Transport Policy 47 (2016) 105–118

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Evaluation of subsidies programs to sell green cars: Impact on prices, quantities and efficiency ☆

Juan Luis Jiménez [a,*,1], Jordi Perdiguero [b], Carmen García [c]

[a] Departamento de Análisis Económico Aplicado, Universidad de Las Palmas de Gran Canaria, Facultad de Economía, Empresa y Turismo, Despacho D. 2-12, 35017 Las Palmas de Gran Canaria, Spain
[b] Universitat Autònoma de Barcelona, Departament d'Economia Aplicada, Research Group of "Economia Aplicada" (GEAP), Spain
[c] European University Institute, Italy

ARTICLE INFO

Article history:
Received 17 September 2015
Received in revised form
17 November 2015
Accepted 8 January 2016
Available online 22 January 2016

JEL Classification:
H23
L52
L62
Q58

Keywords:
Subsidies
Automobile sector
Difference-in-difference estimator
Green policies

ABSTRACT

During the recent period of economic crisis, many countries have introduced scrappage schemes to boost the sale and production of vehicles, particularly of vehicles designed to pollute less. In this paper, the authors analyze the impact of a particular scheme in Spain (Plan2000E) on vehicle prices and sales figures as well as on the reduction of polluting emissions from vehicles on the road. They considered the introduction of this scheme an exogenous policy change and because they could distinguish a control group (both non-subsidized vehicles and the same vehicles in Slovenia) and a treatment group (subsidized vehicles), before and after the introduction of the Plan, the authors were able to carry out their analysis as a quasi-natural experiment. The study reveals that manufacturers increased vehicle prices by 600 € on average. In terms of sales, econometric estimations revealed that the Plan would not cause any increase in sales. With regard to environmental efficiency, comparing the costs (invested quantity of money) and the benefits of the program (reductions in polluting emissions and additional fiscal revenues) and it has been found that the Plan would only be beneficial if it boosted demand by at least 30%.

1. Introduction

The automotive industry is widely considered one of the most important manufacturing sectors in the economy of automobile manufacturing countries. Its high level of production and its labor demand make it a visible sector in any economy. The current economic crisis experienced by Western economies starting in 2008 has significantly impacted this industry, particularly in terms of automobile sales.

Reduced sales resulting in increased unemployment in the sector coupled with demands to meet targets for the reduction of greenhouse gas emissions – a result of the United Nations Copenhagen Climate Change Conference and the Kyoto Protocol – has led many Western governments to introduce special programs aimed at increasing vehicle replacement through new purchases.

These programs were essentially designed to fulfill two objectives: increase automobile sales (thereby minimizing redundancies), and reduce greenhouse gas emission levels generated by the vehicles on the road.[2] These policies were implemented in countries such as Germany, Italy, France, the United Kingdom and the United States during 2008 and 2009.

Although there were many countries that introduced these programs and approved their costs in governmental annual budgets, little attention has been paid to their effect on economies and, as far as the authors know, there are no studies into their effect in Europe. Nor are there any studies into the impact of governmental aid on prices set by industry.[3]

One governmental aid program in the United States that has been extensively analyzed called for the adoption of a hybrid vehicle.[4] The

☆Authors thank comments and suggestions by Daniel Albalate, Javier Campos, Aday Hernández, Héctor Rodríguez, Pilar Socorro, Ancor Suárez, members of Departamento de Teoría e Historia Económica of Universidad de Málaga and two anonymous referees. We also thank collaboration in database by María Montesdeoca. Nevertheless, all errors are ours.
* Corresponding author.
E-mail addresses: juanluis.jimenez@ulpgc.es (J.L. Jiménez), jordi.perdiguero@uab.cat (J. Perdiguero).
[1] Tel.: +34928458191.

[2] Hensher (2002) exposes that this is only one of the tools to influence in the transport behavior and hence in the levels of CO_2.
[3] Sallee (2011) analyzes the effect of subsidies for the purchase of the Toyota Prius hybrid car in its price. Surprisingly, the effect is zero; prices are not affected by the subsidy. The author considers that the effect of current prices on future sales may explain this result.
[4] A hybrid vehicle combines an electric engine and an internal combustion engine.

http://dx.doi.org/10.1016/j.tranpol.2016.01.002
0967-070X/

program offered a rebate of up to $2,000 and was introduced in 2001. A new version was introduced in 2005, increasing the rebate to $3,400. Diamond (2009) carried out a first estimate of the impact of this program on the sale of certain hybrid car models (Toyota Prius, Honda Civic and Ford Escape) and the results showed an increase of approximately 18%, depending on the model.

Beresteanu and Li (2011) studied public aid and the effect of gasoline prices on the purchase of hybrid vehicles. The results of the study showed that if the price of gasoline had not increased between 1999 and 2006, there would be 37% fewer hybrid vehicles on the roads. In terms of public aid, the authors estimated that the program stimulated a 20% increase in the demand for hybrid vehicles. Gallagher and Muehlegger (2011) analyzed this same program in United States and found a similar result (a 22% increase in demand).

Other studies include a report by Huang (2010) in which he analyzed the "Cash for Clunkers" program introduced in United States. This program was introduced in March 2009 and offered between $3,500 and $4,500 to exchange an old vehicle for a more energy efficient one. If the savings were between 4 and 9 miles per gallon of gasoline, the owner received $3,500, and if the savings were even greater they received $4,500.[5] The study shows how the average amount awarded ($4,224) boosted demand for more energy efficient vehicles by between 25% and 30%.[6]

Other papers like Mian and Sufi (2010) or Li et al. (2011) show that the global effect of the program was zero. Both papers find that after the initial increase in sales, they decrease in the months after the program. After few months the accumulative sales return to the normal level and the effect of the program is not really different from zero.

