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Transportation Research Procedia 25 (2017) 2877–2888

Transportation Research Procedia

www.elsevier.com/locate/procedia

World Conference on Transport Research - WCTR 2016 Shanghai. 10-15 July 2016

Impact of Transport Infrastructure on International Competitiveness of Europe

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Abstract

One of the main objectives of the European transport strategy in its 2011 White Paper is to help establish a transport system that enhances competitiveness of European countries. By performing a methodological study, analysing several European transport infrastructure investment cases and conducting a review on various assessment tools, we clarify the relationship between transport infrastructure investment and its wider economic impacts, namely competitiveness and economic growth, we make synthesis of some proposed improvement of the methodology used to assess these impact as well as some recommendations on assessing European Union (EU) policy in transport infrastructure investment in respect of competitiveness and economic growth.

Peer-review under responsibility of WORLD CONFERENCE ON TRANSPORT RESEARCH SOCIETY.

Keywords: Competitiveness; economic growth, transport infrastructure investment; project assessment methods; cost-benefit analysis; wider economic effects.

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2352-1465
Peer-review under responsibility of WORLD CONFERENCE ON TRANSPORT RESEARCH SOCIETY.
10.1016/j.trpro.2017.05.273

1. Introduction

The objective of getting out of the crisis together with the urgent need to remain highly competitive especially against the new emerging economies has made Europe's competitiveness and economic performance fundamental issues in the recent years. European Commission's Transport White Paper 2011 has summarized the main objective of European transport strategy which is to help establish a system that underpins European economic progress, enhances competitiveness and offers high quality mobility services while using resources more efficiently.

Given the above challenges and strategy setting, it is obvious that stronger role and bigger contribution of the transport sector in the improvement of European economic growth and competitiveness are highly expected. In consequence it is also essential first to clarify the relationship between the transport sector and the economic growth and the competitiveness and second, to elaborate a working framework so that transport policy intervention can effectively improve European economic growth and competitiveness.

Our aim in this paper is twofold. First we aim at clarifying the relationship between transport infrastructure investment and its wider economic impacts, namely competitiveness and economic growth in particular and second, at synthesizing some proposed improvement of the methodology used to assess the impacts of investment in transport infrastructures especially on competitiveness and economic growth.

To achieve the above objectives, we have first conducted a methodological study aiming at defining the issue of competitiveness, clarifying the relationship between investment in transport infrastructure projects and the defined competitiveness and finally, at exploring the state of assessment methods used to evaluate transport infrastructure projects.

Second, we involve several case studies that we consider as representing all transport modes and covering different European Union (EU) regions. These cases have been taken from transport infrastructure investment projects which are in operation so that we can analyze if the effects on wider economic benefits, namely economic growth and competitiveness are relevant issues to these projects. We also underline the importance of regional aspects since the effects of growth and competitiveness are variably perceived between the different regions or countries.

We perform a review of a number of tools, ranging from transport network models and social computable general equilibrium models used in the practical assessment of transport policy in Europe. We analyze the ex-post model results in order to determine if competitiveness and regional growth are taken into account to a large extent by those tools and to formulate some improvements.

Finally we provide some recommendations to the European Commission on making political intervention in order to enhance competitiveness of Europe both externally, i.e. in relation to the rest of the world and internally, i.e. between its countries and regions.

2. Issues of Competitiveness: Definition and Determining Factors

The World Economic Forum has for many years been using the same competitiveness definition in its yearly reports on competitiveness at the country level, i.e *.the set of institutions, policies, and factors that determine the level of productivity of a country* (Porter et al., 2007, Schwab & Sala-i-Martín, 2012, p. 4)

Three main characteristics of this definition are its briefness, its non-inclusion of the consequences of being competitive and its closeness to an economists' interpretation, i.e. in competition, productivity is what decides who will gain the upper hand. This is the definition upon which we base our own, with one modification. Even if it looks exhaustive, in our view, the first two determinants, namely institutions and policies are subsumed into the third one, i.e. "factors" which we consider as a hold-all category.

