TRANSPORT COST BENEFIT ANALYSIS IN FRANCE: RECENT CHANGES, PROGRESS AND SHORTCOMINGS

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Transport Cost Benefit Analysis in France: Recent Changes, Progress and Shortcomings

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Abstract

This chapter deals with the situation of Cost Benefit Analysis applied to transport projects in France. The principles of the directives now in force are analysed. They are based on the Dupuit surplus, including user’s surplus, external effects and producer’s surplus. The unitary values of non market goods are presented, as well as the procedures to use them and to reckon the various indicators assessing both the economic and the financial profitabilities. The most recent recommendations deal with the discount rate, which is lowered from 8% to 4%, but does not include risk, while the previous value included the risk of the projects; they also deal with the budget constraints, a subject for which some new results are developed. Finally, an assessment of the recommendations is made, listing the improvements and short-comings, from the points of view of both the economic analysis and the institutional requirements, and suggesting possible solutions.

Key Words: Transport, Cost-benefit Analysis, France

JEL Classification: C61, D61, D62, D63, D81, H43
**Introduction**

Transport project evaluation through Cost-Benefit Analysis (CBA) has a long lasting tradition in France. It dates back to the early sixties, when guidelines for road investment choices had been established in order to match the growing needs to the scarce financial resources. From that period, CBA has been gradually extended to other transportation modes and embedded in various consultation procedures and public hearings.

Significant changes appear about every five years. The usual process is that a Commission is charged to study the specific actual problems and to provide directions of improvement.

The recent Commissions, hosted by the *Commissariat général du Plan*¹, took place in 1994 (Commissariat général du Plan, 1994), 2000 (Commissariat général du Plan, 2000) and 2005 (Commissariat général du Plan, 2005). The first one gave a new impulse to CBA, relying on the strict principles of economic theory and surplus analysis, after a period where CBA practice were founded on a rather loose use of multicriteria analysis. The second one defined the means to take into account external effects and fixed monetary values for those external effects. The third one paid attention to the discount rate and to risk.

These results have been embedded into directives issued by the Ministry Transport for the evaluation of infrastructure projects of national networks (rail, inland waterways and seaports). The most recent directives (Department of Transport 1995, 2004 and 2005) establish the basis of the official procedures, and define the doctrine presently at force.

The second section of this text will be devoted to a general presentation of the main features of the set of procedures they impose. The second one will detail the recent changes. The last one, as a conclusion, will list some of the short-comings of this doctrine and their possible remedies.

**General Features**

The directives have several purposes:

- To define the principles of project assessment
- To set the values of some parameters so as to allow comparisons between different projects
- To define the various indicators to be estimated
- To establish the relation between the economic assessment and the decision process, and more precisely to define which accuracy in economic assessment to achieve at each stage of the decision process

In what follows, we will not dwell on the fourth item, which is clearly linked to the French regulation on public hearings and on the public decision process. We will just develop the recommendations related to the three first ones.

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¹ The *Commissariat général du Plan* was an inter-departments administrative body, formerly in charge of indicative planning, and now doing prospective studies and hosting public concertation teams and working groups. It has been recently suppressed and replaced by the *Conseil d’Analyses Stratégiques* (Council of Strategic Analyses).
Principles of project assessment

Procedures firmly rooted in the surplus theory

The starting point of the recommendations is a rejection of multicriteria analysis, which was used in the past. It had been acknowledged as leading to arbitrary and clearly irrational decisions and a waste of public funds. The whole procedures is now based on a strict use of economic theory, and more precisely on the well known theories of Dupuit surplus theory. The surplus calculation is developed in a partial equilibrium framework, using monetarization of external effects and discounting theory.

Let us mention that these procedures are mainly designed for intercity investments, as it is acknowledged that urban transport infrastructures present quite different features: first the national level has a much smaller participation to the decisions which are mostly in the hands of the local public authorities; and second the decisions give a larger place to the interactions between transports and urban development.

Reference scenario: the second best solution

CBA does not tell what the best solution is, but just compares the project to a base case, the “reference scenario”. It follows that the definition of this base case is of the utmost importance. It is quite clear, and it often happens, that an irrelevant base case provides comparatively a high net benefit for the project under review; but this does not mean at all that the project is the best one; it just means that it is better than the base case. In theory the best test would be to compare the project under review against the second best solution, which of course is unpractical, as it induces a circular reasoning. In practice, it is necessary first to widen the range of tested projects, and second to carefully choose the base case in order to have it as good as possible.

