BBVA Research

Using Big Data at BBVA Research

Opportunities and challenges of using big data for policy analysis

Panel discussion

Macroeconomic policy analyses with big data

Danmarks Nationalbank workshop, October 2019

Creating Opportunities

Main takeaways working with Big Data at BBVA Research

It helps us to …

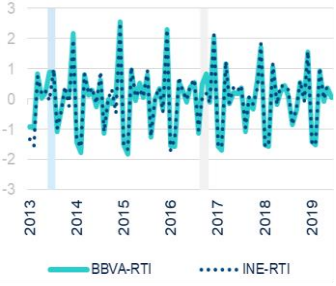
Complement and enrich our traditional databases with high dimensional data:

- Quantifying **new trends** and exploiting new **dimensions.**
- Having **timely answers** on the impact of different events, **providing early warning signals** indicators.
- Improving our models performance at **nowcasting.**

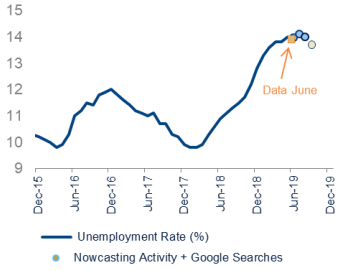
… but still some challenges

- **Data challenges**: missing data, data sparsity, data quality,…
- In most cases, there's not enough **time horizon** to improve our models performance at **forecasting.**
- **Legal and regulatory** issues for data sharing.

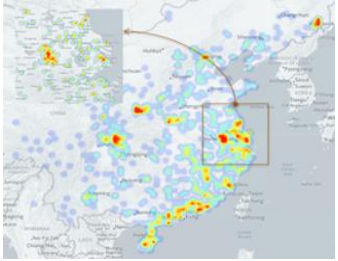
RETAIL SALES IN SPAIN: INE & BBVA



UNEMPLOYMENT NOWCASTING IN TURKEY



HOUSING PRICE MEDIA SENTIMENT IN CHINA 2018



CENTRAL BANK NARRATIVE WORDCLOUD

Data treatment and robustness check became the most time consuming parts of the working process

To face with new and high dimensional data

1 Data treatment and analysis:

Data cleaning, missing values, outlier detection, high heterogeneity, sparsity,…

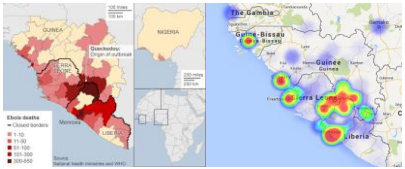
New methodologies to face data challenges: dimensionality reduction, clustering, regularization,…

Massive and unstructured datasets: **Importance of making the right questions**

2 Robustness check:

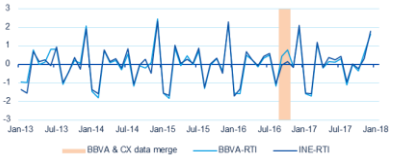
Cross-check of Big Data outcome with traditional data and methodologies.

Ebola Outbreak: WHO and GDELT



Protectionism: GTA and GDELT

Retail sales: INE and BBVA



How to exploit the potential of Big Data?

New framework in the digital era…

- New availability of data
- Combination of historical data with real time data
- Better and faster infrastructure
- Advanced data science techniques and algorithms
- New answers to old questions
- Higher computational abilities to face more data granularity

…which needs the development of new competences to take advantage of it

Economic and business knowledge to guide the question.

Developing the data management and programming capabilities to work with large-scale datasets.

Deepening the statistical and econometric skills to analyze and deal with high-dimensional data.

Interpreting the results: summarize, describe and analyze the information.

New data may end up changing the way in which economists approach empirical questions and the tools they use to answer them.

We use Big Data at BBVA Research to provide a better, ”Real Time” and “High Definition” economic analysis

Some examples of our products

Economic indicators in **Real Time**

Nowcasting:

1. Activity using bank’s data (Retail Sales Index).
2. Unemployment using Google data.

Economic Analysis in **High Definition**

Real time analysis with high granular data to analyse sentiment towards corporates using the media information.

Social & Economic **Networks**

Using NLP to understand monetary policy narrative for European Central Bank, Federal Reserve and Central Bank of Turkey.

