

Towards harmonisation of indirect effects in transport project appraisal

Guidelines and current practice in Europe: miles apart

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Abstract

Indirect effects can be determining factors in cost-benefit analysis. They are particularly interesting because they are caused by changes in market imperfections and borders – two highly relevant European issues. Harmonisation could lead to greater transparency and more inclusive transport project appraisal. In this paper we confront theoretical insights with current practice. It turns out that they are miles apart.

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1. Introduction

Harmonisation of transport project appraisal could deliver vast advantages from a welfare-theoretic point of view. A European approach does not have the distorting effect country borders have on the size of positive project benefits. Furthermore, a single European approach provides a more transparent cost appraisal which will allow different CBA's to be compared. This is important, as many transport projects suffer, *ex ante*, from overly optimistic cost estimations (Sten Pedersen 2005; Flyvbjerg, 2005). Although direct effects are, obviously, central in the harmonisation discussion, the decisive factor in the ultimate decision to invest or not to invest in a large scale infrastructure project are, in many cases, the indirect effects such as employment, the land market or the housing market. Because of a lack of consistency and structure in the assessment of these effects, an arbitrary unsubstantiated value can easily be attributed to these effects. This obscures and deviates the discussion concerning assessment: does the project under consideration improve societal welfare?

In this paper we attempt to take a first step in the harmonisation of indirect effects in transport appraisal. We do this by providing a theoretical framework for indirect effects as well as discussing current practice in EU countries. Questions to be answered include "which effects should be included in what way?" and "how to avoid double counting?". We do not aim for a proposal for quantified indicators at a European level, which would be overambitious regarding current practice. Even at a national level, valuation indicators in the area of indirect socio-economic effects are limited or simply non-existent.

The contents of this paper are as follows. We first provide a framework for analysing indirect effects. Secondly, we discuss how and to which extent two different typical European models (SASI and CGEurope) used for the assessment of indirect effects of transport policy incorporate these effects. Furthermore we discuss how indirect socio-economic effects are currently treated in the Netherlands, the UK, Germany, Japan and the US. Next, we present results from a European-wide survey among policymakers. Conclusively, a comparison is made between theory and practice.

2. Types of effects

Which effects can be considered indirect effects? To answer this question, it is important to distinguish types of socio-economic effects of transport projects in a clear way. Otherwise, the risk of double counting is introduced: counting overlapping effects can give overly optimistic views on projects, or the opposite, none of which is desired. Results from the EU's IASON project provide a useful typology to make the required distinction (Tavasszy et al, 2004).

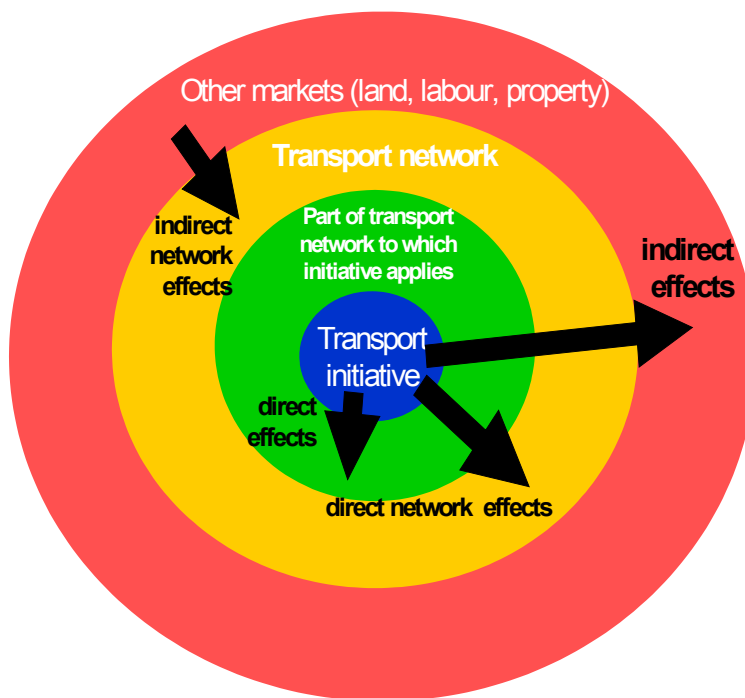


Figure 1. Schematic typology of types of effects caused by transport initiatives

Direct effects: effects on behavioural choice within the transport system (route choice, mode choice, departure time choice and destination choice), by users of that part of the network to which the initiative applies (e.g., the amount of users of a newly planned road)

