**Econometrics videos – advanced**

1. Functional misspecification, leading to bias in estimators
   1. Returns to age/education in terms of wage rate
   2. Advertising – multiplicative model as opposed to a linear model. It is misleading to assume that the effect of advertising is fixed
2. Derivation of the Gauss-Markov theorem
   1. Linear algebra
   2. Summation
3. Degrees of freedom definition – explain what it means.
   1. Give example of a straight line constrained by the y intercept, then the same straight line constrained by the gradient
   2. Explain what it means in regards to a data series e.g. the residuals. The sum of residuals must be zero, and the x-weighted sum of residuals must also be zero
4. Population variance and sample variance <http://en.wikipedia.org/wiki/Variance#Population_variance_and_sample_variance>
   1. The sample variance is a consistent but biased estimator
   2. Again explain in terms of the degrees of freedom. Only (N-1) of the data values are free to vary so have a variance sigma squared.
   3. Sampling distribution of the sample variance proof
   4. <https://onlinecourses.science.psu.edu/stat414/node/174>
5. Derivation of the estimate of the population variance – why should we use RSS divided by n-K rather than RSS/n
   1. <http://web.njit.edu/~wguo/Math644_2012/Math644_Chapter%201_part2.pdf>
   2. Better imagine sum u-squared as a series of n terms. However, the last two terms are not free to vary – therefore have a variance of zero. Hence E(sum(u-squared) = (n-2)sigma\_squared)
6. Errors and estimated errors
7. Residual sum of squares and its relationship with the total sum of squares
8. R – squared of a regression. Explained sum of squares divided by the total.
9. R – squared vs adjusted R squared
   1. Show the graph of R vs adjusted R squared as more noise variables are added to the regression
10. Derivation of beta hat sampling error assuming no serial correlation and no heteroscedasticity
11. Derivation of the standard errors in beta hat for bivariate model: why do we need to get the standard error? As a way so that we can add a degree of confidence to our point estimates of population parameters
12. Serial correlation: the issue of biased standard errors
13. Heteroscedasticity: the issue of biased standard errors
14. Demonstrating unbiasedness of OLS under conditions
15. Mathematical derivation of omitted variable bias
16. The meaning of the expectation of a variable, and the variance of a variable. The difference between the population variance and sample variance

**Distributions**

1. What is meant by a distribution of a random variable?
2. Normal distribution – qualitative description of why it is so popular. Why does it explain so many real life situations and statistics? Introduction to the CLT
3. The mathematics behind the normal distribution
4. The t distribution and its relationship with the normal. As N->inf the t distribution converges to the normal, since the estimator of the population variance tends to the true value. Talk through the basis for formation of the t distribution in terms of the normally distributed LS estimator as a numerator divided by another random variable (our estimator for the population variance).
5. The derivation of the t distribution

**Testing for validity of the Gauss-Markov conditions**

1. Hypothesis testing: the null hypothesis vs the alternative
2. The idea of a distribution under the null hypothesis being true
   1. The null t distribution centred around zero vs the actual hypothesis (a t distribution that is centred away from zero)
3. Normal distribution hypothesis testing example
4. Normal distribution vs t distribution – the t distribution is when the population variance is unknown. <http://en.wikipedia.org/wiki/Student's_t-distribution>
5. The t test as the distribution that is used to test for significance of individual coefficients in regressions. Talk through the basis for formation of the t distribution in terms of the normally distributed LS estimator as a numerator divided by another random variable (our estimator for the population variance). The distribution of the error estimator
6. The F test as a way of testing for the significance for multiple coefficient significance
7. The shape of the F distribution for a number of different degrees of freedom
8. Tests for heteroskedasticity:
   1. Goldfeld-Quant test
   2. Breusch-Pagan test
   3. White test
9. Summary of tests for heteroskedasticity (pros and cons of each test)
10. Tests for serial correlation
    1. Durbin-Watson test
    2. LM test
11. Summary of pros and cons of serial correlation tests
12. No (simple) test for endogeneity of regressors

