Ex Post Appraisal: What lessons can be learnt from EU Cohesion funded transport projects

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SHORT ABSTRACT
The results of an ex post evaluation of ten large transport projects in EU countries is presented. The ex post and ex ante impacts and the respective CBAs are compared. Differences between the two are identified and recommendations made for improving appraisal.

1 INTRODUCTION

Investment decisions are made in the face of uncertainty over future impacts. Minimising this uncertainty plays a large part in any case for funding – for example in the effort to produce robust demand forecasts, benefit estimates and costings. A number of authors have considered the pattern of error and bias that arises between the *ex ante*[1] cost benefit results and the actual outcome – e.g. Mackie and Preston (1998) and Flyvbjerg (2007). In particular, Flyvbjerg's well-known work has found a pattern of *optimism bias*, in which costs are systematically underestimated and demand/traffic/benefits/revenues are systematically overestimated. Some appraisal systems now incorporate *optimism bias adjustments*, which anticipate and counteract this phenomenon (e.g. DfT, 2012).

Completing an *ex post*[2] evaluation for a sample of projects is one way of gathering evidence on the errors and biases in ex ante appraisal and trying to learn lessons for the future. *Ex post* evaluation is surprisingly little used in the transport sector, however, its use is increasing. In England, the Highways Agency (HA) currently evaluates all trunk road Major Schemes (capital cost >£10m) and a large number of smaller schemes, using a process known as POPE (Post Opening Project Evaluation), which has been contracted to Atkins since 2001. POPE collects Pre-opening Baseline Data (such as Annual Average Daily Traffic; Journey Times; Accidents; and Environmental data), then delivers a One Year After Study and a Five Year After Study for

each project, plus a Meta Report every two years across the programme. Thus POPE generates a large quantity of information on the performance of schemes, and notably covers the full range of the Department for Transport's (then) policy objectives of Economy, Safety, Accessibility, Integration and Environment. Examples of recent POPE recommendations are:

- future modelling requirements for scheme appraisal need to be more clearly defined and consistently applied between schemes;
- consideration should be given to a two tier model approach utilising Strategic National or Regional Model estimates of demand feeding into a more scheme specific modelling platform; and
- risk analysis of traffic forecasts should be undertaken, similar to that usually associated with cost forecasts (Atkins, 2009).

A key issue raised by the French experience of ex post evaluations, five years after opening, is the choice between the method and values taken from the original *ex ante* CBA, versus an evaluation conducted to present standards using Boiteux (2001) values – this sometimes had a significant effect, e.g. increasing the appraisal period from 20 to 40 years added 2% to the IRR for TGV Nord.

Another widespread issue is the difficulty of establishing a counterfactual situation in an *ex post* appraisal. Expert consensus based on various trend and control corridor data is the favoured method in France.

In Norway, Kjerkreit, Odeck and Sandvik (2008) report on the post-opening evaluation of road investment projects. They focus on the accuracy of the NPVs, traffic forecasts; and divergences in accident costs, investment costs and changes in project designs. Key findings are that:

- accounting for the severities of outturn accidents has a great influence on accident costs;
- national road traffic forecasts used in appraisal have been too coarse to predict demand growth at the level of an individual project (again evidence on project-level induced traffic);
- generally traffic growth was higher than forecast and NPV higher than predicted; and
- overall, deviations between forecast and actual impacts varied greatly from project to project.

Chevroulet (2008) found that in the European Investment Bank, *ex post* evaluation is conducted for 15% of projects. Meanwhile EC DG REGIO has a programme of evaluations in progress, based on a representative sample (Evaluation Plan 2009). Work has included the calculation of unit costs for key project components and the identification of potential links between project performance and project characteristics. The work provided the Commission with benchmarks for use in the appraisal of future project financing requests. Issues raised included serious gaps in the data (e.g. on output), and *ex ante* CBAs weak in methodology.

This paper describes the results of research funded by the European Commission DG REGIO, which carried out *ex post* evaluations of 10 large transport projects in EU countries benefiting from EU Cohesion and ISPA funding during the period 2000-2006. The research was not only concerned with project- and programme-level outcomes, but also the following two more general questions about ex post appraisal:

- how can ex post CBA contribute to the practice of ex ante CBA?
- what are the potential and the limits of ex post CBA as a tool to identify the impact of infrastructure projects?

Section 2 describes the data and methodology. Section 3 sets out the some of the key findings. Section 4 considers the lessons learnt for both ex ante appraisal and ex post evaluation, and Section 5 draws conclusions on the research questions and highlights areas for future research.

2 DATA AND METHOD

Table 1 presents summary information of the ten projects that formed the basis for this paper. There are four rail projects and six road projects covering eight European Member States. The projects opened between 1999 and 2010, whilst the ex ante appraisals were undertaken between 1995 and 2004. These projects were drawn from a list of 40 transport infrastructure projects that had benefited from EU Cohesion[3] and ISPA (Instrument for Structural Policies for Pre-Accession, aimed at accession countries) funding during the period 2000-2006 and were complete. From this 20 were selected for assessment of feasibility of use in this research. Suitability was determined primarily by data availability including: comprehensiveness of ex ante evaluation; baseline data readily available; likely level of support from key contacts involved in the evaluation process; availability of primary / secondary data from existing sources; and the amount of new ex post evaluation primary data required to support evaluation.

