable or Substitute |
|-------------------|---------------------------|-----------------|-------------------------|
| Processor | H-Silicon Kirin 990 | China | Mediatek Dimensity 1000 |
| Wifi Module | H-Silicon | China | Mediatek or UniSOC |
| Power management | H-Silicon | China | Mediatek PMIC |
| RF transceiver | H-Silicon | China | Mediatek transceiver |
| LNA Switch | H-Silicon | China | Onovo, Murata |
| Audio Codec | H-Silicon | China | Cirrus Logic |
| Audio Amplifier | Onovo, Qualcomm, Murata | US/Japan | Still shipping |
| Front-end Modules | Mediatek | Taiwan | Still shipping |
| Envelope Tracker | Silicon Mitus | Korea | Okay |
| PMIC | NXP | Europe | Okay |
| NFC | STM | Europe | Okay |
| Wireless charging | TI | US | Okay |
| MPII Switch | Hele Micro | China | Okay |
| Battery Mgmt | SK Hynix, Micron, Samsung | Korea, US | Still shipping |
| Mobile DRAM | Samsung, Koxxa, Micron | Japan | Okay |
| NAND | Novatek | Taiwan | Okay |
| OLED Driver IC | | | Okay |

Source: Company data, Credit Suisse estimates

US restrictions on Huawei's chip design and manufacturing a deeper supply chain impact

The US Commerce Department published an amendment to its entity list restrictions for Huawei on Friday 15 May in-line with our original fear that restricts use of US EDA design software for Huawei's chip design and use of US equipment by foundries to fab their chipsets. We discuss implications on the group, which we expect would be a direct revenue hit to its semiconductor chain including TSMC (14% of 2019 sales), SMIC (19% of 2019 sales), ASE (8% of 2019 sales) and Chunghwa Precision (20-25% of 2019 sales) but upside to Mediatek.

US restriction on Huawei's design and fabrication to impact the Asian foundry sales

Restrictions to further impact Huawei's production

Huawei's scale is still large in the chain even after the entity list placement in May 2019, with US\$124 bn sales in 2019, +14% YoY with 29% infrastructure share, 40% routing share, and 18% smartphone share and also #3 largest semiconductor buyer at US\$21bn semiconductor purchases (5% of the industry). Huawei has its own chip design tools but also relies on US EDA with 85% market share in design. If they pass the design threshold, all fabs including TSMC and SMIC will require a license with US tools having 40% share and even higher share in critical etch, implant, deposition and process control. TSMC's announced 20k 5nm fab in Arizona with the Commerce Department on Friday was unable to halt the restriction.

Huawei is the industry's #3 semiconductor buyer at 5% of chip consumption; its production will have difficulty designing around US license restrictions with US EDA at 85% share and fab equipment at 40% share

5G infrastructure impacted more than smartphones

We see 5G infrastructure more at risk than smartphones due to less viable replacements for Huawei for its infrastructure silicon. Huawei has 60% share China's 5G infrastructure tenders and most viable alternatives for its own ASIC designs for its base station are US suppliers of FPGAs and networking ASICs including Marvell, Broadcom, Intel and Xilinx. Huawei's 120 day grace period plus its 114 days ending 2019 inventory should allow it to help China achieve its 600k additional base stations in 2020 but puts risk on 2021 coverage pending licenses, a settlement or other vendors ramp. Huawei's smartphones are having a better alternative with Mediatek's main platform and Samsung Exynos and UniSOC as options. We only trim Huawei smartphone estimates modestly from 196mn/205mn to 190mn/180mn but maintain 2020/21 smartphone industry units at -7%/+7% to 1.28 bn and 1.37 bn and 5G from 222/465mn to 228mn/447mn with some impact to 2021 coverage breadth.

Huawei's infrastructure silicon does not have many viable non US alternatives; smartphones should be able to source from Mediatek

Implications as the trade war broadens to a tech war

We expect most meaningful impact to direct suppliers to Huawei's Hi-Silicon division including the foundries, back-end and probe card suppliers, but could see further impact as US-China expands from trade war to technology war. Some further implications include (1) A handicap to TSMC's goal to be everyone's foundry, (2) further efforts by China to step up import substitution and domestic subsidisation, (3) potential China retaliation on US business interests, (4) risk of reimposed tariffs or further equipment restrictions, and (5) further supply chain redundancy and localisation investments needed by the suppliers. One segment benefiting could be Taiwan's IC design if no competitive China substitutes including Mediatek and a lesser extent Realtek.

Further escalation may cause further collateral damage to semiconductor suppliers

Lowering estimates for TSMC, SMIC, ASE, Vanguard and CHPT, Raising for Mediatek

We lower estimates for foundry/back-end suppliers unable to be fully recoup the Huawei impact by other customers and impacted by net reduction on 5G deployments into 2020:(1) Downgrade TSMC from Outperform to Neutral and TP from NT\$350 to NT\$300, (2) Downgrade SMIC from Neutral to Underperform and TP from NT\$17.60 to NT\$16.00, (3) Maintain CHPT Underperform but lower our TP from NT\$510 to NT\$480, (4) Maintain ASE Outperform but lower our TP from NT\$84 to NT\$75, (5) Maintain Vanguard Neutral but lower our TP from NT\$70 to NT\$66.50. For one positive change, we maintain Mediatek Outperform but raise our TP from NT\$420 to NT\$500 as they should gain into Huawei.

Downgrading TSMC and SMIC, lowering targets on CHPT, ASE and Vanguard, raising our target on Mediatek

Restrictions to further impact Huawei's production

The US Commerce Department published an amendment to its entity list restrictions for Huawei on Friday 15 May, in-line with our [original view](#) but worse than our recent expectation following TSMC's [US fab announcement](#) that it may delay or lessen risk of a Huawei restriction with the US gaining access to domestic leading edge foundry capacity.

The new restriction looks to close the loophole for Huawei in designing its own chips to replace banned US components by restricting use of US EDA design software for Huawei's design of its chips and use of US equipment for the fabbing of their IC designs into finished chipsets. We discuss implications on the group, which we expect would be a direct revenue hit to its semiconductor chain including TSMC (14% of 2019 sales), SMIC (19% of 2019 sales), ASE (8% of 2019 sales) and Chunghwa Precision (20-25% of 2019 sales).

Commerce Dept. license needed to use US EDA for Huawei's IC design and US equipment for fabrication

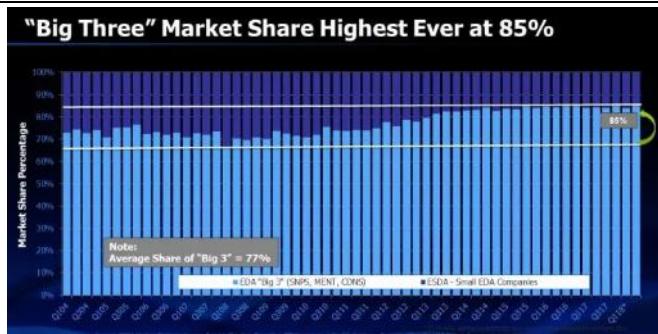
The US Commerce Department's Bureau of Industry and Security (BIS) posted a [press release](#) and document that restricts Huawei's ability to use US EDA software to design its chips or have US semiconductor equipment used by foreign foundries like TSMC and SMIC in the fabrication of its chips. The BIS noted that Huawei's use of EDA software and commissioning of overseas foundries has allowed it to continue to design semiconductors, effectively making its smartphones and infrastructure with aid of US fab and design software technology but at the same time effectively substituting out US semiconductor suppliers for its own chipsets.

The targeted restrictions that now will be prohibited without a US license:

- 1) Semiconductor designs when produced by Huawei or HiSilicon that are the product of US software and technology (EDA design tools – where US suppliers Cadence and Synopsys lead), and
- 2) Chipsets produced from the design specifications of Huawei or Hi Silicon that are the direct product of semiconductor manufacturing equipment located outside the US. The foreign produced chips would need a license if shipping to Huawei or its affiliates.

The rules are designed to close Huawei's loophole both for design and manufacturing equipment so it is unable to produce its own chips substituting out restricted US semiconductor suppliers. Huawei has its own design tools but also like other IC designers rely on US EDA, with the leaders Cadence, Synopsys and Mentor (recently acquired by Siemens) having 85% market share. If they pass that threshold on design, the fabrication from any possible foundry including TSMC and SMIC would be prohibited without a license to use the US fab tools.

Figure 10: The US EDA leaders Cadence, Synopsys and Mentor (now part of Siemens) control 85% share of design software



Source: Semi Wiki

Figure 11: US has 40% market share in fab equipment

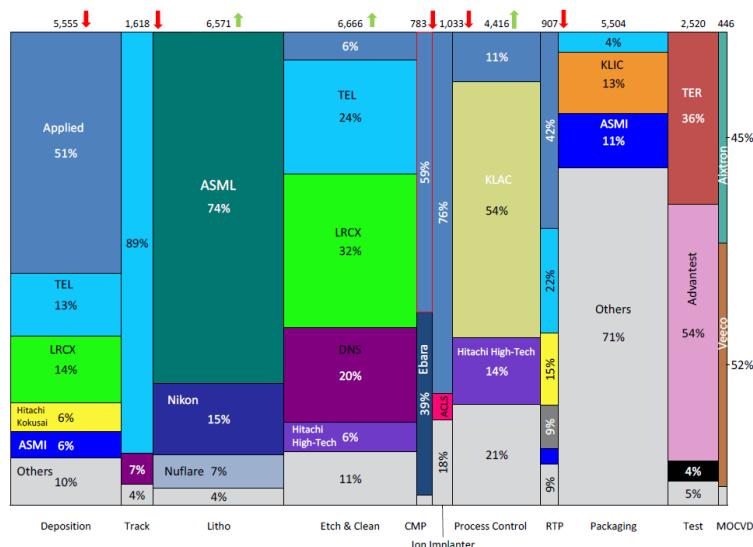
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| SEMES | \$1,129 | 1.9% | Korea | Total (US\$mn) | \$59,442 | 100.0% | |
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| ASM International | \$745 | 1.3% | Holland | Japan suppliers | \$17,078 | 28.7% | |
| Canon | \$695 | 1.2% | Japan | Holland suppliers | \$10,488 | 17.6% | |
| Nikon | \$618 | 1.0% | Japan | Korea suppliers | \$1,512 | 2.5% | |

Source: Gartner, Credit Suisse estimates

US equipment too difficult to work around - TSMC and SMIC will likely stop shipping

The US fab equipment work-around for the foundries is too difficult with US semiconductor suppliers having 40% overall market share including AMAT/LRCX with 65% deposition share, AMAT at 59% CMP and 76% ion implant share, and KLAC with 54% in process control and metrology followed by Applied Materials at 11%. An advanced foundry would not be competitive without the use of leading US suppliers across important process steps. Even an attempt to build a non-US equipment line for Huawei would require years to ramp the process and reach competitive yields but at the sacrifice of efficiency and best in class tools to maintain the foundry model requiring high quality, competitive cost production, time to market and a diversified customer base.

Figure 12: US suppliers (AMAT, LRCX, and KLAC) critical in Deposition, Etch, CMP, Implant and Process Control



Source: Gartner, Credit Suisse estimates

Huawei's foundries for its production are TSMC (14% of 2019 sales) and SMIC (19% of 2019 sales). We expect both to halt their production of Huawei unless a resolution, settlement or loophole is found after a 120 day grace period that allows the foundries to finish the 3-4 month cycle time of in-process wafers as of 15 May.

For TSMC, it has increased its sales to Huawei from 4-5% from 2015-2017 to 14.3% in 2019 at US\$4.95 bn sales (12.6% if we hold Huawei inventory flat YoY), making it the company's #2 customer after Apple at 23% of sales. Huawei's procurement at TSMC grew 82% YoY in 2019 driven by its smartphone shipments by replacing external vendors with in-house silicon, ramping aggressively infrastructure to prepare for 5G deployments in China and inventory builds to build up ahead of potential further US restrictions. The revenue contribution from Huawei would still be growing from 8% to 13% even without considering the company's effort to pre-build inventory. TSMC has noted on its earnings calls that it will comply with US regulations.

Figure 13: TSMC generated 14.3% of sales from Huawei in 2019

| TSMC - Huawei (US\$) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|----------|----------|----------|----------|----------|----------|----------|----------|
| TSMC Total Sales | \$17,195 | \$20,082 | \$25,109 | \$26,525 | \$29,421 | \$32,291 | \$34,200 | \$34,627 |
| TSMC Sales from Huawei COGs | \$394 | \$651 | \$779 | \$1,029 | \$1,224 | \$1,519 | \$2,660 | \$4,380 |
| TSMC Sales from Huawei Inventory | -\$10 | \$15 | \$102 | \$56 | \$33 | \$13 | \$122 | \$567 |
| TSMC Sales from Huawei | \$384 | \$667 | \$881 | \$1,085 | \$1,257 | \$1,531 | \$2,781 | \$4,947 |
| TSMC % of Huawei Production | 1.9% | 2.8% | 3.0% | 2.9% | 2.7% | 2.7% | 4.1% | 5.7% |
| TSMC % of Sales from Huawei | 2.2% | 3.3% | 3.5% | 4.1% | 4.3% | 4.7% | 8.1% | 14.3% |
| TSMC % of Sales if no inventory builds | 2.3% | 3.2% | 3.1% | 3.9% | 4.2% | 4.7% | 7.8% | 12.6% |

Source: Company data, Credit Suisse estimates

TSMC's US fab unable to halt the restrictions

TSMC announced on Friday morning Asia time ahead of the Commerce Department amendment on Huawei that it had intention to build a 20,000 wafer per month fab to produce advanced 5nm chips in Arizona. The fab would have US\$12 bn spending for the capex and opex over the next decade and was put out jointly with an Arizona [news release](#) citing collaboration between TSMC, the US Commerce Department and Trump Administration. The announcement to aid US interests for advanced domestic capacity for national security and to solidify its industry position ended up unconnected or unable to change the US drafting of the entity list amendment noted in our TSMC [earnings report](#) from going ahead. For TSMC, we still view this fab helping it with a source of localisation for its 60% customer base in the US while appeasing US government interests for domestic self-sufficiency in production.

Though some are nervous about TSMC taking sides with the US fab announcement and upsetting its position in China, it also has similar 20k 12" capacity in Nanjing with expansion capability to 80k WPM and have four year lead in process technology to SMIC, leaving no other options for domestic suppliers for the most advanced chips for 5G smartphones and networking, data center, and advanced AI and ADAS applications.

SMIC likely stops shipping – 19% of sales to Huawei

SMIC also has grown its importance to Huawei, up slightly to US\$590 mn sales last year and representing 18.9% of its sales, around the range of its 15-21% from 2015-2018. Some investors and press have speculated the TSMC ban would shift business to SMIC as a China foundry, but we expect SMIC will also comply which it also noted on its last call it has maintained compliance since its founding as an International company. SMIC also relies on ongoing US equipment service and spares and new tools for its fab expansion so needs to maintain compliance on this regulation to keep competitive as a foundry and avoid any further restrictions on US support or ability to supply its US customers (25% of sales).

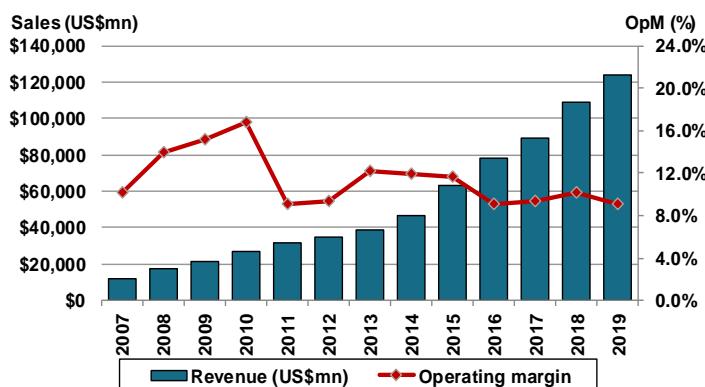
Figure 14: SMIC generated 18.9% of sales from Huawei in 2019

| Top customers | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Hi-Silicon | | | | \$324 | \$610 | \$538 | \$582 | \$590 |
| % of sales | | | | 14.5% | 20.9% | 17.4% | 17.3% | 18.9% |
| Qualcomm | \$283 | \$474 | \$483 | \$367 | \$383 | \$637 | \$528 | \$398 |
| % of sales | 16.6% | 22.9% | 24.5% | 16.4% | 13.1% | 20.5% | 15.7% | 12.8% |
| Broadcom | \$384 | \$270 | \$178 | \$216 | | | | |
| % of sales | 22.5% | 13.1% | 9.0% | 9.6% | | | | |
| Top 5 customers | \$953 | \$1,082 | \$1,007 | \$1,181 | \$1,591 | \$1,594 | \$1,552 | \$1,514 |
| % of sales | 56% | 52% | 51% | 53% | 55% | 51% | 46% | 49% |
| Top 5 YoY | 46% | 14% | -7% | 17% | 35% | 0% | -3% | -2% |
| Rest of SMIC | \$749 | \$987 | \$963 | \$1,056 | \$1,323 | \$1,507 | \$1,808 | \$1,601 |
| Rest YoY | 12% | 32% | -2% | 10% | 25% | 14% | 20% | -11% |
| SMIC Total | \$1,702 | \$2,069 | \$1,970 | \$2,236 | \$2,914 | \$3,101 | \$3,360 | \$3,116 |
| SMIC YoY | 29% | 22% | -5% | 14% | 30% | 6% | 8% | -7% |

Source: Company data, Credit Suisse estimates

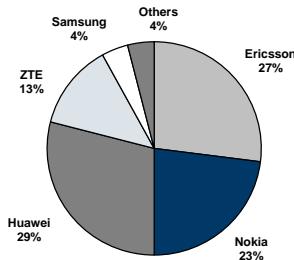
Huawei has a huge scale in the supply chain

The further restrictions on Huawei would have a further impact on the supply chain depending on ability for it to continue to ship products. The company is one of the largest technology companies in China with US\$124 bn in 2019 (+14% YoY) with a net profit of US\$9 bn (+6% YoY) from its annual report. The company derived 35% of its 2019 sales from the carrier business (mainly telecom equipment), 54% from the consumer business (largely smartphones) and 10% from the enterprise business (switches, routers). By geography, China was 59% of sales, EMEA 24%, Americas 6% and Asia Ex-China 8% of sales.

