The British Department for Transport

Procedures for Dealing with Optimism Bias in Transport Planning

Guidance Document

June 2004

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0 Executive summary

0.1 Introduction and rationale

The Supplementary Green Book Guidance on Optimism Bias (HM Treasury 2003) with reference to the Review of Large Public Procurement in the UK (Mott MacDonald 2002) notes that there is a demonstrated, systematic, tendency for project appraisers to be overly optimistic and that to redress this tendency appraisers should make explicit, empirically based adjustments to the estimates of a project's costs, benefits, and duration.

HM Treasury recommends that these adjustments be based on data from past projects or similar projects elsewhere, and adjusted for the unique characteristics of the project in hand. In the absence of a more specific evidence base, HM Treasury has encouraged departments to collect data to inform future estimates of optimism, and in the meantime use the best available data.

In response to this, the Department for Transport (henceforth DfT), has contracted Bent Flyvbjerg in association with COWI to undertake the consultancy assignment *"Procedures for dealing with Optimism Bias in Transport Planning"*. The present Guidance Document is the result of this assignment.

0.2 Objective

The main aims of the present Guidance Document are to:

- provide empirically based optimism bias up-lifts for selected reference classes of transport infrastructure projects[1]; and
- provide guidance on using the established optimism bias uplifts to produce more realistic forecasts for the individual project's capital expenditures.

[1] The present guidance document establishes empirically based uplift for capital expenditures for transport infrastructure projects based on the full business case (time of decision to build). Similar works duration uplifts and reduction factors for project benefit have not been established due to lack of statistical data.

Furthermore, the underlying causes and institutional context for optimism bias in British transport projects are discussed and some possibilities for reducing optimism bias in project preparation and decision-making are identified.

The guidance is however not designed to provide comprehensive information on the range of tools that exist to prevent optimism bias, including project management and risk management techniques. Reference should be made to the Green Book and related sources of guidance, including the Office of Government Commerce.

0.3 The established uplifts

The types of transport schemes under the direct and indirect responsibility of the Department for Transport have been divided into a number of distinct groups where the risk of cost overruns within each of the groups can be treated as statistically similar.

For each of the groups, a reference class of completed transport infrastructure projects has been used to establish probability distributions for cost overruns for new projects similar in scope and risks to the projects in the reference class.

Based on this, the necessary uplifts to ensure that the risk of cost overrun is below certain pre-defined levels have been established. These up-lifts are reflected in the table below.

Table 0: Applicable capital expenditure optimism bias uplifts

Category	Types of projects	Applicable optimism bias uplifts	
		50% percentile	**80% percentile**
Roads	Motorway Trunk roads Local roads Bicycle facilities Pedestrian facilities Park and ride Bus lane schemes Guided buses on wheels	**15%**	**32%**
Rail	Metro Light rail Guided buses on tracks Conventional rail High speed rail	**40%**	**57%**
Fixed links	Bridges Tunnels	**23%**	**55%**

Building projects	Stations Terminal buildings	4-51%*
IT projects	IT system development	10-200%*
Standard civil engineering	Included for reference purposes only	3-44%*
Non-standard civil engineering	Included for reference purposes only	6-66%*

*) Based on Mott MacDonald study, p. 32; no probability distribution available.

0.4 Using the established uplifts

The established uplifts for optimism bias should be applied to estimated budgets at the time of decision to build a project. The approval stage is equivalent to the time of presenting the business case for a project to the Department for Transport with a view to obtaining the go or no-go for that project. The uplifts refer to cost overrun calculated in constant prices.

In relation to the appraisal requirements for Local Transport Plans (LTPs) the application of up-lifts should be in connection with the submission of the appraisal information (Annex E) provided by authorities to help determine the allocation of resources for five-year programmes and major schemes. The application of the uplifts should be transparent for the appraiser.

If, for instance, a group of planners were preparing the business case for a new motorway, and if they or their client had decided that the risk of cost overrun must be less than 20%, then they would use an uplift of 32% on their estimated capital expenditure budget. Thus, if the initially estimated budget were £100 million, then the final budget taking into account optimism bias at the 80%-level would be £132 million. If the planners or their client decided instead that a 50% risk of cost overrun was acceptable, then the uplift would be 15% and the final budget £115 million.

Similarly, if a group of planners were preparing the business case for a metro rail project, and if they or their client had decided that with 80% certainty they wanted to stay within budget, then they would use an uplift on capital costs of 57%. An initial capital expenditure budget of £300 million would then become a final budget of £504 million. If the planners or their client required only 50% certainty they would stay within budget, then the final budget would be £420 million.

It follows that the 50% percentile should be used only in instances where investors are willing to take a high degree of risk that cost overrun will occur and/or in situations where investors are funding a large number of projects and where cost savings (underruns) on one project may be used to cover the costs of overruns on other projects. The upper percentiles (80-90%) should be used when

investors want a high degree of certainty that cost overrun will not occur, for instance in stand-alone projects with no access to additional funds beyond the approved budget. Other percentiles may be employed to reflect other degrees of willingness to accept risk and the associated uplifts can be found in the Guidance Document.

0.5 Causes of optimism bias and possible cures

Transport projects are inherently risky due to the long planning horizon and complex interfaces. Often the project scope or ambition level will change significantly during project development and implementation. Changes may be due to uncertainty at the early project stages on the level of ambition, the exact corridor, the technical standards, project interfaces and geotechnical conditions, etc. Hence, a certain degree of budget uncertainty exists which will typically be reduced through the project cycle.

However, the complexity should not be a surprise to the experienced planner as the occurrence of a certain number of unplanned events is the norm rather than the exception in transport infrastructure projects. It is therefore relevant to ask if there are more deep-seated causes of optimism bias that can explain why project planners do not set aside substantial contingencies when massive evidence show that initial budgets for transport infrastructure projects are characterised by pronounced optimism bias.

Theories on cost overrun suggest that optimism bias could be caused by a combination of how the decision-making process is organised *and* strategic behaviour of actors involved in the planning and decision-making processes.

Our analysis indicates that political-institutional factors in the past have created a climate where only few actors have had a direct interest in avoiding optimism bias.

At the same time it is important to recognise that the introduction of optimism-bias uplifts will establish total budget reservations (including up-lifts) which for some projects will be more than adequate. This may in itself have an incentive effect which works against tight cost control if the total budget reservation is perceived as being available to the project.

This makes it important to combine the introduction of optimism bias uplifts with maintained incentives for promoters to undertake good quantified risk assessment and exercise prudent cost control during project implementation.

It is therefore recommended that the introduction of optimism bias uplifts is supported by:

- Emphasis on establishing realistic budgeting as an ideal and de-legitimise over-optimistic budgeting as a routine

- Introduction of fiscal incentives against cost overruns e.g. through requiring local co-financing of project cost escalation where possible
- Formalised requirements for high quality cost and risk assessment at the business case stage
- Introduction of independent appraisal supported by necessary enforcement measures

1 Introduction

1.1 Background and objective

Most transport projects change in scope during the project cycle from idea to reality. Changes may be due to uncertainty at the early project stages on the level of ambition, the exact corridor, the technical standards, project interfaces and geotechnical conditions, etc. Hence, a certain degree of budget uncertainty exists which will typically be reduced through the project cycle.

This uncertainty is however not unknown and should therefore be duly reflected in the project documentation at any given stage. The problem of optimism bias arises when various factors combine to produce a systematic underreporting of the level of project uncertainty.

The Supplementary Green Book Guidance on Optimism Bias (HM Treasury 2003) with reference to the Review of Large Public Procurement in the UK (Mott MacDonald 2002) notes that there is a demonstrated, systematic, tendency for project appraisers to be overly optimistic and that to redress this tendency appraisers should make explicit, empirically based adjustments to the estimates of a project's costs, benefits, and duration.

HM Treasury recommends that these adjustments be based on data from past projects or similar projects elsewhere, and adjusted for the unique characteristics of the project in hand. In the absence of a more specific evidence base, HM Treasury has encouraged departments to collect data to inform future estimates of optimism bias, and in the meantime use the best available data.

In response to this, the Department for Transport (henceforth DfT), has contracted Bent Flyvbjerg in association with COWI to undertake the consultancy assignment *"Procedures for dealing with Optimism Bias in Transport Planning"*. The present Guidance Document is the result of this assignment.

The consultant would like to express their gratitude towards the many employees of DfT, local governments and sector consultants who have freely shared their experience and knowledge of the planning process in the UK transport sector with the consultancy team during interviews. The consultant would in particular like to thank the Steering Committee established by the DfT for a very productive and fruitful cooperation. However, it should be underlined that

any interpretation in the present report is solely the responsibility of the consultant.

1.2 Structure of the Guidance document

The guidance document is structured as follows:

Section 1 - Introduction (the present section), describes the background, objective and approach for establishing Optimism Bias up-lifts for transport schemes.

Section 2 - Classification of transport schemes, divides transport schemes into a number of reference classes, which will be treated as statistically different, but where the projects within each of the reference classes can be treated as statistically similar.

Section 3 - Benchmarking of optimism bias in Britain, establishes probability distributions for the reference classes defined under the classification.

Section 4 - Managing optimism bias, presents the established optimism bias uplifts and provides guidance on using the established optimism bias uplifts.

Finally, **Section 5 - Causes of optimism bias in transport planning**, discusses the general causes of optimism bias in transport policy in an institutional context and identifies possibilities for reducing optimism bias in British transport project preparation and decision-making.

1.3 Approach

The tendency toward optimism bias in infrastructure planning may be reduced through well structured institutional incentives and well designed processes for project documentation, appraisal and approval.

However, organisational, institutional, and psychological factors that promote optimism are difficult to remove totally in a complex multi player transport infrastructure planning process.

The inside view

There will therefore always be a risk of some degree of optimism bias in the *inside view* (the view held by the project team or other experts closely associated with the project) on the risks for cost increases, time schedule delays and benefit shortfalls.

The outside view

Improved reliability of forecasts may however be introduced into the planning process by introducing an *outside view* (also known as reference forecasting) where information on a class of similar or comparable projects are used to derive information on the extent to which likely - but presently unknown - future events may increase project costs, delay project time schedule or reduce project benefits compared to the base scenario. The outside view does not try to forecast the specific uncertain events that will affect the particular project, but

rather tries to place the project in a statistical distribution of outcomes from a group of reference projects.

The outside view is more likely to produce accurate forecasts and much less likely to deliver highly unrealistic ones[2]. This conclusion is valid across a number of sectors and independent of organisational form (public or private).

Taking an outside view requires the following steps for the individual project:

- **Identification of a relevant reference class of past projects**
  The key is here that the class is broad enough to be statistically meaningful but narrow enough to be truly comparable with the specific project.

- **Establishing a probability distribution for the selected reference class**
  This requires access to credible data on cost increases (or time schedule delays or benefit shortfalls if these are the key parameter) on a sufficient number of projects within the reference class to make statistically meaningful conclusions (normally at least 10).

- **Placing the specific project at an appropriate point in the reference class distribution**
  This step has an element of intuitive assessment and is therefore liable to optimism bias.

Our approach in our work for the DfT has been, in consistency with the reference forecasting approach, to:

- identify a set of relevant reference classes of past projects for transport schemes (please refer to Section 2); and

- establish probability distributions for selected reference classes (please refer to Section 3); and

- provide guidance on placing the specific project at an appropriate point in the reference class distribution (please refer to Section 4).

Furthermore, in recognition of the importance of institutional issues we have provided a preliminary analysis of the possibilities for reducing optimism bias in British transport project preparation (please refer to Section 5).

Whereas the present guidance document establishes empirically based uplift for capital expenditures for transport infrastructure projects, similar works duration uplifts and reduction factors for project benefit have not been established due to lack of statistical data.

[2] This discussion is based on: "Delusions of Success - How Optimism Undermines Executives' Decisions" by Dan Lavallo and Daniel Kahneman, Harvard Business Review, July 2003.

Optimism Bias up-lifts

As noted above, the classification divides British transport schemes into a number of distinct groups, where the projects within a given group can be treated as statistically similar to provide a basis for the definition of the Optimism Bias up-lift within each group.

When a group of distinct transport schemes (a relevant reference class of past projects) has been defined, the available statistical data on actual budget increases in completed historical projects can be used to establish a probability distribution for this group of distinct transport schemes. In order to ensure comparability it is important that the definition of 'budget increase' is identical for all projects. It should hence be as simple and well defined as possible to ensure availability of comparable data. Therefore final costs minus the budget at the time of the initial government approval will be used as the reference wherever possible.

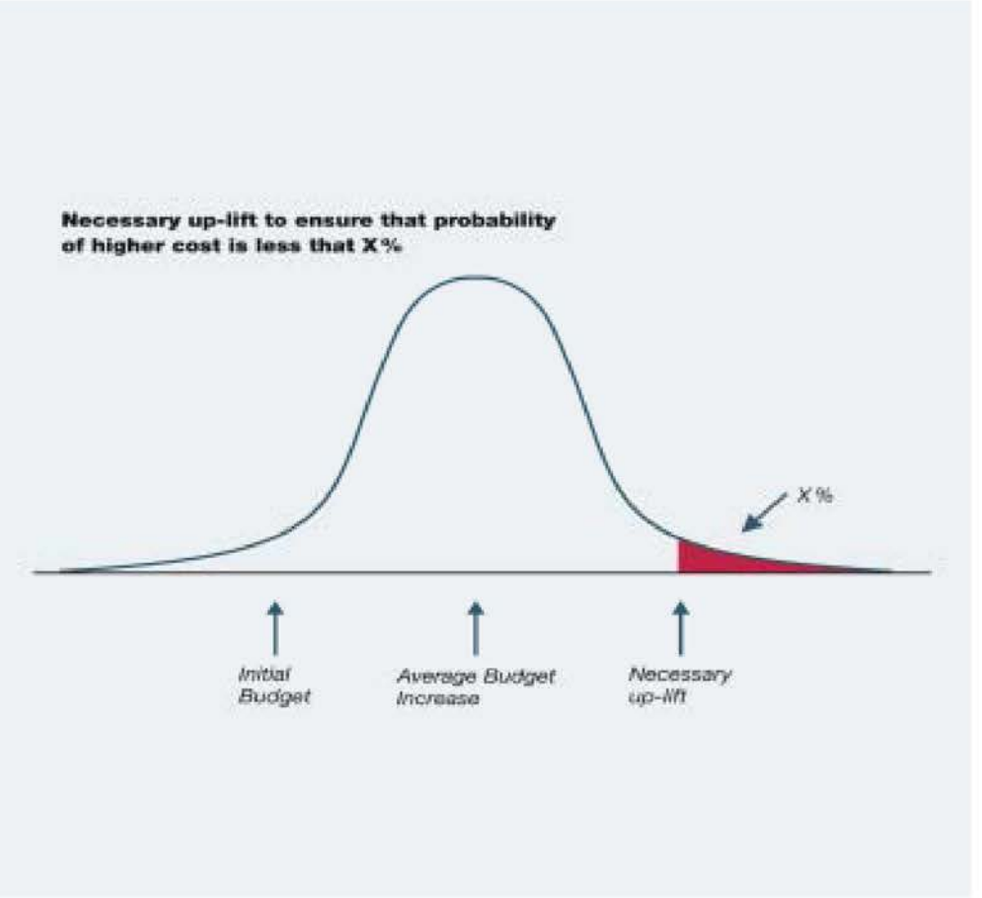
Figure 1 below provides a stylized example of the probability distribution for budget increases in a selected reference class of projects. It furthermore illustrates the link between the observed ex-post cost increases for historical projects and the required up-lift for a new project to ensure that the probability of the final cost being higher than the initial budget plus the up-lift is less than a given threshold level.

