24-044 | Feb 2024

中国金融四十人研究院
CHINA FINANCE 40 INSTITUTE

CF40 Policy Brief

Post-2020 US Semiconductor Industrial Policy

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Abstract: *In August 2022, the US Biden administration introduced the CHIPS and Science Act, with a total scale of nearly $280 billion, sparking widespread discussion on the US new round of semiconductor industrial policies. Unlike previous measures that focused on supporting R&D and innovation, this round of US industrial policies for the semiconductor industry emphasizes providing large-scale subsidies for the manufacturing and investment of semiconductor companies, favoring physical fabrication facilities over R&D, as well as adopting protective provisions to curb the acquisition of advanced chips by China, Russia, and other countries.*

Overall, the new round of industrial policies may bring some benefits such as reversing the decline in the US global share of semiconductor manufacturing, fostering innovation, and creating job opportunities, but its effects are limited. Moreover, the effects of promoting the semiconductor industrial chain security and consolidating the US leading position in semiconductor technology may be less than expected. Additionally, adopting large-scale subsidies may lead to rent-seeking and trade conflicts. Four insights can be drawn from past experience: first, the emphasis on subsidizing fabrication facilities diverges from successful experiences, and its effect remains to be seen; second, the pursuit of self-sufficiency in the semiconductor industry is an illusion; third, semiconductor industrial policy may incur high costs in job creation; fourth, driving the development of the semiconductor industry is not only a matter of splurging money, but also depends on nurturing and reserving talents, and whether existing industrial policies can address future talent shortages is questionable.

Since 2020, the return of United States industrial policy has been widely debated. Previously, US industrial policy prioritized R&D and innovation, and rarely aimed at structural transformation of the economy by providing large-scale subsidies and actively "picking winners" (see the brief"Historical Review of U.S. Industrial Policy"). The new round of US industrial policies that is now taking shape greatly diverges from the previous one, both in terms of measures and scale of funding. This round of US industrial policies mainly focuses on semiconductor and green transition. This brief will zoom in on the semiconductor industry by analyzing the background, current state, and policy effects of the "revival" of US industrial policy, and the subsequent reports will examine the US industrial policy for green transition.

I. Background and State of US Semiconductor Industrial Policy

1. Background of the "Revival" of US Semiconductor Industrial Policy: The threat of competition from China and the severe shortage of chips during the COVID-19 pandemic have prompted the United States to reassess chips as a foundation of national security.

Semiconductors are fundamental to nearly all modern industries and national security activities, as well as essential components of other emerging technologies such as artificial intelligence and quantum computing. The United States initiated the development of the semiconductor industry during the 1960s and 1970s and has long maintained a leading position. Subsequently, the global semiconductor industrial chain underwent three relocations, each of which retained high-value segments domestically or regionally while outsourced high-cost production segments abroad: firstly, from the United States to Japan since the 1980s; secondly, from the United States and Japan to Taiwan of China and South Korea from the late 1990s to the early 21st century; and thirdly, from Taiwan of China and South Korea to Chinese mainland. The current semiconductor industrial landscape is characterized by the United States spearheading advanced chip design, East Asia (primarily Taiwan of China and South Korea) assuming the role of chip manufacturer, and the Chinese mainland leading in mature chip manufacturing, packaging, and testing. Notably, in 2021, US chip companies accounted for nearly half of the global market share in sales, yet their global semiconductor fabrication capacity dwindled from 36% in 1990 to approximately 12% in 2020.

Since 2020, the decline in US chip manufacturing capacity has garnered widespread attention. Policymakers are concerned that the concentration of chip manufacturing in East Asia may lead to supply chain disruptions, thereby imperiling both the economy and national security. The chip shortages during the COVID-19 pandemic compelled automobile manufacturers to halt production and pushed up the prices of certain electronic products, which intensified the concerns. Some studies attribute the decline in manufacturing share to lower wage costs in Asia and substantial government subsidies (BCG & SIA, 2020). Against this backdrop, both the Democratic and Republican parties in the United States have begun to perceive the expansion of the US semiconductor manufacturing industry as a critical economic and national security imperative, culminating in a rare bipartisan consensus to pass the CHIPS and Science Act. Additionally, US concerns regarding competition from China in the technological field, particularly in the semiconductor sector, and the resolve to restrain China and Russia from accessing advanced chips and chip manufacturing equipment, also served as catalysts for the enactment of the CHIPS and Science Act (Hufbauer & Hogan, 2022).

