

A Meta-Analysis of the Impact of Rail Projects on Land and Property Values

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Extended Abstract

The literature on land and property values demonstrates a great deal of variability in the estimated change in values arising from rail investments. This paper focuses on assessing the main causes of the variation. The majority of research has identified positive gains in values (e.g. Agostini and Palmucci, 2008; Laakso, 1992; Pan and Zhang, 2008; Voith, 1991), although some studies suggest depreciation in some locations (e.g. Du and Mulley, 2007), and a small number of reports show no significant differences for some properties (e.g. Clower and Weinstein, 2002).

While there have been previous attempts to analyse the variation in estimates of land/property value change arising from investments in rail, they suffer from limitations related to the analysis techniques used and/or the number of factors considered. The majority of such studies use traditional literature review techniques based on a subjective interpretation of results obtained from case studies without conducting any form of systematic analysis (e.g. RICS Policy Unit, 2002; Zhang, 2009). Moreover, some studies consider only a subset of study-design factors to explain the variation in empirical findings. For example, Ryan (1999) examined the effect of a single factor (time-based and distance-based accessibility) on the estimated change in land/property values arising from rail schemes. Debrezion et al. (2007) considered a larger set of study-design factors in a meta-analysis model; including type of property, type of public transport system, type of empirical model, time period of the analysis, accessibility to different transport modes, and demographic variables. To our best knowledge, this is the only study that conducted a systematic analysis of the empirical literature accounting for the role of a set of study characteristics; however, we believe that the list of factors considered was not exhaustive.

We contribute to existing research by conducting a more extensive quantitative review of the effects of rail on land/property values. Our study provides an up-to-date survey of the literature in the field and considers a wider range of contextual and methodological characteristics of related studies that are expected to influence results. Compared to the previous meta-analysis by Debrezion et al. (2007), we have added or modified 12 contextual factors and introduced 5 additional methodological factors. The study by Debrezion et al. (2007) analysed a sample of 57 observations limited to studies using US data. We use a wider geographical coverage, including European and Asian studies, and a larger dataset made of 102 observations obtained from 23 studies for the period between 1980 and 2007. The results from this meta-analysis can provide a reference point for future research investigating the impacts of new or improved rail schemes on the values of surrounding land/property.

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The factors that may impact land/property values and are expected to give rise to differences in estimations were identified and included in a random-effects meta-analysis regression model. Two model specifications were tested using a different combination of study-design factors. Model 1 uses a comprehensive model specification which includes all contextual and methodological factors affecting land/property value. Model 2 focuses on a subset of factors related to internal characteristics of land/property and factors affecting proximity to rail stations. Both models revealed similar results and indicated that contextual and methodological factors can explain a large portion of the variation in estimates of land/property value changes. We also conducted publication bias tests to examine if researchers tend to report positive and statistically significant values.

Starting with contextual factors, it was found in both models that land value changes tend to be higher than property value changes. However, no noticeable difference was found for rent values of properties compared to purchase prices. The results indicate that changes for commercial land uses tend to be higher than for residential properties, but dwellings and office values exhibit similar changes. The meta-analysis revealed that including property characteristics in the estimation model does not cause estimates to differ and that changes have been similar over time (from 1980s to 2007).

In both models, commuter rail was found to have higher impacts on land/property value changes in comparison to light rail. Model 2 indicated that heavy rail dampened the effect on land/property values compared to light rail. Results also revealed that the estimated change in land/property values after rail service stabilized were lower compared to announcement time but similar for other stages of the rail system life cycle. This study also showed that average across studies land/property value changes tend to be higher at distances from 500 to 805 metres of a rail station, compared to distances longer than half a mile away.

An interesting finding of this study is that the impact of rail on land/property values was found to be higher in European and East Asian cities compared to cities in North America. In addition, model 1 found that accessibility to other modes of transport dampened the effect of rail on value changes. The results also indicated that land/property location within the city (i.e. CBD or as an average value in both CBD and non-CBD) and considering neighbourhood type in the model specification did not affect reported values significantly.

Considering the effects of the methodological factors on the reported estimates, this meta-analysis showed that panel or time-series data produced higher value changes compared to cross-sectional data. We also found that there is no noticeable difference in the reported estimates based on the analysis method, but there is some evidence that average comparison methods can produce lower estimates compared to hedonic price models. The results also suggest that semi-log and double-log models tend to produce lower estimates compared to linear models.

We also conducted several publication bias tests. It was found that both published articles and working papers tend to report positive and negative values although biased towards statistically significant results.

REFERENCES

- AGOSTINI, C. A. & PALMUCCI, G. A. 2008. The anticipated capitalisation effect of a new metro line on housing prices. *Fiscal Studies*, 29, 233-256.
- CLOWER, T. L. & WEINSTEIN, B. L. 2002. The impact of Dallas (Texas) area rapid transit light rail stations on taxable property valuations. *Australasian Journal of Regional Studies*, 8, 389-400.
- DEBREZION, G., PELS, E. & RIETVELD, P. 2007. The impact of railway stations on residential and commercial property value: A meta-analysis. *Journal of Real Estate Finance and Economics*, 35, 161-180.
- DU, H. & MULLEY, C. 2007. Transport accessibility and land values: a case study of Tyne and Wear. *Report RICS Research paper series*.
- LAAKSO, S. 1992. Public transport investment and residential property values in helsinki. *Scandinavian Housing and Planning Research*, 9, 217-229.
- PAN, H. & ZHANG, M. 2008. Rail transit impacts on land use: Evidence from Shanghai, China. *Transportation Research Record: Journal of the Transportation Research Board*, 2048, 16-25.
- RICS POLICY UNIT 2002. Land value and public transport: Stage 1 - Summary of findings. Office of the Deputy Prime Minister
- RYAN, S. 1999. Property values and transportation facilities: finding the transportation-land use connection. *Journal of Planning Literature*, 13, 412-427.
- VOITH, R. 1991. Transportation, sorting and house values. *AREUEA Journal*, 19, 117-137.
- ZHANG, M. 2009. Bus versus rail: Meta-analysis of cost characteristics, carrying capacities, and land use impacts. *Transportation Research Record: Journal of the Transportation Research Board*, 2110, 87-95.