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Assessing the French conversion premium, an incentive for scrapping old cars while buying low emitting vehicles

Mathilde Niay, Maude Jolly (General Commission for sustainable development, France),
David Meunier (LVMT, France)

In order to meet the Paris Agreement's commitments, there is a need for strong investments and shifts in practices in the transport sector, which accounts for 30% of overall greenhouse gases emissions in France. Private vehicles are themselves responsible for around half of the CO_2 emissions resulting from transport. This paper proposes to analyse a conversion premium granted in 2019, designed for households willing to get rid of their old cars in order to buy low emissions ones. It displays descriptive statistics of the beneficiaries' characteristics and of the vehicles scrapped along with those bought thanks to the subsidy. The study further proceeds with an ex-post socio-economic analysis of the measure. The data comes from the national agency allocating the bonus.

The conversion premium scheme (PAC) provides benefits to users and society by accelerating the replacement of older vehicles by more efficient, less polluting vehicles with lower maintenance costs.
In 2018, a first scheme was analysed ex-post, but in 2019 the rules of the PAC changed twice for better fitting more focused environmental and distributive objectives, following the "gilets jaunes" events.

In 2019, around 350 000 people benefited from the measure, which includes additional incentives for low income households and long-distance commuters.
The paper will, first, provide descriptive statistics regarding beneficiaries' income, their age and living area. Information on the scrapped vehicles and purchased ones (new vehicles or recent second hand cars) will also be given concerning fuel, emissions, prices, etc.

Results are soon to be obtained (in March 2020), but the data arrived too recently at the time of abstract submission to be able to show results for 2019 data.

Here are some insights on the findings obtained and assumptions used for the 2018 PAC, that will illustrate qualitatively the type of results and the modelling that will be presented in the paper.

Based on data provided by the State Payment Services Agency containing information on 253 000 beneficiaries of the PAC in 2018, the PAC benefited rather rural households (living in municipalities of 1000 inhabitants per square km on average), income tax-free in 72% of cases, and allowed for the scrapping of old vehicles (19 years old), 80 % running on diesel, to replace them with newer and less polluting vehicles.

The vehicles purchased had an average unit emission rate of 106 gCO2 / km, lower than all new vehicles (112 gCO2 / km) purchased the same year, they were essentially diesel (48%) and gasoline (47%) and 2% are all electric. About two-thirds of them were EURO6 standard (the most recent one). They were mostly purchased second-hand (60% of the cases). The average purchase price was 13 200 €, but a difference of 2 200 € was observed depending on whether the acquiring household was taxable or not.

Most of the environmental gains are perceived in the short term, over the period corresponding to the anticipated duration of the purchase (assumed here of 6 months for taxable households, 2 years for non-taxable households or 1.56 years in average). During this period, instead of old polluting vehicles, new or recent vehicles are running. For CO2 and fuel, however, profits continue beyond this period. The vehicles purchased under the CP are supposed to be of the same engine but more efficient than those that would have been purchased without the CAP 6 months or 2 years later. This performance gain prevails over the life of the vehicle.

The cost related to a year of anticipation of the purchase of a new vehicle is equal to the product of the purchase price of the new vehicle by the discount rate. The discount rate used for the socioeconomic assessment is 4.5%. For the assessment for the user, a rate of 8% is used for non-taxable households and 4,5% for taxable households. To this anticipation cost is added an additional purchase cost related to the performance gain of the vehicle, assumed to be 500 € HTT. The vehicles are furthermore assumed to drive 12 000 km per year.

Our analysis furthermore allows to perform a socio-economic analysis of the measure, drawing up two assessments:
- A socio-economic one taking into account environmental benefits (CO2, fine particles, NOx), gains in fuel consumption, gains in maintenance costs, extra cost due to the anticipation of the purchase of a new and more efficient vehicle ;
- An assessment from the user point of view taking into account the gains in fuel consumption and maintenance costs, and the additional cost of purchasing a new vehicle in advance; including all taxes.

We illustrate here again the types of results obtained for the former PAC scheme.

As a whole, the net present value was positive (65 M€), especially due to the gains in terms of local pollution.

The main gain, 220 million €, arose from the reduction of air pollution due to fine particles and nitrogen oxides (NOx). The emissions of NOx and fine particles got reduced respectively by 2 700 and 240 tons.
The fuel savings were worth 75 M€. Savings in maintenance costs amounted to 60 million €. CO2 gains were estimated for fuel combustion in situ and "upstream" (fuel production and distribution), which corresponded to 440 000 tons (approximately 40% within 2 years, and 60%

over 14 years thereafter) and valued 25 M € with a carbon price of CO_2 of 54 €/ton. All of these benefits (375M €) were higher than the additional costs related to the anticipated purchase (310 M €).

This overall assessment showed disparities at the vehicle level: in more than two thirds of vehicle level cases, the overall assessment was negative or zero. It was positive in more than ¾ cases in densely populated geographic areas (> 1000 inhab./km²), where the social cost associated with air pollution is the highest.

The assessment was typically positive under the following conditions: when a diesel (strongly emitting fine particles) is replaced by another engine, or when the vehicle acquired is an electric vehicle or a vehicle with low CO_2 emission.

Finally, the environmental balance was slightly better for non-taxable households, consistent with the assumption that the premium has a strong behavioral effect and leads them to further foresee their purchase (2 years, against 6 months for taxable households). As a result, the environmental benefits are greater because they run longer, although the cost of anticipating the purchase is also greater. In addition, non-taxable households mostly scrap diesel vehicles.

The average car buyer benefited from the PAC, but the purchase he/she made would not have been profitable for her/him – hence not made, or for a car that would have been more environment harmful

The main gains for the purchaser were due to fuel savings (155 M €) and the reduction of the maintenance costs (75 M €) of the vehicle (old vehicles exhibit mileage costs approximately twice as high). In the absence of PAC, the gain for all acquirers (€ 230 million) would not have covered the cost of anticipating the purchase (€ 535 million), leading to a negative net balance sheet (- € 305 million).

Again this broad picture becomes more diverse at the individual level. Still, it stays negative in 92% of cases, in the absence of PAC. In particular, it is less degraded for the purchaser when it moves from a gasoline vehicle to a recent diesel or from a heat engine to an electric vehicle. It therefore seems that public intervention is justified, because the owners of old vehicles do not have, according to these analyzes, sufficient individual incentives to replace them by recent vehicles, even though it brings a gain for society as a whole. If we take into account the conversion premiums paid to the buyers, the balance sheet becomes positive in almost all cases, with an overall net gain of 140 million €. Please note that no gain related to the buyer's valuation of the environmental improvement "per se" was taken in account, which could explain his decision to purchase despite a seemingly small negative balance sheet) .

The same kind of analyses will be made for the 2019 PAC, with finer observations since the scheme became more differentiated. Indeed, in the last period of 2019, four revenue levels are distinguished, combined with 6 types of low-emitting vehicles.

As usual, the reference scenario will be discussed, distinguishing several periods consistently with the dates the rules of the conversion premium got changed.

The study will conclude by commenting on the efficiency of the subsidy with respect to its environmental and distributive objectives.

Short abstract:
This paper presents descriptive statistics and an ex-post socio-economic analysis of a conversion premium implemented in France for the year 2019. This conditional subsidy is designed as an incentive for replacing old vehicles by more efficient and less polluting ones. The impacts and the efficiency of this public policy with respect to its environmental and distributive objectives are discussed.