AFRICAN ECONOMIC RESEARCH CONSORTIUM (AERC)
COLLABORATIVE MASTERS DEGREE PROGRAMME (CMAP) IN ECONOMICS
FOR SUB-SAHARAN AFRICA
JOINT FACILITY FOR ELECTIVES

ECONOMETRICS THEORY AND PRACTICE
COURSE OUTLINE
(Revised July, 2020)

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1. OBJECTIVE

This course aims to provide a sound foundation in the theory and practice of econometrics for economists. A distinctive feature of the course is its integration of the theoretical developments and practical data analysis. Economic examples with emphasis on African context are consistently used throughout the course to motivate and illustrate the subject matter. Extensive practical work using econometric software packages is an important aspect of the course.

2. PREREQUISITES

The student should be fully familiar with the material covered in the Quantitative Methods course of the Core programme.

3. TEACHING ARRANGEMENTS

The course has two parts, each comprising 60 contact hours, including lectures and labs. At the end of each topic students are guided in estimating the relevant models preferably using data from African countries.

4. GRADING

There will be at least one in class test. Home assignments will include some empirical applications

Course Assessment	Percent
Home assignments/practicals	40
Final Examination	60
Total	**100**

5. SOFTWARE PACKAGES

There are several software–packages that could be used for econometric analysis. These include: E-Views, STATA, GRETL, and R. The students should become acquainted with at least one menu-driven econometric software package (good to analyze empirical data) and at least command driven software package (good for simulations).

COURSE OUTLINE

PART I - ECON 561: ECONOMETRICS I (MACRO-ECONOMETRICS)

1.1 Overview of Classical Regression **(3 Hours)**
Readings: **Greene (2018) Chs. 1-4**

1.2 Estimation Principles **(10 Hours)**

1.2.1 Least Squares Principle
1.2.2 The Maximum Likelihood Principle

1.2.3 Method of Moments (MM)
1.2.4 Instrumental Variables Method
1.2.5 Generalized Method of Moments (GMM) Principles
1.2.6 Nonlinear Least Squares

Empirical applications

Readings: **Greene (2018) Chs. 9,12,13,14**

1.3 Model Specification, Selection and Evaluation **(4 Hours)**

1.3.1 Model Specification
1.3.2 Model Selection
1.3.3 Model Evaluation

Readings: **Greene (2018) Ch.6**

Empirical applications

1.4 Time Series Analysis

1.4.1 Concepts of Stationarity and Non-stationarity **(2 Hours)**
1.4.2 Univariate Time Series Models **(13 Hours)**

- Stationary Stochastic Processes: World Decomposition Theorem
- Univariate Time Series Analysis: AR, MA and ARMA
- ARIMA Modelling and Forecasting
  - Lag Length Selection & Testing Model Accuracy
- Modeling Seasonality
- Forecasting Univariate Time Series

Empirical Applications

Readings:

Enders (2014) Chs. 1, 2, and 5; Greene (2018) Ch. 22; Johnston and DiNardo (1997) Ch.7

1.4.3 Multivariate Time Series Models **(19 Hours)**

- Stationary VAR (Specification, Estimation and Variance-Covariance Decomposition)
- Integrated Variables and Unit Root Testing
- Structural Break and Unit Root Testing
- Cointegration and Error-Correction Models
- Co-integration test approaches: Engle-Granger; Engle-Yoo; Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS); ARDL.
- Non-stationary multivariate linear models: VAR models with unit roots-cointegration and impulse response functions; Testing and estimation of the cointegrating vector and the VECM

Empirical Applications,

Readings:

Enders (2014) Chs. 4, and 6; Greene (2018) Ch. 23, Verbeek (2012), Johnston and DiNardo (1997) Ch.8

1.5 Financial Econometrics (9 Hours)

- Autoregressive Conditional Heteroscedastic (ARCH) Models
- Generalized Autoregressive Conditional Heteroscedastic (GARCH) Models
- Extensions to the Original GARCH Model – Asymmetric GARCH Models
- Multivariate GARCH Models

Empirical Application

Readings:

Enders (2014) Ch. 3, Greene (2018) Ch. 16

Main Textbooks

Enders, W. (2014), *Applied Econometric Time Series*. 4th Edition, New York: John Wiley and Sons.

