



## 23-1 Industrial policy for electric vehicle supply chains and the US-EU fight over the Inflation Reduction Act

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### ABSTRACT

The Inflation Reduction Act (IRA) of 2022 provoked a transatlantic trade spat. After the law was passed, the Biden administration addressed some of the concerns raised by the European Union by writing controversial rules to implement the legislation. These regulations are expected to have complex effects that, in some instances, may offset the intended impact of other provisions in the original legislation. This paper examines how the law, its implementing regulations, policy decisions on leasing, as well as potential critical minerals agreements all have the potential to affect the electric vehicle (EV) supply chain. The EV case study showcases the political-economic complications involved in US and EU attempts to cooperate over clean energy transition policy to address the global externality of carbon dioxide emissions. EVs are but one example of the challenge facing partners with integrated supply chains and similar levels of economic development that share concerns about climate change, rising inequality, workers, other social issues, and democracy itself. The EV conflict laid bare the differing US and EU prioritization of these issues relative to economic efficiency, World Trade Organization rules, the approach to nonmarket economies, and national security vulnerabilities that arise from depending on an authoritarian regime such as China for import sourcing of critical inputs.

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## INTRODUCTION

In August 2022, President Joe Biden signed the Inflation Reduction Act (IRA) into law. The late-breaking deal between Senate Majority Leader Chuck Schumer and Senator Joe Manchin of West Virginia—the product of a deadlocked Senate requiring that every Democratic senator be on board—surprised even Washington insiders.

Less pleasantly surprised was the European Union (EU). It celebrated the fact that the United States finally had an aggressive climate policy, applauding the administration’s commitment to reduce emissions from 2005 levels by 50–52 percent by 2030.<sup>1</sup> But it found fault with a number of the IRA’s details.

One of its most important complaints was the law’s discriminatory “Buy American” (local content) incentives. The legislation’s new tax credit for electric vehicles (EVs), for example, initially seemed to deem eligible only cars assembled in North America. If so, this rule would shut out a Volkswagen imported from Germany but not one manufactured in Tennessee. Over the next few months, the Treasury Department wrote implementing regulations that tweaked key IRA provisions on EVs in ways that accommodated some of the EU’s concerns. Doing so through implementing regulation, however, rather than reform of the statute, comes with its own consequences. And some of the trading partners’ more fundamental concerns with the IRA could not be fixed through implementing regulations.

This paper showcases the political-economic complexity of US and EU attempts to cooperate over clean energy transition policy to address a global externality. EVs are but one example of the challenge facing partners with integrated supply chains; similar levels of economic development; and shared worries over climate and other environmental problems, rising inequality, workers, social issues, and democracy itself. The EV conflict laid bare the different ways in which the United States and the European Union prioritized economic efficiency, World Trade Organization (WTO) rules, the approach to nonmarket economies, and national security vulnerabilities that arise from depending on an authoritarian regime such as China for import sourcing of critical inputs.

The details matter for how the IRA and its implementing regulations affect incentives for international trade in EVs and their key inputs. The paper explores those details, including the potentially transformative decision that leased vehicles could qualify for consumer tax credits under a separate and independent track of the IRA that did not have those discriminatory local content incentives. It also examines numerous other policies—including the considerable differences in US and EU import tariffs on EVs toward each other and toward third countries, such as China—that are also likely to affect EV trade patterns in ways that offset some effects of the IRA. In the pre-IRA policy landscape, for example, EU imports of EVs were increasingly dominated by sourcing from China, which had largely displaced US exports. Furthermore, the United States continued to import large numbers of EVs from Europe even after implementing the IRA. Whether this trend continues, of course, remains an open question.

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<sup>1</sup> Model estimates from Bistline, Mehrotra, and Wolfram (2023) suggest that the IRA could help the United States reduce emissions from 2005 levels by 32–42 percent by 2030, a 6–11 percentage point improvement relative to the business as usual (non-IRA) projections.

Most importantly, this paper explains what the United States did in passing the IRA, as well as its implementing regulations, and why it did it. Along the way it attempts to identify inefficiencies, tradeoffs, inconsistencies, and potential unintended consequences of the US policy approach, especially as manifest in the implementing regulations announced in the eight months following the IRA passage in August 2022.

The analytical framing is driven largely by economics. Because the analysis operates in a setting motivated by both enormous environmental externalities (climate) and growing externalities associated with national security concerns, it is limited to identifying channels and clarifying tradeoffs. Without an explicit model or data, such an approach is admittedly modest. The goal is to provide a detailed explanation of the policy to provide a building block for more formal modeling that can generate informed normative recommendations for enhanced policy cooperation in light of continually shifting real world political-economic constraints.

### THE US POLICY OBJECTIVES FOR ITS ELECTRIC VEHICLE TAX CREDITS

Reducing greenhouse gas emissions, including carbon dioxide (CO<sub>2</sub>), is critical to meeting the Paris Agreement objectives of limiting the rise in global temperatures. This massive environmental externality provides a clear motivation for the US federal government to intervene with policy.

In the climate crisis, the economically efficient, first-best policy is a Pigouvian tax equal to the social cost of carbon. The current US federal estimate of that cost is \$51 per ton of CO<sub>2</sub> emissions, though recent estimates indicate that an updated measure would be in the range of \$185–\$200 per ton (Rennert et al. 2022; EPA 2022). The US federal government has never introduced a carbon price or an economically equivalent cap and trade scheme.<sup>2</sup> It has largely turned instead to regulations mandating certain clean energy standards.

Given the constrained policy environment in which it operated, the Biden administration also focused on second-best policies, including subsidies, in the IRA, which was signed into law on August 16, 2022 (table 1). In general, subsidies for the take-up of clean energy are a second-best solution because they encourage excessive consumption of energy overall.<sup>3</sup>

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2 At the sub-federal level, states like California have introduced carbon pricing programs (Clausing and Wolfram, forthcoming). OECD (2022) estimates that 32 percent of greenhouse gas emissions in the United States in 2021 were subject to some “positive net effect carbon rate” policy instrument.

3 In the absence of a market failure for clean energy, a subsidy will lead to excess equilibrium production and consumption of clean energy relative to the social optimum, even if the subsidy internalizes the negative externality in the dirty energy market (by reducing demand for dirty energy, assuming clean and dirty energy are substitutes in consumption). One potential market failure for clean energy could result from learning-by-doing (increasing returns to scale). Bistline, Mehrotra, and Wolfram (2023) find that the learning-by-doing externality would need to be sizable for a subsidy to be equivalent to the first-best carbon tax.

Table 1  
**Key events affecting US policy on electric vehicles**

Date	Event
November 15, 2021	President Biden signs into law the Infrastructure Investment and Jobs Act (House: 228–206; Senate 69–30). The bipartisan legislation includes funding of up to \$7.5 billion for EV charging stations.
November 19, 2021	The US House of Representatives passes the Build Back Better Act (220–213), which includes tax credits for EVs. The bill never passes the Senate.
July 27, 2022	Senator Joe Manchin and Senate Majority Leader Chuck Schumer announce an agreement to allow a vote on the Inflation Reduction Act (IRA) of 2022. It subsequently passes both the Senate (51–50) and House (220–207).
August 16, 2022	President Biden signs the IRA into law. The North American assembly requirement in IRA Section 30D goes into effect immediately.
September 7, 2022	The Congressional Budget Office releases revised estimates of the budgetary effects of IRA over 2022–31.
December 1, 2022	In response to European complaints, during the state visit of French President Emmanuel Macron, Biden says his administration will make “tweaks” to the IRA.
December 19, 2022	The Treasury Department delays proposed regulation on critical minerals and battery components requirements for Section 30D tax credits in the IRA until March 2023.
December 29, 2022	Treasury (Internal Revenue Service) clarifies that the IRA’s commercial clean vehicle tax credits (Section 45W) are available to consumers who lease vehicles. Treasury also releases a Section 30D White Paper anticipating the direction of proposed guidance on critical mineral and battery component value calculations.
February 3, 2023	Treasury reclassifies certain vehicles, making more models eligible for the Section 30D consumer tax credit.
March 10, 2023	President Biden and European Commission President Ursula van der Leyen launch negotiations on a targeted critical minerals agreement that would enable relevant critical minerals extracted or processed in the European Union to count toward requirements for clean vehicles in the IRA’s Section 30D.
March 28, 2023	The United States and Japan sign a Critical Minerals Agreement that qualifies Japan as a “free trade agreement” partner for the IRA’s Section 30D critical minerals content requirements.
March 31, 2023	Treasury proposes a rule for content requirements in the IRA’s Section 30D, including general criteria for “free trade agreement” partners that will go into effect April 18.
April 12, 2023	The Environmental Protection Agency proposes new regulations for vehicle emissions to ensure that two-thirds of new passenger cars will be all-electric by 2032.
April 18, 2023	The content requirements of IRA Section 30D announced on March 31, 2023, go into effect.

### The Environmental Policy Objectives of US Tax Credits on Electric Vehicles

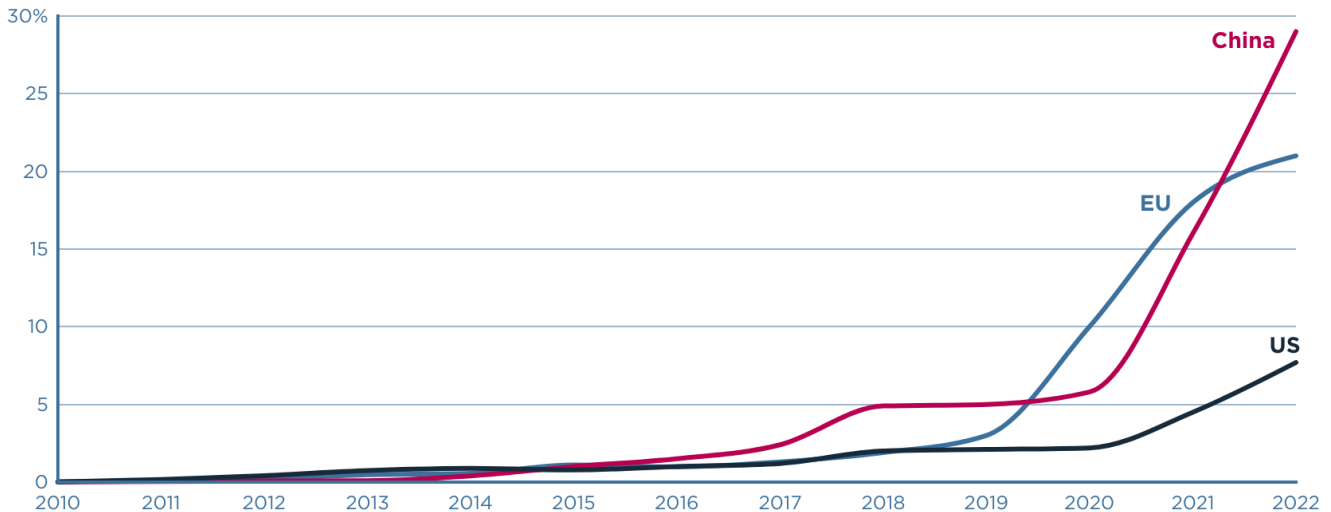
Transportation accounted for 38 percent of US carbon emissions in 2021—the largest single contributor to emissions (CBO 2022a). Of this figure, 83 percent came from personal vehicles (58 percent) and commercial trucks and buses (25 percent); air transport made up another 10 percent. If the United States is to reach its overall goal, CO<sub>2</sub> emissions from transportation will have to fall.

Historically, US consumers have been relatively slow to switch from cars with internal combustion engines (ICEs) to EVs. In 2021, for example, only 5 percent

of new vehicles sold in the United States were EVs—a much smaller share than in China (16 percent) or the European Union (18 percent) (figure 1).

Figure 1  
**The US lags the EU and China in electric vehicle adoption**

Electric vehicles as a share of new vehicles entering the domestic market, 2010–22, percent



Notes: Electric vehicles include battery electric vehicles and plug-in hybrids. Figures are based on number of vehicles, not their value.

Source: International Energy Agency.

Several factors explain why the share is small in the United States. One is EV cost, relative to comparably performing ICE vehicles, especially since the gasoline used to power ICE vehicles has been inexpensive relative to many other countries. Another is consumer tastes. Many Americans prefer large vehicles that can drive long distances, which initial EVs could not easily do, especially given the lack of charging infrastructure in the geographically expansive United States.<sup>4</sup> This constraint on consumer EV take-up is often referred to as “range anxiety.”

