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An inconsistency in the European Union Guidelines for Cost-Benefit Analysis of investment projects

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Abstract

European Union Guidelines have been for long the cornerstone of the evaluation of European funding for projects. An important aspect of this method is the general exclusion of taxation from computation. We argue that when applied on projects that shift demand from a highly taxed mode to a slightly less taxed one, the modus operandi described by the guidelines and used by analysts in documented papers, actually violates the principle of net of taxes computation. In most cases this inconsistency will be hardly visible to the analyst. However, when the procedure deals with projects where mode shift is important, in absolute or relative terms, the inconsistency will create important distortions in the results.

This article is a shortened version of a paper to be published in the Journal of Transport Economics and Policy. Readers are invited to refer to the full version for a more comprehensive and informed understanding.

Keyword: Cost-Benefit Analysis; European Union Guidelines; fuel duties; taxation; rail project; multimodal evaluation.

Introduction

EU guidelines have become very influential, both as a long-standing formal requirement for evaluation of projects funded by the EU and as a scientific authority that influence evaluation practice in Europe and beyond. One of the driving principle of EU guidelines is to substitute observed market prices with "shadow prices" that reflect the real marginal social cost of resources. An important issue relates to the consideration of the taxation which is seen as a distortion that should be corrected when computing the net benefit of a program. This approach derives from the theory of development, where the real cost of a resource is estimated net of taxation and subvention (Dasgupta, P., Marglin, S., & Sen, A., 1972; Mirrlees & Little, 1974; Squire & Van Der Tak, 1979).

In this context, the exclusion of taxation is a driving principle of the EU guidelines. The 2008 guidelines (DG Regio, 2008) were however only going halfway in this process as they mostly excluded indirect taxation. The latest version of EU guidelines (DG Regio, 2014) goes one step further in this direction and mandates to exclude both direct and indirect taxation. "*Taxes and subsidies are transfer payments that do not represent real economic costs or benefits for society as they involve merely a transfer of control over certain resources from one group in society to another"* p. 44: Hence "*prices for input should be considered net of direct and indirect taxes*" (p. 45).

One may wonder how this framework applies to projects that have a strong fiscal impact such as transport projects that shift users from a highly taxed mode (for instance car) to a less taxed one (for instance rail). When users shift from road to rail, less tax will be paid : users benefit a reduction of taxation and the State suffers a reduction in tax revenues. This reasoning expands as well to situations where subsidies exist on the improved mode: it becomes a matter of net, rather than gross, taxation.

In this paper, we examine the possible distortions that the Guidelines procedures imposes on the economic evaluation of project. The next section exposes in detail the modus operandi proposed in the guidelines. The following section provides a simple analytical derivation of why the problem arises. A final section proposes possible solutions and discusses our findings.

The Guidelines approach to project evaluation

In this section we present the Guidelines approach to project evaluation. We exemplify the approach of UE Guidelines focusing on the case of a project that shifts users from one mode to another. It provides a neat example of a situation where different consumption alternatives have strong fiscal implications due to an important tax gap between road and rail transport.

A proposed method for dealing with projects is illustrated in the case studies section of the Guidelines (from p. 101 on). The basic principle is that the benefits of shifted users are computed based on the Rule of Half estimate of user surplus ("*Generalised users cost surplus half of the change in time and fare cost")* (table in p. 110). No allowance is made for the corresponding impact on tax revenues.

To be more complete, this principle though is accompanied by some *caveat*. This relates first to taxes "intended" to internalize externalities, or in the guidelines wording: "*Despite the general rule, in some cases indirect taxes (or subsidies) are intended as a correction for*

externalities" p 45. This relates as well to the consideration of the Opportunity Costs of Public Funds:

"One Euro of uncommitted income in the public sector budget may be worth more than in private hands because of the distortionary effects of taxation. Under non-optimal taxes, Marginal Cost of Public Funds (MCPF) values higher or lower than unity should be used to adjust the flows of public funds to and from the project. If there are no national guidelines on this issue, MCPF=1 is the default rule suggested in this guide." (Footnote 53 p. 45)

A narrow view of these opportunity costs would suggest applying them to the project cost. A wider, arguably more consistent, view would be to apply this opportunity cost to any variations in the net, rather than gross, expenditures of the governments: should a project reduce (increase) fuel taxes incomes, an extra benefit (cost) should be considered as it reduces (increases) the taxation wedge. This would dictate to include all taxation impact into the CBA.