In this study we define competitiveness as: *the extent to which firms in a particular region can compete with those elsewhere. Critical factors for competitiveness are those that determine the level of productivity in a region in relation to other regions.*

In this definition, we understand 'compete with firms elsewhere' to mean that they "produce goods and services that meet the test of international markets". Other key elements of the definition are firms, region, and productivity.

Firms and other individual units such as entrepreneurs, employees are key actors of competitiveness. Regions on the other hand are not key actors but only a construct. Therefore our definition explicitly reads "firms in a region".

Furthermore competitiveness can be considered at any regional scale – nations, supranational bodies (such as the EU), and at any subnational level. Since institutions are generally assumed to play a role in regional competitiveness (Rodrik et al., 2004) a regional level without governmental institutions may be less appropriate. However, any spatial grouping of firms can be analyzed. In this study, as seen later on in the analysis of cases, we particularly looked at the subnational level, since this is where infrastructural investments take place. At the European scale, several large investments cover multiple sub-national regions. Yet in the end, these also amount to a string of regions that are connected, and within a country or a group of countries, the positive effects of these investments are invariably found in some places and not in others. Of course, these local effects can easily be added up to calculate a national or European effect; in fact, large-scale infrastructure investments in European regions are mostly intended to benefit the Union or even the continent as a whole.

Finally, the core concept in competition is a productivity difference. Classical economic models assume that such differences across regions do not exist. It was with the introduction of so-called endogenous growth models that structural differences in productivity were acknowledged. Technically, in these models regions (most often countries) evolve over time towards an estimated steady-state, which is predicted from region-specific factors.

Gardiner et al. 2004 organize competitiveness in a triangle (partly based on Lengyel, 2004), which we reproduce Figure 1. Gardiner et al. acknowledge the position of living standards and quality of life as a "target outcome" – hence, not part of competitiveness per se. Competitiveness itself is revealed in term of labour productivity, lack of unemployment and a high regional GDP ("Gross Regional Product" or GRP), and these also are not the knobs that policy can turn. The factors that actually constitute competitiveness, and we could call these the "critical" factors or success determinants, are found at the bottom of their pyramid: these are culture, human capital ("skills"), accessibility, and some others. We see that accessibility is listed as factors or determinants that contribute to the (regional) competitiveness. The accessibility, transport networks and geographical location of successful regions seem to be more advantageous than that of other regions.

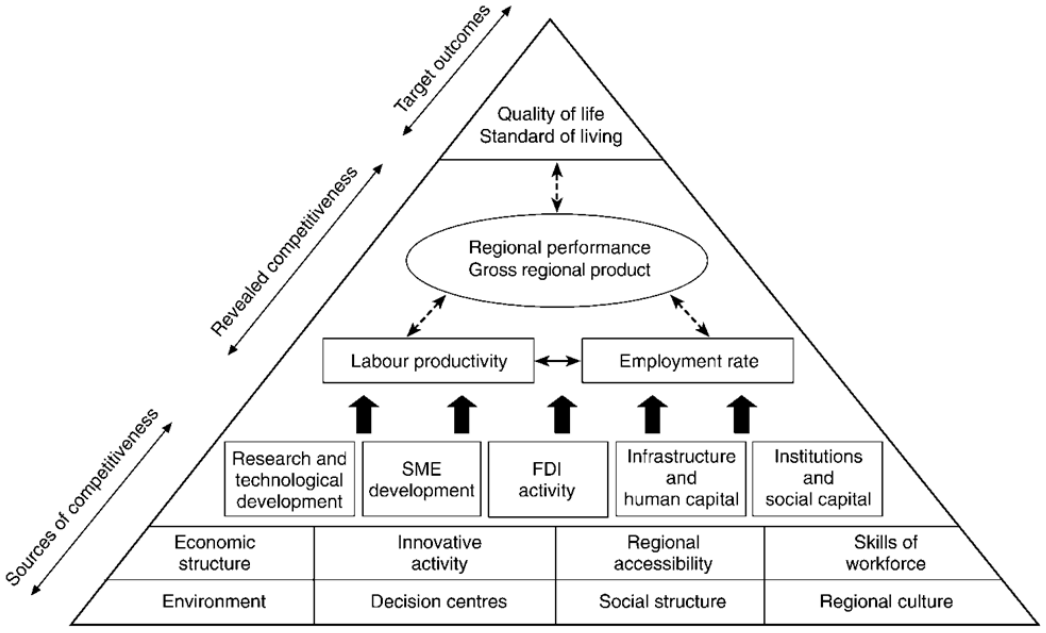

Figure 1Competitiveness triangle of Gardiner et al. (2004)

