

SOCIAL AND PUBLIC COSTS OF RESIDENTIAL URBAN SPRAWL

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Abstract: The long-run costs of different forms of urban development are one of the major problems in the field of land use and transport. This paper summarises and evaluates the most important international literature, dealing with “Costs of Sprawl”: comprehensive studies including many social aspects, studies on public costs and those simulating the local fiscal impact of various development scenarios. Taking these examples, the paper derives criteria and requirements for a calculation framework to estimate Social Residential Urban Sprawl Costs, which includes the aspect of cost-by-cause principle and sponsorship under the viewpoint that economic and fiscal problems basically occur, if costs are not paid by those who are causing them. Both fiscal instruments and land use development methods, which are described for Japan and Germany as an example, need to be taken into account in respect to its impact and its application aiming in socially efficient urban structures.

Key Words: *Urban Sprawl, Infrastructure Costs, Fiscal Impact*

1. INTRODUCTION

Urban development in agglomerations is still characterized by deconcentration of population and employment as well as separation of functions and sprawling land use patterns. Next to the impact of the land price mechanism, one of the main reasons for the housing sector appear to be the decline in environmental quality of the densely built city centre, among others due to traffic congestion and pollution. Although currently many local efforts are undertaken to re-vitalize and enhance the quality of the local environment in city centers and re-urbanize residential development, the predominant trend of suburbanization supports fundamental changes of transport systems, which mainly lead to an increase of private car use the private households' ecological footprint.

One important aspect of these land use – transport interactions is the question of the long-run costs of different forms of urban development. The topicality of this issue can be understood by considering the fact of declining tax revenues and locally higher expenses which results in increasing debts of the public sector in both the developing, but also the developed world. The declining and ageing population as well as the gravity of metropolis to migration flow leads – for instance in Japan and the western part of Germany – to an indifferent development trend: shrinking and growing areas at the same time. In both cases it becomes more and more difficult to shoulder the costs for investment, maintenance and service of the existing and new network and social infrastructure, also indicated as Social Capital. Especially the extend of locally used

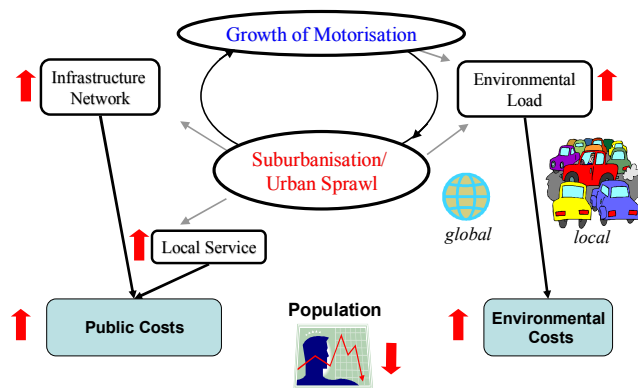


Figure 1 Driving Forces for Rising Social Residential Urban Sprawl Costs

change. Also the quality of living environment is affected by air pollution and noise, and on a global scale, by climate change. These impacts of the residential suburbanization can be economically regarded as Environmental Costs. The interrelations are shown in a simplified way in Figure 1.¹

Population decline leads additionally to local under-utilization of infrastructure, which boosts the maintenance costs not only per capita, but additionally from a technical point of view.² Nevertheless, the financability of the infrastructure stock depends first of all on the sponsorship. Social Costs are partly repaid by the causers, respectively beneficiary. Many fiscal, but also land development instruments have direct relation to the cost-situation in housing and transport sector: one time or regular (recoupment) charges, fees, property tax, and Value Capture due to Urban Development Contracts (often combined with Land Readjustment Projects). On the other hand there are also indirect and direct subsidies, e.g. by tax breaks, or for social housing, depending on households' individual situation. Please see Table 1 for a overview of the living and transport related instruments in Germany and Japan.

However, there is little knowledge about the effects of these instruments on urban form and location of urban development. They are obviously various inefficiencies caused by the fiscal borders (jurisdiction) and neglecting of consideration of the land use effect of many instruments invented to guarantee the local autonomy respectively to implement social policy. The following chapter 2 focuses on findings in international literature on urban sprawl costs as base for formulating the aim and the approach of this research (chapter 3) and for developing an integrated

¹ However, literature also indicates benefits of suburbanisation, mainly in terms of (producing) firms that can realise economic benefits when moving away from the CBD. It is also pointed out that the quality of life rises due to closer proximity of suburbanising jobs, as well as the separation of land use (cf. Kahn 2001). But these arguments can be countered by stating that these are private rather than social benefits; although commuting effects might occur in some cases, this cannot be generalised. The induced traffic by new land use development patterns need to be proved rather case by case, therefore included in the calculation model (see chapter 4).

