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?

U.S. 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," economist 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."[29]

Thus, decentralized, market-based economic activity in general produces better outcomes than centrally-planned ("by one authority for the whole economic system") activity because the former better mobilizes the diffuse knowledge – via price signals and millions of individual, real-time, dynamic transactions – needed for economic actors to make relevant decisions (production, investment, purchases, sales, etc.). Because no single actual 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."[30] They rarely do.

A core part of industrial policy's knowledge problem is timing: because markets 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. History repeatedly has shown that the "critical technology" (and suppliers) of today is often not so "critical" tomorrow.

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, 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."[31] The Carnegie Endowment's James L. Schoff cites these efforts among the U.S. "technonationalism" failures in the 1980s and 1990s. He documents how past U.S. 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 – worried about Japan at the time – could not foresee how the marketplace would develop. They therefore focused on current national champions like Motorola and Toshiba and missed how the internet would transform mobile and digital technologies and "stimulate the rise of internet titans like Google, Amazon, or the modern version of Apple" who 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."[32] After noting another U.S. government miscue – seeing Japan as an unstoppable technological powerhouse – Schoff explains that "U.S. firms prospered because of their ability to innovate and compete effectively, not because of such technonationalist or protectionist measures.[33]

Even if policymakers pick the right industry, moreover, they can struggle to identify and support the right product in that industry. As Lincicome explained in a 2017 Cato Institute policy analysis, for example, U.S. semiconductor policy in the 1980s saw Dynamic Random Access Memory (DRAM) chips as central to national security and the future of U.S. global technology leadership, and believed trade restrictions would encourage new U.S. entrants in the DRAM market. Yet no such investments occurred because "American companies were actually exiting the DRAM market, having already discerned that their future was not in the 'high-volume, low-profit commodity' but in advanced microprocessors, specialty chips, and design."[34]

Similar problems plagued contemporaneous U.S. supercomputer policy, which targeted older technology and "vector" supercomputers produced by U.S. 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.[35] As the American Enterprise Institute's Claude Barfield explained 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."[36]

Examples of Knowledge Problem failures are not limited to history books. For example, the Trump administration in March 2020 invoked the Defense Production Act (DPA) to push domestic manufacturers to make more ventilators, which were deemed essential to fighting the coronavirus at that time. By the summer, however, medical professionals determined that ventilators were not as critical as 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."[37] According to the a December 2020 report from the U.S. International Trade Commission, other DPA-funded medical goods production will only come online after mid-2021[38] (with the pandemic firmly under control), even though there was evidence of a domestic medical goods glut in late January.[39]

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 use the political systems in which they operate to make themselves, not the general public, better off. Elected officials' primary goal is therefore re-election, 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 (lobbying, campaign contributions, and votes) based thereon. Because the public is "rationally ignorant" about these policies (and thus does not tie their votes or contributions to them), elected officials act rationally in supporting them, even when the policies 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 project), but also makes reform or elimination of these programs exceedingly difficult, regardless of their efficacy.[40]

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 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.[41] 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 grow to rely on those entities for both information and manpower.

The U.S. political system amplifies the public choice hurdles facing industrial policies for two key reasons. First, large segments of Congress are replaced (or threatened with replacement) every two years and the president every four. This dynamic not only injects "short-termism" and uncertainty into the decisionmaking process, but also makes elected officials more risk-averse and focused 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.[42] This dynamic has likely worsened since the 1980s, for example because of longer presidential campaigns that far exceed those in other countries.[43] Representatives today essentially start campaigning for the next election shortly after winning the last one.

