POLICY-INDUCED REBOUND EFFECT: THE CASE OF GREEN TAXATION IN THE PRIVATE TRANSPORTATION SECTOR IN ISRAEL

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Overview

In recent years, it has become ever clearer that the promotion of energy-efficient cars has implications far beyond their primary goal of reducing emissions and the costs associated with operating a car (Bento et al., 2018). One major unintended consequence, with substantial social, health and economic repercussions, is increased driving. Defined in the literature as a (direct) rebound effect, driving is estimated as increasing by 20%-40% (Borenstein, 2015; Frondel and Vance, 2013; Gillingham et al., 2016; Linn, 2013; Small and Van Dender, 2007; Sorrell et al., 2009) and under certain circumstances could increase much more (e.g., Frondel et al., 2008). While the rebound effect has been studied extensively, little is known about the potential effect of *policy-induced improvements*, that is, the effect of an actual policy that promotes energy efficiency on the magnitude of the rebound effect *(*Gillingham et al., 2016). Steren et al. (2016) studied one such policy that introduced a major change to the purchasing tax structure in Israel. The uniform *ad valorem* tax levied on new cars was replaced with a *Pigouvian* tax, in which the lower the pollution rating of a car, the lower the tax levied. Consequently, energy-efficient cars became cheaper, thereby increasing demand for these cars. An Israel Tax Authority (2016) report noted that the average pollution ratings of new cars in Israel has declined continuously following the introduction of the policy (Figure 1). At the same time, the number of private cars in Israel has increased by 33% (CBS, 2018) and annual kilometers traveled increased by 30% (CBS, 2017). Using data for the two years before and the two years after the implementation of the policy, Steren et al. (2016) estimated a 40% rebound effect, in line with the literature. In this study, we utilize a structured revision of the *Pigouvian* tax, which was applied in 2013, to estimate the effect of the policy on the magnitude of the rebound effect, seven years after it was first implemented. Importantly, we investigate whether consumers became increasingly aware of (or less myopic about) usage costs over time, thereby contributing to a larger rebound effect.

Methods

In August 2009, Israel introduced an energy-efficiency policy for cars. A subsequent revision implemented in 2013 provides us with an exceptional opportunity to examine the impact of a policy-induced improvement in energy efficiency on the direct rebound effect over time. We used household survey data provided by the Israeli Central Bureau of Statistics (2007-2015). The data contain information regarding the ownership and characteristics of cars, including their brand, type, value, year, engine size, fuel consumption, and fuel price. The data also include socio-economic and demographic data, such as family size, education and income levels, and other variables that might affect the choice of energy efficiency level of a car and the kilometers traveled. Each observation in the data represents a single household, and each household was surveyed only once. To address the endogeneity of consumers who choose cars with an energy efficiency level based on their expectations about traveling, we use a two-stage least square (2SLS) model. Specifically, we utilize the policy introduced in Israel in 2009 and the subsequent update in 2013 to identify each period separately, because they are exogenous country-level events that are expected to influence energy efficiency but not directly alter the number of kilometers traveled. Accordingly, we estimate two separate models for the two policy changes: 1) 2007-2013 and 2) 2009-2015. We ran models w.r.t the various measuring approaches of rebound effect in the literature (Sorrell and Dimitropoulos, 2008). The results below were robust to these approaches.

Results

Our preliminary results indicate an increase in the size of the rebound effect, from 42% in the first period to 60% in the second period. We also found that fuel price elasticity increased from -0.56 in the first period to -0.87 in the second period. In addition, we found that one cannot reject the null hypothesis that the sum of the coefficients of energy efficiency and fuel elasticity differs from zero in both periods. These results may suggest that over time, consumers become less "myopic" regarding the usage costs of driving. In other words, they realize the joint impact of energy efficiency and fuel prices on the usage costs (Allcott & Knittel, 2019; Busse et al., 2016; Gillingham et al., 2019). Other coefficient estimations remain similar across the two examined periods. For instance, income elasticity is about 0.17. In addition, households in peripheral areas are more likely to own less energy-efficient cars than households in central areas, and use them more. The number of adults is positively associated with kilometers traveled. Furthermore, households with a female head drive 6% less than households with a male head. In addition, we document a positive association between education level and kilometers traveled (above and beyond income). Finally, we find that when the head of the household is self-employed, s/he drives 29% less.

Conclusions

We use a policy introduced in Israel in 2009 and revised in 2013 to study the potential of policy-induced improvements in energy efficiency leading to increased driving. We use rich national household survey data and a 2SLS model to estimate the rebound effect over two periods, utilizing the policy and its subsequent revision as exogenous instruments for identification purposes. Our results imply that the rebound effect in Israel has increased from 42% to 60% following the policy revision. Small and Van Dender (2007) show that the rebound effect declines over time. However, perhaps in the case of repeated policy-induced improvements the rebound might increase. We postulate that along with a policy that incentivizes the purchase of energy-efficient cars, consumers may become less myopic about the lower usage costs that come with energy-efficient cars. This increased awareness may encourage the owners of energy-efficient cars to increase their mileage. A review paper by Gillingham et al. (2016) suggests that policy-induced improvements in energy efficiency likely generate a considerable rebound effect. To the best of our knowledge, our study is the first to examine the impact of a policy that incentivizes the purchase of energy-efficient cars on the rebound effect over time.

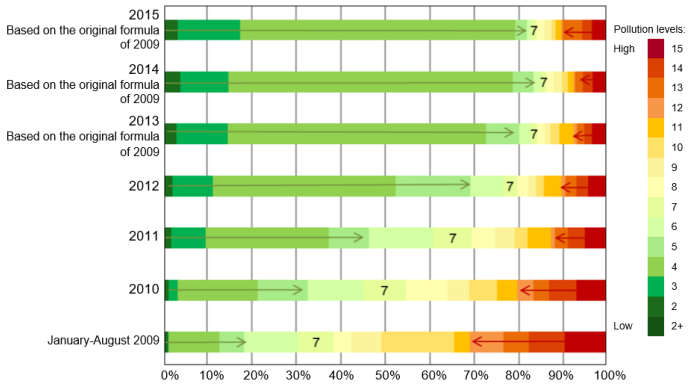

Figure 1: The distribution of new cars marketed in Israel, 2009-2015, by pollution levels (Israel Tax Authority, 2016)

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