



Deposited via The University of Leeds.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/243341/>

Version: Accepted Version

Article:

Dou, H., Jiang, S., Ou, S.S. et al. (2026) Distributional impacts of EU tariffs on Chinese electric vehicles across European markets. Nature Energy. ISSN: 2058-7546

<https://doi.org/10.1038/s41560-026-02105-7>

This is an author produced version of an article published in Nature Energy, made available via the University of Leeds Research Outputs Policy under the terms of the Creative Commons Attribution License (CC-BY), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

Reuse

This article is distributed under the terms of the Creative Commons Attribution (CC BY) licence. This licence allows you to distribute, remix, tweak, and build upon the work, even commercially, as long as you credit the authors for the original work. More information and the full terms of the licence here:

<https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

**EU import tariffs on Chinese electric vehicles reshape electrification in
vulnerable markets**

Hao Dou¹, Shuyan Jiang², Shiqi(Shawn) Ou^{2,3}, Han Hao^{1,4*}, Ming Liu^{1,5}, Jingxuan Geng¹, Boyu Liu¹, Lang Mai¹, Xiaobo Qu¹, Yong Geng⁶, Klaus Hubacek⁷, Fanran Meng⁸, David Reiner⁶, Zia Wadud⁹, James Tate⁹, Yifan Wei¹⁰, Chong Liu¹¹, Zongwei Liu¹, Fuquan Zhao¹, Xin Sun⁷

¹ School of Vehicle and Mobility, Tsinghua University, Beijing 100084, China

² School of Future Technology, South China University of Technology, Guangzhou 511442, Guangdong, China

³ Guangdong Artificial Intelligence and Digital Economy Laboratory (Guangzhou), Guangzhou, 510335, Guangdong, China

⁴ Tsinghua-Rio Tinto Joint Research Center for Resources Energy and Sustainable Development, Tsinghua University, Beijing 100084, China

⁵ Energy Policy Research Group, Cambridge Judge Business School, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, UK

⁶ School of International and Public Affairs, Shanghai Jiao Tong University, Shanghai 200240, China

⁷ Integrated Research on Energy, Environment and Society (IREES), Energy and Sustainability Research Institute Groningen (ESRIG), University of Groningen, Groningen, 9747AG, the Netherlands

⁸ Department of Chemical & Biological Engineering, Faculty of Engineering, University of Sheffield, Mappin Street, Sheffield, S1 3JD, UK

⁹ Institute for Transport Studies, University of Leeds, Woodhouse Lane, Leeds, LS2 9JT, UK

¹⁰ Institute for Resource and Environmental Policies, Development Research Center of the State Council, Beijing 100010, China

¹¹ School of Economics, Peking University, Beijing 100871, China

31 *Corresponding author: hao@tsinghua.edu.cn

32

Abstract

In July 2024, the European Union (EU) introduced additional tariffs on battery electric vehicles (BEVs) imported from China. How these trade measures affect the pace and distribution of vehicle electrification depends critically on automakers' response strategies. Here, we combine model-level cost data with a market adoption framework to quantify how tariff-induced cost shocks propagate through total cost of ownership (TCO) and reshape electric vehicle (EV) adoption across 20 EU countries and 10 vehicle classes. We find that, depending on automaker responses, the EU-wide EV share in 2035 ranges from 56.4% (market withdrawal) to 68.9% (low-cost onshoring), compared with 64.4% under a business-as-usual projection. Adoption losses are concentrated in price-sensitive classes and lower-income countries that rely heavily on affordable China-produced BEVs, while onshoring production can partially offset tariff impacts and accelerate electrification. Our findings highlight the distributional consequences of uniform trade interventions and underscore the importance of aligning trade and industrial policy to support a resilient and inclusive transition.

Introduction

The automotive sector is a cornerstone of the European Union (EU) economy, supporting 13.8 million jobs, and contributing over 7% of the EU's gross domestic product¹. Prior to 2020, EU automakers occupied over 75% of traditional domestic auto market². As road transport represents a major source of carbon emissions, vehicle electrification has become a central pillar of the EU's low-carbon transition strategy, accompanied by ambitious electrification targets in the road transport sector. Up to 2022, the share of electric vehicles (EVs) in new car registrations increased rapidly, reaching 21% across the EU³. However, this momentum has weakened in recent years, with EV growth adoption slowing noticeably. A growing body of evidence suggests that the rollback of purchase subsidies and fiscal incentives has undermined the EV affordability, leaving them less competitive with internal combustion engine vehicles (ICEVs) in many markets. In Germany, for example, only one quarter of battery electric vehicle (BEV) sales were priced below their ICEV equivalents in 2024³.

By contrast, the EV industry has expanded rapidly in China, with China-made BEVs gaining a growing foothold in the EU market. In the first half of 2024, 24% of BEV sales in the EU were imported from China, up from almost zero before 2020^{4,5}. To protect the domestic automotive industry while continuing to promote electrification, the EU has introduced a range of policies and regulations in the EV sector, including import tariffs on China-made BEVs. In October 2023, the EU initiated an anti-subsidy investigation on BEV imports from China and subsequently imposed additional tariffs⁶. Specifically, based on the investigation of subsidy rate by brand, the EU set tariff rates of 17.0% on BYD, 18.8% on Geely, 35.3% on SAIC, 7.8% on Tesla, and 20.7% – 35.3% on other automakers (details in [Supplementary Note S1](#)). This tariff policy was formalized following the publication of the investigation results in July 2024. As automakers may respond to trade policy intervention through a wide range of pricing, production, and market strategies, whether such tariffs can ultimately achieve their intended objectives remains an open empirical question⁷.

80 Despite the broad relevance and attentions of the EU's tariff intervention, existing
81 discussions have so far remained dominated by qualitative analyses and institutional
82 reports^{5,8-10}, which primarily focused on trade disputes, industrial competitiveness, or
83 short-term price effects. Existing quantitative assessments have typically focused on
84 price changes for selected vehicle segments or representative models, rather than
85 examining how such trade measures may translate into changes in the pace and
86 distribution of vehicle electrification. Moreover, these analyses fail to account for the
87 diversity of automaker responses to this tariff policy shocks, such as differences in price
88 pass-through, production relocation, or market withdrawal, even though these strategic
89 responses are likely to be decisive in shaping market outcomes. While trade policies in
90 other sectors, including renewable energy equipment, have been evaluated in terms of
91 their impacts on market diffusion, comparable framework-based assessments remain
92 scarce for passenger vehicle markets¹¹⁻¹⁴. The pronounced heterogeneity across
93 countries, vehicle classes, and powertrain technologies further complicates such
94 evaluations, limiting the ability of current approaches to link trade policy interventions
95 with long-term electrification trajectories.

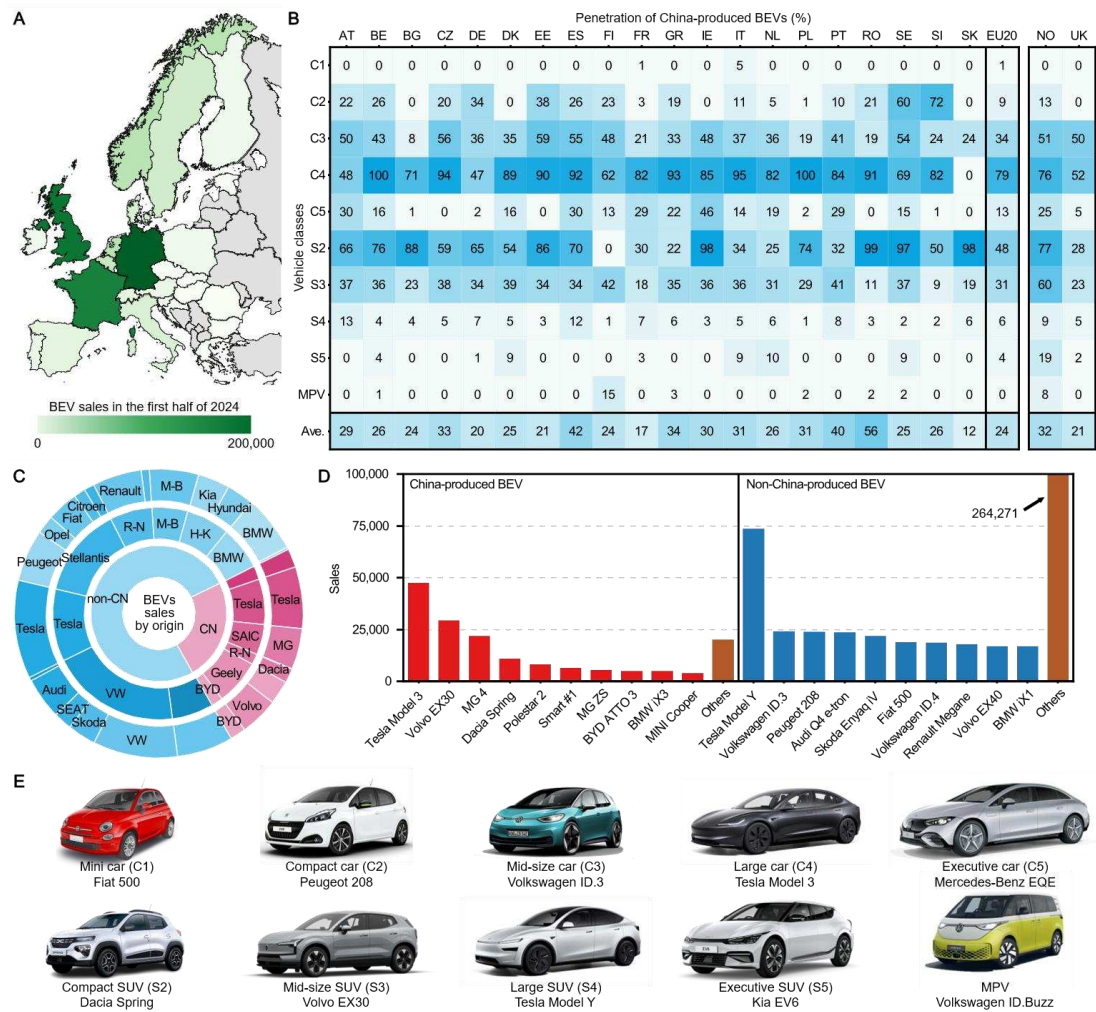
96
97 To address these gaps, we examine how the EU's import tariffs on China-made BEVs
98 may affect vehicle electrification under multiple automaker response scenarios. We
99 integrate detailed model-level cost information with a market adoption framework to
100 assess how tariff-induced changes in total costs of ownership (TCOs) propagate through
101 market structure and shape electrification outcomes. Specifically, the analysis covers
102 all available 168 BEV models and 125 PHEV models across 200 segments spanning 20
103 EU countries and 10 vehicle classes. Rather than assuming a single adjustment
104 mechanism, we explicitly consider heterogeneous firm responses, including price
105 adjustments, production relocation, and market withdrawal, and evaluate how these
106 responses condition the direction and magnitude of tariff impacts on electrification
107 trajectories and distributional outcomes. We find that, depending on automakers'
108 responses, the EU-wide EV share in 2035 ranges from 8.0% lower (market withdrawal
109 scenario) to 4.5% higher (low-cost onshoring scenario) than the business-as-usual

