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Value of Time estimations in Cost Benefit Analysis: the French experience

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Abstract

A recent study has been commissioned by the French Government in the framework of a general review of CBA practices. Among the various outputs of this study is an update of the value of time and the related parameters such as comfort or reliability. The communication first achieves a short presentation of the above-mentioned report and the recommended VOTs. It discusses the differentiation issue and gives comparative elements with a few other national guidelines. Then, it presents the main issues of consistency between traffic modelling and surplus calculation through practical examples, and finally makes recommendations on how to deal with mandatory VOT and how to combine those mandatory values and traffic modeling results.

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1. Introduction

Value of time is a major parameter in transport economics, and many studies have been devoted both to its theoretical foundation and empirical estimation, and to its use in traffic modeling and Cost Benefit Analysis. Among many other studies on this subject, a recent one has being commissioned by the French Government in the framework of a general review of CBA practices. This report addressed many topics, and among them the value of time (VoT) and the related parameters such as comfort and reliability and their use. A first output is a set of reference values of

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these parameters. Another output is related to the use of these values in traffic modeling and CBA and more generally to the links between traffic modeling and CBA

The aim of this text is to present and discuss the recommendations of this report concerning value of time: what are these values, how are they estimated, what is the relative pertinence of mandatory values of time, a procedure which is commonly in use in most countries, and surplus calculations founded on the demand functions drawn from the traffic models?

The second section gives a short presentation of the above mentioned report and the recommended VOTs. The third section discusses debated issues such as the degree and nature of differentiation of VoT, and gives comparative elements with a few other national guidelines. The fourth section presents the main issues of consistency between traffic modeling and surplus calculation, and makes recommendations on how to deal with mandatory VOT and how to combine those mandatory values and traffic modeling results, and the last section concludes.

2. Value(s) of time for cost-benefit analysis of transport projects in France

Cost benefit assessment of investments is an ongoing preoccupation for public authorities. Long enshrined in the legislation concerning certain sectors, this requirement has been quite recently extended to all public investment in civil investments by the French *Loi de programmation pluriannuelle des finances publiques* (LPPFP, multi-year public finance planning act) of 31 December 2012. In this framework, assessment directives and traffic models are compulsory for investment funded at the national level, which happens essentially for intercity investments, as most urban investments are decided freely by the local public authorities without state funding. Only a very few major urban projects are decided at the national level, and for them specific methods can be designed (a good example is the mass transit *Grand Paris*, a ring project the investment cost of which amounts to around 30 G€, see for instance Quinet 2014 for a description of its assessment methods).

France has a long tradition in CBA. After the first directives issued by the road directorate in the 60's, on several occasions, under the aegis of the Commissariat général du Plan (CGP), then the *Centre d'analyse stratégique* (CAS) and, today, the *Commissariat général à la stratégie et à la prospective* (CGSP), commissions met to define and improve evaluation procedures. Their findings are then converted into instructions and directives issued by the competent authorities.

Only looking back over the past twenty years, a commission chaired by Marcel Boiteux in 1994 (Boiteux 1994) set down the doctrine that makes project evaluation an integral part of the doctrine of economic calculation, including the statement, still topical today, that "economic calculation, despite its shortcomings, remains the best way to evaluate investment projects." Another Commission (Boiteux 2001) updated the previous recommendations.

This report is therefore the continuation of a series of studies based on the use of economic calculation, which have gradually adapted and enhanced it. Its proposals deal with many topics (see Box 1 for a presentation of the scope of the report), among which value of time.

Box 1: Presentation of the CGSP report (Quinet 2013)

According to the mission statement which established the Commission, the report focuses on revising the recommendations of previous reports, seeking to enhance the evaluation, leveraging advances in economics concerning domains like spatial analysis, the problems of governing evaluations and the extension of cost benefit assessments beyond their traditional sectors of application, transport and energy.

