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The first rapid tram line in Poland: How has it affected travel behaviours, housing choices and satisfaction, and apartment prices?

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ABSTRACT

The opening of the Poznań Rapid Tram (pol. Poznański Szybki Tramwaj, PST) in the year 1997 symbolically marked the beginning of a new era in the development of urban transportation systems in Poland. In this paper we would like to address the following question: more than one decade after the opening of the PST, what are its effects in terms of travel behaviours, housing choices and satisfaction, and apartment prices? In order to answer this question, we combined data on travel behaviours and housing choices from a survey based on a sample of nearly 300 households with data on housing prices from over 1400 real estate transaction records from the period between 2010 and 2013. Our results show that the proximity to PST affects travel behaviours, as respondents living close to PST stops confirmed that they use this form of transportation more often. There also seems to be some effect on housing choices; in locations close to PST stops we found many households living in rental housing, particularly university students. Also, about 20% of interviewees declared that they would pay more for apartments located closer to the rapid tram. However, that effect was only partly confirmed through the analysis of transaction prices. Using standard and spatial econometric regressions including variables like apartment size, floor number, amenities, and type of building we found a weak correlation between the proximity to PST and apartment prices. In conclusion, we argue that treating property price effects as the main justification for public transportation projects might be a doubtful choice, because in some cases the principal impacts of such projects might be visible in terms of residents' satisfaction and travel behaviours.

1. Introduction

In recent times there has been an increasing interest in studying the wider economic impact of transport infrastructure on urban areas. Within this field of research, the impact of urban rail and light rail transit (LRT) has become one of the main subjects of investigation. Although the state of knowledge has substantially improved in recent years, many questions still remain open, and new evidence is clearly needed. A certain bias can be observed in the existing literature, in both the thematic aspects and the geographical aspects. More specifically, many studies are concerned with the effects of large-scale investments on selected land uses (commercial, single family housing), while small-scale projects and other land uses are being addressed much less frequently. Also, the dominance of studies originating from the USA and Western Europe is evident, while research grounded in the post-socialist context where public transportation plays a relatively important role is still very limited.

With this paper we would like to contribute to the growing, yet in some aspects still largely incomplete, body of empirical evidence regarding the social and economic effects of public transportation projects. In particular, we would like to focus on the following effects of public transportation projects: (1) the effects on travel behaviours, particularly the ability to increase the number of individuals who choose public transportation instead of automobile, (2) the effects on satisfaction with the place of residence and housing choices and (3) the effects on property prices. The case study that is used here is the Poznań Rapid Tram (pol. Poznański Szybki Tramwaj, PST), which is the first example of LRT placed into operation in Poland after the fall of socialism. Opened in 1997, the PST connects the central business district with the prefabricated housing estates of Winogrady and Piątkowo, located in the northern part of Poznań, a city that with its over 500,000 inhabitants is the fifth-largest urban core in Poland. Winogrady, which between the two is the one that was built earlier and is situated closer to the city centre, is the area in which the impacts of PST are investigated in this paper. The main reason why that district was chosen was due to the availability of data on property sales, which, in the absence of general rules regulating the dissemination of such data, are generally quite difficult to obtain (using such data is quite a rare case in studies conducted in Poland). One more advantage of this choice is that the selected research area is very

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homogeneous — almost all the buildings were built in the same period and from similar materials.

The paper starts with a brief overview of the existing literature, which is followed by a presentation of the case study, an overview of data and methods, and an empirical section. In the literature review the main gaps in existing evidence are identified, and are then addressed in the empirical work. In order to answer the formulated research questions, both quantitative and qualitative data and methods are used. In particular, data from a survey conducted among 275 households in the district of Winogrady, as well as a database of over 1400 apartment sales transactions are employed. Transaction data are used to estimate regression models using spatial econometric models as well as geographically weighted regression (GWR).

2. Literature review

There is a growing body of literature related to the diverse effects of LRT projects. The scope of this review is therefore limited to the topics which are then addressed in the empirical section. There are a number of studies which are concerned with the effects of LRT projects on travel behaviours. A positive effect on public transport usage was confirmed in some cases, including for example the Metrolink project in Greater Manchester, which limited the usage of cars (Knowles, 1996); however as a later study showed, it also limited the usage of buses (Senior, 2009). Other research showed that residents were willing to walk longer distances, by 400 to 800 m, to reach LRT stations compared to bus stops (O'Sullivan and Morrall, 1996). However, it must be stressed that a nuanced view on the impacts of LRT projects on travel behaviours is necessary, as a number of factors play a role including the size of population and availability of employment within a walking distance from the stations, the number of available park-and-ride spaces, and the number of bus connections bringing residents to and from nearby districts (Kuby et al., 2004). Knowles and Fairweather (1991) surprisingly suggested that passengers from the upper socio-economic classes were more likely to be attracted by rail services, which obviously contradicts a perception of public transport as a "second best" choice, which is particularly widespread in the post-socialist context.

