SCOTT LINCICOME
AND HUAN ZHU

QUESTIONING INDUSTRIAL POLICY

WHY GOVERNMENT MANUFACTURING PLANS ARE INEFFECTIVE AND UNNECESSARY

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Executive Summary

In the wake of the COVID-19 pandemic and rising U.S.-China tensions, American policymakers are again embracing industrial policy. Both President Biden and his predecessor, as well as legislators from both parties, have advocated a range of federal support for American manufacturers to fix perceived weaknesses in the U.S. economy and to counter China's growing economic clout.

These and other industrial policy advocates, however, routinely leave unanswered important questions about U.S. industrial policy's efficacy and necessity. First, what is industrial policy? Advocates of industrial policy often fail to define the term, thus permitting them to ignore past failures and embrace false successes while preventing a legitimate assessment of industrial policies' costs and benefits. Yet U.S. industrial policy's history of debate and implementation establishes several requisite elements—elements that reveal that most industrial policy successes are not industrial policy at all.

Second, what are the common obstacles to effective U.S. industrial policy? Several obstacles prevent U.S. industrial policies from generating better outcomes than the market. This includes legislators' and bureaucrats' inability to pick winners and efficiently allocate public resources (F. A. Hayek's knowledge problem); factors inherent in the U.S. political system (public choice theory); lack of discipline regarding scope, duration, and budgetary costs; interaction with other government policies that distort the market at issue; and substantial unseen costs.

Third, what problems will industrial policy solve? The most common problems purportedly solved by industrial policy proposals are less serious than advocates claim or else are not fixable via industrial policy. This includes allegations of widespread U.S. deindustrialization and a broader decline in American innovation; the disappearance of good jobs; the erosion of middle-class living standards; and the destruction of American communities.

Fourth, do other countries' industrial policies demand a U.S. industrial policy? The experiences of other countries generally cannot justify a U.S. industrial policy because countries have different economic and political systems. Regardless, industrial policy successes abroad—for example, in Japan, South Korea, and Taiwan—are exaggerated. Also, China's economic growth and industrial policies do not justify similar U.S. policies, considering the market-based reasons for China's rise, the Chinese policies' immense costs, and the systemic challenges that could derail China's future growth and geopolitical influence.

These answers to these questions argue strongly against a new embrace of industrial policy. The United States undoubtedly faces economic and geopolitical challenges, including ones related to China, but the solution does not lie in copying China's top-down economic planning. Reality, in fact, argues the opposite.

SCOTT LINCICOME is a senior fellow in economic studies at the Cato Institute and a senior visiting lecturer at Duke University Law School. **HUAN ZHU** is a former research associate at the Cato Institute's Herbert A. Stiefel Center for Trade Policy Studies.

Introduction

American policymakers on both the left and right are once again embracing industrial policy to fix alleged U.S. market failures and to counter China's own economic interventions. Congress is currently poised to pass—with vocal White House support—several pieces of legislation that would deliver tens of billions of taxpayer dollars to "critical" domestic industries and technologies. Unfortunately, the public discourse has thus far elided several essential questions about what industrial policy actually is; how past U.S. attempts at industrial policy (properly defined) have fared; whether current proposed industrial policies can fix the economic problems they target; and whether the industrial policies of other countries—particularly China—demand that the U.S. government follow suit.

This paper will systematically answer each of these questions, addressing both economic theory and practice (as demonstrated through numerous historical and current examples of U.S. industrial policy in action). Overall, these answers reveal numerous problems that argue strongly against the adoption of new U.S. industrial policies, and they establish a high bar for future government action.

What Is Industrial Policy?

Assessing the necessity and efficacy of U.S. industrial policy requires first defining the term. Without this definition, industrial policy advocates can claim that past failures are not, in fact, industrial policy, while other policies tangentially related to government action are clear industrial policy successes. There also is the risk, as economist Herbert Stein notes in the 1986 book, *The Politics of Industrial Policy*, of "adopt[ing] so loose and sweeping a definition of industrial policy that it becomes virtually synonymous with overall economic policy," thus precluding a legitimate assessment of industrial policy's costs, benefits, and overall desirability.[1] As fellow economist Mancur Olson writes in the same book, often industrial policy proposals "are so vague that they invite the reaction that industrial policy is neither a good idea nor a bad idea, but no idea at all; that it is the grin without the cat."[2] In short, if everything is industrial policy, then nothing is.

INDUSTRIAL POLICY'S REQUISITE ELEMENTS

Fortunately, industrial policy's long history of academic debate and implementation in the United States establishes several requisite elements that, when combined, can identify whether past or proposed government initiatives are properly considered industrial policy. For example, when examining U.S. industrial policy efforts in the 1920s and 1930s, economic historian Ellis Hawley explained:

> By *industrial policy* I mean a national policy aimed at developing or retrenching selected industries to achieve national economic goals. In this usage, I follow those who distinguish such a policy, both from policies aimed at making the macroeconomic environment more conducive to industrial development in general and from the totality of microeconomic interventions aimed at particular industries. To have an industrial policy, a nation must not only be intervening at the microeconomic level but also have a planning and coordinating mechanism through which the intervention is rationally related to national goals, a general pattern of microeconomic targets is decided upon, and particular industrial programs are worked out and implemented.[3]

As the Mercatus Center's Adam Thierer wrote in a 2020 article, Hawley's definition shows that "targeted and directed efforts to plan for specific future industrial outputs and outcomes is at the heart of a proper understanding of industrial policy."[4] Such outputs and outcomes must also occur within national borders: government procurement of foreign-made semiconductors, for example, cannot be industrial policy. Thus, industrial policy is inherently nationalist, with government support for domestic industry either indirect (e.g., tariffs, quotas, and "Buy American" mandates) or direct (e.g., subsidies for American companies, jobs, or investments).

> "Industrial policy's long history of academic debate and implementation in the United States establishes several requisite elements that, when combined, can identify whether past or proposed government initiatives are properly considered industrial policy."

Finally, industrial policy output and outcomes are *commercial* in nature, distinguishing them from both basic scientific research and defense procurement, such as fighter jets. The former has no targeted or strategic commercial application. The latter, as explained by Richard Nelson and Richard Langlois in the 1980s, is categorically different from commercial-oriented industrial policies for three reasons.

First, as the sole consumer of such goods, the federal government has a unique and deep knowledge of the products or technology at issue and its own needs therefor, as well as a strong and direct interest in obtaining high-quality deliverables. Second, the public strongly believes in the legitimacy of the government's primary mission (thus minimizing politicization and short-termism). And third, commercial spillovers are an unintended benefit, as opposed to the main purpose, of government action.[5]

Similar definitions and policies were offered by industrial policy advocates in the 1980s and 1990s, the last heyday of U.S. industrial policy. This includes former Clinton administration official Robert Reich in *The Next American Frontier* (1983); historian Otis L. Graham in *Losing Time: The Industrial Policy Debate* (1992); and former Commerce Department official Erik Pages in *Responding to Defense Dependence* (1996).[6] More recently, the Carnegie Endowment's Uri Dadush and the Hudson Institute's Arthur Herman, citing a 2006 paper by economists Howard Pack and Kamal Saggi, have echoed these historical definitions.[7]

> "Industrial policy aims *not* at making the macroeconomic environment more conducive to industrial development in general but at dictating the specific *composition* of commercial industrial activity within the nation to achieve a broader national goal."

Thus, both advocates and critics coalesce around four essential features of industrial policy:

- a focus on manufacturing, to the exclusion of services and agriculture;
- targeted and directed *microeconomic* (firm or industry-specific) support (e.g., tariffs or subsidies), as opposed to horizontal, sector-wide, or economy-wide policies (e.g., corporate tax rate reductions or patents);
- a government plan to fix market failures, including negative externalities, and thereby achieve in targeted industries/companies clear, specific, and measurable commercial outcomes, such as jobs, investments (research and development, capital expenditures, etc.), output, or products that are better than what the market could provide in the absence of industrial policy; and
- a requirement that these market-beating commercial outcomes be generated within national borders.

As Duke University economist Michael Munger explains, industrial policy is *not* aimed at making the macroeconomic environment more conducive to industrial development in general. It does not target the *levels* of research, jobs, or even industrial activity that we generally have in the United States, nor does it even correct perceived or real shortcomings of markets by any means necessary.[8] It aims at dictating the specific *composition* of commercial industrial activity within the nation to achieve a broader national goal.[9] Thus, for example, industrial policy does not say "we need to lower carbon emissions" (via, for example, a carbon tax or a nondiscriminatory consumer subsidy paired with unilateral free trade in environmental goods); it says "we need to lower carbon emissions *by subsidizing or protecting American solar panel companies and workers*."

WHAT INDUSTRIAL POLICY ISN'T

Many of the industrial policies that advocates propose contain the four elements above, but often these same individuals add events or transactions that cannot be considered industrial policy without rendering the term inutile. A pro-industrial policy symposium hosted by the conservative think tank American Compass, for example, contains proposals for reshoring core digital technologies, offering subsidies for biopharmaceutical and semiconductor manufacturing, and putting local-content restrictions on electrical grid equipment and medical goods.[10] All of these proposals seek to encourage domestic production of targeted commercial industries pursuant to a broader national strategy, and they therefore qualify as industrial policy rightly understood. On the other hand, the symposium adds active labor market policy, environmental regulatory reform, an infrastructure bank, World Trade Organization (WTO) reform, and vigorous antitrust action by a new Department of Economic Resilience. Yet while each might tangentially benefit domestic manufacturing, none directly supports a specific industry or targets specific market-beating commercial outputs.

This confusion permeates the current debate over industrial policy both here and abroad. In fact, many (if not most) of the industrial policy successes that proponents praise are not industrial policy at all, and they often border on the absurd. Examples include Apple and the smartphone (and almost every piece of essential hardware that it contains); Microsoft Windows; Google, Google Maps, and the entire internet; supercomputers; semiconductors and semiconductor lasers; digital optical networks; the graphical user interface; global positioning system (GPS); LED screens; plasma displays; artificial intelligence and speech recognition; videoconferencing; closed captioning; Linux and cloud computing; nanotechnology; renewable energy (lithium batteries, wind power, solar panels); nuclear energy; fracking; seismic imaging; LED lighting; airbags; the civilian aviation industry (and jet engines in particular); the pharmaceutical and biotech industries, as well as most innovative drugs, including HIV/AIDS treatments and mRNA technology; magnetic resonance imaging; advanced prosthetics; the human genome project; hybrid corn; and even lactose-free milk![11]

Yet few of these modern marvels are the direct result of industrial policy in any legitimate sense. For example, industrial policy proponents routinely cite the Defense Advanced Research Projects Agency (DARPA) for its support for (or even invention of) the commercial internet as a poster child of industrial policy success. However, leaving aside the missing manufacturing nexus, DARPA did not have a plan for, or even anticipate, the internet—there was no "mission-oriented directionality" to the government support provided, nor was there any effort to make the Advanced Research Projects Agency Network (ARPANET) or early email a broader commercial success instead of simply "data links to connect computer facilities doing defense-related work." Indeed, a decade earlier the Department of Defense had terminated research done by the Air Force into "a decentralized communications grid distinct from the traditional telephone," and those people involved in ARPANET explained that DARPA "would never have funded a computer network in order to facilitate email."[12]

> "Many (if not most) of the industrial policy successes that proponents praise are not industrial policy at all, and they often border on the absurd."

Overall, ARPANET's contributions to the commercial internet (packet switching and early email) were just that—contributions, as were private-sector efforts such as the early 20th century radio and television technologies, and during the 1970s, Xerox's Ethernet and Randy Seuss's Computerized Bulletin Board System.[13] Just as surely, government funding has supported research that was later used by private companies to produce commercial information technology successes. But none of these scattershot government contributions to one part of an eventual commercial success can properly be considered a coherent, strategic industrial policy.

This conclusion may sound obvious, but the argument is common, especially in the tech sector.[14] As noted, for example, it is routinely asserted that the federal government—via industrial policies that developed core components and financial support for Apple—invented the iPhone![15] However, as documented by researcher José Luis Ricón, such assertions equate as industrial policy any government support given at any point in the history of a product's or company's creation, and assign all credit for the innovation to the state.[16] In particular, the industrial policy that led to the multi-touch screen was actually National Science Foundation and Central Intelligence Agency funding for basic research at the University of Delaware into an entirely different field (neuromorphic systems), and the researchers independently developed the multi-touch system to aid their state-funded research.

Meanwhile, another private company, Bell Labs, was developing a similar technology without state support. The connection between the state and several other core smartphone technologies was similarly attenuated and unplanned, with foreign or private alternatives emerging in parallel. Furthermore, state funding for Apple was just a small government-secured loan issued by a private bank that supplemented substantial private startup capital that the company already had. In other words, "Apple was steaming ahead before the involvement of the [state-backed loan] and given what we know, it is most reasonable to assume that it would have continued to do so hadn't there been government involvement."[17]

> "The COVID-19 vaccines developed under Operation Warp Speed have been heralded as a triumph of American industrial policy, but the first vaccine to reach the market, the Pfizer/BioNTech vaccine, disproves this assertion."

Leaving aside even the wholly private innovation of packaging all of these technologies into the iPhone, crediting these technologies to industrial policy renders the term meaningless. Political scientist Alberto Mingardi finds that these sorts of misattributions routinely plague the much-heralded examples of American industrial policy success.[18]

The space program is also often cited as an industrial policy model, but, as economist John Kay explains, its lessons are limited at best:

> Apollo was a success because the objective was specific and limited; the basic science was well understood, even if many subsidiary technological developments were needed to make the mission feasible; and the political commitment to the project was sufficiently strong to make budget overruns almost irrelevant. Centrally directed missions have sometimes succeeded when these conditions are in place; Apollo was a response to the Soviet Union's pioneering launch of a human into space, and the greatest achievement of the USSR was the mobilisation of resources to defeat Nazi Germany.[19]

It's unfathomable to think that the U.S. government—and American voters—will have the political will for another project such as the moonshot, especially for commercial objectives that, unlike space exploration, lack a traditional government nexus. Furthermore, products developed from space technologies arose not from a central industrial plan, but were instead the result of decentralized private actions utilizing directionless, government-funded research.

Finally, the COVID-19 vaccines developed under Operation Warp Speed have been heralded as a triumph of American industrial policy, but the first vaccine to reach the market, the Pfizer/BioNTech vaccine, disproves this assertion. BioNTech is a German company that had been working on mRNA vaccines for years and began its collaboration with Pfizer (based on an earlier working relationship) months before the U.S. government began Operation Warp Speed in May 2020 or contracted with the companies for a vaccine in July of that same year.[20] (BioNTech management actually predicted in April 2020 that distribution of finished doses would occur in late 2020.) The companies famously refused government funds for research and development or for testing and production—efforts that instead leveraged Pfizer's substantial *preexisting* U.S. manufacturing capacity, as well as multinational research teams, global capital markets and supply chains, and a logistics and transportation infrastructure that had been developed over decades. In fact, the Trump administration's contract with Pfizer was for finished, FDA-approved vaccine doses only, and it expressly excluded from government reach essentially all stages of vaccine development (i.e., "activities that Pfizer and BioNTech have been performing and will continue to perform without use of Government funding").[21] There is even some evidence that Operation Warp Speeds' allocation of vaccine materials to participating companies (some of which still have not produced an approved vaccine) may have impeded non-participant Pfizer's ability to meet its initial production targets and expand production after the vaccine was approved.[22]

Surely, some state support, such as funding for mRNA research and a large vaccine purchase commitment, was involved both before and during the pandemic, but it lacked the necessary commercial, strategic, or nationalist elements of industrial policy. In fact, Hungarian biochemist and mRNA visionary Katalin Karikó left her government-supported position at the University of Pennsylvania "because she was failing in the competition to win research grants" and thus "moved to the BioNTech company, where she not only created the Pfizer vaccine but also spurred Moderna to competitive imitation."[23] The National Institutes of Health grant supporting her early work actually came through her colleague, Drew Weissman, and was not directly connected to mRNA research.[24] Other efforts, such as Moderna's mRNA vaccine, had more state support, but the BioNTech/Pfizer vaccine shows that it was not a necessary condition for producing a wildly successful COVID-19 vaccine.

What Obstacles Must Industrial Policy Overcome in the United States?

American industrial policies face several obstacles that prevent their effective implementation. This section provides the most common of those obstacles, as well as real-world examples of how they have plagued past U.S. industrial policy efforts—and thus why new industrial policy proposals should, in general, be opposed.

THE KNOWLEDGE PROBLEM

Perhaps the most widespread industrial policy obstacle is the knowledge problem. In "The Use of Knowledge in Society," Nobel laureate F. A. Hayek explained that the information needed to secure the best use of scarce national resources "never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess." Because this information is unique and ever-changing, central planners cannot discern it via aggregate, retrospective statistics: "The continuous flow of goods and services is maintained by constant deliberate adjustments, by new dispositions made every day in the light of circumstances not known the day before, by B stepping in at once when A fails to deliver."[25]

Thus, decentralized, market-based economic activity in general produces better outcomes than centrally planned activity (one authority for the whole economic system) because the former better mobilizes the diffuse knowledge—via price signals and millions of individual, real-time, dynamic transactions—that are needed for economic actors to make relevant decisions. Because no single person possesses all such knowledge in real time, economic planners must show how their "solution is produced by the interactions of people each of whom possesses only partial knowledge" and fixes "the unavoidable imperfection of man's knowledge and the consequent need for a process by which knowledge is constantly communicated and acquired."[26] They rarely do.

A core part of industrial policy's knowledge problem is timing: because markets and personal preferences are constantly evolving, the facts (products, investments, supply and demand, etc.) on which an industrial policy is designed will inevitably be different than the facts that exist at the time it is approved, and they will likely change again (and again) upon implementation. Discovery is endless. Thus, history repeatedly has shown that the "critical technologies" (and suppliers) of today are often not so critical tomorrow, and only markets are flexible and nimble enough to reveal the difference. Planners don't stand a chance.

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Past U.S. industrial policy efforts have often struggled to surmount the knowledge problem, particularly in high technology goods. As technology experts Patrick Windham, Christopher T. Hill, and David Cheney noted in 2020, for example, "US efforts in the 1990s to identify 'critical technologies' did not succeed, partly because it is hard to predict which technologies will be most valuable in the future."[27] James L. Schoff of the Carnegie Endowment for International Peace cites these efforts among the U.S. "technonationalism" failures in the 1980s and 1990s. He documents how past efforts to support critical technologies, (as defined by a National Critical Technologies Panel) through trade and investment restrictions, subsidies, and public-private consortia failed because the government—which was worried about Japan at the time—could not foresee how the marketplace would develop. The U.S. government therefore focused on current national champions such as Motorola and Toshiba, and missed how the internet would transform mobile and digital technologies and "stimulate the rise of internet titans" that today "possess some of the world's most coveted technology, investing more than most governments do to push new boundaries and accelerate change through design and systems integration."[28] After noting another U.S. government miscue—seeing Japan as an unstoppable technological powerhouse—Schoff explains that American firms "prospered because of their ability to innovate and compete effectively, not because of such technonationalist or protectionist measures."[29]

Even if policymakers pick the right industry to promote, moreover, they can struggle to identify and support the right product in that industry. For example, U.S. semiconductor policy in the 1980s saw dynamic random access memory (DRAM) chips as being central to national security and the future of U.S. global technology leadership and believed that trade restrictions would encourage new American entrants in the DRAM market. Yet no such investments occurred because U.S. firms were exiting the DRAM market after rightly determining that future success would be in advanced microprocessors, specialty chips, and design, rather than "high-volume, low-profit commodity" memory chips.[30]

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Similar problems plagued contemporaneous U.S. supercomputer policy, which targeted older technology and vector supercomputers produced by the American firm Cray and Japan's NEC, just as those products were losing out to non-vector supercomputers, and as the supercomputer industry was undergoing major structural changes that rendered trade protection obsolete.[31] As the American Enterprise Institute's Claude Barfield explains in his book *High Tech Protectionism*, "With supercomputers, as with semiconductors and flat panels, government officials either never understood or willfully ignored the structure of the industry and the nature of worldwide competition in the sector [and] seemed blissfully unaware of the technological trajectories of the industry."[32]

Examples of knowledge problem failures are not limited to history books. For example, in March 2020 the Trump administration invoked the Defense Production Act to push domestic manufacturers to make more ventilators, which were deemed essential to fighting the novel coronavirus at that time. By the summer, however, medical professionals determined that ventilators were not as critical as they had once thought, but producers continued to churn them out under government orders, leading to reports of the goods piling up in a strategic reserve or being donated to "countries that don't need or can't use them."[33] According to a December 2020 report from the U.S. International Trade Commission, production for other medical goods funded by the Defense Production Act will only come online after mid-2021 (with the virus more contained), even though there was evidence of a domestic medical goods glut in late January.[34]

PUBLIC CHOICE—ESPECIALLY IN THE AMERICAN SYSTEM

Government industrial policy plans also face obstacles inherent in the political system that produces and implements those policies. As detailed in the work of public choice theory, political actors act not in the public interest, but in their own rational self-interest, and thus they use the political systems in which they operate to make themselves, not the general public, better off. Elected officials' primary goal is therefore reelection, whereas bureaucrats strive to advance or protect their own careers.