(BAU) projection of 64.4%. At the segment level, between one-third and two-thirds of segments experience a decline in EV share regardless of how Chinese brands respond, with the most extreme case reaching a 69.4% decline for compact SUVs (S2) in Romania under withdrawal scenario. These effects are most pronounced in lower-income countries and medium-to-small vehicle classes, where heightened consumer sensitivity to ownership costs exacerbates the impact.

Results

Market penetration of China-produced BEVs in the EU prior to tariff implementation

In the first half of 2024 (2024H1), while the anti-subsidy investigation was ongoing and the tariff policy had not yet been implemented, 684,621 BEVs were sold in the EU (Fig. 1A), of which 24% were imported from China (Fig. 1B, [Supplementary Fig. S13](#)). Tesla, Geely, SAIC, and BYD were the leading automakers driving these imports, although Volvo and MG primarily produce vehicles marketed as ‘European’ brands (Fig. 1C). The market penetration of China-produced BEVs varies considerably across EU member states. In Romania, 56% of BEVs sold in 2024H1 were imported from China, reflecting strong consumer preference. Dacia Spring, produced by Renault’s Chinese partner Dongfeng, is Romania’s best-selling BEV, accounting for nearly 40% of total BEV sales. Similarly, in Spain and Portugal, the strong sales of Tesla Model 3 have driven the market share of China-produced BEVs to over 40%. Conversely, Slovakia exhibits the lowest penetration rate of 12%. In the EU’s largest markets, China-produced BEVs account for 20% of total BEV sales in Germany and 17% in France. Pronounced heterogeneity is also observed across vehicle classes. While 79% of large car (C4) BEV are imported from China, China-produced BEVs account for almost zero penetration in the mini car (C1) and multi-purpose vehicle (MPV) classes. China’s flagship BEV models face intense competition from European counterparts, such as MG 4 vs. Volkswagen ID.3, Volvo EX30 vs. Mercedes-Benz EQA (Fig. 1D). Among the ten analyzed vehicle classes, the best-selling BEV models in three classes are produced in China (Tesla Model 3, Dacia Spring, and Volvo EX30, Fig. 1E).



141

142 **Fig. 1: Overview of the EU BEV market in the first half of 2024.** (A) BEV sales across European
143 countries, with color intensity representing BEV sales volume; grey indicates data unavailable for
144 those countries. (B) Penetration rates of China-produced BEVs. Penetration rates are presented for
145 20 EU countries (horizontal) and 10 vehicle classes (vertical), indicated by both the numbers on and
146 the color depth of the cells. Data for Norway and the United Kingdom are also included. (C) EU
147 BEV market breakdown by production origin. Automakers are categorized by production location,
148 brand, and group from the center to the outer layers. Automakers with less than 9,000 BEV sales
149 are not labeled. (D) Top 10 best-selling China-produced and non-China-produced BEV models in
150 the 20 EU countries analyzed (EU20). (E) Best-selling BEV models across all vehicle classes. EU20:
151 the 20 EU countries covered in this study; H-K: Hyundai Kia; R-N: Renault-Nissan Alliance; M-B:
152 Mercedes-Benz; non-CN: non-China-produced; CN: China-produced; C1 – C5: mini, compact,
153 mid-size, large, executive car; S2 – S5: compact, mid-size, large, executive SUV; SUV: sport utility
154 vehicle; MPV: multi-purpose vehicle. Country names are described using ISO alpha-2 code, as
155 detailed in [Supplementary Table S4](#). Source links of the images in Fig. 1E are listed in
156 [Supplementary Table S5](#).

157

158 Following the implementation of tariffs, short-term price rigidity and limited immediate

adjustment by Chinese automakers were accompanied by a decline in the market share of China-produced BEVs in most countries. The overall penetration rate fell from 24% in 2024H1 to 22% in the second half of 2024 (2024H2), and further to 20% in the first half of 2025 (2025H1)⁴. To provide a longer pre- and post-policy context, the evolution of market shares before and after tariff implementation is shown in [Supplementary Fig. S14](#). Given that automakers responses to the additional import duties are expected to evolve over time, we do not treat these short-run shifts as the main focus of inference. Instead, we use the 2024H1 market structure as the baseline for subsequent analysis and construct multiple scenarios and cases to examine potential market trajectories.

Automaker response strategies to EU import tariffs

Understanding automaker responses to the tariff shocks is the key to assessing the policy’s market and transition impacts¹⁵. As an exogenous trade intervention, the EU’s import tariffs directly increase the export-related variable costs for China-produced BEVs, thereby altering automakers’ profit conditions in the EU market. While a temporary pricing hold has been observed following the implementation of tariffs, automakers are likely to reassess their pricing, production, and market strategy over a longer horizon. In this context, we identify three representative response strategies that capture the range of strategic adjustments available to automakers. We formalize these strategies as three automaker response scenarios (Table 1), and quantify the vehicle model-level price changes under each scenario (Fig. 2).

Table 1. Scenarios and cases design on automaker response scenarios

Scenario	Description	Case	Description
Adapting to tariff (ADA)	Automakers continue exporting BEVs from China to the EU and respond to the tariff shock through pricing adjustments.	Low	Prices constrained by variable cost (zero-profit continuation).
		Mid	Partial tariff pass-through (intermediate adjustment).
		High	Full tariff pass-through to consumers.

Onshoring BEV production (ONS)	Automakers shift BEV manufacturing from China to the EU	Low	Onshoring raises retail price by 10%.
		Mid	Onshoring raises retail price by 20%.
	EU to bypass export-related costs.	High	Onshoring raises retail price by 30%.
Withdrawing from the EU (WIT)	Automakers withdraw China-produced BEVs from the EU market.	Low	Exit of purely domestic Chinese brands.
		Mid	Exit of domestic Chinese brands and Chinese-acquired brands.
		High	Exit of all China-produced BEVs, including foreign brands manufactured in China.

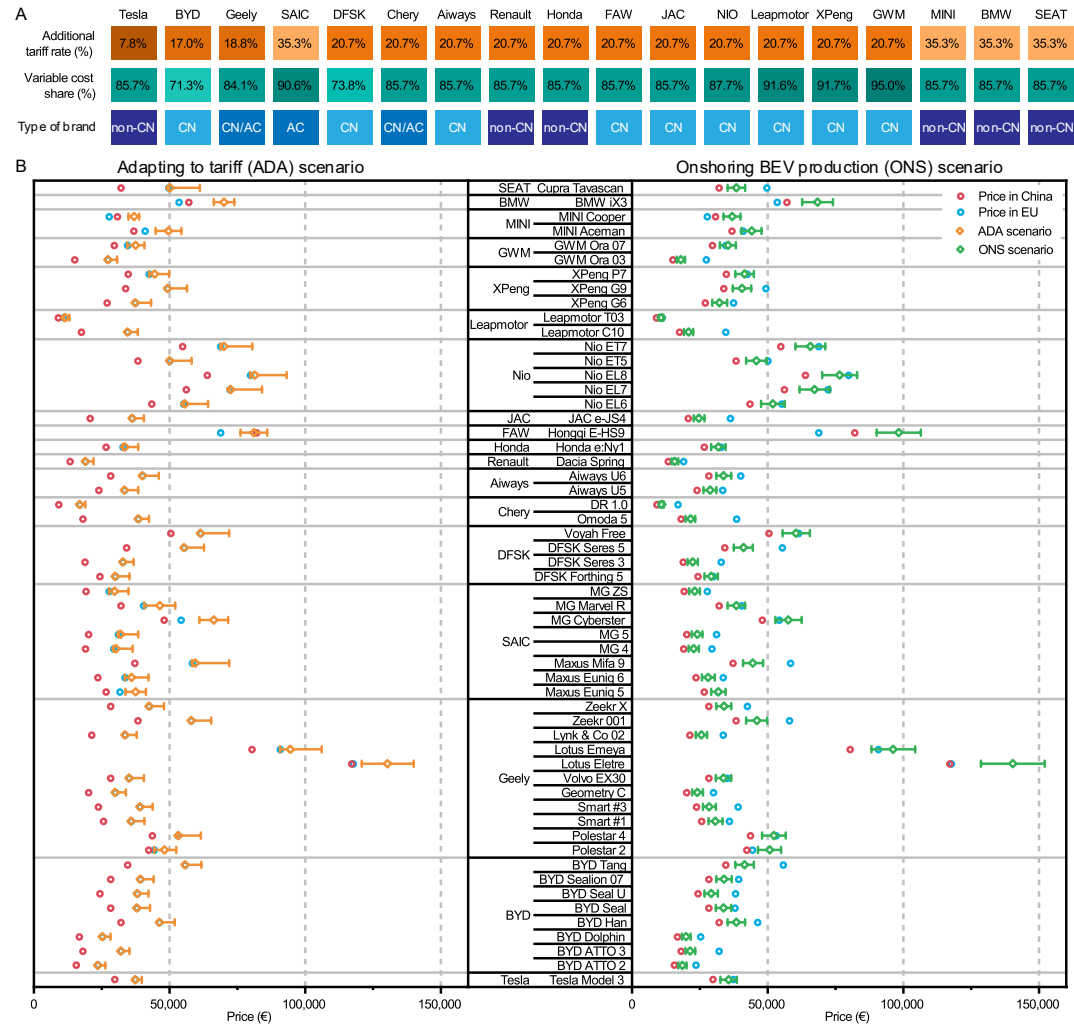


Fig. 2: Projected price changes of China-produced BEVs under different scenarios. (A) Additional tariff rates, the share of variable costs and type of brand for BEVs from different brands. (B) Prices of each model in the EU and Chinese markets, along with projected price changes under the ADA and ONS scenarios. Red and blue dots represent prices in the Chinese and EU markets,

