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## STATISTICAL METHODS FOR FINANCE

## Professor N. H. BINGHAM, Spring 2011

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Course website: My homepage.

This half-unit course consists of 15 lectures (5 weeks, 3 hours per week), Mon 17 January – Fri 18 February. It is divided into three parts (5 lectures each): I Regression,

I Regression,

II Time Series,

III Multivariate Analysis.

Recommended texts

I: Regression.

[BF] N. H. BINGHAM and John M. FRY: Regression: Linear Models in Statistics, Springer Undergraduate Mathematics Series (SUMS), 2010,

or the relevant chapters in most general books on Statistics.

II: Time Series.

[BD1] Peter J. BROCKWELL and Richard A. DAVIS: Introduction to Time Series and Forecasting 2nd ed., Springer, 2002 (1st ed. 1996).

[BD2] Peter J. BROCKWELL and Richard A. DAVIS: *Time Series: Theory and Methods*, 2nd ed., Springer, 1991 (1st ed. 1987).

[D] Peter J. DIGGLE: *Time Series: A Biostatistical Introduction*, OUP, 1990.

[H] Andrew C. HARVEY, *Time series models*, 2nd ed., Harvester Wheat-sheaf, 1993 (1st ed. 1981).

III: Multivariate Analysis.

[MKB] K. V. MARDIA, J. T. KENT and J. M. BIBBY, *Multivariate Analysis*, Academic Press, 1979 [excellent; mathematical; technique-oriented].

[K] W. J. KRZANOWSKI, Principles of Multivariate Analysis: A User's Perspective, OUP, 1988 [very good; less mathematical, more statistical; problemoriented].

[CC] C. CHATFIELD and A. J. COLLINS, *Introduction to Multivariate Analysis*, Chapman and Hall, 1980.

[HJ] Roger A. HORN and Charles A. JOHNSON, *Topics in matrix algebra*, CUP, 1991.

[GvL] Gene H. GOLUB and Charles F. Van LOAN, *Matrix computation*, 3rd ed., Johns Hopkins UP, 1996.

General Statistics.

[CB] George CASELLA and Robert L. BERGER, *Statistical inference*, Duxbury, 1990 (recommended for Ch. 6, Principles of data reduction, on sufficiency, but not for Ch. 12 on linear regression).

Multivariate Time Series.

[Han] E. J. HANNAN, Multiple time series, Wiley, 1970.

For some recent financial applications in this area, see e.g.

[BFK] N. H. BINGHAM, J. M. FRY and R. KIESEL, Multivariate elliptic

processes. Statistica Neerlandica 64 no. 3 (2010), 352-366,

and the references cited there.

## I. REGRESSION.

- 1. Least squares [L1]
- 2. The bivariate normal distribution [L1-2]
- 3. The multivariate normal distribution [L2-3]
- 4. Estimation theory for the multivariate normal [L4]
- 5. Conditioning and regression [L5]
- II. TIME SERIES.
- 1. Stationary processes and autocorrelation [L6]
- 2. The correlogram [L6]
- 3. Autoregressive processes, AR(1) [L7]
- 4. General autoregressive processes, AR(p) [L8]
- 5. Conditions for stationarity [L9]
- 6. Moving-average processes, MA(q) [L9]
- 7. Autoregressive moving-average processes, ARMA(p,q) [L10]

8. ARMA modelling; the general linear process; Wold decomposition [L10]

III. MULTIVARIATE ANALYSIS

- 1. Preliminaries: matrix theory [L11-12]
- 2. Singular Value Decomposition (SVD) [L13]
- 3. Statistical setting [L13-14]
- 4. Sample and population [L14]
- 5. Principal Components Analysis (PCA) [L14-15]