The US enhances sanctions pressure on China and pushes global economy into recession

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Politics and growing global conflicts keep hindering the global economy and microelectronics. The positive sales dynamics in the global semiconductor market has been declining for six months in a row which indicates that the period of shortage which was formed due to the COVID pandemic is ending and is being replaced by an increase in manufacturers' inventories, a drop in demand for consumer goods and a reconsideration of capital expenditures for new production by large companies. One of the main reasons for this is the growth of geopolitical tensions in the world and conflicts that are threatened to turn into an all-against-all format. In terms of economics, the most dangerous is the conflict between the United States and China which may not be limited to a sanctions war. But a global recession is becoming inevitable.

Chinese microelectronics is under new US strikes

2022 finally draws a line under the period of the prevalence of economic globalization in the world economy. The trend of regionalization of production in the economy that has been clearly visible since 2020 has not only not disappeared but has intensified, although last year in microelectronics it acquired the form of a hybrid symbiosis from projects of transnational companies outside their national residence with the governments of foreign countries. Most likely, this is an intermediate stage towards the final transition to regionalization, at least in the creation of new productions and technologies. And two circumstances contributed to this to the greatest extent: the growing geopolitical tension in connection with the conflict in Europe with the participation of Russia and the enhancing US economic sanctions against China.

The economic stagnation in Russia which has been going on for about 10 years with its 2–3% of global GDP has a little effect on the global economy, but the country's aggressive policy accompanied by rising world energy prices and the uncertainty of the future has a negative impact on the market. China which had exponential economic growth for two decades has moved on to a sustained growth and its export-oriented economy is heavily dependent on foreign markets. For these reasons, US economic sanctions are hitting high-tech export sectors of the economy quite noticeably and especially China's electronics industry which is a system-forming for the Celestial Empire.

In 2021, China's electronics industry driving by global COVID and post-COVID shortages, grew at a rapid pace and the US sanctions were limited only by earlier measures imposed by the Trump Administration on sub-10nm semiconductor technologies. However, as the hype around the shortage of electronic components subsided and with the beginning of the fall in global consumer goods markets, the United States increased pressure on China by expanding sanctions on technologies, equipment, and software for 14-nm process technology as well. And it seems that an additional impulse to this was the information that the state-owned company SMIC, the leader of the Chinese semiconductor industry, despite US sanctions reproduced the N+2 process technology, the original version of TSMC's 7-nm process technology [1].

Previous US sanctions were directed against the development of this particular technology at SMIC. It is clear that this process with the use of DUV lithography instead of EUV lithography with multiple exposure of critical layers does not correspond to modern version in terms of cost and yield. In addition, the relatively simple cryptocurrency mining chip produced by SMIC using this technology is significantly inferior to complex logic chips. TrendForce believes that it will be difficult to implement reproducible mass production of more complex logic chips using this 7nm technology, and without US SMIC equipment, it is unlikely to be able to create a complete production line [2].

Probably for the same reason, the United States also increased pressure on the Dutch company ASML, the world's monopoly manufacturer of this equipment with a demand to expand sanctions against China not only on equipment for EUV, but also for DUV lithography [3]. DUV ArF immersion systems are also extremely important for the production of products on 40/28-nm technological processes, for the expansion of which China has staked in 2021-2022 considering the shortage of semiconductors during the COVID period and due to US sanctions. The US strike also

aims to expansion of these mature industries in China. However, neither ASML nor the Dutch government was enthusiastic about the US proposal, as the Chinese market took 16%, or 2.1 billion Euros in ASML sales in 2021 which is the third place after Taiwan and South Korea, and no one wants to lose it [4].

Another area that has raised US concern about China's success is the production of 3D NAND flash memory. The American company Micron Technology controls 11% of the global market, but the Chinese company YMTC, founded in 2016, not only captured 5% of the market, but also quickly organized the production of 128-layer 3D NAND memory. In 2022, YMTC released it to the market, although the most advanced in the world is 232-layer 4D NAND memory, recently introduced by SK Hynix [5].

