

America's Industrial Policy and the Green Transition: A Paradigm Shift Underway?

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This moment demands that we forge a new consensus. President Biden is pursuing a modern industrial and innovation strategy—both at home and with partners around the world. ... This strategy will build a fairer, more durable global economic order, for the benefit of ourselves and for people everywhere (Sullivan, 2023).

Our economic strategy is centered around investing in ourselves – not suppressing or containing any other economy (Yellen, 2023).

As President, I have a responsibility to act with urgency and resolve when our nation faces clear and present danger. And that's what climate change is about. It is literally, not figuratively, a clear and present danger. (Biden, 2022)

Abstract.

The U.S.'s position as a global economic leader means that its industrial policies can have far-reaching effects. By adopting an experimental governance approach, the U.S. can lead by example, demonstrating how innovative, adaptive policies can drive industrial growth while addressing global challenges like climate change and economic inequality. Furthermore, the U.S. can play a pivotal role in international knowledge sharing, contributing to and learning from industrial policy experiments conducted worldwide.

Section 1. Introduction

This article assesses America's modern industrial strategy, made concrete and tangible through a series of major legislative victories and identifies indicators of success, areas of weakness and possible room for further policy redesign, asking whether the Biden industrial policy will prove lasting, or temporary.

This article adopts the definition of industrial policy used by Rodrik et al: "Government policies that explicitly target the transformation of the structure of economic activity in pursuit of some public goal" (Juhász, Lane, et Rodrik 2023, p.4). Industrial policy goals usually include supporting innovation, spurring productivity, and increasing economic growth rates. Industrial policy also includes levers that support climate transition goals. Industrial policy is composed of a suite of regulatory, tax changes, and incentives designed to alter market behavior, current and future expectations, firm-level decisions, consumer choices and plans. Looked at overall, well-designed, coordinated industrial policy, whether in the US or elsewhere, should benefit from network effects that amplify the effects of public expenditure via private sector multipliers.

President Biden's Administration has begun a paradigm shift on industrial and climate change policy, dramatically altering America's stance on the use and design of such policies. The Biden Administration has adopted an explicit place-based industrial strategy (Juhász, Lane, et Rodrik 2023), designed to create jobs for American workers, rebuild America's infrastructure, defend its technological edge over China, and crucially, support and accelerate the green transition, the adoption of new technologies, and the achievement of the country's climate change goals.

This historic, potentially durable shift in policy design, explication, implementation, and use signals a step change in policy orientation of global significance, for the planet, for allies, partnerships, trading competitors, and for future national and global economic outcomes.

A New Economic Narrative: "Bidenomics"

President Biden's embrace of a place-based industrial policy is rejection of the previous dominant policy and economic consensus, both Republican and Democratic, as pursued by prior administrations (except for the Trump administration).

For decades American policymakers, whether on the left or the right, were reluctant mention the words "industrial policy". It was politically radioactive. Leaders were advised by economists who believed such policies were antimarket, a wrongheaded exercise in picking winners and losers. American policymakers leaned away from explicit publicly acknowledged directed investment strategies and toward a defense of neoliberal globalization, characterized by the support of free trade, low tariffs, and cheaper imported goods, predominantly supplied by China and other states where low paid workforces cut importers' costs, lowered consumer prices, and expanded import product choices.

This model of globalized economic growth was seen as beneficial overall, even as the broad-based positive effects were diffuse. The negative downsides were concentrated and painful, with

significant impacts on skilled manufacturing jobs caused by the China shock post-2000 (Autor, Dorn, et Hanson 2016).

Successive US administrations focused on building up and defending the rules-based international system, exemplified by the GATT and the World Trade Organization, their processes, and negotiations. The international financial institutions – the IMF and World Bank – in which the US held sway, defended the tenets of neoliberal globalization, and the Washington Consensus that was part of the dominant economic narrative. To be sure, the explicit backing of ruled-based free trading system did not mean that the US regulatory state did not also apply preferential treatment and incentives that impacted markets and changed outcomes (see box 1), rather it was done implicitly, *sotto voce*.

Box 1. Implicit industrial policy.

Commercial Incentives – Just Don’t Say the “I” Word

American refusal to mention the words industrial policy did not mean that American tax and regulatory policies operated without sector preferences, bent toward some players, and less toward others. Defense contractors benefit from procurement practices that boosted their profits at the cost of unnecessary or overpriced, poorly performing products. Real estate developers (including a serially indicted current political candidate from the right), benefit hugely from the ability to claim losses on properties against tax over multiple years, avoiding any tax liability to the revenue authorities despite living large. Private equity partners use debt to finance acquisitions, while taking advantage of the ‘carried interest’ rule to pay less federal tax than a primary school teacher. Hedge fund partners also benefit from this tax treatment which favors debt over equity. American tax and regulatory policies have operated with implicit commercial financial policy incentives, picking winners and losers. Leaders just took care not to advertise the fact lest the poorer tax paying voting workers became aware of the difference between adherence to the narrative of free market determinism and actual operation of many US markets and sectors.

America’s policy elite accepted that China’s opening could lead a loss of American manufacturing jobs, in return for cheaper consumer goods, higher corporate profits (but also stagnant wages for many). The predominant policy and economic mindset, seen in the Bush 1, Clinton, and Bush 2 presidencies, meant that this was a globalized price worth paying.

The widespread failure in the US to foresee a high populist political cost of focusing on the diffuse but broadly felt benefits of free trade, and the overlooking the concentrated, painful, and community disrupting localized effects of this stance, is now viewed as a mistake but some of free trade’s most ardent proponents (Krugman 2023). Krugman acknowledges proponents failed to anticipate the channeled anger of the left behind, who were ‘strangers in their own land’ (Hochschild 2018).

This voter discontent helped propel a political outsider and rhetorical arsonist to US office in 2016. The shock 2016 presidential results caused a general American reappraisal of the merits of placed-based industrial policy on the right, in power, and the left, out of power, and alarmed by the result (Juhász, Lane, et Rodrik 2023).

President Trump understood and spoke to the anger of the left behind bottom quintiles, especially white male, non-college educated voters, whose wages has stagnated, while the price of education, medical care, and much else besides, rose. Once in office Trump responded by implementing 25 percent tariffs on Chinese imports. He took aim at China's tech giants, such as Huawei. He rejected multilateral rules-based norms, at the WTO, the G20, and in other forums. It was time to put 'America First.' Trump's positioning was domestically popular among his voters, and others.

Democratic candidate Joe Biden reacted by promising and upon election taking an even tougher line on China and in favor of domestic production and US workers. The Biden administration would deliver, widening and deepening sanctions against China. The administration then went onto adopt a modern American industrial strategy.

Section 2. A literature review of industrial policies

In the discourse on economic development and policy, the term "industrial policy" often lacks a precise definition.

In the 2004 work of Dani Rodrik, a reevaluation of industrial policy is presented, particularly in the context of the evolving global economic landscape (Rodrik 2004). Contrary to the prevalent belief that the last two decades have marked the decline of industrial policy, Rodrik's analysis suggests a refocusing of these policies towards exports and direct foreign investment, driven by the assumption that these sectors are key sources of positive externalities. The challenge, as Rodrik posits, especially for developing countries, is not in rediscovering industrial policy but in its strategic redeployment.

Rodrik's framework emphasizes the importance of an institutional approach that is more effective and nuanced. A central tenet of his argument is that industrial policy should not only be about the implementation of policies but also about engaging in a dialogue with the private sector to identify significant externalities and their potential solutions. This perspective marks a departure from the traditional view of government intervention through Pigovian taxes or subsidies. Instead, Rodrik advocates for a model of strategic collaboration between the private sector and the government. This collaboration aims to uncover the most significant barriers to economic restructuring and to determine the types of interventions that would be most effective in addressing these barriers.

This approach underscores the necessity of a government's role that extends beyond regulation or the provision of incentives. It envisions the government as a collaborator in a continuous process of identifying and overcoming structural and market-based challenges to industrial development.

Such a model demands a deep understanding of the specific economic contexts of individual countries, as well as the dynamic nature of industries and global markets.

Rodrik's emphasis on identifying the most significant obstacles to restructuring and pinpointing the most effective interventions reflects a need for industrial policy that is adaptive, responsive, and informed by practical realities rather than solely by theoretical models. This aligns with the broader discourse in economic policy, where the importance of context-specific and informed approaches to industrial policy is increasingly recognized.

Juhász, Lane, and Rodrik (2023) offer a comprehensive conceptualization, defining industrial policies as:

“Industrial policy is much discussed but rarely explicitly defined. We define industrial policies as those government policies that explicitly target the transformation of the structure of economic activity in pursuit of some public goal. The goal is typically to stimulate innovation, productivity, and economic growth. But it could also be to promote climate transition, good jobs, lagging regions, exports, or import substitution. Since industrial policy targets structural change, a key characteristic is the exercise of choice and discretion by the public authorities: “we promote X but not Y,” though the later part of this statement is typically left implicit.”

Two salient features characterize industrial policy: explicit targeting of specific sectors, technologies, or activities, and the exercise of choice and discretion by public authorities in determining what to promote and what to eschew. This necessitates meticulous planning and evaluation by government officials.

The present article aims to scrutinize the evolving landscape of U.S. industrial policy, particularly in the context of climate change. The objective is to explore how this new era of industrial policymaking could potentially restructure the U.S. economy towards greater sustainability. To justify the need for industrial policies, three key economic rationales are identified (Juhász, Lane, et Rodrik 2023): externalities, coordination failures, and activity-specific public inputs. Each of these factors underscores the necessity for targeted governmental intervention to address market failures and to allocate public goods and resources effectively.