The commission addressed several topics: first, revising unit values as the official guidelines for carrying out cost benefit assessments stipulate numerous such unit values. Second, enhancing CBA, in view of the changing world of economics to which they apply and advances in our knowledge in positive economics. Four directions are explored. They are designed to overcome the limits of the standard economic calculation, and pertain to spatial economics, imperfect competition, macro-economic effects such as employment and growth, and distribution effects. Third, improving the rules for projects ranking, especially introducing systematic risk. Fourth, proposing rules for governance of projects CBA. In the present paper we concentrate on value of time and related parameters such as value of reliability and value of comfort, and more precisely for passengers transport.

On this point, the commission is proposing a new set of reference values for the valuation of travel time, consistent with the most recent studies in France and abroad. It incorporates more detail in order to better track the improvements in traffic forecasting models; it supports, for inter-urban travel, the increased valuation of time as a function of travel distance. It now distinguishes the values by mode and purpose for inter-urban travel and by purpose for urban travel. This report also introduces a starting point for considering parameters related to reliability and comfort, previously ignored in evaluations. We know that these parameters play an increasing role in users' behaviour and in the evaluation of many projects, particularly in public transport.

The distinction is made between urban and non-urban transport. In urban areas, the values are given in table 1:

Table 1. Urban values of time, all modes (in €2010/h in 2010)

Trip purpose	France	Île-de-France (Paris region)
Professional	17.5	22.3
Home-workplace/school/day-nursery	10.0	12.6
Other (shopping, care, visits, leisure, tourism, etc.)	6.8	8.7
No reason given	7.9	10.7

In interurban areas, they are given by table 2:

Table 2. Values of time for interurban trips (in €2010/h for year 2010)

Mode	Trip purpose	distances less than or equal to 20 km	distances d between 20 and 80 km	Values at 80 km	distances d between 80 and 400 km	distances d greater than or equal to 400 km	unspecified distance (value for mean distance)	Average distance for mode (km)
Road – passenger car	All purposes	7.9	0.090 x d + 6.1	13.3	0.006 x d + 12.8	15.2	14.4	267
	Professional	17.5	0.202 x d + 13.5	29.6	0.016 x d+ 28.4	34.8	32.7	
	Personal-holiday	6.8	0.031 x d + 6.2	8.7	0.012 x d+ 7.7	12.4	10.9	
	Personal-other	6.8	0.067 x d + 5.5	10.8	0.019 x d+ 9.3	17.0	14.4	
Road – coach	All purposes	7.9	0.166 x d + 4.6	17.9	-0.019 x d+ 19.3	11.9	13.9	294
	Professional	17.5	0.153 x d + 14.5	26.7	0.004 x d+ 26.3	28.0	27.6	
	Personal-holiday	6.8	0.031 x d + 6.2	8.7	0.003 x d+ 8.4	9.8	9.4	
	Personal-other	6.8	0.067 x d + 5.5	10.8	0.006 x d+ 10.4	12.8	12.1	
Rail	All purposes	7.9	0.246 x d + 3.0	22.7	0.011 x d+ 21.8	26.2	25.4	331
	Professional	17.5	0.429 x d + 9.0	43.3	43.3	43.3	43.3	
	Personal-holiday	6.8	0.250 x d + 1.8	21.8	21.8	21.8	21.8	
	Personal-other	6.8	0.265 x d + 1.5	22.7	22.7	22.7	22.7	
Air	All purposes					0.001 x d + 53.2	54.2	1210
	Professional					72.9	72.9	
	Personal-holiday					52.2	52.2	
	Personal-other					53.4	53.4	
All modes	All purposes	7.9	0.155 x d + 4.8	17.2	0.021 x d+ 15.5	0.006 x d + 21.6	19.1	
	Professional	17.5	0.218 x d + 13.2	30.6	0.029 x d+ 28.3	0.020 x d + 32.0	36.2	
	Personal-holiday	6.8	0.055 x d + 5.7	10.1	0.022 x d+ 8.4	0.005 x d + 15.1	11.2	
	Personal-other	6.8	0.215 x d + 2.5	19.7	0.003 x d+ 19.5	0.008 x d + 17.3	23.0	

These values should be changed for specific situations (waiting, walking), according to the following table 3:

Table 3. Waiting time, walking time before and after transport, connecting time

Type of time outside vehicle	Equivalent minutes
Waiting time	1.5
Walking time before and after transport	2
Connecting time	2

Note: one minute of waiting time is perceived, in equivalent minutes, as 1.5 minutes of travel time.