Notwithstanding their theoretical foundations, these two caveats seem of little influence in practice: information converge in indicating that when analysts refer to the EU Guidelines, they discard fiscal incidence and actually do not implement these exceptions.

This setting would be fine for most analysts: reduced tax incomes are not included in the project cost and neither they do not appear neither in the user surplus. Actually, there is no point were the analyst had to consider taxation in the computation of user benefits, hence there would apparently be no room to subtract something (taxes) that has never been added or just considered. A very scrupulous analyst may however want to check further this point. If taxes would be present, in some way or another, in the users' surplus, a hypothetical change in taxation would alter the user surplus (a thought experiment though: project evaluation does not deal with a change in taxation but with a project for a given taxation level). After a few simulations, the analyst can check that the RoH estimate of users' surplus is not changed for hypothetical changes in the level of taxation.

Yet, this point deserves more attention. Actually, users' surplus, and its RoH estimates are not net of taxation.

Analytical derivation

In this section, we propose a simple example illustrating how taxation can be treated in CBA. It shows that if one wants to compute the Net Present Value, net of taxation, care should be taken to exclude taxation not only from State balance but from users' surplus as well, leading to similar results, as long as no second order effects are considered. The idea of excluding taxation only for State revenues leads to a biased result that can profoundly distort the evaluation when the project has strong fiscal implications, namely when users shift between modes that entail a very different taxation.

In the simplified example, we consider a rail improvement, where users can choose between two modes (road, denoted with c for car) and rail (t for train)). For sake of simplicity, we ignore increasing production costs and congestion, so that supply curves and cost curves are assumed horizontal. Still for simplification, we focus on a situation without traffic generation: the improvement of the rail mode shifts users but does not increase the total number of trips on the OD pair.

We consider:

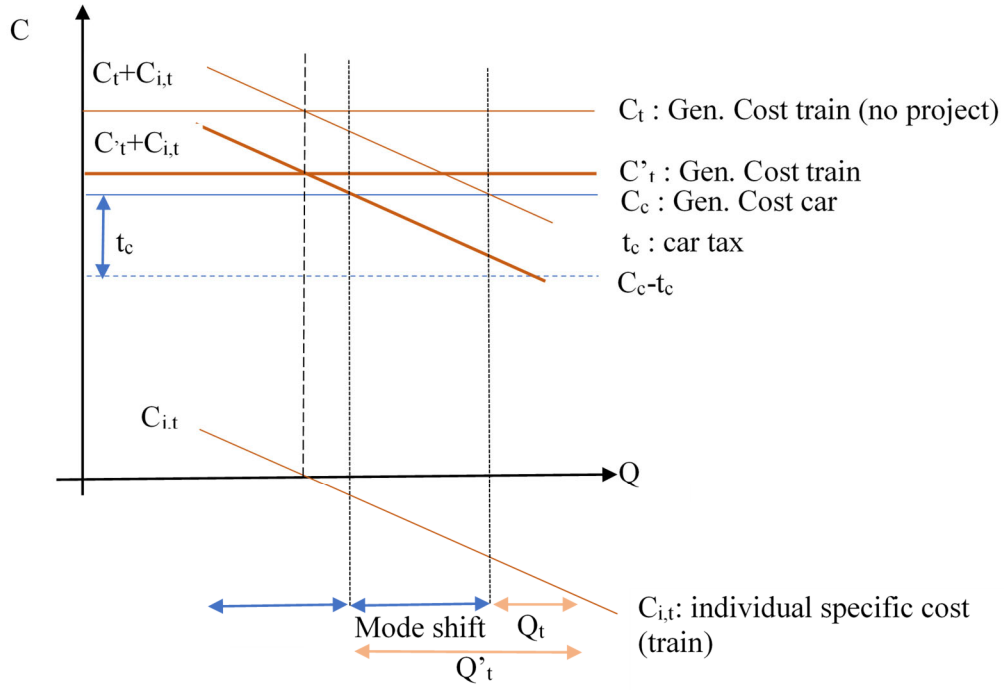
- The Generalized Cost of each mode is:

- C_c for car (road), C_c includes a tax t_c,
- C_t (no project) C'_t (project), for rail (train)

