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Cantos - Sánchez, Pedro; Gutiérrez-i-Puigarnau, Eva; Mulalic, Ismir

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Pedro Cantos-Sánchez and Eva Gutiérrez-i-Puigarnau and Ismir Mulalic

Universitat de València, CPB The Hague, Technical University of Denmark

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The impact of scrappage programs on the demand for new vehicles: Evidence from Spain

Pedro Cantos-Sánchez
Universitat de València
Pedro.Cantos@uv.es

Eva Gutiérrez-i-Puigarnau
(CPB The Hague)

Ismir Mulalic
Technical University of Denmark
imu@transport.dtu.dk

Abstract We evaluate the impact of the Spanish car scrappage program introduced in May 2009 on short-run car purchases. The scrappage program was simultaneously discussed and implemented, and was therefore exogenous to the consumers. We analyse the effect of this program on household new car purchase decision and household expenditures. The results show that the scrappage program increased the probability to buy a new car, but decreased the mean expenditure devoted to the purchase of this new vehicle. We also evaluate the impact of the financial aid on the household welfare, which suggests that the scrappage program was neutral.

Keywords: Car demand; scrappage program; economic crisis; subsidy.

JEL classification: H20; R21.

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1. Introduction

The car industry has been dramatically hit by the economic crisis that started in 2008. Demand for car sales declined sharply, deepening the crisis effect on the car industry in car-producing countries, through the broad linkages the car industry has with other sectors. New car registrations fell from 15 million units in 2007 to 13 million units in 2009, so by about 13%.[1] The governments of many European countries granted financial aids to the (national) car industry to help the country get out of the crisis. This paper analyses the effect of car scrappage program in Spain.

Most of the literature on car demand is devoted to the analysis of car travel demand and car ownership (see e.g. Mannering and Winston, 1985; Train, 1986; De Jong, 1990, 1991).[2] Matas and Raymond (2008) analyse the factors determining the growth in car ownership in Spain, using a discrete choice model at three points in the time. Recently, scrappage programs in different countries have generated widespread interest. This is not surprising, as the impact of these programs on car demand strongly depends on the program design (see Hahn, 1995; Alberini et al., 1995; Esteban, 2007). De Palma and Kilani (2008) analyse these programs in a dynamic setting, finding that the number of households that buy a new car is larger in the presence of the program, but the demand for new cars is not necessarily higher because the scrap value of a car can increase its replacement cycle length, and this might reduce the total demand for new cars.

Empirical papers that estimate the effects of scrappage programs previous to the economic crisis that started in 2008, include the French car market (Adda and Cooper, 2000), the Italian car market (Schiraldi, 2011), the German car market (Böckers et al., 2008), and the Spanish car market (Licandro and Sampayo, 2005). More recently, Mian and Sufi (2012) and Li et al. (2013) apply a differences-in-differences approach to assess the recent US program "cash for clunkers". These empirical studies, in line to the theoretical studies, show that scrappage subsidies have a positive effect on car sales in the short run, but this effect is very small in the long run. Leheyda and Verboven (2013) analyse the scrappage programs recently implemented in nine European countries. They find that, in absence of the programs, the car sales would have diminished by 17.4% for the countries where new cars had to satisfy particular conditions (especially concerning CO_2 emissions) and by 14.8% for those countries where these conditions were not required. They

[1] Based on data provided by the European Automobile Manufacturers' Association.

[2] See also Bunch (2000) and De Jong et al. (2004) for two good literature reviews on car demand.

also identify minor "crowding-effects", because sales of non-eligible cars (that is, cars not satisfying the conditions for the scrappage programs) were not affected during the period when the scheme was effective. The substitution effects are however analysed only within the car industry, and potential effects on other markets where ignored. Note that scrappage programs can provoke significant rises in the purchase of new vehicles, but at the expense of a reduction in the consumption of other types of goods. Finally, Jiménez et al. (2011) analyse the Spanish scrappage program using data on disaggregated car sales. Their analysis suggests that car producers responded to scrappage program by raising the car price by the same amount they were granted through the Plan (around €1,000). They also show that the program raised car sales by almost 5% (which is much lower than the estimated increase by Leheyda and Verboven, 2013).

Our paper contributes to the literature through three ways: (*i*) we analyse the effects of "scrappage programs" using detailed household data, (*ii*) we study the substitution effects not only on the car purchases, but also on other household expenditures, and (*iii*) we assess the economic valuation of the scrappage program".[3] We take into account the substitution effects that the program caused on the other household expenditures by estimating an Almost Ideal Demand System (AIDS) model.[4] We emphasise that the *differences-in-differences* approach, which is usually applied in the recent literature analysing this issue, is not informative about the substitution effects. Our results suggest that the scrappage program has a positive impact on the car demand. However the mean expenditure devoted to the purchase of a new car decreased with respect to both the period previous to the program and the period after the program. We estimate the value of the compensating variation provoked by the financial aid to be close to the financial aid of €1,000 offered by the central government during the scrappage program. The rest of the paper is structured in the following way. Section 2 briefly describes the Spanish scrappage program. Section 3 describes the data used in the analysis. Section 4 presents the applied methodology. Section 5 presents the empirical results, and section 6 concludes.

[3] Note that our study is a micro-study of household purchase behaviour, and does not study important issues such as the role of the subsidy on employment or house prices (Mian and Sufi, 2012).

[4] Traditionally AIDS models have been employed to assess the welfare change put forward by changes in prices (see, for instance, Friedman and Levinsohn, 2002; Abdulai and Aubert, 2004), changes in taxes (Tiezzi, 2005; Barros and Prieto-Rodríguez, 2008) or even changes in the goods or services quality (Shaikh and Larson, 2003).

2. The Spanish scrappage program

Many European countries had introduced scrappage programs in the period before the economic crisis with the main objective to reduce the global air pollution. The economic crisis introduced a new element in these programs, because the fall in the demand of new vehicles raised the risk of many employment losses for the car industry and for the industry's suppliers and distributors. Consequently, the scrappage programs started being used also as a policy to mitigate the crisis effects on the employment and the production. According to an article in The Economist (2009a), this type of financial aid is good to eliminate the liquidity trap in times of economic crisis.

Table 1. Scrappage programs for selected countries in 2009

Country	Maximum incentive	Car age requirement	Emissions requirement	Total cost to government
United States	€3,309 (~$4,500)	Under 25 years old	No	$3 billion
Germany	€2,500	Over 9 years old	No	$7.1 billion
United Kingdom	€2,410(~£2,000)	Over 10 years old	No	$500 million
France	€1,000	Over 10 years old	Yes	$554 million
Italy	€1,500	Over 10 years old	Yes	–
Spain	€2,000	Over 10 years old	Yes	€220 million

Source: Own table based on The Economist (2009b).

Table 1 provides an overview of different scrappage programs implemented in selected countries in 2009, which is the first year where the crisis was globally perceived. Note that in Europe the old vehicle to substitute must be older than 10 years. Moreover, the emissions requirement of the new vehicle is present in several countries, i.e. France, Italy and Spain. The amount of the subsidy in 2009 notably increased with respect to previous programs. For instance, subsidies in Spain for previous programs were between €500 and €1,000 per new car, subsidies in France in 2008 were €350 and in Italy in the same year were between €800 and €900.

The scrappage program in Spain was introduced in the context of a general policy (Plan 2000E), which aimed at providing a short-term stimulus to the economy by increasing public expenditures. The undesirable evolution of the car sector in Spain can be seen in Figure 1. Note that car sales in Spain decreased by about 38%. As a mean to counterbalance this reduction of private consumption

due to the economic crisis, in May 19th of 2009 the government agreed to implement a program called Plan 2000E, which took effect a *few days later*, with the goal to encourage the demand for the acquisition of new vehicles.

Figure 1. Annual new car sales in Spain

Source: Directorate-General of Traffic.