Figure 15: Huawei sales up 6x to >US\$120 bn the past decade

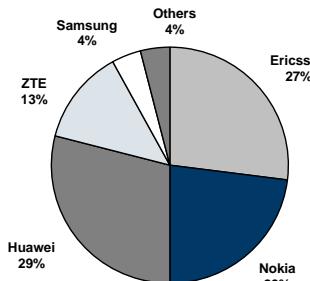
Source: Company data, Credit Suisse estimates

Gartner estimates Huawei in 2019 was the #3 largest OEM semiconductor buyer with US\$20.8 bn of semiconductor purchases (5% of the semiconductor industry), with largest purchases in application specific ICs (US\$9.0 bn) and memory (US\$6.1 bn), lagging only Apple's US\$36 bn and Samsung's US\$33 bn. In 2019, the vendor had to cut back production of many US semiconductor suppliers after the May entity list placement, lowering shipments from Qualcomm, Broadcom, Skyworks, Qorvo, Xilinx, ADI and Micron and ramping up internal silicon. Its own chips included the main smartphone processor, TV/set-top, AI accelerators, ARM server chip, RF front-end module, connectivity chips and Bluetooth IoT chips.

Figure 17: Huawei at 29% wireless radio share in '18

Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

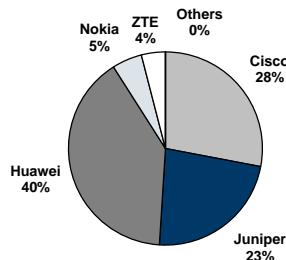
The company has strong share in wireless and network infrastructure with 29% in wireless radio access and 40% in core routing, leading Nokia (27%), Ericsson (23%) and ZTE (13%). In smartphones, it was #2 in 2019, growing its shipments +17% to 240mn units and increasing its share from 15% to 18%. Huawei also has 9% share in mobile phone semiconductors, with 18% application processor share, 7% wireless connectivity share and 3% RF share.

Figure 19: Huawei at 29% wireless radio share in '18

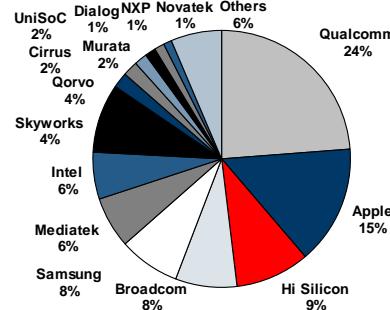
Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

Figure 16: Huawei the #3 semi buyer at US\$20.8 bn in silicon

Source: Gartner

Figure 18: Huawei had 40% core routing share in '18

Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

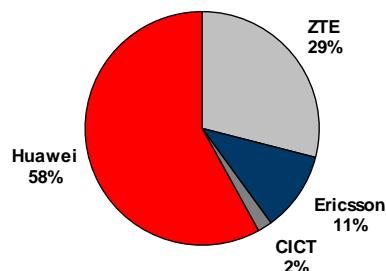
Figure 20: Hi Silicon has 9% share in mobile phone chips

Source: Gartner

5G infrastructure impacted more than smartphones

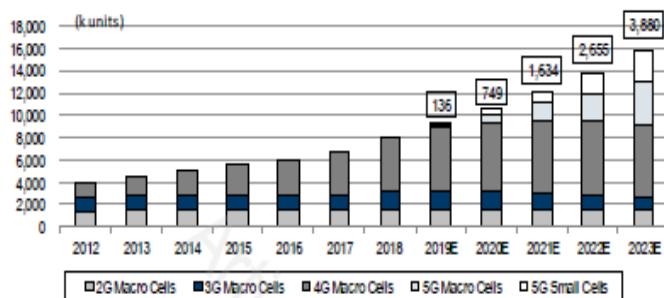
Huawei is a critical portion of China's infrastructure build-out, having secured 58% market share in the second phase of China Mobile's 5G base station tender. Huawei is a key piece in reaching our estimate of 613k base station adds in 2020 and 885k in 2021.

Figure 21: Huawei won 58% of China Mobile's tender



Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

Figure 22: Hi Silicon has 9% share in mobile phone chips



Source: Company Data, Credit Suisse Estimates

For Huawei infrastructure, its ability to make base stations could be difficult as it sources its own ASICs for the main networking processing and communications fabbed at TSMC. Likely alternatives are still banned under the entity list restriction including Xilinx FPGAs and ASICs from infrastructure suppliers Marvell, Broadcom, and Intel. A redesign with another non-US vendor could take another year similar to Nokia's delay shifting to a new ASIC architecture.

We also view it unlikely Huawei can shift the existing design through another chip company or separate distributor, as the US will be monitoring for these alternative arrangements as it did with Huawei and ZTE trying to set up alternative mechanisms to still supply Iran. TSMC has also noted it will have to comply with US regulations and in design verification likely would need to decline a similar template from another company destined for Huawei infrastructure. The lack of alternatives with Huawei could slow China's build after Huawei's inventory runs out by year-end.

Figure 23: US chip suppliers aside from Huawei lead in wired infrastructure ICs

| Company Name | Country | 2018 | 2019 | YoY | Share |
|-------------------------------|--------------|------------|--------------|-------------|-------------|
| Broadcom | US | 5,552 | 5,468 | -1.5% | 27.6% |
| Intel | US | 1,386 | 1,441 | 4.0% | 7.3% |
| Texas Instruments | US | 1,510 | 1,339 | -11.3% | 6.8% |
| HiSilicon Technologies | China | 930 | 1,020 | 9.7% | 5.2% |
| Marvell Technology Group | US | 846 | 936 | 10.6% | 4.7% |
| Micron Technology | US | 1,264 | 797 | -36.9% | 4.0% |
| Xilinx | US | 503 | 604 | 20.1% | 3.1% |
| Realtek Semiconductor | Taiwan | 308 | 418 | 35.7% | 2.1% |
| Analog Devices | US | 376 | 406 | 8.0% | 2.1% |
| Mellanox Technologies | US | 280 | 364 | 30.0% | 1.8% |

Source: Gartner

Huawei's inventory should help it supply through 2020

For this year, we believe the 120-day grace period for the foundry to complete in process wafers through mid-September and its existing balance sheet inventory (114 days as of the end of 2019) should allow the base station ramp, but 2021 would have risk if Huawei does not have a work-around to replace its own chips with competitive base station ASICs.

According to Huawei's annual report, the company has been more aggressively building inventory since 2018 following ZTE's ban, with its inventory up 27% YoY in 2018 and 71% YoY in 2019. The tighter control from the US government and the growing demand for 5G infrastructure builds in China prompted the company to pull in inventory from the tech supply chain through 2019, with raw material inventory up 65% YoY, finished goods up 95% YoY and WIP up 60%. Despite fast sales growth from both mobile and infrastructure business in the past few years, the company's aggressive approach to build inventory on the fear of more stringent ban by the US government lifted the inventory days to 114 days exiting 2019. Huawei would sustain 1-2 quarters beyond a ban in infrastructure with pre-built components, buying time to negotiate a settlement with China's backing and retaliation.

Figure 24: Huawei has been building inventory in 2019 ahead of potential US ban

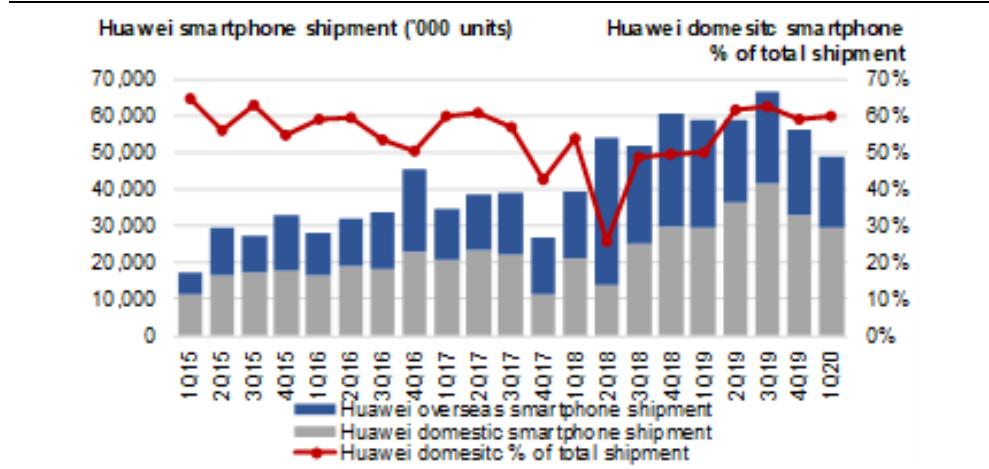
| Huawei Inventory (US\$) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|
| Raw materials | \$1,013 | \$989 | \$1,009 | \$1,681 | \$2,479 | \$2,918 | \$5,163 | \$8,401 |
| Manufacturing work in progress | \$395 | \$686 | \$842 | \$888 | \$1,603 | \$1,655 | \$2,486 | \$3,891 |
| Finished goods | \$920 | \$1,004 | \$1,872 | \$2,471 | \$2,636 | \$2,605 | \$3,832 | \$7,500 |
| Contract work in progress | \$1,240 | \$1,439 | \$3,784 | \$4,295 | \$3,493 | \$3,331 | \$1,660 | \$2,947 |
| Other inventories | \$0 | \$0 | \$0 | \$115 | \$434 | \$601 | \$922 | \$1,292 |
| Huawei Inventory | \$3,569 | \$4,118 | \$7,507 | \$9,450 | \$10,645 | \$11,111 | \$14,062 | \$24,031 |
| % YoY | -13% | 15% | 82% | 26% | 13% | 4% | 27% | 71% |
| Huawei Revenue | \$35,343 | \$39,483 | \$46,453 | \$60,831 | \$75,052 | \$92,694 | \$105,044 | \$123,295 |
| Huawei Cost of sales | \$21,269 | \$23,292 | \$25,910 | \$35,468 | \$44,815 | \$56,124 | \$64,528 | \$76,969 |
| % YoY | 5% | 10% | 11% | 37% | 26% | 25% | 15% | 19% |
| Huawei Procurement (COGs + Chg Inv) | \$20,727 | \$23,840 | \$29,300 | \$37,410 | \$46,010 | \$56,590 | \$67,480 | \$86,938 |
| COGs % of Procurement | 103% | 98% | 88% | 95% | 97% | 99% | 96% | 89% |
| Inventory Build % of Procurement | -3% | 2% | 12% | 5% | 3% | 1% | 4% | 11% |
| Huawei Inventory Days | 61 | 65 | 106 | 97 | 87 | 72 | 80 | 114 |
| Raw materials | 17 | 16 | 14 | 17 | 20 | 19 | 29 | 40 |
| Manufacturing work in progress | 7 | 11 | 12 | 9 | 13 | 11 | 14 | 18 |
| Finished goods | 16 | 16 | 26 | 25 | 21 | 17 | 22 | 36 |
| Contract work in progress | 21 | 23 | 53 | 44 | 28 | 22 | 9 | 14 |
| Other inventories | 0 | 0 | 0 | 1 | 4 | 4 | 5 | 6 |
| Huawei Inventory Days | 61 | 65 | 106 | 97 | 87 | 72 | 80 | 114 |

Source: Company data, Credit Suisse estimates

Huawei's smartphone shipments should fare better

Huawei's smartphone business should fare better as it could still source merchant baseband chips as well as other Asian suppliers and less sensitive chips from US suppliers. The company's volume has not slipped much and still increased from 206 mn units to 240 mn units in 2020. The company would still be somewhat limited competitively in smartphones relative to its pre-entity list position without the Google license as lack of these Google services and application store has impacted it in export markets. Its China position is intact with its own app store and a number of popular 3rd party application stores available in China.

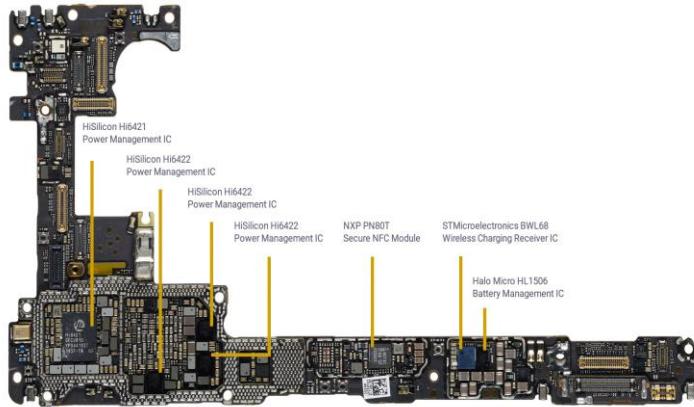
Figure 25: Huawei has been increasing its domestic exposure since the trade ban



Source: Company data, Credit Suisse estimates

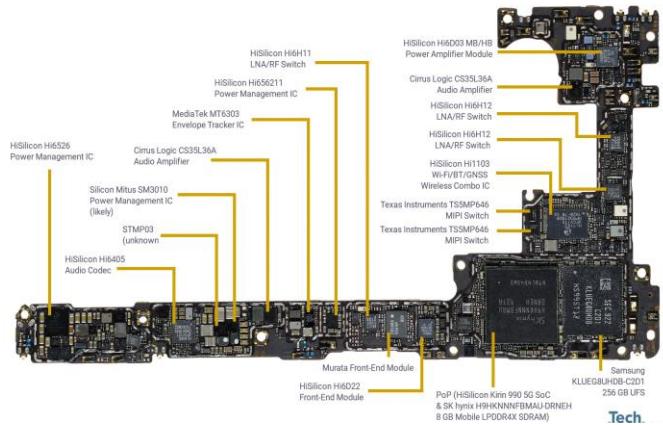
A look at teardowns of Huawei's smartphones designed after the entity list last May including the Mate 30 Pro and P40 show Hi-Silicon with significant content across the main processor, Wifi connectivity, multiple power management chips, RF transceiver, and audio codec. We believe these chips have substitute alternatives. The Mediatek platform chip would encompass the main chip, PMIC, Wifi and transceiver and Cirrus Logic could fill in with a codec as even with entity list, it still appears with an audio amplifier.

Figure 26: Mate 30 side 1 – Hi-Silicon PMICs to substitute



Source: Tech Insights

Figure 27: Mate 30 side 2: Hi-Silicon Processor, LNA, Combo



Source: Tech Insights

Huawei also is still shipping with a mix of global semiconductor suppliers for its smartphones

The chipsets it still sources include US suppliers for RF including Qorvo and Qualcomm, mobile DRAM from Micron and an audio amplifier from Cirrus Logic. The original entity list threshold at 25% and foreign direct product act allowed some US chip companies with overseas production to continue shipping non-military sensitive products. The new Huawei design and fabrication restriction should not change that sourcing further so would only come off if the BIS further tightens the restrictions.

Figure 28: Huawei should have viable chipset substitutes to ship smartphones

| Chipset | Supplier | Supplier region | Shippable or Substitute |
|-------------------|---------------------------|-----------------|-------------------------|
| Processor | Hi-Silicon Kirin 990 | China | Mediatek Dimensity 1000 |
| Wifi Module | Hi-Silicon | China | Mediatek or UniSOC |
| Power management | Hi-Silicon | China | Mediatek PMIC |
| RF transceiver | Hi-Silicon | China | Mediatek transceiver |
| LNA Switch | Hi-Silicon | China | Qorvo, Murata |
| Audio Codec | Hi-Silicon | China | Cirrus Logic, Mediatek |
| Audio Amplifier | Cirrus Logic | US | Still shipping |
| Front-end Modules | Qorvo, Qualcomm, Murata | US/Japan | Still shipping |
| Envelope Tracker | Mediatek | Taiwan | Okay |
| PMIC | Silicon Mitus | Korea | Okay |
| NFC | NXP | Europe | Okay |
| Wireless charging | STM | Europe | Okay |
| MPII Switch | TI | US | Still shipping |
| Battery Mgmt | Halo Micro | China | Okay |
| Mobile DRAM | SK Hynix, Micron, Samsung | Korea, US | Okay |
| NAND | Samsung, Kioxia, Micron | Japan | Okay |
| OLED Driver IC | Novatek | Taiwan | Okay |

Source: TechInsights, Financial Times, Credit Suisse Estimates

Maintain industry units, but 5G slightly lower in 2021

With Huawei not too impacted in smartphones with use of alternate chipsets and other vendors able to pick up the slack, we maintain 2020/21 smartphone units at -7%/+7% to 1.28 bn and 1.37 bn units in 2020/21 following a 3% decline in 2019. Our team is revising 5G smartphone units for 2020/21 from 222/465 mn to 228 mn/447 mn, with this year's volume unaffected and tracking ahead post 1Q20 as China build-outs can progress with inventory and WIP but next year may see a bit less penetration in Tier 3-5 cities and lower price points if Huawei's restrictions slow the 5G build.

