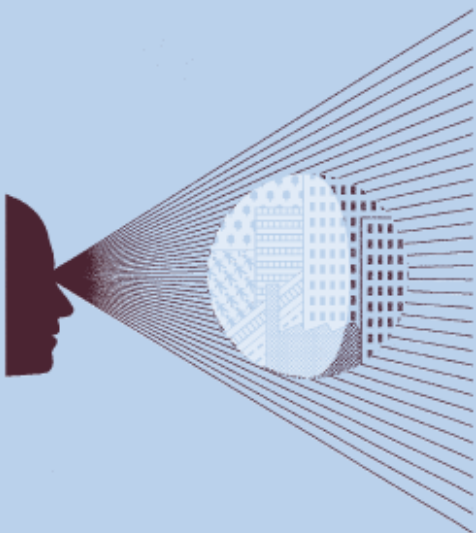


# Disincentivising overbidding for toll road concessions

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## Executive summary

- This study focuses on the phenomenon of overbidding for toll road concessions. Overbidding refers to bidding beyond an asset’s worth, typically in the transport sector through the submission of over-optimistic projections of traffic and revenue. Overbidding for toll road concessions is internationally observed as bidders compete in many countries to win attractive (and potentially lucrative) long-term concession contracts. However, it can lead to project distress and commercial failure, dampening the enthusiasm for subsequent private sector investment. These are outcomes that concession grantors generally wish to avoid.
- The emphasis in this report is on international experience and practice, within the toll roads sector and beyond. The aim is to build on lessons learned from elsewhere and to make recommendations to state and federal agencies in Australia on how overbidding for future concessions might be disincentivised.

### Literature review

- A review of the economics literature provides insight into, and some theoretical underpinnings for, the phenomenon of overbidding. The ‘winner’s curse’, for example, suggests that in certain auction situations (with incomplete information) the winner will, by definition, have overpaid. The ‘planning fallacy’ points to decision-makers’ general tendencies to overestimate project benefits and underestimate project costs. ‘Strategic misrepresentation’, on the other hand, reflects the incentives that stakeholders have to manipulate the parameters of the bid in order to reach a desired goal, for example to win the bid or to influence public policy. The phenomenon of overbidding in auction-like circumstances is observed in many situations and has received considerable academic attention in the past.
- The recommendations from the study—reported later—build on some of the solutions proposed in the literature.
- Internationally, procurement environments that appear to exacerbate the phenomenon of overbidding often share a number of the following characteristics:
  - a public sector focused on maximum upfront value extraction from the sale;
  - a public sector with a track record of contract renegotiation;<sup>1</sup>
  - bid evaluation and contract award criteria that reward high—not necessarily accurate—projections of usage and revenue generation;
  - lots of money chasing relatively few assets;
  - lots of bidders chasing relatively few assets;
  - bidding consortia dominated by parties with short-term objectives;
  - financial structuring focused on high leverage and debt maximisation;
  - equity sold to less-sophisticated third-party institutional and retail investors;
  - traffic consultants on sizeable success fees;
  - the absence of rigorous, independent bidder-model and forecast scrutiny.

<sup>1</sup> While Australian toll road concession grantors have avoided contract renegotiation, it is important to acknowledge that this remains a central driver of overbidding behaviour in other jurisdictions.

## Case studies from the toll roads sector

- The report examines a selection of case studies to illustrate the different approaches being taken around the world to toll road concessions, and their award. The traditional user-paid toll road model is discussed and contrasted with approaches that instead reward the concessionaire according to performance and/or asset availability. However, caution is sounded about constructs that rely on long-term state payments, since such arrangements can cause affordability problems. Furthermore, user charging may be desirable as part of a longer-term policy solution to the requirements for road investment or demand management—even in situations where user revenues cover only part of the overall project costs.
- The report looks at pass-through tolls, whereby the concessionaire collects tolls but passes them through directly to the concession grantor (who separately reimburses the concessionaire against performance or availability-based metrics). Such arrangements highlight the very real possibility of de-linking toll revenues from concessionaire reimbursement, and a number of circumstances are described in the report under which such arrangements could be beneficial to concession grantors. Such arrangements are fairly common under models of incentive regulation in infrastructure sectors.
- The role of flexible-term concessions is also considered. Traditionally, these concessions have been designed to terminate when a predefined absolute volume of revenue has been collected or a certain number of vehicles have used the facility. However, in some countries this model has evolved such that the concession terminates when a predefined present value of revenues has been received. Indeed, the concessions are awarded in the first place to the bidder requiring the least present value of revenues (known as the LPVR model). The pros and cons of such arrangements are considered from the alternative perspectives of different project stakeholders.
- There are international examples of toll roads that the public sector has constructed before being leased to the private sector as a mature brownfield project. One such example, 407 ETR in Canada, is taken in the report in order to walk through the advantages and disadvantages of such arrangements. Given that forecasting errors (and optimism bias) are commonly greatest when estimates of opening-year traffic have been critiqued, this model has an initial intuitive appeal. However, it brings private sector expertise late to the project and many studies (and much anecdotal evidence) point to the possibility that early private sector involvement can reduce project costs through design innovation, the employment of new techniques and materials, and so forth.
- The final toll road case study looks at bundling new construction obligations with the operation of an existing (possibly revenue-generating) asset. Particular developments in the USA with bundling arrangements have seen bidding teams becoming much more involved in the project specification, which is fine-tuned with their input, as concession grantors seek to contain or reduce project costs. In cost-conscious infrastructure investment environments generally, such approaches present interesting opportunities.
- None of toll road case studies presented in this report offers the perfect solution to concession design, contract award or the problems that stem from overbidding, and, importantly, all of them demonstrate the need for project and transaction design to respond appropriately to local objectives and circumstances. However, the case studies themselves demonstrate how individual features can be selected and combined to tailor-make contractual arrangements that perhaps look beyond the traditional toll road concession model to new approaches that could be developed in the future.

## Case studies from other sectors

- Turning from toll roads to other sectors, from which might be learned lessons about overbidding and procurement practice generally, attention in the report then focuses on the passenger rail sector in Great Britain. Since their privatisation back in the early 1990s, GB rail services have been delivered through competitively procured franchises. Of interest to this study:
  - prequalification screening specifically includes assessments of any past failure to deliver on contractual commitments;
  - service requirements are becoming less tightly specified, to promote delivery innovation and flexibility;
  - bid appraisal pays detailed attention and gives a high weighting to the deliverability of the bids themselves.
- Of particular note, however, is the treatment of the bidders' revenue forecasts. These are split into exogenous and endogenous revenue-affecting factors. Exogenous factors (outside of management control, such as GDP) are normalised (equalised across all bid submissions) and the detailed deliverability plans are used to evaluate the residual endogenous revenue-affecting assumptions.
- Other features of GB rail franchising include strong government commitment not to renegotiate contracts and the use of revenue risk-sharing arrangements, including revenue adjustment mechanisms linked specifically to GDP growth. This leads to a reward culture that directly reflects management actions, rather than positive or negative GDP fluctuations. A range of harsh financial penalties is triggered in the event of a franchisee default, providing incentives to structure bids in the first place that have low default risk exposure.
- The second non-toll road case study presented in the report examines third-generation spectrum licences auctioned for mobile phones in the UK. Here, the emphasis was placed on efficient, sustainable solutions that offered the highest economic value (rather than the highest revenue). The auction was based on an open, multi-round, ascending-bid design, with the bid prices being made public at the end of each round (revealing competitor behaviour). Bidders paid substantial deposits (linked to bid size) at the outset as insurance against default and to deter frivolous bidding (overbidding).
- Subsequent UK radio spectrum auctions have moderated the emphasis on revenue-raising more explicitly, with even greater priority being placed on efficient utilisation of the asset.
- The final case study looks at the 'menu-based' system used by Ofwat, the regulator of the water sector in England and Wales, to incentivise truthful revelation of business plan requirements. In short, water companies are required to submit business plans that detail their capital expenditure (CAPEX) projections, which are used in turn to set price caps (the higher the CAPEX, the higher the price cap). Water companies are subsequently rewarded if their outturn costs are equal or close to their original cost forecasts, or penalised otherwise.
- The mechanism itself is structured such that the reward from providing an accurate forecast is greater than the maximum reward from over- or understating the companies' CAPEX requirements. This disincentivises the companies from overstating (gaming) their CAPEX projections simply to benefit from a higher price cap. Similar arrangements could be applied to toll roads, making truthful revelation of demand estimates incentive-compatible, possibly by rewarding companies for the accuracy of their forecasts.

## Conclusions

- Over-bidding is a phenomenon observed in many situations in many countries. Opportunities exist to learn lessons from international toll road procurement practice and from other sectors that share common characteristics and experiences.
- Given the unpredictability of traffic projections generally (and opening-year projections for greenfield projects specifically), the policy goal should be forecasting realism (rather than accuracy), with the elimination of clearly—and sizeably—biased bid submissions as the core objective.
- Procurement practice needs to ensure that the downside (penalties) for submitting unrealistically high traffic and revenue forecasts is greater than any upside (benefits).
- In the **pre-procurement phase**, attention needs to focus on rigorous and transparent project vetting—with an emphasis on value-for-money assessment—such that any public sector or political pressures to oversell projects to the private sector (particularly for short-term gains) are discouraged and neutralised.
- In terms of **concession design**, any incentives for excessive risk-taking should be avoided, yet concessionaires should not be insulated from traffic risk. Concession design needs to ensure that a balance of upside and downside risks remains, allowing for normal risk/reward returns. One design avenue worth further investigation is illustrated through the GB rail franchising case study, which seeks to separate (and treat differently) the influences of exogenous from endogenous factors in terms of revenue risk exposure. This would require the procuring client body to assess actively bid deliverability within its assessment criteria.
- The accounting treatment that different risk-allocation arrangements attract can be problematic. Accounting ‘tricks’ can damage the reputation of companies and of governments.
- Turning to the **bidding process**, aggressive price-based competitions allied to deal scarcity clearly drive overbidding. In response, many concession and licence grantors are today placing much more emphasis on efficiency (rather than revenue) maximisation. The use of bidder deposits, with the size of the deposit linked to the size of the bid, may also have a role in terms of incentive realignment.
- Many commercial collapses of toll roads around the world are a direct result of aggressive financings with too much debt. This suggests that some attention might usefully be directed at the capital structures being proposed by bidders, perhaps with a target structure (percentage equity component), equity lock-ups or lock-ins, or equity ratchets based on the bid size itself. Bid appraisal may seek to differentiate between alternative capital structuring proposed by bidders and apply weightings to penalise over-aggressive bidders. ‘Skin-in-the-game’ lies behind many successful international toll road concessions.
- When considering **bid appraisal**, far more attention needs to be placed on assessing and testing the deliverability of bidder submissions and plans, and the assumptions embedded in their financial models. The trade-off—a possibly reduced sale price—would appear to be worthwhile, particularly over the long run and from a ‘bigger picture’ perspective. Failed concessions are in no-one’s long-term interest. The recent move away from upfront payments in Australian concessions is beneficial in this regard.
- Greater use should be made of independent technical and commercial oversight of bidders’ plans—particularly their forecasts. Left to the private sector, the role of ‘peer reviewer’ or auditor is often diminished to the point of being presentational. As such, the

public sector needs to take the lead, creating structures that embed independent reviews in the bid appraisal process.

### **In closing**

- It is worth emphasising that, throughout the research undertaken for this study, concerns about overbidding for concessions have not led to the conclusion that concessions, or public–private partnerships (PPPs) more generally, are flawed. Many of the concession (and licensing) arrangements are still evolving and most have yet to mature. Under these circumstances it is entirely reasonable for a government to intervene to push industry (and itself) further along the learning curve. The key is to continually search out lessons from international experience which can be used to benefit PPPs specifically, and government procurement practices more generally.
- Effective concession design should facilitate and promote the exchange of ideas between public and private sector players, and provide real—and realistic—opportunities for government and ultimately taxpayers to benefit from private sector initiatives, innovation, experience and efficiency.





# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Research brief	1
1.2	Background	1
1.3	Study team	2
1.4	Structure of the report	3
<b>2</b>	<b>Literature review</b>	<b>4</b>
2.1	The problem	4
2.2	Potential explanations	6
2.3	Potential solutions	14
2.4	Summary	20
<b>3</b>	<b>Toll road case studies</b>	<b>22</b>
3.1	Availability-based payment mechanisms	23
3.2	Pass-through tolls	27
3.3	Flexible-term concessions	29
3.4	Construct-then-concession	32
3.5	Bundle new construction with an existing asset	33
3.6	International case studies and related toll road research: discussion	36
<b>4</b>	<b>International precedent from other sectors</b>	<b>39</b>
4.1	UK Department for Transport	39
4.2	UK 3G spectrum auctions	44
4.3	Ofwat's menu approach to forecasting	47
4.4	International precedent from other sectors: discussion	49
<b>5</b>	<b>Conclusions</b>	<b>51</b>
5.1	Best-practice principles	52
5.2	Discussion	56
<b>A1</b>	<b>Interview questions</b>	<b>58</b>
<b>A2</b>	<b>The winner's curse</b>	<b>60</b>
<b>A3</b>	<b>Traffic and revenue reports: best practice</b>	<b>63</b>

## List of tables

Table 2.1	Errors in toll road traffic forecasts	5
Table 2.2	VfM assessment	15
Table 2.3	Summary of the explanations for overbidding in the literature	21
Table 3.1	International examples of flexible-term highway concessions	29
Table 4.1	Delivery plans in rail franchising	40
Table 4.2	Winning bids in the UK 3G spectrum auctions	45
Table 4.3	Ofwat's CIS matrix	48

## List of figures

Figure 2.1	Stages in the concessions process	14
Figure 4.1	The Department for Transport's revenue assessment guidelines	41
Figure 5.1	Potential causes of overbidding	52
Figure 5.2	Stages in the concessions process	53
Figure A2.1	The winner's curse	60
Figure A2.2	The winner's curse with bid discounting	60
Figure A2.3	Rational bidding to overcome the winner's curse	61

## List of boxes

Box 2.1	Empirical evidence of optimism bias	9
Box 2.2	UK value-for-money assessment guidance	14
Box 2.3	Options for concessions design	16
Box 2.4	Identifying and defining an incentive	20
Box 4.1	The Intercity East Coast franchise	43
Box 5.1	Interviews	51
Box A2.1	Empirical evidence of the winner's curse	61

# 1 Introduction

## 1.1 Research brief

This study looks at ways to disincentivise overbidding for toll road concessions. Overbidding is to bid more than an asset's value or worth, typically in an auction context. Although from a seller's perspective in a private sale, this may be acceptable (perhaps even desirable), such behaviour could have less desirable consequences for infrastructure concessions when the sellers—state procuring agencies—retain strong economic and political interests in, and exposure to, the asset being transferred temporarily to private sector stewardship.

The study has a forward-looking and international focus. Although reference is made to domestic past practice, the emphasis is on looking at lessons from other countries, which might be used at a practical level to shape toll road concessions, contract design, bid submissions and evaluation, and contract award in Australia in the future.

The study is one of a number of related initiatives being pursued by the Department of Infrastructure and Transport (DIT), aimed at improving the planning and delivery of public infrastructure projects.

- In June 2011, the Bureau of Infrastructure, Transport and Regional Economics (BITRE) published an international review of the traffic forecasting performance for toll roads, and proposed possible risk-mitigation measures.<sup>2</sup>
- Also in June 2011, a Patronage Forecasting Symposium in Canberra examined optimism bias and error in predictions of toll road use, and made specific recommendations for future practice.<sup>3</sup>
- In December 2011, GHD/RBconsult published a report—commissioned by BITRE and building on the findings of the Symposium—that investigated in detail the reasons behind over-optimistic forecasts of demand for a number of Australian toll roads.<sup>4</sup>
- In February 2012, the DIT published a consultation paper on potential remedies for managing demand forecasting and patronage risk in public–private partnership (PPP) toll road projects, seeking the views of industry participants and other interested parties.<sup>5</sup>

The findings of this report feed into, and should be viewed in the broader context of, the microeconomic reforms that the Australian government is currently investigating for the toll roads sector.

## 1.2 Background

In the introduction to its recent consultation paper, the DIT states:

<sup>2</sup> Bureau of Infrastructure, Transport and Regional Economics (2011), 'Review of Traffic Forecasting Performance Toll Roads', June, available at [www.infrastructure.gov.au/infrastructure/public\\_consultations/files/attach\\_a\\_bitre\\_literature\\_review.pdf](http://www.infrastructure.gov.au/infrastructure/public_consultations/files/attach_a_bitre_literature_review.pdf)

<sup>3</sup> Bureau of Infrastructure, Transport and Regional Economics (2011), 'Patronage Forecasting Symposium: Summary of Outcomes', June, available at [www.infrastructure.gov.au/infrastructure/public\\_consultations/files/attach\\_b\\_patronage\\_forecasting\\_symposium.pdf](http://www.infrastructure.gov.au/infrastructure/public_consultations/files/attach_b_patronage_forecasting_symposium.pdf)

<sup>4</sup> GHD and Bain, R. (2011), 'An investigation of the causes of over-optimistic patronage forecasts for selected recent toll road projects', December 8th, available at [www.infrastructure.gov.au/infrastructure/public\\_consultations/files/attach\\_c\\_gdh\\_report.pdf](http://www.infrastructure.gov.au/infrastructure/public_consultations/files/attach_c_gdh_report.pdf)

<sup>5</sup> Department of Infrastructure and Transport (2012), 'Addressing Issues in Patronage Forecasting for PPP/Toll Roads', Consultation Paper, February, available at [www.infrastructure.gov.au/infrastructure/public\\_consultations/files/patronage\\_consultation\\_paper.pdf](http://www.infrastructure.gov.au/infrastructure/public_consultations/files/patronage_consultation_paper.pdf)

Traffic forecasts for some recent Australian toll roads have proved to be significantly inaccurate and over-optimistic. This has impacted on investor confidence, reducing the willingness of the private sector to accept patronage risk on toll projects.

The DIT explains that this (over-optimism) has led to: ‘the diversion of scarce resources towards underperforming investments and a dent in confidence to public-private partnerships (PPPs) in Australia.’ This concern forms the backdrop to this study.

The most recent investigation into, and analysis of, Australian toll road traffic forecasting performance is contained in the December 2011 GHD/RBconsult report. Readers are directed there for a full discussion. In summary, the report highlights that:

- general procurement practice has encouraged the submission of optimistic—not accurate—projections of asset usage;
- with the main concession parameters ‘fixed’ (project design, toll tariffs, tariff escalation formulae, etc), bidding evaluation centred on traffic and revenue forecasts as the key economic variables (the ‘points of competition’);
- primary policy objectives of securing the largest upfront payment from the private sector (or requiring the minimum government subsidy), by themselves, exacerbate the trend for over-prediction;
- the extent of over-prediction has been significant, with some assets performing at less than 50% of their original forecasts;
- traffic forecasts may have been influenced by aggressive financing structures and the attendant requirements of financial models;
- over-forecasting has led to financial distress and the high-profile commercial collapse of some urban toll road concessions;
- traffic models can be used to produce optimistic projections of demand through a systematic selection of input variables drawn from the upper ends of their respective ranges;
- bidding competitions have attracted parties which have a short-term focus, rather than being ‘in it for the long run’;
- independent ‘peer reviews’ hold the potential to reduce over-optimism, or at least detect it, in advance of contract award.

The GHD/RBconsult report also points out that over-forecasting for toll road concessions is not restricted to Australia. As the authors identify through a brief literature review, this is an internationally observed phenomenon. The June 2011 BITRE review (see above), reflecting on additional research and studies, underscores exactly the same point. This suggests that the international community will also be looking at possible reforms and remedies—hence the international focus of this report.

### 1.3 Study team

This study was conducted jointly by Oxera and RBconsult.

**Oxera** ([www.oxera.com](http://www.oxera.com)) is an international economics consultancy with 30 years’ experience of advising on optimal contract design and incentives in the infrastructure sector. Covering transport, energy, water, communications and financial services—and through its work on transactions, contract design and implementation—Oxera has been exposed to a wide range of procurement and contracting practices. Oxera identifies and synthesises international best

practice in incentivising preferred behaviours to enable governments and regulatory authorities to achieve their objectives.

**RBconsult** ([www.robain.com](http://www.robain.com)) is the trading name of Robert Bain, an independent consulting engineer. Robert was previously a director with credit rating agency Standard & Poor's working in the agency's Infrastructure Finance Rating team (where he had global responsibility for toll road ratings). Today he runs his own consulting practice, providing advice on infrastructure projects to investment and development banks, super funds, insurers and government agencies.

## 1.4 Structure of the report

Section 2 presents the findings of a two-stage literature review. First, the general literature on overbidding in asset procurement was reviewed to provide background and context for the specific issues under consideration in this study. Second, a more detailed literature review was conducted, with emphasis on international toll road concessions and associated procurement practices.

The literature reviews identified a number of candidate case studies worthy of further examination. These case studies, and lessons from them, are presented in sections 3 (toll roads sector) and 4 (other sectors).

Based on the findings of the literature review and case studies, section 5 presents conclusions and outlines best-practice principles which could inform and guide future procurement policy and practice.

The appendices to the report provide an outline of the interviews undertaken in the course of the project (Appendix 1), and additional technical analysis from the literature (Appendix 2). A review of best practice in traffic and revenue reporting is contained in Appendix 3.

## 2 Literature review

This section contains a review of the academic literature surrounding the problem of overbidding in transport infrastructure projects. It begins by outlining the nature and incidence of the observed overbidding problem (section 2.1), before analysing its potential root causes, including the winner's curse, optimism bias and strategic misrepresentation (section 2.2). Sub-sections 2.2.4 to 2.2.8 present the factors that are likely to have an impact on the incentives for bidders to strategically misrepresent their forecasts. Finally, some potential solutions that have been put forward in the literature are evaluated (section 2.3).

### 2.1 The problem

In the context of the construction and operation of many infrastructure assets, such as toll roads, the market is commonly believed to operate more effectively when competition is introduced at the concession award stage, rather than at the operational stage. Concessions contracting introduces competition 'for the market' in the form of competitive tendering, which should have the effect of ensuring that each contract is awarded to the party, or parties, that can carry out the contracted functions most efficiently. In public-private partnerships (PPPs) this allows the taxpayer to get the best value for money.

However, in tendering for construction concessions, there is evidence that firms systematically underestimate the costs that will be involved in delivering a project<sup>6</sup> or overestimate the demand for the finished product.<sup>7</sup> Both of these biases lead to cost-benefit ratios that overstate the value of the project.

In the context of cost-side bias, Flyvbjerg, Holm and Buhl (2002) found that costs were underestimated in 86% of the 258 transport infrastructure projects they studied, and that actual costs exceeded estimated costs by 28%, on average.<sup>8</sup> The authors reported that:

Estimated costs are biased, and the bias is caused by systematic underestimation... costs are not only underestimated much more often than they are overestimated or correct, costs that have been underestimated are also wrong by a substantially larger margin than costs that have been overestimated.<sup>9</sup>

A later paper by Flyvbjerg, Holm and Buhl (2005) looked at demand- or benefit-side bias, in terms of how projects perform in comparison to forecasts. Studying a sample of 210 projects across 14 countries, with a combined value of US\$59 billion, the authors found that, while nine out of ten rail passenger forecasts exceeded outturn traffic (with an average overestimate of 105.6%), overestimation was not as acute a problem in road traffic forecasts; in fact, road traffic forecasts (for toll-free roads) were underestimated on average.

There is no significant difference between the frequency of inflated versus deflated forecasts for road vehicle traffic...21.3% of projects have inaccuracies below -20%, whereas 28.4% of projects have inaccuracies above +20%. Road traffic forecasts were underestimated by an average of 8.7%.<sup>10</sup>

<sup>6</sup> See, for example, Pickrell, D.H. (1990), 'Urban rail transit projects: Forecast versus actual ridership and cost', US Department of Transportation; Flyvbjerg, B. Holm, M.S. and Buhl, S. (2002), 'Underestimating Costs in Public Works Projects – Error or Lie', *Journal of the American Planning Association*, **68**:3, 279–95.

<sup>7</sup> Flyvbjerg, B. Holm, M.S. and Buhl, S. (2005), 'How (in)accurate are demand forecasts in public works projects? The case of transportation', *Journal of the American Planning Association*, **71**:2, 131–46; Bain, R. (2009), 'Error and Optimism Bias in Toll Road Traffic Forecasts', *Transportation*, **36**: 5, 469–82.

<sup>8</sup> Flyvbjerg et al. (2002), op. cit.

<sup>9</sup> Flyvbjerg et al. (2002), op. cit., p. 282.

<sup>10</sup> Flyvbjerg et al. (2005), op. cit., p. 133.

However, the authors found that the difference between actual and forecast traffic was greater than  $\pm 20\%$  for half of all road projects. Moreover, 13% of road projects had forecast inaccuracies larger than  $\pm 60\%$ , suggesting a large risk of error.

