

How the United States solved South Korea's problems with electric vehicle subsidies under the Inflation Reduction Act

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South Korea felt 'betrayed' when President Biden signed his administration's flagship climate legislation, the Inflation Reduction Act (IRA) of 2022, into law. This article first shows how the Biden administration addressed Korea's concerns about the law's effect on its sales of electric vehicles (EVs) in the United States. Thanks in part to the Treasury Department's regulations written to implement the law, Korean exports of EVs to the United States grew even after the IRA went into force. Whether these actions by the Biden administration are enough to assuage the concerns of the Koreans – and other allies adversely affected by the IRA – remains to be seen. Furthermore, the US accommodation of Korean concerns came with tradeoffs by offsetting key incentives Congress may have intended in passing the IRA. The article also examines potential impacts of the law on South Korean battery companies, and it provides an initial exploration into how the Korean government responded to IRA by adjusting its own policy mix of EV consumer tax credits and industrial policy for its EV plants and battery makers.

Keywords: Electric vehicles, batteries, industrial policy, supply chains, climate, US, South Korea
JEL Codes: L52, F13

1 INTRODUCTION

The Biden administration's flagship climate legislation triggered a political firestorm in South Korea. Almost immediately after the Inflation Reduction Act (IRA) went into effect, in August 2022, a standing committee in the South Korean National Assembly passed a resolution voicing concerns that the new US

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tax credits in the law discriminated against Korean companies.¹ Some Korean officials went so far as to call the IRA an act of betrayal.² The Yoon Suk Yeol administration was suddenly under severe political pressure to do something about the new US law.

Korea's Trade Minister, Ahn Dukgeun, immediately hopped on a plane to Washington. Closely watched back home, he was among the first foreign officials to get face-to-face meetings with the Biden administration to explain his country's concerns.

One complaint involved the IRA's discriminatory local content provisions for electric vehicles (EVs), which were expected to hurt Korea's politically and economically important automakers.³ Ahn's persistence was successful at getting his counterpart, US Trade Representative (USTR) Katherine Tai, to engage frequently to attempt to resolve the issue.⁴ But the IRA remained an ongoing domestic political problem for the Yoon administration for months.⁵

The Biden administration would ultimately take actions to address Korea's most immediate economic concerns about the IRA. Early evidence suggests that the US approach may have fixed Korea's main short-term worries.

The consumer tax credits in the law did appear to discriminate against US imports of EVs, including popular models manufactured in Korea. Yet, the Treasury Department's implementing regulations have accommodated continued growth of Korean exports of EVs to the United States in the nine months since the IRA went into effect. Evidence on increasing EV leasing rates for Korean companies is supportive of the interpretation that Treasury's actions helped address Korea's worries.

If the Biden administration did diffuse the fiery dispute with a key ally over EVs, the diplomatic coup is remarkable. Resolution occurred much more quickly than a formal World Trade Organization (WTO) dispute would have – if such a mechanism could have fixed the problem at all. Because the resolution did not involve reforming the statute or Korea winning a WTO dispute, however, there was no headline moment. The details of how the problem was solved may prove

¹ Jung In-hwan, *Korean Legislative Committee Adopts Resolution Denouncing US EV Tax Credit Snub*, Hankyoreh (31 Aug. 2022).

² Jeong-Ho Lee & Heejin Kim, *South Korea Sees 'Betrayal' in Biden's Electric Vehicle Push*, Bloomberg (1 Sep. 2022).

³ Byun Duk-kun, *S. Korean Trade Minister Arrives in US for Talks on Inflation Reduction Act*, Yonhap News Agency (6 Sep. 2022); see also Chad P. Bown, *Will New US Tax Credits Remake EV Supply Chains?*, Trade Talks podcast, episode 167 (3 Oct. 2022). The industry ministry sent officials to Washington as well; see Grace Oh, *S. Korea Sends Delegation to US over Inflation Reduction Act*, Yonhap News Agency (29 Aug. 2022).

⁴ Byun Duk-kun, *S. Korea, US Agree to Launch High-Level Talks on US Inflation Reduction Act*, Yonhap News Agency (8 Sep. 2022).

⁵ Lee Minji, *DP Demands Yoon Fire Economic Aides over US Inflation Law, Theme Park Default*, Yonhap News Agency (5 Jan. 2023).

difficult for the Korean public to understand, possibly failing to address the domestic political problem the IRA caused for the Yoon administration.

The IRA has also triggered additional domestic policy reactions in Korea. The Biden administration has actively encouraged other key economies to subsidize their clean energy industries and in early 2023, the Korean government implemented new policies, including an industrial policy for its EV plants and support for its considerable battery industry. Depending on the still-emerging details of how these policies are applied, they may support or undermine the incentives and goals of the EV and battery tax credits in the IRA.

This article explores the initial impact of the IRA on Korea. It examines the root of the conflict affecting the Korean EV and battery industry and the process by which the conflict was seemingly resolved.⁶ It explains how the law, the regulations Treasury wrote to implement the law, the trade agreements over critical minerals that the USTR is negotiating in light of the law, and the Korean government's own policy response are likely to affect Korean supply chains. It also explores how the US accommodation of Korean concerns may have introduced other challenges by offsetting key incentives Congress intended in passing the IRA. If Congress reacts with a legislative response, the current solution may prove temporary. If it tides over the needs of Hyundai and other Korean automakers until their new US plants come online in 2025, on diplomacy grounds, it may have done the job.

2 THE CLIMATE PROBLEM AND THE ELECTRIC VEHICLE INDUSTRY

In 2020, the United States had the second-largest share of global greenhouse gas emissions, at 11.9%, trailing only China, at 28.1%.⁷ South Korea was twelfth, at 1.4%.

2.1 CARBON DIOXIDE EMISSIONS AND THE SWITCH TO EV

To cut their overall carbon dioxide (CO₂) emissions, both the United States and Korea would need to cut tailpipe emissions. In the United States, transportation was responsible for 38% of CO₂ emissions in 2021 (CBO 2022). Of that, personal vehicles accounted for 58% and commercial trucks and buses for 25%. In Korea, transportation made up 17% of emissions in 2021, of which 97% was road transport.⁸ Reducing emissions in the transportation sector was thus a key

⁶ On the institutional details of the IRA, this article draws heavily from Bown (2023).

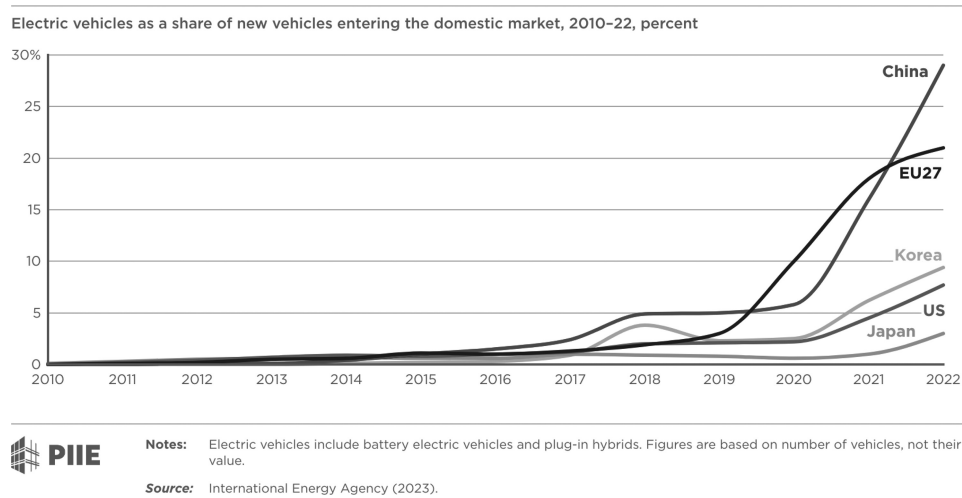
⁷ Data are from the World Bank.

⁸ Ministry of Environment Greenhouse Gas Inventory and Research Center, *2021 Greenhouse Gas Reduction Performance Evaluation Report* (20 Mar. 2023).

mitigation strategy for both countries in their Nationally Determined Contributions submitted under the Paris Agreement.⁹

An important part of the clean energy transition is to convince consumers in both the United States and Korea to switch from internal combustion engine (ICE) vehicles to EVs. Take-up in each country was initially slow (figure 1). That began to change for Korea in 2021, partly as a result of a 2019 amendment to its Clean Air Conservation Act that enabled the Ministry of Environment to set annual supply targets for low- and zero-emissions vehicles.¹⁰ Although EV penetration in Korea continues to lag well behind penetration in the European Union and China, it has begun to outpace the United States and other major automaking countries, including Japan. In March 2023, the Korean government established penetration rate targets for low-emissions vehicles at 26% by 2025, with a 22% penetration rate for zero-emissions vehicles like EVs.¹¹

Figure 1 Though it is growing, electric vehicle penetration in South Korea and US lags the EU and China