Figure 29: Total smartphones: CS revisions by region/vendor

| Total Smartphones | 1Q 20 | 2Q 20E | 3Q 20E | 4Q 20E | 2019 | 2020E | 2021E |
|----------------------|--------------|--------|--------|--------|-------|---------|---------|
| Total | New - May'20 | 275.1 | 276.1 | 350.6 | 374.9 | 1,371.9 | 1,276.7 |
| | YoY (%) | -11.9% | -16.7% | -2.2% | 1.4% | -2.2% | -6.9% |
| | Old - Apr'20 | - | 301.9 | 351.7 | 372.4 | - | 1,284.4 |
| Chg (%) | - | -8.5% | -0.3% | 0.7% | - | -0.6% | -0.2% |
| Regional split (new) | | | | | | | |
| China (new fcst) | New - May'20 | 66.6 | 83.7 | 97.1 | 98.7 | 366.6 | 346.1 |
| | YoY (%) | -20.3% | -14.5% | -1.9% | 14.5% | -7.6% | -5.6% |
| | Old - Apr'20 | - | 93.6 | 99.6 | 98.7 | - | 347.5 |
| | Chg (%) | - | -10.5% | -2.5% | 0.0% | - | -0.4% |
| RoW (new fcst) | New - May'20 | 208.5 | 192.4 | 253.6 | 276.2 | 1,005.4 | 930.7 |
| | YoY (%) | -8.8% | -17.6% | -2.3% | -2.6% | -0.1% | -7.4% |
| | Old - Apr'20 | - | 208.4 | 252.2 | 273.7 | - | 936.9 |
| | Chg (%) | - | -7.7% | 0.6% | 0.9% | - | -0.7% |
| Operating System | | | | | | | |
| iOS | New - May'20 | 36.7 | 26.1 | 44.7 | 72.5 | 191.0 | 180.0 |
| | YoY (%) | -0.3% | -22.8% | -4.0% | -1.7% | -8.5% | -5.7% |
| | Old - Apr'20 | - | 26.1 | 44.7 | 72.5 | - | 180.4 |
| | Chg (%) | - | 0.0% | 0.0% | - | -0.2% | 0.0% |
| Android | New - May'20 | 238.4 | 250.0 | 305.9 | 302.4 | 1,181.0 | 1,096.7 |
| | YoY (%) | -13.5% | -16.0% | -1.9% | 2.2% | -1.1% | -7.1% |
| | Old - Apr'20 | - | 275.8 | 307.0 | 299.9 | - | 1,104.0 |
| | Chg (%) | - | -9.4% | -0.4% | 0.8% | - | -0.7% |
| Brands | 1Q 20E | 2Q 20E | 3Q 20E | 4Q 20E | 2019 | 2020E | 2021E |
| Samsung | New - May'20 | 58.4 | 52.0 | 69.0 | 71.0 | 295.8 | 250.4 |
| | Old - Apr'20 | - | 70.0 | 77.0 | 71.0 | - | 281.0 |
| Huawei | New - May'20 | 49.0 | 44.5 | 49.0 | 47.0 | 240.6 | 189.5 |
| | Old - Apr'20 | - | 49.0 | 54.5 | 53.0 | - | 195.5 |
| Oppo | New - May'20 | 22.8 | 32.0 | 40.5 | 37.0 | 114.3 | 132.3 |
| | Old - Apr'20 | - | 32.0 | 38.5 | 37.0 | - | 143.7 |
| Vivo | New - May'20 | 24.8 | 26.0 | 33.0 | 30.5 | 110.1 | 114.3 |
| | Old - Apr'20 | - | 27.5 | 30.0 | 29.5 | - | 106.5 |
| Xiaomi | New - May'20 | 29.5 | 30.0 | 41.4 | 40.5 | 125.6 | 141.4 |
| | Old - Apr'20 | - | 32.0 | 39.0 | 35.0 | - | 132.0 |
| | | | | | | | 146.5 |

Source: IDC, Credit Suisse estimates

Figure 30: 5G smartphones: CS revisions by region/vendor

| 5G Smartphones | 1Q 20 | 2Q 20E | 3Q 20E | 4Q 20E | 2020E | 2021E |
|------------------|--------------|--------|--------|--------|-------|-------|
| Total | New - May'20 | 21.3 | 32.0 | 62.8 | 112.2 | 228.3 |
| | Old - Apr'20 | - | 33.8 | 63.1 | 114.7 | 221.8 |
| | Chg (%) | - | -5.5% | -0.6% | -2.2% | 2.9% |
| Region | | | | | | |
| China | New - May'20 | 14.5 | 21.8 | 32.8 | 45.5 | 114.6 |
| | Old - Apr'20 | - | 24.4 | 34.6 | 48.3 | 114.4 |
| | Chg (%) | - | -10.7% | 5.2% | -5.9% | 0.2% |
| RoW | New - May'20 | 6.8 | 10.2 | 30.0 | 66.8 | 113.7 |
| | Old - Apr'20 | - | 9.4 | 28.5 | 66.5 | 107.3 |
| | Chg (%) | - | 7.9% | 5.1% | 0.5% | 5.9% |
| Operating System | | | | | | |
| iOS | New - May'20 | 0.0 | 0.0 | 12.5 | 51.3 | 63.8 |
| | Old - Apr'20 | 0.0 | 0.0 | 12.5 | 51.2 | 63.8 |
| | Chg (%) | 0.0% | 0.0% | 0.0% | 0.2% | 0.1% |
| Android | New - May'20 | 21.3 | 32.0 | 50.3 | 60.9 | 164.5 |
| | Old - Apr'20 | 10.0 | 33.8 | 50.6 | 63.5 | 158.0 |
| | Chg (%) | 112.1% | -5.5% | -0.7% | -4.1% | 4.1% |
| Key Brands | 1Q 20E | 2Q 20E | 3Q 20E | 4Q 20E | 2020E | 2021E |
| Samsung | New - May'20 | 6.4 | - | - | - | 40.1 |
| | Old - Apr'20 | 0.0 | - | - | - | 36.3 |
| Huawei | New - May'20 | 8.1 | - | - | - | 56.5 |
| | Old - Apr'20 | 0.0 | - | - | - | 55.8 |
| Oppo | New - May'20 | 2.1 | - | - | - | 19.5 |
| | Old - Apr'20 | 0.0 | - | - | - | 19.2 |
| Vivo | New - May'20 | 2.1 | - | - | - | 18.9 |
| | Old - Apr'20 | 0.0 | - | - | - | 18.6 |
| Xiaomi | New - May'20 | 2.0 | - | - | - | 16.7 |
| | Old - Apr'20 | 0.0 | - | - | - | 16.2 |
| | | | | | | 34.1 |
| | | | | | | 36.0 |

Source: IDC, Credit Suisse estimates

Implications as the trade war broadens to a tech war

Huawei as #3 global chip buyer and its leverage of Taiwan's advanced foundry and back-end and selectively in IC design, memory and RF makes it a significant customer that will impact the chain following the latest restriction. We expect most meaningful impact to direct suppliers to Huawei's Hi-Silicon division, including foundries in our coverage TSMC at 14% of sales, SMIC at 19% of sales, back-end test and packaging supplies including ASE at 7% of sales and King Yuan at 15-20% of sales and probe cards from CHPT at 20-25% of sales.

On the flip side, some IC design companies should benefit as they can stand in as alternative suppliers to Huawei's smartphones as the license requirement should require Huawei to source externally to replace its own chips. Mediatek has only 15% allocation of Huawei's chipsets so it would benefit as the most viable non-US application processor and connectivity supplier. We also could see Realtek pick up some IoT, WiFi and networking business into Huawei.

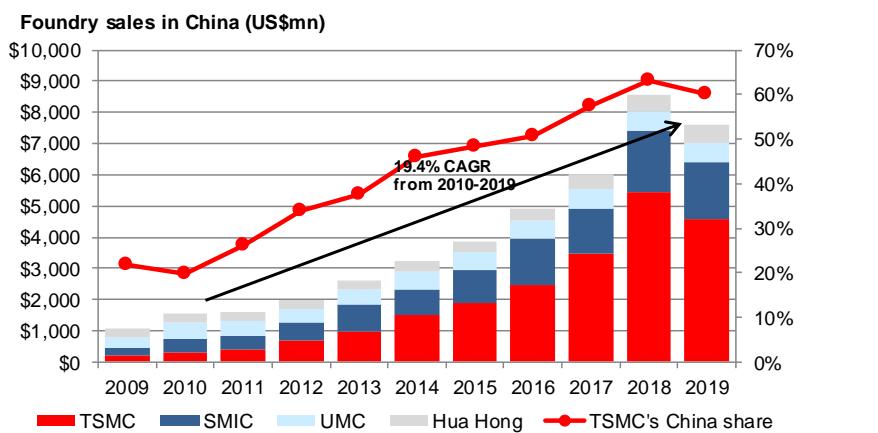
Figure 31: Asian foundry, memory makers and back-end suppliers have ~5-10% Huawei exposure

| Semiconductors | Stock ticker | Sector Analyst | Parts/service supplied | Huawei % of sales |
|------------------------------|--------------|------------------|--|-----------------------|
| Semiconductor Foundry | | | | |
| AWSC | 8086.TWO | Not Covered | Foundry for RF in handsets | 10-15% |
| GCS | 4991.TWO | Jerry Su | Foundry for RF in fiber optics | 5-10% |
| Sanan | 600703.SZ | Kyna Wong | Foundry for RF in fiber optics | <5% |
| SMIC | 0981.HK | Randy Abrams | Foundry for consumer, IoT, and mobile RF/Wifi | 19% |
| TSMC | 2330.TW | Randy Abrams | Foundry for mobile, IoT and HPC applications | 14% |
| Vanguard | 5347.TWO | Randy Abrams | Foundry for Power Management | 5% |
| Win Semi | 3105.TWO | Jerry Su | Foundry for RF/VCSEL in handsets and infrastructure | 15-20% |
| Back-end packaging | | | | |
| ASE | 3711.TW | Randy Abrams | Packaging and testing for mobile, IoT and HPC applications | 7% |
| Chipbond | 6147.TWO | Jerry Su | Wafer bumping for touch driver IC and driver IC | 8-10% |
| Inari Amertron | INRI.KL | Danny Chan | RF filter package and test and fiber optic module assembly | 1-2% |
| King Yuan | 2449.TW | Not Covered | Testing for mobile, IoT and HPC | 15-20% |
| JCET | 600584.SS | Chaoliens Tseng | Packaging and testing for mobile, IoT and HPC applications | 5-10% |
| Huatian | 002185.SZ | Chaoliens Tseng | Packaging and testing for mobile, IoT and HPC applications | ~5% |
| Tongfu | 002156.SZ | Chaoliens Tseng | Packaging and testing for mobile, IoT and HPC applications | ~5% |
| Memory | | | | |
| Nanya | 2408.TW | Haas Liu | Memory manufacutring for IoT, mobile and infrastructure | Limited exposure |
| Samsung | 005930.KS | Keon Han | Limited mobile DRAM, higher server exposure | Limited exposure |
| SK Hynix | 000660.KS | Keon Han | Memory manufacutring for IoT, mobile and infrastructure | 10-12% DRAM; 12% NAND |
| Toshiba | 6502.T | Hideyuki Maekawa | Memory manufacutring for IoT, mobile and infrastructure | 7% of memory business |
| Fabless IC Design | | | | |
| Focaltech | 3545.TW | Jerry Su | Smartphone touch IC, driver IC, touch driver IC | 15-20% |
| Goodix | 603160.SZ | Chaoliens Tseng | Fingerprint sensors | 20% |
| Will Semi | 603501.SZ | Chaoliens Tseng | CIS | 10-20% |
| Mediatek | 2454.TW | Randy Abrams | Mobile devices and IoT chipsets | 4% |
| Novatek | 3034.TW | Jerry Su | Smartphone touch driver IC / driver IC | 15-20% |
| Egis | 6462.TWO | Jerry Su | Fingerprint sensors | 10% |
| Elan | 2458.TW | Harvie Chou | Fingerprint sensors, stylus, touchpad | 2-3% |
| Parade | 4966.TWO | Jerry Su | NB/tablet T-Con / driver IC | 3-5% |
| Realtek | 2379.TW | Randy Abrams | Networking chipsets for infrastructure and IoT devices | 2% |

Source: Company data, Credit Suisse estimates

Restriction handicaps TSMC as everyone's foundry

One impact of this US restriction will be on TSMC's ability to be everybody's foundry, risking TSMC now of losing its China growth both from Huawei directly from the US restrictions and also indirectly. The China supply chain and national policy we expect would further encourage local design and manufacturing and less reliance on overseas following this additional restriction. China overall is 20% of TSMC's sales and could face lower growth over time from nationalization and the Huawei ban.

Figure 32: TSMC has led growth in its China sales the past decade, helped by Huawei

Source: Company data, Credit Suisse estimates

We estimate TSMC's China story was still led by Huawei's growth, representing 70% of TSMC's China sales in 2019 and growing at a 40% CAGR the past 6 years versus 17% CAGR for the other China customers to lift TSMC's China growth to a 32% pace. Crypto was a short-term driver but has now largely corrected.

TSMC's relative loss from this restriction is limited with SMIC also not able to supply Huawei and also TSMC's 4-5 year lead over SMIC on process development on 5nm now vs. SMIC still just starting 14nm still implies that gap does not narrow much if at all and would still require China customers requiring the advanced nodes to source at TSMC. At the same time, TSMC's US fab should help secure its position at US customers (60% of sales) where it now can plug a competitive gap with a fab with rivals Intel, Samsung and GlobalFoundries having US fabs.

Figure 33: TSMC's growth in China is mainly driven by Huawei

| China Mix | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | YoY | % of TSMC | 13-19 CAGR |
|-----------------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|--------------|--------------|--------------|
| Hi-Silicon | 19,825 | 26,751 | 34,509 | 40,492 | 46,356 | 83,886 | 152,877 | 82.2% | 14.3% | 40.6% |
| Crypto | 0 | 0 | 2,862 | 3,866 | 27,243 | 44,788 | 9,734 | -78.3% | 0.9% | NM |
| Other China Customers | 17,821 | 23,763 | 30,291 | 38,275 | 36,603 | 47,121 | 45,491 | -3.5% | 4.3% | 16.9% |
| Total | 39,659 | 52,528 | 69,677 | 84,650 | 112,218 | 177,812 | 210,120 | 18.2% | 19.6% | 32.0% |

Source: Company data, Credit Suisse estimates

China's domestic localisation efforts to continue

China will use the ban as justification to increase its subsidisation and import substitution for its domestic industry, further ramping SMIC subsidies which have been scaling up dramatically in the past five years from about \$30-35 mn recognised in 2012-13 to over US\$200 mn in 2018 and now grants on the balance sheet for future recognition expanding from US\$150 mn in 2012 to US\$639 mn.

Figure 34: China industry support rising – SMIC grants up 4-5x since 2012

| Balance sheet grants & government projects | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Deferred govt funding: Non-Current | 150,347 | 209,968 | 184,174 | 175,604 | 265,887 | 299,749 | 393,902 |
| Deferred govt funding: Current | 0 | 26,349 | 62,609 | 79,459 | 116,021 | 193,158 | 244,708 |
| Total govt grants on the balance sheet | 150,347 | 236,317 | 246,783 | 255,063 | 381,908 | 492,907 | 638,610 |
| New govt funding of specific R&D projects | 54,100 | 145,800 | 57,300 | 40,200 | 181,100 | 178,300 | 265,000 |

| P&L recognition of grants each year | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---------------|----------------|----------------|----------------|----------------|----------------|----------------|
| P&L grants - R&D expenses | 31,000 | 26,900 | 37,400 | 34,300 | 52,517 | 82,245 | 150,258 |
| P&L grants - interest expense | 1,200 | 7,100 | 21,400 | 4,895 | 11,639 | 24,182 | 19,446 |
| P&L grants - other operating income | 200 | 0 | 0 | 2,697 | 9,542 | 27,444 | 32,198 |
| Total P&L govt grants recognized | 32,400 | 34,000 | 58,800 | 41,892 | 73,698 | 133,871 | 201,902 |
| SMIC Net Income | 15,856 | 103,807 | 152,968 | 253,411 | 368,380 | 170,179 | 129,845 |
| Grants as % of Net Income | 204% | 33% | 38% | 17% | 20% | 79% | 155% |

Source: Company data, Credit Suisse estimates

Huawei triggered some de-Americanization by China suppliers, with China suppliers electing to source locally first followed by Asia/Europe before considering the US for sourcing, although this restriction may extend Taiwan suppliers into that camp over time as China tries to build up its own reliance. TSMC still has 4-5 year process lead and substantial capacity and R&D scale lead (10x over SMIC) to address high-end infrastructure, data centre servers, graphics, AI, and 5G mobile so at least that will continue to mitigate the risk.

In the meantime, some companies that may see some local sourcing would include Hua Hong (localized MCUs and analog), Silergy (localized analog), Mediatek (China business against Qualcomm), Maxscend and Richwave (RF business in China), Advantest (local test business) and Anritsu (China 5G test business).

China retaliation and US further actions can follow

According to Global Times [reports](#), China is likely to retaliate with countermeasures including use of its unreliable entity list which can impose restrictions or investing US companies such as Qualcomm, Cisco and Apple and may also suspend purchases of Boeing aircraft. The Chinese Ministry of Commerce last May indicated China will have its own list targeting foreign entities that undermine the interest of Chinese companies which can include foreign organisations and companies that block or shut supply chains or take discriminatory measures for non-commercial reasons or when their actions endanger Chinese companies, global consumers or companies.

Beyond targets on existing companies, China could proceed with other measures including backing down from its trade deal commitments including agricultural purchases, reinstating tariff escalation, and putting restrictions on some medical gear exports.

The US also does have a range of further restrictions it could still take including withholding advanced semiconductor manufacturing to domestic China foundry and memory, restricting EDA design software to emerging fabless, and moving ahead with previously threatened tariffs. The US can also still tighten the squeeze further on Huawei, as this restriction stopped at requiring Huawei to have a license for EDA and fabs to have a license for equipment, but could go a step further to require all chip companies supplying Huawei to have a license to use EDA software, which would also cut off baseband alternatives such as Mediatek.

The case is set-up now for escalation which if carrying a range of restrictions and tariffs would put a tax on the tech supply chain so way out would be a similar reconciliation and settlement similar to the trade deal in December 2019.

Further redundancy built into supply chains, though short-term impacted by feared tariffs/restrictions

The combined COVID-19 and US/China tariffs and retaliations likely leads to a push for more domestic self-sufficiency in the supply chains. TSMC's fab in the US was motivated in part by its customers' desire for some local diversification also in the more charged political climate and rising national interest for advanced domestic production. Additional investment in local capacity and inventory should benefit the equipment industry and automation longer-term, though will still need to monitor offsets from demand destruction from tariffs, restrictions on certain companies or fear of tariffs which can impact investment in the near-term.