Economic Indicators in **Real Time**

Internal databases: working with aggregated and anonymized BBVA Data

710M card transactions from 1M PoS, made by 53M people, representing €43.000M

4 billion card transactions made by 14M people

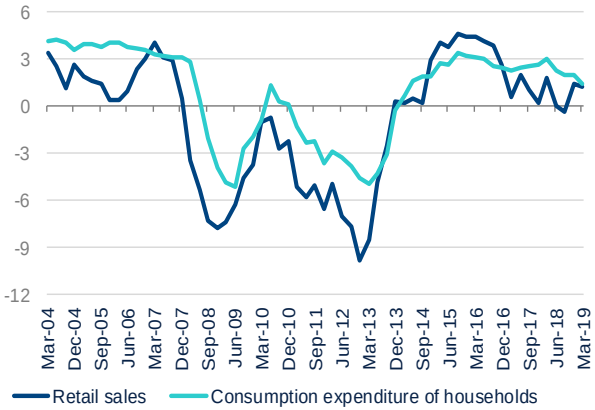
1.500M card transactions from 1,1M PoS, made by 88M people, representing €41.000M

Economic Indicators in **Real Time**

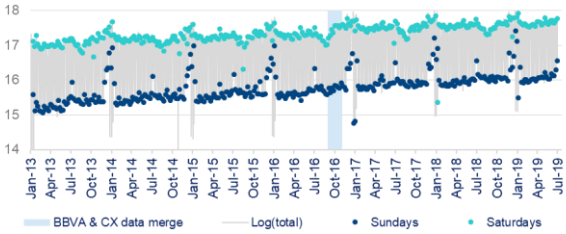
Retail trade sector dynamic leads the evolution of consumption, which represents a high share of the GDP

SPAIN: RETAIL SALES VS. CONSUMPTION EXPENDITURE OF HOUSEHOLDS

(%, YOY)

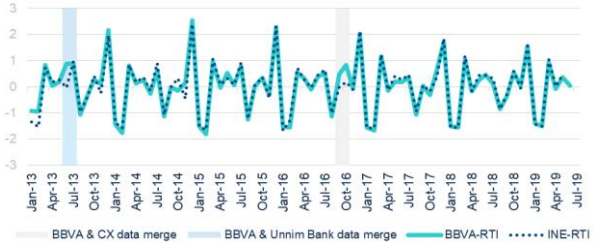


AGGREGATE RETAIL TRADE - DAILY FREQUENCY (LOGARITHMS)



RETAIL TRADE INDICES: BBVA VS INE

(STANDARDIZED MONTHLY GROWTH RATE)



Source: BBVA Research and BBVA Data & Analytics
Bodas et al. (2018). Measuring retail trade through card's transaction data.
Further information here

High granularity: Dynamics down to subnational level

Multi Dimensional: More detailed socioeconomic features

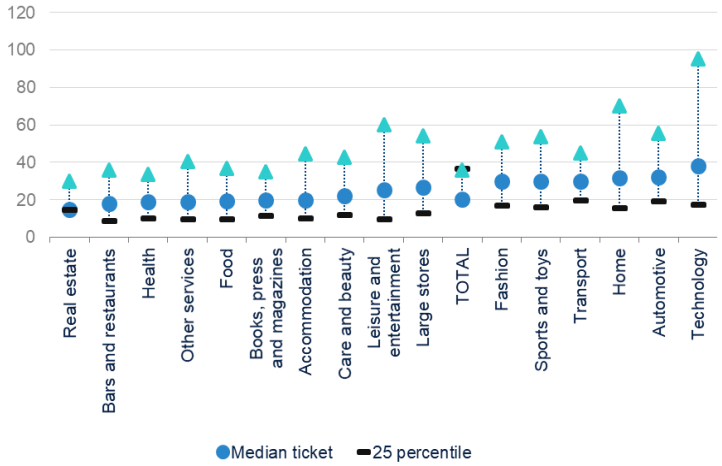
Ultra High Frequency: Dynamics up to sub-monthly frequency

Economic Indicators in **Real Time**

The granularity of the information can be really valuable for the analysis

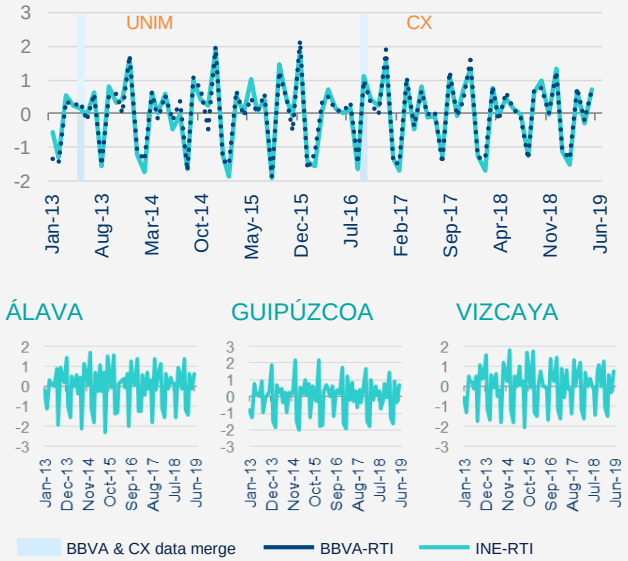
BBVA RETAIL SALES INDEX BY MERCHANT

(MEDIAN TICKET IN JUN-19, €)



