The Effects of Trade Restrictions in the Inflation Reduction Act Electric Vehicle Credits

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Abstract

The Inflation Reduction Act (IRA) is perhaps the most important climate change policy in US history. The IRA expanded and reshaped existing electric vehicle (EV) tax credits by adding trade restrictions, including that battery supply chains be onshored or "friendshored." We propose a two-stage research project. In the first stage, already in progress but not complete, we study the short-run effects of the EV tax credits over the IRA's first two years using quasi-experimental data analyses and structural models. In the second stage, we plan to study the long-run effects on the location of vehicle manufacturing plants and supply chains.

Our research and policy findings would be designed to be useful to the Department of Transportation, and our work fits squarely in the list of priority research topics. Our models will allow us to evaluate the effects of IRA tax credits on greenhouse gas and local air pollution emissions and will deliver an estimated cost of reducing carbon emissions. We will estimate models of demand for electric vehicles and substitution patterns with non-EVs, and we will consider the distribution of costs and benefits of this transportation policy. Our long-run estimates will allow us to consider the effect on the U.S. manufacturing sector. Finally, through counterfactual simulations, we will evaluate alternative EV tax credit and trade restriction designs that could be useful for federal agencies and legislators as they consider updates to the IRA over the next eight years.

1 Overview

The Inflation Reduction Act (IRA), as perhaps the most aggressive climate change policy in US history, has potential to galvanize clean energy markets and reduce greenhouse gas emissions. The IRA has faced domestic and international scrutiny, however, partly due to its reliance on clean energy subsidies rather than carbon prices, and due to its requirements that supply chains

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must center in the US or allied countries (Grimm et al. 2023; Kleimann et al. 2023). Such trade restrictions are popular among policymakers but controversial at best among economists.

The electric vehicle (EV) tax credits represent a central component of the IRA, and ex-post analysis of their effectiveness, efficiency, and distributional effects is essential to understand how US industrial policy generally and the IRA specifically are working. The Joint Committee on Taxation projects the cost of these credits to exceed $72 billion (Committee for a Responsible Federal Budget 2023). The Congressional Budget Office originally estimated that the IRA would cost $375 billion over a decade. Subsequent analysis has increased that ten-year cost estimate to over $900 billion, due in part to high takeup of the EV credits, which have no cap (Bistline et al. Forthcoming).

The IRA provides two tax credits for new EVs, which generate incentives for manufacturers and consumers. The first (Section 30D) is a consumer tax credit, claimed by the consumer on her tax return after purchasing a new EV. This credit provides up to $7,500 per EV based on meeting thresholds for four variables—the share of battery and critical materials from the US and allied countries, vehicle prices, and buyer incomes. The timing of implementing these requirements varies by submodel, a fact we exploit in analysis. The second (Section 45W) is a commercial clean vehicle tax credit, and is claimed by a business. This credit also provides up to $7,500 per EV and can be claimed by a business when leasing an EV vehicle to a consumer, but there are no conditions on domestic content, vehicle price, or buyer income. Thus, a transaction which does not meet the 30D domestic content or other restrictions can circumvent them by leasing the vehicle and therefore qualifying for 45W.

The IRA is part of a "Buy-American" strategy. The Biden administration has a larger push for a "twenty-first-century American industrial strategy—a strategy to strengthen our supply chains [and] rebuild our industrial base across sectors, technologies, and regions of this country" (Atlantic Council 2021). Senator Joe Manchin, who provided the pivotal vote ensuring the passage of the IRA, emphasized a similar point in his motivation for supporting the bill: "the increased risk of geopolitical uncertainty demands that we turn our focus to increasing U.S. energy production and bringing good paying energy and manufacturing jobs back to America" (Manchin 2022). Specifically as they concern the automotive sector, these statements are complementary to the ongoing import tariff rate of 27.5% on Chinese EVs, which began under the Trump administration and was continued by the Biden administration (Wilmot 2024).

