Draft paper

Testing the European-wide spatial equity and efficiency impacts of the priority TEN-T projects

by

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Abstract

This paper studies the spatial impacts of the TEN priority projects and analyses if these projects contribute to the European added value by providing positive spillover effects in the EU countries that are not directly hosting and financing the new infrastructure.

We apply the CGEurope model, which is designed to model the regional economic welfare effects of developments in transport infrastructure on the European scale. Transport policies are simulated by varying the costs of transport and quantifying the impact on the welfare of households brought about by corresponding changes in goods and factor prices.

When addressing European added value, we look at the effects of the projects that accrue to regions that are not located in countries that host and/or finance the new infrastructure. These spillover effects on the other countries can be positive or negative. If a project is profitable, and in addition to that produces considerable positive spillover effects, it would be worthwhile for the EU to participate in financing the project and make sure it is implemented.

In the paper, we present the model outcomes, that is, the regional distribution of the benefits for 22 of the 30 TEN priority projects on NUTS-2 scale, and analyse the efficiency impacts of these projects as well as the distribution of the benefits over the regions. From our results, we can identify only 4 projects that fulfil both conditions of economic efficiency and high European added value.

1. INTRODUCTION

The economic literature has paid much attention to the motives and the ways for a federal government to provide public goods, such as transport infrastructure. One of the key motives is the existence of spillover effects, when the infrastructure in a member state is also used by citizens and firms of the other member states. Whenever this common usage produces a free-rider problem, the incentives for individual states to invest into new infrastructure are reduced. Then, the need for federal government intervention appears, if the spillover effects are important and are to be realized. An obvious way to overcome the inefficiency caused by the free-rider problem is to use a federal subsidy that should ideally be a function of the level of spillovers.

In the EU, the strategy for infrastructure development is summarized in the trans-European transport networks policy. The legal basis for the trans-European transport networks (TEN-T) is provided in the Treaty on the European Union. Under the terms of Chapter XV of the Treaty (Articles 154, 155 and 156), the European Union must aim to promote the development of trans-European networks as a key element for the creation of the Internal Market and the reinforcement of economic and social cohesion. This development includes the interconnection and interoperability of national networks as well as access to such networks. To some of the transport projects the European Commission attributed particular importance, and these were included into a priority list (hence so-called *priority projects*). They were chosen “according to their European added value and their contribution to the sustainable development of transport and the integration of the new Member States”.

In this paper we will look at 22 priority TEN-T projects. We will calculate the welfare effects of each individual project after its implementation for 260 European regions, and we will especially focus on the spillover effects, that is, on the benefits for the regions of countries not involved into the financing of the projects. The rates of return for the investors in the absence of EU-level intervention will be evaluated. Then, the potential subsidy amount will be calculated and the conclusion will be made on whether this aid provides a decisive incentive for the investors to implement the project and thus realize the spillover effects. At last, as the EU subsidy has to be financed (for example by an EU-wide levy), we also assess the regional equity effect of the proposed subsidy scheme.

For the assessment, we use the *CGEurope* model (Bröcker, 2002), a spatial computable general equilibrium model, which is designed to evaluate the economic effects of developments in transport infrastructure on European scale, with special focus on regional detail.

The infrastructure projects of the TEN-T program will be modelled as comparative statics experiments taking place in year 2020 (year when all priority projects will be finished and open for traffic). In such an experiment a reference situation (i.e. reference scenario without project) is compared to a policy scenario situation (with a project) by means of a welfare measure for each region. The parameter that will differ between the two situations will be the interregional transport cost matrix, changes in which are caused by the improved infrastructure.

The paper is organized as follows. In the next section we present the methodology to calculate the regional welfare effects of new infrastructure in money terms, as well as the additional indicators to characterize efficiency and equity effects of EU project funding. In Section 3 we describe the database as well as the methodology used to transform the freight cost matrices into tractable format. Section 4 then presents the results of our analysis and recommendations for EU funding. The conclusions comprise the last section.

2. METHODOLOGY

2.1. Model description

We provide here only a verbal description of the basic model (see Bröcker (2002) for a formal set-up). CGEurope is a spatial general equilibrium model for a closed system of regions covering the whole world. All regions are treated separately and are linked through endogenous trade; the regional coverage is whole Europe divided into NUTS-2 regions (in case of EU-27) or regions of comparable size for the rest of Europe. One region is capturing the rest of the world. The model is comparative-static, which means that for each scenario analysis two equilibria are compared, one with and one without a policy measure (infrastructure project) in place.