If the new project is similar to the projects in the reference class (same type of transport scheme) and the initial budget is established in a similar manner (not including budget contingencies reflecting the risk of cost overruns above the level of contingencies used in the reference cases), the project should be placed at the point marked 'initial budget'.

The project team or other experts closely associated with the project may hold the inside view that the established initial budget is the best possible estimate of the average ex-post realised cost and that the project should be placed in the middle of the distribution. However, overwhelming data on past projects suggest that although this will be the case for a few individual projects it is not the typical case.

Only for projects where risk analysis and mitigation has been applied beyond the level applied in the average projects is there an argument for placing the project in the middle of the distribution.

Figure 1 - Definition of Optimism Bias Up-lifts within a Certain Class of Transport Schemes.



Assuming now that the project in case is an average project, it should then be expected that the final budget - on average - will exceed the initial budget by the average budget increase. This also implies that there is 50% chance of the budget increase being less than the average budget increase and 50% of the budget increase being higher than the average budget increase.

If it is not acceptable that there is a 50% chance of the realised cost being higher than the budget (including up-lift), the up-lift would need to be higher than the average budget increase. Figure 1 shows an example of the necessary uplift to ensure that the probability of a realised cost above the budget (including up-lift) is below a given threshold (x%).

For an organisation implementing a large portfolio of projects, the total realised budget increase across all projects can be expected to be close to the expected average. If the organisation has the ability to reallocate budgets between projects, application of an up-lift reflecting the average budget increase should therefore enable budget compliance on average.

However, for the individual project organisation, a budget based on the initial budget plus an uplift reflecting the average budget increase will mean that there still is a 50% risk of the budget being inadequate.

The right level of optimism bias will therefore also be dependent on the procedural issues related to budget revisions.

At the same time it is important to recognise that the establishment of budgets which on average are more than adequate (as would be the case if uplifts reflecting a higher percentile in the distribution than the 50% percentile is applied) may have an incentive effect which works against tight cost control if the more than adequate budget is available (or perceived as being available) to the project organisation.

Nevertheless, the introduction of an outside view on the risk of cost overruns may together with process oriented initiatives contribute to making cost forecasts more accurate.

2 Classification of transport schemes

The present section establishes the basis for definition of optimism bias uplifts in the transport sector through dividing transport schemes into a number of reference classes, which will be treated as statistically different, but where the projects within each of the reference classes can be treated as statistically similar.

2.1 Types of transport schemes

A key issue to be resolved is how refined a classification should be proposed. If transport schemes are divided into a large number of categories it may be impossible to establish valid optimism bias uplifts for each category due to lack of observations.

An overview of the types of transport schemes under the direct and indirect responsibility of the Department for Transport is provided in the table below.

Table 1 - Types of transport schemes

Transport scheme		Role of Department for Transport
Group	Sub-group	
Road	Highways	Advisor to Highways Agency.
	Trunk roads	Oversee local transport planning and expenditure. Appraisal and approval (projects with budgets over 5 million £) or submission for HM Treasury approval (projects with budgets over 40 mill. £)
	Local roads	
Rail	Metro	Oversee local transport planning and expenditure. Appraisal and approval (projects with budgets over 5 million £) or submission for HM Treasury approval (projects with budgets over 40 mill. £)
	Light rail	
	Guided buses	
	Conventional rail	Executive agency to the Secretary of State for Transport who in turn provides directions and guidance to the Strategic Rail Authority (SRA) and the Office of the Rail Regulator (ORR).

	High speed rail	Advisor
Fixed Links	Bridges	Indirectly as advisor to Highways Agency and directly as they may form part of major schemes.
	Tunnels	
Other	Pedestrian facilities	Oversee local transport planning and expenditure. Direct involvement if they form part of major schemes.
	Bicycle facilities	
	Park and ride	
	Building projects	Indirectly as advisor to Highways Agency and directly as they may form part of major schemes.
	IT projects	

For the classification under the present project we propose to:

- identify the distinct categories of projects where a transport sector specific approach is relevant. This should be relatively few categories thereby securing that there will be a sufficient number of observations in each category. For these transport sector specific categories separate transport sector up-lifts will be established; and

- use relevant Mott Macdonald categories and uplifts for residual projects.

2.2 The classification

Previous work by Bent Flyvbjerg[3] shows that the major differences in cost overruns in an international database of 260 transport infrastructure projects are between the following groups of projects, whereas differences between sub-categories within each of these main categories are of lesser importance:

- Roads
  Statistical tests have shown that Highways and Trunk roads can be considered as equal with respect to the risk of cost overruns.

[3] Please refer to Bent Flyvbjerg, Mette K. Skamris Holm and Søren L. Buhl, "How Common and How Large Are Cost Overruns in Transport Infrastructure Projects?" Transport Reviews, vol. 23, no. 1, January-March 2003, pp. 71-88.

- Rail
  Statistical tests have shown that Metro, Conventional rail and High speed rail can be considered as equal with respect to the risk of cost overruns.

- Fixed links
  Statistical tests have shown that Bridges and Tunnels can be considered as equal with respect to the risk of cost overruns.

These main groups of transport infrastructure should therefore be considered as being distinct from each other in the definition of optimism bias up-lifts.

This however still leaves a question concerning the identification of relevant reference classes of projects for the following types of transport schemes:

- Local roads; Bicycle facilities; Pedestrian facilities; Park and ride facilities
  Although insufficient statistical data is available to make an affirmative classification, the scope and risks of such projects are judged to be similar to other road projects

- Light rail
  Again, although insufficient statistical data is available to make an affirmative classification, the scope and risks of such projects are judged to be similar to other rail projects

- Guided buses
  Here, too, insufficient data is available to make an affirmative classification. Guided buses may vary from bus lane schemes and guided buses on rubber wheels (both of which resemble roads and which therefore may be grouped with roads for the purpose of defining optimism bias uplifts) to trolley schemes on tracks (which resemble the more risky rail schemes and which therefore should grouped with rail for the purpose of defining optimism bias uplifts). Hence, a discrete decision on whether to classify the individual project with road or rail projects is required.

- Stations and terminal buildings
  These projects are building projects rather than transportation projects and hence the relevant Mott Macdonald categories can be applied.

- IT system development
  Again the relevant Mott Macdonald category can be applied.

Projects with several different elements (e.g. a road project with significant bridge and tunnel elements) may be better described by using separate uplifts on the individual elements. In general however, it should be noted that introduction of discretion to select approach opens for reintroduction of optimism bias.

Applying the specific data for transportation projects where relevant and supplementing with relevant Mott Macdonald categories for other civil engineering

/ buildings and IT development schemes hence yields the following categorisation:

Table 2 - Categorisation of transport schemes

Category	Types of projects	Source of optimism bias up-lifts
Roads	Highways Trunk roads Local roads Bicycle facilities Pedestrian facilities Park and ride Bus lane schemes Guided buses on wheels	Reference class of British road projects
Rail	Metro Light rail Guided buses on tracks Conventional rail High speed rail	Reference class of International and British rail projects*
Fixed links	Bridges Tunnels	Reference class of International and British bridge and tunnel projects*
Building projects	Stations Terminal buildings	Mott Macdonald - Non-standard Buildings Capital Expenditures**
IT projects	IT system development	Mott Macdonald - Equipment/Development Capital Expenditure**

Notes:
* It has not been possible to establish a sufficiently large reference class of British projects for Rail and Bridges/Tunnels to create a statistically significant sample, therefore data from the Flyvbjerg Database on international projects from relevant comparable countries has been added to the UK samples. For Roads, a sufficient number of British projects are available in the Flyvbjerg database.
** If the approach is to be consistent across also building projects and IT projects, this would require access to Mott Macdonald's established probability distribution for these types of projects or as minimum information on which percentile in the probability distribution the up-lifts proposed in their reporting represent.

3 Benchmarking of optimism bias in Britain

The present section establishes probability distributions for the reference classes defined under the classification in Section 2. These distributions will then be used in the subsequent section for establishing optimism bias uplifts.

3.1 The statistical data material

The establishment of probability distributions for cost overrun in reference classes requires access to credible data on cost overrun for a sufficient number of projects within the reference class to draw statistically meaningful conclusions.

3.1.1 Sampling and data collection

Cost overrun is here defined as the difference between actual and estimated costs in percentage of estimated costs, with all costs calculated in constant prices. Actual costs are defined as real, accounted costs determined at the time of completing a project (outturn costs). Estimated costs are defined as budgeted, or forecasted, costs at the time of approval of/decision to build a project, which is typically similar to costs as presented in the business case for a project.

Even if the project planning process varies with project type, place and time, it is typically possible to locate for a given project a specific point in the process that may be identified as the time where formal approval was given to build the project. Usually a cost estimate is available for this point in time. If not, the closest available estimate was used, typically a later estimate resulting in a conservative bias in the measurement of cost overrun.

In statistical analysis, data should be a sample from a larger population, and the sample should represent the population properly. These requirements are ideally satisfied by drawing the sample by randomised lot. Randomisation ensures with high probability that non-controllable factors are equalised. A sample should also be designed such that the representation of subgroups corresponds to their occurrence and importance in the population. In studies of human behaviour, however, where controlled laboratory experiments often cannot be conducted, it is frequently impossible to meet these ideal conditions. This is also the case for studies of optimism bias and a different approach therefore had to be taken to sampling and statistical analysis.

Projects for the sample were selected on the basis of data availability. All projects for which data on construction cost development were obtainable have been considered for inclusion in the sample. Cost data were collected from a variety of sources, i.e. annual project accounts, questionnaires, interviews and other studies. Data on cost development were available for 353 projects. Of these 85 projects were rejected because of insufficient data quality. For the purposes of the present study, only projects in Europe and North America were included, 252 projects in all covering 172 road projects, 46 rail projects and 34 fixed link (bridge and tunnel) projects. Information was not available regarding the extent to which contingencies were taken into account in initial budgets. The data and database are described in more detail in Flyvbjerg et al., 'How Common and How Large Are Cost Overruns in Transport Infrastructure Projects?'[4]

As for any sample, a key question is whether the sample is representative of the population, here whether the projects included in the sample are representative of the population of transport infrastructure projects. Since the criteria for sampling were data availability, this question translates into one of whether projects with available data are representative. There are five reasons why this may not be the case:

- First, it may be speculated that projects that are managed well with respect to data availability may also be managed well in other respects, resulting in better-than-average, i.e. non-representative, performance for such projects.

- Second, it has been argued, for instance by the World Bank, that the very existence of data that make the evaluation of performance possible may contribute to improved performance when such data are used by project management to monitor projects. Again, such projects would not be representative of the project population.

- Third, one might speculate that managers of projects with a particularly bad track record regarding cost escalation have an interest in not making cost data available, which would then result in under-representation of such projects in the sample. Conversely, managers of projects with a good track record for costs might be interested in making this public, resulting in overrepresentation of these projects.

- Fourth, even where managers have made cost data available they may have chosen to give out data that present their projects in as favourable a light as possible. Often there are several forecasts of costs to choose from and several calculations of actual costs for a given project at a given time. If researchers collect data by means of survey questionnaires, which is often the case, and which has been done for some of the projects in the present sample, there might be a temptation for managers to choose the combina-

[4] Bent Flyvbjerg, Mette K. Skamris Holm and Søren L. Buhl, 'How Common and How Large Are Cost Overruns in Transport Infrastructure Projects?' *Transport Reviews*, vol. 23, no. 1, January-March 2003, pp. 71-88.

tion of forecast and actual costs that suits them best, possibly a combination that makes their projects look good.

- Fifth, and finally, differences in the representativity of different subsamples may also result in non-representative data.

It should be emphasised that these sources of non-representativeness are not peculiar to the dataset presented here, they apply to all available data on cost overrun. Internally in their organisations, project owners, banks, contractors etc. may have data that are not subject this type of bias, but such data are unavailable today in sufficient numbers to allow the calculation of empirically based optimism bias uplifts.

It should also be mentioned that the available data do not allow an exact, empirical assessment of the magnitude of the problem of misrepresentation. But the little data that exist suggest that points three and four above probably are the most important sources of bias.

It is concluded that the optimism bias uplifts proposed below are on the low side. However, they are the best estimates of uplifts that currently exist, and it is not possible for the time being to adjust these uplifts to take into account bias without re-introducing the subjectiveness and optimism, which it is the very purpose to eliminate by introducing empirically based uplifts.

3.1.2 Roads

The road data from the sample described above cover cost development in 128 UK trunk road and motorway projects and 44 non-UK projects. The latter are located in Denmark, Sweden and the US. Thus the total number of road projects available in the roads reference class is 172.

3.1.3 Rail

Rail data from the sample cover cost development in 46 rail projects of which 3 are British. The rail projects are urban rail, conventional inter-city rail and high-speed rail. The rail projects are located in Canada, France, Germany, the Netherlands, Norway, Sweden, the UK and the US.

3.1.4 Fixed links

The data on fixed links (bridges and tunnels) cover cost development in 34 projects of which 4 are British. The bridges and tunnels are located in Denmark, France, Germany, the UK and the US.

3.1.5 Building projects and IT projects

Building projects and IT projects are not transport projects as such and the database described above does not contain data on these two project types. Instead, data from a study by Mott MacDonald for HM Treasury are used.[5]

[5] Mott MacDonald, *Review of Large Public Procurement in the UK*. (London: HM Treasury, July 2002).

