Weekly Commentary 4 – Jan 2023

The Chips War

On Friday, the Wall Street Journal reported that Intel, once the largest chip maker in the world, reported disappointing losses. Its share price closed down 6.4%, after initially falling 11% in Friday trading at the NYSE, making it the worst performer in the Dow Jones Industrial Index.

The company had said, after the market closed the day before, that it expected to post a loss for Q1 2023, after suffering a quarterly net loss of $664million in the last quarter of 2022 as sales collapsed by almost one third, to $14 billion. This is the first time Intel will be in the red for two sequential quarters in at least 30 years, after it became an undisputed winner in the brave new world of personal computing which it helped to create.

According to the company, the downturn is due a triple whammy of a broad industry downturn, formidable competition, and the pain of turnaround measures. Most analysts believe that Intel has a difficult path ahead, as it needs to invest huge amounts of capital to reengineer its way forward. It is losing market share to competitors such as Advanced Micro Devices Inc. It won't be easy to reverse those losses, when it has a record of execution failures in recent years. The PC market, long the place when Intel has been dominant, is suffering a deep downturn, with sales falling by 29% in the 4th Quarter of 2022. The semiconductor companies in the PC supply chain are now plagued by a surplus of chips when they reacted with excessive ebullience to the supply chain constraints and temporarily high demand for high tech toys for people stuck at home during the 2020-2021 covid lockdowns.

Intel is still America's largest chip company. But it has been crippled and it is hurting. At one time, it was the leader of a group of western technology companies which sold 80 percent of the world's chips. Now that leadership has passed to a number of companies in Asia (based in Taiwan, S Korea, Japan and China) which make more than 80% of all the chips and the western group is left with less than 20%. The US itself accounts for just 12% these days. And it was unthinkable that China, when cheap toys, plastic flowers and garments once represented the bulk of their exports, would now supply 15% of the world's semiconductors considered to be more important than oil in global commerce.

To block this development, America is spending billions to safeguard its supply.

As reported by the WSJ recently, the US has suddenly realised in the last two years that semiconductors are now as central to global trade as oil once was. In the world adopting digital technologies, almost all appliances carry chips; eg. cars now use 1200 chips on

average compared to half that number ten years ago. During the pandemic when chips were in short supply, car factories had to stop production – automakers lost $210 billion of sales in 2021 because of the shortage of chips. The trade war with China has stoked fears that it could dominate crucial key chip components, and restrict American access.

Now, the Biden Administration is promising to spend billions in a frantic effort to build up domestic manufacturing and safeguard the supply of chips. Since 2020, semiconductor companies are planning more than 40 projects across the country worth nearly $200 billion that would also create tens of thousands of manufacturing jobs. Some semiconductor industry executives now boast that whereas oil was once the major geopolitical resource, chips are now more important. That's self-serving commentary, of course.

Nevertheless, the chips wars have started in earnest. The US government is ultimately just a cheerleader, because it does not have state-owned semiconductor companies. Players like Intel will have to bear the brunt of commercial combat against their competitors in Asia, concentrated in Taiwan, Japan, S Korea and of course, China. Given the dismal results announced on Friday, Intel, the biggest American player is starting from very far behind especially since there is zero leading edge production in the US. This is like trying to make the US a global leader once again in leading-edge production of chips and then create the self-sustaining dynamics going forward, which is without question a very ambitious set of objectives, given where Intel is now at.

Given the ambition, how does America plan to regain its lead in the global semiconductor industry, which is one of the biggest initiatives of the Biden White House to recapture global economic leadership from China, or, if you prefer the US version, block China from overtaking it. To put it simply, Biden is doing the Ukraine thing – gather its allies in the collective west, and try to block its adversary.

So we see, over the weekend, another article, this one in the Financial Times, carrying this story on the chips war.

Netherlands and Japan join US in restricting chip exports to China

Demetri Sevastopulo in Washington and Sam Fleming in Brussels

Jan 28 2023

Deal marks significant step in Washington's efforts to limit rival's efforts to develop its semiconductor industry.

