



EUROPEAN CENTRAL BANK

BANKING SUPERVISION

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Modelling the duration of retail bank deposits

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Workshop,

Interest rate and liquidity risk
management, regulation and the
macro-economic environment

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The presentation is not intended for circulation

Intro

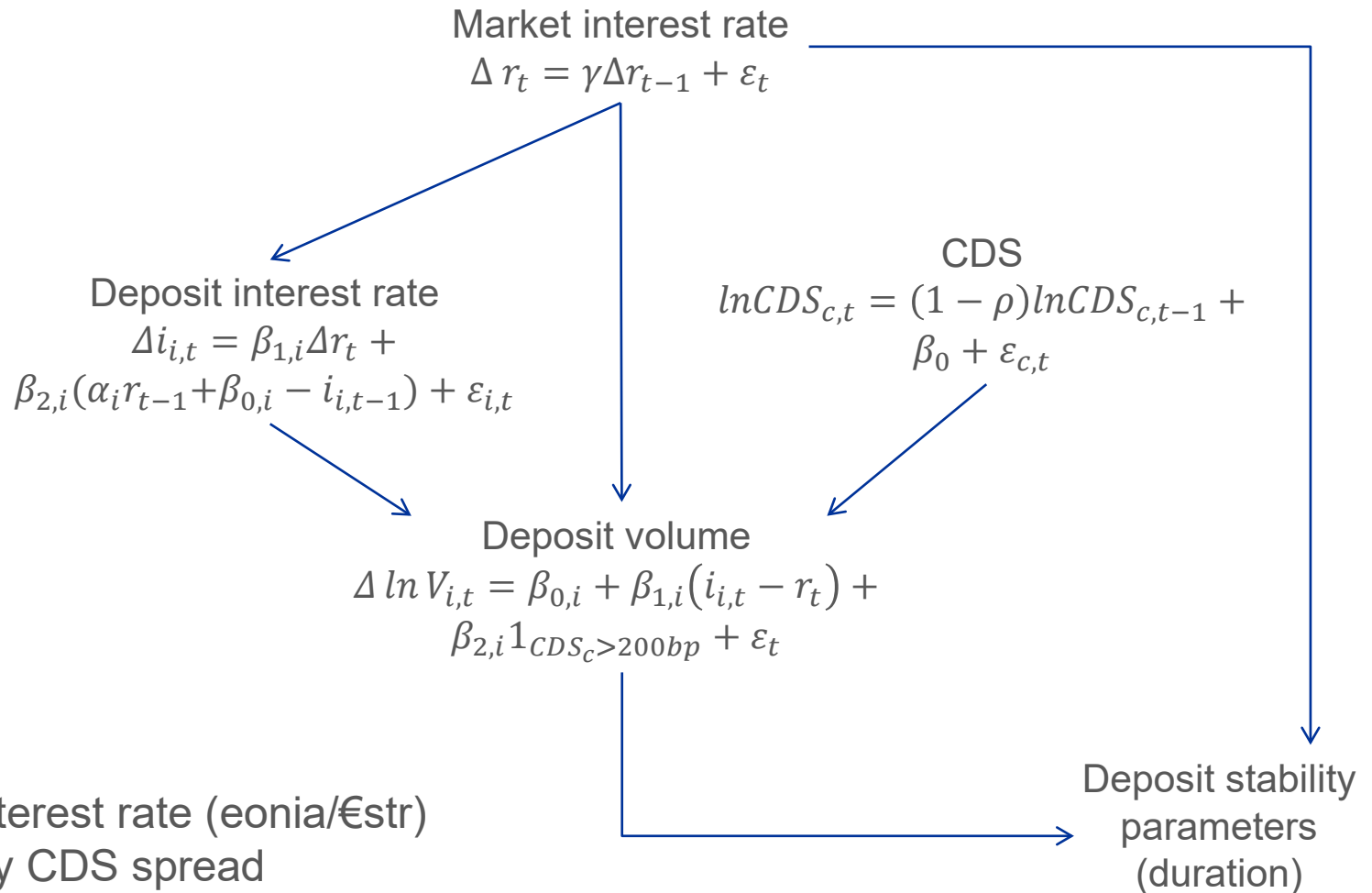
- We build a simple model to explore depositors' behaviour in connection to interest rate movements
- Sight deposits can be withdrawn at any time, but they tend to exhibit a significant degree of stability in practice
- Fluctuations in the timing and intensity of depositors' withdrawal decision expose banks to liquidity risk and interest rate risk. To manage these risks, banks employ statistical models whose estimates are a crucial ingredient in banks' asset liability management (ALM).
- Our model allows us to estimate at bank level modified duration of retail deposits, their distribution and fluctuations overtime
- We show results for two cut off points: 2018 and 2023