It has been argued that transit-oriented developments (TODs), which are compact, mixed-use, and pedestrian-friendly neighbourhoods with a good accessibility to public transport stops (Arrington and Cervero, 2008) might particularly benefit from LRT projects (Kim et al., 2007). Indeed, according to some studies, TOD commuters typically use transit 2 to 5 times more often (Arrington and Cervero, 2008, p. 5), or even 2 to 10 times more often than commuters from other, more car oriented neighbourhoods (Banister, 2011, p. 1544), as well as tend to own 10–30% fewer cars, and drive 10–30% fewer miles. Also, other studies showed that LRT users in TODs chose cars less often and walked much more than non-users (Brown and Werner, 2008).

Despite some positive examples, the empirical evidence related to the effects of LRT projects on travel behaviours remains limited (Kim et al., 2007). Lane (2008) examined 13 cities with LRT systems and 22 other cities which were considering building LRT, finding that the frequency of usage and modal share of public transport was significantly higher in cities where LRT was present; similar conclusions were also obtained by Hass-Klau and Crampton (2002). However, it appears that the presence of LRT alone does not automatically lead to higher frequency of usage and higher modal share of public transport, which are also affected by relatively high levels of transit prioritization and the overall positive quality of public transport services in "rail cities" (Lane, 2008).

Another branch of research concerns the effects of LRT projects on satisfaction with the place of residence and housing choices. Satisfaction with the place of residence (or residential satisfaction) can be understood as residents' subjective perception of the quality of the living environment (Rossi, 1955; Burrows and Rhodes, 1998; Andersen, 2008), which is significantly associated with people's decision to move (Morris et al., 1976; Diaz-Serrano and Stoyanova, 2010). Three groups of factors seem to affect residential satisfaction the most: attributes related to the individual, attributes related to housing itself, and the quality of the local neighbourhood (Lu, 1999). Neighbourhood quality is defined by a set of different aspects, among which the accessibility of public transit, and particularly in the case of larger cities — of LRT infrastructure, plays a major role. By reducing congestion, travel times, and harmful emissions, accessible rail transit may improve the quality of neighbourhood in many aspects, and in that way influence the location choices of inhabitants (Cohen-Blankshtain and Feitelson, 2011). The opening of an LRT project may also have a positive impact on the city, as for example when 27% of the buildings located along the new tram line in the central part of Strasbourg were renovated, and 18% changed their functions (Hue, 1997). Positive effects of LRT projects were also found in the case of urban regeneration and restructuring (Higgins et al., 2014).

While factors such as 'accessibility of public transport stops' or 'congestion level' are commonly used in measuring the general level of housing satisfaction (Sirgy et al., 2000; Mccrea et al., 2005), there is a lack of in-depth studies in this field, with the exception of some analyses of TODs in the US. In the case of a TOD near Salt Lake City's TRAX, the satisfaction with the place of residence and place attachment was much higher among rail users (Brown and Werner, 2008). Moreover, LRT users generally tended to assess the TOD-model more positively, and other suburbs more negatively than non-users (Brown and Werner, 2008). In another study, which concerned the Hiawatha line in Minneapolis, it was demonstrated that the accessibility of LRT expanded the sets of inhabitants' travel choices, and improved the quality of travel, as well as having a positive effect on overall life satisfaction (Cao, 2013).

There is also a distinctive branch of transportation literature that focuses on the links between urban public transit infrastructure and location choices. Transport infrastructure shapes the inhabitants' access to daily activities (Efthymiou and Antoniou, 2013), so each investment in transport infrastructure that significantly affects travel costs may affect in turn the daily travel behaviours of inhabitants (Boarnet and Crane, 2001). Consequently, some people or firms may be encouraged to consider the possibility of relocation to places where the accessibility has improved (Scheiner, 2006; Wegener, 2004; Coppola and Nuzzolo, 2011). A positive correlation between the proximity of LRT and the development of new housing and/or commercial areas was found e.g. by Landis et al. (1995), Kim et al. (2004), Kim and Lahr (2014), Transecon Consortium (2003) and Pagliara and Papa (2011), but the strength of these relationships varied significantly among the case studies. In particular, LRT was found to have a strong stimulating effect on the development of new suburban districts in Naples (Pagliara and Papa, 2011) and Madrid (Transecon Consortium, 2003).

A growing branch of literature concerns the effects of LRT and bus rapid transit projects on property values (Banister and Thurstain-Goodwin, 2011). Existing studies focus mostly on large-scale urban rail and metro investments (Bajic, 1985; Chalermpong, 2007; Debrezion et al., 2007; Lin and Hwang, 2003; Pan and Zhang, 2008), while studies of smaller investments like light-rails/rapid-trams, and conventional trams, are underrepresented (Chen et al., 1997; Henneberry, 1998; Hess and Almeida, 2007). Banister and Thurstain-Goodwin (2011, p. 216) suggested that "*to unravel what effects* [*in terms of property prices*] *can be attributed to the transport investment* […] *knowledge must be built up from a series of carefully constructed case studies*". So far, conclusions from the various cases have been ambiguous.

Some recent studies including Dubé et al. (2013), Efthymiou and Antoniou (2013) and Hess and Almeida (2007) confirmed the expected positive effect of the proximity of urban rail infrastructure on property prices. On the contrary, other recent research found proximity to transportation infrastructure marginally important, or only important under some specific conditions (Adair et al., 2000; Mikelbank, 2005). In a review of 19 studies for 24 mostly North American rail investments, the effect of transport infrastructure turned out to be positive in 13

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