² In case of sewage and heat energy for example, German estimations suggests the necessity of additional maintenance measures in case of 20-30%overcapacity. In case of sewage this is mainly accounted for the increased frequency of cleaning the pipes (Schiller/ Siedentop 2005, p.88)

infrastructure and its servicing depend on the land use pattern, such as local access roads, public transport infrastructure and service, energy and water supply, sewage and waste disposal, telecommunication networks, educational and health facilities, safety and security institutions and local cultural facilities (Public Costs).

Moreover, this process supports the decline of scarce natural resources due to both rising transport demand and ongoing chance of land use from green fields in built-up areas, but also in new transport infrastructure as result of the land use

Table 1 Living and transport related instruments with financial impact

Germany		Japan		
	Local	Regional/ National	Local	Regional/ National
Housing	Development Fees (<i>Erschliessungsbeiträge</i>)	Income Tax (<i>Einkommenssteuer</i>)	Inhabitant Tax (<i>Shichōsonminzei</i>)	Real Property Acquisition Tax (<i>Fudōsanshutokuzei</i>)
	Real Property Tax (<i>Grundsteuer</i>)		Fixed Property Tax (<i>Koteishisanzei</i>)	Fixed Property Tax (<i>Koteishisanzei</i>)
	Urban Development/ Improvement Contract (<i>Städtebaulicher Vertrag, Erschliessungsvertrag</i>)		Special Land Holding Tax (<i>Tokubetsutochihoyūzei</i>)	Prefectural Tax (<i>Dōfukeminzei</i>)
	Land Contribution by Land Readjustment Schemes (<i>Baulandumlegung- Flächenbeitrag</i>)		City Planning Tax (<i>Toshikeikakuzei</i>)	
Transport	Social Housing Subsidies (<i>Sozialer Wohnungsbau</i>)	Home Bonus (<i>Eigenheimzulage</i>)		Social Housing Subsidies (<i>Kōeijūtaku</i>)
	Parking space release fee (<i>Stellplatzablösebetrag</i>)	Vehicle Ownership Tax (<i>Kfz-steuer</i>)	Small Vehicle Tax (<i>Keijidōshazei</i>)	Vehicle Aquisition Tax (<i>Jidōshashutokuzei</i>)
	Parking Fees (<i>Parkgebühren</i>)	Petrol Tax (<i>Mineralölsteuer</i>)		Vehicle Ownership Tax (<i>Jidōshazei</i>)
				Petrol Tax (<i>Gasolin-zei</i>)
	Income Tax Rebate for Commuter (<i>Entfernungspauschale</i>)			

calculation model of social costs of residential urban sprawl including the aspect of sponsorship (chapter 4). Finally chapter 5 represents first conclusions and indicates the necessary further research. This paper represents a part of an ongoing doctoral dissertation, which will be a comparative study of Munich Region/ Germany and Nagoya Region/ Japan on those issues.

2. STUDIES ON RESIDENTIAL SPRAWL COSTS

Generally the important studies can be categorized in studies treating the issue of *social costs* in a comprehensive and full-fledged manner. However, most studies focus on costs for the *public sector*, triggered by different location or form of urban development, a few recent studies focus specifically on the impact on the municipal *fiscal* situation. Table 2 and Figure 2 categorize the most important studies according to the mentioned aspects:

2.1 Social Costs

One of the seminal works on Urban Sprawl Costs was a 1974 study by the American Real Estate Research Corporation titled simply "The Costs of Sprawl" (RERC, 1974). The study - the first of its kind - looked broadly at development patterns in different metropolitan areas across the United States and focused primarily on density. It was regarded as a milestone report and became the measuring rod of alternative forms of future growth, although due to the complexity cost

estimation of urban development, many parts were later second-guessed by experts (so done by Downs, 2004, co-author of the TCRP study). Like following major studies by Duncan (1989), Frank (1989) and Burchell (1992, 97), the RERC study mainly compared the effects of two stereotype development types. These studies found, that in comparison with the infrastructure costs a sprawling land use pattern, it can be estimated as 75 to 95% in compact areas (local roads = 75%, schools = 95%, utilities = 80%) (TCRP, 1998, p.49).

