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# America Needs an Industrial Strategy for Motor Vehicles

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U.S. automotive competitiveness has severely faltered. The federal government needs a comprehensive national strategy to revitalize the industry's competitiveness, especially in the face of Chinese EVs.

## KEY TAKEAWAYS

- The motor vehicle industry is a key industry enabling American national economic power, especially against the looming threat from China.
- However, as a share of GDP, China's auto industry is 2.6 times larger than America's, while Mexico's is 7.3 times larger.
- The United States needs both a coherent, analytically based strategy and a set of policies to spur innovation and production in the sector.
- This report lays out policy proposals in five areas: cost reduction, product development, strengthened "external economies" and industry supports, increased market scale, and roadway infrastructure.
- Some of these changes can be made without significant fiscal impact.
- But an effective policy will require significant direct and tax expenditures to support industry R&D in both product and process development and adoption.
- Congress should also ban both Chinese motor vehicle imports and Chinee vehicle production in the United States.

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## INTRODUCTION

The competitiveness of the U.S. auto industry—American and foreign manufacturers and suppliers producing domestically—has faltered in recent years, as Information Technology and Innovation Foundation (ITIF) reports have documented.[1] America's share of global automobile production fell from 46 percent in 1965 to 20 percent in 1990 to just 14.7 percent today. The Big Three—Chrysler, Ford, and GM—automakers' share of the U.S. auto market has fallen from 92 percent in 1965 to 38 percent today. From 1963 to 2023, the accumulated U.S. motor vehicles trade deficit reached $3.3 trillion in 2023 dollars. And the United States' location quotient (LQ)—which assesses how much an industry contributes to a nation's gross domestic product (GDP) relative to how much it contributes to the global economy—was only 0.54 in 2022 (just 60 percent of the 1995 level), meaning the U.S. auto industry today is 46 percent smaller than the global average.[2]

Awareness of the competitive challenges facing the industry is not new.[3] In the 1970s and 1980s, with the rising competition from Japan and Europe, Congress and various administrations were focused on the industry. But after many of the foreign automakers opened plants in the United States, the issue largely disappeared from policymakers' radar. Now with the rapid rise of the Chinese electric vehicle (EV) industry and China's goal of dominating the global auto sector, the issue has once again attracted the attention of at least some policymakers.

**It's past time for the United States to articulate a comprehensive auto industry competitiveness strategy, as other nations, such as Canada, Germany, and South Korea have recently done.**

As such, it's past time for the United States to articulate a comprehensive auto industry competitiveness strategy. This report represents an initial step in that direction, offering policy proposals across five areas: cost reduction, product development, stronger "external economies," increased market scale, and roadway infrastructure. Most of these policies will help not only U.S. automobile sector competitiveness but also motor vehicle competitiveness writ large, including of heavy trucks, recreational vehicles, buses, and motorcycles.

## KEY ISSUES FOR CONSIDERATION

Before discussing the recommendations, it's worth noting that there are three key issues underlying the idea of whether to have an auto industry competitiveness strategy and, if so, what it should look like.

### Is the Industry Important?

The first is whether the industry is important. Some believe that all industries are the same. For instance, Michael Boskin, head of former president George H. W. Bush's Council of Economic Advisors, memorably quipped, "Potato chips, computer chips, what's the difference?"[4] But as ITIF has written, manufacturing matters for many reasons, including that it's a key source of high-wage jobs, it's a key source of research and development (R&D) investment, it's a key component of the defense industrial base, and because once an advanced-manufacturing industry is lost it's very difficult to recover it.[5] In other words, there's a significant difference between car production and car-rental production.

The U.S. automotive ecosystem contributes over $1.2 trillion to America's economy annually, or roughly 5 percent of U.S. gross domestic product (GDP).[6] More importantly, autos represent a traded sector, meaning that a weak industry will result in a larger trade deficit, as has indeed happened. Between 1963 and 2023, the United States ran a consistent trade deficit in real terms, with the cumulative deficit over this 60-year period reaching $3.3 trillion. This has contributed to a near-term or longer-term fall in the value of the dollar, which lowers U.S. living standards as imports become more expensive.

But even more importantly, the sector is what ITIF terms an "enabling industry" that makes a key contribution to national economic power vis-à-vis China.[7] Enabling industries produce goods in the industrial commons that, while not central to power, strengthen the ecosystem for the production of dual-use and defense goods and are necessary for economic well-being. Many of these industries produce largely final consumer goods; therefore, losing these industries would not have an immediate effect on American security—the U.S. economy would perform fine if, for example, no new cars were available, at least in the near and moderate term.

However, the loss of these industries would erode U.S. production and innovation in dual-use and defense industries, as the technological advances made in industries such as motor vehicles and appliances have downstream effects on the supply chains for dual-use and defense equipment. These industries contribute to the industrial commons that dual-use and defense industries live in, which include science and engineering knowledge, university and technical training programs, professional associations, standards bodies, research institutes, and more. These industries also often share suppliers with defense and dual-use industries.

The automotive sector is a perfect example of an enabling industry. It employs 47,000 engineers and invests over $26 billion in R&D annually.[8] The industry plays a key role in metalworking, mechanical engineering, and machinery manufacturing ecosystems, participating in training and higher education programs and industrial standards groups.[9] And it sources parts from over 5,600 specialized domestic suppliers, which provide essential components and capabilities, such as precision machining and casting, that are crucial for many dual-use and defense industries.[8] Indeed, the Pentagon recently requested the industry to begin producing weapons, given the production bottlenecks in traditional defense contractors.[10]

## Do We Need a Strategy?

Even if the industry is strategic and critical to America's future, why have a government strategy? Why not let the market work? While we lay out some reasons for a strategy, it is important to note that for most people on the other side of this debate, logic and argumentation are irrelevant. This is an ideological position coming from first principles: markets good, government bad.

But nonetheless, here are some arguments. First, other nations are not letting market forces work. The Chinese massively subsidize their EV sector, limit foreign market access, and steal intellectual property (IP).[11] The Canadians require U.S. firms to produce in Canada. Other nations, such as India and Brazil, have steep tariffs, while European Union tariffs on auto imports are four times higher than U.S. tariffs. Both Japan and South Korea have extensive nontariff barriers on auto imports, which is why Japanese automakers record very few sales in South Korea and South Korean automakers post very few sales in Japan. For instance, in January 2024, Japan sold just 1,961 vehicles in South Korea and for all of 2024 South Korea's Hyundai posted only 618 vehicle sales in Japan.[12] Also, unlike the United States, where most consumers

do what neo-classical economists assume all consumers do—maximize their consumer welfare—consumers in many other countries failed or never took Econ 101. They buy cars based on national patriotism. In Germany, German cars account for around 50 percent of car sales, while French cars account for 5.4 percent.[13] In France, it's the opposite. French vehicles account for 34 percent of sales and German 21 percent. This has nothing to do with transport costs of the autos from the factory and everything to do with consumer nationalism. This all suggests that, absent a national strategy (or a U.S. dollar that is allowed to fall to competitive rates), the United States will produce fewer cars, exactly as we do.

Second, there are a host of externalities and other market failures that suggest government involvement. One that economists have long acknowledged is the fact that companies, including car companies, don't retain all the benefits of their R&D, so they underinvest in it compared with what is socially optimal. This is why other nations have auto industry R&D programs. There are also externalities related to localization economies wherein firms are more productive and innovative if they are clustered together. Again, this is why many nations support clustering. And then there are externalities from infrastructure, which is why many nations support related infrastructure such as smart highways and vehicle charging stations.

## How Focused Should the Strategy Be?

Once policymakers accept that the United States cannot lose its motor vehicle industry and that proactive policies are needed, the next question will be to what degree policy should try to drive the industry in a particular direction.

Here it gets difficult. At one level, the answer should be to follow the industry's lead and support key innovations. For example, it's clear that autonomy will be more critical to the industry going forward, so that should be an easy decision: policy should support the development of the industry's autonomous capabilities.

**Absent a national strategy, the United States will produce fewer cars.**

But it gets significantly more complicated when it comes to propulsion modes: should policy tilt in the direction of non-internal combustion engine (non-ICE) technologies (e.g., EVs) or let the industry (and consumers) lead that decision? One can make an argument for either choice. For the former, the argument is that the rest of the world is moving to EVs, if for no other reason than governments are putting their thumb on the scale for such a transition. As such, if producers in the United States lag behind, their export market opportunities will be limited, and if EVs become more popular in the United States, then imports might increase.

For the latter, it's been clear that the U.S. EV market has been limited, as most consumers have not wanted to buy one. This is in part due to higher costs, range uncertainty, and difficulties in charging, especially when consumers live in urban settings. The push to EVs has led to industry losses and taken capital from other more productive areas, such as investing in radical automation. Moreover, the reality is that the U.S. auto market is very different from most others: consumers want larger vehicles and drive longer distances, on average.

On this question, the right policy is one that acknowledges uncertainty. And that means an end to EV mandates but also support for EV R&D and innovation so that the industry has adequate dynamic capabilities should domestic market demand change in that direction.

### Box 1: Foreign Auto Industry Strategies

It is noteworthy that many nations/regions with a significant automobile sector have motor vehicle sector strategies.

China has its New Energy Vehicle Industry Development Plan (2021–2035). Among its proposed steps, it seeks to:

*Establish and improve the joint R&D mechanism among leading enterprises, national key laboratories and national manufacturing innovation centers, focus on weaknesses such as core processes, special materials, key components and manufacturing equipment, and actively explore different technological paths to improve the supply capacity of key common technologies.* [14]

It also seeks coordination for vehicle software systems: "Around the automotive operating system, China will build a development and application ecosystem of in-depth cooperation among market players in the fields of vehicle, key components, basic data and software."[15] It also seeks to identify skills in short supply and the establishment of training programs to address those shortages, and focuses on data and data sharing with a "people, vehicles, roads and clouds" multi-layer data fusion and computing and processing platform, carry out demonstration applications in specific scenarios, regions and roads."[16] And of course, much more.

The EU has its Industrial Action Plan for the European Automotive Sector, which has a number of proposals, including establishing at least three large-scale cross-border autonomous vebicle testbeds, related regulatory sandboxes, and European Automated Driving Corridors. It seeks to end its dependency on foreign chips and software for vehicles, and also expands funding for auto-related R&D.[17]

South Korea has released its 2030 Mobility Innovation Roadmap and Future Car Industry Development Strategy, which, among other steps, works toward a system of fully autonomous cars, buses, and trucks.[18]

The Carney government in Canada has issued its automotive strategy that, among other things, authorizes a $3 billion investment fund to provide incentives to build plants in Canada, boosts industry specific skills training, and establishes an auto task force.[19]

While these and other plans articulate needed policies, they are all generally light on analysis. The Candian "plan" is largely a set of goals the government has established to "go green," and it is backed up with a list of policy actions to get there. But it doesn't ask whether that overarching strategy goal is the one that will best support the future of the industry. Nonetheless, the plan does signal government intent, which could help move legislative and administrative action.

## INSTITUTIONAL CAPACITIES

While this report proposes a number of policies that can be components of an effective U.S. motor vehicle industrial and competitiveness policy, ultimately, any effective policy needs to be backed by ongoing institutional analytical and intergovernmental capacity. That appears to be lacking now. For example, the Department of Commerce (DOC) International Trade

Administration has an automotive team of just six individuals, with the majority working on trade policy issues such as rules of origin and counterfeiting.[20] There is little to no alignment between agencies whose policies impact the industry.

### Box 2: What Is an Industrial Strategy for Competitiveness?

The United States has no truly serious industrial strategies. What is often called an industrial strategy is usually an ad hoc collection of policies related to a particular industry or technology. For example, despite the funding of the CHIPS Act and related provision, there is still no national semiconductor strategy.

An industrial strategy is a strategy that is based on deep understanding of a particular industry or subindustry; how it operates, including its dynamic capabilities; how it has evolved and is evolving; and what its strengths, weaknesses, opportunities, and threats are.

An industrial strategy is also more than a description of an industry's history and current performance, although these need to heavily considered.

An industrial strategy needs to include specific policies. For example, the R&D tax credit is a policy that would help all national economic power industries, but it would not be the core component of an industrial strategy. That would instead be policies that affect only or predominantly that specific industry and no others. For example, for the auto sector, this would include regulations on automonous vehicles, automobile-specific training programs (e.g., Kettering University), fuel economy standards, trade policy on autos, and the like.

To address this shortcoming, Congress should establish and fund within the National Institute of Standards and Technology (NIST) an Advanced Program Office (APO) designed to **bolster America's ability to assess the competitiveness of the U.S. motor vehicle sector and issue a biannual report on the state of U.S. auto sector competitiveness.** ITIF laid out the mechanics for how to develop such an assessment in our report "Assessing the Evolving Global Competitiveness of the U.S. Auto Industry," but the metrics analyzed should include, among others, the following:

- Domestic and global industry share of value-added output (for autos and auto parts)
- Vehicle unit production
- Value-added output
- Share of vehicle content produced in the United States
- Comparative national LQ and their change over time
- Global market share and change over time
- Trade balances in the sector
- Foreign direct investment in the sector
- Firm-level trade balances (i.e., for an automaker operating in the United States, amount [and share] of vehicles imported, vehicles exported, and vehicles produced in America)
- Productivity per worker and total factor productivity
- Employment and wage levels

- Global and domestic sales
- Innovation measures such as scientific publications, patenting activity, and levels of R&D investment
- Industry-level measures of competitiveness, such as R&D investment, capital expenditures, and operating margins[21]

The APO should also be tasked with developing and aggregating auto industry analytics. It should further compel automakers to expand and publish more detailed labeling on the origins of automobiles, publishing what shares of the value of vehicles are made in the United States, Canada, and Mexico. Additionally, it should require all auto firms operating in the United States to report their respective trade balances. This data is critical for the examination of the competitiveness of the U.S. auto industry and should be available in a machine-readable format for public use.