Turning to toll roads, Bain (2009) used a dataset of over 100 road, bridge and tunnel case studies compiled by Standard & Poor's.<sup>11</sup> The Standard & Poor's programme analysed the ratios of actual traffic numbers to those forecast. Ratios smaller than 1.0 suggest an overestimation in the forecast numbers. Bain found that the observed ratios ranged between 0.14 and 1.51 (ie, from actual traffic being only 14% of the forecast to actual traffic exceeding the forecast by 51%), with a mean of 0.77.

These results are indicative of a large range of error and, since the mean is less than 1.0, a systematic tendency to overestimate traffic forecasts, with actual traffic volumes 23% below the forecast levels, on average. In other words, the average forecast overestimated the level of traffic by approximately 25%. Bain argued that similar results were found in a 1997 J.P. Morgan study of 14 US toll roads, as shown in Table 2.1.<sup>12</sup>

**Table 2.1 Errors in toll road traffic forecasts**

	J.P. Morgan study	Bain study
Sample size	14	104
Location	USA	International
<b>Forecasting performance (ratio of actual/predicted traffic)</b>		
Minimum	0.18	0.14
Average	0.58	0.77
Maximum	1.17	1.51

Source: Bain (2009), op. cit., p. 473.

Moreover, since projects with a higher credit quality were likely to be over-represented in the study, the actual incidence and magnitude of overestimation could be even greater in reality:

very poorly performing assets will remain under-represented in the sample and the results derived from our case studies are likely to be flattered in comparison with average, global toll road forecasting performance.<sup>13</sup>

The results of the Standard & Poor's programme also seem to capture two further important concepts. First, the tendency to overestimate, and the range of error in estimation, is greater in countries that are new to toll roads (mean, 0.58; standard deviation, 0.26) than those with history in the sector (mean, 0.81, standard deviation, 0.24).<sup>14</sup> Second, there does not seem to be any systematic improvement in the accuracy of forecasts subsequent to the first year (ie, there is no demand ramp-up effect in later years).

The difference in findings between the Standard & Poor's dataset and that of Flyvbjerg et al. is likely to stem from the fact that the former focused exclusively on toll roads, while the latter primarily considered toll-free roads. Thus, the Standard & Poor's results will capture the

<sup>11</sup> Bain, R. (2009), op. cit.

<sup>12</sup> J.P. Morgan (1997), 'Examining Toll Road Feasibility Studies', *Municipal Finance Journal*, 18:1, Spring.

<sup>13</sup> Bain, R. and Polakovic, L. (2005), 'Traffic Forecasting Risk Study Update 2005: Through Ramp-Up and Beyond', Standard & Poor's, August 25th, p. 8, available at <http://www.robbain.com/Traffic%20Forecasting%20Risk%202005.pdf>

<sup>14</sup> Bain (2009), op. cit.



strategic behaviour of bidders in the tendering process.<sup>15</sup> This appears to be borne out by other studies that focus solely on toll roads:

- Baeza and Vassallo (2008) found that, for a sample of 14 Spanish toll roads, annual traffic was, on average, 35% below forecast in the first year of operations; 31% below forecast in the second year; and 27% below forecast in the third year.<sup>16</sup> The authors conclude that there is ‘a clear bias towards overestimation of traffic in the ramp-up period for toll motorway concessions in Spain’.
- A study of Australian toll roads undertaken by Li and Hensher (2010) found that actual traffic volumes using five facilities (the M2, M7, Cross City Tunnel, Lane Cove Tunnel and EastLink) were 45% below forecast in the first operational year, and, despite the gap reducing over time, remained 19% lower than forecast after six years.<sup>17</sup> The report was prepared before the opening of Brisbane’s CLEM7 Tunnel, which carries traffic volumes 80% lower than predicted.<sup>18</sup>
- Welde and Odeck (2011) found that actual traffic was, on average, 2.5% lower than forecast traffic across a study of 25 Norwegian toll roads.<sup>19</sup> Although the mean overestimation is relatively small, forecasts were found to have been overestimated in 16 (64%) of the 25 projects. Traffic for toll-free roads was found to have been underestimated in the same study.

## Discussion

The literature provides clear evidence that there is a systematic tendency for bidders to overestimate patronage in toll road concessions. This has been observed in a number of studies, and across numerous jurisdictions. Importantly, Flyvbjerg et al. (2002) and Bain (2009) both argue that technical errors alone do not adequately explain the observed forecasting errors, since:

- forecasts do not appear to have become more accurate over time despite advancements in modelling; and
- actual error distributions have been found to have means that are significantly different from zero.

Building on the above, the following section introduces and analyses alternative explanations for overbidding.

## 2.2 Potential explanations

### 2.2.1 The winner’s curse

The tender design determines the process by which bids are made in concessions contracting, and the price paid by the winner. One way to consider this is in the context of auction theory. Although procurement in the Australian toll roads sector does not follow an archetypal auction format, contract award has been closely influenced by the size of the upfront payment offered by the bidding consortia. As such, there is potential for auction theory to provide insight into how tendering processes can be designed to ensure optimal bidding and into the reasons why an overbidding problem may arise

<sup>15</sup> Baeza, M.A. and Vassallo, J.M. (2008), ‘Traffic Uncertainty in Toll Motorway Concessions in Spain: an Analysis of the Ramp-up Period’, TRANSyT working paper, 2008-01, 1–18.

<sup>16</sup> Ibid.

<sup>17</sup> Li, Z. and Hensher, A. (2010), ‘Toll Roads in Australia: An Overview of Characteristics and Accuracy of Demand Forecasts’, *Transport Reviews*, 30:5.

<sup>18</sup> Davidson, P. (2011), ‘Modelling toll roads – where have we gone wrong’, Australasian Transport Research Forum 2011 Proceedings, September.

<sup>19</sup> Welde, M. and Odeck, J. (2011), ‘Do Planners Get it Right? The Accuracy of Travel Demand Forecasting in Norway’, *European Journal of Transport and Infrastructure Research*, 11:1, 80–95.



The literature has distinguished between two (pure) types of auction, according to the value assumptions on which they are founded:

- **private-value auctions**—bidders each value the item differently and, while each is certain of their own valuation, there is uncertainty about the value of the item to other bidders;
- **common-value auctions**—the ‘true’ value of the item is the same to all bidders, but each has a different estimate regarding the underlying value, based on the signals they receive prior to bidding. As such, a feature of common-value auctions is that bidders do not know the value of the item at the time of bidding. The common-value assumption has most frequently been applied to the analysis of auctions for mineral rights, but has also been used in the toll road context.<sup>20</sup>

To the extent that a toll road concession has the same value to all bidders, the procurement process can be thought of in the context of a common-value auction. In this framework, overbidding might be explained by the ‘winner’s curse’. This problem is well-developed (and has been extensively discussed) in the economics literature, and thus provides a reasonable starting point for considering the overbidding problem.

### The theory

The winner’s curse refers to the phenomenon by which winning bidders are found to have systematically bid amounts that are greater than the ‘true’ value of the auctioned item, and thus either lose money or obtain less profit than the winning bidder anticipated. Potential winner’s curse problems have been highlighted in auctions for oil field leases in the Outer Continental Shelf,<sup>21</sup> book publication rights,<sup>22</sup> the free agency market for professional baseball players,<sup>23</sup> and corporate takeover markets,<sup>24</sup> among others.

The occurrence of the winner’s curse follows from the common-value assumption. All bidders would attach the same value to the item (eg, the concession) if they had perfect information, but since no party knows the actual value of the item *ex ante*, each makes an estimate of its value based on the information available to them prior to bidding. In the case of toll road concessions, the available information might, for example, take the form of demand and revenue forecasts.

If the bidders’ estimates are unbiased, the average of the estimates would be expected to equal the true value. However, the estimates that the bidders arrive at on the basis of their forecasts could potentially vary significantly—some will overstate the value of the item; others will understate it. Since the winning bidder will be the party with the highest estimate of those competing for the item, it will typically have overestimated the item’s value.

This problem arises because bidders do not take account of the fact that their bid should be based on the value of the item *conditional on the event of winning*.<sup>25</sup> That is, their bids should take account of the fact that, if they win the auction, they will have paid more than anyone else was willing to.

<sup>20</sup>See, for example, Athias, L. and Nunez, A. (2008), ‘The More the Merrier? Number of Bidders, Information Dispersion, Renegotiation and Winner’s Curse in Toll Road Concessions’, MPRA Paper 10539, University Library of Munich, 1–30.

<sup>21</sup>Capen, E.C., Clapp, R.V. and Campbell, W.M. (1971), ‘Competitive Bidding in High-Risk Situations’, *Journal of Petroleum Technology*, **23**, 618–34.

<sup>22</sup>Dessauer, J.P. (1981), *Book Publishing*, New York: Bowker.

<sup>23</sup>Cassing, J. and Douglas, R.W. (1980), ‘Implications of the Auction Mechanism in Baseball’s Free Agent Draft’, *Southern Economic Journal*, **47**, 110–21.

<sup>24</sup>Miller, E.M. (1977), ‘Risk, Uncertainty, and Divergence of Opinion’, *Journal of Finance*, **32**, 1151–68; Roll, R. (1986), ‘The Hubris Hypothesis of Corporate Takeovers’, *Journal of Business*, **59**, 197–216.

<sup>25</sup>Kagel, H. and Levin, D. (1986), ‘The Winner’s Curse and Public Information in Common Value Auctions’, *American Economic Review*, **76**:5, 894–920.

## Criticism

As noted in the literature, the winner's curse suggests that bidders systematically act in an irrational manner:

Economists typically treat such claims [of a winner's curse] with caution as they imply that bidders repeatedly err, in violation of basic notions of economic rationality.<sup>26</sup>

The winner's curse cannot occur if all bidders are rational...so evidence of a winner's curse in market settings would represent an anomaly.<sup>27</sup>

Accordingly, it has been argued that rational bidders would lower their bids in order to allow for the bidding of competitors.<sup>28</sup>

This leads to the question of why overbidding still occurs if it is not a rational strategy in the bidding process. Would construction companies not go bankrupt if they continually overbid for projects? One explanation might be that the common-value assumption is overly restrictive in the context of toll road concessions. This might be the case for two reasons.

- **Strategic behaviour**—bidders may face considerable political or economic pressures to overbid, in order to win the right to carry out the project. For example, the company may wish to curry political favour, with a view to gaining economic rents in the future on the back of an 'investment' in the current project. Alternatively, bidding teams may stand to gain financially from winning the project rights, in the form of performance-linked bonuses. The potential for such strategic misrepresentation is discussed in more detail below.
- **'Entrepreneurship'**—as argued by Brätland (2011), the value of the concession to each bidder is likely to be determined by endogenous factors and not an exogenous, common value.<sup>29</sup> That is, a firm may be able to benefit from applying innovative processes or from synergies with existing projects which would increase the value they would obtain from ownership of the capital good, relative to the value that would be accrued by other bidders. This is likely to be particularly the case when the concessions confer a greater amount of responsibility on a single contractor. In design, build, finance, operate, and maintain (DBFOM) concessions, for example, the bidders may be differentiated by their access to financing, the input prices they face, their design capabilities, and so on. The literature has also highlighted the potential for complementarities between toll roads and other business areas which might give some firms an advantage over others.

A second literature has taken account of the potential for strategic behaviour in concessions bidding, and has also suggested that overbidding could result from cognitive biases in planners' decision-making. The tendency for bidders to make inaccurate estimates due to optimism bias and strategic misrepresentation (lying) are examined below.

### 2.2.2 Optimism and other cognitive biases

Much of the behavioural economics literature has been built on Simon's (1957) notion of bounded rationality.<sup>30</sup> According to this view, decision-makers are constrained by cognitive, temporal and informational limitations, and arrive at solutions by picking from a restricted set of choices. As an example of this in practice, it has been suggested that, in assessing the probability of future outcomes, decision-makers tend to be optimistically biased, in that they exhibit a tendency to overestimate the likelihood of favourable future outcomes and

<sup>26</sup> Kagel and Levin (1986), op. cit., p. 894.

<sup>27</sup> Thaler, R.H. (1988), 'Anomalies: The Winner's Curse', *Journal of Economic Perspectives*, 2:1, p. 192.

<sup>28</sup> Cox, J.C. and Isaac, R.M. (1984), 'In Search of the Winner's Curse', *Economic Inquiry*, 22:4, 579–92.

<sup>29</sup> Brätland, J. (2011), 'The Myth of the Winner's Curse in Auctions of Capital Goods', *The Quarterly Journal of Austrian Economics*, 14:1, 25–52.

<sup>30</sup> Simon, H. (1957), 'A Behavioural Model of Rational Choice', in *Models of Man, Social and Rational: Mathematical Essays on Rational Human Behaviour in a Social Setting*, New York: Wiley.

underestimate the likelihood of unfavourable future outcomes.<sup>31</sup> This would suggest that, in considering future traffic volumes for toll roads, politicians and bid teams may short-sightedly overestimate the popularity of the road while giving insufficient weight to the probability of a negative volume shock or slower-than-expected GDP or population growth.

### The theory

The propensity for decision-makers to believe that their own project will be completed on time, despite their knowledge that similar projects have overrun, was referred to by Kahneman and Tversky (1979) as the *planning fallacy*.<sup>32</sup> Lovallo and Kahneman (2003) extended this definition to include the tendency for people to overestimate the benefits and underestimate the costs of planned actions, arguing that:

Managers make decisions based on delusional optimism rather than on a rational weighting of gains, losses, and probabilities. They overestimate benefits and underestimate costs.<sup>33</sup>

Kahneman and Tversky (1979) attributed this to overconfidence and the belief that people commonly use singular information—considering their ability to deliver the specific target project in isolation—while failing to apply distributional information (ie, external data on historical precedents). This bias towards singular information was argued to lead decision-makers to take an ‘inside view’ over an ‘outside view’ in the planning or forecasting process. The authors recommended that forecasters ‘should therefore make every effort to frame the forecasting problem so as to facilitate utilizing all the distributional information that is available’.<sup>34</sup>

In toll road concessions, this would imply that, in making their bids, companies focus too heavily on their belief of the likely outcomes for that particular project, given project-specific factors and characteristics, without considering how the project falls into the distribution of outcomes for other toll road concessions or similar PPP projects.

### Box 2.1 Empirical evidence of optimism bias

Evidence of optimism bias has been highlighted in both field and experimental settings. For example, Norris (1971) found that in 300 industrial R&D projects the mean cost and time overruns were 125% and 250%, respectively. In an experimental setting, Buehler, Griffin and Ross (1995) asked students to announce three dates by which they believed it was 50%, 75% and 99% probable that they would have completed an academic project. The authors found that only 13% of students had finished their project by the date to which they had assigned a 50% probability of completion. Moreover, only 19% had finished by the 75% probability level and only 45% had finished by the 99% probability level.

Source: Norris, K.P. (1971), ‘The accuracy of cost and duration estimates in industrial R&D’, *R&D Management*, 2, 25–36. Buehler, R., Griffin, D. and Ross, M. (1995), ‘It’s about time: Optimistic predictions in work and love’, in Stroebe, W. and Hewstome, M. (eds.), *European Review of Social Psychology*, Chichester: John Wiley & Sons.

The accuracy of forecasts may also be influenced by other cognitive biases, aside from the planning fallacy. Tversky and Kahneman (1974) argue that people commonly make

<sup>31</sup> See, for example, Irwin, F.W. (1953), ‘Stated expectations as a function of probability and desirability of outcomes’, *Journal of Personality*, 21, 329–35; Weinstein, N. (1980), ‘Unrealistic optimism about future life events’, *Journal of Personality and Social Psychology*, 39, 806–20.

<sup>32</sup> Kahneman, D. and Tversky, A. (1979), ‘Prospect Theory: An Analysis of Decision under Risk’, *Econometrica*, 47:2, 263–91.

<sup>33</sup> Kahneman, D. and Lovallo, D. (2003), ‘Delusions of Success: How Optimism Undermines Executives’ Decisions’, *Harvard Business Review*, 81:7, 56–63.

<sup>34</sup> Kahneman, D. and Tversky, A. (1979), ‘Intuitive Prediction: Biases and Corrective Procedures’, p. 316 in S. Makridakis and S. Wheelwright (eds), *Studies in the Management Sciences*, Volume 12, Elsevier/North Holland.

estimates by starting from an initial value and adjusting it to reach a final answer.<sup>35</sup> This is referred to as the ‘anchoring heuristic’.

The anchoring phenomenon could be particularly important in the context of toll road concessions, where public sector forecasts might be taken as an initial value. If bidders anchor their forecasts to optimistic forecasts published by the public sector, the result is likely to be overbidding, as the public sector comparator will be considered to represent a bidding floor. The winning bidder will then be the party that makes the greatest adjustment to the public sector comparator, rather than necessarily the party that has the best-justified forecasting model.

### Criticism

A criticism of optimism bias as an explanation for overbidding, provided by Flyvbjerg (2009), is that, as with technical errors, experience could be expected to help root out such optimism over time:

Optimism bias would be an important and credible explanation of underestimated costs and overestimated benefits in infrastructure forecasting if estimates were produced by inexperienced forecasters...[but] it seems unlikely that a whole profession of forecasting experts would continue to make the same mistake decade after decade instead of learning from their actions.<sup>36</sup>

## 2.2.3 Strategic misrepresentation

### The theory

Another alternative theory of why forecasts may be inaccurate, following from the work of Wachs (1986; 1990), is that there are economic or political incentives for the bidders to strategically misrepresent their estimates in order to win projects, and for politicians to do the same in order to manipulate public policy.<sup>37</sup>

Wachs (1990) highlights that the incentives faced by corporate managers to publicise high-demand (or low-cost) forecasts in order to appease investors and to win projects, create significant pressures on forecasters to arrive at corresponding estimates:

I have interviewed public officials, consultants, and planners who have been involved in transit planning...and I am absolutely convinced that the cost overruns and patronage overestimates were not the result of technical errors, honest mistakes, or inadequate methods. In case after case, planners, engineers, and economists have told me that they had had to ‘revise’ their forecasts many times because they failed to satisfy their superiors. The forecasts had to be ‘cooked’ in order to produce numbers which were dramatic enough...whether or not they could be fully justified on technical grounds.<sup>38</sup>

This suggests that forecasters, as well as bid managers and politicians, have incentives that are potentially incompatible with truthful estimation of future patronage. As an example of this politically fuelled strategic misrepresentation in practice, the author highlights the bankruptcy of the Washington Public Power Supply System:

forecasts, which failed to materialize, of low nuclear power costs and growing demand for power, were prepared at the behest of corporate managers who insisted that forecasts be optimistic in order to influence investors and government officials. Technical experts who argued that forecasts were misleading were told to be silent or to leave the project.<sup>39</sup>

<sup>35</sup> Tversky, A. and Kahneman, D. (1974), ‘Judgment under Uncertainty: Heuristics and Biases’, *Science*, **185**:4157, 1124–31.

<sup>36</sup> Flyvbjerg, B. (2009), ‘Survival of the unfittest: why the worst infrastructure gets built—and what we can do about it’, *Oxford Review of Economic Policy*, **25**:3, p. 351.

<sup>37</sup> Wachs, M. (1986), ‘Technique vs advocacy in forecasting: A study of rail rapid transit’, *Urban Resources*, **4**:1, 23–30; Wachs, M. (1990), ‘Ethics and advocacy in forecasting for public policy’, *Business and Professional Ethics Journal*, **9**:1–2, 141–57.

<sup>38</sup> Wachs (1990), op. cit., p. 144.

<sup>39</sup> Ibid, p. 143.

Strategic misrepresentation differs from optimism bias in that it suggests that the bidders have manipulated forecasts, with an explicit intention to deceive. Optimism bias, by contrast, does not represent lying since the deception is not deliberate; rather the decision-makers suffer from self-deception. However, Flyvbjerg (2008) notes that ‘although the two types of explanation are different, the result is the same: inaccurate forecasts and inflated benefit-cost ratios.’<sup>40</sup>

### Criticism

There are two potential issues with applying the theory that overbidding stems from strategic misrepresentation. First, it is difficult to know the true motives and intentions of industry participants, and potentially dangerous to accuse them of deliberate deception.<sup>41</sup> Second, there are laws in place which penalise for knowingly giving inaccurate forecasts of costs and benefits in order to get a project off the ground. These might be expected to discourage parties from adjusting their estimates for strategic reasons.

The following factors are likely to have an impact on the incentives to make strategic adjustments to demand forecasts.

#### 2.2.4 Public sector comparator

Schemes are typically compared with one another and with alternative delivery methods according to a public sector comparator. This comparator should provide an independent and objective assessment of the efficient level of costs, or the expected level of demand, against which the bids made by private contractors can be evaluated. This creates a benchmark against which bidders can be assessed.

However, it is important that the public sector comparator is not influenced by political motivations. Politicians are typically expected to have a short-term bias since they are likely to be seen in a positive light for getting a project ‘off the ground’, but may have left office by the time problems emerge down the line. The public sector may therefore face the same incentives as the private sector to drive up forecasts—by setting a public sector comparator that is unrealistically high—in order to get the go-ahead. Wachs (1990), for example, argues that:

Some of the most egregious violations of the public trust have occurred over the last several decades involve ostensibly objective forecasts which in retrospect can be seen to have been blatant attempts to manipulate public policy in order to promote certain interests at the expense of others.<sup>42</sup>

#### 2.2.5 Political drivers

Parties may be incentivised to make bids other than for financial reasons in pursuit of prestige, out of a desire to beat rival organisations, or with a view to being involved in future concessions (with a chance to ‘learn by doing’ in the current concession).<sup>43</sup> Equally, in some situations, bidders may believe that they have no option but to win contracts, since otherwise they will remain inactive in their core market. The pressure to win auctions is likely to increase if the company has lost in the past, as companies look to get a foothold in the industry.

#### 2.2.6 Structure of bidding consortia

Different parties within a bidding consortium may have a mix of short- and long-term horizons.<sup>44</sup> In particular, constructors and investment banks may have a short-term focus and

<sup>40</sup> Flyvbjerg, B. (2008), ‘Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice’, *European Planning Studies*, 16:1, p. 6.

<sup>41</sup> Flyvbjerg, B. (2011), ‘Over Budget, Over Time, Over and Over Again – Managing Major Projects’, chapter 13, pp. 321–44 in P. Morris, J. Pinto and J. Soderland (eds), *The Oxford Handbook of Project Management*, Oxford University Press.

<sup>42</sup> Wachs (1990), *op. cit.*, p. 143.

<sup>43</sup> See, for example, Ku, G., Malhotra, D. and Murnighan, J.K. (2005), ‘Towards a competitive arousal model of decision-making: A study of auction fever in live and internet auctions’, *Organizational Behaviour and Human Decision Processes*, 96:2, 89–103.

<sup>44</sup> See Bureau of Infrastructure, Transport and Regional Economics (2011), ‘Patronage Forecasting Symposium: Summary of Outcomes’, June, pp. 3–4.



are likely to be much more aggressive in trying to win the concession. Operators, on the other hand, will typically have a longer-term view, stretching over the life cycle of the lease, and thus are likely to be more cautious about demand forecasts and prospects, more generally.

The short-term focus of some bid consortium members has been observed internationally to incentivise them to manipulate revenue forecasts with the objective of maximising debt and securing a high gearing ratio. As the propensity for financiers, including investment banks, to dominate the bid consortium increases, this is likely to become more of an issue, creating increased pressure within bid consortia to be over-optimistic in demand forecasting.

### 2.2.7 Bid assessment criteria

The criteria against which bids are assessed determine the scope for ‘gaming’ the system by submitting upward-biased demand forecasts. Solely evaluating bids with respect to the level of upfront payments could provide strong incentives for ‘gaming’.

A government faces two potentially conflicting policy goals when procuring concessions contracts:<sup>45</sup>

- **revenue maximisation**—maximising the payment made by the private sector for the concession rights, since this is in the best interests of taxpayers in the short run;
- **efficient use of scarce resource**—ensuring that the scarce resource is granted to the party that values it most and will maximise its full economic value—for example, by operating and maintaining the asset in the most efficient manner, while providing strong customer service.

Internationally, the focus of procurers in toll road concessions is commonly on the former policy goal, with bid appraisal effectively coming down to the highest upfront premium.<sup>46</sup> This has meant that, once bidders have pre-qualified, their bids have been subject to little scrutiny outside of their demand forecast. It is only after the concession has been awarded to the highest bidder that attention has shifted to attempting to ensure that the asset is operated efficiently (ie, by viewing the asset as part of a network, not as an isolated and insulated, individual project).

### 2.2.8 Renegotiation

In some jurisdictions, parties may expect that the contract can be renegotiated once it has been won, such that the consequences of overbidding can be dealt with after the event.

