

MARKET COMPETITION AND THE ADOPTION OF CLEAN TECHNOLOGY: EVIDENCE FROM THE TAXI INDUSTRY

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Overview

This paper studies the impact of the intensity of market competition on firms' willingness to adopt green technologies. To do so, we exploit the staggered rollout of different ride-hailing platforms (most notably, Uber) across different metropolitan areas in Spain as a natural experiment that provides time and city-specific exogenous variation in the intensity of competition to study the impact on taxi drivers' decisions to purchase "green" or "dirty" vehicles. We show that the entry of these platforms significantly increased the takeout of green vehicles among professional drivers in incumbent (dominant) conventional taxi companies, and decreased that of dirty vehicles. The exact opposite effect is observed in the cities where these platforms were extremely unlikely to enter. These results speak directly to the recent debate on whether competition policies should be relaxed to achieve certain environmental targets (e.g. the *European Green deal*).

Methods

To study the impact of the entry of well-known ride-hailing platforms, such as Uber and Cabify (a Spanish-based company), across major metropolitan areas on their vehicle purchase decisions according to the type of engines, i.e., whether they are purely fossil-fuel-based or, alternatively, if they use cleaner engines (e.g. electric vehicles, hybrid vehicles, etc.), we use a unique dataset on all the vehicles purchased by professional taxi drivers in Spain between December 2014 and February 2020. The staggered rollout of these platforms, which provides variation across metropolitan areas over time, allows us to study this question using a difference-in-differences (DiD) approach. Moreover, to accommodate the count data nature of the dependent variable (number of new vehicles purchased by taxi drivers by fuel type in the metropolitan area-month) in our panel data setting, we use a fixed-effects Poisson quasi-maximum-likelihood estimation with robust standard errors clustered at the province level, that account for arbitrary patterns of correlation among the observations for each province.

Results

Our main findings are as follows. First, we find that the entry of the aforementioned platforms significantly increased the takeout of green vehicles among taxi drivers. Our findings suggest that in metropolitan areas in which Uber and/or Cabify entered, the average monthly purchases of green vehicles increased by 25-30% relative to the "control" metropolitan areas. In other words, our estimates suggest that the entry of these platforms causally induced one extra green vehicle purchase by taxi drivers in every three/four. This finding is robust across different specifications and several robustness checks, and it also remains robust when we use an alternative estimator, the "stacked-DiD" approach, that addresses some recent concerns raised on the validity of the two-way fixed effects DiD estimator with staggered (time-varying) treatments. Moreover, additional data suggests that taxi drivers were not likely to delay the decisions to scrap their vehicles, and they were not likely either to purchase more used vehicles in the second-hand market following the entry of these platforms.

In Spain, the number of vehicles that ride-hailing companies can operated is limited by local regulation (as a rule of thumb, one Uber or Cabify vehicle is allowed per every thirty taxi licenses). Since Uber and Cabify typically deployed the maximum number of vehicles allowed at the regional level whenever they enter a metropolitan area, then it was extremely unlikely for them to enter also into another metropolitan area within the same province (due to the aforementioned regional binding limitation). As a consequence, taxi drivers in these latter metropolitan areas could anticipate that competition will be less intense for them. Consistently, we find that the effect on the takeout of different types of vehicles in these metropolitan areas is just the opposite to that found in cities where Uber and Cabify entered: taxi drivers did not significantly increase the purchase of green vehicles. In fact, our estimates suggest that they were more likely to buy dirty ones.

Conclusions

The question on the role of competition on the adoption of new, clean technologies has also become an extremely important one from a policy perspective in recent years. For instance, within the European Union, countries are currently profoundly discussing whether competition policy and antitrust should be modified (relaxed) to achieve the policy initiatives and environmental targets included in the so-called European Green deal. However, providing a clear answer to the question of interplay between the intensity of competition and the diffusion of green technologies has been usually challenging, due to the lack of settings that allow researchers to claim causality from one to the other.

In this paper, we aim at providing a straightforward answer to this question using a particular empirical setting that provides some of the key ingredients that allow us to isolate the effect of an (exogenous) shock in the intensity of competition on the adoption of clean technologies by dominant, incumbent suppliers. In particular, we study the takeout of green vehicles by professional taxi drivers before and after the entry of ride-hailing, app-based platforms (namely, Uber and its locally-founded rival Cabify). This setting constitutes an ideal setting with which to explore this question, considering that (a) the rollout of these platforms is unrelated to the vehicle choices by professional drivers in conventional taxi companies, (b) their entry is unlikely to trigger relevant changes in the key characteristics of the incumbent taxi companies (prices, number of licenses, productivity, etc.), and (c) taxi drivers' incentives to purchase green vehicles are unlikely driven to attract customers with particular environmental preferences. We document that the staggered rollout of Uber and Cabify across major metropolitan areas in Spain substantially increased their takeout of green vehicles.

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