respectively. Orange and green squares indicate the projected prices under the ADA and ONS scenarios, respectively. For each scenario, the square represents the projected price in the mid case, with the left and right ends of the error bar indicating the low and high cases, respectively. CN: China domestic brand; AC: brand partially or fully acquired by Chinese brand; non-CN: non-China domestic brand; ADA: adapting to tariff scenario; ONS: onshoring BEV production scenario.

Adapting to tariff (ADA) scenario. This scenario represents a price-adjustment strategy, under which automakers continue exporting BEVs from China and respond to the tariff shock primarily through pricing adjustments. As the EU import tariffs raise the export-related component of variable costs, automakers face a trade-off between preserving market competitiveness and maintaining profitability. While automakers may accept short-term losses to preserve market presence, sustained participation in the EU market over a longer horizon requires that prices at least cover variable production and export costs, even if profits are compressed^{15,16}. Three cases (low, mid, and high) are further developed to represent the extent to which the automakers adjust retail prices (details in Methods). Under this scenario, among the 56 China-produced models, price increases are observed for 8 (the low case), 25 (the mid case), and 56 (the high case) BEV models, respectively. MINI Cooper consistently exhibits the largest price increase, followed by BMW iX3 and MG Cyberster. In contrast, BEV models produced by automakers with strong cost competitiveness like BYD show greater resilience to the tariffs.

Onshoring BEV production (ONS) scenario. This scenario represents a production relocation strategy, under which automakers respond to the tariff shock by onshoring BEV production to the EU in order to bypass export-related costs, including tariffs and long-distance transportation^{17,18}. While onshoring eliminates these export-related expenses, it also exposes automakers to higher factor costs (e.g., labor, land, and energy) and more stringent compliance costs with regulations (e.g., environmental and carbon-related regulations). To parameterize the cost implications, we compare prices of 18 BEV models sold by domestic manufacturing in both the Chinese and EU markets, using the observed price discrepancies as a proxy for production cost variation^{19,20}. This

comparison yields an average price difference of 20% under the mid case (Supplementary Table S7), with assumed differences of 10% and 30% for the low and high cases, respectively. Under this scenario, 46 BEV models exhibit price decreases related to pre-tariff levels under the mid case, with Omoda 5, Leapmotor C10, and DR 1.0 showing the largest reductions. The number of models with price reductions rise to 51 under the low case and falls to 33 under the low case.

Withdrawing from the EU (WIT) scenario. This scenario is designed as a bounding case to examine how EU electrification outcomes would change if China-produced BEVs become less available in the EU market under a more restrictive external environment. Rather than representing a prediction of near-term firm exit under current tariff levels, the WIT scenario captures the potential consequences of broader market disruption arising from non-economic factors, including geopolitical tensions, regulatory uncertainty, investment retrenchment, and strategic supply-chain reallocation. The three WIT cases represent progressively more severe reductions in market availability: in the low case, only China domestic brands (36 models) are assumed to become unavailable; in the mid case, this extends to brands partially or fully acquired by Chinese companies (13 models); and in the high case, all China-produced BEVs are assumed to become unavailable in the EU market. These cases are intended to reflect different levels of disruption severity, rather than calibrated probabilities of firm withdrawal.

Heterogeneous TCO impacts across vehicle classes and EU markets

To translate model-level price adjustments into consumer-relevant cost implications, we convert price variations into TCO based on 2024H1 market conditions, incorporating expenditures on depreciation, energy, maintenance, taxation, and insurance^{21,22}.

At the EU20 level, tariff-induced TCO impacts are moderate on average but highly uneven across countries and vehicle classes, with the strongest effects concentrated in

price-sensitive segments and lower-income markets (Fig. 3). This heterogeneity becomes more apparent when examined across all country–segment combinations (Fig. 3A, Fig. 3E). Under the ADA and ONS scenarios, C2 in Slovakia consistently emerge as the most affected segment, with TCO increases of 25.2% under the ADA (high case) and 27.5% under the ONS (high case). Under the WIT scenario, C5 in Ireland, France, and Spain exhibit the largest increases in the low and mid cases, with TCO rises of 19.1%, 16.1%, and 14.1%, respectively. The impacts become more extreme under the high case, where S2 in Romania experience a TCO increase of 69.4%, followed by Bulgaria (+61.2%) and Estonia (+51.3%). This pattern is driven by the exit of the best-selling Dacia Spring, a low-cost model that is strongly preferred by local consumers.

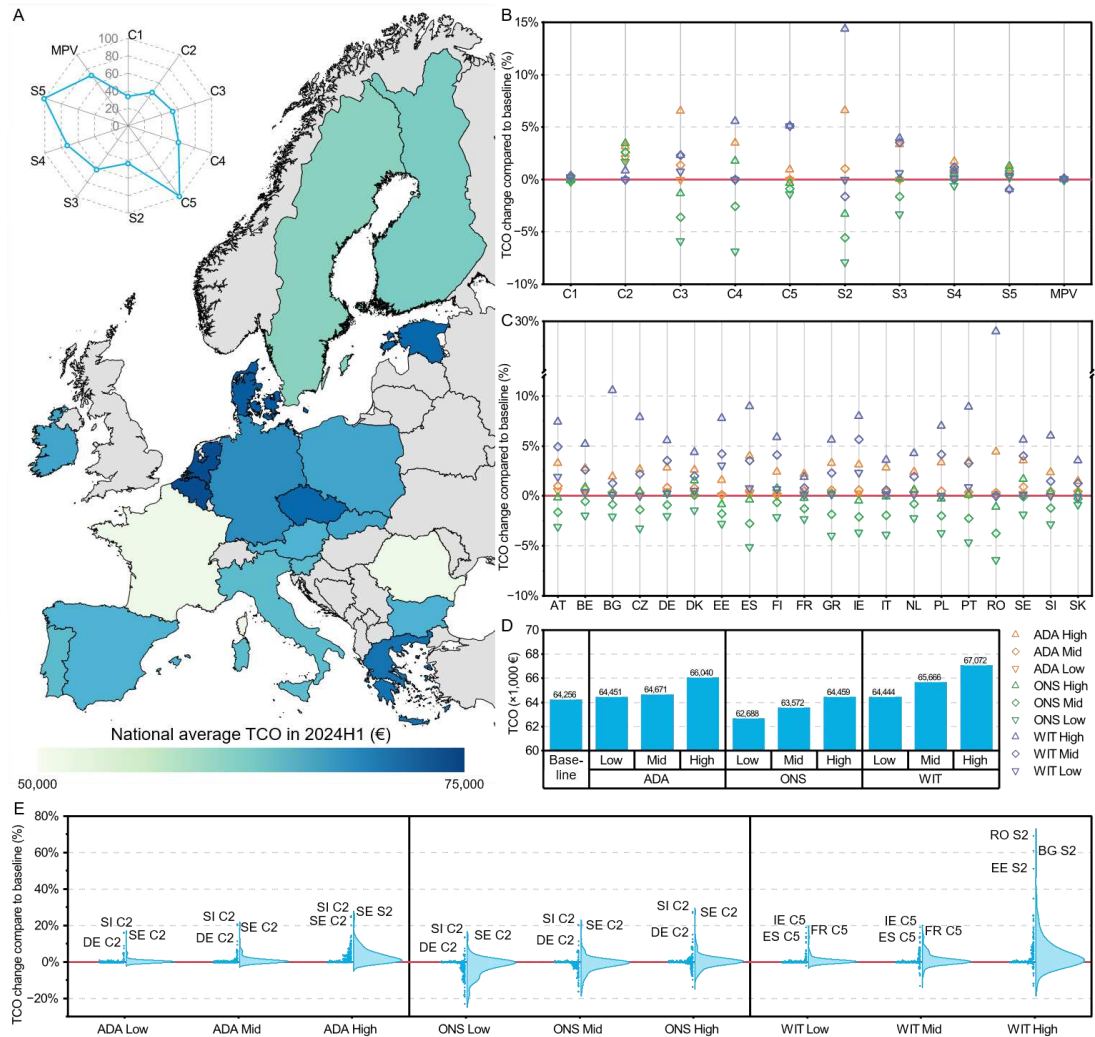


Fig. 3: TCO estimates for BEVs in twenty EU countries across ten vehicle classes. (A) Average TCO in 2024H1 at national and vehicle class levels under baseline. The color shading across countries represents the national average TCO. The radar chart displays the average TCO by vehicle

class. (B) TCO differences by vehicle class compared to baseline under various scenarios and cases. Symbols of different shapes represent TCO changes under various scenarios and cases. (C) TCO differences by country compared to baseline under various scenarios and cases. Symbols of different shapes represent TCO changes under various scenarios and cases. (D) Average TCO at the EU20 level under various scenarios and cases. (E) Distribution of TCO change compared to baseline across various scenarios and cases. Several extreme segments are labeled. More details are shown in [Supplementary Fig. S15 – S43](#). ADA: adapting to tariff scenario; ONS: onshoring BEV production scenario; WIT: withdrawing from the EU scenario; C1 – C5: mini, compact, mid-size, large, executive car; S2 – S5: compact, mid-size, large, executive SUV; SUV: sport utility vehicle; MPV: multi-purpose vehicle. Country names are described using ISO alpha-2 code, as detailed in [Supplementary Table S4](#).