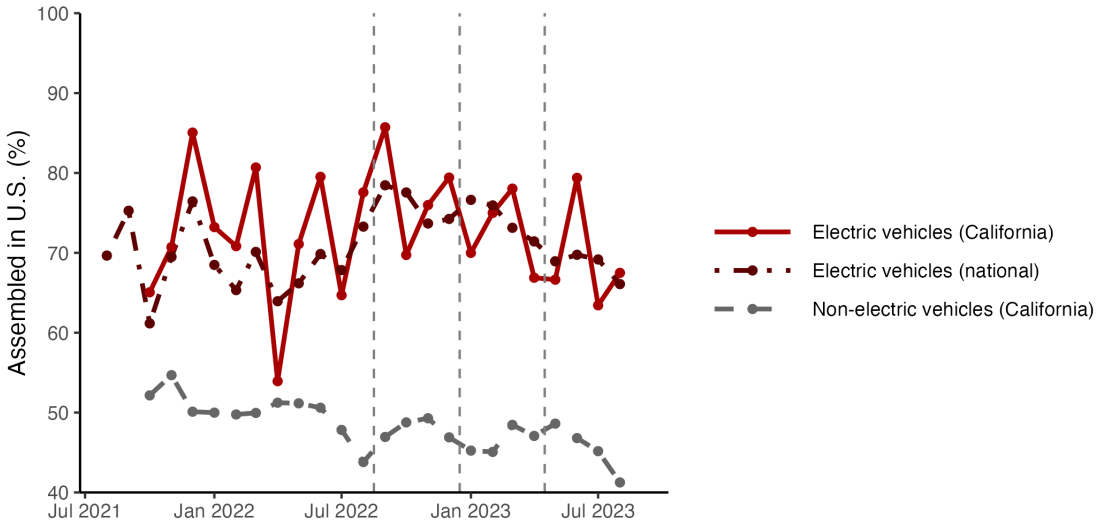
2 First Research Stage: Short-Run Effects

Our first research stage evaluates the short-run effects of the EV credits and Section 30D trade restrictions over the IRA's first two years. To do this, we are assembling a uniquely valuable dataset. We use vehicle registration microdata from California, although (with additional funding) we hope to expand the data to cover the full US. We add proprietary microdata shared specially with our team by Cox Automotive, which runs computer systems at auto dealerships and thus records detailed information for about half of vehicle transactions nationwide. We supplement these data

with additional information about market conditions, such as a self-collected product availability survey, and consumers' second-choice data, also shared specially with our research team.

Figure 1 gives an initial sense of the market trends. Despite the trade restrictions, there is no detectable short-run increase in the share of electric vehicles sold in the US that were also manufactured in the US.

Figure 1: **Domestic Assembly Share for EVs and Gas Vehicles**



We use event study analyses to evaluate the effects when policy changes make specific EV models eligible or ineligible for the tax credits at several times between August 2022 and January 2024. We run event study regressions with transaction prices, discounted lease payments, total registrations, and leasing shares as outcome variables, where the regressions analyze changes in tax credit eligibility. We use either internal combustion engine (ICE) vehicles or other EVs without changes in tax credit eligibility as control groups. These event studies give us a series of descriptive outcomes and we discuss for which of these regressions a causal interpretation seems warranted.

Figure 2 illustrates our identification strategy. The figure shows the trends in vehicle sales for three groups of EVs: those that were excluded from credit eligibility in August 2022, those that were newly included in January 2023, and those that were excluded or reduced in April 2023. The spikes in the green line reflect Tesla's pattern of selling many more vehicles in the final month of each quarter.

We also investigate how the 45W tax credit, that could be claimed by producers for vehicles that did not satisfy the North American assembly restrictions of the 30D credits, affected lease prices and lease shares (the share of vehicle transactions that were leases as opposed to purchases). Figure 3 illustrates our identification strategy, showing how lease shares increase sharply when vehicle models are excluded from 30D credit eligibility.

