Testimony USCC

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Title of Hearing: "Made in China 2025—Who Is Winning?"

Questions

1) **How have the objectives of China's industrial policy shifted in recent years? What factors and drivers are currently shaping the technologies and industries Chinese policymakers are focusing on, and how does this process differ from Made in China 2025?**

China's industrial and innovation policies have significantly changed their objectives over the past twenty-some years. We can clearly identify at least three different stages: (1) Choosing sectors, 2006-2015; (2) Mastering the new technological revolution, 2016-present; and (3) building self-sufficiency, 2020-present. Each of these phases has different characteristics. They have different goals, and also instruments, favored institutional arrangements, and principles of implementation. Each of them envisions a different kind of relationship between government and the market. Yet once one of these policy complexes is set in place, it remains there, and the subsequent phases and objectives are built on top of it. This creates a landscape of enormous complexity as well as an environment of steadily accelerating government commitment to industrial policy.

CHOOSING SECTORS, 2006-2015. Industrial policy in these years was often conceptualized as developing "new growth drivers," and the effort was intensified during the 2009 Global Financial Crisis. The most obvious example is the Strategic Emerging Industries (SEI) program which began in this phase and is still with us. This phase was similar to predecessor industrial policy in Japan and Korea, being largely expressed through the desire to target, nurture, and accelerate the growth and scale-up of specific industries.

The most obvious example of the SEI program has been electric vehicles (EVs). The degree of Chinese policy commitment to the EV and battery sectors was unusual. China has given policy support to EVs for almost twenty years now, and for about sixteen of those years, it was uncertain whether policies would bear fruit. Despite the uncertainty, the government maintained its commitment. Why? This policy consistency was probably due to a convergence of strategic goals: Economically, a new export industry was envisioned to sustain growth, create jobs, and replace labor-intensive exports where China was losing competitiveness. Strategically, they contributed to China's long run effort to reduce its dependency on imported oil. Environmentally, China's severe air pollution problems in major cities reinforced the policy commitment.

With long-term policy commitment, China was willing to try many expensive subsidy programs. There were many missteps and enormous waste, certainly costing tens of billions of dollars over a decade. However, ultimately the willingness to support the sector and the willingness to bear costs from policy experimentation and mistakes led to the creation of a competitive sector.

MASTERING THE NEW TECHNOLOGICAL REVOLUTION, 2016-PRESENT. China's "Innovation-Driven Development Strategy" (IDDS) was formally launched in 2016. This policy marked a clear determination to go beyond promotion of individual sectors and support an entire complex of activities, what I have elsewhere called the "triangle of communication, data, and artificial intelligence." Rather than a specific sector, the IDDS targeted a cluster of inter-related technologies that together formed what economists label a "general purpose technology" (GPT) that transforms every sector in an economy. Such technological revolutions come about less than once a generation.

The IDDS also marked a clear intention to compete with the US at the frontiers of the new technological revolution. It was striking that the IDDS explicitly declared that geostrategic competition was one of the main reasons that China had to master the new technological revolution.

"Made in China 2025" (MIC 2025) was adopted as a policy just as the IDDS was being adopted as a guiding policy document. It represented an effort to bring sectoral policy into harmony with the ambitious strategic aims of the IDDS. While Strategic Emerging Industries had been selected on an individual sector basis, MIC 2025 envisioned making China an overall manufacturing superpower. In pursuit of this goal, quantitative targets for import substitution were (famously) laid out in a supporting document. MIC 2025 represented a melding of different strategic objectives, supporting sector targets as well as goals for general economic upgrading through a new general purpose technology.

BUILDING SELF-SUFFICIENCY, 2020-Present. Self-reliance became an explicit policy objective during the course of 2020. "Science and technology self-reliance and self-strengthening" was written into the 14th Five Year Plan (2021-2025). In terms of industrial policy, a clear shift has been discernable toward identifying and reducing specific "dependencies." That has meant identifying specific technologies, components and materials on which China has relied for imports. The policy of "modernized industrial system," (现代化产业体系) despite its bland name in translation, refers to an ambitious policy to reproduce in China as many of the elements of a modern production system as possible. That includes not just large manufacturing enterprises, but also specialized service providers, niche equipment makers, and all the elements of a robust start-up ecosystem.

One of the motivations in developing this new policy orientation was clearly the heightened tensions between China and the US, and the initiation of a sanctions regime and specific technological embargoes by the US after 2018. Equally, the prospect of withdrawal from China of specialized goods and service providers led Chinese policymakers to strategize developing domestic replacements. The "dual circulation" strategy of this time balanced domestic and foreign "circulation," but the emphasis was clearly on ensuring that domestic economic activity could continue uninterrupted in the case of international economic disruption or foreign sanctions.