- An individual specific penalty (or demand shifter, or individual component) that indicate the individual preference for using rail compared with road C_{it}. Transport planners will be familiar with this concept: attributes that are explicitly present in the generalized cost do not cover the whole set of choice determinants. Other elements influence the choice: some of them could be observable, others may not be. Some of them may be explicated in a given model (typically OD zoning allows consideration of various access-egress conditions) other not (even a fine OD system averages access and egress to the transport service on each OD, so that some unexplained variability persists, a situation that is familiar to the users of Random Utility Maximization). This individual specific penalty may however not be familiar to other readers. But:
  1. In reality, users are different. A model that omits such a variety would be less realistic that a model that acknowledges it.
  2. Readers can easily check that if no variety is considered among users, the model produces the unrealistic conclusion that all users make the same choice in each single scenario (with or without the project), a problematic outcome in its own. One could segment the demand to represent the various choice conditions (typically OD), but this would in essence be similar to including preferences/penalties, although in a discrete, rather than continuous, fashion.
  3. The individual specific preference or cost could equivalently be assigned to road or rail (10 units preference for road is basically equivalent to 10 units penalty for rail). For more clarity, we associate it to the rail mode, as it is the mode we assume is impacted by the project. Note that, for simplicity, we assume this preference is not changed by the project. This assumption can be modified in future development.
  4. Eventually, the definition of C_{it} as a cost is a matter of convention: if individuals have a preference for the investigated mode this can be represented by a negative cost.
- Users' willingness to pay for each trip. This may seem unnecessary: if the number of users is fixed, the users' Willingness to Pay for using the transport service will be the same whatever the mode choice of an individual. We introduce this notation, although not parsimonious, as our experience suggests some readers become reluctant when they cannot visualize the users' surplus.

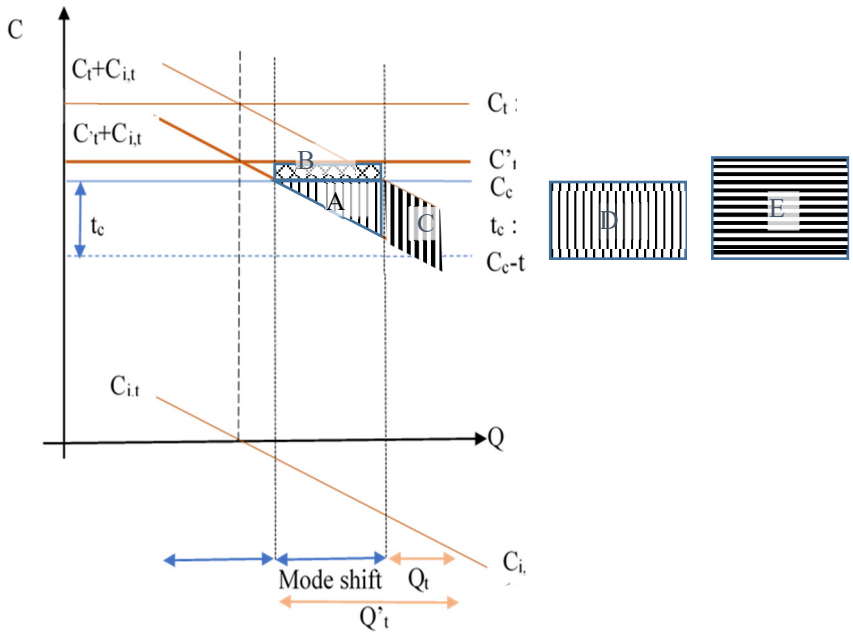
Figure 1 illustrates the resulting equilibrium in the no-project situation (thin lines) and in the project scenario (bold line). Each user will choose his preferred mode based on the sum of the Generalized Cost (horizontal lines: C_c and C_t) and the individual specific cost (C_{it}). In this simplified setting, whenever C_t+C_{it} is larger than C_c, users would choose the road alternative. This is the case for users on the left part of the graphic. When the project takes places, C_t diminishes to C'_t, C_t+C_{it} lowers to C'_t+C_{it}, the indifference point shifts to the left, more users consider rail as the most convenient alternative.

Figure 1 – Users' costs for a rail improvement project



By comparing these equilibrium, one can visualize the mode shift and the change in users' costs and benefits.

Figure 2 – Users' costs and benefits resulting from the rail project



Legend: Vertical line: benefits; horizontal line: costs; diagonal grid: cost and benefit. D and E areas aside the grafic for legibility.

The impact on users is different for previous users and transferred user (Figure 2).