Concerning the development factors, Lengyel mentions factors that together provide an indication for the regional competitiveness. These indicators comprise research and technological development (RTD), small and medium sized enterprises (SME), foreign direct investment (FDI), infrastructure and human capital, and institutions and social capital. Infrastructure is regarded as to serve competitiveness rather than improve competitiveness, by catering the needs of local sectors and clusters.

Competitiveness itself has been a central preoccupation of both advanced and developing countries for a long time (Porter, 1990). Thus, many indices, models and indicators have been proposed in the literature to measure national and regional competitiveness. However, it has been argued that single measures of competitiveness do not capture all the elements. Instead, composite indicators are proposed. Although there are many indices in the literature, there exist three leading composite indicators that measure national competitiveness: (i) The IMD's World Competitiveness Yearbook indicator where transport infrastructure investment is measured in term of basic infrastructure sub-factor through variables such as access to commodities, network density, availability of infrastructures, (ii) the WEF's Global Competitiveness indicator where transport infrastructure investments is contained in its second pillar and where the extensive and efficient transport infrastructure is considered critical for ensuring the effective functioning of the economy, among others determining location and type of economic activities, reducing the effect of distance between regions, integrating the national market connecting it at low cost to other markets, ensuring access of less-developed communities to core economic activities and services, and enabling entrepreneurs to get their goods and services to market in a secure and timely manner and facilitate the movement of workers to the most suitable jobs and finally (iii) Cambridge Econometrics that considers that adequate infrastructure capacity including appropriate transport networks is important to support various activities within a region which induces region's productivity as the main GDP per capita driver.

3. Relationship between transport infrastructure investment and competitiveness

The link between the transport sector and the rest of the economy has been recently discussed extensively in the economic literature for a number of reasons. Two are worth mentioning when the welfare effects of transport infrastructure improvements at an aggregate level are compared to those arising in the transport sector itself.

On one hand, an intense debate at an empirical level was initiated by Aschauer (1989) in a study on the elasticity of aggregate output with respect to public capital. A key role is given in this literature to "core-infrastructure", of which roads, ports and railways are major components. Once elasticities are used to calculate public capital social rates of return, an excess with respect to private capital returns is found and usually explained as reflecting aggregate general equilibrium effects not accounted for in traditional cost-benefit analysis (CBA).

On the other hand, and coincidentally at a similar time, developments towards a more formal spatial economic theory starting with Krugman (1991). Krugman gave transport costs a central role in determining the configuration of the economy through the influence on workers and firm's location decisions, trade flows and regional incomes. Some recent papers have used these theoretical developments, usually dubbed as new economic geography (NEG), to construct and calibrate models addressing the economy-wide benefits arising from improvements in transport infrastructure, to compare them later with benefit estimations arising from a conventional CBA exercise.

Based on these economic literature works and other results of economic researches especially taken from IMD World Competitiveness, WEF's Global Competitiveness Index, and Cambridge Econometrics we can focus the role of transport infrastructure investment on competitiveness on questions of accessibility and connectivity. This approach is also in line with Docherty et al., (2009), and Vickerman (1989 and 1995) who state that the discussion of the role of transport infrastructure in national and regional competitiveness usually concentrates on questions of accessibility and connectivity.

As documented in Kiel et al. (2013), we define few criteria for the choice of a suitable accessibility measure. The selected measure should (i) include a spatial level (location, region, nation), (ii) include both the supply and demand side of a location, (iii) include both freight and passenger transport, (iv) contain the economic value in order to ease the link to economic variables such as GDP, and finally (v) be fit for use in forecasts.

