

UBS Global I/O

Silicon Wafers

Not optimistic about prices [Erratum]

Erratum: This note replaces an earlier version to correct statements in the first paragraph which reversely mentioned long-term contract and spot.

Concern about possible price declines after long-term contracts expire

We have updated our wafer supply and demand outlook. We expect the overall 300mm wafer capacity utilisation ratio in the sector to trend from 88.0% in 2019 to 87.9% in 2020 and 90.2% in 2021. Long-term contract periods differ from wafer maker to wafer maker, but many long-term contracts are expected to expire during the period. In addition to spot (non-contract) prices remaining below long-term contract prices, excess supply is expected to continue as companies add capacity; we see significant risk of prices declining when long-term contracts expire. We concur with market expectations of a demand recovery, but see downside in the outlook for prices.

Demand outlook, mainly for logic, has improved, but capacity continues to rise

Based on results at TSMC and Intel, demand for logic products can be expected to be stronger than previously estimated. With an end to inventory adjustments, we expect a particularly strong demand recovery in the latter half of the year. On the supply side, capex plans at individual companies remain at a high level (see page 5). As a result, we think there are unlikely to be any causes for concern about supply shortages through around 2021. With regard to the coronavirus outbreak, while wafer production in China is limited, the country accounts for around 10% of demand and some degree of negative impact is therefore expected (see page 8-10). Lacklustre final demand, mainly for smartphones, should also be kept in mind.

Bargaining power not expected to return near term

We estimate that as of October-December 2019, there was a difference of around 10%-15% between long-term contract prices and spot prices. Given that oversupply of around 10% will likely continue, it is difficult to foresee a recovery in spot prices. Prices are currently being supported by long-term contracts, but if these contracts expire we think customers are very likely to intensify requests for price reductions. One argument supporting the bullish camp is the view that prices will be able to be maintained since the bargaining power of wafer manufacturers will strengthen again when long-term contracts expire, backed by growth in demand. However, considering capacity expansion plans at individual companies, we think it will be 2022 or thereafter at the earliest before wafer makers regain a dominant bargaining position.

Ratings on individual stocks; maintain a cautious stance

We rate Shin-Etsu Chemical, GlobalWafers, and Siltronic Neutral, SUMCO Sell. In particular, we think valuation indicators for SUMCO are less than attractive.

Equities

Global

Semiconductors

Go Miyamoto

Analyst

go.miyamoto@ubs.com

+81-3-5208 7104

Sunny Lin

Analyst

sunny.lin@ubs.com

+886-2-8722 7346

Francois-Xavier Bouvignies

Analyst

francois.bouvignies@ubs.com

+44-20-7568 7105

Bill Lu

Analyst

bill.lu@ubs.com

+852-2971 8360

Nicolas Gaudois

Analyst

nicolas.gaudois@ubs.com

+852-2971 5681

Kenji Yasui

Analyst

kenji.yasui@ubs.com

+81-3-5208 6211

David Mulholland, CFA

Analyst

david.mulholland@ubs.com

+44-20-7568 4069

Taewoo Lee

Analyst

taewoo.lee@ubs.com

+852-2971 6873

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SIGNPOSTS

Upcoming events likely to become catalysts:

Early March ● **GlobalWafers and Formosa SUMCO will release February sales figures**

Confirming effects of the new coronavirus outbreak

February sales figures should give us a hint of the extent to which the coronavirus outbreak is affecting earnings at wafer makers. The hurdle for yoy growth is declining, but we are not optimistic considering that Apple has just indicated January-March sales may disappoint as a result of the outbreak. However, some customers might be trying to boost inventories in light of the disruption in logistics.

9 March ● **Siltronic is scheduled to announce full-year plans**

Lower prices likely to become more obvious

Siltronic is expected to disclose full-year FY20 (year to December 2020) plans and to host a results briefing. Because of a declining ratio of long-term contracts, we expect a picture of lower average unit prices to emerge. We expect FY20 sales to decline 2% yoy, to €1.247bn, and expect EBIT of €227m, down 24% yoy.

15 March ● **GlobalWafers full-year results**

We will be looking at demand and price trends in particular

October-December sales data have already been released. We will be looking at demand and price forecasts, at trends in long-term contracts, and expected capacity utilisation rates at the new Korean plant (with capacity of 176,000 300mm wafers a month).

Mid-2020 ● **Demand likely to begin recovering**

We expect a recovery in demand

We expect demand to begin to recover from around the middle of the year, supported by an end to most inventory adjustments and by increased production of NAND, logic, and others.

From H2 2020 forward ● **Price outlook likely to deteriorate**

We are concerned about the possibility of lower prices after major long-term contracts expire

Because of continuing oversupply and a price gap between long-term contract prices and spot prices, we expect average unit prices to decline as long-term contracts expire; the price outlook looks set to deteriorate.

Revised supply and demand outlook

We have updated our supply and demand outlook. We now expect industry-wide 300mm wafer capacity utilisation of 88.0% in FY19, 87.9% in FY20, and 90.2% in FY21 (previously 88.3% in FY19, 87.8% in FY20, and 90.3% in FY21).

While we have taken into account the fact that October-December demand was slightly weaker than we anticipated, we have also reflected a brighter outlook for logic-related demand. As a result, we have revised our 2020 300mm wafer demand forecast to growth of 5.8%, from 5.3% growth previously, but our 2020 demand forecast remains unchanged at 6.31m wafers/month.

Based on the most recent results at TSMC and results at Intel, we expect demand for logic applications to be stronger than we previously thought. We raised our 2020 sales growth ratio for TSMC (covered by our analyst Bill Lu) by four points in a 16 January [report](#), to 20% from 16%.

We have made no changes to our production capacity estimates because there have been no major changes in investment trends recently at industry companies (discussed in more detail later in these pages).

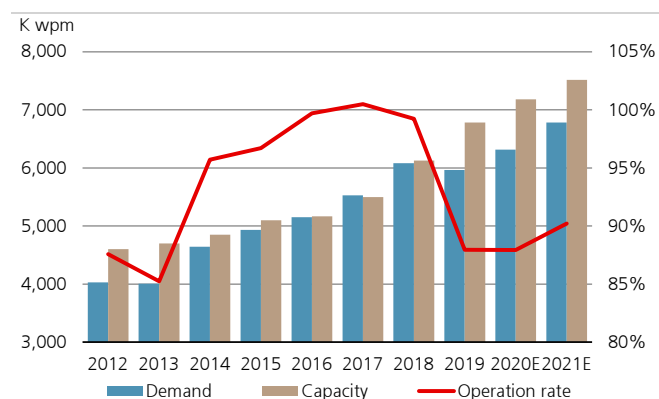
Oversupply of about 10% continues

5.8% demand growth in 2020

Stronger outlook for logic applications

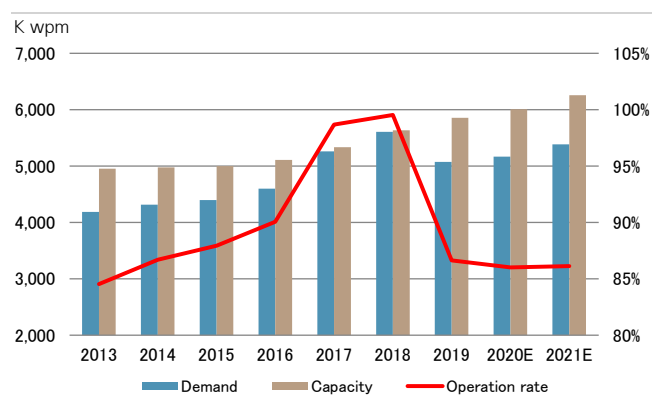
No change to our production capacity forecast

