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Infrastructure and Metropolitan Development in an International Perspective: Survey and Methodological Exploration

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1. Infrastructure and Transport at the Crossroads

Infrastructure and transport have become focal points of vivid policy debates in recent years. The increased interest in these issues is mainly addressed to two constituents of infrastructure and transport, viz. international (or long distance) fast links (e.g., the Channel Tunnel, the French TGV, the German ICE) and urban infrastructure (e.g., the new plans for Paris). Especially in the recent past, urban transport policy has become an important item on the urban policy agenda. And some cities (e.g., Oslo, Stockholm) have in the mean time decided to reduce private transport (or at least to charge the user of urban roads) by means of a system of urban road pricing or urban toll roads.

The idea to focus transport policy instruments (e.g., user charge principles) first on the city makes sense. The large majority of our current world population is living in urban areas (at present at least 70 percent already), and there are no signs of reversal of this trend. And therefore one may most plausibly take for granted that the future of Europe will be an urban future. This is also recognized by various major international initiatives to promote the role of large agglomerations in the emerging new European Community, witness the Euro-city association, the CITIES programme etc.

The critical position of cities in European economic development is not only a phenomenon of today. Cities have always played a crucial role as nodes in a logistic network in the history of Europe. For instance, Andersson and Strömquist (1988) have made a distinction into four major phases in the history of European economies, viz. the Hanseatic period, the Golden Age, the Industrial Revolution and the Informatics Era. In all these phases cities appeared to be the engines of action.

Transport and communications are the major features of a logistic network, and hence it is evident that the position and development of cities is to a large extent determined by the functioning of their intra-urban and inter-urban infrastructure (cf. Vaughan, 1987). Transport and communications generate urban nodes, whilst urban nodes evoke transport and communications.

The high density of transport needs and of infrastructure supply in urban areas is evident, as large agglomerations are the areas par excellence where economies of scale and scope are generated. But at the same time, such agglomerations are glaring examples where also the social costs of transport (e.g., environmental pollution, lack of traffic safety, congestion) are the highest.

The above conflict is not easy to resolve. It has been demonstrated on the one hand that productive investments and social overhead investments (notably infrastructure investments) need each other in order to arrive at a balanced economic development (see for instance Hirschman, 1958). In general, the spin off effects of new infrastructure investments - provided they are tailor-made with respect to spatial-economic needs - are significant. For example, in a recent study, Bruinsma et al. (1990) point at high employment effects of integrated infrastructure investments.

On the other hand, the social costs of transportation may be very high. In a recent OECD report (1989) various costs of traffic have been assessed:

- **noise annoyance**, both damage costs (e.g. productivity losses, health care costs, decline in property values and loss of psychological well-being) and abatement costs (e.g., adjusted vehicle technology, anti-noise screens, double glazing etc.). Studies in various countries show a relatively high level of social costs of traffic noise.

Social costs of traffic noise

Country	**Percentage of GDP**
USA	0.06 - 0.12
Netherlands	0.10
Norway	0.06
France	0.08

- **air pollution**, both damage costs (e.g., damage to health, buildings or forests) and environmental protection costs (e.g., air pollution control, new vehicle technology, catalytic converters etc). Numerical estimates of air pollution costs caused by transport show some variation, but point all in the same direction: social costs of transport are high.

Social costs of air pollution by traffic

Country	**Percentage of GDP**
Germany	0.4
Netherlands	0.2
USA	0.35
France	0.21

- **lack of safety**, mainly resulting in accidents, leading to damage costs and recovery costs (including damage to vehicles, medical treatment, productivity losses, policy and emergency service expenditures etc.). Various cost estimates have been made which show high financial burdens.

Social costs of road transport accidents

Country	**Percentage of GDP**
Germany	2.54
Netherlands	1.67
UK	1.5
Luxembourg	1.85
France	2.6
Belgium	2.5
USA	2.4

The estimated figures lead to the conclusion that on average the social costs of road transport in developed countries falls in the range of 2.5 - 3.0 percent of GDP. Congestion costs are not yet included here.

This relatively high figure has serious implications for transport and infrastructure policy. In order to make transport part of an ecologically sustainable economy, intensified efforts have to be developed to make the need for transport compatible with the need of the European economies. A decline in the social costs of transport requires a more efficient operation of current networks and a better, i.e. more coherent, design of new infrastructures. Also here cities may provide the working floor for a new infrastructure policy.