In each region there is assumed to dwell a set of households, owning a bundle of immobile production factors, which is used by regional firms for production of goods. We distinguish between two types of goods, local and tradable. Local goods can only be sold within the region of production, while tradables are sold everywhere in the world, including the own region.

Producers of local goods use factor services, local goods and tradables as inputs. The output of locals is assumed to be completely homogeneous, and is produced under constant returns to scale. Firms take prices for inputs as well as their output as given, and they do not make any profits. Instead of directly selling this output to households or other producers, firms can use it as the only input needed to produce tradables. The respective technology is increasing returns to scale. Tradable goods are modelled as being close but imperfect substitutes, following the Dixit-Stiglitz (1977) approach. Different goods stem from producers in different regions. Therefore, relative prices of tradables do play a role. Changes of exogenous variables make these relative prices change and induce substitution effects. For producers of tradables, only input prices are given, while the output price can be set under the framework of monopolistic mark-up pricing. Due to free market entry, however, profits are driven to zero, as they are in the market for locals.

Households are assumed to act as utility maximizers, taking all prices as given. Utility emerges from consumption of local goods and a composite of tradables, consisting of all, regionally produced and imported variants. Utility is modelled such that households appreciate a higher number of variants of tradables. The same income spent on more diverse variants means higher utility for the households. In other words, they share the "love for variety". For the sake of simplicity, all components of final demand, that is private and public consumption and investment, are subsumed under household demand. There is no explicit consideration of a separate public sector. Because of perfect price flexibility, the regional factor supply is always fully employed. Apart from factor income, disposable income contains a positive or negative net transfer payment from the rest of the world, depending on whether the regional current account with respect to all other regions has a surplus or a deficit. These transfers are held constant in our simulations. They are negligible with regard to quantitative results, but needed for keeping budget constraints closed.

Two features that give the CGEurope model its spatial dimension are:

- the distinction of goods, factors, firms and households by location, and
- the explicit incorporation of trade costs for goods, depending on geography as well as national segmentation of markets.

The term "trade costs" for interregional transfer of goods is used as a shortcut for any kind of trade-related costs. Usually trade costs are assumed to depend on the quantity of goods traded. Some costs of interregional transfer, especially costs of information exchange and insurance costs, depend on the value rather than the quantity traded, however. Letting transaction costs depend on the value of trade makes the model much simpler, and we therefore prefer this assumption. We therefore assume that the trade costs for goods to be delivered from region *r* to region *s* amount to a share ($\tau_{rs} - 1$) in the traded value, $\tau_{rs} > 1$ denoting the transaction cost mark-up factor.

We introduce two components of trade costs: *travel costs* or costs related to geographic distance, and costs for overcoming impediments to international trade. The first are modelled under the assumption that travel costs are increasing with distance but at diminishing rate. The change of these costs will constitute the policy scenario (infrastructure project implementation). The values for the second type of costs are calibrated within the model and include tariffs, but also, and more important, all costs stemming from non-tariff barriers, like costs due to language differences, costs for bureaucratic impediments, and so forth.

Travel costs are basically subdivided into costs for business and private passengers on the one hand, and for goods transports on the other hand. Road and rail modes are considered, with ferry and maritime shipping links being part of the road and rail networks.

The most important results for project assessment generated by comparative analyses using CGEurope are the monetary measures of regional welfare effects of the evaluated projects. They convert utility gains of regional households to monetary amounts by the concept of *equivalent variation*. The value of this indicator given for each region can be expressed as the percentage change of real income compared to the do-nothing scenario.

The passenger costs (for business and private passengers) are not incorporated into the general equilibrium framework. However, we separately calculate the direct passenger cost savings resulting from the scenario implementation, using the back-of-envelope formula explained in the next section. The total benefit is then the equivalent variation measuring trade cost reduction effects, plus amount of saving for passengers. There are two implicit assumptions behind this approach: (1) gains from adjusting passenger flows are negligible in comparison to cost saving for a given pattern of flows, and (2) passenger total cost change has negligible general equilibrium repercussions.

From a theoretical point of view, the model relies strongly on Shoven-Whalley (1984) approach to general equilibrium modelling, even though it does not assume perfect competition on all markets. In doing so we follow e.g. Venables and Gasiorek (1998), who show that the estimated welfare impact of transaction cost reductions can change dramatically with a deviation from the perfect competition assumption.

