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A Brief on Reshaping the Global Supply Chain of Semiconductors

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The Israeli-Hamas conflict has been ongoing for nearly eight months. As of mid-May, the death toll had reached 3,700, making it the longest and deadliest war in Israel's history, with the exception of the 1st Arab-Israeli War in 1948. Various countries, including the United States, Qatar, Egypt, and others, have been engaged in efforts to end the war, yet ceasefire negotiations have not yielded positive results.

In early June, the U.S. proposed a three-stage ceasefire plan that would lead to a six-week ceasefire and the withdrawal of Israeli forces from populated areas of Gaza, the release of all hostages, a cessation of hostilities, and the reconstruction of Gaza. However, an agreement between Israel and Hamas appears elusive. Meanwhile, Israel is at a political disadvantage at home and abroad. As the war has dragged on and civilian casualties in Gaza have increased, criticism has grown. The stated

objectives of the war, namely the dismantling of Hamas and the rescue of hostages abducted in the October 7 attack, have not been achieved. Consequently, Israeli Prime Minister Netanyahu is being compelled to adopt a more conservative stance in accordance with the country's unique political system. It is therefore unlikely that he will accept a ceasefire for his own political survival.

International Condemnation for Israel's Excessive Retaliation

On October 7, 2023, Hamas initiated a sudden assault on Israel, firing in excess of 5,000 rockets. Hamas and Palestinian Islamic Jihad (PIJ) fighters employed a variety of methods to infiltrate Israeli territory, launching a brutal campaign of violence and massacres that indiscriminately targeted both soldiers and civilians. This resulted in the deaths of over a thousand people and the abduction of more than two hundred Israelis and foreigners. This constitutes a clear violation of international law. Israel immediately vowed retaliation and began bombarding the Gaza Strip with heavy firepower the next day, October 8. Israel was clearly permitted to halt and repel the Hamas attack; moreover, the liberation of the hostages is a legitimate purpose. Self-defense in Article 51 of the UN Charter arguably also allows the prevention of reasonably foreseeable future threats. However, several controversies surround this retaliation as an exercise of self-defense.

Primarily, the exercise of the right to self-defense must respect the customary international law requirements of necessity and proportionality. In terms of the death toll alone, the war has killed more than 36,000 Gazans and 1,000 Israelis, and Israel has retaliated more than 30 times, which is far beyond what is necessary and proportionate.

Secondly, there is a dispute as to whether Gaza is effectively under Israeli control and therefore subject to the right of self-defense. Israel asserts that effective control ceased when Israeli forces withdrew from Gaza in 2005, yet a UN commission of inquiry concluded in 2022 that Israel still controls Gaza.

Thirdly, it is argued that the right of self-defense is only applicable in state-to-state relations and therefore cannot be exercised against Hamas, a non-state actor. In other words, the status of the Gaza Strip determines whether Israel's right to self-defense can be applied under international law.

Humanitarian Issue

Furthermore, Israel's disproportionate retaliation has created humanitarian crises and prompted international condemnation. Of the over 36,000 Gazans killed in Israeli retaliation, 70% are reported to be women and children. Rafah, the city in southern Gaza Strip is home to over 1.4 million displaced individuals, and Israel has been expanding its ground operations there. The Israel Defense Forces (IDF) claims that it is attempting to protect civilians by establishing humanitarian zones, yet this strategy has proven ineffective.

In April, as volunteers with an international aid organization, the World Central Kitchen, were killed in an Israeli airstrike, Israel withdrew most of its troops from Gaza and intensified its relief efforts in the face of mounting international condemnation. However, even after this, activists, including UN staff, have been targeted. Israel bombed a United Nations Relief and Works Agency (UNRWA) school in the Gaza Strip refugee camp, resulting in the deaths of 30 to 40 people. On June 8, at least 236 people were killed and more than 400 injured during the rescue of four Israeli hostages held in the Gaza Strip. While some countries, including the U. S., have praised the rescue of the hostages, critics, mainly from Arab countries, have criticized the 600 casualties.

As a consequence of these recurring issues, the international community has increasingly expressed its disapproval of Israel's conduct of the war. Currently, Israel is facing charges of genocide against Palestinians at the International Court of Justice (ICJ). In addition, the International Criminal Court (ICC) issued arrest warrants in May for Netanyahu, the leadership of Israel's military wing, and the leadership of Hamas. On June 7, the UN Secretary-General added the Israeli military

to a list of perpetrators of child rights violations, along with Hamas and the PIJ. Furthermore, the deterioration of relations with individual countries is also evident. Colombia, Israel's largest coal supplier and a free trade partner since 2020, terminated diplomatic relations with Israel and announced its intention to cease the sale of coal to Israel. In May, the Turkish government also announced a trade suspension, citing criticism of Israel's military operations in Gaza.