2. Measures and Scale of the US Semiconductor Industrial Policy: In contrast to the government procurement and trade measures during the 1950s to 1980s, the current round of industrial policy directly extends substantial production and investment subsidies to chip enterprises. These subsidies tilt toward semiconductor fabrication facilities (fabs) (85%) rather than R&D (15%).

Prior to 2020, the US semiconductor industrial policy underwent the phase of nascent development of the semiconductor industry (mid-1950s to mid-1960s) and the phase of response to the perceived threat of the Japanese semiconductor industry (1980s), supported by measures of government procurement and requirements of open markets and anti-

dumping respectively. In the initial development stage, the industry was bolstered by government procurement, with federal purchases accounting for 30-40% of US chip production. By the 1970s, the proportion had dropped to 10%. During the phase of responding to the threat from Japan, two main actions were taken: first, in 1986, Japan was required to open its market to US manufacturers, which raised US companies' market share in Japan from about 10% before the suspension agreement to "slightly above 20%" within five years; second, anti-dumping measures were taken against Japanese sales in the US and third-country markets. However, these anti-dumping moves were not effective and the anti-dumping duties expired in 1991.

The latest round of chip industry policy is characterized by extensive subsidies (including direct funding and tax credit) - marking one of the largest investments by the federal government in a single industry in decades - as well as protective provisions. Firstly, an allocation of approximately $52.7 billion is directed towards chip manufacturing, research and development, and workforce enhancement initiatives (Table 1), with around $28 billion designated for the development of advanced logic and memory chip manufacturing, around $10 billion for expanding manufacturing capacity for mature and next-generation chips, new and specialty technologies, and industry suppliers, and roughly $11 billion for R&D and workforce development endeavors. **Secondly,** an approximate sum of $24.5 billion is earmarked for tax credit aimed at fostering the establishment of chip fabrication facilities. **Thirdly,** guardrails and protections are established, which are the "National Security Guardrails" under the "Chip and Science Act," serving as pivotal benchmarks for the allocation of subsidies to chip manufacturers. In March 2023, the US Department of Commerce unveiled the implementation specifics of these guardrails, centering on two primary restrictions: first, a categorical prohibition on subsidized semiconductor companies from expanding manufacturing capacities in countries of concern for 10 years, including China, Russia, North Korea, Iran, and others; and second, a constraint on subsidized semiconductor companies from engaging in collaborative research or technology licensing endeavors with foreign entities of concern on technologies and products deemed to pose national security risks.

Table 1: Measures and Scale of Industrial Policy Adopted in the "CHIPS and Science Act" (US dollars) (FY 2022-2027)