Relevant building projects in this context are stations and terminal buildings, and the appropriate category from the Mott MacDonald study are 'Non-standard Buildings Capital Expenditures'. IT projects are IT system development schemes used in transport, for which the appropriate category from Mott MacDonald is 'Equipment/Development Capital Expenditure'.

If the approach used for buildings and IT projects were to be consistent with the approach used for transport projects proper, this would require access to Mott Macdonald's established probability distributions for non-standard buildings and equipment/development, or as minimum information on which percentile in the probability distribution the up-lifts proposed in their reporting represent. This has however not been available to the consultant.

The applied sources of reference data are surveyed in the table below.

Table 3 - Applied sources of reference data

Category	Types of projects	Source of optimism bias uplifts
Roads	Highways Trunk roads Local roads Bicycle facilities Pedestrian facilities Park and ride Bus lane schemes Guided buses on wheels	Reference class of 172 road projects contained in the Flyvbjerg database (of which 128 are British)
Rail	Metro Light rail Guided buses on tracks Conventional rail High speed rail	Reference class of 46 international rail projects (of which 3 are British)
Fixed links	Bridges Tunnels	Reference class of 34 international bridge and tunnel projects (of which 4 are British)
Building projects	Stations Terminal buildings	Mott Macdonald - Non-standard Buildings Capital Expenditures
IT projects	IT system development	Mott Macdonald - Equipment/Development Capital Expenditures

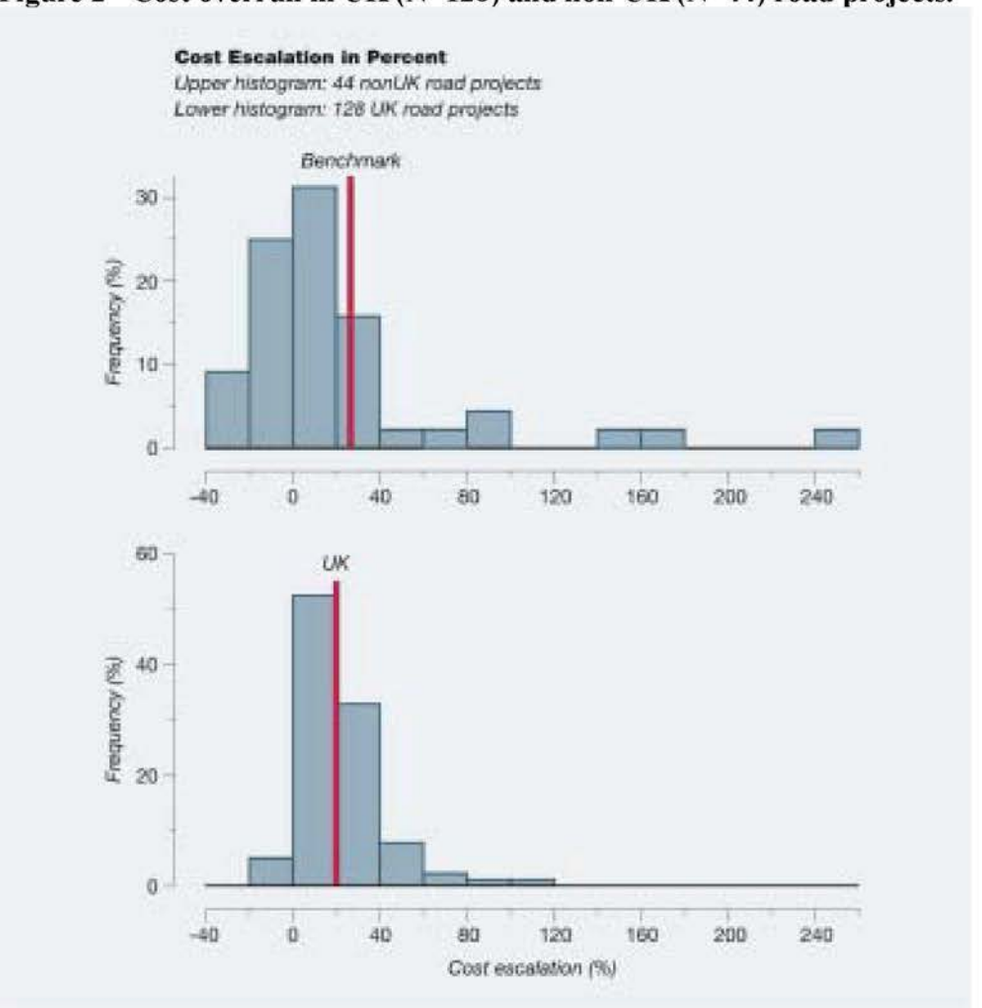
3.2 The benchmarking

In this section, for each transport project type, British projects are benchmarked against international experience and the probability distribution for cost overrun is established.

3.2.1 Roads

Figure 2 shows cost overrun for UK and non-UK road projects. Statistical analyses show that there is no significant difference between the two types of project (p=0.57). UK and non-UK projects are therefore pooled below for purposes of statistical analyses.

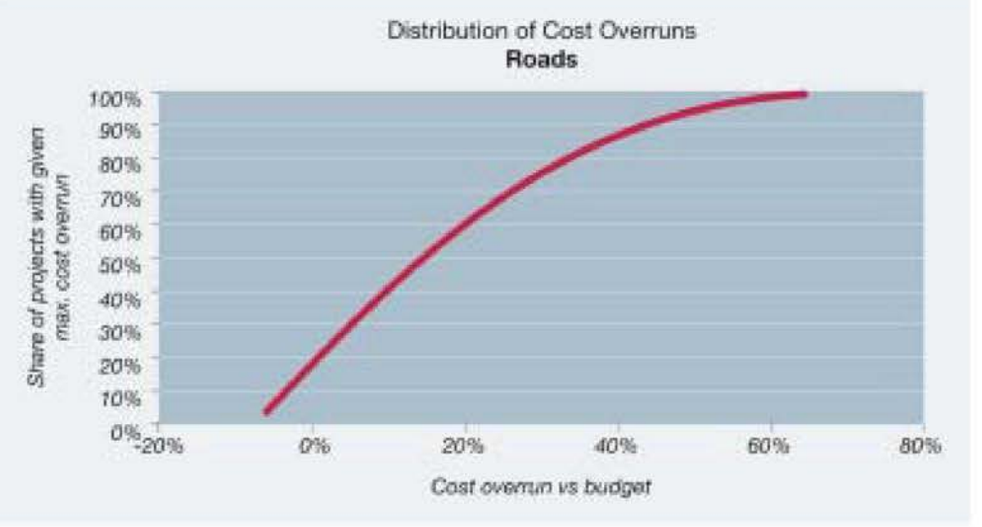
Figure 2 - Cost overrun in UK (N=128) and non-UK (N=44) road projects.



Source: Flyvbjerg database, 2004. Constant prices. Average cost overrun is indicated for each group.

Figure 3 shows the probability distribution for cost overrun in road projects as the share of projects with a given maximum cost overrun. For example, 40% of projects have a maximum cost overrun of 10%; 80% of projects a maximum overrun of 32%, etc.

Figure 3 - Probability distribution of cost escalation for roads, 172 projects.



Source: Flyvbjerg database, 2004. Constant prices.

3.2.2 Rail

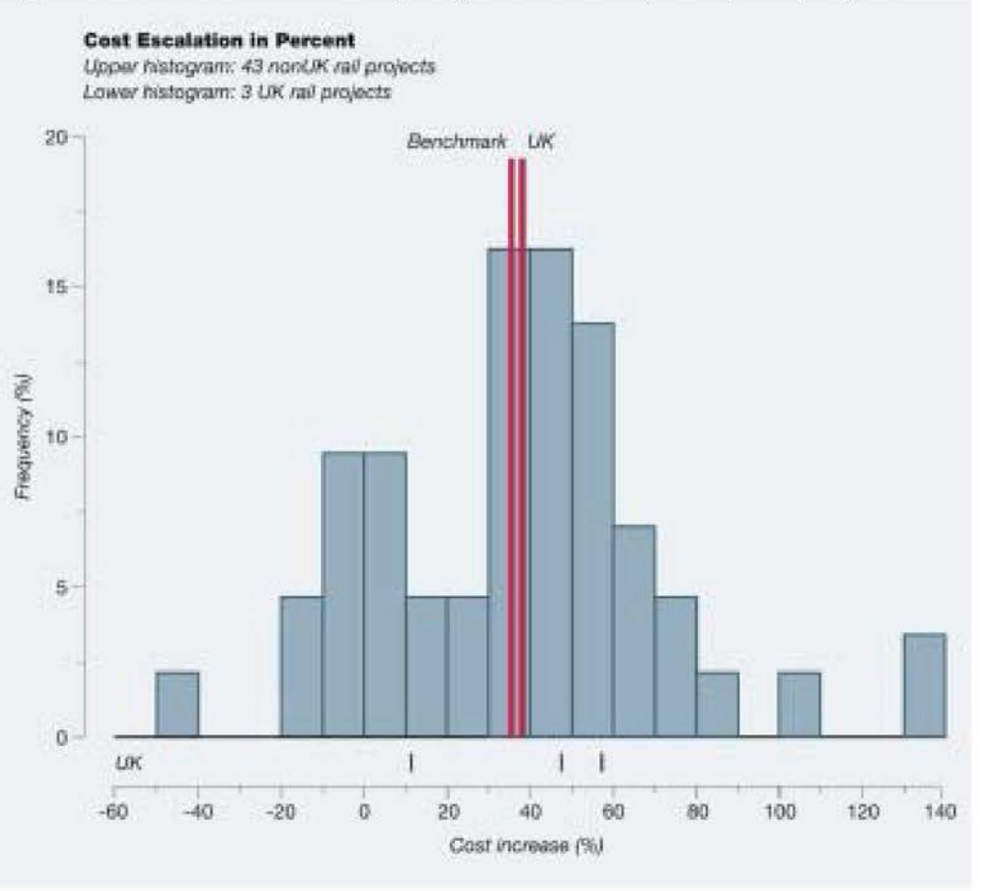
Figure 4 shows cost overrun for UK and non-UK rail projects. Statistical analyses show that there is no significant difference between the two types of project ($p=0.88$). However, with data for only three UK rail projects included, this result may depend on the small number of observations. It would be desirable to repeat the test with data from a larger number of UK rail projects.

One might speculate that the bimodal distribution in Figure 4 is due to significant scope reduction in the projects in the lower peak, resulting in cost underrun. The data do not allow a definitive answer to this question. The fact is, however, that most projects with the size of rail projects will have elements of both scope reduction and scope increase on their way through the project cycle. Furthermore, the number of observations in each column in the histogram is so low (four projects in each of the two columns in the lower peak) that most likely the bimodal distribution is a chance consequence of small numbers, and with more observations the distribution would probably be bell-shaped with only a single peak.

Until data are available from a larger number of UK rail projects, the existing data indicate that UK and non-UK rail projects could and should be pooled for establishing the reference probability distribution of cost overruns and the distribution of required optimism bias uplifts. This conclusion, which is based on statistics alone, is further supported by the fact that international rail projects are relevant as reference group for UK rail projects also because the contractors

in rail are international, risks are fairly identical as are institutional setups. This is increasingly so with the implementation of EU regulation for rail.

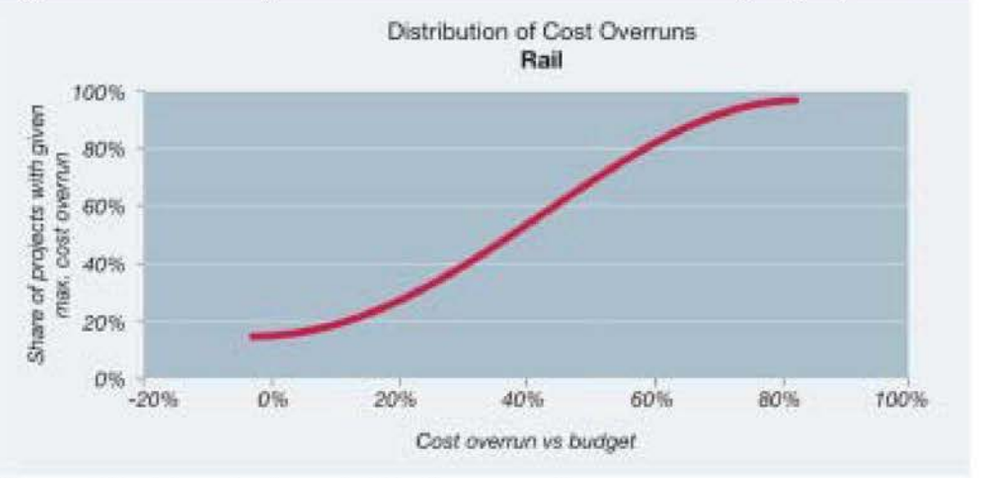
Figure 4 - Cost overrun in UK (N=3) and non-UK (N=43) rail projects.



Source: Flyvbjerg database, 2004. Constant prices. Average cost overrun is indicated for each group.

Figure 5 shows the probability distribution for cost overrun in rail projects as the share of projects with a given maximum cost overrun. For instance, 40% of projects have a maximum cost overrun of 33%; 80% of projects a maximum overrun of 57%, etc.

Figure 5 - Probability distribution of cost overrun for rail, 46 projects.