Standardized Valuations for environmental and non marketable goods

The report recommends the use of standardised monetary values for most items and introduces monetary valuations for time, safety and environmental goods. This recommendation raises two issues.

First, should monetary values be the same for all projects or specific to each project? The standardization is intended to avoid the strategic manipulations from the analysts and project promoters. This choice is sensible for items for which primary studies are expensive and transferable from one case to another; examples of these situations are global warming, value of human life, and to a lesser extent local air pollution and noise; it is more questionable for the value of time, and we will develop this case later.

A second question is how to fix the monetary values. In France, there is a long debate on whether to choose behavioural values, based on willingness to pay (WTP) estimations, or administrative values or merit good values, and reflecting collective valuations which can differ from private valuations, for instance due to equity considerations. The choice has been clearly made to use behavioural values. These values are drawn from a survey of the existing
literature with a special emphasis on the estimates obtained in France from domestic studies, especially for value of time and external effects. The main values are the following ones.

**Values of Safety**

**Value of Human Life**

A distinction is made between individual and public transports. The value of human life for public transport is 1.5 million of Euro, while it is 1 million of Euro for individual (road) transport. The difference is due to the adverse selection made possible in this mode (people with a high value of life are more cautious, and then they are less subject to injury or fatalities).

<table>
<thead>
<tr>
<th>Million of Euros 2000</th>
<th>Public transport</th>
<th>Individual transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 M€</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 M€</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This value is indexed on Final Household Consumption, with an elasticity of 1.

**Values of Injuries**

<table>
<thead>
<tr>
<th></th>
<th>Public Transport</th>
<th>Road Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe injury</td>
<td>225 000 €</td>
<td>150 000 €</td>
</tr>
<tr>
<td>Light injury</td>
<td>33 000 €</td>
<td>22 000 €</td>
</tr>
</tbody>
</table>

These values are indexed on Final Household consumption, with an elasticity of 1.

**Noise**

The following table summarizes the values to be used for housings noise; they are based on depreciation of rents for housings exposed to noise. These values are indexed on GDP, with an elasticity of 1.

<table>
<thead>
<tr>
<th>Daily Leq in dB(A)</th>
<th>55 - 60</th>
<th>60 - 65</th>
<th>65 - 70</th>
<th>70 - 75</th>
<th>above 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>% dépréciation /dB(A)</td>
<td>0,4 %</td>
<td>0,8 %</td>
<td>0,9 %</td>
<td>1 %</td>
<td>1,1 %</td>
</tr>
</tbody>
</table>

These values assume an average difference of noise (5 dB (A)) between night and day noises. If this difference is not 5 dB (A), bonus or malus are calculated. In order to take into account the effects on health, the above cost of depreciation are increased by 30% for noise levels above 70 dB (A) during day or above 65 dB (A) during night. The thresholds of the previous table are reduced by 3 dB (A) for non HST rail links. Words of caution are said for air transport noise, but without given clear values. No cost of noise is calculated for inhabited areas, except for the zones where a future housing is forecasted.
Air pollution

The impacts of air pollution on health are depending on the concentration of pollutants and on the density of population. Consequently, costs are fixed according to three types of neighbourhood: highly dense (density above 420 h/km²), dense (between 420 and 37 h/km²) and country (below 37 h/km²).

Values for individual road transport

Table 4 Values 2000 in veh.km (Euro/100 veh.km) per type of zone

<table>
<thead>
<tr>
<th></th>
<th>Highly dense</th>
<th>Dense</th>
<th>country</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>cars</td>
<td>2,9</td>
<td>1,0</td>
<td>0,1</td>
<td>0,9</td>
</tr>
<tr>
<td>trucks</td>
<td>28,2</td>
<td>9,9</td>
<td>0,6</td>
<td>6,2</td>
</tr>
</tbody>
</table>

Values for buses and coaches

Table 5 Values 2000 in veh.km (Euro/100 veh.km)