4. Current practices in appraisal approaches

The second objective of our study is to synthesize some proposed improvement of the methodology used to assess the impacts of investment in transport infrastructures especially on competitiveness and economic growth. One indispensable step that we perform before proceeding with the synthesis is to analyse the current practices in appraisal approaches.

One of the most established approach used to assess transport infrastructure projects is the conventional Cost-Benefit Analysis (CBA). This approach usually focuses on the direct effects that arise in transport markets, and therefore the derived impacts on competitiveness and growth as driven from direct effects are better known. Nevertheless there are also other effects known as indirect effects and wider economic impacts. Therefore we have proceeded by compiling data about 25 transport infrastructure projects in Europe for which CBA is publicly available (either ex-ante and/or ex-post analysis). This database allows us to identify the direct effects that arise in transport markets and accordingly, the wider economic impacts.

Table 1Case studies database

No.	Project name	Short Remarks	Country/Countries	European region
1	Amsterdam Orbital	Completion of the A10 orbital by opening of Zeeburgertunnel	Netherlands	Western
2	Betuweroute	Freight Rail	Netherlands, Germany	Western
3	HSL Zuid	High speed passenger train Amsterdam-Brussels	Netherlands, Belgium	Western
4	Eurotunnel	Railway tunnel	UK, France	Western, Northern
5	Storebelt Bridge	Road-Rail Bridge Development	Denmark	Northern
6	Spanish HSR network	Passenger high speed train	Spain	Southern
7	Malaga Airport	Airport development	Spain	Southern
8	A20 Baltic Sea Motorway	Motorway	Germany	Western
9	Magdeburg Waterway Crossing	Inland waterway	Germany	Western
10	Öresund Bridge	Motorway-railway bridge	Sweden, Denmark	Northern
11	Southern bypass of Gdańsk	Express road	Poland	Eastern
12	Gdansk Lech Walesa Airport	Airport development	Poland	Eastern
13	E-59 Poznań-Szczecin-Świnoujście	Railway line	Poland	Eastern
14	Maasvlakte 2 Rotterdam	Port development	Netherlands	Western
15	Deurganckdok Antwerp	Port development	Belgium	Western
16	Container Terminal Altenwerder, Hamburg	Port development	Germany	Western
17	Vidin-Calafat Bridge	Road-Rail Bridge Development	Bulgaria, Romania	Eastern
18	Corridor 22	Railway line	Countries on the track of the rail link between Germany and Greece	Western, Eastern, Southern
19	Iron-Rhin	Railway line	Belgium, Netherland, Germany	Western
20	Rail Baltica	Rail	Poland, Lithuania, Latvia, Estonia	Eastern
21	Twente Mittelland canal	Inland Waterway	The Netherlands	Western
22	Crossrail	Railway line	UK	Western, Northern
23	HS2	High speed rail	UK	Western, Northern

24	Außenweser shipping fairway (extension)	Waterway	Germany	Western
25	Stichkanal Hannover-Linden (extension)	Inland waterway	Germany	Western

Based on our analysis we identify several variables which are considered as wider economic impacts of transport infrastructure projects in one or more cases above. Among these variables are the impacts of transport infrastructure on: employment, international accessibility, business situation (represented in some cases by the change of office rental prices), housing prices, commuting situation, imperfect competition, and labour markets. In relation to labour market, we find that some cases make distinction between the effect of project on international employees and the movement of workers to more productive jobs. Some cases also use general equilibrium model and tools to assess the wider economic impacts of projects. Here we obtain more aggregated variables such as GDP, welfare, social impacts, consumption and aggregate employment effects.

The variety of variables shows the difficulty to clearly classify wider economic impacts and at the same time this fact increases the risk of double counting effects. Therefore, the first recommendation is to be cautious with the evaluation of these impacts.

Furthermore as part from methodological review in relation to the current practice, we also perform a review on the modelling tools used in assessment, i.e. transport models such as Basgoed (NL), Extended Riga Model (LV), GBFM (GB), LM (NL), National Transport Model (DK), Trans-tools (EU), Vaclav (EU), and WCM (EU) and several economic models, such as ASTRA (EU), CGEurope (EU), RAEM (NL), RegFin (FI), Rhomolo (BE) and SASI (EU). As reported in Kiel et al. (2013b), we can draw several conclusions.