BASQUE COUNTRY

(STANDARDIZED % MOM)



Source: BBVA Research and BBVA Data & Analytics
Bodas et al. (2018). Measuring retail trade through card's transaction data.
Further information here

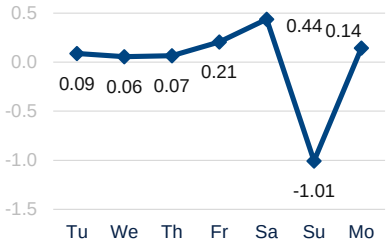
Economic Indicators in **Real Time**

The need of Analysts: Did you know that seasonality can explain 2/3 of time series performance?

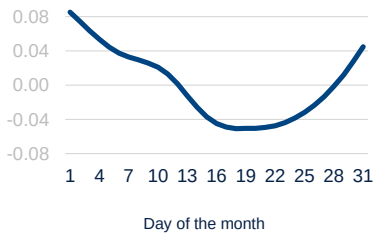
PERIODIC EFFECTS (SEASONALITIES)

$$\log(y_t) = \mu_t + \gamma_t^w + \gamma_t^m + \gamma_t^y + \gamma_t^h + \varepsilon_t$$

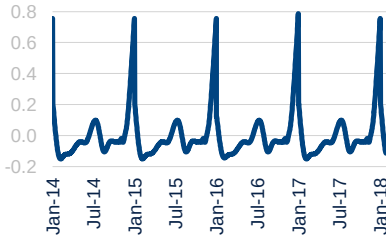
INTRA-WEEKLY SEASONALITY (γ_t^w)



INTRA-MONTHLY SEASONALITY (γ_t^m)



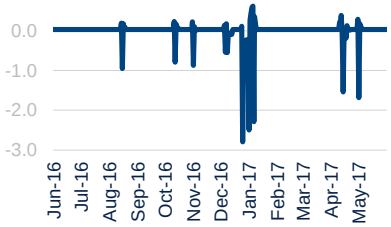
INTRA-ANNUAL SEASONALITY (γ_t^y)



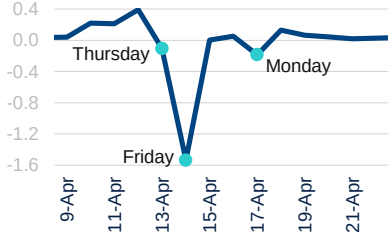
FIXED AND MOVING HOLIDAYS

$$\log(y_t) = \mu_t + \gamma_t^w + \gamma_t^m + \gamma_t^y + \gamma_t^h + \varepsilon_t$$

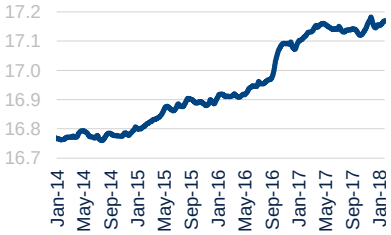
BBVA RTI: HOLIDAY'S EFFECTS (γ_t^h)



BBVA RTI: EASTER 2016



BBVA RTI: TREND (μ_t)



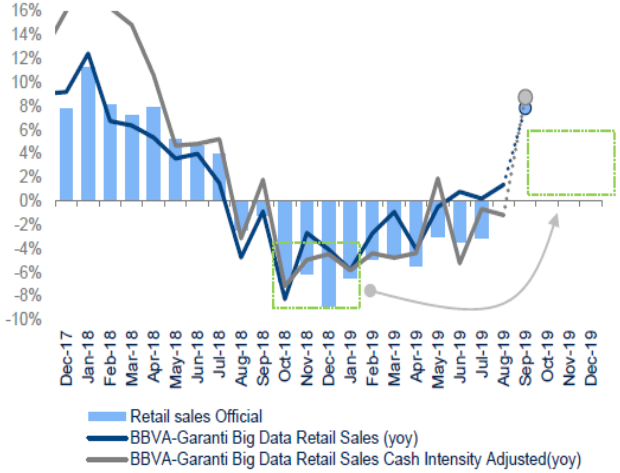
Bodas et al. (2018). Measuring retail trade through card's transaction data.
Source: BBVA Research and BBVA Data & Analytics