Second, the U.S. 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, "proposals for an industrial policy that would allegedly allocate capital on preferential terms to new firms in emerging industries with special promise must explain how they would ensure that the lobbying power of established and often declining industries and firms would be kept at bay" such that "sunrise" industries and firms that lack a strong lobbying presence could prosper.[44] 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 the aforementioned 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."[45]

When policies are implemented, moreover, politics often intervenes – even in systems designed to be implemented from the political process. U.S. supercomputer policy in the 1990s was essentially client-service for one U.S. company, Cray, and its computer model while ignoring other American market entrants, such as IBM, Hewlett-Packard, Intel, and Sun Microsystems that offered different, and arguably better, products.[46] 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-Wis.), whose district includes a Cray facility, that would virtually ensure the contract goes to Cray,"[47] and the Commerce Department imposed record-setting antidumping duties of 454% on Japanese supercomputer imports in 1997. The latter pressured NEC to agree, in exchange for Cray dropping the case, to invest $25 million in Cray and give it exclusive rights to sell NEC's "vector" supercomputers in United States.[48] 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, supposedly impartial Commerce Department'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, as the law intends, injurious dumping, while also revealing a U.S. agency captured by domestic interest groups (especially the steel industry), unconcerned with the views of diffuse consumers (including other manufacturers), and unburdened by congressional or judicial checks on its authority.[49]

More recent U.S. 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 funded by the 2009 American Recovery and Reinvestment Act (ARRA) and administered by the U.S. Department of Energy (DOE) revealed 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."[50] 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 (receiving 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.[51]

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" suffered from similar public choice problems.[52]

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 explained, 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. She 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."[53]

Two separate analyses – from the Reason Foundation[54] and Georgetown University[55] – found a significant connection between Section 1705 loans' size and their recipients' lobbying efforts. These results are consistent with recent research finding that politically-connected firms (as measured by contributions to homes state elections) were "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."[56] 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.[57]

Most recently, a *New York Times* investigation into Maryland vaccine manufacturer Emergent Biosolutions – a "longtime government contractor that has spent much of the last two decades cornering a lucrative market in federal spending on biodefense" – found that the company invested heavily in lobbying while ignoring various safety and manufacturing best practices; had effectively "captured" the government agency, the Biomedical Advanced Research and Development Authority, authorized to disburse and monitor pandemic-related contracts; yet, despite repeated contracting failures, was rewarded with a $628 million contract to manufacture Covid-19 vaccines. Emergent's actions ultimately imperiled millions of doses of Johnson & Johnson vaccines and weakened the Strategic National Stockpile by monopolizing its "half-billion-dollar annual budget throughout most of the last decade, leaving the federal government with less money to buy supplies needed in a pandemic."[58]

These examples show not only how public choice can undermine, if not actively work against, industrial policy objectives, but also that even systems designed to be governed by neutral arbiters and 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 success or failure of which is 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 explained 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.59

The authors – sympathetic to U.S. industrial policy – examined six federal industrial policy programs originating in the 1960s and 1970s and intended to develop commercial technologies for the private sector: the Supersonic Transport, the Applications Technology Satellite Program, the Space Shuttle, the Clinch River Breeder Reactor, Synthetic Fuels from Coal, and the Photovoltaics Commercialization Program. (They omit basic research and defense projects from their retrospective cost-benefit analysis for the same reasons discussed in the section above on defining "industrial policy.") They deemed only one program – NASA's satellite activities – as "worth the effort," but it was killed before being completed. Four others were "almost unqualified failures," costing billions, crowding out more meritorious R&D projects, yet enduring 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. They conclude that "the history of the federal R&D commercialization programs… is hardly a success story," and that case studies overall "justify skepticism about the wisdom of government programs that seek to bring new technologies to commercial practice." 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."60

George Mason University's Hart summarized the *Technology Pork Barrel* problem 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.61

Numerous other industrial policy projects justify this conclusion, despite Hart's personal optimism that these forces might be controlled. For example—