Direct network effects: effects on behavioural choice within the transport system (route choice, mode choice, departure time choice and destination choice), transferred by

network flows to other users of the network who are not themselves users of the part of the network to which the initiative applies (e.g. the change in train use in the area where the new road is planned)

Indirect effects: effects outside the transport market as the result of a transport initiative, typically including the changes in output, employment and residential population at particular locations implied by the choices described above (e.g. households moving to a city because it has better connections to their work due to a new road)

Indirect network effects: effects on the transport network of choices made in other markets (land and property markets, the labour market, product markets and the capital market), as a result of changes in generalised cost brought about by a transport initiative (e.g. the changed traffic flow within a city due to more households locating in the city because of a new road)

In other words, indirect effects concern markets other than the transport market – product markets, the labour market, the land market. As effects on income distribution, public finance, cohesion, and urbanisation are mostly classified under indirect effects as well, one might distinguish indirect effects that take place in markets from those that do not concern markets but rather economic outcomes.

In the remainder of this section, however, we will focus on indirect effects that take place in markets. We will first provide a framework for analysis of indirect effects.

The degree to which indirect effects are additional to direct effects differs widely in the literature. Additivity in this sense means the extent to which indirect effects add to direct effects in terms of costs and benefits. If indirect effects run contrary to direct effects, the term subadditivity is used.

Elhorst et al. conclude that direct effects are the most important in a CBA, as, in a general sense, indirect effects are rarely larger than 30% or smaller than 10% of direct effects. Two prerequisites are identified for indirect effects to exist: market imperfections and cross-border effects.

The essence of *market imperfections* is that the supply side price is unequal to the marginal societal cost, or that demand price is unequal to marginal societal benefit. This

may exist in product, labour and land markets (the land market is assumed to include the real estate market). If no market imperfections exist, the benefits within the transport market can be assumed equal to the benefits in the economy as a whole (Standing Advisory Committee on Trunk Road Appraisal, 1999, pp. 9). Pollution by traffic is a simple example of this: the supply side price of traffic (fuel) does not incorporate exhaust emissions, but they do form part of the marginal societal cost of traffic. An environmental tax on fuel might thus increase societal welfare as it internalises the cost borne by society to the user of the fuel. Other examples of market imperfections are incomplete markets, information asymmetry and hold-up problems. The indirect effects in markets with imperfections caused by transport initiatives may be positive or negative, to the degree that they render imperfections smaller or larger in markets outside the transport market.

Cross-border effects apply to distribution of costs and/or benefits between the country in which the transport project is carried out and other (in most cases: neighbouring) countries. Cross-border effects can be more clearly addressed when a distinction is made between direct project and network effects, indirect network effects and external effects (e.g. air pollution in other countries) on the one hand, and indirect economic effects on the other. Direct project and network effects consider the effect of the use of the transport system by foreign citizens and companies. The question here is whether direct project and network effects are transmitted, via markets other than the transport market, to domestic or to foreign citizens and companies (Elhorst et al, 2004, pp 16). In France, for example, this type of effects is approached as a negative effect, as benefits of the transport projects are ‘leaking away’ to another country, e.g. when a motorway is constructed close to the border and renders road transport in a neighbouring country faster.

3. The case for harmonisation

Now, to which extent are indirect effects relevant in the European context? To find an answer to that question, we should apply the causes for indirect effects in the European setting. First, market imperfections seem to play a relatively important role in Europe. In product markets, outward protection via import barriers is an important policy instrument

(for example, to protect European textiles industries from competition from China). Agricultural markets are, perhaps, the most significant: the EU keeps world prices high by imposing considerable import barriers and guaranteeing minimum prices to its farmers, and then dumping the excess supply on the world market, knocking out competition from other continents. By contrast, the internal market in the EU is free. Nevertheless, lack of competition from outside the EU and price manipulation can be qualified as market imperfections.