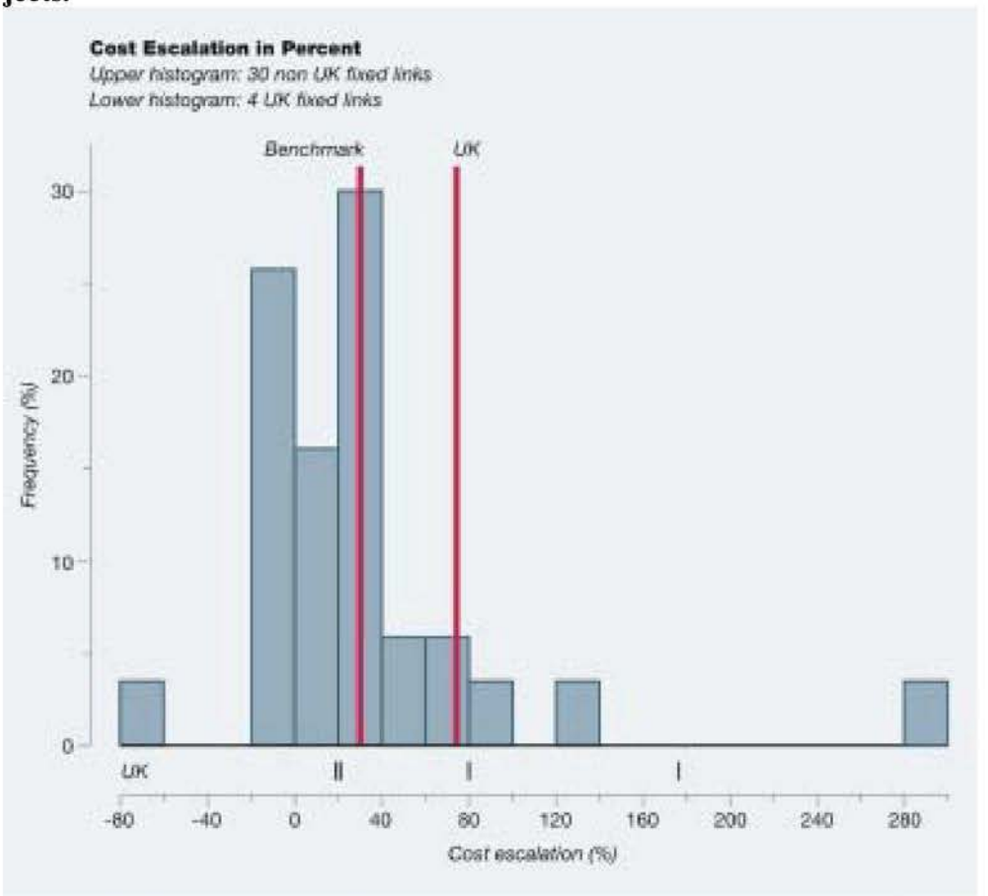
Source: Flyvbjerg database, 2004. Constant prices.

3.2.3 Fixed links

Figure 6 shows cost overrun for UK and non-UK fixed-link projects (bridges and tunnels). Average cost overrun appears to be larger for UK fixed links than for fixed links in the benchmark, than for non-UK fixed links. Statistical tests show, however, that the difference is non-significant (p=0.31). But with data included for only four UK fixed links, this result may be an artefact of the small number of observations. It would be desirable to repeat the test with data from a larger number of UK fixed link projects.

Until the time when such data are available, existing data indicate that UK and non-UK fixed links could and should be pooled for establishing the reference probability distribution of cost overruns and the reference distribution of required uplifts for fixed links. As argued above for rail projects, this conclusion is further supported by the fact that international fixed link projects are relevant as reference group for UK fixed link projects also because the contractors in fixed links are international, risks are fairly identical as are institutional setups. This is increasingly so with the implementation of EU regulation for tendering and construction.

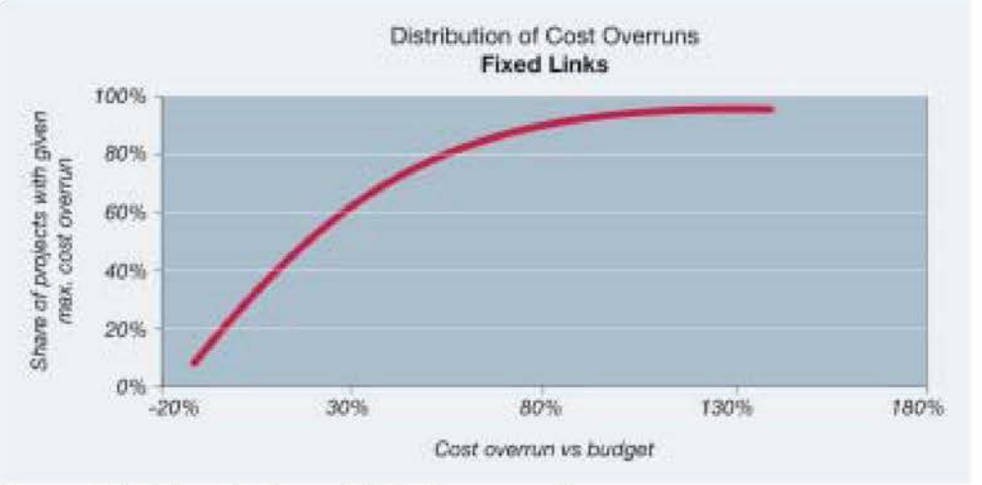
Figure 6 - Cost overrun in UK (N=4) and non-UK (N=30) fixed-link projects.



Source: Flyvbjerg database, 2004. Constant prices. Average cost overrun is indicated for each group.

Figure 7 shows the probability distribution for cost overrun in fixed-link projects as the share of projects with a given maximum cost overrun. For instance, 40% of projects have a maximum cost overrun of 16%, whereas 80% of projects have a maximum overrun of 55%, etc.

Figure 7 - Probability distribution of cost overrun for fixed links, 34 projects.



Source: Flyvbjerg database, 2004. Constant prices.

3.2.4 Building projects and IT projects

Table 4 below shows the Mott MacDonald figures for optimism bias, or cost overrun, in estimates of capital expenditure for (1) non-standards buildings and (2) equipment/development projects. Mott MacDonald calls the higher figures of the intervals the 'upper bound values' for optimism bias. These figures are said to represent the optimism bias level to expect for current projects without effective risk management and with bad scope definition. According to Mott MacDonald, these values reflect the average historic values (p. 32). The lower figures of the intervals are called the 'lower bound values' for optimism bias and they are defined by Mott Macdonald (p. 31) as the optimism bias level to expect with effective risk management.

Table 4 - Cost overrun for building projects and IT projects according to Mott Macdonald.

Project Type	Optimism Bias (%)
Stations and terminal buildings (Non-standard buildings)	4-51
IT system development schemes used in transport (Equipment/development)	10-200

Source: Mott MacDonald, *Review of Large Public Procurement*, p. 32.

The Mott MacDonald study does not present the probability distributions from which the intervals have been derived. Thus the approach used for buildings and IT projects is different from the approach used above for transport projects proper. For the two approaches to be identical, access would be required to

Mott Macdonald's established probability distributions for non-standard buildings and equipment/development.

To the extent that Mott Macdonald's upper bound values represent historic averages for cost overrun, they appear to be somewhat higher than the figures in the Flyvbjerg Database. The main explanation for this seems to be that for many projects Mott Macdonald uses a base case for the calculation of cost overrun that corresponds to an earlier stage in the project cycle than the base case applied for the Flyvbjerg Database. For traditionally procured projects Mott Macdonald (p. 14) uses the strategic outline case and the outline business case stages, whereas for PFI/PPP projects the full business case stage is used. It is unclear, however, how these different baselines combine in the optimism bias uplifts recommended by Mott Macdonald (p. 32). Therefore, it is also unclear exactly what the baseline is for the recommended uplifts. For the Flyvbjerg database, cost overrun and uplifts are calculated on the basis of the full business case stage (time of decision to build), where data for this stage are available[6]. In addition, the data in the Flyvbjerg database are conservative in the manner described in the section on sampling and data collection. Taken together, this means that the Mott Macdonald averages and the Flyvbjerg averages appear to be biased in opposite directions from the time-of-decision-to-build (business) base case, which explains why Mott Macdonald's upper bound values (historic averages) for cost overrun and uplifts appear higher than the Flyvbjerg empirical averages.

[6] Where such data are unavailable, the pre-tender/tender stage is used as baseline.

4 Managing optimism bias

The present section establishes optimism bias uplifts based on the work in the previous sections and provides guidance on how to place a specific project under consideration at an appropriate point in the reference class distribution in order to estimate the required uplift. On the basis of the established probability distributions, uplifts are established as a function of the level of risk that the Department for Transport is willing to accept regarding cost overrun, with lower levels of acceptable risk resulting in higher required uplifts.

4.1 The established optimism bias uplifts

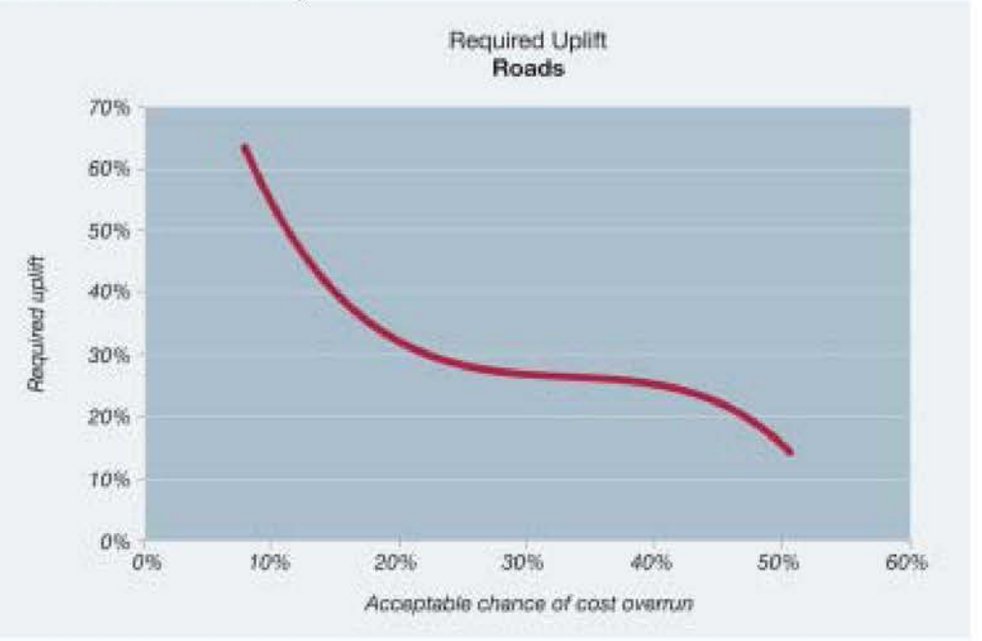
The distribution of the required uplifts is shown below for each project type.

4.1.1 Roads

On the basis of the probability distribution for roads shown above, required uplifts have been calculated, as shown in Figure 8. The lower the acceptable risk for cost overrun, the higher the uplift. For instance, with a willingness to accept a 50% risk for cost overrun in a road project, the required uplift for this project would be 15%. If the Department for Transport were willing to accept only a 10% risk for cost overrun, then the required uplift would be 45%.

Information is not available regarding the extent to which contingencies have been taken into account in initial budgets for roads. According to the Department for Transport, highways in the UK used to use 10% contingencies in initial budgets but now use quantified risk assessment. The uplifts presented here should be considered the upward adjustment that must be applied on top of a standard budget including standard contingencies.

Figure 8 - Required uplift as function of the maximum acceptable level of risk for cost overrun, roads.

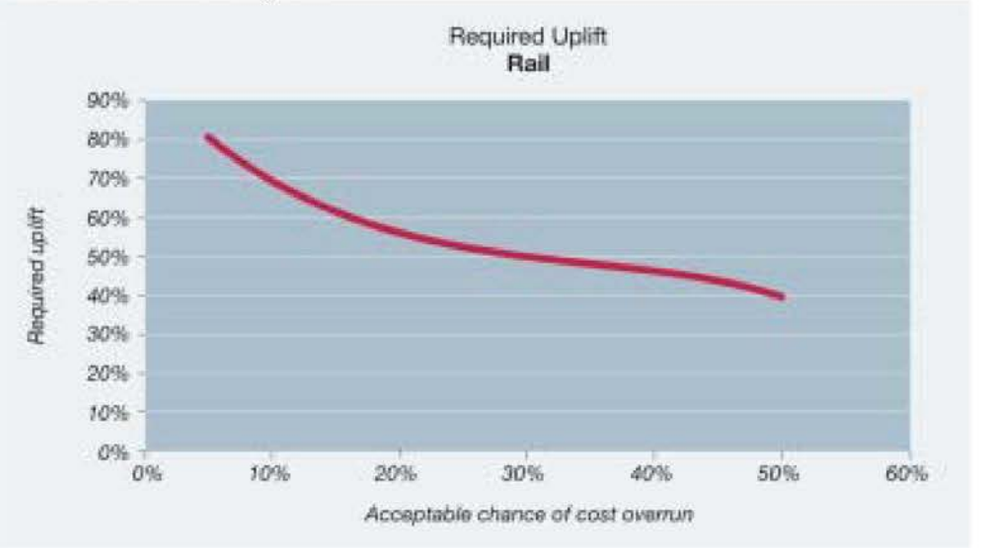


Source: Flyvbjerg database, 2004. Constant prices.

4.1.2 Rail

On the basis of the probability distribution for rail shown above, required uplifts may be calculated, as shown in Figure 9. With a willingness to accept a 50% risk for cost overrun in a rail project, the required uplift would be 40%. If the Department for Transport were willing to accept only a 10% risk for cost overrun, then the required uplift would be 68%.

Figure 9 - Required uplift as function of the maximum acceptable level of risk for cost overrun, rail.

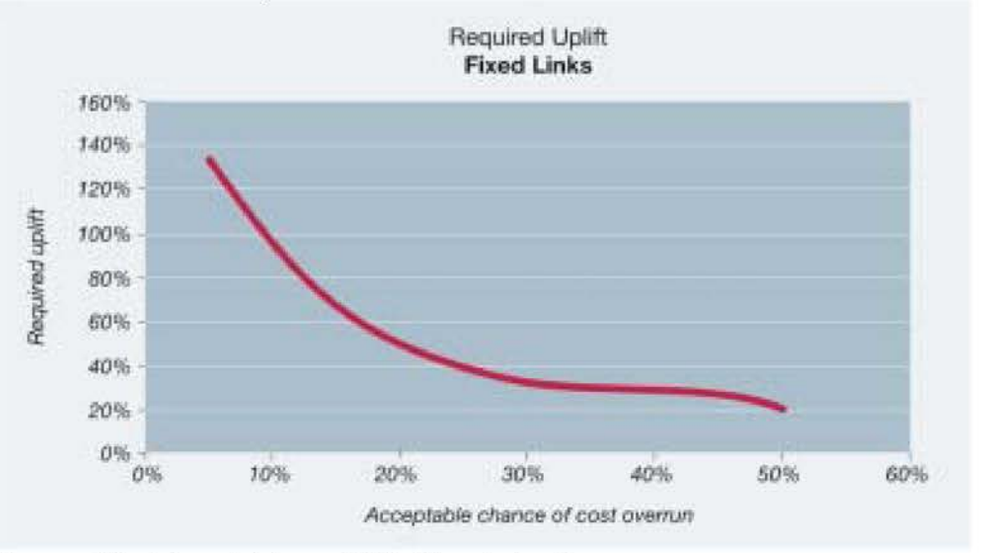


Source: Flyvbjerg database, 2004. Constant prices.

