BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

Electric vehicle adoption and shrinking China's oil footprint

by Lorenzo Bencivelli, Alessandro D'Orazio, Simone Emiliozzi and Andrea Gazzani

November 2026

Number 1080

BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

Electric vehicle adoption and shrinking China's oil footprint

by Lorenzo Bencivelli, Alessandro D'Orazio, Simone Emiliozzi and Andrea Gazzani

Number 1080 – November 2026

The series Occasional Papers *presents studies and documents on issues pertaining to the institutional tasks of Banca d'Italia and the Eurosystem. The* Occasional Papers *appear alongside the* Working Papers *series which are specifically aimed at providing original contributions to economic research.*

The Occasional Papers *include studies conducted within Banca d'Italia, sometimes in cooperation with the Eurosystem or other institutions. The views expressed in the studies are those of the authors and do not involve the responsibility of the institutions to which they belong.*

The series is available online at www.bancaditalia.it .

ISSN 1972-6643 (online)

Designed by the Printing and Publishing Division of Banca d'Italia

ELECTRIC VEHICLE ADOPTION AND SHRINKING CHINA'S OIL FOOTPRINT

by Lorenzo Bencivelli*, Alessandro D'Orazio*, Simone Emiliozzi* and Andrea Gazzani*

Abstract

We quantify the gasoline-demand displacement associated with observed electric vehicle (EV) adoption in China and examine how alternative adoption paths could shape future consumption. Using a transparent fleet-accounting model disciplined by public annual data on vehicle sales, stocks and fuel use, we isolate the fleet-composition channel linking passenger-car electrification to gasoline demand. Relative to a counterfactual without EV adoption, the model implies gasoline displacement of about 0.46 million barrels per day in 2025, equivalent to roughly 14 per cent of observed Chinese gasoline consumption. Under a fast-EV-adoption trajectory, gasoline demand begins to persistently decline in 2027; by 2040, annual savings reach approximately 1.45 million barrels per day relative to a constant-EV-adoption baseline. We provide policy-relevant evidence of an emerging structural shift in transport fuel demand in a central country for the global oil market, with implications for global oil balances, transport policy and CO_2 emissions.

JEL Classification: Q41, Q54, O13, L62.

Keywords: China, electric vehicles, oil demand, gasoline consumption, energy transition, CO_2 emissions.

DOI: 10.32057/0.QEF.2026.1080

* Banca d'Italia (Bank of Italy), Directorate General for Economics, Statistics and Research. Email: lorenzo.bencivelli@bancaditalia.it; alessandro.dorazio@bancaditalia.it; simone.emiliozzi@bancaditalia.it; andrea.gazzani@bancaditalia.it. We thank Alessandro Borin, Riccardo Cristadoro, Fabrizio Ferriani, Alicia Garcia-Herrero, Théo Storella, Marco Taboga, Giovanni Veronese and participants in the "China-Network" Bruegel seminar for helpful comments. The views expressed are those of the authors and do not necessarily reflect those of the Bank of Italy.

1 Introduction

China lies at the intersection of two transformations with potentially large consequences for global energy markets. Over the past decade, it accounted for more than half of the increase in global crude-oil consumption and almost three quarters of the increase in refined-product demand (Energy Institute, 2026) (Figure 1). At the same time, China has become the world's largest market for electric vehicles (EVs). These trends are now beginning to cross: Chinese gasoline consumption peaked in 2024 and declined in 2025, while diesel and petroleum products associated with aviation, industry and petrochemicals remained more resilient. The emerging shift is therefore compositional rather than a general contraction in Chinese oil use: gasoline is weakening even as other sources of petroleum demand continue to expand (Energy Institute, 2026; International Energy Agency, 2025c,b, 2026a) (Figure 2).

Passenger-car electrification is a natural candidate for explaining part of this weakening. The EV share of new passenger-car sales in China rose from around 1 per cent in 2015 to more than one half in 2025, while EVs still represented only around 14 per cent of the circulating fleet. This sales–stock gap is central to our analysis. A higher EV share immediately reduces the inflow of new internal-combustion-engine (ICE) vehicles, but gasoline demand depends on the much larger inherited stock already on the road. Electrification therefore affects aggregate fuel use gradually, as successive EV cohorts accumulate and older ICE vehicles are retired. We quantify this fleet-composition channel historically and examine how alternative EV-adoption paths could shape future gasoline demand.

Our analysis relates to the literature on directed technical change and path dependence. Innovation responds to relative prices and policy, while accumulated knowledge can give incumbent technologies a persistent advantage and slow the transition towards cleaner alternatives (Acemoglu et al., 2012, 2016). The automobile industry provides a particularly relevant application: Aghion et al. (2016) show that fuel prices can redirect innovation towards cleaner technologies, while firms' existing capabilities and knowledge spillovers generate substantial path dependence. Recent work further highlights the role of industrial policy and supply-chain complementarities in accelerating clean innovation (Aghion et al., 2025; Barwick et al., 2026). China's rapid shift towards electric mobility provides a large-scale example of such a transition (Hao et al., 2014; Bencivelli et al., 2026).[1]

A related literature studies the determinants of EV adoption and its consequences

[1] China's EV expansion has been supported by policies operating on both the demand and supply sides, including purchase incentives and preferential registration, public support for innovation and production, and policies favouring the development of domestic automotive and battery supply chains (DiPippo et al., 2022; Bickenbach et al., 2024; García-Herrero and Schindowski, 2024; Ezell, 2024).

for energy use. Vehicle choice depends on purchase and operating costs, energy prices, charging access, driving patterns and consumer heterogeneity (Bushnell et al., 2022; Rapson and Muehlegger, 2023; Cole et al., 2023; Fang et al., 2026), while realised fuel and emissions savings can vary with driving and charging behaviour (Gessner et al., 2025). At the aggregate level, widespread electrification can materially reduce oil demand and reshape energy trade and automotive supply chains (Cherif et al., 2021; Wingender et al., 2024). In China, this transition is occurring while vehicle ownership continues to rise, so rapid electrification can coexist with further expansion of the passenger-car stock (Linn and Shen, 2024).

Our exercise complements this literature by conditioning on an observed or assumed EV-adoption path and quantifying its implications for aggregate gasoline demand. We do not model the determinants of innovation, charging investment or household powertrain choice. Instead, a parsimonious annual fleet-accounting framework maps the composition of new sales into the stocks of EV and ICE passenger cars and, through the ICE stock, into gasoline consumption. This separation provides a transparent benchmark for answering a distinct question: conditional on an EV-adoption path, how much and how quickly does passenger-car electrification displace gasoline demand?

We apply the framework in two exercises. First, we compare the observed 2015–2025 adoption path with a counterfactual in which EV adoption is shut down while total passenger-car sales and gasoline use per ICE vehicle remain at their observed values. Second, we project gasoline demand through 2040 under slow, medium and fast EV-adoption paths and compare them with a baseline that keeps the EV share of new sales fixed at its 2025 level.[2]

The fleet-composition channel is already quantitatively important: in 2025, the historical counterfactual implies gasoline displacement of about 0.46 million barrels per day, equivalent to roughly 14 per cent of observed Chinese gasoline consumption. In the projection exercise, gasoline demand begins to persistently decline in 2027 under the fast and medium adoption paths and around 2028 under the slow path; by 2040, annual savings relative to constant adoption reach approximately 1.2–1.45 mb/d. These results suggest that passenger-car gasoline demand can peak while China's vehicle stock is still expanding. They should not, however, be interpreted as implying an equally early peak in total oil demand, which also depends on freight, aviation and petrochemical uses.

Section 2 documents the motivating oil-market and EV-adoption facts; Sections 3–4

[2]The resulting differences are conditional measures of gasoline displacement through fleet composition, rather than comprehensive causal effects of electrification: the analysis does not endogenise fuel and vehicle prices, driving intensity, total vehicle demand or the policies and infrastructure that determine EV adoption.

present the data and framework; Section 5 reports the historical and projection exercises; and Section 6 discusses the policy implications.

2 China's changing oil demand and the rise of electric mobility

This section documents the two empirical facts underlying the analysis: the recent weakening of gasoline demand relative to other petroleum products, and the much faster penetration of EVs in new sales than in the circulating passenger-car fleet.

2.1 China in global oil markets: from broad-based growth to weaker gasoline demand

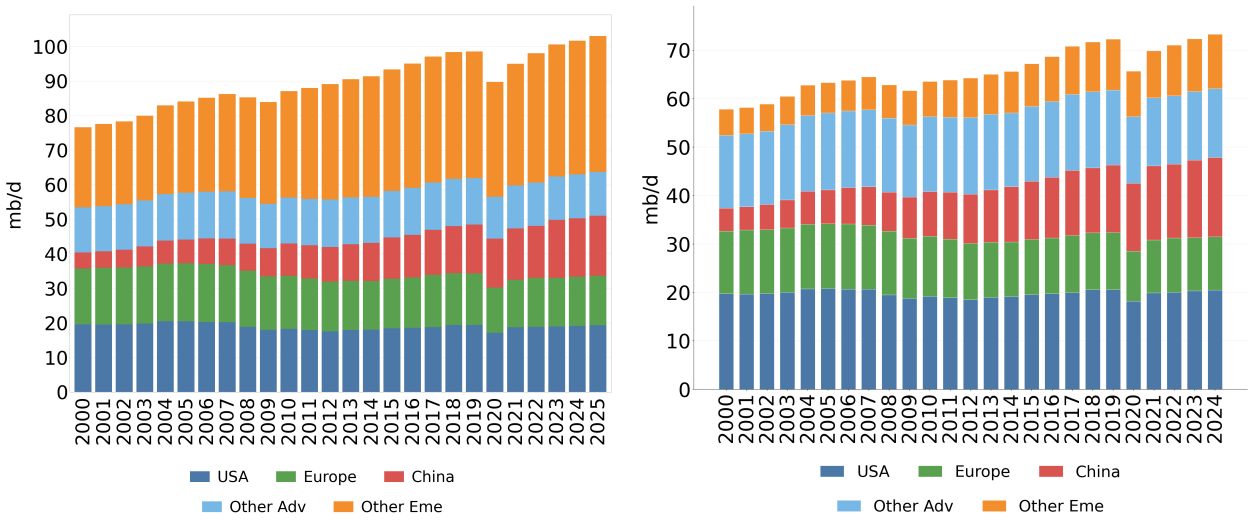
Global oil consumption rose from about 93 million barrels per day (mb/d) in 2015 to around 103 mb/d in 2025, while Chinese consumption increased from approximately 12 to 17.5 mb/d. Over 2015–2024, the latest period for which a complete international comparison is available, global refined-product consumption increased from about 67 to 73 mb/d and Chinese consumption from 11.3 to 15.5 mb/d. China therefore accounted for more than half of the net increase in global oil consumption and roughly three quarters of the increase in refined-product demand (Figure 1; Appendix Figure A.1).