Huawei represents 70% of TSMC's China business

Lowering estimates for TSMC, SMIC, ASE, Vanguard and CHPT, Raising for Mediatek

We factor in the further restrictions on Huawei into our coverage, with negative impact largest for companies with the highest Huawei exposure including TSMC (14% of sales), SMIC (19% of sales), CHPT (20-25% of sales), ASE (7% of sales) and Vanguard (5% of sales), with opportunity for Mediatek to step in to supply Huawei's smartphones.

The following are key revisions:

- 1) Downgrade TSMC from Outperform to Neutral and TP from NT\$350 to NT\$300,
- 2) Downgrade SMIC from Neutral to Underperform and TP from NT\$17.60 to NT\$16.00,
- 3) Maintain CHPT Underperform but lower our TP from NT\$510 to NT\$480,
- 4) Maintain ASE Outperform but lower our TP from NT\$84 to NT\$75,
- 5) Maintain Vanguard Neutral but lower our TP from NT\$70 to NT\$66.50,
- 6) Maintain Mediatek Outperform and raise our TP from NT\$420 to NT\$500.

TSMC: Downgrade to Neutral, lowering our target from NT\$350 to NT\$300

TSMC had 14% of sales from Huawei in 2019 and should be running near that run rate in 1H20 with that customer building up inventory aggressively in preparation for further restrictions and for the 5G infrastructure build-out and smartphone launches in China. TSMC has 120 day period for wafers started by 15 May to ship in process wafers so should have only modest impact on 3Q20 sales. Unless the restriction is changed or TSMC does not receive a license, we expect Huawei sales would fall to zero by 2021.

We revise our estimates by customer taking Huawei out of numbers and lifting Mediatek and UniSOC for some recovery of smartphone units and also factor in iOS Mac launch to lift our Apple 2021 estimate. TSMC's reliance on Apple may rise further to 26% of sales so would have some risk if China retaliates of anti-US sentiment impacts iPhone units in that market.

Figure 35: TSMC revised estimates taking Huawei out of 2021 numbers

| TSMC Revenue | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 20% | 21% |
|--------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------|-------------|
| Apple | \$4,230 | \$4,958 | \$7,283 | \$7,423 | \$8,000 | \$8,810 | \$10,918 | 22.7% | 26.4% |
| Qualcomm | \$4,232 | \$3,335 | \$2,211 | \$1,959 | \$2,463 | \$3,710 | \$2,827 | 9.6% | 6.8% |
| Broadcom | \$1,960 | \$2,750 | \$3,040 | \$3,314 | \$2,699 | \$3,089 | \$3,570 | 8.0% | 8.6% |
| Hi-Silicon | \$1,089 | \$1,281 | \$1,531 | \$2,781 | \$4,947 | \$3,463 | \$0 | 8.9% | 0.0% |
| AMD | \$1,138 | \$1,729 | \$1,498 | \$1,527 | \$1,929 | \$3,013 | \$3,841 | 7.8% | 9.3% |
| Mediatek | \$1,772 | \$2,693 | \$1,740 | \$1,424 | \$1,043 | \$1,914 | \$3,399 | 4.9% | 8.2% |
| NVIDIA | \$1,504 | \$1,934 | \$2,551 | \$2,817 | \$2,321 | \$2,362 | \$2,037 | 6.1% | 4.9% |
| TSMC sales from its top 30 | \$23,449 | \$25,940 | \$28,442 | \$30,706 | \$31,440 | \$35,629 | \$37,711 | 92% | 91% |
| TSMC YoY at its top 30 | 5% | 11% | 10% | 8% | 2% | 13% | 6% | | |
| TSMC's share of top customers | 39% | 40% | 39% | 38% | 38% | 41% | 40% | | |
| Rest of TSMC/Inventory | \$3,157 | \$3,494 | \$3,663 | \$3,490 | \$3,193 | \$3,217 | \$3,609 | 8% | 9% |
| Rest of TSMC YoY | 14% | 11% | 5% | -5% | -9% | 1% | 12% | | |
| TSMC Sales (CS Estimate) | \$26,606 | \$29,434 | \$32,105 | \$34,196 | \$34,633 | \$38,846 | \$41,320 | 100% | 100% |
| TSMC Overall YoY | 6% | 11% | 9% | 7% | 1% | 12% | 6% | | |

Source: Company data, Credit Suisse estimates

We reflect our new Huawei estimates at 189.5 mn in 2020 and 180 mn in 2021 supplied by other vendors which should reduce TSMC's content per phone relative to Huawei which was more aggressive moving to 5nm for the high-end and where TSMC had 100% market share. Mediatek's allocation at TSMC has been running closer to 50% although moving up again in advanced 5G mobile. We still view the 5G cycle moving ahead and coupled with the content gains moving mainstream from 12nm to 7nm and high-end Apple to 5nm and adding back the modem through 1H21 have smartphone revenue growing +8%/+8% YoY in 2020/21.

Figure 36: TSMC smartphone estimates based on the new industry model

| Smartphone/Tablet Units (mn) | 2011 | 2012 | 2013 | 2014 | 2019 | 2020E | 2021E | 15-19 CAGR |
|--------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------------|
| Apple | 231.5 | 215.4 | 215.8 | 208.8 | 191.0 | 180.0 | 213.5 | -5% |
| Samsung | 320.2 | 311.4 | 317.7 | 292.2 | 295.8 | 250.4 | 295.5 | -2% |
| Huawei | 107.0 | 139.3 | 154.2 | 206.0 | 240.6 | 189.5 | 180.0 | 22% |
| Oppo/Vivo/Xiaomi | 151.7 | 230.1 | 292.0 | 333.5 | 350.0 | 388.0 | 432.2 | 23% |
| Others | 627.1 | 573.2 | 485.8 | 362.1 | 294.5 | 268.8 | 248.4 | -17% |
| Tablets | 207.2 | 174.9 | 163.8 | 146.1 | 134.5 | 138.6 | 140.6 | -10% |
| Total smartphone/tablets (mn) | 1,644.8 | 1,644.4 | 1,629.2 | 1,548.7 | 1,506.5 | 1,415.3 | 1,510.3 | -2% |
| YoY Growth | 0% | -1% | -5% | -3% | -6% | 7% | | |
| TSMC content (US\$) | 2011 | 2012 | 2013 | 2014 | 2019 | 2020E | 2021E | 15-19 CAGR |
| Apple | \$17.7 | \$24.8 | \$32.5 | \$32.8 | \$37.0 | \$43.0 | \$47.5 | 20% |
| Samsung | \$3.0 | \$3.0 | \$3.0 | \$3.0 | \$4.5 | \$5.7 | \$3.8 | 11% |
| Huawei | \$7.0 | \$9.0 | \$9.5 | \$11.0 | \$14.0 | \$14.4 | \$12.9 | 19% |
| Oppo/Vivo/Xiaomi | \$7.0 | \$7.4 | \$6.7 | \$6.1 | \$6.0 | \$8.1 | \$8.1 | -4% |
| Others | \$7.0 | \$7.8 | \$7.5 | \$7.5 | \$7.5 | \$9.0 | \$7.2 | 2% |
| Tablets | \$8.0 | \$8.0 | \$7.5 | \$6.0 | \$6.0 | \$6.0 | \$6.0 | -7% |
| TSMC content (US\$) | \$7.9 | \$9.2 | \$10.0 | \$10.1 | \$11.2 | \$12.9 | \$13.0 | 9% |
| TSMC smartphones (US\$bn) | 2011 | 2012 | 2013 | 2014 | 2019 | 2020E | 2021E | 15-19 CAGR |
| Apple | \$4.1 | \$5.3 | \$7.0 | \$6.8 | \$7.1 | \$7.7 | \$10.1 | 15% |
| Samsung | \$1.0 | \$0.9 | \$1.0 | \$0.9 | \$1.3 | \$1.4 | \$1.1 | 8% |
| Huawei | \$0.7 | \$1.3 | \$1.5 | \$2.3 | \$3.4 | \$2.7 | \$2.3 | 46% |
| Oppo/Vivo/Xiaomi | \$1.1 | \$1.7 | \$2.0 | \$2.0 | \$2.1 | \$3.2 | \$3.5 | 19% |
| Others | \$4.4 | \$4.5 | \$3.6 | \$2.7 | \$2.2 | \$2.4 | \$1.8 | -16% |
| Tablets | \$1.7 | \$1.4 | \$1.2 | \$0.9 | \$0.8 | \$0.8 | \$0.8 | -16% |
| TSMC smartphones (US\$bn) | \$12.9 | \$15.1 | \$16.3 | \$15.6 | \$16.9 | \$18.3 | \$19.7 | 7% |
| YoY Growth | 17% | 8% | -4% | 8% | 8% | 8% | | |
| TSMC smartphone share | 42% | 49% | 52% | 51% | 55% | 56% | 52% | |

Source: Company data, Credit Suisse estimates

By platform, our revised estimates are for 12% growth in USD in 2019 versus TSMC's mid-high teens guidance as the foundry would have impact in both smartphones and also the network infrastructure that is in the HPC category. For 2021, the lower infrastructure and lower content within Huawei devices alongside the already existing lower share at Qualcomm and NVIDIA may keep growth to +6% YoY.

Figure 37: TSMC revised growth drivers by platform

| TSMC growth drivers | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 18-21 CAGR |
|------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------|
| HPC - TSMC | \$6.1 | \$8.1 | \$10.9 | \$10.3 | \$12.6 | \$13.3 | 7% |
| HPC - Market | \$19.3 | \$22.5 | \$26.1 | \$26.2 | \$29.0 | \$31.6 | 7% |
| TSMC share (%) | 31.7% | 36.1% | 41.9% | 39.3% | 43.4% | 42.0% | |
| Automotive - TSMC | \$1.3 | \$1.4 | \$1.7 | \$1.5 | \$1.46 | \$1.6 | -2% |
| Automotive - Market | \$10.8 | \$12.2 | \$13.4 | \$14.5 | \$16.1 | \$17.9 | 10% |
| TSMC share (%) | 12.4% | 11.4% | 12.7% | 10.6% | 9.1% | 9.0% | |
| IoT - TSMC | \$1.7 | \$1.8 | \$2.1 | \$2.68 | \$3.1 | \$3.39 | 18% |
| IoT - Market | \$5.6 | \$7.3 | \$9.0 | \$11.4 | \$14.2 | \$17.6 | 25% |
| TSMC share (%) | 29.7% | 24.8% | 22.7% | 23.6% | 21.6% | 19.2% | |
| Mobile - TSMC | \$15.1 | \$16.3 | \$15.6 | \$16.9 | \$18.3 | \$19.7 | 8% |
| Mobile - Market | \$30.9 | \$31.3 | \$30.7 | \$30.5 | \$32.7 | \$38.1 | 7% |
| TSMC Mobile share (%) | 48.9% | 51.9% | 50.9% | 55.3% | 55.9% | 51.7% | |
| Digital Consumer | \$2.6 | \$2.5 | \$2.3 | \$1.8 | \$1.9 | \$1.9 | -5.4% |
| Other | \$2.6 | \$2.0 | \$1.6 | \$1.4 | \$1.5 | \$1.4 | |
| TSMC CS Estimates | \$29.4 | \$32.1 | \$34.2 | \$34.6 | \$38.8 | \$41.3 | 6.5% |
| YoY Growth | 10.6% | 9.1% | 6.5% | 1.3% | 12.2% | 6.4% | |

Source: Company data, Credit Suisse estimates

We revise TSMC's estimates to take out 4% of the 14% sales from 3Q20 for Huawei as it would be only running in-process wafers through part of September and should be fading late in the quarter. In 4Q20, we take a further 5% reduction out, assuming only 1/3 of the existing Huawei business is running. The infrastructure and multimedia may be drawing down inventory at Huawei and Mediatek starting to ramp up to replace some of the lost mobile processor units. For 2020, the full year impact is 3.5% on sales and we project a continuing 3.5% revenue impact to 2021. Our view is TSMC would recover most of the smartphone business and some infrastructure though other chip companies (Xilinx, Broadcom, Marvell) but should still be facing a slower China deployment schedule and a net reduction as Huawei's run rate was above its

production to build inventory the past 18 months. We maintain 2020 capex at US\$14.5 bn with this year largely fixed and already below TSMC's \$15-16 bn guidance and lower 2021 from US\$14.5 bn to US\$13.5 bn as it can pull back capacity without Huawei on the advanced nodes. We estimate Huawei at 20-25% of 28nm and below with about that much of TSMC's 16nm and 7nm nodes and 10-15% of its 5nm business with Apple the main early customer.

Figure 38: TSMC estimate revisions factoring in Huawei

| | Base Case (After the Huawei restriction) | | | | | | Prior Estimates (Before the Huawei restriction) | | | | Huawei Impact | | | |
|---------------------------|--|----------------|----------------|----------------|------------------|------------------|---|----------------|----------------|----------------|------------------|------------------|----------------|----------------|
| | 1Q20 | 2Q20 | 3Q20 | 4Q20 | 2020 | 2021 | 1Q20 | 2Q20 | 3Q20 | 4Q20 | 2020 | 2021 | 2020 | 2021 |
| Sales | 310,597 | 308,010 | 295,689 | 252,500 | 1,166,796 | 1,239,597 | 310,597 | 308,010 | 308,010 | 277,564 | 1,204,180 | 1,321,321 | -37,385 | -81,724 |
| QoQ Growth | -2.1% | -0.8% | -4.0% | -14.6% | | | -2.1% | -0.8% | 0.0% | -9.9% | | | -3.5% | -3.5% |
| YoY Growth | 42.0% | 27.8% | 0.9% | -20.4% | 9.0% | 6.2% | 42.0% | 27.8% | 5.1% | -12.5% | 12.5% | 9.7% | -3.5% | -3.5% |
| Gross Profit | 160,777 | 157,345 | 134,583 | 108,624 | 561,328 | 578,850 | 160,777 | 157,345 | 143,716 | 124,900 | 586,737 | 631,541 | -25,409 | -52,691 |
| GM% | 51.8% | 51.1% | 45.5% | 43.0% | 48.1% | 46.7% | 51.8% | 51.1% | 46.7% | 45.0% | 48.7% | 47.8% | -0.6% | -1.1% |
| Opex | 32,255 | 33,722 | 33,812 | 32,798 | 132,587 | 139,397 | 32,255 | 33,722 | 33,812 | 32,967 | 132,756 | 141,592 | -169 | -2,195 |
| Op Profit | 128,522 | 123,623 | 100,771 | 75,826 | 428,742 | 439,453 | 128,522 | 123,623 | 109,904 | 91,934 | 453,982 | 489,949 | -25,240 | -50,496 |
| OpM% | 41.4% | 40.1% | 34.1% | 30.0% | 36.7% | 35.5% | 41.4% | 40.1% | 35.7% | 33.1% | 37.7% | 37.1% | -1.0% | -1.6% |
| Non-Op | 3,625 | 4,067 | 4,410 | 4,303 | 16,405 | 17,410 | 3,625 | 4,067 | 4,410 | 4,370 | 16,473 | 18,343 | -67 | -933 |
| Pretax | 132,147 | 127,690 | 105,181 | 80,129 | 445,147 | 456,863 | 132,147 | 127,690 | 114,314 | 96,304 | 470,454 | 508,292 | -25,307 | -51,429 |
| Tax | 11% | 12% | 12% | 12% | 12% | 12% | 11% | 12% | 12% | 12% | 12% | 12% | 0% | 0% |
| Minority/other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Net income | 117,063 | 112,367 | 92,559 | 70,514 | 392,503 | 402,040 | 117,063 | 112,367 | 100,596 | 84,747 | 414,773 | 447,297 | -22,271 | -45,258 |
| EPS | 4.51 | 4.33 | 3.57 | 2.72 | 15.14 | 15.50 | 4.51 | 4.33 | 3.88 | 3.27 | 16.00 | 17.25 | -0.86 | -1.75 |
| Shares | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 25,930 | 0 | 0 |
| EPS vs. base case: | 0.0% | 0.0% | -8.0% | -16.8% | -5.4% | -10.1% | | | | | | | -5.4% | -10.1% |

Source: Company data, Credit Suisse estimates

We reflect the BIS restriction impact in estimates and lower our NT\$ sales growth for 2020/21 from +12.5%/+9.7% to +9.0%/+6.2% and trip our EPS from NT\$16.00/NT\$17.25 to NT\$15.14/NT\$15.50. While the Huawei ban is a setback, we still view the company's position intact due to wide distance for its ecosystem and technology to other foundries, growth drivers from the rest of the industry's move to 5G, high performance computing through AMD, AI accelerator, game console and Mac ramps, and from a low base in advanced auto and IoT.

We downgrade from Outperform to Neutral with TP reduced from NT\$350 to NT\$300 to reflect the impact of the restriction on its #2 customer Huawei alongside overhang from COVID-19 which could dampen the sales outlook after the 1H20 inventory build particularly with QCOM/NVIDIA also diversifying some of their advanced products to Samsung over the next year.

