DEPARTMENT OF
STATISTICS

estándar de teoría de probabilidad. Si X es una

g(X) es una función de X, entonces

$$E[g(X)] = \int^{\infty} g(y) f_X(y)\, dy.$$

dado por C(y).

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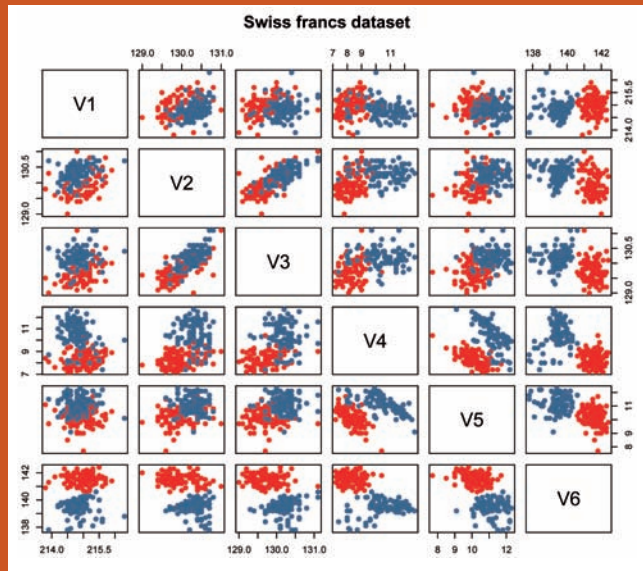
Currency-related data analysis

This Group consists of a multidisciplinary team made up of over 40 PhD's in the areas of Statistics, Econometrics and Operations Research. It comprises members of four multidisciplinary groups specialized in Statistical Modeling and Data Analysis, Macroeconomic and Financial Forecast and Analysis, Operations Research and Non-parametric and Intensive Computing Techniques.

They use the most advanced methodologies and the most appropriate computational tools to solve modeling, forecast, data analysis and optimization problems.

•LINES OF RESEARCH•

· The Operations Research group has expertise in:
  - Optimization of probabilistic dynamic systems by means of mathematical programming methods
  - Stochastic programming
  - Non-linear optimization in very large-scale problems
  - Development of heuristic and exact methods for location and routing problems
  - Stochastic combinatorial optimization
  - Game theory
  - Combinatorial optimization

· The Statistical Modeling and Data Analysis group works on:
  - Heterogeneity in statistical models and model selection
  - Dimension reduction methods
  - Functional data analysis
  - Regression analysis
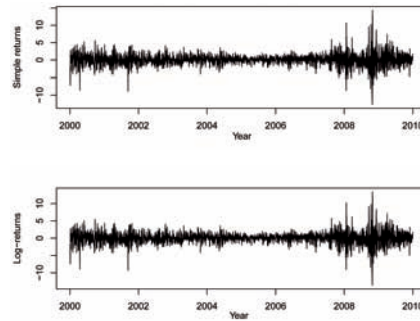
*Volatility in stock exchange prices*

  - Multivariate analysis
  - Biostatistics
  - Bioinformatics
  - Statistical process control
  - Reliability
  - Bayesian inference
  - Robust and diagnostic methods
  - Quality improvement methods
  - Models applicable to wind energy generation
  - Queuing models

  - Dynamic linear models
  - Stochastic optimization
  - Stochastic processes
  - Time series
  - Re-sampling techniques
  - Semi-parametric techniques

· The Macroeconomic and Financial Forecast and Analysis group is particularly oriented towards forecast and diagnosis.
  - Macroeconomic modeling, forecast and diagnosis.
  - Density functions for macroeconomic forecasts.
  - Macroeconomic variables disaggregation.
  - Methodology for constructing macroeconomic vector models for components of the Gross Domestic Product in its itemization of production and expense and combination of results from both itemizations.
  - Application of the previous methodology to Spanish, Euro area and Euro Member Country GDP models.

- Methodology for constructing econometric models on the Gross Added Value of regional economies including internal indicators and their relations to their supra-regional economy.
- Application of the previous methodology to Spanish Autonomous Communities and to the regions of countries in the Euro zone.
- Methodology for the inflation forecast based on the results from our lines of research in modeling and applications.
- Non-linear modeling suited to the most common characteristics of macroeconomic indicators and application thereof.
- Heteroscedastic unobservable component models.
- Use of bootstrap techniques in unobserved component models.
- Uncertainty modeling. Model comparison to represent asymmetric volatility responses.
- Outliers and heteroscedasticity. Effects of atypical observations in identifying conditional heteroscedasticity.