The labour market is almost by definition full of imperfections, but relative unemployment figures for Europe indicate that, to say the least, supply does not match demand very well. Notable examples of market imperfections include income tax, lay-off protection, minimum wages, social insurance, labour subsidies. As well, labour supply is highly segmented and hence not flexibly employable. A typically European rigidity, moreover, is the low level of labour mobility: workers (except, perhaps, the highly educated) are not willing to move to another country (sometimes not even to another region within their country of origin) for another job.

The same concerns the land market, be it from a somewhat more theoretical point of view. The land market is characterised by external effects: those using land will easily affect the well-being of those using neighbouring lands. Examples include noise and visual hindrance. Another factor influencing the land market is spatial planning – which is highly developed in Europe. It mostly puts restrictions on the different purposes to which land can be used. This might as well increase or decrease market imperfections. Last but not least, subsidies for developing and using land cause market imperfections as well (Elhorst et al. 2004, pp. 54-5).

Harmonisation in a European context would deliver a single method for appraisal of indirect effects; these, in turn, can help to make market imperfections more transparent.

The case for harmonizing transport project appraisal becomes even more apparent when we look at the second source for indirect effects: borders. For example, if a road in country A is used by citizens of country B, the effect of the latter citizens doing so is currently not taken into account. Harmonisation of method would allow for more transparency, Secondly, harmonisation of projects reduces the length of borders involved.

Not the internal national borders will be defining but the EU-borders. It goes without saying that these are far shorter than the national borders taken together. Furthermore, an integral assessment of benefits enables a corresponding division of costs, that is to say, of finance.

4. Current practice

4.1 Models

To avoid double counting, it is crucial to distinguish the sources of genuine additionality to direct effects (Mackie et al, 2001, pp. 18). The starting point of the analysis should therefore be markets with perfect competition (constant returns to scale, no externalities) without borders. In this situation, no indirect effects exist whatsoever. From this starting point one can assess market imperfections such as monopoly, monopsony, increasing returns to scale, externalities, information asymmetry, etc. It is thus important that market failure is reflected in models used for transport project appraisal. The same line of thinking applies to borders.

Now, how is this carried out in practice? For illustration, we discuss two state-of-the-art models developed within the IASON-framework, SASI and CGEurope.

Table 1. Coverage of indirect effects in SASI and CGEurope

Model	Product markets			Labour market: rigidities			Knowledge & innovation: spillovers (external effects)	International effects		Land market: spatial policy restrictions and subsidies		Cost of tax collection
	Price ≠ marginal costs	Economies of scale	Product differentiation	Matching supply/demand	Geographical scope			Direct relocation production & work	Macroeconomic feedback	companies	housing	
					qualitative	quantitative						
SASI	+	++	0	+	0	0	0	++	+	+	+	0
CGEurope	++	+++	+++	+	+	+	0	++	+	+	0	0

0 = not taking into account market imperfections, additional welfare effects cannot be identified from indirect effects

+ = not taking into account market imperfections, additional welfare effects can be identified from indirect effects (danger of double counting!)

++ = taking into account market imperfection in a simple way (ad hoc)

+++ = taking into account market imperfections in modelling in an explicit and theoretically correct manner

Source: Elhorst et al (2004), pp. 47.

The SASI model

This model, developed within the IASON-framework, is described as a quasi-production function model. The main focus of the model is on the spatial effects of major changes in transport infrastructure and pricing policy. To measure the spatial effects, Europe is divided in 1341 regions. Boundaries exist in the model on economic and demographic developments in Europe. Because of this, SASI delivers distributive effects, not generative effects. The model explains the regional distribution of production, which is determined by the production factors labour, capital, knowledge and regional accessibility. In the long run these are all assumed to be flexible. Account is thus taken of regional migration by companies and citizens, hence regional unemployment can be measured as well. Effects of incomplete competition can be added to change in production ex post per sector per region. No account is taken of economies of scale, neither of product differentiation (and hence monopolistic competition). On the basis of the changes in employment and labour supply the model generates, additional matching costs on the labour market can be calculated ex post. A distinction is made between levels

of education; it is unclear, however, whether these are used in the production function. The model takes account of change in participation levels, depending on the regional number of available jobs (or, opposite, on the level of unemployment) in the previous year. The fact that macro feedback on the labour market is used enables good distributive estimations. Production redistribution incorporates foreign regions. The model does not include a land market, but the effects of change in the pressure on land due to migrating firms and citizens can be estimated ex post via relocation of production and migration of households.