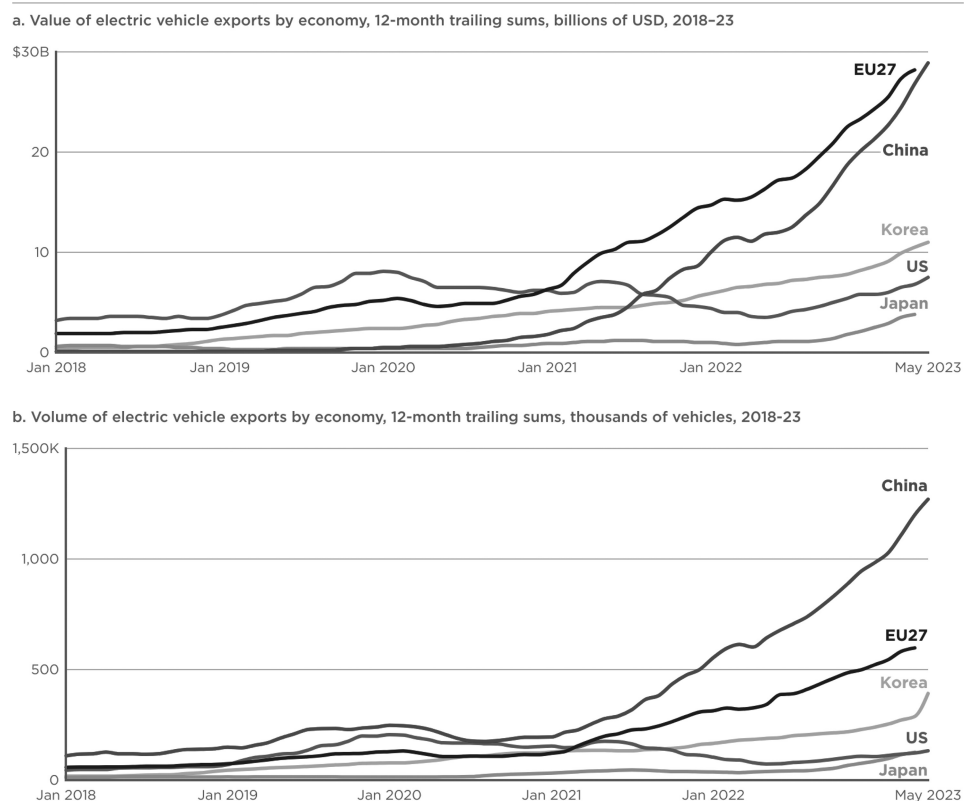
⁹ United Nation Nationally Determined Contributions Registry, *The United States of America Nationally Determined Contribution* (15 Apr. 2021), and United Nation Nationally Determined Contributions Registry, *The Republic of Korea's Enhanced Update of Its First Nationally Determined Contribution* (23 Dec. 2021).

¹⁰ Korea Legislation Research Institute, *Clean Air Conservation Act* (10 Jun. 2022).

¹¹ Ministry of Environment, *Administrative Notice of Partial Revision of Annual Low-Emission and Zero-Emission Vehicle Supply Targets*, legislative notice (17 Mar. 2023).

Exports of EVs have grown in importance for Korean automakers both over time and relative to certain other exporting countries (figure 2). In 2021, Korea overtook the United States and once again became the third-largest EV exporter to the world in value terms (panel a). In 2022, Korean exports exceeded \$8 billion, trailing only the European Union (\$23 billion) and China (\$20 billion) and well ahead of the United States (\$6 billion) and Japan (\$2 billion). In volume terms, Korea trailed only China and the European Union (panel b).

Figure 2 South Korean exports of electric vehicles are expanding but trail the EU and China



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 CN codes are 87038010 and 87038090 in 2017-23 and 87039010 in 2016. For the US, China, Korea, and Japan, the HS code is 870380. The code for these four countries was created in 2017 and did not exist for electric vehicles prior to 2017.

Source: US International Trade Commission Dataweb, Eurostat, China Customs, Korea Customs, Korea International Trade Association, ITC Trade Map.

EVs are making up an increasing share of automobile exports in Korea. By volume, 9% of Korean vehicle exports were electric in 2022, roughly the same share as the European Union and nearly twice the share of the United States. At over 35%, China's EV share of its total vehicle exports far outpaced the historical automakers, as the newest entrant into the auto industry technologically leapfrogged ICE vehicles.

2.2 THE POLITICAL-ECONOMIC IMPORTANCE OF THE KOREAN AND US AUTOMOTIVE INDUSTRIES

Historically, the automobile industry has been very important to both the US and Korean economies. The Korean industry is dominated by Hyundai Motor Group, which owns the Hyundai, Kia, and Genesis brands. The United States has not only the 'Detroit-3' – Ford, General Motors, and Chrysler (now part of Stellantis) – but also a large number of assembly plants with headquarters in other countries, including Korea.

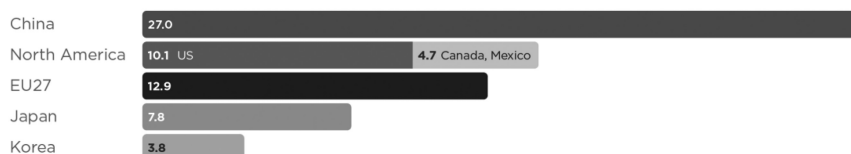
The United States produced more automotive vehicles than Korea did in 2022 (10.1 million versus 3.8 million) (figure 3). But the share of the workforce employed in the automotive supply chain was much larger in Korea (0.6% versus 1.4%).

Nevertheless, the transition from ICE vehicles to EVs is likely to affect a large number of jobs within the US and Korean automotive industries. EVs require many fewer parts and 30% less labour than ICEs, according to estimates from Ford and Volkswagen.¹² Workers tied to plants that either assemble ICE vehicles or manufacture parts needed by ICE vehicles only – such as engines and transmissions – may be displaced. The new EV assembly plants, as well as the critical parts of EV supply chains (such as battery plants), may be located far enough away from existing ICE plants that workers may not be able to find employment in the same industry without migrating. And at least in the United States, some of the most successful EV automakers – such as Tesla – are new entrants. They will take some market share away from the legacy ICE automakers and further shift employment to their locations of production. An additional challenge involves competing globally with a major new entrant (China).

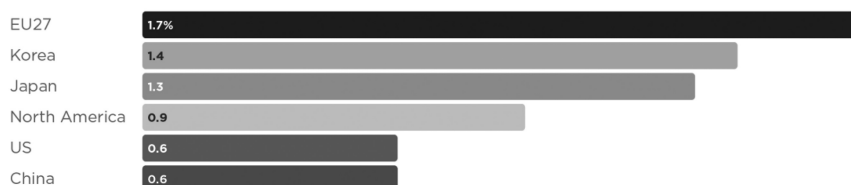
¹² Tim Levin, *Ford Is Slashing Thousands of Jobs as It Goes Electric. Experts Say a Tidal Wave of Layoffs Will Rock the Industry as It Undergoes a Seismic Shift*, Business Insider (23 Aug. 2022).

Figure 3 The US produces more automotive vehicles, but South Korea has a larger share of its workforce employed in the automotive supply chain

a. Total industry vehicle production, 2022 (millions of units)



b. Share of automotive manufacturing industry employment in total employment, 2021 (percent)



Note: Includes employment in manufacturing of motor vehicles, engines, and parts. The European Union uses ISIC Rev.4 industry classification. South Korea, Japan, and China use their own industry classifications, which are all based on and highly consistent with ISIC Rev.4. The United States uses the NAICS industry classification, in which the industry "Motor vehicles and parts" includes more subsectors than its closest counterpart in ISIC Rev.4.

Sources: Author's calculations based on data from Bank of Korea; Japan Automotive Manufacturers Association; United States Bureau of Labor Statistics; Eurostat; China National Bureau of Statistics; Statistics Canada; National Institute of Statistics and Geography; International Organization of Motor Vehicle Manufacturers.

3 HOW THE INFLATION REDUCTION ACT 'BETRAYED' KOREA

3.1 THE CHALLENGES OF THE TRUMP YEARS

Korea confronted four challenging years under the Donald J. Trump administration. Almost immediately after Trump was inaugurated, it was forced to renegotiate elements of the Korea–US Free Trade Agreement (KORUS) to appease a president who had famously threatened to rip it up.¹³ Korea was one of the countries with a chronic trade surplus with the United States; ending those bilateral surpluses was one guiding trade policy principle for the president and his trade team.

¹³ See the prologue to Bob Woodward's book *Fear: Trump in the White House*. See also Damian Paletta, *Trump Preparing Withdrawal from South Korea Trade Deal, a Move Opposed By Top Aides*, Washington Post (2 Sep. 2017).

Beginning in early 2018, Korean exports were caught up in a series of controversial Trump tariff actions.¹⁴ The import tariffs on washing machines mainly targeted Samsung and LG, Korean companies exporting to the United States from plants all over the world. Korean manufacturers of solar panels were hit by Trump's second tariff action. (Korea filed formal WTO disputes against both sets of US tariffs and was also affected by the Trump administration's policy decision to decimate the WTO's dispute settlement system by refusing to appoint new members to its Appellate Body.¹⁵) Korean steel companies had to accept tight, binding volume limits on how much they could export in order to avoid Trump's national security tariffs of 25%.¹⁶ Finally, like automakers in Japan, Europe, Canada, and Mexico, Korean car companies also lived under constant concern that Trump would follow through with his threats to impose a 25% tariff on their auto exports.¹⁷

Outside of trade, Korea faced a trying time as a US military ally. Trump frequently chided the Korean government for not contributing more to the costs of US military defence, and the Korean press reported that his administration was considering withdrawing up to 4,000 of the 28,500 troops stationed on the peninsula.¹⁸ Politically, Korea was in a no win situation. Even when it did cooperate with the United States militarily – as when it deployed America's Terminal High Altitude Area Defence (THAAD) missile system on its territory in early 2017, for example – it faced severe economic coercion measures from China. The Lotte Mart supermarket chain, K-pop stars, and the Korean tourism industry all suffered Chinese retaliation.¹⁹

3.2 CHANGES UNDER THE BIDEN ADMINISTRATION

When the Biden administration entered office, it sought to repair ties with Korea as well as numerous other allies that had suffered under the Trump administration. In one of her first official actions after being sworn in as USTR, Katherine Tai brokered a negotiated solution between LG Energy Solution and SK Innovation, resolving a bitter intellectual property rights dispute between the two major

¹⁴ See Bown & Kolb (2023).

¹⁵ In 2019, the United States' refusal to allow appointments to the WTO's Appellate Body meant that countries could appeal the first-stage (panel) legal decisions 'into the void', – i.e., avoiding a final legal ruling – thus undermining their ability to enforce the rules under the WTO system (Bown & Keynes 2020).

¹⁶ Chad P. Bown & Soumaya Keynes, *Are Trump's Steel Quotas Worse than His Steel Tariffs?*, Trade Talks podcast episode 49 (1 Aug. 2018).