Guasch (2004) studied a dataset of more than 1,000 concessions granted in the Latin American and Caribbean region during the period 1985–2000.<sup>47</sup> Renegotiation of the initial contract was found to have occurred in 55% of transportation concessions, an average of three years after their award. The majority of these renegotiations were made at the request of the private contractor and typically involved an increase in tariffs (62% of cases), delays in investment obligations (69% of cases), and a reduction in the fee paid by the contractor to the public sector (31% of cases).

Although renegotiation can enhance welfare where it helps to address incomplete contracts, the ability of firms to renegotiate in this manner after the contract has been awarded—and, in doing so, to secure more favourable outcomes for themselves—may also provide an

<sup>45</sup> See, for example, discussion in National Audit Office (2001), ‘The Auction of Radio Spectrum for the Third Generation of Mobile Telephones’, October 19th.

<sup>46</sup> Bel and Foote (2009), for example, argue that the motivation for concessioning the Chicago Skyway was ‘to raise cash (in the form of an upfront concession rent) to be used by the city to fund various municipal needs’, and that consequently price was the sole bid award criterion. Bel, G. and Foote, J. (2009), ‘Tolls, Terms and Public Interest in Road Concessions Privatization: A Comparative Analysis of Recent Transactions in the USA and France’, *Transport Reviews*, 29:3, 397–413.

<sup>47</sup> Guasch, J.L. (2004), ‘Granting and Renegotiating Infrastructure Concessions – Doing it Right’, *World Bank Institute Development Studies*, 28816.

incentive for overbidding. Unless companies feel that their bids represent an actual commitment to deliver the stated outcomes, they could have an incentive to push their bids up, on the basis that they can later be revised down.<sup>48</sup> This reduces the likelihood that competitive bidding will ensure that the most efficient bidder is awarded the contract.

However, state governments in Australia have developed a track record for not renegotiating concessions, so this is likely to be less of a concern than other factors that have been discussed above.

### 2.2.9 Discussion

After more than thirty years of study, the winner's curse literature is well developed and provides some important insight into the extent of overbidding in common value auctions. However, while the winner's curse provides a useful foundation for considering overbidding, the common value assumption is restrictive in the case of toll road concessions, since it ignores the potential for strategic bidding and entrepreneurship in the utilisation of the assets.<sup>49</sup>

Optimism bias alone is unlikely to explain the observed forecasting bias in its entirety, but it is an observed phenomenon which likely plays some part in overbidding,<sup>50</sup> particularly in the infancy of toll road concessioning. As such, the impact of optimism bias needs to be considered in combination with analysis of the incentives within the procurement process that lead to strategic bidding.<sup>51</sup> It is these strategic incentives which are likely to provide the greatest explanatory power in determining the cause of overbidding. In the context of cost underestimation in construction concessions, Flyvbjerg et al. (2002) argue that overbidding stems from lying and deceit:

The use of deception and lying as tactics in power struggles aimed at getting projects started and at making a profit appear to best explain why costs are highly and systemically underestimated in transportation infrastructure projects.<sup>52</sup>

However, this suggests that bidders are knowingly acting outside the law, which appears to be highly unlikely. It is more likely that public and private sector agents identify what is needed to win—either in terms of getting their scheme off the ground, or in ensuring that their team wins the bid—and 'play the game' accordingly, within the confines of legal practice. While the concept of strategic misrepresentation is very useful in considering the overbidding problem, it should not be thought of in terms of intentional deceit per se. Rather, strategic misrepresentation should be thought of in the context of how public and private sector agents react to the incentives within the concessions process, where these incentives are determined by the criteria against which competing schemes are assessed, the requirements of the ITT, the method of bid appraisal, and so on.

The onus in tackling the problem of overbidding should be on ensuring that the incentives within the concessions process are aligned with the provision of well-justified, (possibly) conservative demand and revenue forecasts; rather than on penalising the agents who respond to the current incentives to do otherwise. Solutions to the overbidding problem therefore need to take account of—and, where possible, attempt to address—these strategic factors.

<sup>48</sup> For example, Baeza and Vassallo (2008), op. cit., find that the willingness of the Spanish government to renegotiate concession contracts has encouraged aggressive bidding and traffic overestimations.

<sup>49</sup> Brätland (2011), op. cit.

<sup>50</sup> Flyvbjerg (2011), op. cit.

<sup>51</sup> Ibid.

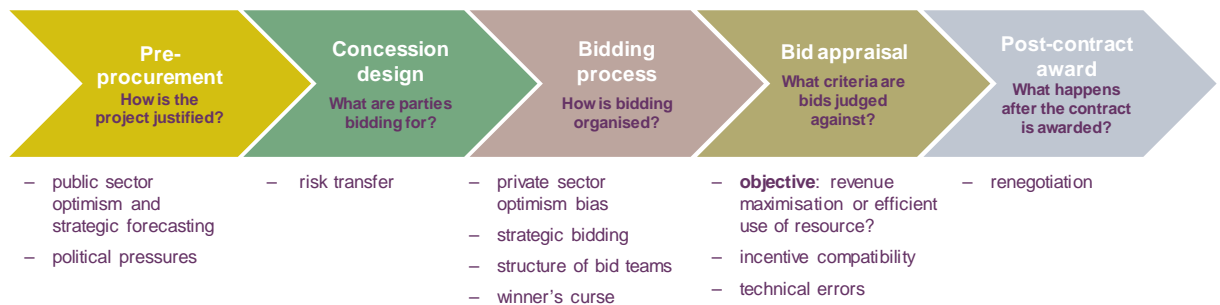
<sup>52</sup> Flyvbjerg et al (2002), op. cit., p. 290.

## 2.3 Potential solutions

This section identifies potential solutions that have been put forward in the literature. These are not necessarily recommendations. The report's recommendations are presented in section 5 and incorporate additional insight from the case studies (sections 3 and 4) and interviews undertaken by the authors, alongside findings from the literature.

The solutions look to address problems broken down into five stages of the concessions process, as shown in Figure 2.1 below. Each of these stages is considered in turn, below.

**Figure 2.1 Stages in the concessions process**



Source: Oxera.

### 2.3.1 Pre-procurement phase

In the UK, certain steps are put into place to ensure that projects are given the go-ahead only where they can be clearly justified. This should provide a level of protection against political opportunism in scheme generation, although it is unlikely that any framework will be able to eradicate such opportunism completely. In particular, public spending decisions are made by taking account of whether schemes:

- are supported by 'a robust case for change that fits with wider public policy objectives'—this is termed the 'strategic case';
- demonstrate value for money—the 'economic case';
- are commercially viable—the 'commercial case';
- are financially affordable—the 'financial case'; and
- are achievable—the 'management case'.<sup>53</sup>

Therefore, a key aspect in determining whether a scheme should go ahead, and how the procurement and delivery processes should be designed, involves analysis in the context of a value-for-money (VfM) framework. This represents the 'economic case' for the project. Indeed, the Accounting Officer of each government department—who is required to sign off all departmental projects—has a duty to ensure VfM in public spending. HM Treasury has therefore set out guidelines for how VfM can be assessed.<sup>54</sup>

#### Box 2.2 UK value-for-money assessment guidance

The VfM framework in the UK is based on ensuring that:

- risks are allocated to the party that is best placed to manage and minimise these risks over the contractual period;
- focus is placed on the whole-life costs of the asset;
- an outputs specification approach is used to describe the project requirements;

<sup>53</sup> Department for Transport (2011), 'Transport Business Case', April, p. 3.

<sup>54</sup> HM Treasury (2006), 'Value for Money Assessment Guidance', November, p. 8.



- there is a rigorously executed transfer of risks to the parties that are responsible for them;
- there is sufficient flexibility to ensure that changes can be accommodated during the life of the project at reasonable cost;
- potential rewards and deductions are included to create sufficient incentives for efficiency and timely delivery within the procurement and project delivery processes;
- due consideration is given to the terms of the contract, including its duration, given the life of the assets and the accuracy of cost forecasting;
- there are sufficient skills and expertise in both the public and private sectors, and these are utilised during the project;
- the scale and complexity of the procurement process are manageable.

Source: HM Treasury (2006), 'Value for Money Assessment Guidance', November, p. 8.

The UK Department for Transport (DfT) applies this framework and has developed a criterion of its own to analyse the business case for certain projects. This requires that projects are categorised according to their benefit–cost ratios, adjusted for wider economic impacts. The categories are as follows.

**Table 2.2 Vfm assessment**

Vfm category	Benefit–cost ratio
Poor	Less than 1.0
Low	Between 1.0 and 1.5
Medium	Between 1.5 and 2.0
High	Between 2.0 and 4.0
Very high	Greater than 4.0

Source: HM Treasury (2006), 'Value for Money Assessment Guidance', November.

DfT guidance published in December 2004 suggests that, with respect to the above considerations, the DfT should generally undertake:

- no projects with poor Vfm;
- very few projects with low Vfm;
- some, but by no means all, projects with medium Vfm;
- most, if not all, projects with high Vfm.<sup>55</sup>

While it will not in itself address the issue of forecast bias, undertaking this analysis from an early stage should at least prevent schemes from going ahead that are never likely to provide good performance. This should prevent problems arising down the line where performance (ie, traffic) is significantly lower than expected. Ensuring that projects are built on a strong economic and commercial case could therefore mitigate some of the overbidding issues which are discussed below. It can also save on costs, since cancellation becomes increasingly expensive as the project enters the design phase, and is even more unlikely once construction has begun.

### 2.3.2 Concessions design

Once a project has been selected it can be delivered, operated and maintained through various means. These concession designs lie along a continuum, from traditional design, bid, build (DBB) methodologies to full asset privatisation, according to the level of private sector

<sup>55</sup> Department for Transport (2004), 'Value for Money Guidance', December.

involvement (in terms of both operations and finance) at each stage and the extent to which ownership of the asset is transferred to the private sector (see Box 2.3).

### **Box 2.3 Options for concessions design**

#### **Design, bid, build**

Under the traditional DBB method of procurement, the design is fully completed before a contract is tendered for the construction of the project. The design and construction functions are thus carried out by separate entities. While this should ensure that the designer produces a design which protects the public sector's long-term interests, it typically involves a long process as construction does not begin until the entire design is in place. There is also less flexibility to adapt the design in response to issues that arise in the early stages of construction. The design and construction contractors may also point the finger at one another should any problems arise, making monitoring more problematic.

#### **Design, build**

Alternatively, the contract can be integrated such that a single contractor is tasked with undertaking both the design and construction functions. This is typically associated with significant time savings, since construction can begin earlier. The fact that there is a single contractor also allows for greater accountability. However, the designer may no longer have the public sector's best interests at heart, and may instead be incentivised to design a project that simplifies the construction phase. Such a design may thus lead to lower quality.<sup>56</sup>

#### **Design, build, finance, operate, maintain**

More recently, concessions have taken the form of DBFOM contracts.<sup>57</sup> A key provision of this approach is that the private sector company is granted stewardship of the asset for a period of time, typically 30 years, subsequent to the construction process being completed. The contractor is also responsible for providing the upfront debt and equity financing for the project and is remunerated post-completion through unitary payments (eg, on a shadow toll or congestion-contingent basis)<sup>58</sup> over the duration of the lease. Since the unitary payment is linked to the contractor's performance, the contractor has an incentive to deliver the project on time, on budget and to a high quality.

Ownership of the asset, unlike under full asset privatisation, remains with the public sector, which takes control of the asset at the conclusion of the lease. To avoid sub-optimal investment decisions being made towards the end of the asset lease, DBFOM contracts are typically granted with a stipulation as to the condition of the asset when it is transferred back to the public sector. This gives the contractor an incentive to consider the whole life cycle of the project, which should result in better quality in design and construction. Indeed, under DBFOM, the contractor's profit-maximisation constraint internalises the higher operation and maintenance costs that may be brought about if corners are cut in the design and construction stages. That is, the contractor realises that cutting costs in early stages of the project will only serve to increase maintenance costs later on, and thus will have no incentive to do so.

The introduction of private financing can ensure that projects that might not be financed with public money can feasibly be undertaken, and that risks are not borne solely by the public sector. At the same time, the increased scrutiny of private sector companies and their financiers, which are both putting their money at risk, should ensure that projects are undertaken only if they are likely to perform well.<sup>59</sup> Indeed, the private sector may be better at evaluating risks than the public sector.<sup>60</sup> Jenkinson (2003) argues that private finance can also free managers from the 'fickle and unreliable rules' that govern public finance.

<sup>56</sup> Loulakis, M. (2003), *Design-build for the Public Sector*, New York: Aspen Publishers.

<sup>57</sup> These are sometimes alternatively referred to as bid, own, operate, and transfer (BOOT) contracts.

<sup>58</sup> Shadow toll payments are based on the number of vehicles using the road, while congestion-contingent payments are related to the level of congestion on the road, and thus provide the operator with an incentive to carry out maintenance at times which will minimise congestion.

<sup>59</sup> Grimsey, D. and Lewis, M.K. (2004), *Public Private Partnerships: The Worldwide Revolution of Infrastructure Provision and Project Finance*, Cheltenham: Edward Elgar.

<sup>60</sup> Jenkinson, T. (2003), 'Private Finance', *Oxford Review of Economic Policy*, 19:2, 323–34.

On the other hand, Jenkinson (2003) argues that unless 'contracts are easy to define, risks are well understood, transaction costs are low, and competition to provide finance is active', private sector finance may push up the costs of financing a particular project.<sup>61</sup> There is also a risk of default, since project finance capital structures are usually highly leveraged. This might lead companies to try to renegotiate the contract and may even require the public sector to step in in the case of bankruptcy.

To summarise, under DBFOM the contractor is involved in all stages of the project, which should encourage them to take a holistic view of delivering the asset, and may create economies of scope.

### **Asset privatisation**

As an alternative to DBFOM, where the public sector retains ownership of the asset, the asset can be fully privatised. This means that the public sector is required to relinquish any influence it has on the setting of tolls, the management of the asset and any future capacity expansion. Aside from this, the advantages and disadvantages of asset privatisation are similar to those for DBFOM contracts.

The design of the concession is an important consideration since it will have an impact on the incentives faced by the firm in the bidding process (and once the concession contract has been awarded), and will typically determine the evaluation framework for bids. This might then be expected to determine the extent to which the firm can gain from strategically overbidding. For example, if the winning contractor is tasked with providing upfront finance for the project (as in DBFOM), the terms on which it is able to gain access to finance may be given significant weight in the appraisal process, and demand forecasts may be given correspondingly less weight. The incentives for firms to push up demand forecasts may then be weaker.

On the other hand, DBFOM contracts provide greater scope for complementarities, a higher degree of prestige and might affect other non-financial drivers of overbidding.

### **2.3.3 Bidding process**

One aspect which might be able to overcome, or at least lessen the impact of, optimism bias and strategic bidding—without changing the way in which forecasts are made—is the design of the bidding process. The auction theory literature has highlighted two potential approaches to achieving this. First, the bidding process can be differentiated according to whether the winning party pays its own bid, or the bid of the second-highest bidder. Second, bids can either take place in the open, such that all participants know the prevailing price, or they can be sealed, such that they are not made public to other parties.

#### **Vickrey auctions<sup>62</sup>**

In a 'Vickrey auction', bidders simultaneously submit sealed bids and the highest bidder wins the item. However, the winner does not pay their own bid, but instead pays the amount offered by the second-highest bidder.<sup>63</sup> Since the winning bid does not affect the price the winning bidder pays (only whether they do, indeed, win or lose), in theory there is no incentive for a rational bidder to misrepresent their value, and consequently there should be no overbidding in a Vickrey auction.

There have, however, been several criticisms of Vickrey auctions in practice. First, they may lead to political embarrassment if the difference between the highest and second-highest bids is large, such that the winner pays much less than their valuation.<sup>64</sup> Second, studies of

<sup>61</sup> Ibid., p. 333.

<sup>62</sup> Vickrey, W. (1961), 'Counterspeculation, Auctions, and Competitive Sealed Tenders', *Journal of Finance*, **16**:1, 8–37.

<sup>63</sup> The highest bidder imposes an externality on the second-highest bidder by taking part in the auction (in preventing the second-highest bidder from winning the item). The second-highest bid is paid since this 'internalises the externality' of the bidding process.

<sup>64</sup> For example, Klemperer (2002) highlights an instance in which a second-price auction raised NZ\$5,000 (the runner-up's bid) despite the highest bidder offering NZ\$7m. Klemperer, P. (2002), 'What Really Matters in Auction Design', *The Journal of Economic Perspectives*, **16**:1, 169–89.

second-price auctions have suggested that overbidding can still occur if bidders do not act rationally.<sup>65</sup> Indeed, in the context of the strong pressures on bidders to win toll road concessions (as discussed in section 2.2), a Vickrey auction might not be expected to eradicate overbidding (although it could lessen its impact), as multiple bidders might still put forward unrealistically high bids in order to win.

### Open bidding

Having open-bid rather than sealed-bid auctions has been emphasised as a way to overcome the winner's curse, since it allows bidders to take into account in their bidding strategies the behaviour of others:

Sealed-bid auctions do not allow bidders to gather information on the business plans of their rivals by observing who is staying in and who is getting out as the price rises. They therefore make it impossible for bidders to refine their valuations of the licenses on the basis of this information.<sup>66</sup>

Greater transparency may thus prevent bidders from getting into a bidding war out of fear of losing out on the concession to others. For example, in the UK 3G spectrum auctions (discussed in greater detail in section 4.2 below), several parties withdrew in quick succession from the bidding, which might suggest that they had realised from the behaviour of other bidders that the price was becoming high. However, transparency could add to a bidding war if it creates reputational incentives in terms of not wanting to be the first party to drop out. This could also explain why bidders in the spectrum auction withdrew in quick succession once the first bidder had done so.

In general, some transparency is likely to be desirable, while, at the other extreme, feeding information between parties is likely to add to the uncertainty surrounding the value of the concession and thus create the bidding wars that can lead to overbidding.

## 2.3.4 Bid appraisal

### Reference class forecasting

Lovalló and Kahneman (2003)<sup>67</sup> and Flyvbjerg (2008)<sup>68</sup> have argued that reference class forecasting can be used to overcome optimism bias. The reference class model looks to improve the accuracy of performance forecasting by using statistical analysis of a reference class of analogous, pre-existing actions. That is, the approach takes an 'outside view' of planned actions by analysing them in the context of a statistical distribution of outcomes.

In terms of transport infrastructure projects, the following steps are required in reference class forecasting.<sup>69</sup>

- **Identification of a reference class**—a reference class should be chosen which is comparable to the target project according to certain variables, but remains broad enough to be statistically significant.
- **Assessment of the probability distribution of outcomes**—the outcomes of prior projects should be arranged into a distribution, showing the extremes, median and any clusters.<sup>70</sup>

<sup>65</sup> See, for example, Kagel, J.H., Levin, D. and Harstad, R.M. (1988), 'Judgment, Evaluation and Information Processing in Second-Price Common Value Auctions', Paper 14, University of Houston Department of Economics.

<sup>66</sup> Binmore, K. and Klemperer, P. (2002), 'The Biggest Auction Ever: The Sale of the British 3G Telecom Licences', *Economic Journal*, **112**, C74–C96.

<sup>67</sup> Lovalló, D. and Kahneman, D. (2003), 'Delusions of Success: How Optimism Undermines Executives' Decisions', *Harvard Business Review*, **81**:7, 56–63.

<sup>68</sup> Flyvbjerg (2008), op. cit.

<sup>69</sup> Ibid; Flyvbjerg, B. and COWI (2004), 'Procedures for Dealing with Optimism Bias in Transport Planning', Guidance Document, June.

<sup>70</sup> Although no such instances have been uncovered from the review of the literature, there is no reason why regression analysis could not be conducted to adjust for different project characteristics in the reference class if this were deemed to be desirable.

- **Comparison of the target project with the distribution of outcomes**—this might begin with an intuitive estimate of the project's position in the distribution, which can be adjusted towards the average to reflect the reliability of the prediction.

In the context of cost-side bias, Flyvbjerg and COWI (2004) recommended that the UK DfT use optimism uplifts based on empirical evidence from reference classes in the tendering process. For road projects, a reference class of 172 road projects was applied (of which 128 were in Britain). The size of the uplift was determined with reference to these comparator projects and as a decreasing function of the willingness of the DfT to accept risk. Typically, the DfT looks to ensure that the risk of cost overrun is less than 20%. For the construction of roads, this results in an uplift on forecast costs of 32%.

The potential for reference class forecasting has been reflected in HM Treasury's Green Book since 2003:

There is a demonstrated, systematic, tendency for project appraisers to be overly optimistic. To redress this tendency appraisers should make explicit, empirically based adjustments to the estimates of a project's costs, benefits, and duration...it is recommended that these adjustments be based on data from past projects or similar projects elsewhere.<sup>71</sup>

Optimism bias uplifts have since been used in numerous transport infrastructure projects in the UK, including the Crossrail project in London and the Edinburgh Trams Line 2 proposal (where an uplift of £145m was given to the forecast).<sup>72</sup> The reference class forecasting model has also been endorsed by the American Planning Association (APA):

APA encourages planners to use reference class forecasting in addition to traditional methods as a way to improve accuracy. The reference class forecasting method is beneficial for non-routine projects such as stadiums, museums, exhibit centers, and other local one-off projects. Planners should never rely solely on civil engineering technology as a way to generate project forecasts.<sup>73</sup>

The benefits of reference class forecasting are likely to be greater in situations where bias is a result of optimism rather than strategic behaviour. Moreover, the Edinburgh trams example highlights that, even after adjustments are applied, forecasts can still vary widely from outturn costs or patronage.<sup>74</sup> In the case of the toll roads sector, which is still in the early stages of its life cycle, there may be difficulties in determining a suitable reference class for comparison.

### **Menu-based appraisal**

This section briefly introduces the notion of appraising bids on the basis of a 'menu' of options. The idea behind menu-based appraisal, explained in more detail in a case study in section 4, is to elicit truthful revelation of costs by presenting bidders with a choice of options. The motivation for this approach can be considered by exploring the notion of an incentive, and of 'incentive compatibility'.

One of the problems with the current procurement process in the toll roads sector is that bid appraisal effectively comes down to who offers the highest upfront premium. As such, truthful revelation of patronage estimates is not incentive-compatible—that is, bidding consortia have incentives to provide high estimates rather than accurate ones.

<sup>71</sup> HM Treasury (2003), 'Supplementary Green Book Guidance – Optimism Bias'.

<sup>72</sup> See, for example, Ove Arup & Partners Scotland (2004), 'Scottish parliament, Edinburgh tram line 2 review of business case'; Flyvbjerg, B (2006), 'From Nobel Prize to Project Management: Getting Risks Right', *Project Management Journal*, 37:3, 5–15.

<sup>73</sup> American Planning Association (2005), 'APA article calls on planners to help end inaccuracies in public project revenue forecasting', cited in Flyvbjerg (2008), op. cit.

<sup>74</sup> The project has been subject to significant time and cost overruns after a contractual dispute between Transport Initiatives Edinburgh and the Bilfinger Berger Siemens consortium that was tasked with delivering the project. See, for example, Audit Scotland (2011), 'Edinburgh trams – interim report', prepared for the Auditor General for Scotland and the Accounts Commission, February 2nd.



## Box 2.4 Identifying and defining an incentive

In everyday language, an incentive is a factor that encourages and motivates someone to follow a particular course of action; any decision that individuals (or companies) make consists of weighing different options and picking the one that yields the highest benefit. The decision process of firms therefore involves comparing the benefits associated with different actions (at the same time, any project is compared with the firm's outside option; namely, not to take any new action). This concept is captured by the incentive-compatibility constraint, which means that actions will not be undertaken where they do not result in net benefits to the party undertaking the action.

In this instance the incentive-compatibility problem stems from there being an ex ante information asymmetry between the public sector (procurer) and the bidding consortia, since the latter are likely to have a better understanding of how accurate their demand forecast is and what outturn volumes will actually be. Similar considerations play out in the field of regulation, where companies, which have a better understanding of their costs than the regulator does, may have an incentive 'to game' the regulatory body by submitting business plans that overstate the amount of capital expenditure (CAPEX) they expect to incur over the period for which prices are set.

However, Laffont and Tirole (1993) showed that, if the choice of regulatory contracts is well-designed, the use of a 'menu' of options, from which the company is allowed to choose its preferred option, should automatically lead the company to reveal its scope for cost reductions.<sup>75</sup> This acts as a truth-revelation mechanism, since, provided that the menu is well-designed, the company will choose the option that is in its best interest. An example of how such a mechanism has been applied in utilities regulation in the UK is given in section 4.3.

### 2.3.5 Post-contract award

Unless companies feel that their bids represent an actual commitment to deliver the stated outcomes once the contract has been awarded, they may have an incentive to push up their bids, on the basis that they can later be revised down. Ensuring that the government has a credible commitment not to renegotiate could thus provide another way of reducing the incentives to overbid in some jurisdictions; although, as noted previously, this is not likely to be applicable in Australia, where the state governments have already established a track record of not renegotiating contracts.

