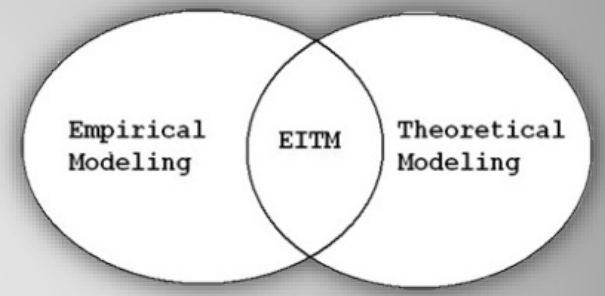
EITM: An Assessment with an Application to Economic Voting



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Introduction and Background

- The 2001 Workshop convened by the Political Science Program at the National Science Foundation (NSF).

- Why was EITM created?

1. Motivation.
2. Problem Diagnosis.
3. Remedies.

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Motivation

- ***Motivation 1***: Perceived weakness of the political science discipline at National Science Foundation (NSF).

❑ Granato and Scioli (2004) cite the following report relating how political science was perceived at NSF.

> "The recent *Report of the APSA Ad Hoc Committee on the National Science Foundation* found that political science had been characterized by as, "not very exciting, not on the cutting edge of the research enterprise, and in certain quarters as journalistic and reformist." We disagree with this statement and believe there has been considerable improvement in political science in the past 40 years through the use of formal models, case studies, and applied statistical modeling (page 313)."

❑ This negative perception also led to skepticism as to whether the political science discipline – and its current training practices – was methodologically equipped to improve upon the existing methodological status quo. Social, Behavioral and Economic Sciences Division Director Bill Butz stated all was not certain about the outcome:

> "Sometimes that works and sometimes you're just pushing on a string because the field isn't ready for it yet... And getting you all here and I judge from the papers it resonated with you, too. And we'll see in the succeeding year or 2 or 3 whether this is pushing on a string or whether it's really lighting a fire (EITM Workshop Transcript 2001: 18)."

Motivation

- ***Motivation 2***: Old antagonisms and the methodological status quo.

- Workshop participants were from varied methodological backgrounds where long antagonisms had existed and led to splits in departments as well as various subfields. But, EITM workshop panelist Dina Zinnes expressed hope that these old antagonisms between formal and empirical modelers could be overcome and lead to some meaningful advice.

> "First let me just say what a pleasure it is to be amongst this group of people. I have to admit that when I got those initial memos I sort of put them on the side burners, thinking, well, okay, I'll look at them eventually, because I was worried about the fights and the antagonisms that I thought would emerge. And it was with great delight that I read those and discovered, my gosh, there really is a consensus going on here. And listening to people this morning confirms that. I find that it's wonderful to see that both the empirical and statistical side and the modeling side really all sort of agree on certain things. And I think that's a fabulous beginning (EITM Workshop Transcript 2001: 113-114)."

Motivation

- ***Motivation 3***: Weaknesses in research design for NSF Competitions.

- In his role as Division Director over a six year period, Director Butz reviewed and approved over 16,000 proposals. He stated:

  "And of those 16,000, about 2 years ago I formulated just a sort of a stylized FAQ what the principal ways are to be sure that you don't get money from NSF. And out of all the possible reasons, there were three that came to the front…Now, it varies some across fields. And I don't mean to say that this is particularly true of political science, but I want to show it to you because it may give you an additional context for the reasons why scientific proposals fail in the social and behavioral sciences –how to get zero money (EITM Workshop Transcript 2001: 14)."

- One reason is even though basic conceptualization exists, there is still a failure to connect theories to tests:

  "there will be a well-developed deductive theory at the beginning, and then the next section will be data, the next section will be empirical equations, and you'll look at the empirical stuff and it's just – it's not connected, or it's only connected in the vaguest sense (EITM Workshop Transcript 2001: 14-15)."

- Another reason in his summary was inadequate specification:

  "I don't know how many panels I've sat in where people say, well, you know, we can't really tell how they're going to form this proxy from these variables, or we can't really tell how they're going to get over the statistical problem with such-and-such (EITM Workshop Transcript 2001: 17)."

- In concluding his presentation Director Butz states:

  "There are many other things that are wrong with proposals, but these two –something wrong with the theory and something wrong with the data or the statistical methods are two of the three most common ones across – and I really don't think there are very many exceptions to this – across the 18, I think now 19, programs in the social, behavioral, and economic sciences here. So I thought I would just point that out (EITM Workshop Transcript 2001: 16-17)."

Problem Diagnosis: Compartmentalization, Siloed Training and Thinking in Methodology

- "Isolation – ***compartmentalization*** – of fields and sub-fields is the *status quo* in political science…current field and sub-field structure exacerbates the separation between formal and empirical modeling. For example, focusing on a question that is particular to American Politics increases specialization and, turn, discourages integrating approaches and theories that would best come about from studying a particular research question in many countries (EITM Report 2002: 6)."

- Moreover, field and sub-field isolation reinforces separation between formal and empirical analysis including the belief that an:

  > "outdated perspective about formal and empirical analysis is the assertion that these technical-analytical approaches are simply interesting intellectual enterprises that lack political and social relevance (EITM Report 2002: 6)."