There is apparently a clear tension between transportation needs and social costs of transportation. This tension has led to the increased policy interest in controlling the growth of mobility. Any policy effort to influence the transport sector should focus attention on both the user side and the supplier side. The user side refers to both the consumptive and productive value of transport systems as needed by households and firms. The supplier side refers to the necessary infrastructure equipment, in terms of design, construction, maintenance, management, control and policy making.

Both the user side and the supplier side experience the economic dynamics from the past years and will no doubt experience a further drastic change in the foreseeable future. Such changes are to a large extent related to broader global and European developments (economic, political, technological), but are reflected at all spatial levels (local, regional, national, international). Bottlenecks in the matching between supply and demand will hence also manifest themselves at all spatial scales.

Despite the increasing popularity of Just-In-Time (JIT) systems and related concepts, the actual practice of both commodity and passenger transport is still disappointing and often frustrating. Severe traffic congestion phenomena at the urban or metropolitan level (e.g., Athens, Rome, Paris), unacceptable delays in medium and long distance transport during peak hours, unsatisfactory service levels of European railway systems (and public transport in general), unreliable airline connections due to limited airport capacity, and slow technical and institutional renewal of air traffic control in Europe; all these phenomena illustrate the difficult position of the European transport sector. And there is no clear perspective for a drastic improvement of this situation. On the contrary, it is increasingly claimed that a free European market (beyond the year 1992) and a further deregulation of the European transport sector may lead to unacceptable accessibility conditions in major regions in Europe (European Round Table of Industrialists, 1990).

As mentioned above, another important complicating factor will be environmental policy. In contrast to the deregulation with respect to the pure transport market phenomena, environmental policy is critically dependent on a great deal of regulations and interventions at both the supply and demand side. In particular, technical restrictions are likely to be imposed, e.g., limited emission levels of motorcars or even a prohibition of the use of certain transport modes. Recently, even a plea for a car-less city has been made. Other cities (e.g., Paris) are trying to build subterranean road infrastructure.

Consequently, transport policy makers in most European countries find themselves in extremely complicated situations. A large number of interest groups, ranging from multi-national companies to local environmentalists, urges them to take action, however, often in quite different directions. On the one hand it becomes obvious that the environment poses its limits on the volume, the character and the pace of the extension of the transport infrastructure, whereas on the other hand the competitive position of firms is hampered by an inadequate infrastructure.

In the light of the previous discussion on infrastructure and transport - with a particular view on urban areas - it is no surprise that there is a growing interest in the functioning and impact of urban infrastructures. Are such infrastructures detrimental to - or just supportive to - urban sustainability (cf. Nijkamp, 1990)?

So far we have pointed out that the city needs infrastructure as a vital tool for its survival and growth, while at the same time this tool may be costly from a social perspective. This holds for all types of infrastructure, but in particular for infrastructure to be used for transport and communication.

Two main economic effects of infrastructure can be distinguished. First, infrastructure exerts positive external effects on both firms and households, leading to a higher productivity or utility level than would occur compared with the situation without infrastructure. Second, the provision of infrastructure leads to relocation of mobile production factors such as labour and private capital giving rise to differential growth rates in a multi-city network.

Surprisingly enough, the social costs of transport and infrastructure mentioned above do not frequently occur in analyses of infrastructure and urban development.

2. Impact Models for Urban Infrastructure Analysis

Various methods and models have been developed to study infrastructure impacts on urban or regional economies. In this section three classes will be distinguished.

2.1. Factor productivity approach

The factor productivity approach takes for granted that the positive external effects of infrastructure projects lead to an improvement of the productivity of other production factors, compared with the situation without such projects. As long as infrastructure has a point character (airports, industrial estates, educational institutions, etc.), their influence on urban productivity can be analyzed by means of traditional production functions.

A general formulation of a production function for sector i in city r, with various types of infrastructure is:

$$Q_{ir} = f_{ir} (L_{ir}, K_{ir}; IA_r, \ldots, IN_r), \qquad (1)$$

where:

Q_{ir} value added in sector i, city r
L_{ir} employment in sector i, city r
K_{ir} private capital in sector i, city r
$IA_r, \ldots, IN_r$ infrastructure of various types in city r.