Japan and the Netherlands will restrict exports of chip manufacturing tools to China after reaching a deal with the US designed to make it harder for the Chinese military to develop advanced weapons.

Several people familiar with the trilateral agreement said the countries reached an agreement on Friday after a final round of high-level talks at the White House. The accord comes three months after Washington imposed unilateral export controls that barred US companies from selling advanced chipmaking equipment to Chinese groups.

The White House declined to comment. But the deal marks a significant milestone in US efforts to work with allies to hinder Chinese efforts to develop its semiconductor industry.

Joe Biden's administration has been negotiating with the countries for two years but faced resistance because they were worried about the effect on their chipmaking tool companies, particularly ASML in the Netherlands and Tokyo Electron and Nikon in Japan.

In October, the US announced sweeping unilateral export controls that were designed to complicate Chinese efforts to obtain, or develop, advanced semiconductors for use in supercomputers and other military-related applications, such as artificial intelligence, nuclear weapons modelling and hypersonic weapons.

The US chip manufacturing tool groups that dominate the sector — Applied Materials, Lam Research and KLA — were concerned that the October move imposed restrictions on them but not ASML and Tokyo Electron. At the time, Alan Estevez, the top commerce department official for export controls, justified the move, saying it would prove to allies that the US had "skin in the game" and was willing to take tough decisions.

Estevez and Tarun Chhabra, the National Security Council official who is the driving force behind the move, stepped up efforts in recent months to convince the allies during visits to Tokyo and The Hague.

Several people said the three countries had decided not to make the details public due to the sensitive nature of the discussions. Washington wanted to give Japan and the Netherlands space to decide how to communicate the restrictions. It remains unclear what mechanisms the countries will use to impose the restrictions on their chip tool companies.

Tokyo and The Hague are also concerned about being seen to have signed up to an American policy that is specifically targeted at China.

Paul Triolo, a China and technology expert at the Albright Stonebridge consultancy, said one of the reasons the US did not provide any details was that while American officials wanted to portray the agreement as a victory, they faced constraints.

"US officials likely want to spin any agreement as a win, but avoid further angering allies with a public announcement after dropping the restrictions unilaterally, at a time when the administration is stressing collaboration with allies and facing criticism from other quarters on the provisions of the Inflation Reduction Act, viewed by the EU and Asian allies as protectionist," Triolo said.

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Dutch prime minister Mark Rutte this week said that while public attention on chip tool exports had been focused on Japan, the Netherlands, US and China, the discussion was "broader than that".

The increase in pressure on the allies in recent months came after US national security adviser Jake Sullivan in September signalled a significant change in policy. In a speech, he said the US should abandon its "sliding scale" approach of trying to stay two generations of chips ahead, and instead "maintain as large as a lead as possible".

Rutte told the Financial Times in an interview that the Netherlands saw "eye to eye" with those who argued that western high-end chips should not be used in the weapons of some countries. He said western nations and Asian partners had to maintain the "leading edge" on chips.

He added that the debate was broader than just one Dutch company. Rutte said he was "absolutely convinced" that it was possible to get to a "solution with the many partners we are discussing with" and added that "The Hague was co-ordinating with everybody".

In a statement, ASML said it understood "that steps have been made towards an agreement between governments which, to our understanding, will be focused on advanced chip manufacturing technology, including but not limited to advanced lithography tools. Before it will come into effect it has to be detailed out and implemented into legislation which will take time."

ASML added that based on comments from government officials and its understanding of the timeline, "we do not expect these measures to have a material effect on the expectations that we have published for 2021.

It is easy to conclude that this is a win for the Biden Administration. This follows from their success at attracting/coercing Taiwan's TSMC to set up a 4 nanometer plant in Arizona, to be followed by a 3 nanometer plant in another year or two (2026). The hope is that this will rebuild the semi-conductor supply chain in the US, as part of a broader effort to re-establish manufacturing industry in the country.