At the federal level, the United States had provided consumer tax credits for EVs of up to \$7,500 dating back to the American Recovery and Reinvestment Act (ARRA) of 2009. They were phased out once a manufacturer’s US sales reached 200,000 units. By the summer of 2022, Nissan and Ford were getting close to reaching the cap, and Tesla, General Motors (GM), and Toyota had exceeded it and were no longer receiving subsidies.<sup>5</sup>

To incentivize buyers to switch from ICE vehicles to EVs, the IRA modified existing federal consumer tax credits. It removed the 200,000 cap, making the

4 The bipartisan Infrastructure Investment and Jobs Act that was signed into law in November 2021 provided \$7.5 billion of funding to address part of this challenge (US Department of Transportation, “President Biden, US Department of Transportation Releases Toolkit to Help Rural Communities Build Out Electric Vehicle Charging Infrastructure,” Press release, February 2, 2022).

5 Jon Linkov, “Toyota Becomes 3rd Automaker to Reach Electric Vehicle Tax Credit Limit,” *Consumer Reports*, July 7, 2002.

tax credits available again to Tesla, GM, and Toyota. The uncapped credits would be available for 10 years.

In an attempt to encourage automakers to build out a fleet of EV models for the mass market, the IRA initially limited the tax credit to lower-priced EVs as well as individuals or households with lower earnings. These provisions were added out of concern that most of the limited EV take-up—and subsidies paid out by US policy under earlier tax credits—had gone to higher-income consumers who purchased expensive models, such as early Teslas. To the extent that these purchases would have been made without the tax credits, they were both costly to taxpayers and had insufficient impact on achieving US climate policy objectives.<sup>6</sup>

### Additional Policy Objectives of the Tax Credits

The IRA includes more than just consumer tax credits, as it also attempts to achieve other objectives. Understanding them requires coming to grips with what the US government perceived as the initial, pre-IRA economic and policy equilibrium, as well as the domestic political-economic forces that would make the green energy transition policy sustainable and not subject to a political reversal of the sort that took place in 2017, when President Donald Trump pulled the United States out of the Paris Agreement.

The United States has a large, legacy ICE automobile industry. As ICE vehicles and EVs involve some different corporate players, as well as different inputs in their supply chains, a transition from one to the other puts hundreds of thousands of jobs at risk (Klier and Rubenstein 2022; Hanson 2023). Many of these at-risk jobs are in politically important swing states, such as Michigan and Ohio, where they affect communities that suffered disproportionately large economic losses since 2001—a period that coincides with the “China shock” (Autor, Dorn, and Hanson 2021). Whatever the source of the shock, the failure of workers and communities to adjust continues to play an outsized role in policy discussions—unsurprisingly, given the effectiveness with which Donald Trump weaponized it during the 2016 presidential campaign and while in office.

The US perception of the pre-IRA equilibrium was that it was dominated by China, which subsidized EVs. Beijing had prioritized the sector as part of its highly controversial “Made in China 2025” industrial policy program announced in 2015. China’s supply-side policies for batteries were also alleged to discriminate in favor of indigenous firms.<sup>7</sup> Finally, its import tariffs were high, providing firms that produced locally protection from foreign competition. (In game-theoretic terms, if the rivalry were modeled as a prisoner’s dilemma, China was already playing noncooperatively; if it were a Stackelberg game, China already had a first-mover advantage.)

As a result, by 2022 China’s EV exports to the world were booming, especially in volume terms (figure 2, panel b), as Chinese exports tended to be in lower-priced models. US exports of EVs lagged considerably.

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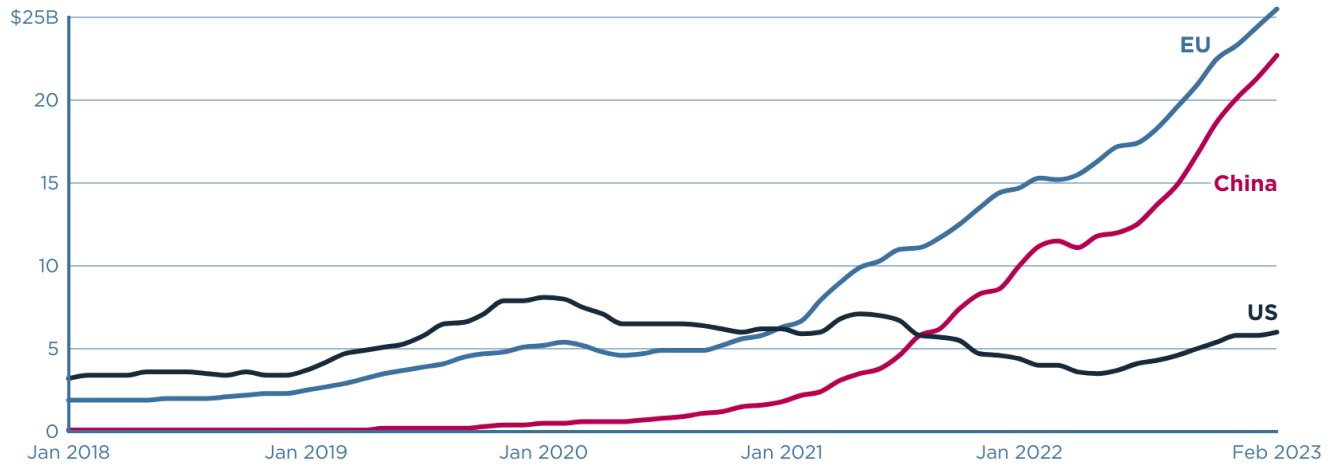
6 For a review of the literature, see Sheldon (2022).

7 See Trefor Moss, “China’s Road to Electric-Car Domination Is Driven in Part by Batteries,” *Wall Street Journal*, October 21, 2017; Trefor Moss, “Power Play: How China-Owned Volvo Avoids Beijing’s Battery Rules,” *Wall Street Journal*, May 17, 2018.

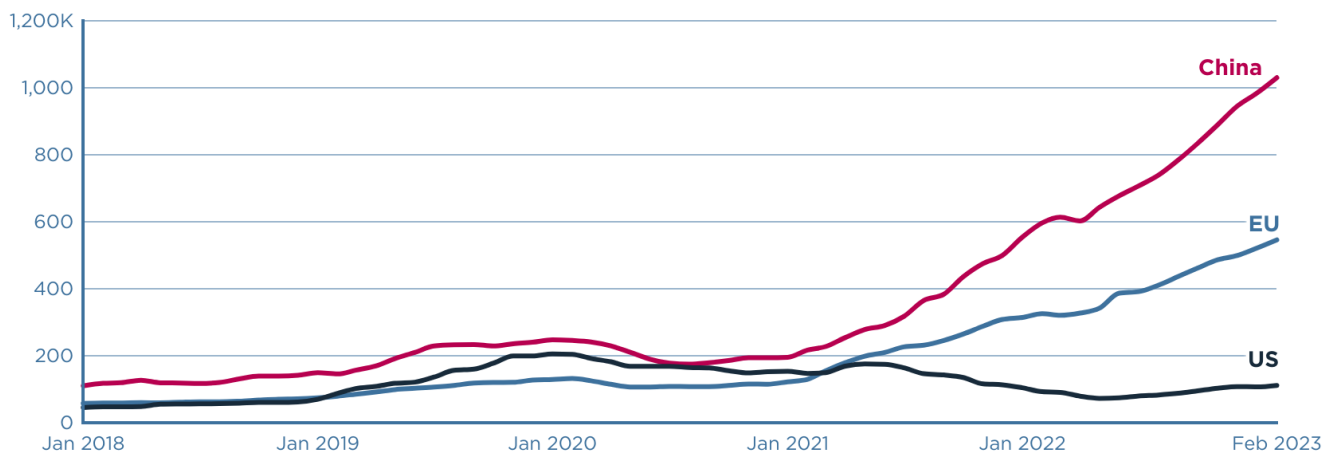


Figure 2  
**US electric vehicle exports are also trailing China and the EU**

a. Value of electric vehicle exports by economy, 12-month trailing sums, billions of USD, 2018-23 (year to date)



b. Volume of electric vehicle exports by economy, 12-month trailing sums, thousands of vehicles, 2018-23 (year to date)



Notes: Figures show battery and fuel cell electric vehicles only. Trade values in panel a for the EU are converted to US dollars from euros using end-of-month USD/euro spot exchange rates from Federal Reserve Economic Data (DEXUSEU). For the EU, the Combined Nomenclature (CN) codes are 87038010 and 87038090 in 2017-23 and 87039010 in 2016. For the US, the Schedule B code is 8703800000. For China, the Harmonized System (HS) code is 87038000. The code for both the US and China was created in 2017 and did not exist for electric vehicles prior to 2017.

Sources: US International Trade Commission Dataweb, Eurostat, China Customs.

In theory, the United States could have confronted China over concerns with its nonmarket economy and system of subsidies, negotiating rules to jointly limit such subsidies to cooperative and globally efficient levels.<sup>8</sup> It could have

8 The United States did confront China unilaterally over a number of Chinese policy issues related to trade; the Trump administration’s trade war tariffs ultimately covered two-third of US imports from China. However, the approach was an ineffective way to address the subsidies issue (Bown 2018). It was thus unsurprising that the “Phase One” agreement that President Trump signed with China in January 2021 contained nothing that would address China’s subsidies (Bown 2021).

worked jointly with other major exporters—such as the European Union and Japan—to address China together. However, the contemporary political reality of US-China tensions had taken that cooperative equilibrium off the table. From the US government’s perspective, failure to intervene in the EV market risked another, automobile industry-specific “China shock,” with potentially devastating domestic political consequences.

Another important policy objective of the IRA is to improve the resilience of the EV battery supply chain by developing input sourcing for batteries outside of China, which dominates the supply chain for battery components, as well as lithium, cobalt, graphite, nickel, and other critical materials (Leruth et al. 2022). Multiple concerns motivate this goal. One is economic competitiveness. China has long used a variety of export-restrictions on inputs—including some critical minerals—to take advantage of its supply-side market power, thereby supporting its downstream, using industries relative to their foreign competitors (OECD 2023).

A second is national security. As Biden administration National Security Advisor Jake Sullivan would later state in a major speech in April 2023,<sup>9</sup> “More than 80 percent of critical minerals are processed by one country, China. Clean-energy supply chains are at risk of being weaponized in the same way as oil in the 1970s, or natural gas in Europe in 2022. So through the investments in the Inflation Reduction Act and Bipartisan Infrastructure Law, we’re taking action.” With US-China geopolitical tensions worsening, the United States was unwilling to expose itself to the same sort of long-run energy dependencies that resulted in the OPEC-led supply shocks of the 1970s, which triggered backups at gas pumps; rationing; and ultimately inflation, recession, and political upheaval at home. Russia’s weaponization of energy supplies to the detriment of the European Union provided even more ammunition to policy makers worried about a military conflict with China doing something similar in the future to restrict the supply of EVs or the ability to manufacture them domestically.

The final policy objective—and the one creating the biggest negative reaction from Europe—was to ease the US labor market transition from ICE vehicles to EVs. The IRA seeks to do so in several ways. First, consumption subsidies appeared initially limited to EVs assembled in North America. This feature of the law transformed the consumption subsidy into a subsidy to production, as it is paid only as long as the EV is both manufactured and sold domestically.<sup>10</sup> Second, the law includes a separate production tax credit for batteries and their inputs (as well as other sources of clean energy), which also affects the competitiveness of the EV supply chain in the United States.

**Clean-energy supply chains are at risk of being weaponized in the same way as oil in the 1970s, or natural gas in Europe in 2022.**

9 White House, “Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution,” April 27, 2023.

10 The main competitiveness spillover was that the subsidy might impede the ability of foreign exporters to sell to the US market; that subsidy did not affect the direct cost of producing an EV for export. The IRA also does not “pick winners” in terms of subsidizing production. Because the subsidy flows through to producers through a consumer tax credit, consumers are still the ones choosing which EV models they want to purchase. This mechanism is different from the subsidies available in the 2022 CHIPS and Science Act, for example, which charges the Commerce Department with disbursing subsidies across semiconductor manufacturing investment projects.



Advocates for the local assembly provisions argued that the green transition would be sustainable in a democracy like the United States only if a political constituency of workers and domestic firms were created to support it. Consumer interests would never mobilize politically in sufficient enough numbers to support the lower prices that might arise through import competition.