Table 1. Overview of projects considered

	Opening date(s)	Date of ex ante appraisal	Capital costs - EURm *(% Cohesion Fund contribution)*
AVE Madrid - Barcelona (Spain)	**2003 - 2008**	**2001**	**1,719** ***(61%)***
A2 Motorway (Poland)	**2006**	**2003**	**476** ***(82%)***
Algarve Railway (Portugal)	**2003 - 2006**	**1999**	**419 (77%)**
A23 Motorway (Spain)	**2001 - 2005**	**1999 and 2003**	**203 (83%)**
Agios Konstantinos Bypass (Greece)	**2008**	**2002**	**441 (55%)**
M1 Northern Motorway (Ireland)	**2003**	**1995**	**232 (66%)**
Railway Thriassio – Kiato (Greece)	**2005 - 2007**	**2000**	**619 (47%)**
IX B Corridor (Lithuania)	**2006 - 2009**	**1999**	**154 (79%)**
Bratislava Railway Upgrade (Slovakia)	**2003 - 2009**	**2001**	**234 (39%)**
M0 Budapest Ring Road (Hungary)	**2008 - 2010**	**2004**	**367 (74%)**

Source: Funding applications

Ex post cost benefit analyses were undertaken using standard transport cost benefit analysis methods, with the principle difference that traffic demands and capital cost data was based on outturn costs and realised demands. The wider socio-economic benefits of the project were assessed through qualitative interviews with stakeholders.

The following data was collected for each project (where relevant) to allow a comparison to be made between the ex ante CBA and ex post CBA:

- Original Ex ante CBA application to the EU for funding (including, core CBA, risk assessment, feasibility study, environmental impact study, planned resources and financial contribution, timetable for inclusion, main justification for public contribution to the scheme
- Ex post CBA – the data requirements were similar to those required for the ex ante CBA. The key difference being that where possible forecasts used in the ex ante CBA were replaced with actual historical

data (post opening). Including revenues from tolls or rail services, maintenance and operating costs, traffic data (e.g. vehicle speeds and counts), journey times and patronage, accidents, emissions.

Certain issues arose while the team were assimilating the information required for the CBA for example, where schemes had only opened in the year that the study was taking place (e.g. M0 Budapest Ring Road) resulting in a lack of actual historical data to populate the CBA, or where the key officials in the country were no longer in position or external consultants had undertaken the analysis limiting the data availability. The project undertook two pilot projects (A2 Motorway in Poland and the Lisbon to Algarve Railway) to identify the framework for analysis and pick up on any initial issues.

A variety of sources were utilised by the study to collect the data required. These included the EC Funding Decision documents, Final Reports, which provided information about project objectives, outcome of ex ante CBA analysis and completion data, contact with DG REGIO, desk officers and contacts in member states. Whenever possible, we relied on publicly available information, such as traffic count databases and accident data, but we also commissioned traffic and journey time surveys where relevant.

The final part of the methodology was to update the ex ante CBA for each of the 10 projects and explore any reasons for differences between the results achieved for the ex ante and updated ex post appraisal.

3 A COMPARISON BETWEEN THE EX ANTE AND EX POST ANALYSIS

Our work was articulated in three main steps:

- First we reviewed the ex ante analyses that project stakeholders had undertaken at the time of submitting the funding application to the European Commission;
- We then carried out an ex post evaluation of each project, collecting the necessary information covering the period since the project opening;
- Finally, we compared and contrasted the results of the ex post evaluation with those of the ex ante appraisal.

We summarise our findings in this order below.

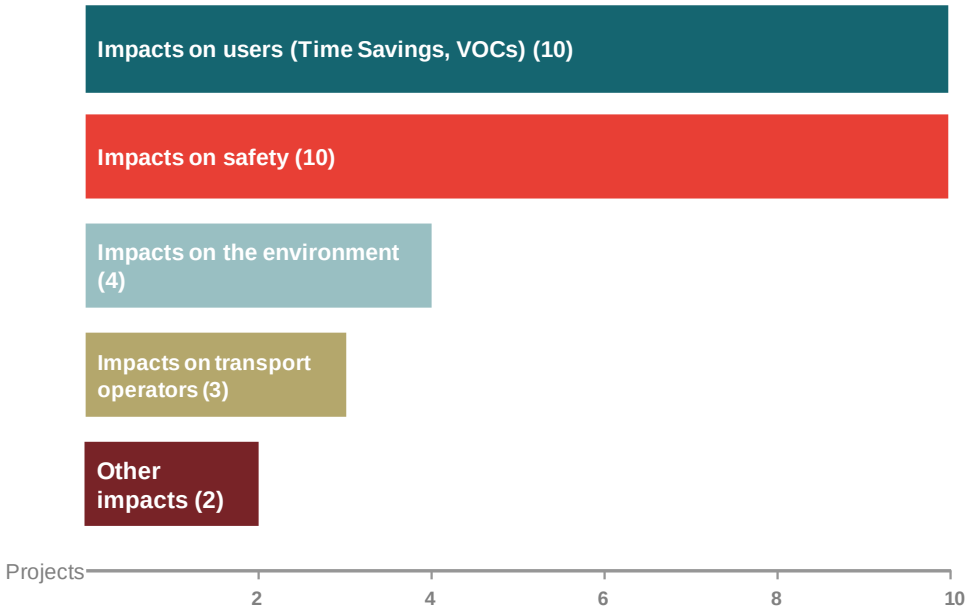
3.1 Review of ex ante analysis

Our review of the ex ante analyses focused on four key aspects: the scope of the analysis, the key parameters considered, the treatment of project risk in the analysis, and the role that cost-benefit analysis played in the stakeholders' decision-making process.