4.1.3 Fixed links

On the basis of the probability distribution for fixed links shown above, required uplifts may be calculated, as shown in Figure 10. With a willingness to accept a 50% risk for cost overrun in a rail project, the required uplift would be 23%. If the Department for Transport were willing to accept only a 10% risk for cost overrun, then the required uplift would be 83%.

Figure 10 - Required uplift as function of the maximum acceptable level of risk for cost overrun, fixed links.



Source: Flyvbjerg database, 2004. Constant prices.

4.1.4 Building projects and IT projects

As mentioned previously, uplifts for building projects (stations and terminal buildings) and IT projects (IT system development schemes used in transport) are based on the Mott MacDonald (2002, pp. 31-32) study. As also mentioned, this study does not report probability distributions for cost overrun and optimism bias but only an interval for capital cost overrun for each project type. These figures are shown in Table 5.

Table 5 - Optimism bias uplifts for capital expenditure for building projects and IT projects according to Mott Macdonald.

Project Type	Uplift (%)
Stations and terminal buildings (Non-standard buildings)	4-51
IT system development schemes used in transport (Equipment/development)	10-200

Source: Mott MacDonald, *Review of Large Public Procurement*, p. 32.

According to Mott Macdonald, the lower figure applies to projects with effective risk management, whereas the higher figure applies to projects without effective risk management and with bad scope definition. According to Mott MacDonald, the higher values reflect the average historic values.

Again it should be mentioned, that the Mott Macdonald figures are not directly comparable to the Flyvbjerg figures for two reasons (see also Section 2.3.4). First, the Mott Macdonald figures are derived from mainly the pre-approval stage of the project cycle, whereas the Flyvbjerg figures are derived from mainly the approval stage. Second, it is unclear to which percentile in the distribution of cost overruns and uplifts to which the Mott Macdonald figures apply. If the Mott Macdonald upper bound values for uplifts are considered as averages, as Mott Macdonald recommend in some cases, the uplifts appear to be substantially higher than the Flyvbjerg database average uplifts. If the Mott Macdonald upper bound values for uplifts are considered to apply to upper level percentiles, as Mott Macdonald recommend in other cases without specifying which percentile, the uplifts are more in line with the Flyvbjerg uplifts (Please refer to table 6 below and Mott Macdonald 2002, pp. 31-32).

4.2 Using the established optimism bias uplifts

The uplifts for optimism bias presented above refer to, and should be applied to, estimated budgets at the time of decision to build. The time of decision to build is typically equivalent to the time of presenting the business case for a project with a view to obtaining the go or no-go for that project. The uplifts refer to cost overrun calculated in constant prices.

In relation to the appraisal requirements for Local Transport Plans (LTPs) the application of up-lifts should be in connection with the submission of the appraisal information (Annex E) provided by authorities to help determine the allocation of resources for five-year programmes and major schemes. The application of the uplifts should be transparent for the appraiser.

Table 6 shows a simple example of how one would use the established optimism bias uplifts in practice. If, for instance, a group of planners were preparing the business case for a new motorway, and if they or their client had decided that the risk of cost overrun must be less than 20%, then they would use an uplift of 32% on their estimated capital expenditure budget. Thus, if the initially estimated budget were £100 million, then the final budget taking into account optimism bias at the 80%-level would be £132 million. If the planners or their client decided instead that a 50% risk of cost overrun was acceptable, then the uplift would be 15% and the final budget £115 million.

Similarly, if a group of planners were preparing the business case for a metro rail project, and if they or their client had decided that with 80% certainty they wanted to stay within budget, then they would use an uplift on capital costs of 57%. An initial capital expenditure budget of £300 million would then become a final budget of £504 million. If the planners or their client required only 50% certainty they would stay within budget, then the final budget would be £420 million.

It follows that the 50% percentile should be used only in instances where investors are willing to take a high degree of risk that cost overrun will occur and/or in situations where investors are funding a large number of projects and where cost savings (underruns) on one project may be used to cover the costs of over-

runs on other projects. The upper percentiles (80-90%) should be used when investors want a high degree of certainty that cost overrun will not occur, for instance in stand-alone projects with no access to additional funds beyond the approved budget. Other percentiles may be employed to reflect other degrees of willingness to accept risk.

Table 6 - Applicable capital expenditure uplifts for selected percentiles. Constant prices.

Category	Types of projects	Applicable optimism bias uplifts				
		50% per-centile	60% per-centile	70% per-centile	**80% per-centile**	90% per-centile
Roads	Motorway Trunk roads Local roads Bicycle facilities Pedestrian facilities Park and ride Bus lane schemes Guided buses on wheels	**15%**	24%	27%	**32%**	45%
Rail	Metro Light rail Guided buses on tracks Conventional rail High speed rail	**40%**	45%	51%	**57%**	68%
Fixed links	Bridges Tunnels	**23%**	26%	34%	**55%**	83%
Building projects	Stations Terminal buildings	4-51%*				
IT projects	IT system development	10-200%*				
Standard civil engi-neering	Included for reference purposes only	3-44%*				
Non-standard civil engi-neering	Included for reference purposes only	6-66%*				

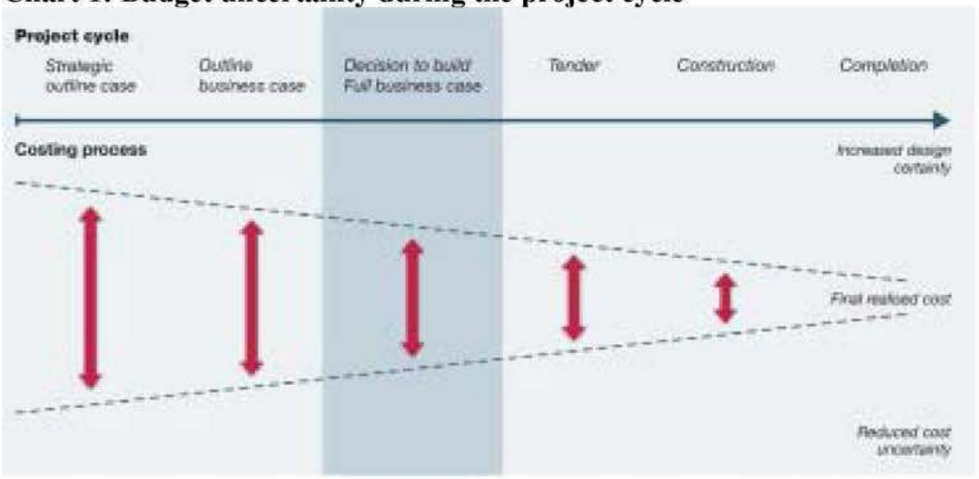
*) Figure based on Mott MacDonald study, p. 32; no probability distribution or percentiles available.

4.3 Adjusting uplifts for combined projects and project stage

Where a project includes significant elements of the different project types identified above, it may be considered a combined project. This could be, for instance, a guided bus scheme or a metro with large elements of IT system development. In this case the project should be considered a combined project consisting of both a guided bus scheme/rail sub-project and an IT sub-project. The relative size of each sub-project should be determined and the appropriate uplifts should be identified and applied to that part of the project as described in the previous section. After this has been done, the adjusted budgets for each sub-project should be aggregated to establish the total final budget for the overall project.

Similarly, where a project has not yet reached the approval stage, but is at the strategic outline case or outline business case stage, uplifts should be adjusted to reflect this. Typically budget uncertainty is reduced throughout the project cycle from inception over feasibility studies and approval to construction and start of operations (please refer to Chart 1 below). Therefore, in order to arrive at a valid cost estimate for a stage prior to the approval stage, the uplifts listed above should generally be adjusted upwards. Conversely, if a project has moved beyond the approval stage to the stage of detailed design or construction, uplifts should normally be adjusted downwards.

Chart 1: Budget uncertainty during the project cycle



In the latter, or post-approval, case, one way of adjusting uplifts downwards would be to follow the simple rule that uplifts are reduced at specific point in time by the same percentage as the percentage of the total budget, which has been spent up to this point, for instance as follows:

Percentage of total budget spent	Uplift as percentage of initial uplift
0%	100%
10%	90%
20%	80%
30%	70%
40%	60%

50%	50%
60%	40%
70%	30%
80%	20%
90%	10%
100%	0%

Using this simple rule of interpolation has the advantage of avoiding the reintroduction of optimism bias for lack of empirical evidence of how much the uplifts should be reduced at key points in the project cycle. The latter information would ideally be available; in reality, often it is not. - If the total budget changes over time, from approval to start of operations, as is often the case, the uplifts would have to be recalculated accordingly, whether or not interpolation or a more empirical method is used to adjust uplifts downwards over time.

For the pre-approval case, it is more difficult to find a simple decision rule for adjusting optimism bias uplifts upwards. Data for carrying out such adjustments do presently not exist with a validity comparable to that which applies to the data presented above. Consequently, planners would have to use their judgement in carrying out such adjustments to the uplift factors, based on their knowledge about the specific project and project type at hand. This would entail a risk of reintroducing optimism bias in the project planning process. But at least the risk would be mitigated by the fact that valid data on uplifts exist for the approval stage, which should therefore serve as reference point for any adjustments made to cost estimates representing other stages in the project cycle.

4.4 Adjusting uplifts as risk mitigation improves

The strength of the uplifts for optimism bias established above is that they are firmly grounded in empirical probability distributions of cost overrun for different types of transport projects. Thus the uplifts allow true reference forecasting for specific projects under consideration. It is crucial that uplifts be empirically based in this manner; otherwise the risk is high of re-introducing optimism and bias in project preparation and decision making.

It may be argued that uplifts should be adjusted downward as risk assessment and management improves over time and risks are thus mitigated. It is however our view that planners and forecasters should carry out such downward adjustment of uplifts only when warranted by firm empirical evidence. For 70 years, optimism bias has been high and constant for the types of transport projects considered above, with no indication of coming down.[7] With practices of optimism as deep-rooted as this, hard evidence from post-audits would be required to convincingly argue the case that optimism bias is finally coming down. In general, only at such a time when this evidence is available should uplifts be reduced correspondingly. If this precaution is not followed the risk is high that optimism would be re-introduced and that, therefore, the work of establishing empirically based uplifts and reference forecasting would be more or less for naught.

[7] Flyvbjerg et al., 'How Common and How Large Are Cost Overruns?'.

Having stated this general rule and precaution, it must be observed that individual projects may exist where the claims to improved risk mitigation are so strong that downward adjustment of uplifts is warranted in order to avoid double counting. This may be the case if advanced risk analysis (e.g. risk identification work shop and statistical calculations of volume and cost risks for individual project components) has been applied and their results adequately reflected in the established budget.

Such cases should however be bolstered by empirical evidence that risk has, in fact, been taken into account. For instance, this could be documented by higher unit costs as compared to similar projects, for instance a higher per-mile cost for planned rail or road projects compared to previous projects of this type, where the higher unit costs may be argued to result from improved risk assessment.

4.5 Possible pitfalls

Budgets that are available to a project organisation often tend to get used. There is therefore an important issue as to the incentive effects on the project management of adding an Optimism Bias up-lift to an established project budget. Furthermore there will always be some degree of asymmetrical information between the project organisation and external observers. The introduction of Optimism Bias up-lifts may therefore in itself introduce an additional moral hazard risk in the principal-agent relation between the project organisation (the agent) and the Department of Transport (the principal). This, and other issues regarding strategic behaviour and institutional set-ups, is further analysed under Section 5.

Another important pitfall in employing the approach described above is that forecasters, when estimating the future costs of a specific transport project, would depart from the basic principles of reference forecasting and would gradually return to the practices of conventional forecasting, with forecasters focusing on the details of the project at hand and attempting to forecast the specific events that would influence the future course of this project. The track record of conventional transport cost forecasting shows that with 90% likelihood, this would re-introduce optimism bias in forecasting.[8] This pitfall may be avoided by consistently sticking to the method of reference forecasting described above.

[8] Flyvbjerg et al., 'How Common and How Large Are Cost Overruns?', p. 78.

5 Causes of optimism bias and possible cures

The present and final section discusses the general causes of optimism bias in transport policy in an institutional context and identifies possibilities for reducing optimism bias in British transport project preparation and decision-making.

Background

Transport projects are inherently risky due to the long planning horizon and complex interfaces. However, the complexity should not be a surprise to the experienced planner as the occurrence of a certain number of unplanned events is the norm rather than the exception in transport infrastructure projects. It is therefore relevant to ask if there are more deep-seated causes of optimism bias that can explain why project planners do not set aside substantial contingencies when massive evidence show that initial budgets for transport infrastructure projects are characterised by pronounced optimism bias.

Theories on cost overrun suggest that optimism bias could be caused by a combination of how the decision-making process is organised *and* strategic behaviour of actors involved in the planning and decision-making processes. It could therefore be the case that optimism bias exists simply because only few actors have a direct interest in avoiding optimism bias.

Purpose

The purpose of this chapter is to address the decision-making process related to local transport projects. In doing so, the chapter proceeds in three steps. It first contains a brief overview of the underlying reasons for cost escalation in transport infrastructure projects and the general causes of optimism bias based on current research. This is followed by a description of key features of local transport project preparation and decision-making practices where we look for institutional factors that could explain the prevalence of optimism bias. This finally makes it possible to indicate recommendations for minimising optimism bias in the future.

The findings are presented in a somehow cautious tone. This reflects that a full understanding of decision-making in relation to local transport projects require a comprehensive study beyond the scope of this project. Rather, this chapter seeks to identify a number of key issues and to introduce a new way of approaching the problem of optimism bias.

The description is based on personal interviews with key experts in planning of transport projects in the UK (see Appendix 1) and review of relevant documents.

Approach

The analysis is inspired by the Rational Institutionalism approach which sees political and administrative decision-making processes as characterised by actors that seek to maximise their utility in line with their *interests* within a rather stable *institutional setting* which impacts upon their *behaviour*.

Interests

All actors have interests - something they strive for. Some actors will have one overriding interest but most actors will have more interests - some of which may be conflicting in the short term. In this study we look for three types of interests: Economic interests (maximise profits), bureaucratic interests (maximise budgets and prestige) and political interests (maximise influence to realise political preferences, e.g. chance of re-election).

Institutional set-up

The institutional set-up is composed of formal and informal rules that structure social interaction in particular ways. The formal rules are legislation and fixed procedures; the informal rules are norms and routines. The actors involved with decision-making in relation to transport projects all face the same framework conditions (see section 5.2.1 below) - that is the general institutional set-up in relation to transport projects. But their particular roles in decision-making and interests also leave them in specific situations. A local politician, for instance, faces different norms than a civil servant or a private consultant.