A related argument is that political support for the United States remaining open at all remains tenuous. (The national psyche remains scarred by the “China shock” that President Trump so masterfully exploited politically.) Policies like the IRA—even if discriminatory and inefficient—are needed to maintain a broader policy of trade openness elsewhere across the economy.

Numerous concerns with the IRA’s objectives emerged. An overarching worry is that using a single policy instrument to target multiple objectives reduces the chance that any one objective will be met.

One set of concerns are domestic. The IRA is a poorly targeted labor market and community adjustment policy. Although the geography of the North American EV supply chain may end up driven by the same forces as the ICE supply chain that emerged by the late 20th century (Klier and Rubenstein 2022), the plants and jobs are unlikely to end up in exactly the same communities as the ICE plants and jobs being wound down. Although there may be a political constituency of workers in the EV supply chain years from now to support a cleaner automobile sector, workers and communities that are losing out as ICE supply chain plants are no longer needed may be nearly as unhappy about their jobs being replaced by EV jobs two or three states away as EV jobs overseas.<sup>11</sup>

A second important domestic concern with the IRA is its fiscal implications. Targeting the climate externality with subsidies requires raising taxes elsewhere, which will generate additional inefficiencies. (A carbon tax does not.)

Even without those inefficiencies, the IRA is expensive for taxpayers, especially if take-up far exceeds initial estimates by the Congressional Budget Office (CBO 2022b; Credit Suisse 2022; Bistline, Mehrotra and Wolfram 2023; Goldman Sachs 2023). If taxpayers end up unwilling to support the IRA fiscally over the long term, Congress could terminate the program early, reducing the chance of achieving its most important objective of reducing CO<sub>2</sub> emissions.

An additional concern (discussed below) is whether the IRA approach will incentivize creation of an EV supply chain for the world outside of China. Two other worries involve how trading partners might respond to the international spillovers created by the US policy approach.

First, to the extent that the IRA displaces legitimate market access expectations of trading partners exporting to the United States, there may be retaliation, which would impose other costs on the US economy. If the IRA leads to excessive US exports, trading partners may respond directly with tariffs (countervailing duties) to limit those exports. Rather than a cooperative equilibrium, in which governments agree to restrain their subsidies

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<sup>11</sup> Other parts of the IRA unrelated to EVs do include place-based policies designed to facilitate new investment in the exact locations where economic activity driven by dirty energy would decline. The IRA also includes Low-Income Communities Bonus Credits for clean energy projects rooted in underserved communities, and the Davis-Bacon Act provides additional tax benefits if wages are high enough (under) and the work involves registered apprentices. See US Department of Labor, “[Prevailing Wage and the Inflation Reduction Act](#),” accessed March 3, 2023.

ex ante to socially efficient levels (and combine them with carbon taxes), the noncooperative equilibrium may end up with the same level of economic activity on EVs and CO<sub>2</sub> reductions but with excessive subsidies (which requires tax-raising elsewhere) and retaliation (which increases other costs).

Second, US subsidies may lead other countries to change their climate policies, especially out of concern over reduced industrial competitiveness. If the trading partner's initial emission reduction targets were insufficiently ambitious, this change could be positive for the environment. However, if it forces a trading partner (like the EU) to deviate from a potentially more efficient policy (such as carbon pricing), then it could be harmful, potentially offsetting some of the global externality (climate) benefits of the US policy.

Finally, the IRA did not include all of the important objectives of the Biden administration's initial version of the legislation (the Build Back Better Act), which passed the House of Representatives in November 2021 but failed to pass the Senate.<sup>12</sup> One was a tax credit of \$4,500 for vehicles assembled at unionized plants in the United States. The European Union lobbied heavily against this provision, in part because it would have discriminated against the US manufacturing facilities of European-headquartered car companies, many of which are located in right-to-work states and whose workforces are not unionized.<sup>13</sup> Canada complained vociferously as well, including in a letter sent by Deputy Prime Minister Chrystia Freeland and Trade Minister Mary Ng to a host of US senators that included explicit tariff threats if they passed the legislation.<sup>14</sup> The IRA stripped out the unionization criterion and changed the requirement for US assembly to a requirement for North American assembly, making Canadian and Mexican plants eligible. (Mexico also has plants for several European-headquartered automakers.)

**US subsidies may lead other countries to change their climate policies, especially out of concern over reduced industrial competitiveness.**

## **THE EFFECTS OF THE INFLATION REDUCTION ACT ON SUPPLY CHAINS FOR ELECTRIC VEHICLES**

Multiple provisions of the IRA affect EVs. They include consumer tax credits for new clean consumer (Section 30D) and commercial (Section 45W) vehicles as well as producer tax credits for other parts of the EV supply chain (Section 45X), which have received much less public attention.<sup>15</sup>

### **Consumer Tax Credits for Consumer Vehicles**

Consumer vehicles are defined as vehicles that weigh less than 14,000 pounds. They include cars, pickup trucks, and sport utility vehicles (SUVs). Even relatively heavy vehicles with batteries fall under the threshold with room to spare. Examples include the Audi RS e-tron (5,200 pounds) for cars, the Ford

12 House Committee on Rules, H.R. 5376: Build Back Better Act, November 3, 2021.

13 See Margaret Spiegelman, "Mexico, EU, Japan, Others Voice Concern about Proposed US EV Tax Credit," *Inside, US Trade*, November 1, 2021; Joe Miller, "German Carmakers Condemn Biden's Electric-Vehicle Subsidy Plans," *Financial Times*, December 11, 2021.

14 See David Ljunggren, "Angry Canada Threatens to Impose Tariffs on US Goods over EV Tax Credit Plan," *Reuters*, December 10, 2021.

15 Section 25 also includes a provision for previously owned clean vehicles.

F-450 Crew Cab (8,600 pounds) for pickups, and the GMC Hummer EV (9,000 pounds) for SUVs.<sup>16</sup>

The consumer tax credit is restricted to vehicles for which final assembly takes place in North America. This requirement went into effect immediately upon implementation of the law (August 16, 2022). The sudden change left consumers who had placed orders but had not legally contracted for vehicle delivery in the lurch.

The consumer tax credit is up to \$7,500, with eligibility determined by the inputs going into the batteries of the EV. Half of the tax credit eligibility (\$3,750) is available for vehicles that include a battery recycled in North America or a battery that meets a critical minerals sourcing requirement. Critical minerals, defined in section 45X(c)(6), include lithium, cobalt, and nickel (Tracy 2022). Certain minimum thresholds have to be sourced from (extracted or processed in) the United States or a country with which the United States has a free trade agreement—a definitional issue that would turn out not to be innocuous. The minimal critical mineral threshold was 40 percent in 2023—on a date (April 18) determined once Treasury issued guidance (March 31)—increasing by 10 percentage points a year until reaching 80 percent in 2027–32.

The other half of the tax credit eligibility is for vehicles meeting a battery components requirement. The components sourcing requirements are much more restrictive than for critical minerals: The threshold amount of material has to be manufactured or assembled in North America. (This difference meant that other Treasury decisions—such as where to draw the line in the battery supply chain between what was a critical mineral and what was a component—could matter substantially.) The minimal battery components threshold was 50 percent in 2023 (once Treasury issued guidance), increasing by 10 percentage points a year until reaching 100 percent in 2029–32.

Also excluded under the law is sourcing from a “foreign entity of concern,” a designation that covers China, Iran, North Korea, and Russia.<sup>17</sup> Beginning in 2024, a vehicle may not contain any battery components manufactured or assembled by a foreign entity of concern. Beginning in 2025, a vehicle’s battery may not contain any critical minerals sourced from a foreign entity of concern.

Section 30D includes at least two other criteria that affect eligibility for a tax credit. The first is the limit on adjusted gross income (AGI), which cannot exceed \$300,000 for married couples and \$150,000 for individuals. The second is a price cap. Beginning in 2023, tax credit eligibility requires that the manufacturer’s suggested retail price (MSRP) be less than \$80,000 for SUVs, vans, and pickup trucks and less than \$55,000 for vehicles under 14,000 pounds. (On February 3, 2023, Treasury made more vehicles eligible for the consumer tax credit by shifting “crossover” SUVs into the SUV category and out of the smaller vehicle

**The consumer tax credit is restricted to vehicles for which final assembly takes place in North America.**

<sup>16</sup> See Matthew Guy, “Weight, Weight: 5 of the Heaviest New Vehicles on Sale Today,” *Driving*, June 19, 2022.

<sup>17</sup> Section 40207(a)(5) of the Infrastructure Investment and Jobs Act (42 USC. 18741(a)(5)) defines a “foreign entity of concern” as own owned by, controlled by, or subject to the jurisdiction or direction of a government of a foreign country that is a covered country (as defined in section 2533c(d) of title 10, United States Code).

category. GM's Cadillac Lyriq; Tesla's five-seat Model Y; Volkswagen's ID.4; and Ford's Mustang Mach-E were suddenly eligible thanks to the increase in the price cap to \$80,000 from \$55,000.<sup>18</sup>)

Treasury and the Department of Energy needed to provide guidance in a number of areas. One was to define which countries the United States has a "free trade agreement" with, as the term was not formally defined under US law. The United States has Congressionally ratified trade agreements with 20 countries, including major auto industry participants such as South Korea, Canada, and Mexico. Its trade agreements with other countries (such as Japan) are more limited, including zero tariffs for only a limited set of products. The United States and the European Union do not have any sort of trade agreement beyond being members of the WTO. The Department of Energy was expected to determine whether part of a battery input was "from" a foreign entity of concern—for example whether it would include subsidiaries or joint ventures in the United States or free trade agreement partners if the parent was headquartered in China or another foreign entity of concern.<sup>19</sup>

These new criteria in Section 30D raised at least two questions. First, in the immediate term—before companies have a chance to adjust their supply chains—would they significantly limit the availability of car models eligible for the tax credit, even for vehicles assembled in North America? (As described below, the answer was yes.) Second, over the long term, would these criteria be enough to shape economic activity and incentivize the shifting of supply chains?

### Consumer Tax Credits for Commercial Vehicles

The IRA created a separate track for clean commercial vehicles. Section 45W provides a tax credit for businesses buying new EVs or fuel cell EVs (FCEVs), which could include a fuel cell stack powered by hydrogen rather than a battery. For businesses purchasing small commercial vehicles (weighing less than 14,000 pounds), eligibility requires battery capacity of at least 7 kilowatt-hours (kWh). For vehicles weighing more than 14,000 pounds (such as buses and delivery trucks), eligibility requires battery capacity of at least 15 kWh.

In the commercial track, the maximum tax credits cannot exceed \$7,500 for vehicles under 14,000 pounds and \$40,000 for vehicles above 14,000 pounds. The actual tax credit amount is equal to whichever of the following is lowest: 15 percent of the vehicle purchase price for plug-in hybrid EVs, 30 percent of the vehicle purchase price for EVs and FCEVs, or the incremental cost of the vehicle compared with an equivalent ICE vehicle. Businesses cannot combine this tax credit with the clean vehicle tax credit for consumers; they can use one or the other.

**The IRA created a separate track for clean commercial vehicles.**

18 US Treasury, "Treasury Updates Vehicle Classification Standard for Clean Vehicle Tax Credits Under Inflation Reduction Act," Press release, February 3, 2023.

19 For example, Jiyeong Go, "Chinese Companies Expanding Footprint in Global Lithium Mines," FDI Intelligence, August 29, 2022; Scott Murdoch and Jaskiran Singh, "China's Tianqi-Led Venture Bids for Australian Lithium Firm Essential," Reuters, January 8, 2023; Claire Bushey and Aime Williams, "US Opens New Cobalt Mine as EV Battery Needs Grow," *Financial Times*, October 7, 2022; David Shepardson, "Rubio Takes Aim at Planned Ford US Battery Plant Using Chinese Technology," Reuters, March 9, 2023.

Table 2 summarizes crucial differences between Sections 30D and 45W. Equally important are all of the criteria not found in Section 45W, as made clear below. None of the eligibility requirements in Section 30D described above (limits related to North American assembly, critical minerals or battery components sourcing, MSRP or income levels) are included in Section 45W.