Economic Indicators in **Real Time**

Our real time indicators give us some advantages to track the business cycle

BBVA-GB BIG DATATRANSACTIONS VS OFFICIAL DATA

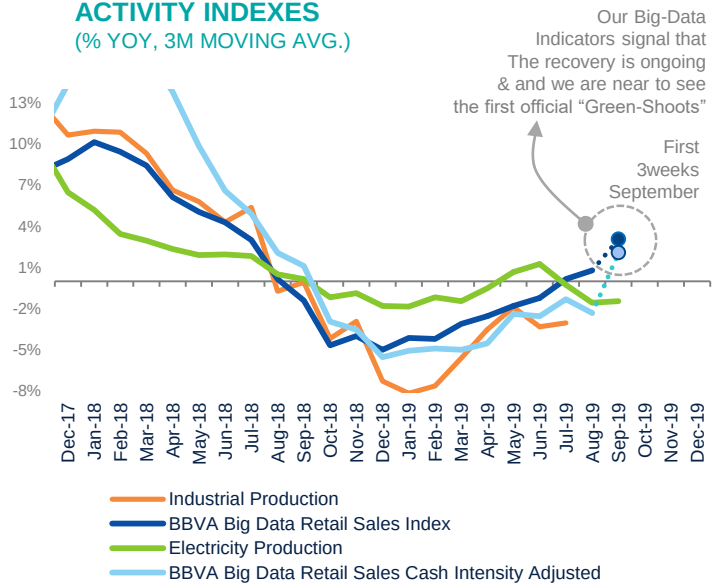
(REAL TERMS, YOY)



Source: BBVA Research

TURKEY: HARD & BIG DATA ACTIVITY INDEXES

(% YOY, 3M MOVING AVG.)



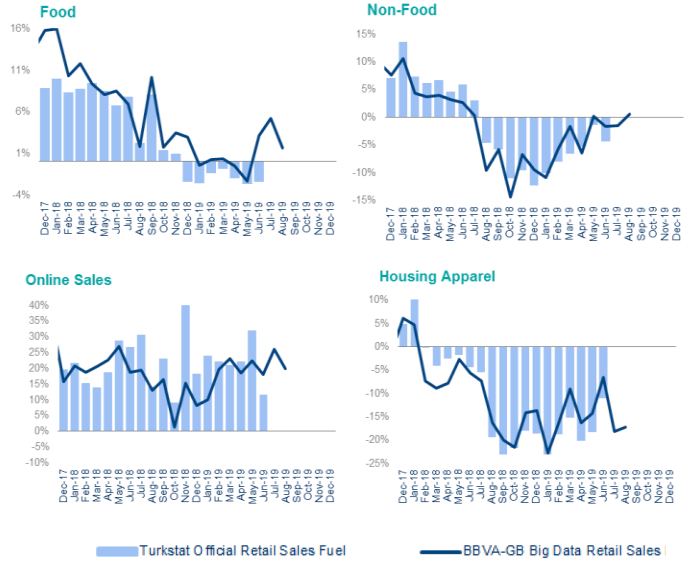
Source: CBRT, TURKSTAT, BBVA Research Turkey

Our Big Data indicators using bank's transactions data signal that the recovery is gaining momentum (consistent with soft data).

Economic Indicators in **Real Time**

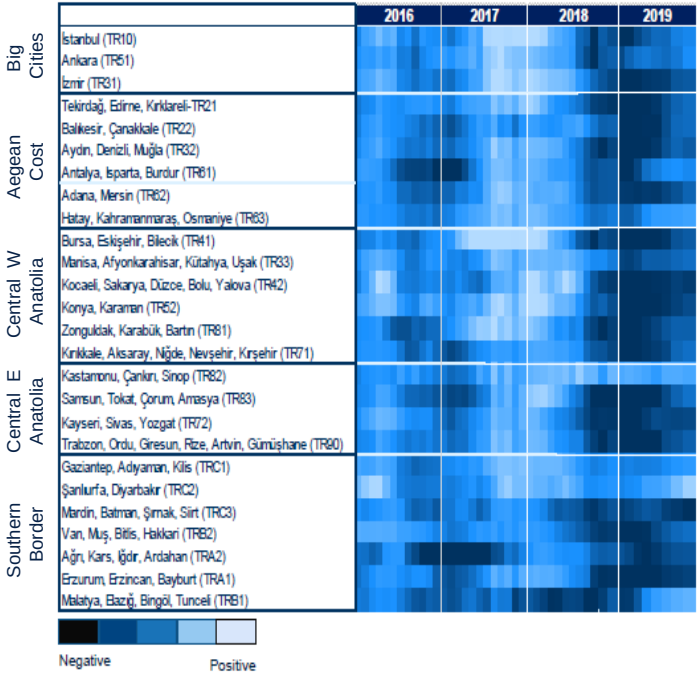
BigData allows us to define high definition indexes and build new statistics as provincial data

