

## Tackling systematic cost overruns in infrastructure projects

**Systematic cost-overruns in major capital infrastructure projects have significant implications for public policy decision makers: Projects that cost more than planned create budget pressures and this can translate into political difficulties. A tendency for projects to cost, on average, more than expected indicates a problem with the estimation method or the decision making process. Researchers have in the past identified 'optimism bias' and 'strategic misrepresentation' as the main culprits for systemic cost overruns. However, all current explanations do not entirely conform to the existing empirical data from actual projects. Research carried out at the International Transport Forum suggests there are in fact additional drivers of cost-overruns in public investment appraisal.**

- **The accuracy of future cost estimates also depends on past construction market developments and bidder behaviour.**
- **The functional relationship between the past development of prices on the construction market, bidder behaviour and current prices on the construction market is sufficient to explain the persistence of cost-overruns through time even in the absence of other explanations.**
- **The usefulness of simple calculatory provision ('uplift') for expected cost overrun is questionable.**
- **For informing decisions on the choice between direct public procurement and a public-private partnership solution, using the uplift as an input for a cost comparison is also questionable.**

### The traditional view

Researchers first looked into the problems with the accuracy of cost estimates decades ago. The subject was popularised by Bent Flyvbjerg of Oxford University with a seminal publication in 2002 and subsequent works. Flyvbjerg provided a clear definition of what is being measured, namely the cost-overruns at the decision to build, i.e. the formal point at which a project is selected for construction. On the then largest sample of large infrastructure projects, spanning decades, Flyvbjerg showed that cost-overruns were persistent through time and systematic across infrastructure type and geography. He proposed several theoretical explanations for his empirical results, suggesting that the dominant (albeit not the only) explanation is political-economic with deliberate deception by parties, standing to benefit from the results of the decision to invest.

► **Empirical data shows overruns of project costs to be both systematic and persistent**

Flyvbjerg made several recommendations to improve transparency, accountability, and also the financing structure of major infrastructure projects. He proposed an application of so-called reference class forecasting. This involves the pooling of infrastructure projects with similar characteristics in reference classes of similar characteristics and measuring their historic cost performance. The measured cost-overruns are then applied as corrections or 'uplifts' to enable a more equitable comparison across projects. This should work against the "survival of the unfittest" projects. Several countries adopted the recommended approach. Most notably a research paper (Flyvbjerg and COWI 2004) produced for the UK Department for Transport suggested reference classes and uplifts for the transport sector.

► **Analysis of comparable projects serve as basis to calculate 'uplifts'**

### **More recent findings on cost-overruns and benefit shortfalls**

In the past decade, studies on the accuracy of cost estimation have provided further insight into different infrastructure sectors, but challenged the general approach put forward by Flyvbjerg. In 2013, Eliason and Fosgerau published a notable study<sup>1</sup>, which demonstrated that any process of investment selection will lead to biased outcomes (cost-overruns and benefit shortfalls) due to the property of statistical selection. The authors thus showed that there is an alternative explanation to 'deliberate misrepresentation' for the persistence of cost-overruns and benefit shortfall through time. Also in 2013, on the demand side, Rose and Hensher suggested that systematic demand shortfalls for toll roads can be at least in part traced to methodological problems in willingness-to-pay studies.<sup>2</sup>

► **New studies challenge traditional methodology**

Now an additional explanation for the persistence of cost-overruns has been discovered: In traditional cost estimation, the dominant project appraisal approach around the globe, planners rely on a historical unit price database from past contracts to calculate a cost estimate for current projects. Because the bidders in non-lump sum construction tenders do not express their revenue expectation through the contract unit price and they aim at generating revenues "beyond the contract" to make a profit, cost-overruns become inherent in future estimates. In a recent paper published in the journal *Transport Policy*<sup>3</sup> by ITF staff a functional link between cost performance and past unit price movements is demonstrated with empirical data.

► **Reliance on historical data skews cost performance**

Because a considerable time lag, sometimes several years, exists between the observations available in the historical unit price database and current market conditions, considerable misalignment between prices and the behaviour of bidders is possible. Although planners will try to adjust for these differences based on their experience, the empirical data indicates they are not always successful. In addition, the mechanism above allows the simultaneous presence of cost-overruns and benefit underestimation, an empirical characteristic which was present in Flyvbjerg's road project data that does not fit well with the argument of strategic misrepresentation.

► **Time lag translates to misalignment between prices and bidder behaviour**

### **Recommendations**

In practical terms, the improved understanding of the drivers of cost performance reveals that the use of the reference class forecasting approach might be difficult for purely technical reasons. Simplistic use of this tool could even exacerbate problems of cost (and benefit) estimation accuracy, rather than reducing it - some (limited) evidence that this can happen is already available<sup>4</sup>. In addition the UK has questioned the "uplift" as it introduced adverse incentives to increase spending on projects. Other authors show that

the systematic bias does not necessarily create a problem for project selection with the CBA<sup>5</sup>.

The new findings on cost performance of investments would probably not improve the ranking of investments in a CBA in a major way, but they can still be useful in informing the cost estimation process. If past cost performance data for informing current estimates is used, it should take into account the 'noise' from unit price movements. Provided a time series of sufficient length is available, it may be possible to separate the unit price component from other drivers of cost estimation inaccuracy, such as deliberate misrepresentation or sampling bias. Better accuracy of cost estimation in turn leads to a more accurate budgeting.

Awareness of how past unit price developments can influence current cost performance can assist in the interpretation of this performance. For example attention should be paid to the construction market and large impact events on the construction market, for instance the break-up of a cartel, which would lead to a major shift in unit prices. Cost performance should be a live (time-series) variable, which is continuously fed with new data.

The same recommendation is valid with regard to quantitative PPP Value for Money comparisons, where in the past uplifts for expected average cost overruns in traditional procurement have been applied (e.g. in the UK).

A holistic approach to cost performance thus needs to take into account two points:

- ▶ That project promoters are prone to misrepresentation of true cost (and benefits) of projects, which can be addressed through measures such as increased accountability and transparency.
- ▶ That bidders are prone to misrepresentation of their revenue expectations, which can be addressed through different contract structures (e.g. the use of Design and Build contracts vs Design-Bid-Build) and bidding approaches (e.g. average bid auction vs lowest bid).
- ▶ Application of the state of the art cost estimation that takes into account both factors above.

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<sup>1</sup> Eliasson, J., and Fosgerau, M. (2013). Cost-overruns and demand shortfalls – deception or selection? *Transportation Research Part B: Methodological*, 57, 105-113.

<sup>2</sup> Rose, J. M., & Hensher, D. A. (2013). Tollroads are only part of the overall trip: the error of our ways in past willingness to pay studies. *Transportation*, 1-19.

<sup>3</sup> Makovšek, D. (2014). Systematic construction risk, cost estimation mechanism and unit price movements. *Transport Policy*, 35, 135-145.

<sup>4</sup> Liu, L., Wehbe, G., and Sisovic, J. (2010). The Accuracy of Hybrid Estimating Approaches: A Case Study of an Australian State Road and Traffic Authority. *The Engineering Economist*, 55(3), 225-245.

<sup>5</sup> Börjesson, Maria, Jonas Eliasson and Mattias Lundberg, (2014), 'Is CBA ranking of transport investments robust?', *Journal of Transport Economics and Policy*, Vol. 48, May, No. 2, pages 189-204.

▶ **A sufficient data sample may enable extraction of 'noise'**

▶ **Interpretation of cost performance depends on the understanding of its drivers**

▶ **Apply state-of-the-art analysis, structure to curb strategic behaviour**