Table 2 summarises the most important features of the Spanish program. The program had mainly three stages. The first stage was launched in the last days of May 2009 for one year period or until the budget (€100 million) would be exhausted. In five months, this budget run out and a second stage of the plan with a budget of €40 million was approved for the last two months of 2009. In aggregate terms, the first stage provided good results in terms of recovering the car demand. In the third quarter of 2009 (when the program was totally developed) the fall in car sales was only 0.32% lower than that of the same quarter in the previous year, while in the fourth quarter there was an increase in the car sales of 18%. Encouraged by these results, the government extended the plan to 2010 with a new budget of €100 million. Similar to the first stage, this third package was implemented for one year period or until the budget would be exhausted (what happened in July 2010). The only change introduced in the plan, with respect to the program in 2009, was that the price limit of new cars was increased to €40,000.

Table 2. The Spanish scrappage program (Plan 2000E)

Timing	May 19th of 2009 (start of first stage program) until end of September of 2009 (budget exhausted) November of 2009 (start of second stage program) until end of 2009 January of 2010 (start of third stage program) until end of June of 2010
Budget	€100 million (first stage) €40 million (second stage) €100 million (third stage)
Aid	€2,000 per car
Eligibility	Replace old vehicle (over 10 years old) Maximum price of new car €30,000 (€40,000 in third stage) Maximum levels of CO_2 emissions

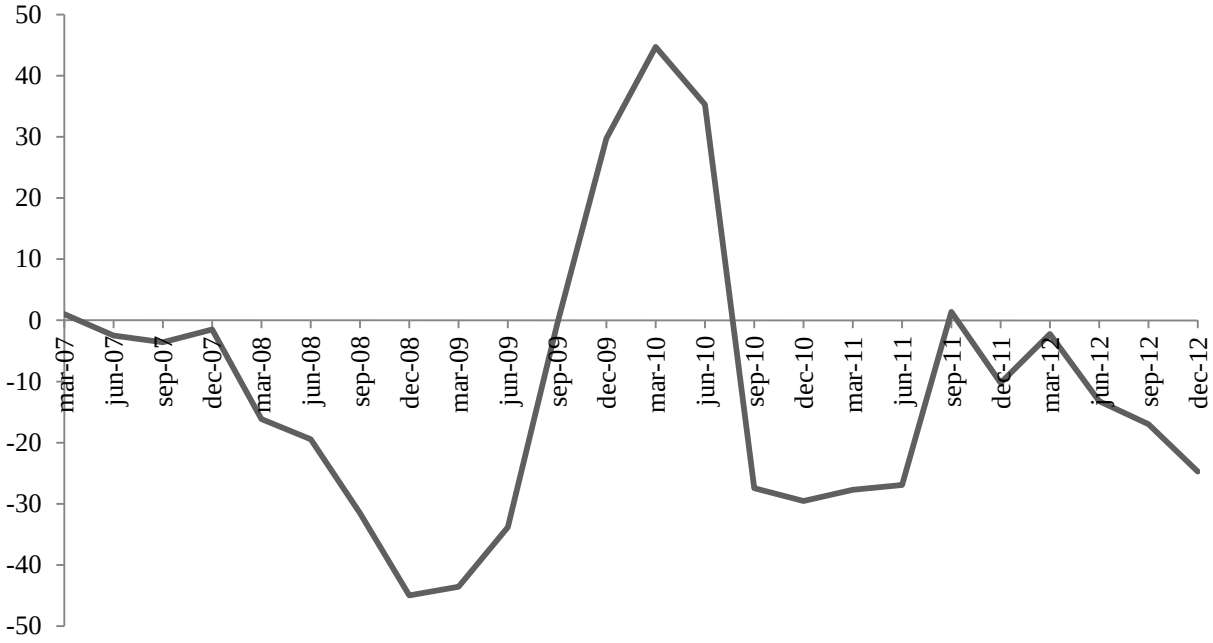
The government aid consisted on a grant of €500 per car from the State government plus another €500 per car from the regional government.[5] Furthermore, it was expected that the car industry would grant an additional subsidy of €1,000 per car. The industry ended adding up to this initiative, and the total aid represented an amount of €2,000 per car. The conditions to obtain the aid were as follows: the price of the new car could not exceed the amount of €30,000, an old vehicle should be retired and substituted, and the new car had to fulfil specific characteristics in terms of maximum levels of CO_2 emissions. These levels of emissions should be under 120 and 160 grs/km depending on the type of car.

One of the most outstanding features of this plan was its *exogenous character*. The program was totally unexpected to consumers when it was announced. In addition, any change in the program was not influenced by the actions of the manufactures or the consumers in the market.

Although the initial valuation of the Ministry of Industry, Tourism and Commerce and the Federation of Automobile Dealers was positive, arguing that the plan had been useful to stop the drop in demand in the car market in 2009, Figure 2 shows that the subsidy produced a short-lived effect. The decline in the sales of new cars was reversed due to the start-up of government aid in the period between July 2009 and July 2010, but the decline trend re-appeared and remained when the aids were stopped. This notably fall in demand when the program ended raised criticism by some groups, as the global demand was hardly modified.

[5] In the first stage of the program the regions of Madrid and La Rioja rejected to contribute to the program, but they offered discounts in the registration tax of around 20%.

Figure 2. Quarterly percentage change in the sales of new vehicles



Source: Directorate-General of Traffic.

Moreover, Jiménez et al. (2011) show that the subsidy implied an increase in the new car sale prices, counteracting the positive effect of the scrappage program over the prices. "Crowding-out" effects on other goods and sectors could also have taken place, and hence these effects should be valued too. Summarising, the implementation of the Spanish scrappage program was controversial, and thus makes it an important empirical question.

3. Data

Our study is based on the annual Spanish Household Expenditure Surveys (EPF) for the period 2008−2010. We observe 51,402 households that report total values of each expenditure. We have information on expenditures on purchase of new cars from those households who decided to buy a new vehicle (see Table 3). For each year, these households stated the expenditures devoted to this purchase in the last twelve months. There are numerous EPF expenditure per purchase categories, which we collapse into five groups: (*i*) food, drinks, tobacco and narcotics, clothes and shoes; (*ii*) housing, water, electricity, gas and other fuels, furniture and housing equipment (*iii*) transport and communications (*iv*) leisure, hotels and culture; (*v*) rest of goods and services.

Table 3. Data on new car sales in the sample

Number of new cars (2008−2010)	3,360
Number of new cars before the scrappage program	2,139
Number of new cars during the scrappage program was in force	835
Number of new cars after the scrappage program	386
Average expenditure on new cars from households buying a new car (in €)	19,070
Number of households	51,402

We also have information on the purchase month of a new car in 2009 and 2010. This allows us to identify whether new cars were purchased during the validity of the scrappage program. We can then define the following 'treatment' dichotomous variables: (*i*) d_{t-1} takes value 1 when the new car was bought in the period before the program, otherwise 0; (*ii*) d_t takes value 1 when the new car was bought in the period that the program was in force; and (*iii*) d_{t+1} takes value 1 when the new car was bought in the period after the program.[6]

Alternatively we can define the following time period dummies: (*i*) dummy year 2008 (no subsidy) takes the value 1 when the household is asked and registered in year 2008, otherwise 0; (*ii*) dummy year 2009 (partly household could get a subsidy) takes the value 1 for year 2009, otherwise 0; and (*iii*) dummy year 2010 (partly household could get a subsidy) takes the value 1 for year 2010, otherwise 0. Note that during 2008 there was no subsidy, during 2009 the household could only get a subsidy on the second semester of this year, and during 2010 the household could only get a subsidy on the first semester of this year.