- The consequence of this divide is not neutral in its effect; indeed the effect can be negative. In particular:

  > "a good deal of research in political science is competent in one technical area, but lacking in another, that is, a formal approach with substandard (or no) empirical tests or an empirical approach without formal clarity. Such impaired competency contributes to a failure to identify the proximate causes explicated in a theory and, in turn, increases the difficulty of achieving a meaningful increase in scientific knowledge (EITM Report 2002: 1)."

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Problem Diagnosis: Compartmentalization, Siloed Training and Thinking in Methodology

- ***Siloed Training:***

1. Consequences for Formal Modeling.

   "Many formal modelers feel uncomfortable with powerful empirical concepts such as social norms, limited rationality, and psychological factors such as personality and identity. The usual argument is that formal models are not meant to fit data, or should not be. While there is much to be learned from pure theory and abstract formal arguments, the formal modeling isolation reinforces distance from basic circumstances that these abstract models could help to illuminate. This isolation also contributes to the basic misunderstanding noted above about the great attributes formal modeling brings to the scientific process (EITM Report 2002: 6-7)."

2. Consequences for Empirical Modeling.

   "Empirical modeling isolation, on the other hand, is equally guilty of not advancing scientific understanding when it fails to incorporate their "more complex and general assumptions" into a mathematically identified model with direct and testable implications. Instead "errors" or "confounding variables" that derail the inferential process are treated as statistical problems that require only statistical fixes (EITM Report 2002: 7)."

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Problem Diagnosis: Compartmentalization, Siloed Training and Thinking in Methodology

- Factors reinforcing the status quo:

1. ***The Intellectual Investment***: Scholars have to invest in different skill sets.
2. ***Training Differences***: Empirical modelers devote their energies to data collection, measurement, and statistical matters, and formal modelers focus on mathematical rigor.
3. ***Research Practice***: For empirical modelers, model failures lead to emphasis on additional statistical training or more sophisticated uses of statistics – usually to "patch over" – a model failure. Formal modelers, on the other hand, deal with model controversies by considering alternative mathematical formulations but this is usually done piecemeal.

- These implementation challenges are deeply rooted in the academic community – fostered by career incentives – taking years to overcome (Poteete, Janssen, and Ostrom 2010: 18-24). Consequently, "Old habits" learned in graduate school inhibit the desire to make the changes in skill development. But, the situation is worse since many things learned in graduate school tend to become out-of-date by mid-career.
- When methodological instruction reflects these status quo forces, successive generations will only repeat the shortcomings. Indeed, disciplines failing to provide incentives for this type of risk taking and re-tooling reduce the threat of an:

> "assembly-line model of research production that imperils innovative theories and methodologies and, in turn, scientific breakthroughs. One could make the argument that EITM or initiatives like it are unnecessary because the unfettered marketplace of ideas expedites best scientific practices and progress. But, it is precisely because there are significant rigidities (training and otherwise) in the current academic setting (imperfect competition) which makes EITM-type initiatives not only necessary – but imperative (EITM Report 2002: 8)."

- We now see, and have repeatedly seen, practices unsuitable for addressing complex issues. Invalid policy prescriptions take place: prediction without basic understanding of how a system under study works is of little scientific or social value.

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Proposed Remedies

- The 2001 EITM Workshop participants recommended that the Political Science Program at the NSF address the technical-analytical divide between formal and empirical approaches in three priority areas:

1. ***Education***: Training and Retraining.
2. ***Dissemination of Knowledge***: Conferences and Workshops.
3. ***Research***: Establishment of Research Work Groups.

Deliverables from the 2001 EITM Workshop

- A key achievement of the EITM initiative over the past years has been the EITM Summer Institutes. So far, the Summer Institutes have taken place or will take place at:

- Harvard University (2002).
- The University of Michigan (2003, 2006, 2009).
- Duke University (2004, 2008, 2014).
- UC-Berkeley (2005, 2010, 2013).
- UCLA (2007).
- Washington University, St. Louis (2003-2009).
- University of Chicago (2011).
- University of Princeton (2012).
- University of Houston (2012-2014).

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Evaluation: The 2009 EITM Workshop

- In 2009, the NSF Political Science Program convened a second Workshop asking faculty participants to evaluate the impact of the EITM initiative and, more specifically, the summer institutes.
- The 2009 Workshop participants indicated that EITM had a major positive scientific impact during the past decade.
- The 2009 Workshop also assessed the impact of the summer institutes. The data from an e-mail survey conducted by Washington University of past student participants in its institutes showed a positive effect of the institute on the participants' future progress. For example, 36 out of 43 respondents indicated that the institute played an important role in framing their dissertation projects, and 11 engaged in further collaboration with other EITM participants. More importantly, 23 of the 43 EITM graduates who participated in the survey went into tenure-track faculty positions.
- Similarly, an e-mail survey of participants of the first rotating summer institutes (Harvard, Duke, Michigan, UCLA, UC-Berkeley) found that 83 currently hold tenure-track assistant professor positions, five hold tenured associate or full professor positions, six were currently completing post-doctoral fellowships, three have other research positions, and nine are still students (the remaining 33 did not respond to the survey).