Greene, W. (2018), *Econometric Analysis*, 8th Ed., Macmillan Publishing Company, New York

Required Textbooks

Johnston, J and J. DiNardo (1997), *Econometric Methods*, 4th Edition, McGraw Hill, New York (USA)

Verbeek, M. (2012), *A Guide to Modern Econometrics*, 4th Ed., Erasmus University Rotterdam)

Supplementary readings

Engle, R. F., Granger, C.W.J. (1987), "Cointegration and Error Correction: Representation, Estimation and Testing," *Econometrica*, 55, 251-276.

Engle, R. F. and Yoo, B.S. (1987), "Forecasting and Testing in Co-Integrated Systems, *Journal of Econometrics*," 35(1), 143-159.

Narayan, P. K. (2005), "The Saving and Investment Nexus for China: Evidence from Cointegration Tests," *Applied Economics*, 37, 1979-1990.

Narayan, P. K. and Singh, R. (2007), "The Electricity Consumption and GDP Nexus for Fifi Islands," *Energy Economics*, 29, 1141-1150.

Phillips, Peter C B, (1995), "Fully Modified Least Squares and Vector Autoregression," *Econometrica*, *Econometric Society*, 63(5), 1023-1078, September. Available online at: http://cowles.yale.edu/sites/default/files/files/pub/d10/d1047.pdf

Phillips, Peter C. B., and Hansen, B.E. (1990), "Statistical Inference in Instrumental Variables Regression with I(1) Processes," *Review of Economic Studies*, 57, 99 – 125. Available online at: https://www.ssc.wisc.edu/~bhansen/papers/restud_90.pdf

Pesaran M.H, Pesaran B. (1997), "Working with Microfit 4.0: Interactive Econometric Analysis," Oxford, Oxford University Press.

Pesaran, M.H., Shin, Y., Smith, R.J., (2001), "Bounds Testing Approaches to the Analysis of Level Relationships," *Journal of Applied Econometrics*, 16, 289-326.

Meltem, U. and Huseyin, M. B. (2009), "Income Inequality and FDI in Turkey: FM-OLS (Phillips-Hansen) Estimation and ARDL Approach to Cointegration," Munich Personal RePEc Archive, 21 January 2009. Available online at: https://mpra.ub.uni-muenchen.de/48765/1/MPRA_paper_48765.pdf

Boffelli & Urga (2016), "Financial Econometrics Using Stata", Stata Press.

Journal Articles

Muchai, D. N. and Muchai, J. (2016), "Fiscal Policies and Capital Flight in Kenya," *African Development Review*, 28(S1), 8 - 21. Blackwell.

Ngui, D.M., Mutua, J.M, Osiolo, H. and Aligula, E. (2011), "Household Energy Demand in Kenya: An Application of Linear Approximate Almost Ideal Demand System (LA-AIDS)," *Energy Policy*, 39, 7084 -7094.

Qiao, P. and Qi, Z. (2018), "The Application of VAR Model in Economic Interaction: The Case of China E-Commerce and Trade," *Wireless Personal Communications*, 103, 847–856. https://doi.org/10.1007/s11277-018-5481-3

Petrova, Y. (2019), "On Cointegration between the Insurance Market and Economic Activity. Empirical Economics. https://doi.org/10.1007/s00181-019-01669-6

PART II - ECON 562: ECONOMETRICS II (MICRO-ECONOMETRICS)

2.1 Linear Panel Data Models (16Hours)

2.1.1 Regression with Pooled Time Series/Cross-Section Data
2.1.2 Static Panel Models – FE & RE Models
2.1.3 Dynamic Panel Models - GMM
2.1.4 Nonstationarity, Unit Roots and Cointegration in Panels

Empirical Applications
Readings: Cameron and Trivedi (2005) Ch. 21 & 22, Greene (2018), Ch. 11; Verbeek, (2013), Ch. 10; Baltagi (2013), Chaps. 1-4, 8, and 12.

2.2 Discrete Choice Models (12 Hours)

2.2.1. Binary Choice Models (LPM, Logit, and Probit)
2.2.2. Multi-Response Models
- Multinomial Logit & Probit Models
- Ordered Logit & Probit Models
- Conditional and Nested Logit Models
- Multivariate Probit Models

Empirical Applications
Readings: Cameron and Trivedi (2005) Ch. 14, 15; Greene (2018) Ch. 17

2.3 Limited Dependent Variable Models **(8 Hours)**

2.3.1 Tobit Models
2.3.2 Sample Selection Models

Empirical Applications

Readings: Cameron and Trivedi (2005) Ch. 16; Greene (2018) Ch. 19; Verbeek (2012) Ch. 7.

