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Investigating the impact of recession on transportation cost capitalization: a spatial analysis

D. Efthymiou *, C. Antoniou

National Technical University of Athens, Laboratory of Transportation Engineering, 9, Iroon Polytechneiou, Zografou, 15780 Attica, Greece

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ABSTRACT

The unprecedented economic crisis experienced by Greece is fertile ground for research at myriad levels. In this paper, the authors aim to investigate the effects of the crisis on real estate prices by measuring the impact of transportation infrastructure location. For the purposes of this research, on-line real estate data collected in 2011, when the consequences of the crisis were still uncertain, and in 2013, when a significant decline had been observed, are combined.

The analysis is based on various spatial statistical methods. In order to identify potential common price patterns, G spatial clustering is first performed. Spatial error models (SEM) are then developed to parameterize the real estate prices. The results show that, overall, purchase prices have been reduced by 18.2% and rents by 15.2%. More specifically, the positive impact of metro station locations (<500 m) has declined 42.5% for purchase prices and 62.5% for rents. Moreover, dwellings located in the Inner Ring are still more expensive than others; however, the impact of the crisis has been reduced by 30.3% for purchases and 50.7% for rents. On the other hand, the negative impact of ISAP station locations (<500 m) has declined by 53.5% for purchase prices.

The findings of this paper could be of great interest to the transportation policy research community and could be used to better predict the benefits and costs of public transport investment under extremely uncertain conditions, such as a long-lasting recession.

1. Introduction

1.1. Land-use and transport interaction

In the era of increasing data availability and computational power, the interaction between transport and land-use has become a leading research objective. The need to better understand the direct and indirect effects of urban planning policies on the environment, society and economy has led to the development of different integrated land-use and transport models (Waddell, 2002). In these systems, location choice, transition, development, real estate price, and transportation models interact in a complex way. They are employed to forecast urban area structures under different policy scenarios, taking into consideration demographic, social, economic, and environmental characteristics.

Significant effort has been invested to improve the modeling framework of the agents' (households and jobs) location choice, which is highly affected by the implementation of a new transport policy. The preference of locating in higher accessibility areas in order to reduce commuting costs leads to increasing levels of real estate demand around transportation infrastructure locations. The generated competition results in the capitalization of transportation costs in real estate (Cervero and Landis, 1993).

The impact of transportation infrastructure locations on real estate prices has been explored by a number of researchers, demonstrating variation depending on the local characteristics, the quality and age of the transportation infrastructure, and the side-effects/externalities that are generated. For example, in Europe Debrezion et al. (2006) found that rail stations have positive impacts on Dutch house prices, while the closer to the railway a property is, the lower the prices due to noise pollution. Martinez and Viegas (2009) found that prices are higher in areas with better accessibility to metro stations; however, this is not always the case near rail stations, where the impact varies by route. In Madrid, Dorantes et al. (2011) concluded that a new metro line had positive impacts on house prices in south Madrid. In another case study, Ibéas et al. (2012) found that, in Santander (Spain), proximity to

* Corresponding author. Tel.: +30 210 77216 75.
E-mail addresses: defthym@mail.ntua.gr, dimitrios.efthymiou09@alumni.imperial.ac.uk (D. Efthymiou), antoniou@central.ntua.gr (C. Antoniou).
URLs: http://users.ntua.gr/defthym (D. Efthymiou), http://users.ntua.gr/antoniou (C. Antoniou).

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train stations drives house prices lower. In Atlanta, Bowes and Ihlanfeldt (2001) found that rail stations have both positive and negative impacts on house values: positive due to the accessibility increase, and negative due to the externalities that are generated. In Santa Clara (California), Weinberger (2000) investigated the impact of light rail and found that houses located closer to the stations are leased at higher prices than others. In Washington, DC, Cervero and Landis (1993) and Benjamin and Sirmans (1996) found that the metro affects house prices positively. Similar effects are found for light-rail stations in Buffalo (NY) (Hess and Almeida, 2007), in Dallas (Clower and Weinstein, 2002), and in Toronto (Canada) (Bajic, 1983). In contrast, Haider and Miller (2000) found that transportation infrastructure does not determine property values in Toronto.

Other studies reviewing the impact of rail transport infrastructure on residential and commercial values include a technical report by Parsons Brinckerhoff Quade and Douglas (PBQD, 2001). In order to deal with the large number of studies that investigate the impact of rail investments on real estate values, Debrezion et al. (2007) and Mohammad et al. (2013) applied meta-analysis and found that the variation in results depends on many factors, such as the type of rail, distance of stations, maturity of the system, and accessibility. Mohammad et al. (2013) performed publication bias tests and found that the positive/negative results reported by researchers are sometimes biased towards statistically significant estimates. In addition, proximity to airports usually has negative impacts on house prices due to noise (see Nelson, 2004; Crowley, 1973; Cohen and Coughlin, 2008). However, there are cases where airport construction has led to higher prices following the increase in accessibility (Lipscomb, 2003).