During this time period, Chinese policymakers stopped talking about "Made in China 2025," but they continued to refer to the same policy under the rubric of "Manufacturing Superpower" (制造业强国)。 Technology roadmaps have continued to be produced in the spirit of MIC2025. The latest versions are careful not to publicize any quantitative targets but they are, if anything, more detailed in terms of the specific components, materials, and technologies that China needs to master. In this as in other respects, policy is cumulative. While Strategic Emerging Industries and Made in China 2025 have been superseded by other headline slogans and new strategic emphases, they have by no means been abandoned.

2) **How has the Party-state used market actors and market forces in pursuit of these objectives? As China's techno-industrial ambitions evolve, is its manipulation of market forces likely to intensify or diminish?**

China's economy is a market economy at its base, and private businesses play a predominant role. Policymakers have tried to steer the market towards their objectives, but in the past 3-5 years, policymakers are showing signs of impatience with market forces and have increasingly used direct administrative interventions.

In the first two stages of China's industrial policy, great attention was given to finding market-conforming instruments to "steer" the economy. In the first phase, much attention was given to tax breaks and low interest loans. Direct subsidies to producers were prominent in the first phase of EV promotion, but they were very expensive and not very effective. Later subsidies shifted toward a mixed program of subsidies to consumers and conditional subsidies to seller (meeting certain technical benchmarks). Waste declined and subsidies are currently being phased out.

Perhaps the most ambitious market-conforming instruments were the "government guidance funds" (GGF) introduced in 2014 and expanded dramatically after 2016 (in line with the IDDS). These were structured like a venture capital fund, with a managing "agency" and limited partners (usually, but not always, state-funded). The managing agency had commercial incentives and rewards, and were supposed to have substantial scope for independent decision-making.

However, recently policymakers have been impatient with market-conforming institutions. The biggest GGF, the national semiconductor "big fund" was rocked by corruption allegations a couple years ago, and its managing agency head replaced by a government bureaucrat. Other GGFs have been reined in, and their subservience to government policy requirements re-emphasized. New forms of direct intervention have been introduced (see next item).

What must be stressed is that many of China's industrial successes can be traced more directly to a strong market environment and entrepreneurial culture than to industrial policy. The electric vehicle industry grew out of a dense network of local battery and component producers. They produced cost-effective solutions, sometimes at a lower technological level, that contributed to downstream producers. Of course, BYD, China's EV champion, also benefited from an infusion of international talent through its cooperation with strategic investor Warren Buffet. More recently, DeepSeek's success in AI large language models came through an independent private firm (investment company, in this case) operating with commercial and individual motives. In all these cases, though, Chinese policy played an important role in investing in human resources and assuring a stable supportive policy environment. However, the main impetus for the actual technological solutions came from private entrepreneurs.

3) What policy instruments have Chinese policymakers developed and deployed to advance China's techno-industrial objectives? How effective have these instruments been?

In the last 3-4 years, the Chinese government has increased its reliance on direct interventions. The "new-style whole-of-nation system" has seen government-led organization of research groups targeted at key technological challenges. "Innovation consortia" organized both at the central and local government levels bring together research institutes (or universities), engineering firms and specialized suppliers, and final product companies. The objective is to organize the entire "innovation chain," with top-down guidance pushing firms into collaborative relationships they might not have chosen on their own.

These more aggressive forms of government guidance are relatively new, and we have not had the opportunity to assess their effectiveness. It seems likely that this type of intervention will be less efficient and will result in substantial waste. However, this more aggressive approach corresponds with a continuing increase in the level of government attention and volume of government resources. Thus, China is throwing more money at its technological objectives, while paying the cost of lower efficiency. It is not an accident that these aggressive institutional interventions have come at the same time that China has committed to trying to recreate domestically an entire semiconductor manufacturing industry. This is an extraordinarily costly, difficult, long-term endeavor. Whether or not it succeeds, it will inevitably commit the Chinese government to an extraordinary long-term commitment, and the Chinese economy to a corresponding long-term burden.

4) What were the market-based and/or policy environment differences between areas where China's policies have been effective and those where they have been less effective?

It is striking that China's biggest successes have come in industrial sectors where entry barriers are not particularly high, and where a diverse and competitive seedbed of enterprises provides numerous candidates for success. When this exists, government policy support seems to be especially effective. This clearly characterizes China's battery, solar panel, and electric vehicle industries.

Alternately stated, Chinese firms have a demonstrated record of success in scaling up production rapidly once they have managed to survive the risky start-up stages. At its most successful, Chinese industrial policy creates a short-term protected environment that welcomes audacious entrepreneurs. Subsequently, the market and policy environment creates a tournament, where only the fastest moving businesses can survive. This impels a frantic race to become established and reach economic scale. Such an environment has obvious costs: excess capacity is created; many firms lose money; and government usually intervenes to facilitate takeover of less successful firms by the winners. The Chinese government unsurprisingly seeks to dilute those costs by dumping some of these low-price goods—potentially priced below cost—on the world market. However, from their standpoint, once a few firms manage to rise out of the competitive bloodbath, they are established as "national champions." Strikingly, the practical skills learned in this phase of vicious competition seem to translate into the next phase of expansion. The best Chinese firms have managed to scale up continuously after establishment. Following the well-known "experience curve," unit costs have continued to decline for an extended period as

cumulative production grows. This experience has been very much in evidence with China's solar panel producers, and with China's electric vehicle champion, BYD.