When aggregated to broader dimensions, the magnitude of TCO impacts becomes more balanced across vehicle classes (Fig. 3B) and countries (Fig. 3C). At the EU20 level (Fig. 4D), average TCO changes range from –2.4% under the ONS scenario (low case) and +4.4% under the WIT scenario (high case), indicating that aggregate impacts are modest relative to the substantial variation observed at the segment level. TCO increases of over 60% are observed for compact SUVs (S2) in Romania and Bulgaria under WIT scenario (high case).

To further illustrate the underlying price-to-TCO transmission mechanism at the model level, we take Germany, the EU’s largest EV market, as an illustrative case (Fig. 4). For example, in the mid-size car (C3) class (Fig. 4C), which account for 16% of total BEV sales in Germany (Fig. 4K), we list the TCO of the three best-selling non-China-produced BEV models (Volkswagen ID.3, Renault Megane, and Opel Astra) alongside the three top-selling China-produced models (MG 4, Polestar 2, and GWM Ora 03). The sales-weighted average pre-tariff TCOs for non-China-produced and China-produced BEVs in this class are estimated at €59,767 and €50,292, respectively.

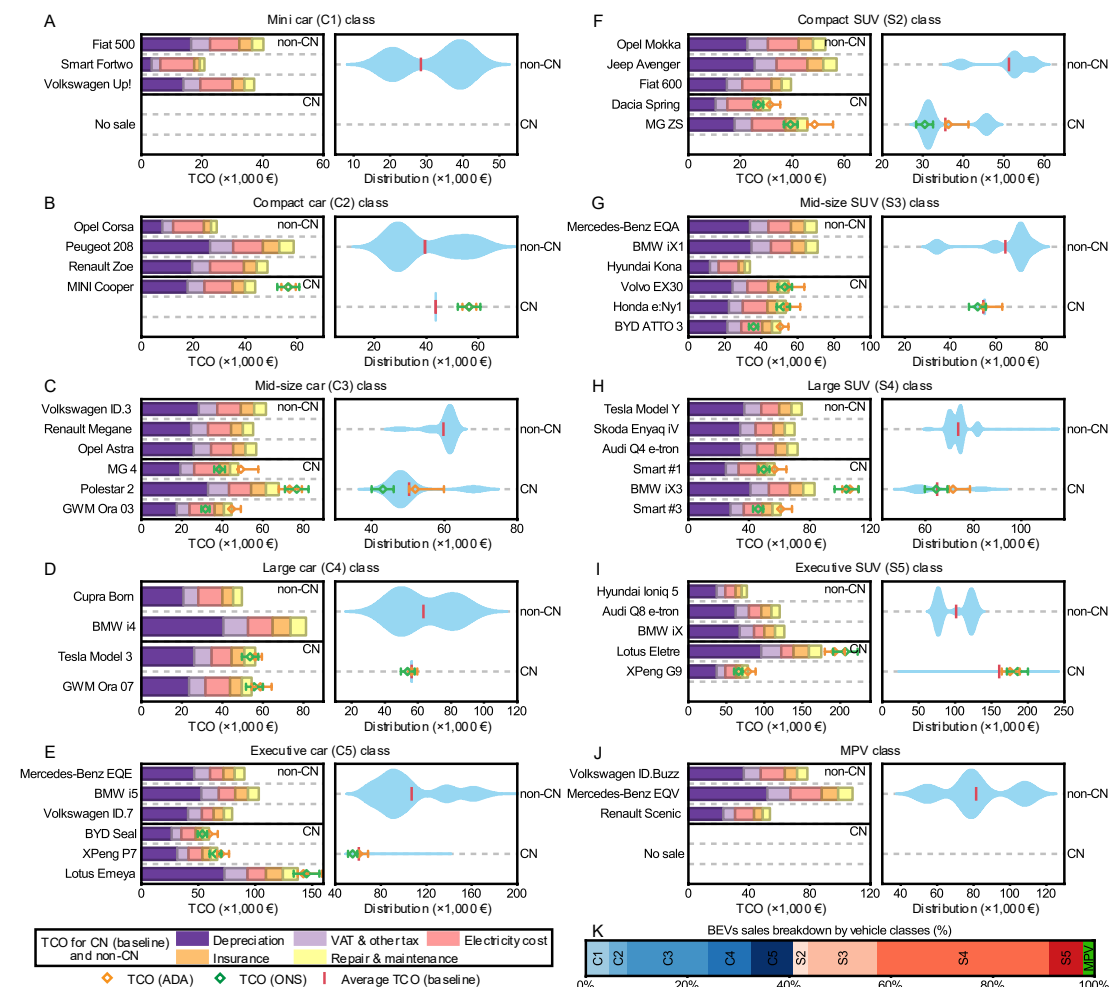


Fig. 4: TCO estimations for BEVs in Germany. (A) – (J) TCO estimations for different vehicle classes. For each panel, the left half displays the TCO breakdown for the three best-selling non-China-produced and China-produced BEV models under baseline (listed in [Supplementary Table S8](#)); in the right half, the blue shades indicate the sales-weighted TCO distribution; the red lines indicate the average TCO under baseline. Orange and green squares indicate the projected TCO under the ADA and ONS scenarios, respectively. For each scenario, the square represents the projected price in the mid case, with the left and right ends of the error bar indicating the low and high cases, respectively. (K) BEV sales breakdown by vehicle classes. Cases in other 19 countries are provided in [Supplementary Fig. S44 – S62](#). non-CN: non-China-produced; CN: China-produced; ADA: adapting to tariff scenario; ONS: onshoring BEV production scenario.

Under the ADA scenario (mid case), GWM Ora 03 is projected to maintain its price, while MG 4 and Polestar 2 experience price increases of 3% and 9%, respectively. As a result, the sales-weighted average TCO of China-produced BEVs rises by 3.0% to €51,950. Under the ONS scenario (mid case), Polestar 2's price increases by 14%, whereas MG 4 and GWM Ora 03 benefit from price reductions of 23% and 34%, respectively, leading to a 14.4% decline in the average TCO. In contrast, under the WIT

scenario (low case), where China-produced BEVs from Chinese domestic brands exit, the average TCO increases by 1.2%. This smaller change reflects the fact that the WIT low case removes only a subset of China-produced BEV offerings, whereas the ONS scenario modifies the prices of the remaining models directly. Consequently, average TCO changes are shaped by model composition and sales-weighted exposure, rather than by the nominal severity of the scenario alone. Across the nine cases, the ADA (high case) yields the largest TCO increase in this segment, whereas the ONS (low case) delivers the greatest TCO reduction.

This price-to-TCO transmission mechanism generalizes across vehicle classes in Germany (Fig. 4A – 4J), but the magnitude and direction of TCO changes vary substantially by segment and automaker response strategies. The largest TCO increase and decrease occur at compact car (C2, +39.0%) under the ONS scenario (high case) and mid-size car (C3, –20.4%) under the ONS scenario (low case), respectively. While China-produced BEVs often remain cheaper than comparable non-China-produced models, tariffs reduce this price advantage to varying degrees, and the resulting impact on EV adoption depends on how automakers adjust prices, production, or market presence under different scenarios.

Electrification trajectories under multiple automaker response scenarios

To examine how EU import tariffs on China-made BEVs may reshape the electrification pathway under multiple automaker response strategies, we further project EV adoption across EU countries and vehicle classes through 2035 by employing the New Energy and Oil Consumption Credit (NEOCC) model (see Methods). The NEOCC model is a transportation market dynamics quantification framework originally developed by Oak Ridge National Laboratory, which has been utilized to project the market shares of vehicle types, classes, and technologies under policy constraints²³⁻²⁵. The NEOCC-based projections in this study do not impose EU fleet CO₂ compliance constraints, but the model allows to calculate annual fleet-wide CO₂ emissions and assess the gap between model outcomes and policy targets (details in [Supplementary Note S3](#)).

Under the BAU scenario, EV adoption accelerates steadily from 2025 onward, reaching 46% by 2030 and 64% by 2035 at the EU20 level (Fig. 5A). Relative to this baseline trajectory, multiple automaker responses to the tariff induce pronounced divergences in electrification outcomes (Fig. 5B). Under the ADA scenario, EV adoption slows modestly, with the EU20 EV share projected to be 0.7% (low case), 1.2% (mid case), and 3.8% (high case) lower than BAU in 2035. By contrast, onshoring BEV production accelerates electrification, making the EV share by -0.1% (high case), +2.1% (mid case), and +4.5% (low case). These contrasting outcomes indicate that changes in EV adoption are not driven by the tariff in isolation, but by how automakers respond to the tariff shock. Tariffs combined with price pass-through tend to increase BEV prices and weaken EV competitiveness, thereby reducing adoption. By comparison, tariffs combined with production relocation remove tariff- and transport-related costs; for some models, these savings more than offset the assumed increase in production costs, leading to lower projected prices and TCOs and, in turn, higher EV uptake in certain markets. The WIT scenario generates more heterogeneous outcomes. If only foreign-brand models produced in China (e.g., Dacia Spring, and Tesla Model 3) remain available, EV adoption increases by 3.2%. However, if all China-produced BEVs withdraw from the EU market, electrification is substantially hindered, with the EV share falling by 8.0%.

