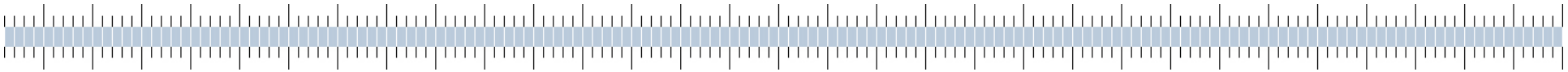
DEUTSCHE BUNDESBANK
EUROSYSTEM

Session 10

Loss given default (LGD)



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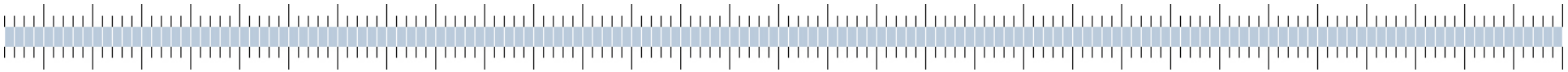
BASEL II ON LGD



Definition of LGD

- **297 Basel II**
  - LGD must be measured as the loss given default as a percentage of the EAD.
  - Banks eligible for the IRB approach that are unable to meet these additional minimum requirements must utilise the foundation LGD treatment described above.
- **LGD is an estimate of the percentage of a credit lost in the event of a default**
  - based on historical data
  - not based solely on callateral‘s estimated market value
  - incorporates the potential inability of the bank to gain control over the collateral and liquidate it.
- **LGD is to a great extent determined by kind and volume of loans‘ liabilities**

Minimum requirements to LGD

- **468 Basel II (Standards for all asset classes)**
  - A bank must estimate an LGD for each facility that aims to reflect economic downturn conditions where necessary to capture the relevant risks.
  - This LGD cannot be less than the long-run default-weighted average loss rate given default calculated based on the average economic loss of all observed defaults within the data source for that type of facility.
  - In addition, a bank must take into account the potential for the LGD of the facility to be higher than the default-weighted average during a period when credit losses are substantially higher than average. (…) Appropriate estimates of LGD during periods of high credit losses might be formed using either internal and/or external data.
- **469 Basel II (Standards for all asset classes)**
  - In its analysis, the bank must consider the extent of any dependence between the risk of the borrower and that of the collateral or collateral provider.
  - Cases where there is a significant degree of dependence must be addressed in a conservative manner.
  - Any currency mismatch between the underlying obligation and the collateral must also be considered and treated conservatively in the bank's assessment of LGD.

Minimum requirements to LGD

- **470 Basel II (Standards for all asset classes)**
  - LGD estimates must be grounded in historical recovery rates and, when applicable, must not solely be based on the collateral's estimated market value.
  - This requirement recognises the potential inability of banks to gain both control of their collateral and liquidate it expeditiously.
  - To the extent, that LGD estimates take into account the existence of collateral, banks must establish internal requirements for collateral management, operational procedures, legal certainty and risk management process that are generally consistent with those required for the standardised approach.
- **471 Basel II (Standards for all asset classes)**
  - (…) the LGD assigned to a defaulted asset should reflect the possibility that the bank would have to recognise additional, unexpected losses during the recovery period. For each defaulted asset, the bank must also construct its best estimate of the expected loss on that asset based on current economic circumstances and facility status.

Minimum requirements to LGD

- **472 Basel II (Additional standards for corporate, sovereign, and bank exposures)**
  - Estimates of LGD must be based on a minimum data observation period that should ideally cover at least one complete economic cycle but must in any case be no shorter than a period of seven years for at least one source.
  - If the available observation period spans a longer period for any source, and the data are relevant, this longer period must be used.
- **473 Basel II (Additional standards for retail exposures)**
  - The minimum data observation period for LGD estimates for retail exposures is five years.
  - The less data a bank has, the more conservative it must be in its estimation.
  - A bank need not give equal importance to historic data if it can demonstrate to its supervisor that more recent data are a better predictor of loss rates.

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ESTIMATING LGD BASED ON COLLATERAL VALUE

Goals

- **Basel II compliant LGD model**
- **LGD model close to handling of finance / lease contract**
- **LGD prediction based on single contract**
- **Recognition of collateral provided by remaining machine value**
- **Risk-diversification compliant with internal observation**