Behaviour

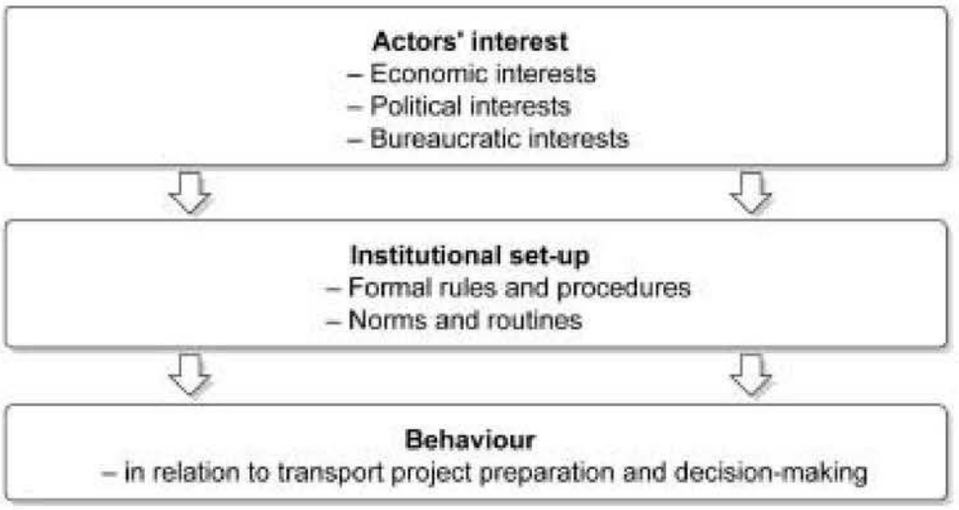
Behaviour is what we ultimately are focussed on: the way key actors behave in relation to the problem of optimism bias. We want to see if it is rational for them to behave in ways which creates optimism bias or if incentives give them reason to work against optimism bias.

Relation between the three concepts

The relation between the three central concepts - interests, institutional set-up and behaviour - is illustrated in the figure below. It shows a simple causal relation in which interests by and large steer the behavioural tendencies of actors but filtered through, and therefore constrained by, the institutional set-up.[9]

[9] It should be noted that this is a simplified of view on what motivate behaviour, but it underlines central mechanisms when actors compete for public resources - and it is as such a useful simplification.

Figure 11 - The approach to analysing causes of optimism bias



5.1 Causes of optimism bias

Four categories of causes

Causes of optimism bias can be grouped in several ways.[10] This section establishes an overview of causes of optimism bias in transportation projects in the form of four categories: Technical, psychological, political and economic causes. It should be noted that this section is not based on UK specific empirical evidence but is a condensed presentation of causes of optimism bias as found in the literature.

Unplanned events should not be a surprise to the experienced planner. Given the right incentives, the prudent planner should include adequate contingencies in the project budget to allow for the unavoidable fact that the realised project on average will be more complex and costly than planned due to a host of technical causes.

However, massive statistical evidence shows this is not the typical situation as initial budgets are generally characterised by pronounced optimism bias. The psychological, political and economic causes of optimism bias reflect reasons why risk factors are not fully reflected in the project budget.[11]

Technical causes

Transport projects are inherently risky due to the long planning horizon and complex interfaces. Often the project scope or ambition level will change significantly during project development and implementation. Traditionally, op-

[10] See for instance the categorisation in the appendix to the Supplementary Green Book Guidance called "Contributory factors". The contributory factors are grouped into procurement, Project Specific, Client Specific, Environment and External Influences.

[11] The section builds primarily on Bent Flyvbjerg, Mette Skamris Holm and Søren Buhl: *Underestimating Costs in Public Works Projects - Error or Lie?*, APA, Journal, Summer 2002, Vol. 68, No 3.

timism bias has thus often been explained with reference to the following three sub-groups:

- **Imperfect information**. Most studies that compare actual and estimated costs of transport projects refer to technical reasons such as imperfect forecasting technique, inadequate data, and honest mistakes. Few would dispute that such factors may be important sources of uncertainty. But it is striking to see that neither the massive improvement of forecasting techniques nor lessons learned from past experiences have led to a decrease in the levels of optimism bias.

- **Scope changes**. Based on our experience of analysing cost overrun in the transportation sector from a number of countries, an important cause for cost increases is that the scope or ambition level for a given project changes significantly during its development and implementation.

- **Management**. Projects that go seriously wrong often have poor initial documentation as the specific technical causes (see the text box below) that may cause cost overrun have not been subject to a detailed risk analysis. Projects that do better than the average project are not necessarily less complex but typically better managed.

This is consistent with the analysis of Mott Macdonald, which for Non-Standard Civil Engineering identifies inadequacy of the Business Case as the key driving factor behind cost increases.

The text box below provides a transport scheme specific typology of causes for cost increases. However, insufficient data is available to provide a statistically meaningful breakdown of average cost increases on individual components.

Typology of specific technical causes for cost escalation in transport projects:

Standards (changed requirements such as speed, road width, road type)

Routing (changed routing)

Norms (changed safety norms or building norms)

Environment (tighter environmental standards)

Geo-techniques (complex or extensive works on geo-techniques, water or mountain)

Archaeology (unexpected archaeological finds)

Expropriation costs (under estimated expropriation costs)

Complex interfaces (urban environment, links to existing infrastructure)

New or unproven technology (limited experience base)

Construction costs (business cycle or competitive situation)
Calculation approach (calculations based on everything goes as planned)
Delays due to weather

Psychological causes

Psychological explanations attempt to explain biases in forecasts by a bias in the mental makeup of project promoters and forecasters. Politicians may have a "monument complex", engineers like to build things, and local transport officials can be very keen to see projects realised. The most common psychological explanation is probably appraisal optimism. According to this explanation, promoters and forecasters are held to be overly optimistic about project outcomes in the appraisal phase, when projects are planned and decided.

Economic causes

Economic explanations conceive of cost underestimation in terms of economic rationality. When a project goes forward, it creates work for engineers and construction firms. If these actors are involved in or indirectly influence the forecasting process, then this may influence outcomes in ways that make it more likely that the project will be built.

Political-institutional causes

Political-institutional explanations see optimism bias in terms of interests, powers, and the prevailing institutional setting that surrounds decision-making on transport projects. A key question is whether cost forecasts are biased to serve the interests of project promoters in getting projects funded and started. This raises the issue of deception: whether project promoters deliberately deceive project sponsors or whether the deception takes places as a result of an institutional set-up that creates inappropriate routines.

Surprisingly little work has been done that explains the pattern of misleading forecasts in political-institutional terms. This chapter, however, apply such a perspective when explaining optimism bias in relation to local transport projects in UK.

Summary

Four categories of causes of optimism bias were identified. One of the categories is the political-institutional approach which will be used in this chapter in to throw light on optimism bias in local transport planning.

An overview of the categories is given in the table below.

Table 7 - Categorises of causes of optimism bias

Causes of optimism bias	Examples
Technical causes	Imperfect information such as unavailability of data, new or unproven technology Scope changes such as changes in relation to speed, road width, routing, safety and environmental norms Management issues such as inappropriate calculation approach, procurement issues and risk sharing
Psychological causes	Tendency for humans and organisations to favour optimism Appraisal optimism
Economic causes	Construction companies and consultants have interests in advancing projects
Political-institutional causes	Interests, power, and institutions Actors may deliberately lie in order to see their projects/interest realised

5.2 Decision-making on local transport projects

This section identifies key issues in relation to decision-making on local transport projects by first briefly presenting the framework for decision-making (the general institutional set-up). This is followed by an overview of the key actors involved and their interest in relation to local transport projects. By combining the insight of the actor's interests and the framework for making decisions on local transport projects, we eventually can identify critical issues that influence the level of optimism bias.

5.2.1 The framework for local transport projects

Local Transport Plans

The Local Transport Plan is the mechanism that links the local and regional transport investment requirements with the national transport objectives and national public finance.

Local Transport Plans were submitted in 2000 by all English local transport authorities outside London. The required content of a plan is: objectives consistent with overarching national objectives, an analysis of problems, a long-term strategy, a costed 5 year implementation programme of schemes and policy measures, and a set of targets and performance indicators. The plans thus provide the framework for funding and implementing local improvements. The individual plan can be seen partly as a bidding document, but also as a strategic planning document for a local audience. There is a statutory duty on local authorities to prepare a Local Transport Plan.

There are two groups of projects proposed via the plans: Integrated transport schemes consisting of packages of smaller schemes/local road maintenance, and major public transport and road schemes costing over £5 million.

The framework for local transport schemes can further be summarised in five points:

- National funding of local projects
- High degree of strategic and long-term planning
- High priority and expanding budgets
- Delivering through others
- Resources allocated via a transparent mega-bidding process

National funding of local projects

The major transport schemes are financed completely by national public finances. However, the Department for Transport is increasingly requiring local and regional co-financing of Light Rail Transport schemes.

Strategic and long-term planning

In 2000, the 10 Year Plan for transport set out a commitment to invest, looking a decade ahead. It is a long-term strategy and investment plan therein that allocations are targeted investments that respect the national transport objectives set forth in the strategy.[12] The plan pledged to build around 25 new tram lines by 2010.

High priority and expanding budgets

When the New Labour government took power it announced a modernisation of the transport sector - and resources followed. The 10 Year Plan committed public and private funding amounting to more than £181 billion across the decade to 2010/11. The investment will be distributed between railways (£64 billion), improvement of road network (£ 59 billion) and local transport investments (£ 59 billion). Total public and private spending for transport projects have therefore dramatically increased.

Public spending for projects generated via Local Transport Plans is to triple in the period 1999 - 2006, cf. the table below.

[12] They are: to protect and enhance the built and natural environment; to improve safety for all travellers; to contribute to an efficient economy and to support sustainable economic growth in appropriate locations, to promote accessibility to everyday facilitates for all, especially those without a car; and to promote the integration of all forms of transport and land use planning, leading to a better, more efficient transport system.

Table 8 - Public spending for projects generated via Local Transport Plans

Year	Amount (£ million)
1998/99	822
1999/00	974
2000/01	1159
2001/02	1608
2002/03	1891
2003/04	2053
2004/05	2431
2005/06	2471

Source: Department for Transport, Annual Report 2003

Delivering through others

The Department for Transport delivers local transport projects through others; by working in partnership with a wide range of public entities (such as local transport authorities) and private-sector bodies (such as constructors and operators).

Mega-bidding process

The above-mentioned process and interaction between transport authorities at different levels can be characterised as a mega-bidding process therein that it

- involves several eligible applicants (local transport authorities)
- that compete for a delimited and earmarked amount of resources
- based on clearly defined application criteria
- where projects are selected on objective reasons.

5.2.2 The interests of the actors

Optimism bias - a subordinated concern?

The framework conditions do not explain optimism bias in itself. It is only when combined with the interests of the actors that the decision-making process can be critically evaluated. However, it appears reasonable to expect that it is a key issue if the Governments strong commitment to "deliver" (realise transport projects) coupled with the local transport authorities' interests in realising project could imply that none of them focuses strongly on avoiding optimism bias.

The following section presents the actors that interact within the framework. Three groups of actors can be distinguished: actors at local and regional levels, actors at national level, and other actors. For each of the actors we deduce if they have an active interest in avoiding optimism bias or if they do not have an active interest in avoiding optimism bias.

Local transport authorities

The interest of local transport authorities is to solve local and regional transport problems just as they want to use transport schemes to spark the local and regional economic development. In fact, the interviewees often mentioned that the last-mentioned objective may be just as important for them as to realise the national objectives. To realise these objectives the authorities submit applications which present the projects as favourably as possible - thereby increasing

the likelihood of national financing. The crucial challenge for them is to "pass the test" as it was expressed in an interview; that is to have a given project accepted at the business case level. The interviews left the clear impression that the local authorities give priority to presenting the virtues of a given project rather than scrutinising for possible risks. Most of the interviewees found that this prioritisation is driven less by intent to cheat and more by a routine which lacks a tradition for and demand after careful risk analyses and management.

It therefore seems reasonable to assume that the local transport authorities are not highly concerned with cost overrun for the individual projects they advance because:

- as a general rule they do not finance the projects[13];
- the costs of optimism bias are allocated thinly to the population nationwide while the benefits of a realised project falls concentrated on a particular region; and
- there have hitherto been no examples of major schemes being cancelled because of cost overrun when the schemes have passed the business case stage - hence from a local perspective there appears to be few financial and political costs associated with pursuing a non-realistic costing practice.

Other local actors

The local transport authorities can be disaggregated into local politicians, local planners, and local economic interests. Allocation of resources from the national Government to a region will most likely be appreciated by the population; hence local politicians see a clear political interest in pushing for such projects. Local economic interests will likewise benefit from transport projects in the form of improved accessibility and increased economic activity. The interest of the local administrations is more difficult to foresee. It is plausible to expect some tension between professional standards of civil servants on the one hand and the massive desire from the political level to see projects presented as favourably as possible. Two of the interviewees commented in fact on the possible dilemma between local planners being aware of the problems of optimism bias and the local politicians and other actors advancing a project. A planner said that:

"You will often as a planner know the real costs. You know that the budget is too low but it is difficult to pass such a message to the counsellors and the private actors. They know that high costs reduce the chances of national funding".

Actors at national level

The formal decision-making authority rests with the Minister of the Department for Transport (jointly with the Minister of HM Treasury for projects above £40 million). The decisions are based on advice from DfT officials. As Ministers which are MPs of the national parliament make the final decisions, it could be argued that there is political involvement in the process, or at least that the process is susceptible to political interference. The interviews showed, in fact, that political interference is a common feature when a project has run into trouble.

[13] However, it should be noted that a 25% local funding requirement primarily aimed at larger majors has been successfully introduced for LRT recently

Individual MPs

Formally, the members of parliament do not get involved with the individual decision-making processes. But the MPs often act with a view to what is popular back home in his/her constituency - and that is to lobby for projects promoted by the local authorities. The planners and consultants interviewed have confirmed that feature and informed that the involvement of MPs is particular intensive in relation to the marginal projects - those who are on the edge of passing the business case test or have ran into problems of cost overrun. One person said:

"The MPs elected here in the region lobbied the case heavily within the Labour party at a critical stage. They also lobbied in relation to the decision-makers within the Ministry of Transport. This is normal; it is very typical".

The interviewees found that it makes sense for the MPs to focus on local transport projects as they are seen as good opportunities for the individual MP to flag his efforts for the region. In sum, it appears plausible to expect that few MPs have a direct political interest in avoiding optimism bias.