Other competitor nations are investing considerable sums in industry-focused R&D. To move in that direction, **Congress should pass and appropriate a $5 billion innovation package for the U.S. automotive industry that would provide pools of money for automotive research activities at U.S. universities and research institutions.** The APO would manage these investments.[22]

**Under the APO, an advisory board composed of representatives from automotive original equipment manufacturers (OEMs) and key Tier 1 and Tier 2 suppliers should be established.** The advisory board should significantly direct the APO on where R&D investments should be made to help develop key automotive technologies to better foster U.S. automotive competitiveness.

**There should be an end to EV mandates but also support for EV R&D and innovation so that the industry has adequate dynamic capabilities should domestic market demand change in that direction.**

## COST REDUCTION

Given the fact that Mexico accounts for 5.6 percent of global auto production, has an industry LQ 7.2 times that of the United States, and runs a $100 billion-plus trade surplus in the industry with the United States, it's clear that the cost of production matters.[23] Mexican auto sector wages, like Mexican wages overall, are instantly lower than American wages. Complete wage parity is not needed to have a strong auto sector. If it were, high-cost Germany would have almost no vehicle production. However, cost differences do matter, and any effective industrial policy should seek to reduce production costs, either generated by external factors (e.g., regulation and currency) or internal factors (e.g., adoption of automation equipment, such as robots).

There are two groups of policies for cost reduction: 1) generic policies that affect more than the auto sector and 2) industry-specific policies.

### Generic Policies

To maximize its ability to compete in global markets, the U.S. auto industry needs regulatory stability, predictability, and certainty so it can reliably make the long-term investments the industry requires. Indeed, for companies that need to plan their vehicle line-ups years in advance, it's especially challenging when rules whipsaw back and forth with each change in

administration.[24] But the industry also needs to confront a common set of regulations to the maximum extent possible, which means auto industry regulations—including those for emission and safety standards—that are national in scope and not a hodgepodge of differing state requirements.

## Currency

When President Reagan's Treasury secretary, Jim Baker, convened the G5 finance ministers in 1985 for what become known as the Plaza Accord, the administration was deeply concerned with U.S. deindustrialization, in part driven by the high value of the dollar that made U.S. exports more expensive and imports cheaper. The jawboning succeeded and the value of the dollar fell by more than 40 percent against the other currencies.[25] The result was that, by the early 1990s, the trade balance had actually shifted to surplus.[26] Since then, it has become largely taboo to call for currency reduction. But the reality is, absent **a serious devaluation of the dollar—at least by 20 percent in general and even more against the Japanese yen and Chinese RMB**—other supportive policies will struggle to make a real dent in the auto trade deficit.[27]

## Productivity Improvement

A key mechanism for companies to lower costs is through productivity improvement, and a key way to do that is through new and better technologies.

### Technical Assistance to Small Manufacturers

NIST's Manufacturing Extension Partnership (MEP) has centers in all 50 states and Puerto Rico and 460 total service locations that help small to medium-sized manufacturers (SMMs) adopt next-generation production processes and technologies.[28]

MEP plays an especially important role in supporting America's automotive industry. Most MEP client companies are "Tier 3" firms, which supply raw materials or inputs to other manufacturers, and the centers help them connect with the larger Tier 2 firms that supply the Tier 1 OEMs at the top of the manufacturing food chain. For instance, the MEP-Assisted Technology and Technical Resource Program connects America's small manufacturers with technical resources at NIST laboratories to help them develop capabilities in collaborative robotics, additive manufacturing, materials design, nanotechnology, and industrial standards.[29]

**MEP plays an especially important role in supporting America's automotive industry.**

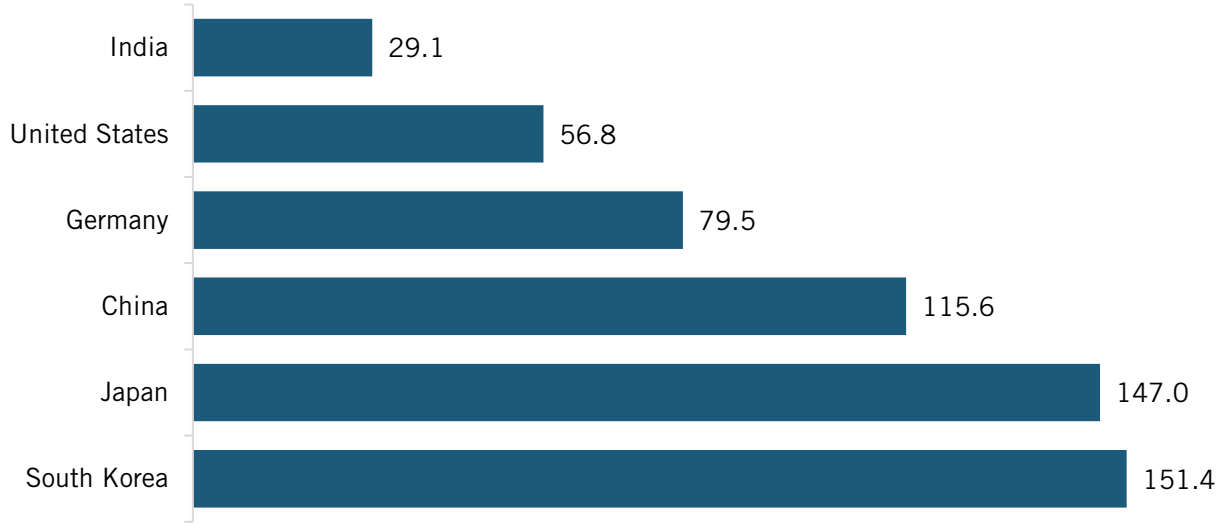
MEPs have been instrumental in helping America's small manufacturers adopt robotics.[30] For instance, in 2020, South Dakota's MEP began a state-wide roadshow, going into the field to demonstrate how rural manufacturers could more effectively deploy cobots. The initiative represents an offshoot of the successful Automation Lab launched in Sioux Falls in 2015, which allows manufacturers to observe firsthand how collaborative robots interact with people while providing a test bed for specific applications.[31] MEP also helps small manufacturers develop quality management systems that meet ever-more-stringent automotive quality standards.

Unfortunately, the Trump FY 2027 budget proposal calls for eliminating MEP funding.[32] This is misguided. **Congress should not just maintain but bolster MEP funding to $300 million annually (up from $175 million).**[33]

**Stimulate Robotics Adoption and Technology Modernization**

The U.S. auto sector lags behind other nations in robotics adoption. For example, auto companies in South Korea and Japan deploy more than 2.5 times as many robots per 10,000 workers as do U.S. automakers. (See figure 1.) The United States should set a goal of achieving parity in robot density with South Korea and Japan by 2030.

**Figure 1: Robot density per 10,000 workers in the automotive sector, 2024**[34]




Tax policy can play a key role in capital investment decisions, including robotics. Last year, President Trump signed into law The One Big Beautiful Bill Act (OBBBA), which permanently restored the 100 percent bonus depreciation (i.e., the full deduction), meaning manufacturers can now fully expense purchases on productivity-enhancing equipment such as computer numerically controlled (CNC) machines, robotics systems, assembly lines, and other capital-intensive equipment.[35] But even stronger incentives are needed. **Congress should pass a 25 percent tax credit for adoption of robotics and other automation technologies.**

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## Industry-Specific Policies

### Product Regulation

Congress first enacted Corporate Average Fuel Economy (CAFE) standards in 1975 with the goal of reducing energy consumption by increasing the fuel economy of cars and light trucks.[36] Animating the auto industry to develop more fuel-efficient vehicles was certainly a laudable regulatory goal, but the operation of the CAFE standards has led to a number of dislocations in the marketplace. Most notably, automakers that don't sell sufficient levels of zero-emission vehicles to meet federal (and state) CAFE standards are either fined or—more likely—have to purchase regulatory credits from EV makers such as Tesla, which generate more credits than they need.

Tesla has actually earned $10.7 billion from selling credits created by government climate programs over the last decade—a total that has accounted for one-third of Tesla's profits over that period.[37] Conversely, since 2022, GM has spent $3.5 billion purchasing regulatory credits to help the company meet fuel economy and tailpipe emissions requirements.[38] Since 2018, Stellantis has paid $773.5 million in CAFE fines, including $190.6 million in 2025 alone.[39] Ford appeared to have budgeted as much as $1.5 billion for purchasing such credits in 2025.[40]

On December 3, 2025, the Trump administration announced a dramatic easing of federal CAFE standards. Under the Biden administration, CAFE rules called for U.S. vehicles to become 2 percent more fuel efficient every year; the Trump administration has proposed reverting the standards to the 2022 baseline and increasing the standard by 0.5 percent annually.[41] Environmental activists blasted the proposed regulatory reforms, while automakers applauded them, asserting that the previous standards were "so stringent that companies were being pushed to sell more plug-in models than the market would bear."[42] Ford CEO Jim Farley asserted that the reforms would "align fuel economy standards with market realities."[43] While certainly the proposed reforms would encourage companies to boost production of higher-profitability trucks and SUVs, several automakers indicated that they'd be able to direct funds previously earmarked for regulatory credits to the development of hybrid vehicles.[44]

**Policymakers should accept the Trump administration's proposed reforms to CAFE standards.** A following section of this report on roadway infrastructure argues that policymakers should go further than that by largely replacing CAFE standards with an increased gas tax.

### Sales Regulation

State dealer-franchise laws prohibit or severely restrict manufacturers from selling new vehicles directly to consumers in most of the country. A Department of Justice (DOJ) economic analysis paper catalogues statutes in 45 states that bar direct sales, noting that they arose long after the assembly line and now "require that new cars be sold only by dealers."[45] The Federal Trade Commission (FTC) has likewise warned state legislatures that such bans "operate as a special protection for independent motor vehicle dealers … likely harming both competition and consumers" because they foreclose alternative, more efficient distribution models.[46] Even today, litigation continues—Tesla's 2024 antitrust suit against Louisiana's direct-sales ban, for instance, was recently revived on appeal—underscoring how these rules still block new entrants and stifle rivalry in electric-vehicle markets.

The consumer cost is substantial. DOJ's analysis estimates that the conventional dealership channel can add up to 30 percent of a vehicle's final price.[47] In addition to lowering costs, direct sales would also let manufacturers roll software updates, servicing, and price transparency into the transaction—capabilities critical for EV startups—yet franchise prohibitions force buyers to haggle at brick-and-mortar lots or cross state lines for the same car.[48] The result is higher prices, less choice, and slower adoption of advanced technologies. For those reasons, **Congress should preempt state dealer-only mandates and allow manufacturers to sell and deliver vehicles directly online while leaving dealers free to compete on service and price.** Giving consumers the option to click "buy" on a factory website would increase competition, spur distribution innovation, and align auto retailing with the e-commerce convenience Americans already enjoy for nearly every other durable good.

## Technical Assistance to SMM Auto Suppliers

In recent years, MEP has made efforts to focus on supporting specific industrial supply chains. In fact, from 2017 to 2023, NIST awarded approximately $400,000 apiece to each of the MEP centers to develop programs to make domestic supply chains more efficient and resilient to geopolitical and pandemic disruptions.[49] Indeed, MEP has made progress in recognizing that, because supply chains cross state boundaries, it needs more cross-state, sector-based MEP initiatives such as autos in the U.S. Midwest and South.[50] For instance, MEP created the Manufacturing Technology Acceleration Center (M-TAC) program to develop an understanding of the technological needs and trends impacting specific industrial supply chains. The Southeast Automotive M-TAC project enrolled Georgia MEP, the Alabama Technology Network, Innovate MEP Mississippi, South Carolina MEP, and Tennessee MEP and partnered them with automakers in the region including BMW, Honda, Hyundai, Kia, Mercedes-Benz, Nissan, Toyota, and Volkswagen to ascertain technology, skills, and R&D needs in the regional automotive supply chain.[51] **MEP should enhance its focus on supporting regionally anchored supply chains that support regional automotive clusters.**

## Supporting SMM Integration and Digitalization Activities

The United States needs to introduce new mechanisms to encourage OEMs to take more ownership of the manufacturing supply chain digitalization. Large U.S. manufacturers have tended to keep their suppliers at arm's length, too often treating them on a transactional basis with cost as the principal concern. But the McKinsey Global Institute has noted that "this approach can affect the bottom line," and that "inefficiencies in OEM-supplier interactions add up to roughly 5 percent of development, tooling, and product costs in the U.S. auto industry."[52] Put simply, U.S. OEMs need to take more ownership for driving digital transformation within their supply chains and with their key suppliers. **The U.S. government should provide incentives for U.S. OEMs to help 10,000 SMMs become Internet-of-things-enabled (that is, smart-manufacturing enabled) within 10 years.**[53]

America's small manufacturers could greatly benefit from investing in modernized plant, machinery, and equipment, but they often lack the upfront capital needed to do so. For instance, one McKinsey study finds that fully one-quarter of SMMs in the mid-Atlantic region lack the money to meet their working-capital needs.[54] Studies estimate that the inability of small firms to invest in equipment and plant upgrades contributes to a stark 40 percent productivity gap with large firms.[55] This is why **Congress should create a U.S. Manufacturing Digitalization Investment Fund that would provide repayable, low-interest loans to America's small manufacturers to help finance their upfront investment in digital manufacturing technologies and solutions.** In 2023, the Department of Energy (DOE) launched a $50 million State Manufacturing Leadership Program to give pilot grants to states to broaden access to smart technologies for SMMs in their states.[56] The effort has thus far supported programs across 12 states, helping SMMs adopt smart manufacturing technologies.[57] But more is needed. **Congress should allocate $250 million annually for such a fund and create a special fund of $100 million specifically for automotive SMMs to adopt smart manufacturing technologies.**

## PRODUCT DEVELOPMENT

Competitiveness stems not only from low costs/prices but also from superior vehicles. R&D, at least as it relates to vehicle innovation, plays a key role. Here, there exists a set of generic and industry-specific policies the government should adopt to encourage product innovation.