Figure 2: **Registrations by 30D Eligibility Group**

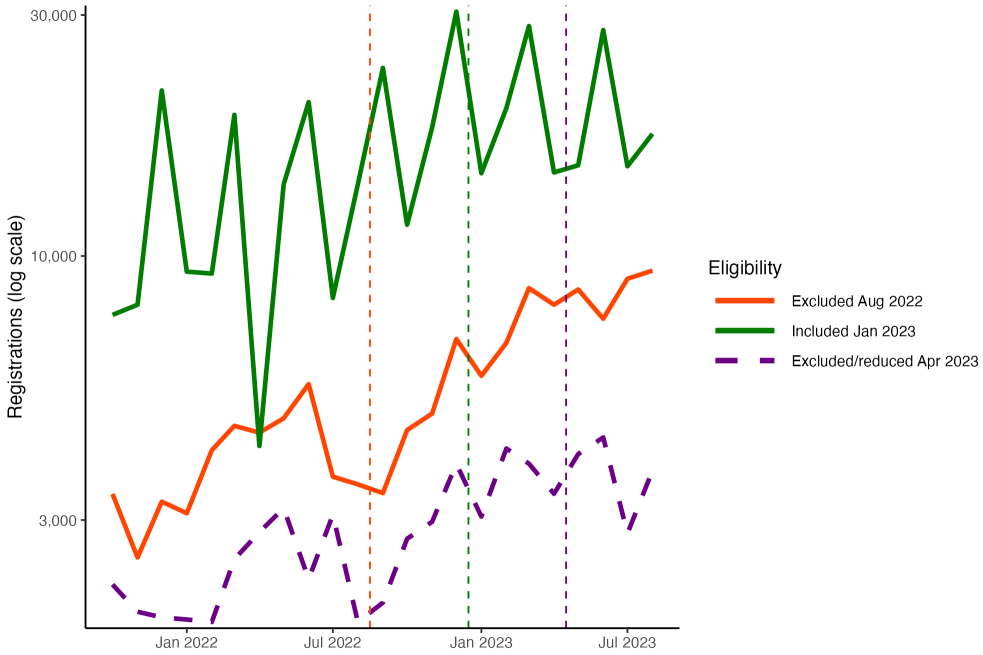
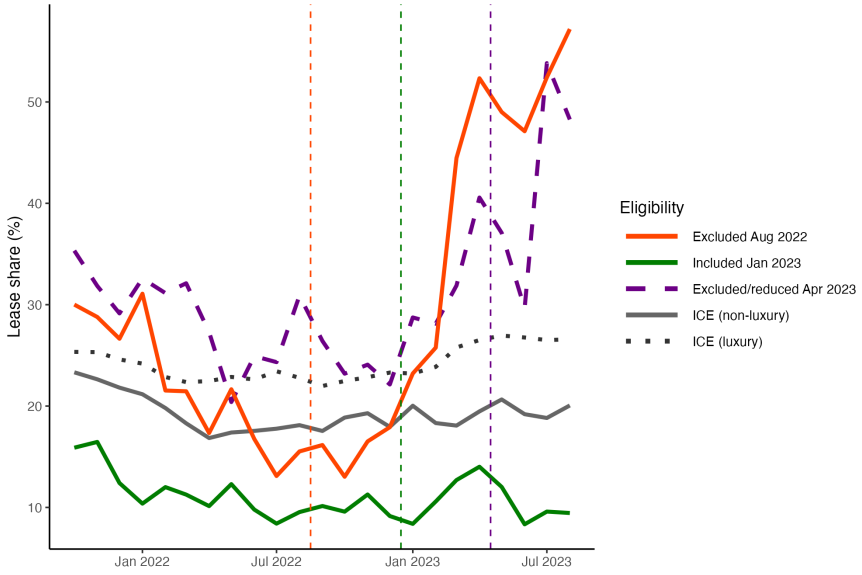


Figure 3: **Lease Shares by 30D Eligibility Group**



In addition to the event study analyses, we are developing a structural model of car demand and supply to conduct counterfactual analyses of alternative policies. Combining design-based and

structural estimation, we parameterize the model by matching the estimates from our preferred event study specification, second-choice data, own-price elasticity estimates from Grieco et al. (2023), and environmental externalities. We use the model to study a series of counterfactuals, including removing domestic content restrictions from vehicle sales under 30D, adding domestic content restrictions to leases under 45W, and other policy options.

3 Second Research Stage: Long-Run Effects

Our proposed second research stage will quantify how the IRA is changing the location of vehicle manufacturing plants and supply chains, using both descriptive evidence and a structural model. If the project is funded, we anticipate that the structural model could be estimated in 2024, and by 2025 there will be enough data for robust reduced-form analyses.

The descriptive and reduced-form analyses will use data on factory announcements and construction, as well as supply chain data for the global auto industry, to evaluate the extent to which auto manufacturers are moving supply chains into the US and allied countries. We will compare these trends for vehicles sold in the US versus vehicles sold in China and Europe, and for manufacturers based in the US versus manufacturers based in China and Europe.

We will then estimate a model of vehicle production and supply chains with economies of scale and transportation costs. In the data, we see that high-volume models are typically produced domestically, while low-volume models (such as luxury European cars) are produced in a centralized location and exported; this is evidence of economies of scale. The data also show that battery manufacturing plants tend to be near vehicle assembly plants; this is evidence of high transportation costs for EVs. Trade restrictions will thus induce more battery manufacturing and vehicle assembly plants to be located domestically, for a set of marginally lower-volume vehicle models. In our model, this increases production costs and generates deadweight loss. We can then use the model to evaluate the deadweight loss of trade restrictions per incremental vehicle or battery produced in the US or an allied country.

One insight that may arise is that the lower-volume models are often luxury models. This raises the possibility that trade restrictions thus have beneficial targeting, because they eliminate tax subsidies that would have gone to wealthy vehicle buyers who are less price sensitive and should have lower social marginal welfare weights. If the project is funded, we would tackle additional methodological issues, such as how to measure and model learning-by-doing.

4 Research Team

The research team will be led by Hunt Allcott (Stanford & NBER), Joseph Shapiro (Berkeley & NBER), and Felix Tintelnot (Chicago & NBER). The team will also include research asssistants and graduate student collaborators. No member of the research team has any conflict of interest or tie to the transportation industry.

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