It should obviously also be asked if MPs on the contrary could devote attention to combating cost overrun (and being rewarded hereof by the voters). The interviewees found that this would seldom be the case. But it was recognised that if cost overrun will be established and accepted as a significant problem in the public domain, it may give MPs incentives not to fight for projects with high likelihood of cost overrun as this may be perceived as action against the common good.

The national Government

The Government has committed itself strongly via the 10 Year Plan to the delivery of numerous major local transport projects. The Government is therefore dealing with two concerns: the delivery of transport schemes to fulfil promises to the population while simultaneously seeing to good management practices and sound use of public finances. The first concern could lead to neglecting cost overrun as a key issue while the other concern establishes optimism bias as a problem. It is not possible to establish which of the two concerns are given the highest priority.

HM Treasury

HM Treasury can likewise be expected to manage the same two concerns, however, with a stronger focus on optimism bias as a problem. This is exemplified in the publication of the so-called Green Book. Most of the interviewees found that it is only recently that optimism bias in the transport sector has become an important issue for HM Treasury.

The Department for Transport

The dilemma between the need to deliver transport schemes and to avoid cost overrun is felt strongly by the Department for Transport, as it is the branch of the national government that is responsible for the transport sector. It has to balance pressure from below (the local network of actors) and from above (the wish of Government to see schemes materialise) with a concern for sound management of projects. Some of the interviewees have questioned whether the Department can be seen as a unitary actor and have indicated that parts of the Department focuses more on delivery of projects while other parts stress the

need to control optimism bias. Specifically in relation to the local transport projects, one interviewee (a senior consultant) said that:

"There is a tendency that the economists take a tougher stance on project proposals while the policy people are more inclined to see projects realised independently of cost overrun. I guess their success criterion first of all is to see projects realised".

This statement indirectly refers to the various interests within the Department for Transport. Ideally the two concerns would be reconciled (equal to a situation where projects are delivered without cost overrun) but this may not be possible in the short run. Therefore, sometime a choice between the two is made. For instance, in the light of severe cost overruns some light rail schemes that have progressed to the construction phase now await a decision on whether to be stopped or reduced; hence they will be a sort of test case of whether the Department for Transport is moving towards a more critical view on projects suffering from cost overrun. The data compilation undertaken does not allow a further qualification of how the Department for Transport handles the above dilemma between the two concerns and whether the balance will eventually come down on the side of one or the other. Many interviewees are nevertheless of the perception that the Department increasingly can be seen as an actor that has a direct interest in avoiding cost overrun.

Private consultants

Consultants are heavily involved in all stages of planning process: they advise local transport authorities in the development of local transport plans; they appraise major projects for the local transport authorities; they audit appraisals on behalf of the Department for Transport and they assist bidders and constructors.

We found little evidence that it is in the direct interest of consultancy companies to avoid cost overrun. The question is furthermore if it is in the economic interest of the individual consultancy company to see projects passing the business case level test and if the consultants in the attempt to please their clients and thereby increase the likelihood of further assignments tend to stress the benefits of a scheme beyond what is reasonable. The interviews gave rise to the following preliminary findings.

- It is in the interest of consultants to see projects advancing through the businesses case level because a consultancy company typically follows a project through all the main stages.

- The non-consultants of the interviewees acknowledged a high professional standard and integrity of consultancy services in general. But they also found that the consultants appear to focus on justifying projects rather than critically scrutinising them. They called on the consultants to be more concerned with critical cost analyses. As an example, a person (project manager) said that:

  "I question whether concern over reputation really is that decisive in how the consultants' approach the studies. Most decent consultants will write-off obviously bad projects but there is a grey zone and I think many consultants in reality have an incentive

to try to prolong the life of projects which means to get them through the business case. It is in line with their need to make a profit".

- The consultants interviewed confirmed that appraisals often focus more on the benefit side of a project than the cost side. That is due to the request of the clients and a further focus on risk assessment has not been required by the Department of Transport until recently because of the overriding priority of Government to deliver local transport schemes. A consultant commenting on the eagerness of the Government in introducing light rail schemes thus said that "there was an incredible rush to see projects realised". The consultants further referred to reputation as their main asset and that this incentivises them to avoid unbalanced appraisals. According to this view, the work of the consultants would follow the same procedures independently of who has requested a study:

  "We have the same approach to undertaking appraisals if we work for local transport authorities or the Department for Transport."

In sum, the views expressed indicate that the consultancy business has not had an active interest in avoiding cost overrun; seemingly because they are seldom instructed to focus as much on the cost side than the benefit side. The interviews also indicate that there are different perceptions between the consultants and other persons interviewed of the role of the consultants.

Other actors[14]

Partnerships UK was established by the Government to accelerate the development, procurement and implementation of public private partnerships (PPP). Partnerships UK assist the Treasury, Government Departments and the Office of Government Commerce. It works with the Government in the development of PPP policy and contract standardisation, helps with project evaluation and implementation, and supports PPPs in difficulty. Partnerships UK assists transport authorities in performing better costing and risk analysis, and is often directly incentivised to combat optimism bias (fee for its consultancy service related directly to meeting the budget); hence it can be grouped as an actor having a direct interest in avoiding optimism bias.

Summary

The simple deduction of actors' interest allow a categorisation of actors having a direct interest in avoiding optimism bias and those not having a direct interest, cf. the table below.

[14] The data compiled does do allow a presentation of the interest of bidders and constructors. A more comprehensive study should include this group of actors as well. If a constructor will build and subsequently operate a given transport system he will obviously have an economic interest in focussing critically on both the revenue/benefit side and the construction cost side; hence Public Private Partnerships can if well structured be a driver against optimism bias.

Table 9 - Categorisation of actors involved

Actors having no or little direct interest in avoiding cost overrun/optimism bias	Actors having a direct interest in avoiding cost overrun/optimism bias
Local transport authorities	Ministry of Finance
Local politicians	(Department for Transport)
Local economic interests	Partnerships UK
(Local civil servants)	
Consultancy companies	
Individual MPs	

Note: The brackets indicate that the categorisation can be questioned cf. the argumentation given in the text.

Few actors have an interest in avoiding cost overrun

Even though the categorisation cannot be considered final, it shows that there are few actors with an active interest in avoiding optimism bias. This, obviously, is not equivalent to concluding that there are actors who have a direct interest in creating optimism bias. But it points to the risk that the issue of optimism bias is not given sufficient priority and that other objectives - first and foremost the objective to see major local transport plans being realised - receive prominence.

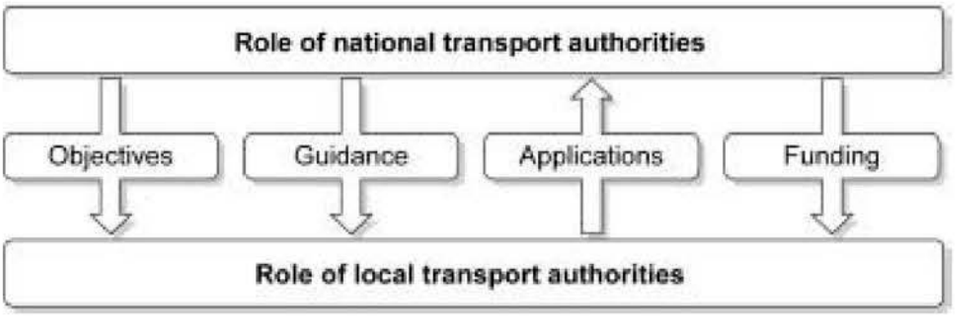
5.2.3 The funding process revisited

Centralised decision-making and allocation of resources

Public administrative structures across countries vary in respect to what services are delivered via the national budget and via public budgets at local and regional level - an issue which further relates to the distribution of responsibilities and revenue sources that are available to each of the administrative levels.

The role between the local transport authorities that prepare Local Transport Plans and the national transport authorities (The Department for Transport) is illustrated below.

Figure 12 - The relations between national and local transport authorities



The figure shows, as already said, that the overall transport objectives are nationally determined. The national transport authorities further provides guid-

ance to the local transport authorities to enable them to react accurately and to secure a standardised approach at local level to project preparation. If a given application is assessed to reflect priorities and likely to provide value for money in delivering integrated transport objectives, funding will be provided.

Principal - Agent relation

This division of responsibilities coupled with the "delivery through others" policy of the Department for Transport means that the relation between the Department and the local transport authorities takes a principal-agent character.[15]

The principal is the Department for Transport which is given the task to realise a well functioning transport system through others (the agents) who do not necessarily hold the same interests as the principal. There appears to be a clear asymmetry:

- in resources: public finance and related allocation responsibilities is available nationally while the revenue (tax) base is limited for local and regional authorities;
- in information: projects are prepared by local authorities that hold detailed knowledge of the project and the local context.

One way by which the principal (the Department for Transport) has sought to counter the informational asymmetry has been to issue several guidance documents on aspects relating to the local transport plans and the documentation of the individual projects. An example is the Guidance on Full Local Transport Plans (DETR, 2000). There appears to be a clear stimuli-response discourse throughout these documents: *if* you act in line with our guidance *then* resources will be provided.[16] The tone reflects the asymmetry in resources and interests

[15] Principal-agent theory arises in a business management context associated with behavioural studies of employer-contractor or employer-employee interactions. The essential point is that many relationships are characterized by asymmetric information leading to dilemmas in decision-making. The central dilemma investigated by principal agent theorists is how to get the contractor/applicant (agent) to act in the best interests of the principal (the donor) when the contractor/applicant has an informational advantage over the principal and has different interests then the principal. A related concept is *agency costs* (a type of transaction cost) reflecting the fact that principals need to take deliberate action to ensure agents will act in the principals' interest. Agency costs include the costs of investigating and selecting appropriate agents, gaining information to set performance standards, monitoring, etc.

[16] In the public presentation of the 2003 allocations for local transport projects (Department for Transport, 2003) it was, for instance, said that: "Top performing and improving councils will be awarded a total of £68 million additional reward funding, awarded according to their performance in delivering better transport. The poorest performers will have part of their allocations held back until they can demonstrate their ability to improve". Local Transport Minister Tony Mcnulty further said that: "Poor performance on transport is not acceptable, but we will recognise and reward strong delivery". The tone is the same in the guidance on local transport plans (DETR, 2002) which introduces the possibility that well-performing local transport authorities can bid for obtaining a privileged status as "Centre of Excellence in Transport Planning".

between the national and local/regional level. It also indicates that the national transport authorities intend to use its strong power as project sponsor to secure consistency across transport projects and to reward/punish applicants depending on the quality of the applications. But judged by experience, e.g. the many light rail schemes suffering from cost overrun, the guidance provided has not prevented optimism bias.

The behaviour of the "agents"

The next issue is therefore whether the "agents" (the local transport authorities) take strategic advantage of the set-up of the funding process to deliberately under-budget their projects in order to see them realised. Based upon the interviews the answer to this appears to be two-fold:

Play the game

First, the local transport authorities "play the game" as several interviewees said. They have had a clear perception that it would pay off to keep the budgets low and not focus too much on the likelihood of unforeseen costs and to emphasise the benefits. This finding is not surprising given existing research that generally indicates that project promoters ignore, hide or otherwise leave out important costs in order to make total costs appear low.[17] Examples of typical comments given by the interviewees are the following:

"It's all about passing the test [the business case level]. You are in when you are in. It means that there is so much focus on showing the project at its best at this stage"

"The system encourages people to focus on the benefits - because until now there has not been much focus on the quality of risk analysis and the robustness. It is therefore important for project promoters to demonstrate all the benefits, also because the project promoters know that their project is up against other projects and competing for scarce resources"

An interviewee (a project manager) also said that there is intentional behaviour to try to make projects look as good as possible - "and that is for sure". He later corrected himself saying that:

"I don't think it is very deliberate; it's not that people sit around a table and make strategies to get money out of a Government; it's more that everybody knows of the competition with the other authorities and that there has not been that much focus on the cost side. This makes it natural to emphasise the benefits of a scheme".

The implication of this is important: it indicates that even actors that do not want to behave in ways leading to optimism bias are de-facto forced to do so: quite simply, it is the rules of the game. Local transport authorities that cost their light rail schemes realistically and therefore high above other similar schemes run the risk of not receiving funding. You loose if you do not behave incorrectly. It was thus interesting to note that some interviewees expressed frustration over the informal rules of the game because they tended to give incentives to them to act in ways which they for ideal reasons did not approve of.

By routine

Second, it would, however, be unfair to say that most local transport authorities in an intentional and calculated manner have under-budgeted their projects. It is

[17] Cf. the article mentioned in footnote 11.

rather the case that they by routine have emphasised benefits over costs and by routine have not performed a broad risk analysis, as illustrated by the below statement (given by a civil servant):

"The whole set of actors in the funding process have not - by tradition, I think - focused on the cost side"

As the local transport authorities were not asked to co-finance cost-overrun it was perfectly rational for them to perform a risk analysis that was just good enough to see a project pass the business case test but not as good as to reveal the likely real cost of a scheme.

Market structure and maturity of construction industry

There are more "agents" than the local transport authorities that the principal must manage. Private construction and operation companies are crucial in determining the final costs of a scheme via the bidding process. As said, the role of the bidders has not been studied; hence we can only present fragmented comments. It was, however, generally argued that the private actor's pricing of risks, in particular revenue risk, has become very substantial and that a good risk analysis therefore should assess the market in relation to a given scheme. Likewise, it is crucial to identify the expected level of competition.

Combating the two asymmetries

This section has identified two crucial asymmetries between the principal and the agents.

- Asymmetry of resources - possible solution: to make it mandatory that local/regional authorities co-finance transport schemes and cost overruns, see section 5.2.4 below.
- Asymmetry of information - possible solution: to require improved risk analysis in combination with application of optimism bias uplifts see section 5.2.5 below.

5.2.4 Asymmetry of resources: asking for local co-financing?

Local co-financing?

Local co-financing of cost overrun will change the incentive structures of the local transport authorises in relation to budgeting meaning that they become more attentive towards risk assessment and optimism bias. Some of the interviewees were asked if specific planning processes for light rail schemes would have been different if the local authorities had to pay an amount of the construction price. The answers were affirmative: more focus would be allocated to a critical review of all costs and benefits.

Limitations

It has recently been established that local authorities shall co-finance up to 25% of new light rail schemes but the percentage is much lower for other larger projects. The interviewees were generally reluctant to suggest the establishment of a general system of local co-financing for all local transport projects as well as to extend co-financing to cost-overruns. This was partly because the revenue base of the local authorities are limited implying that their co-financing ability is small, and partly because a robust market for construction and operation of

light rail schemes has not yet matured; hence the levels of uncertainty are seen as too high in relation to the public finances at local/regional level. Nevertheless, even a limited local economic exposure to the individual project will contribute to improving incentives.