### Generic Policies

#### Increase Incentives for R&D Investment

As ITIF has shown, scholarly studies support the effectiveness of the R&D tax credit, as it leads companies to increase R&D investment more than they would do otherwise. The problem is, compared with other nations, the U.S. credit is now quite small. As of 2024, the United States ranked 31st out of 28 Organization for Economic Cooperation and Development (OECD) nations plus the 4 BRIC economies in their R&D tax credit support.[58] To remedy this, **Congress should triple both the Alternative Simplified R&D Credit and the regular R&D credit.**[59]

Further, policymakers should broaden and expand the R&D credit for collaborative research; that is, research funded by industry undertaken in collaboration with a university or research institution.[60] The United States provides a 20 percent credit for collaborative R&D, but the credit only applies to energy research. **Congress should eliminate the energy restriction and make it applicable to all fields.**[61] **It should also make companies' expenditures on global standards setting eligible for the R&D credit.**

**The U.S. auto industry risks retreating to a "fortress America," concentrating on profitable ICE vehicles at home while EV technology evolves rapidly and Chinese EV makers capture an ever-greater share of global automotive markets.**

#### Industry-Focused Workforce Training

The United States significantly underinvests in workforce training programs, dedicating just 0.1 percent of GDP to active labor market programs compared with the OECD average of 0.6 percent of GDP, meaning America's OECD peers such as Austria and Germany invest at least six times more in their workforce training and support programs.[62] Meanwhile, corporate investment in training as a share of GDP fell from 0.4 percent in 2015 to 0.3 percent in 2024.[63] To address this challenge, **Congress should establish a knowledge tax credit by making expenditures on employee training eligible for the R&D tax credit.**

Furthermore, Section 127 of the federal tax code allows employers to provide employees with up to $5,250 per year in tuition assistance; the employer deducts the cost of the benefit but the employee doesn't have to report it as income. It's an important benefit, but Congress has not increased the eligible amount since 1996. **Therefore, Congress should increase Section 127 to at least $11,060 (per the rate of inflation since 1996) and index the amount to the annual rate of inflation going forward.**[64]

### Sector-Specific Policies

#### Public-Private Research Support

A significant challenge to the U.S. research system is that it's historically been about private investigators and their individual research projects, not about sustained centers with scale.[65] For example, unlike the United States, where a research university may have just a few professors

working on a particular area, China has established research institutes wherein hundreds of researchers work on the same topic. China has close to 50 graduate programs that focus on either battery chemistry or the closely related subject of battery metallurgy. By contrast, only a handful of professors in America work on battery research.[66] In short, the U.S. R&D technology development enterprise needs much greater levels of scale and much more collaboration with industry.

## Box 3: Restoring U.S. EV/EV-Battery Leadership

U.S. automakers continue to excel at manufacturing ICE vehicles, especially highly profitable sport utility vehicles and trucks. And the vehicles remain popular, with a December 2025 Ernst & Young study finding that 50 percent of global car buyers intend to purchase an ICE vehicle in the next 24 months (an increase of 13 points from 2024).[67] Nevertheless, EVs (including plug-in hybrids) continue to grow in global importance, accounting for 26 percent of the global car market last year, up from just 3 percent in 2019.[68] And they are becoming increasingly popular in developing countries, accounting for 40 percent of new vehicle sales in Vietnam and 20 percent in Thailand in 2024.[69] Chinese EV makers are increasingly dominating sales in these markets due to their low, state-subsidized prices. For instance, in Brazil, analysts estimate that Chinese EVs account for 80 to 99.5 percent of the EV market share, while in Malaysia and Thailand, their market share exceeds 80 percent.[70] All in all, reports estimate that the Big Three U.S. automakers have lost over 6 percent of global market share to the expansion of subsidized Chinese EVs.[71] In short, the U.S. auto industry risks retreating to a "fortress America," concentrating on profitable ICE vehicles at home while EV technology evolves rapidly and Chinese EV makers capture an ever-greater share of global automotive markets.

That's a shame, because EVs and EV batteries were actually invented in the United States. In fact, inventor William Morrison developed the first successful electric car in 1890, and by the early 1900s, about one-third of vehicles on U.S. roads were electric.[72] Later, in the mid-1990s, researchers at the University of Texas pioneered a new compound called lithium-iron phosphate (LFP) that would initially become the primary EV battery chemistry.[73] To be sure, EV battery technology had evolved more slowly over the past three decades than many expected, leading to EVs with short ranges and ones that might not start in freezing temperatures, understandably tempering driver enthusiasm for the technology.

But that dynamic is changing rapidly. For instance, in March 2026, Chinese researchers unveiled a new lithium metal battery achieving over 700 Wh/kg (watt-hours per kilogram) at room temperature—double the energy density of many current EV batteries—that operates effectively at temperatures as low as -50°C and can go 1,000 kilometers (km) per charge.[74]

The United States cannot afford to totally lose the EV battery race to China, but the United States is well behind, so much so that U.S. automakers have been forced to turn to Chinese companies such as CATL for battery technology.[75] While the United States has fallen off the global lead in EV battery production, several innovative start-ups including QuantumScape, Factorial Energy, and Solid Power are now trying to develop a next generation of so-called "all-solid-state batteries" (ASSBs) that could possibly reestablish an American foothold in the field.[76]

**U.S. R&D in the EV sector needs to be focused on leapfrog EV technologies with new battery chemistries.** Unfortunately, the vast majority of incentives the United States has offered for battery production, such as the Section 45X tax credits Congress included in the Inflation Reduction Act (IRA), have not targeted next-generation batteries as opposed to existing

technologies. As a result, the incentives have been used almost exclusively to support manufacturing facilities to produce lithium-ion batteries. A study by the Carnegie Endowment for International Peace finds that, from 2022 to 2024, of the $24 billion in U.S. federal grants and loan guarantees made through DOE, more than 90 percent of the funding supported lithium-ion batteries, the current generation of technology. Further, the study finds that less than 1 percent of federal R&D battery funding has supported next-generation solid-state batteries.[77] The United States must refocus battery R&D efforts on next-generation battery technologies.

**Less than 1 percent of federal R&D battery funding has supported next-generation solid-state batteries.**

### EV Product Development

**To the extent federal agencies continue to invest in EV battery R&D, they should target next-generation battery chemistries instead of current generations of the technology.** In 2012, ITIF called for policymakers to organize a "BatteryShot Initiative" that would coordinate government battery research, development, and demonstration with the goal of producing a battery with a total system cost of less than $250/kWh (kilowatt-hours) and a range of at least 300 miles per charge.[78] While the targets will have changed in the 14 years since, the U.S. lag in the EV batteries sector vis-à-vis China suggests that **the Trump administration should launch such a "BatteryShot Initiative" with the goal of producing a battery with a total system cost of less than $200/kWh and a range of at least 1,000 miles per charge.**[79]

### Product Regulation, Especially for Autonomous Vehicles

Autonomous vehicles are the future, if for no other reason than they could significantly ameliorate the roughly 37,000 traffic fatalities and $450 billion in economic losses that occur in the United States annually from traffic accidents, not to mention the $200 billion in economic losses and environmental damage from traffic congestion.[80] If the U.S. industry is to boost its competitiveness, it will need to be at the world-leading-edge of vehicle autonomy.

Policymakers need to ensure that America's regulatory environment is supportive of the development and deployment of autonomous vehicles. To that end, Rep. Bob Latta (R-OH) has introduced the Safely Ensuring Lives Future Deployment and Research in Vehicle Evolution Act of 2026 (SELF DRIVE Act). The legislation would create a regulatory framework for the development and deployment of autonomous vehicles by strengthening safety requirements, clarifying the National Highway Traffic Safety Administration's (NHTSA's) regulatory authority, improving crash data transparency, and promoting overall U.S. leadership in autonomous vehicles innovation.[81] **Congress should pass the SELF DRIVE Act.**

**Further, NHTSA should clarify—through regulatory changes or formal interpretation—that existing requirements for manually operated driving controls and certain driver-focused indicators do not apply to vehicles equipped with Level 4 or Level 5 Automated Driving Systems (ADSs) that are designed to operate without a human driver.**[82] These requirements were developed for traditional vehicles with human drivers and, when applied to ADS-dedicated vehicles, can impede deployment without offering corresponding safety benefits. Removing or exempting these outdated requirements would support autonomous vehicle innovation and deployment while ensuring that safety regulations are appropriately tailored to a vehicle's design and use case.[83]

### Permit Customers, Automakers, and App Developers Access to Vehicle Data

Access to vehicle data gives automakers insights to help them manufacture better vehicles. At the same time, the availability of more vehicle data allows innovators and app developers to create new apps and services for connected vehicles that can benefit consumers.[84] For instance, smartphone apps allow customers to access a vehicle's on-board diagnostic data to review and track vehicle statistics and better maintain their vehicles.

While it is certainly important to address legitimate privacy concerns, policymakers should not let hypothetical fears drive the conversation in ways that unnecessarily limit commercial uses of vehicle data.[85] Unfortunately, some, such as the Electronic Privacy Information Center and the Electronic Frontier Foundation, have called for restrictive privacy rules for connected vehicles.[86] Others, such as Pam Dixon of the World Privacy Forum, have suggested that automakers would use data to track an individual's habits.[87]

Yet, there is no evidence that this is occurring. Rather, in 2014, automakers unveiled a series of public commitments (which they updated again in 2018) establishing strict privacy standards for data collected from connected vehicles. In particular, automakers have committed to 1) providing customers with clear, meaningful information about the types of information collected and how it is used, and 2) obtaining affirmative consent before using geolocation, biometric, or driver behavior information for marketing and before sharing such information with unaffiliated third parties for their own use.[88]

Similar provisions are also mandated by data privacy laws across the country. Currently 21 states have comprehensive data privacy laws, requiring automakers conducting business in those states to uphold data security practices, provide notice of data collection and usage, obtain opt-in consent to process sensitive data, and more.[89] Considered in tandem with the voluntary industry commitments, these laws provide extensive consumer data protection. To ensure similar protections apply across the country, and not only in the 21 states covered by individual data privacy laws, **policymakers should move forward with federal privacy legislation such as the SECURE Data Act.**[90] The legislation would establish uniform protections, replacing the fragmented state-by-state framework that automakers currently have to navigate. **Policymakers should make clear that drivers can opt out of having their on-board vehicle data shared with automakers, but opt-in should be the default setting, and that vehicle manufacturers do not share personally identifiable data.**

Elsewhere, the European Commission has offered to provide guidance to the auto industry on the pooling of automotive data to allow artificial intelligence (AI) advancements in autonomous driving within the context of European competition law. The European Commission should not exclude U.S.-headquartered companies from participating in such data-pooling activities, and U.S. policymakers should ensure that the appropriate frameworks are in place to facilitate such data sharing in the United States if deemed necessary by industry.

## STRENGTHEN KEY INDUSTRY INPUTS, INCLUDING AGGLOMERATION ECONOMIES AND SKILLS

Because firms in innovation-based industries such as automobiles compete on the basis of product and process innovation rather than cost minimization and are more reliant on knowledge than are other industries, they tend to cluster in large metropolitan areas where they can, for instance, tap into specialized workers, suppliers, and institutions (localization) and take

advantage of dense air and ground transport links (urbanization). As ITIF wrote in its first report in this series, these agglomeration economics are important in enabling innovation in the auto sector, but, in contrast to Japanese and German firms, U.S. firms have dispersed production more, weakening these clusters.[91] This should be reversed.

In addition, firms rely on skilled workers, not only to perform better work, but also to enable the upgrading of process technologies. Again, there exist generic and specific policies to help address these challenges.

## Generic Policies

As a forthcoming ITIF report will document, the U.S. education and training system is poorly designed to meet the techno-economic industry power challenge from China. Multiple steps should be taken to boost skills for advanced manufacturing, including in autos. Moreover, there are a number of skills and workforce policies that could help bolster the competitiveness of the U.S. auto industry specifically. These are especially important because demand for automotive technicians (both for individuals manufacturing and repairing vehicles) is expected to grow to over 471,000 workers between 2024 and 2028.[92]

### Support the Creation of Industry-Focused and -Led Industrial Colleges

America needs more universities focused on particular industries.[93] Some already exist, such as the SUNY Maritime College, which trains merchant marine officers, naval architects, and marine engineers. Kettering University (formerly the General Motors Institute) in Flint, Michigan, is built around co-op education in which students alternate between classroom study and paid work at automotive and manufacturing companies.[94] **Congress should appropriate funds to the Department of Education to establish a competition to establish up to 10 industry- or technology-focused universities**, at least one of which should be focused on the automobile industry and modeled after Kettering University, ideally located near another hub for automotive manufacturing and assembly.

**Community colleges need to reimagine their curricula and relationships with manufacturers to position themselves for the development of new skills required in advanced manufacturing.**

### Support Expansion of Critical Technology Degree Programs

U.S. higher education does respond to new science and technology developments in terms of their undergraduate and graduate programs, but the response is often slow and, in part because of lack of funding, haphazard.