This formulation may still be generalized by taking into account spatial spill-over effects: the impact of infrastructure may transcend the boundary of an urban agglomeration. For example, a certain city may not have its own university or airport but still benefit from a university or airport nearby. This may be solved by using the concept of **accessibility** of certain types of infrastructure in the production function.[1]

A summary of models using the production function approach is given in Table 1. It appears that in most of the models a simplified version of Eq. (1) is used. The most complete ones are those developed by Mera (1973) and Fukuchi (1978) for Japan, and Snickars and Granholm (1981) for Sweden.

Sectorial detail is important in these studies. This is shown by Fukuchi (1978) and Blum (1982), who found that the productivity increase due to infrastructure may be quite different among different economic sectors.

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1 There is also a statistical advantage to using the concept of accessibility in this context. Certain types of infrastructure may simply be absent in a region. This causes statistical difficulties when using a Cobb-Douglas production function, the form usually chosen in this type of analysis. It is questionable practice to replace the zero by an arbitrary small number. Introducing an accessibility measure removes this difficulty.

Table 1. Examples of the production function approach to infrastructure modelling.

Author	Country	Number of sectors	Number of types of infra-structure	Presence of: labour	Presence of: private capital	Form of production function
Biehl (1986)	E.C.	1	1	yes	no	Cobb-Douglas
Blum (1982)	F.R.G.	3	8	no	no	Cobb-Douglas
Andersson et al. (1988)	Sweden	1	7	yes	yes	Cobb-Douglas (with modi-fication)
Snickars & Granholm (1981)	Sweden	21	5	yes	yes	Leontief
Nijkamp (1990)	The Nether-lands	1	3	yes	no	Cobb-Douglas
Fukuchi(1978)	Japan	3	3	yes	yes	Cobb-Douglas
Kawashima	Japan	8	1	yes	no	linear
Mera (1973)	Japan	3	4	yes	yes	Cobb-Douglas

2.2 **Factor mobility approach**

Infrastructure improvements or expansions may also lead to a relocation of labour and capital between urban regions. Most empirical studies in this field focus on the influence of inter-urban network infrastructure.

Improvement of transportation infrastructure leads to a reduction of travel time or cost and hence to an improvement of accessibility of markets or inputs. This may in turn lead to a relocation of labour and capital. Accessibility of a certain variable Z in urban regions can be defined as:

$$ACC_r(Z) = \sum_{r'} Z_{r'} f(c_{r'r}) \qquad (2)$$

where $c_{r'r}$ is an index of travel costs between regions r' and r, and $f(c_{r'r})$ is a distance decay function. The variable Z may refer to employment, production, inputs, etc.

Botham (1983) used the following relationship between regional employment and accessibility:

$$\Delta E_r = a_1 ED_r + a_2 w_r + a_3 LAPE_r + a_4 ACC_r(Z) \quad (3)$$

where ED, w, and LAPE denote employment density, wage rate, and an index of labour availability. For Z, several variables mentioned above have been tried. Finally, ΔE is the differential shift in employment, as defined by shift share analysis.

Another approach to accessibility is followed by Mills and Carlino (1989). They measure accessibility by means of the density of the interstate highway network and find that it has a clearly positive impact on employment growth in US states.

In most studies in this section, a positive relationship is found between accessibility and total employment. One must be aware, that such a result is not guaranteed by theory, however. Improved accessibility leads to an intensification of competition so that it is not impossible that some cities will be negatively affected by an improvement of accessibility.

Improving urban infrastructure has both **distributive** and **generative** effects. Distributive effects relate to a redistribution of economic activity among cities, the overall figure remaining constant. On the other hand generative effects occur when the overall total changes.

2.3 Interregional trade approach

This subsection will mainly be concerned with **inter**-regional or -urban) models. In order to be applicable for our purpose, these models should at least contain the following linkages:

1. Linkages between transport infrastructure and transport costs
2. Linkages between transport costs and trade flows
3. Linkages between trade flows and regional development.

These linkages can easily be discerned in Fig. 1, which presents an example of such an interregional model.

