## How to Write a Good Model?

http://scholar.harvard.edu/files/laibson/files/seven_properties_2008.pdf

http://kieranhealy.org/blog/archives/2015/08/31/fuck-nuance/

- Why a model: formally demonstrate a clear explanation, tell a story, illustrate a mechanism
- The simpler the better: you should be able to explain the intuition of your model succinctly (Occam's Razor)
  - vs. Our initial/natural tendency is try to include everything.
  - If you can explain or predict y with f(x) and clear intuition, no need to model y as g(x, z).

- Use "Standard" assumptions as much as possible (need to know the literature)
  - Start with standard benchmarks and know/justify why you (or the model you use) deviate
    - Perfect competition
    - market clearing
    - full information
    - free entry/exit
    - efficient market
    - no agency problem
    - representative agent
    - constant return to scale
    - no friction/rigidity
    - no/low transaction costs
    - externalities?
    - observable quantity/quality
    - enforceable contracts
    - lots of sellers/buyers

    ....

- If your assumptions are not standard, they need to be plausible or defensible => need to carefully defend them!  E.g. with empirics, or other research results (e.g. experimental results for behavioral assumptions)

- Avoid building desired results into preference assumptions.  Have different behavior be the endogenous results, rather than exogenous assumptions.

- Be explicit about the predictions and implications of the model; the more the better

Starting out:

- Be creative (within above constraints) and persuasive
- Think about what the optimization problem is (objective, choice, constraints)
- Try to start reasonably general, then make simplifying assumptions (again, subject to above: standard assumptions)
- Units: normalizing a price to 1, but lose symmetry.
- Pay attention to functional forms*

Common functional forms and their implications:

(Justify why it's appropriate for the situations you try to model)

- Quasi-linear: $u(x) = x_1 + f(x_2, \ldots, x_N)$
  - Set $x_1$ to be the numeraire good with price normalized to 1; No income effect for $x_2, \ldots, x_N$
  - From max $x_1 + f(x_2, \ldots, x_N) + \lambda(Y - \sum_{i=1}^{N} p_i x_i)$, can see that with $p_1 = 1$, $\lambda = 1$ and $f'(x_i) = p_i$
  - Consumption of non-numeraire goods only depends on substitution effect

- Separable: $u(x) = \sum_{i=1}^{N} f_i(x_i)$
  - No cross partials

- Cobb-Douglas: $u(x) = \prod_{i=1}^{N} x_i^{\alpha_i}$ or equivalently: $u(x) = \sum_{i=1}^{N} \alpha_i \ln(x_i)$
  - usually normalized to have $\sum_{i=1}^{N} \alpha_i = 1$,
  - fixed budget shares: $x_i p_i = \alpha_i Y$
  - cross-price elasticities = 0 (neither gross complements nor substitutes)
  - a special case of CES

- CES: $u(x) = [\sum_{i=1}^{N} x_i^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}$
  - elasticity of substitution $\epsilon_{ij} = -\frac{\partial \ln(x_i/x_j)}{\partial \ln(p_j/p_j)} = \sigma$ is constant
  - important in Dixit-Stiglitz to pin down elasticity of demand
  - tractable model for increasing returns
  - useful for modeling complements and substitutes

- Leontief: $u(x) = \min(\alpha_1 x_1, \ldots, \alpha_N x_N)$
    - always consume fixed proportion regardless of price
    - indifference curves are right angles
    - typically used to illustrate special case

- Homothetic: $x \sim y \Longrightarrow \alpha x \sim \alpha y, \forall \alpha > 0$
    - more a property than functional form
    - commonly represented by functions homogenous of degree 1
    - Marshallian demand fo form: $x_i(p, Y) = f_i(p)Y$
    - nice properties for aggregation (income elasticity = 1)
    - Cobb-Douglas and CES are homothetic