



The relationship between urban development and the environmental impact mobility: A local case study



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ABSTRACT

The environmental implications of mobility and its relationship with land uses have been at the centre of recent scientific debate. The aim of this article is to establish whether different types of urban development are related to different mobility-to-work patterns and influence the environmental impact of the relevant journeys. The analysis is performed at local level considering the de-urbanisation process which took place in Biscay (Spain) between 1991 and 2001. When one works with cross-section geo-referenced data, space usually plays an important role as a source of externalities or spillover effects. Consequently, spatial econometrics methods have been applied. This has hardly ever been done in previous research. The results indicate that increases in the environmental impact of mobility are associated with low population densities and geographic concentrations and high residential specialisation (a low ratio of jobs to residents). Moreover, such increases are greater in locations surrounded by others which generate a higher environmental impact.

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Introduction

In the last decade, passenger transport and vehicle stocks in the European Union have grown faster than the population, reflecting the intensification of mobility. The spectacular increase in motorised mobility in general and private vehicles in particular is causing a gradual deterioration of the urban environment. The incursion of the car has been accompanied by air pollution, high noise levels and an increasing use of road space and parking, bringing in its wake traffic congestion in accessing many city centres (Camagni et al., 2002a, 2002b; Henry, 2007; Gibelli, 2007). With the current mobility pattern called into question, there has been a move towards defining policies to promote a more sustainable one. This has led to a reconsideration of what factors determine the characteristics of journeys in a given territory.

Many specialists have established a link between the increase in mobility and urban sprawl observed in the second half of the 20th century, first in US cities and later in Europe. The recent evolution of the city has been characterised by the segregation of residential, leisure and work zones in urban territories as well as the abundance of dispersed residential estates. This has considerably increased the demand for travel to be able to carry out any kind of activity. In turn, the spread of the population in low density concentrations has made it difficult to implement an efficient public transport system, thus creating dependence on private vehicles. As a consequence, some experts hold that land use types resulting from urban development play a significant role in the need for motorised transport and suggest that strategies to reduce the demand for and impact of mobility need to be focused on coordinating planning in terms of both mobility and land uses.

Along these lines there have been many studies in the past 30 years that have attempted to demonstrate empirically a significant relationship between land use types and mobility patterns in a given territory. The findings of these studies can be consulted in various reviews of the relevant literature (Handy, 1996; Crane, 2000; Litman and Steele, 2009; Ewing and Cervero, 2010). Their main results show that factors such as density, urban design, functional diversity, and the characteristics of the transport system are relevant in this field.

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Most of these studies are based on geo-referenced cross-sectional data (neighbourhoods, municipalities, regions); they look at the relationship between land use and mobility via typical regression analysis. However, when it comes to explaining the behaviour of a variable observed at a number of points in space via a set of variables observed at the same points, so-called “spatial effects” frequently appear (heterogeneity and spatial dependence). The consequences of these effects for the validity of the inferences made in these cases cannot always be dealt with by standard econometrics. Spatial econometrics seeks to resolve the problems caused by the nature of the data used in spatial analysis by explicitly factoring the corresponding spatial dependence structure into models (Anselin, 1988). Spatial econometric techniques are frequently used in areas of research such as the analysis of spatial externalities, the expansion of cities and economic growth, but there have been few such studies in the field of mobility (Camagni et al., 2002a, 2002b; Traversi et al., 2006; Moniruzzaman and Páez, 2012; Hong and Shen, 2013; Hong et al., 2013).

Given this context, the aim of this study is to establish whether land use factors deriving from different types of urban development are related to different mobility-to-work patterns and influence the environmental impact of the relevant journeys. This relationship is assessed by means of multiple regression analysis, in which specific spatial econometric techniques are applied in order to avoid biased results and unreliable inferences due to the tendency of geographical data to be spatially dependent. The results may provide policy-makers with significant information on the effectiveness of urban planning policies for managing mobility.

The study area selected is Biscay, one of the three provinces that make up the Autonomous Community of the Basque Country in northern Spain. From the 1970s onwards this area underwent a process of deindustrialisation that culminated in the 1990s with a substantial shift in the basis of its economy towards the service sector and high value-added activities. This new economic situation radically changed its urban dynamics and brought about a process of de-urbanisation involving major internal migration from former industrial hubs to more rural areas with less public transport. Our objective here is to analyse how this process of de-urbanisation was linked to the mobility pattern that could be observed at the end of the 90s, which was characterised by the predominance of private cars. We seek to determine whether it would be effective to use urban planning policies as an instrument for managing mobility. We therefore take the municipality as our basic unit for observation, because it is at municipal level that urban planning is regulated, managed and implemented under current legislation. We believe that this makes for an interesting case study because it offers a paradigmatic case of a process of de-urbanisation due to the speed and extent of the changes that have taken place, and because the study area is a small European province that has not hitherto been analysed in this regard.

The rest of the article is organised as follows. “Case study: industrial crisis, urban transformation and mobility in Biscay” section briefly describes the case study chosen, the urban transformations that have taken place in the province of Biscay in the 1990s and their consequences for mobility. “Methodology” section sets out the methodology used: Section “Spatial econometrics” summarises the principles of spatial econometrics, “Theoretical model” section describes the variables considered for the econometric analysis, and “Statistical analysis of the database” section analyses the data base information. Section “Results” presents the results obtained in the estimation of the proposed spatial econometric model and, finally, “Conclusion” section draws conclusions based on those results.

Case study: industrial crisis, urban transformation and mobility in Biscay

Biscay is one of the three provinces which make up Euskadi, the Autonomous Community of the Basque Country in Spain, which covers an area of 2221 square kilometres (see Fig. 1). According to the Basque Statistics Institute (Eustat), in 2001 Biscay had a population of 1122637 and was divided into 111 municipalities. The amount of land available for urban expansion in certain areas of the province is limited by the nature of the terrain and by intense urban and industrial development.

Biscay has been and continues to be an industrial and financial centre in this autonomous region. From the end of the 19th century to the 1970s this territory underwent intense industrial development based on mining, the iron and steel industry and metallurgy. This attracted a large number of people, particularly from the 1950s onwards, leading to urban growth, especially in the capital (Bilbao) and the industrial areas, with serious costs in terms of environmental decay. At that time industry was the main driving force behind the urbanisation process. However, in the late 1970s and 1980s traditional Basque industry suffered a major crisis that transformed the basis of the territory’s economy, which by the 1990s was centred on services and high added value activities. Urban dynamics also changed, with a decrease in migration from rural areas to the city and the first signs of residential decentralisation and relocation of industrial activities on the periphery. The expansion of cities followed a pattern of dispersed urban development characterised by a general trend towards lower density housing, above all in small rural municipalities where there was land available. This process, known as de-urbanisation or counter-urbanisation, has resulted in major demographic changes.

According to Eustat, between 1991 and 2001 the small rural municipalities in Biscay experienced dramatic population increases, while there was a population drop in the major urban-industrial centres (see Fig. 2). The principal cause of these variations was internal migration from the large urban areas where industry was declining and the urban fabric was decaying to areas located around the major cities. This migration pattern was either towards rural municipalities close to and well connected with densely urbanised areas or towards small municipalities which were further away but highly valued for reasons of environmental quality.

Those who moved to a more rural setting where there was little public transport were mainly qualified professionals and families with children, with a medium-to-high socio-economic level, looking for quality housing, but they continued to work in the urban



Fig. 1. Location of Biscay in the Iberian Peninsula.

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