¹⁷ Song Jung-a & Edward White, *South Korea Urges Trump to Drop Threatened Car Tariffs*, Financial Times (12 May 2019).

¹⁸ Joyce Lee & Phil Stewart, *Pentagon Denies Report US Mulls Pulling up to 4,000 Troops from South Korea*, Reuters (20 Nov. 2019).

¹⁹ Darren J. Lim & Victor Ferguson, *Chinese Economic Coercion during the THAAD Dispute*, ASAN Forum (28 Dec. 2019).

Korean companies that were seeking to make batteries for EVs in the US market (more on the overlooked importance of this deal is below).²⁰

Despite ongoing public health concerns during the COVID-19 pandemic that limited travel, Biden welcomed Korean President Moon Jae-in to Washington in May 2021, making Moon one of the first foreign leaders to visit the White House during his administration. In a joint statement, the two leaders agreed to 'recommit ourselves to an ironclad alliance'.²¹ They committed to work together to confront the pandemic; strengthen their Mutual Defence Treaty; and address a number of other joint concerns on climate change policy, supply chain resilience, and semiconductors, including the shortage of legacy chips, which was holding back automobile production.

Korea held its presidential election in March 2022. Yoon Suk Yeol, of the People Power Party, whose campaign included the pledge to improve ties with the United States, won, defeating Lee Jae-myung, of the incumbent Democratic Party.²² (Outgoing President Moon Jae-in was term limited.)

Two months later, South Korea was the site of Biden's first international trip outside of Europe as president – ahead of Japan, Germany, and even Canada. Biden visited Samsung's Pyeongtaek campus, highlighting the importance of the Korean semiconductor industry for US strategy. Korea would become a critical player in controlling exports of semiconductors, as pushed by the US and other allies, both to address concerns over China's 'military-civil fusion' policy and to respond to Russia's invasion of Ukraine.

During the May visit, Biden held a joint appearance with Hyundai Executive Chair Chung Euisun that would later turn out to be a pivotal part of the EV story. During the event, Chung announced a new EV plant investment in the US state of Georgia, including a surprise additional \$5 billion investment for the project.²³ Together, Biden and Chung celebrated Hyundai's investments, with Biden stating,²⁴:

This new commitment of \$5 billion for advanced automotive technology and \$5.5 billion investment to open a new factory near Savannah, Georgia, is going to create more than 8,000 new American jobs. The plan is to break ground as soon as January of 2023. And the new facility should be rolling out the latest EVs and batteries to power them by 2025.

These developments notwithstanding, it was not all smooth sailing for US–Korea relations.²⁵ In early August 2022, for example, Biden signed into law the Creating

²⁰ Hyunjoo Jin, David Shepardson & Heekyong Yang, *S. Korean Battery Makers Agree \$1.8 billion Settlement, Aiding Biden's EV Push*, Reuters (10 Apr. 2021).

²¹ White House, *US–ROK Leaders' Joint Statement* (21 May 2021).

²² Yoon Suk Yeol, *South Korea Needs to Step Up*, Foreign Affairs (8 Feb. 2022).

²³ Kim Da-sol, *At Biden Meeting, Hyundai Motor Group Unveils Extra \$5b Investment*, Korea Herald (22 May 2022).

²⁴ White House, *Remarks by President Biden on Hyundai's Investments in Savannah, Georgia* (22 May 2022).

²⁵ President Yoon also created political controversy by not meeting with House Speaker Nancy Pelosi during her visit to Korea immediately after her groundbreaking trip to Taiwan in early Aug. 2022 *See*

Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022, which contained billions of dollars of federal subsidies for semiconductor facilities. The intent was to diversify global production geographically, in part by increasing production on US soil, potentially shifting manufacturing of some high-end nodes out of Korea (by Samsung) and Taiwan (by TSMC). Companies that accepted the funding, including Korean firms, would face restrictions on expanding their facilities in China for ten years.

On 7 October 2022, the Biden administration imposed new export controls limiting equipment sales to semiconductor manufacturers in China. (Japan and the Netherlands subsequently adopted similar controls.) Korean semiconductor manufacturing firms Samsung and SK Hynix ultimately received one-year exemptions from the controls to continue to outfit their Chinese plants, but the long-run outlook for their multibillion dollar capital investments in Chinese facilities was suddenly in question.²⁶

3.3 THE BLOW OF THE INFLATION REDUCTION ACT

For Korean EVs in the US market, things were finally looking up by the summer of 2022. After a slow start, Korean EVs were enjoying newfound popularity in the United States. *Car and Driver* magazine named the Hyundai Ioniq its 2022 Electric Vehicle of the Year.²⁷ Hyundai and its subsidiary Kia had three of the ten most popular EV models in the US market, including a number of semifinalists for the coveted North American Car and Truck of the Year Awards.²⁸

Then came devastating news. In late July, the IRA arrived. The headline of the legislation was, of course, overwhelmingly positive: It contained over \$350 billion of US taxpayer commitments – through federal spending and tax credits on a variety of clean energy technologies, such as wind, solar, clean hydrogen, and carbon capture – to help the United States live up to its commitments under the Paris Agreement. However, the last-minute deal struck between Senator Joe Manchin and Senate Majority Leader Chuck Schumer also included new terms on consumer tax credits for EVs that seemed to exclude eligibility for EVs manufactured in Korea, including all of those award-winning models.

Christian Davies & Song Jung-a, *South Korean President Snubs Nancy Pelosi as China Tensions Rise*, *Financial Times* (4 Aug. 2022).

²⁶ Jiyoung Sohn, *SK Hynix Gets One-Year Reprieve from US Chip Restrictions on China*, *Wall Street Journal* (12 Oct. 2022); Jiyoung Sohn, *Samsung, TSMC Win Exemption from New US Chip Restrictions on China*, *Wall Street Journal* (13 Oct. 2022). For a discussion, see Chorzempa (2023).

²⁷ Ezra Dyer, *Presenting Car and Driver's. 2022 EV of the Year*, *Car and Driver* (18 Aug. 2022).

²⁸ *NACTOY Names 26 Semifinalists for 2023 North American Car, Truck and Utility Vehicle of the Year Awards*,TM NACTOY press release (14 Sep. 2022).

Just three months after the highly publicized Biden–Chung event in Seoul, politicians in Korea were suddenly furious. From Korea’s perspective, the main problem was the IRA’s section 30D requirement that, in order to receive the consumer tax credit, the vehicle had to be assembled in North America (table 1). This rule went into effect immediately, implying that models like Hyundai’s increasingly popular Ioniq 5 – assembled at its plant in Ulsan, Korea – would suddenly lose access to the old US consumer tax credit and its new plant being built in Georgia would not have models eligible for those tax credits available until 2025. (Section 30D eligibility was also contingent on EV price caps, consumer income caps, and an additional battery input sourcing criterion that was an attempt to diversify battery supply chains outside of China.²⁹ Each is discussed in more detail below.)

Table 1 Key Requirements for Qualifying for an Electric Vehicle Tax Credit under Sections 30D and 45W of the IRA

<i>Requirement</i>	<i>Section 30D</i>	<i>Section 45W</i>
Gross vehicle must weigh less than 14,000 pounds	X	X ^a
Vehicle must be used for business		X
Vehicle must be assembled in North America	X	
Manufacturer’s suggested retail price (MSRP) 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 (recycled in the United States or extracted or processed in the United States or a free trade agreement partner)	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	

Note: ^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.

²⁹ See Leruth et al. (2022) and Tracy (2022).

In an interview with the *Financial Times*, Trade Minister Ahn described the problem as one of betrayal.³⁰ ‘President Biden himself said “thank you very much, chairman Chung, I will not let you down” – that was the exact statement, and it was widely broadcast in Korea’, he said. ‘Then when this new law was enacted and signed by President Biden and [it became clear that] that company was being discriminated against, this situation provoked emotional and political repercussions’.

The Korean government considered its options. Recognizing that Sweden and Germany had similar concerns on behalf of their automakers, Korean officials announced that they would consult with the European Union and consider a joint response.³¹ Lee Chang-yang, Minister of Trade, Industry, and Energy (MOTIE), raised the possibility of a potential dispute before the WTO but only ‘as a last resort’. (In the past, such disputes had the potential for a country like Korea to impose WTO–authorized retaliatory tariffs against US exports.³²)

In early September, Minister Ahn arrived in Washington and met with Biden administration officials, including USTR Katherine Tai, who committed to help resolve the problem. Over the next few months, Korean efforts to reach out to other US policymakers led Ahn to realize the depth of the confusion surrounding the impact of the IRA on America’s allies, including Korea, and that the problems created by the law had not necessarily been intentional, noting that ‘not many congressmen and senators were fully aware of all the details of the IRA’.³³ Ahn also indicated that US officials had acknowledged problems facing the Korean automakers and were working ‘to minimize the damage’.

Korean interests also reached out to US legislators in hopes of reforming the law itself. They convinced Democratic Senator Raphael Warnock of Georgia – home of the future Hyundai EV plant – to propose a bill that would provide a three-year grace period for automakers assembling EVs outside of North America so that they would retain eligibility for the tax credit until the plant came online in 2025.³⁴ That proposed legislation never came seriously close to passage, and any political window

³⁰ Song Jung-a, *South Korea Complains of Growing Friction with US over High-Tech Trade*, *Financial Times* (18 Sep. 2022). See also Jeong-Ho Lee & Heejin Kim, *South Korea Sees ‘Betrayal’ in Biden’s Electric Vehicle Push*, *Bloomberg* (1 Sep. 2022).

³¹ Grace Oh, *S. Korea Seeks to Join Hands with EU over US Inflation Reduction Act*, *Yonhap News Agency* (25 Aug. 2022).

³² Authorized retaliation was a long shot for other reasons. Again, since 2019, the United States had been blocking appointments to the WTO’s Appellate Body, which meant that any country (including the defendant) could prevent adoption of an adverse legal ruling by appealing it ‘into the void’ to avoid WTO–sanctioned retaliation.