**What to do in the event of violations of Gauss-Markov conditions (serial correlation and heteroskedasticity)?**

1. Heteroskedasticity as a symptom of omitted variable bias
2. Serial correlation as a symptom of omitted variable bias/functional misspecification
3. Heteroskedasticity: review of the problems it causes practically. There are other estimators which are more efficient than OLS. Standard errors which are now reported are biased/wrong when heteroskedasticity is present.
4. Intuition behind weighted least squares as a remedy to heteroskedasticity (give less weight to those observations which are in regions which have a higher associated error)
5. Weighted Least Squares as a new estimation technique to remove heteroskedasticity
6. The problem with weighted Least Squares (we need to know the exact form of the heteroskedasticity that is present)
7. Corrected standard errors for the presence of heteroskedasticity
8. Why can’t we just use corrected standard errors always? Shouldn’t they always just reduce to the normal reported standard errors when we have homoscedasticity? Harmless Econometrics…remember that only under certain circumstances it is ok to use corrected standard errors…
9. Corrected standard errors for serial correlation
10. Estimation of models which correct for the presence of serial correlation. Need to be certain about the differences between Cochrane-Orcutt vs GLS
11. The assumption of normal errors in the t test and F tests: the need for normality
12. The asymptotic distribution of the sum of errors. When is it acceptable to go with the results of the central limit theorem?
13. The LAD estimator as a solution to non-normally distributed errors.
14. The use of non-normal distributions for inference
15. Tests for normality: Jarque-Bera and other test statistics

**What to do in the event of endogeneity?**

1. Causes of endogeneity: quick review. Typically omitted variable bias can be alleviated by inclusion of important variables in regression, functionally specifying the model correctly, reduce measurement error in independent variable. However, it may not always be possible. For example it is not possible to reduce the reverse causality of a process!
2. Introduction to IV estimators – can we give an intuitive example. The effect of variable Z on Y is only through X. Therefore measuring the ratio of the covariance of Y with Z to X with Z gives a measure of how much y moves in response to changes in x. The intuition is that a 1 unit increase in z causes x to increase by 2 unit, and y to increase by 4 units (through its action on x only). Therefore the effect of x on y must have a beta of 2.
3. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.187.8190&rep=rep1&type=pdf>
4. <http://homepage.ntu.edu.tw/~econman/camp/josh2.pdf>
5. Mathematically explain the IV estimator: deriving the conditions for the estimator to be consistent
6. IV bias: how does the bias of IV estimators vary? How does the bias compare with OLS?
7. Bad instruments: a number of examples of this – maybe three videos
8. Weak instruments: what is the effect of using weak instruments on consistency
9. IV vs OLS: when instruments are weak/bad how do they compare?
10. Multiple IVs: 2SLS vs IV estimation
11. Proof that OLS is identical to 2SLS for the case of a single instrument
12. The reduced form relationship importance! Angrist: it allows one to see the manner in which variables affect the dependent variable
13. IV estimator for the case of binary dependent and independent variables
14. Proxy estimation vs IV estimation. Conditions when proxy estimation leads to consistent estimators
15. Inference using IV estimators: finding their variance
16. G-M conditions revisited for an IV estimator
17. Bias of IV estimators derivation (advanced)

<http://www3.grips.ac.jp/~yamanota/Lecture%20Note%208%20to%2010%202SLS%20&%20others.pdf>