<table>
<thead>
<tr>
<th></th>
<th>Highly dense</th>
<th>Dense</th>
<th>country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus and coaches</td>
<td>24,9</td>
<td>8,7</td>
<td>0,6</td>
</tr>
</tbody>
</table>

Values for rail transport

Table 6 Values 2000 per train.km (Euro/100 train.km)

<table>
<thead>
<tr>
<th></th>
<th>Highly dense</th>
<th>Dense</th>
<th>country</th>
</tr>
</thead>
<tbody>
<tr>
<td>diesel (freight)</td>
<td>457,6</td>
<td>160,4</td>
<td>10,5</td>
</tr>
<tr>
<td>diesel (passenger)</td>
<td>163,8</td>
<td>57,4</td>
<td>3,8</td>
</tr>
</tbody>
</table>

Changes over time

These values are the product of quantities of emissions by values of human life. Quantities of emission are assumed to decrease, during the period 2000-2020, by 5, 5% per year for cars, 6, and 5% for trucks and buses. As previously said, value of human life is increasing as the final consumption of households.

Special Zones

Specific values are provided for special zones, especially mountain valleys, through correction coefficients, different according to the slope of the road.
Table 7 Correction coefficients for special zones

<table>
<thead>
<tr>
<th>Correction Coefficients</th>
<th>(small slope, 2 to 4 %)</th>
<th>(large slope, 4 to 6 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>1,1</td>
<td>1,1</td>
</tr>
<tr>
<td>Trucks</td>
<td>1,5</td>
<td>2,1</td>
</tr>
</tbody>
</table>

Global warming

The ton of CO\(^2\) is fixed according to the following values:

Table 8 Value of CO\(^2\) ton

<table>
<thead>
<tr>
<th>2000-2010</th>
<th>after 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 €/ton of carbon, (6,6 cents of € per litre of petrol and 7,3 cents of € per litre of diesel oil)</td>
<td>+ 3 %/an</td>
</tr>
</tbody>
</table>

This value is determined as the level of carbon tax which would allow the country to comply with the Kyoto commitments. A sensitivity test is recommended for projects to be implemented after 2020; the threshold value of CO\(^2\) ton which would change the decision concerning the project should be determined.

Value of time

Value of time for intercity travels (except for intercontinental travels)

Table 9 Value of interurban travel time per passenger and per hour in Euros 2000

<table>
<thead>
<tr>
<th>Mode</th>
<th>Distances below</th>
<th>Distances d Between 50 km or 150 km and 400 km</th>
<th>Distances above 400 km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 km</td>
<td>150 km</td>
<td></td>
</tr>
<tr>
<td>Road</td>
<td>8,94 €</td>
<td>-</td>
<td>50 km &lt; d VoT = 0,016*d + 8,1 €</td>
</tr>
<tr>
<td>Rail 2° Cl.</td>
<td>-</td>
<td>11,3 €</td>
<td>150 km &lt; d VoT = 0,0067*d + 10,3 €</td>
</tr>
<tr>
<td>Rail 1° Cl.</td>
<td>-</td>
<td>28,9 €</td>
<td>150 km &lt; d VoT = 0,021*d + 25,7 €</td>
</tr>
<tr>
<td>Air</td>
<td>-</td>
<td>-</td>
<td>48,2 €</td>
</tr>
</tbody>
</table>

The difference in comfort between various types of roads (e.g. highways and motorways) is traduced through bonus/malus

These values are indexed on the Final Household Consumption, with an elasticity of 0, 7.
Value of time for urban trips

Table 10 Value of time for urban trips per passenger and per hour, in Euros 2000

<table>
<thead>
<tr>
<th>Purpose of the trip</th>
<th>Out of Île-de-France (euros/h)</th>
<th>Île-de-France (euros/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional trip</td>
<td>11,1 €</td>
<td>13,7 €</td>
</tr>
<tr>
<td>Home-Work</td>
<td>10,0 €</td>
<td>12,2 €</td>
</tr>
<tr>
<td>Other purposes</td>
<td>5,5 €</td>
<td>6,7 €</td>
</tr>
<tr>
<td>(shopping, leisure, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Default average value of time</td>
<td>7,6 €</td>
<td>9,3 €</td>
</tr>
</tbody>
</table>

Those values are indexed on the Final household consumption, with an elasticity of 0.7.

