The socio-economic effects of the metro line "U3" in Vienna (Austria) evaluated under the European research project *TranSEcon* (www.transecon.org)

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Introduction

Decisions for urban infrastructure investments are mainly linked to the criteria of transport efficiency. However, such investments have wider socio-economic effects within the area, such as employment effects, urban re-generation effects and economic development effects. The research project *TranSEcon* (Urban Transport and Local Socio-Economic Development) established a common evaluation procedure considering all these so called socio-economic effects. The methodology is driven from a multi-disciplinary perspective requiring expertise in related fields. The main expected outcome of the research work is to provide tested indicators describing social and economic effects of urban transport infrastructure investments by carrying out an ex post cross-site evaluation throughout 13 European cities, one of them being Vienna (Austria) and its metro line U3.

Objectives of the Project *TranSEcon*

The *TranSEcon* research project aims to provide a qualitative and quantitative evidence regarding the existence of the direct and indirect effects and impacts of transport infrastructure investments. Long term effects of implemented large scale infrastructure investments are analysed using existing data-bases together with stakeholder interviews in 13 European case study cities. The selected case studies cover a wide range of city and intervention types (in terms of geographical distribution, city size, transport policies and investments). The research partnership involves 16 organisations (6 universities, 2 research centres, 7 consultancies) in 9 EU member states, 1 EEA country (Switzerland) and 1 accession country (Slovakia).

Socio-economic effects of urban transport investments

Socio-economic effects are a type of indirect effects or third party effects. Economic effects can be:

- broadening the access of employers to a pool of qualified labour,
- the extension of market areas for goods and services,
- the attraction of foot-loose inward investment,
- bolstering the image of an area,
- unlocking suitable development sites and
- spending or employment effects.

Meanwhile social effects can be:

- improved access to mobility for disadvantaged people,
- better accessibility of basic services,
- achievements in terms of safety in traffic and security in public space, but also
- reducing the burden of nuisances in urban or suburban areas and thus improving health conditions.

The term “socio-economic effects” refer to a conglomerate of such economic and social effects. In addition it includes environmental impacts. Beside the transport policy measure itself three other system elements have to be considered if measuring these socio-economic effects and impacts of transport policy measures (Figure 1):

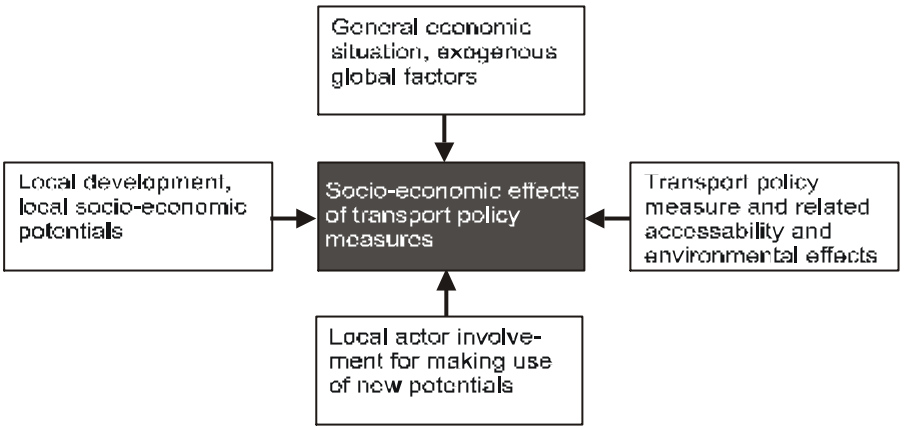

Figure 1: System analysis of relevance of transport policy measure for socio-economic development

Life-cycle of a transport infrastructure

The interaction of the decision makers of the different levels of the socio-economic system like firms, households, politicians, etc. are highly interwoven and non-linear. On the level of a single decision maker (micro-level) a complex mixture of fluctuating rational considerations, professional activities and emotional preferences and motivations finally merge into one of relatively few well demarcated resultant attitudes as reaction of a planned or realised infrastructure investment. On the other hand, all infrastructure investments are also the outcome of a sequence of decisions of different decision makers in a complex interplay of rational and emotional, conscious and subconscious and environmental influences. The obviously non-linear structure of the interaction between individuals implies that there exists a cyclic coupling between causes and effects in society. Learning processes of individuals and organisations as well as speculations may lead to retarded or even anticipated effects on the micro-level (level of individuals) as result of a planned infrastructure investment (macro-level).