To complete the picture, let us quote the values for comfort, given in table 4:

Table 4. Real time weighting according to the vehicle's load factor

Location of the user in the mode, all modes combined (tram, metro, bus, commuter rail)	Changes in the real-time multiplier K(p) depending on the number of standing passengers 'p' per m^2 in the vehicle	
	For situations where permanent seating is available	*For p > 0*
Seated	K(p) = 1.00	Ka(p) = 1.00 + 0.08*p
Standing		Kd(p) = 1.25 + 0.09*p

Note: a user, standing during a journey where an average of 3 people/m2 are also standing is assumed to perceive his travel time (multiplied afterwards by the value of time concerning his travel purpose) multiplied by 1.29 + 3*0.09 = 1.52.

Reliability is dealt with differently according to the area, whether urban or not. In urban areas, the following rule is proposed:

Table 5. Relation between delay probability on a specific origin-destination and value in equivalent minutes in the case of public urban transport

Delay probability	**Delay below or equal to 5 minutes**	**Delay between 5 and 15 minutes**		**Delays above 15 minutes**	
	All purposes	Commuting	Other	Commuting	Other
Equivalent minutes for each % between 0 and 5 %	Delay below 5 minutes is valued as travel time	0,92	1,24	1,34	1,78
Equivalent minutes for each % between 5 and 15 %		0,92	1,22	1,32	1,78
Equivalent minutes for each % between 15 and 30 %		0,84	1,12	1,08	1,44
Equivalent minutes for each % between 30 and 100 %		0,52	0,38	1,08	1,44
		Delay above 5 minutes, all purposes			
Equivalent minutes for each % between 0 and 15 %	Delay below 5 minutes is valued as travel time	1,24			
Equivalent minutes for each % between 15 and 30 %		1,10			
Equivalent minutes for each % between 30 and 100 %		0,60			

Interpretation: if, on a specific origin-destination, a scheme induces a decrease of the proportion of small delays proportion decreases from 30% to 29%, the benefits are equivalent to 0,84 minutes for commuters trips and 1,12 minutes for other purposes. If there is no indication about the impact of the project on small or large delays, a gain of one minute will be taken into account for each percentage point above 5% (considering that delays are in that case composed of 80% small delays and 20% large delays).

For intercity transports, the recommendations are summed up in table 6:

Table 6. Relation between delay probability on a specific origin-destination and value in equivalent minutes in the case of public inter-urban transport.(air, coaches, rail)

Delay probability	**All purposes**	
	Delay below or equal to 10 minutes	Delay above 10 minutes
Equivalent minute for each percentage point	Delays below 10 minutes are valued as travel time	+ 2,5

Interpretation: if a project induces for a TGV service a decrease from 6% to 5% of the probability of delay above 10 minutes, it is considered that this is equivalent to a gain of 2,5 minutes for each user.

These tables deserve some words of explanation. First they are proposal for a use in CBA for current projects, which implies that the definition of variables is compatible with available data; for instance, in terms of reliability, the unit values should apply to available data in terms of delay probability. Similarly, differentiation of VoTs according to categories which are not available through the current statistics would be useless.

Second, the recommended unit values do not stem from a particular study which would have been commissioned for the purpose of updating these values, but from an expert synthesis from available studies and research results. The collected information comes from both foreign sources and French ones.

For VoT, the main foreign sources were Abrantes et Wardman 2011, Bickel and alii 2005 for the contribution of Heatco, Wardman 2004, Wardman and alii 2013, Shires et de Jong 2006 ; the main French sources were Hammadou and Jayet 2002, Picard et al. 2012, De Palma and Fontan 2000, SETRA 2007, 2010 and 2012.

