Forecasts: uncertain, inaccurate & biased?

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Abstract
Cost Benefit Analysis (CBA) is the dominating methodology for appraisal of transport infrastructure projects across the globe. In order to adequately assess the costs and benefits of such projects two types of forecasts are crucial to the validity of the appraisal. First are the forecasts of construction costs, which account for the majority of total project costs. Second are the forecasts of travel time savings, which account for the majority of total project benefits. The latter of these is, inter alia, determined by forecasts of travel demand, which we shall use as a proxy for the forecasting accuracy of project benefits. This paper presents results from an on-going research project on uncertainties in transport project evaluation (UNITE) that find forecasts of demand and costs to be not only uncertain, but at times also highly inaccurate and often displaying a concerning degree of bias. Demand and costs for road projects appear to be systematically underestimated, while demand for rail projects appears to be systematically overestimated. The authors compare the findings in the present study with those of previous studies and discuss the implications for the validity of project appraisal in the form of CBA. It is recommended that more attention is given to exploring various forms of uncertainties in the preparation of decision support, to better inform policy makers of the possible span of outcomes for a given project.

Preamble:
Below is a short outline of the arguments to be presented in the full paper. The main point of the paper is to illustrate a) that the type of forecasts presented herein are crucial to CBA results, b) that forecasting uncertainties can produce quite inaccurate and biased results, and c) that these uncertainties distort policy making when addressed inadequately (or completely ignored) in the preparation of decision support.

Costs and benefits of transport infrastructure
Cost benefit analysis (CBA) is typically the most common method of appraisal employed for public works projects, and transport infrastructure projects are no exception (Haezendonck 2007; Mackie 2010; Morisugi and Hayashi 2000; Odgaard, Kelly, and Laird 2005). As the name implies, CBA methodology measures the total worth of a project by comparing the costs and benefits of project implementation. Such appraisal is typically condensed into a set of performance measures in the form of net present value (NPV), internal rate of return (IRR), benefit cost ratio (BCR), or any combination of these (Leleur, Salling, and Ambrasaite 2012). Due to the complex interaction between transport related activities and other parts of society, there is a wide range of impacts that are desirable to evaluate when appraising transport infrastructure projects. However, for the vast majority of new projects there are two factors that dominate the results of an associated CBA. The first is the construction costs, which is by far the largest item on the cost side of the budget. The second is the travel time savings, which is by far the largest item on the benefit side of the budget. It is common for these two factors to make up three fourths or more of the total costs and benefits respectively (Banister 2008; Mackie, Jara-Diaz, and Fowkes 2001; Nicolaisen and Næss 2011), and for trivial road projects they will be closer to nine tenths of the total budget. It is thus imperative that the associated forecasts of construction costs and travel demand have a considerable degree of accuracy if CBA results in their current form are to hold any validity as decision support for policy makers.

Inaccuracy of forecasts
The inaccuracy of forecasts for both demand and costs has long been a topic of heated debate in transport planning, with contributions from a wide range of different theoretical perspectives (see e.g. Bain 2009; Brinkman 2003; Flyvbjerg 2007; Kain 1990; Mackinder and Evans 1981; NAO 1988; Parthasarathi and
It is probably a fairly uncontroversial claim that forecasting of future events is bound to be associated with some inherent uncertainty that makes completely deterministic forecasting impossible, and thus some degree of inaccuracy is to be expected. However, in the present paper we argue that forecasts are not only uncertain, but at times also highly inaccurate and often displaying a concerning degree of bias. In order to do so we have collected data for large set of completed transport infrastructure projects in Scandinavia and the United Kingdom. This data includes, where available, forecasts for the expected construction costs and travel demand, as well as comparable figures after the projects have been completed. Figures 1-2 display the inaccuracy of travel demand for road and rail projects respectively, with inaccuracy measured by the following formula\(^1\):

\[
I = \frac{E - F}{F} \times 100
\]

Figure 1: Inaccuracy of travel demand forecasts for road (left) and rail (right) projects respectively.

It should be evident from visual inspection of the above figure alone that demand forecasts for neither road nor rail projects display pinpoint accuracy. For road projects around one third of the sample have traffic that deviate more than 20% from the expected values, and there is a significant trend of more demand than expected to materialize after project implementation. For rail projects more than half of the projects deviate more than 20% from the expected values, and there is a significant trend of less demand than expected to materialize after project implementation. While road projects display less forecasting inaccuracy both in terms of imprecision and bias when compared to rail projects, the inaccuracy is quite considerable for both types of projects when used for subsequent appraisal methods such as CBA. We therefore advocate better treatment of uncertainties in the preparation of decision support, to inform policy makers of the possible outcomes of infrastructure projects. Measures for how to accomplish this will be briefly be discussed in this article and will also be the topic of other presentations from the UNITE project at Trafikdage 2012 (e.g. Salling 2012).

References:


\(^1\) I: Inaccuracy, F: forecast value (predicted), E: estimated value (observed)