Decisions for private investments can occur long before a political decision is taken on the infrastructure investment, during construction or after start of operation (see Figure 2). Compared with the phase the infrastructure is ready for operation, the socio-economic impacts could occur earlier and/or later. By probably excluding some important impacts, this time shifts can have a great influence on the result of the evaluation. The reasons for such anticipating, stepwise or retarded private reaction on infrastructure investment may be that not all real estate developers assess investment risks in the same way, and that local or general economic contexts of private investment show certain cycles as well. It is common knowledge that infrastructure investment cycles and private investment cycles often do not have the same rhythm. Monitoring of socio-economic effects of transport infrastructure and policy measurers must take account of such interference

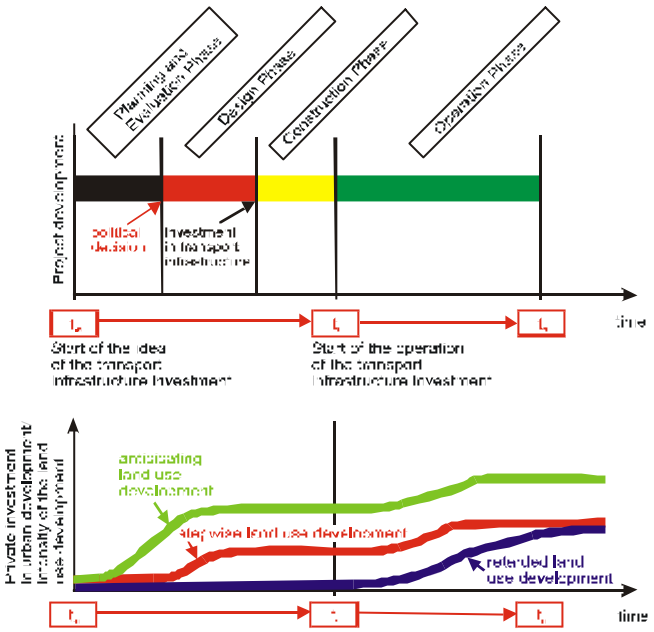

Figure 2: Infrastructure investment development and land use development

The Case study Vienna

Vienna has a population of 1.6 million inhabitants with a car ownership rate of 395 cars per 1000 inhabitants in the year 2000. In 1966 the local government of Vienna agreed to establish the metro network for the City of Vienna, based on an old railway system which was constructed at the beginning of the last century. Currently the metro network consists of 5 lines with about 65 km.