In relation to transport models:

- We need complete information in order to assess competitiveness for regions. However most transport models provide partial information. On one hand either passenger or freight transport demand is included, on the other hand modes are missing.
- We can derive an accessibility indicator from the results of the transport models. However, due the fact that most models provide partial results, the overall accessibility to a region is difficult to assess.
- In order to assess the overall accessibility, different models need extra information, either from a passenger model or a freight model. If possible, an interface between the two is needed in order to calculate the overall accessibility of a region.
- Some transport models possess an assignment model, which is essential for accessibility. It predicts travel distance, travel time, travel costs and volumes for both passenger and freight transport. In the case of passenger transport usually congestion is taken into account, which is not the case for most freight transport models.
- From the results of almost all transport models, it is not possible to assess the impacts upon economic indicators such as GDP and employment. At least an interface and a macro-economic model are needed for this purpose. One transport model among the reviewed models includes an economic model, which allows a feedback from the transport system to the economy, and thus indicators such as GPD and employment.

In relation to economic models:

- From the input and/or output of the economic models, we can derive an accessibility indicator for regions. However, due to the aggregated level of the economic models, modes, purposes and commodities are not always included in full detail.
- Networks and assignment models are usually not part of these models. A link or interface to a transport model is needed, in order to include detailed information about travel time, distance and costs.
- The economic models are able to predict changes upon GDP and employment, due to changes in the transport system. These may include changes in transport infrastructure due to investments as well as changes due to measures like pricing. Changes in transport infrastructure usually have effect if these can be described in terms of changes in transport costs.

5. Proposed improvements in methodology

Our proposed improvement on methodology used to assess the impacts of investment in transport infrastructure can be summarized into two points: (i) combination of micro-macro modelling, and (ii) proposed improvements focusing on two points: first the linkage between transport and the final markets and second, on the impacts of projects on employment and welfare.

5.1. Combination of micro-macro modelling

Micro-models, such as CBA, and macro-models have a mutual interest in each other: on one side CBA as a micro-model is in general simple and straightforward but tends not to see the benefits of macroeconomic analysis. On the other hand assessment of wider economic effects requires the use of complicated macroeconomic models.

CBA can measure direct effects, but CBA cannot measures other "boomerang" effects via other regions and sectors. CBA might cover some indirect effects but other wider economic effects such as multiplier effects in terms of increased productivity are not and cannot be easily addressed.

Thus, it can be advantageous to use both types of models, when they are available, using the macro level for a broader quasi-dynamic and interactive context, and CBA for factors absent from the macro models, or represented there in such a stylized or deterministic way as to make them useless for predictions.

Smit et al. (2013) have noticed that there is a trend over the last years for micro- and macro-models to come together. Wegener (2011) discusses how more data, better computers and, importantly, better theory can facilitate the inclusion of more micro-elements into macro-models, so that at least policy-focused models become 'complete'. He argues in favour of multi-level models, where different policy questions relate to different spatial, temporal and conceptual levels.

A similar trend exists in the scientific literature, where traditional macro-modelling at country and regional level has been expanded with similar models based on micro-data in the past decades (e.g. Bartelsman and Doms, 2000; Smit, 2010). Traditionally, such data came from surveys and other samples; nowadays, census data offer complete datasets that can be mutually linked. For economics, this has led to Linked Employer-Employee Data or LEED (Bryson, Ford, and Barber, 2006). Such trends may allow researchers to refine and enhance any type of model, and it is difficult to foresee which will benefit most.

5.2. Focus on final market and impacts of project on employment and welfare

First, we analyse how transport markets are related to some other final markets that use transport services as an input. In this sense, the demand for transport is considered as a derived demand that follows the final market demand. Secondly, we also refer to the impact of projects on employment and to justifications based on welfare analysis in order to include such effects within a CBA framework. In the following two sub-sections we summarize both improvement focuses as described in more detail in Betancor et al., 2014.