5.2.5 Asymmetry of information: Improved risk assessment?

The principal's (Department for Transport) problems with lack of information on the real cost of projects can be mitigated via improved risk assessment. Two clear features in the perception of risk assessment emerged from the interviews, namely that improved risk analyses is key in combating optimism bias and that the quality of the risk analyses hitherto has been low.

The low quality of risk analyses was detailed with reference to complexity.

Complexity

It was said that it is "relatively easy" to cost a light rail scheme if the components are considered one by one. But the risk analyses have generally fallen short of incorporating a broader view on the complexity of the project. It was argued that there has been a tendency to neglect the following factors:

- The risk of delays. An interviewee called the decision-making process "a slow-moving beast". Even after a decision at the business case level has been reached, it may take years before the project is ready for bidding. Sluggish projects are particularly prone to cost overrun,
- Poor accounting of the complexity of constructing light rail schemes in cities, e.g. costs associated with solving problems of interfaces with other public services.
- Design changes occurring in the course of the decision-making process.
- The immaturity of the construction industry and the private actors pricing of risks. Few companies have experience with constructing/operating more than one tram scheme in the UK.
- The initial costing of a light rail scheme is undertaken by technical experts and subsequently used in the economic appraisals. Some of the interviewees expressed concern that there is a too mechanical use of unit costs based on previous experience - of projects that went wrong.

Why has optimism bias been tolerated?

It was discussed with the interviewees why optimism bias in relation to local transport projects (in particular light rail schemes) has been tolerated? The first element in the answer is cognitive. The complexity of construction light rail schemes appears to have been a real surprise to the sector. There has been a lack of knowledge on what can go wrong due to the short history of constructing light rail schemes in UK.

Another element that was often mentioned is the necessity of the principal to consider other concerns than avoiding cost overrun. As indicated in the presentation of the actors, many interviewees found that the Department for Transport appears to be balancing two concerns which often have been conflicting: to realise projects and to avoid optimism bias/cost over-

run. The Government's announcement to improve the transport system and to build approximately 25 light rail transport schemes created huge expectations locally, and the announcement was therefore a sort of political prestige invested. Withdrawing from the promised projects would therefore not be easy from a political point of view even though they suffered from cost overrun.

5.2.6 "Things are changing"

De-legitimising optimism bias

An effective way to pave the way for the instalment of new procedures - such as requirements for risk assessment and the application of uplifts - is to de-legitimise existing routines. It is the impression from the interviews that optimism bias currently is being de-legitimised. Indices hereof are:

- The publication of the Green Book Supplement which critically focus on optimism bias.
- New procedures on managing optimism bias in local transport projects will be launched in the near future.
- New requirements for risks analyses are being introduced.
- The Department for Transport is reluctant to continue financing light rail schemes suffering from cost overrun.
- Many actors expect that the Department for Transport in the near future will stop the financing of one of the light rail schemes that currently are on hold - thereby signalling a new and harder stance on cost overrun.

Focussing minds

Most of the interviewees were optimistic that the quality of risk assessments of costs will improve significantly over the coming years, and that the level of cost overrun for light rail schemes consequently will go down.

The interviewees further said that "things are changing"; that "the Department is focussing our minds" - and that "Government will not pay what we ask for; it's a new tendency". Such statements indicate that the existing practices and routines are undergoing changes. It means for instance - as mentioned by one of the interviewees - that it not necessarily an advantage if an application from a local transport authority contains low costs for a given scheme. A low cost will only be a competitive advantage if it accompanied by a risk analysis that justify the costs. Otherwise it may be interpreted as an indication of optimism bias.[18]

Although it may sound paradoxically, the endorsement of tougher rules against optimism bias may be perceived as a relief for many of the agents (the local

[18] It should be noted that two persons (civil servant, project manager) raised the issue that if high up-lifts are levied on the light rail projects they may not pass the economic evaluation which further would be a major set-back for public transportation. The persons found that it may necessitate that public transportation projects receive a special priority from the political level if the overall investment level in public transportation shall continue.

transport authorities) some of whom increasing feel uncomfortable with a situation marked by competition on unrealistically low cost.

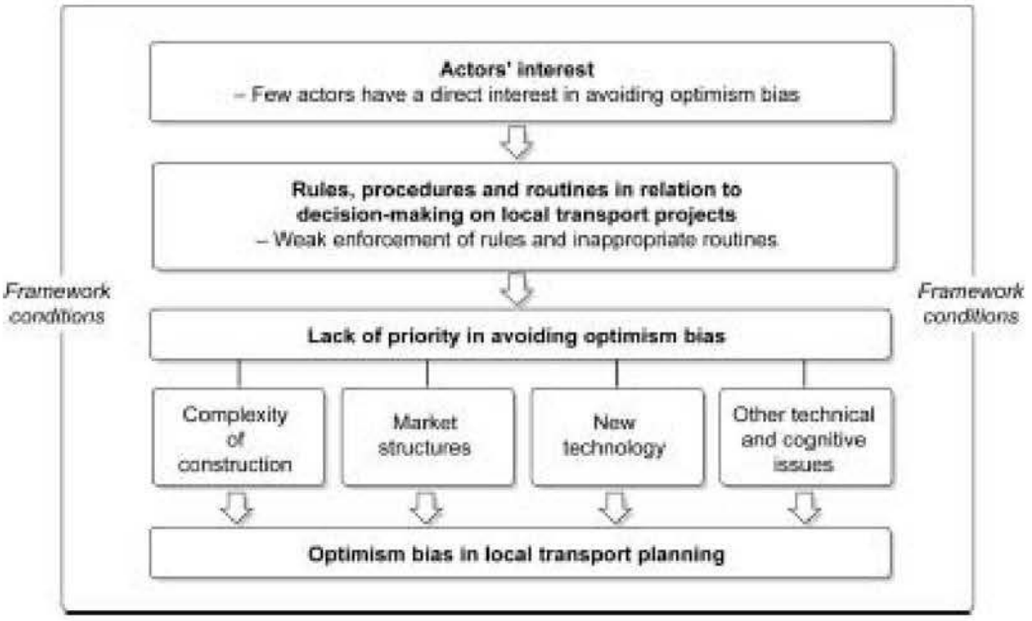
5.2.7 Why optimism bias?

Optimism bias is not a supernatural phenomenon!

This section presents an explanatory model that is an extended version of the simple model given in the introduction to the chapter that saw behaviour as derived from the institutional set-up and the actor's interests.

The explanation given here puts the traditional explanations of cost overrun in an institutional context. It is argued that optimism bias is not a supernatural phenomenon that is explained with diffuse references to construction complexity but a logical product of the actors involved, their interests, the framework conditions for funding and the resulting incentive structures that they face.[19]

Figure 13 - Institutional explanation of optimism bias



The following comments should be given to the figure:

- We suggest that an interpretation of optimism bias should take the actors and their interests as the starting point. We have cautiously deduced (with some empirical support) that it is not in the direct interest of many actors to focus on avoiding optimism bias.

[19] It is interesting to see the terminology used by the Supplementary Green Book Guidance which categorises political factors as "external influences" (Appendix on Contributory Factors). Our findings lead to a warning against a simple internal-external dichotomy. Although political factors in principle may be external to a project design, we are convinced that politics very often will be a very "internal" part of all controversial local transport projects and very often will have a direct impact on the extent of optimism bias/cost overrun.

- The framework conditions establish the playground and the basic rules. It was emphasised that the 10 Year Plan has created enormous expectations to see several major projects realised and that these expectations is a political asset for project promoters because it come to function as a value superior to avoiding cost overrun.

- The need to realise projects impacts on the enforcement of rules; in particular the rules relating to risk analyses. The quality of risk analyses has hitherto been less than ideal and project documentations have focused more on benefits of the projects than the costs.

- The study suggests that the main cause of optimism bias is that it has not been sufficiently important for a sufficient number of influential actors to avoid optimism bias. This does not necessarily mean that actors deliberately have attempted to use the situation for maximisation (although almost all persons interviewed confirmed that there has been an element of that).

- The model acknowledges a cognitive element; the fact that the light rail industry is immature and that light rail schemes represent unknown technology and unknown construction processes.

- Finally, the model puts the traditional explanations of cost overrun such as complexity, market structures, new technology, etc. in a new context. According to this context that traditional factors are highly dependent on the institutional set-up and the configuration of actors. A factor like complexity *is* obviously an important variable but as hundreds of transport projects have documented that complexity leads to cost overruns such information should be internalised by the planner. Given the right incentives, the prudent planner should include adequate contingencies and identification of key outstanding risks (e.g. remaining uncertainties concerning final routing or service/quality level) in the project budget to allow for the unavoidable fact that the realised project on average will be more complex and costly than the initial everything-goes-as-planned project. The institutional explanation given here does thus not deny the importance of the traditional explanatory factors but calls on contextualising them.

5.3 Procedures to minimise Optimism Bias

The findings presented above should not be seen as final conclusions but rather as preliminary observations or qualified hypotheses about a field which is currently going through rapid change. Therefore, the recommendations which follow should also be seen as tentative.

The overall concern is to give higher priority to combating optimism bias and to let the increased priority materialise in the form of:

- new formal rules such as risk assessment requirements combined with application of optimism bias uplifts and fiscal penalties for cost overruns.

- new informal rules in the form of a new culture which establishes "realistic budgeting" as an ideal and de-legitimise optimism bias as a routine.

The study has indicated that there are reasons to be optimistic that a new culture of realistic budgeting could emerge and would be welcomed by some of the key actors. For the idea of realistic budgeting to be fully implemented it must prove to be ideational viable, administrative viable and political viable, cf. the table below.[20]

Table 10 - Conditions for viability of the idea of "realistic budgeting"

Ideational viability	Administrative viability	Political viability
Criteria: Shall be in accordance with dominant ideas within research and public administration Assessment: Is fully in line with dominant norms of sound management of public finance	Criteria: Shall be transferable into procedures and regulation Assessment: Can be transferred into risk assessment requirements in combination with optimism bias uplifts plus other procedures. Necessary to make the procedures and rules unambiguous in order to increase political viability	Criteria: Shall be subject to accept and respect by political actors Assessment: With the existing framework conditions there will always be a risk of political interference. It is therefore important that "realistic budgeting" is promoted widely as an ideal and operationalised in clear procedures and rules to increase the political cost of violating the idea

The table suggests that "realistic budgeting" as an idea is backed by dominant norms in research and normative public administrative theory; that it can be transferred info procedures and regulation, and that the political viability of the norm is questionable. But - and this is a key observation - these three types of viabilities are interdependent, meaning that the more ideational and administrative viable an idea is the more likely is it that the political viability will be high. There will be much less room for political interference if optimism bias is perceived broadly as a problem and a sign of mismanagement and if there are clear procedures installed that inform the principal better of whether a project is realistically budgeted.

Recommendations

Our analysis has indicated that political-institutional factors in the past have created a climate where only few actors have had a direct interest in avoiding optimism bias.

At the same time it is important to recognise that the introduction of optimism-bias uplifts will establish total budget reservations (including up-lifts) which for some projects will be more than adequate. This may in itself have an incentive

[20] The distinction is inspired by Peter Hall (1993): Policy Paradigms, Social Learning and the State. The Case of Economic Policy-making in Great Britain. *Comparative Politics.*

effect which works against tight cost control if the total budget reservation is perceived as being available to the project.

It is therefore important to combine the introduction of optimism bias uplifts with maintained incentives for promoters to undertake good quantified risk assessment and exercise prudent cost control during project implementation. This has motivated the following recommendations.

It is recommended that the introduction of optimism bias uplifts is supported by:

1 Emphasis on establishing realistic budgeting as an ideal and de-legitimise over-optimistic budgeting as a routine

The Department for Transport should in cooperation with other concerned actors (such as HM Treasury) continue their efforts to de-legitimise optimism bias and promote realistic budgeting. In connection with this it is useful to publicly acknowledge that many actors including the local transport authorities and the Department for Transport share the responsibility of past optimism bias in local transport projects. This also means that there is a need for promoting a new risk management culture at all levels, from those who submit applications (local and regional authorities and their consultants) to the civil servants handling the applications and making decisions and that the introduction of such a new culture should be made public and widely communicated.

The slogans for minimising optimism bias

- to get the budgets right at the right moment
- to discriminate between good and badly costed projects
- to reward project promoters that do realistic costing and penalise those who do not.

2 Introduction of fiscal incentives against cost overruns e.g. through requiring local co-financing of project cost escalation where possible

The Department for Transport should, with due respect to the overall public administration structures, investigate the possibilities for and consequences of introducing a general system of requiring some element of local/regional co-financing of all local transport projects (initial budgets and cost overruns) in order to create a local fiscal incentive to curb cost overrun and optimism bias.

3 Formalised requirements for high quality cost and risk assessment at the business case stage

Procedures for the use of empirically based optimism bias uplifts on all projects should be complimented by requirements for high quality cost and risk assessment at the crucial stage in the decision-making process (busi-

ness case level). A standardised risk management methodology could e.g. include:

- generic risk analysis checklists;
- requirements for mandatory risk identification workshops (with multidisciplinary participation);
- requirements for the use of statistical scenario analysis on large projects; and
- requirements for assessment of the market structure and possible levels of competition.

4 Introduction of independent appraisal

Finally, it should be considered to establish an independent critical appraisal unit (internal or external) with the task to give a critical "outside" assessment of larger local transport projects. This naturally will require some enforcement measures and high level willingness to back possible decisions not to endorse insufficiently documented or unrealistically budgeted projects.

Appendix 1 List of persons interviewed

Name	Position & Organisation
Mr Chris Deas	Project director, Nottingham Express Transit
Mr David Carter	Deputy Director, Transport Consultancy, MVA
Mr David Reams	Department for Transport
Mr Doug Rendle	Department for Transport
Mr Ellis Harvey	TWA process, Department for Transport
Mr Gary Thomas	Operational Guidance Group, Highways Agency
Mr Hugh Jones	Principal Consultant, Steer Davies Gleave
Mr Martin Buck	Project Director, Partnerships UK
Mr Michael Faulkner	Department for Transport
Mr Mike Walsh	Department for Transport
Mr Philip Mills	Roads Policy, Department for Transport
Mr Tim Ryder	Director, Steer Davies Gleave
Mr W J Tyson	Chairman and Managing Director, Transport Management Group Ltd, Manchester