1.2. Economic crisis and real estate prices in Athens

Greece has been highly affected by the financial crisis post-2008/2009. As in every market, the impact of the crisis is apparent on real estate. According to the Bank of Greece (2012a), real estate purchase prices in Athens have declined since 2008 (4.5% in 2009, 3.2% in 2010, 6.4% in 2011, 11.8% in 2012, and 12.7% during first quarter of 2013). In a recently published report about the expectations of real estate agencies (Bank of Greece, 2012b), the respondents (agents) stated that they expected a deterioration of market conditions, despite the relative financial stabilization forecasts for 2013. Brokers assumed that prices had declined 11–24% since the last quarter of 2012, while they noted that more people were looking for smaller, second-hand residencies. On average, dwellings were sold for 22% lower than the initial list price, after being advertised for 10 months on average. The aforementioned studies indicate that changes in real estate prices are based on aggregated data. In this paper, we present a methodology that uses disaggregated information to measure the impact of the crisis on two levels: holistic (total reduction between two time periods) and local (impact of transportation infrastructure).

1.3. Previous research

This paper builds upon previous research by Efthymiou and Antoniou (2013), who measured the impact of transportation infrastructure locations on purchase prices and rents of dwellings in Athens, Greece. The data used in that research were collected from on-line sources, using a tool developed in R (R Development Core Team (2014)). Different modeling methodologies were then applied – such as ordinary least squares, spatial econometric models, and geographically weighted regression (GWR) – and their results were compared. The estimations show that dwellings have higher prices when located within 500 m of a metro or tram station, 1500 m of a suburban rail station, 50 m of a bus stop, or 1500 m of a marina. Those dwellings located within 500 m of an urban or the national rail station, 7000 m of the airport, and closer to the port have lower prices. The models were compared in terms of goodness of fit (R^2 and AIC (Akaike, 1974)) and spatial autocorrelation (Moran's I). The authors concluded that spatial econometric models effectively remove the spatial autocorrelation, and suggested that their use should be further investigated with next generation LUTI models. Moreover, they found different elasticities of the impact of transportation infrastructure locations, depending on the type of model being used. Therefore, policy planners should be aware

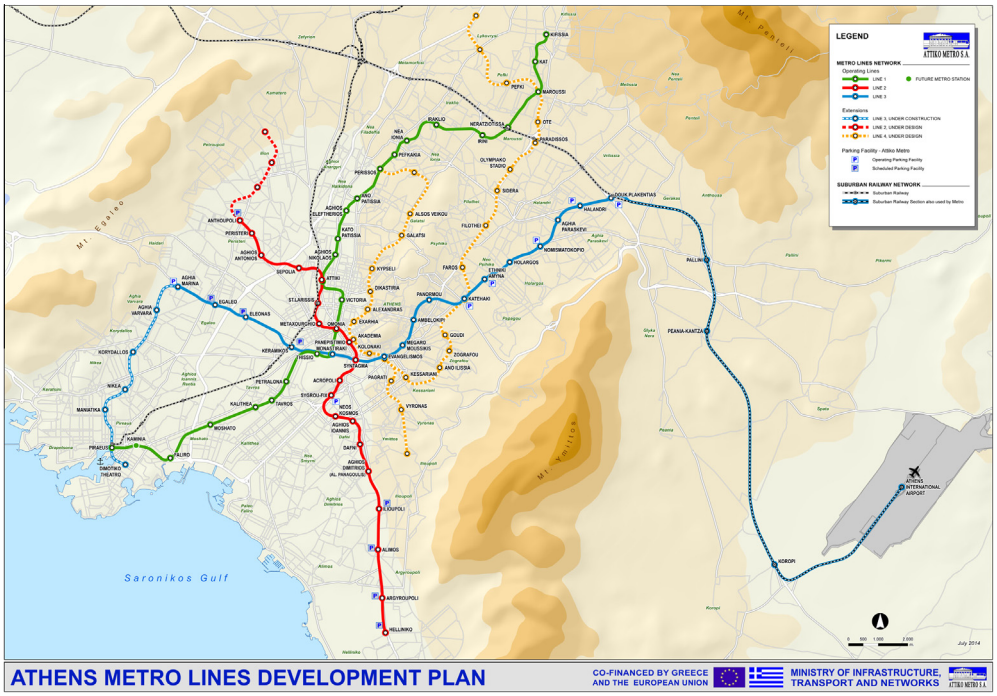

Fig. 1. Central transport network. *Source*: http://www.ametro.gr/files/maps/AM_Athens_Metro_map_July14_en.pdf, inset source: Google Maps.