Table 2: Categorizing of Costs of Sprawl-Studies by Focus

<i>focus on</i>	<i>Reference</i>	<i>Innovation/ Features</i>
1. Social Costs	RERC 1974 (USA) Conrad/ Seskin 1998 (USA) ARE 2000 (Switzerland) Burchell 1992-97/TCRP 2002 (USA)	Internal Capital-, Operating and Maintenance Costs incl. energy and transport costs incl. travel costs Incl. Fiscal Impact
2. Public Costs	Teichgraeber 1972 (Germany) Duncan et al 1989 (Florida, USA) NRDC 1998 (Cleveland, USA) USEPA 1993 (USA) ÖROK 1999/ 2001 (Austria) Speir/ Stephenson 2002 (USA) JSBRI 2005 (Japan) Siedentop et al. 2006 (Germany)	Backcast Cost Analysis (Case Studies) Widening the inquiry beyond density Effects on Wastewater Utility Costs Intra- and interneighbourhood services Consideration of Social Services Isolating effects of spatial attributes Upkeep Costs of each municipality Forecasting incl. demogr. changes
3. Fiscal Impact Simulation	Möckel/ Osterhage 2003 (Dortmund) Gutsche 2004 (Hamburg Region, D) BMBF 2006 (Germany)	Municipal Budget effects of ageing and migration Effects of Housing Policy on mun. budget and induced transport trips Development of a Fiscal Calculation tool for municipalities for different development cases

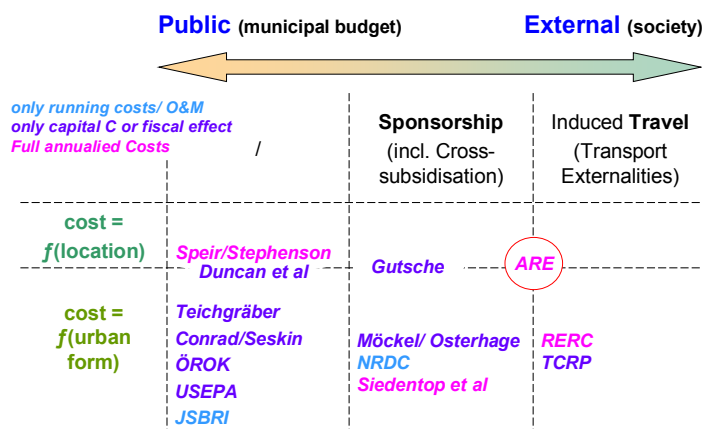


Figure 2: Categorizing of Costs of Sprawl Studies by Approach

An “update” of the RERC-study by the Transportation Research Board of the American National Research Council estimated for the entire USA, that a disperse land use development will lead to extra costs in the dimension of a triple-digit billions of dollars within 25 years (TCRP, 2002). The aim was to measure the cost savings gained by future compact development and to identify the benefits that made sprawl so dominant in the

last 50 years. Therefore, the estimation is based on analyses of two growth scenarios, which are different in terms of the spatial distribution of households and employment at the level of counties due to data availability and consistency (“BAU”, “Compact Development”). Based on several Rutgers University Models, cost estimation is divided in the impact on resources (real estate development, water supply and sewage, road construction, provision of public institutions and the construction of housing and industrial buildings) and personal costs (individual travel costs based on regression-based travel modeling, quality of life, and the livability of cities). Spatial units are urban, suburban and rural counties, considered within interrelated aggregated 172 Economic Areas (EA); therefore the focus is the large scale distribution of land use development. The results of each cost group estimated for both scenarios and aggregated for four parts of the USA show a wide range of monetarized costs.

These comprehensive investigations, as well as other case studies for other countries focused specifically on the impacts of urban sprawl, which is generally defined as land development with unlimited outward extension, low-density residential and commercial settlements and leapfrog development (Downs, 1998).

But not only in USA is the issue of social costs of urban sprawl considered comprehensively. A Swiss study for the Federal Office of Spatial development (Bundesamt für Raumentwicklung) developed a norm cost model for different housing types and location, which is applicable for new and existing developments (ARE, 2000). In the beginning, it considered both technical infrastructure for water supply, sewage, electricity and transport, as well as social infrastructure (health, education, security, culture etc.). The latter category does have a major impact from a fiscal point of view, however the authors found that the land use pattern does not have a big influence on this part of costs. The study also included external costs of transport (e.g. environmental load), and as a result it found three times higher costs per capita for disperse compared to very compact residential structure. Moreover it considered the problem of cost sponsorship in detail and concluded for Switzerland that the question of affordability rather affects the private sector than the society.