However, the implementation of industrial policy is not without challenges. Two primary objections often raised are information shortcomings and rent-seeking behavior. The former questions the government's ability to accurately identify and address market failures due to potential gaps in information. The latter raises concerns about the susceptibility of industrial policy to lobbying and political influence, which could divert policy objectives towards serving private interests at the expense of public good.

Recent empirical studies add nuance to these discussions. Lashkaripour et Lugovskyy (2023) indicate that unilateral interventions could result in adverse terms of trade, offsetting any allocative gains. However, they also suggest that globally coordinated industrial policies could offer substantial benefits.

Turning to international examples, East Asian industrial policies provide valuable insights. Notably, South Korea and Japan have demonstrated that industrial policies can evolve and adapt to the demands of a globalizing economy. Even as these countries liberalized their economies and joined international organizations like the GATT and the OECD, industrial policies remained a key part of their economic strategies. The focus on export and trade facilitation, as evidenced by institutions like the Export-Import Bank of Japan, has been a consistent feature.

Robert Wade's "Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization," originally published in 1990, represents a significant contribution to the field of political economy, particularly in the context of East Asian economic development (Wade 2003). Wade's work critically engages with prevailing narratives about the economic success of East Asian countries, such as Taiwan, and offers a nuanced analysis of the interplay between market forces and government intervention in these economies. Wade challenges two dominant perspectives: first, the view that East Asian economic success is a vindication of free market principles, and second, the simplistic attribution of this success solely to government intervention. Instead, he directs attention to the intricate balance and synergy between market allocation decisions and public administration. This approach underscores the complexity of the economic development process, highlighting that it is not a matter of choosing between the market and the state, but understanding how they can effectively complement each other.

Alice H. Amsden's seminal work, "Asia's Next Giant: South Korea and Late Industrialization," offers a comprehensive analysis of South Korea's remarkable economic transformation (Amsden 1992). Amsden's thesis centers on the concept of "late industrialization," a process through which a nation's industries primarily learn from or adapt innovations from other, earlier industrializing nations, rather than originating innovations independently. In her exploration of South Korea's economic ascent, Amsden emphasizes the principle of reciprocity. This principle suggests that the benefits derived from foreign direct investment and technology transfer are contingent upon certain obligations and performance standards imposed on multinational corporations by the host country. South Korea, in Amsden's analysis, effectively leveraged this principle, ensuring that foreign engagements contributed to the development of local industries and technological capabilities. A critical aspect of Amsden's argument is the contrast she draws between South Korea's experience and that of other late industrializing nations, including Japan. This comparative analysis illuminates the unique strategies and policy choices that underpinned South Korea's success. Unlike earlier industrializers, which often led with innovation, South Korea, according to Amsden, focused on mastering and improving upon existing technologies and industrial processes. This approach was facilitated by a strong state that directed resources and investments, guided industrial development, and set ambitious performance benchmarks for industries. Amsden's work challenges conventional economic theories that emphasize free market principles, instead highlighting the role of state intervention and strategic policy in guiding economic development. Her analysis of South Korea's industrialization process provides valuable insights into the dynamics of economic growth in late industrializing countries, offering a nuanced understanding of how nations can leverage existing global knowledge and technology to catalyze their own economic development.

Recent work by Juhász et al. (2022) further emphasizes the role of trade finance as a critical instrument in modern industrial policies.

The study of industrial policy necessitates a multifaceted approach that integrates both theoretical insights and empirical evidence. The challenges and complexities involved in its implementation make it a subject of ongoing academic inquiry and policy debate. In their influential paper, "Economic Development as Self-Discovery," Ricardo Hausmann and Dani Rodrik delve into the complexities of economic development in the context of uncertainty about a country's productive capabilities (Hausmann et Rodrik 2003). This work addresses a critical aspect of economic growth and industrial policy, particularly relevant for developing countries exploring new avenues for economic advancement. The core argument of Hausmann and Rodrik revolves around the concept of self-discovery in the economic development process. They posit that there is significant uncertainty regarding what a country can efficiently produce and discovering the costs of domestic activities holds substantial social value. This is because once a country discovers a profitable industry or economic activity, this knowledge can be easily imitated and adopted by others, leading to broader economic benefits. To analyze this concept, Hausmann and Rodrik develop a general-equilibrium framework for a small open economy. This framework helps in clarifying both analytical and normative issues related to economic development under uncertainty. One of the key insights from their analysis is the identification of two market failures in a laissez-faire economy: firstly, there is insufficient investment and entrepreneurship *ex ante*, due to the risks and uncertainties associated with discovering new economic activities; secondly, there is excessive production diversification *ex post*, as firms and entrepreneurs imitate successful discoveries. Addressing these market failures, Hausmann and Rodrik argue, requires a nuanced policy approach. Optimal policy, in their view, should aim to counteract these distortions by encouraging investments and entrepreneurial ventures in new sectors (*ex-ante*) while rationalizing and streamlining production once profitable activities are identified (*ex-post*). This approach suggests a dynamic role for policy intervention, one that evolves in response to the stages of economic discovery and development.

In his OECD report, Ken Warwick presents a comprehensive review of the evolving landscape of industrial policy, highlighting emerging trends and new lines of thinking (Warwick 2013). Warwick adopts a broad and inclusive definition of industrial policy, moving beyond traditional conceptions to encompass a wider range of policy interventions and objectives. His work is particularly notable for proposing a new typology of industrial policy, which is structured around the orientation of the policy and the domain in which it operates. Warwick's typology, especially when viewed through the lens of the policy domain, offers a novel framework that draws upon growth accounting principles. This framework mirrors the evolution in the rationale behind industrial policy interventions. Initially, industrial policy was largely focused on product market interventions, such as production subsidies, state ownership, and tariff protection. These interventions were direct and often aimed at protecting or promoting specific industries or sectors within the economy. As thinking in the field has evolved, there has been a shift towards addressing market failures through taxes and subsidies that primarily target factor markets. This includes incentives for research and development (R&D), training subsidies, investment allowances, and support for accessing finance. These interventions are designed to correct inefficiencies in the market and stimulate activities that are socially beneficial but might be underprovided by the market, such as innovation and skills development. The latest focus in industrial policy, as Warwick outlines, is on interventions that aim to build systems, create networks, develop institutions, and align strategic priorities. This approach recognizes the importance of the broader ecosystem in which industries operate. It underscores the need for policies that not only address

specific market failures or support particular sectors but also enhance the overall functioning and connectivity of the economy. This includes fostering innovation systems, developing efficient and effective institutions, and ensuring that various elements of the policy landscape are coherently aligned with broader economic objectives.

Section 3. Methodology

In addressing the topic of industrial policies within the context of International Business, three potential frameworks that could be instrumental in this regard are the Global Value Chain (GVC) framework, the Smart Specialization Strategy (S3), and the Experimental Governance framework (EG).

Global Value Chain (GVC) Framework: This framework provides a comprehensive lens through which to examine the complex and interconnected nature of modern industrial activities on a global scale. It emphasizes the roles of different actors and regions in the creation of value through international production networks. By applying the GVC framework, one can analyze how industrial policies in one country or region affect global production processes, competitiveness, and value distribution. This approach is particularly relevant in the context of International Business, as it allows for a nuanced understanding of how national industrial policies interact with global market dynamics.

Smart Specialization Strategy (S3): Originating in the European Union as a policy concept, Smart Specialization emphasizes the role of regions in identifying and building upon their unique strengths and capabilities. This strategy encourages regions to focus on their competitive advantages and to foster innovation-driven growth. In the context of industrial policy, S3 provides a framework for understanding how localized industrial policies can be designed to leverage regional strengths, promote innovation, and integrate into global markets. This approach is particularly relevant for analyzing how industrial policies can be tailored to specific regional contexts within the broader international business environment.

Experimental Governance: In addressing the topic of new industrial policies, particularly in the realm of green technologies, the work of Sabel and Victor (2022) on "experimental governance" presents a highly relevant and innovative perspective. This framework emphasizes a flexible, iterative approach to policymaking, which is especially pertinent in areas characterized by rapid technological advancements and market uncertainties, such as green technologies.

The escalating climate crisis represents a formidable challenge in global collective action, a challenge that governments have attempted to address through high-level international negotiations. Notable among these efforts is the 2015 Paris Agreement, which mandates compulsory emission reductions and necessitates comprehensive plans for achieving these targets. However, the authors contend that such treaties are falling short, primarily due to their limited scope for initiative and experimentation at the subnational level.

The path to effective emission reduction is inherently uncertain, necessitating a diverse range of experiments with various technologies and methodologies. Since the optimal strategy is not immediately apparent, it is likely that effective solutions will emerge from localized, context-specific initiatives. Rather than rigid adherence to the specifics of a global agreement, it is more pragmatic for governments and firms that share similar goals to pioneer their own solutions. The key lies in sharing the outcomes of these initiatives – understanding what is effective and what is not – to mitigate the costs and risks associated with adapting to climate change. Mechanisms such as trade taxes and reputational penalties can be employed to encourage participation from more hesitant governments and firms.

The authors cite the 1987 Montreal Protocol, a successful instance of such experimental governance that has significantly contributed to the protection of the ozone layer. A similar example can be seen in California's approach, with its stringent fuel economy standards and plans to phase out the internal combustion engine. This approach underscores the importance of experimental governance, highlighting its potential in fostering innovative and localized solutions to the complex challenge of climate change.

The concept of experimental governance allows for an in-depth analysis of how industrial policies can be adapted and refined over time in response to emerging challenges and opportunities. This approach is marked by its adaptability, enabling policies to be more responsive to technological innovation and market dynamics. It also encourages broader stakeholder engagement, involving industry players, researchers, and civil society, leading to more inclusive and informed policymaking. Furthermore, this framework fosters a learning environment where policies are continuously evaluated and improved based on empirical evidence, a crucial aspect in the fast-evolving field of green technologies.