As part of an automotive competitiveness industry strategy, it's not enough to just fund R&D in critical and emerging technology areas. America also needs to fund curriculum development. This is what China is doing. In 2025, top universities, such as Tsinghua University, Peking University, and Shanghai Jiao Tong University, added 150 undergraduate places in emerging engineering fields such as AI, integrated circuits, and new energy. These specializations serve national strategy and align with emerging industries in many cities.[95] **Congress should ensure that the National Science Foundation (NSF) has adequate resources to establish an annual funding program for research universities (including land grant colleges) to establish new science and technology curricula in areas of national importance, including emerging automotive and battery technology.**

### Prioritize Community Colleges and Robotics Education

Community colleges play a critical role in driving affordable education and training for workers going into automotive manufacturing and automotive repair.[96] But the United States underinvests in community colleges, especially as compared with four-year universities. For instance, Richard Kahlenberg observed in a report for the Century Foundation that "the total federal, state, and local appropriations and tax subsidies per full-time equivalent student is $41,100 at private high-endowment institutions, $15,300 at public flagship institutions, $6,700 at public regional institutions, and $5,100 at community colleges."[97] And direct public spending per student is almost twice as much at public research universities as at two-year community colleges. For instance, Kahlenberg cited a Brookings Institution study showing that "four-year institutions received nearly three times as much federal aid ($2,600 per student, including financial aid) as community colleges ($790) [did]."[98] **Policymakers in both federal and state governments should adjust funding programs to reduce these gaps in support between students attending four-year universities and two-year community colleges.**

But community colleges will also need to reimagine their curricula and relationships with manufacturers to position themselves for the development of new skills required in advanced manufacturing.[99] A good example of a community college that has done so is Tennessee's Motlow State Automation and Robotics Training Center (ARTCm).[100] ARTCm represents a collaborative effort co-funded by the Tennessee state government, local industry, and philanthropic supporters that offers robotics industry-recognized training credentials/certificates and robotics degrees programs such as mechatronics degrees with a concentration in robotics. ARTCm represents a model that could be implemented nationwide; **there should be 40 such centers across the United States.** Further, **Congress should designate minimum standards for the establishment of two-year, advanced-manufacturing-focused community college programs in the United States and establish $100 million in funding for states to use for the acquisition of equipment, the development of curricula, and the recruitment of faculty at such community colleges.**

## Sector-Specific Policies

### Invest in Regional Auto Clusters

**Congress should provide funding for a program to support regional auto clusters.** The CHIPS and Science Act of 2022 created the Regional Technology and Innovation Hubs program, with an authorization of $10 billion in funds over five years (of which only $1 billion has been expended). In 2023, the Economic Development Administration (EDA) announced an inaugural 31 designated Tech Hubs, making them eligible to apply for $40 million–$50 million in implementation awards supporting projects in workforce development, start-up support, technology maturation, infrastructure, and governance.[101] The problem with the program is very few of the grants will likely end up creating enough gravitational pull to develop truly self-supporting clusters. Most have just been grants for local research and related activities that might hope to create a few firms.

There appear to be a few exceptions to this, notably the Akron-based Sustainable Polymers Tech Hub that focuses on materials that support the manufacturing of tires and other automotive components, aiming for greener technologies.[102] Unlike many other awards, it is less a "greenfield" project and more one that builds on an existing agglomeration of capabilities.

The clusters would work with pertinent Manufacturing USA institutes, such as America Makes for additive manufacturing, ARM (Advanced Robotics for Manufacturing), IACMI (Institute for Advanced Composites Manufacturing Innovation), LIFT for advanced lightweight materials, and MxD for digital manufacturing.[103] Certainly, several of the Manufacturing USA institutes are working on manufacturing product and process technologies of direct relevance to the U.S. automotive industry (e.g., ARM with robotics), but none of the Manufacturing USA institutes are directly devoted to the U.S. auto industry. Accordingly, the proposed clusters would be charged with aggregating pertinent technologies being developed by the 18 Manufacturing USA Institutes and bringing them directly to bear in regional automotive supply chains. They would also be charged with interfacing with the MEP program and bringing new automotive product and process technologies to the SMMs with which MEP works.

Where relevant, Manufacturing USA Institutes such as MxD should help U.S. automakers with pre-competitive collaborations. For instance, one positive development for the U.S. auto industry is that the sector is working together on a shared software portal, through which automakers and suppliers can buy the software they need rather than write it in-house or shop for it across myriad software companies. The Society of Automotive Engineers has noted that it's "a good example of pre-competitive collaboration between automakers and suppliers to collectively drive innovation, tackle industry challenges, and accelerate product development."[104]

**Congress should provide funding to establish at least six dedicated, seriously funded (e.g., $150 million each over five years) regional automotive clusters working with auto OEMs, suppliers, and universities.** (Industry should equal these investments with at least a 25 percent match.) Such clusters could be focused on various automotive product technologies such as vehicle autonomy, vehicle electrification (i.e., EV batteries and motors), software-defined vehicle (SDV) technology, and lightweight materials and composites or vehicle process technologies such as automotive robotic applications; digitalized vehicle design, development, and testing; and diecasting processes for automotive chassis.

## MARKET SCALE

As an advanced industry with relatively high fixed costs relative to marginal costs, market size and total firm sales are key to auto industry and firm success. The bigger the market firms in the United States can capture, the more competitive the industry can be. As ITIF has written, a key structural challenge for the U.S. industry is that the U.S. market is structurally different from most other foreign markets, wherein consumers desire smaller, more fuel-efficient cars.[105] Nonetheless, steps can be taken to help firms in the United States expand sales.

### Sector-Specific Policies

#### Ban Chinese Motor Vehicle Imports and U.S. Production

The explosive growth of China's EV industry has resulted from an extensive panoply of "innovation mercantilist" practices, including subsidies, IP theft, forced technology transfer, currency manipulation, wage suppression, and other unfair trade practices. China's subsidies to its EV sector have perhaps exceeded those directed toward any other sector. Researchers at the Center for Strategic and International Studies (CSIS) have estimated that, from 2009 to 2023 alone, China channeled $230.9 billion in subsidies and other support to its domestic EV sector.[106] Moreover, Chinese EV subsidies have only increased in recent years, with an estimated

$120.9 billion in subsidies over just the previous three years to that CSIS study ($30.1 billion in 2021, $45.8 billion in 2022, and $45.3 billion in 2023), compared with a total of $49 billion in subsidies the three years prior to that, and $60.7 billion in subsidies from 2009 to 2017 (then at a $6.74 billion annual rate).[107] Considering batteries, from 2018 to 2023, the Chinese government extended a total of $1.8 billion in subsidies to CATL alone.

The extensive government subsidies flowing into China's EV industry have led to considerable global overcapacity. In fact, at one point in 2018, China had over 500 EV start-ups registered, although that number had shrunk to some 200 firms by mid-2024 and to an estimated 130 firms as of August 2025.[108] Nevertheless, significant overcapacity remains, with one assessment finding that Chinese EV overcapacity now stands at between 5 million and 10 million vehicles per year.[109] This overcapacity persists because, as one analyst explained, "Chinese companies are not responding to demand signals from the market, but production incentives from across all levels of the Chinese government."[110]

**The explosive growth of China's EV industry has resulted from an extensive panoply of "innovation mercantilist" practices, including subsidies, IP theft, forced technology transfer, currency manipulation, and other unfair trade practices.**

China has also prioritized pilfering key U.S. and Western automotive IP. For instance, in 2020, Federal Bureau of Investigation director Christopher Wray warned explicitly that "China is placing a priority on stealing electric car technology," as the Chinese government is "fighting a generational fight to surpass our country in economic and technological leadership."[111] In the same year, William Evania, director of the National Counterintelligence and Security Center, singled out two fields in which China is prioritizing technology theft: EVs and aircraft.[112]

But it's not just the Chinese EV sector that has benefited from these policies; so have its other motor vehicle industries, including motor homes, heavy trucks, construction equipment, agricultural vehicles, motorcycles, and more.

Because China's EV sector has benefited from this vast panoply of "innovation mercantilist" practices, ITIF supports the continued imposition of 100 percent tariffs on Chinese EVs, originally introduced by the Biden administration in May 2024 and thus far sustained by the Trump administration.[113] **The Trump administration should continue imposing 100 percent tariffs on imports of Chinese EVs indefinitely. And it should go further and ban the imports of any Chinese motor vehicle, in any sector, produced with more than de minimis mercantilist practices.**

This should extend to not just imports but also domestic production in the United States. Some—even president Trump himself—have suggested that Chinese EV makers be permitted to open manufacturing facilities in the United States. For instance, during a January 2026 speech at the Detroit Economic Club, Trump called China "great" and said he welcomed its factories in the United States as a means to create jobs while circumventing tariffs on foreign autos. "Let China come in," the president said during the speech.[114]

But beyond the fact that Chinese EV makers have unfairly benefited inordinately from the aforementioned innovation mercantilist policies, there are myriad additional reasons why Chinese EV makers should not be permitted to open manufacturing facilities in the United States.[115] For

one, Chinese EV makers are fundamentally unlike other foreign automakers (e.g., BMW, Mercedes-Benz, Toyota, Nissan, Honda, Kia, Hyundai) headquartered in rule-of-law economies that adhere to market-based principles. Those companies came to the U.S. market so that they could compete in it; Chinese EV companies would come with the intent to dominate in the U.S. market and ideally eliminate U.S. competitors, as heavily subsidized Chinese companies have done in a range of other sectors, from solar panels to drones.

Furthermore, if BYD or another Chinese automaker were to open a new factory in America, it wouldn't create any net new manufacturing jobs. Rather, to the extent that a Chinese firm-owned plant produced vehicles that supplanted vehicle sales that would have been produced by workers at another U.S. plant, it would simply shift U.S. manufacturing workers into the hands of a Chinese-headquartered auto manufacturer. Moreover, allowing Chinese EV makers to manufacture in America wouldn't palpably alter U.S. trade balances with China. In fact, if anything, to the extent Chinese EV manufacturers primarily use parts and components produced by vendors within their existing (China-centered) supply chain, then it would only exacerbate the U.S. trade deficit with China, as those parts and components would be imported into America.[116] Further, the U.S. government has already raised serious concerns about cybersecurity and software issues pertinent to Chinese-manufactured connected vehicles.

In summary, **the United States should not allow Chinese EV makers—whether BYD, Nio, Xiaomi, or others—to construct manufacturing plants in the United States,** especially when doing so would reward both Chinese mercantilist policies as well as Chinese EV firms' gambit to circumvent the tariffs the United States has already sensibly imposed on them. Beyond that, **the Trump administration should designate a special task force to identify and document any Chinese or third-party countries' EV or EV battery companies that have benefited from innovation mercantilist practices and work with the United States Trade Representative (USTR) and U.S. International Trade Commission (USITC) to prevent such products from entering the U.S. market.** Lastly, **the United States should affirmatively disallow any Chinese acquisitions of U.S. companies in the automotive supply chain, even without requiring a Committee on Foreign Investment in the United States (CFIUS) review.**

## USMCA

The North American Free Trade Agreement (NAFTA) and its successor, the United States-Canada-Mexico (USMCA) free trade agreement, have enabled a more integrated North American vehicle production marketplace. In some ways, this is a positive development: the advent of a competitive North American production system—a "factory North America"—better positions the United States (and its neighbors) against foreign competitors.[117] But the USMCA has also facilitated the tremendous growth of Mexico's automotive sector, some of which has come at the expense of the United States.

### Mexico

To be sure, due to lower labor costs in Mexico, auto producers operating in the United States can leverage more economically produced parts and cheaper assembly in Mexico to produce more cost-competitive vehicles. Indeed, not only is the vast majority—90 percent—of Mexico's vehicle production exported, but also 79 percent of it goes to the United States.[118]

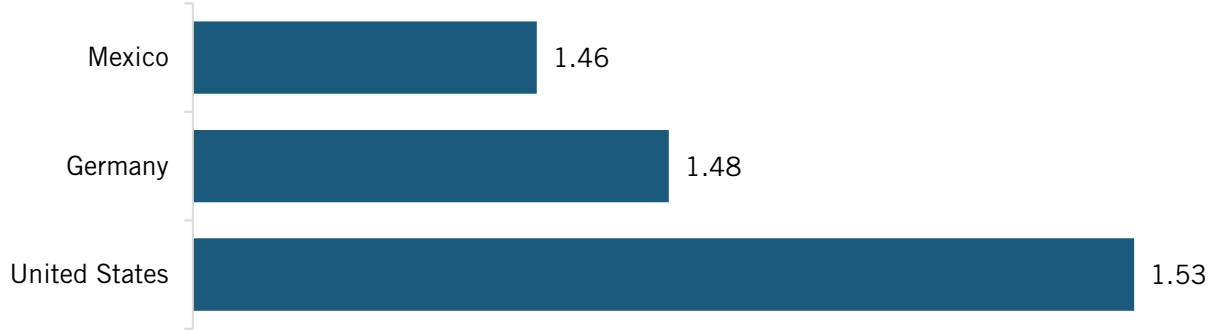
Indeed, Mexico's automotive sector has been wildly successful.[119] This has been significantly driven by low wages. For instance, from 2000 to 2021, Mexican wages per worker were, on

average, 25 to 30 percent of those in the United States. And that matters, especially when labor represents the single largest cost to automobile manufacturers outside materials, accounting for 65 to 70 percent of nonmaterial costs.