RETAIL TRADE INDICES: BBVA-GB BIG DATA



Source: BBVA Research

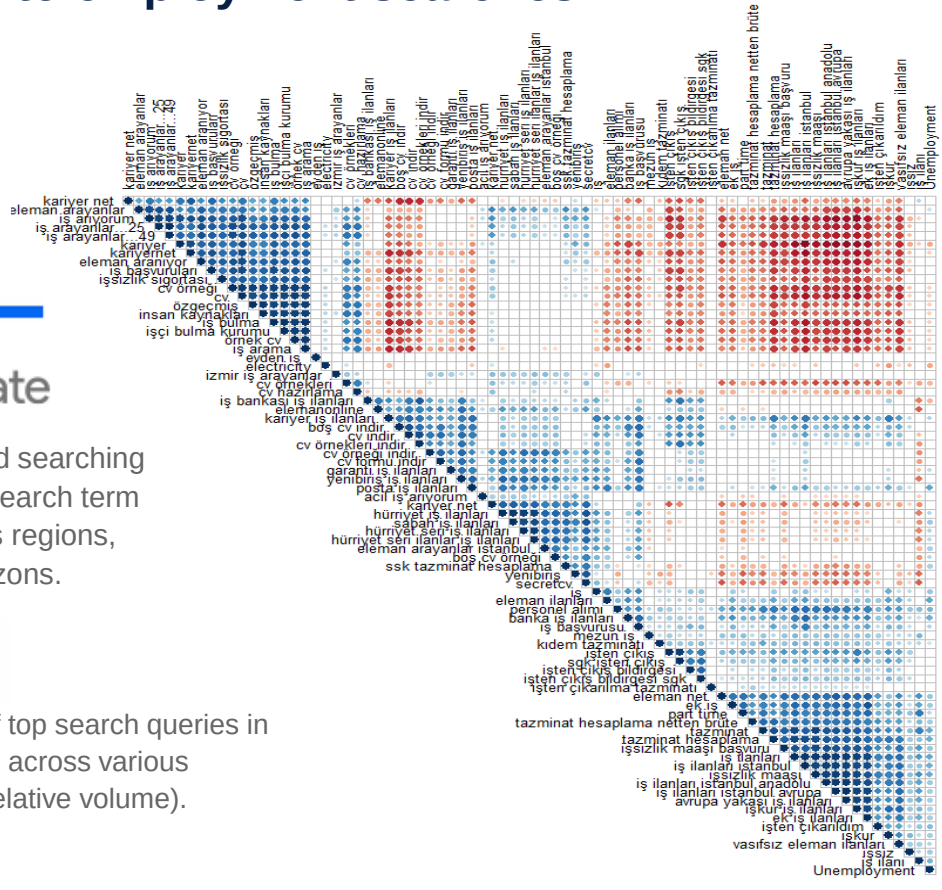
TURKEY: RETAIL SALES REGIONAL HEAT MAP



Source: CBRT, TURKSTAT, BBVA Research Turkey

Economic Indicators in **Real Time**

Google Correlate &Trends can help us to find terms related to employment searches



Google Correlate

Finds the most correlated searching topics (100) for a given search term in interest across various regions, languages and time horizons.

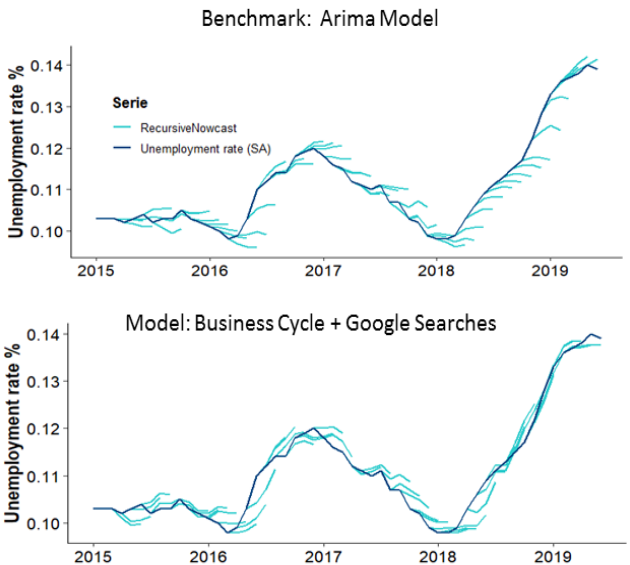
Google Trends

Analyzes the popularity of top search queries in Google Search from 2004 across various regions and languages (relative volume).