From an international business perspective, understanding the dynamics of experimental governance in industrial policy is critical. It provides insights into how different countries and regions might approach the development and regulation of green technologies. This has significant implications for global value chains, international trade, and investment strategies.

This framework (see Figure 1), conceptualized for climate policy, provides a robust foundation for examining industrial policy in a dynamic and increasingly complex global economic landscape.

The rationale for selecting the experimental governance framework as our theoretical lens is multifaceted. Firstly, the traditional top-down approaches to policymaking, characterized by rigid, one-size-fits-all solutions, have shown limitations in addressing the nuanced and evolving challenges of industrial development. The experimental governance framework, with its emphasis on localized experimentation, adaptive learning, and collaborative problem-solving, offers a more flexible and responsive approach. This is particularly pertinent in the context of industrial policy, where regional disparities, sector-specific dynamics, and rapid technological changes necessitate a more agile and tailored policy response.

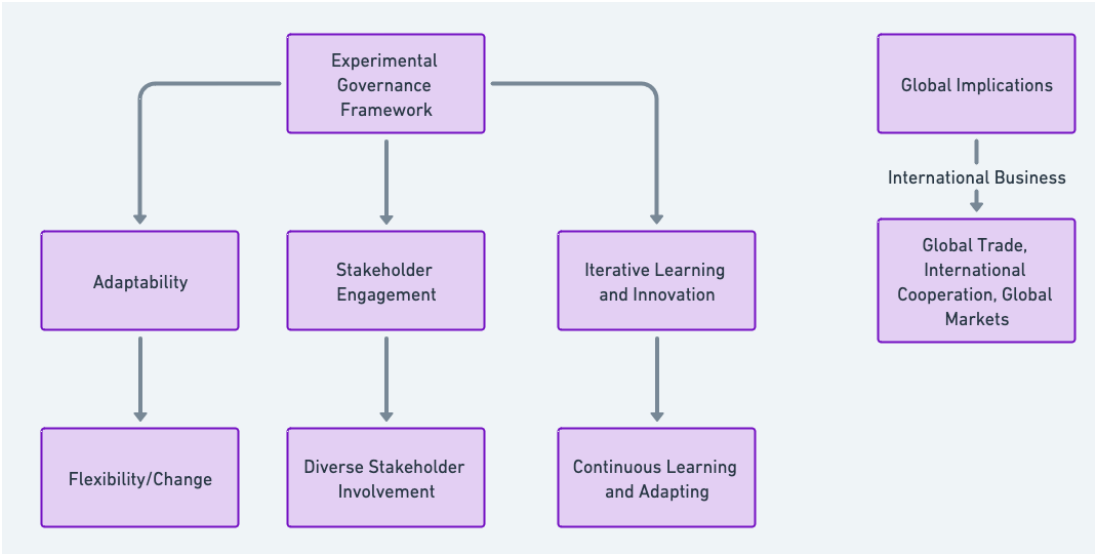
Secondly, the framework aligns with the growing recognition of the importance of public-private partnerships in fostering industrial innovation and growth. By encouraging collaboration between government entities and private sector actors, the experimental governance approach leverages the

strengths and resources of both sectors. This collaboration is crucial for testing and scaling innovative industrial strategies and technologies.

Furthermore, the experimental governance framework underscores the significance of learning and adaptation in policy development. By focusing on iterative processes, continuous feedback, and knowledge sharing, this approach facilitates the refinement of policies based on empirical evidence and real-world experiences. This aspect is vital for developing industrial policies that are not only effective in the short term but also sustainable and resilient in the face of future economic shifts.

Lastly, the global dissemination of knowledge, a key component of the experimental governance framework, resonates with the interconnected nature of today's economies. Successful industrial policies in one region can offer valuable lessons and models for others, fostering a collaborative global approach to economic development.

Figure 1. The experimental governance framework (authors' interpretation).



This flowchart is a valuable tool for visually conveying the intricate workings of experimental governance in the context of green technology policy, highlighting its adaptability, stakeholder engagement, and focus on continuous learning and improvement. This makes it a relevant and useful resource for academics, policymakers, and anyone interested in the governance of green technology initiatives.

The core premise of Sabel and Victor's argument is the recognition that top-down global treaties and broad agreements among nations, while important, have not been sufficient in addressing the complex and evolving challenges of climate change. They suggest that the profound transformations required to significantly reduce emissions are more likely to emerge from localized, experimental efforts. This approach involves government and business sectors working

in tandem to test new technologies, rapidly identify effective solutions, and disseminate this knowledge on a global scale.

By applying Sabel and Victor's experimental governance framework to industrial policy, policymakers can foster a more dynamic, innovative, and effective approach to economic development. This framework acknowledges the complexity of modern industrial challenges and the limitations of one-size-fits-all solutions, advocating instead for a more nuanced, adaptive, and collaborative approach to policymaking.

Section 4. Why is this time different? A Modern American Industrial Strategy

The adoption of by the United States and the Biden Administration of an explicit industrial policy is a step change in policy design. The Biden team not only built on elements of the Trump Administration stance vis-a-vis China, but they also added massive expenditure on tech, infrastructure, and climate change. This is a move away from the neoliberal *laissez faire* narrative. It is an active industrial policy the scale, breadth, and potential impact of which has not been seen since the cold war, in peacetime.

In the past, the ARPA model in the United States stands as a compelling example of successful industrial policy in advanced economies, operating on principles akin to what is termed "embedded autonomy" or, in ARPA parlance, "active program management." Originating with DARPA (Defense Advanced Research Projects Agency) in the late 1950s, the model has been instrumental in fostering groundbreaking technologies such as the Internet, etc. This approach has been adapted in other sectors like energy through ARPA-E and health sciences via ARPA-H (Juhász, Lane, et Rodrik 2023).

The new industrial strategy embodies a “national pivot” (Muro 2023) one where the world is getting less flat (2022). It is seen by as a ‘new Washington consensus’ even by its critics. Industrial policy and climate change policy are now part of national security policy. This embedding and realignment changes the policy conversation and outcomes (Lieven 2020).

This modern industrial strategy is strongly place-based (Juhász, Lane, et Rodrik 2023), designed so that the commercial and economic outcomes are US-centric, sector-focused, and crafted to deliver US jobs and impacts first and foremost.

So, what are the key elements in this modern American industrial policy? A wholesale adoption of place-based tax incentives designed to change markets, corporate, investment, and industrial decisions fast, speed adoption and diffusion of new technologies, defend US industrial edge vis-à-vis a rising China, and embed the green transition and national climate change goals across the economy and government.

The numbers involved in the Biden industrial strategy – the carrots – are huge but staggered and are planned to run throughout the next decade. In designing the policy to run for the medium- and

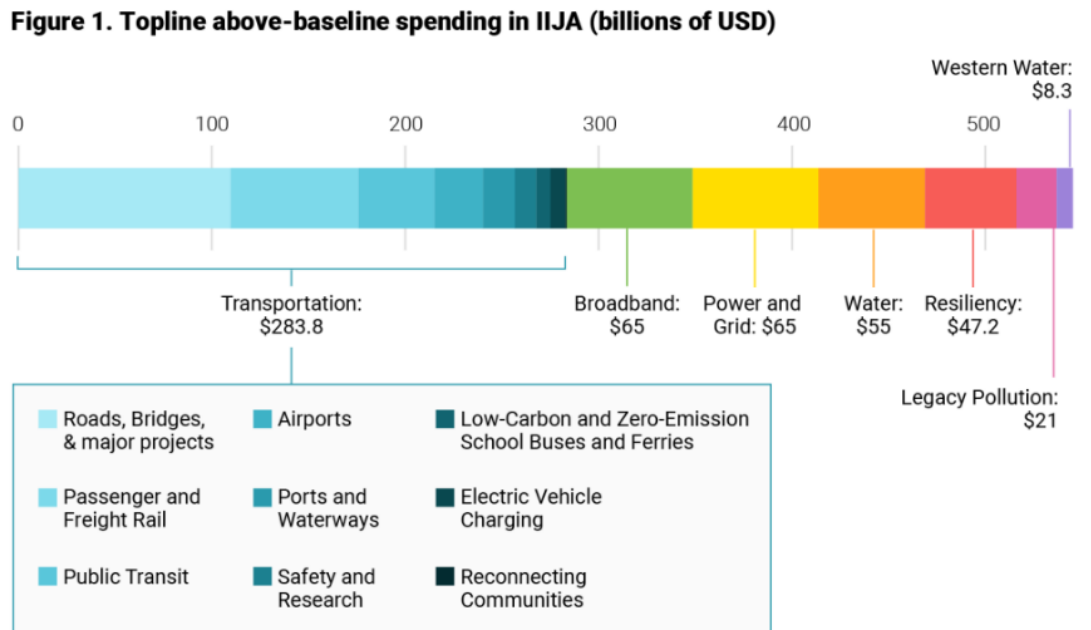
long-term, policymakers are aiming to alter sectoral and individual incentives and so affect commercial decisions, shift CEOs’ strategies, impact investors’ preferences, and change consumers’ behaviors.

The following sections summarize the legislative elements of the Biden industrial policy.

4.1 Infrastructure Investment and Jobs (IIJA) Act

Passage of the landmark IIJA was bipartisan. The act provides \$1.2tr in infrastructure funds, including \$550bn in new commitments, to be allocated over ten years, across a great many sectors and priorities, from transport, to power grids, to highspeed internet, to water systems, to resilience. The Act’s size is unprecedented in recent American policymaking. Its breadth is significant. The figure below breaks down its above-baseline components.

Figure 2. Spending in IIJA. Source: Brookings.