Public choice distorts both the design and implementation of industrial policies. On the former, elected officials frequently advance legislative policies that confer concentrated benefits upon small, homogenous, often local interest groups and impose diffuse (but larger) costs upon the public, because only the former groups have sufficient motivation to follow the issues closely and apply political pressure through lobbying, campaign contributions, and votes. Because members of the general public are rationally ignorant about these policies (and thus do not tie their votes or contributions to them), elected officials act rationally in supporting the policies, even when they are known to produce net losses for the country. This collective action problem not only generates pork-barrel projects (often through "logrolling" bargains, in which legislators trade votes on each other's pet projects), but it also makes reform or elimination of these programs exceedingly difficult, regardless of their efficacy.[35]

> "The same political pressures that distort elected officials' support for an industrial policy can similarly distort the federal bureaucracy's work to effectuate it."

The same political pressures that distort elected officials' support for an industrial policy can similarly distort the federal bureaucracy's work to effectuate it. Research shows, for example, that government agencies' agendas often mirror those of the members of the congressional committees that primarily oversee them—members that often actively seek out these committee assignments in order to affect the regulatory agencies beneath them. Similarly, studies show that agencies can become "captured" by motivated special interest groups or their elected benefactors, who use the agency to further their own narrow interests at the broader public's expense.[36] Even where political pressure is limited (often by design), capture can occur where bureaucrats lack the same level of specialized knowledge as the entities they regulate, and thus they grow to rely on those entities for both information and manpower.

All industrial policies face these political impediments, but two aspects of the American system amplify them. First, large segments of Congress may be replaced every two years and the president every four. This dynamic not only injects short-term thinking and uncertainty into the decisionmaking process, but also makes elected officials more risk-averse and focused on reelection instead of the long-term national interest. Thus, as Mancur Olson explained in 1986, "It is precisely in the areas of uncertainty like high technology and new industries that private venture capital has the greatest advantage" over government.[37] This dynamic has likely worsened since the 1980s, owing partly to longer presidential campaigns that far exceed those in other countries.[38] Representatives today essentially start campaigning for the next election shortly after winning the last one.

Second, the United States has a well-developed lobbying and interest group system, which would inevitably affect, and likely deteriorate, the design and implementation of any significant industrial policy. As Olson explained, because existing organized interests would greatly influence any industrial policy, advocates must explain how proposals to allocate capital on preferential terms to promising new firms in emerging technologies (who usually lack lobbying power) will be insulated from powerful, often declining, firms with a strong lobbying presence.[39] The effect of interest group pressure on federal industrial policy formation and implementation has doubtless increased since Olson first opined on the issue 35 years ago.

Past U.S. industrial policy efforts show how public choice issues can thwart planners' intentions. For example, Windham, Hill, and Cheney note that, along with knowledge problem issues, U.S. critical technologies efforts in the 1990s failed "because decisions about R&D funding priorities inevitably become political, as groups and leaders vie to have their favorites supported"—a process that "results in a broad list that pleases everyone but is largely useless as a guide to policy."[40]

When policies are implemented, moreover, politics often intervenes—even in systems that are designed to be insulated from the political process. The supercomputer policy in the 1990s was essentially client-service for one American company, Cray, and its computer model, while ignoring other American market entrants, such as Hewlett-Packard, IBM, Intel, and Sun Microsystems, which offered different, and arguably better, products.[41] To block a potential National Science Foundation purchase of a supercomputer made by Cray's Japanese rival NEC, the House of Representatives passed legislation sponsored by Rep. David R. Obey (D-WI), whose district included a Cray facility, that all but guaranteed that Cray would win the contract, and the Commerce Department imposed record-setting antidumping duties of 454 percent on Japanese supercomputer imports in 1997.[42] The duties pressured NEC to agree to invest $25 million in Cray, in exchange for Cray dropping the case, and give Cray exclusive rights to sell NEC's vector supercomputers in the United States.[43] This legal extortion scheme was all the more brazen given that Cray did not even make a vector supercomputer at the time its case blocking NEC's model was settled.

Today, the supposedly impartial Department of Commerce's abuse of the U.S. antidumping law, which permits remedial duties on dumped imports found to injure U.S. manufacturers and workers, is common practice. The agency's actions result in duties that go far beyond the levels needed to remedy injurious dumping, while also revealing that it is an agency captured by domestic interest groups (especially the steel industry); that it is unconcerned with the views of diffuse consumers (including other manufacturers); and that it is unburdened by congressional or judicial checks on its authority.[44]

> "These examples not only show how public choice can undermine industrial policy objectives, but also that systems designed to be insulated from political pressures have nevertheless become distorted by them—just as public choice theory predicts."

More recent government efforts to support clean coal and carbon capture technology (CCT) have also fallen victim to politics. A 2018 review by George Mason University's David Hart of 53 energy technology demonstration projects that were funded by the 2009 American Recovery and Reinvestment Act (ARRA) and administered by the Department of Energy (DOE) reveals that coal-related CCT projects "dominate[d] the portfolio from a fiscal perspective . . . accounting for about five out of every six dollars allocated to energy-demonstration projects during the Obama era." They also were subject to more lenient private cost-sharing requirements and over-optimistic government expectations as to whether they would attract follow-on private investment, and were disconnected from "the benefits that each sector might reasonably expect to receive from a project."[45] Meanwhile, technologies with more potential, such as nuclear power, renewables, and gas-fired electricity plants, were ignored.

The government's special treatment of CCT projects, Hart notes, was due at least in part to politics—especially when it came to the largest project in DOE's portfolio (which received almost one-quarter of all government funding), FutureGen:

> This megaproject, which dates back to 2003 and was terminated for the first time in 2008, was revived through ARRA funding earmarked for its Illinois site. President Obama, then a senator from Illinois, had vowed during his 2008 campaign to support clean coal technologies, and the state of Illinois (which had invested its own funds in the project) and its representatives in Congress (and those of surrounding states) pushed to include it among the "shovel-ready" projects eligible for the stimulus. Much like the Clinch River breeder reactor demonstration project . . . the local fiscal benefits of FutureGen apparently weighed heavily in its vampire-like rise from the dead.[46]

Another federally funded clean coal project—the demonstration plant in Kemper, Mississippi—was excluded from Hart's analysis because it had a different funding source, the 2006 Clean Coal Power Initiative, but this "model of President Obama's climate plan" also suffered public choice problems.[47]

Then, of course, there is the case of Solyndra and the Obama administration's "Section 1705" loan program funded by the ARRA. As the Mercatus Center's Veronique de Rugy explains, Solyndra spent almost $1.8 million on lobbyists, employing six firms with ties to Congress and the White House, while DOE reviewed its loan application. Overall, almost $4 billion in DOE grants and financing went to companies with connections to officials in the Obama administration. De Rugy adds that "nearly 90 percent of the 1705 loan guarantees went to subsidize projects backed by large, politically connected companies including NRG Energy Inc. and Goldman Sachs."[48]

Two separate analyses, one from the Reason Foundation and one from Georgetown University, found a significant connection between Section 1705 loan sizes and their recipients' lobbying efforts.[49] These results are consistent with recent research finding that politically connected firms (as measured by contributions to home state elections) are "64 percent more likely to secure an ARRA grant and receive 10 percent larger grants" than other, less-connected companies, yet "state-level employment creation associated with grants channeled through politically connected firms is nil."[50] Analyses have also found that the Section 1705 and other ARRA-funded loan guarantee programs administered by DOE suffered from other political problems, such as conflicting statutory mandates, time constraints, or uneconomic objectives such as job protection and Buy American rules.[51]

> "Unlike private actions, the successes or failures of which are usually adjudicated (often ruthlessly) by the market, government policies often live or die based on political considerations rather than their actual efficacy."

Most recently, a *New York Times* investigation into Maryland vaccine manufacturer and longtime government contractor Emergent BioSolutions found that the company invested heavily in lobbying while ignoring various safety and manufacturing best practices. It had effectively "captured" the Biomedical Advanced Research and Development Authority, which was authorized to disburse and monitor pandemic-related contracts, and yet, despite repeated contracting failures, Emergent was rewarded with a $628 million contract to manufacture COVID-19 vaccines. The company's actions ultimately imperiled millions of doses of Johnson & Johnson vaccines and weakened the Strategic National Stockpile by monopolizing its $500 million annual budget and thus reducing the taxpayer dollars available for pandemic-related supplies.[52]

These examples not only show how public choice can undermine, if not actively work against, industrial policy objectives, but they also show that systems designed to be governed by neutral arbiters and to be insulated from political pressures have nevertheless become distorted by politics—just as public choice theory predicts.

LACK OF DISCIPLINE

American industrial policies can also suffer from a lack of discipline regarding scope, duration, and budgetary costs—often due to public choice issues. Unlike private actions, the successes or failures of which are usually adjudicated (often ruthlessly) by the market, government policies often live or die based on political considerations rather than their actual efficacy. As the Brookings Institution's Linda Cohen and colleagues explain in their 1991 book, *The Technology Pork Barrel*:

> The second difference between public and private decisionmaking is the institutional structure in which decisionmakers are evaluated. Although retrospective evaluation of R&D is difficult and imperfect in the private sector, it is facilitated by the shared recognition that R&D is intended to provide financial returns to the company and by the presence of quantitative, quite easily observed, indexes of success, such as sales, unit costs, accounting profits, and evaluation of the firm in capital markets. In the public sector, the ultimate external test of an R&D program is its ability to generate more political support than opposition.[53]

The authors, who are sympathetic to U.S. industrial policy, examine six federal industrial policy programs that originated in the 1960s and 1970s and were intended to develop commercial technologies for the private sector: the supersonic transport, the Applications Technology Satellites Program, the Space Shuttle, the Clinch River Breeder Reactor

Project, synthetic fuels from coal, and the Photovoltaics Commercialization Program. (They omit basic research and defense projects from their retrospective cost-benefit analysis.) They deem only one program—NASA's satellite activities—as having been worthwhile, but it was killed before being completed. Four others were failures that cost billions of dollars, crowding out more meritorious R&D projects, yet these endured long after fiscal, technological, and commercial failure was established—a survival owed to political pressure (especially financial benefits accruing to numerous congressional districts) and captured regulators. The authors conclude that "the history of the federal R&D commercialization programs . . . is hardly a success story," and that case studies overall "justify skepticism" about such programs. This is because "American political institutions introduce predictable, systematic biases into R&D programs so that, on balance, government projects will be susceptible to performance underruns and cost overruns."[54]

David Hart summarizes the general problem identified by the *Technology Pork Barrel* examples in his 2018 paper:

> Once a project's spending spigot is turned on, its geographically concentrated fiscal benefits attract political support without regard to technological payoffs or commercial viability. Large projects are particularly attractive to legislators whether or not the technologies being demonstrated are ready to be scaled up, and even if cost, schedule, and performance targets are consistently missed. According to this view, white elephants are a virtually inevitable outcome of the U.S. political system.[55]

Numerous other industrial policy projects justify this conclusion, despite Hart's personal optimism that these forces might be controlled. The Jones Act (Section 27 of the Merchant Marine Act of 1920), for example, restricts domestic shipping services to U.S.-built, -owned, -flagged, and -staffed vessels, in order to foment a strong domestic shipbuilding industry and a ready supply of merchant mariners during wartime, yet the act has presided over the long-term degradation of both the industry and the oceangoing merchant marine fleet.[56] Despite these failures, the law has not only persisted for a century, but has actually been made *more restrictive* in recent decades—in large part due to the well-developed lobbying machine comprised of the U.S. shipbuilding industry, maritime unions, the Jones Act fleet, and other groups (including at least one foreign government) that benefit from the policy's continued existence.[57]

> "Numerous U.S. industrial policies have endured long after fiscal, technological, and commercial failure was established—a survival often owed to political pressure."

The U.S. ethanol program has also lasted for decades despite numerous studies showing that corn-based ethanol imposes substantial economic and environmental damage, while raising food prices and *undermining* U.S. climate goals. Yet these mandates are championed by almost every presidential candidate visiting Iowa; even the pro-deregulation Trump White House expanded them in 2018, and both Republicans and Democrats—fully aware of the program's flaws—work tirelessly to maintain it.[58]

The U.S. antidumping law has been subject to widespread and decades-long criticism from economists, legal scholars, and trading partners, and various aspects of its administration have been repeatedly ruled illegal by federal courts and adjudicatory panels under U.S. trade agreements (e.g., the World Trade Organization and the North American Free Trade Agreement).[59] Yet the law not only remains in force—accounting for hundreds of special duties today—but has been repeatedly *expanded* by Congress to achieve desired protectionist results and to permit even greater abuse in the future.[60] The government also routinely ignores WTO rulings against the Department of Commerce antidumping abuses—practices that are becoming increasingly common.[61]

The clean-coal megaprojects FutureGen and Kemper persisted in the face of repeated failures and numerous cost overruns because of their political value (and political problems in case of failure). As the *New York Times* wrote of Kemper, "The system of checks and balances that are supposed to keep such projects on track was outweighed by a shared and powerful incentive: The company and regulators were eager to qualify for hundreds of millions of dollars in federal subsidies for the plant, which was also aggressively promoted by Haley Barbour, who was Southern's chief lobbyist before becoming the governor of Mississippi."[62] As noted above, FutureGen was actually revived because of its importance for former president Barack Obama and his home state of Illinois. That it and other DOE projects were ultimately canceled, Hart notes, likely resulted from a unique confluence of "temporary" events: the ARRA's 2015 expiration date for fund disbursement, a bipartisan push for fiscal austerity, and partisan Republican opposition to Obama-era industrial policy projects.[63] Only the first item might be replicable today. Even the success of the Petra Nova project "suffered chronic mechanical problems and routinely missed its targets before it was shut down" in 2020.[64] According to energy experts, the project reveals the operational and financial impediments to carbon capture more broadly, yet DOE remains committed to funding it.[65]

Surely, not every U.S. industrial policy boondoggle lasts as long as the Jones Act, but the examples above—and many others—reveal that the risk is significant and the problems pervasive.

INTERACTION WITH OTHER POLICIES/DISTORTIONS

Industrial policy implementation is also often undermined by government policies that may have distorted the market at issue. As the Brookings Institution's Shanta Devarajan explains:

> The analytical case for industrial policies is based on the idea that there is a market failure that is preventing industrialization and so some form of government intervention, such as a subsidy, is necessary to correct that failure. The case is usually made in the form of elegant economic models that portray the market failure and show how intervention can lead the economy to higher growth. Most of these models assume that the relevant market failure is the only distortion in the economy. In the real world, however, these economies are full of distortions, such as labor market regulations, energy subsidies, and the like. In this setting, correcting the market failure associated with industrial policy may not promote industrialization; in fact, it may make matters worse. . . . Instead of relying on simple models that assume away all other distortions, governments would do better to identify the biggest distortions in the economy (such as energy subsidies) and work on correcting them. And if the biggest distortion cannot be moved, then governments need to take that into account in identifying the next biggest distortion to be addressed.[66]

Conflicting subsidies are a common problem in the United States. As discussed in the following section on industrial policies' costs, for example, some DOE funding for CCT was allocated to subsidized, politically powerful ethanol producers, despite the product's increasingly obvious shortcomings. Without government support for ethanol, other energy-demonstration projects might have been funded instead, perhaps with better results.

> "Conflicting subsidies are a common problem in the United States, as are preexisting laws and regulations that make industrial policy projects slower and more costly."

Then there are the laws and regulations that make industrial policy projects slower and more costly. DOE loan guarantee applicants, for example, must comply with the Davis-Bacon Act (mandating high wages and favoring labor unions) and Buy American laws (mandating domestic content and favoring U.S. manufacturers), both of which increase project costs and paperwork.[67] Buy American restrictions also can limit companies' access to needed materials or lead to project delays, and they confounded ARRA-funded infrastructure projects that were intended to boost the U.S. manufacturing sector.[68] These same projects also had to comply with the National Environmental Policy Act (NEPA), as well as similar laws at the state level, which require government review and approval of federal actions that significantly affect the environment. A recent assessment of NEPA by Eli Dourado of the Center for Growth and Opportunity finds that publication of NEPA-required environmental impact statements takes an average of 4.5 years, and that ARRA projects have entailed approximately 193,000 NEPA reviews, 7,200 environmental assessments, and 850 impact statements. While these reviews are ongoing, no project funds may be disbursed or actual work begun.[69]

> "Entrenched, policy-driven distortions can turn projected industrial policy successes into costly failures—exacerbating market failures rather than fixing them."

Bipartisan efforts to overhaul NEPA have thus far proven unsuccessful, and Democrats—who currently control the federal government—have expressed a desire to apply both Buy American and Davis-Bacon to future industrial policy initiatives.[70] In fact, both are included in the bipartisan U.S. Innovation and Competition Act and Infrastructure Investment and Jobs Act, each of which passed the Senate in the summer of 2021 and seek to subsidize the domestic production of certain goods and technologies.[71]

These entrenched, policy-driven distortions, and others, can turn projected industrial policy successes into costly failures—exacerbating market failures rather than fixing them. Policymakers should therefore focus on correcting distortions caused by current policies before adding another layer of distortion via new industrial policy.

HIGH COSTS—SEEN AND UNSEEN

Finally, industrial policies impose substantial costs beyond the budgetary line item assigned to a specific project. This includes not only substantial cost overruns, but also numerous unseen costs imposed on other parts of the U.S. economy—costs that often undermine an industrial policy's own objectives.

Seen Costs

Projects frequently fall victim to cost overruns well beyond initial budget projections. Borrowing costs, given the perpetual U.S. budget deficit, also magnify this expense. For example, in 2014 DOE claimed that its green energy lending programs were making money because the agency's assessment ignored the interest costs that taxpayers paid to finance the loans at issue. As the Urban Institute's Donald Marron explained at the time, DOE's alleged $810 million profit became a $780 million *loss* when Treasury's borrowing costs were included.[72]

Furthermore, it often takes years to determine whether a project merits its cost. For example, in 2014 DOE congratulated itself at the opening of the subsidized Abengoa cellulosic biorefinery in Hugoton, Kansas, but that plant was shut down in 2015 and sold off at a severely discounted price as part of a 2016 bankruptcy proceeding.[73] By 2018, the entire U.S. cellulosic biofuel industry was on the ropes, and the Hugoton facility still sits idle today.[74]

Finally, cherry-picked industrial policy successes often obscure a wider portfolio of failures and thus, higher costs per success. For example, Hart's review of DOE energy-demonstration projects found that 10 CCT projects accounted for 82 percent of all DOE funding ($3.49 billion of $4.24 billion) in 2009, but only three were still active in 2018, with the huge FutureGen project among the failures.[75] Since Hart's study, one of these three, the Petra Nova power project, was mothballed after suffering frequent outages and missing its carbon sequestration goals.[76] Another, Archer Daniels Midland's Illinois Industrial Carbon Capture and Storage Project (which captures carbon dioxide as a byproduct of ethanol production), is still operating, but it has reached only half of its annual emissions storage target.[77] Only Air Products and Chemicals' carbon capture facility in Texas (which received $284 million from DOE) can be considered successful.[78] Was this one success worth the total CCT portfolio cost of $3.5 billion?

Other industrial policy portfolios raise similar issues. While Tesla famously paid back its $485 million loan under the Advanced Technology Vehicle Manufacturing program, Fisker Automotive went bankrupt without paying off its $529 million loan; Ford's $5.937 billion loan and Nissan's $1.448 billion loan also remain outstanding.[79] Presumably, they will be paid back, but this story remains unwritten.

Unseen Costs

Beyond these seen costs are the many hidden ones that even government industrial policy successes impose on the economy, including indirect costs paid by private parties, deadweight costs to the economy, opportunity costs, misallocation of resources, unintended consequences, moral hazard and adverse selection, and uncertainty.

Indirect costs paid by others

Industrial policies that restrict access to goods and services from disfavored (usually foreign) suppliers raise prices for both the restricted items and their favored competitors, imposing significant costs on consuming companies and individuals. For example, tariffs that former president Donald Trump implemented to boost the U.S. steel and aluminum industries have been repeatedly found to raise foreign and domestic steel prices, thus harming downstream U.S. manufacturers and reducing GDP.[80] Pervasive Buy American rules, which generally restrict government contracts to domestic producers, have similarly been found to act as a barrier to entering the U.S. market and to raise domestic prices in the same way that a tariff does.[81]

Deadweight costs

Trade restrictions or taxation to fund industrial subsidies also impose deadweight costs on the economy. For example, by raising domestic prices a tariff not only redistributes to producers money that consumers used to save when buying cheaper, non-tariffed imports, but also reduces domestic consumption overall. This portion of the consumer surplus is simply destroyed—a deadweight loss that makes the United States, as a whole, worse off in the amount of wealth destroyed (money that consumers, pre-tariff, could have saved, invested, or spent on other things). Economists have repeatedly found that import restrictions impose substantial deadweight costs on the economy—a key reason why so few economists support them.[82] High tax rates have been found to impose similar costs.[83]

"Given that both time and federal budgets are finite, government industrial policies replace efforts and money that could have been spent on other priorities, potentially imposing significant opportunity costs in the process."