Scope of ex ante cost-benefit analysis

With regards to the scope of the analysis, Figure 1 shows the types of impacts that were considered in the ex ante CBAs we reviewed.

Figure 1. Impacts considered in the ex ante CBA.



Source: Project funding applications

As shown in the figure, all ex ante analyses included an assessment of the core impacts on users (time savings and reduction in vehicle operating costs) as well as the safety benefits of the project. Outside of these core areas, however, the picture is more mixed. In only four cases, the analysis included a monetary quantification of the environmental impacts of the project while in only three cases the impact of the project on other transport operators were considered. Other impacts (such as congestion benefits) were considered only in two cases.

Key parameters

In reviewing the ex ante analyses we have sought to compare the approach used by different project stakeholders. Specifically, while the overall approach used was similar and in line with CBA best practice, there were some significant differences in the key parameters that were used in different Member States. We summarise our main findings below.

- **Discount rates:** discount rates used were normally around 5-6%, except in the rail project in Slovakia (10%) and the motorway in Poland (8%). We note that higher discount rates are associated with shorter appraisal periods.
- **Length of appraisal period:** the length of the appraisal period used for the evaluation shows more variability, ranging between 20 years (A2 Motorway in Poland and Bratislava Railway Upgrade in Slovakia) and 36 years (Railway Thriassio – Kiato in Greece). Generally rail

projects include a residual value for the project at the end of the appraisal period while road projects do not. This is to be expected as railway infrastructures have a longer useful life than road infrastructures.

- **Value of time:** the range of the parameters used was wide. This is to be expected, as the value of time depends on variables such as per capita GDP. We note however that there did not appear to be any relationship between the values used in the analysis and the HEATCO values (.
- **Vehicle operating costs:** The VOC parameters used in the ten ex ante analyses are difficult to compare across projects. This is because VOC parameters are sometimes expressed in Euro/vehicle/Km and sometimes Euro/passenger (or tonne)/Km. In general, VOC parameters are only reported for road transport, distinguishing between passenger and freight.
- **Safety:** The cost of accidents varied significantly between countries. For example, the cost of a fatality in Ireland is more than ten times higher than the value used in Spain, and more than four times higher than in Lithuania. Injury costs seem to be slightly more aligned across countries.

Risk analysis

The ex ante CBA analysis included various sensitivity tests as part of the risk analysis undertaken in all ten projects. The number of sensitivity tests for every project ranges from two to four, with the exception of the M1 Northern Motorway in Ireland which included 27 sensitivity tests. The capital cost of the project is the risk factor most frequently considered in the risk sensitivity analysis (eight out of ten projects include this factor). Also, different values of the key parameters used in the ex ante analysis are usually tested in the risk analysis (five projects).

Table 2 indicates the number of sensitivity tests undertaken in each project the risk factors considered in those tests. It is noteworthy that travel demand is considered as a risk factor in only 2 of the 10 projects.

Aside from sensitivity tests no other form of risk analysis was undertaken.

Table 2. Risk analysis. Sensitivity tests run and risk factors considered

	Sensitivity tests under-taken	Risk Factors considered			
		Travel demand	Fuel prices	Capital costs	CBA para-meters
AVE Madrid - Barcelona (Spain)	2			✓	
A2 Motorway (Poland)	4	✓		✓	
Algarve Railway (Portugal)	2				
A23 Motorway (Spain)	2			✓	
Agios Konstantinos Bypass (Greece)	4			✓	✓
M1 Northern Motorway (Ireland)	27	✓	✓		✓
Railway Thriassio – Kiato (Greece)	2			✓	
IX B Corridor (Lithuania)	3			✓	✓
Bratislava Railway Upgrade (Slovakia)	3			✓	✓
M0 Budapest Ring Road (Hungary)	4			✓	✓

Source: Ex ante CBAs

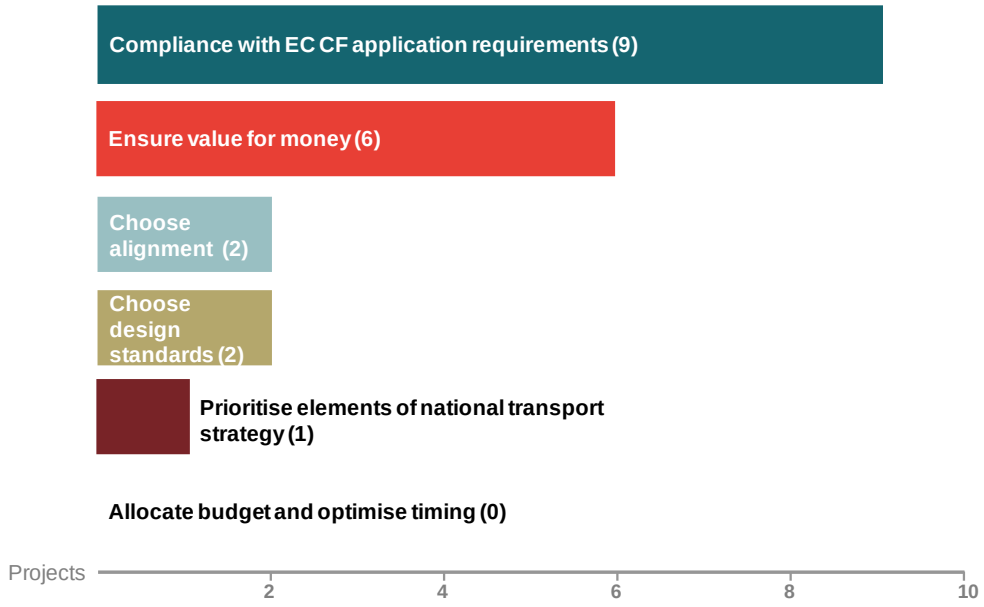
The role of ex ante CBA in the decision-making process