The composition of Chinese refined-product demand has also changed substantially. Gasoline and diesel accounted for around half of consumption during much of the sample, while aviation, industrial and petrochemical products followed different trajectories. Motor-gasoline demand expanded particularly strongly, rising from less than 1 mb/d in 2000 to around 3.4 mb/d in 2025, a larger increase than in any other major region (Figure 2).

The divergence has become particularly visible since 2023. Chinese oil consumption increased by only 0.57 mb/d between 2023 and 2025, after rising by 4.90 mb/d over 2015–2023. More importantly for our analysis, gasoline consumption peaked at 3.55 mb/d in 2024 and declined to 3.42 mb/d in 2025, slightly below its 2023 level. Other products remained more resilient: diesel consumption rose from 3.51 to 3.82 mb/d between 2023 and 2025, while LPG and several products associated partly with petrochemical activity continued to expand (Table 1).

These patterns motivate our focus on gasoline rather than aggregate oil demand. Passenger cars in China are overwhelmingly gasoline-powered, whereas diesel consumption

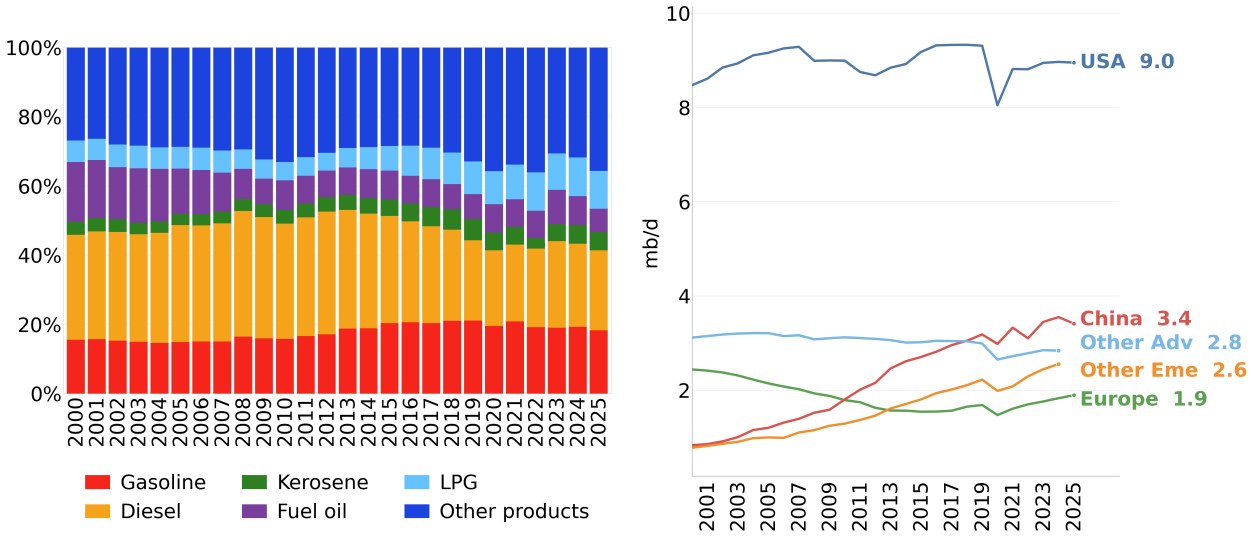
FIGURE 1: *Global crude-oil and refined-product consumption*



(A) *Crude-oil consumption by region* **(B)** *Refined-product consumption by region*

Notes: Refined-product data extend through 2024, while crude-oil data extend through 2025. Other advanced includes Australia, Canada, Hong Kong, Iceland, Israel, Japan, South Korea, Macao SAR, New Zealand, Norway, Puerto Rico, Singapore, Switzerland, Taiwan and the United Kingdom. Other emerging includes Bangladesh, Bhutan, Brunei, Cambodia, Fiji, India, Indonesia, Laos, Malaysia, Maldives, Micronesia, Mongolia, Myanmar, Nauru, Nepal, Papua New Guinea, the Philippines, Samoa, the Solomon Islands, Sri Lanka, Thailand, Tonga and Vietnam. *Source:* Authors' elaborations on Energy Institute data.

FIGURE 2: *China's changing refined-product demand*



(A) *Composition of refined-product consumption in China* **(B)** *Motor-gasoline consumption by region*

Notes: Panel (a) reports China's total refined-product consumption and its main product components, expressed as shares of the total. In Panel (b), the series extend to 2025 only where JODI provides complete and comparable country coverage; Other Advanced and Other Emerging end in 2024. *Source:* Authors' calculations based on CEIC, EIA and JODI data.

Table 1: Crude-oil and refined-product consumption in China: detailed product series

	2025	2024	2023	2015	Average annual growth	
	(mb/d)	(mb/d)	(mb/d)	(mb/d)	2015–23	2023–25
Crude oil	17.36	16.90	16.79	11.89	4.4%	1.7%
Refined petroleum products	16.64	16.37	15.98	11.96	3.7%	2.0%
Gasoline	3.42	3.55	3.45	2.71	3.1%	-0.5%
Diesel	3.82	3.71	3.51	3.54	-0.1%	4.3%
Fuel oil	0.81	0.80	1.02	0.53	8.4%	-10.6%
LPG	2.77	2.50	2.35	1.24	8.3%	8.6%
Other petroleum products	5.02	4.97	4.88	3.36	4.8%	1.4%

Notes: Consumption is expressed in million barrels per day. The last two columns report average annual growth rates over 2015–23 and 2023–25. Other petroleum products include naphtha, petroleum coke, bitumen and other non-specified petroleum products. The aggregate refined-product series in this detailed China-only table follows source-specific product coverage and is not mechanically identical to the harmonised cross-country series underlying Figure 1. *Source:* Authors' elaborations based on Energy Institute, EIA and JODI data.

is concentrated mainly in freight, commercial transport and other non-passenger uses (International Energy Agency, 2025c, 2026a). We therefore ask how much of the recent and prospective evolution of gasoline demand can be accounted for by changes in passenger-fleet composition, conditional on the other determinants of fuel use specified below.

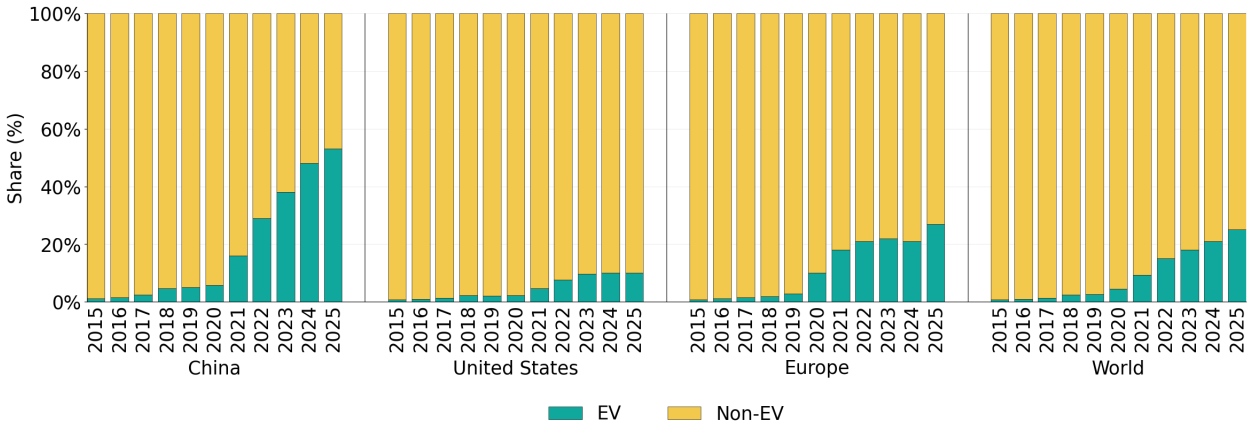
2.2 EV diffusion: rapid sales penetration and gradual fleet turnover

Passenger-car electrification has proceeded particularly rapidly in China. The EV share of new passenger-car sales rose from around 1 per cent in 2015 to more than one half in 2025, compared with around 27 per cent in Europe, 10 per cent in the United States and 25 per cent globally (Figure 3).

China's rapid adoption occurred alongside substantial policy support and expanding domestic supply. Purchase-tax exemptions, trade-in programmes and preferential registration rules supported demand, while domestic vehicle manufacturing and an integrated battery supply chain expanded supply (Hao et al., 2014; International Energy Agency, 2026b). These determinants are not modelled explicitly: the quantitative exercise takes the observed or assumed EV-adoption path as given.