Opportunity costs

Industrial policy programs that entail government spending also entail opportunity costs, as explained by St. Louis Federal Reserve Economist Michelle Clark Neely:

> Each subsidy given to an industry or firm generates an opportunity cost: the cost of foregone alternatives. In other words, to correctly evaluate a policy, you need to know not only what you're getting, but also what you're giving up. Based on industrial policy experiments in several countries, most economists have little confidence in the government's ability to measure these benefits and costs properly.[84]

Given that both time and federal budgets are finite, government industrial policies replace efforts and money that could have been spent on other priorities, potentially imposing significant opportunity costs in the process. In *The Technology Pork Barrel*, for example, Cohen and Noll explain that the Clinch River breeder reactor "absorbed so much of the R&D budget for nuclear technology that it probably retarded overall technological progress."[85] Other nuclear projects, and the Space Shuttle, likely had similar net negative effects.[86] As noted above, more recent government overspending on Emergent BioSolutions' pricey anthrax vaccines left less money available to purchase other medical goods, such as N95 masks, for the Strategic National Stockpile, thus contributing to its shortages when COVID-19 arrived in 2020.[87]

These opportunity costs are sometimes mentioned when government industrial policies publicly fail, but they must also be considered when evaluating the alleged successes, too. As Duke professor Daniel Gross explains, for example, we celebrate that World War II shifted the scientific establishment from its previous projects to atomic fission, radar, and other war-related technologies, but we ignore the canceled projects' potential benefits.[88] Once these types of opportunity costs are considered, allegedly successful industrial policies can end up undermining the economy, as well as various strategic national objectives.

Misallocation of resources

Industrial policies also often distort private investment decisions, pushing resources away from productive transactions, businesses, or industries. When the Trump administration pushed automakers to produce ventilators that were never needed, their efforts occupied machinery, labor, and capital that could have been used to make cars that subsequently were in short domestic supply. The canceled $765 million loan to turn Eastman Kodak into a pharmaceutical ingredient company caused the company's shares to surge 1900 percent, and its market capitalization at one point reached $2.2 billion (a twentyfold increase)—private capital that could not be invested elsewhere (for example, in actual U.S. pharmaceutical ingredient producer Fujifilm).[89] Even after the government loan was stymied, and without any new plan for long-term financial viability (along with continued poor financial performance), the company's shares still traded at three to four times their pre-loan announcement price, thus diverting for several months (if not longer) hundreds of millions of private investment dollars away from other companies.[90]

Industrial policies can also discourage private investment in industries that the government is actually trying to promote. As Harvard's Josh Lerner explains, with respect to the Obama-era DOE's green energy subsidies,

> The enormous scale of the public investment appears to have crowded out and replaced most private spending in this area, as [venture capitalists] waited on the sideline to see where the public funds would go. . . . Rather than being stimulated, cleantech has fallen from 14.9 percent of venture investments in 2009 to 1.5 percent of capital deployed in the first nine months of 2019.[91]

With respect to the Advanced Technology Vehicle Manufacturing program in particular, *Wired* magazine found in 2009 that "this massive government intervention in private capital markets may have the unintended consequence of stifling innovation by reducing the flow of private capital into ventures that are not anointed by the DOE," and then provided instances when this very risk had materialized.[92]

> "Industrial policies also often distort private investment decisions, pushing resources away from productive transactions, businesses, or industries."

Finally, potential industrial policy beneficiaries can divert resources from their actual business to obtaining federal benefits (lobbying, grant writing, etc.), thus undermining the former. *Wired* notes, for example, that

> Aptera Motors has struggled this year to raise money to fund production of the Aptera 2e, its innovative aerodynamic electric 3-wheeler, recently laying off 25 percent of its staff to focus on pursuing a DOE loan. According to a source close to the company, "all of the engineers are working on documentation for the DOE loan. Not on the vehicle itself."[93]

Kodak spent almost $800,000 on lobbying before it received its Defense Production Act loan, and Emergent BioSolutions has spent millions on lobbying and winning federal contracts. Overall, countless millions of dollars—dollars that could have been spent on producing better products—have instead been spent on political efforts by companies in the steel, shipbuilding, ethanol, and other industries that are common industrial policy targets.[94]

Unintended consequences

Industrial policies produce consequences that not only are unforeseen by government planners but also undermine the policies' own objectives. As already noted, government subsidies intended to spur various energy innovations repeatedly discourage them. Steel protectionism has boosted less productive and innovative firms' lobbying efforts and financial returns, thus discouraging overall innovation (R&D spending and creative destruction) in the industry.[95]

> "Industrial policies also can generate moral hazard (i.e., encouraging actors to engage in overly risky behavior by protecting them from its consequences) and adverse selection (i.e., the tendency to attract the highest-risk or least-responsible actors)."

Numerous other examples abound. Semiconductor policy during the 1980s and 1990s sought to boost domestic producers' global competitiveness (while diminishing their Japanese competitors), but instead it enriched Japanese chipmakers via quota "rents" and government-backed collusion and helped turn South Korean companies into global leaders.[96] Jones Act shipping restrictions, intended to bolster national security, have pushed American energy consumers to buy from Russian producers and American shippers to use Chinese shipyards for repairs. Restrictions on imports of machine tools from major producer countries in the 1980s fueled the growth of China's machine tools industry.[97] Ethanol subsidies and mandates have reduced cropland, increased food prices, and harmed the environment. Buy American restrictions tied to federal transportation subsidies have raised the price of domestically produced transit buses and discouraged the purchase of more-efficient foreign-made buses, thus lowering the quality and use of public transit (fewer stops and less geographic coverage), increasing traffic congestion, and harming the environment.[98] Outside of the United States, European innovation policy has stymied innovation, while Japanese industrial policy has slowed productivity growth.[99] The list of countries and industries more harmed than helped by industrial policy goes on and on.

Moral hazard and adverse selection

Industrial policies also can generate moral hazard (i.e., encouraging actors to engage in overly risky behavior by protecting them from its consequences) and adverse selection (i.e., the tendency to attract the highest-risk or least-responsible actors). Research shows, for example, that government loan guarantees that insure lenders against incurring losses from default can encourage banks to take on risky borrowers, discourage them from undertaking standard due diligence to apply for credit guarantees, and attract a disproportionate share of risky borrowers, thus resulting in inefficient resource allocation overall.[100] In the United States, the poster child for these problems was the Section 1705 loan guarantee program and the $535 million loan to solar panel manufacturer Solyndra that it supported.[101] As explained by economist Ryan Yonk, the scandal with Solyndra was not that the company failed, but that its loan application—which a 2015 Inspector General report found was plagued with deficiencies and misrepresentations about a company with publicly known problems—was ever approved in the first place.[102] In a comprehensive assessment of all DOE loans and loan programs implemented between 2009 and 2016, the Heritage Foundation's Nick Loris found that projects routinely featured failed companies that "could not survive even with the federal government's help," and added that both the Government Accountability Office and DOE Office of Inspector General reports "identify that the loan programs were fraught with inefficiencies, lack of due diligence, and inadequate oversight and management."[103]

Uncertainty

Industrial policies often produce uncertainties due to their inherently political nature (frequent elections, program lapses, etc.) and potential to engender trade disputes or retaliation from foreign trading partners. Numerous studies, for example, show that U.S. tariffs during the Trump administration increased trade policy uncertainty and thereby decreased investment and economic growth.[104] These results are consistent with the general economics literature showing that policy uncertainty undermines investment, employment, and economic growth. As the University of Chicago's Steven J. Davis explains,

> a variety of studies find evidence that high (policy) uncertainty undermines economic performance by leading firms to delay or forego investments and hiring, by slowing productivity-enhancing factor reallocation, and by depressing consumption expenditures. This evidence points to a positive payoff in the form of stronger macroeconomic performance if policymakers can deliver greater predictability in the policy environment.[105]

Both theory and practice show why it is difficult, if not impossible, for industrial policies to achieve such predictability. These outcomes not only undermine the common argument that industrial policies fix market short-termism—they are similarly afflicted (if not more so)—but also show that such policies impose significant economic harms.

> "Industrial policies often produce uncertainties due to their inherently political nature (frequent elections, program lapses, etc.) and potential to engender trade disputes or retaliation from foreign trading partners."

Almost all of these seen and unseen costs arose in the 2009 government bailouts of General Motors and Chrysler, which were deemed industrial policy successes by the Obama administration because they only cost taxpayers about $10 billion, which was the difference between the current-dollar value of funds the government invested and recouped.[106] However, this total ignores the true, interest-adjusted cost to taxpayers, which the Congressional Budget Office estimates was 40 percent higher ($14 billion).[107]

Furthermore, as economist Daniel Ikenson has explained, even this larger dollar figure ignores all of the bailout's hidden costs for the economy. For instance, the $61 billion allocated to these corporations could have been spent on more productive initiatives, such as retraining autoworkers. The long-term competitiveness of GM and Chrysler was diminished because they were not reorganized via standard bankruptcy proceedings. Ford and other U.S.-based automakers who did not receive special treatment lost business, thus harming not only their finances but also American consumers and the economy, because these companies' better products and business models were not rewarded. Moral hazards arose from encouraging the continuation of the companies' and the United Auto Workers' irresponsible practices. Bond holders and other investors suffered because they did not receive the fair value of their holdings, potentially short-circuiting U.S. bankruptcy law along the way. Then there are the political costs of protecting well-connected favorites (here, unions), and the cost of uncertainty about whether and when political actors would again decide to intervene in the market and legal system, citing the bailout as precedent.[108]

If It Creates One Tesla?

Some industrial policy advocates argue that these seen and unseen costs are an expected and necessary part of backing ventures considered too risky for private capital and are worth the expense if the project ultimately supports one big winner, such as Tesla Motors. Even assuming that Tesla's story is fully written, or that electric vehicle (EV) proliferation benefits average Americans, however, this argument must have limits: Would government backing of Tesla be worth one trillion dollars' worth of waste, failure, and cronyism? Two trillion? Surely, some number of losers—individuals and the economy overall—would be too much, even if the government picked one winner in the process. Costly public failures might also undermine public confidence in the government and support for future federal policies, industrial or otherwise—jeopardizing the next Tesla (or more worthwhile targets) rather than nurturing it. Solyndra's failure had this very result.[109]

These arguments, as well as other industrial policy defenses, also require quantifying the benefits that alleged successes confer, not merely upon the recipient companies and their workers, but on the U.S. economy more broadly. Positive externalities, market-beating R&D spillovers, and faster economic growth are often claimed, but these benefits are rarely supported by hard evidence or thorough empirical analysis. Indeed, a core theme of scholars Deirdre Nansen McCloskey and Alberto Mingardi's book, *The Myth of the Entrepreneurial State*, is the lack of rigorous and systematic empirical analyses of the overall efficacy of nations' industrial policies, as opposed to whether specific projects achieved certain deliverables.[110] Pack and Saggi examined the issue in 2006 and explained a key hurdle to such analyses:

> Although there are cases where government intervention coexists with success, there are many instances where industrial policy has failed to yield any gains. The most difficult issue is that relevant counterfactuals are not available. Consider the argument that Japan's industrial policy was crucial for its success. Because we do not know how Japan would have fared under laissez-faire policies, it is difficult to attribute its success to its industrial policy. It might have done still better in the absence of industrial policy—or much worse. Given this basic difficulty, only indirect evidence can be obtained regarding the efficacy of industrial policy. Direct evidence that can "hold constant" all the required variables (as would be done in a well-specified econometric exercise) does not exist and likely never will.[111]

The authors nevertheless concluded that sectoral targeting has not been not effective.[112] Since then, several literature reviews have come to essentially the same conclusion: the few empirical studies of industrial policy tend to focus on specific transactions and issues rather than the aggregate, economy-wide effects of industrial policy; they often suffer from methodological or data limitations; and they have produced mixed, country-specific results.[113] The studies therefore cannot permit strong conclusions about the success or failure of industrial policy writ large.

"Positive externalities, market-beating R&D spillovers, and faster economic growth are often claimed, but these benefits are rarely supported by hard evidence or thorough empirical analysis."

Finally, one must also consider whether an industrial policy success would have occurred in a market without the supporting program. Often, subsidized successes perform no better than their unsubsidized competitors. The most recent example is the BioNTech/Pfizer COVID-19 vaccine achieving the same or better results than vaccines that received far more government support. Yonk's 2020 assessment of DOE loan guarantee programs, for example, finds that few loans were extended that couldn't have been obtained in the market.[114] He adds:

> Most Section 1705 funding has gone to large corporations who already have access to capital for investments in research, development, and deployment. Recipients of LPO [DOE Loan Program Office] guarantees include multiple Fortune 200 companies, utility companies, and multinationals. Many are wholly owned by yet larger companies. The application process itself all but ensures that only large, established companies will be capable of participating in the program. Applicants can expect to pay between $150,000 and $400,000 in fees before even being considered.[115]

As noted above, other analyses of the program have come to the same conclusion. Semiconductor consortium

SEMATECH's work has also been found to have produced deliverables that the market could have provided without government assistance.[116] A 2020 analysis of 25 cleantech startups funded by the Advanced Research Projects Agency-Energy (ARPA-E) in 2010 found "no clear evidence" that subsidy recipients performed better than similar cleantech startups in terms of being acquired, launching an initial public offering, or receiving venture capital funding within 10–15 years of their founding. The authors therefore conclude that the program did not achieve one of its primary goals, which was to generate "an increased likelihood of success (measured in different ways) for ARPA-E startups compared to similar companies."[117] The authors find that awardees did obtain more patents than nonsubsidized competitors, but do not rule out that this success was due to ARPA-E encouraging subsidy recipients to patent or choosing companies with a higher propensity to patent.[118] Finally, the authors found that funding from DOE's Office of Energy Efficiency and Renewable Energy did not affect awardees' patenting or follow-on funding, while DOE's Small Business Innovation Research awardees actually patented less than the average unsubsidized firm.[119]

> "One must also consider whether an industrial policy success would have occurred in a market without the supporting program. Often, subsidized successes perform no better than their unsubsidized competitors."

The ARPA-E program was therefore the best of the bunch. However, the bar is low, and success is *still* no better than what the market could produce. As one supporter of ARPA-E put it, "one would hope to see stronger evidence of the impact of ARPA-E support not only on follow-on funding, but also on product introductions, sales and other downstream commercialization variables over a longer time span."[120] Alas, no such evidence exists.

What Problem Will Industrial Policy Solve?

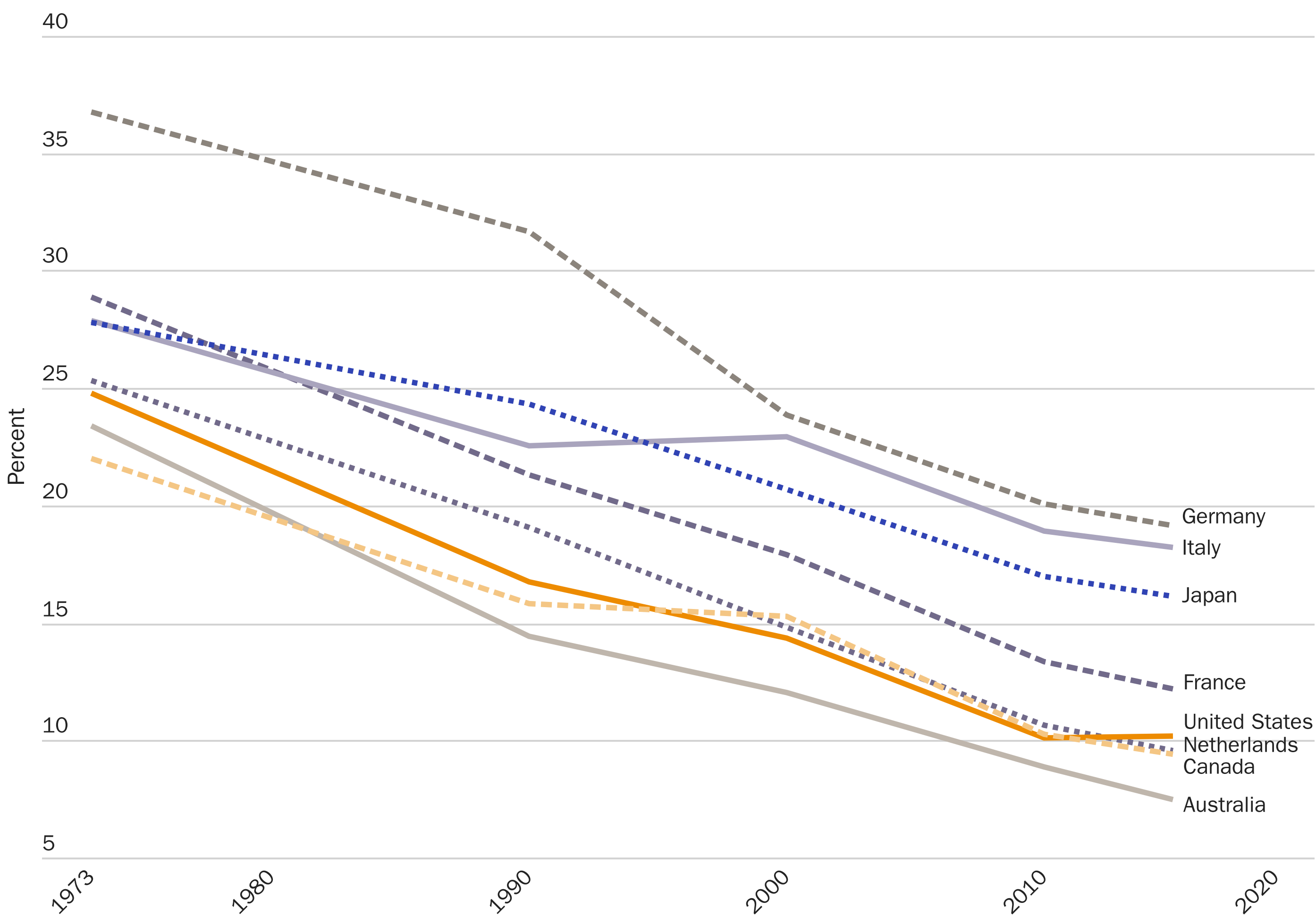
Industrial policy advocates also routinely fail to demonstrate the existence of the specific economic problem that their proposed policies will solve. The most common problems, without which new industrial policy would not be necessary, are either much less serious than advocates claim or else cannot be fixed with industrial policy. This includes allegations of widespread deindustrialization, declining manufacturing jobs and business investment, the erosion of middle-class living standards, and the destruction of American communities.

DEINDUSTRIALIZATION

The supposed deindustrialization of the United States does not justify new industrial policies. There is little merit to the common argument that the U.S. industrial base has been dismantled by decades of free-market fundamentalism and a lack of industrial policy.[121] Both the declining number of manufacturing jobs (Figure 1) and the manufacturing sector's shrinking share of GDP (Figure 2) primarily reflect long-term global trends that are shared by most industrialized nations and that are disconnected from

Figure 1

Share of employment in manufacturing in selected advanced economies, 1973–2016



Source: Robert Z. Lawrence, "Recent US Manufacturing Employment: The Exception That Proves the Rule," Peterson Institute for International Economics Working Paper no. 17-12, November 2017.

specific federal economic policies, whether they are free market or interventionist.

Overall, as Figures 3 and 4 show, the historical trends in U.S. manufacturing jobs and the manufacturing sector's GDP share are a standard story of economic development that all countries eventually experience as they get richer.

Given that these long-term, systemic trends were experienced in other countries, such as Germany and Japan, that had both trade surpluses and active, comprehensive industrial policies, there is little to suggest that new U.S. industrial policies would change the same trends in the United States.

Furthermore, Table 1 and Figures 5 through 7 show that the U.S. manufacturing sector remains among the most productive in the world and has actually expanded since the 1990s—continuing earlier period trends in output, investment (both capital expenditures and R&D), and financial performance.

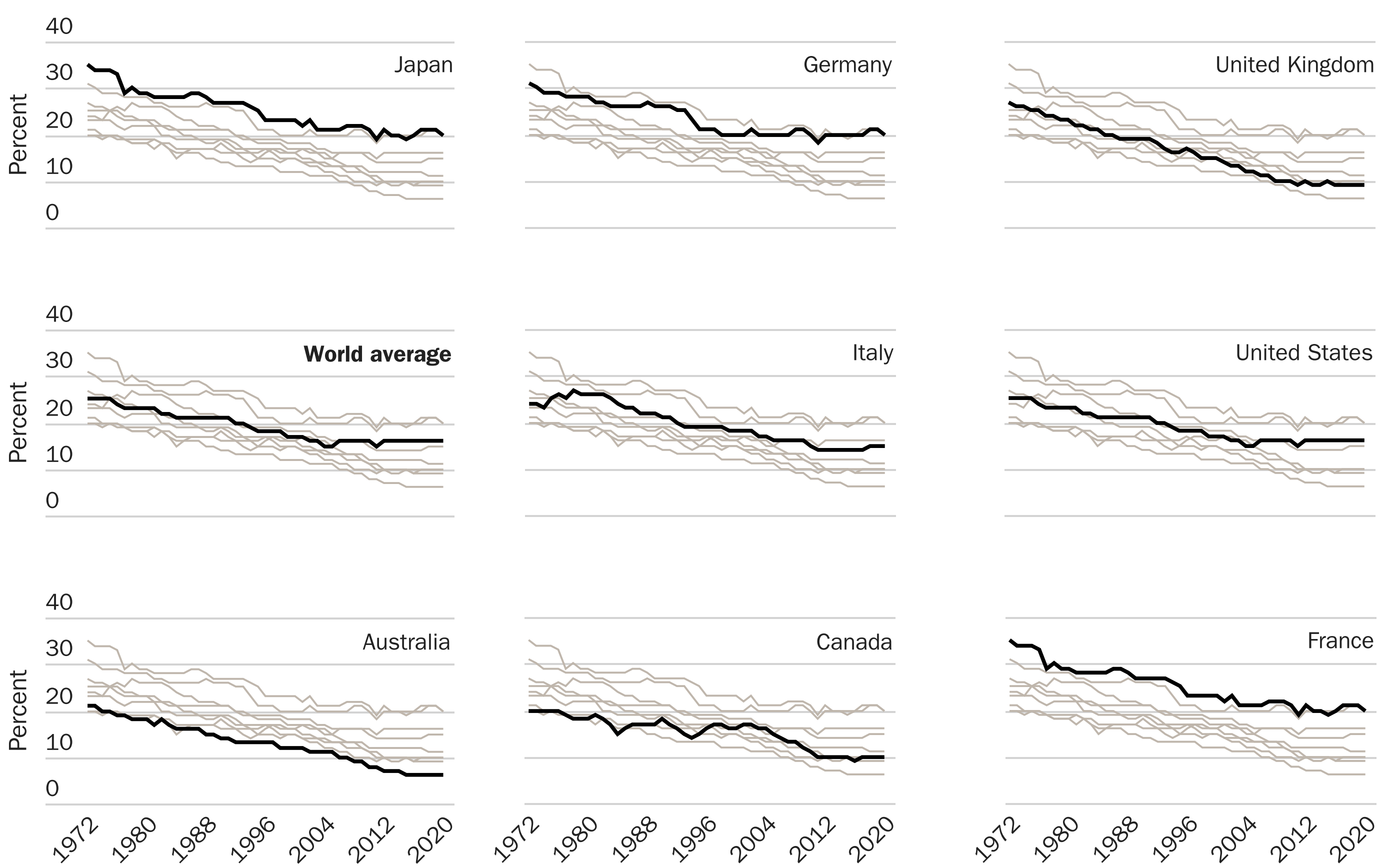
As shown in Table 2 and Figures 8 through 10, moreover, the R&D spending trends for the U.S. manufacturing sector generally track those of the nation overall, which hit all-time highs in R&D spending as a share of GDP and inflation-adjusted dollars spent.

