Spanish Regional Heterogeneity on Communting by Car to Work: Differences of Behaviour or Composition?

Juan A. Módenes-Cabrerizo
Universitat Autònoma de Barcelona y Centre d'Estudis Demogràfics
juanantonio.modenes@uab.es
Teresa Menacho-Montes
Centre d'Estudis Demogràfics
tmenacho@ced.uab.es

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1. Introduction

The environmental and social sustainability of daily mobility is an increasingly relevant issue. During the last decades, the intensive use of private cars and other polluting vehicles has risen concern on their negative environmental impact. This concern has recently become a real urgency to reverse this development. The big ecological footprint of mobility explains the need to analyse correctly the available data and to elaborate appropriate indicators in order to help to design and implement better policies.

In Spain, the use of private car during commuting is as frequent as in the countries of our context. Half of all trips between home and work use a private car, as a driver or passenger. Data from different sources show a significant regional heterogeneity, thus public action on this field has to consider different factors, and maybe different solutions, across regions. This contribution suggests a methodology that allows a more rigorous comparison of regional indicators of daily commuting mobility by car.

2.Problem Statement

From the demand side, the factors that influence the choice to move by car have to do with individual characteristics. Demographic (age, sex, household type), social (type of occupation, education) or residential variables (type and characteristics of the place of residence) influence, according to the literature, this decision. Regional areas are made up of individuals, so the spatial heterogeneity deals with these, but at two levels, behaviour itself and composition.

In order to understand the temporal dynamics of any process and to make relevant comparisons between regions, we must identify which part of the temporal or spatial heterogeneity is caused by behaviour differences and which part by population composition differences. If the focus of the research is on the behavioural side of the equation, we should calculate standardized aggregate indicators to compare accurately populations by controlling differences in composition. Thus, a crude sociodemographic indicator must be standardised when we answer affirmatively to the next two questions

a) Is the indicator sensitive enough to some sociodemographic variable (age, sex, degree of urbanization, level of education)?

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b) Do the compositions of the population according to these relevant variables differ among the territories to be analysed?

Both answers to these questions with regard to car use in daily labour mobility are affirmative. This means that mobility differences between territories should not just be studied by calculating crude indicators.

3. Methodology suggested

In order to take in account behavioural and composition components of the differences between crude rates and to calculate standardised regional rates of car use, this contribution has applied the decomposition method of Das Gupta. Standardised rates are comparable because they suppose equal composition structures among all populations to be compared. The composition effect can be specified in turn by each of the composition variables introduced. The general notation to compare the rates of two populations with two structural variables would be:

$$x - X = (\text{effect T}) + (\text{effect I}) + (\text{effect J})$$

In the equation, x and X are two crude indicators of two populations to be compared. Effect T or effect rate is the part of the difference (x – X) explained by the differences of standardized rates. Effect I is the part of the difference (x – X) explained by the diverse composition of the variable of structure I (for example, level of urbanization), while effect J is the part of the difference between x and X explained by the diverse composition of the structure variable J (for example, structure by age). The equation can add to effects I and J as many others effects as structural variables are being analysed. In brief, this method allow to identify which part of the regional heterogeneity of car use rates is explained because its inhabitants behave differently and which part is explained because their inhabitants are different.

4.Case study results and discussion

In 2011, 48.2% of the occupied population moved by car to their workplace. This crude rate hides a certain regional variability. Most regions studied are above the national value and closer to the 50% threshold. At the top of the list are the Canary Islands, and at the end, one finds Catalonia and Madrid. A simple, but flawed interpretation would say that Canary workers use the car in excess or that Catalan and Madrid car mobility is low and positive. This is true in terms of the environmental impact of mobility. However, with these crude aggregate indicators it is not possible to conclude that the individual behaviour of Catalonia and Madrid workers is better or not.

Individual car use intensity is sensitive to many sociodemographic variables. However, not all these variables are relevant to compare regional heterogeneity of car use. As said before, only are important those that are related with significant differences in regional population compositions.

Several variables are sensitive to car use intensity but does not show enough regional differences of composition structures: country of birth, recent residential mobility, housing tenure. Even age and sex are in this group of variables. The decomposition method has been applied to four variables that combines both layers of heterogeneity, individual behaviour and strong differences in regional compositions: population size of place of residence, urban density, education level, sectors of occupation.

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Regarding the size of the municipality, the use of the car is more intense in small municipalities, given the difficulty of implementing public transport to serve a growing pattern of inter-local mobility. In parallel, but independently, denser environments have less use of private vehicles, as they allow better public transport and encourage the proximity of housing and work. Likewise, workers with a university degree use more often the car, even if we control for other variables. Finally, workers of services use less frequently private vehicles. The heterogeneity between some regions and the whole of Spain in car use rates is due to net compositional effects and not so much to standard rate effects (Figure 7). Northeast (Basque Country, Aragón, Navarra and Rioja) crude rates are higher because sociodemographic structures of this region are favourable to mobility. On the contrary, in the region of Madrid the socio-demographic structure does not favour the car use and that is why its crude rate is much lower than Spain's. In the rest of the regions, the net composition effects are modest and the initial crude differences are explained by real behaviour heterogeneity.

If the regions are ranked according to the rate effect (that is, the part of the difference with the whole of Spain that is not explained by the composition effect) from higher to lower and from positive to negative, the Canary Islands goes first and Catalonia is last. Only Andalusia and Catalonia have lower standardised rates than the average. The Canary Islands and South (basically Murcia) are clearly above. Madrid has a positive rate effect, contrary to what suggest crude rates.

Therefore, Madrid and Catalonia performances are far away than suggested by crude rates. The crude rate of car mobility of Madrid is low because its socio-demographic structures are not favourable to car use; its standardised rate is in fact close to the Spanish average. On the contrary, the crude rate of car mobility of Catalonia is low because individual propensity to car use is also low regardless of sociodemographic characteristics.

5.Conclusions

Regional differences in the crude rates of car commuting in Spain have to do with a mix of composition and rate effects. Thus, crude rates can not explore differences between regions in relation with mobility behaviour, neither they can not be used to rank the regions. The results of this contribution show the importance of correctly measuring and interpreting social processes on a regional perspective with indicators that are not biased by composition effects or whose bias is known. To disentangle these effects, decomposition methods as Das Gupta method are useful. This methodology can also answer questions about the factors that explain the change over time of mobility indicators. For example, to analyse the phenomenon of "peak car", that is, the change to a downward trend in car mobility in several western countries.

This effort to understand the correct meaning of territorial differences may help to the evaluation and design of intelligent mobility policies that act against social inequality and for environmental sustainability. Corrective measures that point to the behaviour of people might fail if they do not take into account the momentum of sociodemographic structures.

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