Figure 1: 300mm wafer supply and demand outlook



Source: SEMI, UBS estimates

Figure 2: 200mm wafer supply and demand outlook



Source: SEMI, UBS estimates

Figure 3: 300mm wafer supply and demand model

	2014	2015	2016	2017	2018	2019	2020E	2021E
Total demand (k spm)	4,642	4,932	5,153	5,527	6,081	5,965	6,313	6,780
YoY	15.9%	6.2%	4.5%	7.3%	10.0%	-1.9%	5.8%	7.4%
NAND	1,165	1,269	1,398	1,535	1,589	1,497	1,598	1,750
DRAM	1,156	1,102	1,104	1,118	1,189	1,254	1,228	1,299
Logic and others	2,321	2,561	2,651	2,874	3,303	3,214	3,487	3,731
Total capacity (k spm)	4,850	5,100	5,168	5,500	6,129	6,782	7,180	7,516
YoY	3.2%	5.2%	1.3%	6.4%	11.4%	10.7%	5.9%	4.7%
Shin-Etsu Chemical			1,500	1,650	1,965	2,143	2,240	2,287
SUMCO			1,330	1,423	1,565	1,742	1,856	1,931
GlobalWafers			738	744	786	816	873	1,020
Siltronic			820	877	948	1,029	1,088	1,099
SK Siltron			780	805	865	1,052	1,123	1,180
Operation rate	95.7%	96.7%	99.7%	100.5%	99.2%	88.0%	87.9%	90.2%

Source: SEMI, UBS estimates

Figure 4: 200mm wafer supply and demand model

	2015	2016	2017	2018	2019	2020E	2021E
Total demand (k spm)	4,397	4,600	5,261	5,606	5,073	5,167	5,386
YoY	1.9%	4.6%	14.4%	6.5%	-9.5%	1.9%	4.2%
Total capacity (k spm)	5,000	5,108	5,332	5,633	5,856	6,008	6,254
YoY	0.5%	2.2%	4.4%	5.6%	4.0%	2.6%	4.1%
Shin-Etsu Chemical	1,200	1,236	1,285	1,363	1,403	1,432	1,460
SUMCO	1,250	1,288	1,339	1,406	1,420	1,434	1,449
GlobalWafers	400	432	477	482	487	491	496
SunEdison (GlobalWafers)	600	600	618	624	630	637	643
Siltronic	650	650	670	676	683	690	697
SK Siltron	630	630	649	655	662	669	675
WaferWorks	200	200	218	297	388	419	494
Ferrotec JV		0	0	50	100	150	250
Others	70	72	76	79	83	87	90
	80						
Operation rate	87.9%	90.1%	98.7%	99.5%	86.6%	86.0%	86.1%

Source: SEMI, UBS estimates

Capital spending

Capex levels at wafer makers have declined compared with end-2018 levels, but they remain high. In 2015-2016, when companies appear to have made almost no investment in capacity expansion, quarterly aggregate capex at five wafer companies averaged ¥13.8bn. The same was ¥60.1bn in July-September 2019.

Capex levels remain high

Shin-Etsu Chemical, SUMCO, and Siltronic have already disclosed capex levels for the October-December 2019 quarter. Spending was down 13% qoq in aggregate. If aggregate five-company October-December spending proves to have declined at the same pace, the total will have been ¥52.3bn, which is still a high level. With demand for ever-better wafer performance continuing, we think some of that spending growth represents investment in performance enhancement, but the increased spending to date is too big to be explained without assuming some money is being directed toward capacity expansion. For reference, we think the cost of a brownfield 300mm wafer capacity expansion of 100,000 units/month ranges between ¥25bn and ¥40bn based on 2019 capacity expansions at SUMCO and Siltronic.

Investment in capacity expansion is moving forward

Regarding capital spending, SUMCO Chairman and CEO Mayuki Hashimoto said at SUMCO's 13 February results briefing 'Our policy is to continue to prepare even during down-cycles'. That suggests to us that investment will continue steadily. While we expect demand to recover, the chances of supply and demand becoming tight again look small to us for the time being given ongoing capacity expansion as a result of this kind of investment.

Tight supply and demand looks distant

Figure 5: Wafer manufacturers quarterly capex (2017-2019)

		CY17Q1	CY17Q2	CY17Q3	CY17Q4	CY18Q1	CY18Q2	CY18Q3	CY18Q4	CY19Q1	CY19Q2	CY19Q3	CY19Q4
ShinEtsu	Yen bn	3.9	7.0	7.0	17.6	20.0	16.6	16.0	18.6	18.1	14.7	16.8	12.4
SUMCO	Yen bn	2.7	2.1	5.4	12.6	8.0	9.9	23.0	18.3	18.8	10.9	15.6	13.5
Siltronic	EUR mn	19.3	25.5	16.9	61.4	33.4	45.2	62.8	115.5	72.8	105.1	88.6	94.0
GlobalWafers	NTD mn	775.4	961.6	977.9	659.2	1,689.6	1,643.4	1,692.3	1,671.1	929.8	1,158.6	2,523.4	
SK Siltron	KRW bn	21.7	21.0	26.6	82.7	192.0	151.1	137.0	195.5	158.2	184.9	93.2	
ShinEtsu	Yen bn	3.9	7.0	7.0	17.6	20.0	16.6	16.0	18.6	18.1	14.7	16.8	12.4
SUMCO	Yen bn	2.7	2.1	5.4	12.6	8.0	9.9	23.0	18.3	18.8	10.9	15.6	13.5
Siltronic	Yen bn	2.4	3.1	2.2	8.2	4.4	5.9	8.1	14.9	9.1	13.0	10.6	11.3
GlobalWafers	Yen bn	2.9	3.5	3.6	2.5	6.2	6.1	6.2	6.1	3.3	4.1	8.7	
SK Siltron	Yen bn	2.1	2.1	2.6	8.4	19.4	15.4	13.5	19.6	15.5	17.4	8.4	
5comps Total	Yen bn	14.0	17.7	20.7	49.2	58.1	53.8	66.8	77.5	64.8	60.1	60.1	

Source: Company data, Bloomberg

Figure 6: Wafer manufacturers quarterly capex (2015-2016)

		CY15Q1	CY15Q2	CY15Q3	CY15Q4	CY16Q1	CY16Q2	CY16Q3	CY16Q4
ShinEtsu	Yen bn	6.0	4.7	4.7	4.2	4.2	3.6	3.6	3.9
SUMCO	Yen bn	2.8	2.9	4.7	5.3	6.2	4.6	2.4	3.3
Siltronic	EUR mn	4.3	9.1	27.2	34.4	20.4	22.4	22.1	23.9
GlobalWafers	NTD mn	333.4	235.5	332.3	250.3	338.8	430.5	274.8	432.5
SK Siltron	KRW bn	8.4	22.8	22.5	12.8	16.7	26.3	13.5	12.8
ShinEtsu	Yen bn	6.0	4.7	4.7	4.2	4.2	3.6	3.6	3.9
SUMCO	Yen bn	2.8	2.9	4.7	5.3	6.2	4.6	2.4	3.3
Siltronic	Yen bn	0.6	1.2	3.7	4.6	2.6	2.7	2.5	2.8
GlobalWafers	Yen bn	1.3	0.9	1.3	0.9	1.2	1.4	0.9	1.5
SK Siltron	Yen bn	0.9	2.5	2.4	1.3	1.6	2.4	1.2	1.2
5comps Total	Yen bn	11.5	12.2	16.7	16.3	15.7	14.8	10.6	12.7

Source: Company data, Bloomberg

Customer inventories beginning to peak out

Based on the analysis presented on page 10 of SUMCO's [results materials](#), months of 300mm wafer inventories at customers began to come down after peaking in November. Results at key customers have suggested the same trend.