- Previous users
  - This is the easy part: each user just benefits from the reduction of Generalized Costs. The benefits of users is represented by the rectangle C.
- Transferred users are affected in several ways:
  - They benefit the value of their individual preference for rail (or, equivalently, support the cost of their individual mode penalty). By definition, this is just what individual preference (or cost) is about. This is represented by the polygon (under C'_t curve) that gathers triangle A and rectangle B.
  - They benefit (suffer) from the difference of the generalized cost between the modes. This is necessary by logic: when switching mode, users do not only benefit (suffer) from their specific mode preference, but they also have to pay a different tariff, have a different transport duration or, more generally, are exposed to a different Generalized Cost. Users who shift from road to rail support a change in generalized cost ; in Figure 2, this is depicted as an increase in the cost of B.

In the end, the change in users' surplus is represented by area A+B-B= A. To put it simply, a shifting user may value 10 his preference for the new mode, but he has to pay (or spend more time) which may have a value of two for him. His net benefit is 8. As the reader can check, this generalizes fairly to other situations: users of improved rail can have a preference for rail of any sign, the Generalized Cost of the improved mode can be larger or smaller than the competing mode, in the initial or final solution or both, and so on.

Once we have formalized the equilibrium in this market, it is possible to look at how taxation can be considered in project appraisal.

Two coherent calculations (and an incoherent one)

We recall that t_c is the tax component of the road mode (or, more generally, the additional taxation of road compared with rail).

We first look at what happens for a single user. In its simplest expression, user's benefit is:

$C_{it} + (C_c - C_t)$.

And the corresponding cost for the state is t_c.

Thus, net benefits for society are:

$$C_{it} + (C_c - C_t) - t_c \qquad \text{eq 1}$$

Whenever one wants to make a net of taxation computation, the tax impact should be cancelled from State income, and from user's benefits:

User benefit is now reduced by t_c compared with the previous situation, but the accounted impact on the State should be reduced by the same amount. The (simplified) Net Present Value is $C_{it}+(C_c-t_c)-C_t$, the same as in equation 1.

In other words, if an analyst wants to make an estimate net of taxation, this should impact both State and users, and this would leave the result unchanged (at least if no second order effects are considered; if instead such effects are to be considered, the inclusion of taxation will be recommended).

This is quite straightforward for a single individual. It can also be expanded to a larger number of users. The project will reduce tax income by $t_c.(Q_t-Q'_t)$, the unit road tax multiplied

by the quantity of users transferred from road for to rail. This amount can be represented by the D rectangle displayed, for convenience, on the right of the diagram in Figure 2. How should analysts deal with these impacts ? We present below three possible approaches (with and without taxation), of which one is inconsistent.

Inclusion of taxes

The first solution, consistent with existing guidelines in the large majority of countries, would consider the impacts on taxation explicitly. Thus:

- Users experience costs and benefits due to (1) individual mode specific preference/penalty (2) change of Generalized Costs. These two components are summarized in consumer net benefit (triangle A).
- Government suffers a reduction of tax income (rectangle D)

The net benefit is represented by A-D.

Net-of-taxes computation

The other solution, a less explicit one, is to make the calculation net of taxes. In this case, tax components have to disappear consistently from cost and benefits (at least in the appraisal phase, it cannot instead disappear completely from the analysis as it should at least be present in the calculation of mode shares, these are determined by the full cost, but one may want to exclude them from the assessment). In this case, for evaluation purpose, the Generalized Cost of the mode should also be introduced net of tax. The result may look strange, but the concept is consistent: taxation is a transfer (although not a neutral one, if one wants to be more precise).

Users are impacted by:

1. individual mode specific preference/penalty (surfaces B and A)
2. increase in net-of-tax Generalized Cost, this is represented by the E rectangle in Figure 2.

The impact on government budget does not appear: this computation is net of taxation. The result is represented by A+B-E=A-(E-B) which, by definition of E and D, is A-D.

The result of this computation would be identical to the previous one (at least as long as no second order effects are considered). Graphically, in one case (including taxes) the analyst would consider D as a cost for the government, and B as a cost for users. Instead, in the other case (discarding taxes), the calculation would consider E, as the change of net-of-tax Generalized Cost to users.

A third method?