We have found that the role of the ex ante CBA in the decision-making process mainly relates to complying with EC requirements, though for 6 projects, ex ante CBA is used to ensure value for money when making choices about project implementation. However, in most cases ex ante CBA is

not used for strategic decision making. In only a few cases, project stakeholders stated that they had used ex ante CBA to help choose between design standards, alignments, and to prioritise elements of the national transport strategy. However, in no case ex ante CBA was used to allocate limited budgets between projects or to optimise the timing of project implementation.

Figure 2 summarises our findings.

Figure 2. Role played by the ex ante CBA



Source: Discussion with project stakeholders

3.2 Results of ex post evaluations

Below we summarise the results of the ex post evaluation exercise, as follows:

- First, we present the overall findings of our analysis, summarised by the key economic appraisal indicators (Present Value of Benefits, Present Value of Costs, Net Present Value, Benefit Cost Ratio, and Internal Rate of Return).
- We then identify and compare the key sources of benefits, for both rail and road projects
- We conclude by discussing the wider socio-economic impacts of the projects considered.

<u>Overall findings</u>

Table 3 summarises the results of the ex post evaluation. As the table shows, most projects have yielded a positive net present value, indicating that the

economic benefits of the projects have exceeded their costs. In the AVE Madrid – Barcelona project the NPV is negative for both the High case and the Low case due to the high upfront capital costs of the project. We note, however, that the cost-benefit analysis of this project does not account for the wider socio-economic impacts of this project. These impacts are expected to be significant, although difficult to quantify and therefore add to the cost-benefit analysis.

Table 3. Ex post evaluation – economic appraisal indicators

	PVB (€m) High Low	PVC (€m) High Low	NPV (€m) High Low	BCR High Low	IRR High Low
Rail projects					
AVE Madrid - Barcelona (Spain)	5,744 4,856	7,692 7,593	-1,948 -2,736	0.7 0.6	3.7% 2.6%
Algarve Railway (Portugal)	410 379	331 331	79 48	1.2 1.1	7.4% 6.7%
Railway Thriassio – Kiato (Greece)	583 358	326 326	258 32	1.8 1.1	9.3% 6.1%
Bratislava Railway Upgrade (Slovakia)	443 291	231 231	98 40	2.0 1.4	10.4% 7.8%
Road projects					
A2 Motorway (Poland)	1,168 791	268 268	900 523	4.4 3.0	22.8% 18.2%
A23 Motorway (Spain)	253 198	225 225	28 -28	1.1 0.9	6.3% 4.6%
Agios Konstantinos Bypass (Greece)	488 438	206 206	283 233	2.4 2.1	13.4% 12.6%
M1 Northern Motorway (Ireland)	4,140 4,040	235 235	3,905 3,805	17.6 17.2	53.0% 53.0%
IX B Corridor (Lithuania)	300 288	88 88	212 200	3.4 3.3	56.0% 55.0%
M0 Budapest Ring Road (Hungary)	1,187	213	974	5.6	24.8%

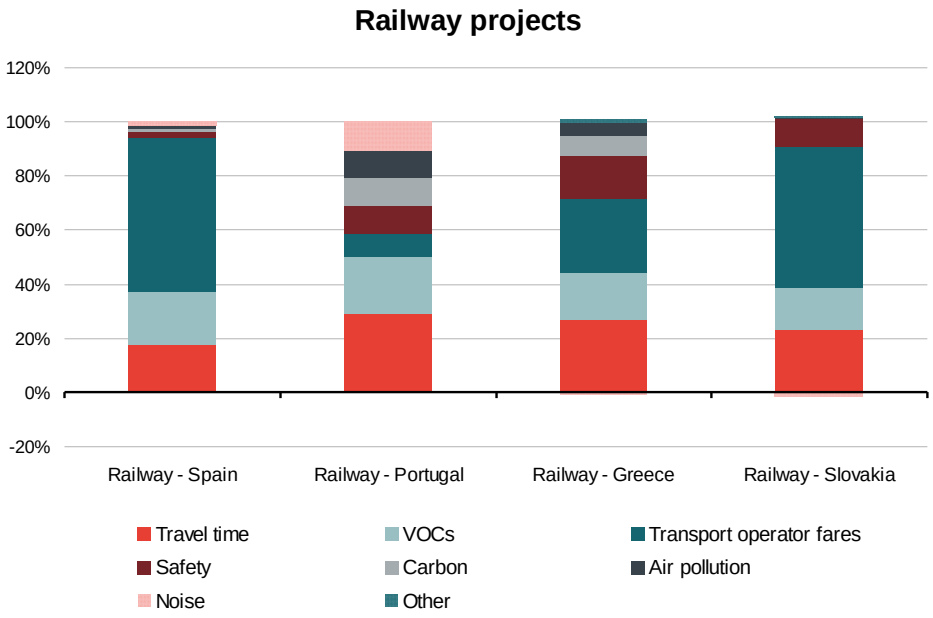
Note: For all schemes except for Bratislava Railway Upgrade (Slovakia) and Railway Thriassio – Kiato (Greece) figures reported are in factor prices as oppose to market prices.