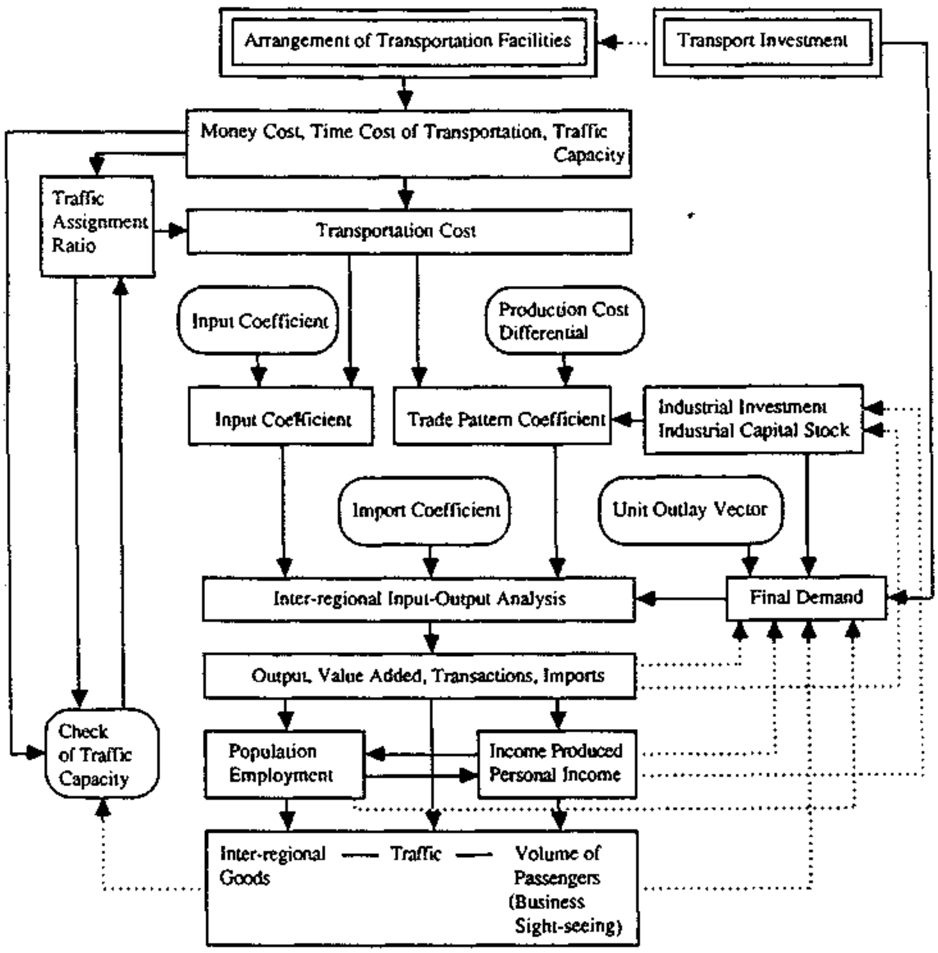
Here we will in particular pay attention to the second linkage mentioned above, i.e., the relationship between transportation costs and trade flows.

Amano and Fujita (1970) put forth the the following formulation for a Japanese interregional model:

$$t_{irs} = K_{ir}\exp[-\beta_i(p_{ir}+v_{irs})]/\sum_q K_{iq}\exp[-\beta_i(p_{iq}+v_{iqs})] \quad (4)$$

where the subscripts q, r, and s refer to regions, and i refers to sectors. K_{ir} and p_{ir} denote capacity and price level in sector i of region r. Furthermore, v_{irs} is transportation cost per unit of i between r and s, and t_{irs} is the share of regions r in the deliveries to region s for goods produced in sector i.

Liew and Liew (1985) propose another modeling procedure. Their model of departure is a Cobb-Douglas production function with capital, labour, and intermediate purchases for each sector and each region. Liew and Liew assume that consumers fully absorb the advantage of a decrease in transportation costs: the equilibrium purchase price in region s is the sum of the equilibrium price of the good in region r plus the cost of shipping it from region r to s.



Note: Dashed lines denote a time lag of one year

Fig. 1 System chart of the Amano-Fujita interregional model

Another assumption is that in equilibrium, transportation costs are a constant fraction of the equilibrium price. Using a profit-maximizing approach, Liew and Liew derive a linear logarithmic system of price frontiers. Changes in transportation costs give rise to changes in equilibrium prices in the various regions. These in turn give rise to substitution effects in the production process. Thus, it is not only interregional trade shares which change as a consequence of changes in transportation costs, but all input-output coefficients may change as a result of it. In this respect, the model of Liew and Liew is more general than the model of Amano and Fujita where input-output coefficients are assumed to be constant.