³³ Song Jung-a, *South Korea Complains of Growing Friction with US over High-Tech Trade*, *Financial Times* (18 Sep. 2022).

³⁴ Baek Byung-yeul, *Hyundai Motor, Kia to Benefit from Georgia Senator Bill for IRA Grace Period*, *Korea Times* (30 Sep. 2022).

of opportunity closed when the Republican Party regained control of the House of Representatives in the November 2022 midterm elections.

The Biden administration was unapologetic about its subsidies-driven approach to tackling the climate problem as well as other challenges facing the global economy.³⁵ Indeed, in an interview with the *Financial Times*, Tai suggested that allies subsidize too, stating,³⁶ ‘Our vision is for an industrial policy that isn’t just about us but is about complementing the work with our friends and allies to allow us to together build a resiliency and to wean us off some dependencies and concentrations that have proven to be so economically harmful over the last couple of years’. In 2023, Korea responded with subsidies (as described below).

Shifting policy efforts back to the Executive Branch, Korean companies forming critical parts of the EV supply chain did their part to inform the Biden administration about the potential impacts of regulatory decisions needed to implement the IRA. A November 2022 Treasury roundtable included input from battery companies LG Energy Solution, Samsung SDI, and SK On, as well as Hyundai and Kia, the latter of which followed up with written comments.³⁷ When he got wind of some of the proposals, Senator Manchin was not pleased and sent his own letter to Treasury Secretary Yellen.³⁸ ‘Unfortunately’, the letter read:

I have heard that some automakers and foreign governments are asking your agency for a broad interpretation of [Section] 45W that would allow rental cars, leased vehicles, and rideshare vehicles ... to be eligible for the full \$7,500 commercial vehicle credit as a way to bypass the strict sourcing requirements in the 30D Clean Vehicle Credit.

Korea was not the only ally to complain about how the IRA discriminated against its EV exports. Ultimately, Europe did so as well, and its complaints may have ultimately been the driving force behind the Biden administration’s policy response. Yet Korean doggedness likely played an important role, including by ensuring that any US accommodation would not be so discriminatory as to benefit European automakers alone. In the short run, the complaints by Korea and the

³⁵ For alternative approaches, such as carbon pricing, as well as an analysis of the channels through which they create spillovers for trading partners, see Clausing and Wolfram (2023) and Bown and Clausing (2023).

³⁶ Andy Bounds & Aime Williams, *Top US Trade Official Urges EU to Join Forces on Subsidies amid Green Deal Tensions*, *Financial Times* (9 Nov. 2022).

³⁷ SK On is the EV battery business unit of SK Innovation. See Treasury, *Readout: Stakeholder Roundtable on Clean Vehicles and the Inflation Reduction Act*, press release (4 Nov. 2022). See also Hyundai Motor Group, *Comments to US Department of the Treasury Request for Comments on Section 45W Credit for Qualified Commercial Clean Vehicles and Section 30C Alternative Fuel Vehicle Refueling Property Credit (Notice 2022-56)*, Federal Register Docket ID: IRS-2022-0027- 0001 (2 Dec. 2022).

³⁸ See Gabrielle Coppola & Ari Natter, *EV Tax-Credit Rules Pit Joe Manchin Against Hyundai*, *Bloomberg* (13 Dec. 2022), and Senate Committee on Energy and Natural Resources, *Manchin Calls on Treasury Secretary Yellen to Ensure Inflation Reduction Act Vehicle Tax Credits Strengthen Domestic Manufacturing and Economic Security*, news release (13 Dec. 2022).

European Union were the same: The North American assembly criterion in Section 30D of the IRA had eliminated vehicles assembled in their economies from access to the USD7,500 consumer tax credit starting on August 16.

3.4 THE BIDEN ADMINISTRATION'S POLICY RESPONSE TO COMPLAINTS FROM KOREA AND EUROPE

President Biden acknowledged the legitimacy of some of the concerns raised by Korea (and Europe) with the IRA during a joint press conference on 1 December 2022 with French President Emmanuel Macron, who had said that the IRA's subsidies risked 'fragmenting the West'.³⁹ Biden admitted to problems with the legislation by stating,⁴⁰:

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 ... when I wrote the legislation – I never intended to exclude folks who were cooperating with us.

Biden was surely referring to Manchin, who would later acknowledge legislative drafting errors. (He would also later complain about the administration's approach to address them.⁴¹) When drafting his part of the law, Manchin had not understood that the United States did not have a free trade agreement with the European Union and other countries in NATO. ('I gotta be honest with you', he said. 'I should have paused and said 'OK, I'm going to make sure our NATO allies are involved in this'.⁴²)

At the same press conference, Biden promised that his administration would offer 'tweaks' to fix the problems allied countries had with the EV provisions of the IRA. The Biden administration could not amend the law without Congress – an unlikely path given that the House had flipped to Republican control. It did so by writing implementing regulations that were friendly to a number of major US allies, especially Korea and NATO-allied countries in the European Union (table 2).

³⁹ Leila Abboud, *Emmanuel Macron Says US climate Law Risks 'Fragmenting the West'*, Financial Times (1 Dec. 2022).

⁴⁰ White House, *Remarks by President Biden and President Macron of France in Joint Press Conference* (1 Dec. 2022).

⁴¹ See also the recount of the last-minute IRA negotiations as reported in Emma Dumain & Hannah Northey, *Manchin says Biden Broke Climate Deal. Others say 'There was no such Agreement'*, Politico (25 Jun. 2023).

⁴² Andrew Duehren, *EU and Japan Strike Deal on Minerals Used in Batteries for Electric Cars*, Wall Street Journal (28 Mar. 2023). In Jan. 2023, Manchin also admitted that 'I did not realize the European Union is not a free trade agreement [country]'. See Ari Natter, *Manchin Says He Didn't Know US, EU Lacked Free Trade Agreement*, Bloomberg (19 Jan. 2023). See also Joe Manchin, *Biden's Inflation Reduction Act Betrayal. Instead of Implementing the Law as Intended, His Administrations Subverts It for Ideological Ends*, Wall Street Journal (29 Mar. 2023).

Table 2 Key Events Affecting US Policy on Electric Vehicles

<i>Date</i>	<i>Event</i>
10 April 2021	Facilitated by USTR Katherine Tai, Korean battery makers LG Energy Solution and SK Innovation settled disputes over EV battery technology.
15 November 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.
19 November 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.
22 May 2022	At a joint appearance during President Biden's state visit to Korea, Hyundai Executive Chair Chung Euisun announces a new EV plant investment in Georgia and a surprise additional \$5 billion investment for the project.
27 July 2022	Senator Joe Manchin and Senate Majority Leader Chuck Schumer announce an agreement to allow a vote on the IRA of 2022. It subsequently passes both the Senate (51–50) and the House (220–207).
16 August 2022	President Biden signs the IRA into law. The North American assembly requirement in IRA Section 30D goes into effect immediately.
5 September 2022	Korean Trade Minister Ahn Dukgeun arrives in Washington to meet with Biden administration officials to discuss the IRA.
7 September 2022	The Congressional Budget Office (CBO) releases revised estimates of the budgetary effects of the IRA over 2022–31.
1 December 2022	During the state visit of French President Emmanuel Macron, Biden says his administration will make 'tweaks' to the IRA.
19 December 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.

<i>Date</i>	<i>Event</i>
29 December 2022	Treasury (the Internal Revenue Service) clarifies that the IRA's commercial clean vehicle tax credits (Section 45W) are available to consumers who lease vehicles. It also releases a Section 30D White Paper anticipating the direction of proposed guidance on critical mineral and battery component value calculations.
3 February 2023	Treasury reclassifies certain vehicles, making more models eligible for the Section 30D consumer tax credit.
28 March 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.
31 March 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. Korea is included as a free trade agreement partner under the Korea–US Free Trade Agreement.
7 April 2023	Korean government announces a public-private strategy for battery industry, including Export-Import Bank loan guarantees.
12 April 2023	The US Environmental Protection Agency proposes new regulations for vehicle emissions to ensure that two-thirds of new passenger cars will be all electric by 2032.
18 April 2023	The content requirements of IRA Section 30D announced on 31 March 2023, go into effect.
20 April 2023	Korean government announces joint investment with battery companies to develop advanced technologies.
9 May 2023	Korean government expands investment tax credits for its own EV plants.

On 29 December 2022, the Internal Revenue Service (IRS) (part of the Treasury Department) clarified that leased vehicles would also be eligible for tax credits under the IRA under a different track of the legislation, Section 45W (IRS 2022). This change made vehicles assembled in Korea – and elsewhere outside North America – eligible for tax credits, as Section 45W did not contain the limiting criterion found in Section 30D (*see* table 1).

Treasury's leasing announcement may not have made headlines in the United States, but it did in Korea.⁴³ Korean automakers had been watching closely. Hyundai immediately indicated plans to boost EV leasing rates from 5% of its new vehicles entering the US market to 30%.⁴⁴

On 31 March 2023, Treasury announced another criterion for the sourcing requirements for components and critical minerals and how countries could become 'free trade agreement' partners for the sake of gaining access to Section 30D tax credits.⁴⁵ Korea was already one of twenty countries with which the United States has a Congressionally approved free trade agreement. Japan became qualified through the Critical Minerals Agreement it signed March 28. Also in March, the European Union announced that it would start negotiating a critical minerals deal with the United States. The United Kingdom, Indonesia, and the Philippines have all said they want one, too.

At least publicly, the Korean government welcomed the Treasury guidelines. In a press release, Minister Lee Chang-yang said that the regulations 'substantially relieves the uncertainty of the domestic battery and material industries' and will help 'strengthen the battery supply chain cooperation between Korea and the US'.⁴⁶ Hyundai Motor CEO Chang Jae-hoon indicated that 'what we can do now is do our best with the leased programs and accelerate the local plant that is under construction'. The Korean battery industry also reacted positively to the new Treasury regulations, for reasons that will become clear below.