Other elements of quality of service are included through penalties:
- Time spent in congested public transport: coefficient 1.5
- Walking time and waiting time for access to stations and interconnections: coefficient 2

Value of time for freight

Two freight values of time are distinguished: the value of time for the shipper and the value of time for the transport firm.

Value of time for transport firm:
- For road: 31.4 € 2000 per hour of truck. This value is supposed to remain unchanged in constant Euro
- For rail: 400 € 2000 per hour of train; this value includes both locomotives and wagons.
- For other modes: to be determined case by case

Values of time for shipper:
- 0.45 € per ton and per hour for road transport and combined transport
- 0.15 € per ton and per hour for other freight transport except bulk
- 0.01 € per ton and per hour for bulk

These values are indexed on GDP with elasticity of 2/3.

Various costs related to the value of time

Recommendations are made for time-related costs such as reliability and frequency for public transports.

Reliability is assessed through coefficients to be applied to the value of travel time for delays and advances; these coefficients are drawn from the existing literature:
Delay : 2.69
Advance : 0.33
The same coefficients can be used to deal with the cost of late or advance arrivals, or modified frequencies. Frequency issues can also, more simply, be dealt with through the rule of thumb consisting in adding to the travel time $\frac{1}{4}$ of the interval between the two adjacent services.

**Problems of surplus calculation**

The total surplus provided each year by the project is composed of:

- External effects, mainly environmental impacts, measured by the variations of level of noise, air pollution, global warming, and monetarized through the unitary values indicated above
- Changes in the profits of the operators
- User’s surplus

The first two points do not raise problem. User’s surplus is more difficult to estimate. The use of the previous standard values of time can lead to incoherencies, if those values are, as it is generally the case, different from the values of time used in the traffic study. The problem is especially acute for the transferred traffic, corresponding to those who used another mode in the reference situation and who now shift to the new infrastructure. The surplus calculation achieved with standard values of time may lead to the incoherency that for such transferred traffic the user’s surplus is negative. This incoherency does not appear if the user’s surplus is estimated in accordance with the traffic model hypotheses - if, for instance, in the case of a logit traffic model, the surplus is calculated through the classical logsum formula, including not only the value of time, but also the other attributes of the user’s utility-.

It is clear that, should the traffic models be perfectly accurate, the use of specific values of time should be preferred. But it is well known that, for various reasons, it is not the case. As a consequence, the estimates of the parameters, and here more specifically of values of time, are also inaccurate. It is easy to exhibit situations where several traffic models, applied to the same project, even providing similar traffic forecasts, lead to very different values of time and user’s surplus.

In order to overcome these shortcomings, two means of calculation of the user’s surplus are recommended:

- The first one is to apply the calculation of the user’s surplus coherent with the traffic model, using the values of time calibrated in the framework of this model, and also the other parameters included in the model.
- The second one is to apply the Dupuit surplus, assuming the demand is depending on the generalized cost of transport (estimated through the standardized value of time) and varies linearly between the reference situation and the project situation, according to the yellow area of the classical diagram (Figure 1) and to the corresponding formula:

$$\text{User’s surplus} = \frac{(T_1 + T_0)}{2}(CG_0 - CG_1)$$

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2 The inaccuracy of data is well known and often caused by the constraints on the time and cost of traffic studies. There is also a frequent uncertainty on model specification (it often happens that the model specification is constrained by the data availability).
A large gap between those two calculations indicates that something is going wrong in the study, which must be deepened.

**Indicators**

**Distinction between economic and financial profitability**

In the more and more frequent cases where the infrastructure is operated by a firm, whether public or private, which it has to ensure a balance between costs and revenues, two sorts of profitability are calculated:

- The collective profitability corresponding to the above-mentioned Dupuit surplus. It includes the producer surplus, the user surplus and the external effects
- The financial profitability; it is related to the effects of the new infrastructure on the accounts of the infrastructure manager.

In fact, for airports, just the financial profitability is calculated, as besides the financial problems, the most important collective issues are due to environment and local economic development, and these issues are dealt through bargaining processes with the local authorities and neighbours' representatives. Both profitabilities, as well as the impact on public budget, are calculated for toll motorways, seaports and railways.