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EITM Definition and EITM Framework

- EITM is a method – even a mindset – where researchers treat formal and empirical analysis as linked entities intended to create a dialogue between theory and test.
- There is more than one way to link formal and empirical analysis.
- Below we present the EITM framework that was created at NSF.

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EITM Definition and EITM Framework

- The elements of EITM – the NSF version – involve a three-step framework:

Step 1. ***Identify and Relate Focal Concepts.***

- Concepts of particular concern in this framework reflect many overarching social and behavioral processes. Examples include (but are not limited to):
  - decision making
  - bargaining
  - expectations
  - learning
  - elements of social interaction (strategic and non-strategic)
- It is also important to find an appropriate statistical concept to match with the theoretical concept. Examples of applied statistical concepts include (but are not limited to):
  - persistence
  - measurement error
  - nominal choice
  - simultaneity
  - prediction

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EITM Definition and EITM Framework

Step 2. ***Developing Formal and Applied Statistical Analogues***.

- To link concepts with tests, we need analogues. Recall that an analogue is a device representing a concept via a continuous and measurable variable or set of variables. Examples of analogues for the behavioral (formal) concepts such as decision making, expectations, learning, and strategic interaction include (but are not limited to):

  - decision theory (e.g., utility maximization)
  - conditional expectations (forecasting) procedures
  - adaptive and Bayesian learning (information updating) procedures
  - game theory

- Examples of applied statistical analogues for the applied statistical concepts of persistence, measurement error, nominal choice, simultaneity, and prediction include (respectively):

  - autoregressive estimation
  - error-in-variables regression
  - discrete choice modeling
  - multi-stage estimation (e.g., two-stage least squares) and spatial econometrics
  - point estimates and distributions

Step 3. ***Unify and Evaluate the Analogues***.

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EITM: Clarifications

- ***EITM is broader than a research initiative***:

1. EITM is not just a research initiative.
2. EITM is an initiative that affects both training (education) and research.

> "The objective of EITM is to encourage political scientists to build formal models that are connected to an empirical test. As scholars merge formal and empirical analysis, we think they lay the groundwork for (social) scientific cumulation. Why? By thinking about the empirical implications of theoretical models, scholars develop clear-cut empirical tests of the models. This symbiosis means that concepts must be clarified, and causal linkages must be specified. Theories must meet the challenge of these tests, and empirical work must be linked to a theory. Theories and concepts that fail are discarded. Empirical work reveals the range and the limitations of theory. Useful generalizations are produced, and political science becomes worthy of its name (Granato and Scioli 2004: 314)."

- To be even more specific, the programmatic initiatives implementing the EITM initiative are found in the 2002 EITM Report (page 10):

> "To address the skills deficit in formal modeling, empirical modeling, and especially both, support can be provided for graduate training, post-doctoral opportunities, and mid-career re-tooling. Such support can include, but is not limited to, courses in formal and empirical modeling. For graduate students, funding could be provided for an additional year or two of graduate school to complete both formal and empirical modeling sequences. For faculty, support could be given to visit another department on campus or another institution."
>
> "Support can also consist of summer training institutes and training centers that are positioned to serve larger numbers of individuals while reaching graduate students and faculty who are in departments that cannot offer this training. These individuals become exposed to more experienced social and behavioral scientists who combine formal and empirical analysis. The forms of exposure can vary, ranging from a summer (semester) to shorter-term lectures or workshops (one-week)."

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EITM: Clarifications

- ***EITM and the division of labor in training and research***:

1. The EITM initiative understands a division of labor, particularly in foundational training courses.

> "…force clarity about assumptions and concepts; they ensure logical consistency, and they describe the underlying mechanisms that lead to outcomes. They also can lead to surprising results, such as the free rider problem or the power of the median voter, which have spawned substantial literatures (Granato and Scioli 2004: 313)."

- For empirical models, they:

> "can provide generalizations and rule out alternative explanations through multivariate analysis. Researchers are forced to conceptualize putative causes so that they can be reliably measured. Models can distinguish between causes and effects, allow for reciprocal causation, and estimate the relative size of effects (EITM Report 2002: 314)."

2. It is not the division of labor that is the problem; rather it is the methodological isolation which is harmful. EITM is meant to break the status quo in siloed training approaches.

> "What we find is that because they are generally treated by scholars as distinct, separable approaches, the three most common current research practices – formal modeling, case study analysis, and applied statistical modeling – deviate from this ideal. They therefore limit the possibilities for substantial enhancement of knowledge (Granato and Scioli 2004: 315)."

- In particular,

> "formal models can fail to incorporate empirical findings in order to provide a more accurate depiction of the specified relations. The models may be elegant, but too often they ignore, or even throw out, useful information. This results in modeling efforts that yield inaccurate predictions or do not fit findings. In fact, data may contradict not just a model's results but also its foundational assumptions (Granato and Scioli 2004: 313)."