- The Jones Act (Section 27 of the Merchant Marine Act of 1920) 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 has presided over the long-term degradation of both the industry *and* the oceangoing merchant marine fleet.[62] Despite these failures, the law has not only persisted for a century, but actually been made *more restrictive* in recent decades – in large part due to the well-developed lobbying machine that is 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.[63]
- The U.S. ethanol program has also lasted for decades despite numerous studies showing corn-based ethanol to impose substantial economic and environmental damage, while raising food prices and *undermining* U.S. climate goals.[64] Yet these mandates are championed by almost every presidential candidate visiting Iowa; even the pro-deregulation Trump White House expanded them in 2018; and "politicians of both parties are conspiring to keep it alive despite knowing full well what its problems are."[65]
- 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 ruled repeatedly illegal by federal courts and adjudicatory panels under U.S. trade agreements (e.g., the World Trade Organization and North American Free Trade Agreement).[66] Yet the law not only continues to be in force – accounting for hundreds special duties today – but has been repeatedly *expanded* by Congress to achieve desired protectionist results and to permit even greater abuse in the future.[67] The U.S. government also routinely ignores WTO rulings against Commerce Department antidumping abuses – practices that are becoming increasingly common.[68]

- Clean coal megaprojects FutrureGen 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."[69] As noted above, FutureGen was actually revived from the dead because of its importance for President 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.[70] 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.[71] Although it "demonstrate[s] the

> difficulties carbon capture and storage as a whole will face to achieve operational stability and economic viability,"[72] DOE remains committed to clean coal today.[73]

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 problems pervasive.

Interaction with Other Policies/Distortions

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

> 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.[74]

Conflicting U.S. 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.

Then there are the U.S. 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.[75] Buy American restrictions also can limit U.S. companies' access to needed materials or lead to project delays, and they confounded ARRA-funded infrastructure projects intended to boost the U.S. manufacturing sector.[76] 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 "significantly affecting" the environment. A recent assessment of NEPA by Eli Dourado of the Center for Growth and Opportunity found that publication of NEPA-required "environmental impact statements" (EIS) takes an average of 4.5 years, and that ARRA projects were "subject to around 193,000 NEPA reviews including over 7,200 environmental assessments and 850 EISs. During the time the reviews were being performed, no funds for the projects could be disbursed and no work could begin."[77]

Bipartisan efforts to overhaul NEPA have thus far proven unsuccessful, and Democrats – who currently control the U.S. government – have expressed a desire to apply both Buy American and Davis-Bacon to future industrial policy initiatives.[78] In fact, both were included in the bipartisan U.S. Innovation and Competition Act, which passed the Senate in June 2021 and seeks to subsidize semiconductor production and other "key technologies."[79]

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

As discussed above regarding U.S. industrial policies' lack of discipline, 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, DOE in 2014 claimed that its green energy lending programs are "making money" because the agency ignored the interest costs that U.S. taxpayers paid to finance the loans at issue. As Brookings' Donald Marron explained at the time, DOE's alleged $810 million "profit" became a $780 million *loss* when Treasury's borrowing costs were included.[80] While interest rates are currently at record lows, they will almost certainly not stay that way – thus raising industrial policy project costs.

Furthermore, it often takes years to determine whether a project merits its cost. For example, DOE in 2014 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.[81] By 2018, the entire U.S. cellulosic biofuel industry was on the ropes[82], and the Hugoton facility still sits idle today.[83]

Finally, cherrypicked 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 only three of ten CCT projects, which accounted for 82 percent ($3.49 billion of $4.24 billion) of all funding, were active in 2018, with the "huge" FutureGen project among the failures.[84] Since then, the Petra Nova power project was mothballed after suffering frequent outages and missing its carbon sequestration goals.[85] Archer Daniels Midland's Illinois Industrial Carbon Capture and Storage Project (which captures CO2 as a by-product of ethanol production), is still operating but has reached only half of its annual emissions storage target.[86] Only Air Products and Chemicals' carbon capture facility in Texas (which received $284 million from DOE) can be considered successful.[87] Was it 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 (ATVM) 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.[88] 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 President 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.[89] 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.[90]

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 restriction impose substantial deadweight costs on the U.S. economy – a key reason why so few economists support them.[91] High tax rates have been found to impose similar costs.[92]

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.[93]

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."[94] Other nuclear projects and the Space Shuttle likely had similar, net negative effects.[95] As noted above, more recent government over-spending 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.[96]

