

***Testimony before the U.S.-China Economic and Security Review Commission
Hearing on “Made in China 2025 – Who Is Winning?”***

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Members of the Commission, thank you for the opportunity to provide you with my testimony.

Manufacturing is China’s key strategic advantage over the United States and its allies, a reality that remains underappreciated in Washington. Over four decades, as America’s industrial base withered, the People’s Republic of China (PRC) built unmatched manufacturing capacity that spans the entire value chain at massive scale. This positions it to outmatch the United States in wartime production during a protracted conflict. It also gives it significant leverage in the emerging industrial revolution, where AI is transforming physical industry. This is happening even as China experiences an enduring economic slowdown. Industrial might now lies at the heart of Beijing’s challenge to American power.

China’s Rise as a Manufacturing Superpower

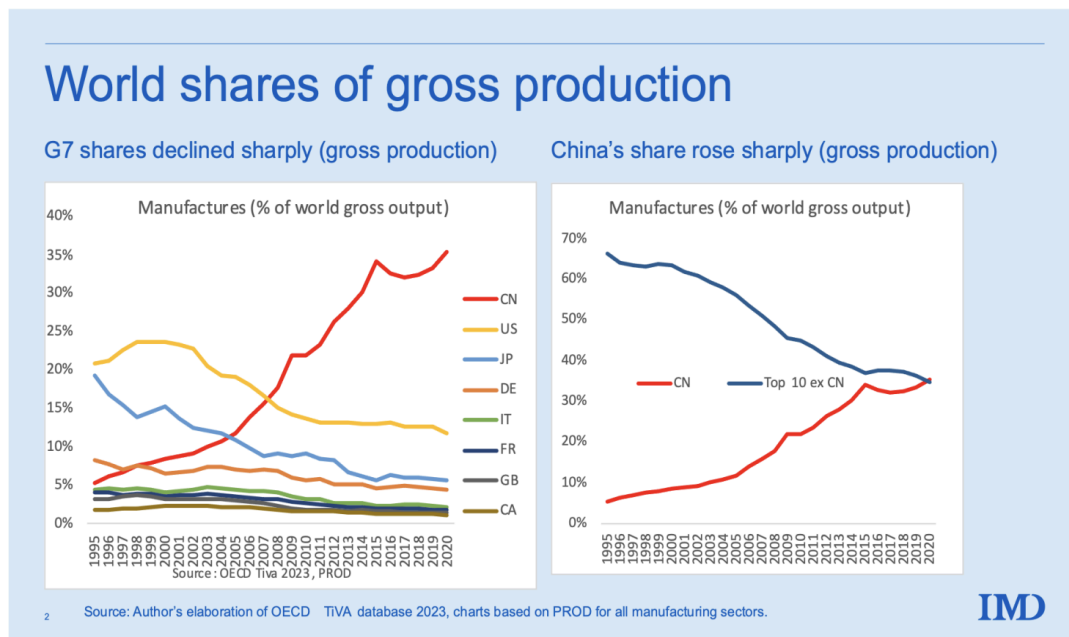
The PRC’s techno-economic strategy represents one of the most systematic and ambitious efforts in modern history to reshape the distribution of global economic, technological, and military power. The PRC’s rise to global manufacturing dominance occurred at an unusually rapid pace by historical standards. While the United States took nearly a century to surpass British manufacturing before World War I, China’s ascendance has been meteoric. In 2001, the PRC accounted for roughly nine percent of global gross manufacturing output. By 2020 it accounted for 35 percent, with gross output nearly three times that of the United States (12 percent), six times that of Japan (6 percent), and nine times that of Germany (4 percent).¹ This dominance extends across both traditional and advanced sectors. China has evolved from primarily producing textiles and clothing in 1995 to becoming the leader in electronics, basic and fabricated metal products, and chemicals and pharmaceuticals by 2020.² Meanwhile, over the past four decades, America’s share of global high-tech manufacturing has fallen from 40 percent to 18 percent.³

¹ Richard Baldwin, “[China is the world’s sole manufacturing superpower: A line sketch of the rise](#),” VoxEU (2024).

² Ibid.

³ Brady Helwig, Addis Goldman et al, “[National Action Plan for United States Leadership in Advanced Manufacturing](#),” SCSP (2024).

China is translating its scale advantages into innovation power: control over manufacturing processes shapes how technologies evolve, which innovations can scale, and who can access critical capabilities. For the United States, this represents a fundamental shift, as our own economic output is now heavily dependent on industrial capacity controlled by our primary strategic rival.



