

# Governments should optimize electric vehicle subsidies

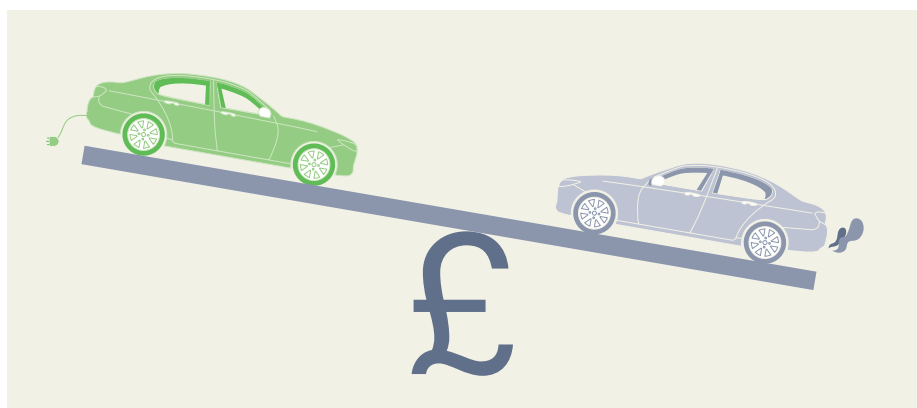


Over the past two decades, various support policies have been adopted to stimulate sales of electric vehicles (EVs). Purchase subsidies are among the most ubiquitous of these. In the USA, consumers can realize tax credits of up to \$7,500 when purchasing an EV. Similar incentives accompany the sale of EVs in several countries worldwide, including Canada, China and Norway (to name a few). EV subsidy programmes aim to accelerate decarbonization efforts by incentivizing the adoption of more fuel-efficient, and hence less carbon-intensive, mobility options. Doing so represents a potential pathway towards achieving net-zero greenhouse gas emissions and meeting targets designated by the Paris Agreement<sup>1</sup>.

However, the economically efficient administration of purchase subsidies – a politically, financially and socially advantageous outcome<sup>2</sup> – necessitates that three conditions must be met. First, the subsidy should target consumers whose vehicle-purchase decisions change owing to the presence of the subsidy. Second, the subsidized EV should replace a petrol-powered vehicle. Third, the vehicle being replaced should, to the extent possible, be ‘maximally polluting’. The more polluting the replaced vehicle is, the greater the emissions reductions that are potentially realized owing to EV adoption. Emerging evidence raises questions about whether, and to what degree, these conditions are being met.

Studies challenge the extent to which purchase subsidies motivate EV adoption. In the USA, up to 70 per cent of federal programme dollars are claimed by EV owners who would have purchased an EV regardless of the presence of the subsidy<sup>3</sup>. Similar purchasing patterns persist in Canada and China<sup>4,5</sup>. These findings are problematic as purchase subsidy claims by consumers who are indifferent to the presence of the subsidy tempers the efficacy of subsidies as an economically efficient pathway to emissions reductions.

Programme efficacy is also affected by substitution patterns. A key requirement for the EV-policy package to be economically efficient is that EVs act as a substitute for (rather than



a complement to) petrol-powered vehicles. Studies suggest this may not always be the case. In Norway, an automobile market in which EV purchase subsidies are both longstanding and generous, EV acquisition is linked to an increase in the number of multivehicle households, implying the absence of a substitution effect<sup>6,7</sup>. Similar absences are observed in Canada and the USA, where EV purchase subsidies have – as in Norway – failed to impede rates of petrol-powered-vehicle ownership<sup>4,7</sup>.

Substitution alone should not be construed as an optimal outcome. Leveraging EVs to substitute away from, for example, a newer model versus an older model yields fewer emissions reduction benefits, as newer vehicles are more fuel efficient than their predecessors. More broadly, facilitating substitution away from fuel-efficient vehicles represents a relatively inefficient approach to reducing emissions compared to replacing less-efficient vehicles with EVs. Yet, in markets such as China and the USA, EVs replace highly fuel-efficient vehicles rather than more polluting ‘gas-guzzlers’<sup>3,5</sup> – thus reducing the potential emissions benefits of such subsidies.

Three recommendations warrant consideration in terms of how policy makers should respond to these inefficiencies.

First, income limits should be established. Interest in EV adoption is concentrated among high-income households that are typically less price sensitive<sup>8</sup> and therefore are less likely to change their vehicle purchase decisions in response to subsidies. However,

having a priori chosen to do so, high-income households can and will nevertheless claim these subsidies, creating deadweight loss<sup>3–5</sup>. Addressing this inefficiency requires establishing income limits beyond which subsidies are unavailable. Doing so restricts public spending to households whose purchasing decisions are most influenced by the presence of the subsidy. The Canadian province of British Columbia recently adopted this approach, as did the USA. Income limits, however, remain the exception, not the norm.

Second, vehicle replacement should be prioritized. The composition of operational vehicle stock reflects the accumulation of new vehicle sales minus vehicle retirements over time<sup>9,10</sup>. The intent of EV subsidies is to change the ‘propulsion profile’ of this stock, and not – as is being observed – to increase the number of vehicles in stock. Increased vehicle stock risks worsening externalities related to higher traffic volumes, such as congestion, traffic fatalities and noise<sup>6</sup>. Consequently, subsidies should be reserved for households that replace rather than complement existing vehicles. Local governments in Wuhu and Taiyuan, China, have adopted this approach to some degree, awarding added subsidies to consumers who trade petrol-powered automobile for electric ones<sup>9</sup>.

Third, existing automobile inventory warrants scrutiny. Limited government capital necessitates maximizing the emissions reduction potential of EVs, rather than accepting an emissions reduction alone<sup>2</sup>. This can be achieved

by prioritizing subsidies – or at a minimum, the most generous ones – for households that trade older, more-polluting (versus newer, less-polluting) vehicles in for EVs. Moreover, even in this scenario, households that possess fewer vehicles overall should receive precedence, given that secondary and tertiary vehicles in a household are driven less than their primary counterparts<sup>11</sup>. Fewer miles travelled in an EV reduces its emissions reduction potential. Consequently, subsidy policy should reflect that, from an emissions reduction perspective, not all vehicles in household stock are created equal – regardless of propulsion source.

Stable and sustainable governance necessitates judicious disbursement of public funds. Where EV purchase incentives are concerned, this requires not only that emission reductions be realized owing to the presence of the incentive but also that emissions

reductions be maximized for every dollar of incentive spent<sup>2,11</sup>. Not doing so risks impeding long-term political, financial and social support for subsidy programmes<sup>2</sup>.

**Ashley Nunes** <sup>1,2,3</sup>  & **Lucas Woodley**<sup>1,3</sup>

<sup>1</sup>Department of Economics, Harvard College, Cambridge, MA, USA. <sup>2</sup>The Breakthrough Institute, Berkeley, CA, USA. <sup>3</sup>Center for Labor and a Just Economy, Harvard Law School, Cambridge, MA, USA.

 e-mail: [anunes@law.harvard.edu](mailto:anunes@law.harvard.edu)

Published online: 3 March 2023

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## Competing interests

The authors declare no competing interests.