Source: Bipartisan Infrastructure Investment and Jobs Act Summary

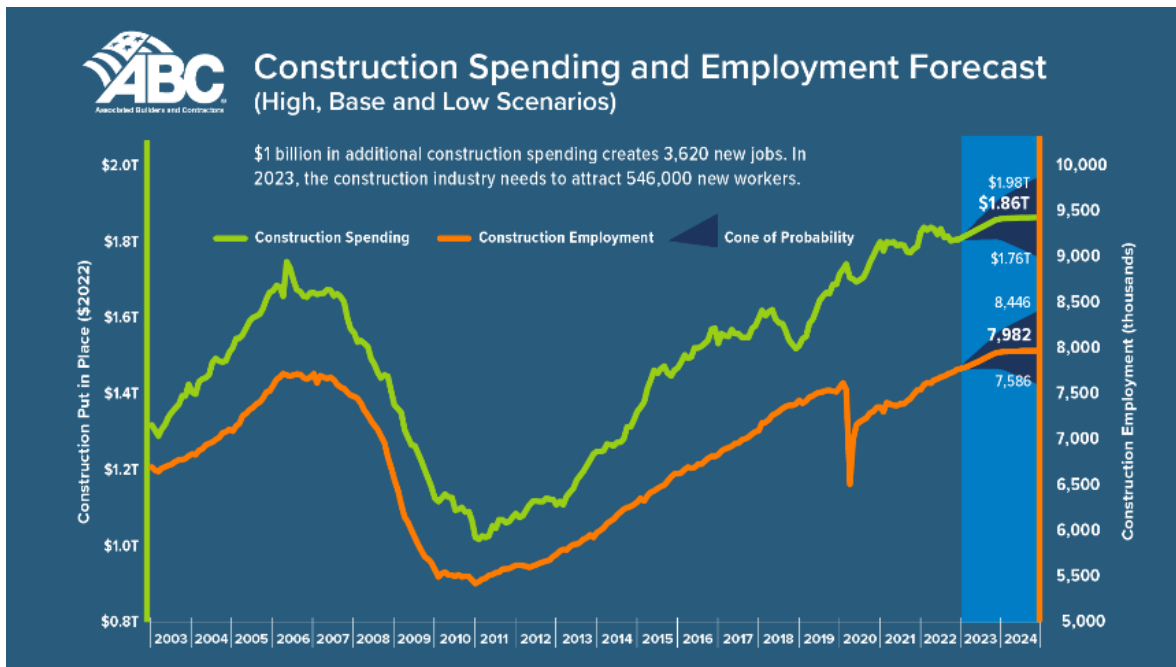
B Metropolitan Policy Program
at BROOKINGS

The IIJA supports hundreds of existing programs and creates many new ones, and will affect national, state, and local investment plans meaningfully and strikingly. It signals for America the

start of “an infrastructure decade” (Tomer, George, et Kane s. d.). The IJJA is the largest investment in US infrastructure in over half a century.

The impact on local communities is striking and immediate as large numbers of major projects begin, and repairs of fraying infrastructure commence. The US construction sector is booming, including projects > \$1bn in size and higher. Construction spending and employment is way up (ABC, 2023) and is forecast to continue its tear as in chart x below.

Figure 3. Construction spending. *Source: ABC, 2023*



4.2 The CHIPS Act Alters Tech Investment Plans

The CHIPS Act of 2022 is designed to incentivize chip manufacturers to build facilities – among the most complex industrial undertakings in the world – in the US and so rebalance the supply chain, making it less reliant on Taiwanese manufacturers whose factories are vulnerable to destruction or seizure if China were to invade Taiwan. In addition to geopolitics, the COVID pandemic demonstrated to US policymakers the dangers posed by strained supply chains, and the administration is alarmed by its fragility.

The CHIPS act commits \$280bn over the next ten years in funds. The majority—\$200bn—is for R&D and commercialization. \$52.7bn is for semiconductor manufacturing, R&D, and workforce development. Another \$24bn comprises of tax credits for chip production. In 2023 American

makes 12 percent of the world's semiconductors, down from 37 percent in the 1990s, according to US Department of Commerce. The CHIPS act is designed to reverse this trend. Initial evidence suggests some success.

In the twelve months after CHIPS became law companies have announced over \$166bn in manufacturing in semiconductors and electronics. Investment in training and skills has been announced in 19 states (White House, 2023). Hundreds of other actors are moving or have announced plans to take advantage of the CHIPS act provisions. Incentives always matter. In this case firms, states, and localities have jumped to secure tax credit for place-based incentives.

Looking ahead, research estimates that worldwide demand for semiconductors will keep growing, with the sector poised to become a \$1tr industry (Burbaky, Dragon, et Lehmann 2022). INVIDIA and ARM share performance show the level of demand for these technology leaders' IP. Had you invested \$1,000 at the INVIDIA IPO in 2019, your shares would be worth \$1.5m in 2023 (Rexaline 2023). Investors know there is a 10-year timeframe for elements of the funding, as well as front loaded tax credits: This alters the self-interested business strategy decisions of CEOs to move now, knowing they will have at a decade to benefit from the new commercial landscape.

Alongside the CHIPS act the Biden administration has also placed strict limits on export of chips, manufacturing technologies, and know-how, for both US firms and any companies that use American made components. Since the supply chain for these goods is complex interdependent and always includes US parts, the prohibitions essentially cut off China's easy access to the key chip designs required for AI research and other cutting edge uses.

4.3 The Inflation Reduction Act (IRA)

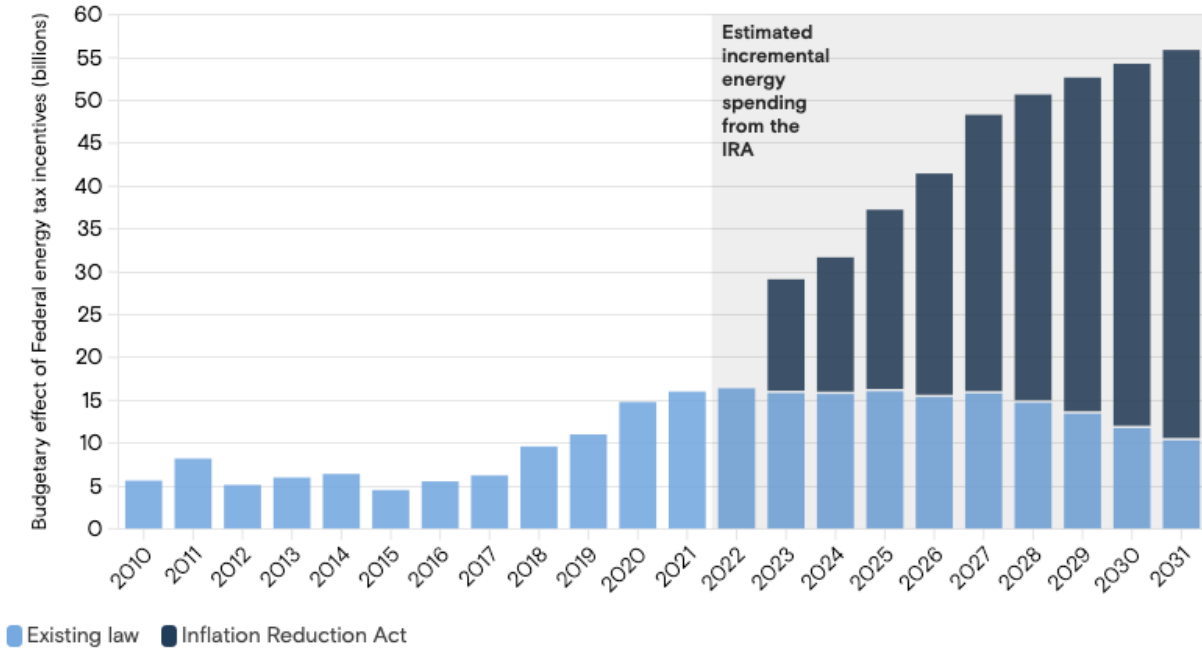
President Biden's climate goal is to. Upon election across government agency staff were told of the triple goals: deal with COIVD, steady the economy, and address climate change. This is the first time a US president has placed climate change right at the heart of the policymaking conversation and processes.

Biden committed to a 1.5°C-aligned goal of reducing US emissions 50-52 percent in 2030. As part of this plan the US committed to decarbonizing energy production on the power sector by 2035, and to achieving net-zero emissions by 2050. The scale of the policy shift is an order of several magnitudes larger than any prior administration. No prior American President has made such commitments.

A principal mechanism for rolling out the incentives-based policy program is the IRA. Passed by one vote in the Senate the IRA altered the climate policy landscape immediately. The IRA (so named to secure the crucial vote of Sen. Joe Manchin of West Virginia), is estimated by the US Congressional Budget Office to cost \$750bn over ten years. The act contains \$361bn for climate change incentives and goals, and the remainder aimed at healthcare subsidies, lowering healthcare costs, and other medical policy fixes. It has been welcomed as a "total gamechanger", as "historic" with one CEO declaring "I see the path to our net zero goals" (Goldman Sachs 2023).

Figure 4. IRA: total US federal tax incentives on energy.

