

# Perspectives on Computational Modeling in Economics

**Dr. Richard W. Evans**

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# Syllabus

- Syllabus on [https://github.com/UC-MACSS/persp-model-econ\\_W19](https://github.com/UC-MACSS/persp-model-econ_W19)
- Go through syllabus
- How to submit assignments
- Tutorials

Assignment	Quantity	Points	Total Points	Percent
Problem Sets	8	10	70	77.8%
Evans Midterm	1	20	20	22.2%

# 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.

# How does Machine Learning fit?

- Increased focus/accuracy on prediction
- More complicated, less transparent models
- Harder to interpret
- Important current work by Susan Athey ([slides](#)) and others
  - Incorporate causality into ML models

## 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
- Talk to people in business; newspapers, magazines
- 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 able 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

# 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

- Is a government shutdown ever optimal?
- Should you fire an NFL kicker if he hits the uprights six times in one season?
- What are the potential effects on growth of the #MeToo movement
- Airline flight prices
- The effect of fake news on elections
- The effect of lying on political candidates
- **PS1**: When do you get married?