Bizarrely the USMCA attempted to address the Mexico-U.S. auto labor wage differential issue through a labor value content rule requiring that 40 to 45 percent of an automobile's content be made by workers earning at least $16 dollars per hour. This made little sense. Why should Mexican auto workers be among the highest-paid workers in Mexico, where the median manufacturing wage is under $5. Wages in an economy in a particular industry are not set by productivity levels (if they were, U.S. cigarette factory workers would be extremely highly paid given how productive they are); rather, they are set by labor market competition.[120] (Also, automakers counted work performed in higher-wage Canada or the United States toward the needed percentages to meet the rule.)

Moreover, wages in the U.S. auto industry are well above the U.S. average, creating a clear competitive challenge. In 2023, fully burdened wages in the U.S. auto sector (which included wages, benefits, and any additional pay) were 1.53 times greater than that of the economy-wide average.[121] In contrast, Germany's auto industry, which is well known for its high wages, pays its workers just 1.48 times more than the national average.[122] In Mexico, this figure is 1.46. (See figure 2.) Such high wages in the U.S. auto sector have led to the offshoring of automotive manufacturing to Mexico for decades.[123]

**Figure 2: Ratio of fully burdened wages in auto manufacturing relative to the economy-wide average, 2023**[124]




**Going forward, wages in the U.S. auto sector must enable the long-term sustainability of the U.S. auto industry, rising at the rate of productivity growth** rather than based on the arbitrary rates set by the United Auto Workers (UAW) union. Traditional international economic theory has long held that wages and productivity should move in lockstep. Thus, low wages in other nations should not necessarily mean less competitiveness in a high-wage nation. But the new globalization changes that, enabling low-wage countries to have similar or even more advanced production facilities than in legacy, higher-wage nations. For example, some studies estimate that Chinese EV factories are as productive as American factories, but workers are paid just 30 percent of U.S. wages and benefits. Similarly, according to a report from the Center for Automotive Research, labor productivity in Mexico is close to, if not comparable to, that of the United States, a phenomenon that has driven firms to offshore production.[125]

A revised USMCA should eliminate the labor value content requirement. Instead, Canada and the United States **should institute a productivity-adjusted wage tariff on Mexico using the unit labor cost**

**of imported products (wages divided by productivity).** If Mexican workers earn about 20 percent as much as their American peers do in dollar-denominated terms but are, conservatively, one-half as productive, the unit labor cost of products produced in Mexico is about 40 percent of that in the United States. A productivity-adjusted wage tariff should be implemented to reduce this deficit, bringing Mexico's unit labor cost to at least 75 percent of that in the United States. Of course, an increase in the value of the peso relative to the U.S. dollar would reduce the amount of the needed tariff.

Elsewhere, USITC has raised concerns that Chinese automakers are using Mexico as a backdoor to bypass U.S. tariffs, taking advantage of the country's free trade agreements.[126] Indeed, from 2019 to 2023, 23 new investments by Chinese automotive companies were announced in Mexico, representing just under half of all Chinese corporate investments in Mexico ($7.06 billion across 2022 and 2023).[127] And between January 2023 and May 2024, roughly 35 percent of new Chinese investments in Mexico focused on EV infrastructure.[128]

For this reason, ITIF has called for **improving the USMCA's rules of origin (ROO) standards —which define where a product is made**—in order to help the United States prevent Chinese inputs from entering Canada's and Mexico's supply chains and the final products derived from them from entering the U.S. market unwantedly.[129] **At the very least, the USMCA should raise thresholds for what is considered locally produced in the region, disqualifying products if their production is derived significantly from Chinese foreign direct investment.** In addition, there are reports that the enforcement of ROOs needs improvement.[130] ROO enforcement under the USMCA could be improved by expanding oversight funding and implementing real-time verification of supply chain data and regional content. **Further, when it comes to permitting a Chinese EV maker to open a manufacturing facility in a USMCA country, it should be forbidden outright: if a country wants to be in the USMCA, then it must have no Chinese EV production.**

### Canada

In the context of the expected USMCA renegotiation process in July 2026, Canada is proposing protectionist policies as leverage to circumvent the current trade agreement. First, in October 2025, amid trade tensions with the United States, the Canadian government limited the number of vehicles Stellantis and GM could import tariff-free after the companies announced plans to end some production in Canada.[131] To be USMCA-compliant, the measure was described as a change to the "auto remission framework"—in other words, conditional tax relief for U.S.-made vehicle imports to companies that maintain domestic production, investment, and retooling in Canada.[132] Later, in February 2026, the Canadian government announced a consultation on further protectionist policies, such as large industrial subsidies, tax incentives, tougher emissions rules, domestic-content preferences, and the reinforcement of the import-remission framework.[133]

Canada's protectionist measures are incompatible with a "factory North America" economic bloc and preferential treatment for localized production, undermining other USMCA partners, and this should not be allowed in the renewed agreement. Canada produces more vehicles than it imports from the United States, with a $6 billion trade surplus in 2025.[134] If Canada wants the benefits of a North American production system, it cannot simultaneously game the rules to privilege assembly and investment at home by circumventing USMCA rules.

### Tariffs

The Trump administration has seized upon tariffs as a central mechanism to revitalize U.S. manufacturing activity, believing that raising the cost of imported goods will encourage more manufacturers to invest in the United States. But tariffs are a double-edged sword. For instance, *Car & Driver* reported that America's Big Three automakers were hit by $6.5 billion in tariff-related costs in 2025.[135] (Its assessment notes that these tariffs represented levies on both imported parts and components as well as final vehicles, but did not provide a full breakdown.)

While certainly—as this report argues with regard to Chinese EVs and Mexican wages—there are certain tariffs that are meritorious and justified. **But the Trump administration could better help U.S. automakers by eliminating or exempting tariffs on key inputs and components within the automotive supply chain**. For instance, the Boston Consulting Group has estimated that the 50 percent tariff the Trump administration has implemented on steel and aluminum imports will add $50 billion in tariff costs to U.S. industries, including automakers.[136] **The Trump administration should at least repeal its aluminum and steel tariffs, with the exception of the import of such goods from China** (sectors that, as ITIF has written, China has also massively subsidized).[137]

Ultimately, **U.S. policymakers should work with other nations to reduce U.S. tariffs on finished vehicles and auto parts to zero, so long as allied, partner nations reciprocate.**

### Domestic Market Integration

As ITIF has written, too much of what should be regulated at the federal level in the United States is regulated at the state and local level. Issues that are inherently national in scope—particularly when they have implications for innovation, productivity, and national power industry competitiveness—should be regulated at the national level.[138] In particular, **Congress needs to make states repeal industry-specific regulations that balkanize national markets.**

**To maximize its ability to compete in global markets, the U.S. auto industry needs regulatory stability, predictability, and certainty so it can reliably make the long-term investments the industry requires.**

Balkanized state regulations—especially pertaining to emissions standards—have particularly hampered the U.S. auto industry. Most famously, California introduced its Zero Emission Vehicle (ZEV) rule in 1990, which was ultimately incorporated into the California Air Resources Board's (CARB's) Advanced Clean Cars Program (which combined several vehicle standards into a single coordinated effort) and mandates that, by 2035, 100 percent of new light-duty passenger cars and trucks sold in the state be zero-emission vehicles.[139] Similarly, in 2022, the state of New York introduced legislation requiring all new sales of passenger cars, pickup trucks, and SUVs to be zero-emission by 2035. The legislation requires an increasing percentage of new light-duty vehicle sales to be ZEVs, starting with 35 percent of sales in model year 2026, 68 percent of sales by 2030, and 100 percent of sales by 2035.[140]

By February 1, 2024, at least 23 states had some form of ZEV mandate.[141] As of that date, 17 other U.S. states—Connecticut, Colorado, Delaware, Maine, Massachusetts, Maryland, Minnesota, New Jersey, New Mexico, New York, Nevada, Oregon, Pennsylvania, Rhode Island, Washington, Vermont, and Virginia—had adopted the CARB vehicle standards.[142]

But if the United States is to win in the global advanced-industry competition against China, a key factor in winning will be to ensure that U.S. producers do not face excess costs, particularly from having to produce multiple different kinds of products for different states to respond to different state regulatory regimes. And here there's no better example than the Californian rules on auto emissions, which essentially balkanized the national industry and forced automakers to produce multiple kinds of cars. Congress actually allowed this when it passed the Clean Air Act.

But in a hypercompetitive global economy, there's simply no justification for allowing states to set up their own rules regarding industry products to the extent they're regulated at the national level. Accordingly, **Congress should step in and compel states to repeal their individual automobile industry emissions laws.** (To be sure, if states wish to set up incentive programs for consumers to purchase EVs or more fuel-efficient vehicles, that's fine.) Similarly, **policymakers should ensure that the establishment of all new motor vehicle safety equipment requirements occurs at the federal level in order to both support automotive manufacturing and establish a uniform set of requirements that best meets the needs of consumers and roadway safety.**

**At the same time, DOC should engage in negotiations with the Canadian government to see if it can adopt the same product regulations as the U.S. federal government. Currently, it has different regulations for emissions that serve to balkanize the North American market.**

## ROADWAY INFRASTRUCTURE

America's current highway transportation funding system is inadequate to finance the needed future expansion and repair of America's roadways. To address this, and to further the push toward more fuel-efficient vehicles, Congress should increase the gas tax in lieu of more stringent CAFE emissions standards. Separately, Intelligent Transportation Systems (ITSs) enable assets within the transportation system—vehicles, roads, traffic lights, message signs, etc.—to become intelligent by embedding them with microchips and sensors and empowering them to communicate with each other through wireless technologies.[143] The United States should prioritize investments in ITSs much more than it currently does in transportation infrastructure funding. Policymakers should also remove impediments (e.g., redundant permitting requirements) to deploying EV charging infrastructure across the nation. Improved roadway infrastructure leads to smooth-running, non-congested highways, encouraging more driving, which ultimately drives automotive demand—something that, to be certain, could benefit all automakers, and especially American ones.

### Increase the Gas Tax and Use Proceeds to Expand Highway Funding

The current approach to funding the U.S. highway system—both in terms of expanding highway capacity and repairing roadways—is unsustainable. Moreover, significant additional highway capacity will be needed to meet future demand. For instance, the U.S. Department of Transportation (DOT) estimates that vehicle miles traveled in the United States will increase by 0.6 percent annually from 2023 to 2053.[144] The advent of autonomous vehicles may actually accelerate driving demand, with one study finding that they could add one trillion more vehicle miles traveled annually by 2050.[145] And between 2022 and 2050, the United States is projected to see freight activity grow by 46 percent in tonnage.[146] Meanwhile, U.S. highways and bridges face an $808 billion backlog of investment needs, including $479.1 billion in critical repair work, while 11 percent of America's bridges have been labeled structurally deficient.[147]

If the United States is going to be able to sustainably finance its roadways—and at the same time achieve greater consumer adoption of more fuel-efficient vehicles—then **Congress needs to increase the gas tax and largely use the money to expand highway capacity.** Over the years, policymakers have tried to push consumers toward more fuel-efficient vehicles obliquely and indirectly through CAFE standards. In fact, the last time the United States increased the gas tax was in 1993 as part of the Omnibus Budget Reconciliation Act, which increased it by 4.3 cents, bringing the total tax to 18.4 cents per gallon.[148]

But CAFE standards actually operate as a hidden tax for consumers. In fact, the Center for Automotive Research estimated in 2011 that CAFE standards could eventually cost up to $6,700 per vehicle.[149] For policymakers, hiding the cost has been preferable to raising gas taxes, but doing so has led to significant inefficiencies.[150] For instance, the Congressional Budget Office (CBO) found in a 2004 study that achieving a given reduction in fuel use costs 27 percent less if achieved through a gasoline tax than through CAFE standards.[151] In other words, the CAFE tax costs consumers 27 percent more than an equally effective gas tax would.[152] As the CBO report explains, "A gasoline tax is a good policy to compare with CAFE standards because it is the most direct way to reduce gasoline consumption. By raising the price of gasoline to consumers, a tax raises the cost of driving and encourages consumers to buy more fuel-efficient vehicles."[153] A different analysis by Karplus et al. finds that new fuel economy standards are 6 to 14 times more expensive than an equal consumption-reducing gas tax.[154] Ultimately, gas taxes provide clearer market signals than CAFE standards do toward the goal of transforming America's vehicle fleet toward more fuel-efficient vehicles.