However, if we put the story on Intel together with the news about the success with Japan and the Netherlands, it tells of an upcoming problem in the effort to cut China off. This is that China represents one of the largest customers for all the western companies as well as TSMC and other S Korean/Japanese companies. Victory for Biden may be a pyrrhic one, because all these companies will now suffer losses when they lose their Chinese customers. That loss will lower the funds available for R&D, which is very important in the semiconductor industry.

The slower revenues affecting their R&D is not just a problem with Intel. It is happening even with the largest of the semiconductor manufacturers, TSMC. And TSMC is the first to admit that its Arizona plant will be plagued by much high costs than its Taiwanese projects as well as difficulty with labour issues it will not have in its home base. The company said in early January that its revenue could drop by as much as 5% in the current quarter, and this will cut this year's capital expenditures compared with last year. This is partly due to weak demand. And higher costs. The last time TSMC's quarterly revenue fell year over year was in the first quarter of 2019 before the pandemic.

The world's largest chip maker has set this year's capital investment budget at US$32-36 billion. Seventy percent of this would go to building up capacity for the most advanced chips (below 3nm). The possibility of R&D contraction indicates that TSMC is running out of momentum, and underscores the headwinds faced by the entire industry after the aggressive expansion during the pandemic years, which triggered an increased demand for gadgets such as smart phones, PCs and other stuff used to support a work-from-home wave of frivolous demand. When that demand reverted to normality, the chip makers faced overcapacity and slackening orders.

Many semiconductor makers have slowed investment or retrenched employees. One memory-chip maker, Micron Technology Inc said it would lay off around 10 percent of its labour force.

Nonetheless, TSMC is in the midst of a global expansion, building new plants in the US and Japan. It is also considering establishing a plant in Europe. This is due more to demand from clients who are concerned about the security of their supply chain, given the tension over the Taiwan Straits. This is not the most cost-effective business strategy as the facilities in the US costs four to five times more than similar plants in Taiwan. But evidently, meeting clients' geopolitical concerns has forced TSMC's hand.

And this is before we consider what is happening on the Chinese side of the tech war. Here is a report from Reuters on SMIC, the largest chip maker in China, the equivalent of Intel in the US.

OAKLAND, Calif./SHANGHAI/WASHINGTON Dec 13 (Reuters) - China's largest chip maker SMIC (0981.HK) is ramping up production of a decade-old chip technology, key to many industries' supply chains, setting off alarm bells in the United States and prompting some lawmakers to try to stop them.

The United States and allied nations could further step up restrictions if China announces a trillion yuan ($144 billion) support package for its chip industry, as Reuters exclusively reported on Tuesday, said TechInsights' chip economist Dan Hutcheson.

Starting with the Trump administration, the United States has been tightening the noose around China's high-tech ambitions. It cut off the world's largest telecommunications firm Huawei

Technologies from the U.S. market and technologies, as well as cut off air supply to China's advanced chip making through a series of rules this year.

But why worry about older chip technology?

China, which in 2020 had 9% of the global chip market, has a track record of dominating key technologies by flooding the market with cheaper products and wiping out global

They did it with solar panels and 5G telecom equipment, and could do it with older technology chips, said Matt Pottinger, former Deputy National Security Advisor of the United States during the Trump administration who has been studying chip policy at the Hoover Institution.

"It would give Beijing coercive leverage over every country and industry - military or civilian - that depend on 28 nanometer chips, and that's a big, big chunk of the chip universe," he said.

"28 nanometer" refers to a chip technology commercially used since 2011. It is still widely used in automotive, weapons and the explosive category of internet of things gadgets, said Hutcheson.

Hutcheson, who has been monitoring chip production capacity for four decades, said the concern is that Semiconductor Manufacturing International Corp (0981.HK) and other chipmakers in China could use government subsidies to sell chips at a low price. And a possible new round of financial support from Beijing would increase chip production even further.

"The Chinese could just flood the market with these technologies," he said. "Normal companies can't compete, because they can't make money at those levels."

U.S. LAWMAKERS PUSHING AGAINST SMIC

Those concerns have pushed some lawmakers to use legislation for setting the defense budget to hold back SMIC.