These opportunity costs are sometimes mentioned when government industrial policies publicly fail, but must also be considered for "successes" too. As Duke professor Daniel Gross explained, we celebrate that World War II shifted the scientific establishment "from whatever work they're doing before to instead focus their energies on atomic fission and radar," but "it's difficult to know, and easy to overlook, what we might have also left behind."[97]

Once opportunity costs are considered, "successful" industrial policies can end up undermining the U.S. economy and 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 since-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 "ballooned more than twentyfold, to about $2.2 billion at one point"[98] – private capital that could not be invested elsewhere (e.g., in actual U.S. pharmaceutical ingredient producer Fujifilm). Even after the government loan was stymied, and without any new plan for long-term financial viability (along with continued poor financial performance[99]), 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.[100]

Industrial policies can also discourage private investment in industries that the government is actually trying to promote. As Harvard's Josh Lerner explained 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% of venture investments in 2009 to 1.5% of capital deployed in the first nine months of 2019."[101] With respect to the ATVM 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 examples of this very thing.[102]

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.'"[103] Kodak spent almost $800,000 on lobbying before it received its DPA 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[104], shipbuilding, ethanol, and other industries that are common U.S. industrial policy targets.[105]

Unintended consequences. Industrial policies produce consequences that not only were unforeseen by government planners but also undermine the policies' own objectives. As already noted, U.S. subsidies intended to spur various energy innovations repeatedly discouraged 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.[106]

Numerous other examples abound. U.S. semiconductor policy in the 1980s and 1990s sought to boost domestic producers' global competitiveness (while diminishing their Japanese competitors) but instead enriched Japanese chipmakers (via quota "rents" and government-backed collusion) and helped to turn Korean companies into global leaders.[107] 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.[108] Ethanol subsidies and mandates have reduced cropland, increased food prices, and harmed the environment. "Buy American" restrictions tied to federal transportation subsidies 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 (frequency and coverage), increasing traffic congestion, and harming the environment.[109] Outside of the United States, European innovation policy stymied innovation[110], while Japanese industrial policy slowed productivity growth.[111] The list 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 the consequences) and adverse selection (i.e., the tendency to attract the riskiest 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.[112]

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.[113] 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[114] – was ever approved in the first place.[115] In a comprehensive assessment of all DOE loan and loan programs implemented between 2009 and 2016, the Heritage Foundation's Nick Loris found that projects routinely featured "[f]ailed companies that could not survive even with the federal government's help," and added that "[b]oth Government Accountability Office (GAO) 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."[116]

Uncertainty. Industrial policies often generate uncertainties due to their inherent political nature (frequent elections, program lapses, etc.) and potential to generate trade disputes or retaliation from foreign trading partners. Numerous studies, for example, have shown that U.S. tariffs during the Trump administration increased trade policy uncertainty and thereby decreased investment and economic growth.[117] These results are consistent with the general economics literature showing policy uncertainty to undermine investment, employment, and economic growth. As University of Chicago's Steven J. Davis explained, "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."[118] Both theory and practice show why it is difficult, if not impossible, for U.S. 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 impose significant economic harms.

Almost all of these seen and unseen costs arose in the 2009 government bailout of General Motors and Chrysler, which was deemed an industrial policy "success" by the Obama administration because they only "cost" taxpayers about $10 billion (the difference between the current-dollar value of funds the government "invested" and recouped).[119] However, this total ignored the true (interest adjusted) cost to taxpayers, which the Congressional Budget Office estimates was 40 percent higher ($14 billion).[120]

Furthermore, as Daniel Ikenson explained in a series of Cato Institute analyses[121], even this larger cost figure ignores all of the bailout's hidden costs for the U.S. economy, such as: that the $61 billion allocated to these large corporations could have been better spent at the time (for example, via direct payments to and retraining for autoworkers); the long-term costs to GM and Chrysler because they were not reorganized via standard bankruptcy proceedings; the costs (e.g., lost business) incurred by Ford and other U.S.-based automakers who did not receive special treatment, as well as the costs to U.S. consumers and the economy because these companies' better products and business models were not rewarded with additional business; the moral hazards that resulted from encouraging the continuation of the companies' and the union's irresponsible practices; the costs to bond-holders and other investors who did not receive the fair value of their holdings, along with the long-term effects of short-circuiting U.S. bankruptcy law; the political costs of protecting political favorites (here, unions); and the cost of uncertainty about whether and when political actors will again decide to intervene in the market and legal system, citing the bailout as precedent.