The IRA is estimated to triple the total US federal tax incentives on energy by 2031

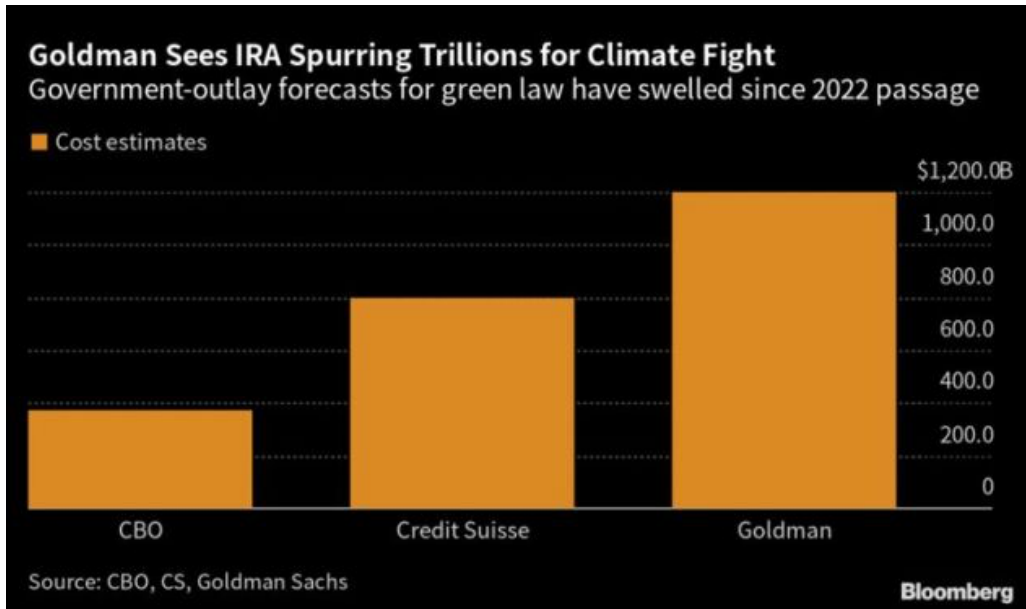


Source: US Department of Treasury, Congressional Budget Office, Goldman Sachs Research



This total funding estimate for the IRA, is likely an underestimate, due to the climate provisions. Credit Suisse (RIP) estimated a price of \$800bn. Goldman Sachs estimates a cost of \$1.2tr, due to many of the key climate technology incentives lacking ceilings on total tax credits; the more individuals and firms apply the greater the final cost. See figure X from Bloomberg (2023).

Figure 5. Trillions for climate fight.



The IRA is all about shifting sectoral and firm decisions and forward planning. The IRA contains scores of generous incentive programs across markets, sectors, agencies, all designed to lower costs for producers and consumers via tax credits and other mechanisms (White House, 2022). These comprise of –

Table 1. Allocation of Funds in Energy and Climate Spending

<i>Category</i>	<i>Allocation (in billions)</i>
<i>Clean Electricity Tax Credits</i>	<i>\$161</i>
<i>Air Pollution, Hazardous Materials, Transportation, and Infrastructure</i>	<i>\$40</i>
<i>Individual Clean Energy Incentives</i>	<i>\$37</i>
<i>Clean Manufacturing Tax Credits</i>	<i>\$37</i>
<i>Clean Fuel and Vehicle Tax Credits</i>	<i>\$36</i>
<i>Conservation, Rural Development, Forestry</i>	<i>\$35</i>

<i>Building Efficiency, Electrification, Transmission, Industrial, DOE Grants and Loans</i>	\$27
<i>Other Energy and Climate Spending</i>	<i>Not Specified</i>

Source: Committee for a Responsible Federal Budget, 2022

The IRA’s wide ranging and generous decade-long incentive structure is dramatically shifting American and overseas corporate CEOs’ profit calculus, even before disbursement of the various programs really has begun.

Battery manufacturers have announced new plants across America in response to the increase in profitability. In 2019, just two battery factories operated in the United States with another two under construction. By August 2023 30 battery factories were planned, under construction or operational in the country: A direct result of IRA place-based incentives to produce batteries of the EV transition in the United States.¹

Automobile companies have sped up their EV production plans, cutting prices (Tesla), and increasing investment (GM, Ford, Tesla others) in a speeding of the transition away from ICE. In one year \$70bn in new investments in the EV supply chain were announced by the private sector.²

At the consumer end the IRA provides up to \$7,500 credit for EV purchases or vehicles built in the US by union labor, for customers earning less than \$150,000 annually. The automobile landscape is shifting fast in response to these self-reinforcing dynamics as incentives change for producers and consumers. As a result in 2023 a third of Americans polled say they are considering an EV as the next car purchase (Reuters, 2023), a dramatic and swift jump that suggests technology adoption and diffusion rates are speeding up in response to the IRA incentives, and other behavioral and network effects. A tipping point on EV adoption may be approaching.

Solar PV firms and customers are rushing to take advantage of the new incentives. The incentives are dramatically changing commercial and consumer decisions. For example, solar PV in some US states can now be supplied and installed for free. In return the installer gets the tax credits and the carbon credits thrown off by the panels for a fixed term (usually a decade). The consumer gets a facility for free and free energy.

¹ Techcrunch, (2023). ‘Tracking the EV battery factory construction boom across North America.’ August 16. Available online: <https://techcrunch.com/2023/08/16/tracking-the-ev-battery-factory-construction-boom-across-north-america/> Accessed September 27, 2023.

² Cleantechnica. (2023). ‘One Year After The IRA, How Have EVs Fared?’ August 16. Available online: <https://cleantechnica.com/2023/08/16/one-year-after-the-ira-how-have-evs-fared/> Accessed September 27, 2023.

Or take the IRA incentives to produce green hydrogen – generated via electrolysis with renewable sources (wind or solar). The IRA credits are so generous that they have doubled the projected return on equity. At a stroke the Act has made production at scale possible, drawing new global investors into green hydrogen as they seek to take advantage of the opportunities.³

Consider the oil majors moving to invest in Carbon Capture and Sequestration technologies and the incentives they include. Oil majors can clean up their image, potentially sequester carbon in existing or modified wells, cut their carbon intensity, while also simultaneously increasing output of the wells being pumped with CO₂.⁴

³ CNBC. (2022). “Biden’s Inflation Reduction Act makes green hydrogen profitable at scale, Goldman Sachs says.” November 30. Available online <https://www.cnbc.com/2022/11/30/the-ira-makes-green-hydrogen-profitable-at-scale-goldman-says.html> Accessed September 27, 2023.

⁴ Reuters, (2023). ‘Biden says climate change is undeniable after hurricane Idalia damage.’, August 28. Available online: <https://www.reuters.com/world/us/biden-says-climate-crisis-is-undeniable-after-hurricane-idalia-damage-2023-08-30/> Accessed September 27, 2023.

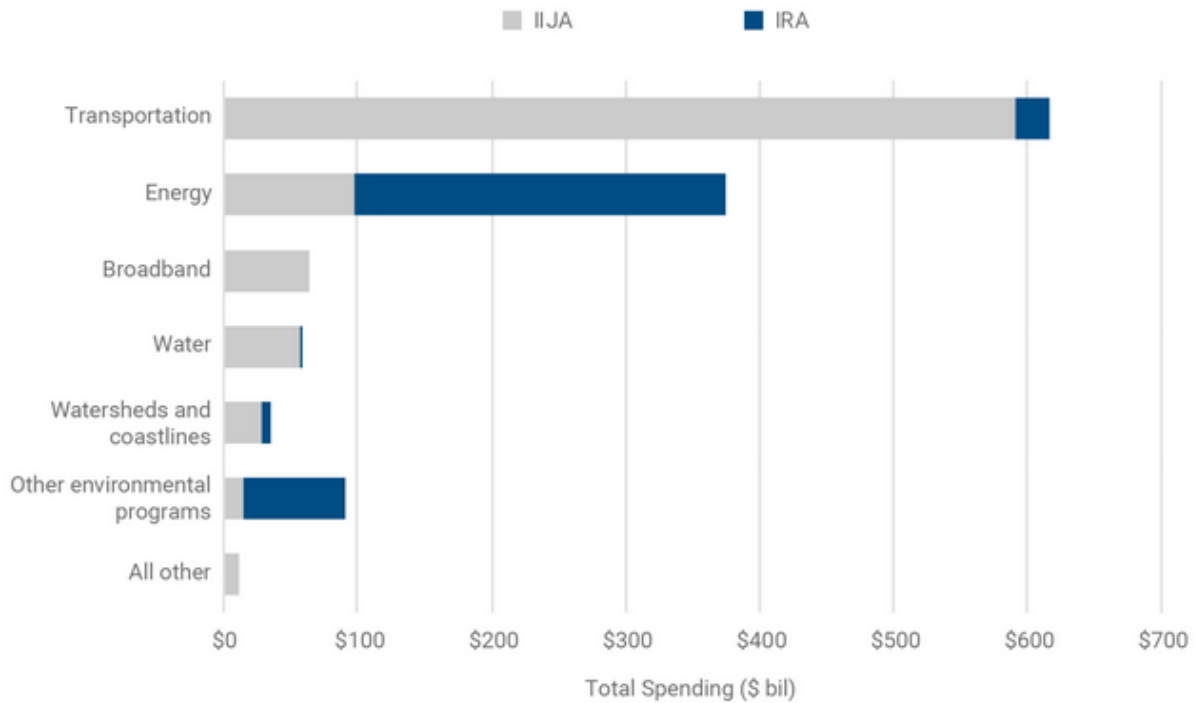
Reuters, (2023). Available online: ‘One-third of Americas would consider an EV purchase.’ March 21. <https://www.reuters.com/technology/one-third-americans-would-consider-ev-purchase-reutersipsos-poll-2023-03-21/> Accessed September 27, 2023.

Reuters, (2023). ‘Energy firm bet big on carbon capture projects in the U.S., Canada.’ Available online: <https://www.reuters.com/business/energy/energy-firms-bet-big-carbon-capture-projects-us-canada-2023-03-10/> Accessed September 27, 2023.

Figure 6. IIJA + IRA.

FIGURE 1

Projected federal spending from IIJA and IRA



Note: Projected spending includes advance appropriations, budget impacts of IRA tax credits as estimated by the CBO, and a small number of authorized programs.

Source: Brookings analysis of Infrastructure Investment and Jobs Act, Inflation Reduction Act, and CBO data.



