Early Warning System for Non-Performing Clients

Abstract

In its "Guidance to banks on non-performing loans", ECB requires banks to implement an Early Warning System (EWS) "to identify and manage potential non-performing clients at a very early stage, in order to monitor performing loans and prevent the deterioration of credit quality". ECB gives freedom to banks in their EWS development. Despite its relevance, the literature on EWS remains scarce. Relying on a unique dataset provided by a systemic European bank including 5 million observations of anonymized data from 2018 to 2024, we predict the customers who will become non-performing (using 90 past-due definition) in a given warning horizon. We propose two solutions to address time and customers' heterogeneity issues.

Firstly, to address clients heterogeneity issue, we divide our dataset into several clusters using k-means, fit a prediction model on each cluster, and combine those models together. This boosts the out-of-sample performance compared to a case where we fit a single prediction model on the whole dataset and a case where we rely on domain knowledge to determine the clusters.

Secondly, to address time heterogeneity issue, we forecast the unconditional probability to be positive using macroeconomic variables and then rescale the output of the prediction model using Bayes' theorem. This boosts the out-of-sample performance compared to a case where the macroeconomic variables are directly included as predictors of the prediction model.

The performance of the models are evaluated using the H-measure, which accounts for the relative cost of type 1 and type 2 errors. Our findings help to increase the performance and the robustness of EWS but can also be useful in a wide range of pattern recognition problems.

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