Data collection

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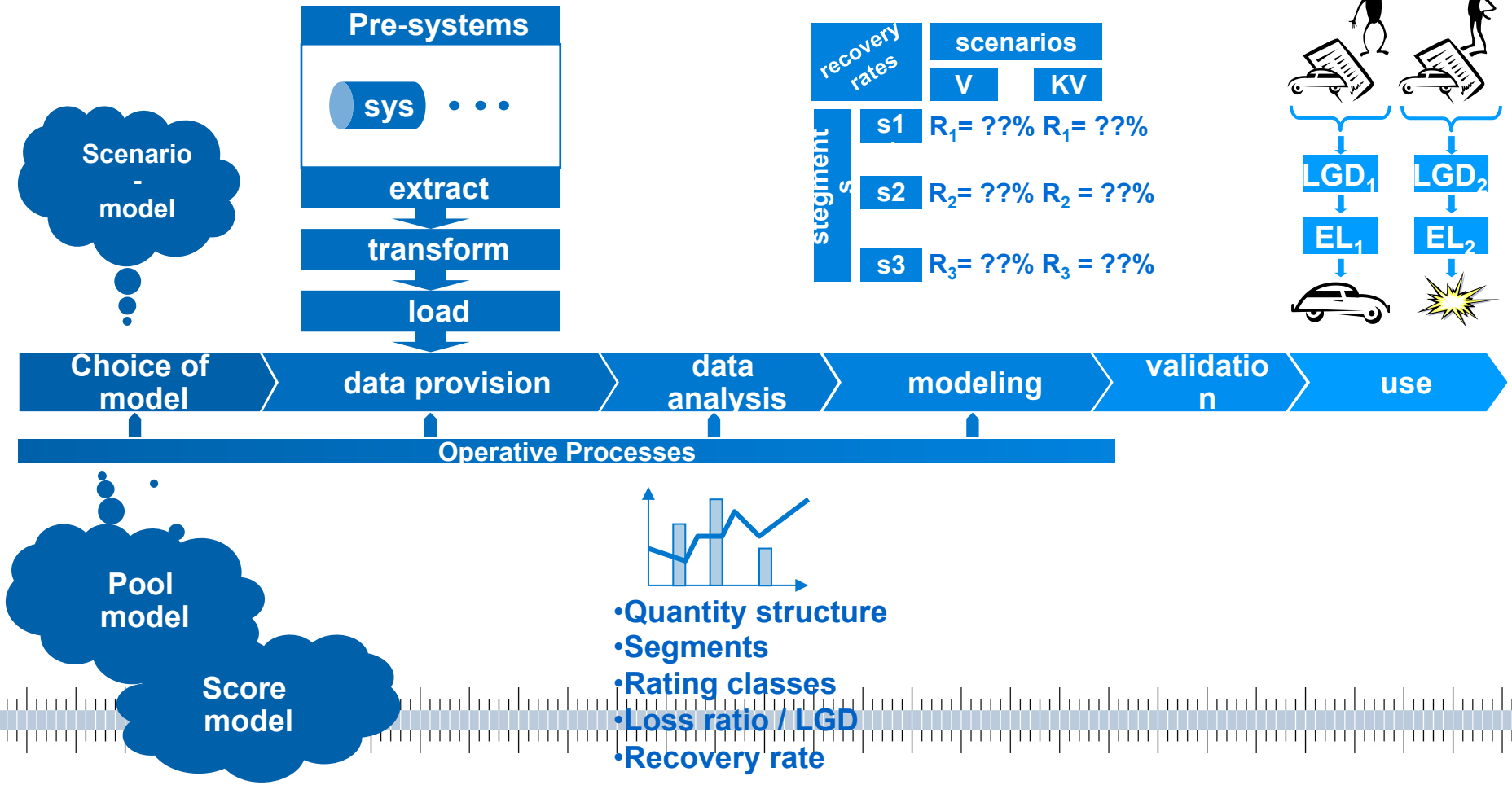
Data collection is a dedicated computer data base

- Homogeneous data source from bank‘s SAP-systems
- Base for the migration of legacy data in future times

