LANCASTER UNIVERSITY
Management School
Department of Accounting and Finance

AcF 609 & 629: Financial Econometrics

Lent Term 2014

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1. Objectives

- To explain how econometric methods can be used to learn about the future behaviour of the prices of financial assets, by using the information in the history of asset prices and in the prices of derivative securities.
- To provide students with practical experience of analysing market prices.

2. Learning outcomes

After completing the course students should:

- Understand the important features of time series of market prices,
- Appreciate the relevance of efficient market theory to predicting prices,
- Be familiar with appropriate methods for forecasting price volatility,
- Be able to use option prices to make statements about the distributions of future asset prices,
- Have acquired experience of applying computational methods in Excel to market data,
- Be informed about a broad range of econometric methods that are applied in Finance research.

3. Reading

The only recommended course text, referred to as APDVP, is:

> Stephen J. Taylor, *Asset Price Dynamics, Volatility, and Prediction*,
> 2007 (paperback edition), Princeton University Press, ISBN 0 691 13479 0.

Photocopies of lecture notes will be provided. They include detailed information about recommended reading from APDVP. A colour version of the notes can be downloaded from the Moodle site for the course.

Copies of APDVP and the following books are in the Library:

Terence C. Mills, *The Econometric Modelling of Financial Time Series*, second edition 1999, Cambridge University Press. Chapters 2, 4 and part of chapter 5 cover course material.

Ruey S. Tsay, *Analysis of Financial Time Series*, third edition, 2010, Wiley. This is a challenging text that includes advanced mathematics. Chapters 2, 3 and 5 cover course material.

Chris Chatfield, *The Analysis of Time Series*, 1996, Chapman and Hall. This is a good general text about time series. Chapters 3 and 4 are particularly relevant.

John Y. Campbell, Andrew W. Lo and A. Craig MacKinlay, *The Econometrics of Financial Markets*, 1997, Princeton University Press. This PhD textbook covers many more methods and applications than our course. Chapter 2 is particularly relevant.

Christian Gourieroux and Joann Jasiak, *Financial Econometrics*, 2001, Princeton University Press. A challenging book for 'advanced graduate students'. Chapter 2, 6 and 14 overlap most with our course.

Ser-Huang Poon, *A Practical Guide to Forecasting Financial Market Volatility*, 2005, Wiley. A short book aimed at practitioners. Chapters 10 and 11 are particularly relevant.

Luc Bauwens, Christian Hafner and Sebastian Laurent, *Handbook of Volatility Models and their Applications*, 2012, Wiley. An advanced book which may interest the most capable students.

4. Administration

Course director:	Stephen Taylor.
e-mail:	s.taylor@lancaster.ac.uk
Office:	C27.
Consultation hours:	Weeks 2, 3, 4, 8, 9, 10: Tuesday 9-11.
	Week 5: Wednesday 11-1.
	Week 7: Monday 3-4.

The course is scheduled to be taught between January 20 and March 18 inclusive, during weeks 2 to 10 of the Lent term. Students attend twelve 90-minute lectures and four 60-minute sessions in a computer laboratory.

Venues:

Lectures:	LT4.
Lab sessions:	Hannaford Computer Lab & A8 Computer Lab, Engineering.

For data and other resources, for both AcF 609 and AcF 629, see the Moodle site.

5. Credits and assessment

AcF 609: 15 credits, examination 75%, coursework 25%.
AcF 629: 10 credits, examination 60%, coursework 40%.

Only students on the Quantitative Finance programme take AcF 629. All other students take AcF 609.

All students take an exam, commencing at the same time on April 14. Students will be required to answer two questions: one compulsory question and one of the other three questions on the exam paper. The exam is "closed book". The durations of the exams (including reading time) are 135 minutes for AcF 609 and 90 minutes for AcF 629.

All students will work independently on the same coursework assignment. The assignment will be distributed by February 12 with a provisional deadline of March 24. The assignment will require Excel calculations using market prices.

6. Syllabus

Lectures 1 & 2, Probability foundations

Overview of the course. Time series notation. Prices, returns and volatility clustering.

Probability concepts – random variables, density functions, independence, conditional distributions and expectations.

Stochastic processes – autocorrelations, uncorrelated processes, autoregressive, moving-average and integrated components. Examples of ARMA models for financial returns.

APDVP reading: Chapters 1, 2 and 3.

Additional reading:

- For elementary probability: P. Newbold, W.L. Carlson and B.M. Thorne, *Statistics for Business and Economics*, Prentice-Hall, 2010 (seventh edition), parts of Chapters 3, 4 and 5.
- For ARMA models: Sections 2.1 to 2.6 of Tsay, Chapter 2 of Mills, Chapters 3 and 4 of Chatfield and Chapter 2 of Gourieroux and Jasiak are relevant.

Lecture 3, Stylised facts for returns from financial assets

The common properties of time series of daily financial returns. Their means, standard deviations and distributions. Calendar properties. Correlations between returns on different days. Autocorrelations of absolute returns and squared returns.

APDVP reading: Chapter 4.

Additional reading: Return distributions are discussed in Mills, Chapter 5.

Computer workshop 1

Students attend **one** 60-minute class. The allocation of students to groups will be provided in a separate document. All the computer workshops require students to obtain solutions using Excel.

Lectures 4 & 5, Expected returns using time series information

The random walk hypothesis and its relationship to market efficiency. Testing for a random walk process using the variance-ratio test. Methods that use trading rules to assess the predictability of returns and the efficiency of markets. The moving-average trading rule and conclusions from its use.

APDVP reading: Chapter 5 and 7.

Additional reading: Return predictability is covered in Campbell et al, Chapter 2.

Computer workshop 2

Students attend one 60-minute class.

Lectures 6 & 7, Modelling changes in volatility using time series information

Reasons for changes in volatility. The autoregressive conditional heteroscedasticity (ARCH) framework. Statistical properties, computational methods, hypothesis tests, examples. Forecasting future volatility using previous returns.

APDVP reading: Chapters 8, 9 and 10.

Additional reading: Sections 3.1 to 3.6 of Tsay, Chapter 4 of Mills and some of Chapter 6 of Gourieroux and Jasiak are relevant.

Computer workshop 3

Students attend one 60-minute class.

Lecture 8, High-frequency analysis of market prices

Typical data and methods for prices recorded every five minutes. The impact of scheduled news. Measures of realised volatility. The information content of the additional information provided by high-frequency data.

APDVP reading: Chapter 12.

Additional reading: Section 5.3 of Tsay and Chapter 14 of Gourieroux and Jasiak.

Lecture 9, Volatility expectations implied by options prices

The definition of implied volatility and computational methods. Typical patterns in implied volatility as either the time to expiry or the exercise price varies. Forecasting volatility using option prices and comparisons with time series forecasts.

APDVP reading: Chapters 14 and 15.

Additional reading: Hull, J., 2000, *Options, Futures and Other Derivatives* (fourth edition), chapter 17, Prentice-Hall, or 2003 (fifth edition), chapter 15.

Computer workshop 4

Students attend one 60-minute class.

Lectures 10 and 11, Probability distributions implied by options prices

Methods that use several option prices to estimate a probability density for the asset price when the options expire. Mixtures of lognormal distributions. A review of other methods. Examples for the U.K. equity market.

APDVP reading: Chapter 16.

Lecture 12, A review of some further econometric methods

Some or all of: generalized method of moments, principal components analysis, factor analysis, cointegration, vector autoregressive models.