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EITM: Criticisms

- EITM has been subject to criticisms. The criticisms center on two issues:

1. ***The lack of motivation for EITM.***

2. ***Disagreement about what constitutes a useful model and how this is related to the hypothetico-deductive method.***

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The lack of motivation for EITM

- There are many motivations for "pursuing an EITM strategy."

1. Reasonableness of assumptions: Abstract modeling is useful – indeed it is fundamental to the EITM framework. The point of departure is whether data exist to force changes in simplifying assumptions (Granato and Scioli 2004: 315).

> "The assumptions on which some formal modeling rests are often so at variance with empirical reality that model results are dismissed out of hand by those familiar with the facts. The problem is not just unreal assumptions, for one way to build helpful models is to begin with stylized and perhaps overly simple assumptions, test the model's predictions, and then modify the assumptions consistent with a progressively more accurate model of reality. Yet these follow-up steps are too often not taken or left unfinished, with the result being a model that does little to enhance understanding or to advance the discipline…
>
> One justification for "theories of unreality" is that realistic models are often so complex as to be of limited value. There is merit to this defense. An important function of formal modeling is to assist in identifying crucial quantitative and qualitative effects from those that are of minimal importance. However, the drive for simplicity can be taken too far."

- Moreover, it matters to respect and explain well understood empirical generalizations:

> "The use of simplifying assumptions is in principle a virtue and remains so when such simplifications do no harm to overall predictive accuracy. However, this does not mean that formal modeling should proceed without regard to glaring factual contradictions in its foundational or situation-specific assumptions. Rather, formal modelers must be especially careful to make sure that they test their models in situations that go beyond the circumstances that suggested the models, for it is there that simplifying assumptions are likely to lead to difficulties."

The lack of motivation for EITM

2. Poor current empirical modeling practices are equally at fault and again serve as motivation:

> "…the following ratio is the subject of much attention by applied statistical analysts because it is the basis for which "theories" survive or perish:
>
> $$\frac{\boldsymbol{b}}{\boldsymbol{s.e.(b)}}$$
>
> This ratio is commonly referred to as a "*t*-statistic". It is the "truth" that most applied statistical analysts are concerned with, and it can be confounded by influences that shift the numerator **(*b*)** in unforeseen ways. The denominator, the standard error **[s.e.(*b*)],** also is susceptible to numerous forces that can make it artificially large or small. In either case, avoiding false rejection of the null hypothesis (Type I error) or false acceptance of the null hypothesis (Type II error) is imperative. While the concern with Type I and Type II errors should be of prime importance, that unfortunately is not usually the case. Instead, the focus is on the size of the *t*-statistic and whether one can get "significant" results."

(1) Data mining.

> "The first tendency in trying to achieve "significant" results is the practice of data mining. Some political scientists put data into a statistical program with minimal theory and run regression after regression until they get either statistically significant coefficients or coefficients that they like. This search is not random and can wither away the strength of causal claims."

The lack of motivation for EITM

(2) Overparameterization.

> "A second practice is that many studies degenerate into garbage-can regression or garbage-can likelihood renditions. By a garbage-can regression or likelihood we mean a practice whereby a researcher includes, in a haphazard fashion, a plethora of independent variables into a statistical package and gets significant results somewhere. But a link with a formal model could help in distinguishing the variables and relations that matter most from those that are ancillary and, probably, statistical artifacts. More often than not there is little or no attention paid to the numerous potential confounding factors that could corrupt statistical inferences."

(3) Omega Matrices --- the use of weighting procedures.

> "The first and second practices lead to the third – statistical patching (i.e., the use of weighting procedures to adjust the standard errors [**s.e.(*b*)**] in the *t*-statistic ratio above)."

Statistical patches are seductive because they (for example):

> "have the potential to *deflate* the standard error and *inflate* the *t*-statistic, which, of course, increases the chance for statistical significance…There are elaborate ways of using error-weighting techniques to "correct" model misspecifications or to use other statistical patches that substitute for a new specification. For example, in almost any intermediate econometrics textbook one finds a section that has the Greek symbol Omega **(Ω).** This symbol is representative of the procedure whereby a researcher weights the data that are arrayed (in matrix form) so that the statistical errors, and ultimately the standard error noted above, are sometimes reduced in size and the *t*-statistic then may become significant."

The Usefulness of Models: Points of Agreement

- Significant scientific progress can be made by a synthesis of formal and empirical modeling. The advancement of this synthesis requires the highest possible levels of communication between the two groups. Formal modelers must subject their theories to closely related tests while, at the same time, empirical modelers must formalize their models before they conduct various statistical tests. The point is not to sacrifice logically coherent and mathematical models. Rather, it is to apply that same rigor to include new developments in bounded rationality, learning, and evolutionary modeling. These breakthroughs in theory will be accomplished with the assistance of empirical models in experimental and non-experimental settings.

- Another point of agreement is the use of "ideal worlds" as basis for understanding the inner working of a system as well as a foundation for subsequent work and cumulation. Clarke and Primo (2012) contend:

> "Ideal worlds also help establish benchmarks against which the real world can be judged. That is, through the examination of ideal worlds, we can begin to understand how reality falls short of some goal (page 82)."