Key sources of benefits

Figure 3 and Figure 4 present the benefit distribution for railway and road projects separately.

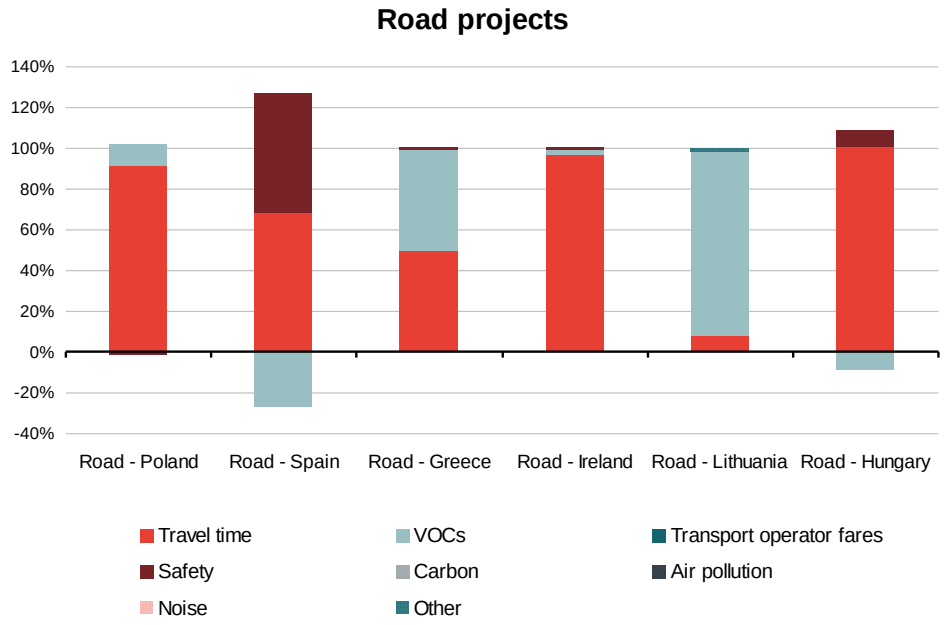
Overall, it can be observed that most of the benefits for railway projects arise from additional revenues from fares and travel time saving. On the other hand, for road projects, most of the benefits come from travel time saving and vehicle operating cost savings. This confirms the importance for rigorous demand modelling, especially when appraising road projects.

Figure 3. Sources of benefits – railway projects



* For the Bratislava Railway Upgrade (Slovakia), the analysis has identified operating cost savings for the transport operator. However, these should be considered in the analysis as cost reductions rather than benefits and therefore are not included in this chart. However, this does not have any impact on the NPV calculation.

Figure 4. Sources of benefits – road projects



Wider socio-economic impacts

All transport projects, especially major ones, tend to have significant impacts on the local, regional and national socio-economic environments. These impacts, however, cannot be quantified. We have considered these impacts from a qualitative point of view, based mainly on gathering evidence through interviews with project stakeholders at Member State level.

Identifying the wider socio-economic impacts of these projects in the absence of a monitoring framework implemented from project opening onwards is particularly challenging for two main reasons:

- the "counterfactual" (i.e. what would have happened in the absence of the project) had not been defined, thus making it difficult to identify the incremental impacts of the project over and above its counterfactual; and,
- many of these projects were implemented as part of wider transport investment strategies and against a backdrop of rapid economic growth; in this situation, the attribution of wider impacts to a specific project is particularly challenging.

Despite these difficulties, we have identified the following types of wider impacts: land use, supply chain, GDP or output, employment, social inclusion, and the environment. However, aside from local land use and environmental effects we generally found it difficult to establish a direct causal link between

the transport infrastructure investments and the observed effects. This is especially relevant for the impact on the GDP of the region/country.

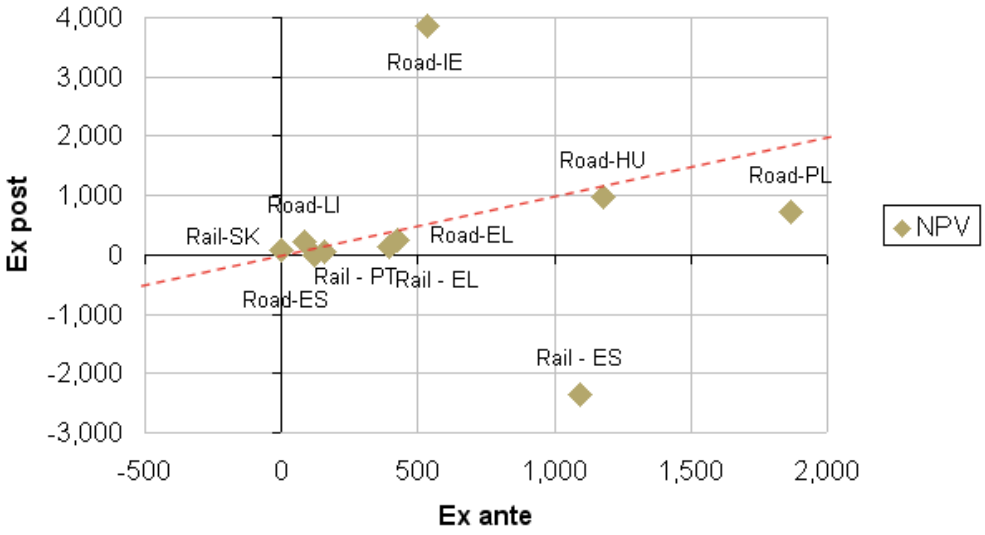
3.3 Comparison of ex ante and ex post analyses

We can compare, using the various economic indicators, the results of the ex ante analysis and those of the ex post evaluation.

