IS THERE A REBOUND EFFECT IN GREEN TAXATION ON TRANSPORTATION? EVIDENCE FROM A NATURAL EXPERIMENT IN ISRAEL

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Overview

As part of its national goals to increase energy efficiency and mitigate greenhouse gas (GHG) emissions, the Israeli government launched a green taxation reform in the purchase of new cars in August 2009. Instead of a single *ad valorem* tax on the purchase of new cars, a *pigovian* tax was introduced in which the lower the car pollution rating is, the higher the tax discount the consumer will receive (Israel Ministry of Finance, 2009). Consequently, relatively more energy efficient and less polluting cars became cheaper to consumers hence more demanded. According to a recent report by the Bank of Israel (2014), the green tax reform succeeded as the average pollution rating of new cars in Israel has been decreasing over time (Figure 1). Nevertheless, the average national profile of new cars is insufficient to declare whether the reform is successful or not. This is because as fuel-efficient cars become more popular, it allows the respective number of car owners to increase their driving distances for the same budget thereby to consume more energy than they used to. This regressive effect is defined in the energy economics literature as a rebound effect (e.g. Berkhout, Muskens, & Velthuijsen, 2000; Greeninga, Greene, & Difiglio, 2000; Turner, 2013). In this paper, we treat the national-scale tax reform in Israel as a natural experiment to examine whether there is a rebound effect in transportation as a consequence of a green tax reform.

Methods

We utilize a rich household expenditure survey data, conducted by the Israeli Central Bureau of Statistics for the years 2007, 2008, 2010 and 2011. The year 2009 is omitted because the reform launched in August that year and we want to make a clear distinction in investigating households' economic behavior before and after the reform. Accordingly, we have fuel consumption data for two years before and two years after the reform. In addition to information about car ownership and fuel consumption, the database includes various household socio-demographic characteristics as education level, income, geographic location and many others variables which may affect car purchase and fuel consumption decisions. Following Archibald & Gillingham (1980) and Kayser (2000), we use an Heckman selection correction model (1976) as a two-steps estimation approach to account for the fact that households that do not own cars do not consume transportation fuel. In the first stage, we account for variables affecting the decision to own a car. Then, the selection correction term is inserted in the second stage to generate unbiased estimates for the coefficients of the variables affecting fuel consumption. Additionally, to investigate directly whether there is a rebound effect we introduce dummy variables for households surveyed after the reform and their decision to purchase a car. Then, we examine whether the fuel consumption of this group is significantly higher than the consumption of the group that bought a new car before the reform. Finally, to examine possible general trend in fuel consumption (irrespective to the reform) we also compare fuel consumptions between households that bought used cars before and after the reform.

Results

Our preliminary results suggest that the short run price elasticity of gasoline demand in Israel is -0.43 and income elasticity estimate is 0.21. Results regarding the existence of a rebound effect found to be statistically significant and positive. We found that the interaction term between household that were surveyed after the reform and purchased a new car that time is associated with higher amounts of fuel consumption. A household who belongs to this group appears to consume on average 17% more fuel than households in the other groups do. Moreover, the control groups describing households that bought used or new car before the reform and those that bought used cars after the reform show no significant difference with regard to fuel consumption. We also found that households located in a rural area consume 15% more fuel than those residing in an urban area in Israel, and that the number of children has a positive effect on fuel consumption as well as whether the head of the household is

male or female as households headed by a female tend to consume 5% less fuel than households headed by a male. In addition, we find statistically significant positive linkage between education level and fuel consumption (above and beyond income). Finally, we find that when the head of the household does not have a spouse she consumes 13% less fuel compare to cases where a spouse is present.

Conclusions

In this paper we examined the outcomes of a green taxation reform which launched in Israel in 2009. We utilized a rich household survey data in a two-steps estimation system for the demand for cars and transportation fuels. Our results imply that households that purchased a new car subject to the new green taxation consume significantly more fuel than other households. This is probably because the marginal cost of driving for this group has been decreased. Because overall fuel consumption for those purchasing a new car after the reform found to be higher, we can conclude that a rebound effect exists in this case. That is to say that although the national average profile of new cars has been improved, the ultimate goal was not achieved. Moreover, due to lower-than-expected tax revenues in 2013 the Israeli government recently reduced the tax benefits given in the green taxation reform. The new tariffs make the economic cars more expensive, while the polluting cars tariffs remain almost as before. An interesting future research will be to examine the effects of this change on households' car ownership decisions followed by their fuel consumption in order to evaluate the sensitivity of the estimated rebound effect found in this study.

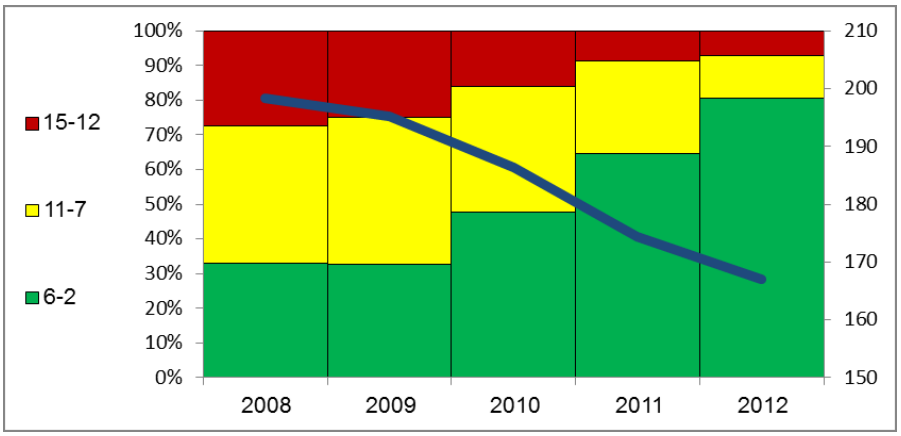

Figure 1: The distribution of new cars by pollution levels (left axis), their green ratings (right axis) and yearly averages (Bank of Israel, 2014)

References

Archibald, R., & Gillingham, R. (1980). An analysis of the short-run consumer demand for gasoline using household survay data. *The Review of Economics and Statistics 62(4)*, 622-628.

Bank of Israel. (2014). *"Green" taxation and changes in the buying patterns of private cars.* Retrieved from Bank of Israel: http://www.boi.org.il/he/NewsAndPublications/PressReleases/Pages/11-03-2014-GreenTax.aspx (In Hebrew)

Berkhout, P. H., Muskens, J. C., & Velthuijsen, J. W. (2000). Defining the rebound effect. *Energy Policy 28*, 425-432.

Greeninga, L. A., Greene, D. L., & Difiglio, C. (2000). Energy efficiency and consumption—the rebound effect—a survey. *Energy Policy, 28*(6), pp. 389-401.

Heckman, J. j. (1976). The common structure of statistical models of truncation, sample selection, and limited dependent variables and a simple estimator for such models. *Annals of Economic and Social Measurement 5*, 475-492.

Israel Ministry of Finance. (2009). *Press Release: "green tax revolution is underway Press Release: "green tax revolution is underway - Harnessing the economy in favor of environmental protection".* Jerusalem : Ministry of treasure - speaking and advocacy (In Hebrew).

Kayser, H. A. (2000). Gasoline demand and car choice: estimating gasoline demand using household information. *Energy Economics 22*, 331-348.

Turner, K. (2013). "Rebound" Effects from increased energy efficiency: A time to pause and reflect. *The Energy Jurnal 34*, 25-42.