All in all, this model seems appropriate to look at equity effects (the outcomes identified in section 3.3) rather than large generative effects (Tavasszy et al 2004, pp. 7). It is, however, possible to review economies of scale and relocation of production and work on an ad hoc basis.

The CGEurope model

In the general equilibrium model CGEurope, the world is divided in 1341 regions (same regional detail as SASI), connected to each other via endogenous trade relations. The model assumes monopolistic competition in six sectors with tradable goods. Interventions like product-specific taxes and subsidies can be added. The production function assumes increasing returns to scale; the degree to which these operate depends on the level of competition. Because of limited forward and backward linkages, economies of scale are transmitted and agglomeration effects appear. The labour market is assumed to clear completely by adjustable wages. Labour mobility is assumed non-existent (this appears to be coherent to a large degree with EU practice). Like the SASI model, the model does not include a land market. Because CGEurope is a general equilibrium model, effects appear immediately and not gradually over time. According to Elhorst et al (2004, pp. 59) the model can be used very well for all types of infrastructure. Like the SASI model, however, rigidities in the labour and land market, and hence indirect effects, do not appear to get full coverage.

These two examples illustrate that market imperfections in product markets seem to get good coverage. Cross-border effects are well developed as well. Land and labour markets, by comparison, appear not to be completely included.

4.1 Current practice in 5 countries

We now discuss shortly how transport initiatives are evaluated in five countries: the Netherlands, the UK, Germany, Japan and the United States.

Netherlands

In 2000 the project OEEI (*Onderzoeksprogramma Economische Effecten Infrastructuur*; the acronym was later changed to OEI, as the word ‘Economic’ was erased to stress the fact that the guidelines deal with all effects of transport projects, not just the economic ones) project was finished. It aimed at providing a standard for carrying out CBA’s. This standard was called *OEI-leidraad*. In the following years, the OEEI standard was applied to all major infrastructure projects in the Netherlands. The goal of the project was to achieve more agreement about the methodological framework, and to define instruments for determination of effects.

An evaluation of experiences with the standard was published in 2002. It revealed that all parties concerned were quite pleased with the standard. However, many possible improvements to the standard were identified, with regard to indirect effects as well:

- Pinpointing indirect effects in a theoretical, empirical and pragmatic sense
- Quantifying and monetising external effects
- Standardising more issues (e.g. rest value, risk valuation)
- Improvement of instruments for estimating socio-economic effects

With respect to the contribution to decision-making, it was concluded that costs and benefits that cannot be monetised tend to be ignored by decision-makers.

Nevertheless, most CBA’s have dealt with indirect effects since OEI was implemented. The international effects of projects should get more attention in CBA’s (Buck 2002, pp.

20-4); more should be known about indirect effects that are as yet difficult to model: image-, cluster- and agglomeration economies. Empirical research into the labour- and housing market would be very useful in that respect (Buck, 2002, pp. 31-2).

UK

The UK has an MCA in which the partial CBA plays an important role. CBA is compulsory for motorways (an identical framework is being set up for other modalities of transport). Indirect effects are, however, not quantified. The method mentions indirect effects; assessments should point to which degree projects foster development of backward regions. Furthermore it is qualitatively evaluated to which extent a project contributes to government policy. Likewise, external effects are only assessed in a qualitative manner. CO₂, noise and local air pollution are identified as external effects. Harmonisation of evaluation criteria has contributed to transparency, and has fostered the role of CBA in decision-making (Dings et al (2000), pp. 29-34; Standing Advisory Committee on Trunk Road Appraisal, 1999).

Germany

The *Bundesverkehrswegeplan* (BVWP, 1992) describes a partial CBA which is not compulsory but has widespread support. It is mainly used to discriminate between infrastructure projects in states and to decide whether federal funds are used or not. It was modified in 2003 (see BVWP 2003). Issues not monetised (which have to be described qualitatively in the MCA) include damage to the environment, ecological damage, effects on urban development and certain project-specific criteria. The BVWP is meant to develop a coherent transport investment programme every 5 years.

Concerning indirect effects, particularly in job creation some forward and backward linkages are included. Experts argue that the way in which indirect effects are included results in double counting (Dings et al 2000, pp. 22-4).