Sasaki et al. (1987) constructed an 8 region model of Japan which is again more general than the model of Liew and Liew. A main difference is that Sasaki et al. do not only take into account the influence of transport costs on prices of inputs and outputs (and hence on input-output coefficients), but also on final demand. Road construction does not only lead to a decrease in transportation costs and a change in trade patterns, but also to an increase in final demand in the region concerned.

2.4 Retrospect

Various attractiveness factors may be distinguished that play an important role in the contribution of infrastructure to the development of an urban agglomeration. Unfortunately, diseconomies from urban infrastructure are hardly considered by any of these studies. Also the dynamic generative impact of urban infrastructure is usually not very adequately considered.

3. Cross-urban Comparative Studies on Infrastructure

The previous sample of infrastructure impact studies showed that comparative studies on the impact of urban infrastructure are rare. In this part we will deal with three of those comparative studies.

3.1 The attractiveness of European cities from the viewpoint of multinational firms: the NEI-study

NEI (1987) carried out an exploratory study for 7 West European urban agglomerations: Randstad, London, Paris, Hamburg, Frankfurt, Muenchen and Brussels/Antwerp. The study focused on the attractiveness of the locational profiles of these agglomerations from the viewpoint of internationally oriented firms. Five groups of activities were distinguished: corporate headquarters, research and development establishments, high-tech production, distribution establishments and producer services.

The data problems, which inevitably arise in such international comparisons have been solved by using qualitative (ordinal) data, based partly on secondary data and partly on expert judgement. Ordinal data are also used in the weighting process of these factors. The various locational factors received a rank ranging from 1 (most important) to 6 (least important). The concept of urban area used here is rather loose: the use of qualitative data allows for some indeterminacy in this respect.

An example of the locational profile for distribution establishments is given in Table 2. Infrastructure components obviously play a prominent role here. Especially network aspects of infrastructure are emphasized. Also tariffs for the use of infrastructure play a role here.

Multicriteria analysis has been used to generate a final ranking of urban agglomerations on the basis of Table 2.

Table 3 gives the ranking of the urban agglomerations for the other types of economic activities. For each activity a specific list of location factors and the corresponding weights has been used.

The most striking aspect of the table is the very favourable result for London: it is unambiguously ranked first for three of the five activities. Relatively favourable results are also found for the Randstad, Frankfurt and Paris. The profiles of Hamburg, Muenchen and Brussels/Antwerp are least favourable.

Among the weak aspects of this study are the soft character of the data used and the lack of an empirical basis for the weights. No efforts have been made to reinforce the analysis by linking these data to actual behaviour of internationally oriented firms. Thus, it is impossible to say whether firms will indeed evaluate urban agglomeration according to the rankings presented in Table 3. Attractive aspects of this study are the sectoral detail used, and the network properties of infrastructure taken into account.

Rank of location factor	Location factor	Rand-stad	London	Paris	Hamburg	Frank-furt	Muenchen	Brussels/ Antwerp
	<u>Demand side factors:</u>							
1	- size of national market	6	5	4	1-3	1-3	1-3	7
1	- distance to point of gravity of European market	3/4	7	2	5/6	1	5/6	3/4
	<u>Institutional factors</u>							
2	- fiscal laws	2	1	7	4-6	4-6	4-6	3
3	- facilities for custom-free entrepot	1	2-7	2-7	2-7	2-7	2-7	2-7
2	- speed of customs procedures	1	2-7	2-7	2-7	2-7	2-7	2-7
2	- computerized processing of administrative data by customs	4/5	1-3	1-3	4/5	6/7	6/7	1-3
3	- government acquisition policies	2	1	4-7	4-7	4-7	4-7	3
3	- investment premiums	3	2	7	4-6	4-6	4-6	1
3	- political stability	4	6	5	1-3	1-3	1-3	7
3	- stability in labour relationships	1	7	5	2-4	2-4	2-4	6
3	- attitude of population	1	7	6	2-4	2-4	2-4	5
	<u>Infrastructure</u>							
2	- proximity to international airport							
3	- costs of handling goods on airport	3	7	2	4-6	4-6	4-6	1
2	- proximity of seaport	1	4	5	3	6/7	6/7	2
3	- costs of handling goods in seaport	2	4/5	4/5	3	n.a.	n.a.	1
2	- connection with international road network							
2	- location near waterway	1	4	3	5	n.a.	n.a.	2
2	- connection with international railway network							
2	- accessibility by lorry							
2	- availability of new telecommunication facilities							
3	- quality of telecommunication	7	1/2	1/2	4-7	4-7	4-7	4-7
3	- tariffs of telecommunication	3	1	2	5-7	5-7	5-7	4
2	- presence of transport firms	1	2-7	2-7	2-7	2-7	2-7	2-7
3	- price level of transport services	1	2-7	2-7	2-7	2-7	2-7	2-7
	<u>Quality of accommodation</u>							
2	- availability of appropriate sites							
4	- price of land	7	1	5/6	2-4	2-4	2-4	5/6
3	- availability of appropriate premises							
4	- price of premises	2	3	7	4/6	4/6	4/6	1

