EWGT2013 – 16th Meeting of the EURO Working Group on Transportation

Modeling the effects of environmental impacts and accessibility on real estate prices in industrial cities

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Abstract

This article presents hedonic Multiple Linear Regression models (MLR) to estimate real estate price variations in metropolitan areas as a result of changing environmental and accessibility conditions. The goodness of fit of the model has been compared along with a series of hypotheses about the performance of the specifications considering spatial relationships between observations. The case study for such analysis is the metropolitan area of Taranto (Southern Italy). The models which considered spatial dependence between observations offered a greater degree of fit in a scenario showing strong spatial correlation in MLR residuals.

Keywords: Hedonic pricing models; Transport and land use interaction; accessibility.

1. Introduction and objectives

Classic theories on urban economy are based on the trade-off between accessibility and space (Alonso, 1964). From this view, since certain decision makers are more willing to pay higher prices for them, then locations with better accessibility to the urban system services and activities usually have higher real estate values per unit area (Muth, 1969). These theories imply that investments in transport system can improve accessibility to certain locations and affect property values.

Actually, in addition to accessibility, and other relevant attributes, urban systems users have been addressing an increasing attention to the quality of the environment. Where pollution is relevant the quality of environment has become an important attribute that could affects the residential choice location behaviour and, consequently land-

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use, mobility and economy in the interested areas.

This issue is important in those cities where environmental problem are very relevant because of the location of big industrial plant and accessibility problem where people daily face the risk of diseases due to high pollution levels. This is the case of the city of Taranto (Southern Italy) where is located the biggest steel factory and the main industrial port in Europe as well as a big oil refinery. As consequence of these issues, the urban area is showing a residential migration flow towards zones far from the city centre that is closed to the industrial plants and to the port.

In addition, as it results from the Local Transport Master Plan, the chosen locations are affected by a lower accessibility and services without relevant potential benefit in term of real estate market prices.

Hedonic models can help in estimating the variation in real estate prices as function of environmental and other local attributes making them a potentially useful tool to support investment in transport projects through value capture policies. These studies was carried out by Court (1939), Lancaster (1966) and formalized by Rosen (1974) who finally showed how markets worked for heterogeneous goods. Furthermore, integrating hedonic models in Land Use/Transport Interaction models (LUTI models) it could also help the analyst to simulate the interactions generated in an urban system where location choices for housing or companies strongly depend on the real estate market (Löchl and Axhausen, 2010; Waddell et al., 2007).

The aim of this paper is to highlight the role of quality of environment on residential location choice considering the real estate price, accessibility and other local land-use attributes to assess how the risk of disease affects for example, the higher transportation cost.

This article presents hedonic regression estimators to verify, in accordance with the accepted economic theory, the hypothesis that the dwellings with better accessibility do capitalise, to a certain extent, these benefits; in other words, to verify to what extent a relationship between the accessibility conditions, environmental context and the dwelling market values does exist.

Throughout this paper, after the following section, presents the state of the art of the models developed to estimate the impacts on real estate, hedonic regression models will be estimated with and without considering the existence of spatial dependence between observations. Then, in Section 3 a Multiple Linear Regression (MLR) model is estimated using the traditional hedonic regression technique applied to a dataset from the urban area of Taranto (Southern Italy).

The specification of the proposed models is presented in Section 4 and the model calibrations are analysed and the results discussed. In the final section some conclusions are drawn on the opportunity to take into account the existence of spatial effects when modelling the real estate market as well as on the opportunity to use a given modelling specification to capitalize environmental issue onto the housing market prices.

2.   Literature review

The hedonic studies relating real estate prices with transport conditions have complemented the theories on urban economy and tested their hypotheses through multiple case studies (Ibeas and al., 2012).

Research about how transport conditions influence real estate prices was initiated by von Thünen (1826) and later served as a basis for creating a theory about the distribution of land use and rents in urban areas proposed by Alonso (1964), Muth (1969) and Mills (1972). The nucleus of the theory lies in the modelling of certain trade-offs in the choice of location, mainly between the transport costs of getting to the city centre and the cost of the space. This tradition has continued to grow through the use of ever more complex models. A systematic review of the various research work carried out can be found in Fujita (1989). Another kind of research, based around the relationship between transport and real estate values, is of a more empirical nature and has provided a growing number of case studies. These have been generally supported by the well-known hedonic regression technique formulised by Rosen (1974) to describe how markets function with heterogeneous goods.

Many hedonic studies have concentrated on the relationship between real estate prices and access to rail transport with heterogeneous results (Pagliara and Papa, 2011, Debrezion et al. 2007). The results highlight a significant influence of variables such as the type of property or station being studied on the variability of the