Bank capital and capital regulation

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GIMM-NBR Macroprudential Modeling Workshop
Kigali, July 2023

Workshop repository:
https://github.com/gimm-institute/july-2023-rwanda-workshop.git

Overview

Bank capital

- Balance sheet capital accumulation
- Internal and external capital flows
- Regulatory capital

Internal and external capital flows

- Components of period profit/loss
- External flows

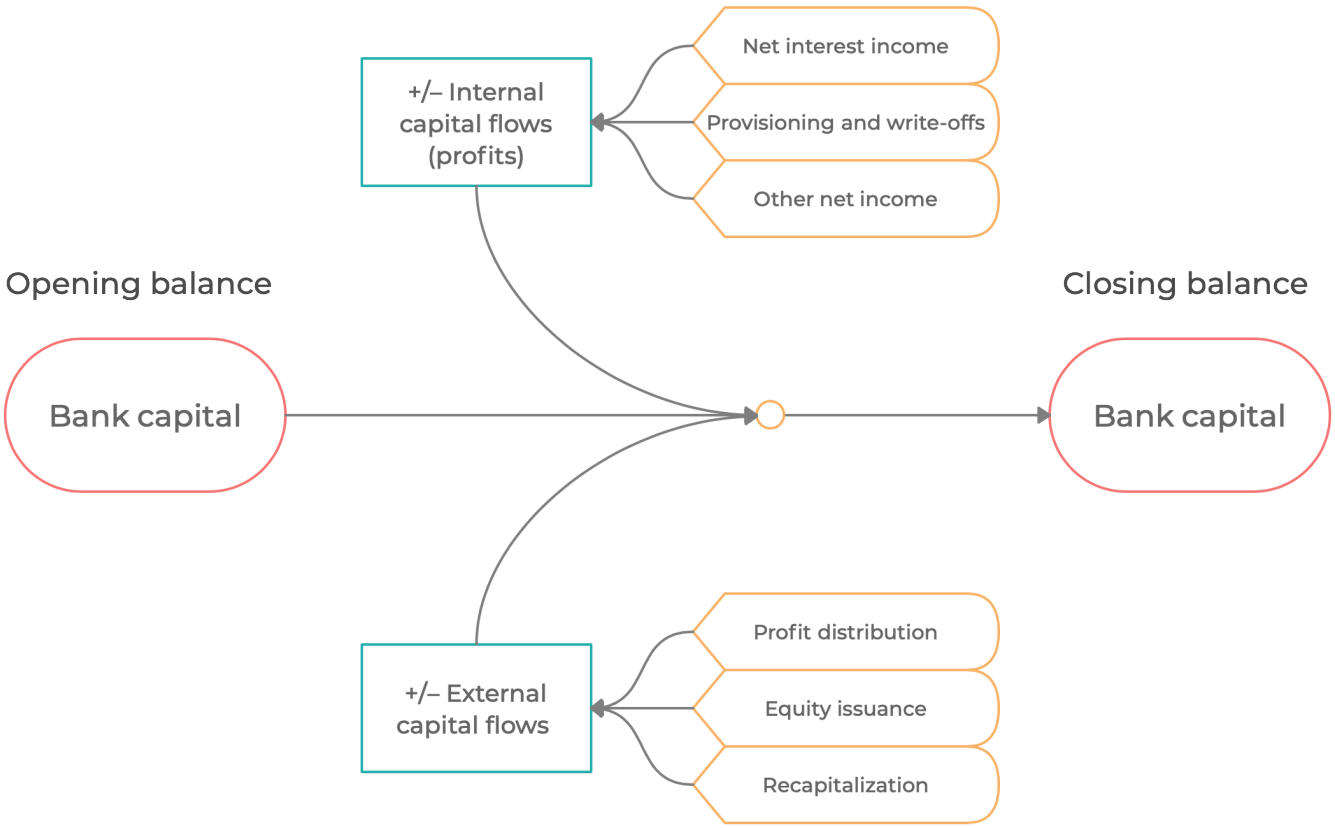
Capital adequacy and bank behavior

- Regulatory capital
- Target capital levels

Feedback to bank lending

- Regulatory capital shortfall
- Nonlinear cost of bank capital

Bank capital accumulation



Bank capital accumulation

$$bk_t = bk_{t-1} + prof_t + xcf_t$$

- bk_t is bank capital (balance sheet capital)
- $prof_t$ is an internal flow of capital (retained profit or loss, PnL) recorded on the closing balance of the balance sheets at $t-1$ and credit events throughout t
- xcf_t is an external flow of capital throughout t: dividends paid out (–), new equity issuance (+), equity withdrawals by parents (–), recapitalization flows (+), etc.