These costs are large and never mentioned.

If It Creates One Tesla?

Some industrial policy advocates argue that these seen and unseen costs are an expected but necessary part of backing ventures too risky for private capital and are worth the expense if the project ultimately supports one big winner (e.g., Tesla Motors). Even assuming that Tesla's story is fully written or that electric vehicle proliferation benefits average Americans, however, this argument must have limits: would government-backing of Tesla be worth 1 trillion dollars-worth of waste, failure, and cronyism? Two trillion? Surely, some amount 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 did this very thing.[122]

These arguments, as well as other industrial policy defenses, also require quantifying the benefits that alleged successes confer upon not merely recipient companies and workers (a low and obvious standard) *but 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 with hard evidence and thorough empirical analysis. Indeed, a core theme of McCloskey and Mingardi's book, *The Myth of the Entrepreneurial State,* is the lack of rigorous and systematic empirical analyses of the overall efficacy of nation's industrial policy (as opposed to whether specific projects achieved certain deliverables). Pack and Saggi examined the issue in 2006 and explained a key hurdle to such an analysis:

> 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.[123]

The authors nevertheless conclude at that time that "[f]ew of the empirical analyses find that sectoral targeting has been particularly effective."[124] Since then, literature reviews – including that of Ángel Zúñiga-Vicente, et al in 2014[125], Lane in 2020[126], and Karlson, Sandström and Wennberg that same year[127] – have come to essentially the same conclusions: the few empirical studies of industrial policy tend to focus on specific transactions and issues (as opposed to the aggregate, economy-wide effects of industrial policy); often suffer from methodological or data limitations; and have produced mixed, country-specific results. They therefore cannot permit strong conclusions about the success or failure of industrial policy writ large.

Finally, one must also consider whether an industrial policy success would have occurred in a market without the supporting program at issue. Often, subsidized successes perform no better than their un-subsidized competitors. The most obvious example is the BioNTech/Pfizer vaccine achieving the same or better results than vaccines with far more government support, but many others exist. Yonk's 2020 assessment of DOE loan guarantee programs, for example, finds that, "[t]he early evidence suggests few loans are extended that would not otherwise be attained."[128] 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 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.

As noted above, other analyses of the program have come to the same general conclusion. Semiconductor consortium SEMATECH's work has also been found to have produced deliverables that the market could have provided (and did previously without government assistance[129]). An 2020 analysis of 25 cleantech startups funded by the U.S. Advanced Research Projects Agency-Energy (ARPA-E) in 2010 found "no clear evidence that [awardees] perform differently from similar cleantech startups as a whole in terms of acquisition/IPO, survival or VC funding post-award within 10–15 yr of founding." As a result, the authors conclude that the program did not achieve one of its primary goals (i.e., to generate "an increased likelihood of success (measured in different ways) for ARPA-E startups compared to similar companies").[130] The authors found that awardees did obtain more patents than un-subsidized competitors, but could not rule out that this "success" was due to ARPA-E "encouraging awardees to patent" or choosing "to fund companies with a higher propensity to patent."[131] Finally, the authors—

> …also examined the impact of funding from other government sources. They found that run-of-the-mill Department of Energy funding from the Office of Energy Efficiency and Renewable Energy had no impact on either patenting or follow-on funding. Meanwhile, Small Business Innovation Research awardees patented at a lower rate than the average firm.[132]

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."[133] Alas, no such evidence exists.

What "Problem" Will Industrial Policy Solve?