2.2. Testing efficiency and equity effects of EU funding

In the cases, when an infrastructure project generates benefit spillovers, it might make sense for the EU to reward this project with a subsidy, as this will encourage the investing country to take into account the benefits in the other countries when it decides on its transport infrastructure.

Using the output of CGEurope model, we can calculate the maximum size of the ideal annual subsidy as the sum of benefits (in money terms), accruing to those other EU countries which potentially benefit from the particular transport project but which are not directly touched by the infrastructure as such. If this subsidy is then distributed among the investors (here: those countries where the project is located) according to their cost shares, one can calculate the updated rate of return of the project, and see whether the subsidy creates enough incentive for the investors (the countries where the project is located) to implement the project. In this way the efficiency effect of EU funding is evaluated.

In order to assess the equity effect of a subsidy we need to take into account who receives the subsidy and who pays for it. As CGEurope is a model without detailed public finance sector, we assume that the subsidy is financed via a proportional EU-wide levy or lump-sum tax on GDP. This assumption is a good approximation for levies that take the form of an extra levy on gasoline taxes or a larger share in VAT receipts.

We can then evaluate the equity effect of a subsidy by calculating the correlation coefficient between regional real income effects due to project implementation (in money terms) less the corresponding levy, and the relative GDP per capita level of the country. A positive value of this correlation coefficient means that richer regions benefit more from the project implementation, the subsidy and the way it is paid for, while a negative value would mean that poorer regions benefit more. Because the majority of the projects are quite big, affecting a lot of different regions and countries, we would not expect the correlation coefficients to be large in absolute value.

3. DATA SOURCES AND MODEL CALIBRATION

3.1. Travel cost matrices

The projects of the TEN-T priority list are described in European Communities (2005). Of the original list we selected only rail and road projects that haven't yet been completed and open to the traffic. Table 1 shows the list of projects to be modelled.

Table 1. TEN-T priority projects under study

No	Priority project
1	High speed train combined transport North-South, incl Messina bridge
2	High speed rail Paris-Cologne-Amsterdam-London
3	High speed rail south: Madrid-Barcelon-Montpellier/Madrid-Dax
4	High speed rail Paris-Karlsruhe / Luxembourg / Saarbruecken
5	Betuwe line Rotterdam-Rhein/Ruhr
6	High-speed rail Lyon-Venice-Trieste/Koper-Ljubljana-Budapest
7	Greek motorways (Via Egnatia, Pathe), motorways in Bulgaria and Romania
8	Multimodal link Portugal-Spain-Central Europe
12	Nordic triangle
13	Ireland / UK / Benelux road link
14	West coast main line
16	High capacity rail across the Pyrenees, freight line Sines-Badajoz
17	High speed train, combined transport East-West
20	Fixed link Fehmarn Belt
22	Rail Athina-Kulata-Sofia-Budapest-Vienna-Praha-Nuernberg
23	Rail Gdansk-Warsaw-Katowice-Brno/Zilinia
24	Rail Lyon/Geneva-Basel-Duisburg-Rotterdam-Antwerp
25	Motorway Gdansk-Katowice-Brno-Vienna
26	Multi-modal link Ireland/UK/continental Europe
27	Rail Baltica
28	Eurocaprail Brussels-Luxembourg-Strasbourg
29	Intermodal corridor Ioannian Sea/Adria

Maps illustrating the spatial alignment of all these priority projects can be found in FUNDING Deliverable D4 (Bröcker et al., 2007).

All priority projects will be treated separately in our study. Strictly speaking this does not represent the reality (as currently parts of all priority projects are under way), however the approach can be considered as a good approximation for project appraisal. The clear advantage of independent treatment is that all projects are assessed in a similar consistent way, and that potential benefits can be directly related to the investment costs. Correspondingly, any future network development other than the priority project under investigation is not assumed.