Deteriorating Relations with the United States

In addition to the international community's concerns, the shift in U.S. attitudes toward Israel is noteworthy. Since the Cold War, the U.S. has demonstrated unwavering support for Israel. Even in the current conflict, it has continued to provide unconditional backing to Israel. However, as the civilian casualties mounted and the prospect of a ground war in the Gaza Strip's Rafah region loomed, it appeared to exert pressure on Netanyahu. President Biden has expressed opposition to the deployment of ground forces in Rafah, advocating for the implementation of more robust measures to protect civilians and the cessation of artillery support. The U.S. was also disinclined towards the Israeli military's actions, when it conducted airstrikes on villages in southern Lebanon on June 8, indicating a more assertive stance towards Hezbollah in Lebanon. The U.S. has determined that Netanyahu is unlikely to develop a post-war plan in the face of pressure from Biden to end the conflict on all fronts. Furthermore, the U.S. has also expressed distrust of Netanyahu, even going so far as to assess that "there is 'every reason' for people to believe that Netanyahu is delaying the war for political purposes."

Right-wing Domestic Politics

Despite the unfavorable publicity at home and abroad, it is evident that Netanyahu is unable to bring an end to the war independently. Israel is a parliamentary cabinet system, whereby a coalition government is formed by a majority of the 120 Knesset members elected in general elections to lead the country. In the event that a party withdraws from the coalition, the coalition is dissolved, and a new election must be held. In recent years, the personal irregularities and corruption of Netanyahu have caused significant upheaval in Israeli domestic politics, including the dissolution of his coalition, early elections, and re-elections. As a result, Israeli politics has been polarised into pro- and anti-Netanyahu camps. Netanyahu's alliance with the far-right has prolonged his political life, as he has pushed through plans to expand Jewish settlements in the West Bank and passed judicial reforms. The reforms sought to eliminate or reduce the Supreme Court's checks on the legislative and executive branches of government, allowing the Israeli government to make laws and implement policies without institutional checks. This signaled a regression in democracy and a far-right turn in politics, with massive anti-government protests immediately erupting.

Netanyahu's political survival necessitates the maintenance of the coalition. Among the right-wing politicians, Finance Minister Bezalel Smotrich and National Security Minister Itamar Ben-Gvir have threatened to resign and collapse the governing coalition if Netanyahu agrees to a ceasefire proposal for Gaza unveiled by Biden. Conversely, Benny Gantz, a centrist politician and long-time political rival of Netanyahu, who joined the wartime coalition in the early days of the war, has called for snap parliamentary elections in September and announced his withdrawal from the coalition. Gantz's departure will maintain the coalition. However, Netanyahu appears to be unable to serve as Prime Minister again if the coalition collapses and elections are called. This is because Netanyahu is not expected to be free of blame for the failure of the initial response to the war and the failure to achieve the war's goals. Thus, Netanyahu is likely to prolong his political life by relying more heavily on the far-right.

Conclusion

The conduct of warfare in the fog of war presents a variety of situations that cannot be anticipated or prepared for. In such situations, the various responses taken to achieve victory can lead to the violation of commitments made to each other in the international community, or to the respect and protection of human rights. Nevertheless, violations of laws, regulations, and human rights can undermine the legitimacy of a state (especially a democracy) and cause it to lose international standing and respect. In the context of the ongoing Israel-Hamas conflict, Israel's violations of international law, including the conduct of the ground war in Gaza, have led to a growing anti-Israel sentiment around the world. This has resulted in mounting criticism of Israel's policies towards the Palestinians, particularly in Gaza, and has eroded the unwavering support traditionally afforded to Israel by countries that are traditionally pro-Israel, including the United States.

In the face of the prevailing circumstances, Netanyahu has chosen to persevere in the war for political survival. Consequently, it seems unlikely that the war will conclude in the near future. War is a continuation of politics and a means to an end, but he is making extreme choices that will result in a significant loss of lives and international prestige. It is hoped that both Israel and Hamas will choose wisely.