Data

- Input data
 - End-of-month by-bank (solo level) deposit volumes (IBSI database) and corresponding deposit interest rates (IMIR database) - not publicly available
 - End-of-month country aggregates (BSI and MIR) - publicly available
 - Household a) sight deposits and; b) 'redeemable at notice' (i.e. saving) deposits

- Data limitations:
 - Time series starting as soon as 1997 for some country-level data, much shorter for bank-level data (mostly starting in 2007)
 - Filtering criteria applied to ensure minimum length of time series (at least 5Y of data) and materiality (bank-level deposit volumes exceed 1 billion euro and constitute at least 5% of total liabilities)
 - Deposit contracts heterogeneous in the euro area (e.g. regulated saving deposits in FR, BE; legal restrictions in some countries for retail deposits <0)

Model setup

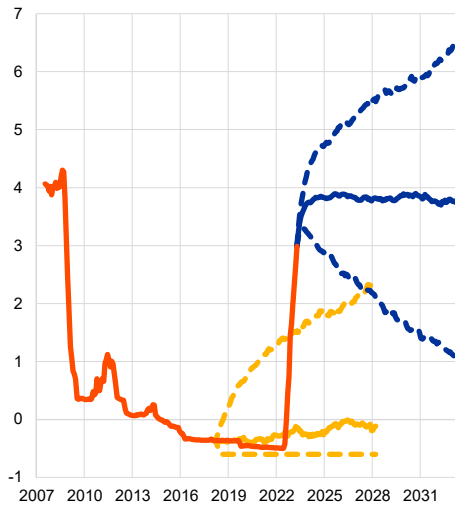


r_t : market interest rate (eonia/€str)
 CDS_c : country CDS spread
 i_i : customer deposit interest rate at bank i
 V_i : deposit volume at bank i

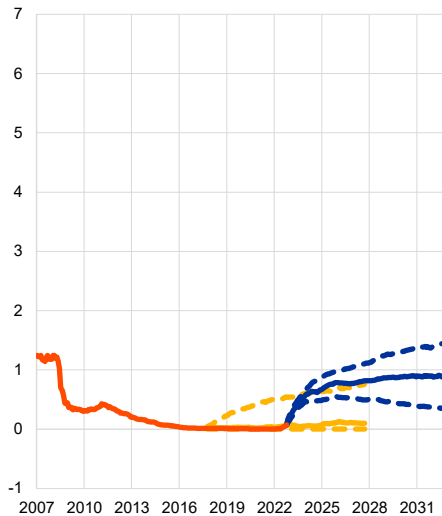
Stochastic simulation of key variables

- Model parameters estimated on past data
- Simulations use correlated error terms in line with the observed correlation
- Market rates floored in simulations at -60 bps
- Deposit rates floored in simulations at 0 bps

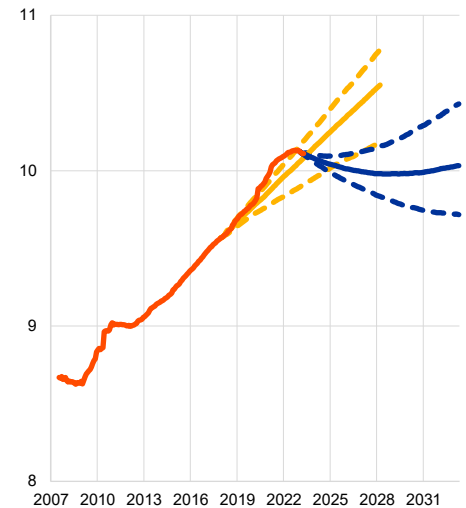
Market rates



Deposit rates



Deposit volumes (ln)



Historical path —
 Median and interquartile range for simulations 2018 —
 Median and interquartile range for simulations 2023 —