2.2 Public Costs

Apart from the Swiss Study described above, other recent and ongoing European research is mainly caused by the rising problem of shrinking regions due to ageing society and out-migration (e.g. in some regions in Eastern Germany). As public costs has been considered the following items: utilities, roads, parking space, schools, public transit. Mostly only the capital costs has been considered, more rarely both

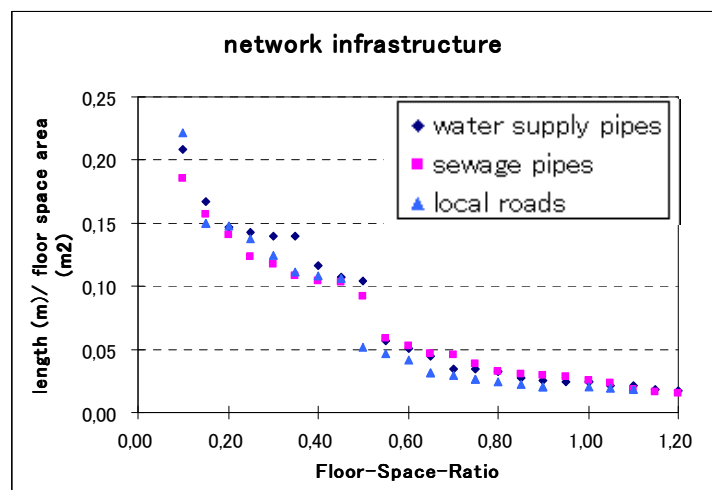


Figure 3 Relationship between network length and building density (Siedentop et al, 2006, pp.107-110)

or only the running costs (maintenance, renewal, repair). The Austrian Conference for Spatial Planning estimated the public costs for providing technical infrastructure in suburban municipalities to be two to four times higher compared to compact municipalities (ÖROK, 1999/2001), depending on the dynamics of development. A main common result of these studies is that public expenses depend on building density as well as land use structure (cf. Figure 3 as one result of a study for the German Federal Office for Building and Regional Planning)³.

2.3 Fiscal Impact Simulation

Most recent German studies, partly sponsored by the Federal Ministry of Education and Research, focus on cost-benefit-analysis for local public budget. Gutsche (2004), for example, showed in his doctoral dissertation the relation between housing policy, municipal budget and trip generation in Hamburg Metropolitan Region. He analyzed public revenues as well as housing related costs and forecasted them for the next 25 years, based on a geographical analysis of residential locations (mesh size 1 ha). One finding was that the current German fiscal system supports housing development at locations triggering high private transport demand. However, although this study is very detailed in terms of revenues and costs related to housing, it did not include the effect of local land use developing methods and instruments, such as Land Readjustment. An ongoing German study aims to collect economical arguments for a sustainable residential development, which should be used by those involved in the process of urban planning (BMBF, 2006). Special consideration is given to develop a new GIS based assessment method with sets of indicators, which enables the evaluation of economic impacts of local urban development

3. AIMS AND APPROACH

The previous chapter showed that the Cost of Sprawl studies, which were based on a continuous population growth, had been recently completed by studies focusing on the problem of declining regions and cities, which is seen as the major future problem in Japan, Germany and many other countries. The aim of all these studies was, or is, a more or less comprehensive estimation of costs as a tool and justification for (mainly local) politicians to support a more sustainable urban policy. However, since the problem is both fiscal and economic, the calculation result should be suitable as a base to develop a land use and fiscal strategy, aiming to reach the cost-by-cause principle and can evolve its power to control land use.

In order to consider the effect of local conditions and policy of each investigated neighborhood in detail, a *multiple case study approach* is chosen. The chosen housing neighborhoods have to fulfill two conditions; firstly to have a significant growth, and secondly to represent a certain development type, so that they are qualified to act as *regional reference areas of different locations, urban form and local policy*. This approach ensures two consequences:

1. the estimation of social costs of residential urban sprawl can be regarded as valid for the

³ Each point stands for empirical investigated values in 8 different building structure types in three municipality types, differed by their compactness. The investigation has been done for the region Haveland-Flaeming in the west of the federal state of Brandenburg (6800 km², 730.000 inh.) and can be regarded as representative for Germany.

entire region, and

2. the results are transferable to other growing areas within the region after assign them to one of the detailed estimated development types.

Therefore the results can be regarded as a base for a fine tuned political and fiscal strategy for each growing area in the regions. By doing so, an applied fiscal strategy can grasp and guide growth within the region, to prepare it for the likely future scenario of declining and ageing tendencies.

A *social* cost calculation model needs to be applied on the level of neighborhoods and breaking down the costs, caused by each private household. Beyond the term of urban sprawl, which exact definition is controversial and varies with the time, this research focuses on the effects of residential developments of different location and urban structure within a different land use policy framework on the costs, remaining for the society, other than the beneficiary. Therefore the estimation needs to focus on both, the *spatial* and *instrumental* dimension, in order to include the applied local land use policy and its internalization effect. By doing so, a reliable foundation can be gained to develop an adequate instrumental strategy.

Based on this background our microscopic social cost model is based on the following hypotheses, which need to be proved by applying the model to real case studies:

- The *Public Residential Land Use Costs* depend on location and urban structure (building type, density) and rise with growing distance from centre/ railway station and with declining density (population + building).
- Fiscal and Land Use instrument have the potential to reduce the Social Residential *Urban Sprawl Costs* and to mobilize under-utilized land at efficient locations.