Not all of the uncertainty facing Korean companies was resolved, however. Korean battery makers reportedly voiced their desire for the USTR to negotiate critical minerals agreements with Indonesia and Argentina, their sources of inputs for batteries.⁴⁷ (Under the Treasury guidelines, such agreements would be needed for batteries derived from inputs from those countries to be eligible for the tax credit under Section 30D.) Even for critical minerals such as nickel, which might be mined in Indonesia, uncertainty remained, because critical minerals and

⁴³ Byun Duk-kun, *S. Korean-Made EVs Entitled to Tax Credit under IRA When Used for Commercial Use: Treasury*, Yonhap News Agency (30 Dec. 2022).

⁴⁴ Han-Shin Park, Hyung-Kyu Kim & In-Seol Jeong, *Hyundai Motor to Boost EV Leasing in US for Tax Credits from 2023*, *The Korea Economic Daily* (30 Dec. 2022). See also Carly Schaffner, *Kia Will Push EV Leasing to Reap Tax Credit Boon*, *Automotive News* (3 May 2023).

⁴⁵ The Mar. 31 announcement also clarified that 'active cathode and anode materials, chemicals used to produce two main parts of a battery [are] "critical minerals" rather than battery components', making them eligible for the credit provided they came from free trade agreement countries like Korea (James Politi, Aime Williams, Amanda Chu & Claire Bushey, *Biden Offers Olive Branch to Allies in Electric Vehicle Subsidy Dispute*, *Financial Times* (31 Mar. 2023)). For a legal discussion, see Claussen (2023). In Dec., Treasury had released preliminary guidelines (Treasury 2022).

⁴⁶ *S. Korea Welcomes New Guidance on EV Tax Credits under US Inflation Reduction Act*, Yonhap News Agency (1 Apr. 2023).

⁴⁷ Kyongae Choi, *Finance Minister Calls for US Cooperation in IRA Guidance on Critical Minerals*, Yonhap News Agency (Feb. 26).

components needed for electric batteries would become ineligible for the Section 30D tax credit over time if they were further processed in a plant located in a foreign entity of concern (*see* table 1).

The US still needed to make other regulatory decisions that would affect Korea and other allies. For example, how broadly would the Department of Energy (DOE) define sourcing from a foreign entity of concern, a list of countries that includes China? Would the sourcing definition be limited to materials that pass physically through China? Would it extend further to also cover materials sourced from other countries, like Indonesia, simply because they were being processed or mined locally by Chinese firms?⁴⁸ Furthermore, how would DOE define a ‘Chinese firm’? Would the definition include a joint venture between a Chinese and local firm? Would it matter whether the Chinese firm is private or a state-owned enterprise? What if Chinese Communist Party officials sit on the company’s board of directors? Would Chinese investments in the United States – including the controversial tie-up between Ford and Contemporary Amperex Technology Co., Limited (CATL), the Korean battery companies’ main rival – be permitted after all?⁴⁹ As of the time of writing, DOE had yet to settle many of these legal issues.

4 HOW HAS THE INFLATION REDUCTION ACT AFFECTED US LEASING AND IMPORTS OF KOREAN ELECTRIC VEHICLES?

4.1 EFFECT ON LEASING

The 29 December 2022 Treasury decision appears to have had a significant impact on the leasing take-up of Korean EVs assembled outside of North America (figure 4).⁵⁰ Any initial Korean automaker skepticism of leasing as a potential solution for their concerns is also clear: in 2022, leases made up only 2% of Korean-assembled EVs in the US market. That figure jumped to 18% in February 2023 and exceeded 40% by April. In contrast, leasing rates for Korean ICE models averaged 17% in 2022 and nudged up to just 19% in the first six months of 2023.

Similar patterns emerge for European EV automakers. Nearly two-thirds of European-assembled EVs were being leased by April 2023, more than double the

⁴⁸ Christian Davies, Song Jung-a & Mercedes Ruehl, *Korea Inc’s Big Battery Bet on Indonesia at Risk from US Restrictions*, Financial Times (31 May 2023).

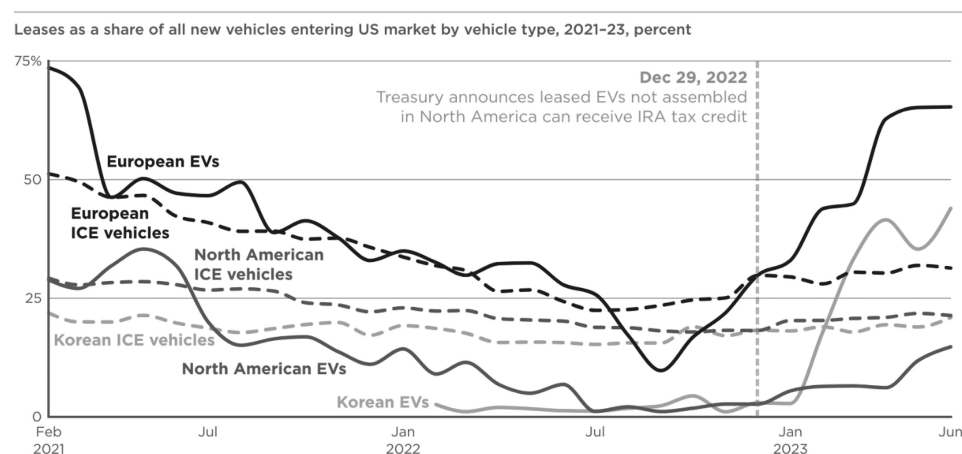
⁴⁹ See Byun Hye-jin, *Ford-CATL Partnership Could Erode Korean Batteries’ Price Competitiveness*, Korea Herald (14 Feb. 2023) and David Shephardson, *US Senator Rubio Seeks Review of Ford Technology Deal with China’s CATL*, Reuters (14 Feb. 2023).

⁵⁰ Earlier work (Bown 2023, figure 7) had noted that, in Dec. 2022 – the month before the Treasury announcement – lease rates for all EV models were only 9.7%. Lease rates rose to 15.7% in 24 Jan. 2023, 9.9% in Feb., and 34.3% in Mar.. In contrast, the lease rate for all vehicles in the United States increased only slightly, from 17.6% in Dec. 2022 to 20.6% by Mar. 2023.

30% figure in December 2022 before the Treasury announcement.⁵¹ European automakers started from a higher leasing rate before the December 29 announcement, possibly because their portfolio includes higher-end models, which target consumers who may be more likely than the average consumer to lease. Another difference is that European leasing rates (for *both* EV and ICE vehicles) had bottomed out by September 2022 and begun to recover earlier and thus for reasons other than the Treasury announcement.

Leasing rates are determined by a number of factors. During the COVID-19 pandemic, leasing trended downward. On average, roughly 25% of all new passenger cars put on the market each year between 2010 and 2019 were leased,

Figure 4 Leases for electric vehicles in the US have increased since the eligibility for IRA tax credits expanded, especially sharply for korean models



EV = Electric vehicle; IRA = Inflation Reduction Act; ICE = Internal Combustion Engine

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. Korean brand EVs include Genesis GV60 and Hyundai Ioniq 5; European brand EVs include Audi Q4 Sportback e-tron, Audi Q4 e-tron, Audi e-tron, Audi e-tron GT, Audi e-tron Sportback, Mercedes-Benz EQB, Mercedes-Benz EQS, Porsche Taycan, Volkswagen ID.4, and Volvo C40. North American assembled EVs include Ford F-150 Lightning, Ford Mustang Mach-E, and Nissan Leaf. (The Volkswagen ID.4 is also assembled at a US facility.) Model coverage is not comprehensive; for example, leasing data for Tesla models are not available from Edmunds.

Source: Compiled by the author with data from Edmunds via Bloomberg.

⁵¹ In figure 4, the Volkswagen ID.4 was allocated to European models, because the first sales from its US plant did not arrive until Oct. 2022 and the plant would not operate at scale until 2023, with imports continuing to play a potentially important role (Mike Pare, *Volkswagen Chattanooga Rolls out Its ID.4 Electric SUV*, Chattanooga Times Free Press (14 Oct. 2022)).

with slightly lower rates for light trucks.⁵² This share fell with the pandemic; even by September 2022, for example, leases still accounted for less than 20% of new ICE vehicles made in North America (*see again*, figure 4). The decline is partly explained by a chain of events that began when new vehicle production in the United States cratered in early 2020 as a result of pandemic lockdowns (reducing supply) and mobility restrictions (reducing demand). Lifting mobility restrictions resulted in a demand spike and a shortfall in new cars that was exacerbated by the semiconductor shortage and other supply chain disruptions. Demand for used cars increased and used-car prices jumped. In the leasing market, many vehicles suddenly had higher residual values at the end of their lease period relative to the option price, which had been set before the pandemic, when the lease was first signed. Consumers responded to the arbitrage opportunity by purchasing their leased cars, reducing demand for new leases and leading to lower leasing rates. Only in the fourth quarter of 2022 did leasing rates begin to recover.⁵³

At least two additional features of figure 4 are worth tracking, because they may lead to additional Congressional discontent. The December 29 announcement on Section 45W not only widened tax credit eligibility for leased EVs assembled outside of North America, it also widened eligibility to EVs assembled in North America but with batteries whose inputs (critical minerals and components) did not satisfy the sourcing constraints⁵⁴ as well as to models above the MSRP price cap and consumers above the income threshold (*see table 1*).

Consider first the leasing rates for even the EVs assembled in North America. These models experienced an increase in average leasing rates – from 3% in December 2022 to 15% by June 2023. (Over the same period, lease rates for ICE vehicles assembled in North America increased only from 18 to 21%.) Lease rates increased for EV models like the Nissan Leaf and the Ford Mustang Mach-E – models assembled in North America that suddenly lost access to the full Section 30D tax credit once the battery sourcing criterion went into effect on 18 April 2023.⁵⁵ If consumers lease their new EVs, those sourcing constraints do not bind, automakers face no additional tax credit incentive to establish new supply chains outside of China, and national security concerns over concentrated battery input supply chains in China are not addressed.