### 2.3.6 Discussion

The literature has identified a number of potential mechanisms for overcoming or reducing the problem of overbidding. These potential solutions apply to distinct stages of the concessions process, but it is important that consideration is also given to incentive compatibility across the procurement process as a whole.

Some of the potential solutions highlighted in this section are strongly founded on theoretical rather than practical applications. Best-practice principles, which build on insight from international precedent and interviews, are presented in section 5 of this report.

## 2.4 Summary

The review of the literature has highlighted several potential explanations for overbidding in the tendering process for concessions. These include:

- strategic behaviour by agents in both the public and private sector;
- a misalignment of incentives within bidding consortia;
- the criteria for bid appraisal;

<sup>75</sup> Laffont, J.J. and Tirole, J. (1993), *A Theory of Incentives in Procurement and Regulation*, Cambridge, MA: MIT Press

- a natural, systemic tendency to make forecasts that are optimistically biased;
- a belief that the terms of the contract are subject to renegotiation;
- a winner’s curse arising from the auction of concessions with a common value; and
- technical error, which causes overbidding in the short term but should correct itself as the industry evolves.

These are summarised, alongside potential solutions, in Table 2.3 below. Ultimately, the evidence would seem to suggest that the overbidding is not the result of simple error.<sup>76</sup> Flyvbjerg et al. (2002, 2005) prefer an explanation based on the strategic behaviour of bidders, who make deceptive bids for reasons other than (short-term) financial gain.<sup>77</sup> It has been argued in this section that bidding should not be seen as intentionally deceptive, and instead represents profit maximising behaviour as determined by the incentives inherent to each of the stages of the procurement process. A second popular theory is that overbidding stems from the planning fallacy, with upwardly biased bids due to excessive optimism. Both lead to the same outcome: inflated benefit–cost ratios and overbidding. However, the means of overcoming the problem will differ according to which of these, if either, is the cause.

**Table 2.3 Summary of the explanations for overbidding in the literature**

Category	Explanation for overbidding	Potential solutions
Strategic misrepresentation by public sector	Public sector comparators are biased upwards due to the short-term outlook of politicians, and participants anchor their bids to these values	Measures could be taken to make the public sector comparator more realistic, or alternatively it could not be made public  Ensuring that projects meet certain VfM criteria from an early stage
Strategic misrepresentation by private sector	Overbidding occurs for non-financial reasons such as prestige, the desire to be in a leading position for future concessions, or for employment purposes	Vickrey auctions or menu-based appraisal approaches could incentivise truthful bidding  Fundamental change in industry mindset, transparency in bidding, etc  Independent evaluation of bidding forecasts by experienced, independent reviewer  Reference class forecasting
Optimism bias	Forecasts are biased upwards due to excessive optimism	Reference class forecasting  Optimism bias adjustments
Renegotiation	Forecasts are biased upwards due to a belief that the contract can be renegotiated at a later date	Government makes public its commitment not to renegotiate contracts and maintains a precedent of never renegotiating
Winner’s curse	Overbidding is the result of the winner’s curse arising from the auction of concessions with a common value to all bidders	Using DBFOM contracts which convey a greater scope for entrepreneurship/ differentiated strategies in delivery, and thus greater private value in auctions  Allowing bidders to observe others’ bids (ie, open auctions), since this should allow them to see when they have overestimated the value
Technical error	Overbidding may be the result of inexperience which leads bidders to make mistakes when estimating the value of the concession. This could be linked to the winner’s curse	Bidders would be expected to learn over time and thus errors should become smaller as the industry evolves and bidders develop a better understanding of the value of concessions

Source: Oxera analysis.

<sup>76</sup> Since Flyvbjerg et al. (2002) and Bain (2009) find that the mean of the distribution of errors in their sample of transportation projects is significantly different from zero. See Flyvbjerg et al. (2002), op. cit.; Bain (2009), op. cit.

<sup>77</sup> Flyvbjerg et al. (2002), op. cit.; Flyvbjerg et al (2005), op. cit.

### 3 Toll road case studies

This section presents a selection of case studies and related material to illustrate different approaches being taken to toll road concessions around the world. Most of these approaches focus on traffic risk and its allocation, many respond to concerns about the predictability of demand (and revenue), and a number specifically address observed patterns of overbidding to secure contract award. The different approaches commonly build on local experience. Lessons from earlier concessions, combined with clearer policy objectives and a more sophisticated institutional understanding of likely bidder behaviour, are employed to reshape or fine-tune projects, the associated procurement processes and, critically, the incentivising mechanisms embedded in concessionaire compensation regimes.

In terms of state-of-the-practice, the case studies presented here are not exhaustive; rather, they provide some illustrative, real-world examples of the different rules applied by public sector concession grantors when seeking to engage with their private sector counterparts. The analysis focuses on five models:

- availability-based payment mechanisms;
- ‘pass-through’ tolls;
- flexible-term concessions;
- construct then concession;
- bundle new construction with an existing asset.

Each of these models is considered in turn, following a high-level, introductory discussion of traffic risk allocation.

#### Traffic risk allocation

Any consideration of mechanisms that could be employed to disincentivise bidders from overbidding for toll road concessions—specifically through the submission of optimistic projections of asset usage (and revenue generation)—should start by examining traffic risk and its allocation. In this context a spectrum can be considered, with full risk transfer to the private sector concessionaire at one end and full retention of traffic risk by the public sector concession grantor at the other. Both approaches are being employed in Australia, as they have been in many other countries.

The traditional toll road concession model involves full traffic risk transfer to the private sector. This has been the dominant model used in Australia and worldwide (Vassallo, 2006).<sup>78</sup> The purest form is the stand-alone (self-funding) fixed-term concession under which the private sector bids on the basis that it will retain all toll receipts; and that these receipts will be sufficient in aggregate to cover all operating and debt-servicing costs, and allow for a return on capital. It is a stand-alone, self-supporting solution insofar as the commercial viability of concession rests entirely on the quantum of user charges generated over its term, with no financial input from (or abstraction by) the public sector grantor. There is a simple, direct link between what and how users are charged and the income received by the concessionaire. As will be demonstrated later, it is perfectly possible, and may be desirable, to sever this link—separating user-generated income from concessionaire reimbursement in part or in full. Before examining such approaches, however, and driving down into the detail, it is important to map out the boundaries of the spectrum referred to above.

The pure form of the traditional model has increasingly made way for variants that recognise and respond directly to the strength of the underlying commercial proposition and start to

<sup>78</sup> Vassallo, J.M. (2006), ‘Traffic Risk Mitigation in Highway Concession Projects: The Experience of Chile’, *Journal of Transport Economics and Policy*, 40:3, 359–81.



introduce forms of traffic risk sharing. Present-value positive projects commonly require transfers to be made to the grantor—in the form of upfront payments or annual revenue share. Present-value negative projects require subsidies. The basis for concession award—the point of competition—is often the size of the payment (largest) or the subsidy (smallest). Popular, easily implementable risk-sharing mechanisms include downside protection—for example, state-provided minimum traffic or revenue guarantees, or compensation arrangements for lower-than-expected performance<sup>79</sup>—commonly with upside sharing provisions or profitability capping mechanisms triggered by the attainment of contractually specified performance thresholds.<sup>80</sup>

This starts to illustrate the way in which different approaches can be combined in response to particular circumstances and to achieve particular objectives.

Critics of the traditional model point to the fact that it fails the first test of risk allocation generally associated with infrastructure investment partnerships; namely that, in order to reduce costs (and maximise VfM), risk should be transferred to the party best able to manage it. By and large, traffic risk lies outside the control of the private sector, and critics suggest that bids will therefore incorporate a risk-adjusted premium to compensate. This is certainly observed in practice through the debt and equity pricing differentials between toll road projects with full traffic risk and those with none.

Proponents of the traditional model, on the other hand, come from a different philosophical starting point, one that goes beyond partnership and promotes commercialisation of the roads sector to the fullest extent possible. As free marketeers, they regard toll roads purely as commercial ventures, businesses where owners take calculated risks about the demand for their services and profit (or make losses) accordingly.<sup>81</sup> The market-based model certainly benefits from simplicity—a quality only appreciated when the full range of interventions required to support alternative models becomes apparent. However, the fundamentals of stand-alone toll road concessions have to be strong, and in some jurisdictions (perhaps Australia), arguably many of the commercially strongest projects have already been developed. Second-tier projects may simply lack the economic underpinning to be able to stand-alone, being financed solely by private sector capital.

The first case study focuses on the opposite end of the spectrum, where the private sector remains insulated from traffic risk.

### 3.1 Availability-based payment mechanisms

Under an availability-based payment mechanism a road concessionaire is reimbursed not by users (through tolls) but through a series of regular payments made by the concession grantor over the lifetime of the concession. Payment deductions are made if the concessionaire fails to keep the road open and available to users; the size of the deductions typically reflecting critical operating times (ie, with larger penalties for peak-period road or lane unavailability). Under pure availability-based payment regimes, the concessionaire takes no traffic risk (payments are received irrespective of asset usage). The grantor (ie, government) thus effectively underwrites demand risk.

The use of availability- (or performance-) based payment mechanisms and variants (or hybrids) as the method of private sector reimbursement in toll road concessions has attracted increasing international attention in recent years. In part this has been driven by a conservative financing environment, concerns about traffic uncertainty and the ability (and

<sup>79</sup> Downside compensation for concessionaires can take many forms, either through contractual specification or by launching a process of negotiation. Other examples include lump-sum payments, ongoing subsidies, economic rebalancing clauses (re-establishing a predetermined internal rate of return), changing tariffs, and extending the concession term.

<sup>80</sup> Upside and downside risk-sharing mechanisms are often labelled 'cap and collar' arrangements.

<sup>81</sup> For this to hold, road operators should strictly retain unfettered pricing flexibility; however, this is seldom the case under concession contracts (wherein prices are typically regulated; employing an inflation-adjustment mechanism or limited by a minimum and maximum threshold).

willingness) of users to pay tolls, the private sector's appetite for and ability to manage traffic risk, and the consequent implications for VfM. All else equal, road projects that insulate lenders from traffic risk exposure attract more competitive financing (a broader community of finance providers offering lower margins), irrespective of upside limitations. Indeed, much of the enthusiasm for availability-based payment mechanisms has come from the financial services sector (banks and financial advisers). While the financing environment cannot be ignored when shaping concession projects and associated transaction structures, the choice of payment mechanism should ultimately be derived from policy objectives, and not selected for the convenience of bankers.

Many toll road concessions (recently awarded or currently in procurement) from around the world employ the availability-based model. These forms of concession are still in a minority compared with the traditional user-pays model, however. Examples can be found in the USA (Port of Miami Tunnel); Spain (the del Oliviari motorway); Russia (the Eastern Bypass Road); the Netherlands (N33); Malaysia (the West Coast Expressway, which is part-tolled, part-availability); Egypt (the Rod El Farag Access Road); Austria (the B4 Maissau Bypass); and Romania (a 46km package of highway improvements in Buzau in the eastern part of the country). The Peninsula Link project in Victoria, Australia, has also embraced the availability-based payment philosophy.

The UK PPP roads sector represents an interesting case study in this regard—partly because of the role of availability payments alongside (blended with) other reimbursement criteria; and partly because of the evolution of mechanisms employed by the concession grantor, the UK Highways Agency. This is summarised in Box 3.1.

### **Box 3.1 UK PPP roads: the rise and fall of availability-based payment mechanisms**

The first generation of PPP roads in the UK employed availability payments in a relatively minor role, primarily incentivising concessionaires to complete construction works on or ahead of time. The principal reimbursement metric involved shadow tolls<sup>82</sup>—payments made by the state for asset usage through 'traffic bands'. Bidders specified bands that would attract different reimbursement amounts, for example:

- Band 1: 9 pence/vehicle-km for the first 70m vehicle-km/year;
- Band 2: 6 pence/vehicle-km for the next 30m vehicle km/year;
- Band 3: 3 pence/vehicle-km for the next 30m vehicle km/year;
- Band 4: zero pence/vehicle-km thereafter (capping the Highways Agency's obligations).

The payment mechanism drew a distinction between light and heavy vehicles (based on length), with heavy vehicle usage attracting higher reimbursement.

Shadow tolls pass traffic risk to the concessionaire; however, with the use of traffic bands, some of this risk is shared with the concession grantor. As the lower levels of traffic usage (about which there is more certainty) attract the larger reimbursement payments in terms of pence/km, capital structures could respond accordingly (senior debt being sized against Band 1 revenues, for example).<sup>83</sup>

Beyond estuarial crossings, user tolls are relatively uncommon in the UK. All of the early PPP roads—and still the majority today—are toll-free, with the state (not users) reimbursing the concessionaire.

In addition to shadow tolls and a service availability component, the first-generation payment mechanisms incorporated performance-related criteria (deductions stemming from lane closure charges and bonus payments for safety improvements).

In the second-generation model, the influence of shadow tolls was reduced and availability-based payments became the dominant component. Shadow tolls were linked to heavy vehicles only and the

<sup>82</sup> User tolls are not collected under a shadow tolling regime. Instead, the concession grantor makes payments—typically, a fee per vehicle—to the road concessionaire based on asset usage. The UK developed shadow tolls in response to early political concerns about the public acceptability of tolls (particularly on upgraded, as opposed to new, roads) and concerns about the impact of tolling in terms of traffic diversion to less suitable routes.

<sup>83</sup> For a full description, see Bain, R. and Wilkins, M. (2003), 'The Evolution of DBFO Payment Mechanisms: One More for the Road?', Standard & Poor's, London, March.

concept of availability was extended beyond the project road itself to cover attendant infrastructure (footpaths, cycle ways, etc). The definition of availability was also broadened to reflect the condition of the road and was fine-tuned to incentivise the operator to keep the road fully operational during predetermined (mainly peak) periods.

The changes made to this payment mechanism reflected lessons learned by the Highways Agency in relation to earlier PPP roads, and, critically, the nature of the project road itself (an urban arterial with specific economic development objectives). This illustrates the fact that different policy objectives for different road types may lead to different approaches to concessionaire reimbursement. There is no one-size-fits-all.

Further changes were made in subsequent UK PPP road concessions. Shadow tolls were dropped completely, removing any direct link<sup>84</sup> between asset usage and the concessionaire's income stream. Availability evolved into 'congestion management' (unitary payments to the concessionaire were reduced if users experienced congestion for reasons under the concessionaire's control). The congestion management formula was particularly detailed and complex, relying on a dynamic combination of monitoring indicators relating to average vehicle speeds and flow, as a percentage of capacity.

The development and application of ever-more sophisticated payment mechanisms is a trend that has also been observed in toll road jurisdictions outside the UK. As the Highways Agency rolled out ever more complicated concessionaire reimbursement criteria, Standard & Poor's warned that, in the extreme, highly sophisticated payment mechanisms introduce performance monitoring and analytical challenges, and, if untested,<sup>85</sup> could start to introduce uncertainties of their own; possibly degrading the credit quality of the underlying asset.<sup>86</sup>

## Discussion

One risk with a case-study approach is that it focuses on description (what) rather than analysis (why). A 2005 interview with the then Manager for Private Finance Policy at the Highways Agency provides further insight into the thinking behind some of the developments in the payment mechanisms used for the UK PPP roads sector over the years.<sup>87</sup> Extracts from that interview, selected for their relevance to this study, are presented in the panel below. The bullet points represent key conclusions from the interview; the accompanying text in italics explains and expands on these conclusions and provides some background information as necessary.

- Originally, shadow tolls were regarded as a precursor to real tolls, which did not transpire.

*However they introduced the UK roads industry to the disciplines of measuring and monitoring traffic usage, allowed for the testing of related equipment, and proved to be a reliable and workable basis for concessionaire payment.*

- Evolving trends in car and, in particular, van design required the length criteria initially used to distinguish between light and heavy vehicles to be redrafted.

*Payment mechanisms need to be developed from a forward-looking perspective, in ways that ensure that industry developments and other exogenously imposed changes can be accommodated.*

- Vehicle length was used as a proxy for weight (a second-best approach).

*Weigh-in-motion technologies were still developing. Payment mechanisms involving the transfer of significant sums of public money have to be based on technologies that are reliable, cost-effective to implement (and maintain) and not exposed to different interpretation (encouraging disputes and claims).*

<sup>84</sup> Indirect links remain as traffic demand affects congestion and, through that, influences concessionaire reimbursement.

<sup>85</sup> Untested under real-life stress conditions, such as fuel price hikes or economic recessions.

<sup>86</sup> Bain and Wilkins (2003), op. cit.

<sup>87</sup> Bain, R. (2005), 'Major Road Works Ahead', *Traffic Engineering and Control*, 46:2, 248–51.

- The move away from shadow tolls to availability was policy-driven.
 

*A newly elected government felt uncomfortable with mechanisms that effectively rewarded private road operators for high traffic usage when the broader policy emphasis had shifted to looking at ways in which people could be encouraged to use their cars less.*

*In addition, availability reflected a renewed emphasis on more effective asset management; making better use of existing resources.*
- The (later) move away from availability-based payment mechanisms reflected a desire for improved customer orientation.
 

*Just because an asset is ‘available’ tells you little about the consumer experience; the level of service enjoyed by the customer. Hence the subsequent focus on consumers and on payment mechanisms focused on measures of congestion.*
- Vehicle speed was used as a proxy for congestion (a second-best approach).
 

*Congestion is a difficult concept to define let alone measure. Targeting low vehicle speeds sends the right incentivising message to operators and provides the travelling public with roads that are not only available, but are operating and performing well.*
- Shadow tolls, availability- or performance-based payment mechanisms that rely on state reimbursement of concessionaires are ‘a rich country game’.
 

*‘One of the most obvious lessons is that few countries can afford to fund PPP roads projects the way that we have here in the UK. Many delegations visit, like what they see, aim to replicate it at home and then discover that they simply can’t afford it. If anything, they end up introducing user-paid tolls...where the resource costs are more manageable.’*

Source: Bain, R. (2005), ‘Major Road Works Ahead’, *Traffic Engineering and Control*, 46:2, 248–51.

Unlike user tolls (a funding solution), availability-based payment and similar mechanisms are essentially financing solutions. The government’s obligation is re-profiled much like a mortgage; nevertheless, it remains the government’s obligation. On an individual basis, this might not be a concern, but the roll-out of availability-based concessions across a programme of infrastructure investment can lead to affordability problems, and has done so in the past. Caution needs to be exercised with the politically seductive characteristics of availability-based concessions as they present opportunities for short-term voter ‘wins’ at the cost of longer-term commitments (which may have intergenerational implications and, often, fall to others to make the payments. This is illustrated in Box 3.2.

### **Box 3.2 Portuguese SCUTs: a lesson in unaffordability**

The following case study considers the ‘SCUT’ programme of PPP road concessions in Portugal. Although the payment mechanism was based on the concept of shadow tolls (with deductions for non-availability), the salient feature is that, in common with pure availability-based constructs, state payments rather than user charges formed the basis of concessionaire reimbursement. SCUT, *Sem Custos para os Utilizadores*, means no cost to the users. The programme became unsustainable and the Portuguese PPP roads sector is currently being reformed as a result.

In 1996/97 the Portuguese Government initiated a major programme of motorway construction to improve accessibility and promote regional development. A highway concession model was employed using the shadow toll-based payment mechanism. However, this placed future financial obligations on the Portuguese state which, because of the scale of the programme, became unsustainable in aggregate. In the early years, government payments to SCUT concessionaires represented 0.04% of GDP, but step-ups in the financing documents saw this increase tenfold, to 0.4% in 2008 (representing about €700m/year). This was a major commitment to one small part of the economy which the government, even before the recent economic crisis, simply could not afford. The

government is currently engaged in the long and difficult process of converting a number of the SCUT highways to regular user-paid toll roads.<sup>88</sup>

Was the Portuguese PPP road concession programme a success? On one level 'yes'. Today Portugal has a motorway network that, given the timescale involved, could not have been envisaged under traditional contracting arrangements. However, like some other countries, it found that overambitious PPP programmes with their not inconsiderable future financing obligations (mortgage payments) place severe constraints on future public sector budgets. This has also been the case in Spain, where the credit rating of the Autonomous Community of Madrid is currently on negative outlook because PPP debt now accounts for around two-thirds of all spending. It has also been the case in the UK to some extent.

The Highways Agency's shadow toll PPP roads programme represents 17% of the UK motorway network, yet PPP payments account for around 40% of the Agency's budget—meaning that there will be no more shadow toll PPP roads procured by the UK Highways Agency.

Several North American jurisdictions had encountered exactly this same issue. In some cases (eg, New Jersey), entire departmental budgets have become devoted to servicing the payment obligations of infrastructure projects procured under, effectively, hire purchase-type agreements. Most recently, the UK's Department of Health has stepped in to provide financial support to seven NHS trusts facing 'financial issues' and 'a £60 billion post-dated cheque to deal with',<sup>89</sup> stemming from its long-term commitments to availability-based PPP hospitals.

The lesson to be learned is that, even when individual PPPs look like offering good value for money, the issue of aggregate affordability, now and in the future, should remain a key concern for finance ministries and public sector policy-makers.

## 3.2 Pass-through tolls

Under a pass-through tolling regime, user tolls are levied by the concessionaire, but the payments are forwarded directly to the concession grantor (they 'pass through' the concessionaire) and, separately, the concessionaire is reimbursed by the grantor based on asset availability or some other performance metric(s).<sup>90</sup>

When users are paying for a service (using a toll road) for which a private operator requires payment (investment compensation), it may be easy to presume that the user charges should simply flow directly to that operator. Through history this has been the dominant operator-reimbursement model. However, there is no reason why this should be adhered to. Indeed, there are a number of reasons why de-linking user charges from operator compensation might be a preferable approach.

Toll tariff schedules are commonly the outputs from financial models. The aggregate financial requirement, divided by the cumulative number of trips, guides or determines the amount to be charged for each trip. However, all else being equal, in networks of facilities each with different demand characteristics, the heavier-trafficked (perhaps congested) sections will, somewhat perversely, enjoy lower tolls. The tariff is a demand-driven variable when, in actuality, concession grantors may wish to treat price as an exogenously determined policy input, not an endogenous financial output. The grantor may wish to over-ride market-based pricing and present users with consistent or comparable tariffs across a toll network, irrespective of the density of use. Alternatively the grantor may wish to set appropriate price differentials between tolled and toll-free links to distribute demand more evenly and to make optimal use of available capacity. Sophisticated pricing based on time of day, levels of demand and other triggers is readily available to modern tolling operations employing electronic toll collection technologies.

<sup>88</sup> This is particularly challenging. Highways designed as toll-free facilities commonly promote access, whereas access control is a key element of toll road design.

<sup>89</sup> The *Guardian* (2012), Andrew Lansley, UK Health Secretary, February 3rd.

<sup>90</sup> Rather confusingly, in the USA 'pass-through tolls' typically refer to the type of shadow tolling arrangement described earlier. For this reason readers are advised to check the terminology applied and definitions used in any American toll road literature.



Furthermore, and possibly of even more importance going forward, a grantor may wish to retain the intervention option to be able to adjust or fine-tune road pricing to meet congestion-related or broader economic objectives as they evolve in the future—perhaps as part of a package of demand management measures. This policy flexibility is difficult to accommodate in the traditional toll road model, typically with contractually specified pricing formulae locked in for the next 25 or 30 years ('set and forget').

In response, and in common with a number of other deployments around the world, the Auto-Estradas do Centro toll road concession employed a 'pass-through tolling' approach (see Box 3.3).

### **Box 3.3 Pass-through tolling: Auto-Estradas do Baixo Tejo**

Auto-estradas do Baixo Tejo involved a 30-year DBFOM concession for a 73km network of motorways in Portugal. Engineering features included 19 interchanges and eight viaducts, three toll stations, a maintenance depot and two motorway service areas (MSAs). Only part of the network was to be tolled (21km), for which the concessionaire would be responsible for toll collection, passing revenues directly to the grantor, Estradas de Portugal (EP). In turn, the grantor would remunerate the concessionaire through availability payments and 'service fees' (shadow tolls). The concessionaire would receive additional income from the MSAs.

In a departure from similar arrangements employed earlier in Portugal, receipt of the availability payments was to be deferred. These payments would be received from the fifth anniversary of contract commencement until the end of the concession. The total availability payment requirement was the point of competition for the financial evaluation of bids. Bidders were allowed to specify different availability payment requirements in each year, at their discretion.

The availability payments would be reduced, on a pro-rata basis, if part of the network was non-operational. Similarly, sections of the network operating for only part of a year would be subject to pro-rata payment deductions. The availability payments were not subjected to any indexation regime.

The service fee component was based on traffic volumes on each section of the network. As above, service fee payments would be deferred until Year 5. A flat rate (€ per vehicle per kilometre) was employed, indexed to the Portuguese consumer price index (CPI), with upside sharing:

- above an average annual daily traffic (AADT) of 35,000, the service fee would be reduced by 25%;
- above an AADT of 40,000, the service fee would be reduced by 50%.

