# New cars and emissions: effects of policies, macroeconomic impacts and cities characteristics in Portugal

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The Paris Agreement on climate change is the first international climate agreement that extends mitigation obligations to all countries. Accordingly, the EU has already put in place some policy measures to decrease $CO_2$ and GHG emissions from cars, e.g. the obligation of each Member State to provide information on the fuel-efficiency of new passenger cars, namely on fuel consumption and $CO_2$ emissions. In Portugal, in 2013, the transport sector was responsible for 33.3% of energy consumption with the road transport accounting for 95% of this percentage. Furthermore, the transport sector was also responsible for 34.7% of $CO_2$ emissions, a value highly concentrated in the major cities. To drive significant reductions on emissions in the transport sector, the Government has introduced several energy efficiency measures. Although there are many countries that have introduced special programs aimed at increasing vehicle replacement through new low-carbon vehicles purchases, little attention has been paid to their impact on sales and prices. Results demonstrate that macroeconomic effects, household characteristics and city specificities are important variables to explain both $CO_2$ emissions and sales behavior, which allow inferring how policy makers should redirect attention when formulating new policies regarding environmental performance. Conclusions: Environmental consciousness of the Portuguese population is needed since the observed lower $CO_2$ emissions or higher sales of electrical vehicles may be related to the effect of the introduced laws rather than to the individual efforts to decrease global warming. This shows that we may have legislation imposing willingness to achieve the emissions level but not consumers' willingness to achieve it, as desired. This also leaves space for a higher intervention concerning population awareness for emission reduction needs and for the importance of choosing cars that should help achieving the emission reduction targets and consequently global warming reduction effects. Results demonstrate that macroeconomic effects, household characteristics and city specificities are important to explain both $CO_2$ emissions and sales behaviour. When long-term interest rates increase, the gasoline car sales decrease. However, only in this category, a significant impact was found. Regarding the population density effect, by considering high urban areas in Portugal (Lisbon and Porto), we observe that there is a positive and significant correlation between $CO_2$ emissions of new cars sold (for all, gasoline and diesel) and population, leading us to the conclusion that higher concentration of persons increases CO2 emissions, by increasing the circulation of vehicles by squared km. The cities specificities allow observing different impacts and the importance to consider city characteristics when designing policies regarding $CO_2$ abatement effects associated to new car sales. Provided the above evidence, we realise that when considering effects over average emissions of new cars sold and average sales we need to be aware of the region/city where we are analysing this interactive effects. As evidenced by the results, the consideration of different cities in our analysis changed the overall results and evidenced different impacts, in both sign and magnitude. In terms of electrical vehicles, the results are not so straightforward to interpret and seem to point into the same direction as of all cars sold. This may be because we have only observed effective sales of this kind of cars from 2010 onwards, since previously they almost did not exist or assumed a value of zero in our sample.

**FIGURE 1**
Sales of New Cars per month by Fuel Type between January 2002 and December 2016 (left vertical axis: sales values of gasoline and diesel cars; the right vertical axis: sales values of electric cars).

**FIGURE 2**
Average CO2 Emissions of New Cars sold in Portugal (Jan 2002-Dec 2016).