**A panel of indicators**

The directive recommends the calculation of several indicators:

- The Net Present Value (NPV)
- The Net Present Value per Euro spent (NPV/E)
- The Internal Rate of Return (IRR), calculated on the basis of a thirty years life time.
- the First Year Rate of Return (FYRR) equal to the surplus of the first year divided by the cost of the investment

Sensitivity analysis are recommended, they should take the form of estimation of the effects of alternative hypotheses for exogenous variables such as economic growth or petrol price and for specific variables such as the cost of the project or the traffic forecasts.
These indicators should be adapted to the case of international projects, and should be calculated both for the national agents and for the international (generally speaking the European) agents. But these calculations are made difficult as the CBA provides general information on the overall efficiency of a project, but cannot straightforwardly distinguish the benefits of the various agents, see below the equity issues

**Equity issues**

The directives address equity and distribution issues, trying to assess the effects on the various kinds of agents: the users, the taxpayers, the neighbours of the infrastructure and the operators. A crude way to assess these effects is to break-down the collective surplus into each kind of user, and this procedure is recommended. Nevertheless, it is clear that these effects are just an approximation of the final effects; each of these primary surpluses is passed on to other agents through the market mechanisms; for instance, in the long run equilibrium, time savings will be partly transferred to the land owners through the increase of rents.

The effects of each project can also be broken-down on a spatial basis. A crude way to get a first insight in this issue is to split a consumer's surplus according to the locations of the users. As in the previous section, this split provides just the primary effects of the investment. In the long run equilibrium, these effects will be passed to the rest of the economy through market mechanisms. The full knowledge of these long run effects would need a multiregional model, which unfortunately hitherto does not exist in France.

**Appraisal of “indirect effects”**

The directive acknowledges that transport projects lead to “indirect effects”, a rather loose category of effects which encompasses consequences on employment, spatial development, effects of endogenous growth. Though mentioning them and the interest to assess them, the directive does not provide procedures for this assessment, leaving it to qualitative considerations. It implicitly considers that these effects are already at least partly counted through the user’s surplus and external effects, and that the overall effects on employment are not clearly identified at the macro-economic level.

**Recent Changes**

On top of these general features, which shaped the directives since 1998, a recent directive (Department of Transport, 2005) has put the emphasis on several points and made important changes. Those points are:

- The parameters of economic and traffic growth
- The discount rate and risk appraisal
- The appraisal of constraints on public funds
- The generalization of ex-post evaluations

**A common set of economic and traffic forecasts**

The economic assessment of any project should use a common set of economic and traffic forecasts, established by the Department of Transport in accordance with the Department of the Environment. These forecasts are developed according various scenarios which differ by the growth rate and parameters such as the petrol price. Let us just mention that the GDP
growth of these scenarios for the period 2002-2025 lies between 1.5% and 2.3% per year (central value of 1.9%).

**The discount rate**

The previous value of the discount rate to be used in social cost-benefit analysis was fixed at 8%, a high value compared to the present interest rates which lie around 4%. This high value was justified by the fact that it included not only the time preference, but also an average premium corresponding to the average risks specific to each project, and the effect of public budget constraint. The new directive aims at distinguishing these three objectives.

In this framework, the discount rate is now determined by the time preference combined with the marginal utility of income, and including macro-economic risks such as risk on economic growth and the corresponding risk-aversion, but exclusive of the risks specific to the projects. Experiments on risk-aversion and knowledge of the average value and the volatility of the rate of growth lead to fix the discount rate to 4%, this value decreasing after 30 years to take into account the effects of the growth rate volatility, down to 3% after 100 years.

Shortly presented, these conclusions are based on the classical following formula linking the discount rate to the time preference and to the rate of growth:

\[
r = \delta + \gamma \mu - \frac{1}{2} \gamma^2 \sigma^2.
\]

Where \( r \) is the discount rate, \( \delta \) is the time preference in the utility function of the representative agent, \( \mu \) is the average rate of growth, \( \gamma \) represents the risk aversion, and \( \sigma \) is the standard deviation of the macro-economic uncertainty. The values taken into consideration are:

- \( \delta = 0\% \)
- \( \mu = 2\% \)
- \( \gamma = 2 \)
- \( \sigma = 2\% \)

The decrease of the discount rate can be justified either by a decrease of the rate of growth \( \mu \) in the far future, or by an increase of \( \sigma \), the dispersion of the rate of growth \( \mu \) (for more developments on this point, see Gollier (2001, 2002a and 2002b) which inspired the recommendations).