2.4 Treatment Effect Models **(14 Hours)**

2.4.1 The Evaluation Problem
2.4.2 Randomization
2.4.3 Regression Discontinuity Design
2.4.4 The Method of Matching
2.4.5 Difference-in-Differences Estimator

Readings:

Cameron and Trivedi (2010), "Microeconometrics Using Stata", Stata Press

Khandker, S., Koolwal, G. and Samad, H. (2010), "Handbook on Impact Evaluation: Quantitative Methods and Practices", The World Bank, Washington DC.

Gertler, P., Martinez, S., Premand, P., Rawlings, L. and Vermeersch, C. (2016), "Impact Evaluation in Practice", Second Edition, World Bank Group.

Journal Articles & Chapters:

Blundell, R. and Dias, C. (2007), Alternative Approaches to Evaluation in Empirical Microeconometrics, The IFS.

Burtless, G. (1995), The Case for Randomized Field Trials in Economic Policy Research, *The Journal of Economic Perspectives*, Vol. 9, No. 2, 63-84.

Heckman, J., LaLonde, R. and Smith, J. (1999), The Economics and Econometrics of Active Labor Market Programs, Handbook of Labor Economics (Ch. 31), Volume 3, Part A, 1865-2097.

2.5 Introduction to Further Topics **(10 Hours)**

2.5.1 Duration Models
2.5.2 Count Data Models
2.5.3 Quantile Regression

Empirical Applications.

Readings: Cameron and Trivedi (2005), Ch. 20, 23, & 25, Greene (2018), Ch. 18; Baltagi (2008), Ch.10; Blundell and Dias (2000)

Main Textbooks

Baltagi, B.H. (2013), *Econometric Analysis of Panel Data*, 5th Ed., Wiley.

Greene, W. (2018), *Econometrics Analysis*, 7th Ed., Macmillan Publishing Company, New York.

Required Textbooks

Verbeek, M. (2013). *A Guide to Modern Econometrics*, 4th Ed**.**, Erasmus University Rotterdam)

Cameron A. Colin, and Pravin K. Trivedi, (2005), *Microeconometrics: Methods and Applications*, Cambridge University Press.

Lee, M. (2010), *Micro-Econometrics: Method of Moments and Limited Dependent Variables*, Springer.

Supplementary Texts

Adkins, L. C. (2010), Monte Carlo Experiments Using GRETL: A Primer. Available at http://www.learneconometrics.com/pdf/MCgretl_rev.pdf

Angrist, J. D., and J. S. Pischke (2009), *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Arellano, M. (2003), *Panel Data Econometrics*, Oxford University Press, Oxford.

Baum, Christopher (2006), *Introduction to Modern Econometrics Using Stata*, Stata Press.

Collins and Trivedi (2009), *Microeconometrics: Using Stata*, Stata Press.

Cuthbertson Keith, Stephen G. Hall and Mark P. Taylor, (1992), *Applied Econometric Techniques*, Philip Allan.

Hamilton L.C. (1992), *Regression with Graphics: A Second Course in Statistics*, Brook/Cole, Pacific Grove, California.

Edward Leamer, (eds.), *Handbook of Econometrics*, 5, 3160-3228, Amsterdam, North Holland

Horowitz, J.L. (2001), "Bootstrap in Econometrics", in James Heckman and Edward Leamer, (eds.): *Handbook of Econometrics*, 5, .3160-3228, Amsterdam, North-Holland.

Hsiao, C. (2014), *Analysis of Panel Data*, Cambridge University Press.

Johnston, J and J. DiNardo (1997), *Econometric Methods*, 4th Ed, McGraw Hill, New York (USA).

Lott W.F. and S.C. Ray (1992), *Applied Econometrics; Problems with Data Sets*, The Dryden Press.

Maddala, G.S. (1983), *Limited Dependent and Qualitative Variables in Econometrics*, Cambridge University Press.

Maddala, G.S. and K. Lahiri (2010), *Introduction to Econometrics*, 4th Ed., Wiley.

Stock, James H. and Mark W. Watson, (2013), *Introduction to Econometrics*, Addison Willey.

