• The BIAS-FD Tool.
  • Tool to calculate the quality of a banknote to determine whether it is usable (FIT-UNFIT) using supervised Machine Learning algorithms.

• The Minijourney.
  • Six NCBs perform extraction of information of banknotes (S/N + 12 properties) using banknotes processing machines.
  • Storage in a Hadoop cluster at the ECB for analysis.

• Neurometrics.
  • Applied to the design of banknotes and their security features.
  • Neurometrics measured on participants performing a visual and physical evaluation of different banknotes.
On going: Text Mining and NLP projects

- New economic policy uncertainty index for Spain (EPU), and Latam
- Extraction of structured data from mortgage loan agreements.
- Semi-Automated review of certain aspects in consumer credit.
- Extraction of Climate-related disclosures from financial reports.
- Sentiment analysis of Bank of Spain’s Quarterly reports.
- Sentiment analysis of Financial Stability Reports.
- Text mining of press bulletin to aid weekly economic situation report.
- Topic modelling of Statements and press conferences of Central Banks.
INNOVATIVE TECHNIQUES AT THE BANK OF SPAIN

On going: Data Quality and anomaly detection projects

• Detecting faults & outliers in CBSO questionnaires.
  • Detect alternative patterns to assess data quality and perform data imputation of missing values via machine learning for questionnaires sent by corporations to the Central Balance Sheet Data Office.

• Data Analytics on Basel III reports to improve data quality.
  • Detect anomalies, quality problems and inconsistencies not covered by the XBRL validations in the COREP and FINREP reports.


• Banknote Image Analysis in the Spatial and Frequency Domains (European Patent EP2911123B1).
• Tool to calculate the quality of a banknote to determine whether it is usable. Fitness classification:
  • FIT for recirculation.
  • UNFIT for recirculation.
• Supervised Machine Learning algorithms based on spatial and frequency information.
• Refines the Economic Policy Uncertainty (EPU) index (Baker et al., 2016) for Spain.
• Fine-tunes richness of expressions and newspaper coverage.
• Based on 7 relevant Spanish national newspapers from January 1997 to the present.
• New EPU shows more consistent chronology of relevant events.
• Available at: http://www.policyuncertainty.com/spain_GPU.html
Relative contribution of keywords, press, and time coverage: GDP responses
• Study on sentiment evolution in Quarterly Reports on the Spanish Economy (mainly in the Overview section).
• Creation of dictionary of positive and negative terms (90 + variants) in Spanish.
• Evaluation of evolution of sentiment and the PIB since Q1 1999.
• Some recent related literature: Clements and Reade (2016); Stekler and Symington (2016); Hollrah, Sharpe, Sinha (2017); Catalfamo (2018); Jones, Sinclair and Stekler (2018)
Quarterly Reports on the Spanish economy published online (PDF) since 1999Q1

Since 1999: description of the economic situation and qualitative risk assessment

As of 2007: quantitative projections published once per year (in March)

As of 2014: quantitative projections published four times per year
Qualitative index vs. Forecasts ("shadow" and published)

• Dynamic stochastic general equilibrium modeling (DSGE) is a method in macroeconomics that attempts to explain economic phenomena through models based on general equilibrium theory and microeconomic principles.

• This paper shows how these models can be computed through neural networks on simulated data.

• Allows model estimation using micro-data.

- Uses summaries of TV news from 1968 to 2007 to create a new information measure on potential tax policy reforms in the USA.
- Applies Random Forests and Fuzzy Forests algorithms.
- Results reveal that one-month-ahead anticipations of tax approvals significantly stimulate current economic activity.
- Figure: predicted probability for tax bill approvals one month ahead based on new media measure.

- Focuses on nowcasting and forecasting quarterly private consumption.
- Uses proxy indicators of economic and policy uncertainty indicators such as consumption-related search queries.
- Google-based and uncertainty indicators perform notably when combined with traditional ones at estimation horizons beyond the nowcasting one, consistent with capturing information about future consumption decisions.