Judging from comments we are hearing from the various wafer makers, inventories are beginning to normalise in the case of logic applications, but wafer inventories for memory production appear to be quite high still. Overall inventories simply have begun to peak out finally, while remaining at high levels. That suggests that, for the time being, wafer demand will have trouble recovering to the same extent as shipments growth at SUMCO wafer customers because these customers will be working down existing wafer inventories.

In contrast, in the second half of the year, once a round of inventory adjustments has run its course, we see reason to look forward to a robust recovery in wafer demand, although risks include the possibility of an extended period of stagnant demand caused by accumulation of inventories in some parts of the supply chain against the backdrop of the coronavirus outbreak.

Inventories at wafer manufacturers

Looking at months of product inventories at the wafer makers, inventories have declined somewhat at SUMCO, but that is probably partly a reflection of company-specific factors. SUMCO carried out scheduled maintenance at its main production base for 300mm wafers in the October-December quarter, which lowered output. Other companies have not yet disclosed information about their inventory situations, which makes it impossible to get a picture for the wafer industry as a whole at the moment. However, given that October-December demand did not recover, we surmise that there will have been no major change in inventory trends at the wafer makers.

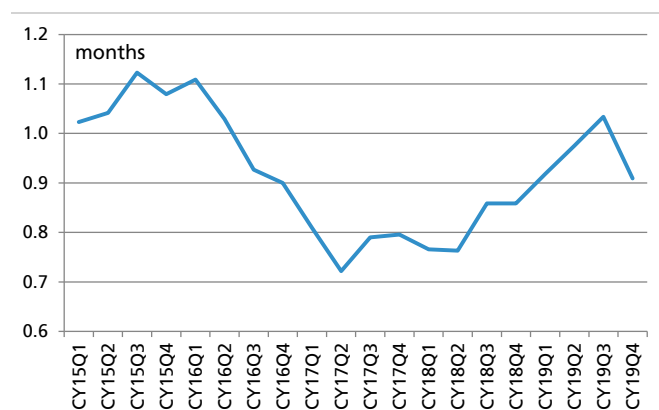
Inventories at customers finally are beginning to come down

Inventories still high at memory makers

We look forward to demand recovery from H2

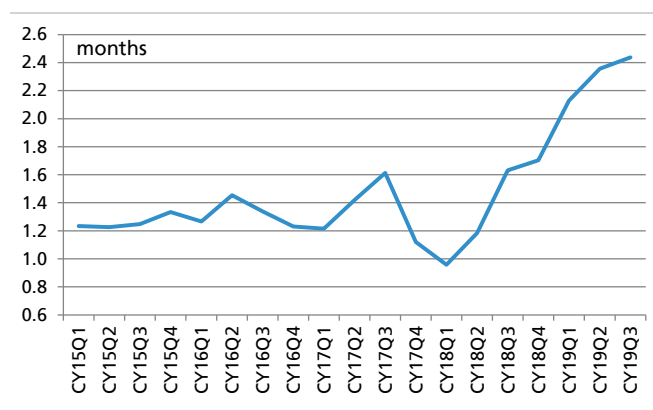
Data for October-December 2019 remain scarce

Figure 7: SUMCO inventory months (finished products)



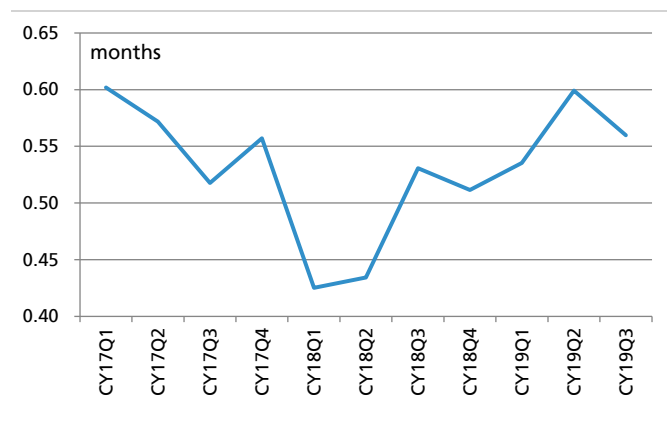
Source: Company data, Bloomberg, UBS (*divided by Cost of Revenue)

Figure 8: SK Siltron inventory months (finished products)



Source: Company data, Bloomberg, UBS (*divided by Cost of Revenue)

Figure 9: GlobalWafers inventory months (finished products)



Source: Company data, Bloomberg, UBS (*divided by cost of revenue)

Possible impact of the coronavirus outbreak

Unlike displays and other products, production of silicon wafers in China is limited. For 300mm wafers in particular, the market is effectively dominated by five companies from Japan, Taiwan, Germany, and South Korea, and wafers produced in China still remain significantly inferior in terms of quality. Accordingly, we think the impact from the coronavirus outbreak on the supply side is very likely to be small. Production bases of the top-five companies are as shown below.

Production in China is limited

Figure 10: Wafer production sites

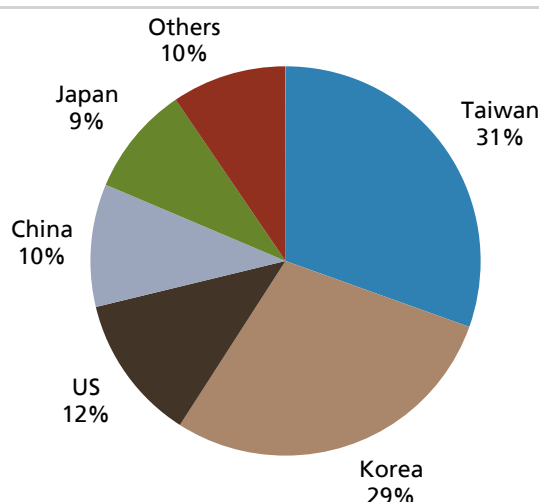
	Japan	Taiwan	USA	England	Germany	Korea	Malaysia	Indonesia	Singapore	China	Others
ShinEtsu	○	○	○	○			○				
SUMCO	○	○	○					○			
GlobalWafers	○	○	○			○	○		○	○	○
Siltronic			○		○				○		
SK Siltron						○					

Source: Company data, Fuji keizai

On the other hand, we estimate that China accounts for roughly 10% of demand in the overall silicon wafer market. This is because in addition to Chinese makers including YMTC, other major customers like Samsung and TSMC also have production bases in China. SUMCO Chairman Mayuki Hashimoto commented in the results briefing on 13 February that the transportation of wafers within China is slowing due to logistical problems. It should be kept in mind, in our view, that there will be an impact on the sales of wafer manufacturers in China.