Further, note that in year 2008 we have information about the purchases of new cars in 2007 and 2008, as we have information about household expenditure on new cars in the last 12 months. Those correspond to 699 and 587 observations respectively. Similarly, year 2009 registers households that bought a new car in 2008 and 2009 (478 and 513 observations respectively). However, in general, only the cars between June and September and between November and December of 2009 were purchased under the program (171 new cars registered for 2008 were purchased during this period, which stands for 17.2% of the total cars registered for 2009). Year 2010 registers households purchasing new cars in 2009 and 2010, being 564 and 519 units

[6] There were two months in which the program funding was over: September and October of 2009. In 2010 certain regions such as Canarias, Asturias, Islas Baleares, País Vasco and Galicia were excluded from the program because the funds had been used up or because such region decided not to subsidise vehicles. We have therefore rewritten d_t to 0 for the corresponding observations.

respectively. The dummy denoting year 2010 includes most of the purchases of new cars under the period of the scrappage program that took place between the second semester of 2009 and the first semester of 2010 (with the aforementioned exceptions). During the period in which the subsidy was in force in 2010, there were a total of 664 new cars registered (which represents 61.3% of new cars registered in whole of 2010).

We have also socioeconomic information for each household, see Table A1 in the Appendix for the descriptive statistics of these variables. In particular, we use information for the main breadwinner of the household (gender, age, marital status and highest obtained education degree), information on the number of children in the household, the number of employed members in a household, and the population density in the household's residence region.[7] In addition, we use data on households expenditures grouped in five types, see Table 4. Index prices for each expenditure group are calculated using the National Institute of Statistics (INE)'s information. These prices indexes are weighted depending on the particular consumption structure of each household.

Table 4. Household annual expenditures and price indexes

	Mean expenditure (€)	Price index
Group of household expenditure 1 (food, drinks and clothes)	7,953	88.31
Group of household expenditure 2 (housing and furniture)	4,470	95.53
Group of household expenditure 3 (transport and communications)	3,086	98.21
Group of household expenditure 4 (leisure and hotels)	4,872	98.92
Group of household expenditure 5 (rest of goods)	4,292	97.37

Note: Price index: 2011=100.

4. Methodology

In this section we specify the econometric models used for the analyses of the possible impact of the scrappage program on car demand. The particular approach used depends on the objective pursued in that analysis. Section 4.1 focuses solely on the car market. A probit and a tobit model are estimated to analyse the effects of the scrappage program on the decision to purchase a new vehicle and on the amount devoted to this purchase. In section 4.2, we consider an extension of the model that takes the interaction of the car market with other markets and finally the effect of the scrappage

[7] We also control for the regions of Madrid and La Rioja in our analysis, because they did not participate in the same conditions in the program as the other regions.

program on household's welfare. An Almost Ideal Demand System (AIDS) is estimated for this aim.

4.1. Partial analysis of car demand

We first estimate a probit model to assess whether the introduction of the scrappage program affects the probability to purchase a new car. The dependent variable takes the value of 1 if the household decides to purchase a new car, that is, when the household has spent a positive amount of money in the last twelve months on new car purchase. Therefore:

$$Y = \begin{cases} 1 \text{ if } Y^* > 0 \\ 0 \text{ if } Y^* = 0, \end{cases} \quad (1)$$

where Y^* stands for the expenditure on new cars in the last twelve months; $Y^* = \boldsymbol{\beta}' \boldsymbol{X_i} + \varepsilon_i$, where $\boldsymbol{X_i}$ denotes the vector of explanatory variables associated with household i, and ε_i is the error term.

The aforementioned 'treatment' dichotomous variables (d_{t-1}, d_t and d_{t+1}) cannot be used to identify the effect of the scrappage program on the household new car purchase decision due to perfect prediction.[8] We therefore use the time period dummies (for years *2008*, *2009* and *2010*); however, at the expense of undervaluing the true effect of the scrappage program. For instance, by introducing the dummy variables for years 2008 and 2010 in a probit model we can estimate the change in the probability to purchase a new car by both households that answered the EPF survey in 2010 (time period with the largest likelihood to buy a subsidised car) and households that answered the survey in 2008 (time period with no subsidised cars), compared to those households that answered the survey in 2009 (time period during the scrappage program). We hypothesise two possible effects: (*i*) the scrappage program had a stronger effect in inducing household car purchase in 2010 than in 2009, and (*ii*) household car purchase decision without the subsidy is negative with respect to that with the subsidy.

[8] Perfect prediction occurs when studying the scrappage program-related household's probability to buy a new car (yes/no) and 'treatment' dichotomous variables indicating the period before/during/after the program are predictors, because the subgroups of households in a certain period have the same probability to buy a new car, without the need of estimating the model. That is, Pr (Y_1= 1 | d_{t-1} = 1) = 1, Pr (Y_1= 1 | d_t = 1) = 1, and Pr (Y_1 = 1 | d_{t+1} = 1) = 1.

Secondly, we estimate a tobit model to identify how much the expenditure on a new car changes due to the scrappage program. The dependent variable is now expressed as follows:

$$Y = \begin{cases} Y^* \text{ if } Y^* > 0 \\ 0 \quad \text{if } Y^* = 0, \end{cases} \tag{2}$$

where Y^* is the expenditure on new car in the last twelve months; $Y^* = \boldsymbol{\beta}' \boldsymbol{X_i} + \varepsilon_i$. Since there is no problem of perfect prediction, we prefer a specification using treatment dichotomous variables rather than year dummies,[9] which allows us to draw more informed conclusions with respect to the effect of the scrappage program on the *household new car purchases expenditure*.

The marginal effects for the expected value of Y (censored and uncensored) can be expressed as $\partial E[Y]/\partial X_i$. For instance, the marginal effect of the treatment variable d_t (the dichotomous variable indicating the period where the program was in force) measures the increase of expenditure on new car provoked by the scrappage program for both type of households, those that decide to purchase a new vehicle and those that do not.[10] The marginal effects for the expected value of Y for uncensored observations can be expressed as $\partial E[Y|Y > 0]/\partial X_i$. In this last case, the marginal effect of the treatment variable d_t measures the increase of the expenditure on new vehicles provoked by the program, but only for households that decide to purchase a new vehicle.

We also hypothesise that the price limit of €30,000 to be eligible for the subsidy in 2009 (and €40,000 in 2010) reduces the expenditure devoted to the purchase of new cars, allowing a higher expenditure on other goods or a greater saving.[11]

4.2. The scrappage program and welfare

We estimate also an Almost Ideal Demand System (AIDS) model that provide a complete demand equation system for the goods and services that households consume. The AIDS model has some

[9] When studying the relationship between household's expenditure in new cars and 'treatment' dichotomous variables indicating the period before/during/after the program are predictors, there may be different expenditure within subgroups of households in a certain period (e.g. household A spends a different amount on a new car than household B does), and there is thus need for estimating a model.

[10] Note that the marginal effect of a dummy variable is calculated as the discrete change in the expected value of the dependent variable as the dummy variable changes from 0 to 1 (Wooldridge, 2002).

[11] For some household, however, it may hold that they use the subsidy to upgrade their car, as long as the price of the car is below the eligibility limit, and the subsidy may thus increase the car expenditure.

attractive features (see Deaton and Muellbauer, 1980). It allows us to account for the common restrictions of homogeneity, adding-up constraint, and symmetry constraint implied by consumer theory. Most importantly, shares of expenditures of goods can be derived from duality theory and exact welfare measurement can be estimated.

