



## RESEARCH BRIEF

# Subsidizing Fuel Efficient Cars: Evidence from China's Automobile Industry

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*This paper examines the response of vehicle purchasing behavior to China's largest national subsidy program for fuel efficient vehicles. Using variation from the program's eligibility cutoffs, we find that the program boosted sales for subsidized vehicles by 87%. However, the program's effectiveness was limited as 53% of beneficiaries would have purchased the subsidized vehicles regardless of the subsidy. We also find that the program caused substitution between highly efficient vehicles.*

In 2010, China's central government launched its largest national incentive program for fuel efficient cars. The program provided a one-time 3000 RMB (455 USD) cash subsidy to any consumer who purchases a government certified fuel efficient vehicle. This amounts to about a 3% discount off the average eligible vehicle's retail price. The cash subsidy proved very popular. By the end of 2011, it subsidized the purchase of more than 4 million cars and cost 12 billion RMB (1.8 billion USD).

Subsidizing energy efficient products can be justified if they alleviate market failures resulting from externalities, asymmetric information, credit constraints, and behavior biases. However, the effectiveness of such policies vary, depending on how and the degree to which they influence consumer purchasing behavior.

Subsidies can fail to elicit effective behavioral

change in a variety of ways. Previous work examined an energy efficiency program in Mexico and found that a large portion of participants were inframarginal - they would have implemented energy efficiency measures anyway (Boomhower and Davis, 2014). An additional problem arises if a subsidy is being used by consumers whose original choices would have been other fuel efficient (but unsubsidized) products. A similar issue arises if consumers take advantage of the subsidy by simply delaying purchases they would have made anyway.

In this paper, we study the effectiveness of China's program using panel data of vehicle sales at the model-month-province level. We evaluate how the program influenced vehicle purchasing using an difference-in-differences approach. This strategy uses the eligibility cutoffs and the effective months of the program to compare consumption of subsidized

vehicles to unsubsidized comparison groups. We explore substitution between vehicle types by looking at substitution patterns of close substitutes. Additionally, we create a pre-event window to test whether consumers delayed making purchases right before the program started.

We further test whether the program targeted consumers who could most benefit from it, such as those do not have enough information or cannot recognize the benefits of fuel efficient products in the long run. For this purpose, we specifically examine whether the effects of the program were stronger in areas where shares of consumers who purchased relatively fuel inefficient models were higher.

Our results suggest that the program boosted sales for subsidized vehicle models by 87%. As a result, we find that the share of marginal consumers subsidized by the program is 47%. Thus, 53% of the program's payments went to inframarginal consumers and were, therefore, ineffective and distributional.

We also discover that some of the increase in sales of the subsidized models was driven by a decrease in purchases of unsubsidized but highly efficient vehicle models. Our results show that the program had a negative (-28%) and significant impact on sales of the 25% most fuel efficient unsubsidized vehicles. In contrast, we find that the impact of the program on purchases of relatively inefficient vehicles is small and not statistically significant. Therefore, we do not find evidence that the program decreased sales of vehicles with very low fuel efficiency. We also find that the program had a negative and significant impact on the sales for unsubsidized vehicles with a relatively small vehicle engine size or weight. These results suggest that most marginal consumers impacted by the subsidy would have purchased smaller or fuel efficient models.

We also tested whether the increase in subsidized vehicle sales occurred because consumers delayed

vehicle purchases. Our results do not show consumers taking advantage of the subsidy simply by delaying vehicle purchases either prior to the program's launch or prior to vehicle eligibility announcements. This can be partially explained by the fact that consumers could not anticipate future vehicle edibility.

This paper also shows that the program was not well-targeted. Subsidies can alleviate market failures when they target consumers with limited information or behavior biases (that make them more likely to buy vehicles with low fuel efficiency). We find that the program's effect on subsidized vehicles was lower in areas where the share of consumers buying fuel inefficient models was higher. Moreover, we show that the increase in sales of subsidized models was higher when the percentage of those with a high school degree was also higher, indicating that the program did not target less educated consumers very well. These results suggest that the program could have been more effective at targeting consumers who were more likely to be affected by limited information and behavior biases.

We measure CO2 reductions by assuming that the program's only two effects were a reduction in the 25% most fuel efficient but unsubsidized vehicles by 28%, and an increase in subsidized vehicles by 87%. We estimate the program reduced around 14 Mt during the studied period of 2010-2011. At a total cost of 1.12 billion USD, the program had an implied carbon price of 82 USD per ton.

To summarize, we show that while the program raised sales of subsidized vehicles and reduced carbon dioxide emissions, it also created a substitution effect between smaller and highly fuel efficient models. The program's cost-effectiveness was hampered as the subsidies were not well-targeted and benefited many inframarginal consumers.

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## References

Boomhower, J. and L. W. Davis (2014). A credible approach for measuring inframarginal participation in energy efficiency programs. *Journal of Public Economics* 113, 67–79.

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