The main source of information needed to specify the policy scenarios (calculate the project-specific travel cost matrices) in our study is the GIS database of the trans-European transport networks developed by RRG (RRG, 2006), hereafter referred to as *RRG GIS Database.*

The *RRG GIS Database* includes all links of the trans-European transport networks, as defined in various policy documents published by the European Communities (1996), the European Commission (1995; 1998; 1999; 2002a; 2002b; 2004a; 2004b; 2005), and the TINA Secretariat (1999; 2002). Beyond the TEN-T networks, this database also includes all trunk roads in Europe and all other railway networks of Europe under operation today, to guarantee connectivity of main cities (i.e. NUTS-3 region centroids). As one of its main features, the *RRG GIS Database* includes a complete coding of the TEN-T priority projects, including the full road and railway outline plans with the envisaged completion years and the type of the project. The database distinguishes high-speed lines, upgraded high-speed lines and conventional lines for the railway networks; and motorways, dual-carriageway roads, national roads, E-roads and other secondary roads for the road network.

Besides the information on the TEN-T outline plans, the road network database also contains information on the type of the link, time penalties in agglomerations due to congestion and in hilly areas due to slope gradients, ferry timetable travel times, road tolls, national speed limits and border delays. The rail network also includes detailed information on the link type and comprises present and future timetable travel times between selected main cities.

Each priority project can be queried individually by using different attributes. In order to simulate the individual policy scenarios, appropriate subsets of the overall road and rail *RRG GIS Database* are extracted for the calculation of the travel cost matrices, by querying these attributes.

The freight costs for interregional goods transfer are functions of travel time and distance. Both represent the most important cost components in travel. In road transport, for example, the distance-related cost components represent fuel, lubricant, and maintenance of the transport vehicle. The time component includes mainly the wage for the driver as well as salary and opportunity cost of the business traveller. The parameter values for all these components were derived from the SCENES project (ME&P, 2000, pp. 38-42), and were adjusted to the present study. For each scenario, the transport costs were computed for two transport modes, road and rail, and for two travel purposes, freight transport and passenger travel (business and private).

For inland waterways and air transport no travel cost matrices were produced. Road and rail ferry connections are, in contrast, included in the road and railway networks and thus are already taken into account in the cost matrices.

Eventually the implemented travel cost parameters differ by:

- mode;
- link type (e.g. motorways, expressways, local roads, high speed rail link, narrow gauge);
- country (different assumptions about speed limits, train speeds etc.);
- relief (in case of road network);
- traffic loads (i.e. congestion, in case of road network);
- means of transport (freight / passengers);
- border waiting times and border delays;
- transhipment times between different modes (e.g. ferry-road);
- ferry timetable travel times;
- rail timetable travel times between major stops.

The cost matrices were then calculated between the centroids of the NUTS-3 regions by using the 'shortest path/accessibility submodel' of the SASI model developed by Spiekermann and Wegener (Bröcker et al., 2002; 2004) based on network datasets extracted from the RRG GIS database. The generated cost matrices contain total travel costs between all NUTS-3 regions considered based on least-cost path calculations, expressed in Euro-Cent.

When inputting the NUTS-3 travel cost matrices into the CGEurope model, they are aggregated to NUTS-2 level because the CGEurope model needs to complement these matrices with information from the ETIS database, which are only available at NUTS-2 level (see Chapter 3.1.2). The aggregation is done using regional GDPs as a weighting scheme.

As the accessibility submodel of the SASI model is not a full transport model, congestion expressed as traffic link loads cannot be taken into account in the road cost matrices. To compensate for this, so-called 'agglomeration effects' were introduced representing speed penalties in areas with high population density. As a rule, the higher the population density the stronger the penalties are (in other words, the lower the average speed on the link). Moreover, the agglomeration effects were also differentiated by link type, in order to reflect different impacts on different type of roads (such as motorways, national roads, interurban roads etc.). In this situation a new road link (with full speed) is contributing over proportionally to a travel time reduction in areas with high population densities than a motorway would usually do in sparsely populated areas. This way congestion is dealt with in the road network.

Concerning the rail network, congestion is not considered explicitly. Congestion on a rail link is not a matter of transported passengers, and thus applying the concept of agglomeration effect would be misleading. It is rather a question of the quality of the technical equipment (i.e. number of tracks, electrification, and, in particular, signalling techniques), and number and length of the trains. Most of this information is not available in the RRG GIS Database. However, congestion in the rail network is indirectly reflected in the (present and future) timetable travel times, which are coded in the network. Train travel times between two stations with congested links in between are longer due to slower average train speeds compared to uncongested links.

Other indirect travel costs than congestion are not included in the cost matrices.

Effects on local intra-regional transport are not modelled, because the system of regions used is too aggregated.

