Perspectives on Computational Modeling

Dr. Richard W. Evans

January 4, 2017

Syllabus

- Syllabus on https://github.com/UC-MACSS/persp-model
- Go through syllabus
- How to submit assignments
- Tutorials

Assignment	Quantity	Points	Total Points	Percent
Problem Sets	9	10	90	90%
Evans Midterm	1	10	10	10%

Model

Def: Model

A set of cause and effect mathematical relationships between variables used to explain, predict, and understand phenomena.

- Exogenous variables: inputs to the model, taken as given, from outside the model
- Endogenous variables: output of the model, dependent on exog. vars.

Data generating process (DGP)

Def: Data generating process (DGP)

- Def. 1: A complete description of the mechanism that causes some observed phenomenon with all its dependencies (too complex)
- Def. 2: A simplified model version of the process that causes some observed phenomenon with its key dependencies.
    - This DGP or model must be specified in such a way that it could be used to simulate data.

Varian (1997): Model Building

- Hal R. Varian, "How to Build an Economic Model in Your Spare Time," in *Passion and Craft: Economists at Work*, eds. Michael Szenberg, University of Michigan Press, 1997.
  - Labor of love
  - Applies to all model/theory building across fields

7 key steps to building model/theory

1. Where to get ideas?
2. Is your idea worth pursuing?
3. Don't look at the literature too soon
4. Building your model
5. Making mistakes is important
6. Now search the literature
7. Give a seminar

1. Where to get ideas?

- Ideas are easy to come up with
- Come up with a lot of ideas and throw out all the bad ones
- Look for ideas outside of academic journals, e.g., newspapers, magazines, conversations, TV programs, radio programs
    - WARNING: This is an advanced and higher risk strategy that just doing incremental work or building directly off of someone else's work.
- Varian example: "A Model of Sales" TV adds

2. Is idea worth pursuing?

- Must be able to phrase your idea as a question?
- Must be bale to phrase your question in a way that a non-expert can understand
- Is it interesting? Ask a few people, both non-experts and senior researchers.

3. Don't go to literature too soon

- Key phrase is "too soon". You have to look eventually
- Good practice to come up with a model, even though you might be reinventing the wheel
- You might come up with a different approach than is found in the literature
- You can often come up with new ideas by beginning the process of modeling

4. Building your model

- Economic models:
  - Who are the people making the choices?
  - What are the constraints they face?
  - How do they interact?
  - What adjusts if the choices aren't mutually consistent?
- Work a simple example first
  - KISS: keep it simple stupid
  - Einstein: "[Your model] should be as simple as possible,... but no simpler."
- Then generalize it piece by piece

5. Making mistakes is important

Piet Hein: Danish mathematician, inventor, designer, author, and poet

The road to wisdom? Well its plain
And simple to express:
Err
and err
and err again
but less
and less
and less

- The back and forth of modeling is beautiful, exhilarating, and frustrating

5. Making mistakes is important

Quoting Varian (1997)

"This is the most fun part of modeling, and it can be very exciting when the form of the idea really begins to take shape. I normally walk around in a bit of a daze at this stage; and I try not to get too far away from a yellow pad. Eventually, if you're lucky, the inner workings of your model will reveal itself: you'll see the simple core of what's going on and you'll also understand how general the phenomenon really is."

- Sounds like Michelangelo sculpting

6. Now search the literature

- Start by talking to senior colleagues
- Puts the value of your contribution in context
  - Very important for publication
- AVOID: finding out late that someone else already did what you did

7. Give a seminar

- Show your work to other people
  - Giving a seminar is often easiest way for both parties
- You can lose perspective when you're deep in the trenches of your project
  - CASE 1: You may think something is obvious, when it is not to others
  - CASE 2: You may think something is complicated, when it is really obvious

Types of models

- static vs. dynamic
- Linear vs. nonlinear
- Deterministic vs. stochastic
- Behavioral vs. statistical

Let's build a model

- What is the research question?
- What is the process in question?
- What are the key factors?
- What are the key dimensions of heterogeneity?
- What is exogenous, what is endogenous?
- (How) Can you get data on these things?
- What are the constraints?
- Is anyone making decisions?

Examples from the news

- Murders are up in Chicago
- Airline flight prices
- The effect of fake news on elections
- The effect of lying on political candidates
- PS1: What determines how long popular musicians live?