⁵² Bureau of Transportation Statistics, *New and Used Passenger Car and Light Truck Sales and Leases* (accessed 20 Jul. 2023).

⁵³ Sean Tucker, *Car Leases Are Declining – Here's Why*, Kelley Blue Book (1 Nov. 2022).

⁵⁴ The sourcing criterion was announced on 31 Mar. 2023 and made effective on 18 Apr. 2023.

⁵⁵ The Nissan Leaf assembled in North America received the tax credit between 31 Dec. 2022 and 18 Apr. 2023, according to the Department of Energy website, but fell off the list on Apr. 18. The Ford Mustang Mach-E received USD3,750 of the tax credit as of Apr. 18, not the full USD7,500. *See* Department of Energy, *Federal Tax Credits for Plug-in Electric and Fuel Cell Electric Vehicles Purchased in 2023 or After*, <https://fueleconomy.gov/feg/tax2023.shtml> (accessed 20 Jul. 2023).

Second, the leasing option implies Section 45W tax credits may be flowing to high-income consumers leasing high-priced models from European companies like Porsche, Mercedes, and Audi.⁵⁶ (Models above the MSRP cap in Section 30D are behind some of the increase in lease rates of European-assembled EVs in figure 4.) A Congressional goal was to create incentives for automakers to produce a greater variety of mass-market models at lower prices, in the hopes of increasing overall EV take-up and reducing tailpipe emissions.⁵⁷ The leasing option would seem to dull that incentive, in addition to having regressive redistributive effects.

Two additional items are worth noting. The analysis here does not speak to the important tax incidence question of who – the end consumer, the automaker, or a leasing intermediary – benefits from the IRA tax credits. It could be that the entire value of the subsidy is captured by companies and is not passed along to the end consumer. The main insight from figure 4 is supportive evidence that some entity in the private sector is enjoying the benefits of the tax credit and that this option is a likely contributor to US imports from Korea (and the European Union) continuing to grow (*see below*) and thus diffusing a potential trade dispute over the IRA.

Finally, even aside from EVs, the IRA has other controversial elements which may eventually lead Congress to revisit the law. The most important is the sheer size of the federal expenditure on the ten-year program. For example, the uncapped nature of the tax credits for several clean energy products led to estimates of the fiscal cost of the IRA that exceed the original CBO score of over \$350 billion (Bistline, Mehrotra, and Wolfram 2023; Penn-Wharton Budget Model 2023).

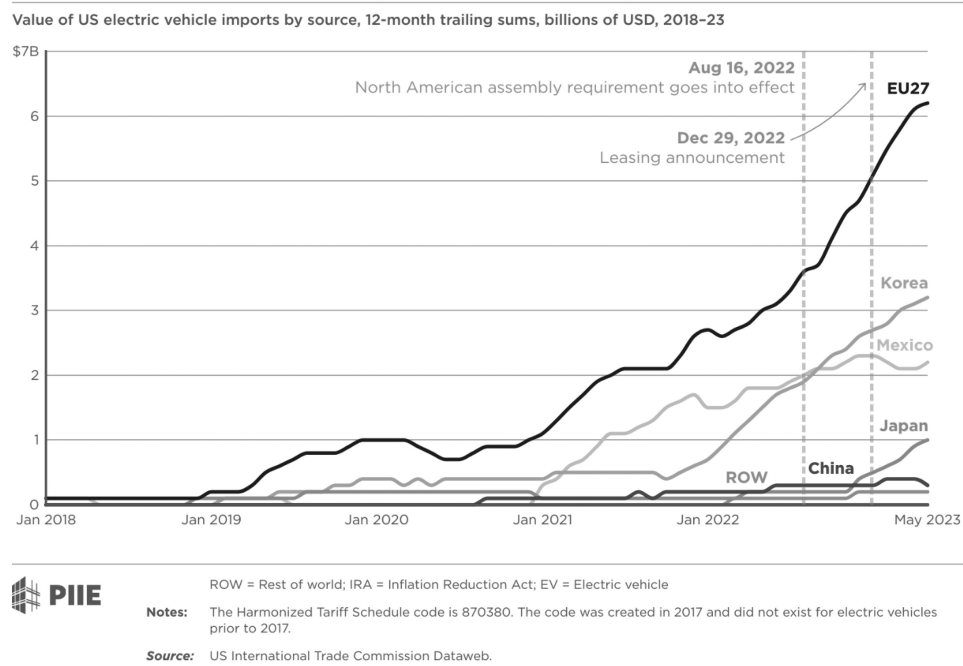
4.2 EFFECT ON IMPORTS OF EV FROM KOREA

Treasury's December 29 leasing announcement partly explains why US imports of EVs from Korea continued in the nine months after the IRA went into effect in August 2022 (figure 5). The reason why Korean automakers and the government were so upset with the IRA's North American assembly criterion in the IRA is also obvious: Their exports at risk were large. In the twelve months leading up to August 2022, US imports of EVs from Korea were \$1.8 billion and showing steady signs of growth. Yet, the feared drop in US imports from Korea beginning in August did not materialize.

⁵⁶ The average MSRP for Mar.–May 2023 was over USD131,000 for the Porsche Taycan, USD127,000 for the Mercedes-Benz EQS, and USD116,000 for the Audi e-tron GT, according to data from Bloomberg.

⁵⁷ Put differently, there is some evidence from earlier US tax credits that higher-income consumers seeking high-end models may have been just as likely to shift from an ICE vehicle to an EV without the tax credit – that is, the tax credit was a regressive fiscal transfer that did little to change behaviour. For a discussion, *see* Sheldon (2022).

Figure 5 US imports of electric vehicles from South Korea have continued growing despite the IRA



A combination of factors helps explain why Korean exports did not decline. First, between September and December 2022, overall US consumer take-up of EVs was likely increasing even without immediate availability of IRA tax credits. Through the Infrastructure Investment and Jobs Act of November of 2021, the US government committed billions of dollars to build charging stations. Seeing more built – and the long-term commitment by the US government to further develop that infrastructure – likely reduced American consumers’ ‘range anxiety’, which had limited their willingness to switch over to EVs. Indeed, EV penetration in the United States jumped from 4.5% in 2021 to 7.7% in 2022, as figure 1 shows.

Second, very few EV models were available for consumer tax credits at all during September–December 2022. Before the IRA, companies were subject to a cumulative 200,000-unit limit on the number of vehicles federal credits could apply to before having their eligibility phased out. Tesla and GM had already exceeded that cap. Revocation of the cap under the IRA did not go into effect

until 1 January 2023. No vehicles from Tesla or GM were thus eligible for tax credits – even if they were assembled in North America – until 2023. Only ten EV models were eligible for consumer tax credits in December 2022.⁵⁸ With few models eligible during September–December, US consumers had so little choice that imports from Korea or Europe were not at a sizeable disadvantage.

The strong results in the early months of 2023 partly reflect Treasury's December 29 decision on leasing. In the twelve months ending in May 2023, US imports of EVs from Korea increased to \$3.2 billion. (US imports from both Korea and the European Union more than doubled relative to the preceding twelve-month period.)

5 KOREA'S BATTERY COMPANIES AND THE INFLATION REDUCTION ACT

Korean companies have built many of the new battery factories in the United States. In part, their ability to do so dates back to the settlement between LG Energy Solution and SK Innovation brokered by Katherine Tai almost immediately upon her confirmation as USTR in April 2021.

Korean companies quickly established joint ventures or made other arrangements with a number of automakers manufacturing EVs across the United States to provide them with batteries (table 3). In addition to the three factories already in operation (entirely or partially) by 2023, LG, SK, Samsung, and Hyundai had another seven factories under construction and five more in planning. Most of these fifteen plants were joint ventures with an automaker, including Ford, GM, Stellantis, Honda, and Hyundai. The IRA did not cause all of these investments, as many plants were being built or were announced well in advance of the certainty of any tax credits being resolved in late July 2022. (By January 2022, for example, announcements had already been made to build 13 large-scale EV battery plants in the United States.⁵⁹)

Although the IRA may not have caused these battery makers to build US plants, companies do stand to benefit financially from the IRA for having done so. Korean battery companies have the potential to gain tremendously from the increased take-up of EVs in the US market and the tax credits available in the IRA through at least two channels.

⁵⁸ See the interview with Kristin Dziczek in Chad P. Bown, *The US–EU Fights over Electric Vehicles and The Inflation Reduction Act*, Trade Talks podcast episode 184 (7 May 2023).

⁵⁹ Dasl Yoon, *EV Battery Maker's Sales Pitch to the West: We're Not Chinese*, Wall Street Journal (26 Jan. 2022).

Table 3 US Battery Facilities Owned or Co-owned by Korean Companies Announced as of mid-2023

<i>Factory</i>	<i>Location</i>	<i>Battery Maker</i>	<i>Joint Venture Partner</i>	<i>Status</i>	<i>Target year</i>	<i>Target Capacity (GWh)</i>
Hyundai Battery Plant Alabama	Alabama	Hyundai	None	Planned	2024	15
Hyundai LG EV Battery Plant	Georgia	LG	Hyundai	Planned	2025	70
LG Energy Solution Michigan	Michigan	LG	None	Operating partially	2025	40
Honda/LG battery factory	Ohio	LG	Honda	Under construction	2025	40
Ultium Cells Michigan Factory	Michigan	LG	GM	Under construction	2024	50
Ultium Cells Ohio Factory	Ohio	LG	GM	Operating	2022	35
Ultium Cells Tennessee Factory	Tennessee	LG	GM	Under construction	2023	50
LG Energy Solution Arizona	Arizona	LG	None	Planned	2025	27
StarPlus Energy Gigafactory	Indiana	Samsung	Stellantis	Under construction	2025	33
GM SDI Battery Factory	TBD (maybe Indiana)	Samsung	GM	Planned	2026	30

<i>Factory</i>	<i>Location</i>	<i>Battery Maker</i>	<i>Joint Venture Partner</i>	<i>Status</i>	<i>Target year</i>	<i>Target Capacity (GWh)</i>
Hyundai SK Battery Facility	Georgia	SK	Hyundai	Planned	2025	35
SK Battery America Plant 1	Georgia	SK	None	Operating partially	2022	9
SK Battery America Plant 2	Georgia	SK	None	Under construction	2023	11
BlueOval SK Battery Park	Kentucky	SK	Ford	Under construction	2025	86
BlueOval SK Battery Facility	Tennessee	SK	Ford	Under construction	2025	43

Source: Jay Turner, EV Supply Chain Dashboard; author's research, as of May 20, 2023.