5.2.1. Transport markets and final markets

When we apply CBA to assess a transport infrastructure project, our main focus lays on the direct effects of that infrastructure in the transport sector itself as the primary market, for example in the form of travel time reduction. If we would like to consider the impacts of that infrastructure in other (secondary) market(s) known as the indirect effects, we have to well justify these effects in order to avoid double counting.

Following Jara-Diaz (1986) and De Rus (2008 and 2010), Figure 2 can represent a situation where the final market of a given good or service and the demand for transport are shown. Both markets are assumed to be competitive. With c representing the cost (or generalized price) of transport and q0, or the equilibrium quantity in the final market 1 is important to note that the area contained between the demand and supply at the final market up to the equilibrium quantity, i.e. consumer and producer surpluses, is equal to the area below the derived transport demand.

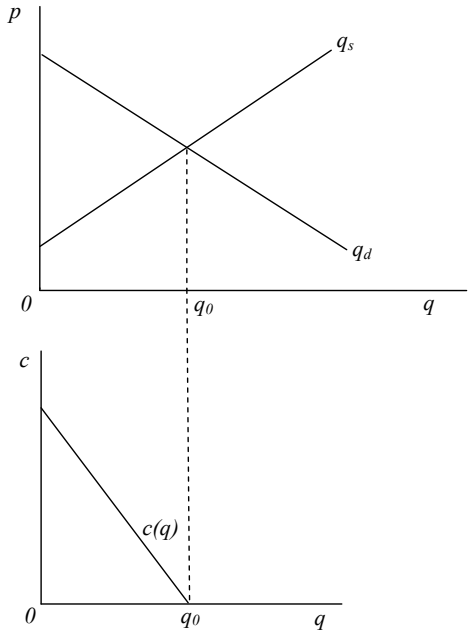

Figure 2Final markets and transport demand (Source: De Rus (2008))

Hence, if a transport project is implemented this will imply a change in the consumer surplus in the transport market, what in turn, will be reflecting a change in consumer and producer surpluses in the final market. Therefore, if both markets are competitive, the correct CBA approach will include only the effects in one of those markets, usually the change in the consumer surplus in the transport market.

Therefore, we have identified two cases in which we should care about the transport project effects upon final markets: first, when the final market is not competitive. In that case the project will have an impact on the inefficiency of those markets that needs to be considered within the assessment (see Jara-Diaz, 1986, and De Rus, 2010, for further analysis) and second, when the affected consumers are not of interest from the point of view of the project assessment according to the nature of funding. This is for example a case in which the affected consumers are from outside the European Union in a project funded at a European level. In this case, the evaluator will not have to include changes in consumer surplus appearing either at the transport market or at the final market, but will have to focus on the impact on the producer surplus at the final market.

5.2.2. Impacts of project on employment and welfare

De Rus (2010) proposes to consider a simplified economy in which we can identify six groups of economic agents: consumers, owners of capital, owners of labour, owners of land, taxpayers and the rest of the society. Under this approach one individual might belong to different groups with all groups being equally weighted. Further, the traditional approach based on the producer surplus is substituted by a situation in which the owners of production factors are perfectly identified. Hence, the social welfare will be given by the addition of all agents' surpluses, as shown in the following expression:

$$SW = CS + GS + OS + LS + RS + ES \qquad (1)$$

Where:

SW= social welfare.

CS= consumers surplus, or the difference between willingness to pay and what is actually paid.

GS=tax payer surplus or tax revenues minus public expenditure in relation to the project.

OS= owners of capital surplus, or the difference between firm revenues and variable costs.

LS= owners of labour surplus, or the difference between revenues from labour minus the opportunity cost of labour.

RS= owners of land surplus, or the difference between revenues from land minus the opportunity cost of land.

ES= other agents surplus, or the value of external effects.

The owners of labour, or labour force, are affected by the project and they will always be better off as long as the project increases their surplus. Hence, the analysis emphasizes the labour force surplus, and not the number of workers. Moreover, if all economic agents involved in the project assessment are equally weighted the society will observe a welfare increase as long as the sum of different surpluses increases, with the labour surplus being just one component.