Source: NEI (1987)

Table 2 Locational profiles of urban agglomerations from the viewpoint of the distribution sector

It is also surprising that no push effects (e.g., high social costs, low environmental quality, congestion) are taken into consideration (see section 1 of this paper), so that some reservations in interpreting the results are necessary. Nevertheless, the need for such comparative research is evident; in the next sections a new approach to an analysis of infrastructure in different European cities will be outlined.

	Rand-stad	London	Paris	Hamburg	Frank-furt	Muenchen	Brussels/ Antwerp
corporate headquarter	3/4	1	2	7	5/6	5/6	3/4
R&D	6/7	1	2-5	2-5	2-5	2-5	6/7
high-tech	1/2	5-7	5-7	3/4	1/2	3/4	5-7
distribution	1	2-6	2-6	2-6	2-6	7	2-6
producer services	2-5	1	2-5	7	2-5	6	2-5

Source: NEI (1987)

Table 3 Attractiveness of urban agglomeration as a location for international economic activity (1 : most attractive)

3.2 Measuring and Explaining the Performance of the EC's Urban Regions: the Cheshire et al. Study.

Urban problems are multidimensional and the construction of an aggregate index to measure the intensity of urban problems is a difficult task, accordingly. One possibility is to apply a priori weights to individual problem indicators in order to arrive at an aggregate problem index. But it is not easy to find a sound basis for such weights. Another approach is followed by Cheshire, Carbonaro and Hay (1986). They estimate the weights of individual problem indication on the basis of expert opinions about which EC cities are healthy and which are unhealthy.

The statistical tool used by Cheshire et al. is discriminant analysis (cf. Hand, 1981), which enables one to estimate coefficients (weights) which minimize the variance within both groups of cities and maximize the variance between the groups.

The analysis has been carried out for 103 cities in the EC in the year 1984. Data have been used at the level of the functional urban region (FUR). Experts agreed on a set of 13 cities to be classified as 'unhealthy' and 16 as 'healthy'. The variables taken into account are:

X: GDP per capita

U: rate of unemployment

M: net migration rate

T: travel demand index (measured as a weighted sum of hotel beds per capita)

This leads to the following discriminant function:

$$\text{Score} = -5.02 + .089U \quad -.32M \quad -.56T$$
$$\qquad\qquad\qquad (5.20) \quad (-2.30) \quad (-4.39)$$

where figures in parentheses refer to t values. GDP per capita was excluded because it was not significant. The signs of the coefficients are consistent with a priori ideas, although, as Cheshire et al. admit, the use of the travel demand index may seem somewhat frivolous. Once the coefficients have been estimated, they can be used to generate the values of the problem index of all cities, including those which had not been classified before by the experts. Thus, one arrives at a ranking of European cities according to the degree of health, ranging from Frankfurt at the first place to Liverpool with rank 103 as the most unhealthy city. Cheshire et al. investigated the relationship between the problem score and the rate of population growth of cities. They find that a large majority of FUR's with urban problems have a declining population, although some notable exceptions exist.

In a more recent study, Cheshire (1990) gives an update for 1988 where also cities from Spain and Portugal are included. The main pattern observed is rather stable. An important element is that an explanatory analysis is given of the urban problem index, or rather the **change** in the problem index between 1971 and 1988. The results are shown in Table 4.