Data base

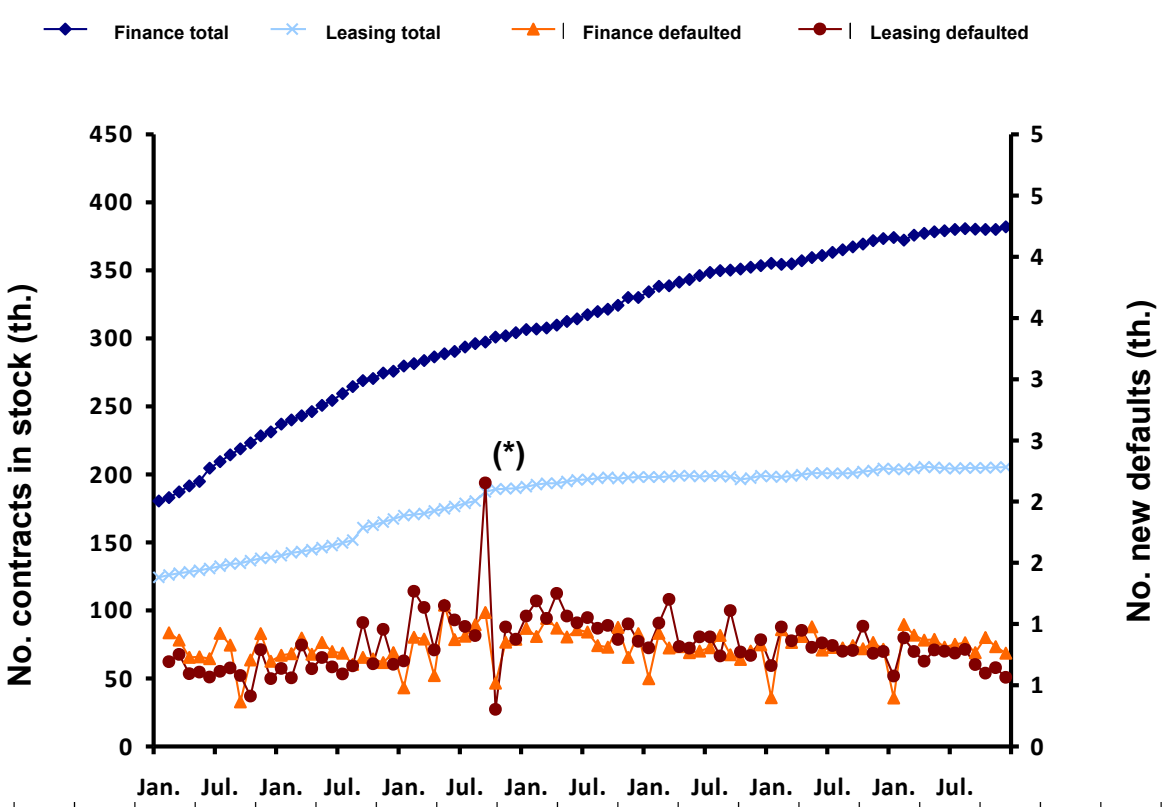
- Contract data (start, type...)
- Customer data (information, SCHUFA, financial statement...)
- Flows (account balance, arrears in payments, deductions, information on collateral …)
- monthly data, beginning 2000

Development



Retail-portfolio and new defaults

(*) missing data



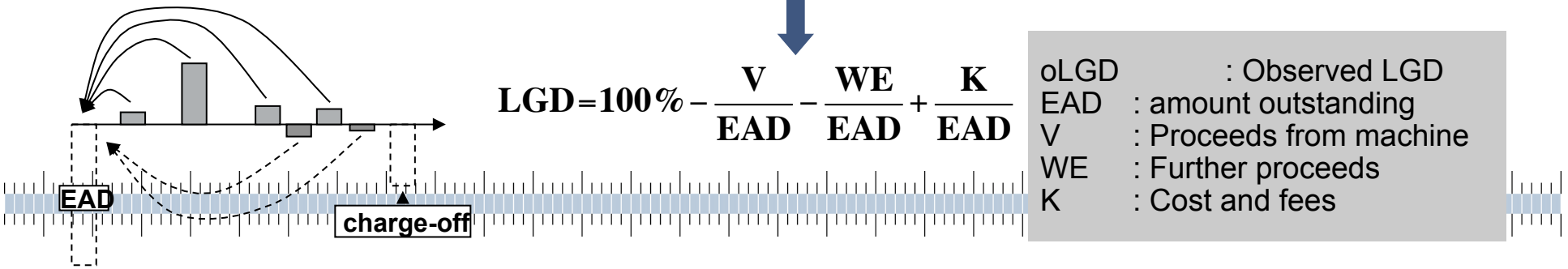
LGD Retail

$$\text{observed LGD} = \frac{\text{observed economic loss}}{\text{amount outstanding at time of default}}$$

debit:
- **amount outstanding at time of default (EAD)**
- Costs for processing default

credit:
- **Proceeds of sale from machine**
- Further proceeds

$$rLGD = \frac{(EAD + K) - (V + WE)}{EAD}$$

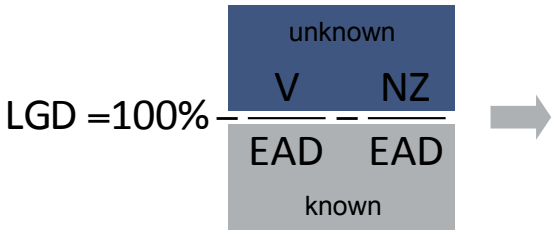


$$LGD = 100\% - \frac{V}{EAD} - \frac{WE}{EAD} + \frac{K}{EAD}$$

oLGD : Observed LGD
EAD : amount outstanding
V : Proceeds from machine
WE : Further proceeds
K : Cost and fees

Transition to estimation equation

- **Properties of the model:**
- **Close to calculation of observed loss rate**
- **applicable to performing and non-performing contracts**
- **Contract data available at any time**