Table 2  
**Key requirements for qualifying for a tax credit under Sections 30D and 45W of the Inflation Reduction Act**

Requirement	Section 30D	Section 45W
Gross vehicle must weigh less than 14,000 pounds	X	X <sup>a</sup>
Vehicle must be used for business		X
Vehicle must be assembled in North America	X	
Manufacturer's suggested retail price cannot exceed \$80,000 for SUVs, vans, and pickup trucks and \$55,000 for smaller vehicles	X	
Annual adjusted gross income cannot exceed \$300,000 for couples or \$150,000 for individuals	X	
Credit of \$3,750 is granted if critical minerals criterion is satisfied	X	
Credit of \$3,750 is granted if battery components criterion is satisfied	X	
Vehicle must eventually include no critical mineral or battery components from "foreign entity of concern"	X	

a. Vehicles with gross vehicle weight of more than 14,000 pounds are eligible for tax credits of up to \$40,000 under Section 45W.

### Production Tax Credits

Section 45X of the IRA provides for a tax credit for the production of battery cells, battery modules, and battery components.<sup>20</sup> These provisions are additive and available only for production taking place in the United States. The tax credits are based on the capacity (in kilowatt hours) of the battery module or battery cell.

These tax credits could result in another \$4,500 in tax credits per vehicle. For EVs eligible for the tax credit under Sections 30D or 45W, the additional \$4,500 from Section 45X means that a single EV could potentially qualify for \$12,000 of total subsidies. (Whether the consumer, the EV company, the battery company, or the company making critical minerals or components will enjoy these subsidies needs to be determined empirically, but the combined benefit to consumers and firms in these markets clearly comes at the expense of the government and

20 Orrick, "Section 45X of the Inflation Reduction Act: New Tax Credits Available to Battery Manufacturers," *Insights*, November 17, 2022.

taxpayer.) McDaniel estimates that at the upper end of take-up, the cost to the US government for the production tax credit could total six times more than the Congressional Budget Office (CBO 2022b) estimate.<sup>21</sup>

While these tax credits may induce additional battery manufacturing investments into the United States, some of the subsidies may be transfers that do not have a marginal effect on investment facility decisions. EV companies had announced considerable new investment projects before July 2022—when passage of the IRA seemed unlikely—and thus may subsequently receive subsidies for investments they had already committed to make. As of January of 2022, for example, plans were already afoot to build 13 large-scale EV battery plants in the United States.<sup>22</sup>

### THE EUROPEAN RESPONSE TO THE INFLATION REDUCTION ACT

The IRA was signed into law in August 2022. The European Union’s political reaction was relatively slow to materialize. In contrast, in early September, the trade minister from South Korea was already in Washington demanding action on behalf of Korean auto companies. He objected to the unexpected cutting off from consumer tax credits of Hyundai’s popular Ioniq models, which were being assembled in South Korea until their US plant was operational in 2025.<sup>23</sup>

Once Europe fully understood the details of the IRA though, its public reaction was fierce. Bernd Lange, the head of the European Parliament’s Trade Committee, called for a WTO dispute, which Thierry Breton, the European Commissioner for Internal Market, indicated could lead to retaliation.<sup>24</sup> There were threats of a subsidy war. In a state visit to Washington in early December, French President Emmanuel Macron said the IRA risked “fragmenting the West.”

The ferocity of the criticism from Europe stunned Washington. To the extent that the United States had been motivated by nondomestic factors, it was the threat of China that it used to mobilize its legislation. It had not realized just how damaging its policy was to the political and economic interests of some of its key allies. The European political response was also remarkable, given the United States’ massive political, economic, and military support to Europe and its coordination with European and NATO allies following Russia’s February 2022 invasion of Ukraine and its subsequent conduct of a brutal war.<sup>25</sup>

Once Europe fully understood the details of the IRA though, its public reaction was fierce.

21 Christine McDaniel, “The Cost of Battery Production Tax Credits Provided in the IRA,” *Forbes*, February 1, 2023.

22 Dasl Yoon, “EV Battery Maker’s Sales Pitch to the West: We’re Not Chinese,” *Wall Street Journal*, January 26, 2022.

23 See Bown (2022) and Christian Davies and Song Jung-a, “South Korea Complains of Growing Friction with US over High-Tech Trade,” *Financial Times*, September 18, 2022.

24 See Riham Alkousaa, “Lawmaker Says EU Should Complain to WTO over US Inflation Reduction Act,” *Reuters*, December 3, 2022.

25 Europe’s aggressive response risked alienating Washington, given the shift in the political climate in the United States in the wake of the November 2022 election, in which Republicans won control over the House of Representatives, potentially jeopardizing continued military support for Ukraine and Europe.



The Biden administration responded in various ways. The White House agreed to a high-level task force with the European Commission President's office.<sup>26</sup> It also placed the IRA on the formal agenda of the semi-annual US-EU Trade and Technology Council (TTC) meetings held in early December in Maryland. Biden's US Trade Representative Katherine Tai also suggested that Europe consider subsidies of its own.<sup>27</sup>

Finally, during the state visit of French President Macron in December, President Biden indicated there would be flexibility.<sup>28</sup> The administration ultimately showed considerable and unexpected flexibility when the Treasury Department, the US government agency in charge of implementing key discretionary elements of the IRA into practice, issued its regulations on December 29, 2022 and March 31, 2023 (as discussed below) especially.

Domestic political constraints meant that the administration could do relatively little to ease the pain of the IRA on its allies. The IRA was not a bipartisan piece of legislation. After the November 2022 midterm elections, when with Republicans took control of the House of Representatives, prospects for legislative reform became even less likely than they were before the election.

### Europe's Perspective

The IRA provoked a tremendous reaction in Europe for a number of reasons. For EVs, the problems were obvious. Under the new law, as of August 16, 2022, an EV manufactured in Europe would no longer be eligible for the consumer tax credit offered on EVs manufactured in North America. The difference created incentives for multinational companies to locate their production facilities in North America instead.

There was also much more. The European Union was caught off guard when the details of the new legislation were abruptly revealed in late July 2022. It had hoped that its efforts to work with the Biden administration and establish the TTC in 2021 would prevent these sorts of policies from emerging with little notice. Failing to include Congress in the TTC proved to have been a mistake, as industrial policy often takes the form of legislation. (Given Treasury's rule-writing function under the IRA and the fact that industrial policy is being implemented through the US tax code, it would also be helpful if the Treasury Department, not only the US Trade Representative, the Commerce Department, and the State Department, were part of the TTC.)

In terms of the European Union's own policies, the IRA was problematic for reasons that went well beyond the EV sector. The European Green Deal and Fit for 55 involved first-best carbon taxes, phasing out free allowances, a carbon border adjustment mechanism, and other potentially WTO-consistent policies as

**Finally, during the state visit of French President Macron in December, President Biden indicated there would be flexibility.**

26 White House, "Statement by NSC Spokesperson Adrienne Watson on Launch of the United States-EU Task Force on the Inflation Reduction Act," October 25, 2022.

27 Andy Bounds and Aime Williams, "Top US Trade Official Urges EU to Join Forces on Subsidies amid Green Deal Tensions," *Financial Times*, November 2, 2022.

28 "For example, there's a provision in it that says that there is the exception for anyone who has a free trade agreement with us. Well, that was added by a member of the United States Congress who acknowledges that he just meant allies; he didn't mean, literally, free trade agreement. So, there's a lot we can work out." (White House, "Remarks by President Biden and President Macron of France in Joint Press Conference," December 1, 2022).

part of its clean energy transition.<sup>29</sup> (The IRA suddenly made apparent the fact that the United States was not interested in solutions consistent with traditional WTO rules.) For Europe, an extremely important policy question was how much of its own original clean energy transition plan would remain feasible. Would the European Union remain politically able to implement a sizable carbon tax, phase out free allowances, and impose other policies that make dirty energy consumption in the European Union more expensive for industry?

The IRA's tax credits for batteries and other sources of clean energy make consumption of US energy cheaper, jeopardizing the European Union's industrial competitiveness. This fear was the major concern facing the European Union that even the fixes to the EV tax credits (discussed below) would not be able to address.

Not only did the IRA put economic pressure on the European Union to move away from the first-best policy (taxing carbon at its high social cost); the new pressure to subsidize posed separate threats to the internal structure of the European Union itself. The Treaty on the Functioning of the European Union (TFEU) has rules prohibiting member states from providing subsidies to companies; these rules are part of the fabric that maintains harmony within the union (Kleimann et al. 2023). The IRA may thus create a wedge between EU member states that can subsidize and those that lack fiscal resources and cannot. If EU member states now feel political-economic pressure to subsidize, their response to the IRA may be to not only discriminate against the United States and other countries; they may also end up discriminating against each other.

The timing of the IRA was also problematic, given the macroeconomic environment in Europe in 2022. Russia's war on Ukraine, its weaponization of gas supplies flowing through the Nord Stream 1 pipeline, and the European policy decision to wean itself off Russian energy created political problems across the continent by straining European economies, creating high inflation and recessionary risk. Heavy industries in Europe—many concentrated in Germany—were already being forced to rethink their business model, given the loss of access to relatively inexpensive Russian natural gas. Adding early fuel to the fire was a September *Wall Street Journal* report that Tesla was putting on hold its plans to produce battery cells in Germany, potentially shifting more EV production to the United States to take advantage of the IRA's battery manufacturing tax credits.<sup>30</sup> Firms across the continent opportunistically threatened to leave for the United States unless Europe provided them with subsidies of its own. The problem was clearly not just the IRA though. Major German energy-intensive firms like chemical company BASF subsequently announced plans to relocate production not to the United States but to China.<sup>31</sup>

**The IRA's tax credits for batteries and other sources of clean energy make consumption of US energy cheaper, jeopardizing the European Union's industrial competitiveness.**

29 European Council, "Timeline - European Green Deal and Fit for 55. Council of the European Union," accessed March 1, 2022.

30 Rebecca Elliott and Mike Colias, "Tesla Shifts Battery Strategy as It Seeks US Tax Credits," *Wall Street Journal*, September 14, 2022.

31 Patricia Nilsson, "BASF Outlines Further Cost-Cutting and 2,600 Job Losses as It Downsizes in Germany," *Financial Times*, February 24, 2023.

The European Union was also concerned about the implications of the US policy actions for the WTO. (The nondiscriminatory, rules-based trading system also formed the legal backbone of the European Union.) Following four years of the Trump administration's policies eroding rules-based trade, the hope had been that the Biden administration might not only be different but that it might be a partner in rebooting efforts at multilateralism.

The IRA was perhaps the final nail in the coffin. By aggressively choosing subsidies—and a particularly discriminatory form of them—the United States clearly indicated that it had caved. At least for the moment, it was forgoing any rules-based effort to address what had been, at least rhetorically, joint EU-US concern over China's own large and discriminatory subsidies and industrial policy that was itself a major driver of the IRA.<sup>32</sup>

The European Union was also powerless to respond to the United States in a rules-based way. WTO dispute settlement was still dysfunctional. The United States continued to block appointments to the WTO's Appellate Body, disabling the European Union's preferred (judicial) approach to send trade frictions off to be litigated. (WTO Director-General Ngozi Okonjo-Iweala discouraged litigation anyway, indicating in a Bloomberg interview that "it's far better for them to speak to the United States and try to resolve this and see if there's any way to take account of their concerns than to come to the dispute-settlement system of the WTO."<sup>33</sup>)

**The European Union was also concerned about the implications of the US policy actions for the WTO.**

### Europe's Own Policies Affecting Electric Vehicles

There has been some discussion in the European Union about whether to respond to the IRA by deploying leftover funds from the €800 billion Recovery and Resilience Facility following the COVID-19 pandemic. As of April 2023, no new subsidy policy decision had been announced, however.<sup>34</sup>

Most EU member states provide consumer tax credits for EVs, which average €6,000 (roughly \$6,400) per vehicle (Kleimann et al. 2023; ACEA 2022). The main difference is that the EU credits are nondiscriminatory (they do not include local content requirements or other limiting criteria found in Section 30D of the IRA). A US-assembled vehicle is eligible for EU member state tax credits just like a European assembled vehicle. (This was the structure of the US tax credits in place between the ARRA in 2009 through passage of the IRA in August 2022.)

Table 3 summarizes important differences in tariffs on EVs by the United States, the European Union, and China. Several of these differences are noteworthy.

32 Under the Trump administration, the European Union, Japan, and the United States formed a trilateral group to potentially consider new subsidies rules to address such concerns (Bown and Hillman 2019).

33 Bryce Baschuk, "WTO Chief Urges Talks to Resolve Green Subsidy Dispute," Bloomberg, January 23, 2023.

34 See, for example, Jan Strupczewski, "Seven EU Countries Oppose New EU Funding as Response to US Subsidy Plan—Letter," Reuters, January 27, 2023.