3.2. Transformation of freight travel cost matrices

The innovation to the CGEurope model made in this study is the updated procedure to convert the *freight cost* matrices for the origin-destination (O/D) regional pairs (described in section 2) into the cost matrices for production-consumption (P/C) pairs. The motivation for this procedure is the obvious fact that the amount of goods that are directly transported from region A (origin) to region B (destination) need not be the same, as the amount of goods produced in A, and bought by region B households for final use. One should take into account that fact that there may exist several routes (O/D chains) connecting a P/C pair, and some of these may involve transportation mode change in-between. Figure 1 illustrates this situation:

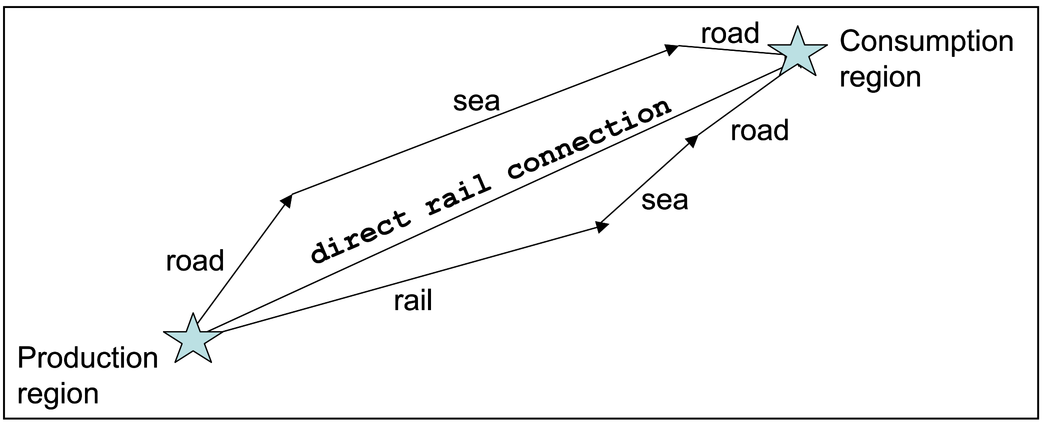

Figure 3.3. Freight transportation mode choice in CGEurope.

The source of data on the set of routes between P/C pairs, as well as on the shares of all segments of all routes in the total transport cost for separate P/C pairs per year, is the ETIS-BASE[1]. The original data was filtered in a way that there are either 0, or 2 well-identified transhipment points (ports) for a given route. The volume of goods transported per year between each P/C pair is expressed in terms of FEU (forty-foot equivalent unit of container capacity).

The total transport cost for each segment (O/D pair) of each route is determined through multiplying the costs per FEU by the number of FEUs transported on this segment per year (data from ETIS-BASE, year 2000). The resulting total cost is then multiplied by the *cost change factor* characterizing the scenario for this O/D pair that has a form 1+(percentage cost change/100). Next, we sum up these values for all O/D links within each route (one O/D link can be a part of several routes, of course), and divide by the value of this sum under reference scenario (all cost change factors=1). Thus, we get the cost change factor for each route, and the reference value of yearly total cost borne on this route. These are used in the next step.

The choice between different routes is modelled using a CES (constant elasticity of substitution) function:

$$C_{pc} = \left(\sum_r a_{pc,r} \cdot c_{pc,r}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$, where:

C_{pc} is cost change factor for a given P/C pair

$a_{pc,r}$ is the value share of the costs borne on the route *r* per year in the total cost borne on all routes connecting a given P/C pair;

$c_{pc,r}$ is the cost change factor on the route *r*, due to scenario implementation

σ is substitution elasticity that should not be very high, we used the value of 1.6.

The value of yearly total cost change for a P/C pair can be then calculated as the sum of yearly total cost borne on all routes connecting this P/C pair times (1- C_{pc}).