Graphic Source: Richard Baldwin, “[China Is the World’s Sole Manufacturing Superpower: A Line Sketch of the Rise.](#)” VoxEU (2024)

Manufacturing in PRC Strategy

Manufacturing has always been central to the PRC’s national strategy, a fact reaffirmed in recent Chinese policy guidance highlighting manufacturing as “the main battlefield” for leading the next industrial revolution.⁴ Made in China 2025 (MIC 2025), launched in 2015, captured significant attention in Washington because it set explicit goals for capturing domestic and global market share in strategic sectors. But it is only the tip of a broader and more deeply entrenched strategic approach spanning decades and many strategies, policies, and Five Year Plans. An early but noteworthy example is the 2006 Medium and Long-Term Plan for Science and Technology Development, a critical marker in the CCP’s emphasis on indigenous innovation.⁵

⁴ “[Implementation Opinions of Seven Ministries Including the Ministry of Industry and Information Technology on Promoting the Innovative Development of Future Industries.](#)” CSET translation (2024).

⁵ I address these PRC plans and strategies further in my 2023 testimony to the Select Committee on the CCP [here](#).

The CCP's plans are not static; Beijing regularly takes stock of emerging technologies with potentially strategic characteristics and updates its priorities accordingly. The 2024 Implementation Opinions on Promoting the Innovative Development of Future Industries, for example, targets cutting-edge technologies such as biomanufacturing, brain-inspired technologies, nuclear fusion, and quantum computing. Manufacturing is a through line, emphasized as crucial for capturing the transformational potential of all these technologies.⁶

PRC industrial strategies and policy documents reflect Xi Jinping's directive to “actively seize the commanding heights of technological competition,”⁷ representing a long-term vision for achieving techno-economic supremacy. While not all Chinese initiatives succeed, the robotics sector – one of ten key areas identified in MIC 2025 – demonstrates remarkable progress. Under the Robotics Industry Development Plan (2016-2020), China not only met but vastly exceeded its production target of 150,000 industrial robots annually, reaching 237,000 units by 2020 and 363,000 in 2021.⁸ The country has made significant progress toward reducing its historical dependence on imported robots – Chinese firms met more than half of domestic demand in early 2024. By 2023, China was deploying more industrial robots than the rest of the world combined⁹ and today is positioning itself to wipe out foreign competition as it has done previously in sectors like electric vehicles and solar panels.¹⁰

This robotics push serves dual strategic purposes. Domestically, it helps offset China's demographic challenges, as the country's working-age population has declined by 14 million since 2016, threatening labor-intensive manufacturing. Internationally, it advances China's aim to dominate global supply chains. The 2016 Chinese takeover of German robotics giant Kuka served as an early warning of these ambitions. While it prompted stricter investment screening in Western nations, it failed to catalyze a comprehensive strategic response from the United States and its allies. Today, American technologists and venture capitalists are excited about robotics, but it is not a significant focus for U.S. policymakers. Without intervention, the United States is on track for its robotics sector to become heavily dependent on Chinese components.

The CCP's technology plans are inherently dual-use and support the party's broader national objectives. The Military-Civil Fusion (MCF) strategy, designed to erase boundaries between military and civilian sectors and enshrined in PRC law, illustrates this.¹¹ MCF has evolved to focus on building what Chinese strategists call an “integrated national strategic system and

⁶ [“Implementation Opinions of Seven Ministries Including the Ministry of Industry and Information Technology on Promoting the Innovative Development of Future Industries,”](#) CSET translation (2024).

⁷ Xi Jinping, [“Strive to Become the World's Primary Center for Science and High Ground for Innovation,”](#) March 18, 2021; translation by DigiChina.

⁸ Angela Shen and Lily Ottinger, [“China's Leap into Robotics for Industry,”](#) China Talk (2024).

⁹ Robert D. Atkinson, [“China Is Rapidly Becoming a Leading Innovator in Advanced Industries,”](#) ITIF (2024).

¹⁰ Erik Britton, [“China is Waving in the Robots,”](#) Fathom Financial Consulting (2024)

¹¹ The National Defense Law (revised 2020) Article 34 stipulates that “science, technology, and industry for national defense shall follow the principles of civil-military integration, peacetime-wartime integration, priority to military products, and innovation-driven, independent, and controllable development.”