- Risk modeling. Alternative risk measurements. VaR and Expected Shortfall estimators.

· The group on Non-parametric and Intensive Computing Techniques in Statistics has experience on:
- Time series analysis.
- Functional data analysis, classification and processing.
- Financial risk analysis.
- Portfolio optimization.
- System reliability.
- Survival analysis.
- Re-sampling methods for high-dimensional data.
- Modeling and forecast in queuing models and shocks models.
- Actuarial models.

● INNOVATIVE TECHNOLOGICAL SOLUTIONS ●

· Statistical models and data analysis in high-dimensional problems: experience in processing data from Microarrays, Bibliometric Databases, Economic/financial Databases and Image Databases.
· Analysis with statistical Data Mining techniques including internally developed pattern recognition and classification problem techniques.
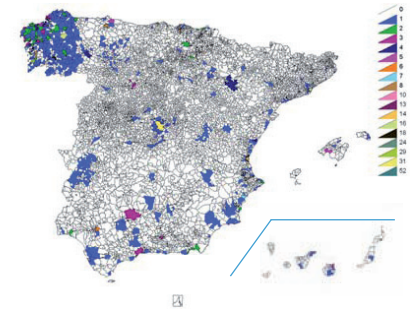
Geographic distribution of business activity

· Implementation of Intensive Computing statistical methods including the design of internal Bootstrap-type re-sampling methodologies with application in time series, or Bayesian techniques with a particular emphasis on the use of Gibbs-type sampling or of MCMC techniques.

· Macroeconomic, sector-based (tourism and energy sectors) and business forecasting, as well as specific market demand studies, and sector-based econometric analyses.

· Integration of forecasts in decision-making processes.

· The application of disaggregated approaches is a useful instrument in economic policy and in business and provides more precise decision-making in aggregate forecast.

· Non-linear modeling, and more specifically, the use of regime-switching models when needed.

· The use of leading indicators.

· Modeling all the calendar effects present in a time series, as well as multiple seasonal pattern, trend and seasonal break, control mechanism-generated restriction modeling, etc.

· Daily and hourly data modeling.

· Macroeconomic forecast methodology.

· Development and resolution of Operations Research Models for optimizing decisions in different areas of application (networks, logistics, finance, energy, etc.).

· Engineering and Medical Systems Reliability Analysis.
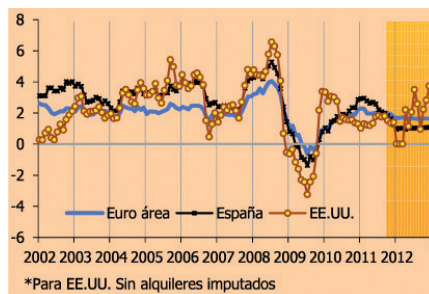
Total inflation: yearly growth rates

· Comparison of medical treatments or treatment of any other type by means of survival techniques.

· Stock exchange studies relating to portfolio optimization.

● SCIENTIFIC–TECHNICAL SERVICES ●

· Construction of macroeconomic indicators of national and regional activity.

· Analytical and computational decision aid tools for agents in electric energy markets.

· Electric energy price and demand forecasting tools based on time series methodologies.

· Development of optimization models and methods under uncertainty for financial decision-making.

· Optimization of the performance of logistic systems (routing design, sizing and management of vehicle fleets, service location).

· Design of dynamic protocols for operating complex probabilistic systems (communication networks, sensor networks, production/inventory systems, etc.) while optimizing their performance.

· Short-term and macroeconomic analysis of the Spanish and Euro Area economy. Thorough regional level analyses and forecasts focused on economic growth, the job market, prices and industrial production and consumer prices. Other elements included in these analyses are the estimation of synthetic demand indicators, provincial-level economic studies and sector-based analyses using high frequency indicators. The regional forecasts are made through specific methodologies which compensate for the lower availability of data and the strong dependence on exogenous factors.

· Analyses and forecasts about the economic climate updated in real time concerning the economies of Spain, the Euro area and the United States of America.
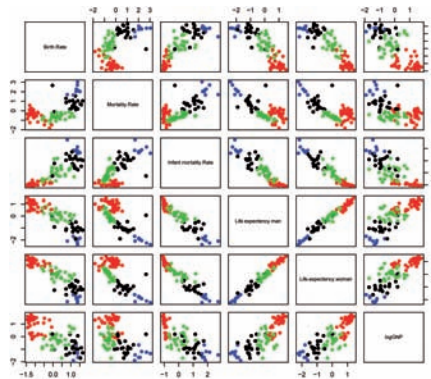
Identification of groups in demographic data

· Sector-based technology innovation and intensity analysis for regional economies. This analysis is performed with three objectives in mind: estimating the technological intensity in economic sectors, identifying the key elements which favor or inhibit business innovation in different sectors, and formulating specific economic policy proposals.