The *direct passenger cost savings* are calculated using the ETIS-BASE data on costs per trip of business and private travel, and total passenger flows between P/C pairs. We infer the respective shares of business and private passenger flows based on data from the SCENES model. The back-of-envelope formula to calculate the passenger cost savings for a P/C pair is:

[1] NEA et al. (2005)

$$\left(\frac{C^{scen}}{C^{ref}}-1\right)\cdot flow\cdot\left[time\cdot VoT+\left(\alpha\cdot Cost^{priv}+(1-\alpha)\cdot Cost^{busn}\right)\right]$$

For every P/C pair and every scenario, the first term is the costs change per trip according to the policy scenario, as a share of reference cost level. This is multiplied by *flow*, the number of trips per year, benchmark data taken from ETIS-BASE. The term in square brackets represents the reference cost per trip, which is the sum of time costs per trip (value of time parameter as applied by the 'shortest path/accessibility submodel' of the SASI model) and direct money costs per trip (these depending on whether the trip purpose is private or business). Parameter α is a share of private trips in total amount of passenger trips in Europe (calculated based on data from the SCENES model). More detailed information of this kind is not available.

The direct cost savings are assumed to accrue to the region of origin.

3.3. Other data

The comparative statics experiment in this paper will be carried out for the year 2020. To describe the future benchmark economic situation we need a consistent database for a recent year, as well as the prediction of relevant growth rates for the period until 2020.

3.2.1 Regional data

The model is at first calibrated for the base year 2001. The source of I-O information on country level is GTAP database[2]. For each region, we need the respective nominal GDP in euro, population and area. These data are taken from the Eurostat Regio database, and GTAP database (for non-EU countries). For the calibration of the model for the scenario year 2020 the GDP and population projections that were published in Cobb were used for the EU countries. For the external countries, we assume a convergence of GDP/capita to the mean EU-27 GDP/capita by 1.5% per year. This for example would lead to an annual growth of GDP by 5-7% for the Eastern European countries in the period from 2001 to 2020.

3.2.2 Data on trade flows and international trade impediments

International trade flows for each country pair are taken from the GTAP Version 6 Data Package. The procedure described in Bröcker (2002) is then used to produce a benchmark interregional trade matrix.

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[2] Center for Global Trade Analysis (2005)

An important piece of data that is not directly available and that must be calibrated is the matrix of mark-up factors for international trade. The mark-up factors represent impediments additional to distance-related costs in international trade. These impediments are specific for each country pair and are determined during the calibration of the interregional trade matrix based on the 2000 national accounts data. They are calculated such that the observed international trade flows equal the corresponding aggregates of trade flows between the regions of the two respective countries.

Next, we need to make an assumption about the development of these calibrated mark-up factors for the period until 2020. In the current situation, these impediments to trade are considerably lower for the EU15 countries than for the new member states, but we assume that the new member states gradually catch-up and their trade integration will increase. We therefore assume that the impediments to trade within the group of new member states and between EU15 and the new member states in our scenario year 2020 will on average be equal to the average of the impediment to trade within EU15 in 2000.

3.2.3 Costs of projects

The evaluation of projects is based on the information about their tentative budgets, and shares of the involved countries in this budget. The sources of this data are:

- deliverable D6 of TEN-STAC project
- deliverable D1 of Tipmac project

For some projects this information may be outdated, but we do not possess of any more reliable data source.

4. RESULTS

4.1. General discussion

The detailed results of project-by-project analysis (tables and maps for each case) can be found in the deliverable D4 of the FUNDING project. In this section we summarize these results by trying to answer the following questions:

1. How do different member countries share the benefits and costs of the TEN projects? Is there an important spillover of benefits to other member countries?
2. What is the rate of return of each project for the country/countries making the investment in the absence of EU subsidies?
3. If the EU were to provide a subsidy equal to the sum of positive spillover benefits to the other countries, how would this affect the incentives for the investing countries?
4. What would be the equity effect of such a subsidy; would these EU subsidies benefit mostly the poorer EU regions?

The table 2 below summarizes the answers to these questions for 22 priority projects under investigation. First, it shows that the EU-wide annual rate of return (third column of table 5.1) for all projects is positive, but for most projects it is low and lies below the benchmark rate of 5% on the invested sum per year. The rates vary from nearly zero for the Betuwe Line and the intermodal corridor Ioannian Sea/Adria up to 23.5% for the multimodal link Ireland/UK/continental Europe. In general, the newer projects, which have been added in the last revision of the TEN, have a higher rate of return than the projects of the old list of 20 projects. However, one has to keep in mind that CGEurope does not represent a full CBA of each project, because it does not take account of most external effects like noise, accidents, and pollution. Changes in congestion are not explicitly modelled in the transport network database, but are taken account of in the way explained in section 2.2. The gains for local transport are also not included. So one cannot directly draw the conclusion that these projects are not beneficial. Nevertheless, regarding the direct and indirect economic effects as they are modelled in CGEurope, most projects perform rather poorly.