According to Reuters, since the beginning of this year, flash memory production in China has reached 23% of the world's market, although just two years ago this figure did not exceed 14% [6]. The United States decided to impose sanctions on the supply of American equipment to Chinese companies, mainly from LAM Research and Applied Materials for the production of 128-layer and higher memory chips. However, as in the case of ASML, such a decision directly affects the interests of Korean companies Samsung Electronics and SK Hynix which have their own production facilities in China which will also be subject to these sanctions. Obviously, the Koreans are not interested in this, since the restrictions will seriously hamper technical and technological innovation at their facilities in China.

In July, the long-discussed CHIPS and Science Act to support the US semiconductor industry [7] was passed in the United States which immediately aroused outrage from China which called the law a typical discriminatory measure in violation of international trade rules [8]. This law is aimed at strengthening the global position of the United States in the market, ensuring technological sovereignty and attracting American and foreign companies to build semiconductor facilities in the United States. The total budget expenditures under this law will reach $280 billion, $52 billion of which is for chip makers. These funds will be eligible for those companies that are going to build new fabs for the production of semiconductor components in the United States, but the recipients of subsidies must not work on export of semiconductor products to China and other "countries of concern" for 10 years, including products manufactured according to mature lithographic standards below 28nm. Companies found in violation of this requirement will have to return the received funds back to the US budget. Such a law runs counter to the interests of TSMC and Samsung which are already building semiconductor manufacturing plants in the US and have received some guarantees for subsidies from the US government, but also have factories in China. The main beneficiaries of this law will be Intel, GlobalFoundries, Micron, while China will be the main indirectly affected party which caused their indignation. Keith Krach, a former Under Secretary of state in the Trump administration who previously negotiated with TSMC for the company's agreement to build a chip manufacturing plant in the United States, who believes the second phase of the law should be to attract leading Asian assembly companies Amkor and ASE for the construction of factories for the assembly of chips in the United States [9]. Currently, the most advanced and innovative assembly plants are located in Asia, not in the US. After TSMC's and Samsung's projects to build semiconductor plants in the US, such a development looks quite possible, and most likely, both companies will be forced to agree to this proposal. Thus, the main goal of the United States is to create a closed national ecosystem for all the most advanced semiconductor technologies on its territory, not only for chip production, but also for assembly. However, this means a transition to the complete dominance of the United States in all areas of the global electronics industry, in which the United States has lost production positions in recent decades. At the same time, the US goal is to suppress the economic growth of China and its flagship electronics industry. This does not bode well for the global semiconductor microelectronics industry. The United States is also well aware that with rising bank rates and in the face of an approaching global recession, the dollar will

become a temporary refuge for investors, especially if there is a recession in the Chinese economy.

All previous global crises began with a sustained slowdown in the global electronics industry, and its current six-month decline is a clear signal that a global economic recession is on the way. The factor against it was the rise in oil prices, provoked by the situation in Ukraine, but it seems that this trend has changed, and the world oil price is responding to the economic downturn, dropping below $100 per barrel.

Gartner Inc. in July adjusted its previous forecast for the global semiconductor industry market for 2022, reducing revenue growth from 13.6% to 7.4%, and in 2023 predicting its decline by 2.5% compared to 2022 [10].

Specialists of the investment company Goldman Sachs for the second time this year also reduce their forecasts for semiconductor and equipment manufacturers. The first time they did this was in March 2022, and in July they adjusted them again, believing that the revenue of electronic component manufacturers would decrease by an average of 22% and by 27% for equipment manufacturers [11]. This will affect all companies and, first of all, those who created electronics for remote work during the COVID epidemic, but manufacturers of components and server equipment, data centers, industrial and even automotive electronics will also suffer. Analysts at Goldman Sachs cut their 2023 EPS forecasts by 46% for Intel, 21% for Texas Instruments, 42% for Onsemi and 43% for Seagate and Western Digital. Companies operating in the military and defense segments will be in a better position due to the increase in corresponding orders. All this suggests that the recession of the global economy has already begun and will continue in 2023, while the exact timing of the global recession is still difficult to predict.