**Risk analysis**

Under this definition of the discount rate, the stress is put on the analysis of the risks specific to the project (the general risks are included in the discount rate) which are no more taken into account through the discount rate. Unfortunately, the directive does not precise how to take into account those risks. It just says that sensitivity analyses should be made for the most important parameters.

In particular it omits the fact that most risks are in fact biases, well documented for instance by Flyvbjerg (for instance Flyvbjerg 2004), and resulting from manipulations and strategies of the actors.
**Optimization and decentralisation of programs under budget constraint**

The decrease of the discount rate will lead to a growth of profitable projects, even taking into account the specific risks which were previously included in the discount rate and have now to be added to the new value of 4%. At the same time, the public budget constraint is tightened, due to the huge French debt and to the Maastricht regulation. Even a more intensive use of private funding will not be sufficient to overcome this constraint. The issue of investment programming under budget constraint is becoming important. The new directive provides two ways to solve it.

The first one is to introduce a cost of public funds. The directive recommends the value of 1, 3. This value seems rather high compared to the current values provided by the literature, which turn around 1, 05 to 1, 2, depending on the structure of the taxes.

The second one is to use procedures for program optimization under budget constraint. An indicator is recommended, the NPV per public Euro spent. This question has been the subject of recent research. Quinet (2005) shows that this indicator is not rigorous and provides a general tool, based on linear programming, to solve this problem; more details on this tool are given in the Annexe.

**Ex post evaluations**

The new directive stresses the importance of ex post evaluations in order to gather information on the efficiency of public policy and to benefit from return of experience. France has already some experience of these ex post studies which are achieved since 2000. Some teachings can be drawn from this experience:

- The difficulty to gather the pertinent data if it has not been previously planned
- The importance of the choice of the reference scenario
- The importance of biases in costs and traffic forecasts
- The main source of error comes for the imperfect forecast of the exogenous variables

**Conclusive remarks: achievements and Issues**

**Achievements**

The directive the recommendations of which have been summarized have clear achievements: they are founded on sound economic basis, they identify the most important problems, they provide the users with workable methods using standard valuations in accordance with the economic literature, and the theoretical problems linked to the consumer’s surplus calculations have been rightly dealt with. Several other problems have been identified but not fully solved, the answers given to them looking more like “wishful thinking” than workable solutions. Let us mention in that respect:

- *The choice of the reference scenario*: it should be the second best solution, which of course is unpractical, as it induces a circular reasoning. In practice, it is necessary first to widen the range of tested projects, and second to carefully choose the base case in order to have it as good as possible. Unfortunately, the CBA rarely compares a wide range of solutions, and often limits itself to match two or three variants.
- **Risk analysis.** The present directive tells that it is necessary to take risk into account, but do not provide workable procedures for this goal. Implicitly, it deals with risk—without telling how to assess the probabilities of the states of the world—, but not with uncertainty, a situation which models well phenomena such as global warming or environmental effects. Furthermore, the dynamic risks of the Brownian type are limited to the economic growth, though they happen in more specific situations.

**Issues**

In their present state, the procedures suffer from short-comings which can be analysed either on the grounds of economic theory or on the grounds of coherence with the decision-making process.

**From the point of view of economic theory**

On the grounds of economic theory, the directive presents the short-comings of a partial equilibrium analysis based on several hypotheses, and mainly:
- competitive markets
- optimal distribution of incomes
- no space

The hypothesis of competitive markets is more and more unrealistic. Imperfect competition in transport market is more and more frequent through the privatisation and the liberalisation. The on-track rail transport competition is imperfect, as well as competition between rail and air passenger transport, rail and road freight transport, and between sea ports or airports. In these cases, it is well known that prices differ from costs; it stems that CBA in the shape of the elementary partial analysis does not hold any more; furthermore, as the prices of transport are endogenous and not exogenous to the traffic model, the traffic model results are biased. The directive gives no indication on how to deal with this situation. Nevertheless recent progress is made in this respect in order to set traffic modelling where transport prices are depending on the type of the market (for instance Ivaldi and Vibes 2005).