While the measure is weaker than what was initially proposed, this week U.S. Senators are expected to pass the annual National Defense Authorization Act 2023 that includes a section barring the U.S. government from using chips from SMIC and two other Chinese memory chip makers. It is not clear what impact the restriction, which kicks in five years after it becomes law, will have on SMIC.

Founded in 2000 with backing from Beijing, SMIC has long struggled to break into the ranks of the world's leading chip manufacturers.

But it is a giant in older technology, including chips that regulate power flows in electronics. And its revenue was close to $2 billion in the third quarter this year (2021), roughly double the same period last year on the back of the global chip shortage.

SMIC FILLING SUPPLY GAP

With U.S. export controls making it impossible to produce advanced chips, SMIC is doubling down on mature technology chips and has announced four new facilities, or fabs, since 2020. When those come online, it would more than triple the company's output, estimates Samuel Wang, Gartner chip analyst. He said there is a huge ramp up in new chip fabs across China.

"All this will start to have an impact from early 2024 and will be full blown by 2027," said Wang, adding the chip supply increase will put downward pressure on chip prices.

The importance of older chip technology hit the industry in the face in 2021 as a shortage of those chips prevented manufacturing of millions of cars and consumer electronics.

Mark Li, Bernstein Research's chip analyst in Asia, said the company is becoming a formidable competitor to Taiwan's UMC Microelectronics Corp (6615.T) and U.S.-headquartered GlobalFoundries Inc (GFS.O).

"SMIC has been much more willing to add capacity than other fabs at the low-end, and especially in this shortage we've seen in the past two years," he says. "It's not an issue now...but who knows, maybe in a few years there will be another shortage and capacity will be a big problem."

If the above Reuters article is accurate, then it is obvious that the Chinese chip companies are doing quite well, especially since the artificially displaced demand away from US, Taiwanese, Japanese companies would now be diverted to Chinese companies. They will be getting a surge of business. Since the bulk of the demand is not at the cutting edge (4, 3 nm), but really in the 28 nm category, the bulk of the revenues will accrue to these Chinese companies. The improved profits will find its way to new R&D efforts and this will be exactly the opposite effect the American initiatives to block Chinese semiconductor development is intended to produce. This is a similar outcome as in the western sanctions on Russia, which boomeranged to hurt Europe instead.

The above outcome is not conjecture. There are already reports that indeed, the R&D in China is already bearing fruit.

China seems to have figured out how to make 7nm chips despite US sanctions

Foiled again, Team America

Dylan Martin

The Register

Fri 22 Jul 2022

Chinese semiconductor giant SMIC has reportedly been manufacturing 7-nanometer chips since last year, the best sign yet that China has found a way to develop advanced components despite US efforts to curb the country's homegrown silicon capabilities.

This is based on findings from American semiconductor analyst firm TechInsights, which recently bought a cryptocurrency-mining ASIC manufactured by SMIC and found that it uses a 7nm process after doing a study of the chip's die. The ASIC is designed by a company called MinerVa, which has been mass producing the chip since July 2021, according to its website.

TechInsights said SMIC's 7nm process appears to be a "close copy" of the one used by Taiwanese foundry giant TSMC. However, the firm said the custom chip was likely a "steppingstone" for SMIC achieving a "true 7nm process" that includes both scaled logic and memory bitcells.

The reason for this is crypto-mining ASICs "likely do not feature the typical bitcell memory that true 7nm technology definition requires," so it's more feasible that the chip is mostly a demonstration of 7nm logic.

"This is the most advanced technology product TechInsights has seen from SMIC so far and may be leading to a true 7nm process that incorporates scaled logic and memory bitcells," TechInsights said.

The development will likely be received as bad news for the US government, which has been trying to slow down China's ability to manufacture advanced chips over national security concerns.

While the 7nm crypto-mining chip is probably meant for consumer or commercial use, the process node will likely end up in military applications in China due to the country's "military-civil fusion" doctrine, where private companies must share their technologies with the nation's military.

