ECONOMICS 6002 CLASSES 1-2
THE CLASSICAL LINEAR REGRESSION MODEL
AND ORDINARY LEAST SQUARES

1. The Classical Linear Regression model
   a. Notation
      i. Dependent variable **y** Nx1 vector
      ii. Independent variables **X** NxK matrix
         (1) Treatment of constant term
      iii. Stochastic disturbance **ε** Nx1 vector
   b. Assumptions
      i. Linearity: $y=X\beta+\varepsilon$
      ii. X has rank K
      iii. ε is a random variable identically and independently distributed with mean 0 and finite variance.
      iv. X is exogenous $\Rightarrow E[X'\varepsilon]=0$.

2. The Ordinary Least Squares Estimator $\beta^{OLS}=(X'X)^{-1}X'y$

3. Motivation for OLS
   a. Best fit - minimizes Mean Squared Error
   b. Implies $E[X\varepsilon]=0$ (errors orthogonal to regressors)
   c. OLS is Best Linear Unbiased Estimator (BLUE) - Gauss-Markov Theorem

4. Stochastic properties of OLS Estimator
   a. β^{OLS} is a random variable, with a sampling distribution.
      i. Sampling distributions and Monte Carlo analysis
   b. Under CLRM, β^{OLS} is unbiased: $E[\beta^{OLS}]=\beta$.
   c. Under CLRM, β^{OLS} is **best linear** unbiased - efficiency property.
   d. Under CLRM, β^{OLS} is **best** unbiased if ε is normally distributed.

5. Large Sample Properties of Ordinary Least Squares
   a. Why should we be concerned with asymptotic properties?
   b. Consistency and the Law of Large Numbers
   c. Asymptotic normality and the Central Limit Theorem
   d. Asymptotic efficiency

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