For comfort and reliability the sources are both foreign (Litman 2007, Brownstone § Small 2005, Markovich 2009) and French (Kroes and alii 2013, Koning 2013). The sources for comfort and reliability are mainly stated preference studies, as in almost all other countries. It is not the case for the VoT, for which, contrarily to other countries, French data are mainly based on revealed preference studies.

Box 2: The price-time model

This approach devised by Abraham and alii (1973) has been used particularly in France by SNCF and by the Civil Aviation Administration to model the competition between rail and air. The model is analogous to the models of product discrimination used in industrial economics, and is intermediate between aggregated and disaggregated models. It is based on the following principles, explained in the case of air-rail competition: assume each user i chooses according to each mode's generalized costs:

$$C_f^i = p_f + h_i t_f \qquad C_a^i = p_a + h_i t_a$$

Where:

- C_f^i, C_a^i are the generalized costs of rail and air
- pa and pf are the prices of the two modes
- ta and tf are the travel times
- hi is the value of time of the user i

User i chooses rail if:

$C_f^i \le C_a^i$ or:

$$h_i \le \frac{p_a - p_f}{t_f - t_a}$$

Knowledge of the supply allows us to calculate the right side of this inequation, which can be called the 'switch value'. From the distribution of VoTs, this allows us to calculate the share of users choosing rail:

$$\Pr(f) = \Pr(h \le h_b)$$

This model has been improved and sophisticated especially through the introduction of random variables in the utility function.

At that point some words on French experience of CBA and traffic modelling assessment may be useful. France has a large and long lasting experience of toll motorways (more than one hundred links from the 70s to now) and high speed rail (around 20 projects). Correspondingly, revealed situations of arbitrage between monetary costs and time savings are numerous, the traffic models have been refined along the years and exhibit a relatively small rate of error, as shown by the comparisons ex ante-ex post which are regularly made for large projects (Meunier 2012, SETRA 2008).

Two features of the French models should be quoted. First, the traffic models often adopt logit formulations for modal choice, using a non linear utility function (Box Cox techniques). Second, it happens often that for interurban route choice the values of time are differentiated among the users in relation with their income: it is the principle of the "*Modèle prix-temps*" (price-time model) widely used and sketched in Box 2.

VoTs provided in the report are from that point of view VoTs after selection by the users (selection of mode or route). Therefore they are average values around which the values relative to each specific project are spread, as the conditions of competition between modes or routes depend on the specificities of the project.

3. Discussion and comparisons

A general feature which appears clearly from the previous tables is that the VoTs increase with distance. This feature is common to many studies (Borjesson 2014, Abrantes and Wardman 2011, Mackie 2001, Ramjerdi et al 2012, Small 2012). The point is not clear whether this link is really with distance or should be made between VoT and time (Borjesson 2012).

Temporal elasticity to income is set at 0,7; which is in the middle of the range of 0,5-1,0 provided by the various studies on the subject Small 2012, Borjesson 2012, Abrantes and Wardman 2011, Mackie 2003. The comparison with the values adopted in the previous French study (Boiteux 2001) shows that the VoTs have not increased as much as the simple consideration of inflation and income elasticity would have implied. This result is also a classical one, confirmed by many studies. The most frequent explanation is that the increased use of items such as smartphones and tablets makes travel time less useless. Let us also mention another related argument: the general use of smartphones to set agendas of activities allows a more efficient allocation of time and makes less stringent the overall time constraint.