Rapid sales penetration has produced the world's largest EV stock, but the transformation of the circulating fleet remains much slower. China's share of the global EV stock rose from less than one quarter in 2015 to close to 60 per cent in 2025 (Appendix Figure A.4). By the end of 2025, around 44 million electric passenger cars were circulating in China,

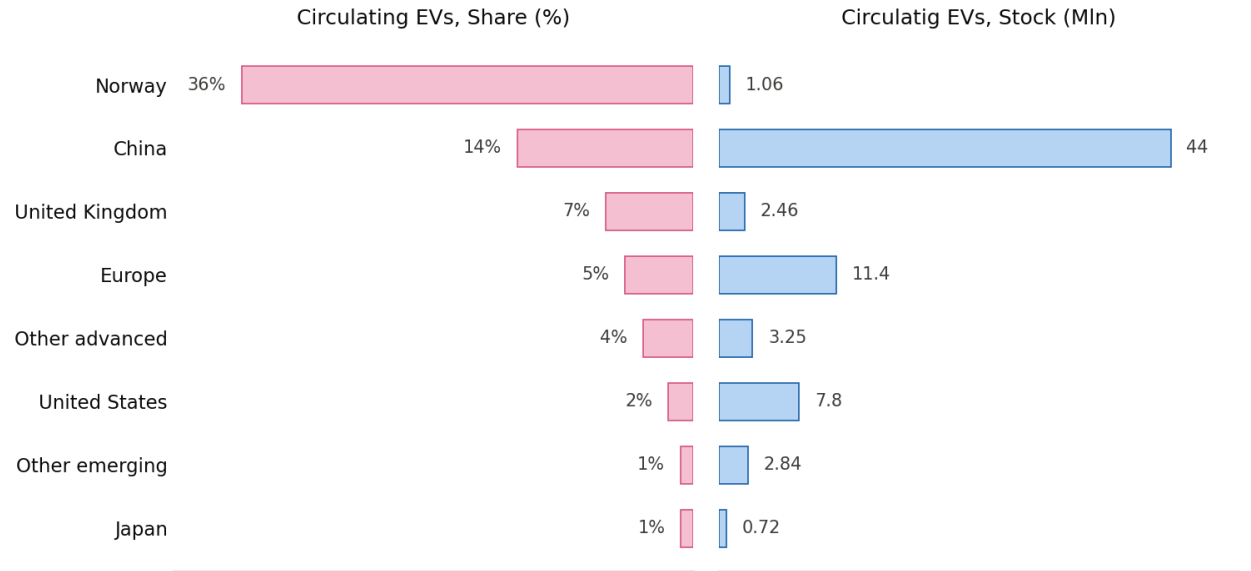
FIGURE 3: *Electric vehicles as a share of passenger-vehicle sales*



Notes: Electric vehicles include battery-electric and plug-in hybrid vehicles. Non-EVs include conventional internal-combustion-engine vehicles and non-plug-in hybrids. *Source:* Authors' calculations based on IEA data.

compared with approximately 11.4 million in Europe and 7.8 million in the United States. Yet EVs still represented only around 14 per cent of China's passenger-car fleet, far below their share of new sales. Norway retains a substantially higher EV fleet share, but China's absolute EV stock is by far the world's largest (Figure 4) and accounted for around 60% of the global EV fleet in 2025 (Figure A.4).

FIGURE 4: *Electric vehicles in the circulating passenger-vehicle fleet*



Notes: The left panel reports electric vehicles as a share of the circulating passenger-vehicle fleet. The right panel reports the corresponding number of electric vehicles, in millions. *Source:* Authors' calculations based on IEA and national data.

The large gap between EV penetration in new sales and in the circulating fleet provides

the empirical basis for the stock-flow mechanism formalised in Section 4.

3 Data for the empirical exercise

Our quantitative exercise uses annual data on China's passenger-car market and gasoline consumption over 2015–2025. Vehicle sales and stocks by powertrain are drawn from CEIC and the International Energy Agency's *Global EV Outlook 2026* (International Energy Agency, 2026b), while aggregate motor-gasoline consumption is taken from the Energy Institute's *Statistical Review of World Energy 2026* (Energy Institute, 2026). Vehicle stocks and sales are expressed in millions of vehicles and gasoline consumption in million barrels per day (mb/d). The historical sample begins in 2015, when EV penetration was still negligible[3], and ends in 2025; the projection exercise starts in 2026 and ends in 2040.[4]

Following the IEA classification, we define EVs as battery-electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs) and fuel-cell electric vehicles (FCEVs). Conventional combustion-engine vehicles and non-plug-in hybrids (HEVs) are classified as ICE vehicles (Table 2). We focus on gasoline because diesel passenger cars represent only a negligible share of China's passenger-car market; diesel consumption is concentrated primarily in freight, commercial transport, and other non-passenger uses.

3.1 Construction of model inputs

The historical exercise uses three main inputs: observed total new passenger-car sales, $NewVehicles_t$; the EV share of new sales, f_t; and the initial ICE and EV stocks, K^{ICE}_{2015} and K^{EV}_{2015}. The corresponding sales-to-stock ratio, $s_t = NewVehicles_t / V_{t-1}$, is therefore observed over the historical sample and becomes a calibration input over the projection horizon 2026-2040.

Vehicle-retirement rates are chosen jointly with the projected sales-to-stock ratio to reproduce a plausible long-run evolution of China's passenger-car fleet. Micro-level evidence on UK vehicle longevity from Nguyen-Tien et al. (2025) provides an external benchmark for the relative durability of EV and ICE vehicles; Appendix Table B.1 reports variable definitions and sources, while Appendix B provides the full calibration.

To map the ICE stock into gasoline demand, we construct

[3]We changed the initial year to 2014 and 2013 and the results are robust to the choice of the initial year.

[4]The broader oil and refined-product series used for the descriptive evidence in Section 2 draw additionally on EIA and JODI data; they do not enter the fleet-accounting exercise.

Table 2: Classification of Vehicle Types

Category	Vehicle Type	Description
Internal Combustion Engine (ICE)	Conventional petrol/diesel cars	Vehicles powered solely by fossil fuels. No electric motor or battery system.
	Non plug-in hybrids (HEV)	Use both combustion engine and electric motor but cannot be charged from the grid. Fuel still primary source.
Electric Vehicles (EV)	Battery Electric Vehicles (BEV)	Fully electric vehicles powered only by batteries.
	Plug-in Hybrid Electric Vehicles (PHEV)	Have both an electric motor and internal combustion engine; can be recharged from the grid.
	Fuel Cell Electric Vehicles (FCEV)	Use hydrogen fuel cells to generate electricity on board. Very small market share.

Source: IEA.
Note: We define electric vehicles (EVs) as battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel-cell electric vehicles (FCEVs). ICE vehicles include non-plug-in hybrids (HEVs) vehicles since they use mainly gasoline.

$$\theta_t \equiv \frac{Gasoline_t}{K_t^{ICE}},$$

where $Gasoline_t$ is aggregate Chinese motor-gasoline consumption and K_t^{ICE} the observed stock of ICE passenger cars. Given the units of the underlying series, θ_t measures average daily gasoline use per circulating ICE vehicle in year t. It is a reduced-form gasoline-intensity measure rather than a technological efficiency parameter, incorporating both vehicle efficiency and average usage.

For the emissions counterparts reported below, gasoline savings are converted into avoided direct combustion emissions as

$$\Delta \mathrm{CO}_{2,t} = \Delta Gasoline_t \times 10^6 \times 365 \times \phi, \tag{1}$$

where $\phi = 0.373$ metric tonnes of CO_2 per barrel of gasoline, derived from the US Environmental Protection Agency's emission factor of 8.89 kg of CO_2 per gallon. These estimates refer to direct gasoline combustion and should not be interpreted as lifecycle

emission reductions.[5]

4 Fleet-accounting model and counterfactuals

Taking EV adoption as given, we map new passenger-car sales into the circulating stocks of ICE and EV vehicles using a parsimonious annual stock-flow model. Let K_t^{ICE} and K_t^{EV} denote the corresponding stocks in year t, with

$$V_t = K_t^{ICE} + K_t^{EV}$$

denoting the total passenger-car stock. Total new passenger-car sales are $NewVehicles_t$, f_t is the EV share of new sales, and δ^{ICE} and δ^{EV} are annual vehicle-retirement rates. The two stocks evolve according to

$$K_t^{ICE} = (1 - \delta^{ICE})K_{t-1}^{ICE} + (1 - f_t)NewVehicles_t, \tag{2}$$

$$K_t^{EV} = (1 - \delta^{EV})K_{t-1}^{EV} + f_t NewVehicles_t. \tag{3}$$

These equations translate the sales–stock gap documented in Section 2.2 into the evolution of fleet composition. Appendix B reports the equivalent inflow–outflow representation, retirement-rate calibration and model fit.

Aggregate gasoline consumption is given by

$$Gasoline_t = \theta_t K_t^{ICE}, \tag{4}$$

where θ_t is the gasoline-intensity measure defined in Subsection 3.1.[6] It follows its observed path over 2015–2025 and is held fixed at its 2025 value over the projection horizon, so that differences across future scenarios isolate changes in fleet composition.

Historical counterfactual. For 2015–2025, we construct a "no EV adoption" counterfactual by setting the EV share of new passenger-car sales to zero while keeping total vehicle

[5]They exclude upstream emissions from crude-oil extraction, refining and fuel transport, as well as emissions associated with electricity generation, vehicle production and battery supply chains.

[6]PHEVs are included in our EV category although they may still consume gasoline. We do not model PHEV gasoline use separately because consistent data on their gasoline consumption and electric-driving share are not available for China over our sample period; doing so would therefore require an additional ad hoc calibration, hence we retain the parsimonious two-powertrain specification.

sales and gasoline use per ICE vehicle at their observed values. Historical gasoline displacement is measured relative to realised gasoline consumption. The model's in-sample fit and the formal construction of the counterfactual are reported in Appendix B.

Projection scenarios. For 2026–2040 we compare model-generated gasoline paths under slow, medium and fast EV-adoption scenarios with a constant-adoption baseline that holds the EV share of new sales at its 2025 level (53% in 2025). All scenarios share the same assumptions for total passenger-car sales, vehicle retirement and gasoline intensity, and differ only in the EV-adoption path. The complete scenario definitions and calibration are reported in Appendix B.