First, Korean companies dominated the handful of EV models eligible for the Section 30D tax credits once the sourcing limitations went into effect 18 April 2023. 'Of 22 vehicles on the list [including plug-in hybrids], seventeen models use batteries made from LG Energy Solution, Samsung SDI or SK On', according to Choi Sang-mok, Korea's senior presidential secretary for economic affairs.⁶⁰ 'So Korea has now become a beneficiary country for battery exports'. If, however, consumers do end up trying to purchase EVs – and thus want access to an EV through the Section 30D tax credit – Korean battery makers may need to adjust their supply chains to source fewer inputs from China and more from qualified input suppliers (e.g., suppliers in North America or the United States' free trade agreement partners for critical minerals, including those with agreements still to be negotiated).

Second, Korean battery companies are also expected to benefit from a separate tax credit in the IRA – the Advanced Manufacturing Production Credit – that arises through Section 45X. Beginning in 2023, the US government will grant production tax credits to manufacturers of eligible components, including batteries.

⁶⁰ Sarah Chea. *Hyundai, Kia Fail to Make IRA Tax Credit List*, Korea JoongAng Daily (18 Apr. 2023).

Battery cells would qualify for \$35 per kilowatt hour of capacity and battery modules for \$10 per kilowatt hour of capacity.⁶¹

LG Energy Solution and SK On expect to receive the Section 45X credits in 2023. LG Energy Solution's plant in Michigan and its Ultium Cells Ohio Factory were producing already in 2023.⁶² (In its 2023 first quarter earnings release, LG Energy Solution projects that it will receive about \$76 million in IRA tax credits, making up 16% of its operating profits.⁶³) SK On, which produces batteries at its site in Georgia, expects to benefit from IRA Section 45X credits starting in the second quarter.⁶⁴ Industry analysts estimate Section 45X credit earnings of \$435 million in 2023.⁶⁵

The locations of the EV battery plants in the United States are important economically and politically (figure 6). If all announced investments materialize, by 2030, 15 of the 52 battery plants would be owned or co-owned by a Korean company. Most of the Korean companies' plants are located in an area of the traditional North American automotive supply chain known as 'auto alley' (Klier and Rubenstein 2008). Over the decades, the clustering of this supply chain emerged largely within a 100-mile corridor of two north-south interstate highways (I-65 and I-75), allowing for just-in-time shipments from parts suppliers to final assembly plants. The auto supply chain also slowly shifted away from the area around Detroit, where it first clustered in the early 20th century, southward, especially as new entrants into the US market from Europe, Japan, and Korea established final assembly plants in southern states, which were much less friendly to unions such as the United Auto Workers union, and then into Mexico, accelerated by implementation of the North American Free Trade Agreement (NAFTA) in 1994.

Historically, engine and transmission plants were often co-located with plants for final assembly of ICE vehicles.⁶⁶ For EVs, batteries are both critical and extremely heavy; their plants may also end up co-located with EV final assembly. (As one example, SK On and Hyundai's joint-venture factory will be located in Bartow County, which is close to both Hyundai's existing and planned EV factories in Georgia.⁶⁷) If transportation costs rise – as expected, as part of the clean energy transition – over the long run there may be relatively less long-distance international trade in finished batteries and EVs than engines and assembled vehicles during the ICE era.

⁶¹ Congressional Research Service, *Tax Provisions in the Inflation Reduction Act of 2022 (H.R. 5376)*, CRS Report R47202 (10 Aug. 2022).

⁶² Ultium Cells was LG Energy Solutions joint venture with General Motors.

⁶³ LG Energy Solution, *LG Energy Solution Q1 2023 Earnings Conference Call* (Apr. 2023).

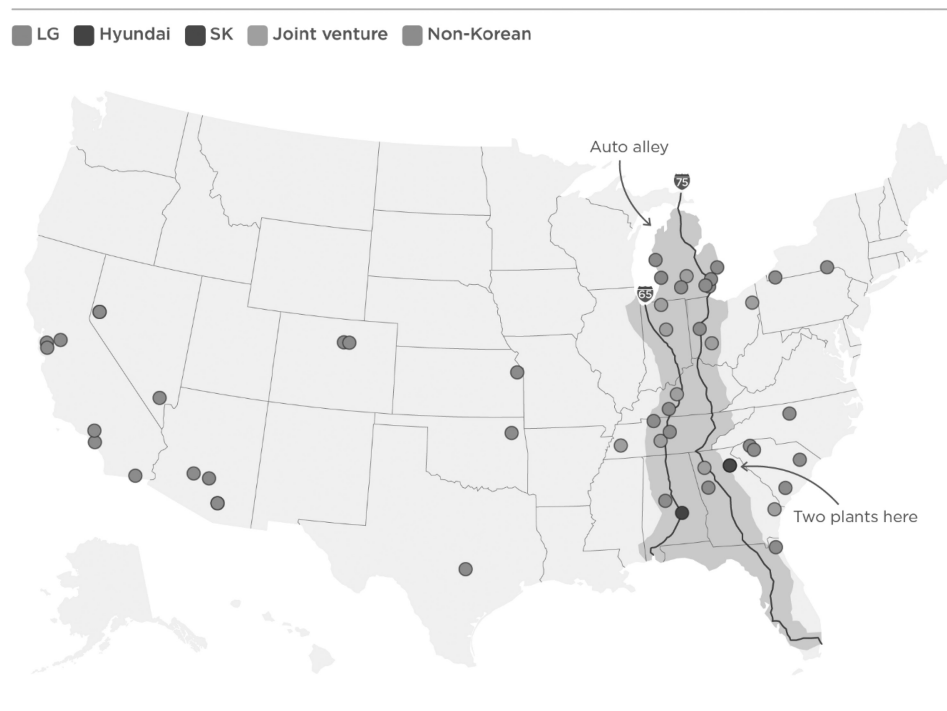
⁶⁴ SK Innovation, *[SK Innovation's Q1 2023 Financial Results] Recording Sales of KRW 19.14 Trillion and Operating Profit of KRW 375 Billion* (4 May 2023).

⁶⁵ Jung Suk-ye, *SK On Expected to Post Surplus Beginning in 2024*, Business Korea (25 Apr. 2023).

⁶⁶ More generally, see Klier & Rubenstein (2022).

⁶⁷ SK, *SK On and Hyundai Motor Bolster Support for US EVs with Georgia Battery Plant*, press release (2 May 2023).

Figure 6 Battery factories owned or co-owned by South Korean companies are often in 'auto alley'



Note: "Auto alley" defined as the area roughly around a 100 mile corridor of interstate highways I-65 and I-75 (Klier and Rubenstein 2008).

Sources: Compiled by the author with data from Jay Turner, EV Supply Chain Dashboard; author's research.

6 KOREA'S POLICY RESPONSE AND ITS ELECTRIC VEHICLE TRADE WITH THE REST OF THE WORLD

This section explores Korea's evolving policies toward the EV supply chain, including how they have changed in response to the IRA and subsequent engagement with US policymakers. It then presents data on Korea's EV trade with the world.

6.1 KOREA'S DEMAND-SIDE AND SUPPLY-SIDE POLICIES FOR EVs

Like the United States, Korea offers consumer tax credits for EVs. The Korean government publishes a list that documents the subsidy amount received by each

eligible EV model.⁶⁸ As of June 2023, the list included models from both domestic automakers like Hyundai and Kia, as well as foreign companies like BMW, GM, Stellantis, Tesla, Smart, Polestar, Volvo, and Volkswagen.

In February 2023, Korea's Ministry of Environment announced reforms to these consumer tax credits.⁶⁹

One question is whether Korea's tweaks to its original, nondiscriminatory consumer tax credits were implemented to discriminate in favour of firms engaged in local production at the expense of foreign firms, motivated by similar features in IRA Section 30D. Additional subsidies were to be granted based on whether an automaker ran its own customer service centre – which was typical for Korean firms – or contracted service out – which was typical for foreign firms.⁷⁰ The February reforms also changed the pricing criterion for tax credit eligibility, which will also likely have differential effects across firms.

Korea also announced an expansion of its own industrial policy for various segments of the EV supply chain, partly in response to the IRA.

In May 2023, Korea's Ministry of Economy and Finance expanded the scope of investment tax credits to cover EV technologies and EV plants, after the National Assembly passed a law in March supporting the country's key industrial sectors.⁷¹ (These technologies were added to Korea's list of 'national strategic technology' that would benefit from government support.) Hyundai and Kia were expected to gain from expanded access to the Korean government's investment tax credit increase to 25% for their EV plants.⁷²

In April 2023, the Korean government offered two separate packages of incentives to Korean battery makers. First, MOTIE announced that the Export-Import Bank of Korea and the Korea Trade Insurance would extend up to \$5.3 billion of loans and guarantees to help Korean companies struggling to meet the sourcing requirements of the IRA, so that they would remain eligible for the

⁶⁸ See *Emission-Free Vehicle Integrated Website* (accessed 3 Jun. 2023).

⁶⁹ Ministry of Environment, *Environment Ministry to Reform Rule on Subsidies for the Purchase of EVs in 2023 to Popularize EVs*, press release (24 Feb. 2023).