China's military technology push was the reason Uncle Sam added SMIC, the Middle Kingdom's largest domestic chipmaker, to the US Treasury Department's entity list in December 2020. This was meant to prevent SMIC from acquiring certain American technologies. The United States put a specific restriction in place for items that would allow SMIC to manufacture chips at 10nm or lower.

Even before that, the US had successfully pressured the Dutch government to block ASML — the only provider of extreme ultraviolet light (EUV) lithography machines used to make chips on leading-edge nodes, such as 7nm — from selling such systems to China.

Despite these efforts, China has apparently managed to create finished products on a 7nm node.

One reason SMIC can do this is because EUV systems are not mandatory when crafting leading-edge chips. Instead, the chipmaker is likely using an older generation of lithography machines, called deep ultraviolet lithography (DUV), to manufacture 7nm chips.

There is precedent for this. TSMC and Samsung developed multiple 7nm nodes without EUV before adopting the machines for newer processes. However, this did come "at the cost of increased process complexity and design rule restrictions," TechInsights said. The foundry giants are now using EUV to reduce the complexity and costs of making such chips.

The implication is that while SMIC has the ability to make 7nm chips, it won't be easy. This also means the company will have to deal with more yield issues than if it were using EUV, according to TechInsights.

This is likely one reason the US has reportedly been trying to convince officials in the Netherlands to block ASML from selling DUV systems to China, though DUV is used more widely to produce less advanced chips for a wide range of devices. According to a BusinessKorea report, SMIC plans to invest $11 billion to grow its DUV capacity by 2023.

Chip world watcher Dylan Patel noted another implication for SMIC's 7nm capabilities. He said the development means China is now further ahead than the US or Europe in having 7nm contract chip manufacturing capabilities since American chipmaker Intel has yet to make its 7nm process available to foundry customers.

This isn't great since one of the two other regions with advanced chip foundry capabilities, Taiwan, is facing continuous aggression from China, which has sparked fears that losing access to the island nation's chips could trigger a "deep and immediate recession" in the US.

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The above news that the Chinese are now capable of 7 nm chips have caught the Americans by surprise, as it was a technological level that everyone had thought to be beyond SMIC's capabilities. Many in Washington were caught blindsided, according to the WSJ.

This is the most advanced technology product TechInsights has seen from SMIC so far, and may be leading to a complete 7nm process that incorporates scaled logic and memory bitcells. It also has critical implications for Chinese chip companies, as it helps to reduce China's reliance on western technologies during this time of restricted access.

It has also been reported in the WSJ that after working for years to catch up on US technology, China has developed a chip that can rival NVIDIA's powerful A100. In short, the 7 nm chip is not a singular breakthrough. Other news I have seen emanating from China, now still unconfirmed, indicate broad advancement in a number of key semiconductor sectors.

The ultimate question is whether American sanctions on China's chip industry can slow it down, end its progress or can China survive these body blows, like its space industry did?

To answer that question, we can look at China's track record. China has already created an alternative to GPS, and a space station, all on its own after similar sanctions by the US. If it can be so successful at outer-space projects, what's the big deal about chips? The challenge to build more advanced semiconductors does not seem so forbidding. And if we also consider that it has leading technologies of its own in the shipbuilding space, high speed trains and in the infrastructure construction sector, none of which is trivial, we can probably assign a high probability of success in chips. Ultimately, this would be attributable to its much larger STEM population and the fact that the country has already surpassed the rest of the world in scientific research, based on citations in reputable international journals.

What can the Chinese do to counter the American sanctions? How long does it take to catch up on and produce its own EUV machines? Here are some guesses:

1) Global semiconductor demand, at least 95% of it, actually focuses on chips that are not even as advanced as 14 nm. China is on the brink of success with 7nm technology, so it can handle most of the global demand for chips without missing a beat. If there is some new gadget like a fancier Phone that requires those 2 nm or 3nm chips which China has not yet mastered, so what? Does it really matter if China does not participate for a couple of years in this "device upgrading" business?