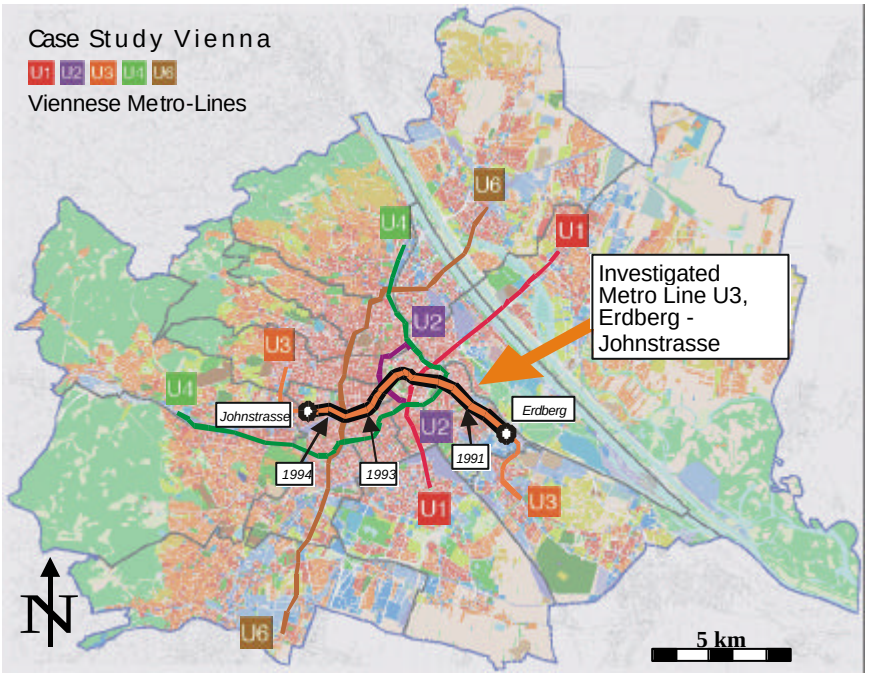

Figure 3: Case study map of Vienna: Metro line U3

The case study selected for *TranSEcon* is the centre part of the metro line U3 (see Figure 3) which connects the 3rd district in the south-east of the city with the western part of the city, passing through the city centre. This new line with 14 stations has a

length of 8.2 km, and was opened step by step between 1991 and 1994. The travel time is about 17 minutes connecting 5 Viennese districts in total.
As the U3 is a diametrical line it crosses several different areas of urban characteristics. The eastern and western parts of the line are areas of middle to low land price. The middle section crosses the inner city high land price area. Due to the construction of the metro several tramlines were closed on the route of the metro. This gave the opportunity to reconstruct the surface in many parts along the line in a pedestrian friendly way.

Effects on accessibility

The evaluation of the transport related socio-economic effects of the Viennese metro line U3 is based on a transport model considering two scenarios, the “scenario with metro” and the “scenario without metro” assuming that the tram lines, which were closed permanently due to the metro, are still in operation. The approach is to calculate the comparison between these two scenarios based on the transport network of the year 2001.
The construction of the metro line U3 represents an important increase in public transport supply. The reorganisation of the network due to this investment was more important in zones directly affected by the metro than in others with an increase of about 19 % of the capacity. This is leading to an increase of 2 % in passenger - mileage in the whole city.
As the metro was constructed to replace several tram lines it permits a strong overall increase of the public transport speed based on the average travel time of passengers in the vehicle per day, weighted with the number of trips. The effect of accessibility in the city of Vienna is significant (Figure 5).

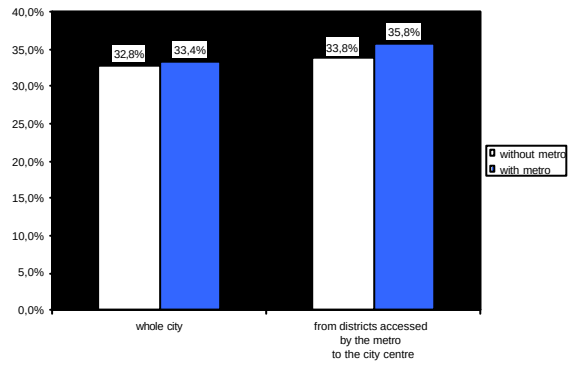

Figure 4: Share of public transport trips

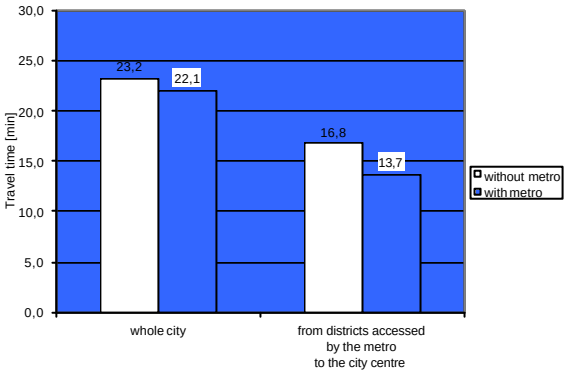

Figure 5: Average travel time per public transport trip

The increase of the share of public transport trips (Figure 4) causes a reduction of car - mileage as well as congestion within the city leading to a reduction of emissions of harmful chemical in the city of Vienna. This leads to a reduction of illness for inhabitants of the city (e.g. cancer, lung diseases), less damage on buildings and vegetation. Therefore the quality of life in the city is increasing, external costs of transport are reduced and are relieving the budget of the public sector. The reduction of CO_2-emissions is a contribution for global targets as well. Additionally, it can be assumed that the reduction of the car - mileage have an influence on the average accidents per year.