Time Series

1. Why do we need to think about time series in a different way to cross sections? There is dependence so we cannot think about the x and ys as coming from an independent sample. Hence there is a need to modify the Gauss –Markov assumptions.
2. The G-M assumptions for time series
3. The modified G-M assumptions: explanation of strict exogeneity
4. Why do we require strict exogeneity?
5. An introduction to time series processes: AR(1)
6. An introduction to time series processes: MA(1)
7. Examples of AR and MA processes
8. Correlograms and partial correlation as a means to test for what type of time series is present
9. Stationary regressors: what does it mean for a series to be stationary?
10. Why is stationarity important? Weak dependence replaces the assumption of a random sample, which allows a CLT to apply to allow inference in large samples.
11. Stationarity: what is the problem with using non-stationary regressors? Spurious regression ex 1
12. Stationarity: spurious regression ex 2
13. Stationarity as a criteria for requiring that the large sample properties of an estimator hold <http://academic.reed.edu/economics/parker/s13/312/tschapters/S13_Ch_2.pdf>
14. Stationarity fully-defined mathematically: mean, variance and covariance
15. Full explanation of the intuition behind these assumptions for stationarity
16. What types of data are most susceptible to time series non-stationarity?
17. Conditions for stationary MA(1) processes
18. Conditions for stationary AR(1) processes
19. AR(1) persistency when rho equals one. How does it differ qualitatively from the case when rho is less than one?
20. A linear time deterministic time trend vs a stochastic trend
21. How do we detect if a data series is time series stationary? Graphical test first!
22. Dickey-Fuller test
23. Augmented Dickey Fuller tests. How to choose how many lags to include in the specification test? Time trends in DF tests.
24. The need to use another distribution rather than a t distribution
25. Transformation of highly persistent series. I(0) vs I(1) vs I(2)
26. Examples of typically I(1) and I(2)
27. Correlograms and partial correlograms
28. Short-run and long-run dynamics
29. The lag operator and the Koyck transformation. The similarity between an AR(1) process and an infinite distributed MA process
30. Cointegration of non-stationary time series
31. The partial adjustment model
32. Error correction models
33. ECM: the long run relationship
34. Rational expectations – the form of series that this leads to

**Undergraduate amends**

1. Random walk not weakly dependent – change end. Not quite correct to say that correlation tends to zero!

**Any further undergraduate topics which need to be covered?**

1. Correlation coefficient and t test for significance
2. The correlation coefficient as a geometric mean of the regression of y on x and vice versa
3. T test for equality of sample means with equal variance
4. T test for equality of sample means with unequal variance
5. Proof that the sample mean is BLUE
6. Chow test
   1. Other tests which are related to coefficients
   2. Testing equality of regression coefficients: explicit form (substitute delta=beta1-beta2), and using unrestricted and restricted models
7. Observation leverage and partialled regression coefficients
8. Ramsey RESET test for functional misspecification
9. The benefits of log models (to reduce heteroscedasticity, and make the dependent variable go from –inf to +inf.
10. Video clarifying the G-M assumptions of a random sample and serial correlation
11. Simultaneous equation models – problems with estimation
12. SEM – demand and supply example
13. Simultaneous equation models – identification
14. Simultaneous equation models – reduced form
15. SEM estimation – using IV estimation
16. Method of moments estimation
17. Example of method of moments estimation
18. Benefits of MM
19. Intro to GMM
20. Regression through the origin
21. Stochastic regressors vs non-stochastic
22. Monte Carlo estimator testing
23. Variance inflation factors: diagnosing the presence of multicollinearity
24. Autocorrelation reference – highly searched term for econometrics
25. Hendry general to specific model building
26. The proof that the correlation coefficient lies between -1<rho<+1
27. Cauchy-Schwarz inequality
28. Score tests(LM test), Wald test, LR test
29. Finite sample choice between LM, Wald and LR
30. Independence vs disjoint
31. Bayesian formula explanation
32. Unit roots: an introduction
33. Represent the variance of an estimator intuitively by showing the slope of an estimated line changing
34. Intuition for benefits of taking of dependent variable (see Jamie and Nathan notes) to do with the error making y (>0) negative if the error is homoskedastic. Also it makes variables look more normal.
35. Negative R-squared: how it can come about
36. Wald estimator IV for binary dependent variables
37. Wald, LM and LR tests introduction in a single video
38. Many dummy variables video
39. Direction of bias for OLS estimators video
40. Intuition behind the superconsistency of OLS

**Discrete choice models**

1. The linear probability model
2. The problems with the linear probability model
3. Logit and probit models as a solution to the issues with the LPM
4. The intuition behind the logit and probit models
5. Interpreting regression coefficients in logit and probit models. Differentiation
6. Log odds ratios
7. Proof of the derivation of the probit model
8. How do we go about estimating these types of models? We need a new paradigm of estimation: maximum likelihood
9. Testing for endogeneity
10. After ML section, a discussion of how we diagnose the problems with a logit/probit model

