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Welfare Implications of Electric Bike Subsidies

Evidence from Sweden

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Greenhouse gas emissions from U.S. transportation account for about 29 percent of total U.S. greenhouse gas emissions, making it the largest contributor by sector to global warming in the United States. Within the U.S. transportation sector, cars are responsible for 58 percent of all transportation emissions according to the Environmental Protection Agency. Along with electric cars, electric bikes (also known as pedelecs or e-bikes) are a potentially important tool to address global warming. With rechargeable batteries, they are capable of long distances and hence can replace car trips for work in dense and growing urban areas around the world.

Electric bikes are not cheap—they cost around a few thousand dollars upfront along with several hundred additional dollars for each battery replacement. A number of governments have or are in the process of implementing subsidy programs to promote household adoption of e-bikes. There is even an e-bike bill (H.R. 1019) introduced in the House of Representatives for the 117th Congress (2021–2022). Hence a welfare analysis of these programs would be valuable.

However, such analyses of these e-bike subsidy programs are challenging for several reasons. First, a welfare analysis requires measures of tax incidence or the passthrough of any given subsidy to consumers to appropriately account for consumer and producer surplus. Second, beyond obtaining reliable passthrough estimates, there is also the concern over inframarginal participation (i.e., those consumers who would have adopted an e-bike even in

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the absence of a subsidy). Third, this difference also raises the question of whether members of a family that buys an e-bike will necessarily cut down their driving.

To address these issues, we combine administrative, insurance, and survey data from a large-scale Swedish e-bike subsidy program in 2018. The Swedish subsidy program is similar in structure to programs run and proposed in other countries around the world, and the choice of e-bikes ought to have commonalities across dense urban areas. Hence our findings can likely be extrapolated to other settings.

The 1 billion kronor program was intended to last for three years but already exceeded its per-year spending limit during its first year, from October 2017 to October 2018. With a cost of 425 million kronor, it was suspended in 2018 and was not subsequently renewed after a change in political leadership following elections. We obtain from the Swedish Environmental Protection Agency (SEPA) all the e-bike transactions in Sweden that received a subsidy. The subsidy was for 25 percent of the retail price with a limit of 10,000 kronor (or around $1,100). The SEPA data have the transaction price, the subsidy amount, the model, and the retailer. There is also basic demographic information about the customers.

We merge the subsidy data with sales data from Solid Försäkring, the leading insurance provider for bicycles in Sweden. Solid offers insurance at the point of sale of new bikes, covering approximately 90 percent of the specialized bicycle dealers. Around 50 percent of all new bikes sold in Sweden are registered with Solid, and we find that 76 percent of all subsidized e-bikes were sold by retailers in the Solid sample. Hence the Solid and SEPA data allow us to create a panel of transactions by representative customers and retailers at a given time for before, during, and after the subsidy program.

The subsidy program coincided with a temporary surge in e-bike purchases. Aggregate data suggest that total e-bike sales grew from around 67,000 to 103,000 in annual terms between 2017 and 2018. The number of e-bikes insured by Solid also increased by around 70 percent year-over-year to 47,000 registered new e-bikes in the subsidy period. We can use a subset of this panel data to estimate the passthrough rates and find that consumers receive the bulk of the subsidy.

We then use data from a follow-up survey conducted by the SEPA of several thousand representative households that used the subsidy. We use their responses to the survey question of whether the subsidy was important for their purchase decision to assess the inframarginality issue. We then use their self-reported usage of their family car before and after the purchase of their e-bike to assess the environmental impact of the e-bike subsidy.

We find using the follow-up survey data that around one-third of households did not list the subsidy as an important reason for their purchase. This incidence sensibly increases to over 53 percent for households in the highest income bracket of two million kronor ($225,000) and decreases to 28 percent for those younger than 35. In regressions where we control for all demographics, we find that subsidy importance decreases with income and age and among women living in Green Party strongholds. Notably, we find the importance of the subsidy to be unrelated to stated commuting distance to work.

We also find meaningful changes in car-driving behavior. Almost two-thirds of our sample report using a car to some extent for commuting before buying an e-bike and more than half of them use it on a daily basis. After having bought the e-bike, only 4 percent keep using the car every day and 54 percent use the car less frequently, of which 23 percent stop using the car for commuting altogether compared with before the purchase. The change in commuting behavior by car is more pronounced than for other means of transportation, such as regular biking or public transport.

The change of car use can be expressed by the change in commuting distance. On average, we estimate that car drivers reduce driving by 1,870 kilometers per year, reducing annual carbon emissions by around 260 kilos (140 grams per kilometer). Since the policy also targets people not driving cars, the reduction falls to 177 kilos per year if everyone is included. The average subsidy paid is around $494 and is very similar across groups of car drivers and others. But the program also covers nonadditional consumers who would have bought an e-bike even without the subsidy. Adding the cost of the program for the nonadditional consumers (those who would have bought an e-bike regardless of the subsidy) to the cost for the additional consumers (estimated to be 64 percent of the 1,873 survey respondents) raises the true cost per bike to $766. Simple back-of-the-envelope calculations pricing a ton of

carbon show that it will take a carbon emission price of $600 to recoup the cost of the subsidy. If the policy had been able to target only car commuters, this number falls to below $400 considering the full cost of the program. Meanwhile, the social cost of carbon is typically calculated to be around $50 to $100.

NOTE

This research brief is based on Anders Anderson and Harrison Hong, "Welfare Implications of Electric-Bike Subsidies: Evidence from Sweden," NBER Working Paper no. 29913, April 2022.