Economic development effects

Since the beginning of the infrastructure project in 1966 (evaluation phase until 1980) 1,936 M€ have been invested in Vienna's metro line U3 (section Erdberg – Johnstrasse) until 1995. With the help of the regional econometric model for Austria the employment effect and the additional GDP was modelled. To be able to model these effects, the investment was split into different sectors.

The dynamic results are calculated using the scenario technique. Scenario 1 assumes that no traffic infrastructure investment is undertaken and scenario 2 assumes that the infrastructure investment is undertaken. From the different development of these two scenarios, the additional value added effects can be calculated, which are demonstrated in additional regional GNP, employment and regional income.

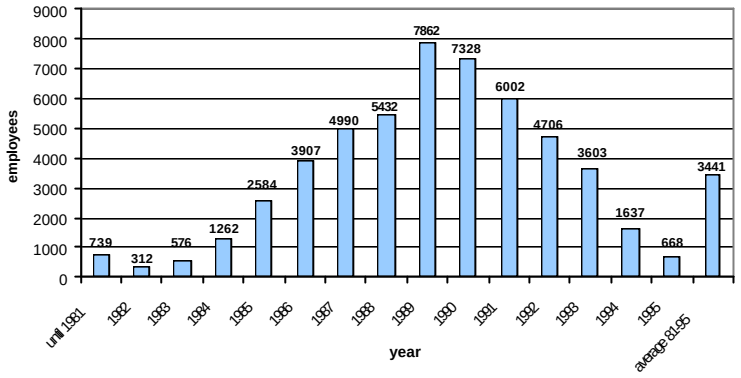

Figure 6: Employment effect of Metro line U3

The dynamic simulations contain all induced multiplier effects, caused by the infrastructure investments, i.e. all indirect effects are captured and the additional value added is quite often sizeable as the following results demonstrate. In carrying out the dynamic simulation with the help of the regional model the result for the employment effect is shown in Figure 6. The additional regional income is considerable too. On average the additional regional income over the period 1981-1995 is 175 M€. On average the additional regional GNP over the period 1981-1995 is 275 M€.

Urban re-generation effects

Investigating the urban re-generation effects two areas in Vienna are analysed:

- sample area with access points to the metro line U3
- reference area without any metro access, but similar in its size, land-use pattern, housing structure, inhabitants structure as well as distance to the city centre

In terms of the constructive condition of houses the difference between the sample and the reference area is rather small due to a well developed subvention system for renovations or improvements of buildings. The main difference is the higher number of totally new constructed buildings in the sample area (Figure 7).

Comparing the development of commerce and retail of both areas the difference is significant. The new metro access stimulates the commercial activities in the sample area. The range of sectors concerned are covering new supermarkets, restaurants, ware-houses and a shopping mall as well. In the reference area the situation is something between stabile and slightly decreasing.

The difference in the development, design and condition of street furniture including public areas like parks or play grounds is significant as well. The situation in the reference area is stabile, the area is well developed. But in the sample area most of the streets were redesigned, trees were planted, the parking areas, play grounds and parks were renovated after the metro construction work was finished. This concerns especially this street, where the metro was constructed, but as well those two streets, where the parallel tram line was closed down due to the new metro line.