Table 7. Values of time for interurban trips from various studies, in Euro per hour

Mode	Purpose	New French values 2010 Euro per hour For average distance	Meta-analysis UK Wardman Abrantes 2011 All purposes	NL Significance 2012	Borjesson 2014	UK TAG databook ressource cost values 2010 Euro/hour
Car	All purposes	14,4			10,9	
	Work	32,7		26,25		28,4
	Personal Holidays	10,9	15	7,5		6,4
	Personal others	14,4	15	7,5		6,4
Bus-Coach	All purposes	13,9			3,9	
	Work	27,6		19		
	Personal Holidays	9,4		6		6,4
	Personal others	12,1		6		6,4
Rail	All purposes	25,4			7,4	
	Work	43,3		19,75		33,6
	Personal Holidays	21,8	19	7		6,4
	Personal others	22,7	19	7		6,4
Air transport	All purposes	54,2				
	Work	72,9				
	Personal Holidays	52,2				
	Personal others	53,4				
All modes	All purposes	19,1				
	Work	36,2				
	Personal Holidays	11,2				6,4
	Personal others	23				6,4

It is also interesting to compare the VoTs with those recommended in other countries. These comparisons are not easy since the years of estimation are not the same from one country to another, the categories of users are not the same either. With these caveats, the following indicative tables have been drawn.

It is tempting to draw several conclusions from these two tables. First the hierarchies between modes or between purposes are the same. Second the magnitudes are roughly similar; in particular, French values are close to the Netherlands values, except for rail. Rail values are higher for France, which could partially be explained by the importance of high speed train in France, which is attractive to high VoT users. Third, the French value are in the upper part of the range, and often above it for interurban values; this point is perhaps due, among other, to the fact that the French values, drawn from revealed preference analyses, include –imperfectly of course- some factors such as mode specificities (reliability for instance) which are not included in the other, and specially foreign, studies, mainly based on stated preference methods.

Table 8. Values of time for urban trips from various studies, in Euro per hour

Urban VOT by purpose	new French values	new Ile de France values	meta-analysis UK Wardman Abrantes 2011	NL (Significance 2012) (1)	Sweden (Borjesson 2014) (2)	UK (Mackie 2003) (3)	UK TAG databook ressource cost values 2010 Euro/hour
Business	17,5	22,3	na	21			28,4
Commute	10	12,6	6,0-11,0	10	8,3	5,2	7,2
Other	6,8	8,7	5,5-10,0	7	5,7	4,8	6,4

(1) Averages of values per mode (2) Medians of values per mode (3) Updated to 2010 using annual growth rate of 4% (for both inflation and economic growth)

4. Consistency between traffic modelling and CBA

In a world of perfect knowledge, VoT, VoR and other parameters driving the behaviour of users should be known for each user; the results from model calibration and from stated preference would provide the same estimates for each specific situation and each specific user, and there would be no reason to estimate reference values for these parameters, except for equity and distribution issues.

Equity and distribution are often presented as a reason to set reference values, and to fix them to figures which can differ from the behaviour values, for instance to set them at the same level for every user, despite the fact that users with higher income have, all other things being equal, higher behavioural VoTs.

But this procedure entails many drawbacks. First, it is well known that, in order to change the distribution, the first best way is to change the incomes, and not to change the situations of specific goods. It could be argued that some goods have a feature of common good or essential facility, or are related to some kind of public service, such as health or education or safety, and should be equally provided to everybody, whatever are the differences in willingness-to-pay of the agents. But there is no reason that this argument applies to travel time; it could make sense to apply such a rule to the generalized cost of transport (at least, several countries, including France, make a public obligation to provide sufficient transport possibilities to every citizen); but nobody has dared to do it.

Furthermore, it is well known that transport users are not the final benefiters of the investment surpluses. For instance, in many simple urban models the final benefiters are the land owners. Therefore, while aiming at favouring some category of users, the public authorities could instead provide benefits to other categories (in the example, to the landlords).

Apart from these equity considerations, in the line of economic theory, users' surplus- or in a more rigorous procedure, the equivalent variation (EV) should be reckoned through the demand functions, which should be drawn from utility functions. If the traffic models are designed according to the principles of micro-economic theory, they should be the basis for surplus or EV calculation; for instance in the well known case of a logit utility function, the surplus is reckoned through the logsum formula. In such a procedure, there is no need for an external value of VoT, the VoT is a parameter of the calibration of the traffic model.