Conversely, Chinese policy has been much less successful in those areas where small-scale and dispersed entry is not technologically possible, and it falls to government or state-sponsored businesses to create new firms. This describes China's semiconductor industry, where China has repeatedly failed to create new national champions at scale. Creation of a state of the art semiconductor fab requires the simultaneous installation of an extraordinary range of equipment and the precise coordination of many different kinds of activity. "Learning by doing" and various kinds of tacit knowledge are essential. China does not generally have the extraordinarily detailed management and coordination capabilities necessary to pull this off. There may, however, be exceptions in some of the state-run, high-priority sectors such as China's space program. China seems to have experienced an extraordinary run of space program successes in recent years, hitting most of its long-range targets more-or-less on schedule. However, this program, like all programs directly or indirectly related to the military, is shrouded in secrecy, so it is difficult to be confident about any generalizations.

5) What are the drivers behind the reorganization of China's science and technology system launched in 2023, and how will the centralization of science and technology policy through the establishment of the Central Science and Technology Commission affect China's approach to innovation?

The reorganization of China's S&T system in 2023 is clearly a part of the increased priority given to technology self-sufficiency and the increased recourse to direct administrative interventions that follow on the post-2020 emphasis on technological self-sufficiency. The Central Science and Technology Commission is a Communist Party body designed to give the highest political priority to science and technology measures. It is headed by Ding Xuexiang, who is very close to Xi Jinping. In addition, Premier Li Qiang has been extremely active in publicly advocating for central government technology policy in visits around the country. There is no question that the Commission directly organizes the "new-style whole-of-nation" projects run by the central government and supervises the "innovation consortia" run by both central and local governments. These measures inevitably undermine the overall entrepreneurial environment in China, even as they lead to greater flow of resources to high-technology industry.

There is little evidence that this administrative set-up is transforming the policy landscape. The Ministry of Science and Technology (MOST) is tasked with staffing the Central Commission, but MOST is a relatively weak ministry that has recently been stripped of some of its powers. The activities of the Central Commission in directly organizing government projects are doubtless significant, but also invisible to outside observers. For example, China has recently been tracked making significant investments in fusion energy, including both basic and applied research. This is undoubtedly linked to the Central Commission, but we do not know the exact processes. Local government activity in organizing innovation consortia does not seem at all coordinated, and even appears disjointed and duplicative in some cases. It is unlikely that China has achieved a higher degree of centralization in the management of science and technology.

Indirect evidence to support this assertion comes from the role of the Huawei corporation. A number of research press and analyst reports have shown that Huawei has taken a leading role in many stages of the semiconductor production chain. In stages from chip design to specialty component production to equipment manufacturing, Huawei provides capital, management

skills, and technological expertise to other companies. It is inconceivable that Huawei is doing this without government permission and support. Its capacity to do this is a testament to the extraordinary capabilities of this company. However, it also indirectly shows that the Chinese government does not have the capacity to do this on its own, and chooses rather to work through this company.

6) The Commission is mandated to make policy recommendations to Congress based on its hearings and other research. What recommendations not already covered in answer to questions above for legislative or administrative action would you make in this area?

The US should take a balanced view of China's achievements and shortcomings. China has many advantages in the development of industrial technology: it has abundant cheap human resources, resulting from massive investment in human capital, including large-scale study abroad funded by households; a huge domestic market that serves as a lead market for many new technologies; and a large, comprehensive industrial base with abundant opportunities for technological spillovers. These basic facts mean that China is today a major player in industrial technology and will be for the foreseeable future. This will be true no matter what the US does.

At the same time, China's statist model imposes huge costs on the Chinese economy and the Chinese people. China is pouring resources into the development of a self-sufficient economy. This implies not only massive waste of resources today, but the creation of an economy that runs with lower productivity in the foreseeable future. The inability of Chinese policymakers today to devise an effective macroeconomic policy; to resolve the housing crisis; and to restructure their fiscal system are all related to the massive over-investment in industrial technology.

In this context our primary tasks are to:

1. Ensure that the US prevails in the competition over critical frontier technologies essential to our national security. China presents a serious antagonistic challenge, and we must continue to invest and improve our competitive position in a limited number of critical technologies.
2. Refrain from imposing unnecessary costs on our economy by trying to do everything ourselves (which would simply mean replicating the Chinese policy error). We can continue to trade with other countries, including China, when that enables us to access cheaper inputs and final goods. This makes the US economy more competitive and more able to prevail in the long run.
3. In some specific sectors where Chinese firms have achieved cost breakthroughs, and where there are no immediate security concerns, we should encourage those firms to invest in greenfield plants in the United States. A good example would be photovoltaic panels. There are no technological or scientific secrets involved in the production of solar panels, and we can benefit from the engineering knowhow and practical skills achieved by Chinese firms in this area if they invest in the US.