In both exercises, the resulting differences should be interpreted as conditional measures of gasoline displacement through fleet composition rather than as comprehensive causal effects of transport electrification of passenger-cars in China.

5 Results

We first quantify historical gasoline displacement over 2015–2025 and then examine gasoline demand under alternative EV-adoption scenarios through 2040.

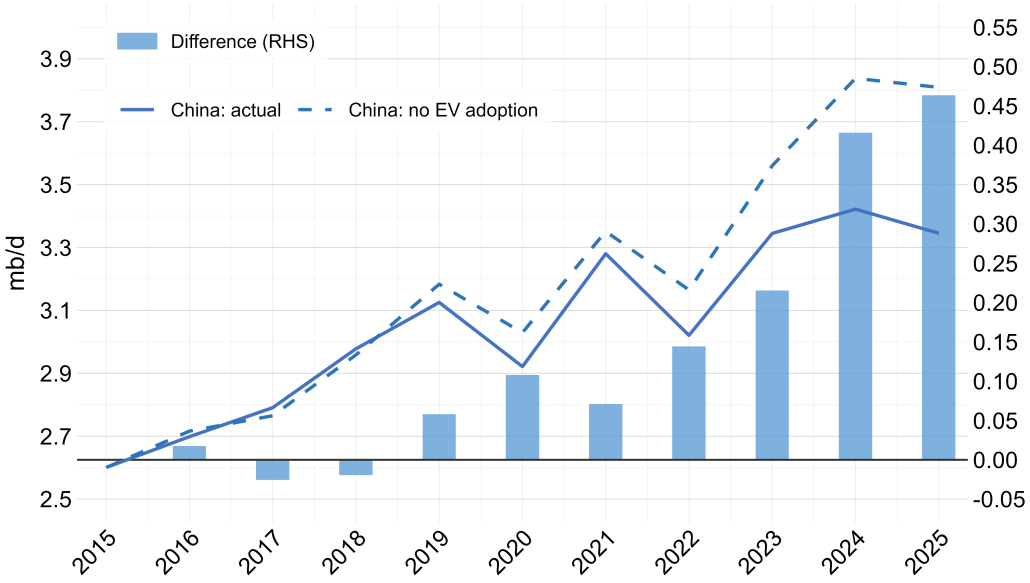
5.1 Historical gasoline displacement, 2015–2025

The historical exercise quantifies the fleet-composition component of the recent weakening in Chinese gasoline demand documented in Section 2.1 (Table 1 and Figure 2). The gasoline displacement associated with EV adoption was initially small but increased rapidly over the second half of the sample. By 2020, the no-EV counterfactual exceeds observed gasoline consumption by approximately 0.1 million barrels per day (mb/d). The gap widens to about 0.43 mb/d in 2024 and 0.46 mb/d in 2025, equivalent to roughly 14% of observed Chinese gasoline consumption in 2025 (Figure 5).

The emissions counterpart is also sizeable, although it captures direct gasoline combustion only. Using the conversion described in Section 3.1, the 2025 gasoline displacement corresponds to approximately 62 million tonnes of avoided direct-combustion CO_2 emissions, about 0.5% of China's territorial emissions from fossil fuels and industrial processes in 2024.[7]

[7] Friedlingstein et al. (2026) estimate China's territorial CO_2 emissions from fossil fuels and industrial processes in 2024 at approximately 12.3 billion tonnes.

FIGURE 5: *China's gasoline consumption: actual vs. counterfactual without EV adoption, 2015–2025*



Source: Authors' calculations based on CEIC, IEA and the Energy Institute.
Notes: The solid line reports observed gasoline consumption and the dashed line the model-implied "no EV adoption" counterfactual, in which the EV share of new passenger-car sales is set to zero over 2015–2025. The bars report the difference between counterfactual and observed gasoline consumption. Gasoline consumption and displacement are expressed in million barrels per day.

5.2 EV-adoption scenarios: 2026–2040 projections

The scenarios isolate the consequences of different speeds of continued EV adoption. We next project gasoline consumption over 2026–2040 under three alternative EV adoption paths—*slow*, *medium*, and *fast*—and compare them to a *constant-adoption* baseline that fixes the EV share of new passenger-car sales at its 2025 level (53% in 2025).

All scenarios use the same assumptions for total passenger-car sales, vehicle retirement and gasoline consumption per ICE vehicle. Differences across scenarios reflect only the pace at which EVs replace ICE vehicles in the circulating fleet. Further, for each projection, total passenger-car stock is calibrated to reach roughly 520 million vehicles by 2040, in line with external forecasts (International Energy Agency, 2025a; BloombergNEF, 2025; Oxford Institute for Energy Studies, 2025).[8] Appendix B details the calibration.

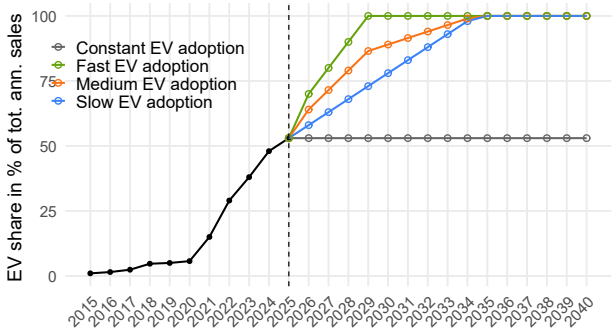
By 2030, EVs account for approximately 75% of new sales under the slow scenario, 87% under the medium scenario and 100% under the fast scenario (Panel (a) of Figure 6).

[8]A fleet of about 520 million passenger cars by 2040 implies roughly one car for every 2.6 Chinese residents. This reflects moderate convergence in car ownership from today's lower levels (about one car per five people) combined with UN population projections for China showing a decline (from about 1.42 billion in 2024 to around 1.34 billion by 2040), in line with projections by IEA, BloombergNEF and the Oxford Institute for Energy Studies.

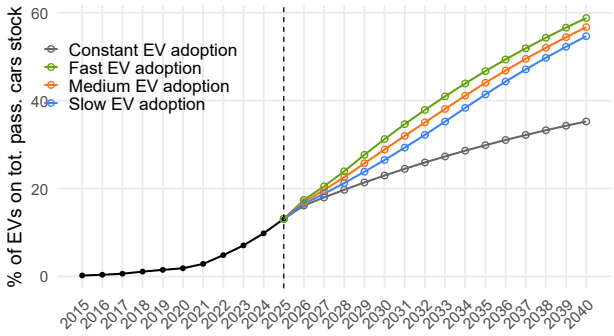
Differences in EV sales penetration translate only gradually into the circulating fleet. By 2040, EVs account for approximately 52% of passenger cars under slow adoption, 55% under medium adoption and 58% under fast adoption, compared with about one third under the constant-adoption baseline (Figure 6, panel b). EVs become the majority of the circulating fleet only in the late 2030s: around 2037 under fast adoption, 2038 under medium adoption and 2039 under slow adoption. ICE vehicles remain predominant through 2040 under the EVs constant-adoption baseline (Panel (b) of Figure 6; Appendix Figure B.3).

FIGURE 6: *EV adoption scenarios and implications for China's gasoline demand, 2026–2040*

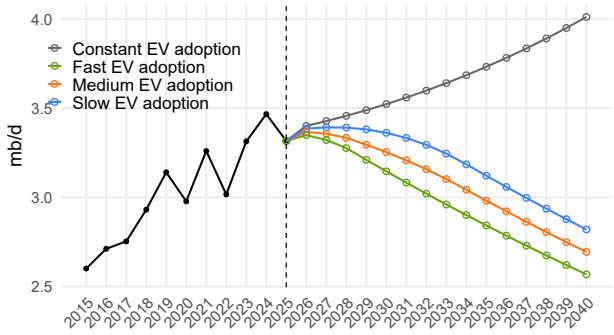
(a) EV share in new passenger-car sales (%)



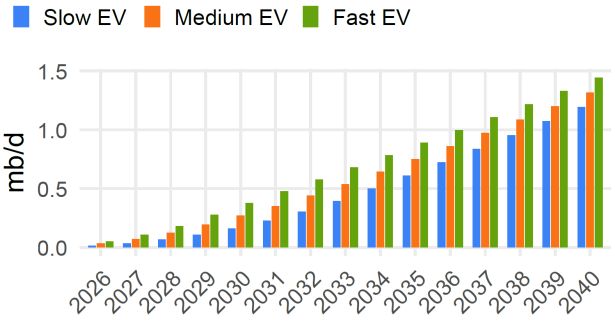
(b) EV share in the circulating passenger-car stock (%)



(c) Gasoline consumption under scenarios and baseline (mb/d)



(d) Annual gasoline savings relative to baseline (mb/d)



Source: Authors' calculations based on CEIC, IEA and the Energy Institute.
Notes: Historical data are reported with solid black lines and markers. The constant-adoption baseline holds the EV share of new passenger-car sales fixed at its observed 2025 level. The slow, medium and fast scenarios assume progressively faster EV penetration. All scenarios use the same paths for total passenger-car sales, vehicle retirement and gasoline consumption per ICE vehicle. Panel (d) reports gasoline savings relative to the constant-adoption baseline.

Continued growth in the passenger-car fleet initially offsets the effect of further electrification, producing a modest rebound in gasoline consumption in 2026. Demand then begins to persistently decline in 2027 under the fast and medium scenarios and around

2028 under the slow scenario, while it continues to rise throughout the projection horizon under constant adoption (Figure 6, panel c).[9]

By 2040, gasoline consumption falls to approximately 2.8 mb/d under slow adoption, 2.7 mb/d under medium adoption and 2.6 mb/d under fast adoption, compared with about 4.0 mb/d under constant adoption. The corresponding annual gasoline savings range from roughly 1.2 to 1.45 mb/d (Figure 6, panels c–d).

These gasoline savings correspond to approximately 162–196 million tonnes of avoided direct-combustion CO_2 emissions in 2040, equivalent to 1.3–1.6% of China's 2024 territorial emissions from fossil fuels and industrial processes (Friedlingstein et al., 2026).

