

Modeling Practices to Ensure a Science of Science Policy

Jim Granato Frank Scioli Michelle Costanzo

Goal: Devising Valid Metrics for Policy

- For Applied Statistics:
 - Focus on the t-statistic ($\frac{b}{s.e.(b)} = t-stat$)
 - The t-statistic provides useful policy information (inference and policy simulation)
- Requirements (from the Cowles Commission):
 - Identification
 - Invariance
- T-statistic satisfies these requirements:
 - Structural parameter(s): numerator (b) of the t-statistic is the appropriate focus

The Challenge

- The policy analyst is rarely able to analyze systematically a complex policy question; especially if there are several options available for achieving a particular set of objectives.
- The goal is to create an integration of policy formulation and policy implementation strategies, within a social scientific framework, that allows the policy makers to make systematic policy choices.
- The issue for policymakers, is the degree to which they rely on such policy research as opposed to just using “common sense.”

The Case for Blurring the Distinction Between Academics and Policymakers

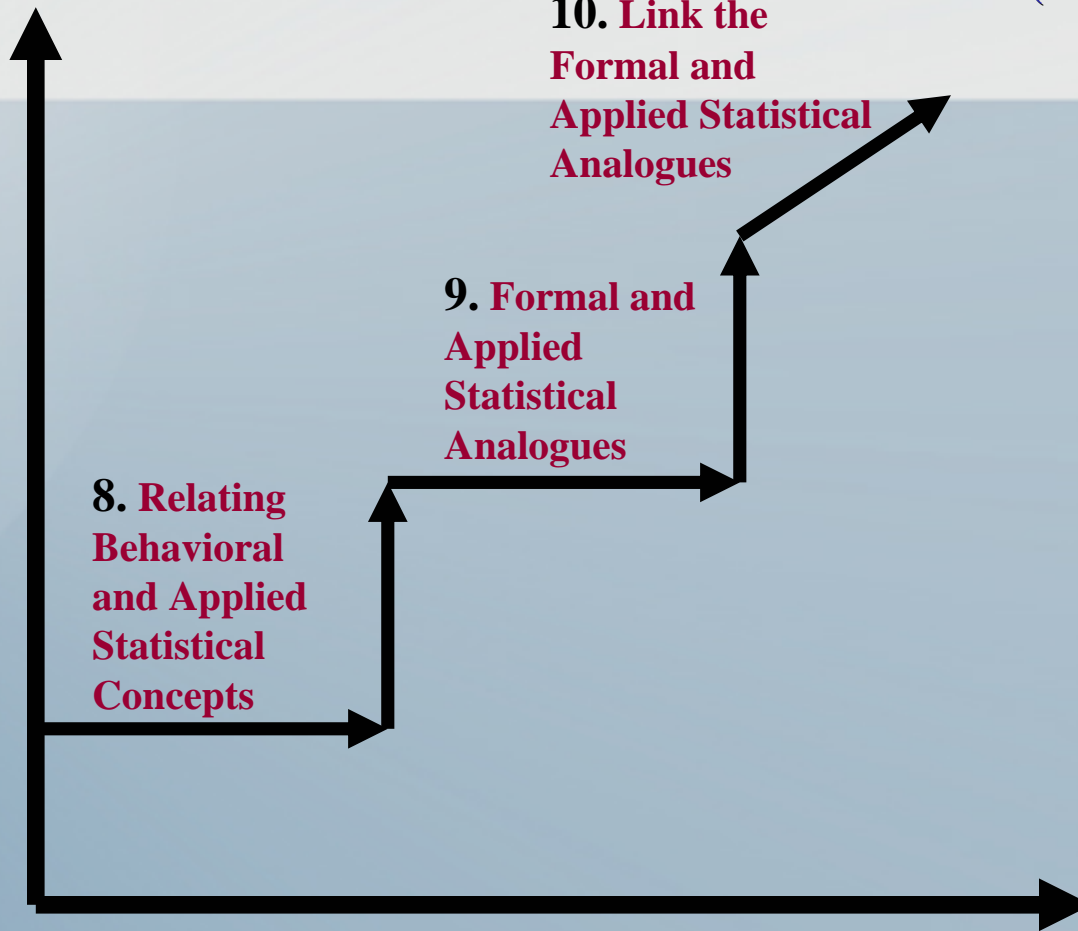
Alan Greenspan (2004) suggests that peaceful coexistence is possible in the conduct of policy:

“In designing strategies to meet our policy objectives, we have drawn on the work of analysts...A critical result has been the identification of a relatively small set of key relationships that, taken together, provide a useful approximation of the economy's dynamics... However,...our knowledge of the important linkages is far from complete and, in all likelihood, will always remain so (p. 5)...For such judgment, policymakers have needed to reach beyond models to broader --- though less mathematically precise --- hypotheses about how the world works.” (p. 7).

Figure 1

1. Scientific Accumulation

$$\frac{b}{s.e.(b)} = t - stat$$



3. IDENTIFICATION: “linking the model to the test” (focusing on “b”)

10. Link the Formal and Applied Statistical Analogues

9. Formal and Applied Statistical Analogues

8. Relating Behavioral and Applied Statistical Concepts

4. *Data Mining: inflating $\frac{b}{s.e.(b)}$

5. *Garbage Cans: inflating $\frac{b}{s.e.(b)}$

6. *Omega Matrices: manipulating *s.e.*, ignoring *b*

7. *Formal Models that Fail to Respect Facts

2. Falsifiability

How Alternative Research Practices Produce Inaccurate Results

- Practices that focus on manipulating the t-statistic provide misleading inferences.

- ✓ the manipulation of standard errors (s.e.(b)), instead of isolating and identifying structural parameters, can cause the t-statistic to lose its scientific merit.