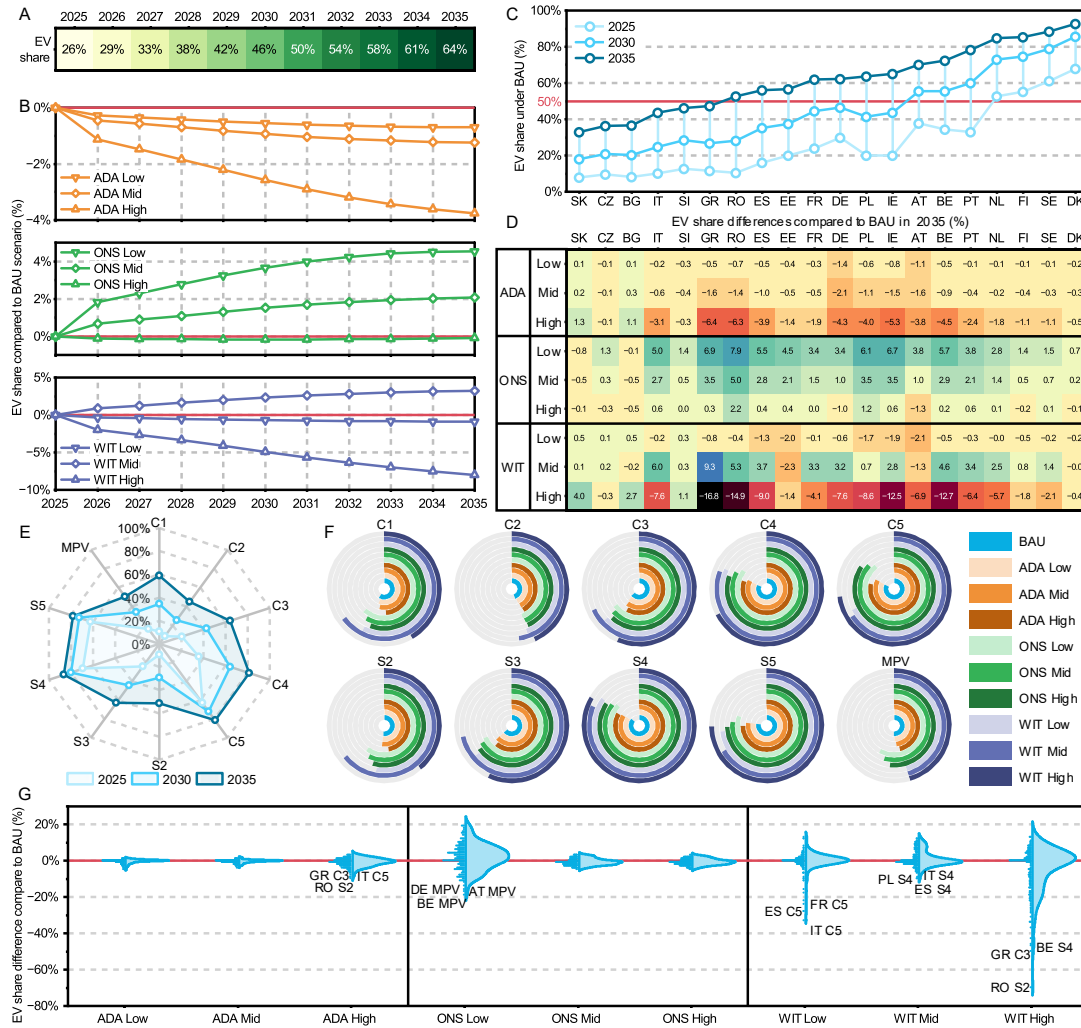


Fig. 5: EV share projections in twenty EU countries across ten vehicle classes. (A) Annual EV share projections from 2025 to 2035 under the BAU scenario. (B) Annual EV share differences compared to the BAU scenario across multiple scenarios and cases. (C) EV share projections across 20 EU countries in 2025, 2030, and 2035 under the BAU scenario. (D) EV share differences compared to the BAU scenario across 20 countries under different scenarios and cases. (E) EV share projections across vehicle classes in 2025, 2030, and 2035 under the BAU scenario. (F) Projected EV share across vehicle classes in 2035 under various scenarios and cases. (G) Distribution of EV share difference compared to BAU in 2035 across various scenarios and cases. Several extreme segments are labeled. More details are shown in [Supplementary Fig. S63 – S96](#). BAU: business as usual scenario; ADA: adapting to tariff scenario; ONS: onshoring BEV production scenario; WIT: withdrawing from the EU scenario; C1 – C5: mini, compact, mid-size, large, executive car; S2 – S5: compact, mid-size, large, executive SUV; SUV: sport utility vehicle; MPV: multi-purpose vehicle. Country names are described using ISO alpha-2 code, as detailed in [Supplementary Table S4](#).

At the national level, electrification trajectories remain highly divergent (Fig. 5C). Denmark, Sweden, Finland, and the Netherlands have already reached EV shares of over 50% and are projected to exceed 80% by 2035, whereas six countries are expected

to remain below 50% by 2035. These trajectories are further reshaped under multiple automaker response scenarios (Fig. 5D). Under the ADA scenario, Greece and Romania are the most affected markets, with EV shares in 2035 falling by 6.4% and 6.3% under the high case. Under the ONS scenario, electrification accelerates most strongly in Romania (+5.0%), Greece (+3.5%), and Ireland (+3.5%) under the mid case. The WIT scenario generates the most polarized outcomes. Under the mid case, EV adoption rises sharply in Greece (+9.3%), Italy (+6.0%), and Romania (+5.3%). By contrast, when all China-produced BEVs exit, these same countries experience the largest declines, led by Greece (−16.8%), and Romania (−14.9%).

At the class level, electrification progresses most rapidly in larger vehicle segments, with C4, C5, S4, and S5 projected to reach around 80% EV share by 2035 (Fig. 5F). However, adoption trajectories diverge under multiple automaker response scenarios. Under the ADA scenario (mid case), EV shares decline in six of the ten classes. By contrast, the ONS scenario (mid case) accelerates adoption in five classes, with particularly strong gains in S2 (+5.7%), C5 (+5.1%), and MPV (+4.1%). Under the WIT scenario (low case), sharp declines already emerge in C5 (−14.1%), S5 (−5.1%), and MPV (−4.9%). These effects intensify under the mid case, where six classes exhibit EV share changes exceeding 5%, including strong contractions in C5 (−15.9%) and S5 (−11.4%), alongside expansions in S2 (+12.9%). Under the high case, EV shares decline across all classes, with the largest reductions observed in C1 (−17.2%).

Although average impacts on EV adoption remain moderate, large disparities emerge across individual market segments (Fig. 5G). Under the ADA scenario (high case), several segments experience strong reductions, including S2 in Romania (−9.7%), C5 in Italy (−8.1%), and C3 in Greece (−8.0%). The ONS scenario exhibits a more dispersed distribution of outcomes, particularly under the low case. The largest declines occur in the MPV segment in Belgium (−18.0%), Austria (−17.0%), and Germany (−15.4%), while the strongest gains appear in S4 in Poland (+19.5%), C5 in Italy (+19.0%), and C1 in the Netherlands (+19.0%). The WIT scenario generates the most

extreme outcomes. Under the low case, nine segments experience EV share reductions exceeding 10%, led by C5 in Italy (−32.8%), Spain (−27.4%), and France (−27.2%). Moreover, the high case produces widespread contraction, with 50 out of 200 segments experiencing declines greater than 10%, including extreme losses in S2 in Romania (−69.4%), C3 in Greece (−50.0%), and C4 in Belgium (−46.3%).

Discussion

Together, these results show that although the average impact of EU import tariffs on EV adoption is moderate at the aggregate level, tariff-induced shocks generate highly uneven electrification outcomes across countries and vehicle classes. Adoption losses are concentrated in price-sensitive markets and segments that rely heavily on affordable China-produced BEVs, reflecting how tariff-induced cost increases interact with heterogeneous model portfolios and consumer price sensitivity to reshape market structure.

This distributional dimension becomes particularly clear when electrification outcomes are examined alongside structural vulnerability indicators (Fig. 6). Small-to-medium vehicle classes (C1 – C3 and S2 – S3) and lower-income member states cluster in the low-adoption, high-affordability-constraint region, and experience larger relative adoption losses under multiple scenarios. Consumers of mini cars (C1) are the most cost-sensitive, with the lowest TCO at €33,514 among all vehicle classes. However, EV adoption in this class remains relatively weak, reaching only 58.9% by 2035, making it particularly vulnerable. The negative impact is more pronounced under policy stress: the EV share drops by 10.0% under the high case of the ADA scenario and by 17.2% under the high case of the WIT scenario. Similarly, Romania is identified as a vulnerable national market, where consumers have the second-lowest median income (€6,568) and an EV adoption rate of just 52.6% in 2035. These vulnerabilities are exacerbated under ADA and WIT responses. However, Romania stands to benefit substantially if automakers opt to onshore their EV production. These patterns highlight a potential tension between uniform trade interventions and the objective of an inclusive

electrification transition.