China accounts for roughly 10% of demand

Figure 11: Wafers sales volume by region (2018)

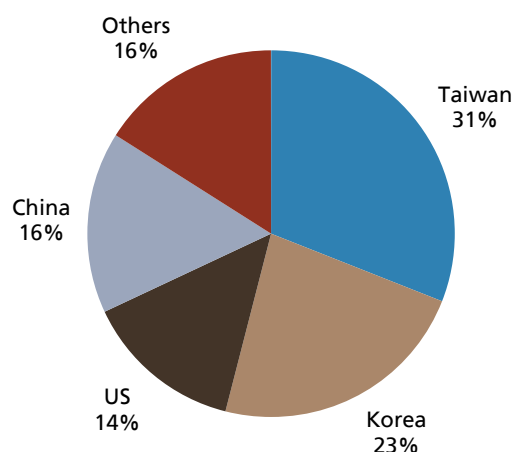


Source: Fuji keizai

In terms of exports from Japan, based on trade data released by Japan's Ministry of Finance, the ratio is shown below. China accounts for 16%, which is higher than US.

16% of exports from Japan are to China

Figure 12: Exports volumes from Japan by region (2019)

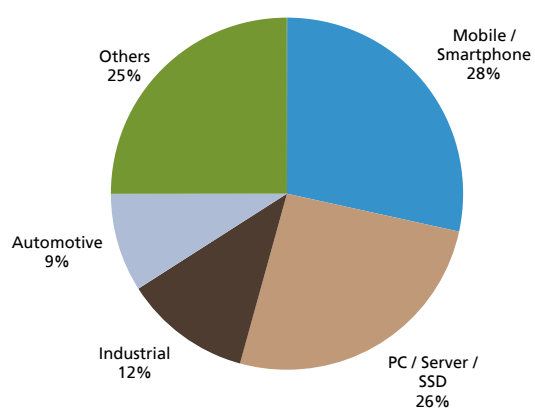


Source: MOF

The impact on final demand should also be noted. China accounts for 25% of global demand for smartphones and 27% for PCs. As shown in the figures below, since these are the largest applications in the overall silicon wafer market, we think this may weigh on the demand side near term.

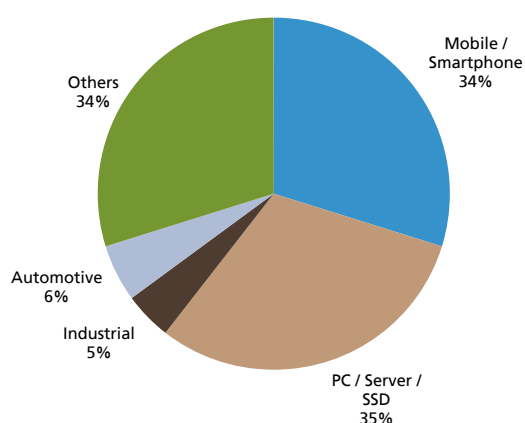
Downside for smartphones and PCs

Figure 13: Wafer demand by applications (2018)



Source: IHS

Figure 14: 300mm wafer demand by applications (2018)

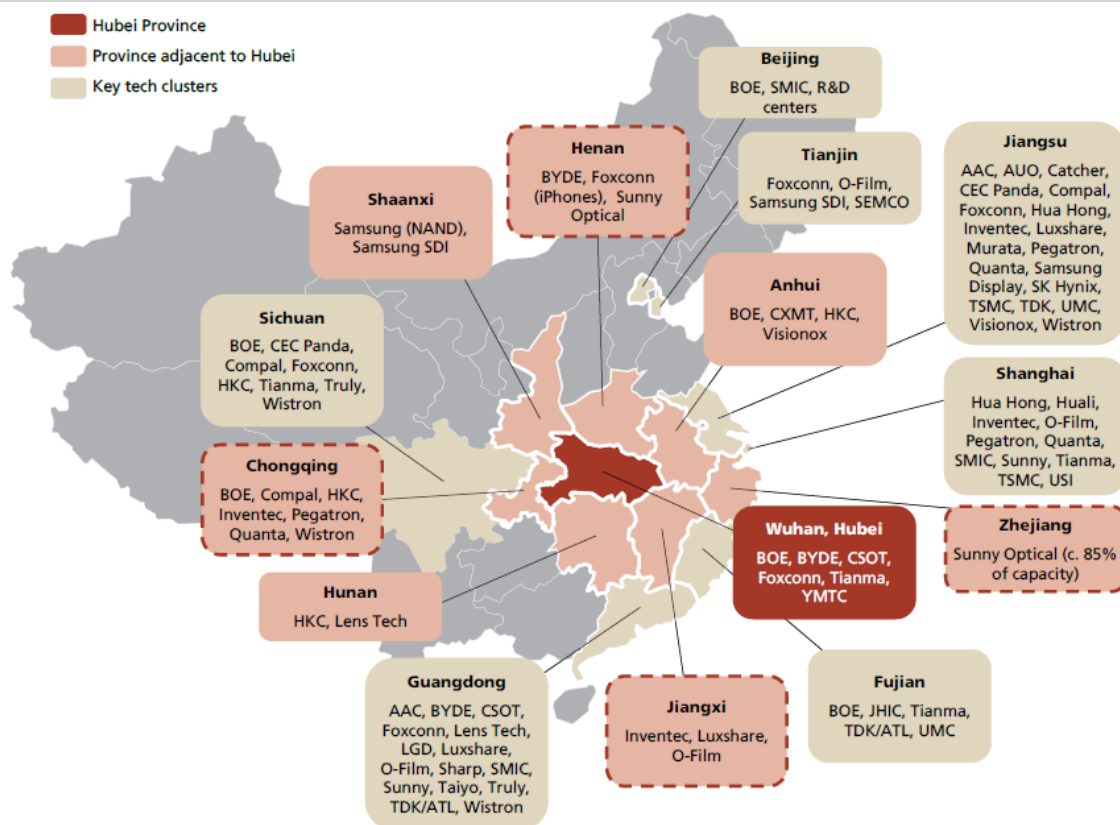


Source: IHS

With regard to the impact on the overall tech sector, please see our report '[UBS Global I/O APAC Technology: Coronavirus: mapping out the risks for the tech supply chain](#)' published by Nicolas Gaudois on 5 February. As pointed out in that report, major technology-related production bases are as shown below.

Impact on supply chain considered

Figure 15: Coronavirus mapping by provinces for key tech production sites



Source: UBS

Changes in market share

The figures below show the shares of sales for the top five companies in the sector as at July-September 2019 and July-September 2018. Over this one-year period, the shares of Shin-Etsu Chemical and SK Siltron expanded, while those of Siltronic and SUMCO contracted. We can see here that share increased for the two companies that led in significantly expanding production capacity.