Based on the AIDS approach by Shaikh and Larson (2003), where quality of the provided service enters as a component of the price vector (so that quality affects demand as an intercept shifter), one may estimate household share (system of) equations using a seemingly unrelated regression (SUR) as follows:

$$w_{iht} = \alpha_i + \rho_i D_s + \sum_{j=1}^{5} \gamma_{ij} \log p_{jt} + \beta_i \log \frac{M_{ht}}{p_t} + \sum_{l=1}^{L} \lambda_{il} X_{lht} + \varepsilon_{iht}, \quad (3)$$

where:

$i = j=1,\ldots,5$

$h = 1,\ldots, H,$

$D_s = d_{t-1}, d_t, d_{t+1},$

$l = 1,\ldots, L.$

In the demand equations (3), w_{iht} is the share of expenditure of the *h*th household on the *i*th good at time *t*, p_{jt} are prices, M_{ht} is total household expenditure, p_t denotes a price index formed from all prices, X_{lht} is household characteristic *l* in period *t*, D_s denotes 'treatment' dichotomous variable to indicate whether a household purchases a new car in the period *before*, *during* or *after* the scrappage program was in force, and ε_{iht} is the error term. The effect of increased expenditure is reflected in the β_i coefficients, whereas the effect of prices is reflected in the γ_{ij} terms. This system of equations represents an arbitrary first-order approximation to any demand system (Deaton and Muellbauer, 1980). The model is estimated under the assumption that households change their spending on new cars as a result of the price changes generated by the introduction and ending of a scrappage program that was unanticipated by the households.

In addition, to fulfil the theoretical properties of the consumption theory, the parameters of (3) are estimated imposing the following constraints:

$$\begin{aligned} &\sum_{j=1}^{5} \alpha_i + \rho_i + \lambda_{il} = 1, && \text{(adding-up)} \\ &\sum_{j=1}^{5} \beta_i = \sum_{j=1}^{5} \gamma_{ij} = 0, && \text{(homogeneity)} \\ &\gamma_{ij} = \gamma_{ji}\ (i \neq j). && \text{(symmetry)} \end{aligned} \quad (4)$$

The parameter values of the equation that is dropped during estimation in the estimation of (3) are obtained by taking into account the constraints in (4) into account. We exclude the equation which corresponds to expenditure on "rest of goods" (expenditure group 5).

Since there are no restrictions on price or income elasticities, aggregating over households (h) and periods, the income elasticity (ε_{iM}) and the price elasticity (ε_{ij}) for the ith good can be estimated as:

$$\varepsilon_{iM} = 1 + \frac{\beta_i}{w_i}, \tag{5}$$

and

$$\varepsilon_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}(\alpha_j + \sum_k \gamma_{kj} \log p_k), \tag{6}$$

where $\delta_{ij} = 1$ for $i = j$, and $\delta_{ij} = 0$ for $i \neq j$.

In order to evaluate the scrappage program, the compensating variation (CV) measure is derived. Assuming that only the price of new cars has changed due to the introduction of the scrappage program (from p^0 in the period before the program to p^1 in the period while the program was in force) and holding constant the initial level of utility achieved by the household $\bar{u}$, that is just before households have had enough time to modify their behaviour under the current price of new cars, the CV for a representative household can be expressed as:

$$\text{CV} = M^0 - \exp[\, logp^1 + [\log M - logp^0]\, \beta_0 \left(\frac{p_1^0}{p_1^1}\right)^{\beta_1}], \tag{7}$$

where $\bar{u} = [\log M - logp^0] / \prod_i (p_i^0)^{\beta_i}$.

By substituting the parameters of the estimated demand equations (3) in (7), we obtain a CV measure. The CV measure indicates the amount of money that a household would need to be compensated due to the price change induced by the introduction of the subsidy, so that the household maintains its initial level of utility. If CV > 0, the scrappage program generates losses along all the expenditure distribution; if CV < 0 the subsidy generates a gain in welfare. It is expected that the CV is negative, and hence, there is a gain for consumers. One can also compile CV when the price of new cars changes due to the removal of the subsidy (from the period when the program was in force to the period after the program). The CV now is expected to be positive, implying a welfare loss.

5. Empirical results

The econometric results of the probit model based on (1) are shown in Table 5. Column [1] shows the estimated coefficients of each variable in the regression, and column [2] shows the corresponding marginal effects.[12] We find that the effects of dummy variables for years 2008 and 2010 on household purchase decision (with respect to *year 2009*) are negative and positive respectively, both effects statistically significant at the 99.9%. Hence, the probability of buying a new car decreases in year 2008 and increases in year 2010. The signs of the coefficients are the expected, in line with the aforementioned hypothesis and in line with literature suggesting that overall the program has been successful in creating additional demand for new cars (Böckers et al., 2008).

The marginal effect of the dummy variable for the year 2010 indicates that the probability to buy a new car in 2010 increases by 1.07% with respect to year 2009. Moreover, the probability to buy a new car in 2008 was 0.86% lower than in 2009. Note that, as we explained before, one should interpret these impacts as being clearly undervalued, because we cannot estimate the effect of dummies standing for the net period when the program was in force, before or after the program. Note also from the table that the coefficients of the prices for "food, drinks and clothes" – group of household expenditure 1 − and "rest of goods" – group of household expenditure 5 − are negative, suggesting a complementary relationship, whereas the coefficients for the other expenditure groups are positive. The effect of total expenditure on household car purchase decision is large and significant. The effect of the obtained education degrees (with respect to the highest level), and living in cities of low density population increase the probability to buy a new car. However, having children, the age of the head of the household and multi-earner households (with respect to one-earner household) decrease the probability to buy a new car. Finally, the dummies standing for the regions of Madrid and La Rioja, that partially implemented the scrappage program, are not statistically significant.

[12] Marginal effects here denote how the probability to buy a new car changes when the explanatory variable is marginally modified. In the case that the explanatory variable is a dummy, the marginal effect measures the effect on probability when the level of the variable changes from 0 to 1.

Table 5. Probit model for the decision to buy a new vehicle in the last 12 months

	[1] Effects	[2] Marginal effects
Dummy year 2008 (no subsidy)	-0.342***	-0.009***
	(0.034)	(0.001)
Dummy year 2010 (partly household could get a subsidy)	0.329***	0.011***
	(0.033)	(0.001)
Price index per group of household expenditure 1 (in log)	-4.088***	-0.115***
	(0.256)	(0.008)
Price index per group of household expenditure 2 (in log)	7.257***	0.203***
	(0.563)	(0.017)
Price index per group of household expenditure 3 (in log)	11.33***	0.318***
	(0.410)	(0.015)
Price index per group of household expenditure 4 (in log)	0.159	0.004
	(0.956)	(0.027)
Price index per group of household expenditure 5 (in log)	-6.974***	-0.195***
	(0.619)	(0.019)
Total value of household expenditure / price index ^{x} 100 (in log)	2.072***	0.058***
	(0.030)	(0.002)
Dummy main breadwinner is a male	-0.013	-0.0004
	(0.030)	(0.001)
Dummy main breadwinner is married	-0.047	-0.001
	(0.032)	(0.001)
Dummy no studies of primary education, of the main breadwinner	0.327***	0.011***
	(0.037)	(0.002)
Dummy secondary education or first cycle, of the main breadwinner	0.221***	0.007***
	(0.029)	(0.001)
Dummy secondary education or second cycle, of the main breadwinner	0.101**	0.003**
	(0.032)	(0.001)
Dummy 1 child in the household	-0.122***	0.018***
	(0.030)	(0.002)
Dummy 2 children in the household	-0.288***	0.016***
	(0.031)	(0.002)
Dummy 3 or more children in the household	-0.560***	0.009***
	(0.052)	(0.002)
Age of the main breadwinner	-0.011***	-0.0003***
	(0.001)	(0.00003)
Dummy no working members in the household	0.001	0.00002
	(0.041)	(0.001)
Dummy 2 working members in the household	-0.068*	-0.002*
	(0.026)	(0.001)
Dummy 3 or more children in the household	-0.113**	-0.003*
	(0.043)	(0.001)
Dummy semi-urban or intermediate population density	0.147***	0.004***
	(0.028)	(0.001)
Dummy sparse population density	0.166***	0.005***
	(0.027)	(0.001)
Dummy region of Madrid	-0.057	-0.001
	(0.044)	(0.001)
Dummy region of La Rioja	-0.076	-0.002
	(0.065)	(0.001)
Constant	-58.58***	
	(6.249)	
Number of observations	51402	51402
Log likelihood	-8035.0	

Notes: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; marginal effects at means,; reference dummy categories for year, education, children, working members and population densities are dummy year 2009 (partly household could get a subsidy), dummy higher education of the main breadwinner, dummy no children in the household, dummy 1 working member in the household, and dummy dense population density, respectively; see Table 4 for a description of the expenditure groups.