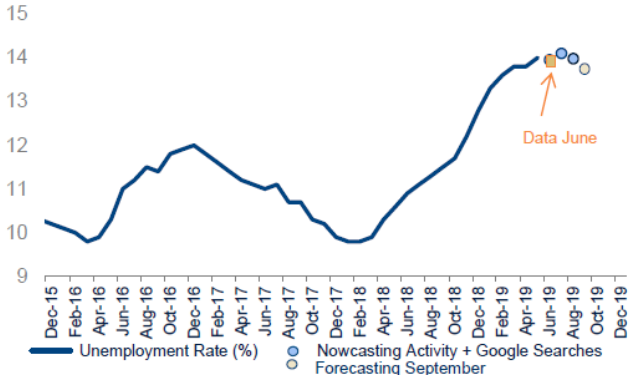
Economic Indicators in **Real Time**

Google searches provide extra information to nowcast unemployment with an advantage of 3 months

UNEMPLOYMENT OUT-OF-SAMPLE FORECASTS
(3M RECURSIVE OUT OF SAMPLE FORECASTS)



TURKEY: UNEMPLOYMENT RATE (SA) NOWCAST



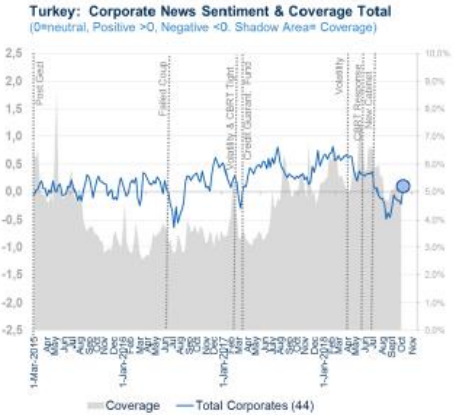
TURKEY: UNEMPLOYMENT CHANGES

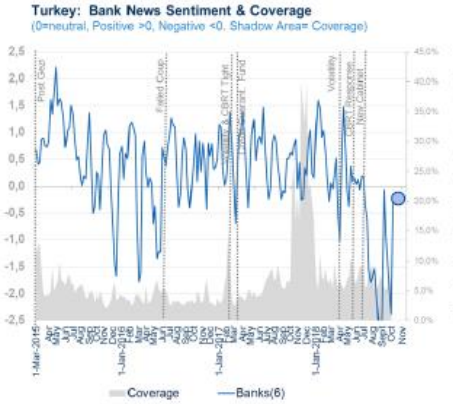
Source: BBVA Research

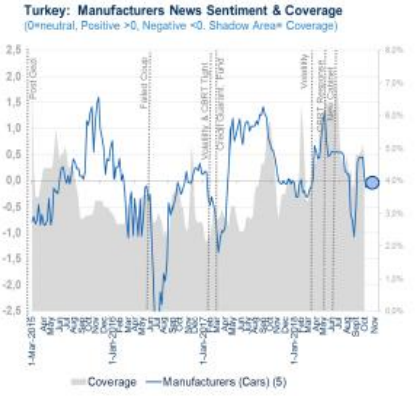
Here you can find a similar project to nowcast Spanish tourism

Economic Analysis In **High Definition**

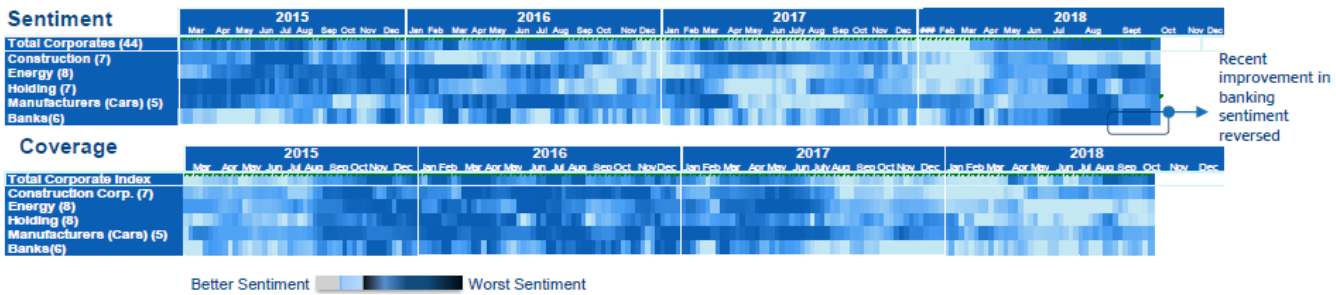
Corporate news Sentiment give us "Early Warning Signals" of corporate balance sheet health…