Market share rose at Shin-Etsu Chemical and SK Siltron

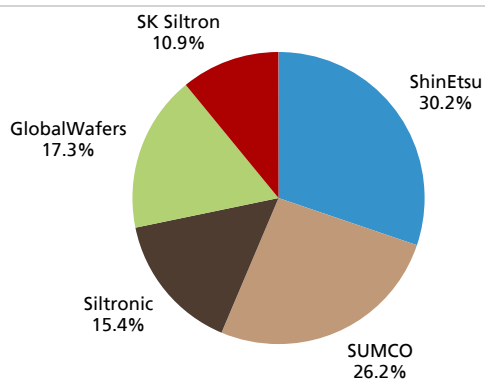
For the most recent October-December quarter, SK Siltron has not disclosed figures, but a comparison of the other top-four companies shows, as below, that while sales grew at Shin-Etsu Chemical and Siltronic, they are declining at SUMCO and GlobalWafers.

Who are the recent outperformers?

Siltronic attributes stronger-than-expected sales in October-December to being able to ship products to customers it was unable to supply in periods of tight supply and demand. Although modest, its share appears to be recovering.

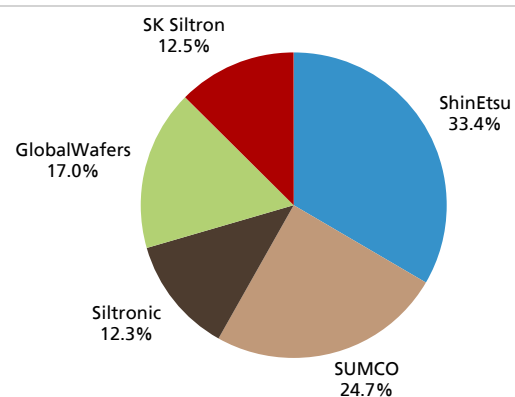
Share recovered at Siltronic

Figure 16: Sales share in July-September 2018



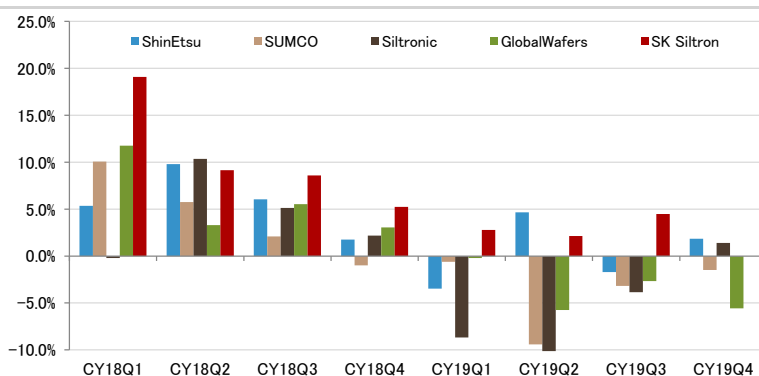
Source: Company data, UBS *Among top 5 companies

Figure 17: Sales share in July-September 2019



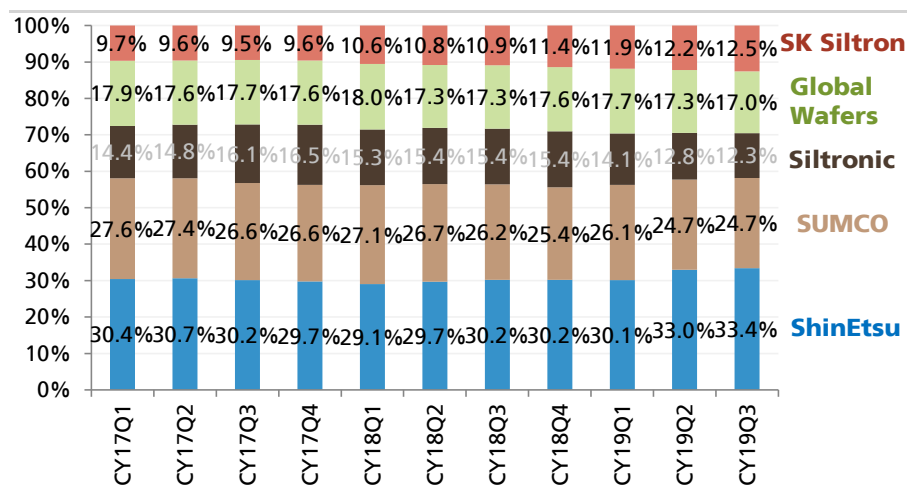
Source: Company data, UBS *Among top 5 companies

Figure 18: Sales growth rate by company (QoQ)



Source: Company data, UBS

Figure 19: Sales share trend



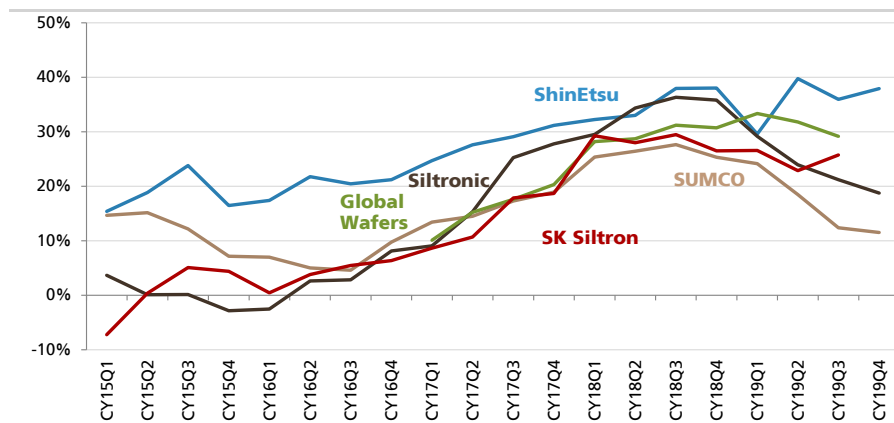
Source: Company data, UBS *Among top 5 companies

Figure 20: October-December wafer company results

	ShinEtsu	SUMCO	Siltronic	GlobalWafers
Currency	Yen bn	Yen bn	EUR mn	NT\$ mn
Sales	99.2	70.9	304.0	13,505.0
qoq	+1.8%	-1.5%	+1.4%	-5.6%
OP (EBIT)	37.6	8.2	57.0	
OPM	37.9%	11.5%	18.8%	
qoq	+2.0pt	-0.9pt	-2.5pt	

Source: Company data, UBS

Figure 21: Wafer company OP margin (EBIT margin) comparison



Source: Company data, UBS

Long-term contracts

There are differences between companies in terms of when long-term contracts expire, but for the overall sector, we estimate that the proportion of long-term contracts is in a downtrend. We estimate that as of October-December 2019, there was a difference of around 10%-15% between long-term contract prices and spot prices. As long-term contracts expire, comparisons with spot prices are very likely to be made. When this happens, we think average unit prices are very likely to decline further, although this will depend on supply and demand.

We estimate the price difference at 10%-15%

SUMCO commented at its October-December results briefing that it expects the proportion of long-term contracts for 300mm wafers in 2020 to be 90% (the overall ratio is estimated at 75%-80%). It expects conditions to be similar in 2021. However, this view also takes into account price negotiations hereafter. Shin-Etsu Chemical is expecting a ratio of roughly 90% in 2020 and over 70% in 2021. For Siltronic, we estimate ratios of around 70%-80% in 2020 and a large decline in 2021. GlobalWafers stated that the LTA coverage should fall in 2020E, but has not provided clear guidance, as we believe it's still negotiating with key customers for the renewal. Assuming limited extension, we think the ratio likely comes down meaningfully into H220 and 2021, from 80-90% in 2019. With regard to 200mm wafers, since the period for long-term contracts tends to be shorter than for 300mm wafers, there may be more of an impact from 2020.