Table 3  
**Tariffs on electric vehicles imposed by the United States, the European Union, and China in 2023**

<b>Economy</b>	<b>Applied most favored nation (MFN) tariff (percent)</b>	<b>Exceptions</b>
United States	2.5	<ul style="list-style-type: none"> <li>• Mexico: 0 percent (under the United States–Mexico–Canada Agreement [USMCA])</li> <li>• Canada: 0 percent (under the USMCA)</li> <li>• South Korea: 0 percent (under the US–Korea Free Trade Agreement [KORUS])</li> <li>• China: 27.5 percent (applied MFN tariff + trade war tariff) imposed since July 2018</li> </ul>
European Union	10.0	<ul style="list-style-type: none"> <li>• South Korea: 0 percent (under the EU–Republic of Korea Free Trade Agreement)</li> <li>• Japan: 3.8 percent (under the EU–Japan Economic Partnership Agreement)</li> <li>• Canada: 0 percent (under the EU–Canada Comprehensive Economic and Trade Agreement)</li> <li>• Mexico: 0 percent (under the EU–Mexico Trade Agreement)</li> </ul>
China	15.0	<ul style="list-style-type: none"> <li>• Applied MFN was 25 percent until July 2018, when it was lowered to 15 percent</li> <li>• United States: 40 percent tariff (applied MFN + retaliatory tariff) between July 2018 and January 2019 during the trade war, then reduced to 15 percent</li> <li>• South Korea: 13.5 percent (under Asia-Pacific Trade Agreement)</li> <li>• Japan: 15 percent (under Regional Comprehensive Economic Partnership)</li> </ul>

Notes: The HS code for battery EVs is 870380.

Sources: US International Trade Commission, European Commission (CIRCABC), State Council of the People's Republic of China (China's tariff schedule, 2023), and trade war tariff announcements from China's Ministry of Finance and the United States Trade Representative.

First, there is an important distinction in the argument that follows below relative to the earlier, Trump administration argument for reciprocal tariffs in levels between the United States and its trading partners (Commerce Secretary Wilbur Ross famously argued that the United States and EU should have the same tariffs on ICE vehicles).<sup>35</sup> Indeed, today's different US and EU tariff rates for ICE vehicles are the result of decades of reciprocal negotiating rounds under the General Agreement on Tariffs and Trade (GATT), in which the European Union received lower tariffs on its ICE vehicle exports in exchange for the United States receiving lower tariffs on some other US export products. However, EVs are

35 Wilbur Ross, "Most Favored Nation Rule Hurts Importers, Limits US Trade," *Wall Street Journal*, May 25, 2017.

relatively new products for both sides; there have been no historical negotiations by the two economies over their tariff levels. This makes directly comparing US and EU EV tariff rates more relevant.<sup>36</sup>

The European Union MFN import tariff for traditional consumer EVs (10 percent) is much higher than the US tariff (2.5 percent). One longstanding fundamental insight from economics is the equivalence of an import tariff and the combined effect of a consumption tax and a production subsidy. The European Union's 10 percent import tariff on EVs is thus economically equivalent to EU member states offsetting some of their EV consumption subsidies with a 10 percent consumption tax while simultaneously granting a 10 percent production subsidy for locally assembled EVs. (The analogue for the United States would be a 2.5 percent consumption tax and a 2.5 percent production subsidy.) The US-EU differential is therefore equivalent to a 7.5 percent EU production subsidy. (For a \$50,000 vehicle, this would equate to a \$3,750 production subsidy.)

Second, US exports of EVs face further discrimination in the EU market because of the European Union's free trade agreements (FTAs) with Korea and Japan—two other major EV manufacturers—as well as Mexico and Canada. The European Union's FTAs with South Korea, Mexico, and Canada already have a 0 percent duty on EVs in effect; the phase-in period for Japan's FTA means that the tariff will fall from its current level of 3.8 percent to 0 in 2026. The implication is that EU imports from these countries enjoy (or will enjoy) a 10 percentage point tariff preference into the EU market relative to the United States. Under the United States' FTAs, the tariff preference offered to South Korea, Mexico, and Canada (2.5 percentage points) and Japan (none) is much smaller (or nonexistent). The United States and the European Union could negotiate a trade agreement to reciprocally lower those bilateral tariffs to zero, but such a move is not currently on the policy agenda.

Third, the EU and US treat China, the other major exporter of EVs to the world, quite differently. In the EU market, imports from China face the same tariff as imports from the United States. In the United States, because of the trade war tariffs in effect since July 2018, EU exporters benefit from a 25 percentage point tariff preference into the US market relative to EVs manufactured in China.

These tariffs are likely to affect trade flows (figure 3).<sup>37</sup> The value of EU imports of EVs from China, for example, is nearly three times as high as EV imports from South Korea and 16 times as high as imports from the United States. Offshored production by Tesla, Volkswagen, and MG—major US and European “brands”—dominate Chinese EV exports to the European Union.<sup>38</sup> Imports of

**The US-EU differential is therefore equivalent to a 7.5 percent EU production subsidy.**

36 For pickup trucks, the United States imposes a 25 percent import tariff; the EU import tariff is only 10 or 22 percent (depending on the cylinder capacity of the engine), and China's is 15 percent. Depending on the type of engine and the gross vehicle weight, pickup trucks could fall under several possible tariff lines in Harmonized System (HS) category 8704.

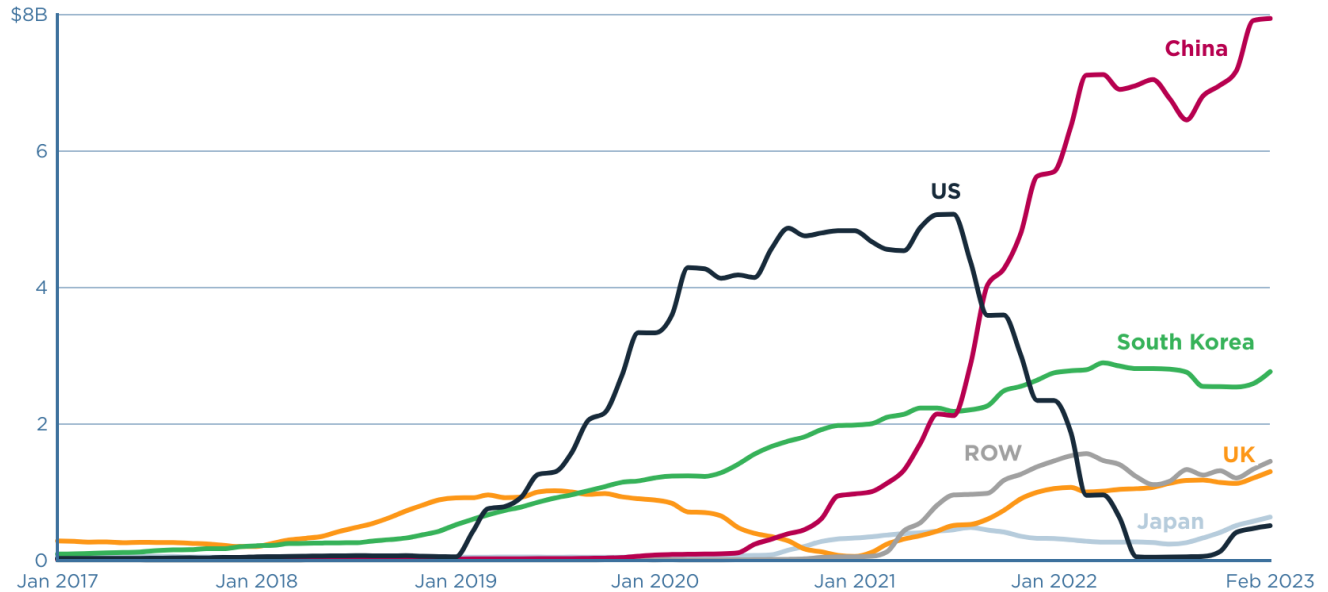
37 In figure 3, almost 90 percent of EU EV imports from rest of world were sourced from Mexico in 2022.

38 See Selina Cheng, “Tesla Rival BYD Leads Push to Sell Chinese EV Brands Around the World,” *Wall Street Journal*, March 3, 2023; Peter Sigal, “Europe Forecast to Import 800,000 Chinese-Built Cars by 2025,” *Automotive News Europe*, November 7, 2022.

EVs from Japan remain small; major exporters like Toyota have been relatively slow to move to battery EVs, in part because they developed and stuck with plug-in hybrids.<sup>39</sup>

**Figure 3**  
**The EU used to import electric vehicles from the US but now mostly imports from China and South Korea**

Value of EU electric vehicle imports, 12-month trailing sums, billions of USD, 2017-23 (year to date)



ROW = rest of world

Notes: The CN codes are 87038010 and 87038090 in 2017-23 and 87039010 in 2016. Trade values are converted to US dollars from euros using end-of-month USD/euro spot exchange rates from Federal Reserve Economic Data (DEXUSEU).

Source: Eurostat.

EU imports of EVs from the United States fell dramatically beginning in mid-2021. The decline was driven partly by Tesla shifting its exports to the European Union away from its US facilities to its plant in China.

In late 2018, Tesla had announced that it would accelerate construction of its gigafactory in China in response to the trade war, after China’s retaliatory tariffs made it too costly to export cars from the United States to China. US EV exports to China disappeared (figure 4).<sup>40</sup> After losing both the Chinese and European markets, the only sizable recent US export growth for EVs has been to Canada.<sup>41</sup>

39 Eri Sugiura and Peter Campbell, “Toyota Was a Hybrid Pioneer with the Prius But Struggles to Leap to Electric,” *Financial Times*, October 18, 2022.

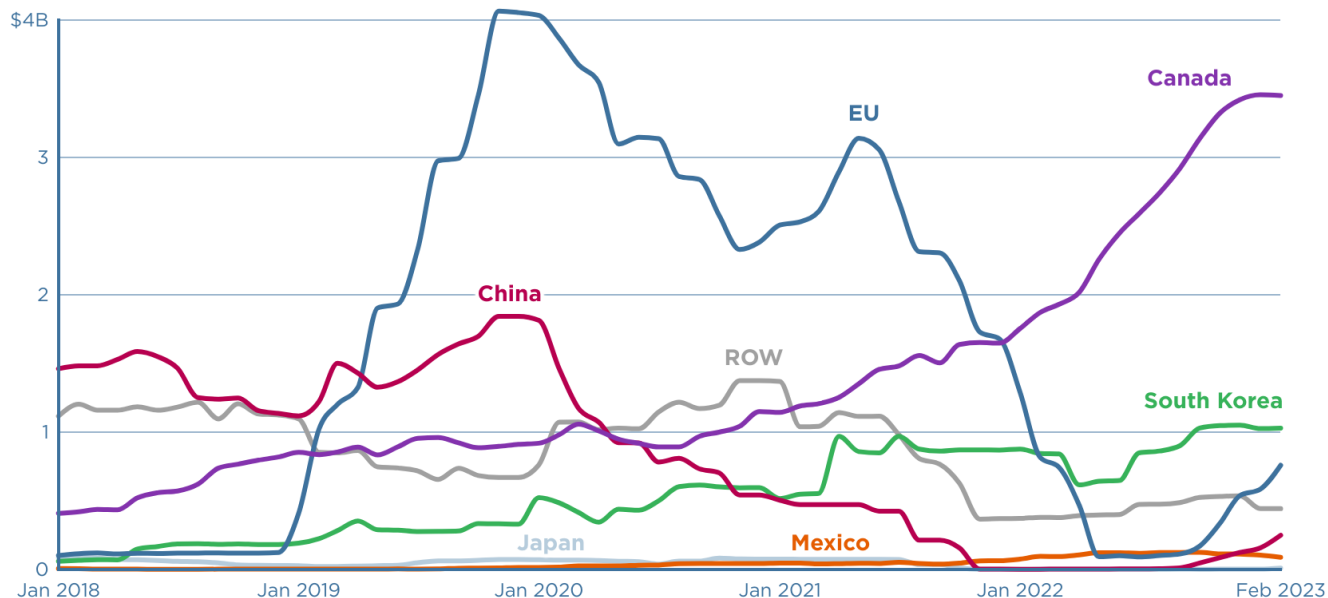
40 “Our vehicle sales in China have been negatively impacted in the past by certain tariffs on automobiles manufactured in the United States, such as our vehicles, and our costs for producing our vehicles in the United States have also been affected by import duties on certain components sourced from China” (Tesla 2020).