Japan

In Japan, a two-level appraisal system of guidelines for the appraisal of CBA is used. In the first stage, certain guidelines are used to determine the benefits/cost ratio. If this ratio is lower than 1,5 a second appraisal (which is in progress) is applied. The extra effects are grouped in three categories:

- extension of cost-benefit items;
- regional factors as distributive weights;
- MCA.

Identified indirect effects include price changes in commodity markets, price changes in land markets and wage changes in labour markets; there is, however, no integral assessment of indirect socio-economic effects (Burgess et al, 2004, pp. 19-20). The types of effects mentioned are only parts of the total indirect effects picture.

USA

In the USA, only environmental effects of transport projects are assessed as required by the National Environmental Protection Act (NEPA). It is required for most transport projects. Other than that, no guidelines for assessing indirect effects exist. The exact structure of assessment differs by state. The scope is on user benefits (see American Association of State Highway and Transportation Officials 2003, pp. 1; Burgess et al 2004, pp. 21).

4.3 Survey

In this section we provide results from a survey on current appraisal practice. 26 countries were surveyed with a number of questions concerning the assessment of indirect effects. The survey focused on three topics:

1. Are indirect effects included in the appraisal according to national guidelines?
2. How is double counting of effects avoided?
3. Which effects are covered, which methods used?

The types of indirect socio-economic effects distinguished include

- land use
- economic development
- employment (short term)
- employment (long term)
- cohesion national level
- cohesion at EU level
- urbanisation
- network effects
- effects on state finances
- equity

Following the aforementioned causes for indirect effects, it appears useful (as was described in section 2) to discriminate between indirect effects in markets, indirect effects as outcomes and network effects, and to note, however, that cross-border effects are not included in the survey.

Land use and employment tend to be the most relevant indirect effects distinguished from a market imperfections point of view. Economic development, cohesion (both national and on EU-level), urbanisation, effects on state finances and equity are outcomes rather than indirect effects. (Of course these effects are highly relevant to CBA and should be assessed as well. From a welfare-theoretic point of view, it is important to identify winners and losers in order to decide whether to compensate them or not.)

Is double counting avoided, and how?

In most countries this issue is not explicitly mentioned, but in a few countries a short rationale is given on how to avoid double counting:

- Include indirect effects only in the MCA (Czech Republic)
- Only a qualitative assessment is made of the indirect effects and therefore economic or financial results are not influenced (Latvia)

- There is no double counting because the indicators measure the compatibility with land use policy objectives or because equity issues are concerned (distribution of effects) (Switzerland)
- The impact is quantified but not monetised. Cohesion objectives and descriptions of socio-economic effects are addressed in the formal guidelines. For example, in the UK the cohesion objectives are assessed in the following way: conduct a review to assess whether it
 - a) contributes to and is consistent with Government policies
 - b) has no overall contribution to Government policies
 - c) is inconsistent with Government policies.

General coverage of assessment methods

Figure 2 gives an overview of current practice concerning the methods used for assessment of indirect effects. There are three main methods distinguished: CBA, MCA and QM (quantitative measurement). The category “Nothing” can either mean that indirect effects are not covered at all or that a qualitative assessment is used.

Figure 2 shows if indirect effects are included in the national guidelines. For example, in the figure one can see that in Denmark CBA and MCA is used for assessment of indirect effects, but that it is not included in national guidelines. It is pointed out in the official recommendations that it is important to highlight that the CBA does not take all effects into account, and it is outlined how such effects could be dealt with. However, no specific recommendations are given.

The grey areas in the figure indicate the countries that are not included in the analysis, these are only included for visual reference.