Long-term contract ratios

Wafer prices rise less readily than memory prices

Investors sometimes ask us whether we expect spot wafer prices to rise. What prompts the question is a bottoming of memory prices and improving prospects of a recovery in wafer demand, but we think higher spot prices are unlikely. First, as the above analysis indicated, we do not see conditions for tight wafer supplies developing any time soon. Beyond that, past experience shows that higher memory prices often fail to result in higher wafer prices.

Until about a year ago, METI's production dynamics statistics were particularly useful among available wafer price data series. Unfortunately, disclosure ended in January 2019. Instead, we now look at trade data released by Japan's Ministry of Finance. Note that these data are quite volatile because of differences in the products that appear from month to month. In addition, the trade statistics are affected by forex trends. To ameliorate these effects, we look at the data converted to dollars and in the form of a six-month average, as shown below. Two significant price increases emerge.

First, in 2011, because of the Great Eastern Japan Earthquake on 11 March of that year, production stopped at three wafer plants in the affected area, including at Shin-Etsu Chemical's Shirakawa plant, in Fukushima Prefecture. Export prices soared, because of fears about supply. Second, price hikes supported by short wafer supply from 2017 forward are still fresh in memory. We might add that prices rose also in 2006 and into 2007 because of tight supplies.

We can look at memory prices by looking at the trend in NAND spot prices, as in the figure below, which shows about five periods of rising prices, including higher prices in 2019. In other words, higher memory prices do not always mean rising wafer prices. It is worth remembering that price hikes of *any* kind are rarely accepted in the electronic materials industry.

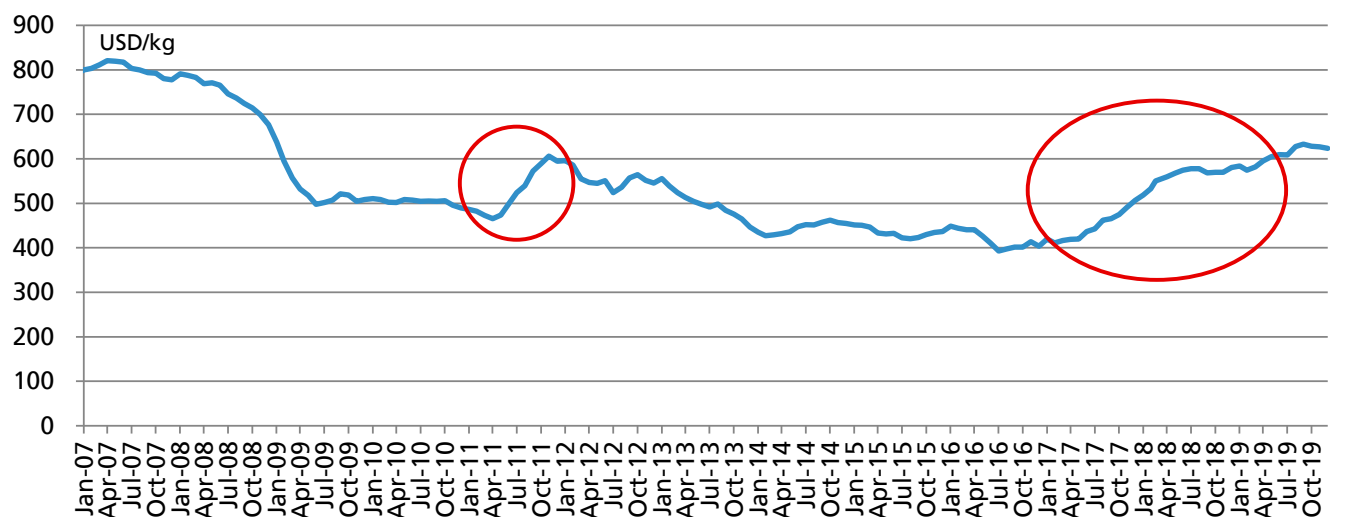
How likely are spot prices to rise?

An analysis of price increases based on trade statistics

When supplies were very tight

Wafer prices do not necessarily rise in tandem with memory prices

Figure 22: Wafer export price trends from Japan (6-month average)



Source: MOF, UBS

Figure 23: NAND spot price trends (32Gb MLC)



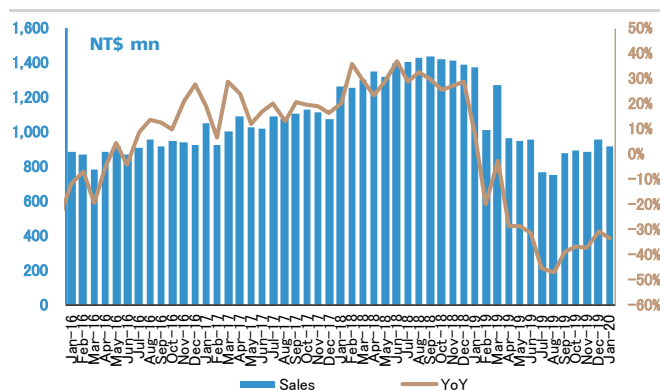
Source: DRAMeXchange

Monthly sales trends

January sales show a 33% yoy drop and a 5% mom drop to NT\$912m for Formosa SUMCO Technology Corporation and a 19% yoy and 12% mom decline for GlobalWafers. There are also expected to be effects from the Lunar New Year from the last week of January. Effects from the coronavirus outbreak should also be noted in February. The yoy growth hurdle is declining, but we find it difficult to be optimistic given that Apple has just announced the likelihood of disappointing sales in January-March because of the outbreak. However, some customers might be trying to boost inventories in light of the disruption in logistics.

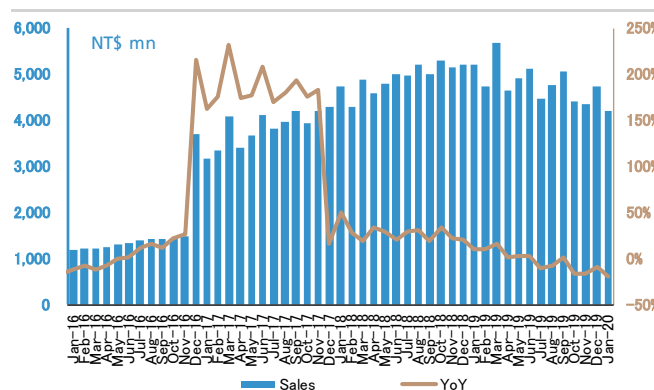
Lower from December

Figure 24: Formosa SUMCO Technology monthly revenue



Source: Company data

Figure 25: GlobalWafers monthly revenue



Source: Company data

Valuations

Setting aside Shin-Etsu Chemical, which has a diversified business portfolio, SUMCO's valuation is on the high side among silicon wafer makers. In particular, the FY20 (year to December 2020) PER is high. We think that reflects expectations of an earnings recovery ahead. Relative to ROE, PBR also looks comparatively high at SUMCO.