As documented by economist Donald Schneider, numerous experts have concluded that overall *net* investment in the nonfinancial corporate sector (i.e., new investment minus depreciation) has not declined in real terms. As shown in Figure 11, this reached an all-time high on a per worker basis during the mid-2010s and leveled off afterward.

Research from University of Houston economist Dietz Vollrath shows that a causal connection between total U.S. business investment and economic growth disappears after accounting for slowing population growth, which is not something that industrial policy can fix.[122]

Figure 2

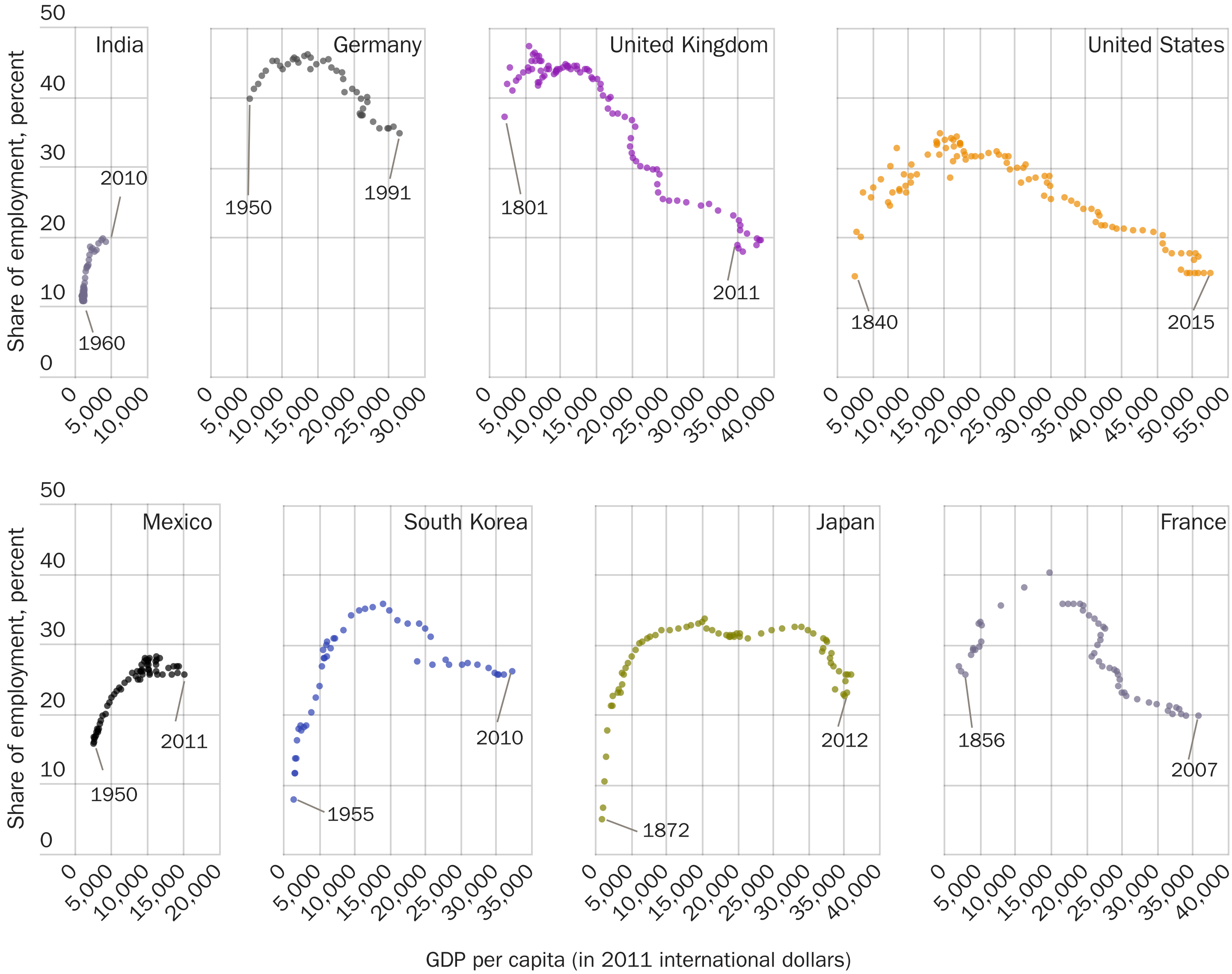
Manufacturing share of gross domestic product in selected advanced economies, 1972–2020



Source: United Nation, National Accounts-Analysis of Main Aggregates, https://unstats.un.org/unsd/snaama/Index.

Figure 3

Manufacturing share of total employment versus gross domestic product (GDP) per capita, selected countries, 1801–2016



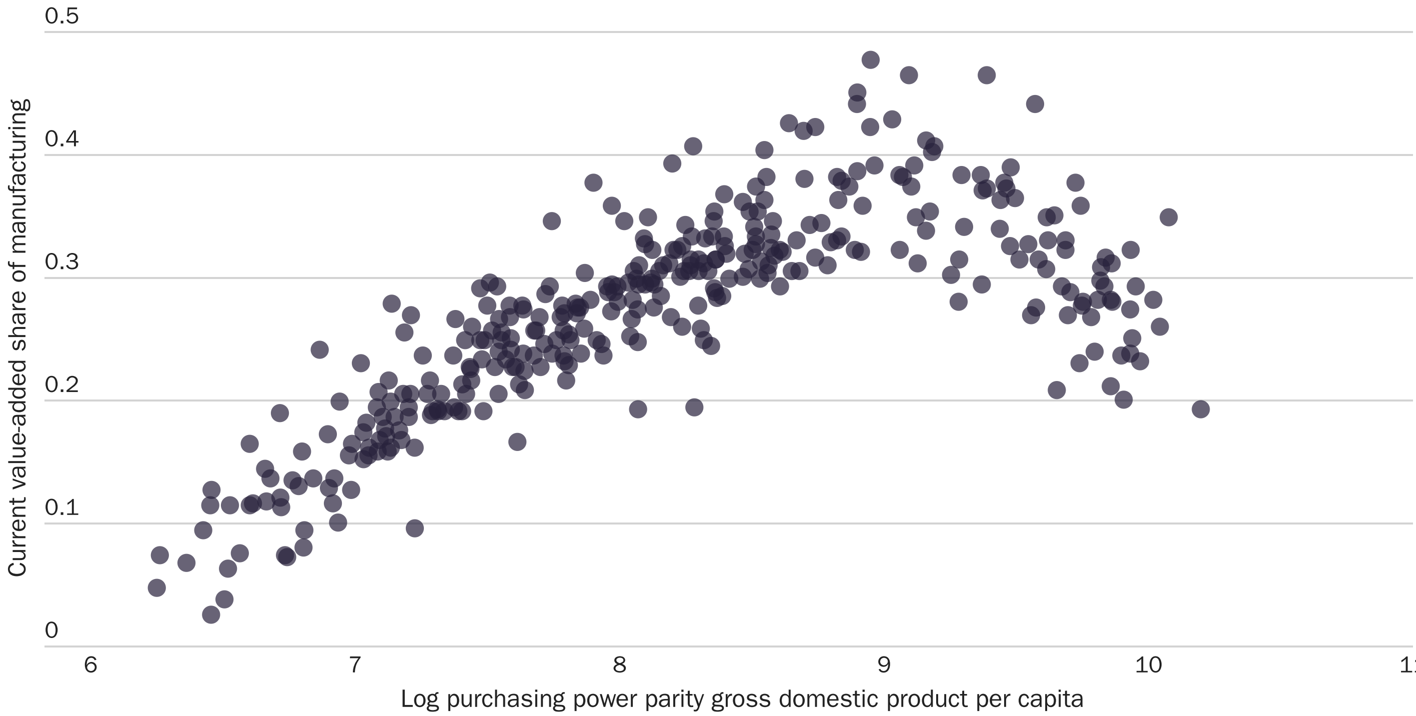
Source: "GDP per Head vs Share of Industry in Employment, 1801 to 2015," Our World in Data, https://ourworldindata.org/grapher/gdp-vs-manufacturing-employment?time=1801..2015.

These topline data underscore that any new American industrial policy would require targeting specific industries to change the sector's composition, *not* the horizontal tax or educational policies that some advocates claim to be industrial policy. And while some manufacturing industries have undoubtedly declined over the last several decades, these changes usually reflect fundamental shifts in U.S. and global markets that are driven by trade, technology, changing consumer habits, and other trends, as opposed to a weak manufacturing sector. The declines also have been offset by gains in other industries, particularly durable goods industries, such as transportation and aerospace, and high-value nondurable goods industries such as chemicals and energy (see Figure 12 and Table 3).

These and other U.S. manufacturing data reveal a flexible and dynamic sector that is generally responsive to free-market forces that are important for the health of the economy overall, not merely for the manufacturing sector. Furthermore, the offshoring or automating of low-wage, low-skill industries in the apparel, furniture, and other manufacturing industries, while undoubtedly difficult for the workers directly affected, is an important part of a healthy,

Figure 4

Manufacturing share versus per capita income (country panels)



Source: Francisco J. Buera and Joseph P. Kaboski, "Scale and the Origins of Structural Change," *Journal of Economic Theory* 147, no. 2 (March 2012): 684–712.

Table 1

Top manufacturing countries, 2018 (millions of dollars, unless otherwise noted)

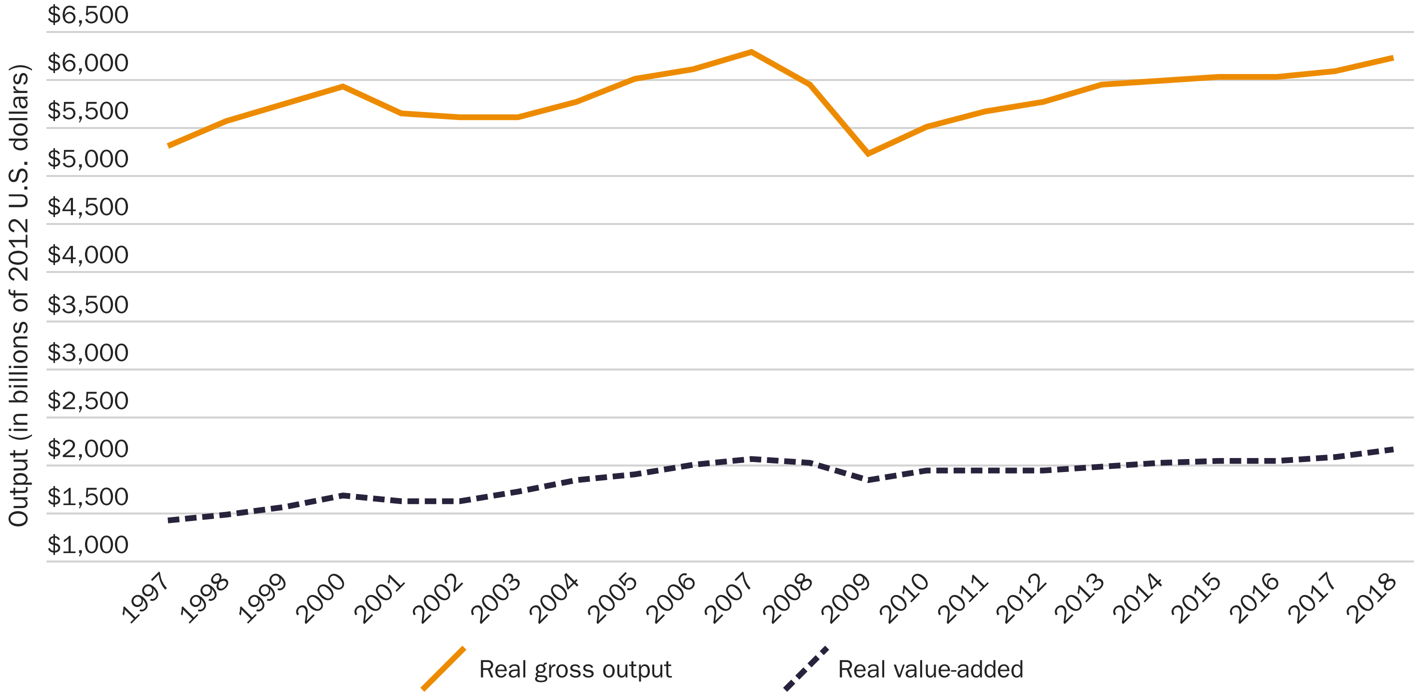
Country	Manufacturing value-added	Merchandise exports	Manufactures exports	FDI inflows (total)	FDI inflows (manufacturing)	Manufacturing value-added per worker (dollars)
China	$3,884,451	$2,486,695	$2,318,153	$138,305	n/a	$29,188
United States	$2,300,398	$1,663,982	$1,176,498	$253,561	$166,889	$177,127
Japan	$959,243	$738,143	$641,106	$9,858	$13,242	$92,448
Germany	$746,485	$1,560,539	$1,364,575	$73,570	$12,826*	$96,632
South Korea	$427,724	$604,860	$528,991	$12,183	$5,245	$94,841
India	$409,087	$324,778	$223,265	$42,156	n/a	$7,169
Italy	$289,160	$549,527	$452,134	$32,886	$8,481	$73,292
United Kingdom	$279,298	$486,439	$468,817	$65,299	$4,058*	$108,223
France	$260,321	$581,774	$462,086	$38,185	$20,128	$100,938
Mexico	$214,789	$450,685	$362,608	$34,745	$16,318	$29,931

Sources: United Nations Conference on Trade and Development; World Trade Organization; Conference Board; Organisation for Economic Co-operation and Development; and author's calculations.

Notes: FDI = foreign direct investment. Gross domestic product value-added figures were provided in 2015 dollars and have not been adjusted. All other figures are in 2018 dollars. Organisation for Economic Co-operation and Development data were not provided for "n/a" countries. Germany FDI inflows (manufacturing) are for 2017, and UK FDI (manufacturing) are for 2015 (the latest data available).

Figure 5

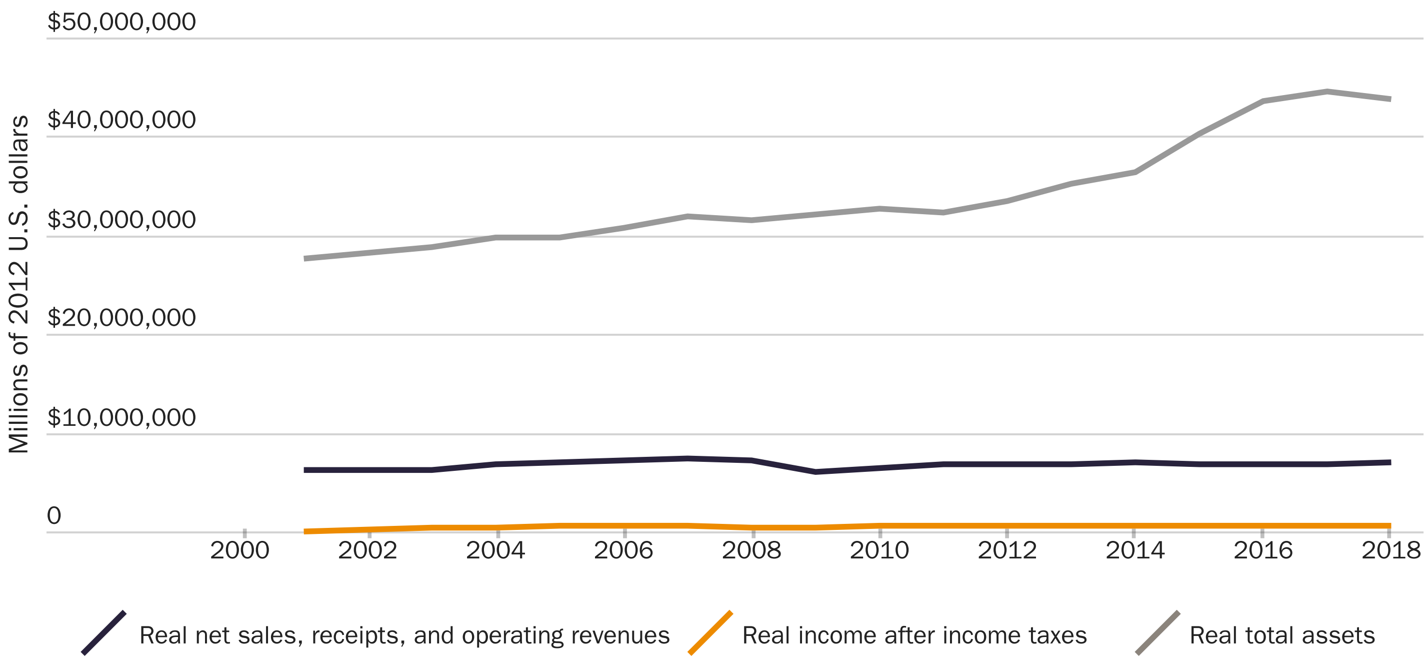
U.S. manufacturing output and value-added, 1997–2018



Source: "GDP-by-Industry," Bureau of Economic Analysis, December 10, 2020, https://apps.bea.gov/iTable/index_industry_gdpIndy.cfm.

Figure 6

U.S. manufacturing sector financial performance, 2001–2018

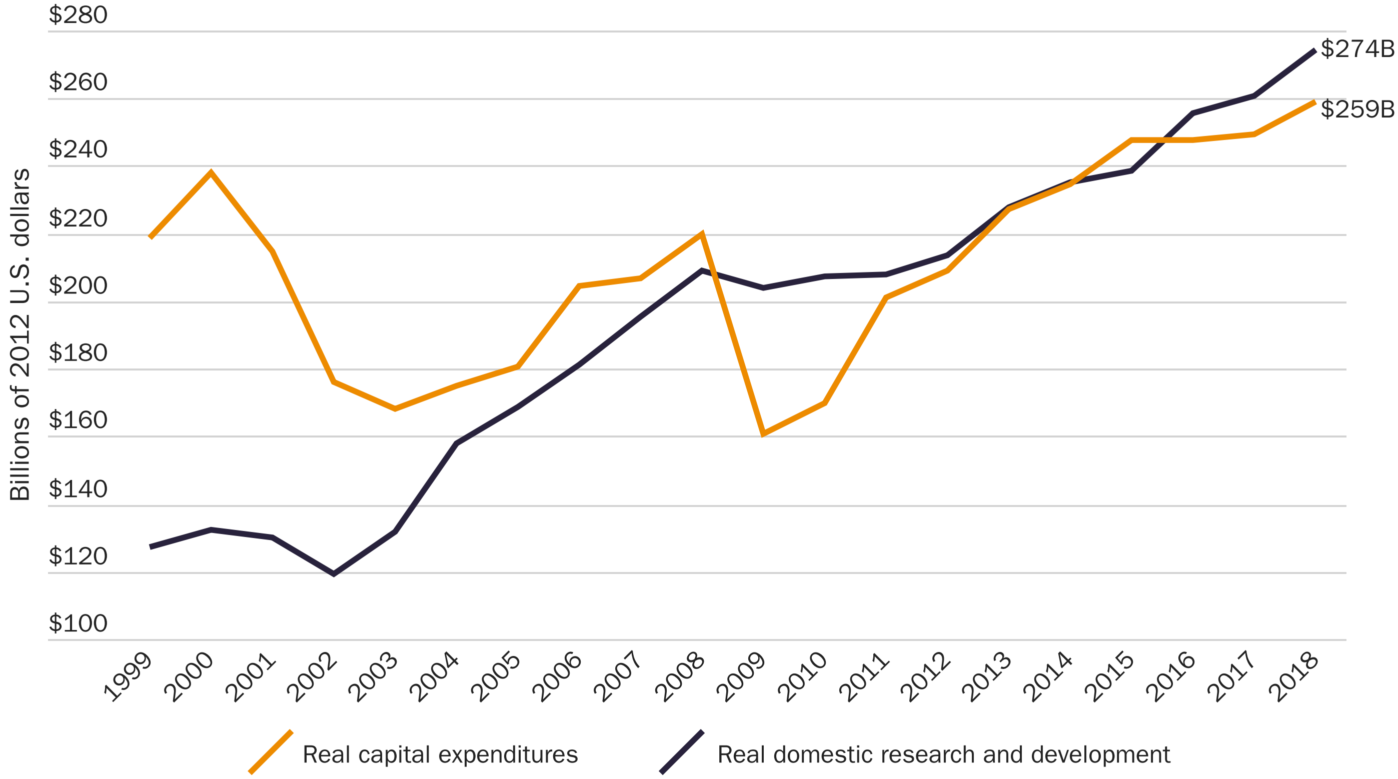


Source: "Quarterly Financial Report (QFR): Manufacturing, Mining, Trade, and Selected Service Industries," U.S. Census Bureau, https://www.census.gov/econ/qfr/.

