Lending and funding rates

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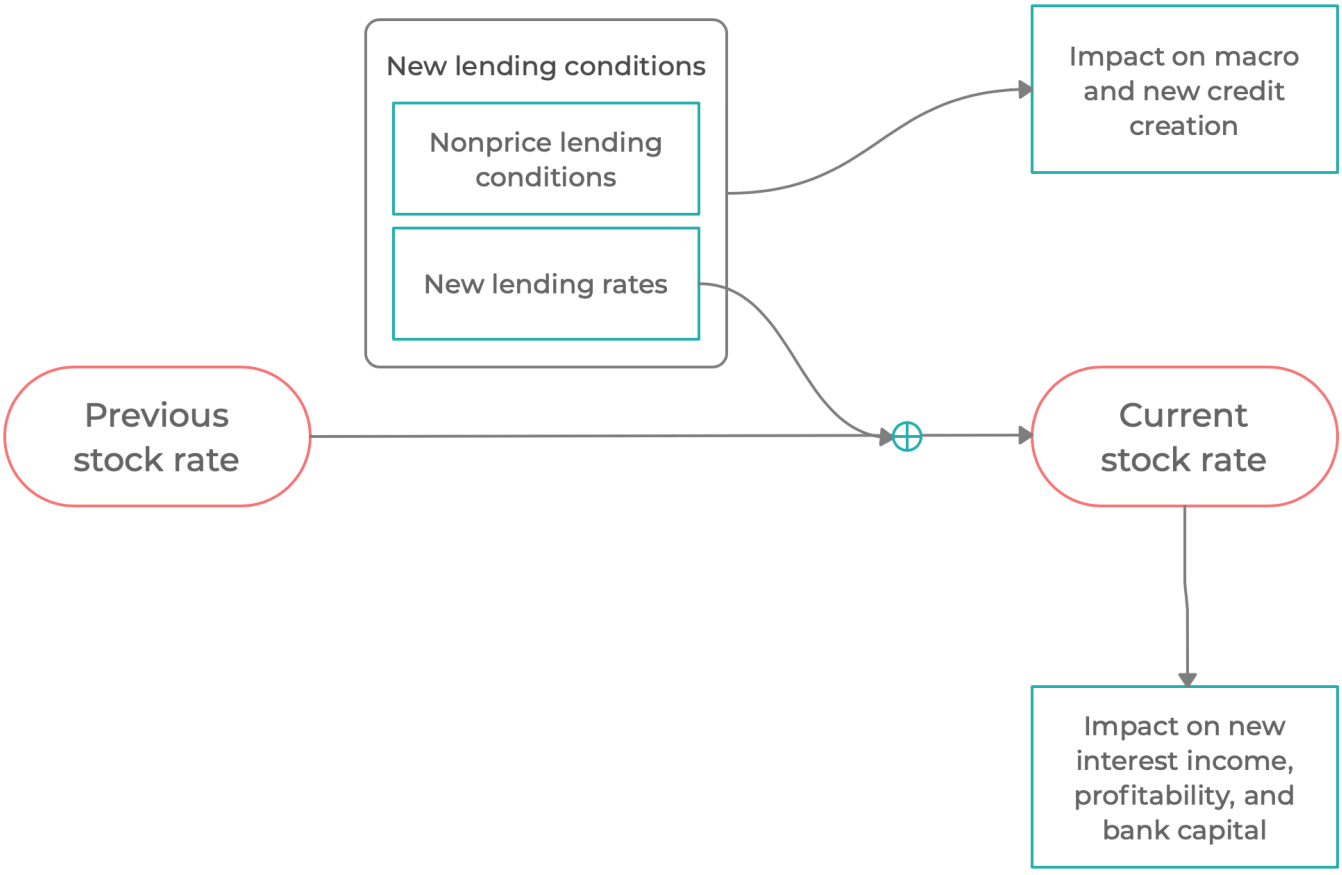
Stock-flow dynamics in lending rates



Stock-flow relationship in lending rates

Each period, a lending rate on newly issued credit ("new lending rate") rl_t^{Δ} is determined by the banks based on a cost-plus loan pricing mechanism described below. The new lending rate then applies to a certain proportion, ψ_{rl}, of the stock of pre-existing outstanding loans (i.e. these loans are repriced), and to all new loans. This is to mimick the fact that the total loan portfolio comprises loan contracts with different interest fixation periods. The duration of interest fixation differs in general, from the duration of the respective individual loans themselves. Depending on the parameter ψ_{rl}, we can choose any point between the following two limit cases to describe the average lending rate fixation period within a portfolio segment:

- $\psi_{rl} = 0$: the duration of the lending rate fixation matches exactly the duration of the underlying loan (a **fixed rate** loan) for each loan in the portfolio
- $\psi_{rl} = 1$: the lending rate is fully adjustable on the underlying loan (an **adjustable rate** loan) for each loan in the portfolio

The effective rate that determines the interest income on the stock of outstanding loans, called the stock lending rate, rl_t, is given by

$$rl_t = (1 - \Omega_t) \cdot rl_{t-1} + \ \Omega_t \cdot rl_t^{\Delta}$$

where $\Omega_t \in (0,\ 1]$ is a (time-varying) share of new lending rates in the updated effective stock rates

$$\Omega_t = \frac{\psi_{rl}\,(1 - \theta)\,lp_t^0 + l_t^{\Delta}}{lp_t}$$

and is given by the proportion of the performing loan portfolio, lp_t, to which the new rate applies, consisting of a ψ_{rl} fraction of the existing loans and all the new loans.

Lending rates in real world

New lending rates affected by the anticipation of three types of risks

- **Interest rate risk**: today's and future changes in short term rates may make the funding costs of fixed rate contracts increase

- **Borrower credit risk**: today's and future credit events (changes in frequency of) may reduce profits from the contracts

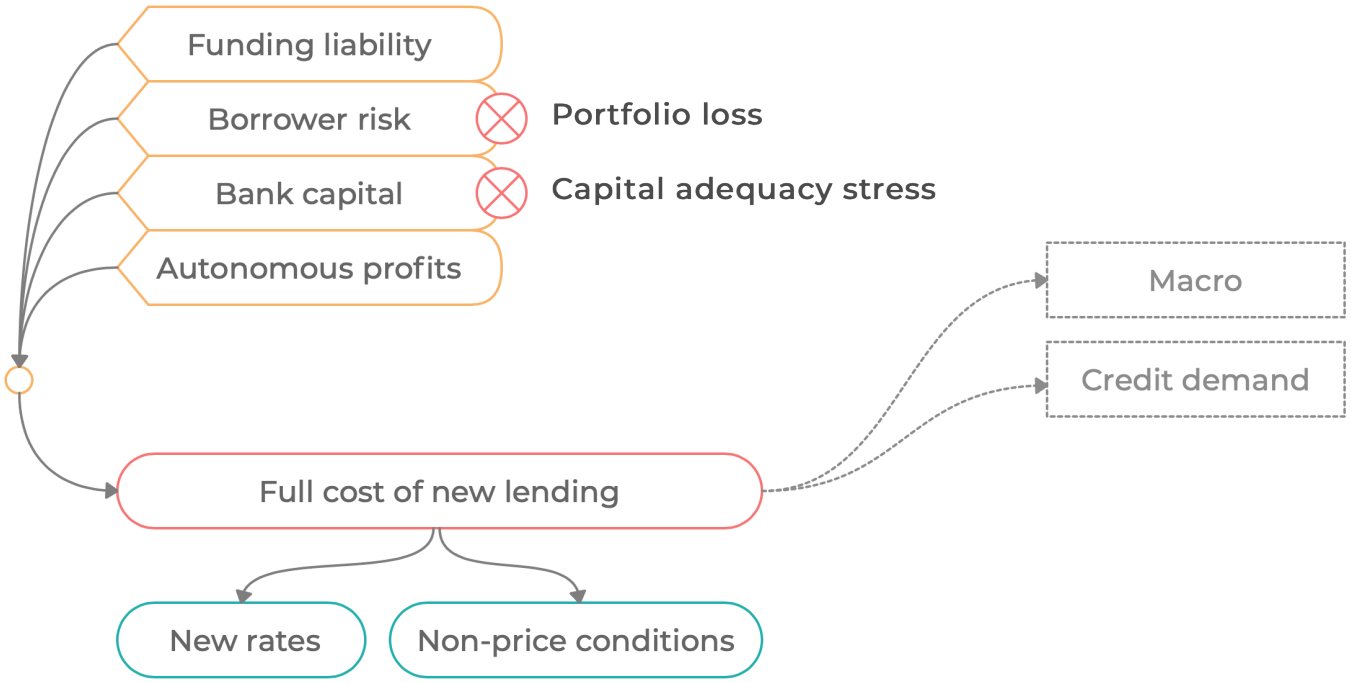
- **Bank capital adequacy risk**: today's and future likelihood of regulatory capital shortfall, capital stress

For a number of reasons, these two types of risks are not always passed through on to lending rates fully.