These are only some examples of hundreds of significant economic changes underway across the US economy and markets. This is a process of green redesign and reindustrialization.

Section 5. Possible Economic Impacts

The impact of the ten-year long spending plans contained within the Biden Administration's industrial strategy is becoming partially visible across the US and overseas, as investment plans

shift, near shoring, homeshoring, and inward investment increases, and sectors and firms adjust their own plans and strategies.

At this stage in 2023, the precise magnitude of the overall economic impact is partially visible at this early juncture. Critics call the policies wasteful spending. Supporters herald the changes as necessary, warranted, urgent, and economically transformative. We suggest that paradigmatic change is indeed underway.

The IRA's, the IJJA, and the CHIPS Acts' multiplier effect is a matter of debate. If we assume it is between 1 and 2 (on the low end of economic estimates), this translates into multiple trillions in additional private sector investments on top of public funds. This will amount to hundreds of billions in new private investments per year, every year. For example, Goldman Sachs forecasts the IRA alone will mean \$290bn in additional investment in America annually, nearly \$3tr in a decade. This is real money. The IJJA and CHIPS add further to the impact. Whatever multiplier you choose, the legislative acts constitute the largest series of coordinated industrial policies adopted for many decades, at least since the depths of the cold war.

As this plays out in the years ahead this industrial policy activism may enlarge of the potential size of the US economy, boost of the maximum rate of growth, and help raise productivity (capex drives productivity gains) in the US economy. A possible answer to Lawrence Summers' secular stagnation trap (2013) may be this application of a modern greening industrial policy; a policy choice which Summers himself rejects, may yet deliver the needed economic boost.

Such potentially long-term economic effects may be durable. Consider for instance that past bursts of capital investment, such as telecommunications revolution, the IT revolution, or the Y2K IT boom, these produced long tails of positive economic effects. It is possible then, that the series of interconnected incentive shifts and investments underway, planned for the next ten years, could significantly alter the US economy's path and prospects in the 2020s and well into the second half of the 2030s, or event longer as the drive to net zero by 2050 speeds up.

5.1 Green Jobs and Growth

President Biden's economic policy and the industrial strategy depends on, and is supposed deliver, better paid jobs for American workers. The president repeatedly says that his climate plan is a jobs plan. He has directly linked its success with economic growth and progress. Some economists remain skeptical either because they oppose industrial policy (Summers 2013), or because they think it just too soon to judge the data (Krugman 2023). Others worry about costs and inflationary pressures from the green shift.

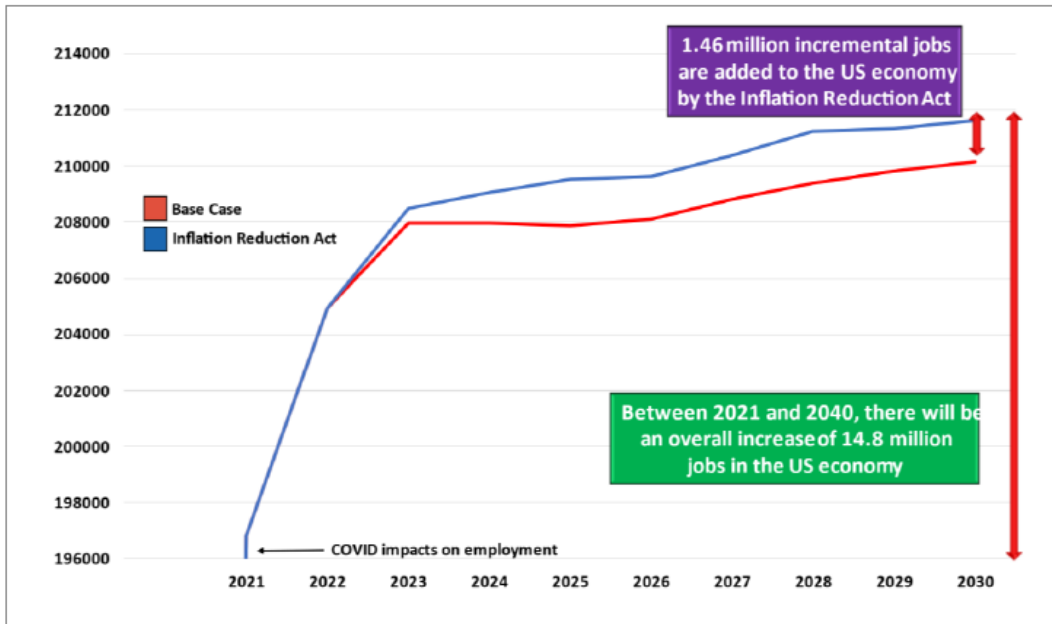
What evidence is there of a positive jobs impact at this early stage?

Research by the Energy Futures Initiative provides some reason for optimism. Already in 2019, clean energy jobs accounted for almost 50 percent of all employment in the sector – over 4 million

jobs. Looking at the impact of the IRA the EFI forecasts over 1.4m green jobs will be created above the baseline of general job creation in the economy.

Figure 7. Job creation from the IFR.

Figure 2: Job Creation from the Inflation Reduction Act, 2021-2030



Source: EFI, 2023

In 2022, boosted by policy action, clean energy job growth ran above 3 percent, double that of payroll growth. Importantly these green collar jobs pay between 8-19 percent more than other comparable jobs. Furthermore research suggests 45 percent of clean energy production jobs only require a high school diploma, while earning higher wages than similarly educated peers in other industries (Muro et al. 2019)(Brookings, 2019).

These new jobs appear to be skilled better paying, and available to many more workers, immediately, or once retrained (on the job, or at community colleges). Green collar jobs are not concentrated on the East or West Coast. The work needs to be done across the country in blue and (even more often) red states. A clean energy boom is underway. IMF research finds that 72 percent of commuting workers from pollution intensive jobs also live in areas that are rich in new green jobs (IMF, 2022). Thus an unemployed person in West Virginia may be able access jobs in battery and green tech in their region and state. This job boom does not benefit tech bros and app designers in Silicon Valley. It is instead resulting in job creation across the country, and in poorer, redder, states.

Looked at in the short-medium- or long-term, fossil fuel jobs are falling in number decline. Green energy jobs will soon predominate. Investment in the renewables sector is already now outpacing fossil fuels (at \$1.7tr versus \$1tr). The future is green not brown.⁵ New green jobs is good news, but what about actual GHG reductions?

5.2 Possible GHG Reductions

With many projects still on paper and not yet built and operating, here too the full effects of the IRA and other incentive changes are hard to see just yet. But the evidence of altered markets is visible as the shifts are underway among firms, and across communities. Government forecasts are also positive.

EPA models suggest implementation of the IRA will have significant impact on the power sector. They forecast a lowering economy-wide CO₂ emissions by between 35 to 43 percent below 2005 levels in 2030. CO₂ emissions reductions from the electric power sector are estimated to be between 49 and 83 percent below 2005 levels in 2030. EPA also finds that CO₂ emissions in all end-use sectors is also projected to decline.

Congressional researchers have drawn similar conclusions from modelling IRA could reduce U.S. GHG emissions by 32% to 40% by 2030 compared to 2005 levels.⁶ Private sector analysts agree. The IRA is the real deal. Rhodium Group calls it ‘a turning point for US climate progress’ producing estimates in line with the CRS.⁷

The consensus from modelers is that this paradigm shift from this green place based industrial strategy will indeed result in real reductions in GHG emissions in the US. The U.S., the world’s largest per capita GHG producer, and the largest contributor to the stock of GHG around the globe, will meaningfully reduction GHG emissions, contribute to climate change commitments and goals nationally, and internationally. With the US on board and committed, what was impossible becomes potentially possible.

5.4 A Green Reindustrialization and Digitization

The US adoption of a modern industrial strategy is policy design and implementation in action. It contains bipartisan support for elements of the construct and design. This is the embedding of

⁵ IEA. (2023). ‘Clean energy investment is extending its lead over fossil fuels, boosted by energy security strengths.’

⁶ Congressional Research Service. (2022). ‘Inflation Reduction Act of 2022 (IRA): Provisions Related to Climate Change.’ October 3. Available online: R47262 (congress.gov). Accessed September 27, 2023.

⁷ Rhodium Group. (2022). ‘A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act.’ August 12. Available online: A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act | Rhodium Group (rhg.com) Accessed September 27, 2023.

economic, infrastructure, technology, climate change, and security and resilience policy implementation goals across agencies, sectors, markets, communities, cities, and towns.

A green reindustrialization is underway in the US . We find it constitutes a paradigm shift in the nature and shape of America’s industrial strategy and policy. It amounts to a reseeded and renewing of globalization in a new shape. The scale of this American modern industrial strategy is one unprecedented in peacetime. The revenues for the policies dwarf those committed by previous administrations.

The US is no longer a bystander, a naysayer, as we experience the terrible effects of climate change upon our daily lives. By aligning industrial and climate change goals across government and within national security policy priorities greenhouse gas reduction strategies, incentives, options, regulations, and implementation plans cease to be ‘add-ons’ and have become part of the ongoing policy dialogue and annual targets.

Section 6. Challenges

6.1 Competing Pathways: IRA and Buy America Upsets Allies, Enrages Competitors

Place-based requirements are embedded across CHIPS and IIJA and the IRA and Biden’s green transition. His industrial strategy is US-centric. As this became clear complaints from allies mounted that these provisions distorted trade and punished friends. The complainers were not wrong. Early evidence does suggest that the scale of US incentives across many sectors and technologies is causing some firms to redirect toward the US and away from other targets for green capex including the UK and EU

In response European and other allies have ramped up their own industrial policy usage, changing rules, incentives, and standards to in part mitigate these effects. The European Union has led this charge (Politico, 2023). The EU leads the way, in legally binding commitments including the *Fit for 55* plan. EU law requires the EU to reduce EU emissions by at least 55 percent by 2030 as a legal obligation (EU Commission, 2023). The EU has also enacted policies that collectively compose a Green New Deal, including funding mechanisms, a carbon border tax, and numerous other levers. Other states have announced similar incentive plans and policies, such as the massive Chinese net-zero 2030/2060 plan and policies, or Japan’s series of policy shifts on industrial policy goals. As the domestic US success of the IRA is the continuing focus of the Biden administration as it seeks to achieve its national climate change goals and hit its commitments, allies now recognize there will be no roll back of these provisions. Diplomacy and policy options are being adjusted accordingly.