Figure 39: TSMC estimate revisions factoring in Huawei

| (NT\$ mn) | 2Q20 | | | 3Q20 | | | 2020 | | | 2021 | | | |
|-------------------|----------------|----------------|----------------|--|----------------|----------------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | CS | CS(old) | Street | Guidance | CS | CS(old) | Street | CS | CS(old) | Street | CS | CS(old) | Street |
| Sales | 308,010 | 308,010 | 307,435 | US\$10.1-10.4bn/NT\$303.0-312.0bn | 295,689 | 308,010 | 307,037 | 1,166,796 | 1,204,180 | 1,227,622 | 1,239,597 | 1,321,321 | 1,348,763 |
| Chg (%) | -0.8 | -0.8 | -1.0 | -2.4% to +0.5% QoQ (NT\$) | -4.0 | 0.0 | -0.1 | 9.0 | 12.5 | 14.7 | 6.2 | 9.7 | 9.9 |
| GM (%) | 51.1 | 51.1 | 50.8 | 50.0-52.0% | 45.5 | 46.7 | 47.7 | 48.1 | 48.7 | 49.1 | 46.7 | 47.8 | 48.9 |
| OpM (%) | 40.1 | 40.1 | 39.7 | 39.0-41.0% | 34.1 | 35.7 | 38.0 | 36.7 | 37.7 | 38.6 | 35.5 | 37.1 | 38.5 |
| Net Inc. | 112,367 | 112,367 | 109,681 | NT\$30.0:1 Guide | 92,559 | 100,596 | 102,070 | 392,579 | 414,773 | 423,652 | 402,040 | 489,949 | 470,097 |
| EPS (NT\$) | 4.33 | 4.33 | 4.23 | | 3.57 | 3.88 | 3.93 | 15.14 | 16.00 | 16.38 | 15.50 | 17.25 | 18.13 |

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

Mediatek: Maintain Outperform, raising our target from NT\$430 to NT\$500

We view Mediatek as one of the few beneficiaries of the increased restrictions on Huawei, as it supplies only about 30mn of the 190mn smartphone processors for Huawei now but is the most viable alternative to Hi-Silicon for those units. Mediatek has been a longtime supplier to Huawei since 2G and is already qualifying its Dimensity 800 and 600 series for 2H20 models so can have a quick ramp either directly or with fast time to market with ODM designed models.

We estimate the market opportunity for Huawei's application processor bundle which includes processor, modem, connectivity, power management and transceiver would be US\$3 bn, based on 190mn units at about US\$16 ASP. We factor in our base assumption Mediatek's 4G market share increases from current 15% to 30%/60% for 2020/21 and 5G market share from 0 in 1Q20 to 20%/60% for 2020/21.

We keep conservative on modeling even higher market share as Huawei still carries some inventory and has some options to try to design in Samsung Exynos or at the low-end UniSOC's designs. Qualcomm could also be an option with no further tightening of US restrictions, although Huawei after a US ban seems unlikely to raise procurement of US components at the expense of its own chips. One key risk on the upside also with the regulations is that US-China tensions could swing either toward resolution that takes away this opportunity or a further restriction is placed that limit IC design suppliers using US EDA to also supply Huawei.

Figure 40: Huawei processors are a US\$3bn TAM, adding 15-20% to Mediatek's 2021

| Huawei Smartphone Application Processor TAM | 4G | | 5G | | Total | |
|---|----------------|--------------|----------------|----------------|----------------|-----------------|
| | 2020 | 2021 | 2020 | 2021 | 2020 | 2021 |
| Units (mn) | 132.9 | 83.9 | 56.5 | 96.1 | 189.5 | 180.0 |
| ASPs (US\$) | \$7.9 | \$7.1 | \$34.3 | \$25.3 | \$15.8 | \$16.8 |
| Huawei Sales TAM (US\$mn) | \$1,053 | \$600 | \$1,941 | \$2,430 | \$2,994 | \$3,030 |
| Mediatek Huawei Share | 30% | 60% | 20% | 60% | 27% | 60% |
| Mediatek Huawei sales (US\$mn) | \$316 | \$360 | \$388 | \$1,458 | \$809 | \$1,818 |
| Mediatek Smartphone sales (US\$mn) | \$2,520 | \$2,202 | \$1,327 | \$3,009 | \$3,880 | \$5,230 |
| Huawei % of Mediatek Smartphones | 13% | 16% | 29% | 48% | 21% | 35% |
| Mediatek Total sales (US\$mn) | | | | | \$8,964 | \$10,611 |
| Huawei % of Mediatek total sales | | | | | 9% | 17% |

Source: Company data, Credit Suisse estimates

We lift our Mediatek 5G units factoring in the Huawei share from 35/80mn to 39/119mn for 2020 and 2021. Within our estimates, we also project Mediatek having 40% share in Oppo, 30% in Vivo and Xiaomi share rising toward 30% in 2021. One potential trade war outcome could also be China vendors sourcing away from Qualcomm although we are not yet factoring in that scenario if vendors still take their same approach to sourcing about 60-70% of their mix with the market leader.

Figure 41: Raising Mediatek 5G units for 2020-21 from 35/80mn to 39/119mn

| Credit Suisse 5G Forecasts | Market 5G volumes (mn) | | | Mediatek share assumption | | | Mediatek volumes (mn) | | |
|-------------------------------|------------------------|--------------|--------------|---------------------------|------------|------------|-----------------------|-------------|--------------|
| | 2019E | 2020E | 2021E | 2019E | 2020E | 2021E | 2019E | 2020E | 2021E |
| Apple | 0.0 | 63.8 | 139.8 | 0% | 0% | 0% | 0.0 | 0.0 | 0.0 |
| Samsung | 5.6 | 40.1 | 74.7 | 0% | 10% | 10% | 0.0 | 4.0 | 7.5 |
| Huawei+Honor | 6.9 | 56.5 | 96.1 | 0% | 20% | 60% | 0.0 | 11.3 | 57.6 |
| Xiaomi | 0.3 | 16.7 | 34.1 | 0% | 25% | 30% | 0.0 | 4.2 | 10.2 |
| OPPO | 0.6 | 19.5 | 36.6 | 0% | 40% | 40% | 0.0 | 7.8 | 14.6 |
| Vivo | 1.3 | 18.9 | 35.2 | 0% | 30% | 30% | 0.0 | 5.7 | 10.6 |
| Lenovo | 0.0 | 3.0 | 7.8 | 0% | 30% | 40% | 0.0 | 0.9 | 3.1 |
| ZTE | 0.0 | 1.1 | 2.2 | 0% | 40% | 50% | 0.0 | 0.5 | 1.1 |
| Others | 1.3 | 8.6 | 20.4 | 0% | 50% | 70% | 0.0 | 4.3 | 14.3 |
| Total 5G Shipments | 16.0 | 228.3 | 446.8 | 0% | 17% | 27% | 0.0 | 38.6 | 119.0 |

Source: Company data, Credit Suisse estimates

We reflect the higher Huawei shipments for Mediatek and lift 2020/21 sales growth from +5%/+10% to +9%/+18% and raise our EPS from NT\$16/NT\$20 to NT\$17.50/NT\$25.00. Our revised estimates still allow Mediatek to scale up some additional R&D for Huawei support and grow opex high single digits in both 2020-21, still delivering operating margin expansion from 11% to 13%. We maintain our Outperform but lift our target from NT\$430 to NT\$500 and view the company well positioned as most viable non-US vendor in smartphones to capitalize on content gains on the move from 4G to 5G with supplementary drivers in non-mobile from networking, IoT, game consoles and analog.

Figure 42: Mediatek 2Q20/3Q20 and 2020/2021 estimates

| (NT\$ mn) | 2Q20 | | | 3Q20 | | | 2020 | | | 2021 | | | |
|-----------|----------|----------|----------|-----------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | CS | CS(old) | Street | Guidance | CS | CS(old) | Street | CS | CS(old) | Street | CS | CS(old) | Street |
| Sales | \$64,864 | \$64,864 | \$64,698 | NT\$62.1-65.9bn | \$70,129 | \$68,059 | \$71,999 | \$268,934 | \$258,933 | \$271,012 | \$318,344 | \$283,607 | \$303,678 |
| Chg | 6.6% | 6.6% | 6.3% | Up 2-10% QoQ | 8.1% | 4.9% | 11.0% | 9.2% | 5.2% | 10.1% | 18.4% | 9.5% | 23.4% |
| GM% | 43.0% | 43.0% | 42.9% | GM: 41-44% | 43.0% | 43.0% | 42.9% | 43.0% | 43.1% | 42.9% | 42.9% | 43.0% | 42.9% |
| OpM% | 10.5% | 10.5% | 10.6% | OpM: 6.5-13.5% | 11.4% | 11.1% | 12.1% | 10.8% | 10.1% | 10.9% | 13.4% | 11.9% | 12.1% |
| Net Inc. | 6,503 | 6,503 | 6,505 | FX: 30.0 | 7,538 | 7,188 | 8,448 | 27,444 | 25,085 | 29,070 | 39,203 | 31,359 | 35,385 |
| GAAP EPS | \$4.09 | \$4.09 | \$4.10 | | \$4.75 | \$4.53 | \$5.34 | \$17.50 | \$16.00 | \$18.41 | \$25.00 | \$20.00 | \$22.72 |

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

By segment, our revised estimates for Mediatek have smartphone sales growing 28%/33% YoY in 2020-21, with the Huawei units now lifting 5G and also helping keep Mediatek 4G more stable even on our more conservative assumption discounting shipment risk from COVID-19 shut-downs in emerging markets. Our mature digital home sales are unchanged and still factor the macro slowdown impact on the TV and set-top to decline -11%/-2% in 2020-21. For the non-mobile growth products, we estimate still mild 6% growth in 2020 and recovery to 13% in 2021 with some revenue resilience from work from home demand in connectivity, routers, networking and from the upcoming PS/XBOX game console launches.

Figure 43: Mediatek estimates raised for 4G and 5G smartphones with the additional Huawei business

| NT\$mn unless noted | 1Q20 | 2Q20E | 3Q20E | 4Q20E | 2016 | 2017 | 2018 | 2019F | 2020F | 2020F | 2021F | 2021F |
|----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 3G Smartphones (mn) | 2.5 | 2.5 | 2.5 | 2.2 | 167.0 | 106.3 | 51.9 | 17.1 | 9.7 | 9.7 | 6.2 | 6.2 |
| 4G Smartphones (mn) | 79.6 | 79.6 | 79.6 | 79.6 | 336.8 | 297.5 | 306.9 | 331.8 | 318.2 | 288.5 | 308.0 | 283.6 |
| 4G ASPs (US\$) | \$8.22 | \$8.02 | \$7.82 | \$7.62 | \$10.98 | \$9.59 | \$9.04 | \$8.61 | \$7.92 | \$7.94 | \$7.15 | \$7.14 |
| 5G Smartphones (mn) | 2.5 | 6.1 | 11.3 | 18.7 | 0.0 | 0.0 | 0.0 | 0.0 | 38.6 | 35.0 | 119.0 | 80.0 |
| 5G ASPs (US\$) | \$60.00 | \$40.20 | \$34.17 | \$29.04 | | | | | \$34.34 | \$34.91 | \$25.29 | \$25.35 |
| Smartphones (mn) | 84.6 | 88.1 | 93.3 | 100.5 | 503.8 | 403.7 | 358.8 | 348.9 | 366.5 | 333.1 | 433.2 | 369.8 |
| ASPs (US\$) | \$9.64 | \$10.12 | \$10.88 | \$11.52 | \$9.09 | \$8.28 | \$8.33 | \$8.37 | \$10.59 | \$10.65 | \$12.07 | \$11.01 |
| Handset/Tablets | 25,785 | 28,381 | 32,170 | 36,323 | 157,716 | 109,390 | 95,354 | 95,989 | 122,659 | 112,658 | 162,793 | 128,057 |
| Handset/Tablet YoY | | | | | 32.1% | -30.6% | -12.8% | 0.7% | 27.8% | 17.4% | 32.7% | 13.7% |
| Smartphone % of sales | 40.2% | 41.2% | 43.4% | 47.5% | 50.2% | 42.9% | 37.8% | 36.8% | 43.3% | 41.1% | 49.3% | 43.1% |
| Feature phones (mn) | 29.9 | 28.4 | 27.0 | 25.7 | 252.4 | 181.1 | 156.0 | 136.2 | 111.0 | 111.0 | 93.0 | 93.0 |
| ASPs (US\$) | \$1.17 | \$1.16 | \$1.15 | \$1.13 | \$1.37 | \$1.30 | \$1.25 | \$1.20 | \$1.15 | \$1.15 | \$1.11 | \$1.11 |
| DTV | 12,893 | 11,604 | 11,604 | 11,256 | 49,740 | 50,217 | 52,598 | 52,478 | 47,357 | 47,357 | 47,440 | 47,440 |
| STB | 2,853 | 2,980 | 3,114 | 2,943 | 9,320 | 9,969 | 11,620 | 12,815 | 11,889 | 11,889 | 11,961 | 11,961 |
| PC Optical | 433 | 420 | 429 | 413 | 5,377 | 3,454 | 2,701 | 2,194 | 1,694 | 1,694 | 1,357 | 1,357 |
| Consumer DVD | 163 | 158 | 150 | 134 | 2,049 | 1,438 | 1,185 | 901 | 605 | 605 | 411 | 411 |
| LCD Monitor | 693 | 831 | 831 | 789 | 2,861 | 2,850 | 3,036 | 3,198 | 3,144 | 3,144 | 3,123 | 3,123 |
| Digital Home products | 18,083 | 16,979 | 17,056 | 16,408 | 80,484 | 75,132 | 77,006 | 76,646 | 68,526 | 68,526 | 67,378 | 67,378 |
| Digital Home % of sales | 29.7% | 26.2% | 24.3% | 22.5% | 29.2% | 31.5% | 32.3% | 31.1% | 25.5% | 26.5% | 21.2% | 23.8% |
| Digital Home YoY | -6.1% | 0.5% | -3.8% | 9.0% | -6.6% | 2.5% | -0.5% | -10.6% | -10.6% | -1.7% | -1.7% | -1.7% |
| Connectivity (Ralink) | 4,946 | 5,574 | 5,686 | 5,509 | 16,550 | 18,140 | 20,094 | 22,964 | 21,716 | 21,716 | 24,484 | 24,484 |
| IoT chipsets | 1,146 | 1,187 | 1,207 | 1,126 | 895 | 3,443 | 4,276 | 4,720 | 4,667 | 4,667 | 4,998 | 4,998 |
| Voice Assistant Devices | 2,673 | 3,059 | 3,044 | 3,028 | 639 | 6,600 | 9,622 | 11,161 | 11,804 | 11,804 | 12,899 | 12,899 |
| Other (GPS, RFID, Ilitek) | 1,853 | 2,131 | 2,344 | 2,344 | 3,552 | 4,552 | 7,272 | 7,878 | 8,671 | 8,671 | 9,534 | 9,534 |
| Game console ASIC | 1,210 | 1,597 | 2,092 | 1,957 | 2,646 | 6,427 | 7,542 | 6,271 | 6,855 | 6,855 | 7,728 | 7,728 |
| Networking | 669 | 784 | 843 | 865 | 0 | 0 | 432 | 2,165 | 3,160 | 3,160 | 5,024 | 5,024 |
| Richtek | 4,497 | 5,172 | 5,689 | 5,518 | 13,028 | 14,530 | 16,460 | 18,426 | 20,876 | 20,876 | 23,505 | 23,505 |
| Growth products | 16,995 | 19,503 | 20,904 | 20,348 | 37,310 | 53,693 | 65,698 | 73,585 | 77,749 | 77,749 | 88,173 | 88,173 |
| Growth Products % of sales | 27.9% | 30.1% | 29.8% | 27.8% | 13.5% | 22.5% | 27.6% | 29.9% | 28.9% | 30.0% | 27.7% | 31.1% |
| Growth YoY | 14.8% | 7.2% | -2.7% | 86.3% | 43.9% | 22.4% | 12.0% | 5.7% | 5.7% | 13.4% | 13.4% | 13.4% |
| Total Sales | 60,863 | 64,864 | 70,129 | 73,078 | 275,510 | 238,215 | 238,057 | 246,220 | 268,934 | 258,933 | 318,344 | 283,607 |
| GM % | 43.1% | 43.0% | 43.0% | 42.9% | 35.6% | 35.6% | 38.5% | 41.9% | 43.0% | 43.1% | 42.9% | 43.0% |
| Op M% | 12.5% | 18.6% | 22.2% | 12.1% | 8.4% | 4.1% | 6.8% | 9.2% | 10.8% | 10.1% | 13.4% | 11.9% |
| Pro Forma EPS | \$12.81 | \$20.13 | \$29.67 | \$16.74 | \$14.47 | \$8.49 | \$11.05 | \$14.65 | \$17.50 | \$16.00 | \$25.00 | \$20.00 |
| EPS growth | | | | | -13.6% | -41.3% | 30.1% | 32.6% | 19.5% | 9.2% | 42.8% | 25.0% |

Source: Company data, Credit Suisse estimates

SMIC: Downgrade to Underperform, lowering our target from HK\$17.60 to \$16.00

SMIC had 19% of sales from Huawei in 2019 and should be expecting further growth from that customer as it has traditionally outsourced its high-end consumer chips, connectivity, and power management and was set to also add its low-end Kirin 710 on 14nm. We maintain our 3Q20 flat QoQ as SMIC would still be shipping with the 120 day grace period for WIP started by 15 May and was running at full capacity so should have other customers to offset the gap from Huawei. We revise down 4Q20 from -5% QoQ to -15% QoQ as shipments would stop and by that point the supply chain could also run the risk of a COVID-19 inventory correction with supply no longer as tight in the foundries post the Huawei restriction.

For 2020-21, we lower our sales from +18%/+14% to +15%/+10% YoY, still outgrowth as we expect localisation to continue at the China design companies but should still have a net impact losing its top customer. On lower sales, we reduce our 2020-21 net income from US\$270/US\$374 mn to US\$238 mn/US\$300 mn and EPS from HK\$0.35/HK\$0.49 to HK\$0.31/HK\$0.39. SMIC would also be losing its lead target on 14nm so may slow down its capex ramp. We trim our capex for 2020 capex from US\$4.3bn to US\$3.8bn as we see higher chance for equipment push-outs to delay depreciation and maintain 2021 capex at US\$3.2 bn.