Program	Appropriation
CHIPS for America Fund (Department of Commerce)	**50 billion**
1. Semiconductor manufacturing (fabrication) incentives	39 billion
Incentives for legacy chip production	2 billion
（2）Cost of direct loans and loan guarantees	Up to 6 billion (to support up to 75 billlion in loans and loan guarantees)
2. Investment tax credit for capital expenses for manufacturing of semiconductors and related equipment	25% of qualified investment, uncapped; The Congressional Budget Office estimates that the use of this tax credit by the industry during FY 2023-2027 will reduce federal revenues by $24.5 billion
3.Chip Research and Workforce Development Programs	11 billion
Establishment and operation of a National Semiconductor Technology Center (NSTC) to conduct research and prototyping of advanced semiconductor technology to strengthen the economic competitiveness and security of the domestic supply chain; （2）Establishment of a National Advanced Packaging Manufacturing Program (NAPMP) to strengthen semiconductor advanced test, assembly, and packaging capabilities in the United States; （3）Research and development at the National Institute of Standards and Technology (NIST) to enable advances and breakthroughs in measurement science, standards, material characterization,instrume ntation, testing, and manufacturing capabilities for next-generation microelectronics metrology, and to ensure U.S.competitiveness and leadership in microelectronics; （4）Establishment of three Manufacturing USA institutes for a. Research in support of the virtualization and automation of maintenance of semiconductor machinery; b. Development of new advanced test, assembly, and packaging capabilities; c. Development and deployment of educational and skills training curricula needed to support the semiconductor sector and to ensure the United States can build and maintain a trusted and predictable talent pipeline	
CHIPS for America Defense Fund (Department of Defense)	**2 billion**
Research, development, test, and evaluation; workforce development; and other requirements unique to the Department of Defense and the intelligence community	$400 million annually during FY 2022-2027
CHIPF for America International Technology Security and Innovation Fund (Department of State)	**5 million**
International information and communications technology security and semiconductor supply chain activities, among other things	$100 million annually during FY 2022-2027
CHIPS for America Workforce and Education Fund (National Science Foundation)	**200 million**
Promote training and growth of the semiconductor workforce	In the FY 2023 and 2024, an appropriation of $25 million each is allocated. In FY 2025 through 2027, an appropriation of $50 million each annually is allocated.
Public Wireless Supply Chain Innovation Fund	**1.5 billion**
National Telecommunications and Information Administration(NTIA) takes in charge of the fund to promote and deploy wireless technologies that use open and interoperable radio access networks	

Source: Sargent et al.（2023）

3. Preliminary Effects of the US Semiconductor Industrial Policy: The actual amount of government grants is small, but it has stimulated a substantial amount of private sector investment, accelerating the construction of semiconductor fabrication plants. However, private sector investment may fall short of sustainability.

The Biden administration's subsidies for the semiconductor industry have been relatively limited, with approximately $1.7 billion in direct appropriations announced thus far. As of February 20, 2024, the Biden administration has announced funding to only three companies: in December 2023, a $35 million appropriation was granted to BAE Systems, a supplier in the defense supply chain, aimed at doubling the manufacturing capacity of chips used in its domestic F-15 and F-35 fighter jets, as well as satellites and other defense systems; In January 2024, a $162 million appropriation was announced to Microchip Technology, one of the largest chip suppliers to the Department of Defense, aimed at increasing semiconductor production for automotive, aerospace, electronics, medical devices, and military products; In February 2024, a $1.5 billion appropriation was announced to Global Foundries, a company specializing in the production of legacy chips, aimed at expanding legacy chip manufacturing capacity. These chips, although relatively inexpensive, are essential components in automobiles and consumer electronics, and are widely used in the defense sector. Thus far, the Biden administration has not announced funding for advanced semiconductor manufacturers, but it is expected that the US Department of Commerce will begin announcing larger subsidies to companies such as Intel and TSMC in the coming months.

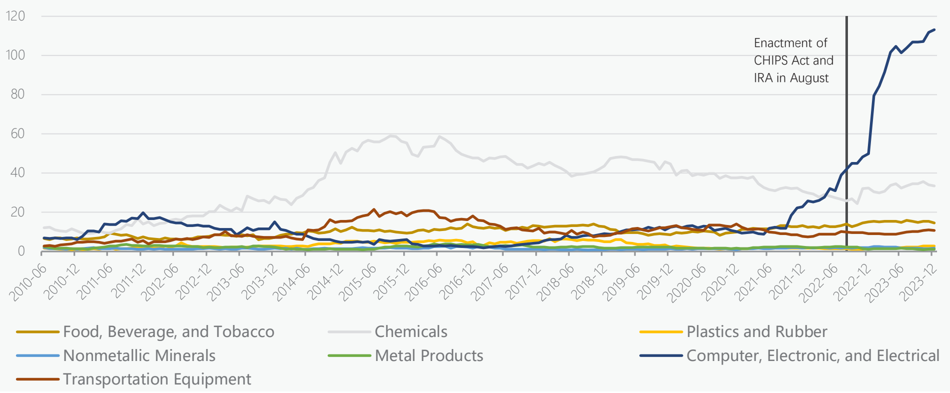
Despite relatively modest government funding thus far, the US semiconductor industrial policy has sparked a wave of private investment, accelerating the construction of semiconductor fabrication facilities. According to the Semiconductor Industry Association (SIA), more than 70 new semiconductor-related projects have been announced following the enactment of the CHIPS and Science Act, with commitments from the private sector exceeding $200 billion. Semiconductor companies across the United States are in the initial stages of large-scale construction, with expansions underway by Intel in Ohio, Samsung in Texas, IBM in New York, Micron in New York, and TSMC in Arizona. Some committed investments have already begun to translate into tangible output, with substantial increases in construction spending in the computer, electronic, and electrical manufacturing industries. From December 2021 to December 2023, the actual construction spending of the industry, adjusted for inflation, increased by 5.0 times, which helped double the overall manufacturing facility construction spending (Figures 1 and 2). The growth, as noted by Bank of America, “may be due to construction of semiconductor fabrication plants as part of the CHIPS and Science Act.” The rapid increase in construction spending in the computer, electronic, and electrical manufacturing industries began several months before the enactment of the CHIPS Act, potentially reflecting adjustments made by the semiconductor supply chain in response to earlier chip shortages. Nevertheless, **the enactment of the CHIPS Act has played a crucial role in sustaining and expanding this growth trend** (U.S. Department of the Treasury, 2023).

