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 prospie 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 interest rates next year if the economy recovers?
- Econometric models
  - Deterministic part of model ("Economic model")
    - Linear or other relationship among the variables
    - What variables should be included?
    - What are the causal relationships among the variables?
      - Which variables are exogenous and which are endogenous?
  - 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.
- Data
  - Experimental vs. observational data
    - Can we control the independent variables exogenously?
    - If not, are they truly exogenous?
    - We assume in the first part of course that explanatory variables are fixed by the experimenter.
      - This is not very realistic for most econometric applications.
      - However, the results that we derive can all be derived nearly equivalently as long as the explanatory variables are truly exogenous: independent of the error term and thus of changes in the dependent variable.

- o 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.
- o Time-series data
  - ▪ Same unit observed at many points in time (usually equally spaced)
  - ▪ Examples include national macroeconomic variables
- o Pooled data
  - ▪ Observations both over time and across units, but not necessarily the same units in each time period
- o 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
  - o Determining the proper estimator for the data and model
    - ▪ May need to test properties of data to determine this
  - o Performing estimation and testing hypotheses of interest
- Diagnostic evaluation of model
  - o Examination of diagnostic statistics
  - o Residuals as clues to missing effects
  - o Revise model, dataset, and/or estimation method and repeat.
- Assessment of validity
  - o Internal validity: Are the assumptions required by the estimators reasonable for the dataset?
  - o External validity: How broad is the set of populations to which these results can reasonably be applied?
- What does econometrics do?
  - o Maps spaces of assumptions (model, data, estimation method) into space of conclusions (Is hypothesis true or false? How sensitive is this to that?).