6 Conclusions and policy implications

China's rapid transition towards electric mobility is already altering passenger-transport fuel demand. Our historical counterfactual implies that gasoline consumption in 2025 was about 0.46 million barrels per day lower than in a counterfactual without EV adoption, equivalent to roughly 14 per cent of observed gasoline consumption. Looking ahead, the projection scenarios imply annual gasoline savings of about 1.2–1.45 mb/d by 2040 relative to constant EV adoption, with faster adoption bringing forward the decline in gasoline demand. The corresponding annual direct-combustion emissions savings could potentially reach approximately 162–196 million tonnes of CO_2 per year in 2040.

The first policy implication is that the pace of electrification should not be inferred from new-sales shares alone. EV penetration can rise rapidly in current sales while gasoline demand adjusts more slowly because it depends on the composition of the much larger circulating vehicle stock. Vehicle longevity and fleet renewal therefore determine how quickly changes in new-sales composition translate into lower fuel demand.

The second implication is that an early peak in passenger-car gasoline demand need not imply an equally early peak in China's total oil demand. Freight transport, aviation, petrochemical feedstocks and other petroleum uses follow different trajectories and are less directly affected by passenger-car electrification. The decline in gasoline demand identified here should therefore be interpreted as one component of a broader rebalancing in China's oil consumption rather than as a forecast of aggregate peak oil.[10]

[9] The annual growth rates corresponding to these trajectories are reported in Appendix Figure B.2.

[10] While passenger-car electrification lowers oil and gasoline use, it does not by itself imply economy-wide decarbonisation in China, where the overall electricity mix remains heavily coal-based (Energy Institute, 2026).

Given China's weight in global energy markets, however, sustained weakness in passenger-transport fuel demand could remove an important source of future oil-demand growth: if lower transport-related oil demand becomes persistent and anticipated, it may also affect upstream investment and hence future oil supply, a mechanism outside the present framework (Kellogg, 2026).

References

Acemoglu, D., Aghion, P., Bursztyn, L., and Hémous, D. (2012). The environment and directed technical change. *American Economic Review*, 102(1):131–166.

Acemoglu, D., Akcigit, U., Hanley, D., and Kerr, W. R. (2016). Transition to clean technology. *Journal of Political Economy*, 124(1):52–104.

Aghion, P., Barrage, L., Donald, E., Hémous, D., and Liu, E. (2025). Transition to green technology along the supply chain. NBER Working Paper 33934, National Bureau of Economic Research.

Aghion, P., Dechezleprêtre, A., Hémous, D., Martin, R., and Van Reenen, J. (2016). Carbon taxes, path dependency, and directed technical change: Evidence from the auto industry. *Journal of Political Economy*, 124(1):1–51.

Barwick, P. J., Kwon, H.-S., Li, S., Wang, Y., and Zahur, N. B. (2026). Industrial policies and innovation: Evidence from the global automobile industry. *International Journal of Industrial Organization*, 104:103230.

Bencivelli, L., Ciarlone, A., Cocozza, E., Gerali, A., Perin, A., and Porello, C. (2026). The global automotive sector after the pandemic: Key questions and answers. Questioni di Economia e Finanza (Occasional Papers) 1030, Bank of Italy.

Bickenbach, F., Dohse, D., Langhammer, R. J., and Liu, W. H. (2024). Foul play? on the scale and scope of industrial subsidies in China. Technical Report 173, Kiel Institute for the World Economy.

BloombergNEF (2025). Electric vehicle outlook 2025. BloombergNEF Report.

Bushnell, J., Muehlegger, E., and Rapson, D. (2022). Energy prices and Electric Vehicle adoption. Working Paper 29842, National Bureau of Economic Research.

Cherif, R., Hasanov, F., and Pande, A. (2021). Riding the energy transition: Oil beyond 2040. *Asian Economic Policy Review*, 16(1):117–137.

Cole, C., Droste, M., Knittel, C. R., Li, S., and Stock, J. H. (2023). Policies for Electrifying the Light-Duty Vehicle Fleet in the United States. *AEA Papers and Proceedings*, 113:316–322.

DiPippo, G., Kennedy, S., and Mazzocco, I. (2022). Red ink: Estimating Chinese industrial policy spending in comparative perspective. Technical report, Center for Strategic & International Studies. Report.

Energy Institute (2026). Statistical review of world energy 2026. Technical report, Energy Institute, London.

Ezell, S. (2024). How innovative is China in the Electric Vehicle and battery industries? Technical report, Information Technology & Innovation Foundation. ITIF Report, July.

Fang, H., Li, M., Wang, L., and Yang, Y. (2026). High-speed rail and china's electric vehicle adoption miracle. *Journal of Public Economics*, 260:105705.

Friedlingstein, P., O'Sullivan, M., Jones, M. W., Andrew, R. M., Bakker, D. C. E., Hauck, J., Landschützer, P., Le Quéré, C., Li, H., Luijkx, I. T., Peters, G. P., Peters, W., Pongratz, J., Schwingshackl, C., Sitch, S., Canadell, J. G., Ciais, P., et al. (2026). Global carbon budget 2025. *Earth System Science Data*, 18(5):3211–3288.

García-Herrero, A. and Schindowski, R. (2024). Unpacking China's industrial policy and its implications for Europe. Bruegel Working Paper 11/2024, Bruegel.

Gessner, J., Habla, W., Rübenacker, B., and Wagner, U. J. (2025). No place like home: Charging infrastructure and the environmental advantage of plug-in hybrid electric vehicles. Technical report, ZEW Discussion Papers.

Hao, H., Ou, X., Du, J., Wang, H., and Ouyang, M. (2014). China's electric vehicle subsidy scheme: Rationale and impacts. *Energy Policy*, 73:722–732.

International Energy Agency (2025a). Global EV outlook 2025. IEA Report.

International Energy Agency (2025b). Oil 2025: Analysis and forecast to 2030. Technical report, International Energy Agency, Paris.

International Energy Agency (2025c). Oil demand for fuels in china has reached a plateau. Commentary. IEA, Paris. Accessed 24 July 2026.

International Energy Agency (2026a). Global energy review 2026. Technical report, International Energy Agency, Paris. Oil chapter.

International Energy Agency (2026b). Global ev outlook 2026. Technical report, International Energy Agency, Paris.

Kellogg, R. (2026). The end of oil. *Review of Economic Studies*. Forthcoming.

Linn, J. and Shen, C. (2024). The effect of income on vehicle demand: Evidence from china's new vehicle market. *Journal of the Association of Environmental and Resource Economists*, 11(1):41–73.

Nguyen-Tien, V., Zhang, C., Strobl, E., and Elliott, R. J. (2025). The closing longevity gap between battery electric vehicles and internal combustion vehicles in Great Britain. *Nature Energy*, 10(3):354–364.

Oxford Institute for Energy Studies (2025). Rising new energy vehicle sales in China: Falling gasoline demand, rising uncertainty. Technical Report Insight 167, Oxford Institute for Energy Studies.

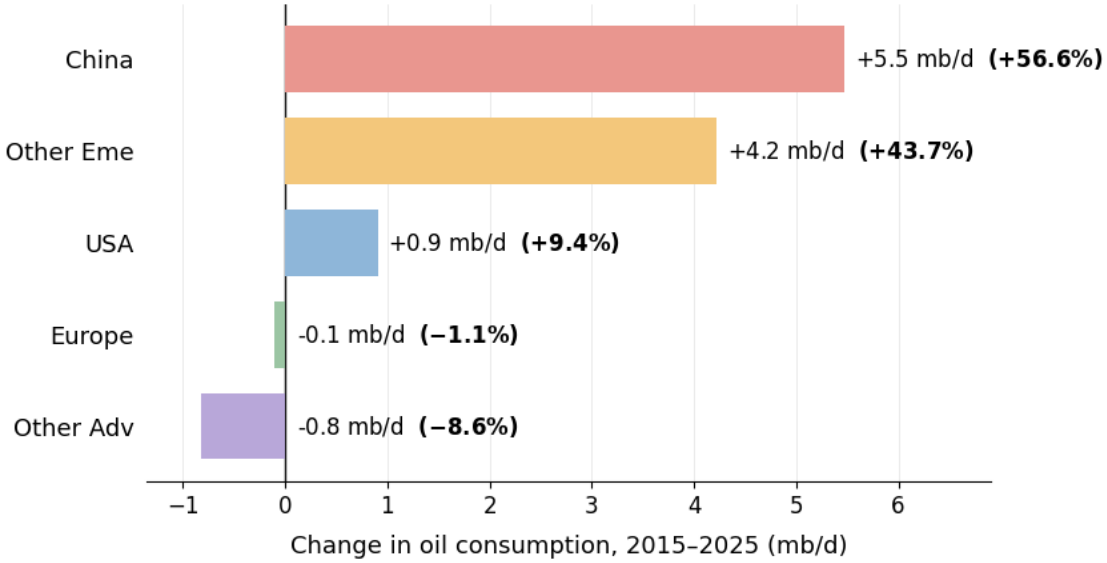
Rapson, D. S. and Muehlegger, E. (2023). The economics of Electric Vehicles. *Review of Environmental Economics and Policy*, 17(2):274–294.

Wingender, P., Yao, J., Zymek, R., Carton, B., Cerdeiro, D., and Weber, A. (2024). Europe's shift to electric vehicles amid intensifying global competition. IMF Working Paper 24/218, International Monetary Fund.

A Additional data and descriptive patterns

Figure A.1 complements the regional consumption paths reported in Figure 1 by decomposing the net increase in global demand across the regions that contributed positively. China accounted for more than half of the increase in global crude-oil consumption over 2015–2025 and for roughly three quarters of the increase in refined-product consumption over 2015–2024.