Figure 1: Actual Construction Spending In the Manufacturing Sector (in billion US dollars, 2022 as the base year)

Sources: U.S. Bureau of Labor Statistics, U.S. Census Bureau.
Note: Actual construction spending in the manufacturing sector refers to nominal manufacturing construction spending adjusted for the Producer Price Index (PPI) for construction: expenditures adjusted for intermediate demand materials and components.

Since August 2023, the actual construction spending in the computer, electronic, and electrical manufacturing sectors has reached a plateau. In addition, uncertainty looms over the sustainability of future private sector investments, due to three key factors: First, the semiconductor industry is characterized by distinct cyclicality, making investments susceptible to fluctuations in demand. In 2023, the semiconductor market experienced a downturn, with preliminary statistics from the Gartner Group indicating an 11.1% decrease in global market size compared to 2022. This decline was primarily influenced by the global economic downturn, sluggish demand for chip-based products, particularly in storage chips predominantly used in smartphones, personal computers, and servers, and the surplus of channel inventory. Second, despite substantial commitments from semiconductor companies to expand investment, inadequate government subsidies may result in project delays or cancellations. For instance, Samsung Electronics announced a delay of mass production at its new semiconductor fab in Texas, from 2023 to 2025. This could be attributed to issues related to delayed disbursement of government subsidies and the complexity of construction permit procedures.Third, labor shortages may impede investment. Semiconductor fabs entail technical personnel to operate machinery and scientists specialized in electrical and chemical engineering. With over 20 years of gap since the last large-scale semiconductor fab construction in the United States, there is a scarcity of contractors with the requisite experience, capabilities, and expertise to deliver such specialized projects. Shortage of talent exists in every domain. A report by Deloitte suggests that the US semiconductor industry may face a shortfall of approximately 70,000 to 90,000 workers in the coming years.

Figure 2: Structure of Actual Manufacturing Construction Spending (in billion U.S. dollars, 2022 as the base year)



Sources: U.S. Bureau of Labor Statistics, U.S. Census Bureau.

Note: The sub-category refers to nominal manufacturing construction spending adjusted for the Producer Price Index (PPI) for construction: expenditures adjusted for intermediate demand materials and components.

II. The Effects of US Semiconductor Industrial Policies May Be Lower Than Expected

The primary objectives of the latest wave of US semiconductor industrial policies are to promote the reshoring of chip manufacturing, reshape the semiconductor industry supply chain, and enhance its competitiveness in the global semiconductor industry. However, the analysis suggests that aside from reversing the decline in semiconductor manufacturing share and fostering technological innovation to some extent, other policy objectives may prove challenging to realize. Furthermore, the adoption of large-scale subsidies may backfire and lead to rent-seeking behavior, chip oversupply, and trade conflicts.