## Prioritize Deployment of Intelligent Transportation Systems

ITSs integrate advanced technologies such as sensors, communication networks, data analytics, and real-time monitoring to enable smarter management of transportation infrastructure and vehicles. Among the most innovative applications of ITSs are vehicle-to-infrastructure (V2I) and vehicle-to-everything (V2X) communication. In these scenarios, vehicles equipped with advanced communication systems can share information with traffic signals, road signs, and other infrastructure, as well as pedestrians and other vehicles, to enhance safety and efficiency.[155] Unfortunately, the United States has lagged behind global leaders in deploying ITS solutions, in part because current dedicated funding for ITS technology stands around 0.10 percent of federal transportation funding.[156]

That's unfortunate, because ITIF has estimated that ITS deployments can reduce congestion by as much as 20 percent or more. That matters when, in 2025, the average American spent 63 hours in traffic and the total cost of congestion on the U.S. economy reached $269 billion, a 16 percent increase from five years earlier.[157]

One of the most effective ITS tools to help address congestion is adaptive traffic signal lights (i.e., "smart traffic lights"). There are roughly 320,000 traffic signals in the United States and the annual congestion costs—direct and indirect—associated with those intersections reaches $22.9 billion. Unproductive vehicle idling could contribute as much as 15 percent of the carbon dioxide emissions from U.S. land transportation.[158] But studies show that the implementation of adaptive traffic signal time can yield a 20 to 30 percent decrease in the number of stops at signalized intersections.[159] Moreover, one study of crash data from 2011 to 2018 on five

corridors found that adaptive signal control technology, which is designed to keep traffic flowing smoothly, led to a reduction in crashes of about 5 percent that year.[160]

To be sure, vehicles themselves are becoming increasingly intelligent, but this does not mean that V2I and V2X integration is unimportant. For instance, a smart autonomous vehicle stopped at a traffic light when there are no other vehicles around, either because the traffic light can't sense the vehicle or the vehicle can't communicate with the traffic light, represents inefficiency in the transportation infrastructure. Moreover, the current average age of the U.S. vehicle fleet is 12.8 years old, with the older models on the road obviously lacking the intelligence of the newer ones built today, reinforcing why bringing intelligence to infrastructure is also imperative.[161]

A September 2023 Government Accountability Office (GAO) report interviewed officials from 17 state and local transportation agencies to garner perspectives from urban and rural locations in geographically dispersed areas where ITSs have been deployed to varying degrees. The study finds that the majority of respondents, 59 percent, reported deploying smart traffic lights at less than 10 percent of their signalized intersections.[162] Another May 2025 study estimates that adaptive signal control has been implemented at less than 1 percent of signalized intersections in the United States.[163] The GAO report notes that significant challenges remain to implementing and operating ITS solutions such as adaptive signal control in the United States, including procurement and obsolescence issues, interoperability problems with ITS-related equipment, and staffing-related challenges.[164]

**The United States has lagged behind global leaders in deploying ITS solutions, in part because current dedicated funding for ITS technology stands around one tenth of one percent (0.10 percent) of federal transportation funding.**

Policymakers need to focus greater attention on ITS deployments. **Congress should authorize and fund a $5 billion funding program for transportation technology. And DOT should update and release a new national strategy for V2X/V2I deployment.** Such a program could include various aspects and uses of technology, such as automation, V2X and V2I, transportation connectivity, AI, advanced air mobility/unmanned aircraft systems, data collection and storage, data cybersecurity, and more.[165] DOT should encourage the inclusion of technology and digital infrastructure in all aspects of R&D, including annual modal research plans and subagencies such as the Advanced Research Projects Agency (ARPA)-Infrastructure. **Congress should also tie federal surface transportation funding to states' actual improvements in transportation system performance.** Lastly**, DOT should ensure that data pertaining to U.S. highway construction is publicly accessible in machine-readable format.**

## Empower States to Expend Highway Trust Funds

One area for potential devolution of federal power to states is noninterstate surface transportation. The Interstate Highway System has an obvious federal rationale. But local transit, bike infrastructure, and noninterstate road and bridge construction funded through federal-aid highway programs come with an enormous and costly compliance apparatus that includes Buy America, Davis-Bacon requirements (which mandate certain wage levels for contractors and subcontractors on federally funded or assisted construction projects), Americans With Disability Act (ADA) design standards, environmental review, etc. The models used in countries such as

Germany and Switzerland, where the federal government sets standards for intercity/interstate infrastructure but local governments finance and design local networks, produce better outcomes. As such, **Congress should allocate approximately 80 percent of Highway Trust Fund revenues as formula grants to states based on their contributions, with no strings attached. The remaining 20 percent should be for interstate projects of national significance.**

### Support the Deployment of EV Charging Infrastructure

American drivers won't adopt EVs if they lack confidence in the existence of a comprehensive, reliable, and dependable national EV charging infrastructure.[166] While some progress has been made in this area, much more needs to be done. For this reason, **U.S. government entities at all levels (federal, state, and local) should increase their coordination to create an easier-to-navigate environment for planning, funding, permitting, and infrastructure investments for EV charging stations.**[167] In particular, governments should implement interoperability and open access requirements for technical equipment while ensuring that they don't constrain the deployment of charging stations and pick "winners and losers."[168] Additionally, all new construction of interstate highways should include EV charging infrastructure.

## CONCLUSION

America's motor vehicle industry stands at a crossroads. Once an engine of U.S. industrial power, it now faces a convergence of pressures: Chinese mercantilism, a widening technology gap in EVs and batteries, offshoring manufacturing, and transformative technologies related to autonomy.

The good news is that none of these challenges are insurmountable, but waiting to act is not an option. U.S. policymakers need to respond to these pressures by supporting the development of a coherent, forward-looking national strategy—one that pairs strategic public investment in next-generation vehicle technologies with institutional and regulatory reforms that align industry, government, and research efforts.

No single policy will reverse decades of relative decline, but together, executed across these five areas, stronger policies can put the U.S. auto industry back on a competitive footing. The stakes extend beyond the factory floor; they go directly to national power. Imagine a nation where we depend on China for our autos. That's not acceptable. Congress and the administration should treat revitalizing the U.S. auto industry not as a legacy obligation but as a strategic imperative and act accordingly.

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This report is the final installment in a three-part series on the U.S. auto industry. Read the series at itif.org by searching #autostrategyseries.

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## ENDNOTES

1. Stephen Ezell and Meghan Ostertag, "Assessing the Evolving Global Competitiveness of the US Auto Industry" (ITIF, March 2023), https://itif.org/publications/2026/03/23/assessing-evolving-global-competitiveness-of-us-auto-industry/; Stephen Ezell and Meghan Ostertag, "Explaining the Relative Decline of America's Automotive Industry" (ITIF, April 2026), https://itif.org/publications/2026/04/20/explaining-the-relative-competitive-decline-of-americas-automotive-industry/.
2. Ibid.
3. United States International Trade Commission (USITC), "Automotive Trade Statistics, 1964–1978" (USITC, November 1979), https://www.usitc.gov/publications/332/pub1002.pdf.
4. Robert D. Atkinson and Stephen Ezell, *Innovation Economics: The Race for Global Advantage* (New Haven Connecticut: Yale University Press, 2012): 93–94; Clyde Prestowitz, "Beyond Laissez Faire," *Foreign Policy*, No. 87 (1992): 67–87, https://www.jstor.org/stable/1149161.
5. Stephen Ezell and Robert D. Atkinson, "The Case for a National Manufacturing Strategy" (ITIF, April 2011), https://www2.itif.org/2011-national-manufacturing-strategy.pdf.
6. Alliance for Automotive Innovation (AAI), "Data Driven: Navigating the Road Ahead" (AAI, January 2025), 2, https://www.autosinnovate.org/DataDriven.
7. Meghan Ostertag, "US National Power Industries Are at Risk" (ITIF, November 2025), https://itif.org/publications/2025/11/17/us-national-power-industries-are-at-risk/.
8. Ibid.
9. Ezell and Ostertag, "Assessing the Evolving Global Competitiveness of the US Auto Industry."
10. Sharon Terlep and Marcus Weisgerber, "Pentagon Approaches Automakers, Manufacturers to Boost Weapons Production," *The Wall Street Journal*, April 15, 2026,

https://www.wsj.com/politics/national-security/pentagon-approaches-automakers-manufacturers-to-boost-weapons-production-19538557.

11. Stephen Ezell, "Don't Let Chinese EV Makers Manufacture in the United States" (ITIF, September 2025), https://itif.org/publications/2025/09/17/dont-let-chinese-ev-makers-manufacture-in-the-united-states/.
12. Park Sang-soo, "Japanese automakers' market share in S. Korea at nearly 5-year high," *Yonhap News Agency*, March 2, 2024, https://en.yna.co.kr/view/AEN20240302000900320; Yukio Hashimoto, "Chinese, Korean automakers finding buyers in Japan's EV sales," *The Asahi Shimbun*, March 18, 2025, https://www.asahi.com/ajw/articles/15673069.
13. Robert D. Atkinson, "Go to the Mattresses: It's Time to Reset U.S.-EU Tech and Trade Relations" (ITIF, October 2024), https://itif.org/publications/2024/10/21/its-time-to-reset-us-eu-tech-and-trade-relations/; "Germany – Automotive Sales volume, 2024" (MarkLines), https://www.marklines.com/en/statistics/flash_sales/automotive-sales-in-germany-by-month.
14. Sebastian Ibold, Xia Yun, and Xiao Shuyue, "NEV Development Plan 2035" (Deutsche Gesellschaft für Internationale Zusammenarbei, 2021), 18, https://changing-transport.org/wp-content/uploads/2021_NEV_Development_Plan_2035.pdf.
15. Ibid., 17.
16. Ibid., 21.
17. European Commission, "Communication From the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions: Industrial Action Plan for the European automotive sector" (European Commission, May 2025), https://transport.ec.europa.eu/document/download/89b3143e-09b6-4ae6-a826-932b90ed0816_en?filename=Communication+-+Action+Plan.pdf.
18. "Korea's Future Mobility Industry: Advancing through Ecosystem Development and Global Competitiveness," *Invest Korea*, December 5, 2025, https://www.investkorea.org/ik-en/bbs/i-5025/detail.do?ntt_sn=490814.
19. Government of Canada, "Prime Minister Carney unveils Canada's new automotive strategy to protect jobs and position our country as a global leader in next-generation vehicle manufacturing," February 5, 2026, https://www.canada.ca/en/innovation-science-economic-development/news/2026/02/prime-minister-carney-unveils-canadas-new-automotive-strategy-to-protect-jobs-and-position-our-country-as-a-global-leader-in-next-generation-vehicl.html.
20. International Trade Administration, "Office of Transportation and Machinery," https://www.trade.gov/about-us/office-transportation-and-machinery.
21. Ezell and Ostertag, "Assessing the Evolving Global Competitiveness of the US Auto Industry."
22. On March 31, 2025, the Trump administration incorporated the Chips Program Office into the United States Innovation Accelerator. John Curran, "White House Wraps CHIPS Office Into New US 'Investment Accelerator'," *MeriTalk*, April 1, 2025, https://meritalk.com/articles/white-house-wraps-chips-office-into-new-us-investment-accelerator/.
23. "Mexican auto sector's trade surplus with the US is bigger than ever," *Mexico News Daily*, November 11, 2024, https://mexiconewsdaily.com/business/mexican-auto-sectors-trade-surplus-us-bigger-than-ever/.
24. Camila Domonoske, "Trump administration rolls back fuel economy standards," *NPR*, December 3, 2025, https://www.npr.org/2025/12/03/nx-s1-5630389/trump-administration-rolls-back-fuel-economy-standards.
25. James Chen, "Understanding the Plaza Accord: Impact on Global Currency Markets," *Investopedia*, April 14, 2026, https://www.investopedia.com/terms/p/plaza-accord.asp.

26. Ibid.
27. "FX Special - Why the US dollar is still overvalued," ABN-AMRO, November 5, 2025, https://www.abnamro.com/research/en/our-research/fx-special-why-the-us-dollar-is-still-overvalued.
28. Manufacturing.gov, "What Is the MEP National Network," https://www.manufacturing.gov/qa/what-mep-national-network.
29. Marc Fasteau and Ian Fletcher, "An Industrial Policy Success Story Trump Should Champion: The Manufacturing Extension Partnership" (Coalition for a Prosperous America, February 25, 2026), https://prosperousamerica.org/an-industrial-policy-success-story-trump-should-champion-the-manufacturing-extension-partnership/.
30. Stephen Ezell, "How Digitalization Is Transforming Modern Manufacturing and Implications for Iowa" (PPT for Iowa Innovation Council, August 7, 2019).
31. South Dakota Manufacturing and Technology Solutions, "Automation in our SD Manufacturing Facilities," https://www.sdmanufacturing.com/services/automation.
32. Jeffrey Kinney, "Trump again proposes eliminating Manufacturing Extension Partnership," *Manufacturing Drive*, April 8, 2026, https://www.manufacturingdive.com/news/trumps-fy-2027-budget-eliminates-manufacturing-extension-partnership-program/816844/.
33. NIST Congressional and Legislative Affairs, "NIST Appropriations Summary FY 2022 – FY 2024," https://www.nist.gov/congressional-and-legislative-affairs/nist-appropriations-summary-1.
34. Ibid.
35. Kasey Pittman of Cherry Bekaert, "How New Tax Policy is Supercharging U.S. Manufacturing Investment," *Industrial Sage*, July 17, 2025, https://www.industrialsage.com/how-new-tax-policy-is-supercharging-us-manufacturing-investment/.
36. U.S. Department of Transportation, "Corporate Average Fuel Economy (CAFE) Standards," https://www.transportation.gov/mission/sustainability/corporate-average-fuel-economy-cafe-standards.
37. Corbin Hiar, "Tesla built Musk's vast wealth through climate credits. Trump may end them." *E&E News*, January 15, 2025, https://www.eenews.net/articles/musk-made-a-fortune-on-climate-credits-trump-is-targeting-them/.
38. David Welch, Keith Naughton, and Keith Laing, "Detroit's Carmakers to Save Billions in Trump Emissions Rollback," *Bloomberg,* September 7, 2025, https://www.bloomberg.com/news/articles/2025-09-07/detroit-s-carmakers-to-save-billions-in-trump-emissions-rollback.
39. Robert S. Miller, "Stellantis Hit With $190.6 Million In Fuel Economy Fines," *Mopar Insiders*, August 28, 2025, https://moparinsiders.com/stellantis-hit-with-190-6-million-in-fuel-economy-fines/.
40. Welch, Naughton, and Laing, "Detroit's Carmakers to Save Billions in Trump Emissions Rollback."
41. Domonoske, "Trump administration rolls back fuel economy standards."
42. Welch, Naughton, and Laing, "Detroit's Carmakers to Save Billions in Trump Emissions Rollback."
43. Ibid.
44. Ibid.
45. Gerald R. Bodisch, "Economic Effects of State Bans on Direct Manufacturer Sales to Car Buyers," *Department of Justice Antitrust Div. Economic Analysis Group Competition Advocacy Paper* 09-1 CA (May 2009), https://www.justice.gov/sites/default/files/atr/legacy/2009/05/28/246374.pdf.
46. Federal Trade Commission, "Missouri and New Jersey Should Repeal Their Prohibitions on Direct-to-Consumer Auto Sales by Manufacturers," press release, May 16, 2024, https://www.ftc.gov/news-events/news/press-releases/2014/05/ftc-staff-missouri-new-jersey-should-repeal-their-prohibitions-direct-consumer-auto-sales.