A Brief on Reshaping the Global Supply Chain of Semiconductors

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1. Semiconductor Supply Chain as a National Security Issue

In the past, semiconductor supply chains were formed based on economic factors centered on efficiency and expertise and fragmented from the United States to Northeast Asia, but recently, the supply chain reorganization based on strategic factors such as national security and technological sovereignty has been discussed.

Semiconductors are a crucial component of some of the newest technologies, including artificial intelligence, quantum computing, and the Internet of Things. The semiconductor industry is also of strategic importance from a national security perspective. Moreover, semiconductors play an important role in the defense industry, as technology itself is becoming weaponized.

Global security is too closely intertwined with whether the semiconductor industry maintains stable output. Disruption to a small number of major fabs around the world could lead to soaring prices, and maliciously inserting vulnerabilities into semiconductor hardware could ostensibly shake the country's major infrastructure. This has led to a wider spread of export controls aimed at preventing semiconductors from being used to develop enemy military capabilities, and a revival of industrial policies aimed at improving domestic manufacturing capabilities.

In a lecture hosted by the Center for Strategic and International Studies (CSIS), U.S. Commerce Secretary Gina Raimondo declared that the U.S. will achieve 20 percent of the manufacturing share of front-end process semiconductors by 2030, become the only country in cutting-edge semiconductor design, and build a semiconductor value chain ecosystem by attracting the intellectual property (IP), fabrication, and materials, parts, and equipment stages of the front-end process Foundry to the country.

To this end, the U.S. government is pursuing semiconductor supply chain de-risking by declaring 'Small Yard, High Fence'. This is a position to maintain technological competitiveness by precisely controlling exports to high-tech fields such as semiconductors, quantum technology, and artificial intelligence while protecting profits from manufacturing exports to China as much as possible. The U.S. has also recently expanded its export controls on China in greater detail, calling for allies to participate. In addition, inbound and outbound investment and intellectual property (IP) are

controlled to check China in multiple ways.

More specifically, Japan and the Netherlands have recently begun regulating the export of equipment and materials to China in response to U.S. demands, and the regulations include the repair and maintenance of equipment already sold. The U.S. is also increasing pressure on export regulations, focusing on equipment and parts, while pressing South Korea and Germany. As a result, there are concerns that multilateral export regulations led by the U.S. could include graphics DRAM, HBM, high-spec memory less than 10 nanometers, or NAND flash products more than 300 layers.

2. The Recent Development of The Supply Chain of Semiconductors

There are more than 30 types of semiconductor products, and their development requires deep hardware and software expertise, advanced design tools, and IP. In addition, up to 300 materials are used in the manufacturing process and processed using more than 50 kinds of precision equipment. As a result, a complex and highly internationalized supply chain has been created, from chip design to manufacturing, assembly, test, and packaging (ATP). Therefore, for the production of good quality semiconductors, the reorganization of supply chains is difficult to occur voluntarily in the market because the network is formed based on deep trust and enormous investment among participating companies at each stage.

Currently, in the semiconductor supply chain, the U.S. leads the field of designing logic chips such as high-end CPUs, external GPUs, FPGA, and AI ASIC, and the U.K. and India also have a lot of talent in this field.

The fab market has two main business models. One is 'Fab', which is owned by Integrated Device Manufacturing (IDM) in the supply chain, and the other is 'Foundry', which focuses on manufacturing chips for third-party customers. Much of the fab market share and production is held by companies based in the U.S., Taiwan, Korea, Japan, and China. Most of the world's high-tech logic fab production is specifically by Intel in the U.S., TSMC in Taiwan, and Samsung in Korea, with Taiwan and Korea having the largest number of state-of-the-art fabs. However, the highest performance lithography equipment is manufactured and supplied by ASML, a Dutch company.

Assembling, testing, and packaging (ATP) services are performed within IDMs and foundries or provided by OSAT (Outsourced Semiconductor Assembly and Test) companies. The main suppliers of ATP services are Taiwan, the United States, China, and South Korea.

Since 2000, China's share and ranking in the global semiconductor supply chain has risen significantly. In particular, China's position in the general-purpose semiconductor supply chain is solid. Currently, Taiwan accounts for 60% of semiconductor production at the level of 20-45nm and China only 27%, but it is expected to reach 80% within the next three to five years. For the 50-180nm process, China currently accounts for 30% of global foundry capacity, and according to their plan, it is expected to increase to 35% within 5 years and achieve 48% within 10 years.

