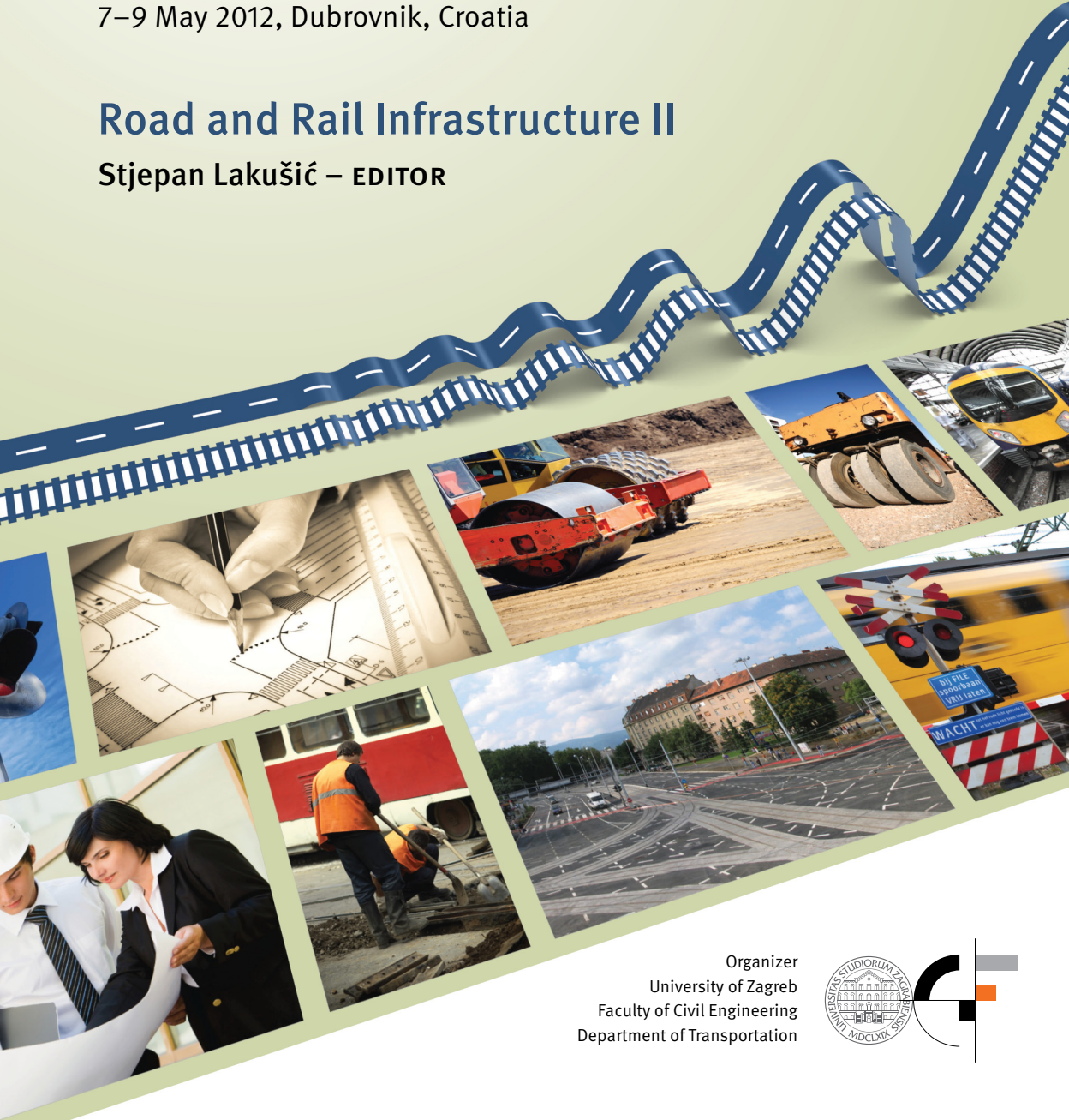


CETRA²⁰¹²

2nd International Conference on Road and Rail Infrastructure
7–9 May 2012, Dubrovnik, Croatia