The econometric results of tobit models based on equation (2) are shown in Table 6. Column [1] in this table shows the effects of the program (d_t) and after the program (d_{t+1}), with respect to before the program (d_{t-1}), on household expenditure on new cars. The results suggest that the expenditure on new car was slightly higher during the period after the scrappage program (around €227 = €8,445 − €8,228 for uncensored observations, that is households that purchased a new car, and around €345 (= €6,514 − €6,169) for the whole sample, that is households that purchased a new car and those that did not). In column [2], we compare the effects of no subsidy (the periods before and after the program), with respect to subsidy (the period during the program). There seems to be a notable fall in expenditure on new cars in the period of 6 months after the program in relation to the period before the program (€1,901 for the whole sample and €1,468 for the uncensored observations). Therefore, although the car scrappage program seems to have an effect on new car sales, there seems to be a decline in household car expenditure. This decline may be particularly explained by an increase in household savings, along the lines of the aforesaid hypothesis, driven by a severe reduction of credit supply to households (Köhler and Calleja Jiménez, 2012). The small expenditure after the program suggests, albeit tentatively, that there is still high household savings.[13]

The effect of other estimates is as follows: gender or marital status does not seem to affect the expenditure on new vehicles. Breadwinners with low levels of education spend more income on new cars. The number of children and breadwinner's age decrease the expenditure on new vehicles. Households in cities of lower population density seem to spend more money on new vehicles.

Finally, we also estimate an economic valuation of the scrappage program based on equation (7). For this, we first need to assess the impact of the scrappage program on the expenditures devoted to the purchase of a new car and on the other expenditure groups based on equations (3) and (4). Using SUR, we evaluate three specifications by introducing a combination of different treatment dummies (d_{t-1}, d_t or d_{t+1}) in each equation for each expenditure group of the AIDS model. The advantage of this specification is that the effects on all the considered expenditure groups provoked by changes produced in the period before, during and after the scrappage program can be estimated. Therefore, many of the substitution effects implied by the scrappage program are taken

[13] The current study focuses on the short run. Looking forward, one may expect a slow fall in the household savings ratio.

Table 6. . Tobit regression on total household expenditure on new cars in the last 12 months

	[1]			[2]		
	Effects	Marginal effects		Effects	Marginal effects	
		$\partial E[Y]/\partial X_i$	$\partial E[Y\|Y>0]/\partial X_i$		$\partial E[Y]/\partial X_i$	$\partial E[Y\|Y>0]/\partial X_i$
Dummy period before the program (d_{t-1})				41660.0***	8147.4***	8685.9***
				(602.0)	(4.194)	(54.63)
Dummy period that the program was in force (d_t)	46957.1***	6168.6***	8228.1***			
	(907.3)	(4.835)	(78.67)			
Dummy period after the program (d_{t+1})	47341.1***	6514.1***	8455.4***	36905.2***	6246.4***	7218.5***
	(1167.2)	(6.220)	(101.2)	(845.4)	(5.890)	(76.72)
Price index per group of household expenditure 1 (in log)	-83097.7***	-442.83***	-7205.3***	22989.5***	160.2***	2086.5***
	(4123.7)	(21.97)	(357.6)	(3702.0)	(25.79)	(336.0)
Price index per group of household expenditure 2 (in log)	108387.2***	577.6***	9398.2***	172631.6***	1202.8***	15667.6***
	(10255.6)	(54.65)	(889.2)	(8873.3)	(61.82)	(805.3)
Price index per group of household expenditure 3 (in log)	310409.8***	1654.2***	26915.4***	35854.6***	249.8***	3254.1***
	(9717.6)	(51.78)	(842.6)	(6230.4)	(43.41)	(565.5)
Price index per group of household expenditure 4 (in log)	12665.8	67.50	1098.2	94196.9***	656.3***	8549.1***
	(16981.6)	(90.50)	(1472)	(15542.8)	(108.3)	(1411)
Price index per group of household expenditure 5 (in log)	-129966.7***	-692.6***	-11269.3***	15394.2	107.3	1397.1
	(10867.2)	(57.91)	(942.3)	(9460.2)	(65.91)	(858.6)
Total household expenditure / price index x 100 (in log)	40717.0***	217.0***	3530.5***	22193.8***	154.6***	2014.2***
	(709.8)	(3.783)	(61.55)	(511.8)	(3.566)	(46.45)
Dummy main breadwinner is a male	667.9	3.4753	57.68	-80.29	-0.561	-7.291
	(605.3)	(3.226)	(52.49)	(479.2)	(3.339)	(43.49)
Dummy main breadwinner is married	-1230.9	-6.796*	-107.3	407.2	2.796	36.86
	(635.0)	(3.384)	(55.06)	(509.1)	(3.547)	(46.20)
Dummy no studies of primary education (main breadwinner)	6153.1***	42.21***	554.9***	2073.4***	16.03***	191.5***
	(736.4)	(3.924)	(63.85)	(598.1)	(4.167)	(54.28)
Dummy secondary education or first cycle (main breadwinner)	4387.2***	26.91***	388.8***	1437.4**	10.59***	131.7***
	(577.2)	(3.076)	(50.05)	(459.8)	(3.203)	(41.73)
Dummy secondary education or second cycle (main breadwinner)	2079.2***	12.31***	183.4***	468.1	3.362	42.71
	(630.3)	(3.349)	(54.66)	(501.4)	(3.494)	(45.51)
Dummy 1 child in the household	-2333.1***	-11.54***	-199.7***	-633.0	-4.293	-57.18
	(603.7)	(3.217)	(52.35)	(481.5)	(3.355)	(43.71)
Dummy 2 children in the household	-5979.5***	-25.94***	-499.5***	-2059.5***	-13.00***	-183.6***
	(629.3)	(3.354)	(54.57)	(498.4)	(3.472)	(45.23)
Dummy 3 or more children in the household	-10987.7***	-30.41***	-847.9***	-5259.9***	-23.88***	-442.0***
	(1027.7)	(5.477)	(89.11)	(832.7)	(5.801)	(75.57)
Age of the main breadwinner	-246.8***	-1.315***	-21.40***	-99.70***	-0.695***	-9.048***
	(21.35)	(0.114)	(1.851)	(17.05)	(0.119)	(1.548)
Dummy no working members in the household	1153.7	6.389	100.7	-823.6	-5.548	-74.30
	(828.2)	(4.414)	(71.82)	(657.9)	(4.584)	(59.71)
Dummy 2 working members in the household	-1183.2*	-6.117*	-102.1*	-1557.2***	-10.32***	-140.0***
	(528.6)	(2.817)	(45.83)	(421.5)	(2.937)	(38.26)
Dummy 3 or more children in the household	-2175.6**	-10.06*	-184.2*	-3697.5***	-18.99***	-317.8***
	(841.2)	(4.483)	(72.94)	(698.0)	(4.864)	(63.35)
Dummy semi-urban or intermediate population density	2239.7***	13.17***	197.3***	405.2	2.887	36.91
	(564.7)	(3.009)	(48.96)	(457.8)	(3.190)	(41.55)
Dummy sparse population density	2458.1***	14.14***	215.8***	1889.0***	14.21***	173.64***
	(536.8)	(2.861)	(46.55)	(428.1)	(2.983)	(38.85)
Dummy region of Madrid	-806.8	-4.083	-69.35	-549.0	-3.654	-49.425
	(880.0)	(4.689)	(76.30)	(679.3)	(4.733)	(61.65)
Dummy region of La Rioja	-790.0	-3.987	-67.88	613.2	4.516	56.192
	(1281.6)	(6.830)	(111.1)	(1015.9)	(7.078)	(92.20)
Constant	-1454757.2***			-1812213.4***		
	(107644.7)			(93333.3)		
Number of observations	51402	51402	51402	51402	51402	51402
Log likelihood	-41374.3			-39332.9		