The duration is computed based on Jarrow and Van Deventer approach

- For each simulated **triplet [market rates, deposit rates and deposit volumes]** a **Net Present Value (NPV)** of the deposit liability is computed based on **Jarrow, van Deventer (1998)** approach → a distribution of PVs

$$PV = E_0 \left(\sum_{t=0}^{\tau-1} \frac{D_t(r_t - i_t)}{B_{t+1}} \right) - D_0 = V_0 - D_0$$

- $\frac{V_0}{D_0}$ → expected % gain (loss) on the deposit liability over the simulation time horizon τ
- The **modified duration** is computed as the derivative of the PV to a local shock in market rates, in percentage of the starting point deposits

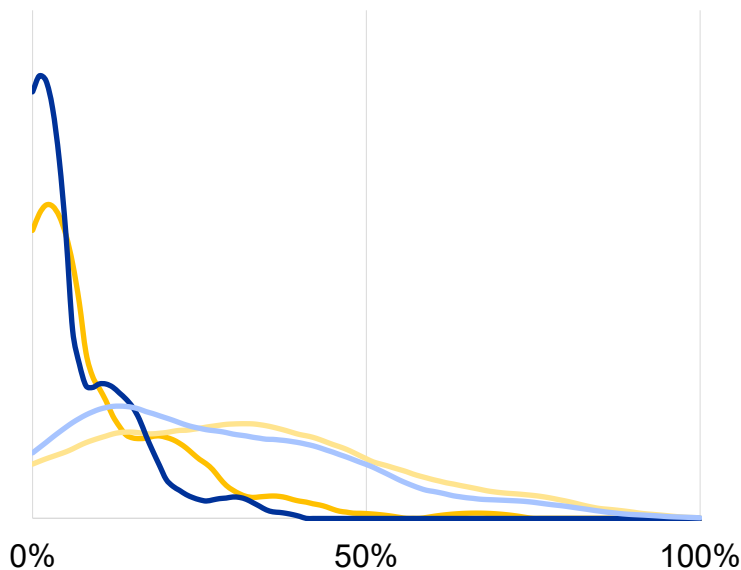
$$Duration = -\frac{1}{PV} * \frac{\Delta PV}{\Delta r}$$

- There is **no single duration** but a **distribution of duration parameters** (percentiles)