Figure 44: CS and street estimates for 2020 and 2021

| (US\$ mn) | 2Q20 | | 3Q20 | | 2020 | | | 2021 | | | |
|---------------|---------|---------|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | CS | Street | Guidance | CS | Street | CS | CS(old) | Street | CS | CS(old) | Street |
| Net sales | \$943 | \$876 | \$932.2-\$950.3mn | \$943 | \$914 | \$3,592 | \$3,687 | \$3,547 | \$3,935 | \$4,213 | \$4,063 |
| Change | 4.2% | 1.4% | +3 to 5% QoQ | 0.0% | 4.3% | 15.3% | 18.3% | 13.7% | 9.5% | 14.3% | 14.5% |
| GM % | 26.5% | 21.0% | 26-28% | 22.1% | 20.1% | 22.9% | 23.2% | 21.0% | 20.9% | 21.4% | 21.0% |
| OpM % | 8.9% | 0.7% | Opex \$240-245mn | 3.7% | -2.8% | 3.4% | 4.2% | 1.4% | 3.6% | 5.2% | 2.8% |
| Net income | 106 | 44 | Minority: \$0-10mn | 70 | 55 | 238 | 270 | 185 | 300 | 374 | 256 |
| EPS (US\$) | \$0.018 | \$0.009 | | \$0.012 | \$0.011 | \$0.040 | \$0.045 | \$0.032 | \$0.050 | \$0.063 | \$0.047 |
| HK EPS (HK\$) | \$0.138 | \$0.070 | | \$0.091 | \$0.085 | \$0.309 | \$0.350 | \$0.248 | \$0.390 | \$0.486 | \$0.364 |

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

We still believe SMIC's Sci-Tech listing should be well received as largest foundry and with the National IC fund and Shanghai/Beijing municipal backing and expect it to raise US\$2.9 bn if at 1.5x P/B and US\$4.4 bn at the median A-Share premium over A-Shares. We trim our target from HK\$17.60 to HK\$16.00 which reflects a more reasonable 1.5x post Star listing P/B valuation, high-end of its historical 1-1.5x range and midpoint of its recent 1-2x range.

Figure 45: SMIC target at NT\$16 based on 1.5x its post Star listing valuation

| | Shares | Share price (local currency) | Market cap (US\$mn) | Net cash | Enterprise Value (US\$mn) | P/B | BV/Share | 2020 ROE | CS TP Multiple | HK Price |
|--------------------------------------|--------|---------------------------------|------------------------|----------|------------------------------|-----|----------|----------|-------------------|----------|
| SMIC - Hong Kong listing | 5,155 | \$13.2 | \$8,781 | \$431 | \$8,350 | 1.5 | \$8.8 | 3.7% | 1.50 | \$13 |
| Premium (Parity) A-share issuance | 1,686 | \$12.02 | \$2,858 | | | 1.5 | \$8.0 | | | |
| SMIC - Hong Kong if parity | 6,841 | \$13.2 | \$11,638 | \$3,288 | \$8,350 | 1.2 | \$10.6 | 2.5% | 1.50 | \$16 |
| Premium (Median) A-share issuance | 1,686 | \$18.63 | \$4,429 | | | 1.2 | \$15.0 | | | |
| SMIC - Hong Kong w/premium | 6,841 | \$15.0 | \$13,210 | \$4,860 | \$8,350 | 1.2 | \$12.4 | 2.2% | 1.50 | \$19 |

Source: Company data, Credit Suisse estimates

ASE: Maintain Outperform, lowering our target from NT\$84 to NT\$75

We see a modest impact to ASE from the restrictions as the fab restriction ultimately will impact the package and test flows. We estimate Huawei's Hi-Silicon chip division as a 7-8% customer for ASE for the chipsets across smartphones, networking and consumer. We do believe the company's loss at Huawei though should be offset by other baseband suppliers, as it also has good market share at Qualcomm and Mediatek and also has good infrastructure share at other fabless including Broadcom, Xilinx and Marvell.

Factoring in Huawei's ban, we still reflect a bit of output that may not be fully recouped and trim 2% from the back-end IC ATM business in 2H20, with full year sales now up 5% YoY. The company should see Huawei's share shift to its other customers in 2021 so only trimming 1% impact from a bit lower 5G forecast in China as the lower infrastructure builds impact some of the penetration into lower price bands. We trim our 2020/21 EPS from NT\$5.50/NT\$6.00 to NT\$5.30/NT\$5.80, reflecting the lower sales and lower our TP from NT\$84 to NT\$75 based on same 13x 2021 P/E.

Figure 46: ASE 2Q20-3Q20 and 2020-21 estimates CS vs. Street

| | 2Q20 | | | | | 3Q20 | | | | | 2020 | | | | | 2021 | | | | | |
|--------------------|--------|--------|---------|---------|---------|---|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | ATM | USI | CS | CS(old) | Street | Guidance | ATM | USI | CS | CS(old) | Street | ATM | USI | CS | CS(old) | Street | ATM | USI | CS | CS(old) | Street |
| Sales | 67,861 | 35,345 | 102,706 | 102,706 | 102,471 | ATM - NT\$67.9bn, +2.5% QoQ EMS: >NT\$35bn, >+7% QoQ | 67,183 | 49,483 | 115,366 | 116,044 | 112,226 | 263,732 | 176,935 | 435,689 | 438,695 | 429,530 | 267,789 | 194,894 | 458,282 | 463,499 | 470,618 |
| Chg (%) | 2.5 | 8.0 | 5.5 | 5.5 | 5.3 | -1.0 | 40.0 | 12.3 | 13.0 | 9.5 | 4.9 | 6.7 | 5.4 | 6.2 | 4.0 | 1.5 | 10.1 | 5.2 | 5.7 | 9.6 | |
| GAAP GM (%) | 21.7 | 8.8 | 17.4 | 17.4 | 17.0 | ATM GAAP GMs >-21.7% | 20.6 | 8.7 | 15.7 | 15.7 | 16.6 | 20.1 | 8.9 | 15.7 | 15.9 | 20.5 | 9.1 | 15.9 | 15.9 | 15.9 | |
| GAAP OpM (%) | 10.2 | 2.2 | 7.5 | 7.5 | 7.2 | EMS OpM >+2.1% | 9.0 | 3.5 | 6.7 | 6.8 | 7.2 | 8.2 | 3.4 | 6.3 | 6.5 | 8.6 | 3.7 | 6.6 | 6.7 | 6.7 | |
| Net Inc. | | | 4,911 | 4,911 | 5,064 | | | | 5,299 | 5,390 | 5,794 | | | 17,886 | 18,752 | | | 20,182 | 21,030 | | |
| GAAP EPS (NT\$) | | | 1.15 | 1.15 | 2.23 | | | | 1.24 | 1.26 | 2.72 | | | 4.19 | 4.39 | | | 4.73 | 4.92 | | |
| Pro Forma GM (%) | 23.0 | 18.2 | 18.2 | | | | 22.0 | | 16.5 | 16.5 | | 21.5 | | 16.6 | 16.7 | | 21.8 | | 16.6 | 16.7 | |
| Pro Forma OpM (%) | 11.9 | 8.6 | 8.6 | | | | 10.7 | | 7.7 | 7.8 | | 10.0 | | 7.4 | 7.6 | | 10.3 | | 7.6 | 7.7 | |
| Pro Forma Net Inc. | | 6,057 | 6,057 | | | | | | 6,445 | 6,536 | | | | 22,626 | 23,492 | 20,593 | | 24,758 | 25,606 | 25,210 | |
| Pro Forma EPS | | | 1.42 | 1.42 | | | | | 1.51 | 1.53 | | | | 5.30 | 5.50 | | | 5.80 | 6.00 | | |

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

Vanguard: Maintain Neutral, lowering our target from NT\$70 to NT\$66.5

We estimate mobile-related applications are 1/3 of Vanguard's power management business, representing 15-20% of its total sales. The 5G smartphone and infrastructure builds have been one of the main drivers for power management IC growth for the company in the past few quarters in a slow demand environment for broad based automotive/industrial applications. We believe Vanguard had a project to ramp up Huawei power management so may see a modest impact from the lost additional opportunity.

With slower 5G infrastructure builds in China following the Huawei foundry restriction and loss of the smartphone PMIC business there, we estimate Vanguard's power management IC could slow down from 3Q20 and modeling 2%/1% sales impact in 2020/21 and lower 2020/21 EPS from NT\$3.35/NT\$3.75 to NT\$3.20/NT\$3.50 and lower our target from NT\$70 to NT\$66.5 based on same 19x 2021 P/E and 16x ex-cash.

Figure 47: Vanguard 2Q20-3Q20 and 2020-21 estimates CS vs. Street

| (NT\$ mn) | 1Q20 | 2Q20 | | | | | 3Q20 | | | | | 2020 | | | | | 2021 | | | | |
|------------|--------|-------|--------|--------|---------------------------------|-------|---------|--------|--------|--------|--------|--------|--------|--------|----|--------|--------|--|--|--|--|
| | Actual | CS | CS Old | Street | Guidance | CS | CS(Old) | Street | CS | CS Old | Street | CS | CS Old | Street | CS | CS Old | Street | | | | |
| Sales | 7,844 | 8,209 | 8,209 | 8,232 | NT\$8.0-8.4bn +2.0% to +7.1% | 8,085 | 8,209 | 8,302 | 31,011 | 31,731 | 32,626 | 32,154 | 33,298 | 35,115 | | | | | | | |
| QoQ (%) | 6.9% | 4.6% | 4.6% | 4.9% | | -1.5% | 0.0% | 0.9% | 9.6% | 12.2% | 15.3% | 3.7% | 4.9% | 7.6% | | | | | | | |
| GM (%) | 31.0% | 32.1% | 32.1% | 32.1% | 31-33% | 32.3% | 32.5% | 32.3% | 31.1% | 31.4% | 31.7% | 33.0% | 33.4% | 33.4% | | | | | | | |
| OpM (%) | 19.2% | 20.5% | 20.5% | 20.2% | 19-21% | 20.4% | 20.7% | 20.7% | 18.9% | 19.5% | 19.7% | 20.7% | 21.5% | 21.0% | | | | | | | |
| Net Inc: | 1,476 | 1,458 | 1,458 | 1,390 | NT\$30:1 | 1,431 | 1,475 | 1,425 | 5,287 | 5,543 | 1,425 | 5,785 | 6,200 | 1,425 | | | | | | | |
| EPS (NT\$) | 0.89 | 0.88 | 0.88 | 0.86 | | 0.87 | 0.89 | 0.87 | 3.20 | 3.35 | 3.48 | 3.50 | 3.75 | 4.04 | | | | | | | |

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

CHPT – Maintain Underperform, lowering our target from NT\$510 to NT\$480

Huawei has been the #2 customer for Chunghwa Precision's probe card business with business across smartphones, infrastructure and consumer multimedia representing the company's 20-30% sales. With the fab license restriction announced, we see another impact to the company's business outlook in 2020 and 2021 in addition to its potential loss in the US flagship smartphone business in 2021. CHPT does have good diversification across the other chip companies including Qualcomm, Mediatek and Samsung, although we do not expect them to fully offset the lost Huawei probe card business particularly as Huawei doubled last year adding more projects to CHPT and aggressively building up its own inventory.

With the reduction of Huawei's business from 3Q20, we factor CHPT's sales to be impacted by 10% in 2H20 and a milder 3-4% in 2021 with its other mobile customers' additional business. On the lower sales, we revise down our 2020/21 EPS from NT\$24.69/25.56 to NT\$23.68/NT\$24.00 and lower our target from NT\$510 to NT\$480.

Figure 48: CHPT 2Q20-3Q20 and 2020-21 estimates CS vs. Street

| (NT\$ mn) | 2Q20 | | | 3Q20 | | | 2020 | | | 2021 | | |
|------------|-------|-----------|--------|-------|-----------|--------|-------|---------|--------|-------|---------|--------|
| | CS | CS(prior) | Street | CS | CS(prior) | Street | CS | CS(old) | Street | CS | CS(old) | Street |
| Sales | 1,035 | 1,035 | 1,061 | 963 | 1,035 | 1,141 | 3,737 | 3,872 | 4,161 | 3,750 | 3,959 | 4,344 |
| Chg (%) | 15% | 15% | 18% | -7% | 0% | 10% | 10% | 14% | 23% | 0% | 2% | 4% |
| GM (%) | 54.3% | 54.3% | 53.3% | 54.5% | 54.5% | 53.4% | 54.0% | 54.0% | 53.0% | 53.9% | 53.9% | 52.9% |
| OpM (%) | 27.0% | 27.0% | 25.7% | 26.0% | 26.4% | 26.5% | 25.6% | 25.8% | 25.5% | 26.0% | 26.3% | 25.8% |
| Net Inc. | 225 | 225 | 216 | 202 | 220 | 239 | 776 | 809 | 850 | 787 | 838 | 906 |
| EPS (NT\$) | 6.85 | 6.85 | 6.51 | 6.16 | 6.71 | 7.31 | 23.68 | 24.69 | 25.99 | 24.00 | 25.56 | 27.64 |

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

Table of Huawei's Asian supply chain

Figure 49: Asian supply chain for Huawei (Semiconductors)

| Semiconductors | Stock ticker | Sector Analyst | Parts/service supplied | Huawei % of sales |
|------------------------------|--------------|------------------|--|------------------------|
| Semiconductor Foundry | | | | |
| AWSC | 8086.TWO | Not Covered | Foundry for RF in handsets | 10-15% |
| GCS | 4991.TWO | Jerry Su | Foundry for RF in fiber optics | 5-10% |
| Sanan | 600703.SZ | Kyna Wong | Foundry for RF in fiber optics | <5% |
| SMIC | 0981.HK | Randy Abrams | Foundry for consumer, IoT, and mobile RF/Wifi | 19% |
| TSMC | 2330.TW | Randy Abrams | Foundry for mobile, IoT and HPC applications | 14% |
| Vanguard | 5347.TWO | Randy Abrams | Foundry for Power Management | 5% |
| Win Semi | 3105.TWO | Jerry Su | Foundry for RF/VCSEL in handsets and infrastructure | 15-20% |
| Back-end packaging | | | | |
| ASE | 3711.TW | Randy Abrams | Packaging and testing for mobile, IoT and HPC applications | 7% |
| Chipbond | 6147.TWO | Jerry Su | Wafer bumping for touch driver IC and driver IC | 8-10% |
| Inari Amertron | INRI.KL | Danny Chan | RF filter package and test and fiber optic module assembly | 1-2% |
| King Yuan | 2449.TW | Not Covered | Testing for mobile, IoT and HPC | 15-20% |
| J CET | 600584.SS | Chaolien Tseng | Packaging and testing for mobile, IoT and HPC applications | 5-10% |
| Huatian | 002185.SZ | Chaolien Tseng | Packaging and testing for mobile, IoT and HPC applications | ~5% |
| Tongfu | 002156.SZ | Chaolien Tseng | Packaging and testing for mobile, IoT and HPC applications | ~5% |
| Memory | | | | |
| Nanya | 2408.TW | Haas Liu | Memory manufacutring for IoT, mobile and infrastructure | Limited exposure |
| Samsung | 005930.KS | Keon Han | Limited mobile DRAM, higher server exposure | Limited exposure |
| SK Hynix | 000660.KS | Keon Han | Memory manufacutring for IoT, mobile and infrastructure | 10-12% DRAM; 12% NAND |
| Kioxia | Japan | Hideyuki Maekawa | Memory manufacutring for IoT, mobile and infrastructure | 10% of memory business |
| Fabless IC Design | | | | |
| Focaltech | 3545.TW | Jerry Su | Smartphone touch IC, driver IC, touch driver IC | 15-20% |
| Goodix | 603160.SZ | Chaolien Tseng | Fingerprint sensors | 20% |
| Will Semi | 603501.SZ | Chaolien Tseng | CIS | 10-20% |
| Mediatek | 2454.TW | Randy Abrams | Mobile devices and IoT chipsets | 4% |
| Novatek | 3034.TW | Jerry Su | Smartphone touch driver IC / driver IC | 15-20% |
| Egis | 6462.TWO | Jerry Su | Fingerprint sensors | 10% |
| Elan | 2458.TW | Harvie Chou | Fingerprint sensors, stylus, touchpad | 2-3% |
| Parade | 4966.TWO | Jerry Su | NB/tablet T-Con / driver IC | 3-5% |
| Realtek | 2379.TW | Randy Abrams | Networking chipsets for infrastructure and IoT devices | 2% |
| PA & MLCCs | | | | |
| ACX | 3152.TWO | Not Covered | RF filters/passive components | 1-2% |
| Hirose | 6806.T | Akinori Kanemoto | Connectors | 3-5% |
| Murata | 6981.T | Akinori Kanemoto | RF fileters/passive components/batteries | 5-10% |
| SEMCO | 009150.KS | Sang Ul Kim | Passive components | <5% |
| Taiyo Yuden | 6976.T | Akinori Kanemoto | RF filters/passive components | 5-10% |
| TDK | 6762.T | Akinori Kanemoto | Battery, passive components | 5-10% |
| Universal Microwave | 3491.TWO | Not Covered | Microwave/mmWave backhaul components | 21% |
| Substrates | | | | |
| Kinsus | 3189.TW | Pauline Chen | IC substrates for infrastructure and smartphone ICs | 0-5% |
| Nanya PCB | 8046.TW | Pauline Chen | IC substrates for infrastructure and smartphone ICs | 10-15% |
| Unimicron | 3037.TW | Pauline Chen | IC substrates for infrastructure and smartphone ICs | 5-10% |
| Wafer | | | | |
| IET | 4971.TW | Not Covered | Epi wafers for mobile devices and infrastructure | 10% |
| Landmark Optoelectronics | 3081.TW | Not Covered | Epi wafers for optical communications | 15-20% |
| visual photonic (EPI wafers) | 2455.TW | Jerry Su | Epi wafers for mobile devices and infrastructure | 7-10% |