3. Strategy for the Stability of Supply Chains by Country

3.1 China

China, which promoted semiconductor growth in the 2000s, surpassed the United States with a 15% share in 2020. China is known to have invested more than \$50 billion in fostering the semiconductor industry with its 'Made in China 2025' and created another \$47.5 billion funds in 2024. At this rate, the market share is expected to reach 24% by 2030. In addition, China has emerged as the ICT Global Value Chain Hub in the 2010s and as the world's largest semiconductor consumer.

However, semiconductor production capacity was far behind that of advanced countries, with China's semiconductor trade deficit reaching \$260.8 billion in 2021, \$35.2 billion in semiconductor manufacturing equipment, and the total semiconductor industry trade deficit reaching \$296 billion. In addition, due to recent export controls by the U.S. and its allies, it has faced great difficulties in designing and developing advanced chip technologies as it has not been able to produce high-end graphics processing units (GPUs) used for AI and machine learning.

China imports 56.73% of its semiconductor manufacturing equipment and components from the U.S. (15.03%), Japan (30.81%) and the Netherlands (10.89%), while its production can meet only about 7% of domestic chip demand.

The addition of Japan and the Netherlands to U.S. sanctions on semiconductors and export controls on China will allow the U.S. to demand more participation from global semiconductor manufacturers in the future. Therefore, the technological gap between China's semiconductor industry and advanced countries is likely to widen further, given China's dependence on CHIP-4 countries.

3.2 The United States

The Biden administration's policy direction of "semiconductor independence" is clear. Although it is the first country to invent semiconductors, it aims to regain the hegemony of

semiconductors lost to East Asia and build all production plants in the United States, from semiconductor design to production and cutting-edge packaging. The United States declared a "semiconductor war" in October 2022, suspending exports of advanced semiconductor production facilities to China, which is investing heavily in semiconductors due to the "semiconductor rise." The United States has focused on keeping China from securing the technology needed to manufacture advanced semiconductors that can be used to strengthen its military power, but recently it is wary of China controlling the general-purpose semiconductor industry used throughout the economy.

As a result of the 6th Trade and Technology Council (TTC) Ministerial Meeting held in Leuven, Belgium in April, the U.S. and the EU issued a joint statement saying, "The EU and the U.S. share concerns about non-market economic policies and practices that can lead to distortion or excessive dependence on legacy semiconductors." This suggests that the U.S. and the EU may respond together through export controls if the Chinese government is judged to support dumping of Chinese semiconductor companies with unfair subsidies.

In addition, the United States is developing a strategy to solve the market disturbance problem through 'Friendshoring'. It is an attempt to reorganize the global supply chain of the semiconductor industry centered on the United States by establishing a semiconductor production network between the allies. As mentioned earlier, considering U.S. Commerce Secretary Gina Raimondo's declaration that the U.S. will complete the creation of an ecosystem for the production of advanced semiconductors by 2030, the U.S. semiconductor manufacturing capabilities are expected to gradually strengthen. The latest report by market research firm TrendForce predicted that the share of U.S. production capacity in the entire advanced foundry market (16 nanometers or less) will increase from 12.2 percent last year to 17 percent by 2027.

First, the U.S. encouraged its allies South Korea and Taiwan to invest in advanced 2-4 nanometer semiconductors. The U.S. Department of Commerce announced in April that it would provide 6.4 billion dollars in subsidies for semiconductors to Samsung Electronics under the CHIPS Act. This is the third largest subsidy after Intel. (8.5 billion dollars) and TSMC. (6.6 billion dollars). In addition to the Foundry 1 plant that is currently under construction in Texas, Samsung Electronics has also decided to build an additional 2 (2 nanometer process) and an advanced packaging plant and an R&D center. Currently, 70 to 80 percent of 2-4 nanometer semiconductors are produced in East Asia, with the company planning to reorganize its supply chain to make about half of them in the U.S.

However, supply chain vulnerabilities are still expected to exist due to the lack of ability to advanced packaging substrates. And 92% of high-tech logic semiconductors under 10 nms are still produced by Taiwan, and there is no production in the United States. However, the United States accounts for 19% of analog semiconductors, similar to 17% in China and much lower than 27% in Korea. It will be difficult for the United States to close the technology gap from Taiwan and Korea in semiconductor manufacturing in the short term.