Maximum Likelihood Estimation

1. The intuition behind maximum likelihood estimation
2. Maximum likelihood: why we can choose to max log likelihood, as opposed to likelihood
3. Properties of maximum likelihood estimation
   1. Regularity conditions
   2. <http://irving.vassar.edu/faculty/wl/Econ210/Maxlikelihood.pdf>
4. Problems with ML (compared with Bayesian techniques for example)
5. The sample mean as a log-likelihood estimator
6. The sample variance as a log-likelihood estimator
7. Bernoulli random variable and Binomial RV: heads and tails – deriving the ML estimator for this distribution
8. Deriving the ML estimators for logit/probit
9. The difference between Logit and Probit models
10. How to do inference in ML estimation: we need an estimate of the sampling error of these estimators: the information matrix, Cramer-Rao lower bound
11. Deriving the ML Cramer-Rao lower bounds for a number of different estimators. Sample mean amongst them.
12. Hypothesis testing using ML estimators. Use the normal distribution as a test distribution.

**Panel data**

1. The problem with panel data as opposed to OLS, and time series: cannot assume independence of cross-sections
2. Pooled OLS
3. Unobserved heterogeneity
4. The benefits of panel data: why do we bother?
5. The amendments to the Gauss-Markov assumptions to take into account the nature of the data
6. First-differenced estimators
7. Fixed-effects estimators
8. Properties of fixed-effects under assumptions
9. Fixed effects estimators: the intuition
   1. Within estimator
   2. Between estimator
10. Fixed effects estimators vs first differenced estimators
11. Random effects estimators
12. Assumptions required for RE to be unbiased
13. Comparing FE with RE.
14. Testing for unobserved heterogeneity

Problem sets

1. Intro to each problem set (slotted into the relevant point in the undergraduate playlist).
2. Problem set overall introduction
3. Problem set answers

**Asymptotic behaviour of estimators (advanced playlist)**

1. The law of large numbers
2. Law of large numbers proof using Chebyshev’s inequality
   1. <http://en.wikipedia.org/wiki/Law_of_large_numbers#Proof>
3. Law of large numbers proof using Characteristic functions
4. The Central limit theorem: scalar
5. Proof of the Central Limit theorem
6. The intuition behind Markov’s inequality
   1. <http://ravi-bhide.blogspot.co.uk/2011/11/markov-and-chebyshev-inequalities.html>
   2. <http://saravananthirumuruganathan.wordpress.com/2011/07/02/detailed-tutorial-on-markov-and-chebyshev-inequalities/> - much better
7. The intuition behind Chebyshev’s inequality.
   1. Essentially can give the same example as for Markov, although using variance rather than mean. If the variance of a certain part of the sample is greater than x, then this would necessarily mean that the variance of the sample would increase
8. Convergence in probability
9. Convergence in distribution
10. Convergence in probability implies convergence in distribution
11. Central limit theorem proof
12. WLLN: intuition
13. Central limit theorem intuition using Matlab
14. An example of the central limit theorem: throwing dice, numbers from a uniform random distribution
15. Lindeberg Levy Central Limit Theorem proof
    1. <http://mathworld.wolfram.com/CentralLimitTheorem.html>
16. Other central limit theorems: non-identically distributed
17. Other central limit theorems: non-independent
18. The Central limit theorem: vector
19. Theorems: Continuous mapping, Slutsky
20. The Cramer Wold device – why do we need it to generalise the Central Limit Theorem to the case of a vector rather than a scalar?
    1. <http://www.stat.umn.edu/geyer/old/5102/n2.pdf>
21. Asymptotic distribution of the sample variance <https://onlinecourses.science.psu.edu/stat414/node/174>
22. Consistency of estimators (OLS)
23. Demonstrating unbiasedness of estimator – taking expectations

**Convergence of random variables + central limit theorems for weighted sums etc.**

[http://faculty.ksu.edu.sa/73125/Publications/[3]%20Convergence%20of%20Random%20Variables.pdf](http://faculty.ksu.edu.sa/73125/Publications/%5b3%5d%20Convergence%20of%20Random%20Variables.pdf)

**Moment generating functions**

<http://courses.ncssm.edu/math/Stat_Inst/PDFS/SEC_2_f.pdf>

Characteristic function:

How to get moments from the characteristic function:

<http://en.wikipedia.org/wiki/Characteristic_function_(probability_theory)>

Full proof of CLT:

<http://www.ems.bbk.ac.uk/for_students/msc_finEng/math_methods/lecture7.pdf>

Simple proof of CLT:

<http://en.wikipedia.org/wiki/Central_limit_theorem>

Proof that a normal variable squared is chi-squared:

<https://onlinecourses.science.psu.edu/stat414/node/154>

<http://www.am.qub.ac.uk/users/g.gribakin/sor/Chap6.pdf> - better using moment generating functions

Distributions of functions of random variables:

<http://www.math.montana.edu/~jobo/st421/chap6n.pdf>

**Graduate course in econometrics**

Various topics

1. The matrix formulation of econometrics
2. Deriving the LS estimators for matrices
3. Expectation of a random variable times a constant matrix
4. Variance of a matrix times a random variable proof
5. Derivation of the variance of LS estimators
6. Derivation of the estimator for the variance of LS estimators
7. Estimating sigma squared
8. Omitted variable bias proof using matrix form of estimators
9. The G-M assumptions in matrix form
10. All the proofs of why we use the CEF function to predict a dependent variable from Harmless Econometrics
11. The geometrical interpretation of LS estimators (a number of parts)
    1. Example in 1D/2D of what LS estimators actually do
    2. Projection matrix P, Mx etc.
    3. LS estimators proof that the solution is unique
12. Heteroscedasticity in matrix form
13. Derivation of BLUE GLS estimators in the presence of heteroscedasticity
14. Derivation of the WLS estimator for the example where the variance is equal to x squared times a constant
15. Derivation of GLS estimators when there is serial correlation amongst errors
16. Matrix Kronecker product definition and examples
17. SURE estimators derivation
18. Collapse of SURE estimators to OLS under:
    1. Same regressors
    2. Diagnonal covariance matrix
19. Examples of SURE estimators
20. Partioned Regression: Geometric explanation and significance in regression
21. Frisch-Waugh-Lovell theorem
22. Nonlinear Least Squares
23. LAD estimator vs LS estimator
24. When a LAD estimator may be better than LS? Non-normal, finite sample data
25. Matrix derivation of how to transform a variable to a normal
26. General way of creating a chi squared variable
27. General way of creating an F distribution
28. Hypothesis testing using matrix forms to derive the various distributions of test distributions under the null hypothesis being true
    1. Chi squared
    2. F test
    3. T test
29. Examples of how we use each of the above tests
30. Introduction to asymptotic theory
31. WLLN stated. Example
32. Lindeberg-Levy Central Limit Theorem. And example
33. Convergence in probability, convergence in distribution
34. Continuous mapping theorem, slutsky theorem, Cramer-Wold device
35. Asymptotic properties of OLS estimators: both stochastic x and non-stochastic
36. Asymptotic consistency of estimators of the variance for LS
37. Asymptotic properties of t statistics under H0
38. Alternative derivation of GLS estimator as minimising (y-Xb)’omega^-1(y-Xb) (see Birkbeck financial engineering 2013 past paper Q2)