Road and Rail Infrastructure II

Stjepan Lakušić – EDITOR



Organizer
University of Zagreb
Faculty of Civil Engineering
Department of Transportation



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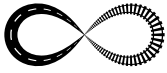
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INFRASTRUCTURE INVESTMENTS AND ITS IMPACT ON REGIONAL ECONOMY – EVIDENCE FROM TWO CASE STUDIES AS STARTING POINT FOR A PLANNING TOOL

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Abstract

Infrastructure investments in rail based systems, such as metro or regional railways, mainly are funded by public sector. Public sector spending needs justification before the tax payers. Traditional cost–benefit analysis is usually used to show the expected effects. However, results are often not satisfying as the expected benefit (user costs, travel time, emission, noise and safety) do not sufficiently cover the investments and operation costs in public transport projects. Effects on regional economy of the areas accessed such as increasing land value, follow up investments or increased consumption of users are usually not included in such analysis. The Institute of Transport Studies of the University of Natural Resources and Life Sciences (BOKU) Vienna, Austria, participated in several research projects (Interreg, EU–framework programme, national) where empirical data of such effects were explored through ex post analysis. Reference projects investigated are the new main railway station of Linz (capital of Upper Austria) and metro line U3 in Vienna. Follow up investments were compared with reference areas to identify different developments. Interviews with stakeholders (shop keepers, investors, etc.) were carried out especially to identify the cause and effect chains. In the Linz case users of the transport systems were interviewed to identify their consumptions at the station. In the Viennese case, data of real estate market was accessible to analyse effects in price developments of offices, shops or apartments. The presentation will give an overview of these results. Results show, these effects are very relevant as basis for decision for rail based infrastructure investment and need to be considered more deeply in future planning. Therefore, the Institute currently develops a calculation model for infrastructure measures as planning tool including land value effects and employment effects.

Keywords: transport planning, rail based transport, evaluation schemes, socio economic effects.

1 Introduction

Traditional cost benefit analysis for rail based infrastructure usually are considering variables such as investment – and operation cost, travel time, accidents, noise, emission, energy consumption and generated demand. Expensive investments such as rail based infrastructure usually do not exceed the necessary cost benefit ratio of 1 plus. But there is some evidence, especially long lasting rail based infrastructure in urban environment are also causing effects on labour market because of third party investment effects and on property market (increasing property values) because of improved accessibility, which will also be a stimulus to further investments. If considering these effects in the cost benefit analysis the decision of public investments could lead to other conclusions as practice shows today.

2 Ex Post Analysis of two case studies

Based on two reference cases ex post analysis were carried out to test the hypothesis, large scale infrastructure investments will have a significant effects on third party investments leading to positive employment effects and additional GDP effects. Another type of benefit is the change of land value because of the new infrastructure supply in the accessed areas.

2.1 Metro Line U3, Vienna (Austria)

Metro line number three was opened in different stages. In order to analyse long term third party effects only sections of the line were included in the analysis, they were opened before the year 1991 [1], [2]. To be able to identify third party effects of the investment, two strategies were followed: A micro approach with detailed data collection at site and a macro approach based on data on district level. The advantage of the micro approach is the use of unbiased and detailed data for analysis. The disadvantage is the missing availability of such data covering the whole city respectively the enormous time consumption to collect these data. The macro approach based on existing data bases can be done for the whole city but data are clustered not perfectly fitting to the needs for analysis and therefore can include effects of different other measures in the area as well.

2.1.1 The micro approach:

For the micro approach three different areas were selected (see figure 1): The centre as the hot spot of the city. This area was accessed already before the access with the new metro line was established. It can be assumed this area is one of the most prosperous areas of the city and will act as potential upper limit of developments. The second area is located on the new metro line with access to two different stations. As a third reference area a region was chosen with the same distance to the city centre, comparable social situation, land use and reputation of the area but no access to any metro.