Turkey: BBVA Research Big Data Sentiment and Coverage on Corporates

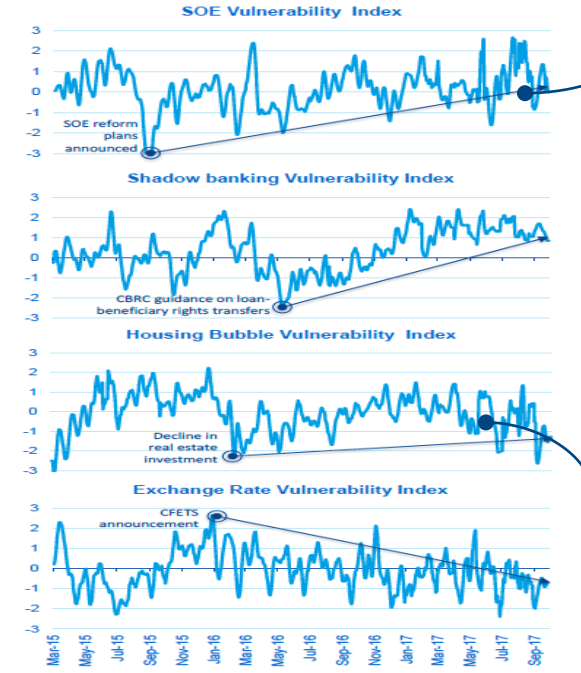


Source: BBVA Research

Economic Analysis In **High Definition**

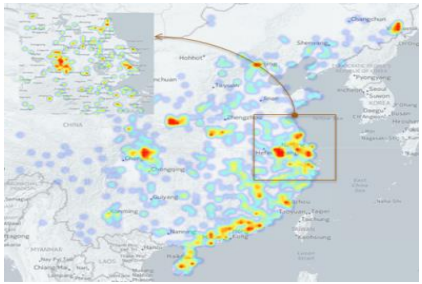
We also developed hybrid Indicators (Hard Data & Sentiment Data) to disentangle risks in China

CHINESE VULNERABILITY SENTIMENT INDEX
(CVSI)



CHINA SOE MAP
(SENTIMENT ON SOE)

GEOGRAPHICAL ANALYSIS HOUSING PRICES
(SENTIMENT ON HOUSING PRICES IN 2018)



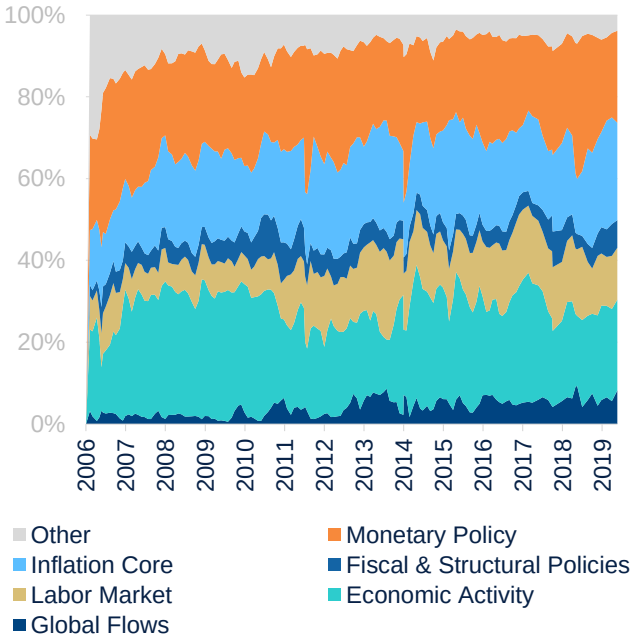
Source: BBVA Research. Further information could be found here.