Deflator: "Table 1.1.9. Implicit Price Deflators for Gross Domestic Product," National Income and Products Accounts, National Data, Bureau of Economic Analysis, https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=13#reqid=19&step=3&isuri=1&1921=survey&1903=13.

Figure 7

U.S. manufacturing investment, 1999–2018



Sources: "Research and Development: U.S. Trends and International Comparisons," Science and Engineering Indicators, National Science Board, https://ncses.nsf.gov/pubs/nsb20203/u-s-business-r-d; and "2019 Annual Capital Expenditures Survey Tables," U.S. Census Bureau, December 16, 2020, https://www.census.gov/data/tables/2019/econ/aces/2019-aces-summary.html.
Deflator: "Table 1.1.9. Implicit Price Deflators for Gross Domestic Product," National Income and Product Accounts, National Data, Bureau of Economic Analysis, https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=13#reqid=19&step=3&isuri=1&1921=survey&1903=13.

Table 2

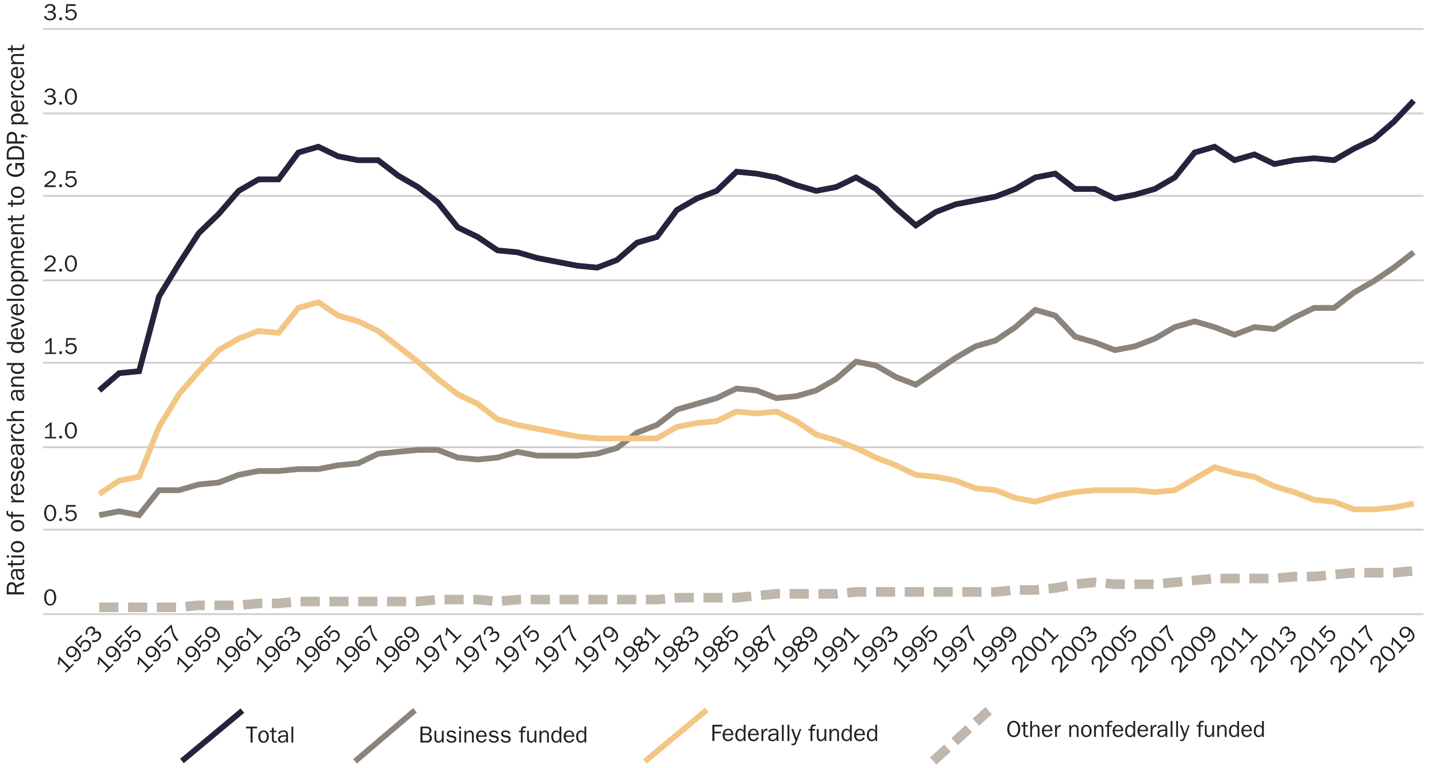
U.S. research and development expenditures by type of work, selected years (2000–2018) (constant 2012 dollar billions)

	All research and development	Basic research	Applied research	Experimental development
2000	343.2	53.8	72.4	217.0
2010	423.1	79.4	82.3	261.4
2011	434.4	74.9	83.5	276.0
2012	433.7	73.8	86.9	273.1
2013	446.4	77.7	86.7	282.0
2014	459.3	79.8	88.6	290.9
2015	472.6	80.5	93.0	299.1
2016	493.5	85.1	101.0	307.3
2017	515.5	86.7	103.0	325.6
2018	549.5	91.7	105.5	352.3
2019	584.4	96.1	111.2	377.1

Source: National Center for Science and Engineering Statistics, *National Patterns of R&D Resources: 2018–19 Data Update* (Alexandria: National Science Foundation, 2021).
Note: Data for 2019 are estimates and will later be revised.

Figure 8

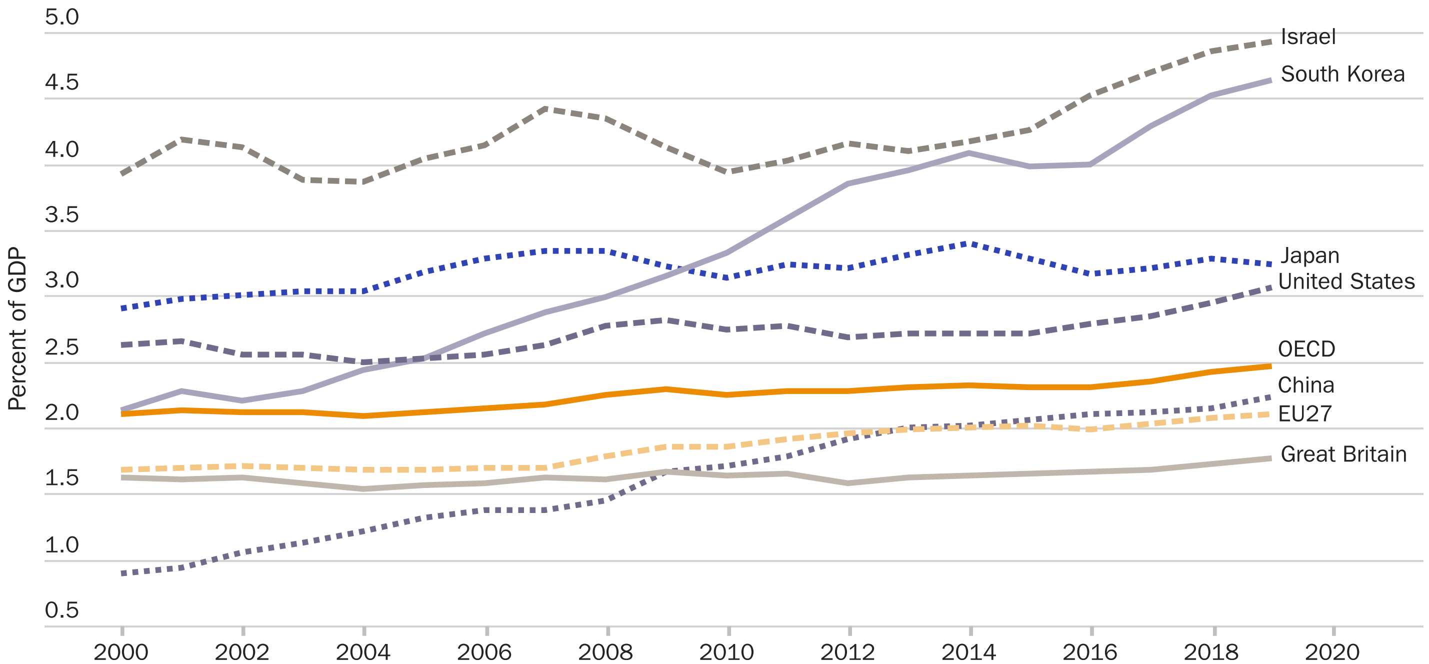
U.S. research and development expenditures as share of GDP, 1954–2018



Source: National Center for Science and Engineering Statistics, National Patterns of R&D Resources, NSF 21-324, https://ncses.nsf.gov/pubs/nsf21324.
Notes: Data for 2019 are estimates; some of these data may later be revised. The GDP data used reflect the Bureau of Economic Analysis's comprehensive revisions of the National Income and Product Accounts of August 2020.

Figure 9

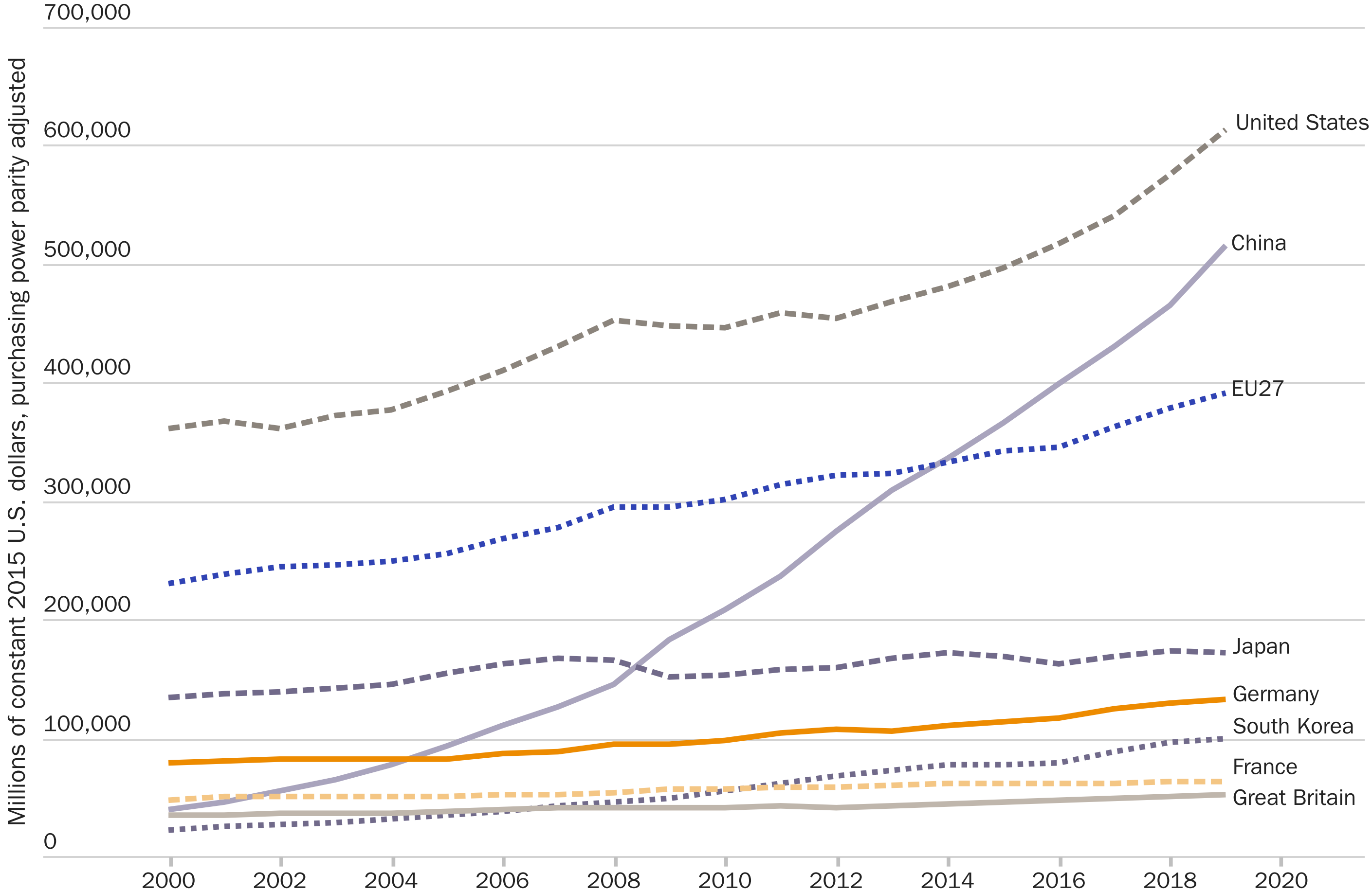
Research and development intensity: gross domestic expenditure on research and development as a percentage of GDP, 2000–2019



Source: “Main Science and Technology Indicators Database,” Organisation for Economic Co-operation and Development, https://www.oecd.org/sti/msti.htm.

Figure 10

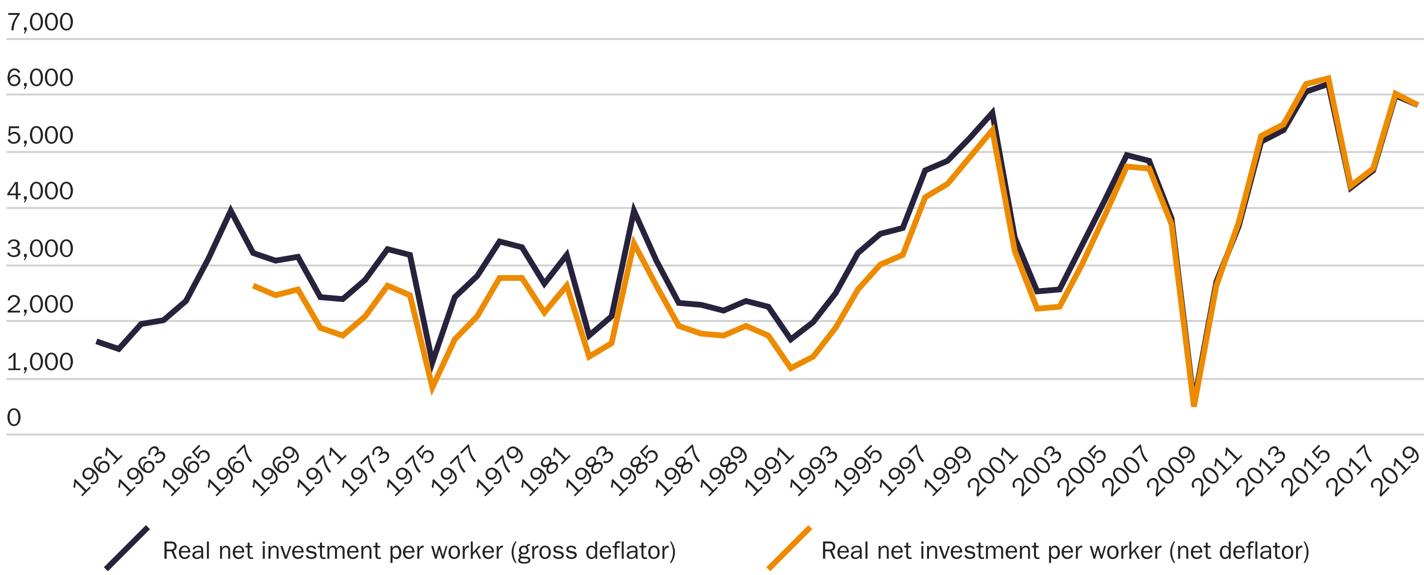
Gross domestic expenditure on research and development, 2000–2019



Source: "Main Science and Technology Indicators Database," Organisation for Economic Co-operation and Development, https://www.oecd.org/sti/msti.htm.

Figure 11

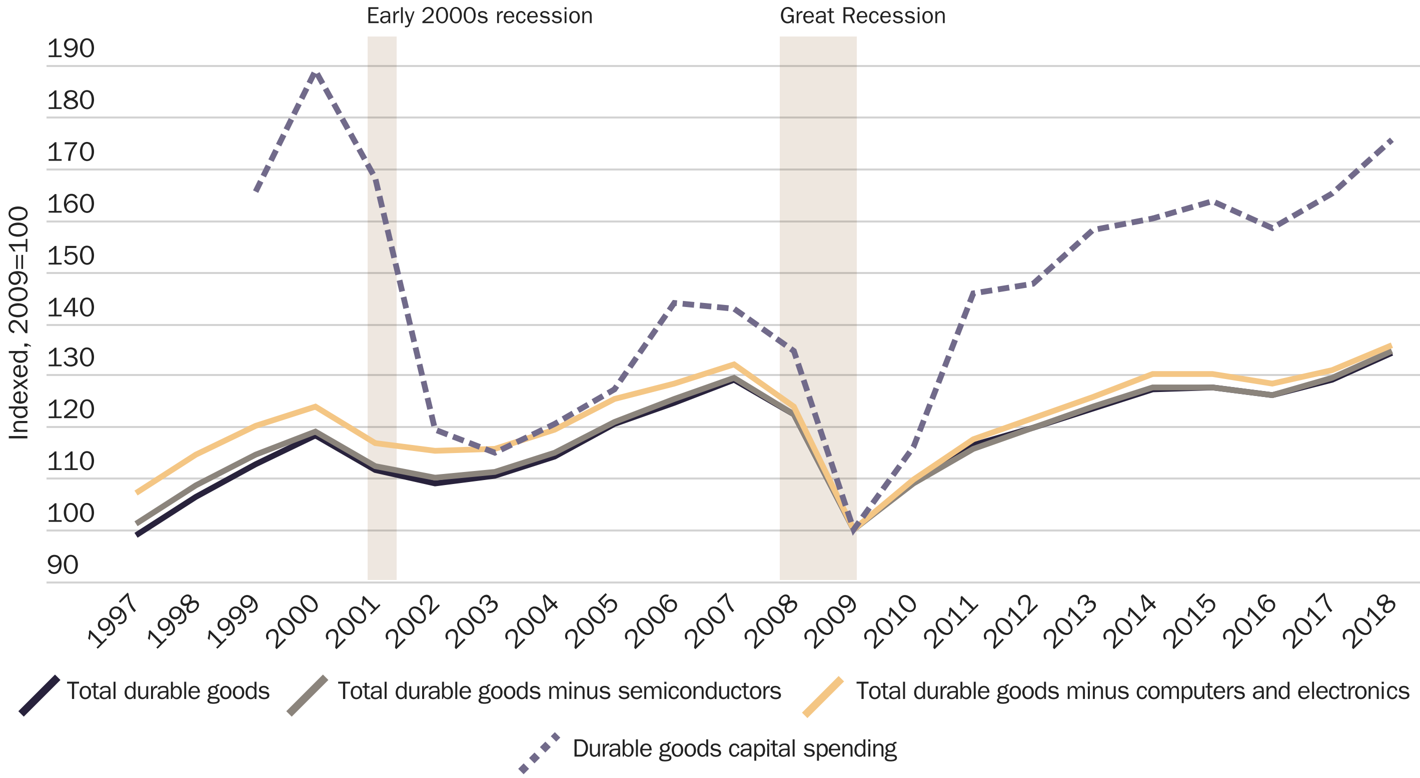
Real net investment in the U.S. nonfinancial corporate sector (2015 dollars), 1961–2019



Source: Donald Schneider, Cornerstone Macro, using Bureau of Economic Analysis data.

Figure 12

Real U.S. durable goods manufacturing output and investment change before and after 2009



Sources: "Gross Output by Industry," Bureau of Economic Analysis, September 30, 2020, https://www.bea.gov/data/industries/gross-output-by-industry#:~:text=What%20is%20Gross%20Output%20by,inputs%20not%20counted%20in%20GDP); and "Annual Capital Expenditures: 2017," U.S. Census Bureau, March 13, 2019, https://www.census.gov/library/publications/2019/econ/2017-aces-summary.html.
Deflator: "Table 1.1.9. Implicit Price Deflators for Gross Domestic Product," National Income and Product Accounts, National Data, Bureau of Economic Analysis, https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=13#reqid=19&step=3&isuri=1&1921=survey&1903=13.