Net present value

Overall, the NPV of the majority of the projects was overestimated in the ex ante compared with the ex post evaluation. With the exception of the M1 Northern Motorway (Ireland), IX B Corridor (Lithuania) and Bratislava Railway Upgrade (Slovakia), the ex ante NPV of all of the other projects exceeded ex ante NPV. Figure 5 summarises our findings

Figure 5. Comparison of ex ante and ex post NPV



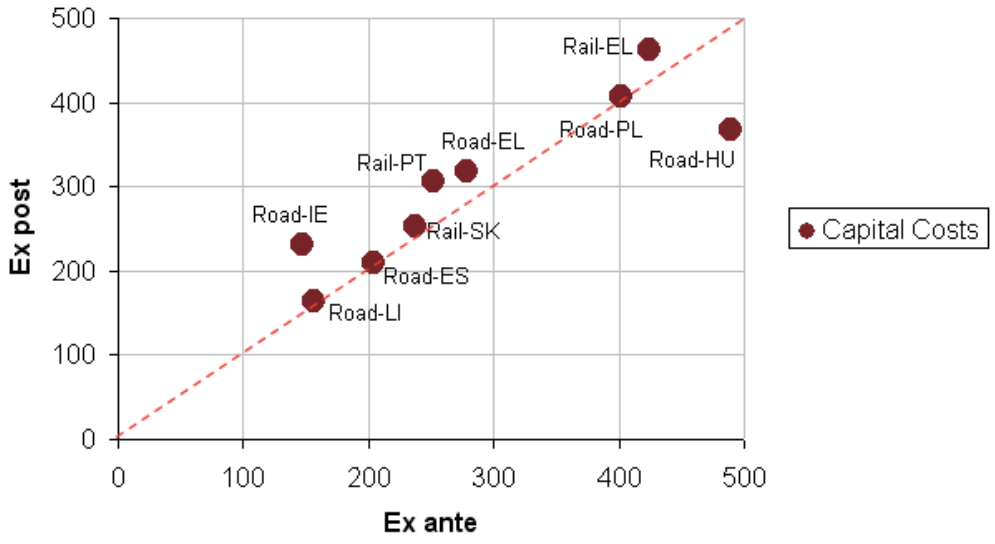
Note: Ex post figures correspond to the average for the high and low case scenarios

Capital costs

With the exception of the Hungarian M0 Budapest Ring Road project, the ex post capital costs exceed ex ante figures in all projects. This indicates that most of the ex ante analysis appeared to be influenced by some degree of optimism bias.

Overall, the average cost overrun for the ten projects is 13.5%. Figure 6 summarises our findings.

Figure 6. Capital Costs comparison.

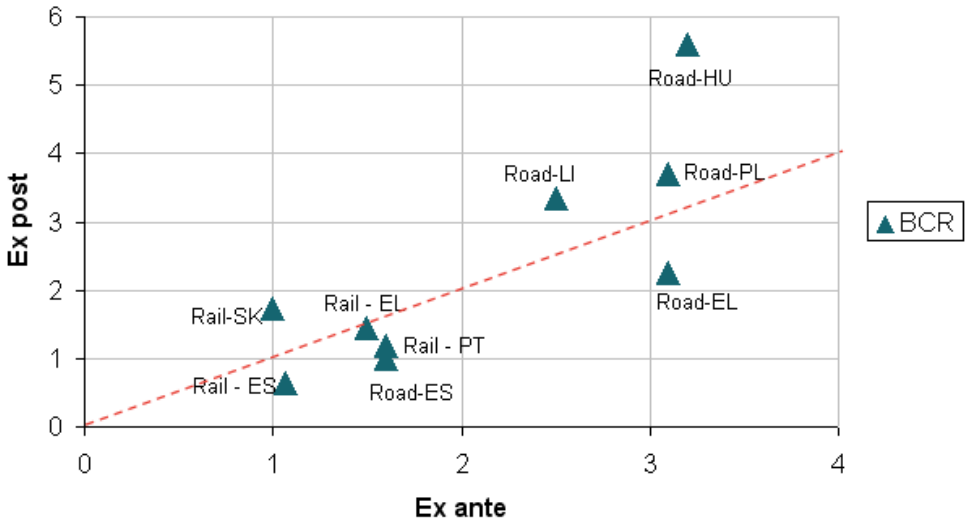


Note: AVE Madrid Barcelona has been excluded from the graph as it is an outlier.

Benefit-cost ratio

As shown in Figure 7, generally ex ante and ex post BCRs differ. However, the evidence here is more mixed: for half of the projects, the ex post BCR is higher than the ex ante BCR. There is also no clear pattern between road and railway projects. The lack of systematic variation between ex ante and ex post BCRs unlike the systematic bias evident in the NPV and capital cost estimates results from the relative rates of change in user benefits and capital costs between the ex ante and the ex post. Where BCRs decrease the capital costs have increased by a larger percentage than user benefits, and where BCRs decrease capital costs decrease by a larger percentage than user benefits.