V = f (time value, …) Estimator proceeds of sale

NZ = f (blank, …) Estimator net inflow

Estimation equation for LGD

Foundation equation:

$$\mathbf{LGD = 100\% - \underbrace{\frac{ZW \cdot Q \cdot z}{EAD}}_{\text{recovery rate}} - \underbrace{\frac{(EAD - ZW \cdot Q \cdot z)^{+} \cdot R}{EAD}}_{\text{Recovery on blank}}} \quad \text{mit} \quad \begin{cases} V = ZW \cdot Q \cdot z \\ NZ = (EAD - V) \cdot R \end{cases}$$

- Parameter specific to contract:
  - EAD : Amount outstanding at time of estimation
  - ZW : Market value of machine at time of estimation

- Anhand der Historie zu schätzende Parameter:
  - Q : Recovery rate on sale of machine relative to market value at time of default
  - z : Correction factor
  - R : Net recovery on blank

Enhancement

- **Motivation:**
  - Not all Basel II defaults lead to economic loss
  - ➢ Inclusion of scenarios

- **Requirements for LGD scenarios**
  - Compliance with credit processes for non-performing loans
  - Reconstruction of handling is visible from data
  - Independence from change in processes (e.g. change of invoice no., manufacturing no.)

Scenarios

- ***Scenario 1 „Total recovery“:***
  - No significant charge-off (≤ 400 €), no sale of machine and current account = 0
    - Customer defaults, but pays outstanding debt in full at a later point in time
    - Default shortly before end of contract and no significant charge-off
- ***Scenario 2 „Default without recovery“:***
  - No sale of machine, significant charge-off (>400 €)
    - Default on residual claim in leasing contracts after expiration of contract
    - Insolvency and sale by insolvency administrator
    - Theft, betrayal, total damage
- ***Szenario 3 „Default with recovery“:***
  - Proceeds from sale of machine
    - Customer defaults, machine is sold

Estimation equation with scenarios

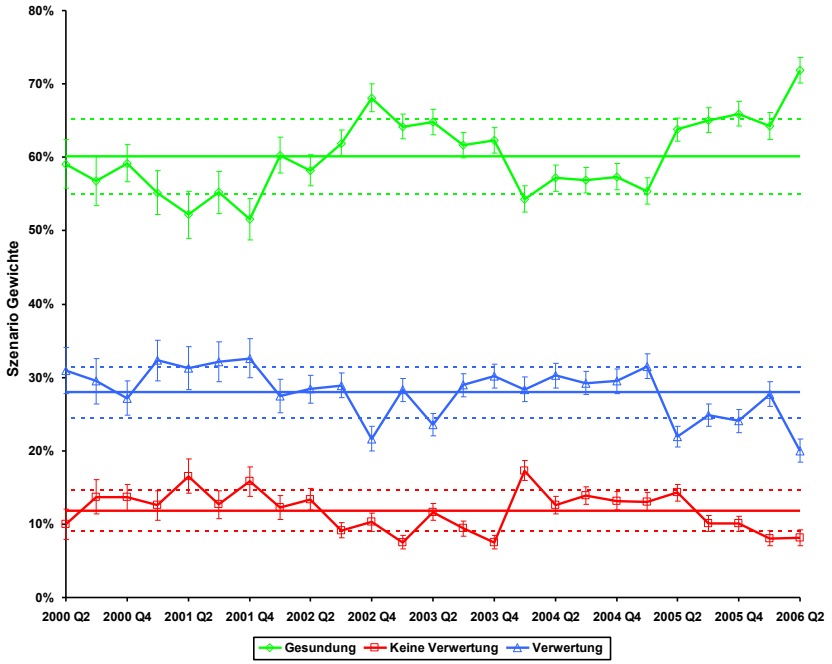
$$LGD = \underbrace{p_1 \cdot (1 - R_1)}_{\text{Szenario 1}} + \underbrace{p_2 \cdot (1 - R_2)}_{\text{Szenario 2}} + \underbrace{p_3 \cdot \left[1 - \frac{ZW \cdot Q \cdot z}{EAD} - \frac{\left[EAD - ZW \cdot Q \cdot z\right]^+ \cdot R_3}{EAD}\right]^+}_{\text{Szenario 3}} + DA$$

- p_1, p_2 and p_3 : probability of occurece of each scenario
- R_1 and R_2 : Net-recovery-rates scenario 1 and 2
- R_3 : Net recovery rate on blank in scenario 3
- EAD: amount outstanding at point of time of estimation
- Q : Recovery rate from sale of machine at point of time of default
- z : correction factor
- ZW : Market value of machine at default
- DA : Add-on for downturn scenario