Giblin and McNabola (2009) study the carbon-based tax system for new vehicles implemented in Ireland in 2008. Using a car choice model, they predict that carbon-dioxide emissions will be reduced by 3.6–3.8%. While the annual tax revenues are expected to decrease, they argue that the cost savings of reductions in carbon-dioxide emissions may outweigh this loss. Rogan et al. (2011) analyze this policy one year after being implemented, showing that it was successful: emissions of new cars fell by 13% and there was a significant shift to diesel cars. However, as expected, there was a revenue loss. On the other hand, Hennessy and Tol (2011) conclude that despite the increase of market share for diesel cars, carbon dioxide emissions fall but only modestly, or even minimally once the rebound effect of people driving more is accounted for. Moreover, the cost to the revenue per tonne of carbon dioxide avoided is high.

Given that most studies focus on the effects on vehicle sales (and not the impact on prices), the objective of this study is to analyze the impact of a program that promotes pollution reducing vehicles (Plan 2000E in Spain) from three different perspectives: firstly, on the prices set by automobile manufacturers (the effect of subsidy on price); secondly, its effect on the sales of automobiles in a European market, and thirdly, on the viability of the program in terms of environmental benefits (measured by assessing empirical evidence).

The present study contributes to the literature surrounding this issue in the following ways: firstly, as far as the authors know, the impact of public assistance on prices set by manufacturers in the conventional cars has not been previously analyzed. Secondly, studies that analyze European cases are not available in the literature. Thirdly, it is provided evidence on the environmental viability of the program, by comparing its costs and the environmental benefits.

The difference-in-difference analysis reveals that the manufacturers' response to the introduction of the Plan was to significantly increase the prices of the subsidized vehicles, thereby keeping a part of the funds. The fact that automobile manufacturers (hereinafter manufacturers) received one part of the credit by increasing vehicle prices illustrates that the effect of the Plan on the sales and on pollution reduction levels is actually quite low, which significantly reduces the efficiency of the Plan. Econometric results showed that the impact of the program on the sales of automobiles was around 0%. Results also indicate that the costs of the program far exceed the resultant environmental benefits, and as such Plan 2000E not only turned out to be inefficient, but probably was socially undesirable too.

After this introduction the rest of the paper is organized as follows: Section 2 describes the characteristics and the implementation of Plan 2000E in detail and Section 3 focuses on the data used in the empirical study, which is presented in Section 4 for both objectives (effects and environmental efficiency). Conclusions are given in Section 5.

2. Plan 2000E

The manufacture of automobiles and bicycles in Spain during 2009 was valued at approximately 40 billion euro and employed 145,645 workers that same year. These figures accounted for 11.5% of total production and 7.2% of employment in all manufacturing sectors.[7] These figures demonstrate the importance of this sector in the Spanish economy, and explain why this industry has received so much media attention during the ongoing economic crisis.

To put Spanish automobile manufacturing into an international perspective, Spain was the eighth largest manufacturer in the world and third largest in Europe in 2009. Despite this, there is evidence that starting at the end of 2007, the economic crisis was starting to affect the sector, and by 2009 the sector had reached an alarming level of suffering, with a reduction in year-on-year manufacturing of almost 20% for motor vehicles in businesses with more than two hundred employees, and 35% in the remaining businesses.[8]

This negative evolution in the sector in 2008 and 2009 led the Spanish Government to take action (as did other countries with similar problems)[9] by introducing a scrappage scheme that would reactivate sector activity, called Plan 2000E. This Plan would subsidize the replacement of an old vehicle for a new one, with specific characteristics, and was co-financed by the National Government (who contributed 500€), the Autonomous Communities (who contributed 500€) and manufacturers (who contributed 1000€) with the aim of providing a total subsidy of 2000€.

Only specific vehicles with the M1 classification could be subsidized (motor vehicles with at least four wheels, designed and manufactured for the transport of passengers) and those with the N1 classification (vehicles designed for the transport of merchandise, whose gross vehicle weight did not exceed 3.5 t). A list of vehicle requirements is shown in Table 1.

Consumers could benefit from the subsidy by exchanging an M1 or N1 classified vehicle, which was at least 10 years old or with

[5] An extensive explanation of the "Cash for Clunkers" program is available in Cooper et al. (2010) and Yacobucci and Canis (2010).

[6] Alberini et al. (1995) present a theoretical model in order to determine user participation in vehicle substitution programs. Nevertheless, the participation ratios estimated from the model are quite distant from those confirmed in empirical studies, reaching 78% by offering only $2,000.

[7] MITYC (2011). *Estadística de Fabricación de Vehículos Automóviles y Bicicletas*.

[8] Fundación SEPI (2009). *Las empresas industriales en 2009: Encuesta sobre estrategias empresariales.*

[9] During 2008 and 2009, public assistance was also provided to purchase of vehicles in Germany (2.500€ per vehicle, with a total of 600,000 vehicles being subsidized), Italy (rebate ranged from 1500€ to 3000€, depending on the vehicle), France (allocation of 1000€, with approximately 400,000 vehicles subsidized), the United Kingdom (2000 GBP, of which the Government contributes 1000, and the manufacturers the rest) and the United States (rebate of $3500 or $4500, according to vehicle fuel consumption).