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The Usefulness of Models: Points of Disagreement

- We begin to part company with Clarke and Primo (2007) on their view of assumptions and how this influences testing validity. They argue:

> "This argument would be quite valid except that *political scientists are well aware that almost all assumptions are false*. Data analysis therefore cannot inform a researcher as to whether or not a model is "confirmed." We should note that it is no defense to argue that our assumptions are "approximately true" or "true enough" (page 745)"
>
> "[t]esting a prediction or implication deductively derived from a model cannot help us to learn about the model itself (page 745)."

- This theme is also expressed in Clarke and Primo (2012):

> "whether the assumptions of a theoretical model are true or not, a test of the conclusions derived from the model are uninformative (page 169)."

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The Usefulness of Models: Points of Disagreement

- In short, their argument boils down to an act of preemptive scientific surrender and a recipe for continued compartmentalization and the status quo. We fail to understand why it is so difficult to consider fact based, data-driven assumptions --- using inductive reasoning, deductive reasoning or both --- to improve the linkage between theory and test.

- On this matter, Robert Solow (1956: 65) maintains:

> "[a]ll theory depends on assumptions which are not quite true. That is what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive. A "crucial" assumption is one on which the conclusions do depend sensitively, and it is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect."

- From Clarke and Primo's arguments it is unclear how they would sort out *the usefulness* of what they see *as useful models*. Would not data and testing enter into this process? Even undertaking logical exercises modelers at some point would need to know how much their argued for factor or factors matter. Reality is not optional.

EITM and the Hypothetico-Deductive (H-D) Method

- Clarke and Primo assert EITM is linked to the H-D method because of this statement about Granato and Scioli's (2004) "ideal world."

> "In an ideal world, where there is unification in approach, political science research should have the following components: 1) theory (informed by field work, or a "puzzle"); 2) a model identifying causal linkages; 3) deductions and hypotheses; 4) measurement and research design; and 5) data collection and analysis."

- What Clark and Primo fail to mention is this quote builds on a more general point about research design competence and overall proposal competitiveness for NSF proposals. Specifically, these same points were discussed in the 2001 EITM Workshop. The 2002 EITM Report summarizes the issues of basic construction:

> "In an ideal world, political scientists should be educated to do research that incorporates five major components: 1) theory (informed by field work or some "puzzle"); 2) a mathematical model identifying causal linkages; 3) deductions and hypotheses; 4) measurement and research design; and 5) data collection and statistics. However, one or more of these components often is absent in political science research and as argued by the EITM Workshop participants, the quality of formal and empirical modeling in political science is substandard (page 7)."

- The question we have is this. Are students not to be exposed to these elements in a research design (e.g., scope and methods) course? Moreover, since the EITM initiative is about methodological unification it makes no sense to think H-D is what EITM is about. Indeed, Clarke and Primo only focus their criticism on components 3 and 5 above, but the idea that students should not be trained to know the basics of deductive reasoning, hypothesis formation, data collection and statistics (analysis) --- which are all part of what constitutes the EITM framework --- strikes us as impairing student development with harmful future consequences for any scientific discipline.

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EITM and the Hypothetico-Deductive (H-D) Method

- The H-D method works in this way: first, formulate the hypotheses, then test the hypotheses, and finally examine whether the hypotheses are confirmed or disconfirmed (Clarke and Primo 2007: 744).

❑ Clarke and Primo's (2004) solution to their description of the problem is to "abandon the practices of the hypothetico-deductivism" (Clarke and Primo, 2004: 748), and suggest the following rules to integrate models and data:

1) explaining the purpose(s) that the model is used;

2) abandoning the practice of model testing;

3) performing data analysis *only* when the theoretical model serves empirical purposes;

4) considering data analysis as a way of new theoretical investigation, rather than just a final step of a study in a paper.

- The H-D method emphasizes the role of empirical models in scientific research, whereas the EITM framework emphasizes the integration of theoretical and empirical models.
- The EITM framework requires scholars to think about an abstract mechanism and simultaneously its connection to a real world.

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EITM and the Hypothetico-Deductive (H-D) Method

- When researchers use abstract concepts to constitute their ideal worlds and explain how their ideal worlds work, they must think about how to operationalize these abstract concepts and observe the function of their ideal worlds in the real world.
- We believe the rules proposed by Clarke and Primo serve as a good foundation for model building on both the formal and empirical side. We agree with the importance of explaining the purposes of a theoretical model (Rule 1) and treating the data analysis as a new path of future research (Rule 4).
- However, we argue that the quality of research based on these rules may remain sub-standard and preserves the harmful practices of the methodological status quo. Setting up "toy" models, which consists of just high-powered mathematics can serve as a starting point, but if successive iterations of said model continue to be at variance or any realistic regularity (i.e., explain facts) or provide any insight in the real-world system, then the value is questionable. We are also in favor of well-executed data analysis, which helps investigate the missing components (or even defects) in the theoretical model.
- The EITM framework emphasizes the role of a formal or mathematical model in building a theoretical relation between the variables of interest, and where an empirical model and test(s) are closely connected to the theoretical model. The EITM framework focuses on the unification between theoretical relations and empirical tests. The H-D method, by way of contrast, begins with a theory about how things work and derives testable hypotheses from it and its focus is to use empirical data to test the hypotheses that then validate a theory. In short, the H-D method concentrates on the relation between hypotheses and empirical tests, but is not necessarily about unification --- a transparent and direct link between theory and test.
- As a final point we are struck by Clarke and Primo's focus on the past and how they try to fit the EITM initiative and framework into a box. Their criticisms conjure up long ago debates including John Maynard Keynes (1939) critique of econometric methods and their usefulness. Then as now, formal and empirical tools continue their forward progress but it is a mistake to think this progress in tool development will not foster tighter linkages between theories and tests. This enhanced dialogue allows us to improve upon our current assumptions that often are short-cuts for the current state of data and formal and empirical techniques.