1. The new round of semiconductor industrial policies may bring positive effects: reversing the downward trend in the US semiconductor manufacturing share and fostering innovation of semiconductor technology as well as job creation to some extent.

First, the global share of US semiconductor manufacturing is expected to rise from the current 12% to 14% by 2030. The decline in the US semiconductor manufacturing share was a catalyst for the enactment of the CHIPS and Science Act. Research widely suggests that semiconductor industrial policy will help reverse the US's 30-year downward trend in global semiconductor manufacturing share. An influential report jointly published by the Boston Consulting Group (BCG) and the Semiconductor Industry Association (SIA) in 2020 predicted that $50 billion in government investment, coupled with corporate investment leveraged by it, could elevate the US semiconductor manufacturing share from the current 12% to 13%-14% by 2030, compared to a decrease to 10% without government support. The chairman of SIA stated that 14% is a conservative estimate, as the CHIPS and Science Act approved subsidies exceeding $76 billion (direct appropriation + tax credit), suggesting a more optimistic outlook for the increase in the US semiconductor manufacturing share compared to the results based on the $50 billion calculation. On the other hand, a report released by the Peterson Institute for International Economics (PIIE) in 2022 argues that while the increase in US semiconductor output is almost certain, the high inflation in the US since 2020 may mean that the impact of larger-scale subsidies ($76 billion instead of $50 billion) on raising semiconductor manufacturing share may not exceed the forecasts of BCG and SIA (Hufbauer & Hogan,2022).

Second, industrial policies can foster semiconductor technology innovation to some extent, but the effects may be limited. Approximately $11 billion under the CHIPS and Science Act is granted for R&D and workforce development projects, including the establishment and operation of the National Semiconductor Technology Center (NSTC) to research and prototype advanced chip technologies, which will help consolidate the US's leading position in semiconductor technology to a certain degree. However, given that the funding scale is less than 8% of the expected cumulative research and development capital expenditure by US semiconductor companies from 2021 to 2030 (Hufbauer & Hogan, 2022), its impact will be quite modest.

Third, while industrial policies can create a significant number of jobs for regions where factories are subsidized, the costs may be substantial. It is worth noting that job creation is not the primary driver behind the enactment of the CHIPS and Science Act, as the legislation was passed during a period of record-low unemployment in the United States, standing at 3.5%. However, the impact of the Act on the labor market is not to be overlooked. According to Hufbauer & Hogan (2022), drawing from the experience of semiconductor foundry company GlobalFoundries, semiconductor fabs supported by the CHIPS Act are expected to generate a considerable number of employment opportunities locally, but the subsidies for each new position are anticipated to be significantly higher than average industry wage.

2. The effects of new semiconductor industrial policies may fall short of expectations: Difficulties in promoting the security of semiconductor industrial chain security and long-term risks posed by "guardrail provisions"

First, the effects of industry policies in protecting the security of the semiconductor industrial chain may not meet expectations. Subsidies under the CHIPS Act favor physical fabrication facilities (constituting 85% of total subsidies) rather than research and development, with the primary aim of relocating new fab construction to the United States. However, it appears that US reliance on Taiwan of China for advanced chips is unlikely to decrease, although the US may reduce (but not eliminate) its reliance on Asia for other types of chips.

On one hand, the manufacturing processes of advanced chips are complex, and it remains unclear whether manufacturers will bring the most advanced manufacturing technology to new fabs in the United States. For example, reports are suggesting that TSMC's investment in US fabs will not introduce state-of-the-art chip manufacturing technology.

On the other hand, the investment surge in the semiconductor industry may diminish America's reliance on Asia for other types of chips. However, shortages are likely to persist in various legacy chip technologies. For instance, domestically produced memory chips in the United States account for only about 4% of global output. These traditional chips, essential for data storage in devices such as computers and smartphones, may see an increase in the US market share due to investment plans from companies like Micron and GlobalFoundries. Consequently, this could partially reduce US reliance on Asia.