Scenario weights

$$LGD = \underbrace{p_1 \cdot (1 - R_1)}_{\text{Szenario 1}} + \underbrace{p_2 \cdot (1 - R_2)}_{\text{Szenario 2}} + \underbrace{p_3 \cdot \left[1 - \frac{ZW \cdot Q \cdot z}{EAD} - \frac{\left[EAD - ZW \cdot Q \cdot z\right]^+ \cdot R_3}{EAD}\right]^+}_{\text{Szenario 3}} + DA$$

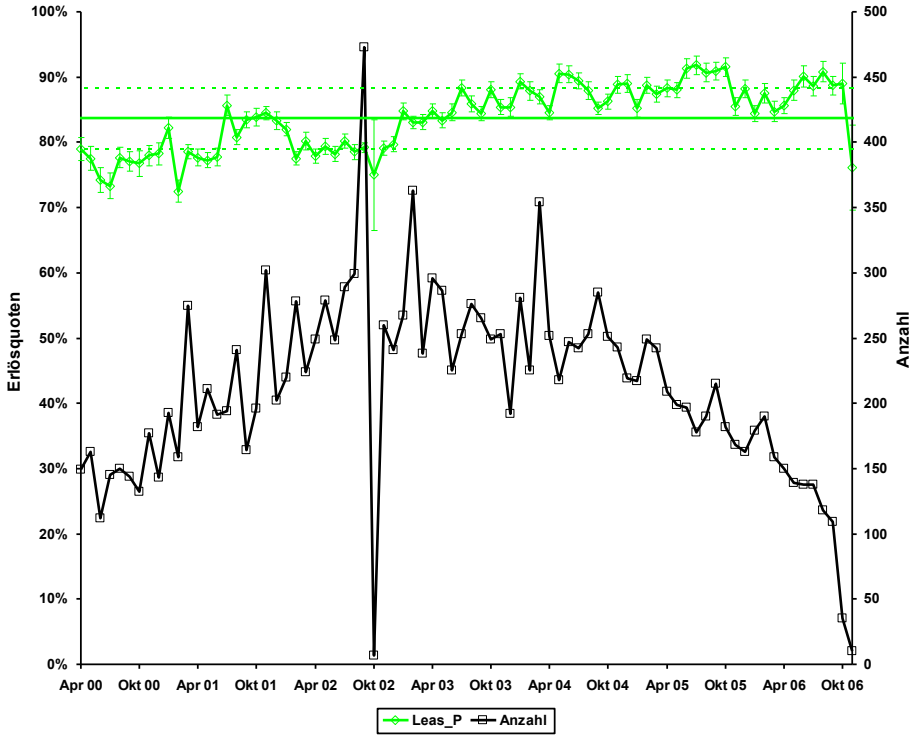
- Szenario weights are estimated fro observed relative frequencies
  - p_1: relative freq. total recovery
  - p_2: rel. freq. default without recovery
  - p_3: rel. freq. default with recovery



Recovery rate

$$LGD = \underbrace{p_1 \cdot (1 - R_1)}_{\text{Szenario 1}} + \underbrace{p_2 \cdot (1 - R_2)}_{\text{Szenario 2}} + \underbrace{p_3 \cdot \left[1 - \frac{ZW \cdot Q \cdot z}{EAD} - \frac{\left[EAD - ZW \cdot Q \cdot z\right]^+ \cdot R_3}{EAD}\right]^+}_{\text{Szenario 3}} + DA$$

- **Q**: Recovery rate related to point of time of default
- Only used in scenario 3: default with recovery