Figure 7. BCR Comparison (without outlier: Road IE)



Note: Ex post figures correspond to the average for the high and low case scenarios.

Factors explaining the difference between ex ante and ex post results

Our analysis suggests that the differences between ex ante and ex post results can be associated with the following causes:

- differences between actual and forecast investment costs;
- difference between actual and forecast economic growth;
- errors in population growth forecasts;
- errors in travel demand forecasts (aside from economic growth and population growth errors);
- marginal values used for the analysis (for example value of time) and discount rates; and,
- delays.

Realised investment costs are the main source of difference in 5 projects, while it plays a secondary role in another 4 projects. Travel demand is a primary factor for the discrepancy between ex ante and ex post results in 8 of the 10 projects. The discount rate is a key factor in all 10 projects. Interestingly, the opening year is also a contributing factor in 9 of the 10 projects.

4 LESSONS LEARNT

4.1 Ex ante appraisals

Overall, the ten case studies examined in this report demonstrate an acceptable or good value for money from the perspective of the European taxpayer. The exceptions are the two Spanish studies. The A23 road project is marginal in terms of value for money and the AVE Madrid Barcelona high speed line offers poor value for money. Whilst these general findings represent positive news, there is some concern regarding the fact that two substantial and expensive projects are not giving good or even acceptable value for money. Additionally our findings suggest optimism bias is present. Seven out of the 10 case study projects yielded an NPV that was lower *ex post* than expected *ex ante.* Clearly there are some lessons that need to be learnt.

In the main the scope of the ex ante CBAs undertaken were quite narrow with most not including environmental externalities, network effects or disaggregating between business and non-business traffic. Whilst the environmental externalities do not have a big impact on the NPV, network effects can. In only 5 out of the 9 projects where re-routed/re-assigned traffic was relevant was it modelled. Only four projects accounted for modal shift and generated traffic – and these are significant infrastructure investments. Transport/economy network effects including land use effects and second order impacts on travel demands were not modelled in any of the projects. Related to this is the definition of the counterfactuals, which were sometimes inadequately defined. For example in only four of the ten projects were other expected changes in the transport network included in the analysis. For rail and toll motorway projects it is essential that the pricing policy is defined correctly. Not only does the pricing policy affect the distribution of benefits between operators and users but it also strongly influences the demand for a project. A better modelling and forecasting exercise would have gone someway to improve the discrepancies between the realised and ex ante expected travel demands.

As mentioned earlier the average difference between ex ante and ex post capital costs across the ten projects is 13.5%. This value is low compared to other ex post findings (e.g. Flyveberg, 2007). Five projects experienced significant cost overruns with the most significant occurring on the Ireland M1 motorway (see Figure 6). Four projects experienced slight cost overruns. Interestingly there was also a significant under-spend in Hungary (M0 motorway). A number of factors seem to be at play here. As is typical in the literature: project delays, alterations in scope and other unforeseen circumstances all increased capital costs. However, the reason that average level of overspend is lower than in the optimism bias literature is that ex ante costs were in the main updated at the time Cohesion Funds were applied for. The ex ante costs are therefore fairly advanced cost estimates. This updating process did not happen for the Ireland M1 motorway and unsurprisingly the largest cost overrun of the 10 projects occurred there. In the Hungary case, despite an update in capital costs immediately prior to submission for

Cohesion Funding, there was a large over estimate in the ex ante costs due to the uncertainty of the impact of international construction firms bidding at very competitive rates for work in the old Eastern Block. Optimism bias in capital costs therefore remains prevalent despite cost estimates from advanced stages of design being used.

Clearly it is almost impossible to forecast the future with precision – accounting for risk and uncertainty in the appraisal is therefore essential. While some of the risk bearers were identified in ex ante risk analysis, not all of them were. As has been discussed above the main sources of difference between ex ante and ex post economic analyses were differences in capital costs and travel demand. For eight of the projects capital costs were identified as a risk bearer but in only two of the ten projects were travel demands identified. The risk analysis undertaken was also of the more basic sensitivity test form. None of the studies undertook a quantitative risk analysis using Monte Carlo simulation via comprehensive software packages such as @RISK or Crystal Ball. A more comprehensive risk analysis that paid greater attention to variations in travel demand and the sources of that (economic growth, development impacts and other transport projects in the locality) would have improved the robustness of the ex ante appraisals.

Our interviews and workshop identified the limited use that cost benefit analysis and for that matter other forms of appraisal (e.g. multi-criteria analysis) play in decision-making in the eight countries where case studies were made. In the main cost benefit analysis appears to be treated as a hoop that is jumped through to achieve funding, though there was some recognition that cost benefit analysis does offer a value for money test. This raises a number of issues of which the two most pertinent are that if cost benefit analysis is just a procedural issue and has no input into the project development then few resources will be invested in ensuring the analysis is robust. This is undoubtedly one of the main contributors to the travel demand models used in the appraisals being weak and the risk analysis limited. A second problem with applying formal appraisal procedures late in the project development cycle is that by this time political momentum has built up and there is therefore an incentive to be overly optimistic regarding the benefits of the project in the appraisal. Bringing robust appraisal methods into play earlier in the project development cycle can therefore help minimise the number of poor decisions made.