The hypothesis of optimal distribution allows to sum up the surpluses. But it impedes to assess equity and distribution effects. The usual procedure is to split the overall surplus according to the agents who, according to the usual partial analysis, benefit from it. But it is well known that, in the framework of the general equilibrium processes, these initial benefits are transmitted to the other agents. To identify them, it would be necessary to run equilibrium models, for instance Computable General Equilibrium distinguishing various types of agents (for instance split according to the incomes for instance).

The partial equilibrium procedures prevents from assessing the spatial effects of investment. In order to take them into account, it is necessary at least to run Land Use Transport Integrated Models which can distribute the total effect between the various zones surrounding the project. But such model generally does not take into account the usual mechanisms at work in the New Geographical Economics, such as those explaining the urban development:
- increasing returns to scale and positive externalities due to communication effects;
- Distributional effects due to transportation infrastructures;
- Strong interactions among transport, land use and urban dynamic: transport improvements have consequences on land use through mechanisms characterised by irreversibilities, non-linearities and distortions due to imperfect prices and subsidies.

A consequence of these last two shortcomings is that the present cost-benefit analysis cannot properly disentangle the domestic and international effects of a project.

**From the institutional point of view**

The CBA suffer from a bad relation to the decision-making process in several respects:
- First, it looks too sophisticated and difficult to understand to the politicians. Its results are often considered as uncertain and manipulable.
- It does not provide the decision-makers with the information they want. In short, CBA gives indications on the efficiency while the main concerns of politicians are, at least in France, related to distribution (who will benefit?) and to the so-called “Indirect effects”. Whether these indirect effects exist or not, whether they are important or negligible, is a question. But the problem is that the political decision-makers are mainly interested by those indirect effects, namely the effects on economic growth, and unfortunately the CBA, in its present stage, cannot afford a clear answer to their question on this ground.
- There is an essential contradiction in the use of CBA, a kind of “uncertainty theorem”: CBA is the most useful when the list of projects is not yet decided; but unfortunately at this stage, the information on each project (cost, traffic, environmental effects) is sparse, and CBA is inaccurate, or even impossible to achieve.
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Annexe. A method for Transport Infrastructure programming

Let us consider the typical situation of a network made of links which bear transport flows varying according to the time (usually increasing along the year). The transport costs are composed of such costs as monetary costs, time costs, safety costs and environmental costs. They depend on the traffic flows and on the characteristics of the links (for instance width of the motorways, or authorised speed of rail tracks).

These links can be improved through various schemes. Each of them bears investment costs and allows for lowered transport costs. Various situations are faced:

- On each link, a choice has to be made among alternative schemes, both on technical grounds and on financial grounds (level of infrastructure charges, public or private funding).
- The year of implementation of each scheme has to be decided.
- On a given link, several alternative schemes are competing and have to be chosen.
- On different links schemes can be either independent (the existence of one scheme does not influence the benefits of the other), substitutes (the existence of one scheme reduces the benefits gained by the other one) or complements.
- There may be a constraint on public funds available for the program.

The addressed problem is how to choose among these schemes in order to maximize the collective surplus, more precisely, as time is involved, the discounted collective surplus, or discounted Net Present Value?

Although it is a current problem for the public authorities in charge of infrastructure investments programming, it seems not to have drawn much attention.

Among the main references, let us quote Abraham et Laure who showed that in the case of independent schemes, the solution was to implement each scheme at the year when the ratio between the benefit of the year and the investment cost is equal to the discount rate; they also established that when the funds are insufficient to finance the whole program, the previous rule has to be amended by multiplying the discount rate by a dual coefficient adapted to each year and adjusted to the budget constraint of the year. But this result is valid under very restrictive hypotheses.

1 C. Abraham et A. Laure, "Étude des programmes d'investissement routiers a", Annales des Ponts et chaussées, novembre 1989
The fact that any decision relating to a scheme has consequences on the whole program raises the question whether it is possible to find decentralization procedures which are "sufficiently" accurate to alleviate the burden of the central planning unit and decrease the need of information exchanges with the lower levels. Some limited tests tend to think that such a decentralization may be possible for such decisions as the choice between alternative schemes, the use of the NPV being a good approximation for these decisions.