Shao, U. and D. Tu (1995), *The Jackknife and Bootstrap*, New York: Springer

Thomas, R. L. (1997), *A Guide to Modern Econometrics: An Introduction.*

Wooldridge, Jeffrey M. (2010), *Econometric Analysis of Cross Section and Panel Data, 2nd Ed, The MIT Press, London.*

Wooldridge, Jeffrey M., (2015), *Introductory Econometrics: A Modern Approach*, 6th Ed., South Western College, Cincinnati (USA).

Journal Articles

Adkins, L.C. (2011), "Using GRETL for Monte Carlo Experiments, *Journal of Applied Econometrics*, 26, 880-885.

Amemiya, T. (1981), "Qualitative Response Models: A Survey", *Journal of Economic Literature*, 19 (4), 481-536.

Anderson, T.W. and C. Hsiao (1982), "Formulation and Estimation of Dynamic Models Using Panel Data," *Journal of Econometrics*, 18, 47–82.

Arellano, M. and S. Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58, 277-297.

Arellano, M. and O. Bover (1995), "Another Look at the Instrumental Variable estimation of Error-Components Models," *Journal of Econometrics*, 68, 29-51.

Blundell, Richard and Monica Costa Dias (2000), "Evaluation Methods for Non-Experimental Data," *Fiscal Studies*, 21(4), 474-468.

Cappellari, L. and Jenkins, S.P. (2003), "Multivariate Probit Regression Using Simulated Maximum Likelihood," *Stata Journal*, 3, 278–294.

Judson, R.A. and A.L. Owen (1999), "Estimating Dynamic Panel Data Models: A Guide for Macroeconomists," *Economics Letters*, 65, 9-15.

Mesnard, A. and M. Ravallion (2006), "The Wealth Effect of New Business Startups in a Developing Country," *Economica*, 73, 367-392.

Mullahy, J. (2016), "Estimation of Multivariate Probit Models via Bivariate Probit,"*The Stata Journal*, 16(1), 37–51.

Mullahy, J. (2011), "Marginal Effects in Multivariate Probit and Kindred Discrete and Count Outcome Models, With Applications in Health Economics," NBER Working Paper No. 17588, The National Bureau of Economic Research. http://www.nber.org/papers/w17588. Google Scholar.

Selected Journal Articles on Empirical Studies in the African Context

Abdulai, A. and D. Aubert (2004), "Nonparametric and Parametric Analysis of Calorie Consumption in Tanzania," *Food Policy*, 29, 113-129.

Adjasi, C.K.D. and N. Biekpe (2009), "Do Stock Markets Matter in Investment Growth in Africa?" *Journal of Developing Areas*, 43, 109-120.

Adu, G. (2013), "Determinants of Economic Growth in Ghana: Parametric and Nonparametric Investigation," *Journal of Developing Areas*, 47, 277-301.

Akims, K., A, and Ngui, D.M. (2019), "Productivity and Export Performance: Micro-Level Evidence from the Manufacturing Sector in Nigeria," *Frontiers of Economics in China*, 14(3), 428 – 460.

Baah-Boateng, William (2013), "Determinants of Unemployment in Ghana," *African Development Review*, 25, 385-399.

Ben Hammouda, H., S. Karingi, A. E. Njuguna, and M. Sadni-Jallab (2009), "Why Doesn't Regional Integration Improve Income Convergence in Africa?" *African Development Review*, 21(2), 291-330.

Ben Hammouda, H., S. Karingi, A. Njuguna, M. S. Jallab (2010), "Growth, Productivity, and Diversification in Africa", *Journal of Productivity Analysis*, 33, 125-146.

Boopen, S. (2009), "The Economic Importance of Education: Evidence From Africa Using Dynamic Panel Data Analysis," *Journal of Applied Economics*, XII, 137-157.

Budd, J.W. (1993), "Changing Food Prices and Rural Welfare: A Nonparametric Examination of Cote D'Ivoire," *Economic Development and Cultural Change*, 41, 587-603.

Cichello, P.L., G.S. Fields and M. Leibbrandt (2005), "Earnings and Employment Dynamics for Africans in Post-apartheid South Africa: A Panel Study of Kwazulu-Natal," *Journal of African Economies*, 14, 143-1.

Diiro, G.M. and A.G. Sam (2015), "Agricultural Technology Adoption and Non-Farm Earnings in Uganda: A Semiparametric Analysis," *Journal of Developing Areas,* 49, 145-162.