Table 3

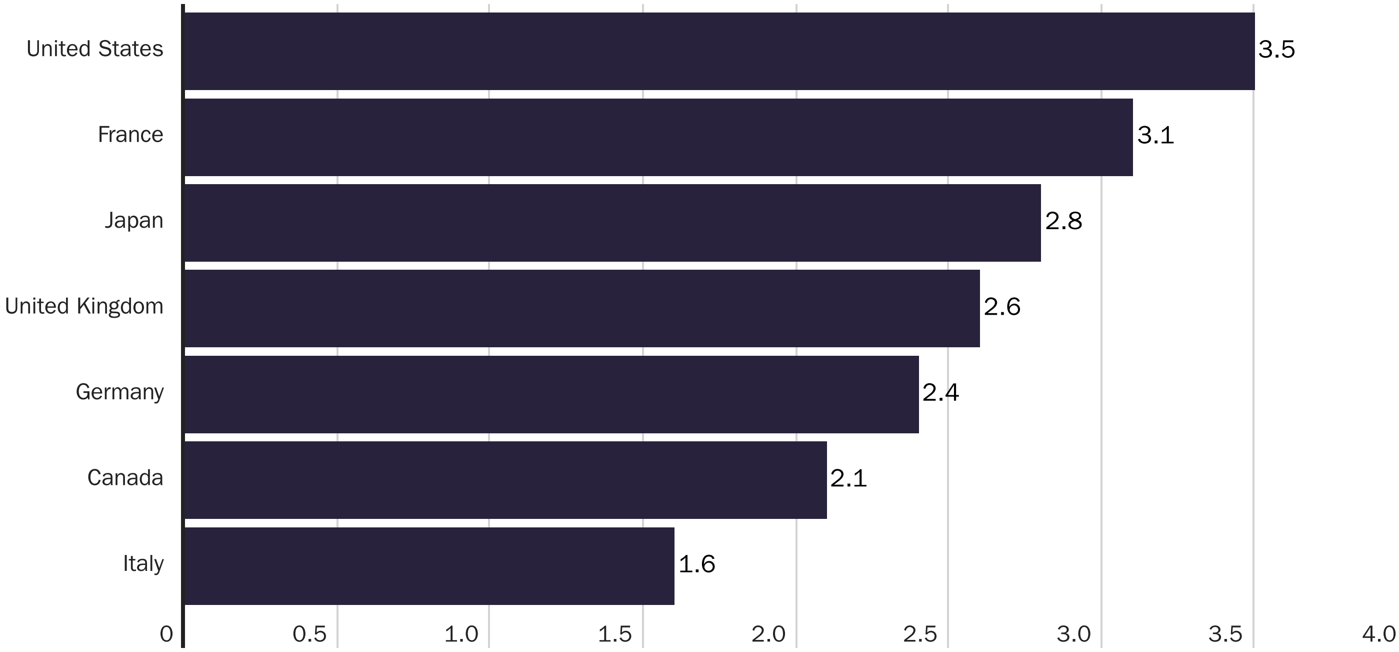
Change in U.S. nondurable goods manufacturing output, total and select industries

Industry	Percentage change in real value-added (1997–2018)	Percentage change in real gross output (1997–2018)
Total nondurable goods	0.2%	3.53%
Food and beverage and tobacco products	8.3%	12.5%
Food manufacturing	45.6%	27.9%
Beverage manufacturing	86.2%	22.2%
Tobacco product manufacturing	–72.7%	–70.1%
Textile mills and textile product mills	–38.9%	–51.5%
Apparel and leather and allied products	–65.4%	–81.6%
Paper products	–36.3%	–22.4%
Printing and related support activities	5.6%	–30.1%
Petroleum and coal products	13.0%	21.5%
Chemical products	14.2%	4.9%
Nondurable goods (excluding textiles, apparel, paper, printing, and tobacco)	22.9%	10.3%

Source: "GDP by Industry," Bureau of Economic Analysis, updated December 10, 2020, https://apps.bea.gov/iTable/index_industry_gdpIndy.cfm.

Figure 13

Real value-added per hour worked in manufacturing, annual percent change, 1990–2018



Source: The Conference Board International Labor Comparison program, January 2020.

dynamic economy and an essential part of economic development, moving resources from less- to more-productive domestic enterprises. This is true regardless of whether the enterprises are in manufacturing or other sectors.

MANUFACTURING JOBS

Manufacturing jobs cannot justify a new industrial policy push. It is highly questionable to assume that the significant decline in the number of factory jobs during the 1990s and 2000s could have been reversed via industrial policy because those same trends were happening in all industrialized nations, including those with robust industrial policies. American policy could, in theory, produce a one-time increase in overall manufacturing employment, but the long-term downward trend would continue. Furthermore, as shown in Table 1 and Figure 13, U.S. manufacturing workers continue to be among the most productive in the world, even accounting for a slowdown since the Great Recession.

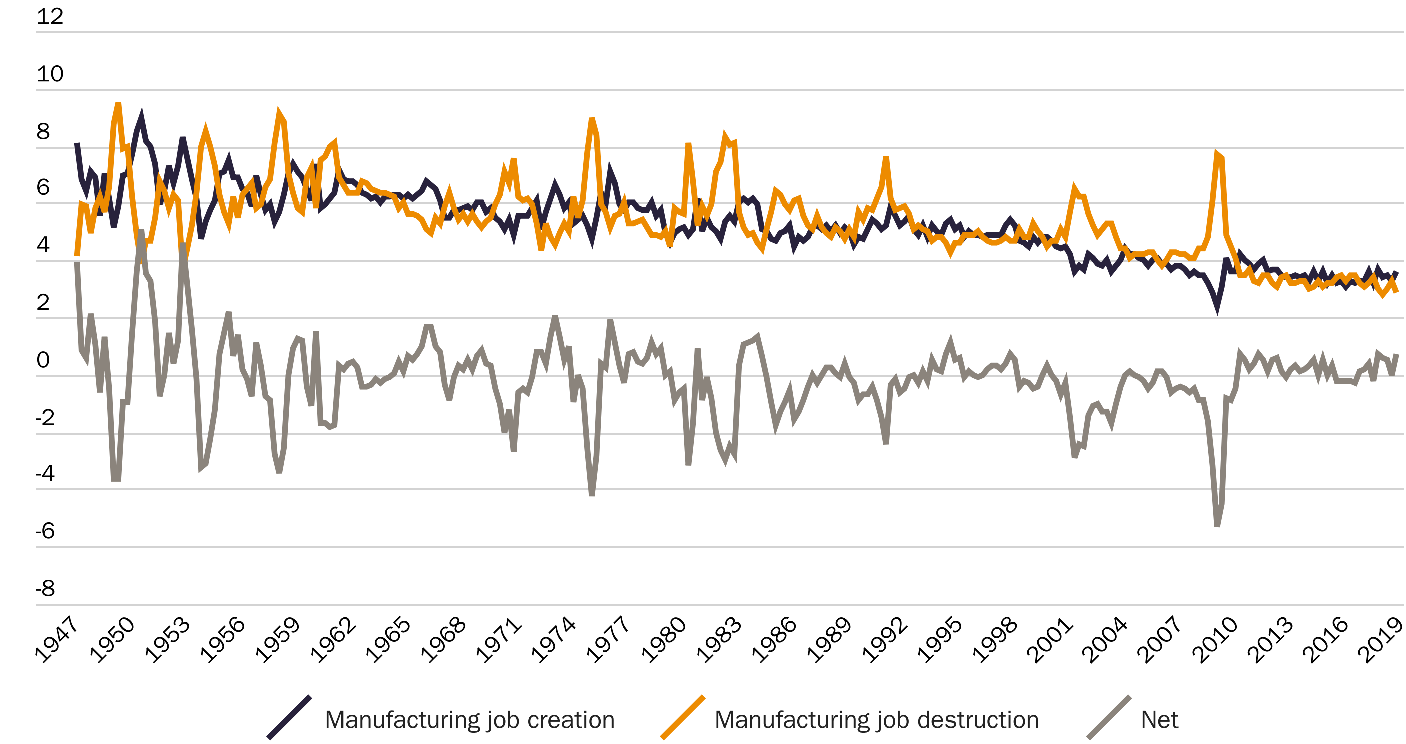
However, altering the composition of the 165-million-person American workforce to include an additional one or two million manufacturing jobs would not necessarily be better for the workforce or for the U.S. economy overall, because manufacturing jobs are not sufficiently special or economically beneficial as to warrant government industrial policy interventions, even assuming that such interventions would be successful.

As the Cato Institute's Ryan Bourne documented in 2019, manufacturing jobs are not significantly more stable or secure than jobs in other sectors, especially for low-skilled workers whose jobs have been disappearing for decades and who are most exposed to, and replaced by, automation and trade.[123] As shown in Figure 14, annual job creation in manufacturing has been low since the 1960s, and there was net job destruction from the 1960s through 2010.

Although the number of manufacturing jobs has increased since the Great Recession, the Bureau of Labor Statistics projects that the sector will resume its long-term trend of shedding manufacturing jobs (444,800 of them, to be exact) over the next decade due to international competition and productivity-enhancing technologies.[124] On the latter issue, for example, the number of man-hours required to produce a ton of steel in the United States dropped from 10 in 1980 to approximately 1.5 today. The *newest* steel plants, however, need even fewer workers—one Austrian mill needs only 14 employees to make 500,000 tons of steel wire per

Figure 14

Manufacturing job creation, job destruction, and net job creation rates in the United States



Sources: Ryan Bourne made these calculations using these sources: Steven J. Davis and John Haltiwanger, "Measuring Gross Worker and Job Flows," *Labor Statistics Measurement Issues* (Chicago: University of Chicago Press, 1998), pp. 77–122; and "National Private Sector Business Employment Dynamics Data by Major Industry Classification: Manufacturing," Bureau of Labor Statistics, https://www.bls.gov/bdm/bdmind.htm#MANUFACTURING.

year.[125] Because demand for steel is finite, steel industry employment will thus continue to decline while productivity continues to climb.

Indeed, American manufacturing jobs tend to be highly productive, but this benefit has a downside: it caps industrial employment. For example, U.S. manufacturing gained almost 1 million jobs between 2010 and 2018, outpacing job growth in China, Germany, and Japan in the process. However, over the same period, real manufacturing value-added per worker and per hour worked in the United States increased by only 0.3 percent per year and 0.1 percent per year, respectively, as compared to 5.6 percent and 5.7 percent per year between 2000 and 2008—a time of significant manufacturing *job loss* in the United States.[126]

In other words, American workers were improving their ability to produce manufactured goods at a much more rapid pace during the height of manufacturing job loss than during the subsequent period of reemployment. Thus, the goal of promoting high-productivity, high-innovation industries that need fewer higher-skilled workers conflicts with the goal of supporting numerous comfortable, stable, and secure jobs. An industrial policy that seeks to achieve the latter objective—for example by reshoring jobs in the textile, apparel, or consumer electronics industries—would inevitably sacrifice the former.

There is also little to indicate that boosting nominal manufacturing employment would solve the sagging labor force participation, even among less-educated male workers. For starters, the labor force participation rate hit 63.4 percent in January 2020, which was lower than its 2000 peak but was at approximately the same level as in June 1979, when U.S. manufacturing jobs were at an all-time high in nominal terms. The prime-age (25–54) employment to population ratio, by contrast, was far higher in January 2020 (80.5 percent) than it was in 1979 (around 74.5 percent).[127] Only male prime-age employment dropped from 1979 to January 2020, but a 2020 Bureau of Labor Statistics review of the increase in male prime-age nonworkers attributes the rise to issues other than deindustrialization, most notably health issues and past incarceration.[128]

Previous research by the American Enterprise Institute's Scott Winship, moreover, finds that most (56 percent) prime-age men who were inactive or not in the labor force in 2014 reported that they were disabled, while another third were retired, enrolled in school or training, or taking care of a family member.[129] Just 1 in 10 prime-age men not in the labor force fell outside of these categories, while about one-quarter of them said they wanted a job. Leaving aside what may be driving these trends, nothing here supports an *industrial policy solution*—whether it targets low-skill, labor-intensive jobs or higher-skill, grey-collar jobs that require advanced training. Indeed, even in late 2018, when both the U.S. labor market and manufacturing sector were booming, there were approximately 500,000 manufacturing job openings (a 3.9 percent opening rate)—the highest levels ever recorded, dating back to 2000.[130]

Thus, the connection between male prime-age employment and nominal manufacturing jobs may be weak today, and there is no reason to think that targeted policies to *boost manufacturing jobs,* as opposed to broad macroeconomic policies that produce a strong labor market generally, will increase male labor force participation.

Finally, wages and incomes, both in and out of manufacturing, do not justify new industrial policies. Contrary to the conventional wisdom, middle-class compensation has not been stagnant, nor has significant "wage polarization" (i.e., increasing numbers of high and low wage jobs) occurred over the last several decades.[131] Economist Michael Strain finds, for example, that median production and supervisory wages have increased by more than 30 percent since the early 1990s, and total personal compensation—wages, benefits (an increasing portion of pay), taxes, and transfers—is up 61 percent. Instead, stagnation occurred between the late 1970s and the early 1990s, long before the largest declines in manufacturing jobs and before the advent of modern globalization. Ironically, it was during this stagnation period that the United States last became enamored with industrial policy.

In general, most Americans are becoming financially better off over time, although they may be doing so through different jobs.[132] Among them are e-commerce warehouse jobs, which have increased substantially and are increasingly well-compensated. In fact, the average hourly pay for blue-collar and administrative jobs in the warehousing industry now exceeds the average pay for similar jobs in both manufacturing and the private sector overall (Table 4); it is now more lucrative to transport and deliver the proverbial "cheap T-shirt" than it is to make it (Figure 15).

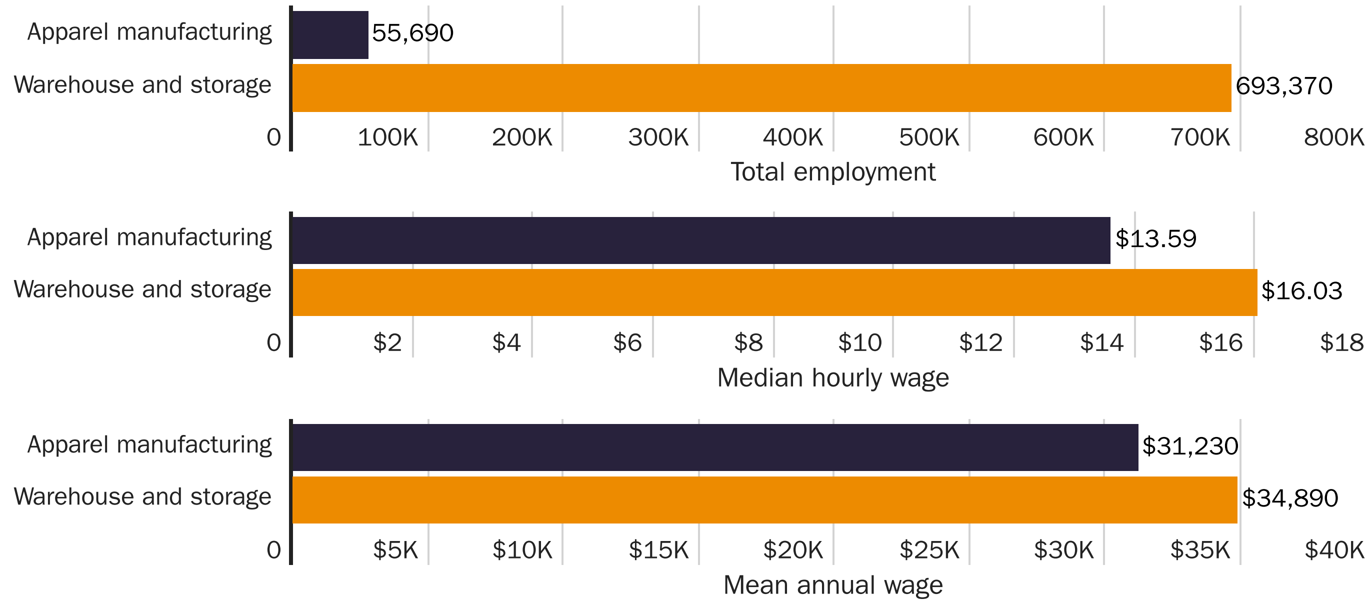
The growth of these and other well-paying services jobs underscores that the manufacturing wage premium today is small, if it exists at all. According to a December 2019 report by the Bureau of Labor Statistics, for example, by the end of 2018 "average hourly earnings of production and nonsupervisory workers in the total private sector had surpassed those of their counterparts in the relatively high-paying durable goods portion of manufacturing" (nondurables pay was even lower).[133] As shown in Table 5,

Table 4
2019 U.S. average hourly pay (dollars)

	Warehousing	Manufacturing	Private sector
All occupations	19.77	26.09	25.20
Management occupations	52.65	65.11	60.26
Business and financial operations	31.99	36.92	37.92
Computer and mathematical occupations	33.56	49.38	45.88
Office and administrative support	19.62	20.91	19.46
Installation, maintenance, and repair	24.82	25.98	23.95
Transportation and material moving occupations	17.96	17.58	18.01
Laborers and material movers	16.19	15.78	14.64
Packers and packagers, hand	15.01	13.94	13.30

Source: "Occupational Employment and Wage Statistics," Bureau of Labor Statistics.

Figure 15
Apparel manufacturing jobs versus warehousing jobs, 2020



Source: "Occupational Employment and Wage Statistics," Bureau of Labor Statistics, https://www.bls.gov/oes/.
Note: Apparel jobs are in "production occupations" (51-000), https://www.bls.gov/oes/current/oes_nat.htm#51-0000; warehousing jobs are in "laborers and material movers" (code 53-7060), https://www.bls.gov/oes/current/oes_nat.htm#53-0000.

many blue-collar services jobs in the United States not only have grown faster than manufacturing jobs since 1990, but also pay higher hourly wages and have faster wage growth. The number of these jobs is also expected to increase in the future.

The Bureau of Labor Statistics reports that manufacturing workers continue to have higher weekly earnings, but only because they work more hours per week to compensate for the relatively low hourly pay. The report adds that manufacturing employment declined across virtually all industries since 1990, and that manufacturing hours are more volatile from month to month.

In the face of these realities, manufacturers routinely report having difficulty attracting workers, even when offering higher wages, which is consistent with the data on labor force participation and job openings. Prior to the COVID-19 pandemic, for example, finding workers was consistently the biggest problem that manufacturing employers reported to the Federal Reserve's *Beige Book* survey, and the Department of Defense explained in its 2019 *Industrial Capabilities* report that one of the defense industrial base's biggest needs was "increasing the prestige of manufacturing as a profession in order to inspire more prospective workers to choose it as a career."[134] Meanwhile, *Bloomberg* reported in 2019 that furniture manufacturers in trade-impacted Hickory, North Carolina, which had an unemployment rate of 4.3 percent, could not find local workers willing to do physically demanding work that sometimes entailed risk, even by offering $2,000 hiring bonuses and paying $35 an hour wages.[135] The *Wall Street Journal* found a similar dynamic nationwide in January 2021: despite a red-hot sector and increasing wages, manufacturers reported difficulties in finding qualified workers, which was due in part to competition from warehousing jobs, and had resorted to waiving drug-use restrictions and tapping local jails' work-release programs.[136]

Finally, it is essential to note that the United States has been trying to increase manufacturing jobs for decades with little avail. As a 2013 Congressional Research Service report concluded about the state of American manufacturing, "Although Congress has established a wide variety of tax preferences, direct subsidies, import restraints, and other federal programs with the goal of retaining or recapturing manufacturing jobs, only a small proportion of US workers is now employed in factories."[137]

This again indicates that, even if manufacturing jobs deserve to be saved, a U.S. industrial policy would be unable to

Table 5

Employment and average hourly earnings of production and nonsupervisory workers in selected industries, 1990 versus 2018

	1990		2018		Annualized percent change, 1990–2018	
Industry	Employment	Average hourly earnings	Employment	Average hourly earnings	Employment	Average hourly earnings
Total private	73,721,000	$10.20	104,319,000	$22.71	1.2%	2.9%
Manufacturing	**12,669,000**	**$10.78**	**8,899,000**	**$21.54**	**–1.3%**	**2.5%**
Durable goods	7,397,000	$11.40	5,463,000	$22.51	–1.1%	2.5%
Wood products	451,500	$8.82	319,000	$17.88	–1.2%	2.6%
Nonmetallic mineral products	413,200	$11.11	309,900	$21.41	–1.0%	2.4%
Primary metals	525,100	$12.97	293,600	$23.31	–2.1%	2.1%
Fabricated metal products	1,190,100	$10.64	1,084,900	$20.55	–0.3%	2.4%
Machinery	938,900	$11.73	718,200	$23.06	–1.0%	2.4%
Computer and electronic parts	980,200	$10.89	613,100	$25.09	–1.7%	3.0%
Electrical equipment and appliances	465,200	$10.00	260,500	$20.59	–2.0%	2.6%
Transportation equipment	1,473,400	$14.44	1,188,300	$26.32	–0.8%	2.2%
Motor vehicles and parts	869,500	$15.00	778,700	$22.77	–0.4%	1.5%
Furniture and related products	475,200	$8.53	291,500	$17.86	–1.7%	2.7%
Miscellaneous durable goods	484,200	$8.87	384,100	$19.14	–0.8%	2.8%
Nondurable goods	5,272,000	$9.87	3,436,000	$19.96	–1.5%	2.5%
Food manufacturing	1,165,000	$9.04	1,271,500	$17.49	0.3%	2.4%
Textile mills	417,900	$8.17	87,700	$16.46	–5.4%	2.5%
Textile product mills	194,900	$7.37	85,600	$15.31	–2.9%	2.6%
Apparel	805,200	$6.22	80,900	$15.32	–7.9%	3.3%
Paper and paper products	493,200	$12.06	276,100	$21.88	–2.1%	2.2%
Printing and related support activities	597,600	$11.11	294,900	$18.74	–2.5%	1.9%
Petroleum and coal products	97,500	$17.00	77,400	$40.32	–0.8%	3.1%
Chemicals	620,300	$12.85	547,700	$25.46	–0.4%	2.5%
Plastics and rubber products	646,700	$9.76	548,100	$18.49	–0.6%	2.3%
Miscellaneous nondurable goods	233,800	$10.28	165,700	$20.11	–1.2%	2.4%
Mining and logging	**538,000**	**$13.40**	**544,000**	**$28.30**	**0.0%**	**2.7%**
Construction	**4,115,000**	**$13.42**	**5,438,000**	**$27.74**	**1.0%**	**2.6%**
Wholesale trade	**4,167,500**	**$11.55**	**4,698,000**	**$25.18**	**0.4%**	**2.8%**