Social & Economic Networks

NLP to analyze monterary policy narrative of Central Banks, identifying what they are talking about…

IDENTIFIED TOPICS IN CENTRAL BANKS REPORTS

CENTRAL BANK OF TURKEY: EVOLUTION OF TOPICS



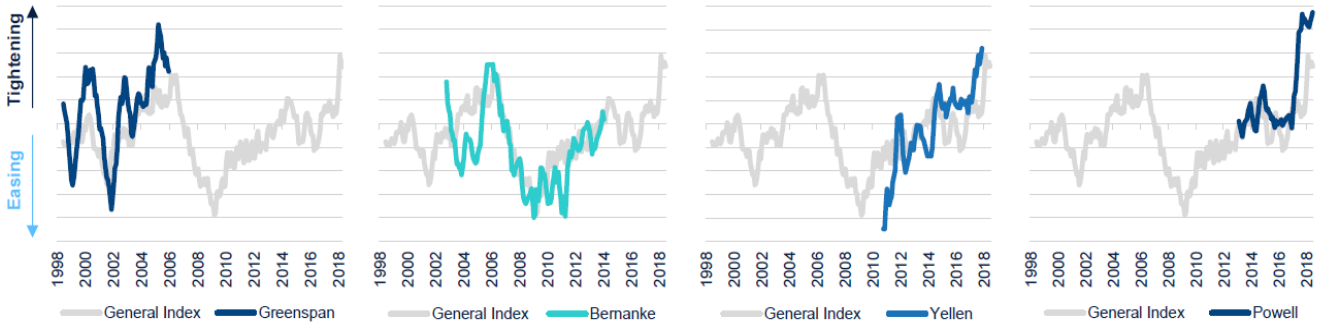
Source: BBVA Research. Further information can be found here.

Social & Economic Networks

… and how they are talking, even focusing in personal tone according to particular speeches …

GENERAL AND FED GOVERNOR HAWKISH/DOVISH INDEX BY SPEAKER OVER TIME

(TONE. 12 MONTHS MOVING AVERAGE TONE)



From a EM Crisis Reactive and tigtening… (Mr Greenspan) 1987-2003

To a Governor Managing the crisis… (Mr Bernanke) 2016-2014

To a Lady managing the Exit Strategy… (Mrs Yellen) 2014-2018

To a Normalization Policy (Mr Powell) 2018-

Source: BBVA Research. Further information can be found here.

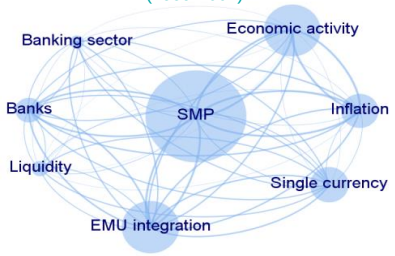
Social & Economic Networks

…Or understand the inter-connexions between topics and Central Banks

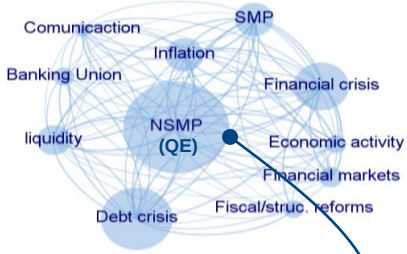
MONETARY POLICY IN DEVELOPED ECONOMIES AND RESPONSE IN THE EMERGING MARKETS
(NETWORKS)

ECB

PRE LEHMAN
(1999-2007)



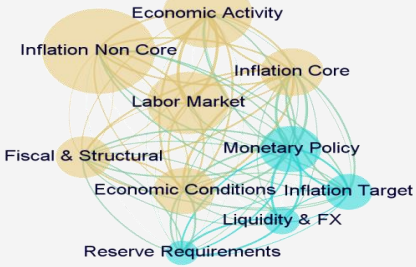
CRISIS
(2007 -2013)



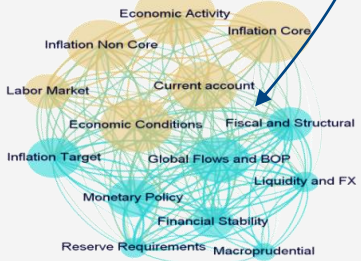
QE & RECALIBRATION
(2013-2018)

CBRT

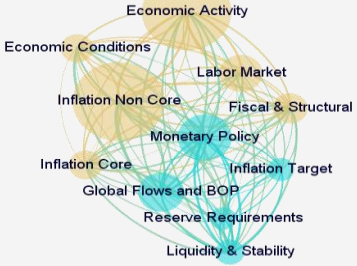
INFLATION TARGET
(2006-2008)



FINANCIAL CRISIS
(2009-2012)



THE GLOBAL POST-CRISIS
(2012-2017)



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Panel discussion

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Danmarks Nationalbank workshop, October 2019

Creating Opportunities