

Credit risk

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Workshop repository:

<https://github.com/gimm-institute/july-2023-rwanda-workshop.git>

Feedback through credit risk

Credit risk creates several types of feedback linkages in the model:

- Current credit events impair loan performance: allowances, write-offs, losses, capital deterioration
- Expected credit risk gets priced in new lending rates/conditions
- Capital adequacy stress gets priced in new lending rates/conditions
- Unexpected risk (i.e. value at risk between expected risk and a particular percentile) is buffered in regulatory capital
- Macro conditions trigger credit events: nonlinear mapping of current and expected macro conditions into credit events

Summary of credit risk feedback elements

Credit risk feedback element	Module
Credit events → Loan performance	Bank loan performance
Expected risk → Lending conditions	Bank interest rates
Capital adequacy stress → Lending conditions	Bank capital
Macro conditions → Credit events	Credit risk connector
Lending conditions → Output and forex	Local macro economy

Credit risk function

- Implicitly based on Basel asymptotic single risk factor approach
- Mapping from a macro conditions index, z_t , (a single composite factor) into a portfolio default rate, q_t

$$q_t = f(z_t)$$

- Sign and location conventions for z_t :

Value	Meaning
$z_t = 0$	Macroeconomic and macrofinancial steady state
$z_t > 0$	Better than average times
$z_t < 0$	Worse than average times

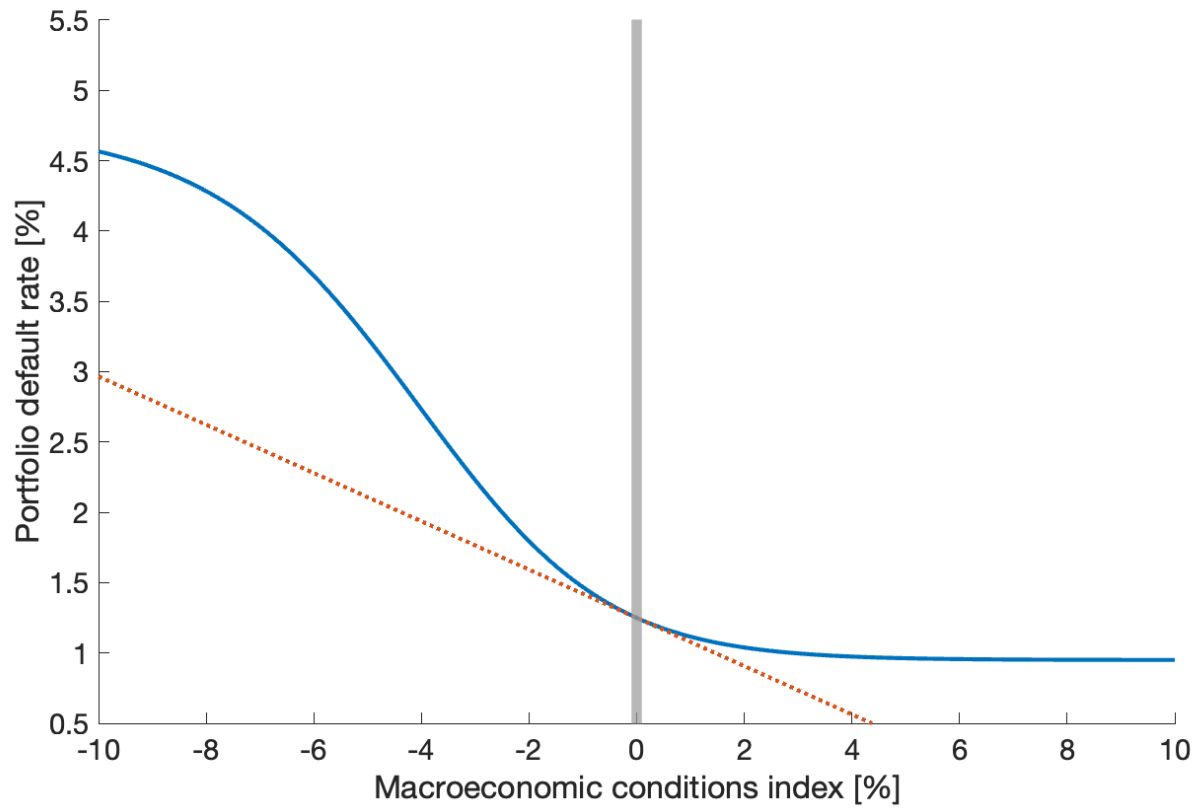
Places where the portfolio default rates enter the model

- Actual performance of the existing loan portfolio
- Expected credit risk used in pricing new loans

Key properties of credit risk function

- Nonlinear and asymmetric
- Around normal times, the credit risk function can be safely approximated as a linear function
- Large distress leads to disproportionately larger deterioration in loan performance
- Conversely, exceptionally good times reduce defaults to a much smaller extent
- Lower and upper bounds different from $[0, 1]$: Autonomous defaults, technical maximum

Example shape



Functional form

- Five-parameter generalized logistic function

$$f(z_t) \equiv \underline{q} + (\bar{q} - \underline{q}) \left[\frac{1}{1 + \exp - \frac{z - \mu}{\sigma}} \right]^{\exp \nu}$$

Parameter	Meaning
μ	Location: moves the curve left-right
σ	Scale: makes the curve steeper/flatter
ν	Shape: makes the curve asymmetric
\underline{q}	Lower bound
\bar{q}	Upper-lower bound spread

Macro conditions index

The portfolio segment specific macro conditions index combines

- **current** macro performance: output gap
- borrower **vulnerability**: annualized credit (loans) to GDP ratio

Constructed as a weighted average of (percent/percentage point) deviations from the long-run sustainability trends

$$z_t = (1 - c_1) \left(\log y_t - \log \bar{y}_t \right) - c_1 \left(\left[\frac{l}{4 \cdot py \cdot fwy} \right]_t - \left[\frac{l}{4 \cdot py \cdot y} \right]_t^{\text{tnd}} \right)$$