The negative sign of the population variable indicates that, ceteris paribus, the problems of large cities have been mitigated compared with smaller cities during the period considered. Another explanatory variable is the change in economic potential, measured by means of the gravity model. Major reasons for changes in economic potential are changes in the composition in the EC. This result means among others that cities in the Northern and Western periphery of the EC have been facing increasingly severe urban problems.

Most of the other variables relate to economic structure. Cities in regions with a strong orientation on industry, agriculture and coal mining experienced increasing urban problems. A similar result holds true for cities with a large natural population change. There is only one **infrastructure** variable among the independent variables and it has an increasing influence on urban problems: the dependence of the local economy on ports (measured on a scale from 0 to 4 to indicate the volume of seaborne trade). This reflects the negative influence of containerisation on employment in ports during the period considered. The loss of employment may relate both to the substitution of labour by capital and to indirect effects on processing industries since containerisation means that ports loose their initial locational advantage compared with other cities (Cheshire, 1990).

The overall pattern emerging from table 4 is that skill-based cities have fared better than cities with a basis in natural resources. Except for the port variable, infrastructure does not play an explicit role in the explanation, but Cheshire indicates that it may play a role in the unexplained variance. He suggests for example that favourable developments in cities such as Paris and (more recently) Rotterdam are due to coherent strategic plans for development and modernisation of its transport infrastructure. In addition, it plays an implicit role in the economic potential variable, since this variable depends on transport costs which in its turn depends on the infrastructure network (cf. section 2.2).

Independent variable	
Constant	17.2
Log total population (1981)	-.96 (-2.95)
Change in economic potential	-4.82 (-5.31)
Percentage of labour force in industry in wider region, 1975	.067 (2.16)
Percentage of labour force in agriculture in wider region, 1975	.169 (1.86)
Percentage of labour force in agriculture in wider region, squared, 1975	-.0056 (-2.44)
Dependence of local economy on port	.63 (3.85)
Dependence of local economy on coal	1.21 (3.42)
Natural rate for population change	.174 (2.75)
county dummies	
Adjusted R^2	.80

source: Cheshire (1990)

Table 4 The changing incidence of urban problems, 1971-88 (t values in parentheses)

In Table 5 some numerical results are presented for a set of larger cities in the North Western part of the EC. Most of these cities considered have a problem index below the EC median in 1981, i.e. they are relatively healthy. Also from the viewpoint of change most of the cities perform well compared with the EC average. The worst development observed occurs with London and some cities in Northern and Central Germany.

	urban problem index (1981)	change in urban problem index (1971-1988)
Kobenhavn	-2.14	n.a.
London	-4.35	3.92
Amsterdam	-8.16	-.22
Rotterdam	3.19	.69
The Hague	-.05	.19
Antwerp	-2.11	-.89
Brussels	-10.59	-5.09
Paris	-1.71	-.98
Lyon	-2.71	-.39
Milano	-4.94	1.66
Hamburg	-5.02	4.70
Essen	-.43	4.51
Duesseldorf	-8.25	4.06
Koeln	-3.10	2.74
Frankfurt	-18.24	-3.56
Muenchen	-10.67	3.29
EC average	-.17	3.29

Source: Cheshire (1990)

Table 5. Incidence of urban problems in European cities

Cheshire's idea to use discriminant analysis to construct an index of urban problems is quite interesting, although some of the variables used may be questioned. The use of the transportation index (hotel beds) as an inverse indicator of urban problems is not entirely convincing (why it it not used as an explanatory variable?). In addition, we note that the scope of the urban problem indicators is rather limited. Problems related to the urban environment, housing or transport are not taken into account.

The explanatory analysis of changes in the problem index yields plausible results, but it is a pity that infrastructure did not receive more systematic attention as a policy variable. Although data on public investments may be difficult to obtain, one might use other infrastructure data, such as the presence or accessibility of airports.

3.3 The performance of European Cities; the DATAR Report.

In 1989, a French study (DATAR) was published on the socio-economic performance of 165 European cities with a population of more than 200,000 inhabitants. Data relate to functional urban regions. The performance of the cities is measured by means of 16 indicators which can be classified as follows:

1,2	population (size, growth)
3-5	infrastructure (airports, ports, telecommunication)
6-9	skills (high tech industry, R&D, skills of labour force, universities)
10-12	knowledge exchange (congresses, exhibitions, press)
13,14	international relations (seats of multinational firms, financial institutions)
15,16	cultural (museums, festivals, etc.)