47. Bodisch, "Economic Effects of State Bans on Direct Manufacturer Sales to Car Buyers," 1.
48. Daniel Crane, "Podcast: The Future of Buying Cars, With Daniel Crane," *Innovation Files*, April 18, 2022, https://itif.org/publications/2022/04/18/podcast-future-buying-cars-daniel-crane/.
49. Fasteau and Fletcher, "An Industrial Policy Success Story Trump Should Champion: The Manufacturing Extension Partnership."
50. Stephen Ezell et al., "Manufacturing Digitalization: Extent of Adoption and Recommendations for Increasing Penetration in Korea and the U.S." (ITIF, August 2018), 42, https://www2.itif.org/2018-korean-manufacturing-digitalization.pdf.
51. NIST, "MEP Manufacturing Technology Acceleration Center (M-TAC) Pilot Project: Southeast Automotive M-TAC," August 2014, https://www.nist.gov/system/files/documents/2017/05/09/Southeast-Auto-MTAC-Aug2014.pdf.
52. Sree Ramaswamy et al., "Making It In America: Revitalizing U.S. Manufacturing" (McKinsey & Company, November 2017), 56, https://www.mckinsey.com/~/media/McKinsey/Global%20Themes/Americas/Making%20it%20in%20America%20Revitalizing%20US%20manufacturing/Making-it-in-America-Revitalizing-US-manufacturing-Full-report.ashx.
53. Ezell et al., "Manufacturing Digitalization: Extent of Adoption and Recommendations for Increasing Penetration in Korea and the U.S."
54. Phone conversation with Sree Ramaswamy, April 27, 2018.
55. Ramaswamy et al., "Making It In America," 56.
56. Jamie Bennet, "DOE Debuts $50M Smart Manufacturing Funding Program for Small & Mid-sized Companies," *ExecutiveGov*, April 3, 2023, https://www.executivegov.com/articles/doe-debuts-50m-smart-manufacturing-funding-program.
57. U.S. Department of Energy, "Factsheets State Manufacturing Leadership Program," https://www.energy.gov/sites/default/files/2023-09/State%20Manufacturing%20Leadership%20Program%20Selections%20Factsheets_0.pdf.
58. Robert D. Atkinson, "The Case for Improving America's Research and Experimentation Tax Credit," *The Hill*, May 28, 2021, https://itif.org/publications/2021/05/28/case-improving-americas-research-and-experimentation-tax-credit/.
59. Trelysa Long, "Tracking R&D Leadership: US Advantage Narrowing as China Gains Ground" (ITIF, February 2026), https://itif.org/publications/2026/02/09/tracking-rd-leadership-us-advantage-narrowing-as-china-gains-ground/.
60. Matthew Stepp and Robert D. Atkinson, "Creating a Collaborative R&D Tax Credit" (ITIF, June 2011), https://itif.org/publications/2011/06/09/creating-collaborative-rd-tax-credit/.
61. Robert D. Atkinson, "Twelve Tax Reforms to Spur Innovation and Competitiveness," *Innovation Files*, September 25, 2024, https://itif.org/publications/2024/09/25/twelve-tax-reforms-to-spur-innovation-and-competitiveness/.
62. Executive Office of the President, "Artificial Intelligence, Automation, and the Economy" (Executive Office of the President, December 2016), 25, https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-IntelligenceAutomation-Economy.PDF, accessed January 1, 2018.
63. Lorri Freifeld, "2024 Training Industry Report," *Training*, November 20, 2024, https://trainingmag.com/2024-training-industry-report/; Federal Reserve Bank of St. Louis (Gross Domestic Product; accessed April 23, 2026), https://fred.stlouisfed.org/series/GDP.
64. Stephen Ezell, "Assessing the State of Digital Skills in the U.S. Economy" (ITIF, November 2021), https://itif.org/publications/2021/11/29/assessing-state-digital-skills-us-economy/.

65. Robert D. Atkinson, "Mobilizing for Techno-Economic War, Part 6: Transforming R&D Policy" (ITIF, forthcoming 2026).
66. Keith Bradsher, "How China Built Tech Prowess: Chemistry Classes and Research Labs," *The New York Times,* August 2024, https://www.nytimes.com/2024/08/09/business/china-ev-battery-tech.html.
67. Aparna Sankaran, "Global consumers driven back to ICE vehicles as EV enthusiasm cools: EY research," press release, December 9, 2025, https://www.ey.com/en_gl/newsroom/2025/12/global-consumers-driven-back-to-ice-vehicles-as-ev-enthusiasm-cools-ey-research.
68. "Japan's mighty carmakers are in serious trouble," *The Economist*, April 9, 2026, https://www.economist.com/business/2026/04/09/japans-mighty-carmakers-are-in-serious-trouble.
69. Euan Graham, "The EV leapfrog – how emerging markets are driving a global EV boom," *Ember*, December 16, 2025, https://ember-energy.org/latest-insights/the-ev-leapfrog-how-emerging-markets-are-driving-a-global-ev-boom/.
70. Jang Woo-jeong and Lee Young-kwan, "Chinese EVs Dominate Emerging Markets with 80% Share in Thailand, Israel," *The Chosun Daily*, November 4, 2025, https://www.chosun.com/english/industry-en/2025/11/04/AQ2KWUSWNBFTTKDOPRZADO5T4M/; Merritt Enright, "How Chinese EV makers are winning in Brazil," *CNBC*, November 5, 2024, https://www.cnbc.com/2025/11/05/chinese-evs-brazil.html.
71. Society of Automotive Engineers (SAE) Detroit Section, "The U.S. Automotive Industry at Risk" (white paper, October 2024), https://www.sae-detroit.org/wp-content/uploads/2024/12/24-GLC-White-Paper.pdf.
72. Shannon Osaka and Naema Ahmed, "How the U.S. lost its lead in electric vehicles and other clean energy inventions," *The Washington Post*, July 31, 2025, https://www.washingtonpost.com/climate-environment/2025/07/31/china-clean-energy-united-states-inventions/.
73. Gabrielle Coppola, "America's Long, Tortured Journey to Build EV Batteries," *Bloomberg*, June 8, 2023, https://www.bloomberg.com/news/features/2023-06-08/a-us-startup-s-failure-paved-the-way-for-china-s-ev-battery-dominance.
74. Victoria Bela, "Chinese lithium battery electrolyte could double EV range and run in extreme cold," *South China Morning Post*, March 28, 2026, https://www.scmp.com/news/china/science/article/3348185/chinese-lithium-battery-electrolyte-could-double-ev-range-and-run-extreme-cold.
75. Lili Pike and Keith Naughton, "Why Ford Is Expanding a Partnership With Top Chinese Battery Maker," *Bloomberg*, December 23, 2025, https://www.bloomberg.com/news/articles/2025-12-23/how-ford-and-catl-expanded-partnership-despite-political-minefield.
76. Stephen Ezell, "How Innovative Is China in the Electric Vehicle and Battery Industries?" (ITIF, July 2024), https://itif.org/publications/2024/07/29/how-innovative-is-china-in-the-electric-vehicle-and-battery-industries/.
77. Varun Sivaram, Noah Gordon, and Daniel Helmeci, "Winning the Battery Race: How the United States Can Leapfrog China to Dominate Next-Generation Battery Technologies" (Carnegie Endowment for International Peace, October 2024), https://carnegieendowment.org/research/2024/10/winning-the-battery-race-how-the-united-states-can-leapfrog-china-to-dominate-next-generation-battery-technologies.
78. Ibid.
79. Ezell, "How Innovative Is China in the Electric Vehicle and Battery Industries?"
80. ITIF, "The Social and Economic Case for Autonomous Vehicles," April 10, 2013, https://itif.org/media/social-and-economic-case-autonomous-vehicles/.

81. Representative Bob Latta, "Latta Introduces Legislation to Safeguard Autonomous Vehicles," press release, February 6, 2026, https://latta.house.gov/news/documentsingle.aspx?DocumentID=406708.
82. Stephen Ezell, "Comments to OMB Regarding Deregulation" (ITIF, May 2025), https://itif.org/publications/2025/05/12/comments-to-omb-regarding-deregulation/.
83. See also: National Highway Traffic Safety Administration, "NHTSA Finalizes First Occupant Protection Safety Standards for Vehicles Without Driving Controls," March 10, 2022, https://www.nhtsa.gov/press-releases/nhtsa-finalizes-first-occupant-protection-safety-standards-vehicles-without-driving.
84. Alan McQuinn, "Privacy advocates are wrong on connected cars," *The Hill*, February 3, 2018, https://thehill.com/opinion/technology/372186-privacy-advocates-are-wrong-on-connected-cars/.
85. Ibid.
86. Electronic Privacy Information Center, "Comments of the Electronic Privacy Information Center to the National Highway Traffic Safety Administration Federal Motor Vehicle Safety Standards: 'Vehicle-to-Vehicle (V2V) Communications'," October 20, 2014, https://epic.org/wp-content/uploads/privacy/edrs/EPIC-NHTSA-V2V-Cmts.pdf.
87. Peter Holley, "Big Brother on wheels: Why your car company may know more about you than your spouse," *The Washington Post*, January 16, 2018, https://www.washingtonpost.com/news/innovations/wp/2018/01/15/big-brother-on-wheels-why-your-car-company-may-know-more-about-you-than-your-spouse/.
88. Alliance for Automotive Innovation, "Automotive Privacy," https://www.autosinnovate.org/privacy.
89. "U.S. Consumer Data Privacy Law Guides," Baker Donelson, accessed April 30, 2026, https://www.bakerdonelson.com/consumer-data-privacy-law-guides.
90. Daniel Castro, "Congress Rightfully Moves Forward on National Data Privacy Framework, Says ITIF," press release, April 22, 2026, https://itif.org/publications/2026/04/22/congress-rightfully-moves-forward-on-national-data-privacy-framework-says-itif/.
91. Ezell and Ostertag, "Assessing the Evolving Global Competitiveness of the US Auto Industry."
92. Tech Force Foundation, "2024 Supply & Demand Report" (Tech Force Foundation, 2024), https://techforce.org/supplydemand/.
93. Robert D. Atkinson, "Mobilizing for Techno-Economic War, Part 4: Transforming Education and Workforce Policy" (ITIF, forthcoming 2026).
94. "Kettering University," accessed February 9, 2026, https://www.kettering.edu/.
95. "China Policy Leads," *Substack,* https://chinapolicy.substack.com/s/briefs?utm_source=substack&utm_medium=menu.
96. Bureau of Automotive Repair, "Automotive Repair and Smog Check News," Spring 2025, https://www.bar.ca.gov/arsc/newsletters/newsletter/spring-2025/community-colleges-drive-career-growth-with-affordable-auto-tech-training.
97. Richard Kahlenberg, "How Higher Education Funding Shortchanges Community Colleges" (The Century Foundation, May 28, 2015), https://tcf.org/content/report/how-higher-education-funding-shortchanges-community-colleges/.
98. Harry J. Holzer and Sandy Baum, *Making College Work: Pathways to Success for Disadvantaged Students* (Brookings Institution Press, August 29, 2017).
99. Stephen Ezell, "Policy Recommendations to Stimulate U.S. Manufacturing Innovation" (ITIF, 2020), https://www2.itif.org/2020-policy-recommendations-us-manufacturing.pdf.