Source: Company data, Credit Suisse estimates

Figure 50: Asian supply chain for Huawei (device and infrastructure)

| Infrastructure | Stock ticker | Sector Analyst | Parts/service supplied | Huawei % of sales |
|------------------------------|---------------------|-----------------------|---|------------------------------|
| Test equipment | | | | |
| Anritsu | 6754.T | Hideyuki Maekawa | Mobile + network infrastructure | <5% |
| Chroma | 2360.TW | Jerry Su | VCSEL and fiber optic testing | 4% |
| Fiber optics/Backhaul | | | | |
| Accelink | 002281.SZ | Not Covered | Fiber optic modules for backhaul | 30% |
| FIT | 6088.HK | Kyna Wong | Connector/cable, Fiber optic modules for backhaul | <5% |
| Hengtong | 600487.SZ | Not Covered | Fiber optic modules for backhaul | <5% |
| Innolight | 300308.SZ | Not Covered | Fiber optic modules for backhaul | c.10% |
| Luxshare | 002475.SZ | Kyna Wong | Long haul optics cables and transceivers | 5% |
| O-Net | 877.HK | Not Covered | Optical networking components | 5-10% |
| YOFC | 601869.SZ | Not Covered | Fiber optic modules for backhaul | <5% |
| Data Center Equipment | | | | |
| FIH | 601138.SS | Pauline Chen | Data center switches and routers | <10% |
| Hon Hai | 2317.TW | Pauline Chen | Data center switches and routers | <5% |
| Inventec | 2356.TW | Pauline Chen | Data center switches and routers | < 3-4% smartphone |
| Power supply | | | | |
| Delta | 2308.TW | Pauline Chen | Networking equipment and power supplies | <5% |
| Mobile Devices | Stock ticker | Sector Analyst | Parts/service supplied | |
| Casing | | | | |
| Biel Crystal | Private | Not Covered | Cover glass and back glass casings | 10% |
| BYDE | 0285.HK | Kyna Wong | Casing, EMS | 40% |
| Lens Technology | 300433.SZ | Kyna Wong | Cover glass and back glass casings | 20% |
| Tongda | 0698.HK | Kyna Wong | Casing | 2% |
| Acoustics | | | | |
| AAC | 2018.HK | Kyna Wong | MEMS microphone | 15-20% |
| Goertek | 002241.SZ | Kyna Wong | MEMS microphone | 10-20% |
| Crystal | | | | |
| TXC | 3042.TW | Pauline Chen | Crystals and oscillators in mobile devices | 15-20% |
| LCP Antenna | | | | |
| Luxshare | 002475.SZ | Kyna Wong | Connector/cable, antenna, wireless charging | 5% |
| Sunway | 300136.SZ | Kyna Wong | Antennas, wireless charging | 5-10% |
| Copper Clad Laminate | | | | |
| Elite Materials | 2383.TW | Not Covered | Copper clad laminate for small cells and data center PCBs | 5-10% |
| ITEQ | 6213.TW | Not Covered | Copper clad laminate for small cells and data center PCBs | 5-10% |
| TUC | 6274.TW | Not Covered | Copper clad laminate for small cells and data center PCBs | 5-10% |
| Display | | | | |
| BOE | 000725.SZ | Kyna Wong | OLED | 5-7% |
| Innolux | 3481.TW | Jerry Su | Smartphone TFT panel | 7-10% |
| Tianma | 000050.SZ | Kyna Wong | LCD | 20-25% |
| Camera | | | | |
| Largan | 3008.TW | Pauline Chen | Lens, mostly in high end smartphones | 15-20% |
| LG Innotek | 011070.KS | Sang Uk Kim | Camera modules (multi-cam) | <10% |
| O-film | 002456.SZ | Kyna Wong | Camera modules | 20-30% |
| Q Tech | 1475.HK | Kyna Wong | Camera modules | 10-20% |
| Sony | 6758.T | Mika Nishimura | Image sensor | 15% image sensor; 1-2% total |
| Sunny Optical | 2382.HK | Kyna Wong | Camera modules and lens | 25-30% |
| Probe PCB / PCB | | | | |
| CHPT | 6510.TWO | Randy Abrams | Probe PCB for mobile devices and RF chipsets | 20% |
| Compeq | 2313.TW | Not Covered | PCBs in smartphones | 5% |
| Gold Circuit Electronics | 2368.TW | Not Covered | PCBs in base stations and networking | 0-5% |
| Tripod | 3044.TW | Pauline Chen | PCB and HDI for low/mid end smartphones | 0-5% |
| Smartphone ODM | | | | |
| Hon Hai | 2317.TW | Pauline Chen | Smartphone assembly (mfg by FIH, consolidated by HH) | <5% |
| Inventec | 2356.TW | Jerry Su | Smartphone assembly | 0% |

Source: Company data, Credit Suisse estimates

Companies Mentioned (Price as of 15-May-2020)

AAC Technologies (2018.HK, HK\$42.65)
ACX (3152.TWO, NT\$294.0)
ADLINK (6166.TW, NT\$65.5)
AIC (3693.TWO, NT\$49.85)
ALi (3041.TV, NT\$17.05)
ASE Industrial Holdings (3711.TW, NT\$66.4, OUTPERFORM, TP NT\$75.0)
ASM Pacific Technology Ltd (0522.HK, HK\$78.5)
AU Optronics (2409.TW, NT\$7.61)
AVC (3017.TW, NT\$38.4)
AcBel (6282.TW, NT\$19.95)
Accelink (002281.SZ, Rmb30.9)
Accton (2345.TW, NT\$209.0)
Acer Group (2353.TW, NT\$16.25)
Advanced Wireless Semiconductor Company (8086.TWO, NT\$91.1)
Advantech Co., Ltd. (2395.TW, NT\$278.0)
Airtac (1590.TW, NT\$555.0)
Alpha Networks (3380.TW, NT\$26.0)
Amkor Technology Inc. (AMKR.OQ, \$9.39)
Amtran (2489.TW, NT\$7.05)
Anritsu (6754.T, ¥2,184)
Axiomtek (3088.TWO, NT\$53.5)
BOE (000725.SZ, Rmb3.93)
BYD Electronic (0285.HK, HK\$17.56)
CMC Magnetics (2323.TW, NT\$8.65)
COMPEQ MFG. (2313.TW, NT\$42.0)
Cameo (6142.TW, NT\$7.0)
Career Tech. (6153.TW, NT\$26.6)
Casetek Holdings Limited (5264.TW, NT\$42.4)
Catcher Technology (2474.TW, NT\$232.5)
Chauan-Choung (6230.TW, NT\$238.5)
Chenbro (8210.TW, NT\$91.4)
Cheng Uei Precision Industry Co. (2392.TW, NT\$36.35)
Chicony (2385.TW, NT\$80.6)
Chicony Power (6412.TW, NT\$62.6)
Chin-Poon Industrial Co., Ltd. (2355.TW, NT\$22.5)
Chinasoft (0354.HK, HK\$4.66)
Chipbond (6147.TWO, NT\$58.9)
Chroma (2360.TW, NT\$135.5)
Chungwha Precision (6510.TWO, NT\$623.0, UNDERPERFORM[V], TP NT\$480.0)
Compal Electronics (2324.TW, NT\$18.45)
Coretronic Corp (5371.TWO, NT\$30.8)
CyberPower (3617.TW, NT\$79.6)
CyberTAN Technology Inc. (3062.TW, NT\$14.6)
Cyberlink (5203.TW, NT\$115.0)
D-Link (2332.TW, NT\$12.5)
Darfon (8163.TW, NT\$35.8)
Delta Electronics (2308.TW, NT\$138.5)
Dynapack (3211.TWO, NT\$72.4)
E Ink Holdings Inc (8069.TWO, NT\$35.8)
E-Tron (096040.KQ, W168)
EDOM (3048.TW, NT\$17.15)
Edison Opto (3591.TW, NT\$12.1)
Egis Technology Inc. (6462.TWO, NT\$180.0)
Elan Microelectronics Corp (2458.TW, NT\$91.5)
Elite Material (2383.TW, NT\$144.0)
Elitegroup Comp (2331.TW, NT\$11.3)
Enncoconn (6414.TW, NT\$184.0)
Epistar Corporation (2448.TW, NT\$35.7)
Eson Precision (5243.TW, NT\$30.4)
Etron (5351.TWO, NT\$6.22)
Everlight Electronics Co Ltd (2393.TW, NT\$32.1)
FIT Hon Teng (6088.HK, HK\$2.08)
Faraday Technology Corporation (3035.TW, NT\$41.35)
Flytech (6206.TW, NT\$67.5)
FocalTech Corporation, Ltd. (3545.TW, NT\$31.2)
Foxconn Industrial Internet (601138.SS, Rmb13.79)
Foxconn Technology Corp (2354.TW, NT\$54.8)
G-Tech (3149.TW, NT\$7.11)
GCE (2368.TW, NT\$34.1)
GCS Hldg (4991.TWO, NT\$52.8)
GTK (2441.TW, NT\$44.1)
GUC (3443.TW, NT\$216.0)
Gemtek Technology Co Ltd (4906.TW, NT\$21.1)
Giantplus Technology (8105.TW, NT\$8.92)
Gigabyte Technology Co., Ltd (2376.TW, NT\$62.4)
Global Mixed-Mode Technology (8081.TW, NT\$139.0)
GoerTek (002241.SZ, Rmb21.16)
HOLY STONE (3026.TW, NT\$127.5)
HTC Corp (2498.TW, NT\$28.3)
Hannstar Display (6116.TW, NT\$6.0)
Hirose Electric (6806.T, ¥12,070)
Hiwin (2049.TW, NT\$283.5)
Hon Hai Precision (2317.TW, NT\$77.1)
Hua Hong Semiconductor Limited (1347.HK, HK\$16.5, NEUTRAL[V], TP HK\$17.5)
Huatian (002185.SZ, Rmb14.66)
I Chiun (2486.TW, NT\$7.38)
IBASE (8050.TWO, NT\$37.65)

IEI (3022.TW, NT\$40.1)
ITEQ CORP (6213.TW, NT\$142.0)
Ichia (2402.TW, NT\$12.4)
Infortrend (2495.TW, NT\$11.25)
Innolux Corporation (3481.TW, NT\$6.22)
Intel Corp. (INTC.OQ, \$58.28)
IntelliEPI (4971.TWO, NT\$54.6)
Inventec Co Ltd (2356.TW, NT\$23.6)
JCET (600584.SS, Rmb31.21)
KINPO (2312.TW, NT\$11.6)
KYEC (2449.TW, NT\$35.55)
King Slide (2059.TW, NT\$301.0)
Kinsus Interconnect Tech (3189.TW, NT\$50.7)
LG Innotek (011070.KS, W146,000)
LPI (2369.TW, NT\$9.41)
LandMark (3081.TWO, NT\$281.5)
Lanner Elec (6245.TWO, NT\$55.3)
Largan Precision (3008.TW, NT\$4065.0)
Ledlink (5230.TWO, NT\$23.2)
Lens Technology (300433.SZ, Rmb18.66)
Lite-On Technology (2301.TW, NT\$46.1)
Luxshare (002475.SZ, Rmb48.23)
Macronix (2337.TW, NT\$32.5)
MediaTek Inc. (2454.TW, NT\$411.0, OUTPERFORM, TP NT\$500.0)
Merry Electronics Co. Ltd (2439.TW, NT\$131.5)
MiTAC Holdings Corporation (3706.TW, NT\$29.75)
Micro-Star International Co., Ltd (2377.TW, NT\$103.5)
Min Aik (3060.TW, NT\$12.9)
Motech Industries (6244.TWO, NT\$7.3)
Murata Manufacturing (6981.T, ¥6,122)
Nan Ya Printed Circuit Board (8046.TW, NT\$69.9)
Nanya Technology (2408.TW, NT\$60.1)
Nissin Foods (1475.HK, HK\$6.61)
Novatek Microelectronics Corp Ltd (3034.TW, NT\$204.0)
O-film (002456.SZ, Rmb16.06)
On-Bright Elec (4947.TWO, NT\$228.5)
Orient Semicon (2329.TW, NT\$11.5)
Pan Jit (2481.TW, NT\$23.25)
Parade Technologies (4966.TWO, NT\$892.0)
Pegatron (4938.TW, NT\$62.6)
Posiflex (8114.TW, NT\$88.1)
Promate (6189.TW, NT\$33.7)
Promise (3057.TW, NT\$4.55)
QUALCOMM Inc. (QCOM.OQ, \$75.77)
Qisda (2352.TW, NT\$16.25)
Quanta Computer (2382.TW, NT\$65.2)
Radiant Opto-Electronics (6176.TW, NT\$97.3)
Realtek Semiconductor (2379.TW, NT\$245.5)
Ritek (2349.TW, NT\$7.1)
SENAO (2450.TW, NT\$27.7)
SK Hynix Inc. (000660.KS, W81,900)
SZS (3376.TW, NT\$127.5)
Samsung Electro-Mechanics (009150.KS, W119,500)
Samsung Electronics (005930.KS, W47,850)
Semiconductor Manufacturing International Corp. (0981.HK, HK\$19.16, UNDERPERFORM, TP HK\$16.0)
Sercomm (5388.TW, NT\$72.1)
Silergy (6415.TW, NT\$1470.0)
Silitech Technology Corp (3311.TW, NT\$27.5)
Sino-American Silicon Products (5483.TWO, NT\$87.0)
Sony (6758.T, ¥6,865)
Sunny Optical (2382.HK, HK\$122.5)
Sunway Communication (300136.SZ, Rmb44.52)
Syncomm (3150.TWO, NT\$9.1)
Synnex Technology International Corp (2347.TW, NT\$42.4)
Systex (6214.TW, NT\$77.6)
TDK (6762.T, ¥9,440)
TPK Holdings (3673.TW, NT\$40.0)
TXC Corp. (3042.TW, NT\$57.0)
Taiwan Semiconductor Manufacturing (2330.TW, NT\$298.0, NEUTRAL, TP NT\$300.0)
Taiyo Yuden (6976.T, ¥3,085)
Teco (1504.TW, NT\$26.95)
Tianma (000050.SZ, Rmb14.25)
TongFu (002156.SZ, Rmb25.76)
Tongda (0698.HK, HK\$0.51)
Toshiba (6502.T, ¥2,691)
Transcend (2451.TW, NT\$69.0)
Tripod Technology (3044.TW, NT\$109.5)
UDE (3689.TWO, NT\$23.15)
UMT (3491.TWO, NT\$72.7)
Unimicron Technology Corp (3037.TW, NT\$43.9)
United Microelectronics (2303.TW, NT\$15.4)
Unity Opto Tech (2499.TW, NT\$4.12)
Vanguard International Semiconductor (5347.TWO, NT\$70.1, NEUTRAL, TP NT\$66.5)
Visual Photonics Epitaxy Co., Ltd (2455.TW, NT\$90.9)
WT (3036.TW, NT\$38.75)
Win Semiconductors Corp (3105.TWO, NT\$268.5)
Wistron (3231.TW, NT\$28.1)
YTEC (6261.TWO, NT\$57.9)

ZHONGJIINNOLIGHT (300308.SZ, Rmb64.43)
eMemory (3529.TWO, NT\$297.5)
tuc (6274.TWO, NT\$144.0)

Disclosure Appendix

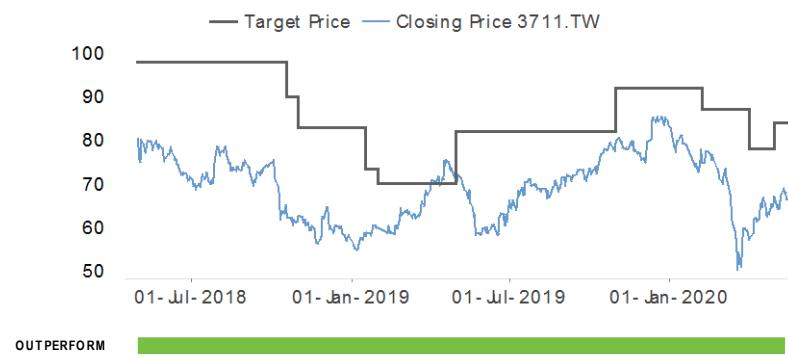
Analyst Certification

Randy Abrams, CFA, and Haas Liu each certify, with respect to the companies or securities that the individual analyzes, that (1) the views expressed in this report accurately reflect his or her personal views about all of the subject companies and securities and (2) no part of his or her compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

3-Year Price and Rating History for ASE Industrial Holdings (3711.TW)

| 3711.TW | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (NT\$) | (NT\$) | Rating |
| 30-Apr-18 | 80.30 | 98.00 | O * |
| 18-Oct-18 | 63.20 | 90.00 | |
| 31-Oct-18 | 62.40 | 83.00 | |
| 17-Jan-19 | 58.10 | 73.50 | |
| 31-Jan-19 | 60.00 | 70.00 | |
| 01-May-19 | 71.70 | 82.00 | |
| 31-Oct-19 | 79.50 | 92.00 | |
| 08-Feb-20 | 74.80 | 87.00 | |
| 02-Apr-20 | 57.20 | 78.00 | |
| 30-Apr-20 | 67.10 | 84.00 | |

* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Chunghwa Precision (6510.TWO)

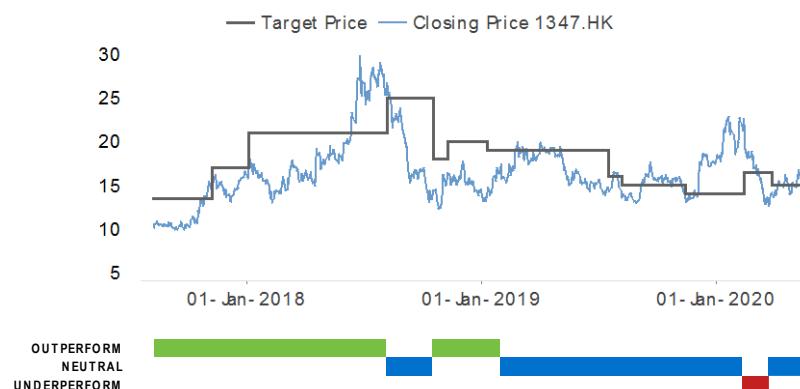
| 6510.TWO | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (NT\$) | (NT\$) | Rating |
| 09-Jan-18 | 1080.00 | 1070.00 | N * |
| 08-Feb-18 | 1050.00 | 1020.00 | |
| 11-Apr-18 | 820.00 | 860.00 | |
| 08-Aug-18 | 794.00 | 825.00 | |
| 05-Oct-18 | 459.00 | 470.00 | |
| 07-Jan-19 | 509.00 | 440.00 | |
| 15-Feb-19 | 419.00 | 285.00 | U |
| 25-Apr-19 | 490.00 | 500.00 | N |
| 13-Jun-19 | 382.00 | 360.00 | |
| 08-Aug-19 | 585.00 | 600.00 | |
| 04-Oct-19 | 835.00 | 835.00 | |
| 09-Dec-19 | 983.00 | 1100.00 | |
| 14-Feb-20 | 941.00 | 1050.00 | |
| 02-Apr-20 | 715.00 | 850.00 | |
| 23-Apr-20 | 671.00 | 510.00 | U |

* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Hua Hong Semiconductor Limited (1347.HK)

| 1347.HK | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (HK\$) | (HK\$) | Rating |
| 15-May-17 | 11.38 | 13.50 | O |
| 08-Nov-17 | 14.72 | 17.00 | |
| 04-Jan-18 | 17.60 | 21.00 | |
| 08-Aug-18 | 25.70 | 25.00 | N |
| 18-Oct-18 | 14.40 | 18.00 | O |
| 09-Nov-18 | 16.36 | 20.00 | |
| 10-Jan-19 | 14.46 | 19.00 | |
| 01-Feb-19 | 15.80 | 19.00 | N |
| 17-Jul-19 | 14.58 | 16.00 | |
| 07-Aug-19 | 13.64 | 15.00 | |
| 14-Nov-19 | 13.48 | 14.00 | |
| 14-Feb-20 | 19.32 | 16.50 | U |
| 27-Mar-20 | 14.10 | 15.00 | N |



* Asterisk signifies initiation or assumption of coverage.