3.3 European Union

Europe's global semiconductor market share is about 10% as of 2020, which means that semiconductors are highly dependent on imports from third countries. Most semiconductors over 22nm are produced in Europe, and advanced semiconductors under 7nm are not produced in the region, so there is a big difference from advanced countries in chip manufacturing capabilities. However, it has the advantage of having manufacturing equipment such as EUV lithography system and Mask Aligner required for large-scale production and world-class research organizations such as IMEC (Interuniversity Microelectronic Centre) and CEA-Leti.

In April 2023, the EU agreed to enact the 'European chips Act', which focuses on industrial support measures to increase semiconductor supply capacity in the region. The public and private sectors plan to invest a total of 43 billion euros to increase their global share of semiconductor manufacturing to 20% by 2030. In addition, the EU is implementing the Important Project of Common European Interest (IPCEI) to reduce offshore dependence on supply chains and secure autonomy. In principle, regional industrial subsidies are prohibited due to concerns about competition distortion, but they are considered EU future industries and allow subsidies at the member state level when selected as IPCEI. In addition, it will establish a 2 billion euro "EU Chips Fund" to strengthen financial support for the European semiconductor ecosystem and provide up to 50% of finance for all value chain processes ranging from semiconductor innovation research to design and production equipment and large-scale manufacturing.

3.4 Japan

Japan maintains the world's the largest market share in semiconductor materials and post-processing and the second largest in equipment, but few Japanese companies are seen in manufacturing.

Japan and the United States agreed on the "basic principles of semiconductor cooperation" at a summit in Washington, DC in May 2022, and recently issued a joint statement with the European Union for cooperation in the semiconductor sector. Through this, IBM of the United States and IMEC of Belgium decided to distribute cutting-edge semiconductor manufacturing technologies and equipment to Japan. Taiwan's TSMC has decided to build a factory in Kumamoto and produce general-purpose semiconductors. It plans to establish Lapidus through joint investment with eight major private companies, including Toyota and Sony, to produce prototypes of 2nm semiconductors by 2027 and start mass production in 2027. In fact, IBM started supporting Lapidus, and Micron, the largest semiconductor company in the United States, announced that it would invest up to 500 billion yen to produce next-generation DRAMs with 10nm 6th generation processes in Hiroshima.

3.5 Taiwan Province of China

The core of Taiwan's semiconductor growth stems from the state-led creation of a non-memory semiconductor

ecosystem through scientific complexes for 40 years from the 1980s. In 1980, the Taiwanese government built a science and industrial complex in Shinju, near the capital Taipei, modeled after Silicon Valley in the United States. The core industry of the Shinju Science Industrial Complex is semiconductors, which have developed into a cluster of about 200 semiconductor-related companies. Since then, it has established the Southern Science Park in Tainan and Kaohsiung in 1999, and the Central Science Park in Taichung, Heowri, and Huwei in 2004. About 20 semiconductor-related companies have entered clusters in the south and central regions, respectively. These three clusters are the core supporting Taiwan's Silicon Island project.

In response, Democratic Progressive Party candidate Lei Ching-te, who was elected president of Taiwan, said, "We will support the establishment of a comprehensive (semiconductor) cluster in Taiwan." During his mayorship of Tainan, a city in southern Taiwan, Lei Ching-te succeeded in attracting the plant, promising to solve infrastructure problems such as land, power, and water when TSMC, the world's largest semiconductor foundry company, established a 3nm fab site. Tainan has attracted more than 20 semiconductor companies and became Taiwan's second semiconductor cluster after the Shinju Science and Industry Complex (HSP) in the north. Taiwan is already working on a project to create a semiconductor material cluster in Kaohsiung in the south by 2030.

According to global market research firm TrendForce, TSMC accounted for 57.9 percent of the global Foundry market in the third quarter of 2023, while second-largest Samsung Electronics held only 12.4 percent of the market. The gap is attributable to semiconductor clusters. Success factors in Taiwan's semiconductor cluster include government policies, the state-funded Institute of Industrial Technology (ITRI), industry-academia-research system between nearby universities and companies, talent flow due to high pay in the semiconductor industry, and ecosystem-oriented joint growth that even takes care of small and medium-sized enterprises.

TSMC's business model, which plays a key role in Taiwan's semiconductor cluster, also contributed to the development of the cluster ecosystem. With the motto of "not competing with customers," TSMC chose a model that grows together while securing small and medium-sized fabless companies as customers. Nvidia, the world's largest AI semiconductor company, was also able to grow thanks to TSMC in the early stages of its business. This means that a cluster in which fabless and foundry are in a virtuous cycle has been formed. In fact, Taiwan holds a 21% global fabless market, ranking second only to the U.S. (68%).