100. The College System of Tennessee, "Motlow State Automation & Robotics Training Center now open for business," news release, April 30, 2019, https://www.tbr.edu/news/motlow-state-automation-robotics-training-center-now-open-business-2019-04-30.
101. U.S. Economic Development Administration, "Regional Technology and Innovation Hubs (Tech Hubs)," https://www.eda.gov/funding/programs/regional-technology-and-innovation-hubs.
102. The Sustainable Polymers Tech Hub of the United States, "About Us," https://polymerindustrycluster.org/.
103. Manufacturing USA, "Institutes," https://www.manufacturingusa.com/institutes.
104. SAE, "The U.S. Automotive Industry at Risk."
105. Ezell and Ostertag, "Explaining the Relative Competitive Decline of America's Automotive Industry."
106. Scott Kennedy, "The Chinese EV Dilemma: Subsidized Yet Striking" (CSIS, June 20, 2024), https://www.csis.org/blogs/trustee-china-hand/chinese-ev-dilemma-subsidized-yet-striking.
107. Ibid.
108. "400 Chinese EV companies ceased operations between 2018 – 2025, only a few will dominate towards 2030," *EVBoosters*, April 29, 2025, https://evboosters.com/ev-charging-news/400-chinese-ev-companies-ceased-operations-between-2018-2025-only-a-few-will-dominate-towards-2030/; "Only 15 electric vehicle brands in China will be financially viable by 2030, AlixPartners says," *Reuters*, July 3, 2025, https://www.reuters.com/business/autos-transportation/only-15-electric-vehicle-brands-china-will-survive-by-2030-alixpartners-says-2025-07-03/.
109. Alliance for American Manufacturing, "On a Collision Course," 2023, https://www.americanmanufacturing.org/wp-content/uploads/2024/02/on-a-collision-course-report-final-022324.pdf.
110. Luke Patey, "The Great EV Glut" (Danish Institute of International Studies, May 19, 2024), https://www.thewirechina.com/2024/05/19/the-great-ev-glut-european-union-electric-vehicle-china-chinese-electric-vehicles-evs-eu/.
111. Michael Gauthier, "FBI Warns Automakers That China Is Placing A Priority On Stealing Electric Car Tech," *CarScoops*, February 9, 2020, https://www.carscoops.com/2020/02/fbi-warns-automakers-that-china-is-placing-a-priority-on-stealing-electric-car-tech/.
112. Alex Lauer, "China Really Wants to Steal EV Tech, Warns U.S. Counterintelligence," *InsideHook*, February 10, 2020, https://www.insidehook.com/autos/china-steal-electric-vehicle-tech-counterintelligence.
113. Alan Rappeport and Jim Tankersley, "U.S. to Announce New Tariffs on Chinese Electric Vehicles," *The New York Times*, May 10, 2024, https://www.nytimes.com/2024/05/10/us/politics/us-biden-china-tariffs-electric-vehicles.html.
114. Heather Somerville, Alexander Ward, and Gavin Bade, "Trump Quietly Scraps His Own Playbook on China," *The Wall Street Journal*, April 9, 2026, https://www.wsj.com/world/china/trump-china-xi-beijing-e247250d.
115. Ezell, "Don't Let Chinese EV Makers Manufacture in the United States."
116. Ibid.
117. Rodrigo Balbontin and Stephen Ezell, "Comments to USTR Regarding the Trade Agreement Between the United States, Mexico, and Canada" (ITIF, November 2025), https://itif.org/publications/2025/11/03/comments-to-ustr-regarding-the-usmca-trade-agreement/.
118. International Trade Administration, "USMCA Automotive Sector," https://www.trade.gov/usmca-auto-report.

119. Robert D. Atkinson and Meghan Ostertag, "The Hamilton Index, 2025" (ITIF, forthcoming report); OECD, "Trade in Value Added (TiVA) 2025 Edition."
120. Celeste Drake, "United States-Mexico-Canada Agreement: Likely Impact on the U.S. Economy and on Specific Industry Sectors" (AFL-CIO, November 15, 2018), https://aflcio.org/testimonies/united-states-mexico-canada-agreement-likely-impact-us-economy-and-specific-industry.
121. Leo Banks, "Automakers Must Leverage Biden-Harris Administration Policies To Boost Affordable EV Production" (Center for American Progress, October 31, 2024), https://www.americanprogress.org/article/automakers-must-leverage-biden-harris-administration-policies-to-boost-affordable-ev-production/; Kathryn Mayer, "Total Compensation Costs on the Rise," SHRM, March 13, 2024, https://www.shrm.org/topics-tools/news/benefits-compensation/employer-costs-for-employee-compensation-bls-march-2024.
122. Victoria Waldersee and Christoph Steitz, "Exclusive: In High-Wage Germany, Volkswagen's Labour Costs Outstrip the Competition," *Reuters*, November 20, 2024, https://www.reuters.com/business/autos-transportation/high-wage-germany-vws-labour-costs-outstrip-competition-2024-11-20/; Eurostat (Wages and labour costs; accessed April 22, 2026), https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Wages_and_labour_costs.
123. "U.S. and Mexico Labor Cost Comparison: An Overview," Ivemsa, February 19, 2025, https://www.ivemsa.com/us-and-mexico-labor-cost-comparison/; "Mexico Labor Rates," Ivemsa, https://www.ivemsa.com/manufacturing-in-mexico/mexican-labor-rates/.
124. Banks, "Automakers Must Leverage Biden-Harris Administration Policies To Boost Affordable EV Production"; Mayer, "Total Compensation Costs on the Rise"; Waldersee and Steitz, "Exclusive: In High-Wage Germany, Volkswagen's Labour Costs Outstrip the Competition"; Eurostat (Wages and labour costs); Ivemsa, "U.S. and Mexico Labor Cost Comparison" Ivemsa, "Mexico Labor Rates."
125. Center for Automotive Research (CAR), "The Growing Role of Mexico in the North American Automotive Industry" (CAR, July 2016), https://www.cargroup.org/wp-content/uploads/2017/02/The-Growing-Role-of-Mexico-in-the-North-American-Automotive-Industry-Trends-Drivers-and-Forecasts.pdf.
126. David Coffin, Sharon Ford, and Edward Petronzio, "Chinese Automotive and Electronics Trade and Investment in Mexico" (U.S. International Trade Commission, Office of Industry and Competitiveness Analysis, November 2024), https://www.usitc.gov/publications/332/working_papers/chinese_aei_mexico.pdf.
127. Fernando Navarrete, "Does China have a 'shortcut' to circumvent auto tariffs? The US accuses them of using Mexico to evade them," *El Financiero,* July 1, 2025, https://www.elfinanciero.com.mx/empresas/2025/07/01/estados-unidos-acusa-a-china-de-usar-a-mexico-para-evadir-los-aranceles-a-los-autos-y-autopartes/.
128. Teresa De Alba, "US Warns China May Use Mexico to Bypass Auto Tariffs," *Mexico Business News*, July 3, 2025, https://mexicobusiness.news/automotive/news/us-warns-china-may-use-mexico-bypass-auto-tariffs.
129. Balbontin and Ezell, "Comments to USTR Regarding the Trade Agreement Between the United States, Mexico, and Canada."
130. Duncan Wood, "6 Top Issues To Review in U.S.-Mexico-Canada Trade," *The Hill*, June 21, 2025 https://thehill.com/opinion/international/5357376-usmca-review-north-america/.
131. Rob Gillies, "Canada cuts tariff relief on some US cars due to Stellantis, GM ending some Canadian production," *Associated Press*, October 23, 2025, https://apnews.com/article/canada-us-auto-production-tariffs-a64f16e120fca93af501fa9c8ce39866.
132. Government of Canada, "Canada takes decisive action to protect auto industry and workers," https://www.canada.ca/en/department-finance/news/2025/10/canada-takes-decisive-action-to-protect-

auto-industry-and-workers.html; Government of Canada, "United States Surtax Remission Order (Motor Vehicles 2025): SI/2025-60," https://gazette.gc.ca/rp-pr/p2/2025/2025-05-07/html/si-tr60-eng.html.

133. Government of Canada, "Prime Minister Carney unveils Canada's new automotive strategy to protect jobs and position our country as a global leader in next-generation vehicle manufacturing," https://www.canada.ca/en/innovation-science-economic-development/news/2026/02/prime-minister-carney-unveils-canadas-new-automotive-strategy-to-protect-jobs-and-position-our-country-as-a-global-leader-in-next-generation-vehicl.html.
134. Bureau of Economic Analysis, "International Data - International Transactions, International Services, and International Investment Position Tables."
135. Caleb Miller, "Report: Trump's Tariffs Have Cost Automakers $35 Billion So Far," *Car and Driver*, February 16, 2026, https://www.caranddriver.com/news/a70758296/trump-tariffs-cost-automakers-35-billion/.
136. Boston Consulting Group, "June 2025 Update: The Impact of US Tariffs of 50% on Steel and Aluminum," June 12, 2025, https://www.bcg.com/publications/2025/june-2025-update-impact-us-tariffs-50-percent-on-steel-aluminum.
137. Stephen Ezell, "China-Induced Global Overcapacity an Increasing Threat to High-Tech Industries," *Innovation Files*, February 27, 2018, https://itif.org/publications/2018/02/27/china-induced-global-overcapacity-increasing-threat-high-tech-industries/.
138. Robert D. Atkinson, "Mobilizing for Techno-Economic War, Part 6: Transforming Regulatory Policy" (ITIF, forthcoming July 2026).
139. California Air Resources Board, "Zero-emission Vehicle Regulation," https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program.
140. New York State, "Governor Hochul Drives Forward New York's Transition to Clean Transportation," press release, September 29, 2022, https://www.governor.ny.gov/news/governor-hochul-drives-forward-new-yorks-transition-clean-transportation.
141. Lauren Fletcher, "Which States Have Zero-Emission Vehicle Mandates?" *Green Fleet*, February 1, 2024, https://www.worktruckonline.com/10214784/which-states-have-zero-emission-vehicle-mandates.
142. Ibid.; "Understanding California Air Resources Board Compliance Regulations," *World Truck*, July 1, 2021, https://www.worktruckonline.com/10146632/understanding-california-carb-compliance-regulations.
143. Stephen Ezell, "Explaining International IT Application Leadership" (ITIF, January 2010), https://www2.itif.org/2010-1-27-ITS_Leadership.pdf.
144. U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, "2025 FHWA Forecasts of Vehicle Miles Traveled (VMT)," September 2025, https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm.
145. "Research Finds Autonomous Vehicles Could Add One Trillion More Vehicle Miles Traveled Annually by 2050," *Body Shop Business*, November 19, 2015, https://www.bodyshopbusiness.com/autonomous-vehicles-miles-traveled-2050/.
146. U.S. Department of Transportation, Federal Highway Administration, "Budget Estimates: Fiscal Year, 2026" (U.S. DoT, 2026), 64, https://www.transportation.gov/sites/dot.gov/files/2025-05/FHWA_FY_2026_Budget_Estimates.pdf.
147. U.S. Department of Transportation, "Grow America Act: Making Critical Investments in Highway and Bridge Infrastructure,"

https://www.transportation.gov/sites/dot.gov/files/docs/Making_Critical_Investments_in_Highway_and_Bridge_Infrastructure.pdf.

148. U.S. Department of Transportation, Federal Highway Administration, "Ask the Rambler: When did the Federal Government begin collecting the gas tax?" https://highways.dot.gov/highway-history/general-highway-history/rambler/ask-rambler-when-did-federal-government-begin.
149. "Obama Announces New Standards To Double Vehicle MPG By 2025," *CBS News*, August 3, 2011, https://www.cbsnews.com/boston/news/obama-announces-new-standards-to-double-vehicle-mpg-by-2025/.
150. Timothy G. Nash, "When even the best regulations go wrong" (Northwood University, November 4, 2022), https://www.northwood.edu/news/when-even-the-best-regulations-go-wrong/.
151. Congressional Budget Office (CBO), "Fuel Economy Standards Versus a Gasoline Tax" (CBO, March 9, 2024), 3, https://www.ftc.gov/sites/default/files/documents/public_events/Energy%20Markets%20in%20the%21st%20Century%3A%20Competition%20Policy%20in%20Perspective/austin.pdf.
152. Nash, "When even the best regulations go wrong."
153. CBO, "Fuel Economy Standards Versus a Gasoline Tax," 2.
154. Valerie Karplus et al., "Should a vehicle fuel economy standard be combined with an economy-wide greenhouse gas emissions constraint? Implications for energy and climate policy in the United States," *Energy Economics* Vol. 36 (March 2013), https://www.sciencedirect.com/science/article/abs/pii/S0140988312002150; Alex Tabarrok, "CAFE Standards are Extremely Inefficient," *Marginal Evolution,* February 23, 2013, https://marginalrevolution.com/marginalrevolution/2013/02/cafe-standards-are-extremely-inefficient.html.
155. "Intelligent Transportation System Definition," Digit International, https://www.digi.com/resources/definitions/its.
156. Intelligent Transportation Society (ITS) America, "2026 Surface Transportation Reauthorization Policy Principles" (ITS America, March 2025), 2, https://itsa.org/wp-content/uploads/2025/03/ITS-America-STR-Principles_Final.pdf.
157. Texas A&M Transportation Institute, Mobility Division, "2025 Urban Mobility Report," https://mobility.tamu.edu/umr/.
158. Adam Zewe, "Eco-driving measures could significantly reduce vehicle emissions," *MIT News*, August 7, 2025, https://news.mit.edu/2025/eco-driving-measures-could-significantly-reduce-vehicle-emissions-0807.
159. Jim Lynch, "Optimized traffic signal timing approach cuts delays 20%, real-world test shows," University of Michigan Engineering Department, February 20, 2024, https://news.engin.umich.edu/2024/02/improving-traffic-signal-timing-with-a-handful-of-connected-vehicles/.
160. Government Accountability Office (GAO), "Intelligent Transportation Systems: Benefits Related to Traffic Congestion and Safety Can Be Limited by Various Factors," September 2023, 2, https://www.gao.gov/products/gao-23-105740.

161 Todd Campau, "Average Age of Vehicles in the US Rises to 12.8 Years in 2025," *S&P Global*, May 21, 2025, https://www.spglobal.com/automotive-insights/en/blogs/2025/05/average-age-of-vehicle-in-us.

162. GAO, "Intelligent Transportation Systems," 16–17.
163. Sensys Networks, "How cities adapt to growing traffic," https://sensysnetworks.com/how-cities-adapt-to-growing-traffic/.

164. GAO, “Intelligent Transportation Systems,” 2.
165. ITS America, “2026 Surface Transportation Reauthorization Policy Principles,” 4.
166. Ezell, “How Innovative Is China in the Electric Vehicle and Battery Industries?”
167. Climate Group EV100, “Key Policies to Drive the Electric Vehicle Transition in the U.S.” 5, https://www.theclimategroup.org/sites/default/files/2021-09/Key%20Policies%20to%20Drive%20the%20Electric%20Vehicle%20Transition%20-%20Updated.pdf.
168. Ibid.