3-Year Price and Rating History for LG Innotek (011070.KS)

| 011070.KS | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (W) | (W) | Rating |
| 13-Jul-17 | 157,500 | 185,000 | O |
| 30-Oct-17 | 178,000 | 175,000 | N |
| 11-Jan-18 | 150,500 | 145,000 | |
| 23-Jan-18 | 130,500 | 130,000 | |
| 15-Mar-18 | 133,500 | 125,000 | |
| 24-Apr-18 | 125,000 | 100,000 | |
| 15-Jun-18 | 153,500 | 125,000 | |
| 05-Jul-18 | 145,500 | 190,000 | O |
| 24-Oct-18 | 121,500 | 195,000 | |
| 08-Nov-18 | 111,500 | 190,000 | |
| 03-Jan-19 | 81,700 | 135,000 | |
| 25-Jan-19 | 96,100 | 130,000 | |
| 23-Apr-19 | 122,000 | 140,000 | |
| 29-Oct-19 | 126,500 | 150,000 | |
| 11-Dec-19 | 133,500 | 160,000 | |
| 29-Jan-20 | 158,000 | 195,000 | |
| 25-Mar-20 | 113,500 | 185,000 | |
| 22-Apr-20 | 129,500 | 150,000 | |



* Asterisk signifies initiation or assumption of coverage.

3-Year Price and Rating History for MediaTek Inc. (2454.TW)

| 2454.TW | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (NT\$) | (NT\$) | Rating |
| 12-Jul-17 | 254.50 | 225.00 | N |
| 12-Oct-17 | 303.50 | 300.00 | |
| 01-Nov-17 | 338.00 | 330.00 | |
| 05-Dec-17 | 318.00 | 315.00 | |
| 01-Feb-18 | 307.00 | 350.00 | O |
| 30-Apr-18 | 340.00 | 400.00 | |
| 09-Jul-18 | 272.50 | 350.00 | |
| 01-Aug-18 | 275.00 | 325.00 | |
| 09-Oct-18 | 228.50 | 300.00 | |
| 17-Jan-19 | 237.00 | 290.00 | |
| 01-Apr-19 | 285.50 | 350.00 | |
| 01-May-19 | 295.50 | 365.00 | |
| 08-Oct-19 | 384.50 | 440.00 | |
| 31-Oct-19 | 408.00 | 450.00 | |
| 13-Jan-20 | 422.00 | 500.00 | |
| 07-Feb-20 | 381.00 | 480.00 | |
| 02-Apr-20 | 334.00 | 430.00 | |

* Asterisk signifies initiation or assumption of coverage.

3-Year Price and Rating History for SK Hynix Inc. (000660.KS)

| 000660.KS | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (W) | (W) | Rating |
| 04-Jun-18 | 89,800 | | NR |
| 21-Jun-18 | 88,500 | 140,000 | O |
| 25-Oct-18 | 64,700 | 108,000 | |
| 11-Jan-19 | 65,100 | 95,000 | |
| 08-Mar-19 | 66,700 | 91,000 | |
| 25-Apr-19 | 80,200 | 98,000 | |
| 29-May-19 | 66,100 | 95,000 | |
| 25-Sep-19 | 81,900 | 103,000 | |
| 02-Apr-20 | 80,000 | 118,000 | |

* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Samsung Electro-Mechanics (009150.KS)

| 009150.KS | Closing Price (W) | Target Price (W) | Rating |
|-----------|----------------------|---------------------|--------|
| 15-Jun-17 | 86,000 | 120,000 | O * |
| 13-Jul-17 | 104,500 | 130,000 | |
| 11-Jan-18 | 105,000 | 140,000 | |
| 27-Apr-18 | 121,500 | 145,000 | |
| 07-Jun-18 | 145,000 | 165,000 | |
| 25-Jul-18 | 158,500 | 180,000 | |
| 31-Oct-18 | 118,000 | 185,000 | |
| 29-Jan-19 | 113,500 | 160,000 | |
| 13-Mar-19 | 100,500 | 154,000 | |
| 03-Apr-19 | 111,000 | 150,000 | |
| 24-Jun-19 | 95,500 | 125,000 | |
| 14-Aug-19 | 91,800 | 120,000 | |
| 18-Sep-19 | 97,100 | 125,000 | |
| 24-Oct-19 | 113,000 | 130,000 | |
| 15-Jan-20 | 133,500 | 160,000 | |
| 10-Mar-20 | 128,500 | 150,000 | |
| 02-Apr-20 | 96,800 | 125,000 | |

* Asterisk signifies initiation or assumption of coverage.

3-Year Price and Rating History for Samsung Electronics (005930.KS)

| 005930.KS | Closing Price (W) | Target Price (W) | Rating |
|-----------|----------------------|---------------------|--------|
| 23-May-17 | 44,920 | 63,000 | O |
| 27-Jul-17 | 49,800 | 69,200 | |
| 31-Oct-17 | 55,080 | 72,400 | |
| 09-Mar-18 | 49,740 | 70,800 | |
| 27-Apr-18 | 53,000 | 74,000 | |
| 11-Jun-18 | 49,900 | 72,000 | |
| 21-Sep-18 | 47,400 | 70,000 | |
| 13-Dec-18 | 40,000 | 64,500 | |
| 08-Jan-19 | 38,100 | 53,000 | |
| 31-Jan-19 | 46,150 | 58,000 | |
| 15-Mar-19 | 44,200 | 54,800 | |
| 19-Sep-19 | 49,150 | 61,300 | |
| 31-Jan-20 | 56,400 | 82,000 | |
| 02-Apr-20 | 46,800 | 66,000 | |
| 29-Apr-20 | 50,000 | 65,000 | |

* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Semiconductor Manufacturing International Corp. (0981.HK)

| 0981.HK | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (HK\$) | (HK\$) | Rating |
| 09-Aug-17 | 7.96 | 9.05 | N |
| 07-Nov-17 | 13.80 | 11.30 | U |
| 17-Nov-17 | 11.08 | 11.15 | |
| 12-Feb-18 | 8.86 | 8.00 | |
| 10-May-18 | 10.78 | 11.00 | N |
| 18-Oct-18 | 6.76 | 7.80 | |
| 08-Nov-18 | 6.56 | 6.60 | |
| 15-Feb-19 | 8.03 | 8.20 | |
| 09-May-19 | 8.03 | 8.35 | |
| 09-Aug-19 | 8.91 | 9.50 | |
| 13-Nov-19 | 10.34 | 10.20 | |
| 14-Feb-20 | 16.26 | 13.00 | U |
| 02-Apr-20 | 12.46 | 10.70 | |
| 07-May-20 | 16.94 | 17.00 | N |
| 14-May-20 | 18.84 | 17.60 | |



* Asterisk signifies initiation or assumption of coverage.

3-Year Price and Rating History for Taiwan Semiconductor Manufacturing (2330.TW)

| 2330.TW | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (NT\$) | (NT\$) | Rating |
| 15-May-17 | 206.00 | 202.00 | N |
| 13-Jul-17 | 214.50 | 210.00 | |
| 10-Sep-17 | 218.00 | 217.00 | |
| 20-Oct-17 | 237.50 | 241.00 | |
| 19-Jan-18 | 255.50 | 259.00 | |
| 20-Feb-18 | 236.50 | 275.00 | O |
| 12-Jun-18 | 229.00 | 270.00 | |
| 12-Dec-18 | 226.50 | 250.00 | |
| 01-Apr-19 | 245.50 | 280.00 | |
| 19-Apr-19 | 264.50 | 300.00 | |
| 27-May-19 | 231.00 | 270.00 | |
| 19-Jul-19 | 259.00 | 290.00 | |
| 14-Oct-19 | 290.00 | 325.00 | |
| 16-Dec-19 | 336.00 | 375.00 | |
| 17-Jan-20 | 333.00 | 385.00 | |
| 04-Mar-20 | 320.50 | 360.00 | |
| 02-Apr-20 | 271.50 | 320.00 | |
| 15-May-20 | 298.00 | 350.00 | |



* Asterisk signifies initiation or assumption of coverage.

3-Year Price and Rating History for Vanguard International Semiconductor (5347.TWO)

| 5347.TWO | Closing Price | Target Price | |
|-----------|---------------|--------------|--------|
| Date | (NT\$) | (NT\$) | Rating |
| 10-Jul-17 | 55.00 | 51.00 | N |
| 07-Nov-17 | 57.60 | 58.00 | |
| 05-Dec-17 | 68.70 | 62.00 | |
| 08-Feb-18 | 61.60 | 65.00 | |
| 02-Jul-18 | 69.80 | 69.00 | |
| 08-Aug-18 | 83.10 | 75.00 | |
| 09-Oct-18 | 60.00 | 70.00 | |
| 31-Oct-18 | 57.00 | 60.00 | |
| 09-Jan-19 | 58.00 | 57.00 | |
| 10-Apr-19 | 67.20 | 65.00 | |
| 07-Jun-19 | 58.20 | 60.00 | |
| 30-Jul-19 | 63.50 | 64.00 | |
| 13-Jan-20 | 79.80 | 80.00 | |
| 02-Apr-20 | 58.90 | 67.00 | |
| 28-Apr-20 | 68.40 | 70.00 | |



* Asterisk signifies initiation or assumption of coverage.

As of December 10, 2012 Analysts' stock rating are defined as follows:

Outperform (O) : The stock's total return is expected to outperform the relevant benchmark* over the next 12 months.

Neutral (N) : The stock's total return is expected to be in line with the relevant benchmark* over the next 12 months.

Underperform (U) : The stock's total return is expected to underperform the relevant benchmark* over the next 12 months.

**Relevant benchmark by region: As of 10th December 2012, Japanese ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. As of 2nd October 2012, U.S. and Canadian as well as European (excluding Turkey) ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. For Latin America, Turkey and Asia (excluding Japan and Australia), stock ratings are based on a stock's total return relative to the average total return of the relevant country or regional benchmark (India - S&P BSE Sensex Index); prior to 2nd October 2012 U.S. and Canadian ratings were based on (1) a stock's absolute total return potential to its current share price and (2) the relative attractiveness of a stock's total return potential within an analyst's coverage universe. For Australian and New Zealand stocks, the expected total return (ETR) calculation includes 12-month rolling dividend yield. An Outperform rating is assigned where an ETR is greater than or equal to 7.5%; Underperform where an ETR less than or equal to 5%. A Neutral may be assigned where the ETR is between -5% and 15%. The overlapping rating range allows analysts to assign a rating that puts ETR in the context of associated risks. Prior to 18 May 2015, ETR ranges for Outperform and Underperform ratings did not overlap with Neutral thresholds between 15% and 7.5%, which was in operation from 7 July 2011.*

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Market Weight : The analyst's expectation for the sector's fundamentals and/or valuation is neutral over the next 12 months.

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| Rating | Versus universe (%) | Of which banking clients (%) |
|--------------------|---------------------|------------------------------|
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| Underperform/Sell* | 12% | (23% banking clients) |
| Restricted | 1% | |

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Target Price and Rating

Valuation Methodology and Risks: (12 months) for ASE Industrial Holdings (3711.TW)

Method: Our target price of NT\$75 for ASE is based on 14x 2021 P/E (price-to-earnings) consolidated earnings contribution from SPIL, following the approval of its acquisition by anti-trust regulators and shareholders at both companies. The consolidation gives the new ASE 30% global outsourced packaging and test market share, and half of advanced packaging, also a favourable scale advantage to #2 player Amkor at 15% market share. We thus rate the stock OUTPERFORM. We view the merger as a necessary counter-balance to China's aggressive M&A and expansion strategy, and also the ability to invest in advanced packaging to keep the foundry entry limited to high-end and more customised projects.

Risk: Risks to our target price of NT\$75 and OUTPERFORM rating for ASE would be an escalating trade war that places tariffs on imports to China or the US limiting tech demand, a recession and semiconductor downturn, or a rise in competitive pricing from Chinese suppliers.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Chunghwa Precision (6510.TWO)

Method: We rate Chungwa Precision UNDERPERFORM with a target price of NT\$480, based on 20x 2021 P/E, in line with its growth peers, as we believe the company's sales will moderate in 2021E due to market share loss in application processors, offsetting growth in full-solution business. In addition, the company's opportunity in satellite PCB is also more moderate with lower content from spec downgrade.

Risk: Upside risks to our UNDERPERFORM rating and TP of NT\$480 for Chungwa Precision include faster-than-expected full-solution ramp-up at high margin from key customers and the satellite project's opportunity delivering well.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Hua Hong Semiconductor Limited (1347.HK)

Method: Our target price of HK\$17.5 for Hua Hong Semiconductor Limited is based on 1.5x P/B (price-to-book), which is its mid cycle valuation and reflecting only low single digits ROE (return on equity) in the next 1-2 years. Hua Hong will still benefit from the China localization but in the next 2 years will face margin pressure from ramping new capacity for its 12" fab and higher depreciation, dragging its profitability, offsetting the premium the company benefits from China semiconductor localization. We therefore rate the stock NEUTRAL.

Risk: Hua Hong faces several risks that could impact its business outlook and our HK\$17.5 target price, and could cause us to change our NEUTRAL rating including better China semiconductor demand and more disciplined capacity expansion from its major foundry competition on 8" and mature 12" nodes.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for MediaTek Inc. (2454.TW)

Method: Our target price of NT\$500 for Mediatek is based on 15x 2021E ex-cash EPS (earnings per share), in line with global peers. We have a more positive outlook as the company is now bottoming out and set for share gain in the core mobile business with improving margins and thus have an OUTPERFORM rating on Mediatek.

Risk: Risks that could impede achievement of our NT\$500 target price and cause us to change our OUTPERFORM rating for Mediatek include the impact of competitive products and pricing, timely design acceptance by its customers, timely introduction of new technologies, ability to ramp new products into volume, industry-wide shifts in supply and demand for semiconductor products, industry overcapacity, availability of manufacturing capacity, and financial stability in end markets.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Semiconductor Manufacturing International Corp. (0981.HK)

Method: Our HK\$16 target price for Semiconductor Manufacturing International Corp. is based on 1.5x P/B (price-to-book), at the low end of its 1-1.4x past three-year range. We have an UNDERPERFORM rating on SMIC due to profitability upside being limited by its investment.

Risk: Risks to our HK\$16 target price and UNDERPERFORM rating for SMIC include: (1) the global semiconductor cycle picks up stronger than expected especially for China smartphones in 2020 from 5G ramps (being an upstream company, SMIC tends to be more cyclical than other tech plays). (2) Price competition from peers is less severe than expected. (3) Its advanced technology development is faster than expected, allowing the company to penetrate into new markets at better pricing and profitability.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Taiwan Semiconductor Manufacturing (2330.TW)

Method: Our NT\$300 target price for TSMC is based on 18.5x 2021E EPS (earnings per share), implying 3.2x P/B (price-to-book), near the midpoint of its average 11-15x and 2.5-3.5x range. We see its business outlook improving, and technology leadership should keep its market share and profitability intact; dividends will likely rise again as capex moderates. We therefore have an NEUTRAL rating on the stock.

Risk: Risks that could impede achievement of our NT\$300 target price and NEUTRAL rating for TSMC would include: fierce competition, demand failing to pick up, or Apple orders not being as strong as expected.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Vanguard International Semiconductor (5347.TWO)

Method: Our target price of NT\$66.5 and NEUTRAL rating for Vanguard International Semiconductor are based on 16x 2021E P/E estimate, which is the mid-cycle valuation for the company, to reflect a more muted business outlook. While ROE (return on equity) looks modest at 15%, RONA (return on net assets), excluding the cash, is a healthy 32%. Thus, we have a NEUTRAL rating on Vanguard.

Risk: Upside risk to our NT\$66.5 target price and NEUTRAL rating for Vanguard International Semiconductor is a growing fingerprint business and continued healthy growth for its power management IC business from both fabless and IDM customers. Downside risk is weaker-than-expected driver IC demand and more competition from its China peers for power management IC business.

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Within the past 12 months, Credit Suisse has received compensation for investment banking services from the following issuer(s): 3481.TW, INTC.OQ, 000660.KS

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Credit Suisse currently has, or had within the past 12 months, the following issuer(s) as client(s), and the services provided were non-investment-banking, non securities-related: 005930.KS, INTC.OQ, 3673.TW, 011070.KS, 000660.KS, 009150.KS

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This research report is authored by:

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