Key results – model takeaways

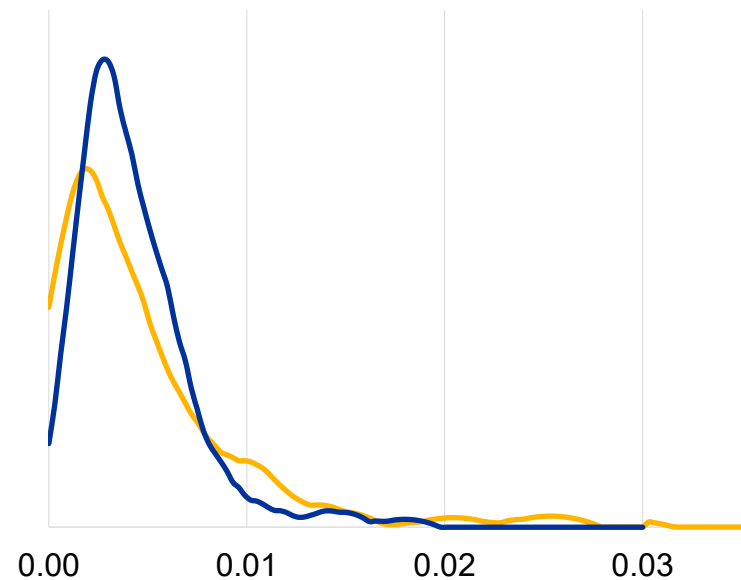
Long and short term pass through rates

Long term pass through 2023 — 2018 —
 Short term pass through 2023 — 2018 —



Distribution of „opportunity cost” coefficient

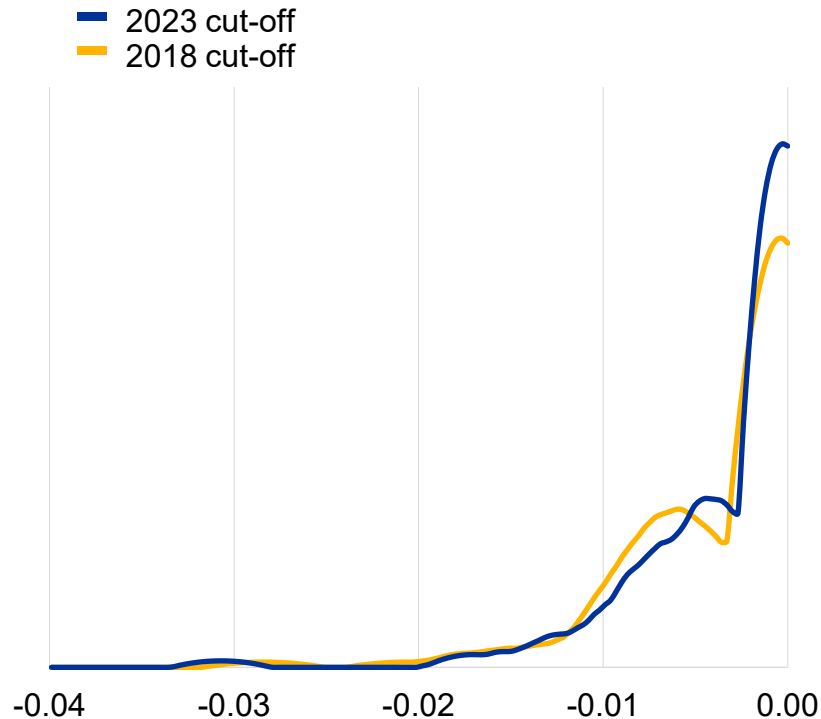
2023 cut-off —
 2018 cut-off —



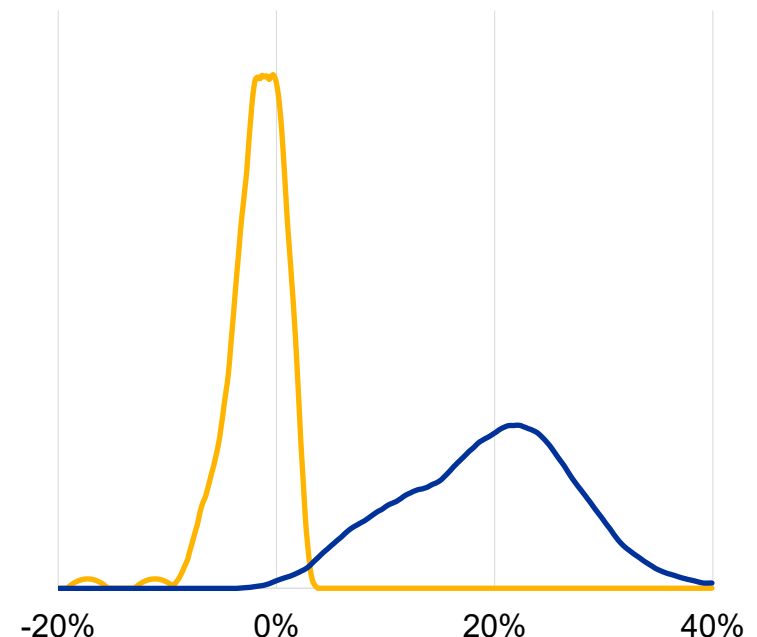
- The long term pass through rate is very heterogenous among banks, with average long term pass through of 28%.
- On average, a 100 bps increase in the difference between deposit and market rates implies a monthly increase (decrease) of 0.4% (or 5% per year) in deposit volumes.
- Model parameters remained stable between 2018 and 2023

