Econometric basics
Applied Macroeconometrics
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Econometric Basics

Every well-trained economist—perhaps all but the most purely theoretical—should understand the following. You will be responsible for knowing the following at all times.

1 Basic probability/stats

1.1 Basics

- Random variable
- Probability model (sometimes: complete probability model)
- Distribution function
- Density function
- Independence
- Conditional distribution
- Joint distribution
- Marginal distribution
- Relation among conditional, joint, and marginal distributions
- Mean, expectation, conditional expectation
- Variance
- p^{th} moment, p^{th} central moment.
- Covariance
- Correlation
- Skewness

- Kurtosis
- Median
- Quantile, percentile, decile, quartile, ???tile.
- Sample versions of mean, variance, covariance, correlation, moment, skewness, etc. (e.g., sample mean)
- Bayes's Rule

1.2 Building blocks of asymptotics

- Weak law of large numbers
- Convergence in probability; probability limit (plim)
- Convergence in distribution
- Central limit theorem
- Delta method

1.3 Distributions

- Binomial
- Gaussian or normal
- Chi-squared
- t, (student's t)
- F
- Wishart, inverse Wishart

2 Estimators

2.1 Basics

- Estimator
- Unbiased estimator
- Consistent estimator

- Variance of estimator
- Mean squared error of estimator
- Efficient estimator
- Robust, heteroskedasticity/autocorrelation consistent estimator of variance-covariance matrix
- Model selection criterion (AIC, BIC, etc.)

2.2 Ordinary least squares (OLS)

- Ordinary least squares estimator
- see also Gauss-Markov Thm. in classic results

2.3 Generalized least squares (GLS)

- GLS estimator
- feasible GLS estimator

2.4 Method of moments

- Method of moments estimator
- Generalized method of moments estimator
- Moments (to be used in estimation)
- Weight matrix

2.5 Maximum likelihood estimation (MLE)

- Likelihood function
- Maximum likelihood estimator
- Score function
- Information matrix (Fisher's information matrix)
- Also, likelihood ratio test (see testing) and Neyman-Pearson lemma and Cramer-Rao bound in classic results.

2.6 Relations among estimation strategies

- Relations among OLS, FGLS, GMM, MLE

3 Endogeneity/Simultaneity/Identification

- Endogenous variable/endogenous regressor
- Identified parameter vector
- Instrument
- Instrumental variables estimator
- Two stage least squares estimator
- Classical rank condition for identification

4 Inference

- Classical confidence interval/confidence set
- Confidence level or coverage of confidence interval
- Classical test
- Size
- Nominal size
- Power
- Type I error
- Type II error
- Pivotal statistic, asymptotically pivotal statistic
- Consistent test
- Uniformly most powerful test
- Wald test
- Lagrange multiplier (LM) test

- Likelihood ratio (LR) test
- Relations amon Wald, LR, LM tests.
- also see Neyman-Person lemma in Classic Results

5 Some classic results

- Chebyshev's inequality
- Cauchy-Schwarz inequality
- Gauss-Markov Theorem
- Cramer-Rao bound
- Neyman-Pearson lemma

6 Bayesian statistics

- Model/likelihood function
- Prior distribution
- Data
- Posterior distributoin
- Bayesian update
- Conjugate prior