Table 5 (continued)

	1990		2018		Annualized percent change, 1990–2018	
Industry	Employment	Average hourly earnings	Employment	Average hourly earnings	Employment	Average hourly earnings
Retail trade	**11,311,000**	**$7.71**	**13,529,200**	**$15.91**	**0.6%**	**2.6%**
Transportation and warehousing	**2,943,200**	**$12.5**	**4,721,000**	**$21.84**	**1.7%**	**2.0%**
Utilities	**584,900**	**$16.14**	**444,700**	**$36.77**	**–1.0%**	**3.0%**
Information	**1,866,000**	**$13.4**	**2,278,000**	**$31.93**	**0.7%**	**3.1%**
Financial activities	**4,973,000**	**$9.98**	**6,637,000**	**$26.94**	**1.0%**	**3.6%**
Credit intermediation and related services	1,808,100	$9.06	2,015,000	$23.72	0.4%	3.5%
Real estate	849,100	$8.71	1,255,800	$21.69	1.4%	3.3%
Rental and leasing	415,000	$8.49	458,400	$20.45	0.4%	3.2%
Professional and business services	**8,915,000**	**$11.15**	**17,123,000**	**$26.81**	**2.4%**	**3.2%**
Professional and technical services	3,499,800	$14.00	7,255,900	$35.41	2.6%	3.4%
Management of companies and enterprises	1,279,900	$11.11	1,540,200	$28.86	0.7%	3.5%
Administrative and waste services	4,135,100	$8.48	8,326,700	$18.32	2.5%	2.8%
Education and health services	**9,784,000**	**$9.98**	**20,788,000**	**$23.65**	**2.7%**	**3.1%**
Health care	7,344,400	$10.42	14,121,200	$25.92	2.4%	3.3%
Social assistance	966,900	$6.99	3,478,400	$14.84	4.7%	2.7%
Leisure and hospitality	**8,299,000**	**$6.02**	**14,382,000**	**$13.87**	**2.0%**	**3.0%**
Other services	**3,555,000**	**$9.08**	**4,839,000**	**$20.78**	**1.1%**	**3.0%**

Source: Bureau of Labor Statistics.
Note: Numbers are not seasonally adjusted.

achieve that objective. Perhaps for these reasons, even some industrial policy advocates have stopped citing manufacturing jobs as a core industrial policy objective.[138]

LIVING STANDARDS

American living standards also cannot justify industrial policies. In terms of basic necessities such as food, clothing, and home goods, Americans today are absurdly rich as compared to only a few decades ago. According a 2016 report from Southern Methodist University, the share of American households with access to telephones or cell phones, electricity, air conditioning, home appliances, TVs, computers, and other common household goods is at or approaching 100 percent.[139] Research from economist Bruce Sacerdote finds the consumption gains for below-median income families to be particularly impressive: low-income consumption (adjusted for inflation) increased between 62 percent and 164 percent between 1960 and 2015, not fully accounting for improvements in quality (which for some items, such as cars and homes, have also been substantial).[140] Accounting for these consumption improvements also dramatically narrows inequality, especially for single parents.[141]

The improving quality of life for low- and middle-income Americans has not been fueled by new debt, but instead by a combination of higher incomes and lower prices. According to the Cato Institute's Marian Tupy, for example, the average amount of time that unskilled American workers had to work to earn enough money to buy a long list of everyday items has declined by 72 percent since the late 1970s, when manufacturing jobs were at their zenith.[142] That means that, for the same amount of work that allowed unskilled workers to purchase one item in 1979, they could buy 3.56 items in 2019, on average. Tupy has found similarly impressive gains for food consumption, helping to explain why food insecurity reached an all-time low before the COVID-19 pandemic hit.[143] The United States' poverty rate also hit a record low in 2019, and one recent study found that only 2 percent of Americans were living in poverty (as it was defined in 1963, when it was almost 20 percent).[144]

Of course, some consumption challenges remain, particularly in health care, higher education, and housing. However, each of these sectors is already highly subsidized, protected, and regulated, and new industrial policies targeting them, especially trendy "worker-centric" approaches, could just as easily raise prices and discourage innovation rather than the opposite. Market-oriented improvements to tax, trade, immigration, and regulatory policy are far more likely to improve these sectors—and thus raise American living standards—than any new industrial policies targeting them.

COMMUNITIES

Finally, industrial policy will not solve the problems of struggling communities in the United States. To begin with, most American localities that once centered on low-skill manufacturing have since transitioned to other industries and are doing well today. A 2018 Brookings Institution report, for example, found that 115 of the 185 counties with a disproportionate share of manufacturing jobs in 1970 had successfully transitioned away from manufacturing by 2016.[145] Forty of the remaining 70 older industrial cities, moreover, exhibited strong or emerging (average) economic performance. Overall, only 30 of the original 185 manufacturing communities were still struggling. Anecdotal evidence reiterates these findings: towns such as Greenville-Spartanburg, South Carolina, or Pittsburgh, Pennsylvania, which once depended on low-skill manufacturing, have since adapted and are now home to thriving companies and modern workforces. The contrast between these localities and those still reeling from decades-old economic shocks indicates that the latter's problem is not a lack of federal industrial policy, but instead one of local policies and these specific communities' inability to adjust to global economic forces *and* competition from other states.

> "The improving quality of life for low- and middle-income Americans has not been fueled by new debt, but instead by a combination of higher incomes and lower prices."

Additionally, as the Peterson Institute's Adam Posen recently explained, "there are precious few examples of a government successfully reviving a community suffering from industrial decline."[146] He cites failed U.S. efforts to revive the Massachusetts textile towns of Lawrence and Lowell, and similar futile efforts in the Midwest. Then there are the continued struggles of former steel town Youngstown, Ohio: "A succession of presidents has promised—and failed—to turn around Youngstown, which, despite all the political attention and federal dollars lavished upon it, doesn't have a supermarket in the residential neighborhoods closest to downtown."[147]

Posen details similar failures to revive struggling communities or regions in Germany, Italy, Japan, the United Kingdom, and even China— a nation that has pursued unprecedented levels of industrial subsidization and government intervention and that runs perpetual manufacturing trade surpluses.[148]

Thus, leaving aside whether national economic policy should relieve states and towns of their responsibilities to create viable commercial centers, little evidence indicates that it can.

Do Other Countries' Industrial Policies Demand a U.S. Industrial Policy?

Finally, the industrial policy experiences of other countries, particularly China, cannot justify similar policies in the United States. Significant political and economic differences limit the extent to which these experiences can inform U.S. industrial policy efforts. Regardless, other countries' industrial policy successes have been exaggerated, while numerous failures have been ignored. This includes China, which has commonly been cited to justify new U.S. industrial policy, yet has a spotty industrial policy record and faces numerous economic challenges in the years ahead—some caused by its own industrial policy efforts.

THE PERILS OF CROSS-COUNTRY COMPARISON

In general, real or perceived industrial policy successes in other countries cannot inform whether similar results are possible in the United States or whether the federal government should adopt industrial policy as broadly defined. For example, reviews of the economics literature conclude that the empirical studies of industrial policy are limited and, of the few that have been published, they primarily assess specific cases, industries, and policy episodes. These papers cannot, therefore, predict whether the analyzed cases would translate to the United States. As José Luis Ricón explained, "If there is one conclusion from the recent empirics of [industrial policy] it's that it's pretty much dependent on which industry, which country, in which period of development it is applied."[149]

This challenge is particularly significant for proposed U.S. industrial policies, given our political system and the special obstacles that industrial policies face here. As economist Nathan Lane explained in 2020 after reviewing the academic literature, "Without a doubt, future research must do more to understand the interaction between political economy and industrial policy. Because industrial policy is state policy, its success, scope, and efficacy is sensitive to institutional context."[150] He adds that, thus far, few empirical papers have examined how politics affects industrial policy, leaving it an open question.[151]

The American political system is particularly susceptible to public choice problems due to the short duration of many elected federal positions and our well-developed lobbying and special-interest group system. One would also need to consider the specific laws and regulations, such as Buy American restrictions and NEPA, and the sheer size and diversity of the U.S. economy (as opposed to, say, Israel)—both of which would further diminish assertions that industrial policy can work in the United States simply because specific programs worked in other countries.

> "In general, real or perceived industrial policy successes in other countries cannot inform whether similar results are possible in the United States or whether the federal government should adopt industrial policy as broadly defined."

Industrial policy successes abroad are routinely exaggerated. Numerous analyses, for example, have punctured the myth that Japanese industrial policy was primarily responsible for the country's impressive growth and productivity during the 1970s and 1980s.[152] As the *Wall Street Journal* reported in 2002, Japan's Ministry of Finance admitted that the Ministry of International Trade and Industry's interventionist and protectionist policies had "eroded the competitiveness of the industries the government had sought to support."[153] Economist Saul Lach's 2003 assessment of much-heralded R&D subsidies for Israeli manufacturers found that such funds did benefit small firms, but it had negative effects on large firms, and, because most subsidies went to the large firms, they generated statistically insignificant improvements in company-financed R&D.[154]

In his 2019 book, *Free Trade and Prosperity*, New York University's Arvind Panagariya shows that the supposed industrial policy success stories of South Korea and Taiwan, both of which experienced rapid, manufacturing-led economic growth in the mid to late 20th century, are less accurate than alleged.

> "Industrial policy successes abroad, such as in Japan, Korea, and Taiwan, are routinely exaggerated and must be balanced against other countries' numerous failures."

Taiwan's growth should be attributed to a general shift in trade policy away from import substitution toward trade and investment liberalization, particularly for industrial inputs, and to various domestic policies and outcomes, such as political stability, labor market flexibility, macroeconomic stability, infrastructure expansion, and secondary education.[155] Government intervention, moreover, did not cause economic outcomes to differ from that of a neutral policy regime. Instead, sectors that had the best export performance were labor intensive ones not subject to government targeting via industrial policy, and the public sector's share of manufacturing output declined significantly over the growth period examined.[156]

The South Korean government intervened heavily in its economy, promoted exports, and maintained import restrictions from the 1950s through the 1970s. However, when considering the economy as a whole, South Korea's policy regime was only slightly biased toward exports when compared to a hypothetical free trade alternative.[157] In other words, the overall industrial policy effects were modest. Moreover, the exported goods that grew rapidly during the 1960s—plywood, woven cotton fabrics, clothing, footwear, and wigs—were labor intensive and not subject to state targeting.[158] The South Korean government also implemented domestic policies similar to those in Taiwan, and pushed industrial targeting in a limited number of sectors. The government pursued greater targeting of the heavy and chemical industries between 1974 and 1982, but the supported industries performed poorly during this period, with relatively low total factor productivity as compared to unsupported industries. The nation's overall GDP growth rate was significantly below that achieved during the previous, less-interventionist period. Economic growth returned to this level and heavy and chemical industries' performance improved only after the government ended specific support for those industries in 1983 through 1995, ceased promoting strategic industries more broadly, and liberalized both import restrictions and the country's financial sector.[159]

In both cases, Panagariya's evidence leaves those crediting industrial policy with Taiwan and South Korea's growth to argue not that government interventions boosted growth above that which a more liberalized regime would have produced, but instead that such benefits cannot be dismissed as implausible.[160] Such a standard is hardly a ringing endorsement of industrial policy, but even it is too kind, given that—as Panagariya also shows—the less-interventionist Singapore, Hong Kong, and Taiwan grew faster than the more interventionist South Korea.[161] Indeed, a 1991 analysis from economists Jaime de Melo and David Roland-Holst finds that South Korea's industrial policies in the 1970s erected barriers to entry and allowed incumbent firms to exploit their policy-induced market power, and that additional liberalization would have increased national welfare by as much as 10 percent of GDP.[162]

Finally, industrial policy successes must be balanced against the numerous failures of such policies in countries around the world. This includes not only the U.S. policies noted in this paper, but also well-known debacles abroad, such as British automotive, aviation, and computer efforts in the 1960s and 1970s; French "national champions" in computers and machine tools during the same period; numerous European technology projects in the 1990s and 2000s; Argentina's national smartphone initiative (and several other consumer electronics failures); Tunisia's "Ben Ali" firms (named after the country's leader, who owned most of the favored firms); India's Planning Commission and License Raj between the 1950s and early 1990s; and numerous iterations of Brazilian automotive policy.[163] Other, lesser-known industrial policy failures are also plentiful.[164]

THE CHINA THREAT

American industrial policy advocates, including high-level officials in the Biden administration, routinely cite China's growing economic and geopolitical power—both supposedly fueled by Chinese government industrial policy—as necessitating urgent federal government action.[165] China's recent and troubling embrace of illiberalism and expansionism, as well as the COVID-19 challenges to U.S. and global supply chains, have amplified these views and lead to a bipartisan push for American industrial policy in order to counter the China threat.

> "While China's deepening authoritarianism surely warrants criticism and attention, the view that Chinese industrial policy is an urgent threat to the United States—one justifying a broad rejection of free markets and strong embrace of American industrial policy—is misguided."

However, while China's deepening authoritarianism surely warrants criticism and attention, the view that Chinese industrial policy is an urgent threat to the United States—one justifying a broad rejection of free markets and strong embrace of American industrial policy—is misguided. Similar to that of its Asian neighbors, China's rapid growth since the 1980s can be largely attributed to market-based domestic reforms following decades of self-imposed poverty, and its general liberalization of trade and investment policy, including its accession to the WTO—*not* industrial policy. Despite this "catch-up growth," moreover, China still lags behind the United States in both GDP per capita and in many important industries. Chinese industrial policy may have helped some other industries, perhaps even overtaking Western competitors in the process, but the cost of doing so was enormous, and those policies have introduced systemic challenges that could hamper future growth. China also faces several other headwinds, financially and demographically, that could derail its ascension to the top of the global economic order.

Combined, these facts rebut the all-too-common perception in the United States of China as an unstoppable economic juggernaut that—fueled by industrial policy—will inevitably overtake the United States unless we adopt similar policies here. American industrial policy should be considered on its own merits, not on the basis of an overwrought fear of the China threat.

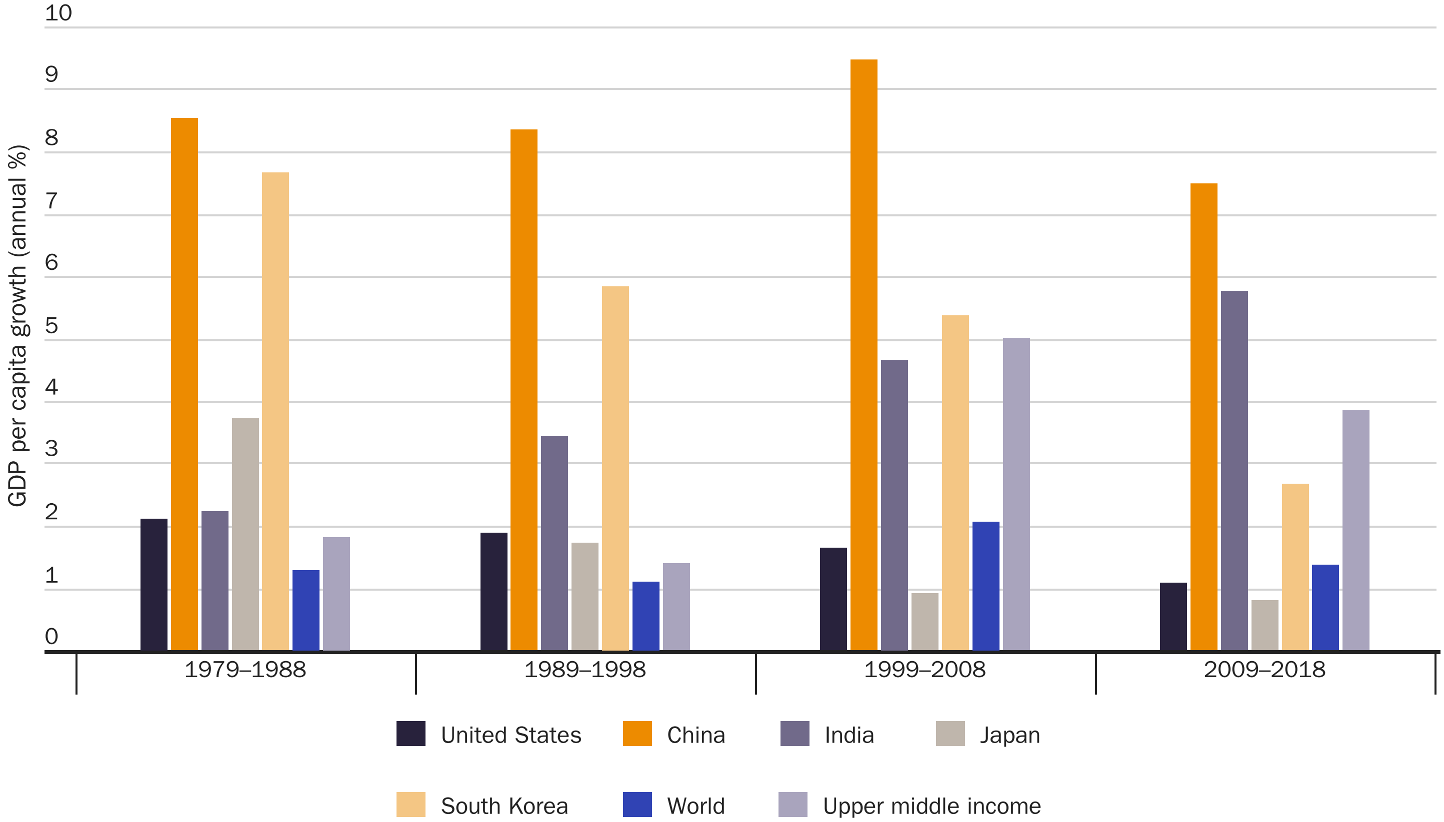
China's Rise and Subsequent Embrace of Industrial Policy

China's economic rise is undeniable. Growth in GDP per capita over the past four decades has been relatively steady, with a slight decline over the past decade (see Figure 16), at rates easily surpassing the United States and other countries. Furthermore, China's share of global trade grew from 3 percent in 1995 to 12 percent in 2018, and China is now the world's largest manufacturing nation, with growing high-tech and internet industries. Over the same period, China became the world's second largest economy and the largest trading partner of many economies, including the European Union.[166]

Little of China's impressive historic growth, however, can be attributed the nation's industrial policies. Instead, China's economic outperformance began during its period of reform and opening up in 1978 (starting from a very low, communism-induced baseline), followed by its integration into the multilateral trading system—that is, the World Trade Organization—in 2001 and the requisite structural and economic changes that accession required. For example, a 2012 study by the University of Toronto's Xiaodong Zhu concluded that China's growth was driven not by capital investment but by productivity growth, which can

Figure 16

Growth in gross domestic product per capita, select countries and periods



Source: The World Bank, https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

be attributed to "gradual and persistent institutional change and policy reforms that have reduced distortions and improved economic incentives."[167] Numerous other economists have found that most of China's export competitiveness stems from internal, market-based reforms—on property rights, privatization, price controls, trading rights, and import liberalization, for example—that are often initiated in response to new WTO commitments.[168]

Along the same lines, Barry Naughton, an economist specializing in China, and author of *The Rise of China's Industrial Policy*, explains that China's impressive pre-2010 economic growth did not result from the type of top-down industrial planning and state intervention that has become prevalent in China today. He notes that

> there is a huge disconnect between the success that we attribute to the Chinese economy today and the orientation of Chinese policy today. China's emergence as an economic and technological super-power is due primarily to the policy package that it followed from 1978 through the first decade of the 21st century, that is, until about 2006–7. China's policy package today—that is, the policies that started tentatively after 2005 but were fully in place by 2008–2010—are radically different. Because of this, it is a mistake to attribute China's success to the policies China is currently following.[169]

By contrast, Naughton agrees with many other economists that the driving force of Chinese industrial development was market-oriented reforms, with the government primarily relying on market forces and minimizing direct interventions; economic success was particularly tied to China's WTO entry.[170] "How much of that success could be attributed to industrial policy and planning?" Naughton asks. "The answer is simple: none."[171]

As Naughton notes, the Chinese industrial policies that American critics are targeting today only began in 2006, when Beijing adopted plans focusing on innovation and seeking to match the industrial capabilities of advanced economies. The 2008 global financial crisis amplified these efforts, and by 2010 China established innovation priorities for strategic emerging industries programs with its desire to surpass, not merely match, other nations.[172] Five years later, China adopted a new wave of industrial policies that were focused on emerging and general-purpose technologies and supported by new public-private industrial guidance funds, which allowed it to become a technological frontrunner.

