

## **Tax avoidance and environmental implication: Vehicle registrations in Mexico**

Private motor vehicles offer unparalleled convenience, yet they are a significant contributor to greenhouse gas emissions, and pose other challenges such as local air pollution, congestion, and accidents. Corrective Pigouvian taxes on vehicle purchase and ownership are one policy approach for dealing with these externalities. In this paper, we examine the effects of the decentralization of vehicle registration taxes in Mexico. Before 2012, these taxes were set uniformly at a federal level; after 2012, each of the 32 Mexican states set their own taxes. We show how vehicle purchasers in Mexico City exploited the geographical discontinuities in the tax levels by registering their vehicles out-of-state. We then show the effects of this tax avoidance on government revenue, the makeup of vehicle fleets, and environmental outcomes.

Greenhouse gas emissions from transportation are particularly relevant in the developing world, where their contribution to overall greenhouse gas emissions is growing over time (Rapson & Muehlegger, 2023). We contribute to the existing literature on how regulatory changes shape the vehicle fleet (Ito & Sallee, 2018; Jacobsen et al, 2023). By investigating tax avoidance as a behavioral response, our results highlight the trade-offs between revenue collection and environmental objectives. This exploration emphasizes the need for nuanced policy solutions, especially in regions such as Mexico where institutions may be weaker (Davis, 2008; Oliva 2015).

### **Data**

The study uses comprehensive administrative data to investigate the effects of a decentralized approach to vehicle registration fees in Mexico. Our dataset combines publicly available information from the 2010 and 2020 census, vehicle registration data from six states representing approximately 50% of the country's registrations, smog check outcomes linked to vehicle prices through plate matching, and reported fuel efficiency data from the Ministry of Environment. This data set provides an unprecedented level of detail because it allows us to see the price of the vehicle, the date and zip code of their registration, vehicle attributes, zip code demographic characteristics, and smog check outcomes of such vehicles.

### **Methods:**

We employ a difference-in-difference per price bin framework to gauge the impact of the policy on the number of “missing” cars and change in the vehicle fleet composition. The time variation in our estimation comes from our observation of vehicle registrations before and after the decentralization of the vehicle registration tax. The geographical variation comes from a comparison of zip codes in jurisdictions that adopted a registration fee based on the vehicle’s price, against zip codes in other jurisdictions with similar characteristics that were selected using nearest neighbor matching.

Initially, we define two price bins, above and below the price for tax exemption, which allow us to estimate the magnitude of the missing vehicle registrations following a triple difference in difference methodology. Subsequently, we extend our analysis to a more granular level, employing fine price bins of approximately US\$500 to capture heterogeneous effects across the vehicle price spectrum. Using the estimates from the price bin regression we can calculate a counterfactual distribution of the vehicle fleet. With this counterfactual distribution, we compute the effect of the vehicle taxes on environmental outcomes such as fleet fuel efficiency and (with our smog check data) vehicle emissions.

### Results:

Our results provide unequivocal evidence that vehicle purchasers avoid higher registration taxes by registering their vehicles in a different state. We quantify the extent of missing vehicle registrations, calculating the effect on government revenue. Moreover, the analysis explores the spillover effects on vehicle choice, fuel efficiency, and smog check outcomes.

Our results on environmental outcomes indicate a trade-off between cleaner vehicles entering the fleet and potential reductions in fuel efficiency, providing a nuanced understanding of the consequences of vehicle taxation policies. We document the relationship between a car's price, its fuel efficiency, and its smog check outcomes. We find that the policy led to the adoption of cheaper vehicles which are more fuel-efficient but fare worse in their smog check readings. However, imperfect compliance mitigates these effects, leading to less improvement in fuel efficiency but also lower emissions of local air pollutants.

### Conclusions:

Our study contributes to the literature on vehicle taxation, shedding light on its implications for government revenue, the composition of vehicle fleets, and environmental outcomes. While the previous literature focuses on manufacturers' responses to regulatory changes, we emphasize the importance of consumer behavior and tax avoidance for understanding the effects of these policies.

Our findings highlight the significant impact of tax avoidance on vehicle registrations, emphasizing the need for policy that balances revenue goals and environmental objectives. Understanding these tradeoffs will be particularly important for policymakers in developing countries, where private vehicle ownership rates are low but are rapidly increasing. Policies that affect the composition of the vehicle fleet will have long-run implications for greenhouse gas emissions from the transportation sector in these countries.

### References:

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