ITAM

ESCUELA DE NEGOCIOS

DIVISIÓN ACADÉMICA DE
ADMINISTRACIÓN Y CONTADURÍA

BUSINESS FORECASTING

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Professors

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(near room 402)

Objectives

By the end of the course, students will be able to:
- Explain the importance and usefulness of forecasting models in the context of decision-making and planning in an organization.
- Formulate, construct, evaluate and select the most appropriate model to develop the right forecast, applying the essential characteristics required by the situation and selecting and using relevant variables.
- Construct databases suitable for the appropriate forecast.
- Specify a model using a computer, develop the appropriate forecast and interpret results.

Evaluation

Weight of activities as a percentage of final grade:

Participation in class, homework (individual) and **quizzes**:   20%
Mid-term exam I: 25%
Mid-term exam II: 25%
Final **cumulative** exam: 30%

Important notes

- In order to pass the course, the student should obtain an **average grade of six or higher on all three exams and also an average course grade of six and higher. Also, the student must attend atleast 80%of the total classes during the course.**
- In addition to theoretical classes, the course will include several computer sessions, where students will learn how to use EXCEL and SPSS to apply the different tools covered in class (consult *Nota Técnica 088-08-MER-NT Manual de SPSS for Business Forecasting*, May 2009).
- The statistical tables used for the course are those of the Department of Statistics for the Econometrics course at ITAM available in the bookstore.
- If you have any comments or need further information, contact the coordinator of the course (Julieta Sarralde) at the Department of Business Administration.

Students' role in the course

Students are expected to have an active participation in class. **Completing assignments is one of the most efficient forms of learning in this subject. Assignments must be completed by students individually. Assignments turned in after the corresponding deadlines will not receive credits.**

Students are strongly encouraged to start working on the course assignments and laboratory assignments as early as possible. The contents and scope of each assignment will be explained by the professor during the early weeks of classes.

Academic honor principle

Students are expected and encouraged to discuss the different reading materials and concepts covered in class. Active participation in each and every aspect of the course is essential for its success. Students must bear in mind the classroom is not the only place where learning takes place. Therefore, reading the material covered everyday and turning in assignments on time is highly important. While external support can be useful, students must rely on their own effort to learn the contents covered throughout the course and solve the problems involved in the assignment. **<u>Any violation of the rules established in ITAM's internal regulations will be strictly resolved in accordance with strict regulations.</u>**

CONTENTS

1. INTRODUCTION TO FORECASTING
(2 sessions, Hanke et. al. Ch. 1, Wilson et. al., Ch.1)
- The importance of forecasts in the organization: planning for the short and long-term future, decision-making. Applications to distinct areas of a firm.
- Historical Aspects of Forecasts.
- Forecasting as an art and science: myths and reality, limitations.
- Types of forecasts and approaches to study the future
   - Quantitative: General characteristics. Induction, external validity and types of data required. Extrapolation models for time series and structural models (regression).
   - Qualitative: General characteristics. Case study. Brainstorming. Experts panel. Delphi. Qualitative scenarios, Prospective planning.
- The different stages in developing a forecast.
- The data:
   - Data types: data and information, time-series and cross-section data.
   - Scaling: ratio, interval, ordinal and nominal, table encoding.
   - Data sources: Primary and Secondary.

ACTIVITIES:
   - Create a time series using a secondary data source.
   - Translate the series into a line graph using EXCEL and SPSS.
   - Reading: Sarbeleche A and Sarralde J.(Dec. 2007-Feb. 2008) Cómo predecir el futuro, Dirección estratégica no. 24, 6th year, page 17-20

2. STATISTICAL CONCEPTS REVIEW
(2 sessions, Gujarati, Appendix A; Hanke Ch. 2, Wilson Ch. 2, Nota Técnica: 088-08-MER-NT)
- Scatter plots and histograms.
- Measures of central tendency. Scatter and order.
- Sample, population and central limit theorem. Degrees of freedom.
- Random variables and normal distribution, t, χ^2, F.
- Statistical inference: hypothesis tests, confidence interval, observed "p" significance and assigned "α"significance.
- Third (asymmetry) and fourth (kurtosis) moments of the probability density function. Jarque-Bera statistic for normality tests.
- Introduction to the SPSS software package: basic statistics and graphs.

ACTIVITIES:
   - Generate the series' basic descriptive statistics using SPSS and interpret them.
   - Apply the Central Limit Theorem to time series.
   - Conduct hypothesis tests: how to set up hypotheses, understanding test statistic, significance level, rejection region and conclusion.
   - Using the software Gretl (http://gretl.sourceforge.net/) for normality tests.

3. DATA BEHAVIOR PATTERNS
(2 sessions, Hanke et. al., Ch.3)
- Time Series Components: trend, cyclical, seasonal, irregular and stationary series.

- Data patterns, correlation, autocorrelation and correlogram. Confidence intervals and hypothesis tests.