Today, Chinese industrial policy covers a wide range of government actions, including direct investments, budgetary support, cheap loans, tax breaks, and regulatory preferences, and it is therefore difficult to estimate these initiatives' total price tag.[173] However, the industrial guidance funds offer some insights into the magnitude of China's industrial policy: by June 2020, these funds had raised approximately 40 percent ($672 billion) of a targeted $1.55 trillion goal, the majority of which (61 percent or possibly higher) is dedicated to high technology and advanced manufacturing, with infrastructure, agriculture, and other services also prioritized.[174]

Chinese Industrial Policy's Mixed Record

While American politicians and pundits often portray Chinese industrial policies as uniformly successful, the reality is much more complicated. Surely, not all Chinese industrial policies have been costly failures. The China State Grid Corporation, for example, developed ultra-high-voltage transmission projects and is now a world leader in the field.[175] Similarly, industrial planning and subsidies have helped cultivate China's renewable energy sector, which now leads the renewable energy output worldwide.[176] China's industrial policies in steelmaking, high-speed rail, and machinery have also helped the nation become a global economic power in those industries.[177]

However, Chinese industrial policy successes are matched by failures. Perhaps the most notable example is China's unsuccessful decades-long quest to be a global leader in semiconductors, an industry considered by U.S. industrial policy advocates as "too critical to fail."[178] Despite receiving billions of dollars in government funding and being prioritized in government policy documents, such as the Guidelines to Promote a National Integrated Circuit Industry, Made in China 2025, and the Technical Area Roadmap, China's domestic players are still, by most expert accounts, decades behind the world's best producers.[179] Its share of the global installed semiconductor capacity jumped from 1 percent in 2000 to 15 percent by 2020, but three-fourths of that capacity is owned by foreign multinationals.[180]

"Chinese industrial policy successes are matched by failures. Perhaps the most notable example is China's unsuccessful decades-long quest to be a global leader in semiconductors."

Government support also has not stopped six multibillion-dollar Chinese chip projects from failing over the past two years, and high-profile manufacturers, including Wuhan Hongxin, Tacoma, and Dehuai, have dissolved or declared bankruptcy.[181] The manufacturers that have survived are still two to three generations behind the United States, not to mention the current industry leader, Taiwan Semiconductor Manufacturing (TSMC), and China's national champion, Semiconductor Manufacturing International Corporation (SMIC), are developing facilities to produce chips that are much smaller and less technologically developed than the world's leading firms.[182] By contrast, China's major advances have come in the form of less technically challenging and more labor-intensive back-end manufacturing and "fabless" design companies that have low barriers to entry because of widely available design tools.[183]

China's Semiconductor Manufacturing International Corporation and other producers also remain heavily reliant on the United States and other countries for semiconductor manufacturing equipment, which is why current Chinese industrial policy is focused on simply surviving U.S. sanctions, rather than leading the world.[184] According to a 2021 report in Japanese newspaper *Nikkei*:

> U.S. research firm IC Insights in January predicted that China's self-sufficiency ratio for semiconductors would be only 19.4% in 2025. This was a slight downward correction after the firm in 2020 predicted the ratio would rise to 20.7% by 2024. It also noted that over half of the ratio was accounted for by mainland China units of overseas manufacturers, such as Taiwan Semiconductor Manufacturing (TSMC), and South Korea's SK Hynix and Samsung Electronics, with the self-sufficiency ratio that involves only Chinese manufacturers estimated at around 10%.
>
> China's government under Xi had put large amounts of subsidies into semiconductor projects across the country until 2020, but the results of the funding were limited, with many projects failing. The government now seldom mentions the 70% self-sufficiency target laid out in its Made in China 2025 industrial policy.[185]

Indeed, industrial policy shoulders much of the blame for the current state of the Chinese semiconductor industry, which features rampant misallocation of resources, ineffective implementation, corruption, and a significant shortage of human capital, as well as heavy reliance on well-funded but uncompetitive state-owned enterprises (SOEs).[186] Future success is also far from guaranteed. According to Christopher Thomas from the Brookings Institution, most segments of China's semiconductor industry trail its foreign competitors and face numerous economic obstacles to catching up.[187]

Industrial guidance funds were intended to combine government direction with private capital and market forces, and have also proven to be unsuccessful. In particular, they have not met their objective of attracting private investors and instead rely on state-owned entities for funding.[188] Because of poor management and risk assessment, moreover, many funds are underinvested, redundant, or wasted on illicit activities.[189] It is also unlikely that these investments, if they materialize, will be profitable, because the government is targeting only a 5 percent rate of return in order to focus on social objectives like acquiring intellectual property and expanding domestic output rather than profits.[190] Even these alternative goals, however, could prove to be wishful thinking, because history has repeatedly shown that new general-purpose technologies spread slowly through an economy and have effects that were often difficult to foresee.[191]

Even where Chinese industrial policy has developed a competitive industry, its efforts in electric vehicles show that the costs can be astronomical, successes modest, and future, market-based growth uncertain. The Chinese government started providing subsidies to the EV industry in 2009, aiming to develop quality domestic manufacturers and a domestic supply chain ecosystem.[192] These subsidies helped Chinese firms to go from 10 percent of global market share in 2011 to 53 percent in 2019, with 1.5 million electric vehicles sold in China in 2018 alone.[193]

"Even where Chinese industrial policy has developed a competitive industry, its efforts in electric vehicles show that the costs can be astronomical, successes modest, and future, market-based growth uncertain."

It is estimated, however, that the Chinese government spent nearly *$60 billion* cultivating its EV industry between 2009 and 2017, through a mixture of R&D grants, consumer subsidies, public procurement, and local protectionism. These subsidies may have created an EV market from scratch, but they also produced numerous problems that made the Chinese government fear that it was repeating the same mistakes it made when trying to boost its traditional auto industry. In particular:

> Instances of fraud and collusion were made public by a 2016 government investigation. In several instances, manufacturers received subsidies for vehicles that existed only on paper or that were equipped with batteries that didn't meet subsidy eligibility requirements. In some cases, vehicles were sold to companies related

> to the manufacturer so they could pocket the subsidies.
>
> The cost of subsidies may have been worthwhile if the irrational exuberance that accompanied this "let 100 EV firms bloom" period also led the way in technological superiority. Yet even as registered EV firms mushroomed to more than 400 by 2018, according to some estimates, only about 15% of them are actually manufacturing cars. The vast majority of these firms appears to have either not reached the production stage or have products of questionable quality.[194]

The Chinese government quickly curtailed EV subsidies and shifted to a market-based program emphasizing quality, fuel efficiency, and competition.[195] (It is far from certain that the U.S. political system could so quickly permit the same.) The EV sector, however, may not be sustainable in the absence of state interventions, as consumer subsidies alone accounted for one-quarter of total EV sales. Indeed, sales in China declined by 20 percent in 2019 compared to 2018, shortly after subsidies to private passenger EVs were terminated in June 2019.[196] Chinese EV companies still lag behind the world's leaders, and the United States' Tesla is venerated there.[197]

> "Not only do projects' direct costs often outweigh their benefits (if there are any), but the broader costs imposed by China's industrial policies may actually hinder rather than accelerate China's economic development."

China's shipbuilding sector offers another example of industrial policy subsidies not commensurate with returns. According to a 2019 study from Panle Jia Barwick and colleagues, Chinese industrial policy generated more production and investment in the domestic shipbuilding industry, but not only did it come at a very high cost; it also generated "sizable distortions," industry fragmentation, and increased idleness. The authors estimate that, between 2006 and 2013, the Chinese government directed policy support totaling 550 billion renminbi (RMB) (approximately $80 billion at the time) to the shipbuilding industry, but these subsidies generated only 145 billion RMB ($21 billion) of net profit for domestic producers. Furthermore, a large share of the subsidies (230 billion RMB/$33 billion) went to global ship owners—of which Chinese shipping companies are a small share—via lower ship prices.[198]

Similar evidence of Chinese industrial policy problems can be found in its domestic aircraft and automotive manufacturing industries, as well as 3G mobile technologies.[199] These and other examples call into question the overall economic benefits of China's recent embrace of industrial policy. Not only do projects' direct costs often outweigh their benefits (if there are any), but the broader costs imposed by China's industrial policies may actually hinder rather than accelerate China's economic development. In particular, China's industrial policies have been shown to create the following problems that hinder stable, long-term economic growth.

Resource misallocation

According to a 2013 government audit, for example, the new energy sector generated 1.6 billion RMB (approximately $258 million) of misallocated funds between 2011 and 2012.[200] A 2021 paper from Chong-En Bai and colleagues finds significant talent misallocation in China, with potential entrepreneurs instead being attracted to the large state sector.[201] Given the extent of Chinese industrial policy activities since 2010, not to mention the Chinese government's penchant for downplaying economic problems in official statistics, the total amount of resource misallocation—capital, labor, materials, equipment, and time—caused by such policies is likely substantial.

Corruption

Corrupt behavior stems from the state's control over resources and financing, and is evident in Chinese sectors such as tobacco, banking, and infrastructure, in which state monopolies dominate.[202] In general, corruption is more prominent in countries with active industrial policies, and this is appears to be the case in China, too: according to Transparency International's Corruption Perceptions Index, China ranks 87th out of 180 countries, indicating a fairly high level of corruption.[203] Such corruption slows economic growth and development by thwarting competition, deterring investment, exacerbating market distortions, and reducing tax revenue.[204]

Investment bubbles

Chinese industrial policies also have created investment bubbles and overcapacity in many targeted industries—bubbles that Beijing is now trying to deflate. For example, both China's semiconductor and EV industries show signs of irrational exuberance and financially stressed "paper companies" that will never be productive. The large-scale bankruptcies and business failures associated with Chinese industrial policies contribute to broader financial challenges in China, such as its growing debt load and share of nonperforming commercial loans.

Overcapacity

Meanwhile, the subsidized companies that survive may engage in duplicative projects or produce *too many* goods, resulting in overcapacity (where supply exceeds demand). We can find evidence of subsidy-induced overproduction in China's steel, cement, chemical fiber, aluminum, solar panel, and other industries.[205] This not only threatens China's economy, but also fuels tensions among China's trading partners and generates global economic distortions. Chinese government efforts to rein in overcapacity have thus far had limited success.

Finally, one must consider whether the United States *could* emulate Chinese industrial policy, even if doing so were desirable. China's industrial policy model is unique: the Chinese government controls a large share of the economy and therefore has an enormous amount of money at its disposal. As Naughton explains, this "puts limits on the degree to which industrial policies can impose costly distortions on the economy."[206] The U.S. system—thankfully—lacks such characteristics and would therefore suffer far more damage from "China-style" industrial policy interventions. As noted above, moreover, the United States also differs from China in that our political system is less tolerant of costly public failures, particularly in the commercial (as opposed to, say, national defense) arena. Popular backlash, which the U.S. system fortunately permits (again, unlike China), would be all but guaranteed.

China's Systemic Challenges

China also faces broader systemic challenges that call its future global economic dominance into question. First, China is experiencing significant demographic headwinds that will only accelerate in the coming years. Despite relaxing its decades-long family planning policy, China continues to have a falling birth rate. Last year, its population rose to only 1.41 billion from 1.40 billion in 2019, with individuals over 60 now accounting for almost one-fifth of the population.[207] An aging China creates pressures on its health care system and the overall economy.[208]

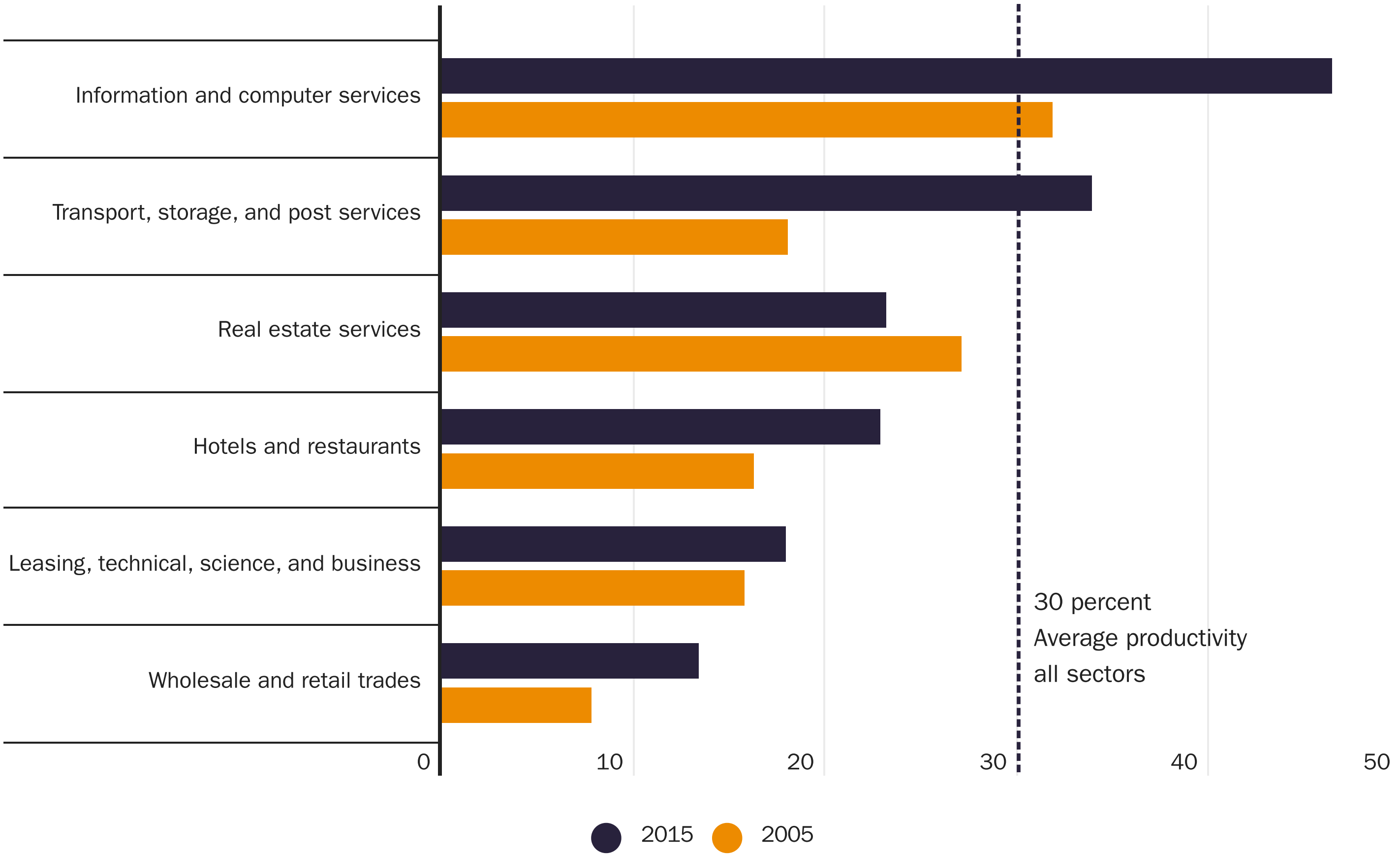
> "China also faces broader systemic challenges that call its future global economic dominance into question."

China could offset demographic concerns with rising productivity (it appears uninterested in immigration), but this factor is also lagging—likely due in part to Chinese industrial policy. According to a 2020 International Monetary Fund Report, China's average productivity rate, as shown in Figure 17, is only a third of that in other developed economies—including Japan, Germany, and the United States.[209]

A 2014 study published by Europe China Research and Advice Network corroborates the International Monetary Fund's findings: although Chinese Global 500 firms grew from 3 in 1995 to 89 in 2013, these firms compared unfavorably to their Western counterparts, with larger payrolls, less capital intensity (assets/employees), lower profitability, and fewer innovation capacities.[210]

Figure 17

China productivity, percent of the global frontier level



Source: "People's Republic of China: Staff Report for the 2020 Article IV Consultation," International Monetary Fund.

It is an open question as to whether China will catch up to more productive developed economies. China's productivity growth has stagnated in recent years, with average annual growth dropping from 3.5 percent between 2007 and 2012 to only 0.6 percent from 2012 to 2017.[211] Growth in total factor productivity is now only a third of what it was before the Great Recession, a much sharper decline than other countries have experienced.[212] As noted by the *Wall Street Journal*, much of China's productivity slowdown is attributable to the government's "massive stimulus program to prop up economic growth" instituted after the financial crisis, and productivity has further deteriorated under President Xi Jinping.[213] Other contributors to China's slowdown include recent government efforts to control private businesses, especially technology firms, and growing bureaucratization, which has confounded central government efforts to implement economic and social reforms that might boost national productivity.[214]

Inefficient SOEs are also a significant cause of China's productivity issues. Despite constituting a smaller share of China's economy today as compared with decades ago, "SOEs are dominant in key industries, including energy, aviation, finance, telecoms and transportation."[215] A 2021 Bruegel study similarly finds that "China's competitive environment is generally poor," with Chinese SOEs generally in an "advantageous position" across most economic sectors.[216] However, even though SOEs benefit from privileged access to credit and other resources, they lag in productivity behind privately-owned counterparts by 20 percent.[217] As noted by Cato adjunct scholar Terence Kealey, "as judged by the numbers of patents granted for every unit of investment in R&D, private companies in China are three times more efficient than are state-owned enterprises."[218]

Unfortunately, Chinese SOEs' economic prominence appears to be growing, with the government increasingly favoring these entities, while cracking down on private firms and entrepreneurs and limiting foreign investment. As explained by China expert Nicholas Borst, much of SOEs' rise is attributable to Chinese industrial policy: "State-owned firms have been at the forefront of the Chinese government's drive to develop domestic sources of key technologies, such as semiconductors."[219]

Finally (and in part due to the aforementioned issues), China faces a growing debt burden that will, unless tamed, weigh on future growth. China's debt-to-GDP ratio reached approximately 280 percent in 2020 (295 percent if foreign debt is included), the majority of which is in the form of corporate bank loans. However, China's banks—long considered tools of Chinese industrial policy (via, for example, low-interest loans to preferred industries)—are showing signs of strain. In 2020, Chinese banks had a record high of $466.9 billion in nonperforming assets—a number that is expected to continue rising.[220] According to the Bank of Finland, moreover, "China was already engaged in efforts to bail out small and medium-sized banks before covid-19 struck," and stress tests released by the People's Bank of China in November 2020 showed that 10 of 30 banks—including all of China's systemically critical banks—would fail under even mild stress scenarios.[221]

Chinese government debt may be more manageable (constituting approximately 70 percent of GDP), but it is expected to expand significantly in the coming years as the government funds a social safety net for its aging population.[222] Certain Chinese industrial policy projects, such as high-speed rail, also contribute to China's growing public debt burden.[223] As the same Bank of Finland analysis explains, China's substantial increase in debt has long concerned observers of the Chinese economy, because similar trends in other countries' indebtedness have typically led to economic collapse or banking crises. While a crisis seems unlikely in the near term, such concerns are almost certain to weigh on future growth and other government initiatives.

"China's economic challenges, caused in no small part by its relatively recent embrace of industrial policy, argue strongly against the implementation of a U.S. industrial policy as a last-ditch effort to counter an unstoppable global hegemon."

It is possible that China can overcome these economic headwinds and others, including environmental degradation, overseas project failures, restive populations, alienation of foreign firms, and increasing illiberalism.[224] It is undeniably a large economy with an increasingly educated population. But China's economic challenges, caused in no small part by its relatively recent embrace of industrial policy, argue strongly against the implementation of a U.S. industrial policy as a last-ditch effort to counter an unstoppable global hegemon.

Conclusion

Resurgent calls for American industrial policy suffer from several flaws. They depend on a malleable definition that prevents legitimate analysis, omits past industrial policy failures, and takes credit—often absurdly—for innovations only tangentially related, at best, to government action. They ignore the many economic, political, and practical obstacles that have historically prevented U.S. industrial policies from producing market-beating outcomes. They claim, often without support, to solve problems—deindustrialization and declining American innovation, the disappearance of good jobs, the erosion of middle-class living standards, and the destruction of American communities—that are often exaggerated or most likely cannot be solved via industrial planning. And they erroneously use the experiences of other countries, particularly China, to justify new American industrial policy.

In reality, industrial policy, as properly defined, has an extensive and underwhelming history in the United States, featuring both seen and unseen high costs, failed objectives, and political manipulation. Surely, not every U.S. industrial policy effort has ended in disaster, but facts both here and abroad argue strongly against new government efforts to boost critical industries and workers and thereby fix alleged market failures. Such efforts warrant intense skepticism—skepticism that today is unfortunately in short supply.

> "Surely, not every U.S. industrial policy effort has ended in disaster, but facts both here and abroad argue strongly against new government efforts to boost critical industries and workers and thereby fix alleged market failures."

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1000 Massachusetts Ave. NW
Washington, DC 20001
www.cato.org

1000 MASSACHUSETTS AVE. NW
WASHINGTON, DC 20001
TEL: 202-842-0200 FAX: 202-842-3490
WWW.CATO.ORG