Second, "guardrail provisions" may bolster America's leading position in the short term but pose numerous long-term risks. Research views these provisions as manifestations of America's weaponization of the global value chain (Luo & Van Assche, 2023). The logic behind this "weaponization" is as follows: Only a few global chip companies have the capacity to produce the most sophisticated chips, including TSMC, Samsung, Intel, Micron, SK Hynix, GlobalFoundries, and Texas Instruments. If the majority of these companies decide to accept subsidies from the United States, then according to the guardrail provisions, they will be prohibited from engaging in significant transactions to expand chip manufacturing capacity in China and other countries for ten years. Essentially, this forces chip companies to weigh their options: do the benefits of accepting US subsidies outweigh the costs of decoupling their global value chains from China?

Their assessment is that so far, accepting subsidies appears more enticing. In the short term, the "guardrail provisions" may impede countries like China and Russia from accessing advanced chips, thereby reinforcing America's leading position in the semiconductor industry. However, in the long run, the measure poses three significant risks that could ultimately undermine America's global competitiveness. Firstly, the impact of the vicious cycle of US actions and subsequent retaliation from other countries on America's technological leadership remains uncertain. Secondly, the provisions are highly likely to catalyze deeper cooperation between the Chinese government and chip companies, leading to a concerted effort to develop advanced chips and forge their own development path, making it China's "Sputnik moment." The PIIE report also suggests that these measures could prompt China to intensify efforts to strengthen self-sufficiency and accelerate technological breakthroughs to catch up with the levels of Samsung and TSMC in the coming years. Thirdly, it could potentially estrange the US from its allies who may feel torn about being drawn into a technology war between the US and China.

3.The potential counter-effects of large-scale subsidies adopted in the new round of semiconductor industrial policies: inefficiency and trade conflicts.

In effect, there has been criticism of industrial policies like the CHIPS Act that adopt large-scale subsidies. One prominent critic comes from Cato Institute, a leading libertarian think tank in the United States, whose core principles revolve around "restoring traditional American values of limited government, individual liberty, free markets, and peace." The institute's opposition to the new round of semiconductor subsidies centers on the belief that the **market mechanism is adequate to incentivize chip companies to invest in manufacturing facilities in the US and address geopolitical**

risks, whereas widespread subsidies not only fail to address the issue of chip shortages but may also lead to rent-seeking behavior, chip oversupply, and trigger trade conflicts (Lincicome & Blumsack, 2021).

Firstly, chip companies are inherently inclined to seek profit and thus would invest in the United States without the need for taxpayer-funded subsidies. These companies have amassed substantial profits in the past and their ample cash flows enable them to invest globally, including in the United States. According to Willy Shih, a Harvard University expert in chip supply chain research, companies such as Intel, Samsung, and TSMC would proceed with their investment and factory construction plans in the United States regardless of whether the US government provides subsidies. This is because chip manufacturers seek to capitalize on the skilled workforce in the US and maintain relationships with manufacturers of specialized equipment for producing advanced chips.

Secondly, multinational corporations would evaluate geopolitical risks and adjust their supply chains accordingly. Geopolitical considerations weigh heavily on multinational enterprises when making investments abroad and deploying their supply chain. Major chip-consuming companies such as Ford and Apple have undertaken restructuring of their chip supply chains. For instance, they have collaborated with chip manufacturers to establish new "nearshore" supply arrangements. Similarly, leading chip manufacturing companies continue to reconfigure their supply chains. For example, Samsung has been expanding its business in the United States due to geopolitical considerations. With growing uncertainty in Taiwan of China, Intel has established new fabs in the United States and other countries like Malaysia. TSMC has also chosen to establish fabrication facilities in the United States, with the potential aim to bolster its US business and become a key component of the US Department of Defense's "trusted supply chain."

Thirdly, subsidies may result in chip oversupply and trade conflicts. This risk is becoming increasingly pronounced, especially as other major economies such as the European Union, South Korea, and China also provide subsidies. The semiconductor manufacturing industry is inherently cyclical, characterized by periods of robust capital expenditure leading to surplus capacity, often followed by sharp price slumps and market downturns. Such circumstances can escalate into international trade disputes where countries resort to trade protection measures like anti-dumping duties, countervailing duties, and the imposition of protective tariffs to shield their domestic chip industries. Similar disputes arose in the 1980s and 1990s when the United States imposed various restrictions on memory chips from Japan.