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How EITM Fits With Existing Research Strategies

- EITM can fit with existing research strategies in three ways:

1. ***Evolution of scientific accumulation***.
2. ***Comparing contradictory ideas***.
3. ***Test versus consistency evaluation***.

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How EITM Informs Debates

- Social scientists face two common challenges face in their research undertaking: developing useful theories that are realistic representations of human behavior on the one hand and making use of feedback from empirical observations in refining the theory on the other.
- In the scenario where the two processes are not linked – such as in the case where theoretical and empirical work is carried out separately in a silo – researchers are unable to obtain the benefits from the interaction of the two activities.
- The dilemmas that theory is ahead of data or data are ahead of theory can be dealt with more effectively employing the EITM approach.

How EITM Informs Debates

- ***Empirical Virtues***:

Data can inform theory (Ostrom 2010; Smith 2010).

- ***Formal Modeling Virtues***:

Formal modeling brings structure and discipline to theory building and model specifications (Achen 2002; Sartori 2003; Signorino 1999; Viner 1958).

- ***The synergy of the two processes***:

The EITM can play a significant role in linking these two activities. For example:

1. Vote choice (Orit Kedar 2005).
2. Voter turnout (Achen 2006).

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Limitations of EITM

- There are two main limitations:

1. ***Observational equivalence***: Observational equivalence is related to identification. Recall reduced form estimates fail to provide structural parameters and this requires use of model or parameter restrictions so identification is achieved. Observational equivalence occurs when two or more rival models provide statistically indistinguishable reduced form results. Moreover, observational equivalence can occur even if the respective models are identified. An important paper on this issue is by Thomas Sargent (1976). In his review of this issue Patrick Minford (1992) summarizes Sargent's (1976) results as follows:

> "…models may be fully identified; that is, the parameters of each may be individually retrieved by estimation of the full model (i.e. subject to all its restrictions). However, there is a useful potential connection with the concept of identification. If two models can be 'nested' in a more general model (usually a linear combination of the two), then, provided the coefficients of each model can be identified in this general model, it is possible to test for their significance and accordingly that of each model. In this situation, if (and only if) the coefficients cannot be identified, the models will be 'observationally equivalent' (page 425)."

- The good news is this challenge in distinguishing between rival models can be narrow --- occurring in one dependent variable, but not in other dependent variables --- but the bad news is its existence is still a problem. Potential solutions do exist but none are generalizable. They are for a specific case. These solutions include either imposing theoretically justified exclusion restrictions or identifying regime shifts that can yield theoretically distinct predictions. A combination of both is also possible, but this would depend on the specific set of models and data.

Limitations of EITM

2. ***Analogue development***: two technical challenges emerge:

   (1) One technical challenge is in developing analogues.

   (2) The other technical challenge relates to the framework's emphasis on parameters as a building block for ex post and ex ante prediction.

An Application to Economic Voting

- ***Statistical Fixes: The Wrong Approach***

- Past studies of economic voting based on survey data normally assume that voters hold government responsible for all changes in their personal financial situations.
- Under this assumption, theoretical specifications for the cross-sectional estimates of these studies are similar to the time-series estimates in macro-level studies.
- This similarity in specifications has led researchers to expect that the individual-level studies should produce findings in support of the aggregate-level ones, which show significant effects of economic performance on election outcomes.
- As it turns out, many of the micro-level research findings show instability of the coefficients as well as variations in the magnitude of economic vote. These cross-sectional studies fail to uncover an individual-level basis for the macro-level relation between economic circumstances and vote choice.

An Application to Economic Voting

- ***A Theoretical Solution: Opening the Way to EITM***

- Gerald Kramer (1983) is the first scholar to offer a paradigm change to the theoretical assumptions about retrospective voting by positing that the perception of individual welfare by the voter is determined by a governmental-induced component and an exogenous component caused by life-cycle and other factors that are beyond governmental control.
- Under this alternative specification, voters respond not to changes in their real income as a whole, but instead only to the portion of the change that is government-induced.
- This explains, to a large extent, why older approaches to estimating the effect of personal financial conditions on vote choice fail to produce satisfactory findings.
- Kramer's assumption has important methodological implications. The behavioral relation to be estimated involves only the government-induced component, but since both the government and non-government components are not observable to the voter, we have to deal with the "noisy" version of the variable which poses complicated estimation problems.