All the parcels of land of the three areas were investigated and classified in four categories: (1) no building exists (brown field area), (2) buildings are in poor condition (fully or partly uninhabited), (3) no investments were made in the period 10 years after opening of the metro line number three, but the condition of the buildings are quite acceptable and (4) newly constructed or mayor renovation works were carried out in this period. Results can be seen at figure 2. As expected, the city centre area shows the most dynamic situation all buildings are in acceptable condition, no building land is available in this area. The area with the new metro access shows a lower share of investments in the building stock, but a significantly higher rate comparing to the reference area without metro access. Contrary to this is the situation for unused land or buildings in problematic condition. This indicates a clear third party effect of the metro investment in the area under investigation. Based on the floor space of the affected buildings and classified after new construction, basic renovation (including technical infrastructure of the building) and light renovation (windows, facade only) the investment activities were transferred into money values based on standard values (see figure 3). Results are showing the investment per square meter is twice as high in the area with new metro access compared to the one without metro access.

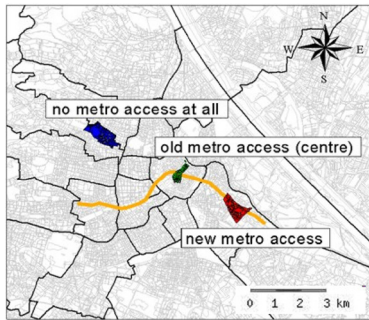


Figure 1 Map of areas of micro analysis, Vienna.

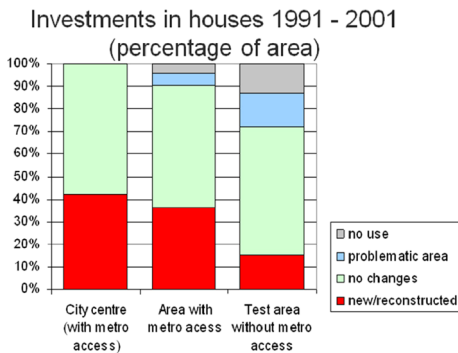


Figure 2 Investment activities in the areas of micro analysis, Vienna.

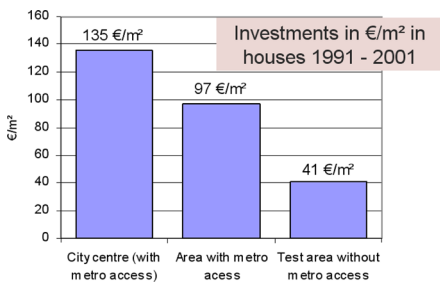


Figure 3 Investment rate in the areas of micro analysis, Vienna.

2.1.2 The macro approach:

For the macro approach the three districts were chosen, where the chosen areas of the micro approach were embedded, which are districts 01 (city centre), 03 (new metro access) and 17 (no metro access at all). Time series data of rents for dwellings, offices and shops based on district level were accessible for the analysis. Data were clustered for the period before and after the opening of the metro (10 years time period each). Rent prices were chosen as indicator as data were available due to the database of the office called Schlichtungsstelle, where renters can check their appropriateness of their rents. Additionally these values are reflecting both investment activities in better quality of the facilities and the better accessibility of a specific area. Results are shown in figures 4–6. In all districts a clear increase of the rents can be observed between the two time periods. Again the city centre (district 01)

shows the possible upper limits for the city of Vienna, which concerns all three categories. Comparing the development of the two other districts, it is interesting, that the district with new metro access (district 03) has overtaken the other district (17) in the two categories: rents for dwelling and for shops because of a more dynamic development. The price level for renting an office was higher in district number three already before opening of the metro, nevertheless the gap between the two districts raised. As stated before, there is some evidence, the new metro contributed to this development, but the cause-and-effect chain is more biased here in comparison with the micro approach.

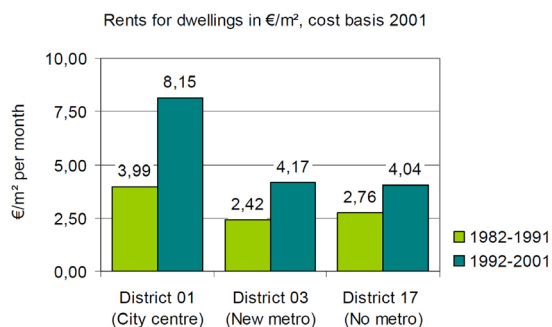


Figure 4 Development of rents for dwellings, macro analysis, Vienna.

