Session 6: Administrative and Alternative Data Sources

Big Data and Macroeconomic Nowcasting: From Data Access to Modelling

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*The views expressed are the author’s alone and do not necessarily correspond to those of the corresponding organisations of affiliation

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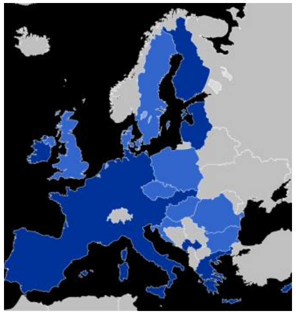
Eurostat, the Statistical Office of EU



- About 700 people with 28 different nationalities
- Statistical Office of European Union, part of EC
- Core business:
  - **Euro-zone (19) & EU (28) aggregates**
  - **harmonization, best practices, guidelines, trainings & international cooperation**
- Methodology team: Time Series, Econometrics, SDC, Research & EA

Why interested in Big Data for nowcasting?

- **Big Data** are complementary information to standard data, being based on **different information sets**
- More **granular** perspective on the indicator of interest, both in the temporal and cross-sectional dimensions
- It is **timely** available, generally **not subject to revisions**

European research project: Apr 15 to Jul 16

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Research questions and findings

Can Big Data help for Macroeconomic Nowcasting?

What are the potential Big Data sources?

1. Literature review
2. **Models/methods** to be used for Big data
3. **Recommendations** on how to handle Big Data
4. **Case study**: IPI, Inflation, unemployment of some EU countries

Big Data types & dimensionality

- When the dimensionality increases, the volume of the space increases so fast that the available data become **sparse**.
- For statistically significant result, the amount of data needed often grows exponentially with the dimensionality.
- Use of a typology based on Doornik and Hendry (2015):
  - **Tall** data: many observation, few variables
  - **Fat** data: many variables, few observations
  - **Huge** data: many variables, many observations

Models race

- Dynamic Factor Analysis
- Partial Least Squares
- Bayesian Regression
- LASSO regression
- U-Midas models
- Model averaging

255 models tested, **macro-financial** & **google trend** data

Statistical Methods: findings

- Sparse regression (LASSO) works for fat, huge data
- Data reduction techniques (PLS) helpful for large variables
- (U)-MIDAS or bridge modelling for mixed frequency
- Dimensionality reduction improves nowcasting
- Forecast combination: Data-driven automated strategy with model rotation based on forecasting performance in the past works well

From Data Access to Modelling

Step-by-step approach, accompanied by specific recommendations for the use of big data for macroeconomic nowcasting, guiding to

- **the identification and the choice of Big Data**
- **pre-treatment and econometric modelling**
- **the comparative evaluation of results to obtain a very useful tool for decision about the use or not of Big Data**

Step 1: Big Data usefulness within a nowcasting exercise

Recommendations

1. *Evaluate the **quality** of the existing nowcasts and identify issue (bias or inefficiency or large errors in specific periods), that can be fixed by adding information in Big Data based indicators*
2. *Use of Big Data only when expecting to improve the timeliness and/or the quality of nowcastings*
3. *Do not consider Big Data sources with **spurious correlations** with the target variable*

Step 2: Big Data search

Recommendations

1. *Starting point for an assessment of the potential benefits/costs of the use of Big Data for macroeconomic nowcasting: identification of their source*
   - **Social Networks (human-sourced information)**
   - **Traditional Business Systems (process-mediated data)**
   - **Internet of Things (machine-generated data)**
2. *Choice is heavily dependent on the target indicator of the nowcasting exercise*

Step 3: Assessment of big-data accessibility and quality

Recommendations

1. *Privilege data providers with guarantee of **continuity** and of the availability of a good **metadata** associated to the Big Data*
2. *Privilege Big Data sources ensuring sufficient time and cross-sectional coverage*
3. *If a bias is observed a **bias correction** can be included in the nowcasting strategy.*
4. *To deal with possible instabilities of the relationships between the Big Data and the target variables, nowcasting models should be **re-specified on a regular basis** (e.g. yearly) and occasionally in the presence of unexpected events.*

Step 4: Big data preparation

Recommendations

1. *Big data often unstructured: proper mapping*
2. *Pre-treatment to remove deterministic patterns*
   - **Outliers, calendar effects, missing observations**
   - **Seasonal and non-seasonal short-term movements should be dealt accordingly to the characteristic of the target variable**
3. *Create a **specific IT environment** where the original data are collected and stored with associated **routines***
4. *Ensure the availability of an **exhaustive documentation** of the Big Data conversion process*

Step 5: Big Data modelling strategy Recommendations

1. *Identification of appropriate econometric techniques*
2. *First dimension: choice between the use of methods suited for large but not huge datasets, therefore applied to summaries of the Big Data (Google Trends)*
   - **nowcasting with large datasets can be based on factor models, large BVARs, or shrinkage regressions**
3. *Huge datasets can be handled by* ***sparse principal components****, linear models combined with heuristic optimization, or a variety of* ***machine learning*** *methods such as* ***LASSO & LARS regression***
4. *In case of mixed frequency data, methods such as UMIDAS and, as a second best, Bridge, should be privileged.*

Step 6: Results evaluation of Big Data based nowcasting

Recommendations

1. *Run a critical and comprehensive **assessment of the contribution** of Big Data for nowcasting the indicator of interest based, e.g., on standard criteria such as **MSE or MAE**.*
2. *In order to reduce the extent of data and model snooping, a cross-validation approach should be followed:*
   - **various models and indicators, with and without Big Data, estimated over a first sample and selected and/or pooled according to their performance**
   - **then the performance of the preferred approaches re-evaluated over a second sample**

Case study

*- Implementation of all these steps for nowcasting **IP growth, inflation and unemployment in several EU countries** in a **pseudo out of sample context**, using Google trends for specific and carefully selected keywords for each country and variable*

- Big Data specific features: transform unstructured into structured data, time series decompositions, handling mixed frequency data

*- Overall, the <u>**results are mixed**</u> but there are several cases where Google trends, when combined with rather sophisticated econometric techniques, yield forecasting gains, though generally small.*

- Gains in term of timeliness or revisions have not been considered

Literature contribution

Big Data and Macroeconomic Nowcasting: from data access to modelling

[illegible]

2016 edition

eurostat

Eurostat Statistical Working Paper

"Big Data and Macroeconomic Nowcasting: From data access to modelling"

- Methodological finding will be included in 2 chapter of the **Eurostat/UNECE Handbook on Rapid Estimates** currently under 2nd peer review, (forthcoming in 2017)

What's next? Big Data Econometrics

2017, a new project focusing on:

- Econometrics, Filtering issues, advanced Bayesian estimation and forecasting methods
- **Real time** empirical evaluations (including a direct comparison with Eurostat flash estimates),
- **New ways and new metrics** to present nowcasts
- Possible data **timeliness/accuracy gains**
- Big data handling tool developed as **R package**
- Scientific summary for Big Data Econometric **strategy**

Thank you for your attention!!

Some References:

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