

Memorandum on the U.S. CHIPS and Science Act 2022

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INTRODUCTION

On August 9, 2022, President Joe Biden signed into law the CHIPS and Science Act of 2022 (the Act), marking the passage of a bipartisan effort to strengthen American semiconductor manufacturing and research.

Over past decades, the art of crafting microchips out of silicon wafers has become a global endeavor. American firms are still leaders in designing the devices. However, the Netherlands produce the most critical machinery for making them, while Taiwan, South Korea and, increasingly, China manufacture them.

Amongst the objectives of the Act is to bring manufacturing of semiconductors back to the United States.

On October 7, 2022, following the passage of the Act, President Biden's administration announced the most sweeping set of export controls in decades. The new rules cut off people and firms in China from many advanced technologies of American origin and the products made using these technologies. The list includes chips used for artificial intelligence, software to design advanced chips and the machine tools to manufacture them. Selling such items to China is now barred without explicit permission from the U.S. government. Rulebreakers risk being cut off from American tech themselves.

The Act provides \$52.7 billion for American semiconductor research, development, manufacturing, and workforce development, alongside another ~\$200 billion for more general investments in technology and science, including artificial intelligence and fusion energy. Even with varying degrees of skepticism about the effectiveness of the Act from involved parties, this is undoubtedly an endeavor of massive proportions, and another escalation of the technology war between China and the U.S. It will be crucial to monitor the aftermath of the Act closely for the lasting impact it will have on the trajectory of the geopolitical and economic landscape in the years to come.

1. SUMMARY

a. Background

Over two-thirds of the most advanced semiconductors are manufactured in Taiwan. As many advanced semiconductors are crucial for development and manufacturing of cutting-edge technologies and military equipment, it is crucial for the United States to maintain its self-sustainability and technological superiority.

b. Semiconductor Research

At its core, the Act provides \$52.7 billion for American semiconductor research, development, manufacturing, and workforce development. This can be broken down into \$39 billion in manufacturing incentives, \$13.2 billion in R&D and workforce development, and \$500 million for international information communications technology security.

Additionally, the Act provides a 25 percent investment tax credit for capital expenses and various investments for the manufacture of semiconductors and related equipment.

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Various companies have announced more than \$44 billion in new semiconductor manufacturing investments, citing the Act (and specifically the investment tax credit) as the catalyst for these investments. This \$44 billion is mainly comprised of investments by three companies, Micron, Qualcomm, and GlobalFoundries.

Qualcomm and GlobalFoundries have announced a partnership centered around investment of \$4.2 billion for the purpose of manufacturing chips in an expansion of GlobalFoundries' New York facility. Qualcomm, which holds its place as the leading fabless¹ semiconductor manufacturer of the world, has announced a plan with the goal of increasing semiconductor production in the U.S. by up to 50 percent over the next five years.

Micron, America's largest enterprise focusing on computer memory and computer data storage, has announced a substantial \$40 billion investment in memory chip manufacturing. This investment is projected to increase U.S. market share of memory chip production from less than 2 percent to up to 10 percent over the next decade. At the same time, this investment will create up to 40,000 new jobs in construction and manufacturing.

In addition to the above, there is significant additional potential investments in the semiconductor industry in the United States as described below.

c. Investments in Science and Technology

In addition to the investment and tax credit on semiconductor research, the Act provides nearly \$200 billion for programs generally aimed at American invention in science and technology.

A large proportion of the cash will flow to create 20 regional technology centers for developments backed by the government in related areas. The Act will also authorize new investments in STEM² education and training, ranging from K-12 to undergraduate and graduate education across the board. These investments will specifically pair with the National Science Foundation (NSF) to support Historically Black Colleges and Universities (HBCUs).

Additionally, there will be a \$1 billion Recompete pilot program at the Department of Commerce's Economic Development Administration (EDA) to alleviate persistent economic distress. The Recompete program is an economic development initiative that will provide grant funding to distressed communities across the country to create, and connect workers to, good jobs and support long-term comprehensive economic development by helping to reduce the high, prime-age (25 to 54 years of age) employment gap.

d. Goals

There are several stated goals of the Act, summarized in the official White House Fact Sheet. These include encouraging American innovation in wireless supply chains, solidifying U.S. positioning for the development of the technologies of the future, catalyzing regional

¹ In the semiconductor industry, "fabless" refers to a company that outsources its manufacturing to another provider. A fabless company designs, develops, and markets semiconductor products but does not manufacture them. This business model allows fabless companies to focus on their core competency of product development while leaving manufacturing to those with the necessary facilities and expertise. <https://trupathsearch.com/fabless-semiconductor/>. (Accessed March 19, 2023).

² STEM means science, technology, engineering, and mathematics.

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economic development and growth, expanding lucrative skilled STEM jobs related to a wider range of Americans, and driving opportunity and equity for all of America in STEM and innovation.

Specifically for the \$50 billion CHIPS for America Fund focused exclusively on semiconductors, the Department of Commerce has identified four strategic goals:

- Investment in U.S. production of strategically important semiconductor chips.
- Set up the path for a sustainable supply of older and current generation chips.
- Strengthening U.S. semiconductor R&D leadership.
- Grow a diverse semiconductor workforce.