4.2 Challenges with ex post analyses

We experienced a number of technical challenges in undertaking the ex post analysis – some of these are not pure ex post related but were an outcome of our desire to learn lessons on ex ante analyses. The first challenge is, what we have termed, a loss institutional memory. In terms of planning and design, most of the projects we considered date back to the late 1990s. Due to the time elapsed, some of the institutional memory regarding the ex ante analyses has inevitably been lost – for example, it was not possible in all the projects to identify all the assumptions underpinning the original analysis. Related to this

is the need to engage with different stakeholders and the provision of information. This is particularly the case for rail projects, where national railway organisations are split between network and train operations. Here the information underpinning the ex ante analysis may be split between different companies.

The impacts of transport projects typically take some time to feed through into all aspects of both travel behaviour and land use. Additionally transport projects have long lives. Thus whilst undertaking ex post studies within several years after project completion gives accurate information on outturn project costs and existing traffic levels, there is a need to make assumptions about future traffic levels over the remainder of the project life – which was always in tens of years. The ex post CBA analysis that can be undertaken therefore has some uncertainty about it – as it is more of an update of the ex ante analysis. Some of the case studies had only been operational for 12 months and therefore travel behaviour was still adjusting. This can lead to a further degree of uncertainty in the calculation of the 'ex post' project benefits, especially in the context of the current global economic downturn. Secondly, wider socio-economic impacts generally take a significant period of time to emerge. For this reason, it can be difficult for an ex post analysis to consider all the effects since some of them may have not yet materialised.

There clearly exists a dilemma regarding the best time to undertake an ex post CBA analysis. On the one hand, it needs to undertaken as soon as possible to minimise institutional memory loss, maximise the value of feedback into the ex ante planning, modelling and appraisal processes and to make the definition of the counterfactual as easy as possible. On the other hand, there may be a desire to wait until the transport impacts have fully fed into the wider economy and land use patterns have settled down. Drawing from the experience of existing ex post programmes, our experiences and the considered opinion of attendees at the workshop scheduling ex post CBA 3-5 years after project opening was considered an appropriate compromise.

Wider social and economic benefits are typically regarded as a key outcome of Cohesion Funded transport projects. However, the lack of project monitoring frameworks, implemented at or before project opening, makes the identification of these wider impacts almost impossibly challenging. This is especially the case for projects being implemented as part of a wider modernisation strategy, against a backdrop of rapid economic growth in the early 2000s and infrastructure investments.

A perennial challenge with ex post studies is the definition of the counterfactual. Any change that occurs simultaneously with the opening of the transport project makes it difficult to identify the effects of the project. In these case studies, economic change and changes to the transport network were the two biggest confounding factors. Rapid economic growth in some EU accession countries before 2008 and the economic recession have influenced the general pattern of economic growth in the EU. All of the projects studied suffered from this in one form or another. Another problem that is most evident with the Hungarian road project is that the impacts are

confounded with that of other transport projects. With respect to the M0 Eastern Sector several other transport initiatives of a similar scale to the M0 Eastern Sector affected traffic flows within weeks of the M0 opening.

5 CONCLUSIONS

Despite much attention being placed on the issue of optimism bias over the last decade our research identifies that it remains prevalent. In the ten major transport projects we have reviewed there has been a systematic bias towards an underestimation of costs and higher NPVs than can be justified from outturn impacts – this is despite most of the ex ante analyses being re-visited fairly close to construction beginning.

From a policy perspective this is of concern as it can be evidence that poor decisions are being made. There is a clear need to improve the quality and consistency of ex ante analysis – particularly in the areas of capital cost estimation, travel demand modelling and risk analysis. Ex post analysis can make a valuable contribution to this. With an ex post evaluation program, patterns and best practices can be identified. These can be fed back into the ex ante planning, modelling and appraisal processes.

An ex post program should not be confined to just the practicalities of undertaking an ex ante analysis, but should also concern itself with the processes that lead to decisions being made as these can also lead to poor decision-making. Our research identified that formal cost benefit or multi-criteria analyses do not routinely form part of the decision-making processes in the majority of the countries in which the case studies were undertaken. Typically they do appear in these processes as either a final value for money check or as a hurdle that has to be crossed to obtain funding. Bringing robust appraisal strategies earlier into the project development cycle would identify strong and weak projects at a time when significant political momentum has yet to develop behind any particular project.

The cost of obtaining data, defining the counterfactual and institutional memory loss are the key challenges associated with undertaking ex post appraisal. Taking these issues into account our view, based on our research, is that the ex post analysis needs to be conducted between 3 and 5 years of scheme opening. This of course means that many of the benefits of the projects are yet to be realised, so some forecasting is necessary to generate an ‘ex post’ cost benefit analysis. Additionally it is necessary that monitoring frameworks are put into place before opening and maintained after opening. If these monitoring frameworks can be incorporated into the infrastructure (e.g. automatic traffic counters) this will also minimise the costs of undertaking ex post appraisal.

Ex post analysis is relatively infrequent – despite the noted programmes in Britain, France and Norway. There therefore remains substantial scope for further research. A meta-analysis of international ex post studies would

provide a rich data source – as too often a national meta-analysis is confounded by the fact that the same forecasting and appraisal process is used for all schemes. There also remains the challenge not yet fully addressed in the literature of identifying ex post the scale of wider economic impacts in an econometrically robust manner. This would require monitoring programmes that included household and business surveys before and after scheme opening.

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Notes

1. Ex ante means pre-implementation
2. Ex post means post-implementation
3. The Cohesion Fund was established in 1993 to strengthen the economic and social cohesion of the European Union.1 The eligibility criterion is that the GNP per capita in the applicant country is 90% or less than the EU average.