FIGURE A.1: *Contributions to global oil-consumption growth*

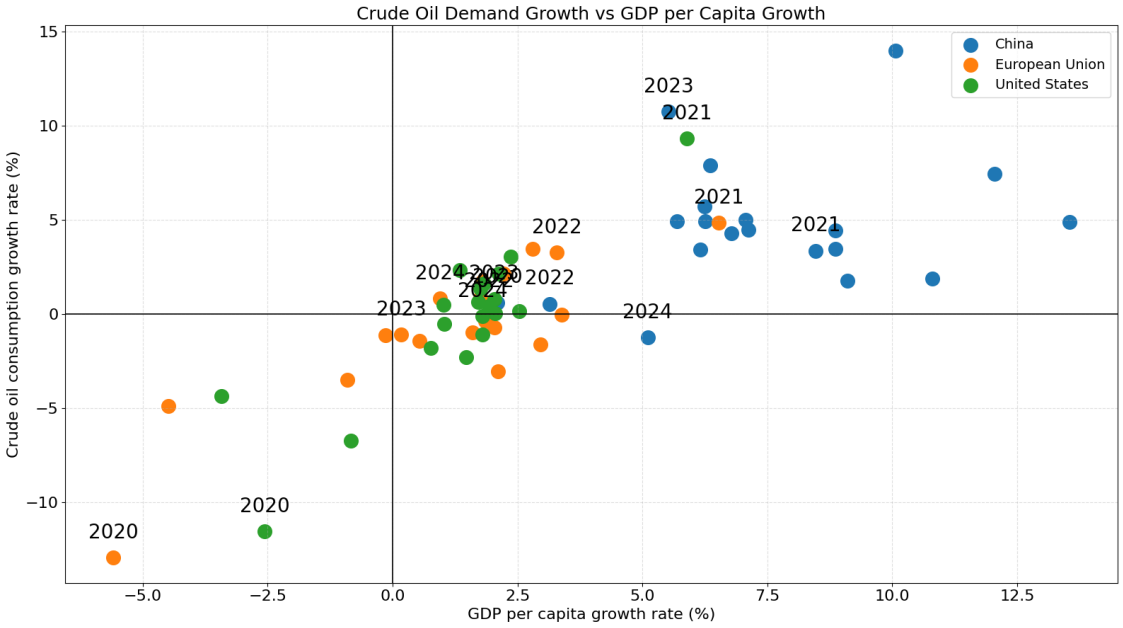


Changes refer to the period 2015–2025. Percentages in parentheses indicate each economy's contribution to total world oil-consumption growth over the period. Total world oil consumption growth from 2015 to 2025 was 9.7 mb/d. *Source:* Authors' elaboration on Energy Institute.

A.1 Oil consumption and income growth

Figure A.2 relates annual growth in crude-oil consumption per capita to growth in GDP per capita in China, the United States and Europe. China's observations generally display a stronger association between income growth and oil-demand growth than those of the advanced economies. The most recent observations suggest some weakening of this historical relationship, although the figure is purely descriptive and should not be interpreted as identifying a structural decoupling of oil demand from economic activity.

FIGURE A.2: *Crude oil consumption and GDP per capita in major economies*



Each point refers to a year (2005–2025). *Source:* Authors' elaboration on World Bank and Energy Institute.

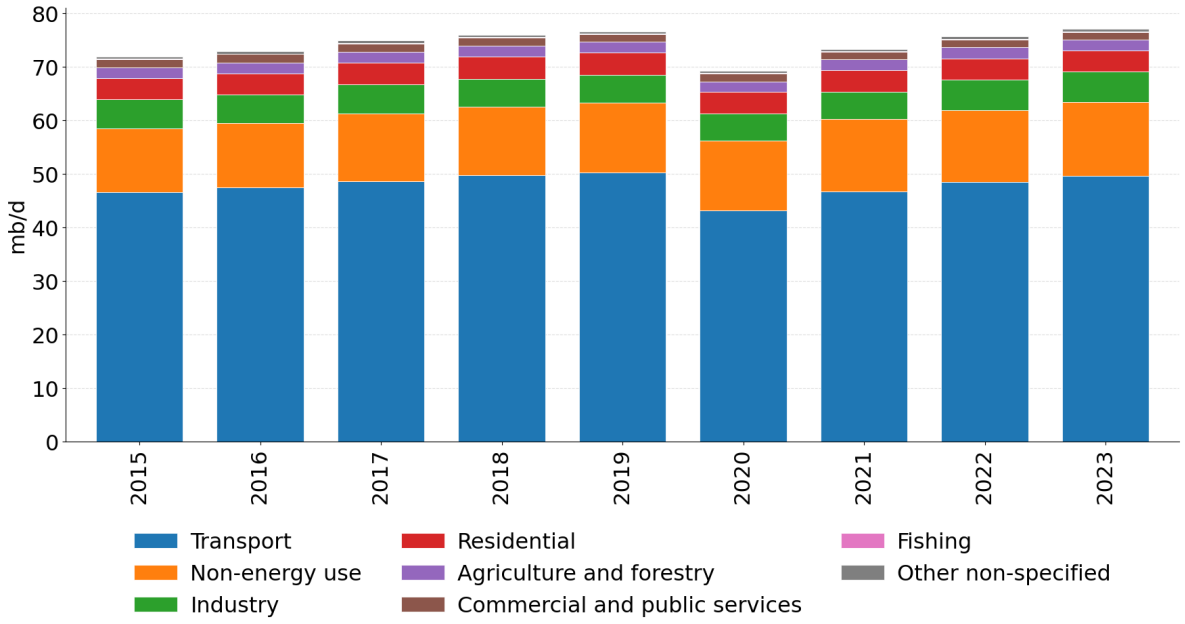
A.2 Oil consumption across end-use sectors

Figure A.3 decomposes global final consumption of oil products across end-use sectors. Transport remains the largest source of final oil demand, but industry and non-energy uses also account for substantial shares. The latter include petroleum products used as feedstocks rather than combusted as fuels. This distinction helps explain why a reduction in passenger-car gasoline consumption need not generate a contemporaneous decline of equal magnitude in aggregate oil demand.

A.3 China's rising share of the global EV stock

Figure A.4 reports the geographical composition of the global stock of electric passenger vehicles. China's share increased from less than one quarter in 2015 to close to 60 per cent in 2025. Over the same period, the shares of Europe and the United States declined, even though their absolute EV stocks continued to increase.

FIGURE A.3: *Global final consumption of oil products by sector*



Each bar reports total global final consumption of oil products, with segments showing the contribution of individual end-use sectors. Values are expressed in million barrels per day and cover 2015–23. Non-energy use refers to oil products used as feedstocks or raw materials rather than as fuels. *Source:* Authors' calculations based on IEA data.

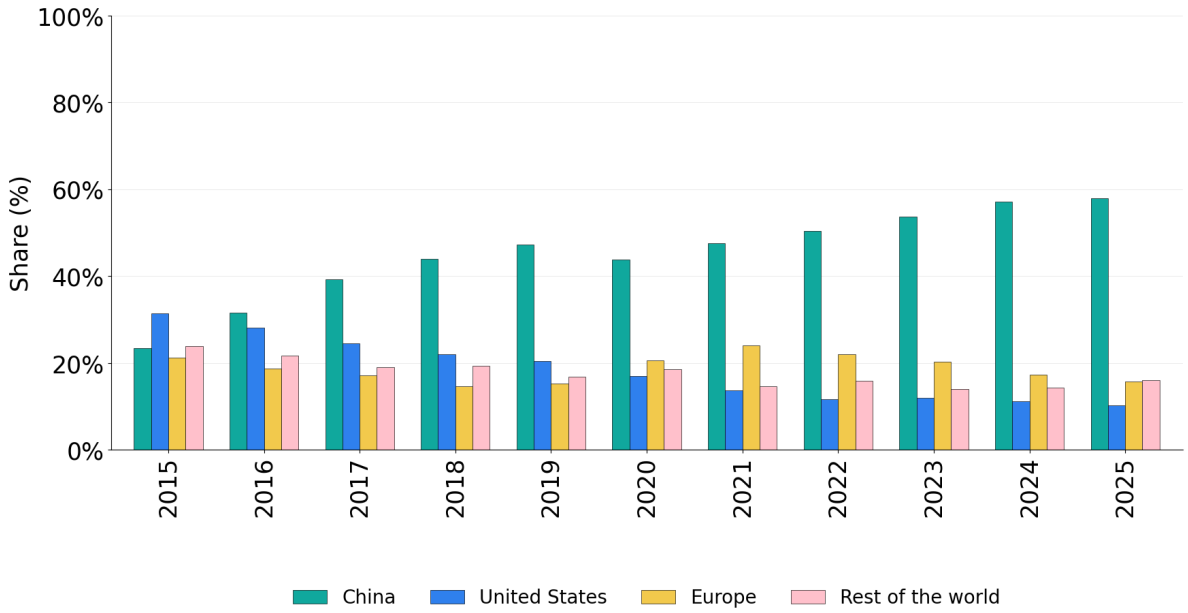


FIGURE A.4: *Regional composition of the global electric-vehicle stock*

Notes: The bars report each region's share of the global stock of electric passenger vehicles. Electric vehicles comprise battery-electric and plug-in hybrid passenger vehicles. *Source:* Authors' calculations based on IEA data.

B Model details, calibration, and fit

This appendix presents the complete fleet-stock accounting system, its data inputs and calibration, the construction of the historical counterfactual and projection scenarios, and the model's in-sample fit over 2015–2025.

B.1 Equations

Time is annual, indexed by t. Let K_t^{ICE} and K_t^{EV} denote the stocks of ICE and EV passenger vehicles, respectively, and let

$$V_t = K_t^{ICE} + K_t^{EV}$$

denote the total passenger-car stock. Let $NewVehicles_t$ denote total new passenger-car sales in year t, s_t the ratio of new passenger-car sales to the circulating vehicle stock, and f_t the EV share of new passenger-car sales. Finally, let δ^{ICE} and δ^{EV} denote the annual retirement rates of ICE and EV vehicles, respectively, and let θ_t denote gasoline consumption per circulating ICE vehicle.