In order to specify the dependence of Social Residential Urban Sprawl Costs on land use parameters (microscopic location, building type and density) on the one hand, and policy parameters (contributions by fiscal and land use instruments) on the other hand, the aim of this paper is to point out key points for a Social Cost estimation model on a microscopic (neighborhood) scale, by considering the local parameters. The calculation result should be a reliable base for an appropriate regional strategy of land use and fiscal instruments for new housing development based on the estimated Social Residential Urban Sprawl Costs.

4. KEY POINTS OF A COST MODEL

4.1 Requirements for a microscopic Social Cost Model

All studies treated in chapter 2 showed the lack of transparency and often less causer orientation of funding systems of infrastructure. Indeed only part of previous studies allocated the sprawl costs fragmentary to the beneficiaries (cf. TCRP, 2002, ch.IX for a model calculation of revenues for local public services). However the Swiss study pointed out that from a fiscal as well as an economic point of view high costs are not problematic inherently, but only if they are not included in the market-mechanism (ARE, 2000).

Table 3 summarizes the main characteristics and findings of international important studies on focussing on social and on public costs. It also includes their main innovations (in bold-italic), as well as the weak points, as pointed out by other authors, or as a result of our own evaluations. The basic RERC-Study from 1974 had been criticized for the failure to disentangle the density from other factors, especially local conditions had been found as very important in subsequent studies and can partly overlay the relationship between density/ centrality and infrastructure costs (cf. ARE, 2000, p.26f, Biermann, 2002, EPA, 1993, Seitz, 2002, p.19). For example the local supply-demand-situation (capacity utilization) of each type of infrastructure has huge influence on the marginal costs. One of the main problems of the most comprehensive TCRP study is the large scale scope of investigation, which inevitable leads to leveling effects. But when choosing an appropriate microscopic unit, the allocation of the true costs becomes more difficult. Though it is quite easy to do this for new technical *network* infrastructure, such as water distribution pipes, sidewalks, streetlights, sewer collector pipes, and local streets, it is harder for technical or social *point* infrastructure, such as kindergartens, schools, police, fire, recreation centers, libraries, and general government. Therefore this is often done on the residential proportion of the total assessed valuation of the catchment area and some other spatial parameters.

Moreover, the choice of the case study areas requires special consideration. The regional population development based motivation of German studies, as well as the findings of the Austrian studies, which found a strong interrelation with the dynamics of the development lead to the conclusion, that the investigated areas should be characterized by a dynamic development – either growing or shrinking – in order to get realistic local cost values.

⇒ *The investigation units should be dynamically developing neighbourhoods (microscopic scope) and in each case local data need to be collected and local conditions investigated.*

The most important recent German infrastructure study (Siedentop et al, 2006) aimed to develop a generally applicable cost estimation model. However, by doing the pre selection of cost sectors, only those sectors had been selected that are not subject to local political decisions and that are not influenced by the urban structure and policy (so that waste collection, for example, had been excluded). Even though this argument is traceable, this approach does not allow a total estimation of social costs. The TCRP-study however has a wider, more comprehensive scope, but the choice of considered cost sectors is not justified and seems to be indiscriminately. Among the network infrastructure, for example, only local roads, water supply and sewage is considered (cf. chapters VII, VIII).

⇒ The choice of cost sectors should be done as a result of a pre analysis in order to find out all land use and location sensitive items.

A further research gap in almost all of the relevant studies can be stated in a missing straight “society oriented approach”, which allocates the costs to the beneficiary and investigated the existence of individual repayment by burden charges, taxes etc. The most studies did not consider this aspect or have a different focus. The TCRP investigation is distinguished costs of *resources*, which include a part of the fiscal impact of public services and external costs of land use and building construction, and personal costs, which comprises both monetary private costs and non-monetary costs, to be paid by individuals independent from the beneficiaries.

Yet European studies often the impact on municipal budgets are the motivation for the studies. As mentioned above, only the Swiss study considers the problems of sponsorship, causer allocation and cross-subsidization – in fact in two steps (ARE, 2000, p.K-8):

- 1st step: sponsorship of the costs by the beneficiaries as a whole (burden charge level, cost coverage),
- 2nd step: Cost allocation according to the causer pay principle (burden structure).

⇒ A detailed analysis of cost sponsorship is important in order to find out, to what extend cost are paid by others than the beneficiary.