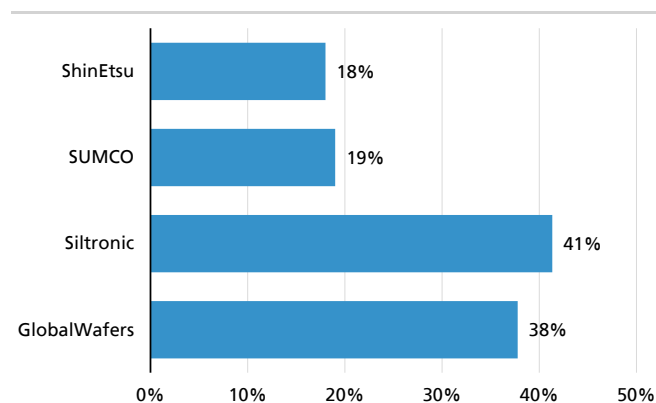
SUMCO's valuations are comparatively high

Figure 26: Valuation table (based on Bloomberg consensus)

		PER		EV/EBITDA		PBR		ROE	
		2020E	2021E	2020E	2021E	2020E	2021E	2020E	2021E
ShinEtsu Chemical	4063.T	17.3x	16.1x	8.2x	7.6x	2.0x	1.8x	11.9%	11.8%
SUMCO	3436.T	19.5x	15.4x	8.0x	6.9x	1.8x	1.7x	9.6%	10.7%
Siltronic	WAF:GR	16.9x	13.9x	6.9x	5.9x	2.9x	2.4x	21.1%	17.8%
GlobalWafers	6488.TT	14.9x	13.3x	7.6x	6.8x	4.3x	3.9x	28.5%	28.9%
Average		17.2x	14.7x	7.7x	6.8x	2.8x	2.5x	17.8%	17.3%

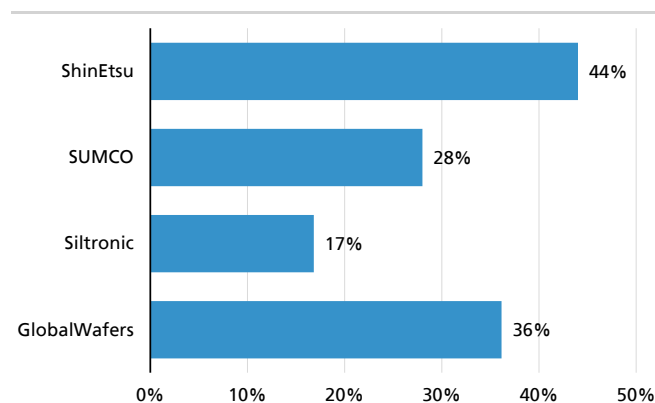
Source: Bloomberg *As at 21 February 2020

Figure 27: Share price change (past 3months)



Source: Datastream

Figure 28: Share price change (past 12months)



Source: Datastream

Links to UBS reports

ShinEtsu Chemical (4063.T): [Profit growth trend likely to continue](#), 21 February

SUMCO (3436.T): [Expectations look excessive to us](#), 21 February

GlobalWafers (6488.TWO): [Cycle update: inflection point is yet to emerge](#), 6 December

Siltronic (WAF:GR): [Uncertainty remains. Neutral.](#), 7 February

Valuation Method and Risk Statement

Our price targets for Shin-Etsu Chemical and SUMCO are based on PER. We value GlobalWafers based on PBR and Siltronic based on discounted cash flow.

Key risks we identify for silicon wafer manufacturers include lower semiconductor demand due to economic contraction, lower wafer demand caused by rapid miniaturization progress, inventory adjustments in the supply chain, price competition stemming from oversupply caused by expansion of production capacity, the growing presence of Chinese manufacturers, and forex fluctuations.

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Sell	FSR is > 6% below the MRA.	15%	20%
Short-Term Rating	Definition	Coverage ³	IB Services ⁴
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Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

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

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

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GlobalWafers	6488.TWO	Neutral	N/A	NT\$455.00	24 Feb 2020
Shin-Etsu Chemical	4063.T	Neutral	N/A	¥13,755	21 Feb 2020
Siltronic AG¹⁸	WAFGn.DE	Neutral	N/A	€94.24	24 Feb 2020
SUMCO¹³	3436.T	Sell	N/A	¥1,967	21 Feb 2020

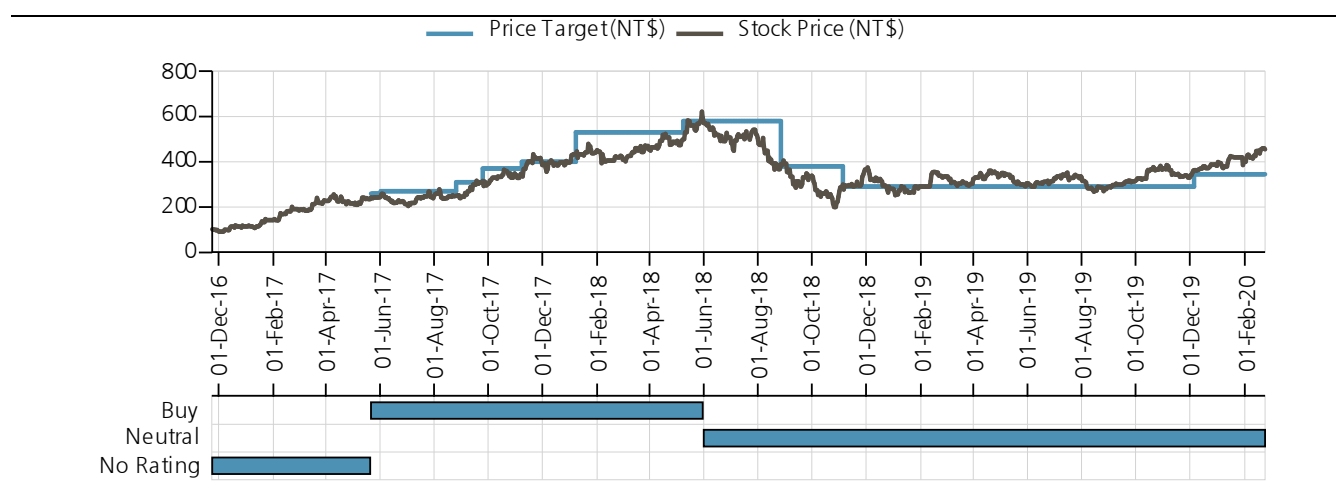
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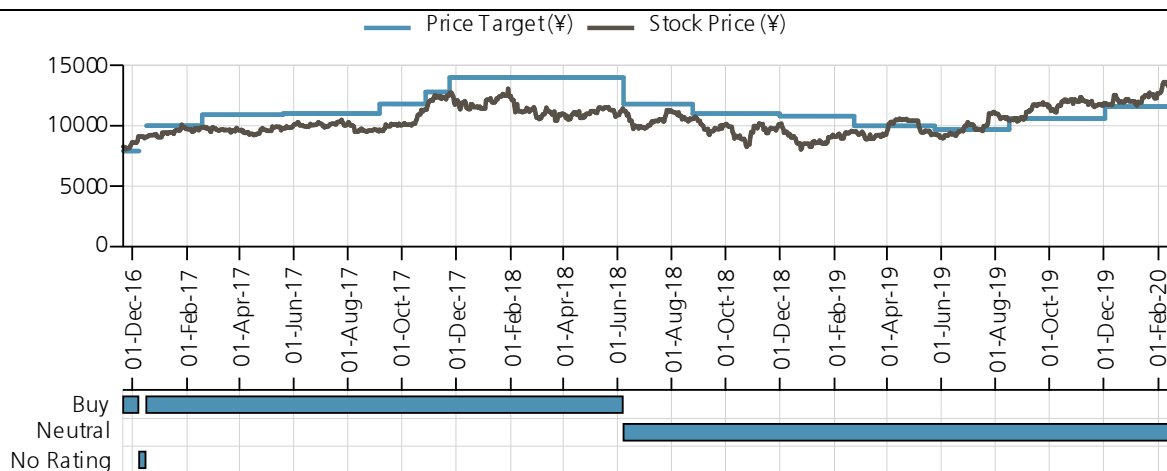
GlobalWafers (NT\$)



