Examining Benefit-Cost Analysis (BCA) in Infrastructure Projects

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

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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

Probability of Net Benefits	Total count of BC score for round/% of count awarded				
	TIGER II-V	TIGER II	TIGER III	TIGER IV	TIGER V
1	6/0***	0	1/0***	2/0***	3/0***
2	65/24.6***	11/36.4	15/20.0**	20/20.0**	19/26.3
3	234/27.8	66/25.8*	61/27.9	51/25.4	56/32.1
4	194/28.9	32/25.0*	46/21.7	56/39.3***	60/25.0
5	94/44.7***	19/68.4***	9/77.8***	34/23.5	32/43.8***
ALL	593/30.0	128/32.8	132/28.0	163/28.8	170/30.6
F-Test (Probability)	3.53 (0.007)***	4.82 (0.00)***	3.41(0.01)**	1.33 (0.26)	1.26 (0.29)

*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