Although the importance to consider the sponsorship of costs, excluded from the market system has been emphasized in the Swiss study, the estimation of the external costs (in terms of the pricing system) in the transport sector could be done only roughly on the base of aggregate data for two types of communities in agglomerations (ARE, 2000, p.A-18). A more detailed approach to estimate this cost block seems to be necessary, first of all considering the individual conditions, as well as the transport supply of each neighborhood (e.g. demography, distance to railway station) and its influence to the transport demand in person-km of each transport mode, e.g. by taking empirical data from person trip surveys. Negative externalities as a result of residential land use, such as loss of biodiversity and other natural damage costs, have not been considered at all. The same study showed that it is not enough to focus on existing settlements, but also on enlargements or compactions of settlements, so that a marginal cost approach, focusing on additional private households, seems most appropriate to determine the additional costs occurred by an additional beneficiary of a certain public service. A difference in the cost estimation occurs especially, if infrastructures have over-capacity. Yet these costs need be calculated in the long run, i.e. including maintenance, repair and replacement. The TCRP-study, however, capitalizes on water, sewer and local road infrastructure and excluded the repair and upkeep costs in case of roads (TCRP, 2002 , p.11).

⇒ Only a marginal approach, which includes all externalities ensures, that social costs are fully to be taken into account.

Table 3 Studies on Social Costs and Public Costs introducing *new* approaches

	<i>RERC 1974</i>	<i>TCRP 2002</i>	<i>USEPA (1993)</i>	<i>ARE (2000)</i> <i>ÖROK (1999/2001)</i>	<i>Siedentop et al. (2006)</i>
Area	USA	USA	Chesapeake Bay Area/ USA	Switzerland; Austria	Haveland-Fläming/ Germany
Scope	neighbourhood/ community	counties	neighbourhood	neighbourhood/ community	neighbourhood
Method	standard unit cost figures; 5 Prototype development pattern <i>Pioneer Research</i> focussing on Cost of Urban Sprawl	Forecast using 2 scenarios (2025) by Rutgers University Model Calculating savings of land consumption and infrastructure costs	Analysis of sensitivity of capital cost for different service classes	Norm cost model (amount x value) for different types and locations (ARE); empirical standard determination (ÖROK); Prototype development pattern	Estimating parameters for social and technical infrastructure in scenarios (2020), considering the regional problem of <i>shrinking population</i> ; Quantity structure in relation to municipality + building structure
Cost Items	Infrastructure capital and operating costs; Transport and travel costs; Land and natural habitat preservation; Quality of life	costs for resources (public expenses); Personal costs (private and external costs)	Capital costs of <i>intra-neighbourhood</i> , <i>inter-neighbourhood</i> and regional services	Sewage, water supply, transport, electricity, waste (Capital, running and <i>external follow up costs of transport</i>) (additional in ÖROK: student transit, social service)	<i>Social</i> : educational, care and sport facility; <i>Technical</i> : roads, water, sewage, heat
Main Results	Planned development with higher density reduces public infrastructure costs by 47%	Savings by compact dev.= > \$100 billion/ year	Intra-neighbourhood services are “highly sensitive” to lot size and density	ARE: savings by strongly compact dev.= 70%; ÖROK: savings technical infrastr. = 25-50%	No savings social infrastructure, but techn. infrastructure 15% for compact vs. status quo development
Critical Points	Density not disentangled from other factors no consideration of sponsorship or causer allocation	Comprehensive study, but too large scale scope; Infrastructure only partly and only in terms of investment considered	No externalities; No consideration of sponsorship or causer allocation	Focussed only on network infrastructure environmental externalities included, but only rough estimation of add. traffic (ARE)	No externalities Only choice of relevant infrastructure

Also the alleged static character of many studies had been object of criticism. In case of leapfrog development for instance, it would not be considered that the cost difference can be leveled in future when “urban infill” between the central and the sprawled development occurs, so that in the end they could turn to compact developments (urban sprawl regarded as limited transformation phase). However, the forces of sprawl were historical mainly centrifugal (Schiller/ Siedentop, 2005, p.85). In regard to the ongoing population decline such a development is rather unlikely, so that this drift cannot be followed.

4.2 Applied Theory and Basic Framework

The basic framework includes all cost effects in relation to residential land use including private transportation demand in order to estimate Social Residential Urban Sprawl Costs by comparison of the microscopic Social Living Costs. Therefore a well considered definition of Social Living Costs is necessary, different from common understanding: The classic economic definitions regard social costs as all costs associated with an economic activity, and therefore includes both costs borne by the economic agent and also all costs borne by society at large. However, in order to establish a clear border between *social* and *private* costs, this paper defines Social Living Costs as the

remaining net costs for the society triggered by residential land use including the demand of private transport. The society comprises the collectivity of affected people in current and future generations, who are paying directly or indirectly, but have no benefit from the occurrence of these costs.

A strategy based on the costs-by-cause principle can only be applied, if the full range of relevant social costs are known or can be estimated. Therefore the main criteria for choosing the cost items should be a possible sensitivity to certain microscopic locations and land use parameters, especially those which are characterize sprawling development.