Notes: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; marginal effects at means; $\partial E[Y]/\partial X_i$ denotes to the unconditional expected value (all households), whereas $\partial E[Y|Y>0]/\partial X_i$ denotes conditional on being uncensored (households that purchase a new car); reference dummy categories for education, children, working members and population densities are dummy higher education of the main breadwinner, dummy no children in the household, dummy 1 working member in the household, and dummy dense population density, respectively; see Table 4 for a description of the expenditure groups.

into account. Tables A2.A−D in the Appendix shows the detailed SUR estimates on share of household expenditure per expenditure group.

Table 7 shows estimates for the income and own-price elasticities based on equations (5) and (6). As it is expected, "food, drinks and clothes" is the most inelastic group of household expenditure in terms of income and own-price. On the contrary, "leisure and hotels" is the most elastic group in income and own-price.

Table 7. Income and own-price elasticities per group of expenditure based on AIDS estimates

	Specification (1) with d_{t-1}		*Specification (2) with d_t*		*Specification (3) with d_{t+1}*	
	mean	s.d.	mean	s.d.	mean	s.d.
Income elasticity food, drinks and clothes (group 1)	0.79	0.12	0.75	0.14	0.74	0.14
Income elasticity housing and furniture (group 2)	0.92	0.03	0.87	0.06	0.87	0.06
Income elasticity transport and communications (group 3)	1.25	0.11	1.59	0.27	1.65	0.30
Income elasticity leisure and hotels (group 4)	1.27	0.24	1.21	0.19	1.20	0.18
Income elasticity rest of goods (group 5)	1.19	3.86	1.10	2.16	1.09	1.81
Own-price elasticity food, drinks and clothes (group 1)	-0.25	0.42	-0.03	0.54	-0.05	0.52
Own-price elasticity housing and furniture (group 2)	-3.10	0.92	-2.82	0.80	-2.82	0.80
Own-price elasticity transport and communications (group 3)	-7.97	3.17	-3.96	1.35	-3.66	1.21
Own-price elasticity leisure and hotels (group 4)	-8.38	6.51	-7.02	5.31	-7.66	5.88
Own-price elasticity rest of goods (group 5)	-7.34	131.26	-7.05	125.29	-6.59	115.62

Note: Based on the estimated coefficients from Table A2.A−D; d_{t-1} denotes dummy period before the program, d_t denotes dummy period that the program was in force and d_{t+1} denotes dummy period after the program.

In order to estimate the CV, we define three different scenarios:

- Model $AIDS_1$: we define the AIDS model with the 'treatment' dichotomous variable d_{t-1} with respect to the AIDS model with the 'treatment' dichotomous variable d_t;
- Model $AIDS_2$: we define the AIDS model with the 'treatment' dichotomous variable d_{t-1} with respect to the AIDS model with the 'treatment' dichotomous variable d_{t+1};
- Model $AIDS_3$: we define the AIDS model with the 'treatment' dichotomous variable d_t with respect to the AIDS model with the 'treatment' dichotomous variable d_{t+1}.

Table 8 shows the results for the CV estimates for these three scenarios. For the average household there is a gain in welfare for consumers when comparing demand of new cars before the program and during the program (CV = -998.88), and also when comparing demand of new cars before the program and after the program (CV = -846.41). There is, however, a loss in welfare for consumers when the program ends (the compensating variation comparing demand of new cars during the program and after the program is of 149.17). Note that this latter CV is, approximately, the difference of the former two CV's (998.88 − 846.41 = 152.47). The relative small loss in welfare

obtained in the $AIDS_3$ model can be explained due to the short period of 6 months (from July to December 2010) when the program was ended.

Table 8. Resulting compensation variation (CV) by deciles of the total expenditure (in €)

	AIDS$_1$ (d_{t-1} *versus* d_t)		*AIDS*$_2$ (d_{t-1} *versus* d_{t+1})		*AIDS*$_3$ (d_t *versus* d_{t+1})	
	mean	s.d.	mean	s.d.	mean	s.d.
Mean CV	**-998.88**	**1334.26**	**-846.41**	**1590.72**	**149.17**	**406.36**
Decile 1	-418.90	310.01	-405.95	370.12	11.40	91.71
Decile 2	-556.44	467.98	-515.65	575.94	38.88	149.95
Decile 3	-674.64	584.99	-620.14	720.56	52.28	186.13
Decile 4	-746.00	706.83	-664.43	878.79	78.89	226.51
Decile 5	-885.60	790.73	-789.08	982.42	94.16	253.57
Decile 6	-947.06	932.89	-811.98	1166.43	132.29	301.28
Decile 7	-1021.85	1046.48	-841.54	1311.82	178.12	345.82
Decile 8	-1125.51	1228.92	-891.89	1532.10	231.60	391.92
Decile 9	-1339.29	1583.18	-1032.72	2002.43	302.08	521.78
Decile 10	-2266.80	2751.01	-1885.80	3407.01	370.31	838.91

Notes: d_{t-1} denotes dummy period before the program, d_t denotes dummy period that the program was in force and d_{t+1} denotes dummy period after the program.

In addition, we compute the CV estimates by deciles of total expenditure based on the average effect estimate of the parameters in equation (3). That is, the CV is calculated for the mean of total expenditure per decil (and every part represents 1/10 of the sample). It seems that gains obtained by the scrappage program are clearly increasing with the total expenditure per household. Assuming total expenditure as a proxy for income, our results suggest that the relative wealthier households are those who gain most from the scrappage program.[14] For instance, take results for the CV from $AIDS_1$: households with the lowest expenditures obtain a gain in welfare of €419 by comparing the previous period of the program with the period where the program was in force, whereas this gain is of €2,267 for the households with the highest expenditures for the same periods.

Considering the longest period in our analysis, that is, comparing the situation previous to the program in 2008 until the program was developed, and six months after finishing the program at the end of 2010, the average household would value this program by €846. It means that an average household could receive a lump-sum transfer of €846 (being able to be spent it in any type of good) and the welfare would be identical to that obtained with the financial aid to purchase a new vehicle during the scrappage program. Assuming that the private aid from the industry is a transfer to the

[14] Total expenditure is chosen here because expenditure data are more reliable than income data in budget surveys. A measure based on consumption (more precisely, expenditures) is more relevant than a measure based on income for providing an account of the level of material well-being, because households tend to smooth their consumption so as to maintain a stable standard of living over time (Rogers and Gray, 1994; Slesnick, 2001).

consumers,[15] the welfare gain for the consumers approximated by the CV is very close to the public aid of €1,000.

6. Conclusions

The economic crisis provoked a dramatic drop in the sales of the European car industry. Many European countries developed different scrappage programs with the main aim to revitalize the sector and the sales of new cars. In Spain, at the end of May 2009, an unexpected scrappage program was launched by the Government. This consisted on a public aid of €1,000 (splitted at 50% between the state and the corresponding regional government) and an aid of €1,000 that the car industry could additionally offer to the potential customers. With some exceptions, due to the scarcity of funds and the reluctances of some regions, the program ended in June 2010. This paper shows that the scrappage program had a positive and significant effect on the car demand. However, it reduced the household purchase expenditure for a new car. For the representative household, the estimated welfare gain of the scrappage program is very similar to the public subsidy of €1,000 (assuming that the aid offered by the car industry is a transfer from producers to consumers).