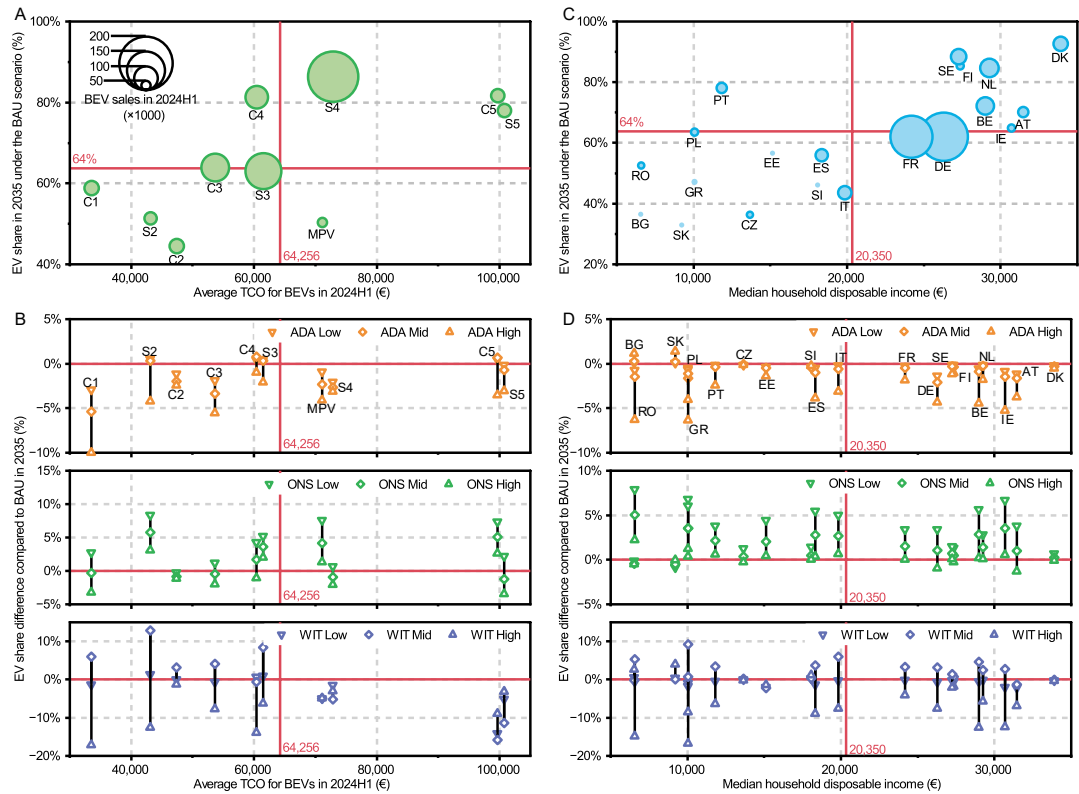


Fig. 6: EV penetration against vulnerability indicators across countries and vehicle classes under various scenarios and cases. (A) Projected EV penetration in 2035 versus TCO in 2024H1 at the vehicle class level under the BAU scenario. The red lines represent the sales-weighted average values of all countries and vehicle classes. (B) Projected EV share difference compared to BAU in 2035 versus TCO in 2024H1 at the vehicle class level under the ADA, ONS and WIT scenario. (C) Projected EV penetration in 2035 versus median household disposable income in 2024H1 at the national level under the BAU scenario. The red lines represent the sales-weighted average values of all countries and vehicle classes. (D) Projected EV share difference compared to BAU in 2035 versus median household disposable income in 2024H1 at the national level under the ADA, ONS and WIT scenario. ADA: adapting to tariff scenario; ONS: onshoring BEV production scenario; WIT: withdrawing from the EU scenario; C1 – C5: mini, compact, mid-size, large, executive car; S2 – S5: compact, mid-size, large, executive SUV; SUV: sport utility vehicle; MPV: multi-purpose vehicle. Country names are described using ISO alpha-2 code, as detailed in [Supplementary Table S4](#).

Recognizing these vulnerable markets, tariff policy needs to be embedded with a broader policy framework that reconciles industrial objectives with distributional considerations. In small-to-medium classes, China-produced BEVs retain a cost advantage, in part due to their extensive use of low-cost LFP batteries, a technology in

which EU automakers lag²⁶. In the absence of complementary measures, uniform tariff application in these markets risks weakening affordability. Mitigation strategies could focus on strengthening the competitiveness of EU based supply chain, including accelerated onshoring of LFP battery production, and the strategic use of tariff revenues to support incentives for consumers in vulnerable countries and classes purchasing EU-produced BEVs. The EU's consideration of recycling tariff income into EV subsidies points in this direction^{27,28}, but a more explicitly distribution-aware design is essential to ensure that trade policy and electrification objectives remain mutually reinforcing.

Automakers' responses are shaped not only by tariff policy, but also by the broader regulatory and industrial environment. Our results indicate that onshoring BEV production represents the most cost-effective strategy, with the potential to lower transition costs while supporting EU's manufacturing base. However, the current EU policy environment does not yet appear fully aligned with this objective. For example, Farasis Energy, a leading battery manufacturer in China, has proposed a 10 GWh battery production facility in Saxony-Anhalt, Germany, serving an expansion of local production capacity²⁹. Yet regulatory hurdles, including land-use approval delays and concerns over supply chain security, have stalled the project for over three years³⁰. While not all onshoring initiatives face similar barriers, for instance, the investments and construction projects by BYD and CATL in Hungary are progressing successfully, such frictions illustrate how regulatory uncertainty and permitting constraints can weaken investment incentives in strategically important segments of the EV value chain. Given the projected electrification gains from onshoring, closer alignment between trade policy and industrial policy could play a critical role in realizing cost-effective electrification while strengthening EU's domestic EV supply base.

The WIT scenario, in which China-produced BEVs become less available in the EU market under a more restrictive external environment, is intended as a stress-test of market disruption rather than a prediction of near-term firm exit. Since the introduction of the additional tariffs, limited progress in EU-China negotiations and retaliatory trade

measures have increased political and commercial uncertainty^{31,32}. In this context, several automakers and battery suppliers have begun to reassess their European investment strategies^{33,34}. From a transition perspective, such dynamics raise concerns about the resilience of Europe's electrification pathway. Our results indicate that China-produced BEVs play an important role in several price sensitive and lower-income markets, where affordable models are essential for sustaining adoption momentum. If broader trade, regulatory, or geopolitical disruptions were to reduce the availability of these models, the resulting supply contraction could not only reshape market structure, but also slow electrification precisely where progress is already fragile. These findings highlight the importance of confidence-building measures that preserve investment incentives and supply-chain continuity during the transition. Potential approaches include joint ventures between global and EU automakers to strengthen local value chains, clearer regulatory guidance for overseas manufacturers, and more structured dialogue between industry and EU institutions to reduce policy uncertainty³⁵. More broadly, maintaining a predictable and cooperative trade environment may be an important condition for ensuring that electrification proceed in a stable and resilient manner.

In addition, Price undertaking arrangements have recently been introduced as an alternative to tariff-based measures in the EU–China EV trade context, reflecting a broader evolution in trade policy instruments³⁶. While such arrangements are conceptually distinct from the automaker response strategies, their potential implications for electrification outcomes are assessed in the [Supplementary Note S5](#). The EU's Fit for 55 packages also requires manufacturers to meet fleet-wide emission targets by 2035. As the 2035 target of 90% reduction on fleet emissions is not reached under any scenario, additional policies and incentives that support EV adoption in the EU will also be necessary to advance electrification ([Supplementary Note S3](#)).

This study is subject to several limitations. First, our analysis adopts a scenario-based framework to explore plausible automaker response strategies rather than to predict

firm-level decisions, which will ultimately depend on evolving market, regulatory, and geopolitical conditions. Second, while our adoption projections capture dynamic interactions between ownership costs and consumer choice, future policy adjustments, such as changes in purchase incentives or CO₂ standards, could alter electrification trajectories beyond the scope of this study. Third, the market diffusion analysis focuses on new passenger vehicle sales and does not explicitly account for secondhand vehicle markets, which may moderate observed EV penetration in some countries (see [Supplementary Note S6](#))³⁷. Finally, our focus is on consumer affordability and adoption outcomes, rather than on the full system-wide implications of trade policy for lifecycle emissions and supply-chain transformation. These limitations could be addressed in future studies.

Methods

Definitions

Tariff scope and applicability. According to the EU tariff regulation, the product concerned is new BEVs, principally designed for the transport of nine or fewer persons, propelled solely by one or more electric motors³⁸. Therefore, the analysis focuses on vehicles classified in the M1 category, aligning with the scope of the EU's anti-subsidy investigation^{38,39}.

Determining Vehicle Production Origin. The additional tariff is applied to BEVs produced in China. We determine the production locations of BEV models by collecting automakers' production information via MarkLines database⁴. Given the complexity of the global supply chain, there are BEV models that have multiple production sites. For these models, we examine their production capacity via official website and make the following assumptions: (I) for models with production capacity in both China and the EU (e.g., BMW i5), the EU-sold vehicles are assumed to be primarily produced in the EU, and free from the tariff; (II) for models with production capacity in both China and other countries beyond the EU (e.g., Tesla Model 3), we trace the actual supply chain relationship to determine their subjection to the tariff. The list of models subject to the additional tariff is provided in [Supplementary Table S10](#).

Vehicle segmentation and classification. In this study, passenger vehicles are divided into three main types (cars, SUVs, and MPVs). Cars and SUVs are further divided into five classes according to vehicle wheelbase, i.e., mini (less than 2450 mm), compact (2450 mm – 2600 mm), mid-size (2600 mm – 2750 mm), large (2750 mm – 2900 mm), and executive (more than 2900 mm). Due to the negligible sales, mini SUVs are not covered in the analysis. MPVs are not further divided due to the largely consistent size within this vehicle type. Above all, we categorize passenger vehicles into ten vehicle classes (5 for cars, 4 for SUVs, and 1 for MPVs), as detailed in [Supplementary Tables S11](#). The vehicle models covered in the vehicle classes are shown in [Supplementary Table S12](#).

Data sources

Vehicle sales. Vehicle sales are obtained from the MarkLines database⁴, which provides country-level, monthly vehicle sales records. Out of the 27 EU countries, data are available for 23 countries, with data for Cyprus, Malta, Latvia, and Lithuania unavailable. In addition, for Croatia, Luxembourg, and Hungary, the database only reports EV sales for Tesla and unknown brands, which is insufficient to support the analysis. Thus, these seven countries are excluded from the analysis. For reasons discussed in the main text, we retrieve sales data for the first half of 2024 as the baseline for analysis.