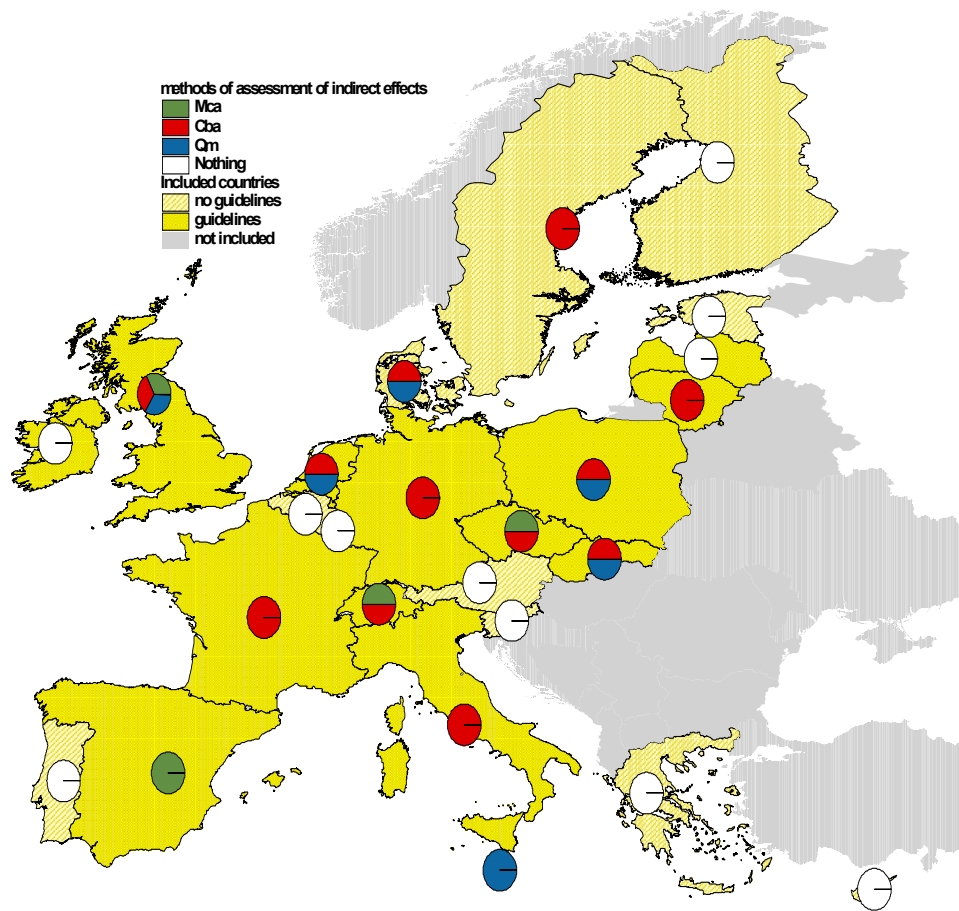


Figure 2. Coverage of guidelines and methods of assessment of socio-economic effects

Types of indirect effects covered

Figure 3 gives an overview of the effects which are included in the assessment, regardless of the method for assessment used (MCA, CBA or QM). The most included indirect effects are the effects on employment and state finances. The inclusion of cohesion effects are mainly used in the peripheral countries like Hungary, Czech Republic, Poland and Malta.

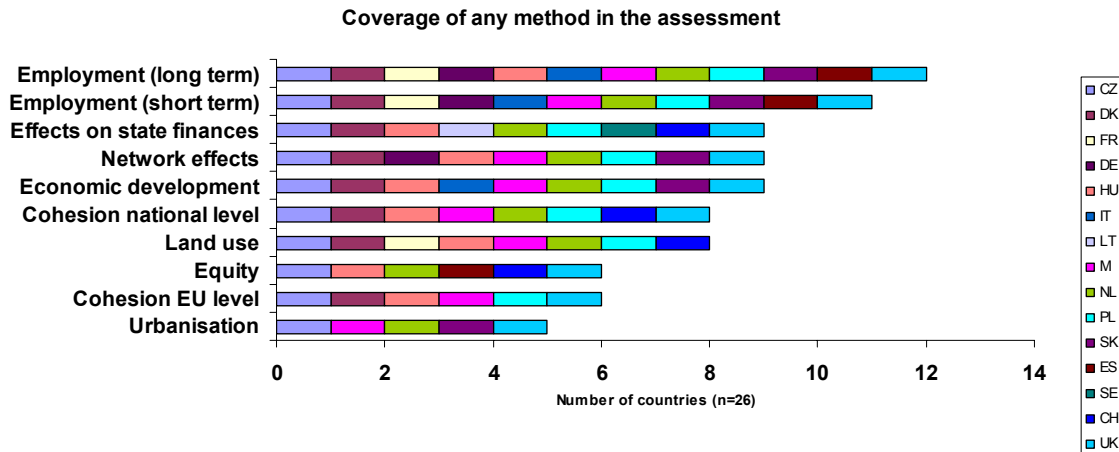


Figure 3. Overview of types of indirect effects covered by any method

In some countries specific effects are included (which are not listed in figure 3) like