Leaving out other potential benefits, as reductions in CO_2 emissions and other pollutants derived from the substitution of old vehicles, our results show that the scrappage program was practically neutral in welfare terms. Moreover, the amount spent by the state on the scrappage programme may have an opportunity cost in terms of social benefits that there could have been by alternative ways of spending the same amount of money elsewhere.

[15] Note however that Jiménez et al. (2013), as mentioned above, show that car prices increased by a similar amount to the aid offered by the car industry of €1,000.

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Appendix

Table A1. Descriptive statistics

	mean	sd
Dummy year 2008 (no subsidy)	0.34	0.47
Dummy year 2009 (partly household could get a subsidy)	0.35	0.48
Dummy year 2010 (partly household could get a subsidy)	0.31	0.46
Dummy household bought a new car in the period before the program	0.04	0.19
Dummy household bought a new car in the period that the program was in force	0.02	0.12
Dummy household bought a new car in the period after the program	0.01	0.08
Share of household expenditure on food, drinks and clothes (group 1)	0.33	0.13
Share of household expenditure on housing and furniture (group 2)	0.20	0.10
Share of household expenditure on transport and communications (group 3)	0.13	0.11
Share of household expenditure on leisure and hotels (group 4)	0.18	0.11
Share of household expenditure on rest of goods (group 5)	0.16	0.09
Dummy main breadwinner is a male	0.73	0.44
Dummy main breadwinner is married	0.66	0.47
Dummy no studies of primary education, of the main breadwinner	0.28	0.45
Dummy secondary education or first cycle, of the main breadwinner	0.30	0.46
Dummy secondary education or second cycle, of the main breadwinner	0.16	0.37
Dummy higher education, of the main breadwinner	0.26	0.43
Dummy no children in the household	0.47	0.50
Dummy 1 child in the household	0.26	0.44
Dummy 2 children in the household	0.22	0.42
Dummy 3 or more children in the household	0.05	0.21
Age of the main breadwinner	53.72	15.41
Dummy no working members in the household	0.31	0.46
Dummy 1 working member in the household	0.34	0.47
Dummy 2 working members in the household	0.30	0.46
Dummy 3 or more children in the household	0.05	0.21
Dummy dense population density	0.48	0.50
Dummy semi-urban or intermediate population density	0.21	0.41
Dummy sparse population density	0.31	0.46
Dummy region of Madrid	0.06	0.24
Dummy region of La Rioja	0.03	0.18
Number of observations	55558	

Table A2.A SUR estimates on share of household expenditure on food, drinks and clothes (group 1)

	Specification (1) with d_{t-1}	*Specification (2) with d_t*	*Specification (3) with d_{t+1}*
Dummy household bought a new car in the period before the program	-0.095***		
	(0.004)		
Dummy household bought a new car in the period that the program was in force		-0.097***	
		(0.005)	
Dummy household bought a new car in the period after the program			-0.099***
			(0.007)
Price index per group of household expenditure 1 (in log)	0.188***	0.230***	0.224***
	(0.011)	(0.011)	(0.011)
Price index per group of household expenditure 2 (in log)	-0.040***	-0.017	-0.020*
	(0.010)	(0.010)	(0.010)
Price index per group of household expenditure 3 (in log)	0.043***	-0.074***	-0.058***
	(0.008)	(0.009)	(0.009)
Price index per group of household expenditure 4 (in log)	-0.031**	-0.001	-0.004
	(0.010)	(0.010)	(0.010)
Total value of household expenditure / price index x 100 (in log)	-0.058***	-0.067***	-0.069***
	(0.001)	(0.001)	(0.001)
Dummy main breadwinner is a male	0.013***	0.013***	0.013***
	(0.002)	(0.002)	(0.002)
Dummy main breadwinner is married	0.033***	0.034***	0.034***
	(0.002)	(0.002)	(0.002)
Dummy no studies of primary education, of the main breadwinner	0.049***	0.047***	0.047***
	(0.002)	(0.002)	(0.002)
Dummy secondary education or first cycle, of the main breadwinner	0.037***	0.036***	0.036***
	(0.002)	(0.002)	(0.002)
Dummy secondary education or second cycle, of the main breadwinner	0.019***	0.019***	0.019***
	(0.002)	(0.002)	(0.002)
Dummy 1 child in the household	0.025***	0.027***	0.027***
	(0.002)	(0.002)	(0.002)
Dummy 2 children in the household	0.035***	0.038***	0.038***
	(0.002)	(0.002)	(0.002)
Dummy 3 or more children in the household	0.055***	0.058***	0.058***
	(0.003)	(0.004)	(0.004)
Age of the main breadwinner	0.0003***	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)
Dummy no working members in the household	-0.004	-0.006**	-0.006**
	(0.002)	(0.002)	(0.002)
Dummy 2 working members in the household	-0.004*	-0.004*	-0.003
	(0.002)	(0.002)	(0.002)
Dummy 3 or more children in the household	0.012***	0.010**	0.011***
	(0.003)	(0.003)	(0.004)
Dummy semi-urban or intermediate population density	0.011***	0.010***	0.010***
	(0.002)	(0.002)	(0.002)
Dummy sparse population density	0.016***	0.016***	0.015***
	(0.002)	(0.002)	(0.002)
Dummy region of Madrid	-0.009***	-0.009***	-0.010***
	(0.003)	(0.003)	(0.003)
Dummy region of La Rioja	-0.011**	-0.013**	-0.013***
	(0.004)	(0.004)	(0.004)
Constant	0.104*	0.295***	0. 298***
	(0.044)	(6.74)	(0044)
Number of observations	28084	28084	28084

Notes: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ; d_{t-1} denotes dummy period before the program, d_t denotes dummy period that the program was in force and d_{t+1} denotes dummy period after the program; reference dummy categories for education, children, working members and population densities are dummy higher education of the main breadwinner, dummy no children in the household, dummy 1 working member in the household, and dummy dense population density, respectively; see Table 4 for a description of the expenditure groups.

Table A2.B SUR estimates on share of household expenditure on housing and furniture (group 2)

	Specification (1) with d_{t-1}	*Specification (2) with* d_t	*Specification (3) with* d_{t+1}
Dummy household bought a new car in the period before the program	-0.061***		
	(0.003)		
Dummy household bought a new car in the period that the program was in force		-0.040***	
		(0.004)	
Dummy household bought a new car in the period after the program			-0.032***
			(0.007)
Price index per group of household expenditure 2 (in log)	-0.337***	-0.300***	-0.300***
	(0.027)	(0.027)	(0.027)
Price index per group of household expenditure 3 (in log)	0.342***	0.202***	0.202***
	(0.013)	(0.013)	(0. 013)
Price index per group of household expenditure 4 (in log)	0.070**	0.104***	0.104***
	(0.023)	(0.023)	(0.023)
Total value of household expenditure / price index x 100 (in log)	-0.012***	-0.020***	-0.021***
	(0.001)	(0.001)	(0.001)
Dummy main breadwinner is a male	-0.013***	-0.013***	-0.013***
	(0.002)	(0.002)	(0.002)
Dummy main breadwinner is married	-0.017***	-0.016***	-0.016***
	(0.002)	(0.002)	(0.002)
Dummy no studies of primary education, of the main breadwinner	-0.005**	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)
Dummy secondary education or first cycle, of the main breadwinner	-0.007***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)
Dummy secondary education or second cycle, of the main breadwinner	0.002	0.0010	0.001
	(0.002)	(0.002)	(0.002)
Dummy 1 child in the household	-0.009***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)
Dummy 2 children in the household	-0.016***	-0.014***	-0.014***
	(0.002)	(0.002)	(0.002)
Dummy 3 or more children in the household	-0.010***	-0.008**	-0.008*
	(0.003)	(0.003)	(0.003)
Age of the main breadwinner	-0.0005***	-0.0005***	-0.0005***
	(0.00005)	(0.00005)	(0.00005)
Dummy no working members in the household	0.017***	0.015***	0.015***
	(0.002)	(0.002)	(0.002)
Dummy 2 working members in the household	-0.008***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)
Dummy 3 or more children in the household	-0.001	-0.001	-0.0005
	(0.003)	(0.003)	(0.003)
Dummy semi-urban or intermediate population density	-0.009***	-0.010***	-0.010***
	(0.001)	(0.001)	(0.001)
Dummy sparse population density	-0.005***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)
Dummy region of Madrid	0.010***	0.010***	0.009***
	(0.002)	(0.002)	(0.002)
Dummy region of La Rioja	0.009**	0.009**	0.008*
	(0.003)	(0.003)	(0.003)
Constant	0.215*	0.497***	0.522***
	(0.215)	(0.107)	(0.107)
Number of observations	28084	28084	28084