Vehicle retail price. The manufacturer's suggested retail prices of vehicle models are sourced from Chinese²⁰ and EU^{19,40} online databases. For one BEV model, there are typically multiple trims with varying performances (such as, range capacity, horsepower, hardware and software configurations) and prices. For comparability, we consistently use the medium-performance trim's retail price as the basis for analysis. In addition, the exchange rates are based on the average value during the first half of 2024, listed in [Supplementary Table S13](#).

TCO-related data. We compile a wide range of data sources to support the TCO estimation. The details are introduced in the total cost of ownership section.

Scenarios and cases design and related price change prediction

ADA scenario. In this context, we characterize a feasible price-adjustment space bounded by two economic constraints⁴¹. The lower bound corresponds to a zero-profit continuation condition, under which automakers price their vehicles at variable cost in order to remain in the market under intense competitive pressure. The upper bound corresponds to full tariff pass-through, whereby the entire tariff burden is shifted to consumers. Between these bounds, intermediate adjustment paths reflect partial pass-through under heterogeneous demand and competitive conditions. We therefore

construct three cases to span this response space. In the low case, prices are adjusted only when the post-tariff variable cost exceeds the current price. In the high case, prices increase by the full amount of the tariff-induced cost increment. In the mid case, prices adjust to the average of the variable-cost threshold and the full pass-through price whenever this exceeds the current price. Variable costs are proxied using automaker-level operating cost shares derived from financial statements, providing a conservative benchmark for long-run pricing constraints.

Price adjustments are driven by the interaction between tariff-induced cost increases and model-specific variable cost structures. We construct three cases that span the feasible price-adjustment space under competitive and cost constraints. Detailed parameter values and data sources ranges are reported in [Supplementary Note S2](#).

In the low case, prices are bounded by a zero-profit continuation condition, under which automakers adjust prices only when the post-tariff variable cost exceeds the current EU retail price. The projected price is determined by equation (1).

$$P_{ADA,low} = \max(P_{EU}, P_{VC}) \quad (1)$$

where,

$P_{ADA,low}$ is the projected retail price under the ADA low case (€);

P_{EU} is the pre-tariff retail price in EU market (€);

P_{VC} is the post-tariff variable-cost threshold price in the EU market (€).

The post-tariff variable-cost threshold price is calculated in equation (2).

$$P_{VC} = P_{CN} \times \omega_{VC} + C_{Ins} + C_{Fre} + C_{Tar} \quad (2)$$

where,

P_{CN} is the Chinese-market retail price (€);

ω_{VC} is the variable cost share inferred from automaker financial statements (%);

C_{Ins} is the insurance cost (€);

C_{Fre} is the freight cost (€);

C_{Tar} is the tariff amount (€).

The tariff amount is calculated in equation (3).

$$C_{Tar} = (P_{CN} + C_{Ins} + C_{Fre}) \times q_{TT} \quad (3)$$

where,

q_{TT} is the total tariff rate, including 10% basic tariff and additional tariff (%).

In the high case, tariffs are assumed to be fully passed through to consumers. The projected price is determined by equation (4).

$$P_{ADA,high} = P_{EU} + (P_{CN} + C_{Ins} + C_{Fre}) \times q_{AT} \quad (4)$$

where,

$P_{ADA,high}$ is the projected price under the ADA high case (€);

q_{AT} is the additional tariff rate (%).

In the mid case, prices follow an intermediate adjustment path between the zero-profit floor and full pass-through ceiling. The projected price is shown in equation (5).

$$P_{ADA,mid} = \max\left(P_{EU}, \frac{P_{VC} + P_{ADA,high}}{2}\right) \quad (5)$$

where,

$P_{ADA,mid}$ is the projected price under ADA mid case (€).

ONS scenario. To parameterize the cost implications of production relocation, we draw on both industry estimates and observed cross-market price differentials. According to an investigation by United Bank of Switzerland (UBS), relocating BEV production from China to the EU is expected to increase production costs by 25%^{42,43}. Consistent with this assessment, we compare prices of 18 BEV models sold by domestic manufacturing in both the Chinese and EU markets, using the observed price discrepancies as a proxy for production cost variation^{19,20}. This comparison yields an average price difference of 20% (Supplementary Table S7), aligning closely with UBS's estimation.

Based on these benchmarks, we define three cases to reflect uncertainty around the magnitude of onshoring cost increases. In the mid case, onshoring raises production costs and hence prices to 120% of their Chinese market prices. The low and high cases assume price increases of 10% and 30%, respectively, capturing a plausible range of outcomes around the central estimate. We parameterize the resulting price change using observed cross-market price differentials as a proxy for production cost differences. The projected EU retail price under onshoring is given by equation (6).

$$P_{ONS,case} = P_{CN} \times (1 + \alpha_{case}) \quad (6)$$

where,

$P_{ONS,case}$ is the projected price under the ONS scenario (€);

α_{case} is the assumed production cost differential, set to 10%, 20%, and 30% for the low, mid, and high cases, respectively.

WIT scenario. Rather than representing a prediction of firm-level market exit, the WIT scenario is designed as a stress-test to examine how electrification outcomes would change if the availability of China-produced BEVs in the EU market is reduced under a more restrictive external environment. Given the heterogeneity in ownership structures, production networks, and strategic positioning across automakers, we also construct three cases to capture progressively more restrictive levels of market availability. In the low case, only purely domestic Chinese brands (e.g., BYD and GWM) are assumed to become unavailable in the EU market. In the mid case, withdrawal extends to brands that have been partially or fully acquired by Chinese firms (e.g., MG and Volvo). In the high case, market exit further encompasses foreign automakers whose BEVs are primarily manufactured in China for export to the EU, such as Tesla and BMW.

Total cost of ownership

The TCO is defined as the discounted lifetime costs incurred by a vehicle owner over the service life of the vehicle^{21,22}. In this study, TCO is estimated for both BEVs and PHEVs, capturing their respective cost structures over the ownership period. Typically,

TCO comprises depreciation, taxes, energy, insurance, and repair & maintenance costs. Depreciation reflects the loss of value over the operational lifetime. Taxes include one-off purchase taxes (e.g., value-added tax (VAT), registration and license fees) and recurring ownership-related taxes (e.g., road tax, inspection tax). Energy costs capture the cost of electricity consumption for BEVs, and the cost of both electricity and fuels for PHEVs. Insurance is compulsorily required and typically determined by vehicle retail price. Repair & maintenance cost represents the cost of repairing and replacing components over a vehicle's lifetime. The TCO calculation is shown in equation (7).

$$TCO = C_{DP} + C_{T0} + C_{IS} + C_{RM} + \sum_{t=0}^{LS} \frac{C_{Tt} + C_{EC}}{(1 + DR)^t} \quad (7)$$

where,

C_{DP} is the depreciation cost (€);

C_{T0} is the one-off purchase tax (€);

C_{IS} is the insurance cost (€);

C_{RM} is the repair & maintenance cost (€);

C_{Tt} is the annual recurring tax (€/yr);

C_{EC} is the annual energy cost (€/yr);

LS is the assumed vehicle lifespan (yr);

DR is the discount rate (%).

Depreciation cost is estimated as the difference between the purchase price and the end-of-life residual value, based on the AFLEET model⁴⁴. Taxes are calculated according to ACEA's Tax Guide, which provides country-specific vehicle taxation and incentive schemes across the EU^{45,46}. Insurance and repair & maintenance costs are estimated by referring to the Car Cost Index report by LeasePlan in 2018, which provides TCO estimations across EU countries with a detailed cost breakdown⁴⁷. The discount rate is determined by 5% under the baseline, based on the existing TCO assessment targeting Europe. See [Supplementary Table S14 – S16](#) for detailed information.

Energy cost is calculated based on vehicle use intensity and the energy consumption under the Worldwide Harmonized Light Vehicle Test Procedure (WLTP) cycle, which is the standard fuel and electricity consumption testing protocol in the EU. Electricity and fuel prices are distinguished by country and the charging location (household or public). The calculation is shown in equation (8).

$$C_{EC} = D \times \left(EC \times \frac{(p_{el,hh} \times \tau_{hh} + p_{el,pb} \times (1 - \tau_{hh}))}{\eta_{ch}} + FC \times p_{fuel} \right) \quad (8)$$

where,

D is the annual vehicle use intensity (km/yr);

EC is the electricity consumption rate under the WLTP cycle (kWh/km);

$p_{el,hh}$ is the household electricity price (€/kWh);

$p_{el,pb}$ is the public charging electricity price (€/kWh);

τ_{hh} is the share of household charging (%);

η_{ch} is the charging efficiency (%);

FC is the fuel consumption rate under WLTP cycle (L/km);

p_{fuel} is the fuel price (€/L).

The electricity and fuel consumption rate are sourced from an online database, and the fuel consumption for BEVs is set at zero⁴⁸. The vehicle use intensity is from carVertical⁴⁹ (Supplementary Table S17). The country- and year-specific electricity and fuel prices are sourced from the EU Commission⁵⁰ (Supplementary Table S18 – S19). The ratio of charging in households is assumed to be 80% following previous empirical studies⁵¹. The charging efficiency is assumed to be 90%⁵².

EV share projection

To translate tariff-induced changes TCO into market adoption dynamics, we employ the New Energy and Oil Consumption Credit (NEOCC) model, a transportation market dynamics quantification framework originally developed by Oak Ridge National Laboratory.

The NEOCC model integrates the discrete choice method with the genetic algorithm to quantify and project the market share of vehicle types, classes, and technologies under policy constraints, while accounting for the dynamics interactions among refueling infrastructure development, technological evolution and consumer preferences. In this study, we implement NEOCC as a three-level nested logit model, in which consumers choose sequentially across vehicle type, powertrain, and vehicle class. Within this framework, changes in TCO enter the utility function directly and are translated into changes in market share through the nested choice structure. In addition to TCO, we calibrate an “other cost” term to capture implicit and hard-to-quantify factors affecting vehicle choice. The calibration aims to minimize the discrepancy between simulated and observed market shares, and the resulting root mean square errors (RMSEs) are below 0.002 across all calibrated years.