<https://web.archive.org/web/20250130000133/http://www.mod.gov.cn/gfbw/fgwx/flfg/4876050.html>

capabilities”¹² – an overarching framework designed to harness all state and societal resources to achieve the CCP’s ultimate goal to make China the “global leader in terms of comprehensive national power and international influence.”¹³ The CCP viewed its COVID-19 response as a successful test of this system, with the pandemic enabling the party to implement and retain new forms of social control – from community-based surveillance to militarized robots – that blur the lines between wartime and peacetime governance. Party leaders celebrated whole-of-nation, pandemic-era mobilization efforts as validating their “People’s War” approach to crisis management, while using it to advance their broader narrative of governance superiority.¹⁴

The party’s newest focus is on dominating not just production but also the tools of production themselves – the base layer of machines, materials, and systems that determine who can manufacture and who cannot and who reaps the benefits of innovation. Control over the tools of production will grant Beijing still greater power over the future of production.

Tactics: Brute Force Economics

For years, U.S. policymakers, myself included, have grappled with Beijing’s complex fusion of industrial strategy and predatory practices. What makes this a particularly vexing policy challenge is how the CCP blends legitimate competition with unfair and even ruthless tactics. This combination has often stymied American policymakers, whose natural tendency to respect worthy competitors makes them hesitant to confront even obvious predation or take actions that could be perceived as trying to slow China down.

To capture the unique features of this challenge, I coined the term “brute force economics” as an analytic frame to sum up “the aggressive, evolving, and often opaque web of policies and tactics that Beijing employs to give its national champions—corporations acting to advance government policy—an advantage and seize a dominant global market share in strategic sectors.”¹⁵ Brute force economics shares characteristics of garden-variety mercantilism and industrial policy used by many nations, but is distinguished by three characteristics:

- **Force:** Beijing can marshal the full force of the party-state apparatus – including military, intelligence, and diplomatic actors; state-owned enterprises, and private sector entities, universities, and military and intelligence capabilities – toward strategic

¹² Liza Tobin, Addis Goldman and Katie Kurata, “[Beyond Fusion: Preparing for Systems Rivalry](#),” War on the Rocks (2024).

¹³ Xi Jinping, Work Report to the 19th Party Congress, October 18, 2017, in *The Governance of China*, volume 3.

¹⁴ Liza Tobin, Addis Goldman and Katie Kurata, “[Beyond Fusion: Preparing for Systems Rivalry](#),” War on the Rocks (2024).

¹⁵ Liza Tobin, “[China’s Brute Force Economics: Waking Up from the Dream of a Level Playing Field](#),” TNSR (2022).

objectives.¹⁶ Xi Jinping has touted this feature, saying, “Our greatest advantage is that our country's socialist system can concentrate resources to accomplish great undertakings.”¹⁷

- **Scale:** As the world’s second-largest economy, China wields two powerful tools: a market that other nations can’t ignore, and massive resources for industrial policy. In 2022, Beijing’s \$248 billion in industrial policy spending dwarfed comparable U.S. and European efforts.¹⁸
- **Ruthlessness:** Beijing approaches economic competition as a zero-sum game, targeting smaller countries with economic coercion, and has consistently fallen short of fulfilling its international commitments. While U.S. officials have invested extensive time negotiating joint statements, frameworks, trade agreements, and other bilateral accords across various domains of mutual interest, the PRC’s track record of implementation ranges from poor to theoretical.

In sum, China’s brute force economics distorts activities that are usually thought of as positive sum – trade and technology cooperation – and turns them into zero-sum games. The United States and its allies need to abandon the notion that competing on a level playing field with China’s state-led economy is possible and build policies that account for this unfortunate reality.

Future Prospects

Beijing’s decades-long pursuit of technological self-reliance has yielded significant results, with the PRC surpassing the United States in areas such as 5G, hypersonics, minerals processing, and EVs, and establishing a lead in 6G development with more patents than the United States. It is making fast progress in other areas such as AI and biotechnology.¹⁹

The Party is determined to lead the fourth industrial revolution, but faces new headwinds: China’s success thus far has depended on strong economic growth and access to foreign technology, expertise, and capital—resources that are becoming increasingly constrained as democracies restrict access and China’s economy enters a structural slowdown. Traditional growth drivers like real estate and infrastructure are waning, while demographic pressures mount.