Furthermore when the project is big enough, and if we assumed that the labour market is competitive, the implementation of such project will shift demand for labour to the right. The competitive equilibrium wage will increase as well as the number of equilibrium workers, resulting into three types of effects:

- Deviated labour: this is the amount of labour that is deviated from other sectors to the project. It is not clear whether these workers are better or worse off with the project, as they can shift between activities voluntarily or involuntarily.
- Voluntary unemployment: these are the people that before the project were not participating in the labour market and that after the increase in wages decide to participate. These workers clearly observe an increase in their surplus due to the project.
- Involuntary unemployment: these are the people that before the project were not working and that after the increase in the labour demand start working. Involuntary unemployment appears at labour markets under disequilibrium conditions, and is also expected to observe an increase in their surplus as result of the project.

While the project implies a positive effect for voluntary and involuntary unemployed workers the effect on deviated workers is ambiguous. Thus, an increase in the number of workers due to the project may increase the labour surplus or not. Moreover, an increase in the labour surplus does not necessarily imply an increase in social welfare. However, if there are market imperfections or interventions (e.g. monopsony or minimum wages), or inefficiencies associated with the labour market (e.g. unemployment subsidies that are obtained through distortionary taxation) the increase on the number of workers due to the project can be welfare enhancing.

We apply both suggested improvement for the case of the Malaga airport enlargement (case no 7 - Table 1) and the Spanish High Speed Railway Networks (case no 6 - Table 1).

In the first case, the Malaga Airport, we see how infrastructure projects may provide additional employment generation. This application shows how to estimate such employment generation due to an airport enlargement. The methodology is based on two steps. The first step deals with the impact on arrivals which are modelled with time series analysis. The second step shows how such arrivals provide gross added value (GAV) and employment. Key linkages among these variables are provided by National Accounts, in particular with Input-Output Analysis, Satellite Accounts, or Computable General Equilibrium. The effects on GAV and employment are especially relevant when the airport enlargement is capable to attract international tourists.

In the second case, the Spanish HSR Networks we quantify the potential impact on employment density that might arise from infrastructure provision. In particular we examine the effect that the construction of high-speed lines has had on employment density in the municipalities close to the network.

More detailed discussion on the above two case studies is available in Betancor et al. (2014).

6. Recommendations on assessing European Union (EU) policy in transport infrastructure investment

All countries face the basic economic problem of allocating scarce resources among competing uses in a way that maximizes the net benefits to the society. In assessing the transport infrastructure projects, it is essential to clearly specify the goals they are designed to achieve. Both economic research and EU policy documents – prove that transport infrastructure investments are considered to be an important variable when measuring regional or national competitiveness.

The inclusion of indirect effects in an economic assessment of investment projects allows for a more complete, more accurate assessment of the expected effects generated by transport infrastructure investments. But the problem of wider economic benefits (WEB) is a complex one. For WEBs to be accounted for specific challenges in current transport assessments need to be tackled first. Firstly the existing modelling schemes used across Europe to model transport need to be amended to incorporate the idea of WEBs. Secondly a link between WEBs and competitiveness could only be established if both sides of this relation are accounted for. If one has to measure WEBs one is also challenged to properly measure competitiveness. There is also certainly need to steer EU transport policy into better acknowledgement of the role of WEBs. Finally there is a question of how WEBs should be measured while making appraisals and decisions on transport infrastructure investments.

There is a trend over the last years for micro- and macro-models to come together. Wegener discusses how more data, better computers and, importantly, better theory facilitates the inclusion of more micro-elements into macro models (Wegener 2011), so that at least policy-focused models become 'complete'. He argues in favour of multi-level models, where different policy questions relate to different spatial, temporal and conceptual levels. A similar trend exists in the scientific literature, where traditional macro-modelling at country and regional level has been expanded with similar models based on micro data in the past decades. We summarize our recommendations as follow:

- On modelling, first to focus on archiving model, input, documents and model results that will allow future reproduction or recalculation of the results. We recommend also that these elements should be available to public (as well as the appraisal documents) for large infrastructure projects or infrastructure projects that are co-financed by the European Commission. Second, to use a good modelling practice (GMP) for transport and economic models that have been elaborated that takes into account five aspects, i.e. model organization, model project, model development, model testing and model application.
- On the goals on policy documents: to include competitiveness objective as a primary goal while removing contradictory goals from policy documents.
- To review transport sector policies in view of competitiveness objective as well as to identify policies which will support competition policy and establish interrelation between them, i.e. competitiveness and transport infrastructure
- To standardize current assessment methodology whenever possible to include wider economic effects in the procedures including the condition when to assess the effects and to make it operational at country or regional level.
- And finally to propose the following measures in order to assess the relation between transport infrastructure investments and competitiveness and to monitor the achievements in these areas: (1) Accessibility index; (2) Transport infrastructure endowment index; (3) House rental prices/Office rental prices; (4) Reduction of CO_2, NO_x, SO_x; (5) Reduction of noise level; (6) Employment growth in short and long term [%]; (7) Increasing labour supply; (8) Increasing GDP per capita; (9) Increasing productivity; (10) Increasing new business density; (11) Increasing number of enterprises in certain sectors; (12) Market price reduction; (13) Growth of FDI inflows; (14) Increasing export of goods and services as a percentage of GDP.

7. Conclusion

Competitiveness is among one of the wider economic benefits of transport infrastructure investment. In this study we define competitiveness as the extent to which firms in a particular region can compete with those elsewhere. Competitiveness itself is revealed in many aspects. Among the most significant aspects are labour productivity, employment and gross regional product.

Based on economic literature works including formal spatial economic theory and other results of economic researches such as IMD World Competitiveness, WEF's Global Competitiveness Index, and Cambridge Econometrics we can focus the role of transport infrastructure investment on competitiveness on questions of accessibility and connectivity.

We analyze the current practice of transport infrastructure project assessment in term of methodology and tools through the use of a set of selected transport infrastructure project cases in Europe. Based on this case study analysis

we propose some improvements on methodology. First, we recommend a combination of micro-macro modelling and second we suggest to put emphasize on two aspects, i.e. (i) the linkage between transport and final markets and (ii) on the impacts of projects on labour surplus.

First on micro-macro modelling: micro-models and macro-models have a mutual interest in each other. On one side CBA as a micro-model is in general simple and straightforward but tends not to see the benefits of macroeconomic analysis. On the other hand assessment of wider economic effects requires the use of complicated macroeconomic models.

On the focus on the linkage between transport and the final market: we point out two cases in which we should care about the transport project effects, namely (i) when the final market is not competitive so that projects will have an impact on the inefficiency of those markets and (ii) when the affected consumers are not of interest from the point of view of project assessment according to the nature of funding. Finally in term of project impacts on unemployment: we suggest that analysis emphasizes on the labour force surplus, and rather than on the number of workers. This is a very important distinction for the purpose of project assessment. Moreover, when all economic agents involved in the project assessment are equally weighted the society will observe a welfare increase as long as the sum of different surpluses increases, with the labour surplus being just one component.

Finally in our recommendations on assessing European Union policy in transport infrastructure investment, among others we emphasize the importance of ability to reproduce or recalculation of the assessment results of large infrastructure projects or projects that are co-financed by the European Commission and that model, inputs and all related documents be available to public. We recommend also to standardize current assessment methodology whenever possible to include wider economic effects in the procedures including the condition when to assess the effects and to make it operational at country or regional level. At the end we propose to apply the following measures in order to assess the relation between transport infrastructure investments and competitiveness and to monitor the achievements in some identified areas, i.e. accessibility index, transport infrastructure endowment index, house rental prices/Office rental prices, reduction of emission and noise level, employment growth and labour supply, growth of GDP per capita, productivity, new business density, number of enterprises, FDI inflows, export of goods and service and finally reduction in market price.

Acknowledgements

This paper is based on the I-C-EU project results. I-C-EU stands for Impact of transport infrastructure on international competitiveness of Europe and has been a project funded by the European Commission (Directorate General - Research and Innovation) in the 7th Framework Programme.

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