- tourism, flora and fauna, landscape protection (Hungary)
- attractiveness of cities as residence, participation possibilities of population (Switzerland)
- Improved access to sea ports and airports (Germany). Valuation includes changes in transport costs and external costs as well as impacts on regional employment. The spatial impacts covered by CBA are employment effects from the construction and operation of the transport infrastructure; and the contributions to the promotion of international. Regional planning effects are taken into account outside the CBA within the framework of a specific spatial impact assessment.
- Groundwater, animal life/habitat (Denmark, Poland)
- Project specific issues (Latvia, Netherlands, Denmark, Poland)

Overview of types of effects covered in CBA

Figure 4 gives an overview of the effects which are included in CBA.

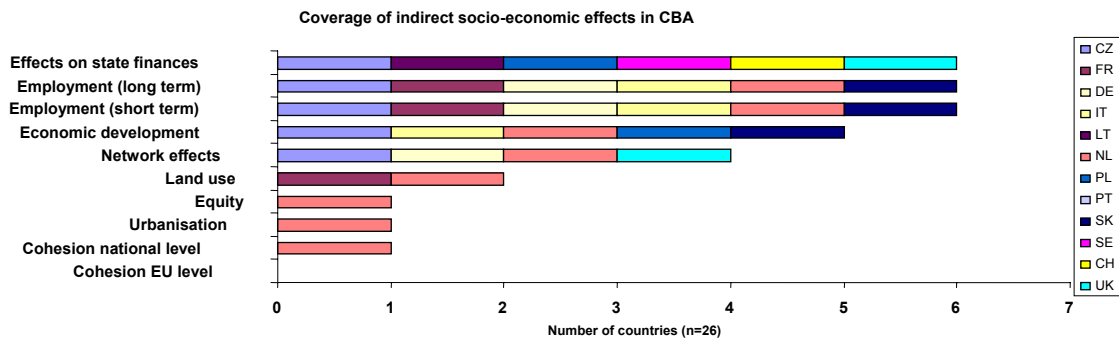


Figure 4. Coverage of indirect effects using CBA

It is interesting to note that effects on state finance and on employment (in the short as well as in the long term) are considered by and large the most relevant. Another remarkable observation from an indirect effects point of view is the low score for the land market; only two countries, France and the Netherlands, take effects in this market into account in CBA. The survey shows that six countries include the labour market (the Czech Republic, France, Germany, Italy and the Netherlands). If we take a somewhat broader view and include effects on state finances, economic development, equity and cohesion (both on national and EU-level) the conclusion is that 12 countries include indirect effects. Six countries include the effects on state finances, five include economic development, and only one (the Netherlands) includes equity, urbanisation and national cohesion.

5. Conclusion

If we confront theory and practice, what kind of picture emerges? The general picture is that of about half of the countries including indirect effects, but without specific guidelines on how to assess them. The proposed starting point for analysis, being the total absence of market disturbances and borders, is used nowhere.

The gap between theory and practice turns out to be large. Bridging this gap requires, first of all, more complete inclusion of indirect effects in CBA; secondly it is important to arrive at an unambiguous standard for all EU member countries. Regarding the state of the art in current practice, it is most realistic to concentrate on the former and discuss better inclusion of indirect effects in appraisal.

For optimal assessment of indirect effects resulting from market imperfections, it appears best to combine the advantages of different models rather than using just one model. Models do not feature standardised, complete inclusion of indirect effects so it is best to (when not constructing new models) adapt the choice of model to the type of effect (for example, urbanisation effects could need another model than labour market effects). If indirect effects cannot be modelled, qualitative assessment can be done. The same applies when model outcomes are not considered reliable.

The land market seems to be the main candidate for (further) inclusion in modelling as it clearly features market imperfections like external effects and, beyond a certain degree, a finite supply. Furthermore it would be a major step forward to integrate differences in education levels, labour mobility, and restrictions on labour in the form of taxes, rules, subsidies etc., as labour markets in general, but specifically the European labour market, incorporate many market imperfections. Making imperfections in product markets would, last but not least, contribute greatly to providing a view to the performance of the EU's internal market and market policy.

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