Date	Stock Price (NT\$)	Price Target (NT\$)	Rating
2016-11-24	102.5	-	No Rating
2017-05-22	242.5	260.0	Buy
2017-06-02	248.5	270.0	Buy
2017-08-26	250.0	310.0	Buy
2017-09-25	315.5	370.0	Buy
2017-11-08	342.5	400.0	Buy
2018-01-08	435.0	530.0	Buy
2018-05-09	500.0	580.0	Buy
2018-06-01	571.0	580.0	Neutral
2018-08-27	389.0	380.0	Neutral
2018-11-05	299.0	290.0	Neutral
2019-12-06	363.0	345.0	Neutral

Source: UBS; as of 24 Feb 2020

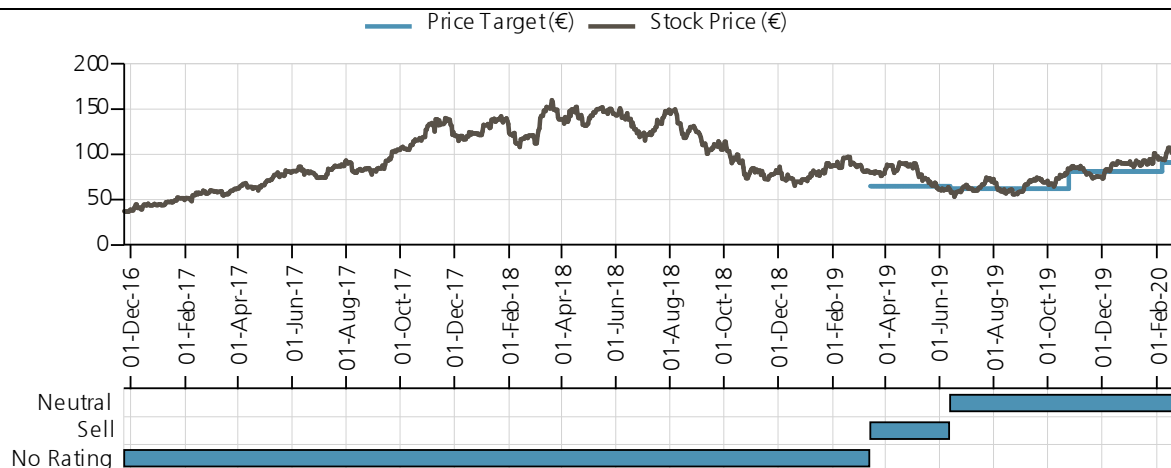
Shin-Etsu Chemical (¥)



Date	Stock Price (¥)	Price Target (¥)	Rating
2016-11-21	8275.0	7900.0	Buy
2016-12-09	9123.0	-	No Rating
2016-12-17	9078.0	10000.0	Buy
2017-02-18	9893.0	10900.0	Buy
2017-05-20	9796.0	11000.0	Buy
2017-09-06	9695.0	11800.0	Buy
2017-10-28	11365.0	12800.0	Buy
2017-11-24	12745.0	14000.0	Buy
2018-06-08	11245.0	11800.0	Neutral
2018-08-25	10590.0	11000.0	Neutral
2018-12-01	10135.0	10800.0	Neutral
2019-02-23	9529.0	10000.0	Neutral
2019-05-25	9322.0	9700.0	Neutral
2019-08-17	10490.0	10600.0	Neutral
2019-12-03	11890.0	11600.0	Neutral

Source: UBS; as of 21 Feb 2020

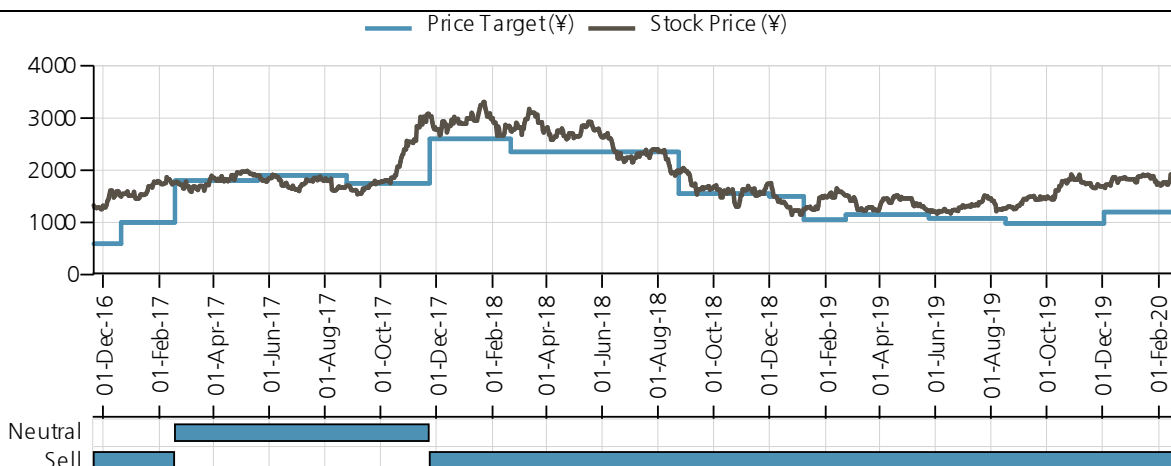
Siltronic AG (€)



Date	Stock Price (€)	Price Target (€)	Rating
2016-11-24	37.25	-	No Rating
2019-03-15	79.9	65.0	Sell
2019-06-13	61.12	62.0	Neutral
2019-10-25	83.76	81.0	Neutral
2020-02-07	94.48	91.0	Neutral

Source: UBS; as of 24 Feb 2020

SUMCO (¥)



Date	Stock Price (¥)	Price Target (¥)	Rating
2016-11-21	1327.0	590.0	Sell
2016-12-21	1496.0	1000.0	Sell
2017-02-18	1762.0	1800.0	Neutral
2017-05-20	1903.0	1900.0	Neutral
2017-08-25	1704.0	1750.0	Neutral
2017-11-24	3035.0	2600.0	Sell
2018-02-21	2755.0	2350.0	Sell
2018-08-24	1960.0	1550.0	Sell
2018-12-01	1740.0	1500.0	Sell
2019-01-08	1254.0	1050.0	Sell
2019-02-23	1520.0	1150.0	Sell
2019-05-25	1225.0	1080.0	Sell
2019-08-17	1270.0	980.0	Sell
2019-12-03	1692.0	1200.0	Sell

Source: UBS; as of 21 Feb 2020

Additional Prices: Taiwan Semiconductor Manufacturing, NT\$320.00 (24 2 2020); Intel Corp., US\$61.76 (24 2 2020); Source: UBS. All prices as of local market close.

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