· Sector-based competitive analysis for regional economies. The competitiveness of the different regional economic sectors is analyzed through a comparative analysis of labor costs. Both the whole of the Spanish economy and of the related regional economies can be used as a term of comparison. The indicators analyzed are primarily Unit Labor Costs (ULC), Mean Labor Costs, and the Mean Productivity of the workforce. The regional productive sectors are classified in 4 categories depending on the relative evolution of these four variables with respect to the national average.

· Sector-based studies for the Spanish economy. Analysis and challenges for specific sectors of the Spanish economy. It is a product mainly intended for the business world that seeks to offer market studies based on the objective observation of the economic indicators and on their rigorous econometric analysis.

· Competitive analysis in regional and local markets. Through this consumer price analysis compared with the historical evolution of said prices, it is possible to estimate specific national, regional and provincial level markers which indicate possible market distortions and lack of competition, therefore orienting control and regulation policies.

· Observatory for unemployment and estimation of the individual unemployment risk. The job security of economic agents depends both on individual characteristics and on systemic variables. This analysis offers detailed forecasts of the global evolution of the job market as well as the possibility of consistently estimating the individual unemployment risk according to the macroeconomic setting and personal characteristics.

· Efficient management of industrial orders which adapt in real time to the national and local economic climate. Modern production techniques are based on optimizing production processes, minimizing stocks and planning production according to the actual demand.

The estimation of future orders is essential in this planning. This analysis will allow estimating the demand of each client according to not only his history but also the national, regional and even provincial economic conditions.

•COLLABORATIONS•

The Statistics Department research activities are funded by the European Commission, the Public Administration of Spain and by the Community of Madrid through a number of national and international research projects received in public tenders.

This funding allows our team to collaborate with a large number of researchers worldwide belonging to renowned institutions such as the **University of Chicago, Stanford University, Massachusetts Institute of Technology, London School of Economics,** in the United States, Europe and in Latin America, the **Universidad de Buenos Aires, ITAM and CINVESTAV,** among others.
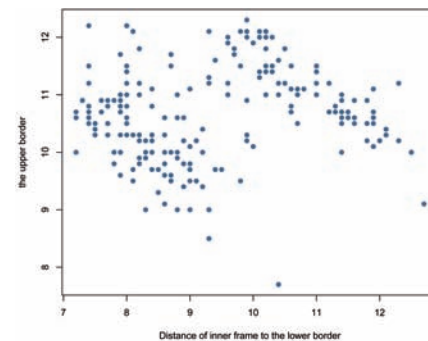

Image analysis

The Group's main partners and clients inclu-
de the companies: **Acciona Energía S.A., Iber-
drola, Repsol, BBVA, Indra S.A., Caja Madrid,
Caixa Catalunya, Price Waterhouse, Endesa,
Enusa, and Ernst&Young S.L.,** among others.

We have also collaborated with national and
regional public entities: **Generalitat de Cata-
lunya, Comunidad de Madrid, Junta de
Andalucía, Agencia de Defensa de la Com-
petencia de Andalucía, and Consejo Supe-
rior de Cámaras de Comercio.**
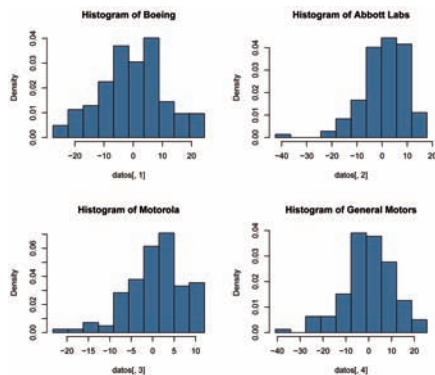
Profit distribution stock exchange prices

●**TECHNOLOGICAL EQUIPMENT**●

In addition to our human capital, the group
also has:

· Computer programs for data processing and
  simulations.
· Decision-making analytical and compu-
  tational tools.
· Computer equipment for intensive nume-
  rical calculation.
· Electronic access to academic publications
  in different sectors.
· Access to publications of different com-
  panies and institutions in the sector.

DEPARTAMENT OF
STATISTICS

Contact Information

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