The fleet-accounting system is given by:

$$Outflow_t^{ICE} = \delta^{ICE} K_{t-1}^{ICE}, \tag{B.1}$$

$$Outflow_t^{EV} = \delta^{EV} K_{t-1}^{EV}, \tag{B.2}$$

$$NewVehicles_t = s_t V_{t-1}, \tag{B.3}$$

$$Inflow_t^{EV} = f_t \, NewVehicles_t, \tag{B.4}$$

$$Inflow_t^{ICE} = (1 - f_t) \, NewVehicles_t, \tag{B.5}$$

$$K_t^{ICE} = K_{t-1}^{ICE} + Inflow_t^{ICE} - Outflow_t^{ICE}, \tag{B.6}$$

$$K_t^{EV} = K_{t-1}^{EV} + Inflow_t^{EV} - Outflow_t^{EV}, \tag{B.7}$$

$$V_t = K_t^{EV} + K_t^{ICE}, \tag{B.8}$$

$$Gasoline_t = \theta_t K_t^{ICE}, \tag{B.9}$$

$$Share_t^{EV} = \frac{K_t^{EV}}{V_t}. \tag{B.10}$$

The sales-to-stock ratio s_t determines the size of the annual inflow of new vehicles relative to the existing passenger-car fleet, while f_t determines how that inflow is allocated between EV and ICE vehicles. Over the historical period, both $NewVehicles_t$ and s_t are

disciplined by observed passenger-car sales and stocks; over the projection horizon, s_t becomes an explicit calibration input, as described below.

The system captures the gradual nature of fleet turnover. A higher EV share in new sales changes gasoline consumption only progressively, as successive EV cohorts enter the circulating fleet and older ICE vehicles are retired. The speed of this adjustment therefore depends jointly on the composition of new sales and on the rate at which the existing vehicle stock turns over.

B.2 Calibration

Time-varying inputs and projection assumptions. For the historical period 2015–2025, total new passenger-car sales, $NewVehicles_t$, the EV share of new sales, f_t, and average gasoline consumption per ICE vehicle, θ_t, are constructed using data from CEIC, the International Energy Agency, and the Energy Institute (see Table B.1 for variable definitions and data sources). The corresponding sales-to-stock ratio, s_t, is obtained from observed passenger-car sales and the circulating vehicle stock. Over the historical sample, this ratio declines markedly, from around 14% in the mid-2010s to about 8% by 2025.

For the projection period 2026–2040, we impose a conservative long-run sales-to-stock ratio of 5%, consistent with the downward trend observed in the data. Combined with the retirement-rate calibration described below, this assumption generates a gradual increase in China's passenger-car stock to approximately 520 million vehicles by 2040, broadly consistent with available long-run projections (BloombergNEF, 2025; Oxford Institute for Energy Studies, 2025; International Energy Agency, 2026b).[11]

To isolate the fleet-composition channel, θ_t is held fixed over the projection horizon at its last observed value in 2025. This assumption abstracts from future changes in both ICE vehicle efficiency and driving intensity. A common decline in gasoline use per ICE vehicle would lower gasoline consumption across all scenarios and, for given fleet paths, reduce the absolute gasoline savings attributed to additional EV adoption.

The constant-adoption baseline holds the EV share of new passenger-car sales fixed at its observed 2025 level. Under the slow, medium and fast scenarios, the EV sales share rises to approximately 75%, 87% and 100%, respectively, by 2030. The subsequent scenario paths are reported in Panel (a) of Figure 6. All scenarios use the same sales-to-stock rule, retirement-rate parameters and gasoline consumption per ICE vehicle, and differ only in

[11]The 520-million figure should be interpreted as a calibration target rather than an exact terminal constraint. Because ICE and EV vehicles have slightly different retirement rates, total fleet size varies modestly across EV-adoption scenarios while remaining close to this benchmark.

the assumed path of f_t, the EV share of new passenger-car sales.

Table B.1: Variables and parameters of the simple dynamic model

Variable/Param.	Description	Source/Calibration
K_t^{EV}	EV stock at time t (Endo. var.)	Initialized in 2015 (IEA data)
K_t^{ICE}	ICE stock at time t (Endo. var.)	Initialized in 2015 (IEA data)
V_t	Total stock of passenger vehicles in the Chinese car market in year t (Endo. var.)	Initialized in 2015 (IEA data)
$Outflow_t^{ICE}$	ICE vehicles exiting the Chinese car market in t (Endo. var.)	Initialized in 2015 (IEA data)
$Outflow_t^{EV}$	EV vehicles exiting the Chinese car market in t (Endo. var.)	Initialized in 2015 (IEA data)
$Inflow_t^{ICE}$	ICE vehicles entering the Chinese car market in t (Endo. var.)	Initialized in 2015 (IEA data)
$Inflow_t^{EV}$	EV vehicles entering the Chinese car market in t (Endo. var.)	Initialized in 2015 (IEA data)
s_t	Ratio of new passenger-car sales to the circulating vehicle stock	Initialized in 2015 (IEA data)
$NewVehicles_t$	Total flow of new passenger vehicles entering the Chinese car market in year t (Endo. var.)	Initialized in 2015 (IEA data)
$Share_t^{EV}$	Share of EV vehicles on the total stock of circulating vehicles in China in year t (Endo. var.)	Initialized in 2015 (IEA data)
$Gasoline_t$	Gasoline consumption in millions of barrels per day (mb/d) at time (Endogenous variable) t	Initialized in 2015 (IEA data)
f_t	Proportion of new cars that is of the EV type at time t	Calibrated on obs. data (IEA data)
θ_t	Average annual mb/d gasoline consumption for each passenger vehicle circulating at time t	Calibrated on obs. data (IEA and Energy Institute data)
δ^{EV}	Scrappage for EV vehicle	Calibrated param.
δ^{ICE}	Scrappage for ICE vehicle	Calibrated param.

Scrappage-rate calibration. The annual vehicle-retirement rates are treated as reduced-form fleet-exit parameters. We set

$$\delta^{EV} = 0.0168, \qquad \delta^{ICE} = 0.0201. \tag{B.11}$$

Together with the long-run sales-to-stock assumption described above, these parameters generate a gradual expansion of China's passenger-car fleet to approximately 520

million vehicles by 2040. They should therefore be interpreted as aggregate calibration parameters governing the speed of fleet turnover, rather than as the inverse of individual vehicle lifetimes.

Micro-level evidence nevertheless provides a useful external benchmark for the relative magnitude of the two retirement rates. Using vehicle-level administrative data for Great Britain and a Weibull survival model, Nguyen-Tien et al. (2025) estimate median lifetimes of approximately 18.4 years for battery-electric vehicles and 18.7 years for petrol vehicles in their preferred specification. Their estimates therefore point to broadly similar longevity across the two powertrains, consistent with the relatively small difference between δ^{EV} and δ^{ICE} in our calibration.[12]

Counterfactual construction. For the **historical exercise**, we construct a "no-EV-adoption" counterfactual by setting the EV share of new passenger-car sales equal to zero over 2015–2025:

$$f_t^{\text{NoEV}} = 0, \qquad t = 2015, \ldots, 2025. \tag{B.12}$$

Total new passenger-car sales and gasoline consumption per ICE vehicle are held at their observed values. Historical gasoline displacement is therefore measured as the difference between model-implied gasoline consumption under the no-EV counterfactual and the observed EV-adoption path:

$$D_t^{\text{Hist}} = \widehat{G}_t^{\text{NoEV}} - G_t^{Observed}. \tag{B.13}$$

For the **scenario exercise**, we compare the slow, medium, and fast EV-adoption scenarios with a constant-adoption baseline in which the EV share of new passenger-car sales remains fixed at its observed 2025 level:

$$f_t^{\text{Baseline}} = f_{2025}, \qquad t = 2026, \ldots, 2040. \tag{B.14}$$

All scenarios share the same paths for total new passenger-car sales, scrappage rates, and gasoline consumption per ICE vehicle, and differ only in the assumed evolution of the

[12]The constant-rate approximation deliberately abstracts from the age composition of the vehicle fleet and from the age-dependent retirement hazards estimated in micro-level survival models. Accordingly, the parameters in equation (B.11) should not be interpreted as a direct mapping of the individual-level longevity estimates in Nguyen-Tien et al. (2025), but as parsimonious aggregate counterparts suited to the annual stock-flow framework used here.

EV share of new sales. Gasoline savings under scenario s are defined as

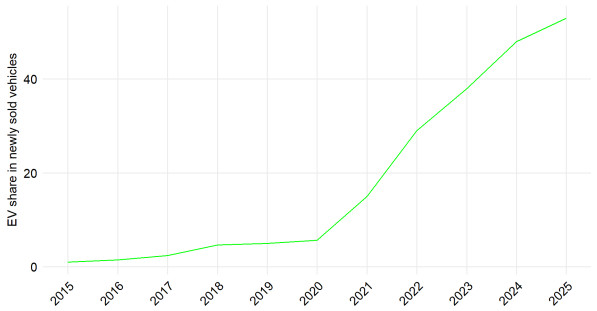
$$D_t^s = \widehat{G}_t^{\text{Baseline}} - \widehat{G}_t^s. \tag{B.15}$$

B.3 Initialization and fit

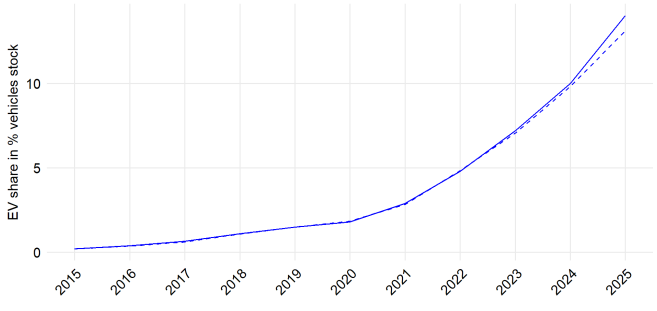
We initialize $(K_{2015}^{ICE}, K_{2015}^{EV})$ using observed stocks in 2015. When disciplined by the observed paths of total passenger-car sales, the EV share of new sales and gasoline use per ICE vehicle, the model closely reproduces the observed dynamics of China's passenger-car stocks and aggregate gasoline consumption over 2015–2025. Figure B.1 reports the corresponding in-sample fit. The fit of the vehicle stocks provides an assessment of the stock-flow accounting equations. The replication of aggregate gasoline consumption should instead be interpreted as an accounting-consistency check since it is a targeted moment.