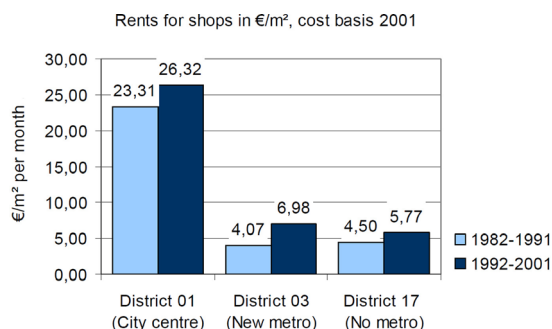


Figure 5 Development of rents for shops, macro analysis, Vienna.

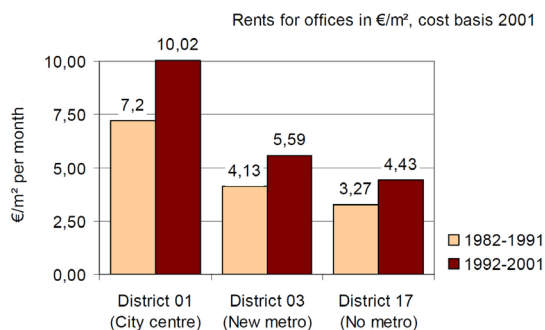


Figure 6 Development of rents for offices, macro analysis, Vienna.

2.2 Railway station in Linz (Austria)

As a second case study, the new railway station in Linz, capital of the province of Upper Austria was selected for analysis [3]. The station was totally new constructed, its accessibility with urban public transport was significantly improved and a shopping centre was integrated in the railway station building [4], [5]. The shift of the function from a pt–node only to a multi functional building could be shown based on interviews made at the station building (figure 7). Meanwhile only little less than 78% of people visiting the station are using the railways infrastructure whereas one third is carrying out shopping activities. Another 20% share is visiting the bars or restaurants and little less than 10% are using the station building for meetings. On average expenses of persons who have purchased goods at the railway station are € 9.80 (public transport related goods or services are excluded here). This equals ca. € 180 000 revenue per workday in the shops and bars within the railway station only [6]. Furthermore, the number of passengers using the railway station building increased from 27 600 trips per day to 46 700 trips per day within two years only (+70%) [6], [7].

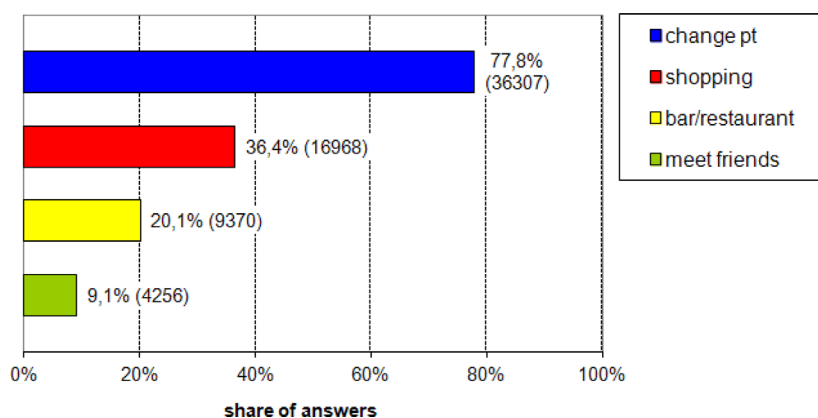


Figure 7 Purposes to visit the new pt node (multiple answers allowed), Linz.

Table 1 summarizes the main building developments within the area investigated (within a walking distance of 5 minutes from/to the station building), segregated after transport and non transport related investments. As the table shows the ratio of non transport related investments is three times higher in comparison to the transport related investments, even if one focuses on the main investments only. A lot of further investments – but of a smaller scale – were recorded in the area during a site visit but not crossed up to an investment sum here. A major problem, if analysing these developments is to determine causality within the cause and effect chain. Developers are clearly benefiting of the infrastructure upgrade, but in tendency denying the influence towards their decision to invest/settle down or not, when interviewing them. On the one hand, the availability of land to develop and the actual land use plans are further main drivers of these developments. On the other hand, investors want to avoid to start a discussion about implementing a beneficiaries tax to be paid by land developers to the public investor (as cases exists already, e.g. in Madrid conurbation, tram of Valdemoro case [8] or Cambridge, guided bus–way case [9]). For a cost benefit analysis, the estimation of the third party effects is difficult, especially as these effects are of great potential to influence the results of an investment and therefore the decision making process.