41 Beginning in 2022, some lower US exports in the short run would also be partially attributed to an increase in US domestic demand for EVs driven by US policy—e.g., the consumer tax credits in the IRA as well as charging stations funded by the Infrastructure Investment and Jobs Act.



Figure 4  
**Trade war tariffs wiped out US electric vehicle exports to China. Exports to the EU have also suffered, but exports to Canada have grown**

Value of US electric vehicle exports, 12-month trailing sums, billions of USD, 2018–23 (year to date)



ROW= rest of world

Notes: The Schedule B code for electric vehicles is 8703800000. The code was created in 2017 and did not exist for electric vehicles prior to 2017.

Source: US International Trade Commission Dataweb.

Fourth, sales to the United States and Norway have dominated EU exports of EVs (figure 5). EU exports to the United Kingdom have resumed, after a brief decline in the aftermath of Brexit implementation at the end of 2020. EU exports of EVs to China are modest.

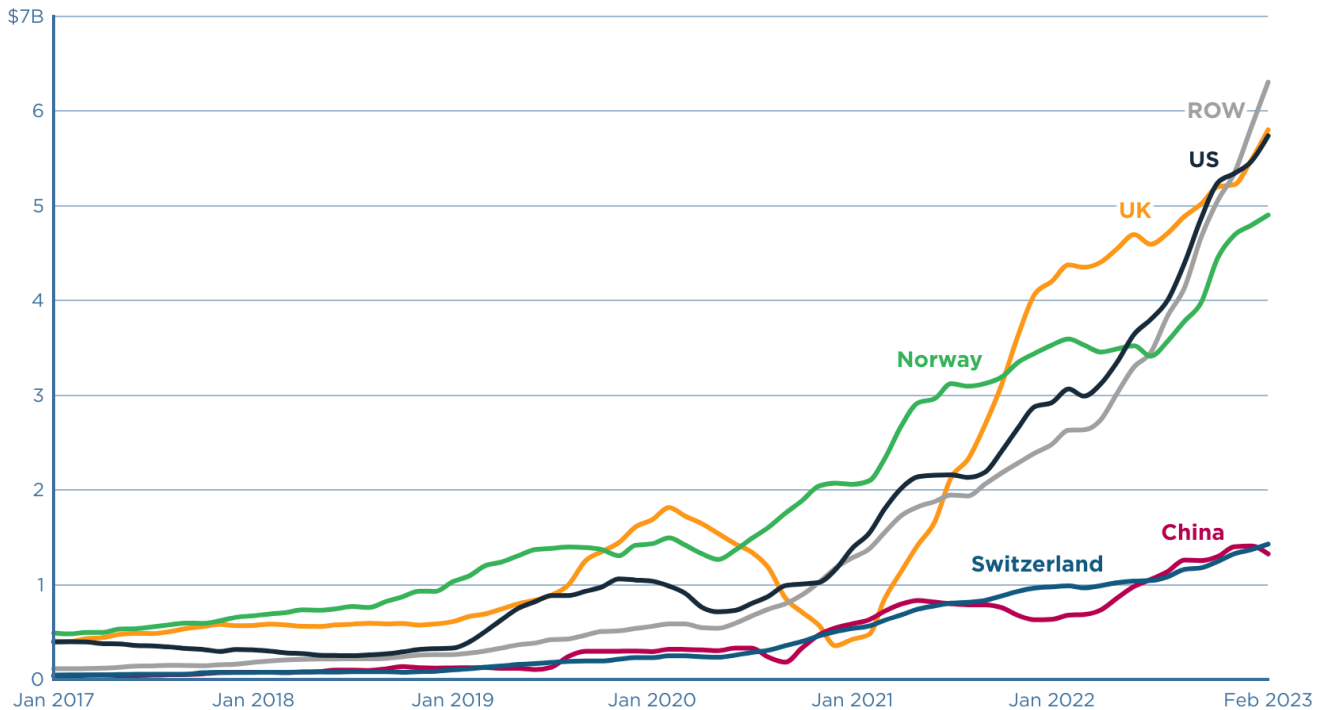
### THE US POLICY RESPONSE TO EUROPEAN PLEAS AND OTHER ANNOUNCEMENTS

On December 29, 2022, the Biden administration quietly announced what may turn out to have been an economic bombshell. The Internal Revenue Service (IRS) in the Treasury Department issued guidance indicating that consumers that leased vehicles weighing less than 14,000 pounds—normally falling under the Section 30D tax credits—could qualify under the Section 45W tax credits whether or not the leased vehicle was assembled in North America (IRS 2022). Leased vehicles assembled in Europe, South Korea, Japan, or anywhere else were suddenly eligible for the tax credit.

Put differently, almost none of the constraints found in Section 30D—including the price and income caps—apply when US consumers lease vehicles to access the tax credit under Section 45W. Expensive European-assembled models from Porsche, BMW, and Mercedes—and the high-income consumers who can afford them—suddenly became eligible for US tax credits. For European luxury brands, the benefit of the December 29 decision was thus potentially even greater than if the United States had eliminated the North American assembly requirement in Section 30D by Congress amending the law.

Figure 5  
**Major EU electric vehicle export destinations include the US, UK, and Norway**

Value of EU electric vehicle exports, 12-month trailing sums, billions of USD, 2017-23 (year to date)



ROW = Rest of world

Notes: The CN codes are 87038010 and 87038090 in 2017-23 and 87039010 in 2016. Trade values are converted to US dollars from euros using end-of-month USD/euro spot exchange rates from Federal Reserve Economic Data (DEXUSEU).

Source: Eurostat.

The Section 45W leasing option will also dull the battery supply chain sourcing incentives, which are also found only in Section 30D. If consumers choose to take up the tax credit primarily via leasing under Section 45W, automakers will not face financial pressure to use battery components sourced from the United States, use recycled batteries, or source critical minerals from the United States or free trade agreement partners. Section 45W thus reduces the incentive to create a separate redundant EV battery input supply chain outside of China.

In a second set of announcements in early 2023, the Biden administration made additional decisions affecting implementation of the consumer tax credits. On March 31, Treasury released its proposed rule regarding which countries would be considered “free trade agreement” partners to satisfy the critical minerals sourcing criterion in Section 30D. It highlighted countries with which the United States “has reliable and trusted economic relationships.” In addition to the 20 countries with which the United States had a Congressionally ratified FTA,<sup>42</sup> the criterion for a critical minerals agreement would be one in which each side

42 The 20 countries are Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, the Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordan, Korea, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, and Singapore.

(A) reduces or eliminates trade barriers on a preferential basis, (B) commits the parties to refrain from imposing new trade barriers, (C) establishes high-standard disciplines in key areas affecting trade (such as core labor and environmental protections), and/or (D) reduces or eliminates restrictions on exports or commits the parties to refrain from imposing such restrictions on exports. (88 Federal Register 23370, April 17, 2023)

The Biden administration had foreshadowed these details on March 28, when it announced and released the text of a critical minerals trade agreement with Japan.<sup>43</sup> On March 10, European Commission President van der Leyen and President Biden had announced that the European Union and the United States would negotiate a similar agreement specifically “to count toward requirements for clean vehicles in the Section 30D clean vehicle tax credit of the Inflation Reduction Act.”<sup>44</sup> Countries such as the United Kingdom, Indonesia, and the Philippines immediately indicated they, too, would like to negotiate such an arrangement with the United States.<sup>45</sup>

The purpose of such an agreement is obvious. If a country gets such a deal, it becomes a more attractive location for critical mineral supply chain investments, because of access to the \$3,750 tax credit under Section 30D. What remains unclear is whether such an agreement would be simply a memorandum of understanding or if it would force a trading partner to adopt new laws or regulations. For the United States, these laws or regulations are currently being negotiated as executive agreements (Claussen 2023), which do not require Congressional ratification. Negotiating them as such also means that a future administration could revoke them. This situation creates uncertainty for firms as they make decisions about where to locate substantial investments.

Some lawmakers were not pleased with the Biden administration implementing regulations of December 29 and March 31 and its negotiations of such critical minerals agreements. In March, a bipartisan group called out the administration for not consulting with Congress, arguing that it was interfering with Congressional authority under the Constitution.<sup>46</sup>

For its part, Congress also admitted that it made errors when drafting the original IRA text on the EV tax credits in haste in July. Senator Manchin, who had negotiated the last-minute IRA details with Senate Majority Leader Schumer stated, “I gotta be honest with you. I should have paused and said ‘OK, I’m going to make sure our NATO allies are involved in this.’”<sup>47</sup> In January 2023, Manchin also admitted that “I did not realize the European Union is not a free trade

**For its part, Congress also admitted that it made errors when drafting the original IRA text on the EV tax credits in haste in July.**

43 See “Agreement Between the Government of the United States of America and the Government of Japan on Strengthening Critical Minerals Supply Chains,” concluded March 28, 2023.

44 White House, “Joint Statement by President Biden and President von der Leyen,” March 10, 2023.

45 See Graham Lanktree, “Rishi Sunak Presses Joe Biden for a Trade Deal — Just Not the One the UK Wants Most,” *Politico*, April 11, 2023; Stefano Sulaiman, “Indonesia to Propose Limited Free Trade Deal with US on Critical Minerals,” Reuters, April 10, 2023; and Brett Fortnam, “The Philippines calls for FTA, critical minerals deal with the U.S.,” *Inside US Trade*, April 25, 2023.

46 Margaret Spiegelman, “Ways & Means Trade Chair: Guidance on EV Tax Credits ‘Unconstitutional,’” *Inside US Trade*, March 31, 2023.

47 Andrew Duehren, “EU and Japan Strike Deal on Minerals Used in Batteries for Electric Cars,” *Wall Street Journal*, March 28, 2023.

agreement [country].”<sup>48</sup> Such statements suggest that he may have welcomed Treasury’s efforts at writing the implementing regulations that would make the EV tax credits more accessible to NATO allies and the European Union. Writing in the *Wall Street Journal* on March 29, however, Manchin made clear his displeasure with the way in which Treasury was implementing the tax credit regulations to include partners like Japan and the European Union by asking President Biden “to instruct his administration to implement the Inflation Reduction Act as written and stop redefining its credits and other subsidies.”<sup>49</sup>

The full impact of these critical minerals agreements and the Treasury announcement of March 31 remains unknown. At one extreme, they could turn out to be meaningless. For example, if all consumers and automakers switch to transacting via lease instead of purchases, there would be no additional tax credit benefit from sourcing critical minerals from such a partner country. Or, if the executive agreement nature of the critical minerals deals does not create enough certainty about future access to the US tax credits, firms may not invest. At the other extreme, if consumers seek the tax credit under Section 30D instead, the ability to source inputs from such countries might create additional incentives to develop alternative supply chains outside of China.

Finally, on April 12, the Biden administration proposed another policy to increase the take-up of EVs.<sup>50</sup> The Environmental Protection Agency announced new regulations that require two-thirds of new passenger cars to be all-electric by 2032. If implemented, the regulations would tend to increase consumption of all EVs, domestic or imported, relative to ICE vehicles.

**The concern expressed by South Korean and European officials over the North American assembly provisions in the IRA is understandable.**

## **ELIGIBILITY FOR US TAX CREDITS, US IMPORTS OF ELECTRIC VEHICLES, AND LEASING**

It is too soon to look for the impact of these emerging regulations on the EV supply chain, but it is worth examining the US import market to provide context (figure 6). The concern expressed by South Korean and European officials over the North American assembly provisions in the IRA is understandable. In the lead-up to the sudden announcement of its details (in July 2022), US imports of EVs from both the European Union and South Korea had been growing: In the 12 months ending in July 2022, US imports were \$3.3 billion from the European Union and \$1.8 billion from South Korea. Cutting off those exports would obviously hurt both economies.