2) Semiconductor chips for AI and cloud technologies can be designed and produced using alternative technology – like photonics – that are more powerful and energy efficient. Experts have already been claiming that current semiconductor technology and Moore's Law will be reaching its limit within this decade. It is not beyond expectations that

China might be at the cutting edge of alternative technologies and lead the next generation semiconductor platform to replace silicon wafers. China is already known to have success at the following alternative materials – graphene polymer composites – which can be integrated into a range of photonic systems. These are being explored in Chinese labs, and commercial enterprises such as at Huawei, while other chip companies are working on replicating EUV machines. Photonics plays an essential role in our day-to-day lives. The technology offers an incredible opportunity for the design and manufacturing industry, helping to create faster, more accurate results while also transforming the telecommunications industry. Photonic devices are able to transmit vast amounts of data in an instant, and the technology plays a crucial role in how we access the internet and connect with people.

3) On the military constraints of the lack of advanced chips, there is none of that sort of thing. Weapons don't need the smaller chips as just it has been shown that Russian rockets designed decades ago still work pretty well in Ukraine. China is not competing to replace the US as global hegemon, and the PLA can make do with larger chips in the meantime, and still have good stuff to upgrade itself. Most chips used in military hardware are old proven technologies. They don't need the latest fad. And besides, it is China that has the hypersonic missiles and the newest satellite technologies that the US is trying to catch up on.

4) The most important thing we have covered in the above exposition is that China does not lack the talent pool that can do everything that has been achieved by the Taiwanese. It is already well known that Chinese companies are actively recruiting engineers from TSMC (it is culturally easier for Taiwanese to live and work in Shanghai than in Arizona), attracting international talent like Daniel Povey (a British engineer who helped developed Siri for Apple); as well as developing its home grown talent, which include some extraordinarily smart people who are making breakthroughs in various fields in physics that will have an impact on the industry. The inability of western companies in the American corner to sell to China, will lose them significant revenues, while their competitors in China, expanding into the less sophisticated but well demanded chip market within their own country, will reap most of the business left on the table. Again, this is analogous to Europe not buying energy from Russia to hurt it – it didn't work because the Indians and the Chinese stepped up and bought everything in sight. Over time, this will impact on the western companies' ability to push the envelope through R&D. On the other hand, Chinese companies will acquire exactly those resources to pursue just that.

5) There is of course the initiative by the Biden White House to provide subsidies to semiconductor companies to bring their technology to a higher level or to build more plants in America. I think that this will ultimately fail. Firstly, the US Government is facing tremendous pressures on limiting its expenditures in the following ways: a) higher interest rates mean more debt servicing; b) US$110 billion spent in supporting Ukraine in just 11 months will put tremendous pressure on other spending; and c) American government is ill-suited to engage in the kind of government-private sector coordination

that its entire economic system has been rejecting since Ronald Reagan. It cannot turn around overnight and practice the kind of state-private business model that has brought rapid growth in China. It just won't work in the States. The subsidy program will die a natural death as has the Build Back Better initiative on infrastructure. There is simply no money available to the American government to do this, nor do they have the experience to run business related projects in an economy that eschews government participation.

6) The Chips and Science Act is atypical of American government initiatives. The US has long been leery of industrial policy, unlike in China, under which the government rather than the market steers resources to particular industries. Most economists in the US frown on industrial policy and criticise it as picking winners. But there is bipartisan support for this effort, because it is another anti-China initiative. Both Republican and Democratic legislators support it because they regard semiconductors can be made an exception because like oil, they are of vital importance to the American economy. One cannot argue against this line of logic, but American government is not streamlined for this kind of work. The red tape, generally anti-business, will likely kill the effort.

All in all, the biggest hurdle historically for semiconductor innovation is money. In a way, this is a winner takes all game – the best producers sell the most, make the most money and push on with that funding to stay at the top. Those companies that make the most advanced technologies can produce better chips cheaper and dominate the market. It is therefore ironic that the US is forcing Chinese companies to buy Chinese chips and helping to finance Chinese chip R&D.

Guess where this is all gonna end up, in a few years from now?

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Un-Influencer in a World full of Hubris