**Time Series**

1. Time series
   1. Introduction to the modified G-M conditions for time series
   2. Introduction to the gamma-form of deriving the variance and covariance of estimators
2. Univariate modelling: why do we do it? What uses does it have? Disha notes
3. See Disha notes for more advanced time series discussion
4. Box-Jenkins methodology for fitting an appropriate ARMA process (See Disha and Ivan notes)
5. AR(1) variance, covariance derivation using gamma, then derivation of the autocorrelation function. Example of AR(1) process
6. AR(2) process same as AR(1) derivation
7. MA(1) process same as above
8. ARMA (1,1) process, variance & covariance derivation, correlation
9. An example of a process which is ARMA(1,1)
10. Sum of two AR processes not necessarily AR(1) (see Disha notes)
11. Diagnosing for misspecification in univariate modelling (see Disha notes)
12. Disha notes generally
13. Infinite MA representation of AR processes
14. Infinite AR representation of MA(1) process
15. MSE predictions of future variables: the expectation is the forecast which minimises the
16. ARIMA processes: definition and examples
17. Invertible processes definition and reasoning
18. Stationary processes
19. Lagged dependent variables – inconsistency of OLS
20. Unit route tests: Dickey Fuller
21. Unit route test: Dickey Fuller Asymptotic distribution
22. Cointegration tests: the superconsistency of OLS. Explain what the superconsistency of an estimator actually means.
23. Prove superconsistency
24. Intuition as to why OLS actually will find the cointegrating relationship between x and y if it exists. (See Disha notes from April 2014).
25. What is the intuition as to why OLS is superconsistent? Is this because of the fact that the sum of squared residuals will be that much lower if we find exactly the cointegrating vector?
26. Problems with Dickey-Fuller tests: see Ivan Bath exams/notes
27. Bias of regressor coefficients away from one for a unit root.
28. KPSS test
29. Phillips-Perron test
30. Definition of a white noise process
31. The problem with the Box-Jenkins method: see all of Harvey’s time series book!
32. Kalman filters as a way of modelling processes
33. GARCH and ARCH models: an introduction (mentioning the fact that they still satisfy the GM assumptions)
34. GARCH as a parsimonious way of writing down an ARCH model
35. Unconditional means and variances
36. Conditional means and variances for Arch/GARCH
37. Derivation of the formula for the unconditional variance
38. Intuition of the fact that Var(X) = E(Var(X given I\_t-1)) + Var(E(X\_t-1))
39. GARCH in mean
40. Error correction models
41. VARs – Introduction
42. VAR stationarity: what do we mean by a stationary VAR? Give a simulation (I have one on laptop for the Birkbeck sessions)s
43. VARs – Johansen Stationarity test for vectors
44. VAR impulse functions
45. VAR impulse functions: orthogonalisation. Why do we need to do this? See Birkbeck Mo Mcrossen notes
46. Cointegration in VAR systems: check the rank of matrices etc.
47. Forecasting with VARs
48. Structural VARs
49. VECM

**Maximum Likelihood estimation**

1. Definition and intuition behind ML estimation. Why we can maximise log likelihood and not worry.
2. The score vector and the conditional information matrix
3. The Cramer-Rao lower bound
4. Proof of consistency of estimators based on unbiasedness and variance
5. Proof that an estimator is ‘fully efficient’ – see Mo Mcrossen Birkbeck exams on this
6. Functional invariance of ML – ie beta = exp(theta) has ML estimator beta\_ml = exp(theta\_ml)
7. Proof of functional invariance of ML
8. Functional invariance does not imply same asymptotic variance of estimators
9. Introduction to asymptotics of ML estimators
10. Regularity conditions
11. The exponential distribution – ML estimation + asymptotics
12. Coefficient tests
    1. Likelihood ratio tests
    2. Wald test
    3. LM score test
       1. LM test for serial correlation
13. Linear probability model
14. Multinomial logit and probit
15. Censored models: Tobit etc.
16. Asymptotics of maximum likelihood estimators

**IV estimators**

1. Asymptotics of IV estimators
2. Generalised IV estimation
3. LATE
4. GIVE vs IV

**Panel models**

1. Random vs fixed effects models in matrix form
2. Properties of random vs fixed effects
3. Problems with lagged dependent variable in panel models: the need for an IV
4. Hausman’s test for fixed effects vs random
5. Random effects derivation: matrix form
6. Fixed effects derivation
7. Conditions when FE is the same as RE
8. Chamberlain approach and minimum distance
9. Synthetic cohorts
10. Dynamic panel models
11. Nonlinear panel models
    1. State dependence vs hetetogeneity
    2. Initial conditions
12. Panel 2 way fixed/random effects

**Causality**

1. What is causality and why is it important in the social scientists
2. The Rubin Causal model
3. Random assignment
4. The Average Causal Effect and Selection Bias: Both continuous and discrete cases
5. The Conditional Independence Assumption
6. Linear regression given a causal interpretation
7. Linear Regression vs Matching
8. Matching as a solution to unbalanced samples
9. Propensity scores: introduction and usefulness of this for estimating causal structure
10. Overview of matching and propensity scores
11. Different methods of estimating propensity scores
12. Different methods for using propensity scores: weighted regression, propensity score matching etc.
13. The Heckman 2-step estimator
14. IV estimators in the causal framework: LATE
15. Heckman general
16. CEM – coarsened matching
17. Covariate balanced PSM