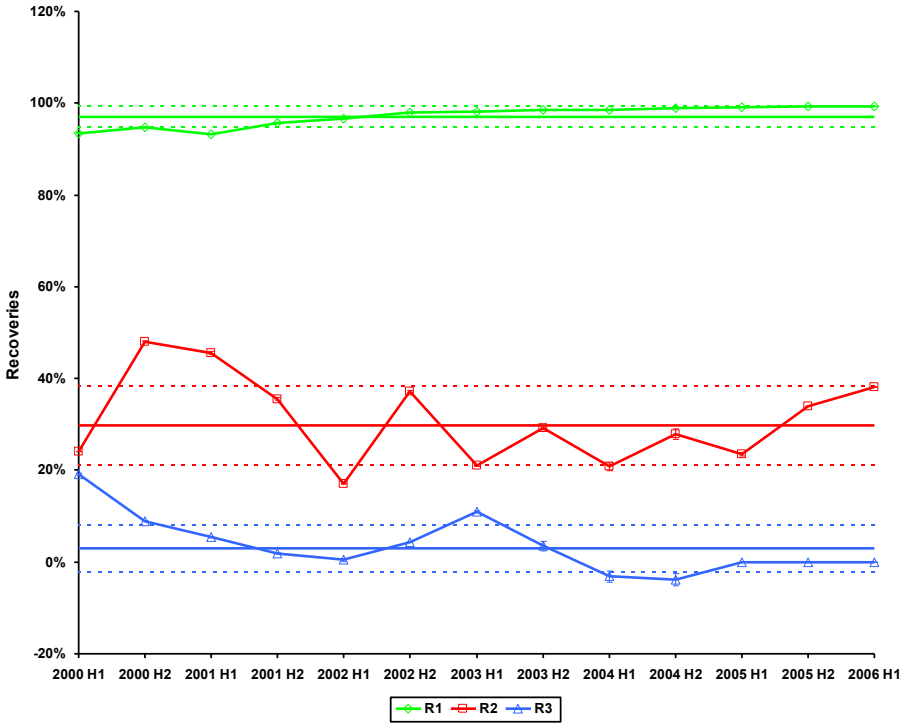


Recovery

$$LGD = p_1 \cdot (1 - R_1) + p_2 \cdot (1 - R_2) + p_3 \cdot \left[1 - \frac{ZW \cdot Q \cdot z}{EAD} - \frac{\left[EAD - ZW \cdot Q \cdot z \right]^+ \cdot R_3}{EAD} \right]^+ + DA$$

Szenario 1 | Szenario 2 | Szenario 3

- **Recovery from observed data**
  - discounted cash flow without recovery
  - interest rate and fees nominal
  - recoveries for recent past extrapolated
- **Required parameters:**
  - **R_1:** Total Recovery (for the most part 100% minus discount effects)
  - **R_2:** Recovery on EAD for default without recovery
  - **R_3:** Recovery on blank for default with recovery

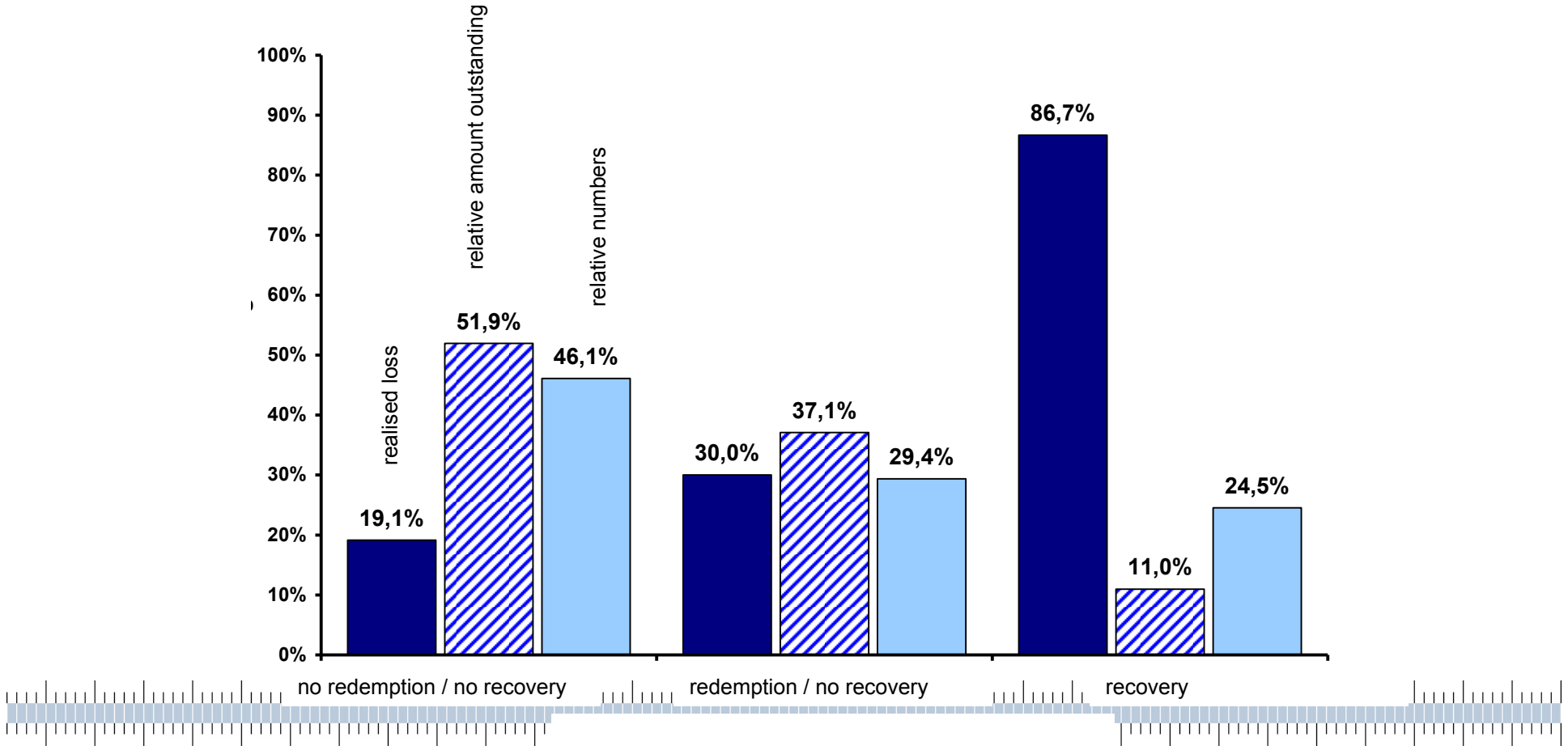


Best Estimate Expected Loss (BEEL)