Internal capital flows (Period profit/loss)

Components of period profit/loss

- Interest income on loans (by segments)
- Income on other assets
- Interest expense on non-equity liabilities (by currency of denomination)
- Provisioning and write-offs
- Exchange rate valuation
- Other net income (proxy for fees, commissions, labor costs, etc.)

$$
\begin{aligned}
prof_t = & \sum rl_{t-1}^{k} \left(lp_t^{0k} + lnc_t^{0\,k} \right) \\
& + rona_{t-1}\, ona_{t-1} \\
& - rd_{t-1}^{\text{lcy}} d_t^{0\,\text{lcy}} - rd_{t-1}^{\text{fcy}} d_t^{0\,\text{fcy}} \\
& - \sum \left(a_t^k - a_{t-1}^k + w_t^k \right) \\
& + \sum l_{t-1}^{k} \left(j_t - 1 \right) - d_{t-1}^{\text{fcy}} \left(\frac{e_t}{e_{t-1}} - 1 \right) \\
& + c_1 \cdot tna_{t-1}
\end{aligned}
$$

External capital flows

Switch between two extreme cases

- $c_1 \to 0$ External capital flows do not respond to fluctuations in capital adequacy ratio. Bank owners do not adjust external flows (e.g. dividends) based on the current profit/loss at all.
- $c_1 \to 1$ External capital flows bring capital adequacy ratio to its target level at all times. Bank owners adjust external flows (e.g. cut dividends, add capital) to always ensure $car_t = car_t^{\text{tar}}$.

$$(1 - c_1) \left(\left[\frac{xcf}{bk} \right]_t - \left[\frac{xcf}{bk} \right]_{\text{ss}} \right) - c_1 \left(car_t - car_t^{\text{tar}} \right) = 0$$

Regulatory capital and CAR

- Balance sheet capital, bk_t, and regulatory capital, bg_t, differ in their definitions and reporting standards
- Either use a mechanical reconciliation process (as is here) or model the details of the differences

Regulatory capital

$$bg_t = \left[\frac{bg}{bk}\right]_t bk_t$$

Standard capital adequacy ratio

$$car_t = \frac{bg_t}{riskw_t \cdot [(l_t - a_t) + ona_t]}$$

- $riskw_t$ is the effective average risk weight, an exogenous variable

Comfort (target) levels of CAR

In equilibrium (steady state), banks target a comfort level of CAR

$$car_t \longrightarrow car_t^{\text{tar}}$$

$$car_t^{\text{tar}} = car_t^{\text{min}} + car_t^{\text{exc}}$$

where

- car_t^{min} is the regulatory minimum including regulatory buffers
- car_t^{exc} is the excess capital target above the regulatory minimum targeted by banks. Banks are motivated to hold excess capital to avoid approaching regulatory minimum in case of unexpected adverse shocks.