6.2 Can Industrial and Green Transition Policies Be Deconstructed?

Looking ahead even if the Republicans take back control of the presidency in 2024 the extent to which there would be a wholesale zeroing out of CHIPS, IJJA and IRA industrial policy incentive programs is unclear. Why? Because these policies are rapidly becoming facts on the ground. Better jobs for workers without college degrees. Investment commitments with local backing and support. Krugman suggests that this is part of the reason why firms have moved fast and invested heavily in red states: to help alter the political and economic calculus (Krugman, 2023). Perhaps Krugman is right. Republicans in the heartland may not be seeing red over green policies for much longer, as local leaders rush to be a part of the transition, from Kansas, to Texas, to West Virginia, to Wyoming (NREL, 2023). Deep red states are set to benefit much more monetarily than blue states (Bloomberg, 2023). This is not a coincidence: the spending lean towards red states has been planned by the White House and is championed; they want to change the conversation and narrative to jobs and economics and they may yet succeed.

In the place of the prior neoliberal globalization, we have the rise of competing national and regional industrial strategies. The US versus China. China versus the US. Europe defending its prerogatives and firms. Japan and others engaging in similar moves. Other advanced economy states, where industrial policy incentives can be afforded have sought to take similar, although generally less generous steps. This type of costly industrial policy is a rich leaders' game, too rich for most states.

6.3 Industrial Policy Downsides and Spillovers

As has already been observed, the neoliberal critique of industrial policies' effectiveness has weakened, it has waned as an influential stance in the US, and in other advanced economies, some responding to the US move, and others already committed to national champions and industrial strategies and economic levers.

Nonetheless there are troubling spillover effects from the industrial policies, particularly on emerging and the low-income economies, who are struggling to secure funding in a world awash with incentives for advanced economy investments.

Industrial policy is a rich nation's game. America can offer colossal carrots, drawing batter investments away from Europe. China can subsidize solar PV and wind, to shift markets at home and abroad with massive price cuts and supply of technology, built upon huge reserves of capital and rare earth elements.

Low-income and poor states do not have this option and thus can be adversely impacted: They cannot compete or offer such incentives. The impacts are worrisome and potentially damaging. For instance, of the estimated \$1.8tr in renewables investment tallied by the IEA, only a measly 2 percent of that investment flow has gone to lower income countries in Africa and elsewhere. Thus,

an industrial policy that may deliver for Americans, may disincentivize essential investments elsewhere.

6.4 Waiting for a Just Transition

Lower income states were promised \$100bn per annum at the Paris COP to help support and finance transition. In 2023 that number has still not been reached: A sad testament to the G20 nation's unwillingness to follow-through on longstanding commitments. Countries severely affected by climate change and least able to finance adaption, mitigation, and the green industrialization needed for the transition, lack the funds to do so.

COP27's creation of an unfunded Loss Damage Fund simply underscores promises are easy, but delivery is still hard. Advanced economy polluters are loathe to pay the GHG pollution bill they have run up. They can afford to – look at the huge COVID expenditures (at approximately 25 percent of GDP in many states – for their own electoral and political economy reasons, they refuse to pay the check.

Issues around the essential need for a just transition are massive and continue to grow. If the US, Europe, China, Japan and other advanced economies want lower-income countries to pay more for carbon, to finance the transition, to go directly to green without passing through brown industrialization, they need to finance and support the shift. They have yet to do so.

As the South Africa Reserve Bank governor Kganyago observed in Morocco, failure to fund the transition, will result in voters in those states opposing the increased costs that comes with early phases of the transition and green industrialization. Addressing the merits and components of a just transition cannot be done in this brief article; but it looms over issues around industrial policy spillovers, and paltry green financial flows.

6.5 Can we 'De-risk'?

Confronted by a relative lack of funds to address the transition and industrial policy challenges faced in lower income states the IMF, World Bank, aim to 'de-risk' green investments: i.e., provide increased funding and mechanisms to support and cut the risk premium on green transition investment. These steps may prove useful. Private investors repeatedly state they want to invest but need MBD backing and project development support to ensure they can bear the risks. It is too soon to see if this will close part of the large green funding gap in lower-income countries. If history is any guide, such multilateral these moves will fall short, except in states where macro stability, market transparency, and governance norms are already firmly rooted, such as Morocco, Botswana, Costa Rica, for instance.

Section 7. Potential Improvements

7.1 On Missing Mechanisms, Progress, and Penalties

America's reliance almost entirely on giant incentive carrots needs eventually to be matched with modest sized, and then gradually bigger and bigger sticks. To take the next step change, to further accelerate the speed of adoption, and alter GHG emissions outcomes even more rapidly than at present (a demand made by IPCC, the UN, and the IEA, among many others) will require both – it is the combination of the two that forces an even more dramatic and permanent shifts in decisions, behaviors, and GHG outcomes.

The following brief sections identify a few missing policy levers that the Biden Administration should consider using to complement their incentives heavy industrial policy and speed the green transition. These include permitting reforms; carbon taxes and pricing; emissions trading schemes; and a new use for carbon border adjustment mechanism revenues.

7.2 On Permitting and Regulation

Take the example of Washington DC. The city has the most generous state tax credits for solar installation for homeowners. This has resulted in swift uptake of solar panels. However, the impact is leveraged and multiplied by legally binding Building Energy Performance Standards (BEPS). These are requirements for all facilities over 25,000SF to put in place a GHG reduction plan, agreed by the municipality under which they (hospitals, universities, office blocks, condo developments all are covered) must lower their energy consumption and GHG emissions progressively, annually to achieve 50 percent reductions by 2032. Failure to have plans in place and operating by a specific date means escalating fines of up to \$7.5m per facility (DC BEPS, 2023). The strict BEPS requirements have changed the calculus entirely for all large property owners in the city. They must reduce GHG emissions, plan it, and deliver, or be fined. Now the race is on across the city to go green fast. This is why DC is viewed as the greenest city in the US in 2023. This example shows that incentives matter, and work. But incentives coupled to financial penalties work even better.

On permitting and regulation, the Biden Administration understands how important local regulations are. When used effectively, like the DC case, they change the business reality. When used as roadblocks they may stymie action. How much the Federal government can do on local permitting and NMBY-ism is less clear. With such large sums at stake in the CHIPS, IJJA, IRA not only are the opportunities massive but so are the dangers of fraud, greenwashing, and market manipulation. IN many cases states and localities may resist change and slow adoption. What is possible and underway in DC, may be opposed and stopped in Texas or Louisiana. Often local trumps national in building regulations and oversight.

7.3 On Carbon Taxes and Pricing

US politicians are extremely leery of tax increases, remembering the fate of President George H.W. Bush after he reversed himself and broke his ‘Read my lips no new taxes’ pledge. The right uses taxes as a cudgel on their opponents, cutting taxes when possible, knowing the likelihood of raising them again is very low. The left runs scared, assuming almost any fee increases, especially for energy, will result in electoral defeat. Nonetheless carbon pricing and carbon taxes are needed to shift decisions and outcomes. Such pricing need not be electorally suicidal.

Canada levies a gradually rising carbon tax rising from CAD\$20 to \$170 by 2030 (Canada.ca 2023). The passage of the carbon tax was neither electorally catastrophic nor economically damaging. With a gradual understood upward glidepath actors and consumers can plan how to react.

Sweden has led on carbon taxes enacted the world’s first carbon tax in the 1970s and now has among the highest carbon price in the world – at 122 Euros per tonne in 2023 (government.se. 2023). This plan has propelled Sweden to the front of the green economy, slashed emissions, and helped create an increasingly circular economy of firms operating within new limits, of the kind we all must apply, eventually.

Could President Biden – assuming he secures a second term – enact a carbon tax? Perhaps. He could consider levying a gradually rising carbon tax on utilities, and so get benefits of scale and impact, while avoiding the cost being applied directly upon consumers at the gas pump. If he chose that path, he should rebate some of the revenues to those poorer voters most burdened by associated price rises. However, if as is likely, Biden’s advisors balk at selling a carbon tax in a split country, a national carbon trading scheme should be pursued.

7.4 On Emissions Trading

Emissions Trading should be an important part of climate policy and is missing at the national level in the US. This is sadly ironic since US policymakers implemented the most effective ETS first: The SO₂ market designed to slash acid rain. It was a huge success slashing acids rain in a decade. This was held up as the poster child for ETS design. And it was. Yet the US has failed to create a national ETS since then, due to political opposition from the right and among polluting utilities.

Today only California and the Regional Greenhouse Gas Initiative (RGGI), a scheme for 5 states in the North-East operate in the US. California’s ETS has an average price of carbon credits at \$30 per ton, and series of allowances, credits, and regulated auctions (CARB, 2023). California rebates a significant proportion of revenues to poorer consumers. Prices are higher, but the scheme has shifted utility strategies, and lowered GHG emissions. California operates a cap-and-trade system,

with an average price of carbon credits at \$30 per ton, and series of allowances, credits, and regulated auctions (CARB, 2023). The RGGI operates on a similar design as California, which levies an emissions price of \$13.85 per short ton at the last auction, double the price of three years ago, but still very low comparatively (RGGI.org). The RGGI provided net revenues of almost \$5bn. In-state electricity GHG emissions fell by 36 percent from 2005 and 2012, and between 2012 and 2018, by a further 20 percent (CRS. 2019).