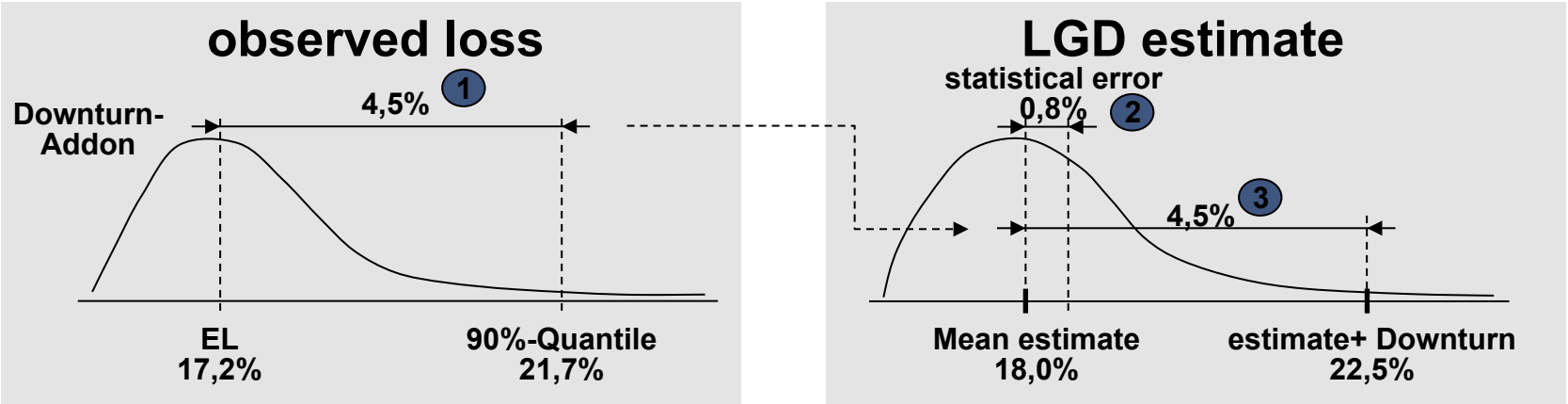
- **Min. Requirements (Basel II Paragraph 471):**
  - *„Recognising the principle that realised losses can at times systematically exceed expected levels, the LGD assigned to a defaulted asset should reflect the possibility that the bank would have to recognise additional, unexpected losses during the recovery period. For each defaulted asset, the bank must also construct its best estimate of the expected loss on that asset based on current economic circumstances and facility status.* ***The amount, if any, by which the LGD on a defaulted asset exceeds the bank's best estimate of expected loss on the asset represents the capital requirement for that asset, and should be set by the bank on a risk-sensitive basis*** *(...)“*

- **Model:**
  - Categorisation of non-performing contracts
  - Separation of classes in compliance with credit process
    - Redemption
    - Recovery
  - Default classes
    - D1: no redemption / no recovery
    - D2: redemption / no recovery
    - D3: recovery