3.6 South Korea

In January, the Korean government confirmed its plan to invest 622 trillion won and build a "semiconductor mega cluster" for the construction of 16 new fabs. According to the semiconductor cluster strategy, 13 semiconductor factories and three research facilities will be established as semiconductor clusters connecting Pyeongtaek, Hwaseong,

Yongin, Icheon, Anseong, Pangyo and Suwon in Gyeonggi Province by 2047, and a total of 37 semiconductor factories and facilities will be built.

Samsung Electronics and SK Hynix will build a semiconductor plant and research facility on a site five times the size of Yeouido. Samsung Electronics will spend 360 trillion won to build six semiconductor plants in Namsa, Yongin, and 120 trillion won to expand three semiconductor plants in Pyeongtaek. SK Hynix will build four new memory semiconductor plants in Wonsam, Yongin. The mega cluster of semiconductors will start with the completion of three plants and two research facilities in 2027, and will produce 7.7 million units per month based on wafers by 2030.

The government also supports private investment by expanding infrastructure, providing tax breaks and nurturing manpower. Moreover, it has decided to extend the tax credit for investment in semiconductors, which expires this year.

The government also plans to provide 68 billion won (62 million U.S. dollars) in large-scale R&D projects for materials, parts and equipment this year. The government also aims to overcome the technological limitations of Korea by attracting R&D centers for global top 10 equipment companies. Its targets include inspection, cleaning, and etching, which are lacking in domestic competitiveness. To this end, the government plans to actively utilize incentives to attract foreign investment worth 200 billion won (194 million dollars), which has quadrupled from last year. Previously, the government attracted a total of six R&D centers, including five of the world's top 10 semiconductor equipment companies including RAM Research, TEL, ASM, AMAT, and ASML, as well as domestic SEMES. In addition, a project to invest in ultraviolet (EUV)-based R&D centers between ASML and Samsung Electronics is underway. Through this, the government aims to expand its market share in system semiconductors, including fabless, to 10 percent by 2030, and foster 10 fabless companies in the top 50 in global sales.

Conclusion

If Samsung Electronics and SK Hynix build a plant in the U.S., in addition to global equipment, there is a possibility that they will use existing Korean companies' equipment, which could be an opportunity for domestic materials, parts, and equipment companies to enter new markets. Therefore, Samsung, SK Hynix, and domestic materials, parts, and equipment companies need a strategy to strengthen a win-win by forming a single semiconductor production network. This is because, in order for the semiconductor supply chain to remain stable, it is necessary to grow Korean materials, parts, and equipment companies through good competition to attract semiconductors as well as connectivity with companies in Korea.

Samsung's entry into the U.S. market with U.S. support can be positively evaluated, but unlike TSMC, which has large customers such as Apple, Qualcomm and Nvidia,

Samsung, which lacks demand, can be burdened by the additional construction of factories.

In addition, U.S. semiconductor subsidies could be an opportunity for Korean companies wishing to enter the U.S. and could be a burden in that they have to reduce their dependence on China. In the mid- to long-term, the U.S. could put pressure on it to reduce its relationship with China, which is likely to put a heavy burden on Korean companies, which are highly dependent on China for semiconductor exports and production compared to major countries. To receive U.S. semiconductor subsidies, we have to comply with strict application requirements such as restrictions on investment in China, recovery of excess profits, and submission of sensitive information. It is known that Samsung Electronics and SK Hynix have invested in China worth 68 trillion won. Samsung Electronics produces 40% of NAND flash memory, and SK Hynix produces 40% of DRAM memory and 20% of NAND memory in China.

Finally, semiconductor supply chains are intricately intertwined in relationships, in which dozens of related suppliers and factories around the world are interdependent, from raw materials to machines and the intellectual property that deals with them. Therefore, even if some of the production plants are moved to the United States, it is difficult to become independent from major regions such as East Asia that dominate the semiconductor market. More precisely, self-sufficiency in the semiconductor industry is impossible, and with 90% of the post-semiconductor manufacturing processes still taking place in Asia, building fabs in the country alone cannot solve the national security problem. More than \$1 trillion in additional upfront investment is required to come up with a hypothetical alternative that is fully self-sufficient and has a local supply chain in each region to meet the current demand for semiconductors. As a result, semiconductor prices will rise by 35% to 65%, which will have significant negative ripple effects, such as leading to an increase in the price of home appliances.



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