ACTIVITIES:
- Obtain and interpret a Pearson's correlation coefficient both manually and using EXCEL and SPSS.
- Obtain and interpret a correlogram of levels and first differences using SPSS and EXCEL.
- Form and interpret hypothesis tests and confidence intervals for different statistics.
- Use of statistics tables.

4. FORECAST TECHNIQUES SELECTION CRITERIA
(1 session, Hanke et. al., Ch.3)
- The forecast error concept.
- Error measurements: ME, MPE, MAE; MAPE, MSE and RMSE.
- Test period, characteristics and selection criteria.
- Forecast confidence interval in time series.
- Hypothesis testing about the mean error.

ACTIVITIES:
- Application of all the above concepts.

5. TIME SERIES EXTRAPOLATION TECHNIQUES
(6 sessions, Hanke et. al. Ch 4, Nota Técnica: 093-09-EST-NT, Wilson et. al., Ch. 3,6 & 10)
- Naïve models (basic, trend, rate of change, seasonal, trend and seasonal).
- Average methods: simple and moving averages.
- Methods of smoothings: Simple exponential smoothing and Winters multiplicative. Note: To apply these techniques use the **Solver** function in Excel.
- Time series decomposition: multiplicative model.

ACTIVITIES:
- Apply the different techniques to obtain forecasts, error measurements and graphs.

6. SIMPLE REGRESSION ANALYSIS
(9 sessions, Gujarati Chapters. 1- 5)
- The causality concept.
- Simple Linear Regression Model: sample and population regression line, error and residue.
- Ordinary Least Squares (OLS).
- Linear estimation.
- Concept of R^2: Coefficient of determination.
- Estimator significance tests: standard error and t test.
- Standard error of estimate and standard error of point forecast.
- ANOVA Table: Determination coefficient.
- Point and interval forecasts for each particular case.

ACTIVITIES:
- Calculation of simple regression estimators both manually and using softwares. Interpretation of these estimators.

- Analysis of the significance of the independent variable and the coefficients.
- Calculation of ANOVA table both manually and using EXCEL. Interpretation.
- Calculation of forecast and its confidence interval.

7. FUNCTIONAL FORMS
(2 sessions, Gujarati Chapter 6)
- Linear model in variables and parameters.
- Transformation of variables.
- Functional forms: Constant elasticity model (Log linear model), Saturation model (Lin-Log model), Growth model (Log-Lin model), Experience curve model (reciprocal model) and Life cycle model (log reciprocal model).

ACTIVITIES:
- Application and interpretation of these distinct models.

8. MULTIPLE REGRESSION ANALYSIS
(8 sessions, Gujarati Chapters 8-12, 15 and Appendix B &C)
- Prediction of variables and correlation matrix.
- Multiple Regression Model: matrix form of a regression model, coefficients' interpretation and inference.
- ANOVA table: adjusted R^2 and F test.
- Relative importance of variables and standardized betas.
- Regression on standardized variables.
- Non-metric or "dummy" variables (ANOVA models and ANCOVA).
- Regression with dichotomous dependent variable: Linear Probability Model.
- Regression model assumptions: nature and consequences of their violation.
- Jarque-Bera normality test of residues and variables.
- Multicollinearity: nature, detection (R^2, sign and significances of β, correlations) remedial measurements and consequences (specification bias, transformations).
- Heteroscedasticity: nature, detection (Park test and White's complete test), remedial measures and consequences (transformations).
- Autocorrelation: nature, detection (graphs, correlogram and Durbin-Watson), remedial measures and consequences (first differences).

ACTIVITIES:
- Calculation of regression estimators both manually and using software packages. Interpretation.
- Calculation of ANOVA table both manually and using software packages. Interpretation.
- Calculation of forecast and its confidence interval.
- Exercises to detect violation of assumptions.

* * * DEPARTMENTAL CUMULATIVE FINAL EXAM * * *

BIBLIOGRAPHY
Textbooks:

- Gujarati, Damodar N. (2003). *Basic Econometrics.* Fourth Edition. New York, USA: McGraw-Hill Higher Education. In Spanish:. *Econometría*. Cuarta edición (2004). México: McGraw-Hill.
- Hanke, Jonh E; Wichern, Dean W. & Reitsch, Arthur G. (2009). *Business Forecasting*. Ninth Edition. USA, New Jersey: Prentice Hall.
- *Nota Técnica 088-08-MER-NT Manual de SPSS* for Business Forecasting, May 2009.
- Nota Técnica *093-09-EST-NT Descomposición de series de Tiempo* for Business Forecasting, May 2009.

Supplementary books and papers:
- Sarbeleche A and Sarralde J.(December 2007- February 2008) Cómo predecir el futuro, Dirección estratégica no. 24, 6th year page 17-20.
- Armstrong, J. Scott. (2001). *Principles of forecasting: a handbook for researchers and practitioners*. Boston, Mass. USA: Kluwer Academic.(003.2/P957)
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- Wilson, J. Holton; Keating, Barry & Galt, John. (2007). *Business Forecasting.* Fifth Edition New York, USA: McGrawHill.