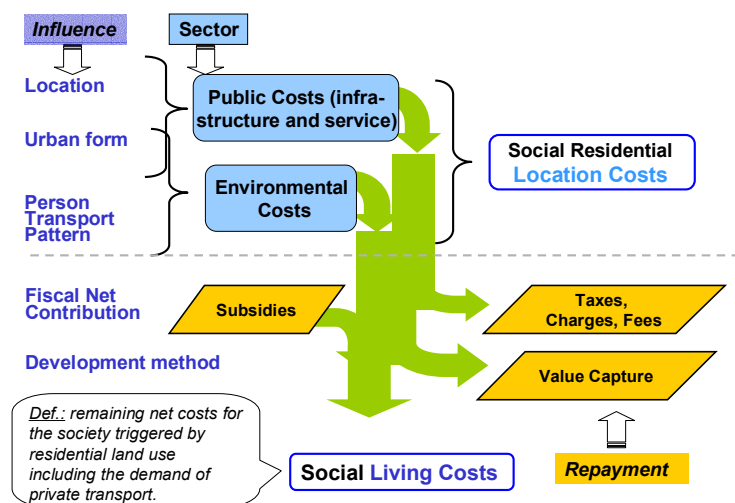
The social costs problem can be regarded as a problem of the existence of external effects according to the *Theory of external effects*. In economics, an externality is a cost or benefit from an economic transaction that parties "external" to the transaction receive. Every decision made by an economic agent will also have an impact on the other members of the society: those enjoy the benefit of the land use and transport system impose costs or dis-benefits on society, but do not themselves pay for them (spillover effects). The basic framework of the social costs model is constructed upon the viewpoint that all costs not paid by the causer-pays-principle are externalities, in other words: Social Living Costs. With focus on residential land use it includes the costs of both housing and private transportation demand; by comparing the values of Social Living Costs for different locations, the Social Residential Urban Sprawl Costs can be estimated as a final result

With special consideration of cost influencing factors, the Social Living Costs can be estimated as a result of the following calculation steps (cf. Figure 4):

- Determination and comparison of marginal *Public* Residential Land Use Costs of growing areas with different urban structure and in different locations within one economical functional region,
- Consideration of the impact of (national and local) housing and transport related Taxes, Charges and Fees as well as local Land Use Instruments, applied to the inhabitants of these areas,

- Taking the development method into account, and the repayment of social costs by different methods of Value Capture (e.g. by land contributions within Land Readjustment Scheme)

In order to verify the hypotheses and to reach the aims, a microscopic empirical approach is



chosen: While taking the national framework into account, the case studies will be chosen on a *neighborhood scale*. Although Social Living Costs are partly internalized by both fiscal and land use instruments, the net effect never results in full internalization of costs. The importance of the right amount and mix of these instruments can be seen – in Japan for example – in the spatial impact of savings in inheritance and property taxes towards agriculture use even though it is much more efficient and part of the land use policy to convert it to residential use.

Figure 4: Estimation Flow for Social Living Costs

4.3 Determination of relevant Public Residential Land Use Cost Items

The following steps of narrowing down the Public Costs to identify those with spatial dimension as well as with impact on the neighborhood level will be undertaken, based on previous findings and the aim of this research:

4.3.1 Qualitative Pre-Selection

The cost sectors are chosen according to the following criteria:

- *Cost Influence*: Influence on PRLUC by new housing developments?
- *Cost Allocation*: Causation by new residents allocatable
- *Cost Relevance*: relatively small circle of causer, but big impact⁴

The application of these criteria to every public cost sector leads basically to the exclusion of those sectors which are not in the responsibility of local governments. Although also the regional and national governments provides municipal services, such as regional roads and education facilities, those services always serve major parts or the whole municipality, so that the inter-relation with small scale land use development is not given (cost allocation). Moreover, expenses of the semi public sector, such as public transport and utility companies are subject of the investigation, which are important in terms of sponsorship and cost coverage.

This methodology can be underlined by the choice criteria of the US American Chesapeake Bay Program's study (USEPA, 1993), which made a classification of the PRLUC sectors

⁴ This criterion allows excluding public expenses for social welfare, which seems not to be relevant for this research question.

based on capital intensity, form (network vs. point), spatial arrangement, and the size of service area. The study divides the capital cost sectors in *intra-neighborhood*, *inter-neighborhood* and *regional services* and concluded that those of intra-neighborhood services are most sensitive to net-density and lot size (USEPA, 1993, p.ES-8).

4.3.2 Quantitative Selection

Since in some cases the qualitative estimation might be difficult (e.g. the influence of a housing development on the construction or extension of a junior high school) other steps of narrowing down are necessary.