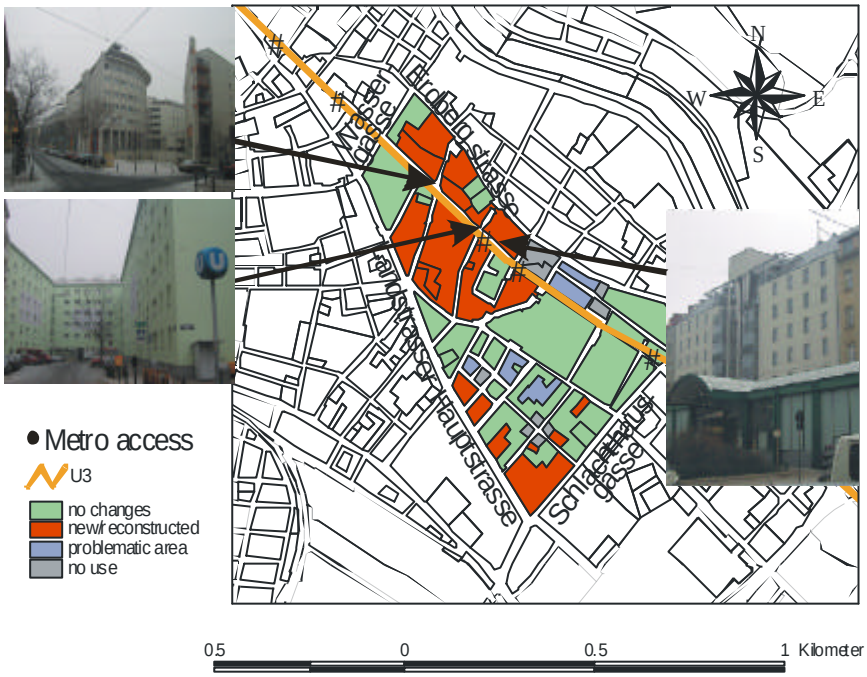

Figure 7: Constructive condition of houses in the sample area

Economic Development Effects

Spatial redistribution processes are the result of an interlinked process of spatial interactions where different agents (households, accommodation agencies, employees, firms, ...) with different, partly inconsistent interests, are involved. The multiple decisions of the different agents result in migration flows of households (people), changes in commuter flows and in a redistribution of workplaces, due to firms decisions to search for an optimal location. As a consequence each investment into the transport system leads to changes in accessibility measures of the different areas. However, changes in the transport infrastructure in a specific area can have a positive or negative impact in other parts of an urban region. In addition transport infrastructure may have a positive or negative impact on the city region as whole. For the identification of economic development effects a statistical analysis framework based on an improved shift-share analysis is applied fulfilling the following conditions:

- stable estimation algorithm (for different time series and zoning)
- data base (stock data for different time steps, not necessarily equal time steps)
- introduction of as little model parameters as possible
- separation of “spatial” effects and “growth” effects in a specific zone
- estimation and separation of the “natural” growth effect

The shift share analysis in Vienna is performed for the eleven variables (population, workplaces, employed persons registered at the place of work and home, income per

capita, gross wage payment, purchase prices of used flats, land prices, rents of housing, offices and shops).
The population of the city centre received an significant growth impulse, when the metro line accessed this area in 1991, before and after this period the population development was below the average. The number of workplaces within the project corridor stayed stable, whereas the other areas are confronted with a negative development. The number of employees registered at the place of home is correlating with the population. That means, the employment rate is stable over the period observed and the same effects like the development of the population can be observed. The growth rate of income per capita and the cross wage payment in the city centre is clear above average. Well developed infrastructure like the access of a metro is a precondition of such prosperous developments in this area. Best correlation between the project corridor and the construction of the metro can be observed on land price (Figure 8), rents of offices and purchase price of used flats. As these markets are liberal, the price is very flexible and regularly adapted to the market conditions.