Realised loss



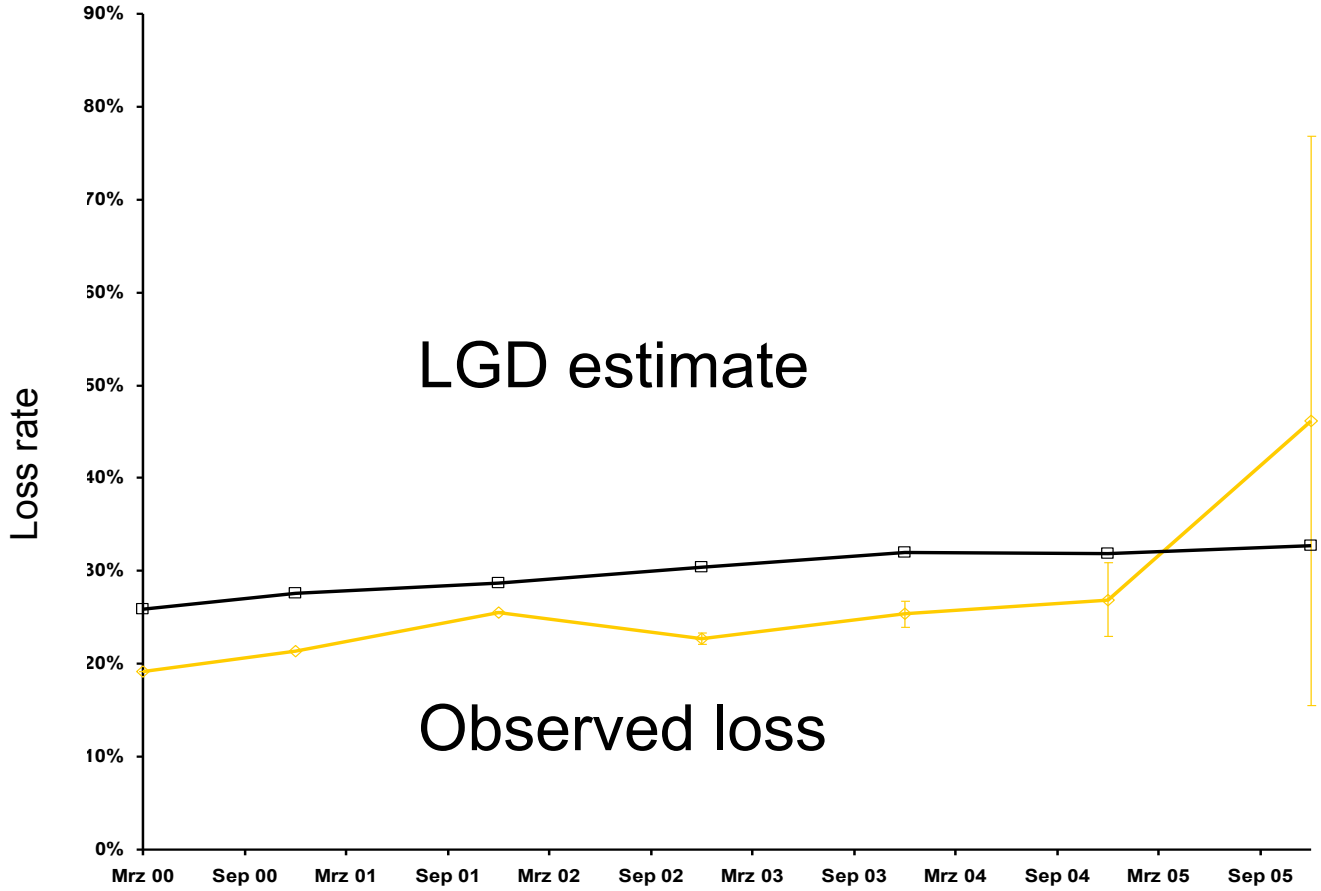
Downturn-Addon



(1) **Downturn-Addon is a measure for the variation of the distribution of observed loss**
(2) **Statistical error of the model is the lower limit for the downturn Addon**
(3) **Downturn-Addon is added to the mean LGD estimate**

- **Used Quantile:**
  - STD observed Loss: No positive Correlation between default rate and LGD
  - 90%-Quantile: Positive Correlation between default rate and LGD

Backtesting

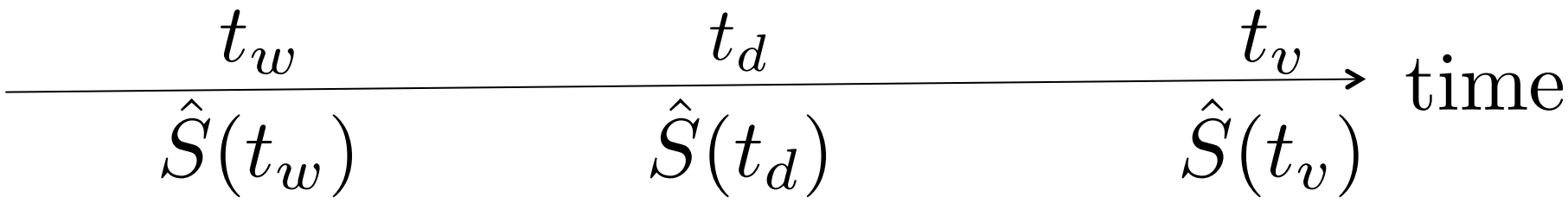


APPENDIX

Description of method

- **Estimate LGD from cash flows after event of default**
  - Recovery without loss: LGD = 0
  - Recovery with loss: LGD > 0
  - Insolvency: No recovery, LGD > 0
- **LGD depends on,**
  - Type of collateral
  - Degree of collateralisation of the loan
  - General economic situation, collateral market
  - Lien

Estimating LGD



$$\text{LGD} = 1 - \frac{S(t_d + \Delta t_{\text{liq}})}{\hat{S}(t_d)(1+r)^{\Delta t_{\text{liq}}}} = 1 - \frac{R}{(1+r)^{\Delta t_{\text{liq}}}}$$

Q & A