Firstly, the remaining public cost items from the qualitative pre-selection are displayed against the municipal population development (simple regression). Its sprawl relevance can be assumed, if the *annual running costs*, which can be filtered from municipal budget statistics, grow faster than population over time. A time span of at least ten years seems to be appropriate for this analysis.

Secondly, another regression analysis will show how each remaining cost item developed in relation to population density, respectively population distribution.

As a conclusion of the review of previous studies (USEPA, 1993, Gutsche, 2004, Siedentop et al, 2006), the following cost categories and items are expected to be included in the cost estimation:

- Utilities (Electricity, Natural Gas, Telecommunication, Water, Post Service)
- Disposal (Sewage, Waste Collection)
- Transport (Local Roads, Railway Transit, Bus Service)
- Health/ Local Recreation (Public Green, Play Grounds)
- Education (Public Nurseries, Elementary Schools)
- Safety/ Security (Fire Stations, Police Stations)

5. FIRST CONCLUSIONS AND FURTHER RESEARCH

In order to specify and fine-adjust the model, housing neighborhoods with different parameters are being selected as case studies. Next to the public costs resulting from urban form and location, also the effects of the fiscal framework and the locally applied land use development methods, such as Land Readjustment, are objects of investigation and quantification.

From the international literature review with main focus on North American and European studies we learned that there was a recent shift from social costs studies with a wide spatial and thematic focus towards leaner studies focusing only on certain issues of current interest, such as the fiscal impact of sprawl or the impact of shrinking regions on public costs. Although these aspects are of legitimate interest for local politicians, we argue that a reliable and correct social costs estimation need to include all kind of externalities. This is the only way to appropriately consider the rising costs for people and generations who are not involved in these processes as an economic agent (= the society). Based on this we suggest a microscopic calculation approach, to be pursued for reference areas as the base for further estimations..

In terms of urban policy another conclusion can be made from literature: With regard to

residential land use and private transport, one strategy to control land use development, as well as influence the private transport choices to more sustainable modes is the promotion of Transit Oriented Development. In Germany there are several policies specifically supporting this development direction – from enacting legally binding land use plans (*Bebauungsplan*) to governmental subsidies to the residents who decide to move inside of the catchment area of a railway-based public transport line. Also Land Readjustment is a well used method to tackle the problem of rising municipal costs.

It can be expected that the comparison with German examples will unfold interesting aspects: After reunification and the need of new land use development they had been several advancements of the concept of Land Readjustment by other private-public-partnership instruments, such as Development Agreements (*Städtebaulicher Vertrag*), which burden the developer and partly internalize social costs. Nowadays, especially Munich city supports affordable flats and houses in integrated sites (former use for railway, industry or military purposes) by requesting to enter into a legally binding promise to provide social or technical infrastructure for certain location, in order to achieve a “socially fair land use” (*Sozialgerechte Bodennutzung*).

All major instruments currently used in Germany have in common, that only certain cost elements can be legally binding privatized. However, the Social Residential Urban Sprawl Costs comprises much more than initial costs of constructing the necessary infrastructure. Therefore, after estimating this value for the reference areas (including the marginal externalities), the existing instruments need to be further developed and applied, considering the specific regional and local conditions, i.e. taking into account differences of location, density and urban form. However, this consequently requires a strong local policy, as well as deep insight and understanding of the rising social cost problem by the private sector, i.e. the private households living in high costly areas.

However, due to the diversity of considered cost aspects the suggested approach is relatively comprehensive. Moreover the applicability and success of this approach depends very much on the data availability and the cooperation of involved institutions and private companies – at least for the reference area. A problem is foreseeable because of the growing competition and privatization of the utilities in developed countries: Within our ongoing research it begins to show that getting quantitative network and cost data might turn out to very difficult in some cases. Also for developing countries it can be stated that the cooperation of land use planning, fiscal administration and the utility sector is a necessary condition for this approach.

Presuming the availability of necessary data for the reference areas, it can be concluded that even with infrastructure and person trip data only available for specific small scale areas, the introduced calculation approach enables a detailed estimation of the full range of triggered social costs of residential land use in monocentric agglomerations as base for a fiscal policy in consequent application of the polluter-pays-principle. Since the choice criteria ensures the reference status of the investigated areas, the result can be used to design appropriate fiscal and land use instruments, to be applied for the entire interrelated region. Utilizing the economic behavior will have an important contribution to a more sustainable, cost saving future land use development in growing metropolitan regions. For regions in industrial countries this ensures the development of a sustainable urban form for the region, in order to be prepared for times of financial constraints. However, it also can be regarded as a good model for economically rapidly growing regions in developing countries, since their

infrastructural and land use development often suffers from limited financial resources.

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