Feedback to bank lending

Capital adequacy risk surcharge

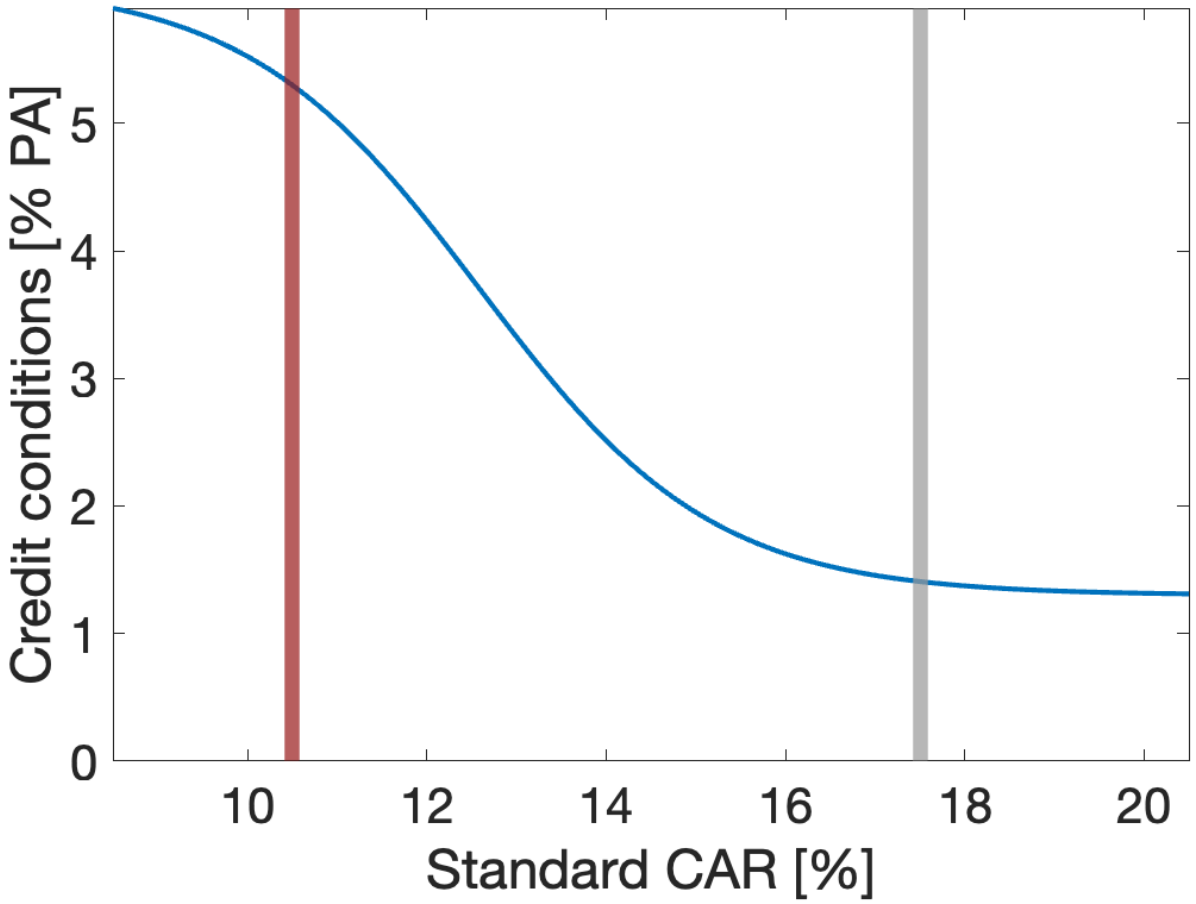
Negative shocks can push the the actual CAR car_t below the optimal level car^{tar}. If car_t approaches regulatory minimum $car_t^{\min}$, capital shortfall triggers increase in capital adequacy risk surcharge rx_t. The surcharge is added to the lending rates as the bank attempts to increase profitability as well as reduce lending to shrink its balance sheet.

- $car_t < car_t^{\text{tar}}$ Tighter lending conditions: Increase spreads, reduce leverage
- $car_t > car_t^{\text{tar}}$ Lax lending conditions: Reduce spreads, expand balance sheets

Functional form of risk surcharge

The risk surcharge is a non-linear function of the distance to regulatory capital shortfall (distance to $car_t^{\min}$)

$$rx_t = \underline{rx} + \left(\overline{rx} - \underline{rx}\right)\left[1 + \exp - \frac{car_t - car_t^{\min} - \mu}{\sigma}\right]^{-\exp \nu}$$



Parameter	Meaning
μ	Location parameter: moves the curve left or right
σ	Scale parameter: makes the curve steeper/flatter
ν	Shape parameter: makes the curve asymmetric, heavy left/heavy right
$\underline{rx}$	Lower bound

Parameter	Meaning
$\overline{r}x$	Upper bound