

Section 1 Elements of Econometrics

- Econometric tasks
 - Estimation
 - How big a change in one variable tends to be associated with a unit change in another?
 - What is the elasticity of the demand for asparagus?
 - Testing hypotheses
 - Is the income elasticity of the demand for money equal to one?
 - Does the weather on the day a prospective student visits Reed affect his or her probability of attending?
 - Conditional forecasting/prediction/simulation
 - How many more students would Reed need to admit in order to fill its class if tuition were \$1000 higher?
 - What will happen to GDP next year if the Fed raises interest rates vs. not?
- Econometric models
 - Deterministic part of model (“Economic model”)
 - What is the **dependent (explained) variable**?
 - Linear or other relationship among the variables
 - What **regressors** (independent or explanatory variables) should be included?
 - What are the causal relationships among the variables?
 - Are there variables other than the dependent variable that are endogenous?
 - If so, we need to account for that and think about a model of the behavior of all endogenous variables jointly as a multi-equation system.
 - Stochastic part of model (“Statistical or econometric model”)
 - How should the error term enter?
 - Additive?
 - Multiplicative?
 - What probability distribution might it plausibly follow?
 - Vast majority of econometric analysis is done with linear (or log-linear) models and additive, Gaussian (normal) errors.
 - Specifying the econometric model is the **first step** of an econometric analysis
- Data
 - Experimental vs. observational data
 - Can we control the independent variables exogenously?
 - If not, are they truly exogenous?

- Cross-section data
 - Many units observed at one point in time
 - Examples include individual Census or survey respondents, states or countries, Reed students, colleges, etc.
- Time-series data
 - Same unit observed at many points in time (usually equally spaced)
 - Examples include national macroeconomic variables
- Pooled data
 - Observations both over time and across units, but not necessarily the same units in each time period
- Panel (longitudinal) data
 - Special case of pooled data
 - Multiple (same) units observed at multiple points in time
 - Examples include state-level or national-level time-series data (for many states or countries), a few survey datasets (e.g., PSID), many colleges observed over time.
- Estimation and testing
 - Determining the proper estimator for the data and model
 - May need to test properties of data to help determine this
 - Performing estimation and testing hypotheses of interest
- Diagnostic evaluation of model
 - Examination of diagnostic statistics
 - Residuals as clues to missing effects
 - Revise model, dataset, and/or estimation method and repeat.
- Assessment of validity
 - Internal validity: Are the assumptions required by the estimators reasonable for the dataset?
 - External validity: How broad is the set of populations to which these results can reasonably be applied?
- What does econometrics do?
 - Maps spaces of assumptions (model, data, estimation method) into space of conclusions (Is hypothesis true or false? How sensitive is this to that?).