Notes: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ; d_{t-1} denotes dummy period before the program, d_t denotes dummy period that the program was in force and d_{t+1} denotes dummy period after the program; reference dummy categories for education, children, working members and population densities are dummy higher education of the main breadwinner, dummy no children in the household, dummy 1 working member in the household, and dummy dense population density, respectively; see Table 4 for a description of the expenditure groups.

Table A2.C SUR estimates on share of household expenditure on transport and communications (group 3)

	Specification (1) with d_{t-1}	*Specification (2) with* d_t	*Specification (3) with* d_{t+1}
Dummy household bought a new car in the period before the program	0.302***		
	(0.003)		
Dummy household bought a new car in the period that the program was in force		0.251***	
		(0.004)	
Dummy household bought a new car in the period after the program			0.257***
			(0.006)
Price index per group of household expenditure 3 (in log)	-0.617***	-0.246***	-0.239***
	(0.013)	(0.014)	(0.014)
Price index per group of household expenditure 4 (in log)	0.071*	-0.024	0.027
	(0.036)	(0.041)	(0.041)
Total value of household expenditure / price index x 100 (in log)	0.022***	0.054***	0.060***
	(0.001)	(0.001)	(0.001)
Dummy main breadwinner is a male	-0.006***	-0.005***	-0.005**
	(0.001)	(0.002)	(0.002)
Dummy main breadwinner is married	-0.007***	-0.012***	-0.012***
	(0.001)	(0.001)	(0.002)
Dummy no studies of primary education, of the main breadwinner	0.008***	0.015***	0.015***
	(0.002)	(0.001)	(0.002)
Dummy secondary education or first cycle, of the main breadwinner	0.008***	0.011***	0.011***
	(0.001)	(0.001)	(0.002)
Dummy secondary education or second cycle, of the main breadwinner	0.005**	0.004*	0.004*
	(0.001)	(0.001)	(0.002)
Dummy 1 child in the household	-0.007***	-0.013***	-0.013***
	(0.001)	(0.001)	(0.002)
Dummy 2 children in the household	-0.014***	-0.022***	-0.022***
	(0.001)	(0.001)	(0.002)
Dummy 3 or more children in the household	-0.024***	-0.032***	-0.033***
	(0.003)	(0.003)	(0.003)
Age of the main breadwinner	-0.00004	-0.0001**	-0.0001*
	(0.00005)	(0.00005)	(.00005)
Dummy no working members in the household	0.004**	0.013***	0.014***
	(0.002)	(0.002)	(0.002)
Dummy 2 working members in the household	-0.006***	-0.006***	-0.007***
	(0.001)	(0.001)	(0.001)
Dummy 3 or more children in the household	-0.013***	-0.008**	-0.011***
	(0.002)	(0.003)	(0.003)
Dummy semi-urban or intermediate population density	0.002	0.005**	0.004*
	(0.001)	(0.001)	(0.002)
Dummy sparse population density	0.006***	0.007***	0.009***
	(0.001)	(0.001)	(0.001)
Dummy region of Madrid	-0.002	-0.001	-0.0001
	(0.002)	(0.002)	(0.002)
Dummy region of La Rioja	-0.0004	0.002	0.005
	(0.003)	(0.003)	(0.003)
Constant	0.651***	0.253	-0.143
	(0.180)	(0.200)	(0.204)
Number of observations	28084	28084	28084

Notes: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ; d_{t-1} denotes dummy period before the program, d_t denotes dummy period that the program was in force and d_{t+1} denotes dummy period after the program; reference dummy categories for education, children, working members and population densities are dummy higher education of the main breadwinner, dummy no children in the household, dummy 1 working member in the household, and dummy dense population density, respectively; see Table 4 for a description of the expenditure groups.

Table A2.D SUR estimates on share of household expenditure on leisure and hotels (group 4)

	Specification (1) with d_{t-1}	*Specification (2) with d_t*	*Specification (3) with d_{t+1}*
Dummy household bought a new car in the period before the program	-0.081***		
	(0.003)		
Dummy household bought a new car in the period that the program was in force		-0.066***	
		(0.004)	
Dummy household bought a new car in the period after the program			-0.079***
			(0.006)
Price index per group of household expenditure 4 (in log)	-0.760***	-0.632***	-0.706***
	(0.066)	(0.072)	(0.073)
Total value of household expenditure / price index x 100 (in log)	0.031***	0.0243***	0.023***
	(0.001)	(0.001)	(0.001)
Dummy main breadwinner is a male	0.019***	0.0185***	0.018***
	(0.002)	(0.002)	(0.002)
Dummy main breadwinner is married	-0.012***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)
Dummy no studies of primary education, of the main breadwinner	-0.030***	-0.032***	-0.032***
	(0.002)	(0.002)	(0.002)
Dummy secondary education or first cycle, of the main breadwinner	-0.021***	-0.022***	-0.022***
	(0.002)	(0.002)	(0.002)
Dummy secondary education or second cycle, of the main breadwinner	-0.014***	-0.014***	-0.014***
	(0.002)	(0.002)	(0.002)
Dummy 1 child in the household	-0.011***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)
Dummy 2 children in the household	-0.007***	-0.005**	-0.005**
	(0.002)	(0.002)	(0.002)
Dummy 3 or more children in the household	-0.020***	-0.019***	-0.019***
	(0.003)	(0.003)	(0.003)
Age of the main breadwinner	-0.0003***	-0.0003***	-0.0003***
	(0.00005)	(0.00005)	(0.00005)
Dummy no working members in the household	-0.021***	-0.023***	-0.023***
	(0.002)	(0.002)	(0.002)
Dummy 2 working members in the household	0.012***	0.012***	0.012***
	(0.001)	(0.001)	(0.001)
Dummy 3 or more children in the household	0.019***	0.016***	0.017***
	(0.003)	(0.003)	(0.003)
Dummy semi-urban or intermediate population density	-0.004*	-0.004**	-0.004**
	(0.001)	(0.001)	(0.002)
Dummy sparse population density	-0.009***	-0.010***	-0.010***
	(0.001)	(0.001)	(0.001)
Dummy region of Madrid	-0.0007	-0.0010	-0.001
	(0.002)	(0.002)	(0.002)
Dummy region of La Rioja	0.0121***	0.011***	0.011**
	(0.004)	(0.003)	(0.003)
Constant	2.898***	2.515***	2.649***
	(0.181)	(0.188)	(0.189)
Number of observations	28084	28084	28084

Notes: Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ; d_{t-1} denotes dummy period before the program, d_t denotes dummy period that the program was in force and d_{t+1} denotes dummy period after the program; reference dummy categories for education, children, working members and population densities are dummy higher education of the main breadwinner, dummy no children in the household, dummy 1 working member in the household, and dummy dense population density, respectively; see Table 4 for a description of the expenditure groups.