But the models often do not follow the principles of micro-economic theory (in a word and in technical terms, the demand functions cannot be integrated). Furthermore, there are a wide variety of models, and their parameters are estimated with errors. These facts entail the comparability of the results between projects evaluated with different models, and can lead to manipulation from the promoters of the project. On top of that, surplus reckoned through the traffic models induce the syndrome of black box vis-à-vis the decision makers, and their calculation lacks transparency. VoT reference values are the way chosen to avoid those drawbacks: they are transparent, lead to more comparability and avoid manipulation.

However, recent studies underline the complexity of VoT, the diversity of its drivers, and how it is difficult to seize their influence. Let us quote the main well known ones (Fosgerau 2006, Small 2012):

- The purpose of the trip
- The time of the day, or of the year
- The characteristics of the mode (comfort, ability to have an activity during the trip, …)
- The distance (or duration) of the transport
- The income of the user
- The reliability.

Furthermore, the effect of each of these drivers is specific to the user (generally this idiosyncrasy is accounted for through random variables). Research for a better knowledge of these effects is presently very active (Small 2012). It is indeed very useful as it provides input to traffic modellers on how to design the models (which variables to introduce, according to which functional form,…) and to statisticians (which type of data to record, how to design the regular periodic surveys,…).

But the diversity of these factors poses problems for evaluation. First, the transparency goal is the less reached the more complicated VoT structure is; in this respect, it is probable that the structure of French recommendations (table 2 for instance) is close to the maximum degree of differentiation acceptable. As complexity increases, comparability decreases too, and risks of manipulations are growing: more details, more devils.

On top of that, research provides the effect of these parameters before selection of modes or routes, but not after selection, as the selection of modes and routes depends on the specific characteristics of the project under assessment, and for each project is different according to the origins and destinations. This point is exemplified in box 3, where its consequences are simulated on a very simple model focussing on the effect of income, assuming all other parameters are without influence.

Box 3: Effects of specific competition situation on user's surplus

Let us consider a situation where 5 users have VoTs which are independent of all characteristics except their incomes. There are five income classes and then five VoT classes of equal sizes (each of 1 user): 10, 20, 30, 40 and 50; the average VoT of the users is clearly 30. In the ex ante situation there is just a toll motorway, whose toll is 29, for a trip whose time is 1 hour; assume that the monetary cost of car is zero. Let us introduce a new mode, whose travel time is half an hour and consider two cases: first the price is 50 and second the price is 40. the following table shows the consequences of VoT after selection in each of these two cases. It is clear that the average VoT of transferred users changes a lot according to these two cases, and it is this VoT which matters for project assessment; the last column shows the importance of the gap between surplus reckoned according to an average reference VoT (here taken as 45) and surplus reckoned according to the traffic model teaching.

Case 1	Ex ante (one user)		Motorway			Ex post		Motorway + Rail	Mode chosen	VoT of transferred users	Surplus according to model	Surplus with reference VOT=45
Users' Class	Nb users	VoT	time	price	GC	time	price	GC				
A	1	10	10	29	39	5	50	55	M			
B	1	20	20	29	49	10	50	60	M			
C	1	30	30	29	59	15	50	65	M			
D	1	40	40	29	69	20	50	70	M			
E	1	50	50	29	79	25	50	75	R	50	4	1,5
								Average	per user	50	4	1,5

Case 2	Ex ante		Motorway			Ex post		Motorway +Rail	Mode chosen	VoT of transferred users	Surplus according to model	Surplus with reference VOT=45
Users' Class	Number of users	VoT	time	price	GC	time	price	GC				
A	1	10	10	29	39	5	40	45	M			
B	1	20	20	29	49	10	40	50	M			
C	1	30	30	29	59	15	40	55	R	30	4	11,5
D	1	40	40	29	69	20	40	60	R	40	9	11,5
E	1	50	50	29	79	25	40	65	R	50	14	11,5
								Average	per user	40	9	11,5

Furthermore most of the traffic models use the generalized cost variable, but on top of price and time include in it a modal and/or route constant, which stands for omitted variables such as reliability, frequency or comfort. Great errors and inconsistency arise if these modal/route constants are not introduced in standardized user's surplus calculation. The problem is especially acute for the transferred traffic, corresponding to the users who used another mode in the reference situation and who now use the new infrastructure. This inconsistency does not appear if the user's surplus is estimated in accordance with the traffic model specifications.