FIGURE B.1: *Model inputs and in-sample fit - 2015-2025 period.*

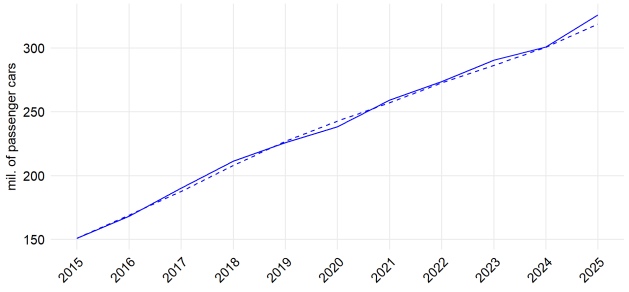
(a) EV share in new sales



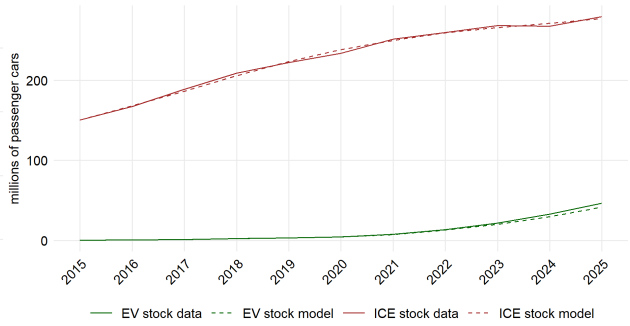
(b) EV share in total Chinese vehicle stock



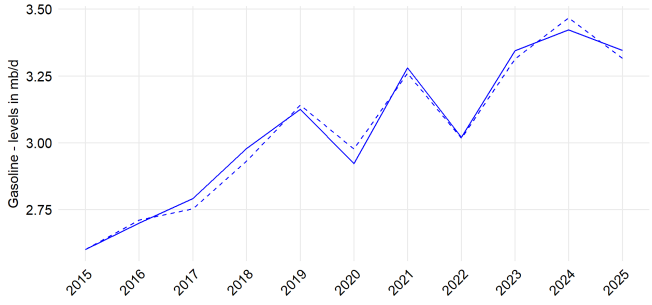
(c) Total passenger-car stock



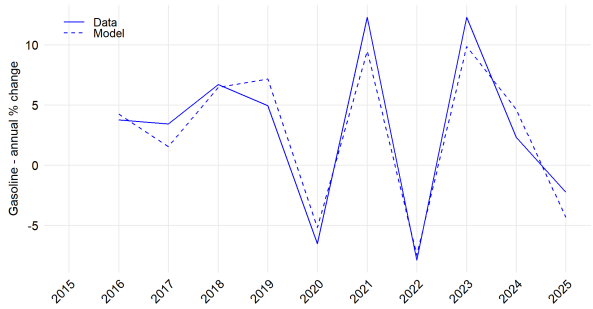
(d) Vehicle stocks: EV and ICE



(e) Gasoline consumption (mb/d)

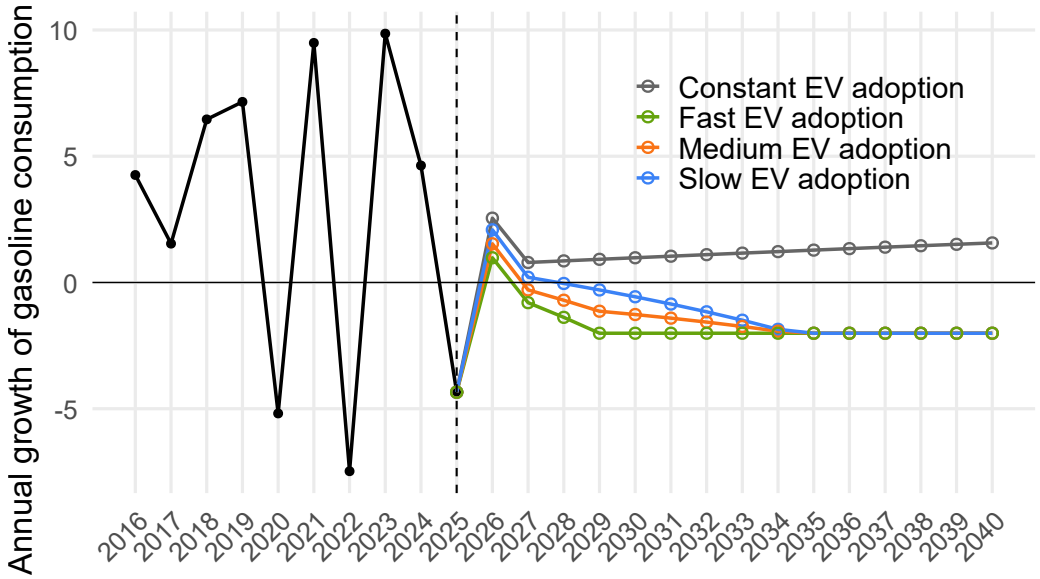


(f) Gasoline consumption growth



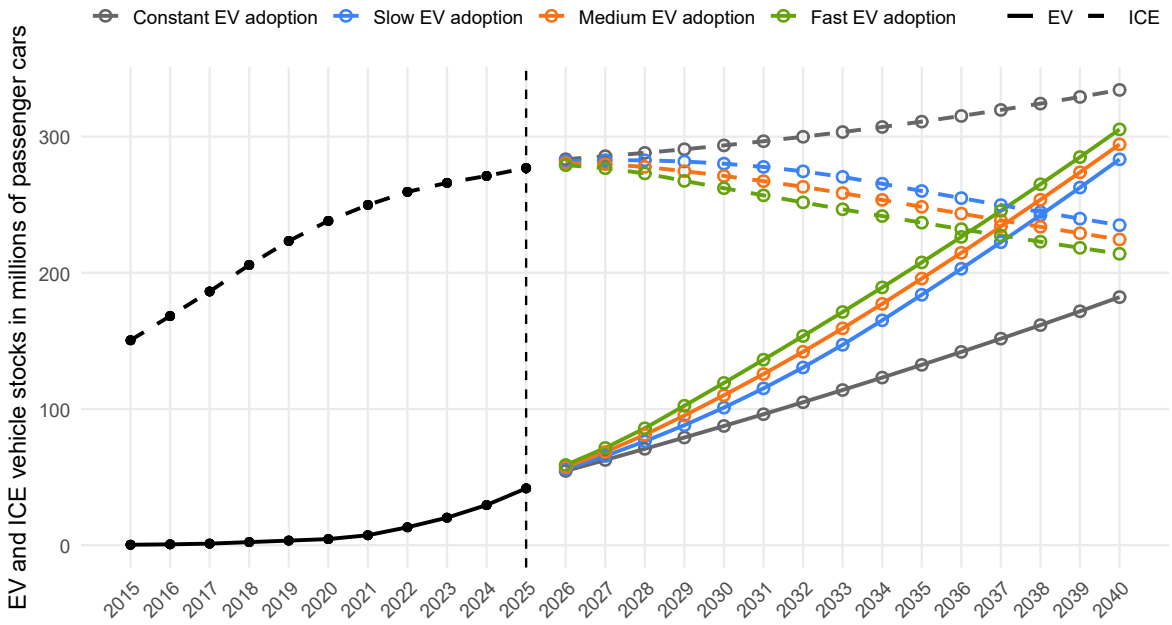
Source: Authors' calculations based on CEIC, IEA and the Energy Institute.
Notes: Solid lines report observed series and dashed lines report the corresponding model-implied series. Panel (a) shows the observed EV share of new passenger-car sales, which enters the model as an input. Panels (b)–(d) compare observed and model-implied fleet outcomes. Panels (e) and (f) report gasoline consumption in levels and growth rates; their fit provides an accounting-consistency check because gasoline use per ICE vehicle is constructed from observed gasoline consumption.

FIGURE B.2: *Annual growth of China's gasoline consumption under alternative EV-adoption scenarios, 2016–2040*



Source: Authors' calculations based on CEIC, IEA and the Energy Institute.
Notes: The black line reports the realized annual growth rate of gasoline consumption through 2025. The vertical dashed line separates the historical sample from the projection period. Coloured lines show model-implied growth rates for 2026–2040 under alternative paths for the EV share of new passenger-car sales. The constant-adoption baseline holds the EV sales share fixed at its 2025 level, while the slow, medium, and fast scenarios assume progressively more rapid EV penetration. Annual growth rates are expressed in percent and are computed as $100(Gasoline_t / Gasoline_{t-1} - 1)$.

FIGURE B.3: *China's passenger-car fleet under alternative EV-adoption scenarios, 2015–2040*



Source: Authors' calculations based on CEIC and IEA.
Notes: The black lines report the historical stocks of electric vehicles (EVs) and internal-combustion-engine vehicles (ICEs) over 2015–2025. The vertical dashed line separates the historical sample from the projection period. Coloured lines show the model-implied evolution of EV and ICE stocks over 2026–2040 under alternative paths for the EV share of new passenger-car sales. The constant-adoption baseline holds the EV share of new passenger-car sales fixed at its observed 2025 level, while the slow, medium, and fast scenarios assume progressively more rapid EV penetration. All scenarios use the same projected path for the total passenger-car stock and differ only in the allocation of new sales between EV and ICE vehicles. Solid lines denote EV stocks and dashed lines denote ICE stocks. Vehicle stocks are expressed in millions of passenger cars.