Examining Benefit-Cost Analysis (BCA) in Infrastructure Projects

Role of BCA in TIGER Grant Reviews – Common Errors & Extensions

Tony Homan

The views expressed herein are those of the author and do not necessarily reflect the views of any organization.
Transportation Investment Generating Economic Recovery (TIGER) – Department of Transportation (DOT)
What is TIGER?

• Part of 2009 Recovery Act
  • 9 Rounds 2009-2017
    • Primary focus of discussion rounds II-V
    • Conducted by the Office of the Secretary (OST)

• Provides funding for surface transportation infrastructure projects

• Merit based competitive process
  • Applicant had to prepare a BCA
  • DOT provided detailed BCA guidance and webinars to applicants
  • Key metric whether projects costs < project societal benefits
    • Reported by applicant in BCA but re-rated by DOT and placed in rating buckets
    • Most rounds before round VIII DOT could not award a grant if C>B
      • Currently, projects can be awarded grants if C>B

• Rating teams
  • Technical Evaluation teams, Project Readiness, Economic Review Team, & Control and Calibration (C&C) team
  • Review Team for final forwarding to DOT Secretary
Expected Issue with BCAs

• Quality of BCAs were bad
  • On an A-D grading, the average score was between a C and a C- (1st 5 rounds)
    • WHY?

• Projects forwarded to TIGER often not selected for economic reasons and often for political considerations
  • BCA ex-post exercise

• A quality BCA would often reveal a project that does not make economic sense
  • Solution is to prepare a poor BCA

• Want quality BCAs then award projects that make economic sense
  • If +net benefits don’t matter in awarding grants then keep on expecting bad projects and the corresponding poor quality BCA to justify them
    • Also don’t expect to maximize economic returns
Common Errors – Hall of Shame

• Incorrect Baselines
• No Alternatives
• Incorrect level of Affected Population
• Transfers as Benefits
• Property Value Increases
• Bike Trails paved with Gold
• Unjustified Benefit Categories
• Transparent and Reproducible Analysis
  • Intended math errors
How can this of Happened?

• Remember, BCA is an ex-post exercise for applicant’s pre-selected projects
  • Prior award patterns also matter (more to come on that)
• Box Checking and Bias to overestimate benefits and hide costs (Flyvbjerg, Holm, and Buhl (2005))
  • Don’t expect anyone to review the BCA & BCAs not linked to project selection
• When BCA’s reviewed often a Bias to Revenue Expenditure – focus on transfers (Boardman, Greenberg, Vining, and Weimer (2006))
  • “Guardian Effect”
• So does both reviewing the BCA and reviewing for the correct items change things? Hint: you still need stakeholder buy-in!
• Kroll (2015) – Transportation projects driven by political forces & poor quality BCA’s are a deliberate political decision
  • Public choice argument because benefits localized and costs spread out
DOT Econ Team

• Given these issues, DOT could not use applicant self reported net benefits
• Econ team re-rated projects Net benefits to provide useful information to Rating Team
  • Did not recalculate BCR but rather placed in a rating bucket
    • Benefits>Costs
    • Uncertain but B>C (likely)
    • Uncertain
    • Uncertain by C>B (likely)
    • Costs>B
  • Allowed for comparisons of projects by likely net benefit ranges
• Did this matter in selection?
• TIGER I - No (Adams, Homan, and Marach (2014 Public Work Management & Policy))
Program Review Rounds II-V (Homan 2014 Journal of Benefit Cost Analysis)

• 1st assign an ordinal scale to the ordered categorical ratings
  • Benefits>Costs = 5
  • Uncertain but B>C (likely) = 4
  • Uncertain = 3
  • Uncertain by C>B (likely) = 2
  • Costs>B = 1
  • Create average scores

• ANOVA single factor test
  • awardees and non-awardees – between means
  • by rating category (likelihood of getting award different by category) – among means

• Hypothesis test between rating category & average

• Pearson Tests
Results

• Net Benefits of grant awardees statistically significantly higher for awardees vis-à-vis non-awardees for all of rounds II-V
  • But only for individual rounds 2-3

• Probability of getting an award significantly likely not equal across ratings
  • Results skewed by highest rated projects
    • Not likelihood increasing as relative net benefits increases

• Highest rated projects (B>C) statistically likelier to get awards (II-V total and 4/5 individual rounds)
  • second highest category statistically not likelier to get award (II-V total) and 4/5 rounds less likely to get award (probability less than average)
    • Second lowest category likelier to get award than 2nd highest in two rounds (probability greater than average)
Implication

• Mixed bag
  • Some evidence that net benefits matter but some evidence that it does not
  • Continued incentive to forward projects that don’t make economic sense
  • Relatively few projects rated as $c > b$
    • Do all projects have some economic merit?
      • or something else?

• Program review discontinued after Tiger V
<table>
<thead>
<tr>
<th>Probability of Net Benefits</th>
<th>Total count of BC score for round/% of count awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TIGER II-V</td>
</tr>
<tr>
<td>1</td>
<td>6/0***</td>
</tr>
<tr>
<td>2</td>
<td>65/24.6***</td>
</tr>
<tr>
<td>3</td>
<td>234/27.8</td>
</tr>
<tr>
<td>4</td>
<td>194/28.9</td>
</tr>
<tr>
<td>5</td>
<td>94/44.7***</td>
</tr>
<tr>
<td>ALL</td>
<td>593/30.0</td>
</tr>
<tr>
<td>F-Test</td>
<td>3.53 (0.007)**</td>
</tr>
</tbody>
</table>

*Significant at a 90% level of confidence.
**Significant at a 95% level of confidence.
***Significant at a 99% level of confidence.
DOT IG Audit Tiger VII

- Audit Complete February 2018
- Audit review of a statistical sample of 55 projects did not identify any inconsistent application of BCA practices in econ team BCA reviews
  - Econ team determined 47 projects where c>b
- C&C team reassessed all 47 projects and effectively overturned 20 of the ratings – Six of those projects received grants
- IG reported that above actions “reduced OST’s ability to ensure a fair and equitable project application review process”
- Implication
  - Lack of stakeholder buy-in for project selection based on economic merits
  - Don’t expect project quality to improve and keep on expecting uninformative BCAs
  - Reduces economic returns from the program
There is Another Way! – Private Sector

• Project Finance is an ex-ante exercise
  • ROI analysis
    • Select projects that ≥ internal hurdle rate
  • NPV Analysis
    • Compare projects using NPV (common discount factor)
    • Asset Valuation
    • Investors want to know what an asset is really worth
      • Sellers want to know what is a reasonable price
• So is solution to mimic the private sector?
Chilean Model

• Chilean National Public Investment System
• Originally introduced by “the Chicago Boys” under Pinochet & kept by subsequent civilian administration starting with Patricio Aylwin
• Several filters before project selection
  • Checks and balances between promoting and evaluating agencies
• Strict BCA criterion
• No projects advance if c>b
• Run by civil servants with little political interference
• Best practices designed to stress economic returns of public investment of scarce resources
• Gómez-Lobo 2012 *Journal of Benefit Cost Analysis*
Conclusions for Improving Economic Returns

• Firewall between promoters and evaluators
• Transparent and standardized guidelines for preparing and evaluating projects based on best practices
• Incentivize use of ex-ante BCA in forwarding projects for consideration
• Credibility in evaluation process
  • Don’t move forward projects that do not make economic sense
• Minimize political involvement