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### ECO 2401S: Ph.D. Econometrics

#### EVALUATION:

Midterm	35% Wednesday February 14, 2018, 9 AM – 11 AM.
Final Exam	35% Exam period.
Paper	30% Due date by midnight Friday March 30, 2018

The only generally acceptable reason for missing a term test is illness. A medical certificate is required under such circumstances. We are asked to remind you that plagiarism is a **serious** academic offence with potentially serious penalties.

#### Due dates

**Outline: Friday, February 2, 2018, by midnight. This is a hard deadline. Late submissions will be penalized.** Please submit the outline electronically as an attachment and name the file using your name. For example, my outline would be "YatchewOutline.doc" or "YatchewOutline.pdf". Your outline must contain the following:

1. preliminary model
2. key references (be sure to do a citation search)
3. anticipated results
4. actual numerical data on first observation.

**Problem Sets: Wednesday February 14, 2018, by midnight.** Please submit electronically as an attachment and name the file using your name. For example, my problems would be "YatchewProblems.doc" or "YatchewProblems.pdf". The problems will be considered in marginal cases.

**Paper: Friday, March 30, 2018, by midnight. This is a hard deadline. Late submissions will be penalized 10% per day.** Please submit the paper electronically as an attachment, and name the file using your name. For example, my paper would be "YatchewPaper.pdf". You must also attach a copy of the computer code (in \*.txt format) used to produce the results in the paper.

#### References:

Greene, William, Econometric Analysis, Prentice Hall.

Davidson, Russell and James MacKinnon, Estimation and Inference in Econometrics, Oxford University Press, 1993.

Hamilton, James Time Series Analysis, Princeton University Press, 1994.

## 1. Nonparametric and Semiparametric Regression (3 lectures)

Nonparametric regression, curse of dimensionality, consistency, rate of convergence, bias-variance trade-off, asymptotic distribution of estimators, cross-validation -- how much to smooth, testing procedures. Estimation and inference in the partial linear model, tests of specification and equality of regression functions, index models, equivalence scale estimation.

1. Yatchew, A. 2008: "Perspectives on Nonparametric and Semiparametric Modeling", The Energy Journal, Special Issue to Acknowledge the Contribution of G. Campbell Watkins to Energy Economics, 17-30.
2. Yatchew, A. "Nonparametric Regression Techniques in Economics", Journal of Economic Literature, 1998, 669-721
3. Yatchew, A. Semiparametric Regression for the Applied Econometrician, Cambridge University Press, 2003.

## 2. Modes of Inference: Asymptotic v. Bootstrap Techniques (2 lectures)

Weak and strong convergence, convergence in distribution,  $O_p$  and  $o_p$  notation, convergence of functions of sequences of random variables, laws of large numbers, central limit theorems, Cramer's Theorem, efficiency vs. asymptotic efficiency and the Cramer-Rao lower bound, Glivenko-Cantelli lemma, uniform law of large numbers, consistency and asymptotic distribution of least squares and maximum likelihood estimators; likelihood ratio, Lagrange multiplier, Wald tests. Bootstrap estimates of standard errors, bootstrap based confidence intervals and hypothesis tests. Validity of bootstrap inference, Edgeworth expansions and superiority of bootstrap inference procedures.<sup>1</sup>

1. Greene (4th edition) Ch. 4, 9.3,9.4; Greene (5th edition) Ch. 5.2, Appendices C and D; Greene (6th edition) Appendix D, Ch 4.9, 16.4
2. Davidson and MacKinnon, Ch. 4, 5.
3. Beran R. and G.R. Ducharme (1991): Asymptotic Theory for Bootstrap Methods in Statistics, Centre for Recherche in Mathematiques, Universite de Montreal, Ch. 1,2,4
4. Horowitz, J. "Bootstrap Methods in Econometrics", in Advances in Economics and Econometrics: Theory and Applications, Seventh World Congress, Volume III, ed. D. Kreps and K. Wallis

## 3. Generalized Least Squares (1 lecture)

Heteroscedasticity, White's HCSE, tests for heteroskedasticity, autocorrelation, moving average models, Newey-West SE, variance components, panel data -- time series/cross-section models; mixed estimation, multivariate regression – SUR estimation, random coefficient models.

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<sup>1</sup> See also Yatchew, A. Semiparametric Regression for the Applied Econometrician, Cambridge University Press, 2003, Appendix A (available on my website).

1. Greene (4th edition) Ch. 11.3-11.4,12,13,14,15; Greene (5th edition) Ch. 10,11, 12,13,14; Greene (6th edition) Ch. 8,9,10, 19.1-19.3.
2. Davidson and MacKinnon Ch. 9, 10, 16.

#### **4. Models Where a Right Hand Side Variable is Correlated With the Residual (1 lecture)**

Instrumental variables, IV estimation as identification via method of moments, 2SLS, errors in variables, simultaneity, Hausman-Wu specification test.

1. Greene (4th edition) Ch. 9.5, 16; Greene (5th edition) Ch. 5.4, 5.6, 15. Greene (6th edition) Ch. 12, 13.
2. Davidson and MacKinnon Ch. 7, 18.

#### **5. Introduction to Time Series Analysis (4 lectures)**

Overview - categorization of models; basic concepts -- stochastic processes, stationarity and invertibility, ergodicity, autocorrelation and partial autocorrelation functions.

ARCH and GARCH models.

ARMA models - identification, estimation, inference, forecasting. Yule-Walker equations, Wold Decomposition Theorem; distributed lag models -- Almon lags, Koyck lags; ARMAX models; partial adjustment, dynamic regressions, error correction models, vector autoregressions, seasonal adjustment, spectral density estimation.

Nonstationary models -- trend stationarity, difference stationarity, random walk with/without drift, spurious regressions, ARIMA models, unit roots, tests for unit roots, Dickey Fuller and Augmented D-F tests, Weiner processes. Cointegration, testing for cointegration.

1. Davidson and MacKinnon Ch. 19, 20, pp. 556-560.
2. Greene Ch. 17, 18.
3. Hamilton Ch. 15-19, 21.
4. Hendry, D. and K. Juselius (2000) "Explaining Co-integration Analysis: Part I", The Energy Journal, vol. 21, 1-42.
5. Hendry, D. and K. Juselius (2002) "Explaining Co-integration Analysis: Part II", The Energy Journal, vol. 22, 75-119.
6. Bollerslev, T., R. Engle and D. Nelson (1994) "ARCH Models", in Handbook of Econometrics, vol. 4, ed. R. Engle and D. McFadden, North Holland, 2959-3040.