Jaunky, V.C. (2008), "Divergence in Per Capita Electric Power Consumption: An African Perspective," *Applied Econometrics and International Development,* 8, 137-150. Available at: http://www.usc.es/~economet/aeid.htm

Jaunky, V.C. (2013), "Democracy and Economic Growth in Sub-Saharan Africa: A Panel Data Approach," *Empirical Economics,* 45, 987-1008.

Juselus, Katarina, N.F. Moller and F. Tarp (2014), "The Long-Run Impact of Foreign Aid in 36 African Countries: Insights from Multivariate Time Series Analysis," *Oxford Bulletin of Economics and Statistics,* 76, 153-184.

Kassie, G.T., A. Abdulai and C. Wollny (2010), "Implicit Prices of Indigenous Bull Traits in Crop-Livestock Mixed Production Systems of Ethiopia," *African Development Review,* 22, 482-494.

Kassie, M., S. Ndiritu, and J. Stage (2014), "What Determines Gender Inequality in Household Food Security in Kenya? Application of Exogenous Switching Treatment Regression", *World Development,* 56, 153-171.

Kelly, R. and G. Mavrotah (2008), "Savings and Financial Sector Development: Panel Cointegration Evidence for Africa," *The European Journal of Finance,* 14, 563-581.

Kerr, A. and F. Teal (2015), "The Determinants of Earnings Inequalities: Panel Evidence from KwaZulu-Natal, South Africa," *Journal of African Economies,* 24, 530-538.

Keswell, M. (2004), "Non-linear Earnings Dynamics in Post-Apartheid South Africa," *South African Journal of Economics,* 72, 913-939.

Khadaroo, J. and S. Boopen (2007), "The Role of Transport Infrastructure in FDI Evidence from Africa Using GMM Estimates," *Journal of Transport Economics and Policy,* 43, 365-384.

Kouadio, A., Monsan, V., and Gbongue M., (2008), "Social Welfare and Demand for Health in the Urban Areas of Cote d'Ivoire", AERC RP. 181.

Leibbrandt, M. and J. Levinsohn (2011), "Fifteen Years On: Household Incomes in South Africa, National Bureau of Economic Research, Inc, NBER Working Papers, 16661. Available at: http://www.nber.org/papers/w16661.pdf

Mariotti, M. and J. Meinecke (2015), "Partial Identification and Bound Estimation of the Average Treatment Effect of Education on Earnings for South Africa," *Oxford Bulletin of Economics and Statistics,* 77, 210-233.

Naude, W.A. (2004), "The Effects of Policy, Institutions and Geography on Economic Growth in Africa: An Econometric Study Based on Cross-Section and Panel Data," *Journal of International Development,* 16, 821-849.

Naude, W.A. and W.F. Krugell (2007), "Investigating Geography and Institutions as Determinants of Foreign Direct Investment in Africa Using Panel Data," *Applied Economics,* 39, 1223-1233.

Novignon, J., J. Novignon and E. Arthur (2015), "Health Status and Labor Force Participation in Sub-Saharan Africa: A Dynamic Panel Data Analysis," *African Development Review,* 27, 14-26.

Ogada, M. J., Muchai, D. and Mwabu, G. (2014), "Farm Technology Adoption in Kenya: Simultaneous Estimation of Inorganic Fertilizer and Improved Maize Variety Adoption Decisions," *Agricultural and Food Economics,* 2:12. Springer.

Ogada, M. J., Muchai, D., Mwabu, G. and Mathenge, M. (2014), "Technical Efficiency of Kenya's Smallholder Food Crop Farmers: Do Environmental Factors Matter?" *Environment, Development and Sustainability*, 16(5), 1065 -1076. Springer.

Oyekale, A. (2014), "Factors Explaining Child Survival in Ethiopia: Application of Two-Stage Probit Model," *African Development Review*, 26, 237-249.

Sackey, A. Harry, (2005), "Female Labour Force Participation in Ghana: The Effects of Education," AERC RP.150

Walle, Y.M. (2014), "Revisiting the Finance-Growth Nexus in Sub-Saharan Africa: Results from Error Correction – Based Panel Cointegration Tests," *African Development Review*, 26, 310-321.

Yasar, M., C. Nelson and R. Rejesus (2006), "The dynamics of exports and productivity at the plant level: A panel data error correction model (ECM) approach", in *Panel Data Econometrics: Theoretical Contributions and Empirical Applications*, B. Baltagi (ed.), Elsevier, Amsterdam.

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