In this study, the NEOCC model is adapted to the EU passenger vehicle market and calibrated using country-level sales data and TCO estimates for BEVs and PHEVs from 2019 to 2025. Based on the assumed automaker response scenarios from 2026 onward, the model is then used to simulate market dynamics through 2035 under multiple scenarios. Market structure and technology shares in 2023 – 2025 are used to initialize the baseline conditions. The projected EV shares therefore refer to new passenger vehicle market shares, rather than the full vehicle stock or all car acquisition channels in each country. Detailed model structure, calibrated sensitivity parameters, and projection inputs are provided in [Supplementary Note S4](#).

Data availability

The data generated in this study are provided in the Supplementary Information. Source data are provided with this paper.

Code availability

This paper does not report original code, which is available for academic purposes from

765 the lead contact upon reasonable request. Any additional information required to
766 reanalyze the data reported in this paper is available from the lead contact upon request.
767

References

- 1 Automotive Industry *European Commission* (2024). https://single-market-economy.ec.europa.eu/sectors/automotive-industry_en.
- 2 Economic and Market Report: state of the EU auto industry – Full-year 2020 *ACEA* (2021).
- 3 Global EV Outlook 2025 *IEA* (2025).
- 4 *Passenger vehicles sales in Europe* (Marklines, 2025); <https://www.marklines.com/>.
- 5 EU's Trade Defence. Where's next for EU's EV and battery trade policy *T&E* (2024).
- 6 Document 52023XC00160 *EU Commission* (2023). <https://eur-lex.europa.eu/eli/C/2023/160/oj>.
- 7 Fletcher, I. How EU Tariffs Will Impact the Battery Electric Vehicle Market *S&P Global* (2024).
- 8 Sebastian, G., Barkin, N. & Kratz, A. Ain't No Duty High Enough *Rhodium Group* (2024).
- 9 Weken, H., Bestebreurtje, E., Kerényi, L., Weken, P. & Csukas, M. Quick scan: New EU Import tariffs on BEV's produced in China *FIER Sustainable Mobility* (2024).
- 10 Sheldon, T. L. & Dua, R. A perspective on the evolving plug-in electric vehicle landscape amid trade tariffs and strategic responses. *Energy Research & Social Science* **127**, 104327 (2025).
- 11 Fedoseeva, S. & Zeidan, R. Tariff reduction on renewables inputs for European decarbonization. *Nat. Sustain.* **1**, 436-440 (2018).
- 12 Wang, M. *et al.* Breaking down barriers on PV trade will facilitate global carbon mitigation. *Nat. Commun.* **12**, 6820 (2021).
- 13 Liang, H. & You, F. Reshoring silicon photovoltaics manufacturing contributes to decarbonization and climate change mitigation. *Nat. Commun.* **14**, 1274 (2023).
- 14 Dehghanimadvar, M., Egan, R. & Chang, N. L. Quantifying the costs of diversifying silicon PV module assembly with local economic policies. *Joule* **8**, 1322-1349 (2024).
- 15 Feenstra, R. C. Symmetric Pass-Through of Tariffs and Exchange Rates Under Imperfect Competition: An Empirical Test. *J. Int. Econ.* **27**, 25-45 (1987).
- 16 Demetz, I. & Dobrzyniewski, M. Carmakers respond to EU tariffs on Chinese-made EVs *Reuters* (2024). <https://www.reuters.com/business/autos-transportation/carmakers-respond-eu-tariffs-chinese-made-evs-2024-07-03/>.
- 17 Papp, E. O., Sychev, A. & Maciag, M. Chinese EV makers' plans to make cars in Europe *Reuters* (2024). <https://www.reuters.com/business/autos-transportation/chinese-ev-makers-plans-make-cars-europe-2024-05-07/>.
- 18 Eddy, M. Chinese Automakers' Answer to E.U. Tariffs: Build in Europe *The New York Times* (2024). <https://www.nytimes.com/2024/09/19/business/china-automakers-eu-tariffs.html>.
- 19 *Electric Vehicle Database* (EV Database, 2025); <https://ev-database.org/>.
- 20 *Specific parameters for NEVs* (Autohome, 2025); www.autohome.com.cn.
- 21 Palmer, K., Tate, J. E., Wadud, Z. & Nellthorp, J. Total cost of ownership and market share for hybrid and electric vehicles in the UK, US and Japan. *Appl. Energy* **209**, 108-119 (2018).
- 22 Burnham, A. *et al.* Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains *Argonne National Laboratory* (2021).
- 23 He, X. *et al.* Greenhouse gas consequences of the China dual credit policy. *Nat. Commun.* **11**, 5212 (2020).
- 24 Ou, S., Lin, Z., He, X., Przesmitzki, S. & Bouchard, J. Modeling charging infrastructure impact on the electric vehicle market in China. *Transp. Res. Part D Transp. Environ.* **81** (2020).
- 25 Ou, S. *et al.* China's vehicle electrification impacts on sales, fuel use, and battery material demand through 2050: Optimizing consumer and industry decisions. *iScience* **24**, 103375

(2021).

26 Liu, M. *et al.* The potential for differentiated vehicle segment tariffs. *Nat. Energy* **10**, 1042-1044 (2025).

27 Germany's Scholz calls for Europe EV subsidy plan *AFP* (2024).
<https://www.france24.com/en/live-news/20241210-germany-s-scholz-calls-for-europe-ev-subsidy-plan>.

28 Nienaber, M. Scholz Says EU Is Preparing Bloc-Wide Incentive Plan for EVs *Bloomberg* (2025).
<https://www.bloomberg.com/news/articles/2025-01-21/scholz-says-eu-prepares-bloc-wide-purchase-premiums-for-evs>.

29 Randall, C. Bitterfeld-Wolfen is cancelling contract with Farasis *electrive* (2022).
<https://www.electrive.com/2022/05/04/bitterfeld-wolfen-is-cancelling-contract-with-farasis/>.

30 Liao, S. Chinese Battery Firms Reassess Overseas Factory Plans Due to Policy, Supply Chain Issues, Report Says *Yicai Global* (2024). <https://www.yicaiglobal.com/news/delayed-european-us-plans-make-chinese-battery-firms-eye-turkey-se-asia>.

31 Steitz, C. & Overstraeten, B. V. EU, China close to agreement over EV import tariffs, leading MEP says *Reuters* (2024). <https://www.reuters.com/business/autos-transportation/eu-china-close-agreement-over-ev-import-tariffs-leading-mep-says-2024-11-22/>.

32 Liboreiro, J. EU and China take new step to resolve row over subsidised electric vehicles *Euro News* (2026). <https://www.euronews.com/my-europe/2026/01/12/eu-and-china-take-new-step-to-resolve-row-over-subsidised-electric-vehicles>.

33 Mishra, A. Why Chinese EV Makers Are Leaving Europe *Swarajya* (2024).
<https://swarajyamag.com/infrastructure/why-chinese-ev-makers-are-leaving-europe>.

34 Kastner, J. China's SVOLT, like CATL, halts German growth plans as EV sales fall *Nikkei Asia* (2024). <https://asia.nikkei.com/Business/Automobiles/China-s-SVOLT-like-CATL-halts-German-growth-plans-as-EV-sales-fall>.

35 Chun, H. Y. & Park, T. J. How car and battery companies can work around US trade tariffs and rules. *Nature* **637**, 31-33 (2025).

36 Commission issues Guidance Document on submission of price undertaking offers for battery electric vehicles from China *Directorate-General for Trade and Economic Security* (2026).
https://policy.trade.ec.europa.eu/news/commission-issues-guidance-document-submission-price-undertaking-offers-battery-electric-vehicles-2026-01-12_en.

37 Held, M., Rosat, N., Georges, G., Pengg, H. & Boulouchos, K. Lifespans of passenger cars in Europe: empirical modelling of fleet turnover dynamics. *European Transport Research Review* **13**, 9 (2021).

38 Commission Implementing Regulation (EU) 2024/1866 *European Commission* (2024).

39 Directive 2007/46/EC *Council of EU* (2007). <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0046>.

40 *Vehicle price in Germany* (mobile.de, 2025); <https://www.mobile.de/>.

41 Cavallo, A., Gopinath, G., Neiman, B. & Tang, J. Tariff Pass-Through at the Border and at the Store: Evidence from US Trade Policy. *Amer. Econ. Rev.: Insights* **3**, 19-34 (2021).

42 UBS on its Teardown of BYD Seal *Bloomberg* (2023).
<https://www.bloomberg.com/news/videos/2023-09-19/ubs-on-its-teardown-of-byd-seal-video>.

43 Will Chinese electric vehicles (EVs) win globally? *UBS* (2023).

44 AFLEET tool *ANL* (2024). <https://afleet.esia.anl.gov/home/>.

856 45 ACEA Tax Guide 2022 *ACEA* (2022).

857 46 Electric cars: Tax benefits and incentives 2024 *ACEA* (2024).

858 47 Car Cost Index *LeasePlan* (2018).

859 48 *Car Specification Database* (ultimateSPECS, 2025); <https://ultimatespecs.com/>.

860 49 Bareckas, K. Research: In which countries do people drive the most kilometers per year?

861 *carVertical* (2024).

862 50 Dashboard for energy prices in the EU and main trading partners 2023 *European Commission*

863 (2023). [https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-](https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-europe/dashboard-energy-prices-eu-and-main-trading-partners-2023_en)

864 [europe/dashboard-energy-prices-eu-and-main-trading-partners-2023_en](https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-europe/dashboard-energy-prices-eu-and-main-trading-partners-2023_en).

865 51 Global EV Outlook 2024 *IEA* (2024).

866 52 How Efficient Is Each Type Of EV Charger? *InsideEVs* (2024).

867 <https://insideevs.com/features/711659/ev-charger-efficiency-losses/>.

868

869