¹⁶ For a case study, see, e.g. “[TikTok: A Threat to National Security](#),” Jamestown Foundation (2024).

¹⁷ The phrase is 我们最大的优势是我国社会主义制度能够集中力量办大事. Xi Jinping, “The Distinctive Advantage of Being Able to Concentrate Resources to Accomplish Great Undertakings,” www.cpcnews.cn, May 15, 2020.

¹⁸ Liza Tobin, “[China’s brute force economics: Waking Up from the Dream of a Level Playing Field](#),” TNSR (2022).

¹⁹ For assessments of U.S. vs. PRC leadership in key technologies, see David Lin et al, “[Mind the Gaps](#),” SCSP (2024), and Robert D. Atkinson, “[China Is Rapidly Becoming a Leading Innovator in Advanced Industries](#),” ITIF (2024).

Policymakers in Washington and allied capitals would be unwise to assume that China's slowing economy diminishes the urgency of a strong response. Beijing's capacity to pursue its military and technological ambitions should not be underestimated. Even with reduced growth, the world's second-largest economy can still direct massive resources toward strategic objectives, achieving dominance in targeted sectors even amid broader economic challenges. While decoupling must over time constrain Beijing's ability to pursue its ambitions, timing is uncertain and China's technological capabilities and industrial base may have already reached a critical mass to outpace the United States across a growing array of sectors. This evolving reality demands close attention from policymakers and analysts—particularly to China's transition from “fast follower” to “peer competitor” and “leader” in key technologies, the CCP's assessment of its comprehensive national power relative to the United States, and how these shifting dynamics could shape its strategic behavior and willingness to take provocative action. Understanding these trends will be crucial for democracies to maintain a technological edge and shape a future that advances both innovation and freedom.

Implications for the United States and Its Allies

The Arsenal of Autocracy has eclipsed America's Arsenal of Democracy. This creates two urgent challenges for our industrial base:

- **Wartime Production:** We are unprepared to sustain a prolonged conflict with our primary strategic rival. The U.S. defense industrial base now depends on a potential adversary for critical inputs, from rare earth minerals to advanced electronics and even the energetic materials used in explosives for weapons.²⁰
- **The Next Industrial Revolution:** We risk losing the next industrial revolution, which is unfolding as AI converges with physical industry to transform how things are made.

But we still have a window of opportunity to turn this situation around. The convergence of two trends — an AI-driven industrial revolution that is transforming manufacturing, and decoupling from China — create a window of opportunity to rebuild American industrial might, leveraging American advantages in finance, software, disruptive innovation, and a global network of allies and partners. But this window is finite.

Policy Recommendations

The U.S.-China tech race will be won by whoever can innovate, produce, and deploy technology at scale. As code fuses with physical systems and algorithms direct assembly lines, China's control of manufacturing gives it a crucial advantage. While America leads in finance and software, China's industrial might has enabled it to surge ahead in critical emerging technologies.

²⁰ Nadia Schadow, Brady Helwig et al, “[Rocket's Red Glare: Modernizing America's Energetic Enterprise](#),” (2022).

Just as confronting a schoolyard bully’s brute force requires building your own strength, standing up to abuse, and teaming up with friends, responding to China’s brute force economics demands a comprehensive approach: rebuilding domestic industrial capabilities, countering predatory economics, and forging deeper partnerships with democratic market economies. This three-part strategy is a path to maintaining technological leadership while preserving economic freedom.

Promote

America has finally awakened to the industrial challenge, as shown by the CHIPS and Science Act of 2022. While this experiment in industrial strategy marks a vital shift, we must do far more to accelerate domestic competitiveness. Here are three specific steps to build on this momentum:

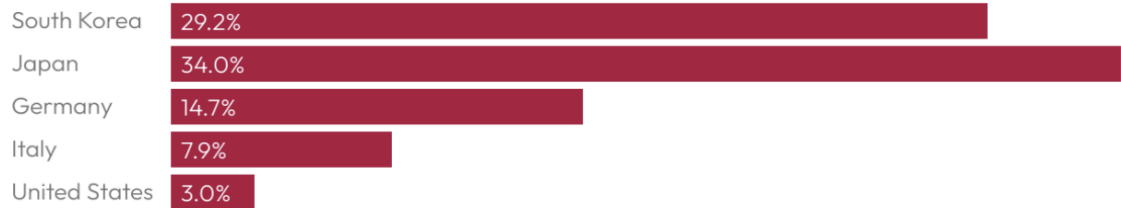
- **Finish what we’ve started:** CHIPS aimed to reverse the decline of domestic U.S. semiconductor fabrication capability and it is already starting to bear fruit. TSMC has begun production of leading-edge 4 nm chips in Arizona, and the CHIPS Act’s \$52 billion in funding has catalyzed nearly \$450 billion in private investment in semiconductors and incentivized the creation of tens of thousands of jobs.²¹ We must now ensure rigorous implementation and look beyond today’s chips to strategically direct R&D funding toward breakthrough technologies that will secure American leadership in post-silicon computing.²²
- **Reindustrialize:** Semiconductors are just the start. America needs a comprehensive approach to lead the fusion of AI with physical industry. When only 12% of U.S. factories use advanced robotics, we’re not ready for an era where software meets steel. Ninety-eight percent of U.S. manufacturers are small and medium-sized enterprises, and many of them face difficulties financing upgrades and adopting cutting-edge technologies. Moreover, U.S. government support for manufacturing is miniscule compared to other leading manufacturing nations. We need a national action plan that uses targeted government support to unlock private investment and drive widespread technology adoption, enabling efficient, localized, high-mix production.²³

²¹ “[Biden-Harris Administration Announces CHIPS Incentives Award with TSMC Arizona to Secure U.S. Leadership in Advanced Semiconductor Technology](#),” Department of Commerce (2024).

²² For specific recommendations, see Brady Helwig, “[National Action Plan for U.S. Advantage in Advanced Compute and Microelectronics](#),” SCSP (2023).

²³ For specific proposals, see Brady Helwig, Addis Goldman et al, “[National Action Plan for United States Leadership in Advanced Manufacturing](#),” SCSP (2024).

Share of Total R&D Spent on Manufacturing-Related R&D



Graphic Source: [National Action Plan for United States Leadership in Advanced Manufacturing](#),” SCSP (2024). Data is from OECD as of 2022.

- **Talent:** The numbers tell the story: there are 600,000 unfilled manufacturing jobs today, a figure projected to rise to 2.1 million by 2030.²⁴ This talent bottleneck threatens to undermine our entire industrial strategy. We need to accelerate factory automation, modernize high-skilled immigration, and dramatically expand workforce development programs. Without addressing the talent crisis, our investments in technology leadership will fall short.

Pushback

“Promote” alone is insufficient when our rival is a Leninist superstate weaponizing the world’s second-largest economy. The PRC has been sprinting since the 1980s and is now overtaking us in critical areas. The United States and its allies must both defend against brute force economics, and buy time to rebuild their own strength.

- **Export controls:** Export controls are an essential tool to maintain U.S. and allied advantage.²⁵ But they are a speed bump, not a moat, to slow China’s progress. The recent release of Chinese AI company DeepSeek’s large language model reinforces the case for doing everything we can to strengthen, protect, and leverage U.S. advantages in compute scaling. DeepSeek has made impressive strides in catching up with leading U.S. AI firms, but it did so with access to U.S. advanced semiconductors, some of which only became restricted in October 2023. If enforced, the effect of the restrictions should grow over time, given the enduring importance of computational resources to AI model development.²⁶ As DeepSeek’s CEO Liang Wenfang said, “Money has never been the problem for us. Bans on shipments of advanced chips are the problem.”²⁷

²⁴ Ibid.

²⁵ Matt Pottinger and Dario Amodei, “[Trump Can Keep America’s AI Advantage](#),” Wall Street Journal (2024).

²⁶ Dario Amodei, [On DeepSeek and Export Controls](#) (2025).

²⁷ Jordan Schneider et al, “[DeepSeek: The Quiet Giant Leading China’s AI Race](#),” *China Talk* (2024).

To strengthen the system of export controls, a few steps are required. *First*, the controls must be updated regularly to keep up with the technology they govern. *Second*, export controls only work if they are enforced. Along with a strong enforcement mandate and licensing policies, agencies need modernization and proper resourcing. They should be equipped with AI-enabled agentic systems to help humans monitor trade flows and detect potential violations; they should also work with industry to develop technological solutions to combat smuggling.²⁸ A whistleblower program, modeled after the SEC’s framework, could provide critical intelligence about violations and emerging risks. *Third*, we should accelerate the shift from a blacklist approach (which PRC companies can easily evade) to country-wide controls. This can expand on the process already underway to create a chokepoint coalition with Japan and the Netherlands to restrict PRC access to advanced semiconductor manufacturing equipment.