There is no discernible impact of the IRA on the US electric vehicle import data thus far. The North American assembly provision went into effect on August 16, 2022 and has remained in place for purchased vehicles since. Adoption of the August provision was not followed by a reduction in US imports of EVs from either the European Union or South Korea in the fourth quarter of 2022. The lack of decline suggests that US demand for EVs in this period was high, as US consumers continued to purchase imported EVs even though the Section 30D consumer tax

48 Ari Natter, “Manchin Says He Didn’t Know US, EU Lacked Free Trade Agreement,” Bloomberg, January 19, 2023.

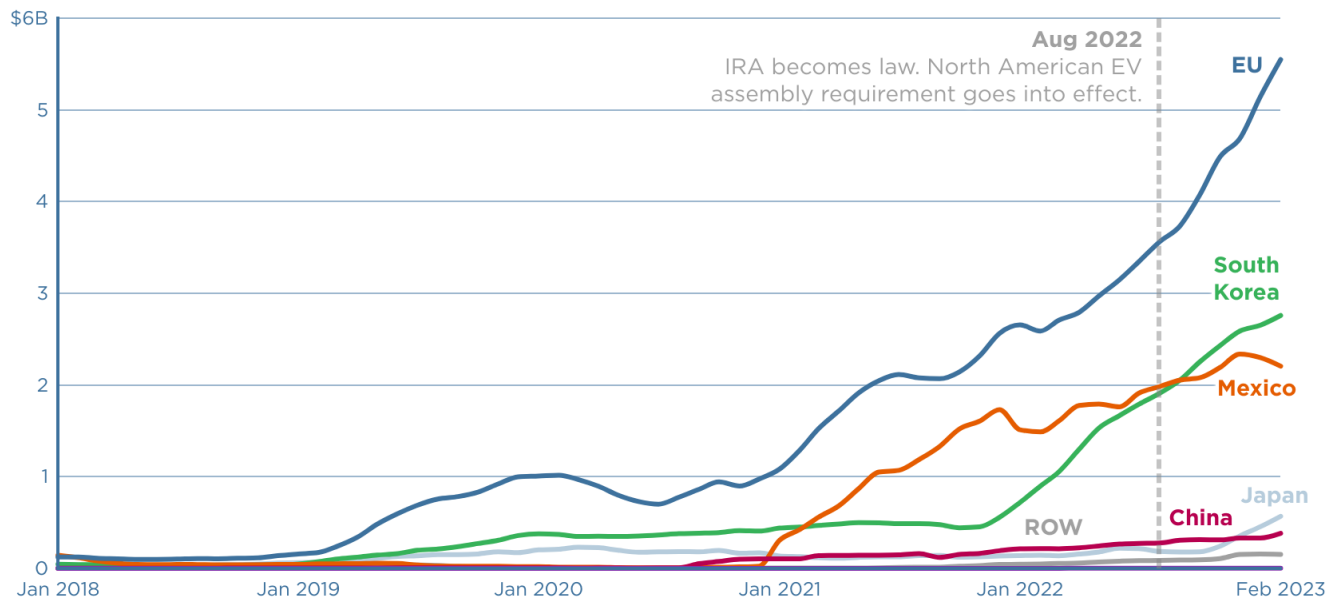
49 Joe Manchin, “Biden’s Inflation Reduction Act Betrayal. Instead of Implementing the Law as Intended, His Administration Subverts It for Ideological Ends,” *Wall Street Journal*, March 29, 2023.

50 See EPA, “Biden-Harris Administration Proposes Strongest-Ever Pollution Standards for Cars and Trucks to Accelerate Transition to a Clean-Transportation Future,” April 12, 2023.

credits discriminated against most foreign-assembled vehicles. It was only on December 29 that Treasury announced that leased vehicles were eligible for the consumer tax credit even if assembled outside of North America. Thus, any positive impact from that announcement would only be expected to arise in the 2023 data.

**Figure 6**  
**US imports of electric vehicles from the EU and South Korea have continued growing despite the IRA**

Value of US electric vehicle imports, 12-month trailing sums, billions of USD, 2017-23 (year to date)



ROW = rest of world; IRA = Inflation Reduction Act; EV = electric vehicle

Notes: The Harmonized Tariff Schedule code is 8703800000. The code was created in 2017 and did not exist for electric vehicles prior to 2017.

Source: US International Trade Commission Dataweb.

Before moving on, at least three other interesting trends are apparent in the US import data. First, US imports of EVs from Mexico are increasing, thanks in part to sales of the Mustang Mach-E assembled at the Ford Cuautitlan Stamping and Assembly Plant. (While US imports from Mexico were unaffected by the IRA’s North American assembly requirement that went into effect in August 2022, they may be affected by the input sourcing requirements that went into effect in April 2023 discussed below.) Second, like the European Union, the United States is importing relatively few battery EVs from Japan. Third, and unlike the European Union, the United States is not importing many EVs from China. These sales are probably limited by the 25 percent US trade war tariffs imposed in July 2018 on imports of cars from China, which remain in effect.

Stronger recent American take-up of all EVs, including imports, may reflect several additional factors. First, improvements to the EV charging infrastructure—including the roll-out of fast charging stations—may have reduced “range anxiety” concerns. Second, so few models may have been assembled in North America that consumers found it difficult not to buy imports. (If more vehicle models are assembled in North America, that constraint would be relaxed over time).

Table 4  
**Electric vehicles eligible for the Section 30D tax credits before and after April 18, 2023**

<b>Automaker</b>	<b>Model</b>	<b>Credit amount (\$)</b>	<b>MSRP limit (\$)</b>
<i>Models that remained eligible on April 18, 2023, for at least part of the tax credit</i>			
Ford	E-Transit	3,750	80,000
Ford	F-150 Lightning (Extended Range Battery)	7,500	80,000
Ford	F-150 Lightning (Standard Range Battery)	7,500	80,000
Ford	Mustang Mach-E (Extended Range Battery)	3,750	80,000
Ford	Mustang Mach-E (Standard Range Battery)	3,750	80,000
GM (Cadillac)	Lyriq	7,500	80,000
GM (Chevrolet)	Blazera	7,500	80,000
GM (Chevrolet)	Bolt	7,500	55,000
GM (Chevrolet)	Bolt EUV	7,500	55,000
GM (Chevrolet)	Equinox a	7,500	80,000
GM (Chevrolet)	Silverado	7,500	80,000
Rivian	R1S	3,750	80,000
Rivian	R1T	3,750	80,000
Tesla	Model 3 Performance	7,500	55,000
Tesla	Model 3 Standard Range Rear Wheel Drive	3,750	55,000
Tesla	Model Y All-Wheel Drive	7,500	80,000
Tesla	Model Y Long Range All-Wheel Drive	7,500	80,000
Tesla	Model Y Performance	7,500	80,000
Volkswagen	ID.4 AWD Pro	7,500	80,000
Volkswagen	ID.4 AWD Pro S	7,500	80,000
Volkswagen	ID.4 AWD Pro S Plus	7,500	80,000
Volkswagen	ID.4 Pro	7,500	80,000
Volkswagen	ID.4 Pro S	7,500	80,000
Volkswagen	ID.4 Pro S Plus	7,500	80,000
Volkswagen	ID.4 S	7,500	80,000
Volkswagen	ID.4 Standard	7,500	80,000



Table 4 (cont)

<b>Automaker</b>	<b>Model</b>	<b>Credit amount (\$)</b>	<b>MSRP limit (\$)</b>
<i>Models that had been eligible for a tax credit after December 31, 2022 but lost eligibility on April 18</i>			
Hyundai (Genesis)	Electrified GV70	7,500	80,000
Nissan	Leaf S	7,500	55,000
Nissan	Leaf S Plus	7,500	55,000
Nissan	Leaf SL Plus	7,500	55,000
Nissan	Leaf SV	7,500	55,000
Nissan	Leaf SV Plus	7,500	55,000
Tesla	Model 3 Long Range	7,500	55,000
Tesla	Model 3 RWD	7,500	55,000
Volkswagen	ID.4	7,500	80,000

a. Models introduced only in April 2023.

Source: US Department of Energy, <https://fueleconomy.gov/feg/tax2023.shtml> (accessed April 19, 2023).

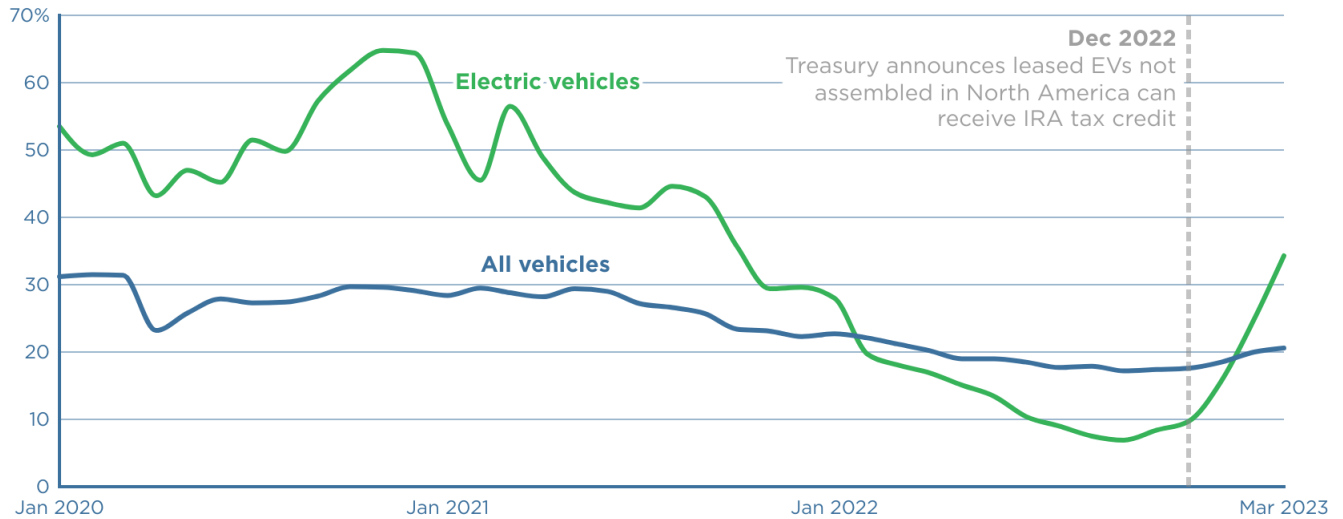
Indeed, when the sourcing regulations announced on March 31 went into effect on April 18, only 20 models from four automakers—Ford, GM, Tesla, and Volkswagen—remained eligible for the full \$7,500 tax credit under Section 30D (table 4). Another six models (one from Tesla, two from Rivian, and three from Ford, including the Mustang Mach-E) were eligible for \$3,750 of the credit. Apparently nine models from four automakers—Hyundai (Genesis), Nissan, Tesla, and Volkswagen—were not able to adjust their input sourcing requirements in time to remain eligible for the tax credits on April 18. For these and other non-eligible models, it remains to be seen whether automakers shift their input sources (and regain access under Section 30D), lease to consumers instead (and gain access under Section 45W), sell without the tax credit, or discontinue the models entirely.

US imports of EVs may remain high, especially if consumers choose to lease instead of buy. In the short run, this may also be impacted by the fact that so few models satisfying the tax credits were available to buy.

Early indications suggest US leasing of electric vehicles increased considerably in the immediate aftermath of the Treasury announcement of December 29, 2022 (figure 7). EV leasing rates increased from only 9.7 percent of new EVs entering the market in December 2022 to 34.3 percent by March 2023. The steady increase from January to March is consistent with dealers and consumers learning about and responding to the tax credit differential available under the leasing option. While the leasing rate of all US vehicles increased between December 2022 and March 2023, the uptick was much larger for EVs. (In 2022, ICE vehicles still made up more than 90 percent of all new vehicles in the US market—see again figure 1.)

Figure 7  
**US electric vehicle leases have increased since the eligibility for IRA tax credits was expanded**

Leases as a share of all new vehicles entering US market by vehicle type, 2020-23, percent



EV = electric vehicle; IRA = Inflation Reduction Act

Notes: On December 29, 2022, the US Treasury announced that EVs leased to consumers would be eligible for tax credits under Section 45W of the Inflation Reduction Act.

Source: Edmunds.

More generally, figure 7 also illustrates how US lease rates, including for EVs, had fallen dramatically during the COVID-19 pandemic and remained extraordinarily low as of December 2022. (Between 2010-19, on average, 25 percent of all new passenger cars put onto the market each year were leased, with slightly lower rates for light trucks.<sup>51</sup>) Pandemic lockdowns and mobility restrictions resulted in a crash of US car production in early 2020. When mobility restrictions were lifted, there was a shortage of new cars—further exacerbated by supply chain disruptions, including semiconductor shortages—increasing demand for used cars, causing used-car prices to spike. As a result, many leased vehicles had higher market values at the end of their lease period than the option price set when the lease was first signed. That price differential led many consumers to purchase their previously leased cars outright, forgoing the need for another lease. This is one reason why leasing rates fell and have only recently begun to recover.<sup>52</sup>

**CONCLUSION**

Section 30D of the IRA restricts eligibility for consumer tax credits on the purchase of EVs. For a consumer to receive the full subsidy, the vehicle must not only be assembled in North America, but the source of key inputs for its batteries must be sourced outside of China and from a restrictive set of locations.

