Project

(Model risk on Regulatory Capital)

Financial Engineering

Consider the Vasicek model on a homogeneous portfolio to quantify portfolio credit risk and consider an additional estimation risk, i.e. the risk arising from errors in model parameters.

It is required to quantify the estimation risk (as discussed in [1]), i.e. to evaluate the impact of the uncertainty of each parameter of the model on the capital requirement.

The dataset, with Moody's public data, includes for the years 1983-2019 the following quantities (computed as a mean on all Moody's rated corporate issuers):

  a. the one-year Default Rate (DR) for only *speculative grade* issuers and for *all rated* issuers

  b. the one-year Recovery Rate (RR).

Consider both the *All Rated* issuers' Default Rate and the *Speculative Grade* issuers Default Rate. Consider a confidence levels (CL) α=99.9%, an asymptotic a homogeneous portfolio (LHP) and considering the correlation between assets a deterministic function of PD as chosen by the Basel Committee (see e.g. [1] eq.2 or [2] p.13).

It is required to reply to the following points.

A. Statistical analysis and calibration.

   1. Statistically test the distributional assumptions on PD and LGD using a Shapiro-Wilk test (both univariate and bivariate).

   2. Estimate the Pearson correlation between LGD and PD and its 95% Confidence Interval.

   3. Comment the results.

B. Measure of model risk in capital requirement (see e.g. [1]).

   1. Compute the capital requirements in the nominal model.

   2. Compute the regulatory capital Add-On (as defined in [1]), introducing uncertainty on one parameter at a time and on both parameters together (first suppose independent parameters and then dependent).

   3. Robustness checks of the results: Repeat the analysis in previous point for a confidence levels (CL) α=99% and a small homogeneous portfolio composed of N=50 obligors (HP) [for both confidence levels].

C. Capital Stress test. Consider instead the case where LGD and k are modelled via a double t-student with the same parameters calibrated in the Gaussian case and the number of d.o.f. ν. Stress test the

results of previous sections varing v in the range from 20 to 2. How would the regulatory capital Add-On change in the LHP case?

D. Discuss the results.

Realize a library in Matlab.

[1]   Baviera, R. (2021). The measure of model risk in credit capital requirements. *Finance Research Letters*, 102064.

[2]   BIS (2005). An explanatory note on the Basel II IRB risk weight functions. Bank for International Settlements.

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