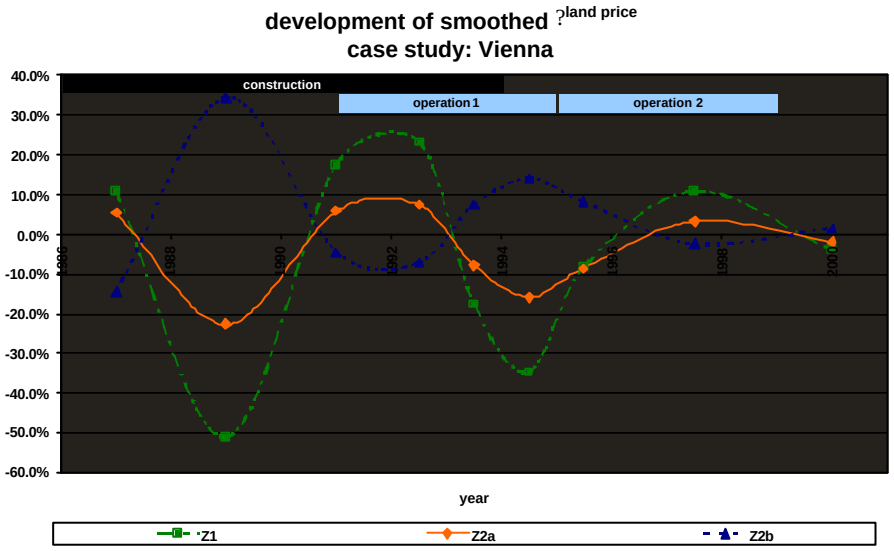

Figure 8: Annual deviations from the average growth $\tilde{?}^{\text{land prices}}(t)$ in the city centre (Z1), districts accessed by the metro (Z2a) and districts not effected by the metro (Z2b)

Attitudes of key persons towards the construction of the metro and its socio-economic impacts

20 key persons were interviewed in Vienna in order to allow a more in-depth analysis of the history of the construction of the metro line U3 and the contents under which it has been developed and has had its impacts. Of special interest is the role of actors. The main results of all 20 interviewees can be summarised as follows:
There is a clear **transport effect** caused by the metro project perceived from most of the interviewees. This effect is evident on the supply side, whereas on the demand side the effect is smaller. This divergence is argued primarily by the unachievable convenience of private car traffic, even in inner city areas. This leads to a weak effect on the operational efficiency of the public transport system and the modal shift towards public transport as well.
The construction of the metro line is one of the rare case of **transport planning** in the city without major opponents. Reasons of the few cases of opposition are mainly

private interests of land owners. The reasons of the strong support within the city is the absence of significant negative effects for relevant actor groups in the city. This situation leads to an easy decision process on political level for the development of metros in the city. The only question is the acceptance from the federal level as construction costs of metro projects in Vienna are shared between the city and the federal level. Exclusive metro funding with federal money leads to the support of metro constructions more than other public transport projects.

The effect of **urban regeneration** can be seen in a small area around the metro stations (approx. 500m). This effect is influenced by the structure of the area accessed, the development level before and the availability of land plots. The effects on the prices are significant, but these markets are very statically and can only be seen on new contracts. Existing contracts (especially rents for tenants) are protected by law in Vienna. The land use planning sector is perceived as a strong supporter of developments along the metro line. Metros are accelerating the trend of concentration of market places to only few shopping areas or other commercial zones. The effect on employment is a long term effect as well, but it is obvious, that all larger buildings newly constructed for bureaus are currently oriented to the metro network.

Due to missing opposition the group of **actors involved** is small and the decisional process is concentrated to few key persons. Primarily politicians and the city administration responsible for transport development are involved.

Most of the interviewees perceive the metro project as the most **sustainable** transport measure in the city, including environment, efficiency and socio-economic aspects.

Conclusion

The socio-economic effects of the case study Vienna metro line U3 are significant in terms of economic development, urban re-generation, and capable to improve the quality of life in the city targeting a well developed but sustainable mobility. This effects are strengthening the attractiveness of the city in local and international competition. The project *TranSEcon* is ongoing until December 2003, the next steps are the cross site evaluation of all 13 European case study cities to get knowledge about different efficiencies of different investment sums and different transport policies in the different regions. Further details can be found on the regularly updated homepage of *TranSEcon* (www.transecon.org).

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