The latest EU guidelines propose another computation where users' benefits are considered through the Rule of Half and reduced tax incomes are discarded. A similar approach has been referred incidentally in the Italian debate on the Turin-Lyon High Speed line as "senza accise" ("no-excise") calculation. This approach would be inconsistent and would not recognize that taxation is a transfer, so it impacts both public funds and users. Actually, the users' surplus incorporates the difference in taxes paid by them. If taxes are excluded from the computation, the surplus needs to be recalculated considering the change in taxation (Figure 2).

A tempting test to confirm this statement (taxes impacts are included in the users' surplus) would be to look at what happens to users' surplus when one assumes a change in the level of taxation. If the benefits of reduced taxation are included in user surplus, then one expects that larger taxes change user surplus. This informal check provides counterintuitive and interesting lessons. Essentially, if demand is linear, the users' surplus does not change according to the

level of taxation. This intriguing result – that disappears when demand is not assumed linear – may have contributed to the development of the misunderstanding of the fact that users' surplus actually includes the benefit due to the tax gap among modes.

When does this inconsistency have major effects?

In many projects, this inconsistency will barely be visible. In some cases, the inconsistency may become more visible. As far as project features are concerned, the magnitude of the inconsistency will be larger in the following circumstances:

- there is an important tax gap between the modes: if not, the project will have little or no incidence on tax revenues and payments;
- the mode shift is important in absolute terms: the larger the mode shift the larger the taxation impacts;
- the mode shift is important in relative terms compared with existing traffic and other elements of the analysis. If not, the tax incidence of the mode shift will only be a small part of the wider picture with limited impact on the project Net Present Value.

A typical example where this inconsistency would become sizeable would be the building of large rail infrastructure with low level of initial traffic and prevision of a large mode shift. In other cases, the inconsistency is unlikely to appear to the analyst. It can become visible only if analysts additionally perform the calculation using other methods, typically the ones used in traditional CBA as performed by transport economists. In other situations, it is unlikely that the practitioners question the issue.

We thus conclude that the EU guidelines likely contain an inconsistency: the claimed principle that taxation should be excluded is not respected when user benefits are based on users' surplus calculated using market prices like in the Rule of Half calculation. Yet, CBA is a tricky topic and the theoretical framework behind the EU guidelines is complex enough to allow for counterintuitive effects. This is often the case when General Equilibrium impacts are considered and generates mechanism that defy immediate understanding. While we have interacted with several colleagues on this issue, none of them could indicate a convincing reason on why this inconsistency would result from the valid features of the theoretical framework. Eventually, if the claimed inconsistency results from a misunderstanding of the modus operandi proposed by the Guidelines, we hope this paper will help to clarify the recommended computation: various users have confirmed the interpretation we give here of the Guidelines, so that a clarification would in all cases be necessary.

Conclusion

In this short article, we have argued on the existence of a likely inconsistency in EU guidelines for the evaluation of transport projects. The inconsistency arises in situation of mode shift among modes with different levels of taxations. It occurs when the project net benefits contain traditional measures of users' surplus but excludes the impact on government revenues.

In such circumstances, the inconsistency is solved by considering the impact on government revenues (a solution that would generally contradict the theoretical setting of the Guidelines). Equivalently, the inconsistency is solved if one subtracts the tax incidence from user surplus. This would be more in line with the theoretical setting of the guidelines but would somehow be cumbersome. Additionally, one could wonder how a fully consistent consideration

of the opportunity cost of public funds could be possible if taxes incidence is not included in the calculation.

One may also wonder how much such inconsistency may touch other fields of applications of the method. Potentially the energy sector, is also one where taxation is highly heterogeneous among technologies. However, the computation of users' benefits in this field can be quite different from the one in use in transport economics, so that a specific investigation would be necessary.

Generally, our analysis casts an intriguing view on one aspect of the EU guidelines. Notwithstanding the coherency of the theoretical approach it is founded on, the process illustrated in the guidelines seems inconsistent: it is also inconsistent with the driving principle that the guidelines provide: exclusion of taxation.

Guidelines, as human constructs cannot be perfect and should be open to discussion and scrutiny. On this topic, sociologists have identified conditions that limit the persistence of errors in organisations (Morel, 2002). A first element is to mitigate the weight of authority. In our specific case, guidelines result from the work of high ranking and respectable experts who elaborate on a highly prestigious theoretical stream of research: this deserves respect, as long as it does not exclude a sincere questioning of findings and recommendations that derives from their contributions. Second, "open deliberation" is a key element in clarifying the potential inconsistencies. We hope that the present paper will be a useful contribution to this open deliberation.

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