51 Bureau of Transportation Statistics. 2023. *New and Used Passenger Car and Light Truck Sales and Leases*. Last accessed April 19, 2023.

52 Sean Tucker, “Car Leases are Declining - Here’s Why,” Kelley Blue Book, November 1, 2022.

Furthermore, access requires that consumers satisfy legislatively mandated income caps and specific models meet price caps. On the other hand, the December 29 Treasury announcement meant that Section 45W of the IRA does not restrict eligibility for tax credits provided consumers lease the EV.

Thus, those Section 30D restrictions may be significantly dulled if consumers start leasing EVs and accessing tax credits under Section 45W instead. If consumers do not lease EVs, then the IRA's Section 30D constraints will bind and affect incentives in a number of ways. First, fewer models will be available and limited to those assembled in North America. Second, the binding nature of the EV supply chain constraints also found in Section 30D may further limit eligibility—e.g., only a few models were eligible for the full tax credit as of April 2023 when the input sourcing regulations first went into effect. More models may become eligible over time if automakers choose to assemble in North America and if their supply chains for inputs adjust. However, that outcome may also be influenced by the restrictiveness of other Treasury and Department of Energy Section 30D decisions that are still under consideration, as well as whether countries negotiate critical minerals agreements with the US Trade Representative.

Even if consumers opt to buy instead of lease EVs so that the battery input sourcing criterion binds, several questions remain. To address concerns over dependency on imports from an authoritarian regime with a history of restricting exports, how will the United States coordinate with trading partners to establish an additional EV battery input supply chain outside of China? In June 2022, the United States, the European Union, Japan, South Korea, the United Kingdom, and Australia established the Minerals Security Partnership.<sup>53</sup> How it will be used remains unclear. Where will the mining and the environmentally challenging refining take place? Incentivizing industry to invest in an additional supply chain outside of China is resource intensive and requires policy coordination, including through potentially discriminatory policies. Those policies include subsidies (to favored producers); tariffs (on Chinese production); or establishment of environmental, social, and governance standards that China would be deemed unable to meet. Even adding Japan, the European Union, or the United Kingdom as “free trade agreement” partners to provide them eligibility under Section 30D is unlikely to be sufficient on its own, as these economies currently mine or process few critical minerals.

From the European Union's perspective, although the EV subsidies made the headlines, they were only one small part of its concerns with the IRA. And even they were only partially fixed. Whether EU EV exporters are affected will ultimately depend, in part, on whether consumers switch to leasing.

Another issue that could not be resolved is the IRA's producer tax credits for batteries and their inputs arising under Section 45X.

Furthermore, none of the tweaks arising from Treasury regulations tackled the larger and more fundamental European worry about the IRA: the divergence between the US and EU approaches to reducing CO<sub>2</sub> emission and tackling climate change. Even ignoring the local content requirements and other discriminatory elements associated with all of the other tax credits for production

**Those Section 30D restrictions may be significantly dulled if consumers start leasing EVs and accessing tax credits under Section 45W instead.**

<sup>53</sup> US State Department, “Minerals Security Partnership,” Press release, June 14, 2022.

of hydrogen, solar, wind, and other forms of clean energy,<sup>54</sup> Europe's primary concern is that the US approach is to subsidize energy while the European Union has been planning to tax carbon. This policy divergence may make certain energy-intensive industries artificially competitive in the United States relative to their European counterparts. How great this impact will be is an empirical question.

To keep tabs on the issue, French and German economy ministers Bruno Le Maire and Robert Habeck requested additional US transparency.<sup>55</sup> Although transparency is obviously welcome, at least two challenges remain. First, take-up of the subsidies is difficult to project, because it depends on consumer responsiveness, producer responsiveness, and many other factors. (It will also be difficult to measure and report on publicly because much of the subsidization arrives through credits and the tax code as opposed to direct government expenditures.) Second, understanding the potential impacts of these other parts of the IRA on competitiveness will require more complex assessments than simply counting up the total amount of subsidies disbursed.

From the US perspective, the IRA also remains imperfect. As already described, the implementing regulations may impact economic outcomes in ways that diverge from the law's initial intentions.

Even putting that to the side, additional domestic policy is needed to assist workers and communities adversely affected by the transition from ICE vehicles to EVs. Displaced workers need help reaching opportunities, both within the automobile and clean energy sectors and in other important and growing areas of the US economy (Hanson 2023).

The IRA also raises longer-run fiscal concerns. Because its tax credits are uncapped, if consumer and producer take-up of incentives exceeds expectations, the federal government may need additional sources of tax revenue. One potential solution—included in the Build Back Better Act, which passed the House in 2021 but failed to pass the Senate, but was not included in the IRA—was a global minimum corporate tax that is consistent with that of the OECD (Clausing 2022, 2023).<sup>56</sup>

The United States and European Union may have resolved the most pressing bilateral frictions associated with their electric vehicle industries. But the European concerns associated with the IRA overall have not been fixed, and the considerable political-economic challenges associated with coordinating the US and EU green transitions are far from over.

**From the US perspective, the IRA also remains imperfect.**

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54 Many of the production tax credits in Section 45X may also distort trade through by reducing purchases of imported inputs. As they are for domestic energy products that may be nontraded, the resulting outputs may not be trade distorting. However, the impact of reducing US energy prices (relative to the EU climate policy approach, which increases energy prices) will affect the relative competitiveness of other US and EU energy-intensive industries.

55 Christian Kraemer and David Lawder, "France, Germany Protest US Green Subsidies on Washington Trip," Reuters, February 8, 2023.

56 In December 2022, the Council of the European Union approved a directive to introduce a global minimum tax; EU countries were directed to translate the proposal into domestic law by the end of 2023 (Council of the European Union, "International Taxation: Council Reaches Agreement on a Minimum Level of Taxation for Largest Corporations," Press release, December 12, 2022).

## REFERENCES

- ACEA (European Automobile Manufacturers' Association). 2022. [Overview—Electric Vehicles: Tax Benefits & Purchase Incentives in the European Union \(2022\)](#), September 21.
- Autor, David, David Dorn, and Gordon Hanson. 2021. [On the Persistence of the China Shock](#). *Brookings Papers on Economic Activity* September 8: 381–447.
- Bistline, John, Neil R. Mehrotra, and Catherine Wolfram. 2023. Economic Implications of the Climate Provisions in the Inflation Reduction Act. *Brookings Papers on Economic Activity* Conference Draft, March.
- Bown, Chad P. 2018. [Why the United States Needs Allies in a Trade War Against China](#). *Harvard Business Review*, December 11.
- Bown, Chad P. 2021. [The US–China Trade War and Phase One Agreement](#). *Journal of Policy Modeling* 43, no. 4: 805–43.
- Bown, Chad P. 2022. [Will New US Tax Credits Remake EV Supply Chains?](#) *Trade Talks* podcast, episode 167, October 3.
- Bown, Chad P., and Jennifer A. Hillman. 2019. WTO'ing a Resolution to the China Subsidy Problem. *Journal of International Economic Law* 22, no. 4: 557–78.
- Clausing, Kimberly. 2022. [The Global Minimum Tax Lives on. America Has Abandoned It for Now but Will Likely Come around](#). *Foreign Affairs*. August 17.
- Clausing, Kimberly. 2023. [The international tax agreement of 2021: Why it's needed, what it does, and what comes next?](#) Peterson Institute for International Economics Policy Briefs 23-4, April.
- Clausing, Kimberly and Catherine Wolfram. Forthcoming. Asymmetric Climate Policies and International Trade. *Journal of Economic Perspectives*.
- Claussen, Kathleen. 2023. [What Is a Free Trade Agreement, Anyway?](#) *International Economic Law and Policy Blog*, January 3.
- CBO (Congressional Budget Office). 2022a. [Emissions of Carbon Dioxide in the Transportation Sector](#), December. Washington.
- CBO (Congressional Budget Office). 2022b. [Summary Estimated Budgetary Effects of Public Law 117- 169, to Provide for Reconciliation Pursuant to Title II of S. Con. Res. 14](#). Congressional Budget Office and Joint Committee on Taxation, September 7. Washington.
- Credit Suisse. 2022. [US Inflation Reduction Act: A Tipping Point in Climate Action](#). November 30.
- EPA (Environmental Protection Agency). 2022. [EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances](#). PA-HQ-OAR-2021-0317, September. Washington.
- EPA (Environmental Protection Agency). 2023. [Biden-Harris Administration Proposes Strongest-Ever Pollution Standards for Cars and Trucks to Accelerate Transition to a Clean-Transportation Future](#). News Release, April 12. Washington.
- Goldman Sachs. 2023. [Carbonomics: The Third American Energy Revolution](#).
- Hanson, Gordon H. 2023. [Local Labor Market Impacts of the Energy Transition: Prospects and Policies](#). NBER Working Paper 30871. Cambridge, MA: National Bureau of Economic Research.
- IEA (International Energy Agency). 2022. [Electric Vehicles](#). Paris. Available at <https://www.iea.org/reports/electric-vehicles>, last accessed March 3, 2023.

- IRS (Internal Revenue Service). 2022. [Frequently Asked Questions Related to New, Previously-Owned and Qualified Commercial Clean Vehicle Credits](#). RS Fact Sheet FS-2022-42, December. Washington: US Department of Treasury.
- Klier, Thomas H., and James M. Rubenstein. 2022. [North America's Rapidly Growing EV Market: Implications for the Geography of Automotive Production](#). *Chicago Fed Economic Perspectives* 5.
- Kleimann, David, Niclas Poitiers, André Sapir, Simone Tagliapietra, Nicolas Véron, Reinhilde Veugelers, and Jeromin Zettelmeyer. 2023. [How Europe Should Answer the United States Inflation Reduction Act](#). Bruegel Policy Contribution Issue 04/23, February.
- Leruth, Luc, Adnan Mazarei, Pierre Régibeau, and Luc Renneboog. 2022. [Green Energy Depends On Critical Minerals. Who Controls the Supply Chains?](#) PIIE Working Paper 22-12. Washington: Peterson Institute for International Economics.
- Noland, Marcus. 2023. [Electric Vehicle Uptake: Hawaii as a Natural Experiment](#). *PIIE Realtime Economics*, April 4. Washington: Peterson Institute for International Economics.
- OECD (Organization for Economic Cooperation and Development). 2022. [Pricing Greenhouse Gas Emissions: Key Findings for the United States](#). Paris.
- OECD (Organization for Economic Cooperation and Development). 2023. [Raw Materials Critical for the Green Transition. Production, International Trade and Export](#). OECD Trade Policy Paper 269. Paris.
- Rapson, David S., and Erich Muehlegger. 2022. [The Economics of Electric Vehicles](#). NBER Working Paper 29093 (revised). Cambridge, MA: National Bureau of Economic Research.
- Rennert, Kevin, Frank Errickson, Brian C. Prest, Lisa Rennels, Richard G. Newell, William Pizer, Cora Kingdon, Jordan Wingenroth, Roger Cooke, Bryan Parthum, David Smith, Kevin Cromar, Delavane Diaz, Frances C. Moore, Ulrich K. Müller, Richard J. Plevin, Adrian E. Raftery, Hana Ševčíková, Hannah Sheets, James Stock, Tammy Tan, Mark Watson, Tony E. Wong, and David Anthoff. 2022. [Comprehensive Evidence Implies a Higher Social Cost of CO<sub>2</sub>](#). *Nature* 610: 687–92.
- Sheldon, Tamara L. 2022. [Evaluating Electric Vehicle Policy Effectiveness and Equity](#). *Annual Review of Resource Economics* 14: 66988.
- Tesla. 2020. [Form 10-K. Annual Report Pursuant to Section 13 or 15\(D\) of the Securities Exchange Act of 1934](#). January 29.
- Tracy, Brandon S. 2022. [Critical Minerals in Electric Vehicle Batteries](#). CRS Report R47227, August 29. Washington: Congressional Research Service.
- US Treasury Department. 2022. [Anticipated Direction of Forthcoming Proposed Guidance on Critical Mineral and Battery Component Value Calculations for the New Clean Vehicle Credit](#). 30D White Paper, December 29. Washington.





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