The observed lending rates typically only reflect the anticipated risks partially.

The remaining part of the risk (that is not priced in the lending rates) is expressed in (unobservable) new non-price lending conditions.

Forward-looking cost-plus loan pricing



Forward-looking cost-plus loan pricing

The new lending rates respond to four components of bank costs

Cost components
Marginal funding cost including short rate risk over LRF[1]
Borrower credit risk premium over LRF[1-1]
Endogenous profit margin to cover cost of bank capital (balance sheet stress)
Autonomous profit margin to cover other unmodeled cost drivers

Expected funding costs depending on lending rate fixation

The lending rate fixation period is approximated at a portfolio segment level using the average lending rate fixation period ψ_{rl}.

Short-term base rate

The short term base rate derives from the money market (or policy) rate, depending on the LCY vs FCY denomination of the respective portfolio segment:

$$r_t^{\Delta\text{base}} = (1-\sigma)\, r_t + \sigma\, rw_t$$

Cost component 1: Short-term rate risk and credit risk

The hypothetical lending rate covering the full credit risk is given by

$$1 + rl_t^{\Delta 1} = (1-\Psi)\, \mathrm{E}_t\left[\frac{1 + rl_t^{\Delta\text{base}}}{1-\lambda\, q_{t+1}} \;+\; \Psi\, \frac{1 + rl_{t+1}^{\Delta\text{base}}}{1-\lambda\, q_{t+2}} \;+\; \Psi^2\, \frac{1 + rl_{t+2}^{\Delta\text{base}}}{1-\lambda\, q_{t+3}} + \;\cdots \right]$$

where

$$\Psi \equiv (1-\psi_{rl})\,(1-\theta)$$

is the effective discount factor applied on each future base cost

Cost component 2: Bank capital cost

The cost of bank capital (capital shortfall stress) is also reflected in loan pricing given by

$$1 + rl_t^{\Delta 2} = (1-\Psi)\, \mathrm{E}_t\Big[\, (1+rx_t) + \;\Psi\,(1+rx_{t+1}) + \;\Psi\,(1+rx_{t+2}) + \;\cdots \,\Big]$$

Cost component 3: Autonomous profit margins

Exogenous process $rl_t^{\Delta\text{arm}}$

Hypothetical new lending rate covering all costs

$$1 + rl_t^{\Delta\text{full}} = (1 + rl_t^{\Delta\text{full},1}) \cdot (1 + rl_t^{\Delta\text{full},2}) \cdot (1 + rl_t^{\Delta\text{arm}})$$

Price and non-price lending conditions

The hypothetical full-cost rate $rl_t^{\Delta\text{full}}$ splits into

- a price component, i.e. the actually observed new lending rate;

- non-price conditions measured by an interest rate equivalent and passed on to borrowers)

The extraction of the price component is based on the spread over the base rate. Parameter c_1 controls what share of risk is reflected in the price components as opposed to the non-price conditions:

$$rl_t^{\Delta} = rl_t^{\Delta \text{base}} + c_1 \left(rl_t^{\Delta \text{full}} - rl_t^{\Delta \text{base}} \right) + (1 - c_1) \left(rl_{\text{ss}}^{\Delta \text{full}} - rl_{\text{ss}}^{\Delta \text{base}} \right)$$

The hypothetical full-cost rate $rl_t^{\Delta \text{full}}$ enters the aggregate demand and credit demand equations, as it represents the true cost of credit for borrowers.

The observed lending rate rl_t^{Δ} enters the bank profits calculations.

Stock-flow relationship in funding rates

The effective rate that determines the interest expense on the stock of non-equity liabilities, called the stock funding rate, rd_t, is given by

$$rd_t = (1 - \psi_{rd}) \cdot rd_{t-1} + \psi_{rd} \cdot rd_t^{\Delta} + \epsilon_{rd,t}$$

where $\psi_{rl} \in (0,\ 1]$ is the effective impact of new funding rates on the stock rates, and is parameterized as an exogenous number.

New funding rates

The new funding rates are set as a markdown (with a parameterized autonomous profit margin, rd^{apm}) below the short-term cash rate

$$rd_t^{\Delta} = r_t - rd_t^{\text{apm}}$$

1. Lending rate fixation↩↩