- **Trade Restrictions:** We need smarter trade barriers targeting the world’s leading cheater, China. This should include resourcing and stronger enforcement of existing restrictions designed to target egregious behavior by the CCP, such as the Uyghur Forced Labor Protection Act (UFLPA). UFLPA’s innovative “rebuttable presumption” principle offers a powerful model that can be applied more broadly in new rules and laws. A potential “presumption of subsidy” principle could be applied to PRC firms in strategic sectors, requiring them to prove they operate without state support before accessing lower trade barriers.²⁹ Congress should consider codifying the Commerce Department’s [ICTS authorities](#) (enabling it to restrict imports of internet-connected technologies from adversarial nations) into law, protecting it from potential executive branch reversals in the future. Commerce should consider using ICTS authorities to restrict the import of robotics components and other key components in the manufacturing base. Manufacturing is already the most cyber-attacked sector; digitalization is needed to modernize the sector, but if it is done with components subject to Beijing’s control, it will create new vectors of attack.³⁰
- **Investment:** Inbound and outbound investment restrictions should be updated to account for China’s evolving technology strategy – focusing on sectors where China is investing in, or surpassing, the U.S. but has not yet done so, like biotechnology and humanoid robotics.

Pooling

²⁸ Onni Aarne, Tim Fist and Caleb Withers, “[Secure, Governable Chips](#),” CNAS (2024)

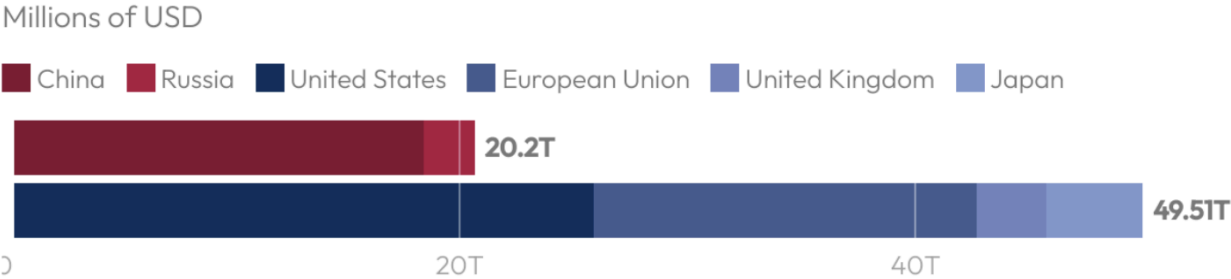
²⁹ “[Memorandum for President-Elect Trump’s Transition Team: The Economy](#),” Special Competitive Studies Project (2025)

³⁰ Additional proposals to strengthen trade protections and cyber-harden the manufacturing base can be found in the [National Action Plan for United States Leadership in Advanced Manufacturing](#),” SCSP (2024), on pp. 29-35.

America needs a new vision for trade, one that takes inspiration from the original General Agreement on Tariffs and Trade, the predecessor to the WTO: *free trade for free people, managed trade for autocracies*. While tariffs can play a role, they're just one tool in what must become a comprehensive restructuring of the international economic order.

The WTO has failed to contain China's brute force economics. It's time to build something better: a dual-track system that leverages the combined market power of democracies – more than 60% of global GDP – to overmatch the PRC's ability to weaponize its market. This means preferential treatment for trusted partners who have a track record of fulfilling commitments, while putting strict guardrails around trade with strategic rivals in order to minimize unsafe dependence and blunt PRC economic coercion. Recent initiatives that show promise include G7 coordination on PRC economic coercion, the State Department's Minerals Security Partnership, and the AI Diffusion Rule's three-tiered framework. These efforts need to be expanded.

Nominal GDP (2022)



Source: World Bank, World Development Indicators

Conclusion

The U.S. response that has unfolded since 2017 is moving in the right direction but fails to match the scale and sophistication of this challenge. What is required is reimagining how democratic market economies approach economic security: combining robust industrial renewal with modernized trade and technology protections and the creation of a new economic architecture among friendly nations with real markets. In the age of cyber-physical systems, power flows to those who control both code and steel – and nations that excel in software but lack industrial capacity face a bleak strategic reality. A comprehensive response to Beijing's industrial strategy, executed with urgency and precision, can secure America's economic vitality and strategic leadership in the decades ahead.

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