Table 2: Summary of internal rates of return and distribution of welfare effects

1. Project #	2. Name of the project	3. EU-wide yearly rate of return, %	4. Share of total welfare effect on investing countries, %	5. Share of total welfare effect on other EU-27 countries, %	6. Maximum subsidy size, mln. euro	7. Return for the investing countries without a subsidy, %	8. Return for the investing countries with a subsidy, %	9. Correlation between the predicted regional welfare effects and GDP per capita, %
1	HSR combined transport North-South	1.46	97	3	24.47	1.41	1.46	-9.55
2	HSR Paris-Cologne-Amsterdam-London	1.96	55	46	216.51	1.05	1.96	4.00
3	HSR south: Madrid-Barcelon-Montpellier/Madrid-Dax	4.05	96	6	66.58	3.78	4.05	-4.43
4	High speed rail Paris-Karlsruhe / Luxembourg / Saarbruecken	4.72	97	4	8.26	4.57	4.72	6.36
5	Betuwe line Rotterdam-Rhein/Ruhr	0.01	62	42	0.22	0.01	0.01	3.50
6	HSR Lyon-Venice-Trieste/Koper-Ljubljana-Budapest	1.35	91	8	41.37	1.24	1.35	-19.83
7	Greek motorways (Via Egnatia, Pathe), motorways in Bulgaria and Romania	4.27	73	20	121.80	3.35	4.27	-12.07
8	Multimodal link Portugal-Spain-Central Europe	6.61	79	25	204.63	5.02	6.61	-13.51
12	Nordic triangle	1.90	91	5	14.71	1.80	1.90	13.97
13	Ireland / UK / Benelux road link	8.76	131	-15	0	9.89	9.89	18.69
14	West coast main line	1.13	93	7	14.80	1.04	1.13	17.60
16	HSR across the Pyrenees, freight line Sines-Badajoz	7.34	103	-1	0	7.44	7.44	-8.85
17	HSR combined transport East-West	4.68	51	50	244.41	2.37	4.68	-8.31
20	Fixed link Fehmarn Belt	9.94	56	39	229.67	5.76	9.94	2.68
22	Rail Athina-Kulata-Sofia-Budapest-Vienna-Praha-Nuernberg	7.94	80	18	83.46	6.52	7.94	-27.82
23	Rail Gdansk-Warsaw-Katowice-Brno/Zilinia	6.99	71	25	83.93	5.21	6.99	-32.47
24	Rail Lyon/Geneva-Basel-Duisburg-Rotterdam-Antwerp	2.74	97	2	8.72	2.68	2.74	7.42
25	Motorway Gdansk-Katowice-Brno-Vienna	8.91	73	26	167.27	6.60	8.91	-26.69
26	Multi-modal link Ireland/UK/continental Europe	23.49	123	-11	0	25.83	25.83	15.17
27	Rail Baltica	16.60	101	-6	0	17.57	17.57	-11.25
28	Eurocaprail Brussels-Luxembourg-Strasbourg	8.53	84	14	9.26	7.30	8.53	5.72
29	Intermodal corridor Ioannian Sea/Adria	0.04	86	15	0.07	0.04	0.04	-7.94
	Total	3.49	86	14	1340.60	2.99	3.49	-11.84

Second, we see that in many cases the share of the non investing ("other") countries in the benefits of the project (see column 5 in Table 5.1) is rather low, which is surprising given the fact that the priority projects were selected under the criterion that they yield cross border effects and are benefiting for the whole EU. Among the projects on the list, four projects have even a negative impact in other countries, namely projects no. 13, 16, 26 and 27. On the other hand, some projects have a low internal rate of return, but provide a relatively high share of the benefits in other countries. These are projects no. 2, 5 and 17. In addition, we have three projects that have a high internal rate of return of over 5% and a high share of benefits in other countries, which are projects no. 8, 20, 23, and 25.

Third, we find that for some projects the provision of the EU subsidy increases the internal rate of return to the investors significantly and may induce them to take better into account the European value added of these projects. But in none of the cases is the EU subsidy sufficient to increase the return of an unprofitable project over the threshold of 5%.