Even economists who believe that there are sound economic and geopolitical reasons for employing industrial policies (expanding markets rather than restricting trade and cross-border investment) are concerned about the capability of the United States to implement those industrial policies. Laura Tyson, Chair of the White House Council of Economic Advisers during the Clinton administration, and John Zysman, a professor at the University of California, Berkeley, School of Business, have pointed out that the problem of "political capture" by special interests and crony capitalism in industrial policy is real. The problem of "political capture" by special interests and crony capitalism in industrial policy is real, and the risk is particularly high in the U.S. In 2022, US companies spent $4 billion on lobbying, up from about $1.5 billion in 2000. At the same time, the US government, which for many years has been engaged in a policy of outsourcing and downsizing, also lacks the administrative capacity to design and implement industrial policy.

III. Conclusion

A comprehensive assessment of the new round of US semiconductor industrial policies, combined with lessons learned from the period before 2020, reveals four key insights.

First, the policy emphasis on subsidizing fabrication facilities does not align with successful experience, and its effectiveness remains to be seen. Experience indicates that support for public research and development (R&D) tends to be the most successful model of industrial policy.

Government-funded R&D projects in the United States have shown high rates of return, with successful projects yielding returns ranging from 20% to 67%. One of the most typical examples is the Defense Advanced Research Projects Agency (DARPA) of the U.S. Department of Defense, which played a central role in sparking innovation waves such as the emergence of the internet in the latter half of the 20th century. However, this round of chip subsidies (a total of around $76 billion) is predominantly appropriated for the construction of fabrication plants (85% of the total subsidies), rather than R&D (15% of the total subsidies), which diverges from the most potentially effective industrial policy measures of the past few decades. Hence, the ultimate effects of this approach remain to be observed.

Second, the pursuit of "self-sufficiency" in the semiconductor industry is an illusion. The new round of semiconductor industrial policies endeavors to leverage subsidies to relocate new fab construction to the United States, thereby enhancing industrial chain security. However, given that the chip manufacturing processes are complex and diverse, even if the US chip manufacturing capacity were to rise from the current 12% to 20%, or even higher, it may not necessarily translate into a significant improvement in supply chain security. To become more "self-sufficient", the US needs to prioritize the production of basic, low-value chips, which goes against the logic of comparative advantage (Hufbauer & Hogan, 2022).

Third, semiconductor industrial policy may incur high costs in job creation. Past US experiences with industrial policies targeting steel, textiles, and apparel have shown that the cost of job creation in these sectors is significant. The cost to consumers of saving one job in these industries is tens of times higher than the average wage of industry workers (Hufbauer & Jung, 2021). Although job creation is not the primary driver behind the new round of semiconductor industrial policies, it is foreseeable that subsidized chip fabs will create a large number of jobs locally. However, the cost of job creation may be equally high, with subsidies for each new position significantly exceeding industry wage levels.

Fourth, driving the development of the semiconductor industry is

not only a matter of splurging money; it also relies on the cultivation and reserve of talent, and there are doubts as to whether existing industrial policies can address the future shortage of talent. Following the announcement of a new round of semiconductor subsidies in the United States, the construction of semiconductor fabs and their manufacturing equipment has significantly accelerated. However, due to the lack of experience in conducting large-scale fab construction in the United States over the past 20 years, there is a shortage of talent at various levels, including fab construction and machine operation. According to a report by the Semiconductor Industry Association (SIA), based on the current degree completion rate in the United States, the semiconductor industry is expected to witness around 67,000 job vacancies by 2030, with a shortage rate of technical workers for new positions reaching as high as 58%. The funds specifically allocated for workforce development in this round of semiconductor industrial policies exceed $200 million: the CHIPS for America Fund specifically appropriated funds to establish Manufacturing USA institutes for the development and deployment of educational and skills training curricula needed to support the semiconductor sector; CHIPS for America Workforce and Education Fund would provide funds for the training and development of semiconductor workforce. Nevertheless, in the face of immense labor shortage, whether existing supporting policies can meet the demand remains to be seen.

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