Process automation for treatment of missing values in e-invoice data

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Introduction

e-invoice:

- monthly data on mandatory e-invoice declaration from Tax Authority;
- 80M+ registries on issuer/acquirer transaction values;
- incomplete administrative data that needs to be treated to be useful for statistical production;
Aim

Implement an automated process to detect and correct missing values.

- Review data from 2000+ most economically relevant issuers;
- A reproducible pipeline allowing for robust data-driven decision making;
Methodology

Assumptions:
- The identification of the most relevant issuers was done with feedback from users;
- Missing values:
  - *total missing*: no value is reported by the issuer;
  - *partial missing*: both the reported value and the number of acquirers by issuer are much lower than expected.
Methodology (cont.):

An isolation forest algorithm for anomalies’ detection is applied to the identification of partial missing values both for transaction values and reported number of acquirers:

- the algorithm of isolation forest consists in splitting sub-samples of the data according to the feature;
- the rarer the observation, the more likely is that the outlier (anomaly) is put alone in one branch and fewer splits will take to isolate it;
- it allows us to have a conservative approach, only treating the more obvious (higher probability) anomalies.
Methodology (cont.):

Kalman Smoothing on structural time series models is used for imputation:

- imputation is done on taxable amounts univariate time series at level issuer / acquirer’s class;
- imputations are done both for total and partial missings:
  - for partial missings, the reported partial value is subtracted from the Kalman Smoothing imputation.
Results

Process network
Conclusions

- This procedure allows to identify and correct missing data and to ensure an increase in the quality of administrative data;

- When possible, the goal is to replace data collected through traditional surveys with administrative sources, in the field of short-term statistics.
Cheers from Portugal

Thank you for your time.