The today EU operates the largest ETS globally with emissions permits prices selling at 80 Euros per tonne in September 2023, down from a recent peak of nearly 100 euros at the start of the year.⁸ After a disappointing performance in the early years, with too many allowances, market manipulation, and poor regulation, the EU ETS is now the global leader in ETS operation, price levels, and supervision. Overall GHG reductions have been real: Researchers found that the EU ETS, which initially regulated roughly half of EU carbon emissions from energy production and large industrial polluters, saved more than 1 billion tons of CO₂ between 2008 and 2016. This translates to reductions of 3.8 percent of total EU-wide emissions. Thus the EU ETS impact is quantifiable and meaningful (Bayer et Aklin 2020).

The Biden Administration should consider building on the historic example of the successful US SO₂ market, learn from California and RGGI schemes, and from the success and failures of the EU ETS. A US ETS could complement the Biden industrial strategy carrots with transparently operating, effectively overseen, progressively rising carbon prices, realized through public auctions. These markets work: they are manageable; they further incentivize utilities to plan for net-zero goals and progressive GHG reductions; they reward those engaged in the transition and punish the firms that lag; and they allow a markets and investors to operate, internalize costs of carbon, supporting achievement of national climate goals.

7.5 On a Carbon Border Adjustment Mechanism

The European Union is enacting a Carbon Border Adjustment Mechanism (CBAM) designed to charge tariffs on polluting imports from overseas exports in certain sectors (such as steel and cement). This is a reasonable and understandable move. Why should modernizing greening steel producers in Europe be undercut by polluting subsidized producers in China or India?

The Biden administration should support this approach and work with European and NAFTA partners to ensure the mechanisms, methodology and application are the same across in both regions. There will be complaints. But Chinese policymakers admit (privately) they view the CBAM as forcing their own industry to modernize, while pushing the polluters to change or close; an external pressure which is not negative.

⁸ Ember. (2023). 'The price of emissions allowances in the EU and UK.' Available online: <https://ember-climate.org/data/data-tools/carbon-price-viewer/> Accessed on September 27, 2023.

CBAM revenue flows, which may be significant in the short and medium term, i.e., until we are much closer to net-zero and headed towards net negative pathways, should not just be swallowed up by domestic spending demands in the advanced economies.

We proposed that regional and national CBAM revenue streams should be used to finance the green transition in low-income states. What do we mean? The revenues should be diverted to MDBs and used (with leverage) to support much expanded de-risking, market reforms, project development, identification, and securitization.

Section 8. Conclusion: Tipping Points, Paradigm Shifts and a Hot House Future

In the context of the experimental governance framework, the significance of our study extends beyond the immediate scope of our research and holds substantial implications for the broader global community. This framework, adapted for industrial policy, offers a model that can be instrumental for countries and regions around the world grappling with similar challenges in economic development and industrialization.

The experimental governance framework is inherently adaptable, making it relevant for a wide range of economic and political contexts. Different countries and regions can tailor this approach to suit their unique industrial landscapes, resource endowments, and socio-economic conditions. This adaptability is crucial in a world where economic and industrial challenges vary significantly across different geographies.

The framework encourages localized experimentation in industrial policy, which can lead to a rich repository of case studies and best practices. These localized experiments become valuable sources of learning for other regions and countries. By observing and analyzing the successes and failures of various policy experiments, policymakers worldwide can gain insights into effective strategies and avoid potential pitfalls.

The U.S. has traditionally leveraged a mix of top-down and market-driven approaches to industrial policy. The experimental governance framework suggests a paradigm shift towards more collaborative, decentralized, and adaptive policymaking. This shift is crucial for addressing contemporary challenges such as the need for sustainable development, the integration of advanced technologies in various industries, and the re-skilling of the workforce in the face of automation. A more dynamic approach to policymaking can help the U.S. maintain its competitive edge while addressing socio-economic disparities. The U.S., as a major contributor to global emissions and a leader in technological innovation, has a critical role in shaping a sustainable industrial future. The experimental governance framework encourages policies that not only drive economic growth but also prioritize environmental sustainability. This is particularly relevant as the U.S. confronts the impacts of climate change and transitions towards a greener economy. Policies that support renewable energy, sustainable manufacturing practices, and green infrastructure are integral to this approach. The U.S.'s position as a global economic leader means that its industrial policies can

have far-reaching effects. By adopting an experimental governance approach, the U.S. can lead by example, demonstrating how innovative, adaptive policies can drive industrial growth while addressing global challenges like climate change and economic inequality. Furthermore, the U.S. can play a pivotal role in international knowledge sharing, contributing to and learning from industrial policy experiments conducted worldwide.

In conclusion, the relevance of our study, framed within the experimental governance framework for industrial policy, extends far beyond its immediate context. It offers a versatile, collaborative, and learning-oriented approach that can inform and enhance industrial policymaking globally. By sharing our findings and insights, we contribute to a collective understanding and capability to craft more effective, sustainable, and responsive industrial policies in an increasingly interconnected world.

References

- Amsden, Alice H. 1992. *Asia's Next Giant: South Korea and Late Industrialization*. Oxford, New York: Oxford University Press.
- Autor, David H, David Dorn, et Gordon H Hanson. 2016. « The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade ». *NBER Working Paper 21906*. <http://www.nber.org/papers/w21906>.
- Bayer, Patrick, et Michaël Aklin. 2020. « The European Union Emissions Trading System Reduced CO2 Emissions despite Low Prices ». *Proceedings of the National Academy of Sciences of the United States of America* 117 (16): 8804-12. <https://doi.org/10.1073/pnas.1918128117>.
- Burbacky, Ondrej, Julia Dragon, et Nikolaus Lehmann. 2022. « The semiconductor decade: A trillion-dollar industry | McKinsey ». 2022. <https://www.mckinsey.com/industries/semiconductors/our-insights/the-semiconductor-decade-a-trillion-dollar-industry>.
- Goldman Sachs. 2023. « Is the Inflation Reduction Act a Game Changer for Reaching Net Zero? » Goldman Sachs. 3 novembre 2023. <https://www.goldmansachs.com/intelligence/pages/is-the-inflation-reduction-act-a-game-changer-for-reaching-net-zero.html>.
- Hausmann, Ricardo, et Dani Rodrik. 2003. « Economic development as self-discovery ». *Journal of Development Economics*, 14th Inter-American Seminar on Economics, 72 (2): 603-33. [https://doi.org/10.1016/S0304-3878\(03\)00124-X](https://doi.org/10.1016/S0304-3878(03)00124-X).
- Hochschild, Arlie Russell. 2018. *Strangers in Their Own Land*. The New Press. <https://thenewpress.com/books/strangers-their-own-land>.
- Juhász, Réka, Nathan J Lane, et Dani Rodrik. 2023. *The New Economics of Industrial Policy*. Cambridge. <https://doi.org/10.3386/w31538>.
- Krugman, Paul. 2023. « Globalization and Industrial Policy ». Apple Podcasts. 2023. <https://podcasts.apple.com/gb/podcast/30-30-vision/id1675120781>.
- Lashkaripour, Ahmad, et Volodymyr Lugovskyy. 2023. « Profits, Scale Economies, and the Gains from Trade and Industrial Policy ». *American Economic Review* 113 (10): 2759-2808. <https://doi.org/10.1257/aer.20210419>.
- Lieven, Anatol. 2020. *Climate Change and the Nation State: The Case for Nationalism in a Warming World*. Oxford, New York: Oxford University Press.
- Muro, Mark. 2023. « Biden's Big Bet on Place-Based Industrial Policy ». Brookings. 2023. <https://www.brookings.edu/articles/bidens-big-bet-on-place-based-industrial-policy/>.
- Muro, Mark, Adie Tomer, Shivaram, et Joseph W. Kane. 2019. « Advancing Inclusion through Clean Energy Jobs ». Brookings. 2019. <https://www.brookings.edu/articles/advancing-inclusion-through-clean-energy-jobs/>.
- Rexaline, Shanthi. 2023. « What A \$1,000 Nvidia Stock Investment At IPO 24 Years Ago Would Be Worth Now - NVIDIA (NASDAQ:NVDA) ». Benzinga. 2023. <https://www.benzinga.com/analyst-ratings/analyst-color/23/05/32502246/nvidia-stocks-24-year-journey-what-a-1-000-investment-during-ipo-would-be-worth-now>.
- Rodrik, Dani. 2004. « Industrial Policy for the Twenty-First Century ». *CEPR Discussion Papers*, CEPR Discussion Papers, , novembre. <https://ideas.repec.org/p/cpr/ceprdp/4767.html>.

- Summers, Lawrence. 2013. « Why stagnation might prove to be the new normal ». *Financial Times*, 15 décembre 2013, sect. Financial Times. <https://www.ft.com/content/87cb15ea-5d1a-11e3-a558-00144feabdc0>.
- Tomer, Adie, Caroline George, et Jane W. Kane. s. d. « The Start of America's Infrastructure Decade: How Macroeconomic Factors May Shape Local Strategies ». Brookings. Consulté le 16 novembre 2023. <https://www.brookings.edu/articles/the-start-of-americas-infrastructure-decade-how-macroeconomic-factors-may-shape-local-strategies/>.
- Wade, Robert. 2003. *Governing the Market*. <https://press.princeton.edu/books/paperback/9780691117294/governing-the-market>.
- Warwick, Ken. 2013. « Beyond Industrial Policy: Emerging Issues and New Trends ». Paris: OECD. <https://doi.org/10.1787/5k4869clw0xp-en>.