How does Transport Infrastructure Affect Dwelling Prices in Athens?

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1 Current situation

1.1 Transport systems

Athens is the capital of Greece, with a metro area of approximately 4 million citizens. The very high percentage of jobs located in the city center (30%), indicates the need for multiple transportation connections between the center and the suburbs. Many transportation systems and policies have been introduced in the last two decades, especially due to the Olympics in 2004, in order to address the growing needs for inner-city transport. The transportation systems and policies in Athens, are: 1) metro -two rail lines of 51 km in total-, 2) tram, 3) ISAP - an overground railway which connects the Northern suburbs with Piraeus (Central Port), 4) suburban railway, 5) buses, 6) trolleys, 7) the Attica Toll Way -a partial ring road of 65km in total-, 8) the National railway -which connects Athens with other regions in Attica and mainland Greece- and 9) the inner ring -a policy that restricts the entrance of cars in the city center so as to limit the rising smog levels.

1.2 Financial situation

Since 2008, Greece faces one of the worst financial situations of the recent years. Real estate market has been affected by the recession. For the last three years, the average price of apartments sold in Athens had fallen, -4.6% in 2009, -3.2% in 2010 and -6.3% in 2010 [1]. The need to investigate the spatial attributes that affect the house prices, is more topical than ever.

2 Data collection

Finding a dwelling-price database proved to be a challenging task for the authors, because real estate data are usually unavailable from the authorities. In Greece, the Ministry of Economics provides -only in hard copies- tables of the average house prices per square meter per zone -that is defined descriptively by the names of the surrounding streets. In order to overcome this difficulty, similar to Löchl and Axhausen [2], we developed a web scrapper for data collection from publicly available real estate websites. In our case, the tool was created in R [3], where the packages XML [4] and RCurl [5] provide the necessary functions for this purpose. Within a period of 5 months (from September 2011 to January 2012), the following house attributes were parsed: 1) price, 2) type of house, 3) square meters, 4) number of bedrooms, 5) floor, 6) year of construction, 7) availability of independent heating, 8) air-conditioning, 9) garden, 10) fire place, 11) parking, 12) type of parking, 13) type of view, 14) orientation and the 15) geo-location (X,Y coordinates) on the ellipsoid WGS84. Duplicate data, houses of unusual sizes and prices, and data with missing geographical information, price, or year of construction, were removed. However, several factors that might cause biases remained: 1) not all the dwellings for sale and rent are advertised in the internet, 2) wrong characteristics could be used in the advertisement and 3) the final transaction cost is sometimes different than the one advertised. The final database is composed from two subsets: i) one with 8066 houses for sale and ii) another with 8400 for rent.

The distances of dwellings from the transportation infrastructure, were then computed. In order to do that, the locations of metro, ISAP, tram, bus and railway stations were extracted from the portal: http://geodata.gov.gr -where data are listed according to the Infrastructure for Spatial Information in Europe (INSPIRE) Directive- while the

position of the airport, ports (Piraeus, Rafina), marinas (Zeas, Floisvos, Alimos, Glyfada), Attica Toll Way and the inner-ring, were downloaded from the public website http://www.index.pois.gr. In addition, other spatial information such as distance from the Central Business District (CBD), distance from main archaeological sites and distance from the coastline, data that were available at the School of Rural and Surveying Engineering of NTUA, were added.

3 Models

Different linear models were estimated using both 'price' and 'rent' datasets: 1) Hedonic price models, where the dependent variable is the natural logarithm of price and the explanatory variables are either continuous, dummies or natural logarithms, depending on their spatial variability; 2) Log-log models -following DiPasquale and Wheaton [6], who suggest the use of both explanatory and response variables as logarithms for house price model estimations-; 3) Generalized additive models (GAM) using quadratically penalized likelihood maximization (penalized least squares) with splines (p-splines) -the method is described by Wood [7] and offers advanced numerical stability because it uses isotropic smooths of the independent variables. Moreover, spatial econometric models were estimated. The: 4) spatial error model (SEM), 5) spatial lagged model, 6) spatial durbin model (SDM), 7) spatial autocorrelation (SAC) [8] and 8) geographically weighted regression (GWR) [9].

4 Results

The impact of externalities on house prices and rents, is evident. The values are negatively affected by the presence of an ISAP or national rail station within 500m distance, because of the noise, a finding similar to Brons [10]. On the other hand, houses located within 500m around the metro stations have higher prices and rents. Proximity to a tram (<500m) or bus station (<50m) increases the transaction price, however, both variables are insignificant when estimating rents. Since the tram network is relatively new, future comparisons should also be made, as Henneberry [11] found that in the case of Sheffield's supertram, the importance of proximity to tram station changed from positive in 1988 to negative in 1993 and then ended to be insignificant in 1996. Dwelling prices and rents

around the International Airport of Athens (<7000m) are lower, because of the airplanes' noice during take off and landing, a finding that is consistent with Espey and Lopez [12]. Furthermore, houses in 1500 meters of the main four marinas of Attica are more expensive, while both prices and rents increase with the distance from the ports of Piraeus and Rafina. Finally, the impact of Attica Toll Way has examined. Three different classes corresponding to three distance ranges, were considered: <250m, 250-1500m and >1500. Unlike other studies [13] which conclude that prices are lower when closer to the highway (1st class) and higher in a middle range, our price models show that proximity lessens the value, while the farer from the highway, the more expensive the house. On the other hand, rent models estimations show that dwellings belonging in the middle-range (250-1500m) have the lowest rents.

5 Conclusion

In this paper, the authors examine the factors that affect the dwelling prices and rents in Athens, Greece. A tool that parses house attributes and prices from real estate websites was developed in R. Distances from transport infrastructures and policies were computed, and different linear regression and spatial econometric models were estimated. The estimations suggest that prices and rents are -either positively or negatively- affected by transportation infrastructure, so this spatial information should always be considered when estimating price models. The findings will be used for further analysis and for a possible future application of Urbansim [14]

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