Key results – model takeaways

Distribution of CDS coefficient in deposit volume equation



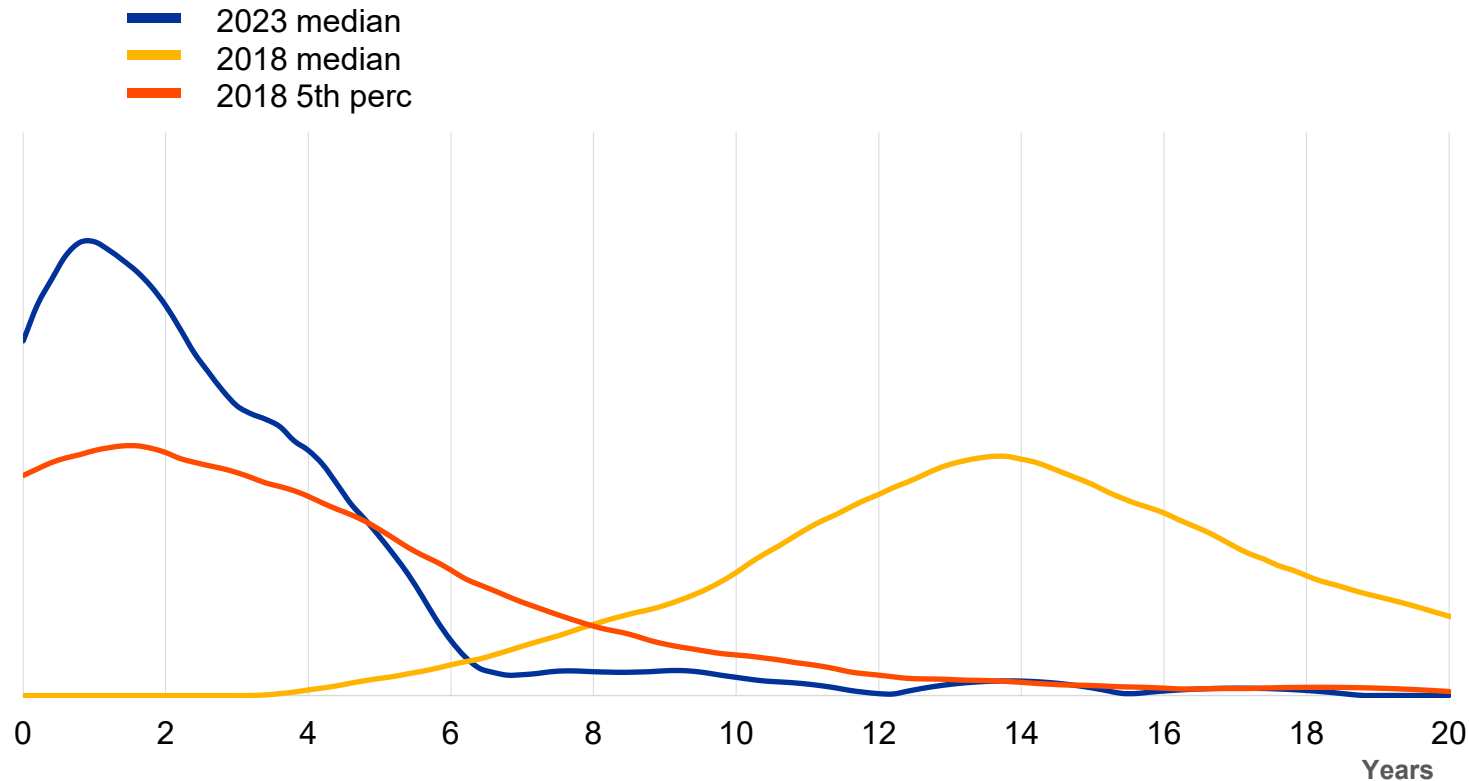
Expected margin on deposits (NPV/D₀)



- Bank's creditworthiness affects their deposit volume growth - the cut-off for the first quartile is 0.5% per month (6% p.a.)
- Expected margin on sight deposits in 2018 was negative, while after increases in market interest rate deposits got back to be a lucrative business for banks

Key results – modified duration

Density of median bank duration



- Median duration decreased from on average 14.4Y in 2018 to 2.5Y in 2023
- The model in 2018 foresaw the shortening of the duration we observed in 2023 at 5th percentile

Key takeaways

1. Deposit duration is time-dependent, as it lengthens (shortens) significantly in a decreasing (increasing) interest rate environment, due to changes in customer behaviour
2. The cyclical behaviour of deposits duration can be a source of vulnerability
3. Depositors do react to changes in a bank's creditworthiness leading to uncertainty over the reliability of duration estimates
4. Our stochastic model highlights the limitations in deposit modelling: in a low interest rate environment, duration estimates grow with the time horizon of the simulation, as depositors have no incentive to move their deposits and volumes increase. The opposite happens when market interest rate starts to rise.