**MM and GMM estimators**

1. Introduction to method of moments estimation
2. Generalised Method of Moments estimation: GIVE vs IV
3. Benefits of GMM over other estimation paradigms
4. The idea behind weighting matrices in GMM
5. Various examples of GMM estimators
6. Dynamic panel GMM estimators: Bond estimator

**Factor Analysis and SEM modelling**

1. What is FA and why is it used?
2. Introduction to FA
3. Exploratory Factor Analysis and Confirmatory Factor Analysis
4. Maximum Likelihood Estimators of EFA and CFA
5. Interpretation of CFA and EFA
6. Factor rotation: oblique and orthogonal
7. Intro to SEM software

**Generalised Linear Modelling**

1. The Link function
2. Representing different classes of model using different link functions
3. Logistic etc. link functions

**Bayesian Econometrics**

1. An introduction to Bayesian Econometrics/Statistics
2. How is Bayesian econometrics useful/different to frequentist approaches?
3. Example of frequentist vs Bayesian approaches and results
4. Prior vs posterior vs likelihood
5. Grid approximation
6. Monte Carlo Markov
   1. Metropolis-Hastings
   2. Gibbs sampler

**Semi-parametric and non-Parametric estimation**

1. Introduction

**Other misc**

1. Law of iterated expectations
2. Proof of above
3. Minimum distance estimators
4. Regression discontinuity design: sharp, fuzzy

**Quantile Regression**

1. Introduction and motivation

**Nonlinear Least Squares**

1. Intro

**Control Functions**

1. What do these entail? What is the motivation and purpose?

**Truncation and selection**

1. Tobit etc.
2. Selection issue
3. Grouped corrections
4. Micro corrections
5. Bounds

**Hazard data**

1. Censoring
2. Kaplan-Meier estimates
3. Semi-parametric duration models
4. Competing hazards

**Survival Analysis**

1. Introduction and motivation
2. Examples
3. How to estimate

Markov chains

1. Discrete vs continuous
2. Hidden Markov chains
   1. Viterbi algorithm

**An introduction to distributions (introduces all the distributions and how they relate to one another)**

1. Bernoulli
2. Binomial
3. Exponential
4. Gamma
5. Chi-squared
6. Normal
7. Beta

**Videos that need to be redone**

1. What is econometrics?
2. Natural experiments econometrics – cropping off
3. Populations vs samples – cropping off (also unsure about whether the material I mention is absolutely correct)
4. Estimators – the basics – cropping off
5. Estimator properties
6. Unbiasedness & consistency – very messy!
7. Efficiency of estimators – hard to see
8. Lines of best fit in econometrics – hard to see
9. The mathematics behind drawing a line of best fit
10. Least Squares estimators as BLUE – redo, completely invisible!!!!
11. Deriving Least Squares – all videos are hard to see!!! Check the first video here to see what it looks like
12. Least Squares Estimators - in summary
13. Taking expectations of a random variable
14. Population regression function – hard to see!!
15. G-M assumptions – hard to see!
16. Omitted variable bias – example 1 - cropping!
17. Reverse causality – hard to see!
18. Measurement error in independent variable – impossible to see!!!!
19. Functional misspecification – impossible to see!
20. Serial correlation biased standard errors (advanced topic) - part 2
21. Heteroskedasticity summary – hard to see!!!
22. Heteroskedastic errors - example 1 – hard to see!!
23. Heteroskedasticity - example 2 – impossible to see!!!
24. Index - where we currently are in the overall plan of econometrics
25. Errors in populations vs estimated errors – hard to see!!!
26. R squared part 1 – hard to see!!!
27. Degrees of freedom part 2 (advanced) – hard to see
28. Unbiasedness of OLS - part one – hard to see!!!
29. Variance of OLS estimators - part one
30. Estimating the population variance from a sample - part one