Estimates suggested that total revenue due to the concessionaire would be 55% availability payments and 45% service fees.

The twin-component-based revenue stream used in this concession still exposes the private sector to traffic risk (through the service fee). This departs from other availability-only pass-through toll models described below. However, the service fee arrangement is supplemented by 'rebalancing clauses' in the concession contract, which specifically allow for concessionaire compensation should the grantor wish to introduce real tolls on the (currently) toll-free sections of the network during the concession term.

In the Mersey Gateway project in the UK (a toll bridge in Liverpool currently in procurement), the concessionaire will collect tolls on behalf of the grantor and, separately, will be reimbursed on the basis of a monthly 'unitary charge'. This unitary charge is subject to deductions based on: deviations from predetermined journey time standards (a proxy for the level of service enjoyed by users); and performance (further reflecting service levels, but extending to incorporate asset condition).<sup>91</sup> The concessionaire therefore has no direct traffic risk exposure, except through the way in which demand affects journey times if not appropriately managed by the private sector operator.

<sup>91</sup> <http://www.merseygateway.co.uk/public-inquiry/>

## Discussion

This case study has considered arrangements under which the concessionaire collects tolls on behalf of the grantor and is paid separately for its services (against a range of metrics). To illustrate the diversity of international practice, there are even instances of the grantor—not the concessionaire—collecting tolls and separately reimbursing the private road operator.

The A8 Ulm–Augsburg motorway in Germany imposes distance-based tolls for all trucks weighing 12 tonnes or more. Vehicle locations are identified through the satellite-based GPS and those locations are transmitted through an on-board unit to a central processing facility for billing purposes via mobile communications (GSM) technology. A variety of toll payment mechanisms are available to customers, appealing to both regular and infrequent users. Toll collection, data processing and invoicing are managed by a private company on behalf of the German government. Separately the government reimburses the A8 concessionaire (and others) through a formula based on the number of kilometres travelled by heavy goods vehicles multiplied by a rate per kilometre. Traffic risk remains, but it is the grantor collecting the tolls, not the concessionaire.

### 3.3 Flexible-term concessions

The majority of highway concessions around the world employ fixed terms, typically of 25–30 years, during which the concessionaire enjoys the right to collect tolls (or receive state income) to cover its costs and make a return on its investment. In a departure from this traditional fixed-term approach, a smaller number of procuring agencies worldwide have adopted flexible-term (or variable-length) concessions. In traditional auctions for fixed-term concessions, traffic uncertainty translates into revenue uncertainty. Flexible-term concessions sever this link. Selected examples of flexible-term concessions are presented in Table 3.1 below.

**Table 3.1 International examples of flexible-term highway concessions**

Country	Project	Type	Concession signed	End of concession agreement	Comment
UK	Dartford Crossing <sup>1</sup>	Toll bridge	1988	20 years; or once the debt is repaid	Permanent toll charging scheme introduced in April 2003
	Second Severn Crossing <sup>2</sup>	Toll bridge	1990	30 years; or once the 'required cumulative real revenue' of £995m (in July 1989 prices) is received	Concessionaire took over existing bridge
	Skye Bridge <sup>3</sup>	Toll bridge	1991	27 years; or once the 'required net present value' (NPV) of £23.6m in toll revenues is received	Strong public opposition to tolling encouraged the government to buy back the bridge in December 2004 and tolling immediately ceased
Portugal	Lusoponte (second Tagus Crossing) <sup>4</sup>	Toll bridge	1996	March 2028; or once cumulative traffic of 2.25 billion vehicles is reached	Concessionaire took over existing bridge
	Litoral Centro <sup>4</sup>	Motorway	2003	Minimum of 22 years. Maximum of 30 years or once the NPV of total revenues reaches €784m	Only example in Portugal of the LPVR approach (due to opposition from potential concessionaires)

Country	Project	Type	Concession signed	End of concession agreement	Comment
Spain	Intermodal Exchange Stations (various) <sup>5</sup>	Transit passenger interchange facilities	1998 on	Terminates at specified date $\pm$ 5 years; when cash flow discounted at a prescribed rate equals the original investment	Included here to illustrate usage of a termination date range
Colombia	'Second generation' highway concessions <sup>6</sup>	Various	Early 2000s	Terminates once a predetermined level of accumulated revenue is collected	No discounting of revenue flows so some incentives to renegotiate remain (as the concessionaire bears more risk than under a 'standard' LPVR concession)
	'Third generation' highway concessions <sup>6</sup>	Various	Late 2000s		Discounted total revenue preferable to total revenue as the bidding variable
Chile	Santiago - Valparaiso Highway <sup>4</sup>	Motorway	1998	Terminates once the present value of total revenues reaches the amount specified in the (winning) bid submission.	First LPVR auction for a concessioned highway. Bidders could choose a fixed or variable discount rate
	Various <sup>6</sup>	Motorways	2008 on	As above	Despite its conceptual attractiveness, only four out of 28 highway concessions in Chile were awarded on the basis of LPVR, largely in response to private sector opposition (see main text)

Sources: <sup>1</sup> Highways Agency (2011), 'Dartford-Thurrock Crossing Charging Scheme', Account 2010-2011, HC 1734. <sup>2</sup> Wilkinson, R. (2010), 'Severn Crossings Tolls', Paper Number 10/059, June, Members' Research Service, National Assembly for Wales. <sup>3</sup> Comptroller and Auditor General (1997), 'The Skye Bridge: Report by the Comptroller and Auditor General', HC 5 Sessions 1997-98, National Audit Office, May. <sup>4</sup> Vassallo, J. (2009), 'Flexible-Term Highway Concessions: How Can They Work Better', TRB 89th Annual Meeting of the Transportation Research Board, 10/01/2010 - 14/01/2010, Washington D.C. <sup>5</sup> Di Ciommo, F., Vassallo, J.M. and Saldana, P. (2010), 'Privately Financing Intermodal Exchange Stations in Madrid', 12th World Conference on Transport Research, July 11th-15th, Lisbon, Portugal. <sup>6</sup> Engel, E., Fischer, R., and Galetovic, A. (2008), 'Public-Private Partnerships: When and How', available at [http://cowles.econ.yale.edu/~engel/pubs/efg\\_public-private.pdf](http://cowles.econ.yale.edu/~engel/pubs/efg_public-private.pdf)

Much of the literature points to the UK's tolled Second Severn Crossing as being the pioneer of the flexible-term highway concession, although the earlier (tolled) Dartford Crossing in the UK also employed a similar approach. A maximum term was specified in the concession agreement, but provisions allowed for the term to be shortened (ie, the concession to end sooner) if a certain financial milestone or trigger were reached. This can take the form of the receipt of a specified quantum of revenues, full debt repayment, or, as in Portugal's Lusoponte concession, the passage of a certain cumulative volume of traffic. In other countries, for example Chile, in order to compensate the private sector for recession-induced asset underperformance, concessions were specifically switched from fixed to variable terms.

An interesting approach to flexible-term concessions, which acts as a powerful traffic risk mitigant and has been used as the basis for concession award, employs accumulated project



revenues as the variable and least present value of revenues (LPVR) as the trigger—the LPVR approach (see Box 3.4).<sup>92</sup>

### **Box 3.4 Flexible-term concessions using the least present value of revenues**

The first highway concession to be awarded using this mechanism is reported to have been the Santiago–Valparaiso (Route 68) motorway concession in Chile.<sup>93</sup> Under this arrangement the government sets the toll tariffs and a discount rate to be used to calculate the present value of the toll revenues. The concession is awarded to the bidder who bids the least present value of toll revenues and the concession terminates when toll revenues reach that amount. The concession length is therefore determined by the traffic (revenue) required by the concessionaire. If traffic falls short of expectations, the concession is extended.<sup>94</sup> If traffic exceeds expectations, the end of the concession is brought forward. This provides a strong mitigant against traffic risk for the project as a whole, although variations in year-to-year revenue performance can still have an impact on debt-servicing capabilities and cause project distress. For this reason, the LPVR approach may be supplemented with minimum traffic or revenue guarantees.<sup>95</sup>

Bidders for the Santiago motorway could choose between a fixed (real) discount rate of 6.5% or a variable (real) discount rate. A 4% risk premium was added to both. However, as the present value of revenues requested by the winning consortium turned out to be below the construction plus the maintenance costs estimated by the grantor, this suggested that the risk premium (hence, the discount rate) applied by the grantor in this instance was too high.<sup>96</sup> It also illustrates the sensitivity of this mechanism to the choice of discount rate (a return on capital of 10–20% was estimated if the risk premium had been selected from a 1–2% range). Some care is needed with the discount rate as it might induce strategic behaviour. A concessionaire might terminate a concession if estimates suggest that the associated lump-sum compensation is worth more than the future stream of toll receipts.

A key reason for selecting the LPVR mechanism was policy flexibility. It established the value of the concession such that fair (clear and indisputable) concessionaire compensation could easily be calculated at any point should the grantor decide to terminate the concession— a call option embedded in the concession agreement. This was important as the grantor estimated that, at some point before the end of the concession, capacity-enhancement works would be required on a competing highway parallel to Route 68. The grantor could simply buy back the concession (by compensating the concessionaire for the winning bid minus revenues already collected) and repackage a new tender if required.

When the present value of revenues is used as the evaluation criteria, bidders in effect disclose the revenue they require to meet their targeted return on investment. The process discourages gaming or strategic bidding. Furthermore, the importance of establishing a clear buy-back price is especially relevant in jurisdictions where renegotiations with concessionaires are frequent and protracted, with outcomes (government rescue plans) often favouring the concessionaire. Indeed, the clear buy-back price itself has been observed in Chile to reduce the incidence of (sometimes speculative) calls for contract renegotiation.

### **Discussion**

The intellectual appeal of flexible-term concessions, and the LPVR approach specifically, is perhaps stronger than their applicability.<sup>97</sup> They commonly incorporate asymmetries, which the private sector dislikes—for example, the buy-out call option which a government can exercise is not accompanied by a put option allowing the private sector to sell the concession. Other parties, particularly equity providers, may be troubled by possible limited upside potential and may have reservations about entering into a business where operating efficiency improvements do not translate into higher rates of return. In addition, the fact that

<sup>92</sup> The LPVR approach was designed specifically to address issues arising from the difficulties associated with accurately forecasting traffic levels.

<sup>93</sup> Engel et al. (2008), op. cit.; Vassallo (2009), op. cit.

<sup>94</sup> A maximum allowable term is usually contractually specified.

<sup>95</sup> An alternative solution to temporary liquidity problems can be for the grantor to make a cash transfer to the concessionaire and count that transfer as income in the computation of LPVR—hence, the concession term becomes shorter.

<sup>96</sup> Engel et al. (2008), op. cit.

<sup>97</sup> An international review for this study found only four, possibly five examples of toll road concessions employing the LPVR approach.

LPVR concessions are usually bounded by an absolute maximum term (duration cap) means that, by term end, it may be possible that concessionaires with underperforming assets will remain loss-making.

Various authors have suggested enhancements to address this latter asymmetry.<sup>98</sup> Typical solutions include the specification of a minimum concession term or—less politically palatable—having unlimited term extensions. Neither of these approaches appears to have enjoyed widespread acceptability. Other researchers have proposed the use of least present value of net revenues to take account of the existence of fixed operations and maintenance (O&M) costs in toll road operations.<sup>99</sup> However, this, too, remains conceptual. This international review of concession mechanisms demonstrates that flexible-term concessions generally remain a minority application. That said, they merit consideration if only as an example of a different approach to the twin issues of demand uncertainty and overbidding.

On the other hand, flexible-term concessions (such as those based on the LPVR) are more likely to appeal to debt providers, as the attractive bond pricing on some Chilean toll road deals suggests. Concession grantors may also warm to this approach since it makes no direct call on government finances and places no upward pressure on toll tariffs. Grantors can adjust tariffs (within reason) to reflect broader pricing policy objectives and, in terms of aggregate revenue receipts, concessionaires will not be affected. The role of such mechanisms in limiting the incentives for contract renegotiation is proven, especially in host jurisdictions with a propensity to renegotiate. A recession in Chile prompted widespread contractual renegotiations for toll road concessions; the only contracts not renegotiated were those based on the LPVR mechanism. By reducing renegotiating expectations, bidders have less incentive to inflate their forecast from the outset.

### 3.4 Construct-then-concession

At its simplest, traffic forecasts comprise three components: opening-year demand, a ramp-up profile and a longer-term growth trajectory. Analysis of the forecasting errors associated with greenfield projects repeatedly demonstrates that the greatest contributor to such errors is getting the opening-year demand estimate wrong. Although departures from the longer-term growth trajectory will have a cumulative effect over time, the most economically sensitive time for toll road concessions tends to be the early years, which is when any project distress and/or default are most typically observed. One practical way of mitigating traffic risk is therefore to expose the private sector to projects once their opening-year and ramp-up periods have passed. In other words, the public sector would have the road constructed, possibly through traditional procurement, and would steward it through its formative years before letting (leasing) it to a concessionaire as a maturing ‘brownfield’ asset with a considerably reduced risk profile.<sup>100</sup> This is effectively what happened with 407ETR in Toronto (see Box 3.5).<sup>101</sup>

#### Box 3.5 Construct-then-concession: 407ETR

In the early 1990s the Province of Ontario wanted to procure 407ETR as a PPP. The need for a high-capacity freeway across the top of the Greater Toronto Area—bypassing the Toronto segment of Highway 401 (one of the busiest highways in North America)—had been identified in transport plans dating back to the 1950s. However, mainly due to the complexities of the project (not least of which was the introduction of a pioneering free-flow, fully electronic toll collection system), the deal failed to

<sup>98</sup> See, for example, Vassallo, J. (2010), ‘Flexible-Term Highway Concessions: How Can They Work Better?’, *Transportation Research Record: Journal of the Transportation Research Board*, **2187**, 22–8.

<sup>99</sup> See, for example, Nombela, G. and de Rus, G. (2003), ‘Flexible-Term Contracts for Road Franchising’, available at <http://uctc.net/research/papers/660.pdf>

<sup>100</sup> A variant on this model was used by the Queensland State Government, through the state-owned Queensland Motorways, to fund projects such as the Logan Motorway and the Gateway Bridge Update.

<sup>101</sup> This case study was compiled from publicly available reports and presentations, and—critically—through correspondence with several individuals close to the project at the time. The authors are most grateful to those individuals who wished to remain anonymous.

gain traction in the private sector and the Province subsequently moved forward using a design, bid and build approach.

The project (at the time, around 67km long) was financed through the issuance of C\$1.6billion of revenue bonds and opened to traffic in 1997. In the run-up to elections, however, the government became sensitive to the fact that it had not advanced its PPP programme as promised and issued a request for proposals (RFP) to extend the road east and west by 40km (perhaps up to 100km), leasing the entire O&M to enable the project to be self-supporting.

Four bidding teams were shortlisted and invited to bid by December 1998, with price proposals due in March 1999. Key aspects of the procurement were as follows:

- the concession was awarded to the most economically advantageous offer (highest price paid), followed by a best-and-final-offer (BAFO) phase between the best two offers within a 5% or 10% range of each other;
- prior to bid submission, bidders negotiated the project's terms and conditions iteratively with the grantor. The Province issued draft RFP documentation, bidders made comments, the Province reviewed the comments and adopted those deemed acceptable, before releasing a revised RFP. This process was repeated two or three times until final bid documents were issued;
- bidders priced several different options, including different concession terms (50, 99 and 199 years) and three different project configurations.

The contract was duly awarded to a Cintra/SNC-Lavalin consortium on the basis of a 99-year term and the 'minimum configuration' (which included a 24km extension to the west and a 15km extension to the east).

The transaction was considered to be successful by the parties involved. Through the long-term lease, the Province generated C\$3.1billion, more than double the debt quantum originally used to finance the project. In addition, the Province passed various risks to the private sector (responsibilities for cost and schedule overruns, operations, traffic risk, toll collection risk and obligations to expand capacity in the future). It also eliminated the potential for toll rate-setting to fall under political influence by establishing clearly defined contractual formulae.

It is worth noting that the risks involved in the 407ETR lease were still deemed significant. They effectively capped the value of the asset under public sector ownership, limiting the ability of the Province to issue debt against projected cash flows. Even under private ownership—considered to be optimal in terms of risk allocation and management—financiers would not lend more than C\$2.3 billion to the project in its early stages, leaving the sponsors needing a sizeable equity commitment. Nevertheless, this case study highlights that, if appropriately structured, the same cash flows can have higher value under private rather than public sector control.

Since 1999 407ETR (the concessionaire) has invested a further C\$1.2 billion in highway maintenance, extensions and capacity expansion (additional lanes).

## Discussion

One clear downside of the construct-then-concession approach is that the private sector is presented with an already constructed asset. As such, it has no opportunity to influence asset design, the construction programme, the materials used, and so forth. In a number of international highway concessions, VfM has been enhanced through innovative design and construction techniques suggested by the private sector. Indeed, PPPs more generally tend to benefit most from early private sector involvement when 'good ideas' can still be incorporated in the works and works programme.

### 3.5 Bundle new construction with an existing asset

A variant on the construct-then-concession model is for government to bundle an existing cash-generating asset (eg, a toll bridge) with new-build requirements (construction of a capacity-enhancing second crossing). This approach was used in the UK on the Dartford and Second Severn Crossing Private Finance Initiative, design, build, finance, operate projects in the early 1990s. It is a corridor approach insofar as competing projects (one existing; one to be constructed) are combined, with the existing project generating cash from day 1 that can be used to service construction-related debt obligations. The concept of a corridor, especially one with semi-monopolistic characteristics, reduces traffic risk as a history of part-operations

can be observed and is immediately 'bankable'; and the competitive landscape is contained (the twin facilities effectively compete with each other).

A not dissimilar approach was recently used for the procurement of a second Midtown Tunnel (along with access road and interchange improvements) in the US State of Virginia. The (to-be-tolled) Midtown Tunnel is bundled with the highway improvements and the main competing crossing (the to-be-tolled Downtown Tunnel). Other crossings of the Elizabeth River exist, but lie further to the south and are therefore less attractive—dampening the difficult-to-predict demand suppression that tolling will induce.

However, some of the most innovative toll road concessions currently being rolled out in the USA concern 'managed lane' projects; these also commonly bundle existing facilities with new-build obligations. The Federal Highway Administration, acknowledging that the precise definition of managed lanes is different in different parts of the USA, identifies four attributes that are shared by most:

- the managed lanes are typically a road within a road—ie, a set of lanes within the highway cross-section but separated from regular (general-purpose) lanes;
- the concept incorporates a high degree of operational flexibility such that operations can be actively managed over time in response to growth or evolving needs/objectives;
- the operation of, and demand for, the facility is managed through a combination of strategies to ensure the maintenance of free-flow operating speeds;
- these strategies include pricing, eligibility and access control, or some mix thereof.

This broad definition therefore embraces high-occupancy vehicle (HOV) lanes, high-occupancy toll (HOT) lanes, 'value priced lanes' (innovative tolling initiatives employing variable or dynamic tolling), and exclusive or special-use lanes (eg, truck-only facilities).

In Texas, a Comprehensive Development Agreement (CDA) programme is reported to have allowed the state to invest US\$1 billion since 2008 to leverage and invest more than US\$10 billion in transportation improvements through the engagement of the private sector. Two recent Texan projects—the North Tarrant Express and the Lyndon B Johnson (LBJ) Express Managed Lanes—attracted more than US\$3.75 billion in private investment in 2009 and 2010. In common with other concessioned roads, these two long-term toll projects transferred the DBFOM responsibilities to the private sector. The State of Texas deemed this to be the best solution since the projects were large, with investment requirements of over US\$2 billion, and they were high-risk, involving the construction of new capacity within heavily congested urban corridors and the deployment of new tolling technologies (see Box 3.6).

### **Box 3.6 The North Tarrant Express**

The North Tarrant Express 52-year concession project is the second-largest highway project currently under way in the USA. The project will entirely reconstruct a 13-mile corridor, adding continuous frontage roads and two new managed (tolled) lanes in each direction. The (toll-free) general-purpose lanes will be completely reconstructed together with bridges and connector roads. Additional capacity to both the general-purpose and the managed lanes is required at a certain point in the future, or if specified traffic levels are reached before that. The North Texas Tollway Authority collects tolls under a Tolling Services Agreement. Variable tolls, based on travel time and demand, will be used to ensure constant 50mph traffic conditions.

The concessionaire has also signed a separate CDA with the Texas Department of Transportation (TxDOT) to analyse the financial feasibility of five additional segments which might be developed in the future and would double the length of the project (under new concessions).

**Project highlights**

Capital value: US\$1.4 billion  
 Investment value: US\$2.05 billion  
 Stage of development: Currently under construction; completion is expected for 2015  
 Concessionaire: A consortium composed by Cintra Infraestructuras, S.A., Meridiam Infrastructure Finance, and the Dallas Police and Fire Pension System.

**Funding details**

Private activity bonds: US\$400m  
 TIFIA<sup>102</sup> loan: US\$650m  
 Equity contribution: US\$427m  
 Public funds: US\$537m

**Box 3.7 The LBJ Express (IH 635)**

The IH 635 Managed Lanes Project is designed to relieve congestion north of Dallas on 13 miles of IH 635 (the LBJ Freeway). The project involves:

- reconstruction of the main lanes and frontage roads along IH 635;
- the addition of six managed lanes (mostly subsurface) along IH 635 and four managed lanes stretching west and east;
- the addition of six elevated managed lanes along I-35E to the I-35E/IH 635 interchange.

The project is set to relieve congestion in one of the most congested corridors in Texas (and the USA), and is being built under a PPP (CDA) between TxDOT and LBJ Infrastructure Group, which will operate and maintain the facility for 52 years. Construction is expected to take five years.

When completed, this project will have one of the most comprehensively managed HOT lane systems in the world, employing state-of-the-art electronic toll collection technologies and pricing mechanisms to dynamically manage congestion on the managed lanes (and guarantee managed-lane users speeds of at least 50 miles per hour). HOV2+ users will receive a 50% discount during peak operating periods.

**Project highlights**

Capital value: US\$2.2 billion  
 Investment value: US\$2.7 billion  
 Stage of development: currently under construction; completion is expected for 2015/16  
 Concessionaire: a consortium of Cintra Infraestructuras, S.A., Meridiam Infrastructure Finance, and the Dallas Police and Fire Pension System.

**Funding details**

Private activity bonds: US\$615m  
 TIFIA loan: US\$850m  
 Equity contribution: US\$665m  
 Public funds: US\$496m

The North Tarrant Express and LBJ concessions both pass full traffic risk to the private sector concessionaire. Contract award was based on the maximum scope of works. If two (or more) bidders offered the maximum scope, the winner would be the one requiring the minimum subsidy. The subsidies were capped at US\$600m for the North Tarrant Express and US\$750m for the LBJ.

**Discussion**

Not without basis, the USA has some strong advocates of managed-lane concessions and the approach that has been adopted in Texas. Proponents point to the following.

<sup>102</sup> The Transportation Infrastructure Finance and Innovation Act (TIFIA) 1998 established a federal credit programme for eligible transportation projects of national or regional significance under which the US Department of Transportation provides three forms of credit assistance: secured (direct) loans, loan guarantees and standby lines of credit. The programme is designed to leverage federal funds by attracting private (and other non-federal) co-investment.



- **Improved road design and economic performance.** On the LBJ Express, an earlier plan to put several miles of the new IH-635 toll lanes in a pair of bored tunnels was abandoned in favour of the present entrenched/cantilever design—a solution less costly to build and operate (and without which the project would have not been economically feasible).
- **Optimised investment strategy and corridor development programme (project life-cycle approach).** Managed-lane policies and a progressive approach to project delivery also helped to address feasibility issues, delivering optimised revenues (from a state perspective) under a framework that balanced capacity requirements with economic viability (through the provision of managed toll lanes today and additional free capacity when traffic requires it). The concessionaire is contractually obliged to construct additional lanes and other future enlargements and expansions of the project—including the construction of additional general-purpose lanes and additional managed lanes—and (at TxDOT’s discretion), capacity improvements on connectors to the project road (or earlier if certain traffic levels are reached).
- **Economic and social impacts.** Motorists benefit from a reduction in travel times associated with increased speeds due to the upgrades. Other benefits include increases in reliability, comfort and safety and improved air quality, and a number of new jobs during the construction period.

In a climate where cost savings may become increasingly important to procuring agencies worldwide, the approaches being carried forward in Texas (and beyond) may appeal to those seeking to reduce costs through private sector input, expertise and innovation, while still passing all design, construction and revenue risk to the concessionaire.