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- ***The Relation Between Expectations, Uncertainty, and Measurement Error***

❑ Alesina and Rosenthal relate the behavioral concepts of expectations and uncertainty to a measurement error problem in applied statistical analysis concerning economic voting. Specifically, they develop a formal model based on the – expectation-augmented – Lucas aggregate supply curve (Lucas 1973).

$$y_t = \bar{y} + \gamma(\pi_t - \pi_t^e) + \varepsilon_t \qquad (1)$$

❑ In equation (1), economic growth is a function of expectation on inflation (a government policy component) and uncertainty about incumbent competence (a non-policy component).

❑ where y_t is the rate of economic growth at time *t*, $\bar{y}$ is the natural (average) rate of growth. The component in the parenthesis denotes government policy: π_t is the actual inflation rate at time *t*, and π_t^e is the expected inflation rate at time t formed at time *t-1*.

❑ The model implies that growth is positive (negative) when the actual inflation rate is higher (lower) than the public's expected inflation rate.

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- Voters' uncertainty about competence of the incumbent is captured by the error term, ε_t which represents the unobserved shock to economic growth.

- The analogue in equation (2) formalizes the concept of uncertainty as a "signal extraction" or measurement error problem.

- Specifically, ε_t is broken down into two component parts: $\eta_t$is competence attributed to the incumbent administration relative to the other party, and ξ_t is the shock to growth beyond administration control. Both η_t and ξ_t are of zero means, with variances σ_η^2 and σ_ξ^2 respectively.

$$\varepsilon_t = \eta_t + \xi_t \qquad (2)$$

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- The model depicts the voter as myopic about the incumbent component.

- Uncertainty about incumbent competence follows a first-order moving average process (MA(1)).

$$\eta_t = \mu_t + \rho\mu_{t-1}\,,\ 0 < \rho \leq 1 \qquad (3)$$

- μ_t is incumbent competence at the current period (μ_t is iid, $(0, \sigma_\mu^2)$), μ_{t-1} is competence at the last period, and ρ denotes strength of persistence. It implies that competence is persistent for one time period (defined as two years in the model): it is fully realized at time *t*, and either fully or partially realized at lag time *t-1*. The lag allows for retrospective voter judgments (Granato, Lo, and Wong 2010a).

An Application to Economic Voting

- If the rational voter predicts inflation with no systematic error (that is, $\pi_t = \pi_t^e$, hence, $\gamma(\pi_t - \pi_t^e) = 0$), then the economic growth rate deviation from the natural growth rate is attributed solely to the incumbent's competence (η_t) and the stochastic economic shock (ξ_t):

$$\varepsilon_t = \eta_t + \xi_t = y_t - \bar{y} \qquad (4)$$

- When $\varepsilon_t = \eta_t + \xi_t > 0$, the actual economic growth rate is greater than the natural growth rate. This implies that the voter will determine whether this above-average economic growth is due to competence (η_t) or economic shock (ξ_t) or both.

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- Suppose voters make forecasts based on the belief that competence can persist and so they give greater or lesser weight to competence over time. This behavioral concept can be formalized using conditional expectations as an analogue for the optimal forecast of competence (η_{t+1}):

$$\begin{aligned} E_t(\eta_{t+1}) &= E_t(\mu_{t+1}) + \rho E(\mu_t \mid \mu_t + \xi_t) \\ &= \rho E(\mu_t \mid \mu_t + \xi_t) \\ &= \rho E(\mu_t \mid y_t - \bar{y} - \rho\mu_{t-1}) \end{aligned} \qquad (5)$$

- where $\mu_t + \xi_t = y_t - \bar{y} - \rho\mu_{t-1}$
  and $E_t(\mu_{t+1}) = E(\mu_{t+1} \mid \mu_t + \xi_t) = 0$

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- ***Unifying and Evaluating the Analogues***

- The behavioral analogues for expectations and uncertainty are linked to the applied statistical analogue for measurement error as an error-in-variables equation:

$$E(\eta_{t+1}) = \rho E\,(\mu_t \mid \mu_t + \xi_t) = \rho E(\mu_t \mid y_t - \bar{y} - \rho\mu_{t-1})$$

$$= \rho \frac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_\varepsilon^2}(y_t - \bar{y} - \rho\mu_{t-1}) \qquad (6)$$

- where $0 < \frac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_\varepsilon^2} \leq 1$

- Equation (6) is the competence model expressed as an error-in-variables regression. It illustrates the linkage of the behavioral analogue for expectation and uncertainty, and the applied statistical analogue of measurement error.

An Application to Economic Voting

- The expected value of competence at time *t+1*, $E(\eta_{t+1})$, is positively correlated with economic growth net of natural growth, $y_t - \bar{y}$, and the proportion of competence that does not carry over to the next term, $\rho\mu_{t-1}$.
- The variances fraction, $\frac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_\varepsilon^2}$, is the proportion of competence the voter observes and interprets and thus can be called the "competency signal" (Duch and Stevenson 2010). Its interpretation is two-fold:

1. When $\sigma_\varepsilon^2 \rightarrow 0$, $\frac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_\varepsilon^2} \rightarrow 1$ (The voter interprets the variability of economic shock as coming solely from incumbent competence.)
2. When σ_ε^2 increases, $\frac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_\varepsilon^2}$ decreases (The voter recognizes the increase of variability of exogenous shock, he/she assigns weight to competence.)