Fourth, as far as the equity issues are concerned, some of the 22 priority projects benefit mostly the richer countries and other projects benefit mostly the poorer countries. Some projects qualify for an important EU subsidy because they produce substantial spillover benefits. Do the projects that qualify for these high subsidies benefit mostly the poorer or the richer countries when account is taken of who receives the benefits and the subsidies, and who pays for the investment costs and the financing of the subsidies? Of the 6 projects that qualify for large subsidies (2,7,8,17,20,25), four have a negative correlation between net benefits and per capita GDP (thus favouring poorer regions relatively more), but two have a positive correlation. Drawing conclusions on this basis is difficult but it cannot be argued that the proposed EU subsidy scheme systematically hurts the poorer countries.

4.2 Recommendations on a project by project basis

One can classify the projects into 4 groups according to their economic performance and looking at whether they just have a local or a positive trans-European impact.

We have 4 projects in the list that have a high positive overall impact (rate of return ≥ 5 %) and a high share of benefits that accrue to other countries. These are projects no. 8, the multimodal link Portugal-Spain-Central Europe, no. 20, the fixed link over the Fehmarn Belt , no. 23, the rail line Gdansk-Warsaw-Katowice-Brno/Zilinia and no. 25, the motorway Gdansk-Katowice-Brno-Vienna. These are the projects that are profitable from the economic point of view and that deserve attention from the EU, as they provide benefits in countries that are not touched by the new infrastructure.

The second group is formed of 6 projects that have a poor economic performance and whose impacts are only local, i.e. within the financing countries. In our list, these are no 1, 6, 12, 14, 24 and 29. From our results, we would not recommend implementation of these projects for the financing countries because of their poor economic performance, and we would not recommend their funding from the EU budget from the viewpoint that only projects that provide positive added value for the community should be selected.

The third group are 8 projects that perform well economically (rate of return > 4%), but whose benefits accrue to the financing countries only; these are no. 3, 4, 13, 16, 22, 26, 27 and 28. For these projects, there should be a sufficiently high incentive for the hosting countries to implement these projects, as they are beneficial for their countries. However, they do not produce sufficiently enough positive spillovers in other countries, so one should not advise the European Community to subsidise them, but to let the hosting countries finance them on their own.

The last group are the 4 projects that have low economic performance, but whose benefits are trans-European. These are projects no. 2, the PBKAL, no. 7, the Greek motorways and motorways in Bulgaria and Romania, no. 5, the Betuwe line, and no. 17, high-speed rail combined transport East-West. The internal rates of return of these projects lie under 5%, but their benefits accrue to a high degree to other countries than the ones that finance them: for the first it is 46%, for the second it is 20% (27% if one includes the rest of the world, which is mainly Turkey in this case), for the third one it is 42%, and for the last one even 50% These projects could be considered for co-financing by the community or could because of the low overall return not be funded at all.

4.3 Caveats of the analysis

As already mentioned, the CGEurope results do not represent the full cost-benefit-analysis of each project, because it does not take account of most external effects like noise, accidents, pollution; changes in congestion are not modelled endogenously in the transport network. Benefits to local transport are also not included. We also have to fix the number of passenger trips to calculate the direct cost savings for the passengers, which leads to a slight underestimation of the effect on passengers. The impact of pricing and the financing by mark-ups is also not included in the analysis.

5. CONCLUSIONS

In this study we have looked at the 22 infrastructure projects from the TEN-T priority list. We have applied the same methodology, namely the CGEurope model, for the analysis of each individual project. Our goal was to identify the spillover effects that would arise due to project implementation, and evaluate the necessity for EU-level subsidy in the cases where these spillover effects are considerable.

A methodological innovation in this paper is the procedure to convert the freight cost matrices for origin-destination regional pairs into cost matrices for production-consumption regional pairs. For this we make use of the freight transport data from the ETIS-BASE.

Our results suggest that out of 22 projects only 10 have a yearly rate of return for investors that lies above 5% benchmark. The rest of the projects can be considered unprofitable. Of the projects with low return to investors, in 4 cases the spillover benefits are considerable (more than 20% of the total benefits), and thus the provision of EU-level subsidy would be appropriate. However, in none of these cases is the subsidy (equal to the size of spillover effects) enough to bring the return to investors over the 5% threshold.

As far the equity effects of EU-funding are concerned, we do not get a homogeneous picture for all projects, but it definitely cannot be argued that the proposed EU subsidy scheme systematically hurts the poorer countries.

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