Will China invade Taiwan?

This question until the beginning of 2022 looked rhetorical, and only a few could give a positive answer to it. However, the events of 2022 have dramatically changed the situation in the world, and the answer to the question no longer looks so clear. The invasion of Russian troops into Ukraine, which also seemed unlikely until the end of 2021, dramatically changed the world situation and, moreover, the threat of a nuclear war in the world ceased to seem like just a Hollywood scenario. The scandal over the visit of US House Speaker Nancy Pelosi to Taiwan, accompanied by Chinese military exercises and missile launches around the island, has not yet ended, and it only adds tension to relations between these countries and throughout the entire world.

The second argument for the possibility of such a step is the continuous US sanctions against China, which seriously undermine its economic growth. The possibility of taking control of the world's main chip manufacturers TSMC, UMC, Powerchip and other companies whose production facilities are located in Taiwan, in order to influence world politics, is certainly being worked out in Chinese Government offices. TSMC Chairman Mark Liu said in an interview with CNN that fears about China's desire to seize Taiwan to gain control of the world's largest contract chipmaker are unreasonable [12]. According to him, no one will be able to seize TSMC's power, since complex industrial relationships and technological processes in the event of a Chinese invasion will be irreversibly disrupted and everyone will suffer from this. But how many cataclysms and wars in world history could have been avoided if all the decisions of the country leaders were made only with a common sense approach!

The third important argument is that China's already completed departure from the legacy of Deng Xiaoping and the rule of no more than two five-year tenures as the country leader. Xi Jinping may want to repeat the Russian experience of Vladimir Putin and extend his stay in power indefinitely, justifying this decision by complicating the world situation and a possible war with the United States, which will become real if China seizes Taiwan. In that case China will be forced to switch to a mobilization economy and relying on an alliance between China and Russia against the United States will not only become inevitable but will also undermine the world economy for many years to come and further increase the risk of a new world war. The Chinese

economy, unlike the Russian economy, has something to lose in such a scenario. World semiconductor microelectronics will not only stop developing but will also take a few steps back. Will this become an obstacle for the leader of China? The answer, given the autocratic nature of the regime, no longer looks as clear as before.

Apparently, this is also well understood in the United States as they decide to create a safety net for Taiwan with the most advanced production of chips according to the standards of less than 3nm in the allied countries - South Korea and Japan. But while the South Korean Samsung has been working on these technologies for a long time, Japan is far behind, and in order to pull it up to the most advanced semiconductor production, the United States together with Japan are creating a research center on the island to develop a process technology for mass production using 2 nm technology, scheduled in this country for 2025 [13].

By taking over Taiwan, China could theoretically gain control of state-of-the-art chip manufacturing facilities but would be cut off from thousands of international suppliers of materials and components for domestic production, and lose most of its current export as well as the American market. And this means the beginning of the decline of Chinese microelectronics and the economy. Is it worth it? So far, over the past decades, unlike in Russia, economic arguments have always dominated political ones when China makes political decisions. However, now many are not guided by prudence.

Conclusions

The semiconductor industry as a barometer of the global economy is the first to respond to the approaching recession of the global economy due to sharply increased geopolitical risks, military conflicts and increasing sanctions pressure on China's electronics industry, the development of which in recent decades has kept the world economy from deeper failures during previous economic crises. The United States is trying in every possible way to slow down the Chinese economy, including restriction of access to the most modern technologies, equipment, software, at the same time continuing the economic policy of regionalization and trying to create a self-sufficient domestic production ecosystem on the territory of the United States and its allies. China, unlike the United States, does not have any successful high-tech economic allies in this struggle and being alone there are no chances to win the economic war with the United States. This means that the United States does not exclude the transition of the economic conflict with China into a military one with the participation of Taiwan. Then the world economy and politics will face the darkest days since the end of World War II.

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