## 3.6 International case studies and related toll road research: discussion

### Overview

A review of the academic literature on toll road concession payment mechanisms finds that most analysis has focused on solutions that can be employed in the context of tolling applications (ie, user charging regimes). This reflects many studies undertaken by development bank personnel focused on applications of the traditional user-pays toll road model in transitioning economies in Asia and Latin America; and a pressing need to guard against frequent and protracted contract renegotiations.<sup>103</sup> The scope of this report extends beyond that; hence, the wider discussion of availability-based payment mechanisms and the variants that can be applied when a state, rather than users, funds highway enhancements. The roll-out of tolling initiatives may be better aligned with longer-term policies aimed at acclimatising the driving public to the principles of point-of-use charging and putting highway financing on a more sustainable footing.

### Overbidding and overselling

In terms of overbidding, it is challenging to find a country with a sizeable portfolio of toll road concessions which has not, to some extent, suffered from overbidding—particularly when competition has been aggressive and where upfront payments (or minimum required subsidies) are used as a basis for contract award. The subsequent adoption of additional or alternative bid evaluation criteria is an often-observed direct result.

Another trend observed internationally is an early-period tendency for governments themselves to overforecast, effectively overselling potential toll road businesses to the private sector.<sup>104</sup> PPP teams or privatisation units want auctions to be profitable, bearing in

<sup>103</sup> The best bargaining chip for the private sector in renegotiations is often the financial distress of an essential infrastructure asset—hence, the policy interest in reducing the potential for financial distress in the first place.

<sup>104</sup> Estache, A. and de Rus, G. (2000), ‘Privatization and Regulation of Transport Infrastructure: Guidelines for Policymakers and Regulators’, World Bank Institute Development Studies, World Bank, Washington DC. This can even be done quite innocently

mind the often high short-term financial rewards and the associated political gains. This may be exacerbated in the toll roads sector because of the lag between contract award and steady-state operations, reducing the potential for institutional learning as the individuals concerned may simply have moved on. Strategic biases and incentives can drive both private and public sector behaviour, and have an impact on demand forecasts.

### **Strengths and weaknesses**

Each of the payment mechanisms described earlier—in common with most initiatives designed to mitigate traffic risk—has strengths and weaknesses. With economic rebalancing clauses, for example, the private sector may have little incentive to reduce operating costs if a project's internal rate of return is approaching its lower limit. Minimum traffic or revenue guarantees across a portfolio of projects can cause systemic problems if countries experience severe economic downturns. For these reasons, payment mechanisms are often tested under alternative hostile scenarios to highlight limitations and quantify possible state obligations (contingent liabilities). Widespread stakeholder consultation (possibly including roadshows) can also identify application and appetite issues in advance of scheme implementation.

### **Commercialisation and transparency**

The alternative approaches that are being adopted in relation to highway concessions in different countries can be viewed as part of a broader, global, drive to commercialise the roads sector. One implication of this is that practices formerly undertaken by public sector agents (and largely hidden from view) become much more transparent and open to wider scrutiny. The increasing interest in the accuracy of traffic forecasts, for example, is a direct result of structuring businesses around the commercial performance of roads. Concerns about predictive reliability are dampened when forecasts are only of interest to small groups of technically minded public servants, and when the taxpayer is effectively (and unwittingly) taking demand risk. Those concerns come to the fore and attract much wider interest when private investment capital is at risk. Forecasting accuracy per se has not changed, but the interest in it has changed significantly. In a similar vein, costs that commonly remain opaque and concern only a limited number of people in the public sector become (sometimes uncomfortably) much more transparent when transferred to private sector management. This could be a key benefit deriving from increasing sector commercialisation.

### **Appropriate risk/reward structures**

The review of global practice has highlighted the potential dangers of the risk/reward structures currently being devised by public sector procuring agencies. There appears to be a trend of looking back at successful projects and concluding that the private sector risk was minimal and the private sector rewards were excessive. The reality is often very different at the time of the contract award given the not-inconsiderable challenges that lie ahead. In response, however, concession grantors focus on mechanisms designed to limit future rewards—almost to the point of removing any upside potential from infrastructure investment. Caution should be taken with such asymmetric approaches. Even allowing for healthy profit margins, ex ante economic assessment demonstrates that many—if not most—concessioned infrastructure projects place reduced burdens on limited public sector resources when transferred to public sector stewardship. The Texan case studies demonstrate further that costs can be driven down through models that promote early engagement with experienced private sector contractors and road operators.

### **Policy credibility**

In a paper published over ten years ago, Trujillo et al. (2001) made a number of detailed points that resonate with the findings from the research reported here.<sup>105</sup> Towards the end of the paper the authors reflect on some of the implications and costs of getting transport

through the incorporation of exogenous variable forecasts in traffic models (such as those for population, employment and income growth), which may themselves be politically influenced.

<sup>105</sup> Trujillo, L., Quinet, E. and Estache, A. (2001), 'Dealing with Demand Forecasting Games in Transport Privatization', *Transport Policy*, 9:4, 325–34.

demand forecasts wrong. They conclude that ‘bad forecasts...can ruin the credibility of a whole concession program; a much costlier but often underestimated consequence of demand forecasting failures.’ This—rather than the underperformance of individual assets—appears to be a key reason why policy-makers around the world are paying increasing attention to the design and award of their toll road concessions.



## 4 International precedent from other sectors

In this section, the focus shifts away from the toll roads sector to other sectors that have faced similar issues. Section 4.1 introduces the approach of the UK DfT to introducing 'competition for the market' in passenger rail franchising. This provides important insight into best practice from an international comparator, but also highlights that issues surrounding overbidding are not confined to the toll roads sector.

The UK 3G spectrum auction discussed in section 4.2 outlines the steps taken by the Radiocommunications Agency to achieve efficiency in the allocation of radio spectrum.

Finally, the CAPEX menu forecasting regime adopted by Ofwat, the regulator of the water sector in England and Wales, is presented in section 4.3. While not directly comparable in terms of the overbidding problem, this regime could represent an innovative solution to the problem of incentivising truthful revelation of forecasts by corporations that stand to gain by 'gaming' the system.

### 4.1 UK Department for Transport

Passenger rail services in the UK have been delivered through franchising since the privatisation of British Rail's passenger rail operations under the Railway Act 1993. The franchises are competitively procured and form an agreement between the DfT and the privately owned train operating companies (TOCs). The DfT's objective in awarding franchises to bidders is to provide passengers and taxpayers with a safe, reliable service and VfM. This section reviews the procurement process currently adopted by the DfT to draw out lessons for procurement best practice.

#### 4.1.1 The procurement process<sup>106</sup>

##### Pre-qualification

Before issuing an invitation to tender (ITT), the DfT requires bidders to complete a pre-qualification questionnaire, which is used to narrow down all submissions into a small field of 'high quality' bidders. The DfT has noted that it believes the optimum number of bidders in the franchising process to be between three and five (since this balances the need for competition against keeping the costs of the bidding process low).<sup>107</sup> The companies that pre-qualify are those that score highest against two equally weighted criteria in their questionnaire responses:

- demonstration of a 'proven track record of service delivery and financial management in relevant areas of activity', including an assessment of any past failure to deliver on contractual commitments;
- demonstration of 'appropriate outline plans and experience for the development and management of the Franchise'.

Only those three to five companies that make it through the pre-qualification phase are issued with an ITT.

##### Invitation to tender

Actual competition for the franchise takes place once the ITT is published. The most important aspect of the ITT is the base-service specification, as agreed by the Secretary of

<sup>106</sup> Department for Transport (2011), 'A guide to the railway franchise procurement process', December.

<sup>107</sup> Ibid.

State for Transport, which outlines the duration of the franchise, any franchise-specific contract conditions, and the service and investment requirements that are expected of the winning bidder. This specification is used as the basis for appraisal of bidders' submissions, although the DfT explicitly aims to ensure that it is not over-specified so as to allow for innovation and flexibility in the delivery of train services over the course of the franchise.

### Appraisal

As well as considering the financial aspects of bids, the DfT assesses the deliverability and quality of the bidders' proposals so as to be confident that the successful bidder is able to deliver on the commitments made in the bidding process. For this assessment, bidders are required to produce a set of ten delivery plans, as outlined in Table 4.1.

**Table 4.1 Delivery plans in rail franchising**

Delivery plan	Weighting (%)
Organisation, staffing and stakeholder relations, mobilisation and migration	7
Management and delivery of change (including sustainability and the environment)	14.5
Modelling change and profit sharing	7
Marketing and fares	7
Ticket sales and revenue protection	7
Timetabling to accommodate current demand and future growth	14.5
Rolling stock, depots and train maintenance	7
Operational performance improvement	7
Stations and accessing the network	14.5
Improving service quality	14.5

Source: Department for Transport (2012), 'InterCity West Coast Franchise – Invitation to Tender', January 20th.

Each bidder's forecast revenues are split into exogenous and endogenous revenue-affecting factors. The former are factors, such as national GDP, that would have an impact on the expected revenues of all bidders, but are outside of managerial control. These are compared against a DfT revenue benchmark. If a bidder's assessment of these exogenous factors differs from the benchmark, the DfT assesses the evidence provided in the bidder's submission, and either:

- adjusts the exogenous factor for all bidders to equal that submitted by the bidder (if the bidder has provided comprehensive evidence for such an adjustment); or
- adjusts that bidder's exogenous factor such that it is equal to the DfT benchmark view (if the difference between the submission and the benchmark is not well-justified).

This means that all bidders end up with a common exogenous revenue factor based on the best available evidence of the external factors that affect the bidder's expected revenues—whether the best evidence is the DfT's initial benchmark, or a new benchmark adjusted for evidence provided by a bidder.

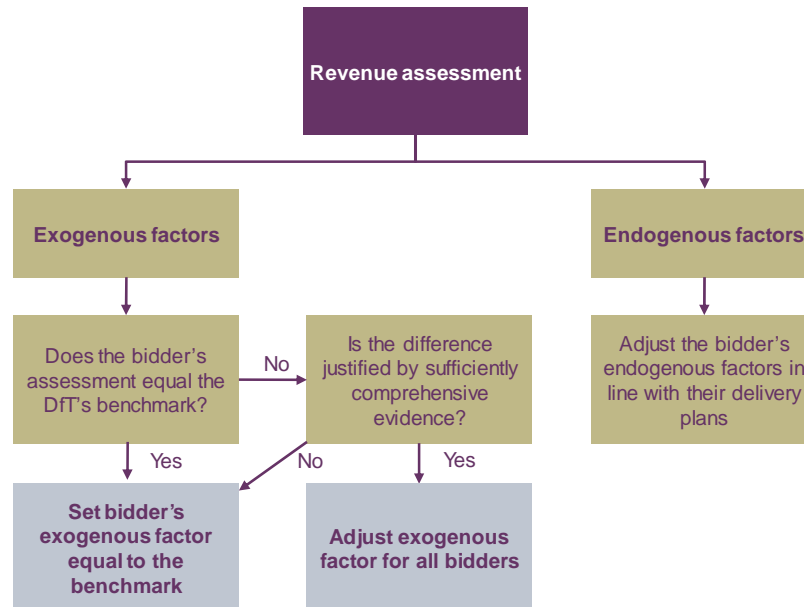
Endogenous factors, on the other hand, are individual to that bidder, since they are within managerial control. The bidder's delivery plans are used to form an assessment of the risk-adjusted, endogenous revenue-affecting factors. This assessment is then combined with the exogenous revenue-affecting factors to derive an overall, risk-adjusted revenue. For example, if a company submits a high revenue based on a particular, individual management strategy, but its delivery plans suggest that there is a high degree of risk associated with this strategy, the endogenous revenue factor would be revised downwards to reflect this risk.

To summarise, each company's risk-adjusted revenue is therefore made up of:

- a common exogenous revenue factor; and
- an individual, endogenous revenue factor that is adjusted for risk consistent with that company's delivery plans.

This process is outlined in Figure 4.1.

**Figure 4.1 The Department for Transport's revenue assessment guidelines**



Source: Based on Department for Transport (2012), 'Franchise Evaluation Process Charts for Intercity West Coast Franchise competition', January, issue 3.

The deliverability of projected revenues and costs is also used in the assessment of the financial risk of the bid, to inform a risk-adjusted view of the entire premium offered by the bidder:

If this assessment indicates that there is a significant risk that costs or revenues will not be delivered, or identifies other reasons why the franchisee is likely to be financially unstable, the Department may exclude bids from the competition on the grounds that they are financially high risk.<sup>108</sup>

#### 4.1.2 During the franchise

##### Renegotiation

The DfT has made a commitment not to renegotiate despite precedents of the Office of Passenger Rail Franchising (OPRAF) and the Strategic Rail Authority (SRA), its predecessors, renegotiating the contracts of failing franchises:

The Department has not, and will not, follow that precedent. Such rescues may have been justified in a relatively immature market where there was only limited experience of passenger-service operation for bidders to draw on, and only limited evidence on which they could base revenue and cost forecasts. Given a more mature market, franchisees must build resilience into both their operational and financial plans to deal with the changes in the economic environment to which a passenger rail operation may be subject.<sup>109</sup>

<sup>108</sup> Department for Transport (2011), 'A guide to the railway franchise procurement process', December, para 23.

<sup>109</sup> Ibid, para 30.

### Allocation of risk

Under the original TOC franchise agreements, made in 1996/97, operators were fully responsible for revenue risk. Since 2004, however, newly let franchises have included revenue risk-sharing mechanisms in the form of cap-and-collar arrangements, which require the DfT to make additional payments to the franchisee if revenue falls below a target level (as specified at the time of the bid) after four years of the franchise being in operation. Under this approach, the DfT meets a proportion (up to 80%) of the shortfall and the operator is responsible for the remainder. If the franchisee outperforms on its revenue target, the government receives some of the additional revenues.

Going forward, revenue risk-sharing mechanisms will be designed on a case-by-case basis to match more closely the specific characteristics of individual franchises. For example, the latest Intercity West Coast franchise will include:

an adjustment mechanism linked to fluctuations in GDP growth which cushion the franchisee against a major downturn in revenue due to exogenous economic factors (in return for a share for the Department of the potential upside).<sup>110</sup>

By directly linking franchise payments to GDP, the DfT hopes to ensure that management actions are focused entirely on increasing revenue (eg, through service improvements). Moreover, operators would not benefit from wider economic growth or suffer the impacts of a downturn outside of their control.

#### 4.1.3 Protection against overbidding and default

The DfT has several safeguards in place which act both to disincentivise overbidding (since the companies will face significant costs from defaulting) and to ensure that, if a company does default, there is sufficient protection for the taxpayer. These safeguards include:

- a performance bond provided by the holding company of the franchisee. The bond is typically 5.5% of the franchisee's annual operating costs and is intended, at a minimum, to be large enough to offset the costs that would be incurred in re-letting the franchise in the case of default. The level of the performance bond has been increased for future tenders as a result of experiences in the recent economic downturn;
- a season-ticket bond—since rail passengers pay for season tickets in advance, a franchisee has the potential to gain financially by defaulting upon receipt of these advance payments. The replacement operator would then be required to provide a service to season-ticket holders without receiving compensation. To protect against this, a defaulting operator is liable to pay a bond that is equivalent in value to the advance payments. The season-ticket revenue is then passed to the replacement operator;
- a subordinated loan—the franchisee's holding company is required to provide an upfront loan to help cover any losses that the franchisee incurs. As the loan is subordinated to claims from other creditors of the franchisee, the holding company is unlikely to be repaid if the franchisee defaults. The size of the loan is determined by an assessment of the risks to forecast revenue contained in the winning bid.

A further disincentive is provided by the fact that companies which have defaulted in the past have not been compensated for investments made in the franchise prior to their failure. In the case of National Express's default for the East Coast franchise, this represented a loss of £45m (see Box 4.1 below).

<sup>110</sup> Ibid.

## Box 4.1 The Intercity East Coast franchise

The Intercity East Coast franchise covers passenger trains between London, the north-east of England and Scotland. After a competitive tendering process in 2005, the franchise was awarded to Great North Eastern Railway. However, following financial difficulties, the DfT negotiated an end to the franchise in late 2006, with GNER put on a replacement management contract until a new operator could be found.

National Express East Coast, a subsidiary of National Express Group, was awarded the franchise after a second competitive procurement process, and began its operations on December 9th 2007. It had offered to pay £1.4 billion in return for operating the service for a period of seven and a half years, on the basis of annual passenger revenue growth of 5–12%. Although this represented the largest-ever payment for the rights to operate a rail franchise, other bidders had offered more, and National Express was selected for the deliverability of its plans as well as its payment.

In 2009, the DfT was forced to intervene in the East Coast franchise for a second time after National Express announced that it would not provide further financial support to the services. The failure was linked to the economic downturn, which resulted in lower passenger revenues than forecast. The DfT considered three options for dealing with the failure:

- renegotiation of the terms of the franchise—National Express East Coast would have remained as the operator but with changes to the terms of the contract;
- negotiation of a consensual exit—National Express would have been allowed to withdraw on a consensual basis which would have meant that it would not have been regarded to have defaulted on the terms of the agreement;
- termination for contract default—this would allow the DfT to step in as ‘operator of last resort’ under Section 30 of the Railways Act 1993.

The DfT immediately announced that it would not renegotiate National Express’s contract as it was concerned that this would encourage other franchisees to apply for similar renegotiations. The company subsequently offered the DfT £150m in return for a consensual (‘no fault’) exit, but this was also rejected on the basis that other franchisees in financial difficulty might be incentivised to seek a similar settlement, and the belief that National Express should not be allowed to hand back a loss-making franchise while retaining others that were profitable.<sup>111</sup>

National Express was therefore issued with a termination of contract notice in November 2009. Consequently, the East Coast franchise was transferred to Directly Operated Railways, a publicly owned company, and is due to be put up for competition again in late 2012.

The default of the Intercity East Coast franchise cost National Express £116m: £45m on surrendered investments in franchise assets, £31m on paying the performance bond, and £40m from the non-recovery of the holding company’s subordinated loan. Although this was £34m less than the £150m it offered for a ‘no fault’ exit, the DfT wanted to send a clear warning to other operators. The company also paid £235m to the DfT for operating the services for two years, as per the contract.

This case led to some recommendations for the future, including that the DfT should test bids against different economic conditions.

Source: National Audit Office (2011), ‘The Intercity East Coast Passenger Rail Franchise, March 24th; House of Commons Committee of Public Accounts (2011), ‘Department for Transport: The InterCity East Coast Passenger Rail Franchise’, 39th report of session 2010-12, June 22nd.

<sup>111</sup> National Express subsidiaries were also responsible for the operation of the South East and East Anglia rail franchises at the time.

## 4.2 UK 3G spectrum auctions

Between March 6th and April 27th 2000, the UK Radiocommunications Agency held an auction for five third-generation (3G) spectrum licences for providers of mobile phones. The licences allocated radio spectrum capable of data transfer rates of up to 2 Megabits per second, allowing providers to offer a wide range of innovative multimedia services (including video, voice, Internet access and data transmission). Its objectives in undertaking the auction were to:

- utilise the available spectrum with optimum efficiency;
- promote effective and sustainable competition for the provision of third-generation services;
- design an auction that is best judged to realise the **full economic value** to customers, industry and the taxpayer of the spectrum (subject to the overall objectives above).<sup>112</sup>

The third of these objectives makes it clear that the government's aim in auctioning off the spectrum was not merely revenue maximisation; rather, economic benefits would also be maintained from ensuring that the spectrum was assigned to the company that would value it the most and would therefore exploit it to its full potential (with consequent benefits for customers).<sup>113</sup> A revenue-maximising auction would not fulfil this objective if the benefit to the taxpayer were offset by losses to the industry and consumers, for example due to a company defaulting.

Our clear instructions were that efficiency considerations were to take priority over revenue considerations. Efficiency was understood as putting the licenses into the hands of the bidders with the best business plans. Since a bidder with a better business plan will generally value a license more, this aim roughly reduces to seeking to maximise the sum of the valuations of the bidders who are awarded licenses.<sup>114</sup>

### Auction design

Although there were four incumbent operators at the time (Cellnet, Orange, Vodafone and One2One), five licences were put up for sale, one of which was reserved for bidding by new entrants only. This ensured that the auction would result in additional competition in the market. Reserve prices were also set for each of the five licences, which differed according to the size of the spectrum (in Megahertz) granted by the licence. The government made a commitment not to put up for re-sale any licence that did not meet its reserve price.

The auction took the form of a simultaneous, ascending-bid design whereby:

- each bidder made a bid on a licence of its own choice in the first round and was required to be active in every subsequent round;
- for a bidder to be active, it had to be the current highest bidder for a particular licence, or to have raised the bid on a licence by at least the minimum bid increment (5% in early rounds, 1.5% in the later stages of bidding);
- a company that was the current highest bidder for a licence could not raise or withdraw its bid, and could not bid on any other licences;
- bids were revealed at the end of every round, such that all bids were public knowledge;
- the auction ended when as many bidders remained as there were licences, and each of these was allocated the licence for which they were the highest bidder.

<sup>112</sup> National Audit Office (2001), 'The Auction of Radio Spectrum for the Third Generation of Mobile Telephones', October 19th, p. 2.

<sup>113</sup> Binmore and Klemperer (2002), op. cit.

<sup>114</sup> Ibid, p. C79.



This process ensured that each company could win only one licence, guaranteeing that there would be five distinct competitors in the market for 3G services. Importantly, bidding was also open and transparent such that all bidders knew the identities of all other bidders and were informed about others' bids at the end of each round. An auction of this kind has the advantage that it allows companies to take cues from the behaviour of their competitors.

As part of this framework, the Radiocommunications Agency required bidders to make an initial deposit of £50m, which rose to £100m for bids with a value greater than £400m.<sup>115</sup> This deposit was intended to protect against frivolous bidding and default, by increasing the losses that would be faced by any firm which found itself in financial difficulty due to overbidding. Both Binmore and Klemperer (2002) and the National Audit Office, in a report in 2000, are in favour of the use of such a rule, but suggest that, with the benefit of hindsight, the deposits should have been larger—and subject to further ratcheting in line with bidding values—given the eventual size of the bids:

Requiring bidders to pay substantial deposits at the outset as insurance against default provides protection for the seller and acts as a deterrent against ill-considered bidding. Departments should provide for these deposits to increase as the value of bids rises beyond the levels expected.<sup>116</sup>

### Auction outcome

The auction attracted 13 bidders: the four incumbents and nine potential new entrants. The first company to withdraw (3G UK) did so in the 94th round of bidding, as the price of each of the licences passed £2 billion. This was followed by four further withdrawals in quick succession. However, the last three withdrawals took considerably longer and bidding was only concluded with the withdrawal of NTL Mobile in round 150.

In total, the auction raised £22.5 billion across the five licences. In comparison, development and management of the auction cost £8m (less than 0.1% of the proceeds).<sup>117</sup> The winning bidders were allowed to pay the full amount for the licence immediately upon the conclusion of the auction, or to spread the payment across a ten-year period (with half upfront and five equally sized annual instalments to start on the sixth anniversary of the licence award). All five companies paid upfront, on the basis that it was not viable to provide a bank guarantee against default which was required if they chose to defer payment. Payments were made in May and September 2000, with licences immediately awarded upon the receipt of payment.

**Table 4.2 Winning bids in the UK 3G spectrum auctions**

Licence	Winning bidder	Price (£m)	Reserve price (£m)
A (largest, reserved for new entrant)	TIW	4,385	125
B (second-largest)	Vodafone	5,964	107
C (small)	BT	4,030	89
D (small)	One2One	4,004	89
E (small)	Orange	4,095	89
<b>Total</b>		<b>22,478</b>	<b>499</b>

Source: National Audit Office (2001), op. cit., p. 18.

Some industry commentators pointed to overbidding in the aftermath of the spectrum auction—indeed, the official pre-estimate of the licences' combined value was between £1 billion and £3 billion (4.5–13% of the final sale value). However, Binmore and Klemperer (2002) present evidence that the market and telecoms companies did not believe this to be

<sup>115</sup> Losing bidders were fully refunded their deposit.

<sup>116</sup> National Audit Office (2001), op. cit.

<sup>117</sup> Ibid, p. 29.

the case. First, Hutchison was able to sell 35% of its stake in TIW—which won the licence reserved for new entrants—in a deal that valued the licence at about £6 billion in July 2000 (two months after the auction). TIW had paid around £4.4 billion for the licence. Second, Orange (UK) was sold to France Telecom in May 2000 for £6 billion more than Mannesmann AG had paid for it six months before the auction. This would appear to suggest that the licence added considerable value to the company.

Moreover, Cable, Henley and Holland (2002) apply an event-study methodology to share price movements and find no evidence of the winner's curse in the auction:

Positive as well as negative one-day wealth effects are observed amongst both winners and losers, and there is no lasting adverse market reaction to the winners, taken as a group. We conclude there is no case for easing the regulatory stance in the industry on grounds that the winners paid too much...[And] there is no evidence that the outcome of the auction was anything but efficient.<sup>118</sup>

This leads Binmore and Klemperer (2002) to conclude:

The final outcome cannot, of course, be proved to be efficient, but the evidence strongly suggests it was, in the sense of maximizing the sum of the valuations of the bidders who were awarded licenses, given the number and sizes of licenses that were sold.