- Why? These practices have little to do with establishing causal mechanisms (i.e., a failure to link the model to the test) .
- Leads to a lack of clarity of what the parameters signify (nonfalsifiability).

The Advantage of this Framework

- Identifies causal relations that explain empirical regularities.
- Provides a road map that has the flexibility to be modified, corrected, or followed.
- Provides a transparent linkage between theory and test.
- Allows for falsifiability: A result does not mean the model is correct.
 - But, if minimal requirements are met it supports the claim that the theory and test are related.
- This method allows identification of errors in the model.
- Allows for policy simulation (identification/invariance conditions emphasized).

Implications for Future Metrics

- Shares a similar emphasis to the Cowles Commission.
- Identify parameters in the model.
- An emphasis on parameters --- structural parameters --- provides transparent interpretation and allows for falsification.
- However, structural parameters are only part of what is necessary for falsification.
- It is equally important to account for shifts in behavioral traits such as public tastes, attitudes, expectations, learning, and the like.

Implications for Future Metrics (cont.)

- Need analogues (measurable devices) that represent formal and empirical concepts --- and ways to link them.
- Develop metrics on the degree to which free parameters can confound results:
 - the potential shifts in the free parameters may undermine invariance, which may result in nonfalsification.
- Develop “tolerance” criteria on the relation between the structural equations, the number of free parameters, and the potential to maximize falsification.

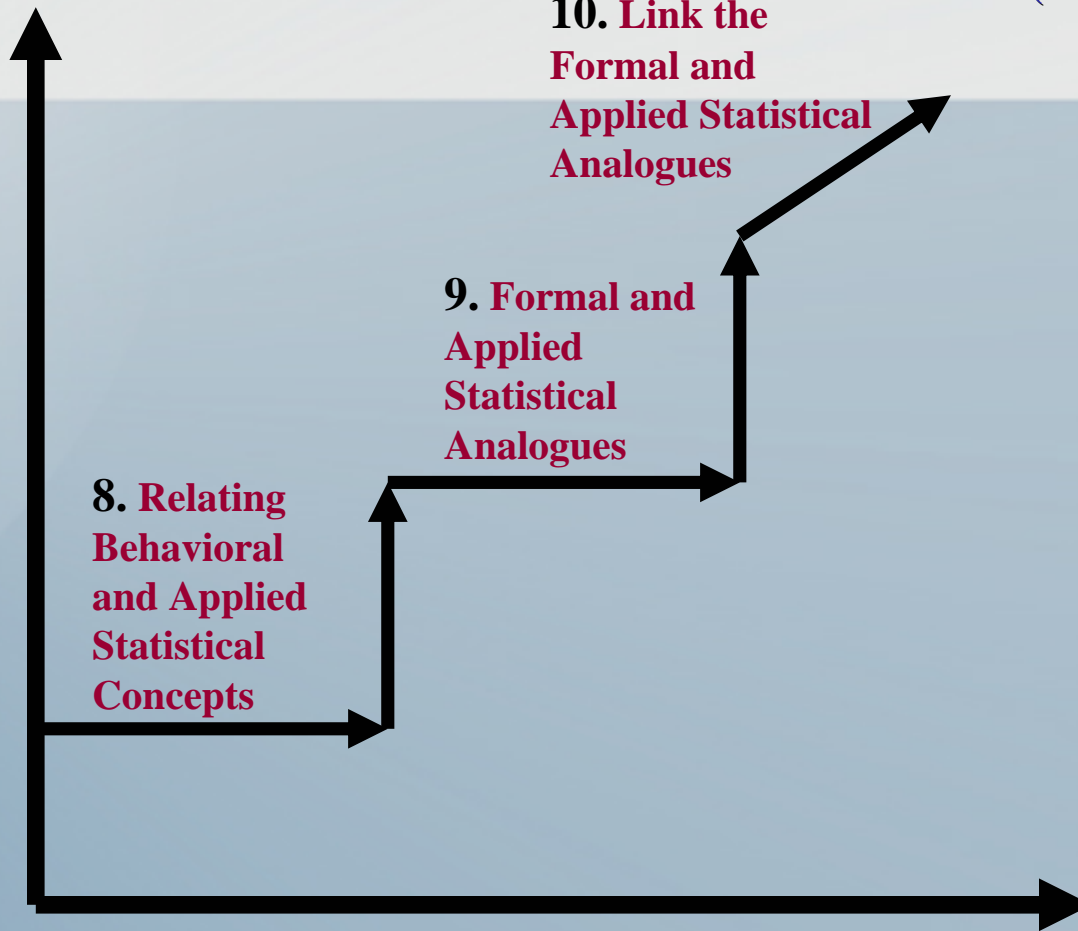
Short-Term and Long-Term Solutions

- The short-term solution is to structure training programs so policymakers can determine the robustness of existing practices. A standard can be enforced that will discourage current non-falsifiable practice.
- The long-term challenge is to restructure technical training so that metrics include a linkage between formal and empirical analysis.

Figure 1

1. Scientific Accumulation

$$\frac{b}{s.e.(b)} = t - stat$$



3. IDENTIFICATION: “linking the model to the test” (focusing on “b”)

10. Link the Formal and Applied Statistical Analogues

9. Formal and Applied Statistical Analogues

8. Relating Behavioral and Applied Statistical Concepts

4. *Data Mining: *inflating* $\frac{b}{s.e.(b)}$

5. *Garbage Cans: *inflating* $\frac{b}{s.e.(b)}$

6. *Omega Matrices: *manipulating s.e., ignoring b*

7. *Formal Models that Fail to Respect Facts

2. Falsifiability