Another reason can be evoked for reference values: standardization makes sense for items for which primary studies are expensive and for which the results are 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, which can be drawn from model traffics the methodology of which has greatly improved as well as the practice and quality of calibration.

On the whole, the choice between surplus calculation through VoT reference values or formulae issued from traffic models is not clear cut and simple. This choice depends on the trade-off between various arguments such as, focussing on some technical issues: accuracy of traffic models, complexity of reference values, diversity of choice situations, institutional structures implying more or less possible manipulations.

Balancing these arguments, the choice in the CGSP report (Quinet 2013) has been made to use both procedures under the following conditions:

- Check, through external independent expertise, to what extent the traffic model is in accordance with the micro-economic theory, and make explicit the user's surplus calculation following the model
- In parallel, estimate the user's surplus with the reference VoT's
- Presently, very few traffic models include reliability of comfort as explanatory variables of the users' behavior. These variables are then imperfectly embedded in the time parameter. Adding an estimation of reliability or comfort based on stated preferences (as they are now valued) exposes to a risk of double counting or at least overlapping. Adding the corresponding valuations should then be considered as variants of the main assessment including only time effects. Obviously, improvements in this respect and inclusion of reliability and comfort variables in the traffic models would be a considerable improvement and would allow to add the corresponding terms to surplus without double counting
- Compare the results, and in case of large discrepancy, analyze its causes.
- Develop models taking into account the various dimensions of VoT.

5. Conclusions

Despite the long record of research and studies, the value of time and its related variables such as comfort or reliability remain a subject of interrogations (Small 2012). The present text aims at putting a stone in the building, recording the experience and recommendations made in the case of France in the framework of a recent report intending to update the rules of project appraisal through Cost Benefit Analysis.

Based on a kind of meta-analysis of both domestic and foreign information, a set of values have been established. Contrarily to the procedures used in other countries, no specific study has been commissioned, and the main sources for VoT are revealed preference studies, made reliable through the large experience of choices between price and time of toll motorways or high speed train, whether purely public or under public private partnerships. Comparisons with foreign values show that the French recommended values lie in the range of currently admitted values, perhaps a bit in the upper part. This point could be explained by the fact that revealed VoT's include a part of comfort and reliability as up to now these param²eters are not included in traffic models, whereas stated preference values take account purely of time and money.

This point raises the issue of whether and how to use these values for CBA. The main alternative to mandatory VoTs is to reckon surplus according to the demand functions on which the traffic models are based. After a discussion of the arguments pro and con, the final recommendations are made:

- Check, through external independent expertise, to what extent the traffic model is in accordance with the micro-economic theory, and make explicit the user's surplus calculation derived directly from the model
- In parallel, estimate the user's surplus through the reference VoT's
- Presently, very few or no traffic model includes reliability of comfort as explanatory variables of the users' behavior. Adding an estimation of reliability or comfort based on stated preferences (as they are now valued)

presents a risk of double counting or at least overlapping. Adding the corresponding valuations should then be considered as variants of the main assessment including only time effects. Of course, improvements in this respect and inclusion of reliability and comfort variables in the traffic models would be a considerable improvement and would allow adding the corresponding terms to surplus without double counting.
- Compare the results, and in case of large discrepancy, look after its causes.
- Develop models taking into account the various dimensions of VoT.

These conclusions raise the question: how to estimate surplus through traffic models, clearly a subject for another communication.

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