The cities have been rated on a scale from 1 (least attractive) to 6 (most attractive). An index of the aggregate socio-economic performance of cities is constructed by unweighted summation. Thus, infrastructure variables contribute 3/16 of the aggregate index. The results for a subset of cities are presented in Table 6. According to this table London and Paris have by far the highest scores, followed by Milan.

Although the DATAR report brings together interesting information, it can be criticized for various reasons. First, it is not made clear what the aggregatre index actually stands for. Second, for several of the underlying variables quantitative data are readily available so that an unneccessary loss of information occurs when one used a scale such as (1, 2, 3, 4, 5, 6). Third, no basis is given for the assumption of equal weights, although the DATAR report mentions that sensitivity analysis reveals that other assumptions lead to approximately the same results.

Copenhagen	56
London	83
Amsterdam	63
Rotterdam	55
The Hague	44
Antwerp	44
Brussels	64
Paris	81
Lyon	53
Milan	70
Hamburg	57
Essen	35
Duesseldorf	44
Koeln	51
Frankfurt	65
Muenchen	65
EC (average)	28

Table 6. Aggregate performance of European cities.

Fourth, the definition of the variables is not always mutually consistent. Most of the variables relate to absolute figures. Thus, Paris and London score 5 or 6 for most variables simply because of their size: these cities host most people, they have the biggest airports, most students, etc. Thus, it is no surprise to see that the figures in Table 6 are closely related to population size. Such an approach is defendable, but it is not easy to understand why in some cases a standardization is used. For example, the university variable is based on the absolute number of students but the labour force skill variable is based on the **share** of people in the labour force having certain skills.

3.4 Retrospect

Given the growing importance of the international dimension in urban infrastructure policies we surveyed three recent studies on the role of infrastructure in the development of EC cities: NEI (1987), DATAR (1989) and Cheshire (1990). NEI and also Cheshire follow the location factor approach. The approach followed by DATAR is difficult to classify. Also the type of data used are quite different in the three studies. Concerning the role of infrastructure, Cheshire finds that the main influence of in frastructure runs via the potential variable. But one must be aware that changes in the potential variable may be both due to changes in transport costs and changes in the composition of the EC. It is not possible to say precisely what is the contribution of infrastructure to the amelioration of urban problems, accordingly. In the NEI study, infrastructure is assigned a very important role as a location factor, but no statistical testing is carried out. The role of infrastructure in the DATAR study is more limited, but also here statistical tests are not used.

The three studies considered give rankings of European cities in order of attractiveness. These rankings express different things, and it is therefore no surprise to see that they may be so different. For example the largest metropolitan areas London and Paris have very high scores in the NEI and DATAR studies, but in the Cheshire study their rank is much more mediocre.

4. Conclusionary Remarks

In this exploratory paper we focussed attention on theoretical and modelling work on the (positive and negative) role of (mainly) transport infrastructure, followed by some examples of recent fieldwork.

The most important lesson that could be learned from this exploration is that there appears to be a gap between the various modelling approaches and the empirical studies carried out in the EC countries.

To close the latter gap and to stimulate cross-national comparative research just more empirical studies alone will not be sufficient. It is of utmost importance that the data bases of various urban economies will be harmonized in terms of both quantity and quality. This does not only mean that an extended set of data should become available, but also that the various data bases on urban economies should become more standardized so that data on urban economies become compatible.

In light of the united European market in 1992 it is not only for scientists interesting to work on inter-European urban relations and development. Both for national governments and for the business community it is important to have better information about the new possibilities this new European market has to offer. In the introduction it is already stated that the large majority of our population is living in urban areas. As a consequence the position of an urban area within the total European network and its relations within this network will represent the possibilities an urban economy will get within Europe. It may be expected that the synergetic effects would be considerable when urban economies can use exact notion of their relative position within the European network in their advantage.

Working on such a comparative study it has become clear that the lack of reliable, compatible data severely hampers fruitful research. Therefore we end with a plea for a smooth exchange of data sets at least between universities.

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