Table 1 Table 1. Main investment projects in the quarter of the railway station [10].

	Project	Investment sum	Work-places	Opening date
infrastructure investments	Linz railway station	~ 43 Mio. €	150	12/2004
	Integration of light railway (LILO)	~ 47 Mio. €		12/2004
	Integration of tram	~ 70 Mio. €		12/2004
	total	~ 100 Mio. €	150	-
Other investments	Provincial administration centre (LDZ)	~ 140 Mio. €	~ 1800	2005
	Tower of knowledge (library)	~ 31 Mio. €		07/2007
	Head office of regional energy supplier Energie-AG (Power Tower)	~ 37 Mio. €	~ 600	09/2008
	Administration building chamber of labour	~ 30 Mio. €	~ 400	10/2008
	Terminal Tower (office building)	~ 50 Mio. €		03/2008
	total	~ 288 Mio. €	~ 2800	-

3 First attempts to develop a standardised model

In order to consider these effects identified in the case studies described above in future cost benefit analyses, during a PhD a model was developed [11]. Within this work, based on the developments in Vienna the effects on the labour market and property market were analysed and dependencies with regard to accessibility were formulated in algorithms. Input data for the estimation of effects on the labour and property markets are (1) changes in travel time both for public transport and private car as matrix between all cells in the catchment area of the investment, (2) the number of inhabitants per cell, (3) the number of workplaces per cell, (3) the number of floor space for housing in square meters per cell, (4) the average labour productivity per sector in the area and (5) the modal split of the city.

3.1 Effects on Employment market

The additional jobs per year for the whole catchment area of the investment in relation to the changes of accessibility were multiplied with the labour productivity of each economic sector as follows:

$$\Delta av = \sum_w (\Delta emp \times lpr) [\text{Euros}] \quad (1)$$

- Δav = change of added value per year [Euros/year]
- Δemp = change of employment per year
- lpr = labour productivity [Euros/employee]
- w = cells of area
-

Whereas the number of additional jobs can be calculated per cell based on:

$$\Delta emp = 196,75 + 13703,43 \times \Delta A \times P \quad [-] \quad (2)$$

- Δemp = change to employment per year
- ΔA = change of accessibility of a cell based on changes in travel time
- P = modal split share of public transport

3.2 Effects on Property market

The added values in the property market were modelled for the Viennese city in relation to the changes of public transport accessibility for the years 1991 and 2001. The derived algorithms to calculate the effects on the property market are:

$$av = \sum_{o=1}^n (pp_{o,with_measure} - pp_{o,without_measure}) \times fs_o \text{ [Euros]} \quad (3)$$

- av = added value [Euros]
- pp_o = specific property price of a property transaction [Euros/m²], property in cell o
- fs_o = living floor space in cell o

Whereas pp_o of a cell can be calculated on absolute values, both for the situation with and without investment:

$$pp_o = 1458,06 + 0,002 \times A^2 \times P \text{ [Euros /m}^2\text{]} \quad (4)$$

- ΔA = accessibility of cell based on changes in travel time
- P = modal split share of public transport

4 Conclusions

The model was tested on a tram extension project for the city of Innsbruck (province of Tyrol) and results show a potential of added value of about 22 Mio €/a on the labour market and an increase of land values by 6 Mio €. If including these effects in the cost benefit analysis (which was carried out for this project), the cost benefit ratio would increase from 0.12 to ca. 1.60 [12]. This proves the statement introducing this paper that if including these effects the results of the cost benefit analysis leads to different results. A cost benefit ratio of 1 is the threshold if an investment is recommendable or not. Research on this issue is at a very early stage now and more case studies would bring in a clearer picture of these effects. Main obstacle for further analysis is the poor data situation to further improve the model. Additionally regional variance of the effects is not included so far in these first results as the data currently are based on Austrian case studies only.

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