### Implications for best practice

The UK 3G spectrum auction is generally considered to have been a success—when assessed against its objectives, as set out above—and provides several lessons for best practice in auctions. However, this case study represents a more pure auction form than the tendering process in Australian toll road concessions. In the latter, resources are allocated through comparison of business plans and thus more closely resemble what the literature terms 'a beauty contest'.

The features of the spectrum auction that could be transferable to the context of concessions, include the following:

- **open, ascending-price bidding**—transparency was at the heart of the process, allowing bidders to observe the behaviour of other parties;
- **the requirement for bidders to make deposits**—these were sufficient to keep out unqualified bidders, disincentivise overbidding and ensure that bidders would not renege on their bids. The deposits were ratcheted upwards as bids increased in size. Academics have since highlighted that further ratcheting could have been advantageous as the maximum deposit ended up being roughly 2.5% of the final bid amount. This, however, was related to bidding being higher than expected, rather than due to the design;
- **commitment to reserve prices**—the government made a commitment not to put licences up for re-sale if they failed to meet their reserve price;
- **encourage competition**—the Radiocommunications Agency hired NM Rothschild to attract a high level of interest in the auction, and paid a fee based on Rothschild securing a certain number of competitors for the auction: from £300,000 if seven or more bidders participated in the auction, to £700,000 if more than 11 bidders participated. In the tendering phase of concessions, there will be an optimum number of bidders, beyond which the cost of assessing bids becomes sub-optimally high. However, encouraging as much competition as possible in the pre-qualification phase could help to ensure that the ITT is limited to a smaller field of high-quality bidders.

<sup>118</sup> Cable, J.A., Henley, A. and Holland, K. (2002), 'Pot of gold or winner's curse? An event study of the auctions of 3G mobile telephone licences in the UK', *Fiscal Studies*, 23:4, 447–62.

In terms of the specific impact on incentives to overbid, while the 3G auction was successful in many ways with respect to its objectives, subsequent UK spectrum auction designs have moderated the emphasis on revenue-raising even more explicitly. This suggests that, while some degree of overbidding appears to have been present in the 3G auctions, changing the priority of future auctions to an even greater emphasis on efficient utilisation of the asset appears to have eliminated or reduced overbidding.

### 4.3 Ofwat's menu approach to forecasting

In section 2.3.4, the potential for a menu-based system to be used to incentivise truthful revelation was examined. Such an approach has been adopted by regulators in the energy in Great Britain and the water sector in England and Wales. This section considers the Capital Expenditure Incentive Scheme (CIS) adopted by Ofwat for the price control period 2010–15.

#### Background

As part of the traditional system of price cap regulation employed by utilities regulators in the UK, companies are required to submit business plans to the regulator, detailing the level of CAPEX that they believe will be efficiently incurred over the course of the price control period. The regulator then assumes a level of CAPEX which forms part of its determination of the price cap for the provision of the regulated service. Since a higher CAPEX assumption leads to a higher price cap, companies may have an incentive 'to game' the regulator by submitting business plans that overstate the amount of CAPEX they expect to incur.<sup>119</sup>

To overcome this gaming in business plan submissions, Ofwat has introduced a menu approach for CAPEX forecasting, with the aim of incentivising truthful revelation of the scope for cost efficiencies by rewarding companies for having outturn costs equal to (or, at least, close to) their cost forecasts:

The key benefit of adopting CIS is that it strengthens the incentives for each company to submit realistic business plans, providing an important information base that enables us to deliver better value for consumers.<sup>120</sup>

#### Framework

The CIS involves the following steps:<sup>121</sup>

- Ofwat determines a **baseline** level of costs, which represents its assumption of the level of expenditure over the course of the price control period;
- each water company submits a CAPEX forecast, in the form of a (final) business plan, which is compared with the baseline set by the regulator;
- Ofwat sets each company a (capital) expenditure allowance, which is used in the setting of prices over the control period, on the basis of the ratio of the company's forecast to the regulator's baseline. For the current price review, allowed expenditure was calculated by making an adjustment to the baseline expenditure of  $\pm 25\%$  of the difference between the baseline and the company's forecast;
- an incentive rate is set, which determines the amount of any outperformance on the expenditure allowance that the companies are allowed to keep for each level of outturn CAPEX. The incentive rate declines as the difference between the company's forecast and the baseline increases;

<sup>119</sup> This is because, if they beat the assumption made by the regulator, they will have lower costs and higher profits for each unit of the service provided.

<sup>120</sup> Ofwat (2008), 'Setting price limits for 2010–15: Framework and approach', March, p. 33.

<sup>121</sup> Oxera (2007), 'Assessing approaches to expenditure and incentives', prepared for Ofwat, October; Ofwat (2009), 'Future water and sewerage charges 2010-15: Final determinations', November.

- additional rewards/penalties (termed ‘additional income’) are paid in order to ensure that the overall menu is incentive-compatible, in that the company maximises its payoff by submitting a forecast expenditure that is equal to its expected outturn level of costs. These rewards/penalties are also declining as a function of the ratio of the company forecast to the baseline.

The benefits of submitting a lower forecast CAPEX relative to the baseline are thus twofold: the incentive rate will be larger than if the company submitted a higher forecast, allowing it to retain a greater proportion of any outperformance; the additional rewards received by the company for meeting its forecast will be greater than if it submitted a higher forecast.

The total reward that each company receives under the scheme is calculated as follows:

$$\text{total reward} = (\text{allowed} - \text{actual expenditure}) \times \text{efficiency rate} + \text{additional income}$$

The CIS matrix (see Table 4.3) sets out the total level of reward for each combination of forecast and outturn costs. The matrix is pre-specified and common to all companies, such that any two companies making the same forecast will receive the same rewards for any given level of outturn costs. The figures given in the actual expenditure and total reward columns are ratios relative to the baseline. For example, an actual expenditure of 95 (in dollars or pounds as the case may be) refers to outturn CAPEX that is 95% of the level assumed in the baseline, while a total reward of 3.5 refers to a reward of 3.5% of the value of the baseline.

**Table 4.3 Ofwat’s CIS matrix**

Company:baseline ratio	90	95	100	105	110
Efficiency incentive	37.5%	33.75%	30.0%	27.5%	25.0%
Allowed expenditure	97.5	98.75	100.0	101.25	102.5
Additional income	0.69	0.39	0.00	-0.41	-0.88
Actual expenditure	Total reward				
90	3.50	3.34	3.00	2.69	2.25
95	1.63	1.66	1.50	1.31	1.00
100	-0.25	-0.03	0.00	-0.06	-0.25
105	-2.13	-1.72	-1.50	-1.44	-1.50
110	-4.00	-3.41	-3.00	-2.81	-2.75

Note: Some columns and rows have been removed.

Source: Ofwat (2009), ‘Future water and sewerage charges 2010-15: Final determinations’, November, Appendix 2, p. 149.

The matrix highlights that the greatest possible total reward for each level of actual expenditure (the shaded cells) is achieved when the company submits an accurate forecast of these costs ex ante (ie, when forecast costs are equal to actual costs).

Consider, for example, the case in which a company is set a baseline of \$100 and has an outturn CAPEX of \$95. In this instance, it will obtain:

- a total reward of \$1.66 if it provided an accurate forecast of its CAPEX requirements (ie, a business plan forecast that is 95% of the baseline) prior to the control period;
- a maximum total reward of \$1.50 if it overstated its requirement by submitting a forecast with a higher ratio than its outturn expenditure;

- a maximum total reward of \$1.63 if it understated its requirement by submitting a forecast with a lower ratio than its outturn expenditure.

Since the total reward from providing an accurate forecast is greater than the maximum rewards from over- or understating the CAPEX requirement, truthful revelation should be incentive-compatible. At the same time, the menu does not eradicate the company's incentive to make cost efficiencies. That is, although a company gains the greatest reward when it accurately forecasts its costs, once it has made a cost forecast, it still has an incentive to beat it.

To see this, consider that a company makes a forecast equal to the baseline (ie, its forecast:baseline ratio is 100). If it delivers outturn expenditure equal to the baseline, it receives a total reward of \$0. If, on the other hand, it realises cost efficiencies and delivers outturn CAPEX of 95, it receives a reward of 1.5% of the baseline. (This does not, however, affect the incentive compatibility of the regime since the company would have been even better off if it had made a forecast of 95.

### **Outcomes**

The outcome of the CIS scheme—in terms of the extent to which it has removed the incentive for companies to overstate their CAPEX requirements—is not yet entirely clear and will only become clearer once the water companies' outturn expenditures have been observed at the end of the current price control period (in 2015). However, the continued use of a similar mechanism in the regulation of energy companies (Ofgem's information quality incentive (IQI) scheme)<sup>122</sup> suggests that there have been benefits.

### **Applicability to toll road concessions**

The menu scheme represents an innovative mechanism by which expenditure, or demand, plans can be elicited by a regulatory authority with a view to encouraging more accurate revelation of these variables. Further research would be required into the details of how such a scheme could be applied to toll road concessions, but there is merit in considering a scheme that makes truthful revelation of demand estimates incentive-compatible, possibly by rewarding companies for the accuracy of these estimates.

## **4.4 International precedent from other sectors: discussion**

The case studies presented in this section highlight that concerns surrounding overbidding are not confined to the toll roads sector. In the UK, procurement agencies, such as the DfT and the Radiocommunications Agency, have actively taken steps to reduce the potential for overbidding. This has included attempts—for example, by holding deposits or bonds—to increase the penalties for defaulting and increasing the level of assessment of delivery plans. The latter ensures that demand and revenue forecasts are adequately justified and obtainable, and are robust against different assumptions.

Like toll road concessions (and, in general, large infrastructure concessions with equity at risk), the 3G spectrum auctions involved a scarce resource—with only five licences ever to be issued—and no secondary purchasing market. The case study suggests that, even if the bidding process is well-designed and efficiency rather than revenue maximisation is emphasised, scarcity can lead to bids that look high (and possibly resemble overbidding). However, the focus on efficiency in the 3G auction at least prevented the overbidding from being more serious—Klemperer (2002) noted that if the UK government had wished to, it could have raised higher revenues by limiting the number of licences even further—and, ultimately, all of the licensees are still operating today.

The final case study, on menu-based appraisal, introduces an approach to bid appraisal that could potentially provide an innovative and effective means of incentivising bidders to provide

<sup>122</sup> Ofgem is the regulator of the energy sector in Great Britain.

their best forecast, although it is not currently widely adopted in procurement. The design of such an approach is beyond the scope of this report, but should be seen as an area for potential future research.



## 5 Conclusions

This report has looked at international lessons and analysis that might be used to guide future practice, project design, transaction structuring, procurement, bid evaluation and contract award in toll road concessions. This section summarises the findings from this research and outlines best practice principles which, along with the outputs from parallel initiatives currently being progressed by the DIT (including consultations with stakeholders), can be used to guide and inform future procurement policy and practice. The role played by interviews in the project is summarised in Box 5.1.

### Box 5.1 Interviews

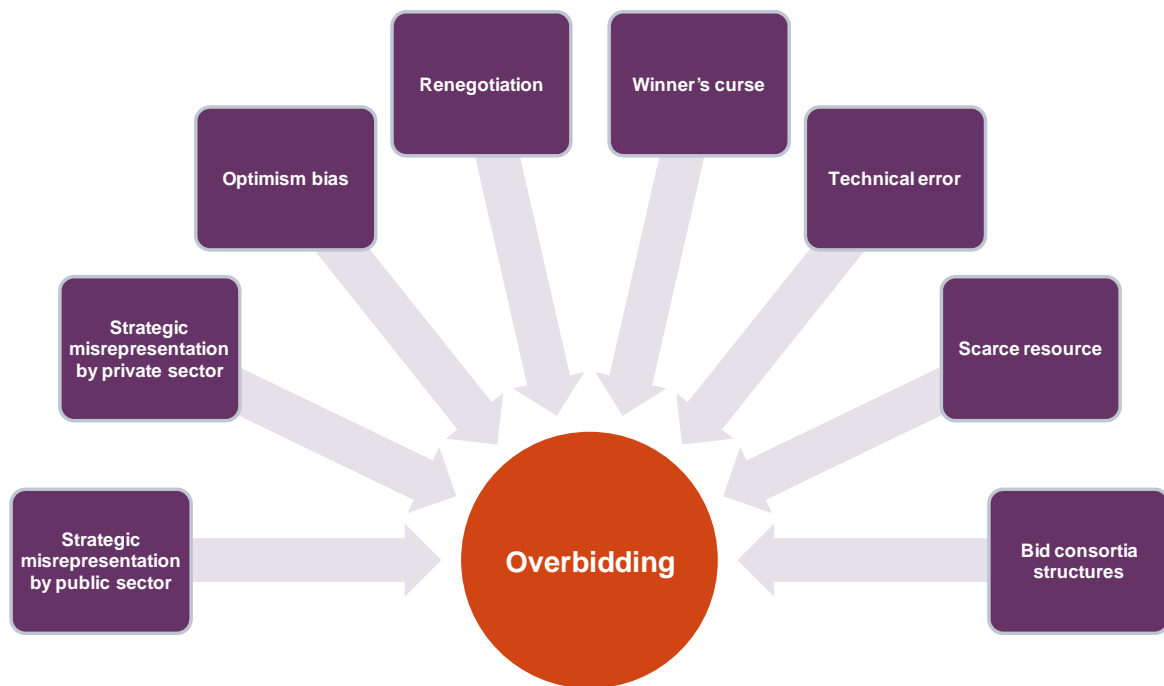
As part of the research for this report, the authors held a series of semi-structured interviews with international representatives from the toll road industry and other sectors, as well as key academics in the field of concessions and auction design. These interviews provided opportunities to present the findings from the literature review and case studies, while encouraging input and feedback from seasoned sector participants. Since these interviewees have not been named, and remarks have not been attributed to them, they expressed their opinions frankly, giving the full benefit of their insight and experience. The insight from these interviews is reflected in the conclusions and recommendations presented in this section, and throughout the report.

The preceding sections have highlighted that overbidding is not a problem which is confined to the toll roads sector, nor just to Australia. It is a global phenomenon, spanning numerous industries and jurisdictions. In the case of toll road concessions, however, two general trends are observed:

- **opening-year forecast**—the biggest contributor to demand (and hence revenue) forecasting errors associated with many toll road projects is that opening-year asset usage falls well below expectations. Even though subsequent year-to-year growth often trends as anticipated, the opening-year mistakes are effectively carried forward into future years with little opportunity for catch-up. This differs from the GB passenger rail franchising case study, for example, in which there is a base level of demand (from previous operating years) against which forecasts can be made;
- **resource scarcity**—industry participants can face significant pressures to win toll road concessions as the opportunities to bid arise relatively infrequently. A track record (or the possibility) of failure can promote aggressive bidding and a win-at-all-costs culture, as company executives respond to management targets and shareholder expectations. Procuring agencies focused on sustainable programmes of infrastructure investment need to remain alert to this behaviour.

The literature review and case studies examined in this report have suggested several potential explanations for overbidding in the tendering process for concessions, as shown in Figure 5.1. These potential causes—exacerbated by deal scarcity and the unpredictability of opening-year demand—provide bidders with incentives to deliver high rather than accurate forecasts. This is observed internationally. Identification and awareness of these issues form the first step in the process of reforming and fine-tuning concession programmes to ensure the long-term viability of appropriate infrastructure partnership arrangements.

**Figure 5.1 Potential causes of overbidding**



Source: Oxera analysis.

Targeting these causes may not necessarily result in accurate toll road traffic and revenue projections. Indeed, limitations in the predictive capability of state-of-the-practice forecasting—especially for greenfield projects—suggest that errors will not be eliminated entirely. Consequently, forecasting realism (rather than accuracy) should be the policy goal, with the elimination of clearly biased bid submissions as the core objective.

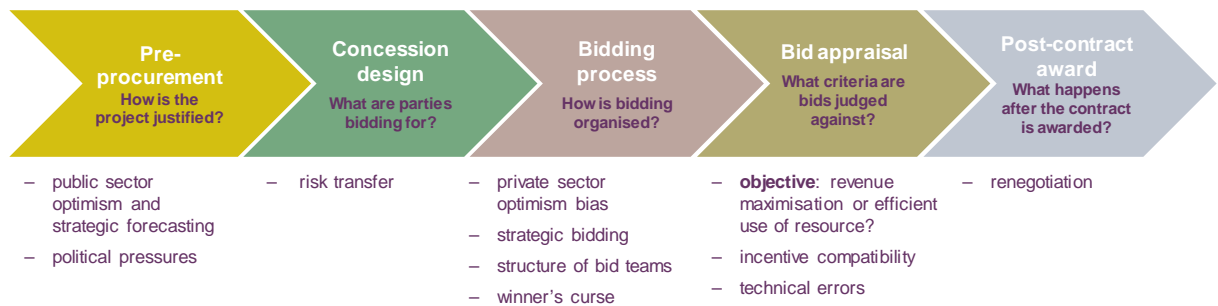
At the very least, the public sector should look to introduce measures which ensure that the downside to providing unrealistic forecasts is comparable to the large upside for providing high numbers.

Equally, an over-emphasis on forecasting accuracy may not be particularly desirable from a concession grantor's perspective. There may be some strategic reasons for overbidding that the state can benefit from, which should not necessarily be discouraged as they represent normal commercial and competitive business practices (eg, undertaking an investment project to stimulate further work opportunities).

## **5.1 Best-practice principles**

In this section, problems and solutions are considered in each of the five distinct stages in the concessions process introduced in section 2.3 (and reproduced in Figure 5.2). Across each procurement stage, greater consideration needs to be given to incentive compatibility and incentive alignment within bidding consortia.

**Figure 5.2 Stages in the concessions process**



Source: Oxera

### 5.1.1 Pre-procurement phase

In considering overbidding, it is important to look at how the decision to carry out the project was originally reached. Politicians may be biased towards the short term in their decision-making since they are likely to be seen positively for getting a project 'off the ground' and are likely to have left office by the time the project runs into any problems. The public sector may therefore face incentives to drive up demand or revenue forecasts in order to get the go-ahead for a project. This can result in public sector comparator figures that are unrealistically high.

Consequently, it is important to ensure that political pressure does not push up demand expectations (and feed into an unrealistic public sector comparator) in the pre-procurement phase. The UK government has looked to overcome this problem through its VfM model, which requires that projects are assessed against strategic, economic, commercial, financial and management criteria; and that they receive sign-off from a senior civil servant (in the form of the department's permanent secretary).

#### Key principle

Further consideration is needed about how political pressures to produce over-optimistic forecasts can be reduced, and how to ensure that projects are undertaken only where they are commercially and economically viable.

### 5.1.2 Concession design

#### Traffic risk

Ideally, there should be nothing in the design of the concession that should incentivise excessive risk-taking. At the same time, exposure to traffic risk should not be removed completely from the concessionaire, as they should face incentives (in relation to their rewards) to provide higher-quality service levels to the end-user. Moreover, interviews conducted for this study revealed that some concessionaires want traffic risk—as they have invested heavily in understanding it and believe themselves to be in a better position than the public sector to handle it—so long as there is a balance of upside and downside risk to allow for normal risk/reward returns.

One means of doing this, as adopted in GB passenger rail franchising, could be to give the concessionaire some traffic risk while tying risk-sharing mechanisms to aspects outside their control (ie, possibly not to their bids, but rather external factors such as GDP or population growth).

#### Accounting treatment

International concession design is often focused on achieving a certain accounting treatment, even though governments typically state that they should remain policy-driven (with the accounting treatment sorted out at a later stage). Over-emphasis on off-balance-sheet structuring may raise concerns in the minds of politicians and the public. Accounting

strategies are a significant and unnecessary distraction in the real policy debate about what infrastructure should be built and how it should be funded.

#### **Key principle**

Best practice dictates that there should be nothing in the design of the concession that should incentivise excessive risk-taking, but removing traffic risk completely is not the way to achieve this.

### **5.1.3 Bidding process**

In terms of the bidding process, several problems can contribute to overbidding:

- optimism bias;
- strategic bidding;
- the winner's curse;
- incentive misalignment across bidding teams.

The first three of these issues are exacerbated by the pressure to win, which has already been considered in the context of international deal-flow scarcity.

#### **Bidding wars**

In some situations, bidders may believe that they have no option but to win contracts, since otherwise they will remain inactive in their core market. This can encourage them to bid more than their estimate of the value of the concession. Combined with the nature of the bidding process—which is centred on aggressive, price-based competition—this can lead to bidding wars. This could be particularly damaging from an efficiency perspective if it discourages well-qualified (and perhaps better-qualified) parties from entering the bidding process because they understand that they will win the concession only by overpaying.

The report has highlighted several mechanisms that could be introduced to discourage such bidding behaviour. One such mechanism of note, which has been applied in both UK spectrum auctions and GB rail franchising, requires bidding parties to make deposits that increase as a function of the value of bids. In the case of the 3G auction, this was a £50m initial deposit, rising to £100m for bids of £400m or more. For rail franchising, the holding company of the franchisee is liable for a performance bond (5.5% of operating costs), a season-ticket bond and a subordinated loan in the case that the franchisee defaults. These are used to cover the costs of re-letting the franchise and also as a penalty for breaking the contract. This increases the losses that a party would make should it default, thereby further disincentivising frivolous submissions and overbidding.

Other suggestions include designing a second-price system, whereby the winning bidder would pay the premium offered by the second-highest bidder, and making the bidding process more open and transparent. In theory, a second-price mechanism should incentivise bidders to reveal their true valuations. However, such designs are rarely used in practice and would be likely to result in lower revenues than the existing model.

#### **Structure of bid consortium**

Further problems in the bidding process have been created by the misalignment of incentives across bidding consortia. To overcome this, a requirement of pre-qualification could be to ensure that the bidding consortia are compliant with a target capital structure (eg, realistic gearing). Bidders might, for example, be required to show that they have a minimum of, say, 30% equity. While this may be partly required by the current market conditions anyway, enshrining a proper financing structure would be expected to reduce further the pressure on forecasts. Thinly capitalised special-purpose vehicles (SPVs) do not sit naturally with projects exposed to income streams that may vary considerably from expectations.

One element of an appropriately structured concession competition might be an evaluation of the bids that includes giving credit for the amount of equity, parent guarantees or similar support that are proffered and serve to provide 'skin in the game' by the bidder. The more the

concessionaire (at the parent level) is on-risk, the lower the incentive to overstate revenues or 'overbid' using an over-leveraged transaction structure.

A number of additional structural features might be considered to ensure that the concessionaire has a long-term interest in the project, but the key ones are addressed above.

A second possible means of ensuring closer incentive alignment would be to have a longer lock-up period on sponsor equity and make (real) sponsor equity a meaningful part of the overall equity pool. It would be desirable to prohibit dividend distributions or the sell-down of equity in circumstances of underperforming projects, and to avoid the practice of passing equity risk to less-sophisticated third parties or to those unable to exercise full and appropriate due diligence.

#### **Key principle**

Mechanisms should be applied to increase the downside risk of overbidding and to penalise certain bidding consortia on the basis of their investment objectives and capital structures. This would reduce short-termism and create better incentive alignment across stakeholders within the consortia.

#### **5.1.4 Bid appraisal**

Best practice from international precedent suggests that, in the bid appraisal stage, procurers should scrutinise the deliverability of bidding parties' business plans and the robustness of the assumptions behind their financial models. The UK DfT recently announced its intention to focus more on cost side as well as demand-side considerations in awarding franchises in the future. This is intended to encourage the realisation of efficiencies over the duration of the franchise, ensuring that infrastructure assets are efficiently utilised, while also reducing the incentive for parties to overbid. Similar criteria could be applied to bid assessment in the toll roads sector.

While imposing rules to this effect might reduce the size of the upfront payment, this is a trade-off that the government might need to accept if it wishes to overcome the overbidding problem. The UK 3G spectrum auction is an example of a case in which the government agency emphasised that its objective was to maximise the full economic value of the auctioned resource rather than the revenues received. Since spectrum was a scarce resource—with only five licences for 13 bidders—the price paid by concessionaires remained high enough for the taxpayer to receive substantial benefits, but was not so high as to cause irreparable damage to the winning bidders' finances. This would likely also be the case in toll roads—owing to the infrequent nature of concessions, winning bids would be likely to remain at an acceptably high level, even if they were required to pass enhanced scrutiny.

If the economic case for a project is sufficiently strong, instead of governments extracting money in the form of upfront payments, they might more usefully do so in the form of payment instalments over the lease period, which, even in NPV terms, could be smaller than the upfront payment would otherwise be. In GB rail franchising, the winning bidder pays annually rather than upfront. This removes some of the political pressure that incentivises the procurer to announce as high an upfront payment as possible, and thus to accept the highest demand forecast. Indeed, in the case of the Intercity East Coast Line, the DfT awarded the franchise to a party that had not offered the highest payments over the lease period.