- The above process links the behavioral concepts of expectations and uncertainty with the empirical analogues of conditional expectations and measurement error, respectively, and estimates the variance-covariance structure of the residuals to analyze voter behavior. This illustrates that the unification of theoretical and empirical analogues contributes to analytical clarity and interpretative power that are otherwise not possible by relying on statistical fixes that are not based on correct specifications.

An Application to Economic Voting

- ***Leveraging EITM: Cumulation***

- Alesina and Rosenthal's model can be tested in other ways. Since not all microeconomic policies can induce politically relevant permanent changes in output, it is reasonable to assume that voters may reward incumbents for permanent growth, but punish them for less desirable cyclical growth. We can therefore test uncertainty differently by examining competence analogue of (η_t) with alternative measures.
- We summarize the cumulation of knowledge originated from Kramer's theoretical work in economic voting, as a result of a series of activities integrating various aspects of the theory and statistical analyses.
- These examples illustrate the contributions of the EITM approach of methodological unification through the emphasis on basic behavioral concepts, and the synergy of the mutually reinforcing properties of formal and empirical analysis.

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Study	Synergy between Theoretical Formalization and Empirical Analysis
Kramer (1983)	The study develops a theory of competence comprising two components: a government-induced change in economic outcome, and an exogenous shock to the economy.
Alesina and Rosenthal (1995)	The authors develop a competence model --- informed by Kramer's work --- and relate the theoretical concepts of expectations and uncertainty to the empirical analogues of conditional expectations and a measurement error problem.
Suzuki and Chappell (1996)	The study develops a version of the competence model with different measures for uncertainty. Voters are able to differentiate between permanent and temporary changes in economic growth in evaluating competence.
Lin (1999)	Lin develops a dynamic method with a rolling regression technique for diagnosing any structural instability of coefficients in aggregate-level economic voting models. The time-varying parameter regression technique is useful for examining historical contingencies in economic voting.
Mebane (2000)	The research formulates voter behavioral analogues in the form of a strategic coordination game formulation. Voters are assumed to possess both common knowledge and private information about the election. The analogues improve upon the homogeneous specifications about voters' knowledge in the original framework of Alesina and Rosenthal.

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Duch and Stevenson (2008)	The authors modify the competence model of Alesina and Rosenthal by using different measures for uncertainty that distinguish electorally dependent decision makers from non-electorally dependent ones. The modified analogues are applied to a variety of signal extraction problems, including the arrangement of domestic political institutions, attribution of policy responsibility, and the influence of the global economy.
Duch and Stevenson (2010)	The study applies the error-in-variables analogue in Alesina and Rosenthal to complex signal extraction problems in the contexts of uncertainty over domestic and global economic volatilities, as well as openness to global trade. The technique provides a competence signal explanation for the cross-national and dynamic variations in the magnitude of economic vote.
Alcañiz and Hellwig (2011)	Following Alesina and Rosenthal and Duch and Stevenson the authors apply this modified economic voting 17 Latin American countries. The findings indicate voters assign blame for economic outcomes to international and private-sector actors instead of electorally accountable actors.
Achen (2012)	The study relates the behavioral concept of uncertainty to a measurement error problem, but differs from Alesina and Rosenthal's myopic voter specification MA(1). Achen modifies the behavioral analogue so that voter's have a memory that is geometrically declining. This alternative formulation of voter memory is conditioned by the volatility of the economy which is unattainable in the Alesina and Rosenthal specification.

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Conclusion

- The EITM framework offers a synthesis of formal modeling and empirical analysis.
- ❑ Current methodological practices inhibit the cumulation of knowledge due, in part to the ongoing disconnect between formal and empirical modelers. The status quo is one where isolation of fields and sub-fields is dominant. Different fields and sub-fields are like different isolated islands and there is no bridge between them. Such compartmentalization exacerbates the separation between theoretical and empirical models leading to harmful effects for the cumulation of knowledge.
- Significant scientific progress can be made by unifying formal and empirical modeling.
- ❑ This methodological unification also leads to the use of an ever increasing set of behavioral concepts. Applying the EITM framework means new and better ways will be discovered to model human behavior. The repeated application of competing analogues raises the possibility of conceptual proliferation in thinking how humans act, but now with a sense there is a rigor in putting these new behavioral developments to the test.
- Application of the EITM framework means new and better ways will be discovered to model human behavior.
- ❑ We also believe we need to avoid the trap of conducting current debates using our past and current training as the basis for the debate. Straight jacketed thinking translates to an avoidance to dealing with known weaknesses in our current practices. Instead, what is needed is the belief that every idea can be pushed further and these new ideas survive --- for a limited time --- if they improve upon past and current practice.
- ❑ To work these new innovations are certain to possess properties we know to enhance understanding, whether it involves measurement, better ways to characterize human behavior, sampling, and more. But bear in mind the new ways of analyzing important and numerous social science research questions must also be designed to preserve and enhance the dialogue between the inner workings of a system and tests.

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