⁷⁰ See Cheon Kwon-Pil & Shin Ha-Nee, *Changes Soon to Come in Korea's EV Subsidy Plan*, Korea JoongAng Daily (6 Feb. 2023).

⁷¹ See Korean National Assembly, Partial Amendment to the Restriction of Special Taxation Act (alternative) (President of Planning and Finance Committee); Kim Jung-hwan, Lee Yu-sup & Lee Eun-joo, *Korea Expands Tax Credit on EV Investments by up to 35%*, Pulse (10 May 2023); Kang Yoon-seung, *S. Korea to Offer Tax Benefits on Investment in EV Sector*, Yonhap News Agency (9 May 2023); and Sarah Chea, *Korea's EV Investment Tax Credit Going to a Maximum 35Percent*, Korea JoongAng Daily (9 May 2023).

⁷² Kyung-Min Kang & Se-Min Huh, *Hyundai Motor, Kia to Receive 25% Tax Credit for EV Plant Spending*, Korea Economic Daily (9 May 2023).

Section 30D tax credits.⁷³ Exactly how was not disclosed; it could involve helping input suppliers to battery companies deepen their ties with source countries outside of China.

Second, the Korean government and its top battery companies announced joint investments of \$15.1 billion through 2030 to advance new battery technologies. This measure could help these companies compete with new technologies arising from Chinese battery companies like CATL in particular.⁷⁴ Some day these companies may deploy new technologies resulting from the Korean government subsidies into their operations in other markets, such as the battery plants being built in the United States.

Third, in terms of trade policy, Korea offers zero import tariffs to exporters in both the United States (under KORUS) and the European Union (under the EU–Republic of Korea Free Trade Agreement). However, it still applies its most favoured nation tariff rate of 8% on EV imports from China and Japan, providing exporters from both the United States and the European Union a substantial tariff preference into the Korean market relative to other major foreign competitors.

6.2 KOREA'S IMPORTS AND EXPORTS OF EVs

Korean imports of EVs from the United States rose to around \$1 billion per year in mid-2021 and have not increased much since (they fell for a period in mid-2022), as figure 7 shows. In contrast, imports from the European Union grew steadily during that period. Korean imports from China remained much lower – at less than \$200 million per year.

Korean EV exports to each of the US and EU markets were over \$3 billion over the most recent twelve month period, but their growth paths in each export market were quite different (figure 8). For the EU export market, Korea's EV exports began earlier and proceeded more slowly. For the US export market, they proceeded much later and increased quite rapidly.

⁷³ See MOTIE, *MOTIE Announces Post-IRA Public-Private Joint Strategy for Battery Industry* (7 Apr. 2023); Heekyong Yang, *South Korea to offer \$5.3 Bln in Financing to Support Battery Investment in North America*, Reuters (7 Apr. 2023); and Joseph Ho, *South Korea to Provide Battery Industry More Support*, Argus Media (10 Apr. 2023).

⁷⁴ Heekyong Yang, *South Korea Announces \$15 Bln Investment in Advanced Battery Technologies*, Reuters (20 Apr. 2023).

Figure 7 South Korean imports of electric vehicles from the EU have grown recently but from the US have mostly been uneven since mid-2021

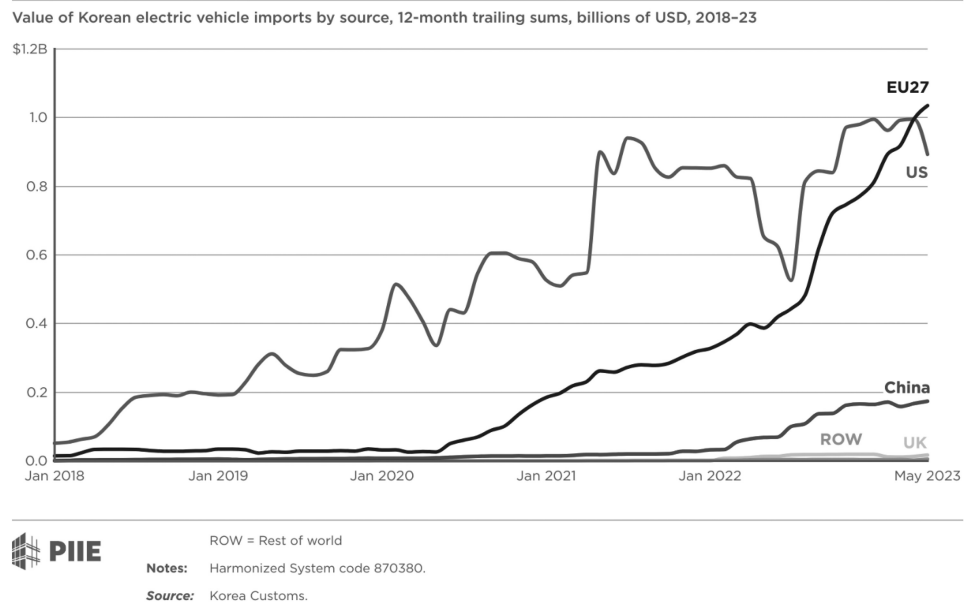
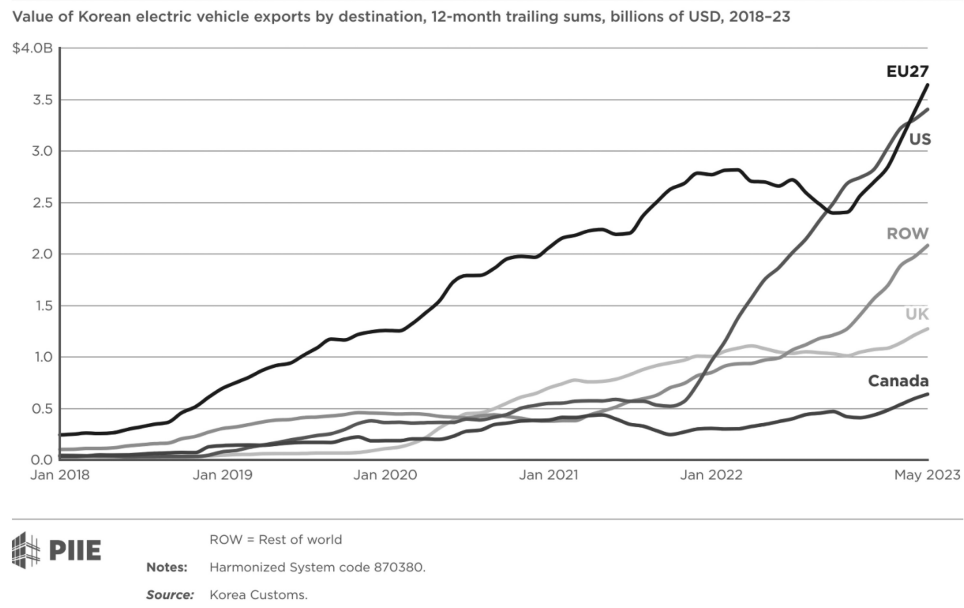


Figure 8 South Korean exports of electric vehicles disproportionately go to the EU and US



7 CONCLUSION

The consumer tax credits for EVs in the IRA provoked concerns by and political problems for the Korean government. The Treasury Department implementing regulations may have appeased key interests in Korea and other important US allies, such as the European Union, that manufacture and export EVs.

The long-term fate of certain EV provisions in the IRA remains uncertain, however. If, for example, the leasing decision creates other problems, Congress may revisit the legislation. Leasing opens up tax credit eligibility beyond lower-income consumers for mass-market EV models, and it dulls the incentives for firms to shift their battery input supply chains out of China. Yet, even if temporary, the leasing accommodation may be sufficient for a company like Hyundai, whose main concern is maintaining access to US tax credits for exports from its Ulsan plant in Korea until its new EV plant in Georgia is operational in 2025.

How the Biden administration resolved this trade friction with Korea and the European Union is noteworthy. Resolution did not involve Korea filing a formal WTO dispute challenging the US local content provisions for the consumer tax credits.⁷⁵ Although a smaller economy like Korea may, in general terms, miss losing access to the WTO dispute settlement to confront US policy, at least in this instance, Korea's short-term interests may have been taken care of without litigation. (It is also not clear from the historical caseload of WTO disputes that the system worked all that well on behalf of Korean export concerns with prior US policies.) Korea managed to engage with the Biden administration, and it received a potentially satisfactory outcome. The issues were also resolved much more quickly than they are in a typical WTO dispute, which often allows policymakers to delay politically difficult issues of how to resolve their differences. This feature of the trading system is not attractive, especially for time-sensitive policies needed to address the imminent and existential threat of climate change.⁷⁶

Because resolution of the fight over EVs did not involve changing the law or winning a WTO dispute, trumpeting it as a win to the Korean public may prove difficult, however. Whether the resolution fixes the Yoon administration's domestic political problem that the IRA caused remains unclear.

The impact and evolution of climate-oriented policies in a trading system that is less rules-based will be important to monitor and evaluate. Korea has already

⁷⁵ The WTO's Agreement on Subsidies and Countervailing Measures Art. 3.1(b) prohibits 'subsidies contingent, whether solely or as one of several other conditions, upon the use of domestic over imported goods'.

⁷⁶ WTO Director General Ngozi Okonjo-Iweala encouraged WTO members to negotiate solutions to the IRA with the United States rather than challenge the law under formal WTO dispute settlement. See Bryce Baschuk, *WTO Chief Urges Talks to Resolve Green Subsidy Dispute*, Bloomberg (19 Jan. 2023).

adjusted its own consumer tax credits for EVs. Furthermore, the government's response to the IRA was to increase subsidies for Korean EV plants locally – its own form of industrial policy – and to provide lending and other financial guarantees to help Korean battery companies seeking to retain access to the US tax credits in the IRA that require them to take substantial investments to orient their supply chains outside of China. The full effects of each of these policies remain an open question.

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