Integrated Modelling of Transport and Regional Development in Europe

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Model levels

Globalisation

"Old-established national industries have been destroyed or are daily being destroyed. They are dislodged by new industries, whose introduction becomes a life and death question for all civilised nations, by industries that no longer work up indigenous raw material, but raw material drawn from the remotest zones; industries whose products are consumed, not only at home, but in every quarter of the globe."

Karl Marx and Friedrich Engels (1848): Manifesto of the Communist Party

Globalisation (continued)

- growing polarisation of population growth and decline but growing disparities in freedom of migration,
- growing hierarchy of territories with different economic and political interests – but declining power of central governments to propagate common goals,
- growing competition between territories for the same resources (investors, jobs, citizens, tourists) – but little incentives for regional co-operation,
- growing potential for exploitation of resources, negative environmental impacts and social conflicts – but little power of governments to counteract.

Climate change: CO₂ per capita (t) 1990-2006

Data: CDIAC (2009)
Climate change: emission targets

Source: Deutscher Bundestag (1990)

Energy transition: Peak Oil

Source: ASPO, 2007

The end of the Oil Age

In July of 2008 the price of crude oil rose to almost 150 $ per barrel. During the recent world-wide financial and economic crisis it went temporarily back to below 40 $ per barrel and is now rising again.

Most experts believe that, because of the final depletion of oil resources, of political instability in the Middle East and of rising demand of fast growing developing countries, oil will continue to become more expensive.

This will have significant impacts on fuel production, fuel types, fuel efficiency, location choice and mobility.

What will be the impacts on regions and cities?

Limits to growth

The conclusion is: another multiplication of production, consumption and resource use of the rich countries as in the past would exceed the resources of the planet:

- Even with the most optimistic assessment of the potential for energy conservation and increasing energy efficiency, the greenhouse gas emission targets are incompatible with continued economic growth.
- If the energy consumption of the world continues to grow as in the past, the known deposits of fossil fuels will be exhausted before the end of this century.
- Similar constraints apply to other raw materials, such as copper.

The SASI Model

There are essentially three methods to model the impacts of transport on regional economic development:

- Multiplier effects of infrastructure investments (Aschauer, 1993)
- Regional production functions incorporating infrastructure as production factor (Jochimsen, 1966; Biehl, 1986, 1991)
- Interregional trade flows as a function of interregional transport costs (Peschel, 1981; Bröcker, 1995), input-output linkages (Echenique, 1990) and economies of scale (Krugman, Venables, 1995)
The SASI Model

The SASI model is a recursive-dynamic simulation model of socio-economic development of regions in Europe under exogenous assumptions about:

- the economic and demographic development of the European Union,
- transport infrastructure investments and other transport policies, in particular the trans-European (TEN-T) networks.

The SASI model differs from other regional economic models by modelling not only production (the demand side of labour markets) but also population (the supply side of labour markets).

Regional production function

In state-of-the-art models of regional development based on the theory of production functions the classical production factors land, labour and capital are complemented by factors, such as:

- Economic structure
- Productivity
- Accessibility
- Labour supply
- Services
- Settlement structure
- Research and development
- Education
- Quality of life

Extended production function:

\[ Q_i = L_i R_i K_i A_i ... \]

where \( A_i \) is potential accessibility:

\[ A_i = \sum_{j} W_{ij} \exp(-\beta \gamma_{ij}) \]

Accessibility of region \( i \) = Summation of \( W_{ij} \exp(-\beta \gamma_{ij}) \)

Transport policy

Multimodal accessibility 1981
Multimodal accessibility 1986
Multimodal accessibility 1991
Multimodal accessibility 1996
Multimodal accessibility 2001
Multimodal accessibility 2006
Multimodal accessibility 2011
Multimodal accessibility 2016
Multimodal accessibility 2021
Multimodal accessibility 2026
Multimodal accessibility 2031

The AlpenCorS Project

TEN and TINA projects
The AlpenCorS project (2004-2005)

The Interreg III B programme “Alpine Space” (2000-2006) aimed at developing a concept for economic and spatial development in the pan-European Corridor V between France, Italy, Slovenia and Austria.

The project AlpenCorS (“Alpen Corridor South”) focused on the central segment of the corridors south of the Alps. The application of the SASI model was to assess the effects of the intersection with Corridor I, the Brenner Corridor.

The STEPs Project:

Europe

Scenarios

The STEPs scenarios combined three rates of energy price increases with three sets of policies:

<table>
<thead>
<tr>
<th>Policies</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-nothing A-1</td>
<td>1.60 €</td>
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<tr>
<td>Do-nothing A-1</td>
<td>3.33 €</td>
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<tr>
<td>Do-nothing A-1</td>
<td>6.80 €</td>
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<tr>
<td>Business as usual</td>
<td>3.35 €</td>
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<tr>
<td>Infrastructure &amp; technology</td>
<td>3.95 €</td>
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<tr>
<td>Demand regulation</td>
<td>3.25 €</td>
</tr>
<tr>
<td>All policies</td>
<td>5.05 €</td>
</tr>
</tbody>
</table>

* € of 2008 per litre  A-1 Reference Scenario

The STEPs project (2004-2006)

The EU 6th RTD Framework project STEPs (Scenarios for the Transport System and Energy Supply and their Potential Effects) developed and assessed possible scenarios for the transport system and energy supply of the future.

In the project five urban/regional models were applied to forecast the long-term economic, social and environmental impacts of different scenarios of fuel price increases and different combinations of infrastructure, technology and demand regulation policies.
New submodels

- **Productivity**: forecast labour productivity as a function of accessibility etc.
- **Migration**: migration flows instead of net migration as a function of regional attractiveness and jobs
- **Capital**: model mobility of capital as a function of labour productivity and accessibility
- **Competition**: model regional subsidies, corporate taxes, labour costs
- **ICT**: include information and communications technology variables in the regional production function
- **Revenues**: model effects of revenues of transport pricing on GDP and employment

Output indicators

- **Transport**: person-kilometres and ton-kilometres by transport mode
- **Greenhouse gases**: CO₂ emissions by transport by mode per year
- **Air pollution**: NOₓ and PM₁₀ emissions by transport by mode per year
- **Noise**: noise emissions by transport by mode per year
- **Land take**: land area used for new transport infrastructure and landscape fragmentation
- **Revenues**: revenues of transport pricing by mode per year for reinvestment scenarios

More information


More information on the SASI model and its applications is available at [http://www.spiekermann-wegener.de/mod/sasimod_e.htm](http://www.spiekermann-wegener.de/mod/sasimod_e.htm).

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