Other options for enhancing the bid appraisal process, highlighted in this report, include:

- reference class forecasting;
- explicit optimism bias adjustments;
- separation of forecasts into an exogenous factor, which is common to all firms, and an endogenous factor which is unique (and allows for differentiation according to individual bidders' ability to grow traffic, as evidenced through delivery plans).

These solutions all suggest that greater independent (technical) oversight is needed of parties' bid forecasts and submissions.<sup>123</sup> This could stem from stricter government guidelines on how forecasting should be carried out and the publication of criteria with which traffic modelling should be compliant. Independent traffic and financial modellers could then be employed to carry out a third-party review as part of the evaluation process, in order to identify overambitious forecasts and ensure that realistic traffic forecasts form the basis of the successful bid. Alternatively, the government could require projects to secure a specified rating from an international credit rating agency, since this would also involve the demand forecast being subjected to greater external scrutiny.

#### **Key principle**

Best practice dictates that far less emphasis (if any) should be placed on any upfront premium offered by the bidders, since this merely ensures that companies are incentivised to provide high, rather than accurate, numbers. If NPV-positive, financial flows could instead be spread across the lease period. Bid appraisal should also include an assessment of the assumptions on which demand and revenue forecasts are based, to ensure that they are well-justified and deliverable. Such approaches, in combination with many of the other best practice principles, have the potential to maintain investor confidence by ensuring that concessions are awarded to the most qualified party and for the correct reasons.

### **5.1.5 Post-contract award**

In terms of contractual design, it is perhaps unrealistic to strive for complete contracts that perfectly cover all eventualities that might arise over a 30-year period. The default assumption should probably be that some forms of renegotiation will be required over such a long time horizon—and possibly more value would result from efforts to ensure that effective partnering arrangements are in place to accommodate and respond to changes that are inevitable. Contractual renegotiations are usually regarded negatively when, in fact, positive (welfare-enhancing) outcomes can flow from periodically revisiting the terms and conditions governing service delivery.

In short, there could be good and bad renegotiations. The situation to avoid is a forced renegotiation with, at its core, a financially distressed project and a concession grantor feeling obliged to step in and solve the problems. Policies of, and demonstrated commitment to, no renegotiation under such circumstances are essential, but awarding concessions to the correct parties for the correct reasons goes a long way to avoid such situations arising in the first place.

#### **Key principle**

Best practice indicates that the Australian government's current position of not renegotiating contracts is essentially the right one and should thus be maintained. However, consideration might usefully be given to ways in which long-term partnerships between the public and private sectors could evolve to ensure that the true spirit of partnership is maintained throughout the concession term.

## **5.2 Discussion**

While several best practice principles and lessons from international precedent have been presented, it is perhaps too early in the life cycle of toll road concessions to reach definitive conclusions on what best practice looks like. Indeed, as the majority of modern Western concessions are still in the early period of operations, the existing model has not yet been tested fully. The current difficulties that some toll roads face (and failures in other sectors, including National Express's default of the Intercity East Coast franchise in Great Britain) are likely to have been exacerbated by the volume shock created by the global recession. In particular, given the age of many of the toll road projects in Australia, financing was likely to

<sup>123</sup> See Appendix 2 for further discussion of potential improvements to traffic and revenue reports.



have been accessed at, or near, the top of the economic cycle, while the roads opened at the bottom of it. This might lend credence to the argument that the overbidding problem would be expected to sort itself out naturally, given time. If the concessionaire defaults due to having made a bid that later proves to be excessive, the costs are borne by equity first and fixed income second, as with any business that overestimates its demand. The 'invisible hand' should therefore force bids to become more accurate over time, as bidders learn not to take on too much risk and lose their credibility with the debt markets. This would be expected to be more likely in the absence of renegotiations.

Even if this is the case, a government may wish to implement current best-practice processes and deliberately test alternative structures to speed up the learning process.

In closing, it is worth highlighting that the experiences of, and concerns about, overbidding for concessions do not lead to the conclusion that concessions—or PPPs, more generally—are fundamentally flawed. As stated above, these arrangements are evolving and most have yet to mature. In such circumstances, it is entirely reasonable for a government to intervene to push the industry (and itself) further along the learning curve. The key is to actively search out lessons that can be used to benefit other PPPs specifically and government procurement practices more generally. In this context, full, proper and constructive engagement with the private sector has a role to play.

Above all, effective concession design should facilitate the exchange of ideas between public and private sector players, and provide real opportunities for government (and ultimately taxpayers) to benefit from private sector initiatives, innovation and experience.

# A1 Interview questions

## Disincentivising overbidding for Toll Road Concessions

A study on behalf of the Australian Department of Transport by RBconsult and Oxera  
Information Sheet for Interviewees

### Notes:

- With your permission we will record the interview (for our internal purposes only).
- Neither you nor your employer will be identified in our report.
- Any quotes used will be non-attributable.
- You will have a chance to see and approve any text we wish to include in our report.
- Frank and candid views are encouraged.

### Background:

- The Australian toll roads sector has long suffered from overbidding (bid submissions based on over-optimistic projections of demand and revenue).
- The Government is looking at ways in which overbidding might be avoided.
- Our focus is outward-looking; examining lessons from around the world that might be used to guide future practice, project design, transaction structuring, procurement, bid evaluation and contract award.

### Topics for Discussion:

From your experience:

- What is the single biggest issue that leads to overbidding?
- To what extent are public sector procurers observed to learn from previous experiences?
- Is a track record of not re-negotiating concessions contracts sufficient to deter overbidding or do there need to be contractual commitments not to re-negotiate?
- Is the traditional auction theory literature, in particular common value auctions and the winner's curse, applicable to the case of toll road concessions?
- To what extent does the design of the concession (eg. who is responsible for operation and maintenance, how operators are remunerated for their up-front investments) incentivise overbidding?
- Can insights into the problem be drawn from behavioural economics or other sectors?
- Are there any solutions to the overbidding problem (eg, reference class forecasting, optimism bias adjustments) which you think are particularly worthy of consideration or should be avoided?
- To avoid overbidding, some procuring agencies have tried the following:
  - Availability-based payment mechanisms
  - Pass-through tolls
  - Construct-then-concession
  - Competition based on least present value of revenues (LPVR)

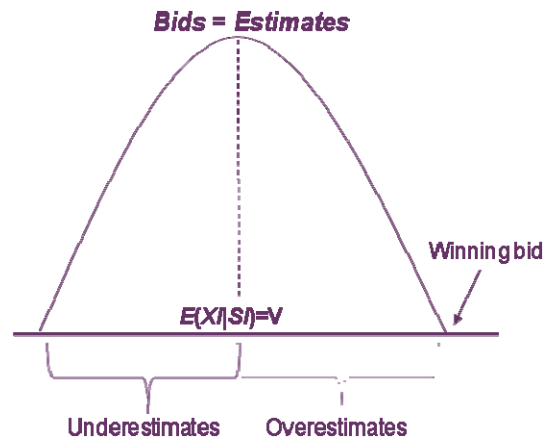
Could you give us your views on each of these solutions?

- Does the solution to the problem differ depending on whether the overbidding is deliberate or the result of behavioural/cognitive biases?

## A2 The winner's curse

If  $X_i$  is the  $i$ th bidder's estimate of the item's common value ( $V$ ), and it is an unbiased estimate, the expected value of the estimate conditional on the bidder's signal ( $S_i$ ) will be equal to the item's common value—ie,  $E[X_i|S_i] = V$ . If all bidders follow the same strategy, basing their bids on their individual estimates, the winning bidder will be the party with the highest estimate of those competing for the item. Intuitively, this party will typically have overestimated the item's value. That is, the winning bidder's estimate is likely to be biased upwards such that  $E[\max(X_i)|S_i] > E[X_i|S_i] = V$ .

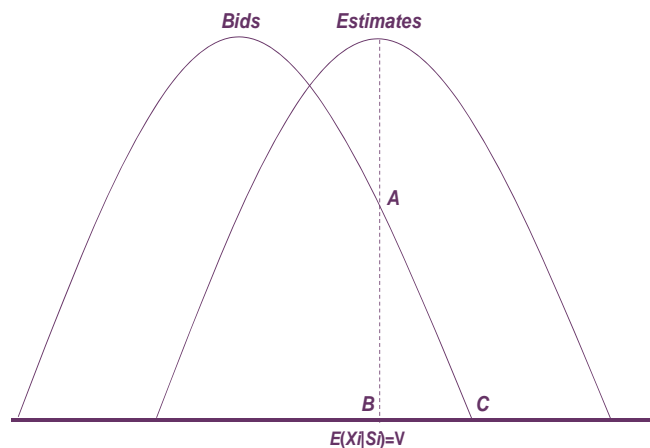
**Figure A2.1 The winner's curse**



Source: Oxera.

In Figure A2.1 it is assumed that estimates are normally distributed and unbiased, such that the average of the estimates is equal to the auctioned item's actual value. Furthermore, the competitors make bids equal to their estimates. In this case, there is a clear winner's curse problem, with the winning bidder being the party that has overestimated the value of the item by the largest amount. The winner's curse could also arise when bidders revise their estimates downwards when making bids, but not by enough to ensure that the winning bid is lower than the 'true' value, as shown in Figure A2.2. Here, the winner's curse arises but is smaller than when bids are directly equivalent to estimates. This occurs when the discount the bidder makes to its estimate (ie, the horizontal distance between the 'bids' distribution and the 'estimates' distribution) is smaller than the overestimation (the horizontal distance between the 'estimates' distribution and the dotted line).

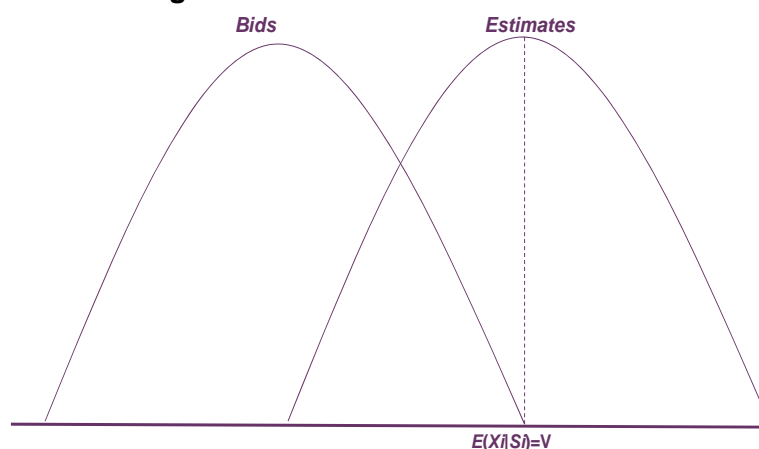
**Figure A2.2 The winner's curse with bid discounting**



Source: Oxera.

Rational bidders, maximising their expected utility, would lower their bids in order to allow for the bidding of competitors.<sup>124</sup> Through this strategic discounting of bids, the bidding distribution should be shifted far enough to the left such that the winning bidder will still be able to earn a rate of return on its investment. This is the case shown in Figure A2.3.

**Figure A2.3 Rational bidding to overcome the winner's curse**



Source: Oxera.

### Empirical evidence

The winner's curse was first observed from field data. Capen, Clapp and Campbell's seminal article in 1971 introduced the concept into the literature.

#### Box A2.1 Empirical evidence of the winner's curse

Between 1954 and 1970, oil and gas leases in the Outer Continental Shelf (off the coasts of Louisiana and Texas) were sold in US federal auctions. Capen, Clapp and Campbell (1971), and a later study by Mead, Moseidjord and Sorensen (1983), identified several interesting features of the competitive bidding process for these leases.

- The highest bid for a lease was frequently between five and ten times larger than the lowest bid.
- In 1969, winning bids amounted to \$900m, while the aggregate of the second-highest bids was US\$370m.
- The winning bid was at least twice as large as the second-highest bid for 77% of the leases.
- Across the 1,223 leases issued between 1954 and 1969, firms made a mean present-value loss of US\$192,128 per lease (using a 12.5% discount rate).
- Only 22% of all leases were profitable.

Source: Capen, Clapp and Campbell (1971), op. cit. Mead, W.J., Moseidjord, A. and Sorensen, P.E. (1983), 'The Rate of Return Earned by Lessees under Cash Bonus Bidding of OCS Oil and Gas Leases', *The Energy Journal*, 4, pp. 37–52.

The winner's curse has also been observed in laboratory settings in numerous studies. Bazerman and Samuelson (1983), for example, held studies in which MBA students made sealed bids for a jar of coins which, unbeknown to the subjects, had a value of \$8 in each instance.<sup>125</sup> Interestingly, the mean estimate of the value of the jars was \$5.13, representing an average underestimation of \$2.87. As noted by the authors, this would be expected to reduce the likelihood and magnitude of the winner's curse.

<sup>124</sup> Cox, J.C. and Isaac, R.M. (1984), 'In Search of the Winner's Curse', *Economic Inquiry*, 22:4, 579–92.

<sup>125</sup> Bazerman, M.H. and Samuelson, W.F. (1983), 'I Won the Auction but Don't Want the Prize', *The Journal of Conflict Resolution*, 27:4, 618–34.

In fact, the mean winning bid for the 48 auctions was \$10.01, such that the winning bidder made on average a loss of \$2.01. Moreover, losses were made in 26 of the auctions, and in 23 of these the losses were greater than \$1. The authors thus concluded that:

The evidence strongly indicates that individuals fail to take undertake the necessary inference and to adjust their bids accordingly. Thus while individuals recognize that uncertainty exists, they do not take this into account sufficiently when formulating their bidding strategies.<sup>126</sup>

Some important conclusions can be taken from the studies that have followed since.

- **Learning over time**—one argument might be that mistakes observed in toll road concessions to date could be attributable to the bidder's inexperience and might be overcome in subsequent (repeated) interactions. Equally, it might be expected that early results would be sensitive to 'a number of grossly inflated bids' and that these might be expected to be eliminated over time as a result of bankruptcies. This was an early criticism of Bazerman and Samuelson's study, but does not seem to have been borne out by later experimental work, where the winner's curse has been observed to exist throughout repetitions. Thaler (1988), for example, says of one study of repeated auctions:

There was no sign of any learning among the others; in fact the average bid drifted up over the last few trials. It may be possible to learn to avoid the winner's curse in this problem, but the learning is neither easy nor fast.<sup>127</sup>

- **Experiment design and subjects**—importantly in the context of concessions, evidence of a winner's curse has also been found to hold when the experimental subjects are construction firm managers, rather than students,<sup>128</sup> where participants are given full financial liability for losses made during the experiments,<sup>129</sup> and in situations where the number of bidders is determined endogenously, such that subjects can decide whether or not they wish to participate in an auction.<sup>130</sup>
- **Bid group size**—Kagel and Levin (1986) compared the outcomes of auctions across different bidding group sizes.<sup>131</sup> In the small groups, the authors recorded mean positive profits of US\$4.32 per auction. In the large groups, however, the winning bidder made an average loss of US\$0.54 and exceeded the value of the item in 54% of auctions. The authors found that, contrary to what rational bidding theory would suggest, subjects bid more aggressively, rather than less so, in large groups.

<sup>126</sup> Bazerman and Samuelson (1983), op. cit., p. 631.

<sup>127</sup> Thaler (1988), op. cit., p. 194.

<sup>128</sup> Dyer, D., Kagel, J.H. and Levin, D. (1989), 'A Comparison of Naive and Experienced Bidders in Common Value Offer Auctions: Laboratory Analysis', *Economic Journal*, **99**, 108–15.

<sup>129</sup> Lind, B. and Plott, C.R. (1991), 'The Winner's Curse: Experiments with Buyers and Sellers', *American Economic Review*, **81**, 335–46.

<sup>130</sup> Cox, J., Dinkin, S. and Swarthout, J. (2001), 'Endogenous Entry and Exit in Common Value Auctions', *Experimental Economics*, **4**:2, 161–81.

<sup>131</sup> Kagel and Levin (1986), op. cit.



The following article was written by Robert Bain (RBconsult). It is reproduced here as it offers recommendations about the structure and content of toll road traffic and revenue forecasting reports. In line with the general PPP philosophy, these recommendations focus on the output (the final report), leaving consultants to design their research and traffic modelling activities as they feel appropriate.

During my years with the Infrastructure Team at Standard & Poor's and, more recently, running my own technical consultancy for banks and institutional investors, I have reviewed over 100 toll road traffic and revenue (T&R) study reports from around the world. Traffic consultants often self-define their work as 'investment grade', however my analysis suggests that this is commonly more of a marketing ploy than a serious attempt to understand and respond to the needs of potential financiers. The traffic studies themselves typically represent variations on a similar theme – however the variance in the quality of reporting is staggering. This is unhelpful at a time when international investor confidence in traffic forecasts is at an all time low.

If toll roads globally are going to reassert themselves as attractive investment propositions to a broad investor base, project risk and uncertainty needs to be better understood and communicated. Improved study reporting has a central role to play in that context and those commissioning traffic studies need to be more demanding in their terms of reference. For too long, the outputs from traffic studies have been dictated by traffic consultants – not their clients.

From my reviews – and from numerous discussions with bankers, bondholders, insurers and fund managers – recurring reporting deficiencies have emerged. Addressing these deficiencies would go a long way to restoring investor confidence. The remainder of this article identifies ten simple yet practical ways in which the quality and transparency of toll road T&R study reports could be improved.

#### **Clear Presentation of (and Justification for) the Assumptions Used**

All of the traffic modelling assumptions adopted in a study should be made explicit. This is rarely the case. The assumptions should be consolidated in a single table for easy review, rather than being scattered across different chapters – and strong empirical evidence (with robust justification) should be provided in support. The implications of adopting alternative yet still plausible assumption sets on the resulting forecasts should be highlighted. Addressing these deficiencies would be of considerable benefit to an investor audience.

#### **Clear Description of the Product Offering**

A number of traffic forecasting reports fail to describe the toll facility under consideration in simple terms highlighting the key characteristics of the project – such as future time savings or improved journey time reliability – that would attract users. Facilities tend to be discussed in engineering or modelling terms. Investors need to understand what a toll road represents to consumers (the product offering); who would use it, why, how, when, for what purpose(s) and so forth. Lenders frequently talk about the "*traffic story*" pointing out that a simple story with an intuitive appeal is likely to attract a more positive response from credit committees than toll facilities (and their attributes) that remain difficult to comprehend and communicate.

<sup>132</sup> Reproduced with the kind permission of Tollways, the journal of the International Bridge, Tunnel and Turnpike Association (IBTTA).

### **Avoid Over-Emphasis on Supply-Side Issues**

Many reports reviewed place considerable emphasis on the 'supply side' of transport models, devoting numerous pages to descriptions of highway networks in the base and future years. In itself, this is not unreasonable, however rather less attention is often paid to the representations of base and future year demand in the models. Traffic forecasting is frequently described as being a blend of science and art. Supply side modelling represents the science. It can be depicted accurately – indeed, with military precision using today's digital maps – and is generally uncontroversial. However demand forecasting models are only as strong as their weakest links – and the weakest links inevitably relate to the 'art' of demand representation and the treatment of demand growth. To be of most help to potential investors, more critical attention needs to be focused on demand side issues, uncertainties and risks in traffic study reporting.

### **Avoid Over-Emphasis on a Validated Base Year Model**

A well calibrated and validated base year model – one that reflects the travel environment and its competitive dynamic today – is an important tool for toll road traffic and revenue forecasters; although it is difficult to imagine that the leading consultancies in this field would struggle to produce validated base year models. This is particularly true when, as is frequently the case, they limit themselves to relatively straightforward weekday peak-period modelling. For the investor, however, the construction of a satisfactory base year model is not the end of an important process – it is the beginning of one. It is the work that follows – focused on the future – that is of most importance. More emphasis placed on possible future states of the world (and their travel demand and asset usage implications) in traffic and revenue reports would help to improve credit risk analyst and investor understanding.

### **Provide a Clear Explanation of the Link Between Traffic and Revenue Forecasts**

A number of traffic study reports present their forecasts in terms of aggregate vehicle miles (or revenue miles) for future years – or the total number of toll transactions (and total toll revenues). These output metrics clearly build from projections of traffic volumes using tolled links in the demand model – however the link volumes themselves are often not reported. This makes it difficult for the reader to understand how future traffic patterns are expected to evolve (in any detail) and to determine whether – or not – the projections make sense. A clear explanation of how future-year link volumes translate into project revenues would be of considerable help in this context.

### **Conduct Comprehensive and Realistic Sensitivity Testing**

Most of the reports reviewed present the toll revenue results from sensitivity tests – however, frequently, these tests are limited in both scope and scale. Sometimes they appear to have been 'cherry picked' for their lack of impact on future cash flows! Investors need comprehensive sensitivity testing of the key project variables about which there is uncertainty. These sensitivity tests need to be realistic in terms of the alternative parameter values being evaluated. Simply reducing an input by 10% (with no explanation or justification provided) does little to enhance investor confidence. Sensitivity testing needs to respond intelligently, on a project by project basis, to the specific risks and uncertainties to which financiers may be exposed.

### **Discuss What the Results Mean**

Some traffic and revenue reports leave the reader with the distinct impression that the forecasts were produced at a very late stage in the study. They are presented, *fait accompli*, at the end of the report – perhaps in a table – with little or no explanatory text. This is unhelpful. Investors need to know, not only what the results are, but what they mean. Is a forecast of 24,000 vehicles/day in the year 2015 high or low? Is it unexpected, in line with other toll road performance or what? Traffic consultants would add considerable value to their work if an explanatory commentary and/or discussion followed on from the presentation of their projections.

### **Provide a Candid Description of Future Uncertainties and Modelling Limitations**

In academic literature researchers are required to bring to their readers' attention any limitations associated with their work. It would be helpful if the authors of traffic and revenue studies adopted this practice. Instead of providing pseudo-comfort to potential investors, the avoidance of any discussion about modelling limitations – or other sources of uncertainty which could impact on future cash flows – simply serves to undermine confidence. This is especially true when these limitations and uncertainties become apparent only under later cross-examination.

### **Provide Consistency in Terms of Risk Analysis Reporting**

One of the challenges facing the reviewers of toll road traffic and revenue study reports is the lack of consistency in terms of reporting content and style. This is most evident when considering project risks and the technical advisor's commentary on investors' residual risk exposure. It would be useful if a common risk register or template was used by way of a summary. This would enable investors to build-up their analytical experience and expertise over time and, importantly, would assist with the project comparisons and benchmarking often used in credit analysis.

This type of template has already been developed, although it is employed by different traffic consultancies to different degrees. At Standard & Poor's we developed a 'Traffic Risk Index', based on years of credit risk analysis specifically focused on toll road risks (see [www.robbain.com](http://www.robbain.com) for more detail). Key project risks are scored on a single summary sheet using a simple 10-point scale. Wider use of this template (or an alternative that fulfils the same role) would summarise the main project risks quickly and would help investors to apply more consistency to their analytical endeavours.

### **Commission an Independent Peer Review**

As a condition of receiving state support, some programmes – such as the TIFIA programme in the United States – require independent peer reviews to be conducted of toll road traffic and revenue forecasts. This is good industry practice as it provides oversight of the original study by technically-conversant professionals, thus enhancing investor confidence. Selection of the impartial peer reviewer, however, is critical. Some are less rigorous than others, suggesting a possible reluctance to be critical of parties who – next time around – might be conducting the peer review process themselves.

### **Concluding Remarks**

There is a rich seam of literature from around the world demonstrating the potential exposure of traffic and revenue forecasts to the influences of error and optimism bias. These commonly represent the most critical operational-period project risks to toll road investors. In Australia, investor confidence in toll demand projections is reported to be at an all time low, encouraging procuring agencies to shy away from the traditional standalone user-paid toll road model. Better reporting with more transparency could help to reverse this regressive policy trend.

Although many advances have been made in transport modelling since the 1950s, for the purposes of accurate toll revenue prediction, today's traffic models – while essential – remain crude and imperfect. In the past, financial engineers have been seduced by consultants' marketing brochures and claims of predictive prowess. Too much reliance has been placed on pinpoint forecasting accuracy leading to the development of aggressively structured transactions and financings with restricted flexibility. This has resulted in project distress and, in a number of high-profile cases, failure.

Project stakeholders who commission traffic studies need to reassert their requirements. You don't need to tell traffic consultants how to do their job. You simply need to reinforce your expectations in relation to study outputs. This is no different from the more general public-private partnership philosophy with the spotlight usefully on outcomes rather than inputs. Toll road traffic and revenue forecasting best serves the investment community when it is

focused on the identification of key usage trends and is accompanied by incisive reporting providing an explicit and comprehensive discussion of all project risks and uncertainties.

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