Another significant goal of the CHIPS program is to attract private capital for investment in the semiconductor industry. Although the \$39 billion in federal funds are important investments, they will not be enough on their own to propel America into a position of global semiconductor leadership. Similar to the announcements of Micron, Qualcomm, and GlobalFoundries, the program is holding firm to the belief that this display of public confidence will result in other investments that will follow. See below in particular.

e. Implementation

The White House lists various mechanisms to ensure efficient and responsible deployment of funding under the Act. First, the Department of Commerce will implement the CHIPS program through the creation of two new offices, the CHIPS Program Office (CPO) and CHIPS R&D office. Additionally, the Act provides essential seed capital to the National Semiconductor Technology Center (NSTC), a private-public entity that will consist of a collaborative effort from industry, universities, Department of Energy, and Department of Defense to conduct research and provide prototyping capabilities. The CHIPS R&D office will incubate the NSTC and work collaboratively to create a 10-year financial plan for the new center.

The Act facilitates the creation of a sector-specific interagency expert working group on permitting and permitting-related project delivery issues for high-tech manufacturing. According to the President's Council of Advisors on Science and Technology (PCAST) recommendations and the official White House announcement, these mechanisms are expected to include:

- Forming a national microelectronics training network for semiconductor workforce development across academic institutions, including minority-serving institutions and community colleges.
- Fostering innovation by reducing barriers of entry to startups.
- Recommending the development of a "chiplet platform" to enable startups and researchers to more rapidly innovate at lower cost.
- Setting a national semiconductor research agenda with fundamental research and grand challenges to, for example, build the first "zettascale supercomputer" which would be 1,000 times faster than the fastest supercomputer available today.

2. REVIEW OF EXISTING COMMENTARY

There are various opinions throughout different industries on the passage of the Act. Within the semiconductor industry itself, there are complaints that the majority of the cash will flow to “old-guard” manufacturers such as Intel, rather than to companies such as Qualcomm and Nvidia that design their own chips but use partners to make them. On the other side, supporters of the Act are properly optimistic while maintaining realistic expectations.

There are also certain implications for the legal industry as well. Although the passage of the bill was an enormous accomplishment within itself, the CHIPS Program Office (CPO) must now turn to enacting the components of the Act from a legislative success to actual programs and policies. This will require the CPO to coordinate with industry and other stakeholders: Lawyers will have an important role to play in this process. This can be seen as the beginning of a long process in defining the new policy, tax, and incentive architecture for a 21-st century global economy whose outline has very much yet to be solidified.

3. IMPLICATIONS

In anticipation of incentives under the Act, some projects have already begun ground-breaking and construction activities, with production to start as early as the end of 2024.³ Other projects will begin construction in 2023. Some projects incentivized by the Act may operate on an even quicker timeline, including such projects as tool upgrades or additions. The announced projects include the construction of 23 new chip fabs and the expansions of nine fabs.

Increased fab construction spurs investments by suppliers of materials, chemicals, and equipment. As a result, companies that supply semiconductor manufacturing equipment and the materials used in the production of chips—including high-purity chemicals, specialty gases, and wafers—announced plans to invest in several facilities to support increased domestic manufacturing capacity.

The total impact of the new fabs, expansion of existing fabs, and equipment and materials supplier projects amount to nearly \$200 billion in company investments and the creation of approximately 40,000 jobs throughout the U.S. semiconductor supply chain. Job creation in this sector supports jobs throughout the broader U.S. economy. A recent study found that for each U.S. worker directly employed by the semiconductor industry, an additional 5.7 jobs are supported in the wider U.S. economy.

³ The CHIPS Act Has Already Sparked \$200 Billion in Private Investments for U.S. Semiconductor Production, Robert Casanova, Semiconductor Industry Association, December 14, 2022, <https://www.semiconductors.org/the-chips-act-has-already-sparked-200-billion-in-private-investments-for-u-s-semiconductor-production/>. (Accessed March 19, 2023).

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Companies can expect to navigate a complex geopolitical climate for the foreseeable future. Intense and focused competition with increasing investment and inputs will be the norm during this period. Many recent actions taken by companies to base their manufacturing in the United States signal a modification of long-standing strategies caused by geopolitical concerns, countering the historical trends that have led many companies to shift the majority of semiconductor manufacturing to Asia. Above all, the obvious implication of these events is the rapidly widening recognition of the importance of chips and new technologies for producing them.

4. FURTHER DEVELOPMENTS

Another major development relates to Taiwan Semiconductor Manufacturing Company Limited (TSMC), the biggest maker of leading-edge chips in the world. In December 2022, the Taiwan-based manufacturer outlined a \$40 billion plan to upgrade and expand an American production hub in Phoenix, Arizona. This serves as a material upgrade over the \$12 billion pledged previously, leading to an increase in the estimated number of permanent workers added from 2000 to 4500.

With respect to export controls on semiconductors introduced in October 2022 by the Biden administration, there has been dialogue on the legality of these restrictions. It is still to be determined whether these restrictions will be supported by the courts if litigation results as to the validity of these measures.

At the same time, this will create an opportunity for certain illegal black markets. Recently, guards on the border between Macau and mainland China received public attention after they intercepted a woman utilizing a fake “baby bump”, not in order to smuggle drugs, but 202 semiconductor processors and 9 smartphones. The main objective of the various U.S. measures is to prohibit access of high-end chips to China for military purposes. However, this adds more incentive to smuggle these chips similar to the manner in which Russia and North Korea have evaded sanctions for decades on much bigger objects.

In direct response to the passage of the Act, China recently unveiled an RMB 1 trillion (or approximately \$146 billion) chips fund of its own, to respond to the Act and to catch-up with the technology that Washington seeks to keep from China.

It will be important to monitor further developments and actions taken by either government, as this back-and-forth of increasingly aggressive actions will have ramifications on the technological and economic power balance over the rest of the 21st century.

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