

# IFRS 9 and lifetime ECL modelling

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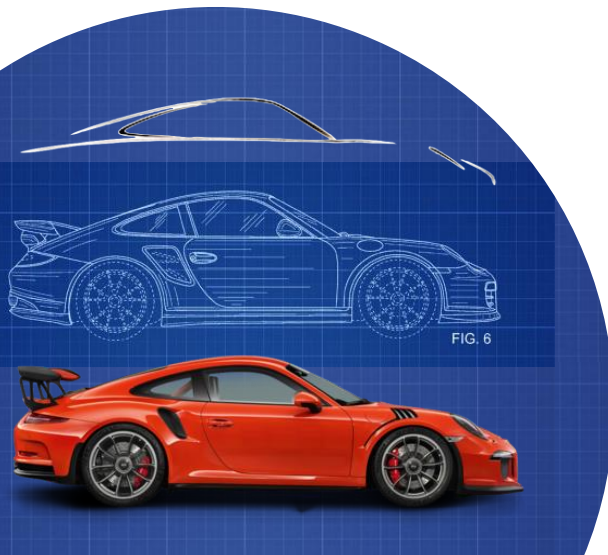
# IFRS 9 Modelling

## Lifetime Expected Credit Loss

„ ... ECLs are a probability-weighted estimates of the present value of cash shortfalls (i.e., the weighted average of credit losses, with the respective risks of a default occurring in a given time period used as the weights). “

„ ... unbiased (i.e. neutral, not conservative and not biased towards optimism or pessimism) and (...) determined by evaluating a range of possible outcomes. “

„ ... reasonable and supportable information that is available without undue cost or effort at the reporting date about past events, current conditions and forecasts of future economic conditions.“



# IFRS 9 Modelling

## Introduction

### Background

IFRS 9 has sought to address a key concern that arose as a result of the financial crisis, that the incurred loss model in IAS 39 contributed to the delayed recognition of credit losses.

Impairment paradigm change from *Incurred Credit Loss* to *Expected Credit Loss (ECL)*.

### Main targets

- Ensure a more timely recognition of ECLs than the existing incurred loss model
- Distinguish between financial instruments that have significantly deteriorated in credit quality and those that have not
- More forward looking and better approximate the economic ECLs

The expected credit loss model applies to debt instruments recorded at amortized cost or at fair value through other comprehensive income, such as loans, debt securities and trade receivables, lease receivables and most loan commitments and financial guarantee contracts.

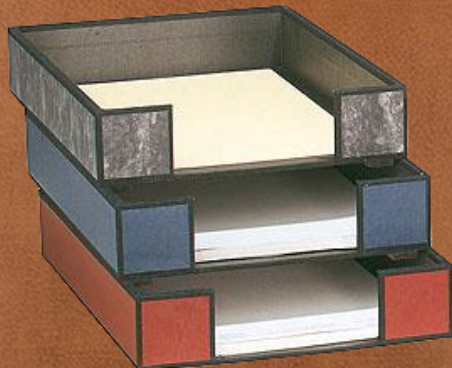


# IFRS 9 Modellierung

## Stage-Transfer

IFRS 9 states three stages which reflect different level of credit risk since recognition.

- (1) Financial instruments that have not deteriorated significantly in credit quality since initial recognition or (where the optional simplification is applied) that have low credit risk at the reporting date.
- (2) Financial instruments that have deteriorated significantly in credit quality since initial recognition (unless the optional simplification is applied and they have low credit risk at the reporting date) but that do not have objective evidence of a credit loss event.
- (3) Financial instruments that have objective evidence of impairment at the reporting date.



The IFRS 9 credit risk assessment that determines whether a financial instrument should attract ECL allowance in either stage, is based on whether there has been a relative increase in credit risk since initial recognition.

The assessment of significant deterioration in credit risk can be made at the level of the counterparty rather than the individual financial instrument.

# IFRS 9 Modelling

## Stage transfer criterion

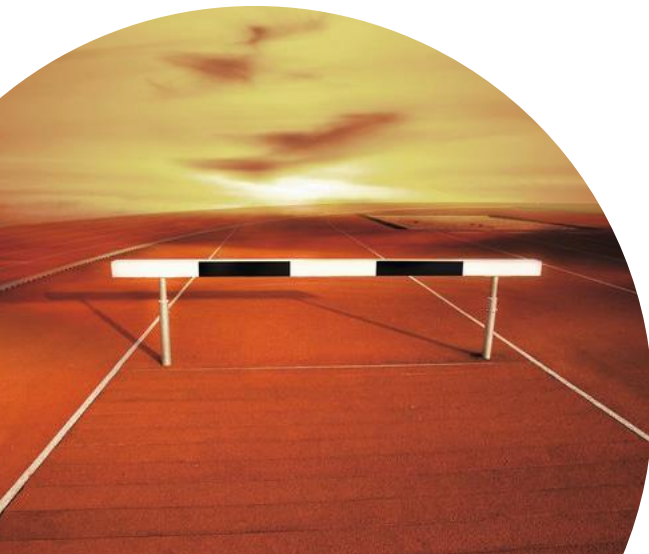
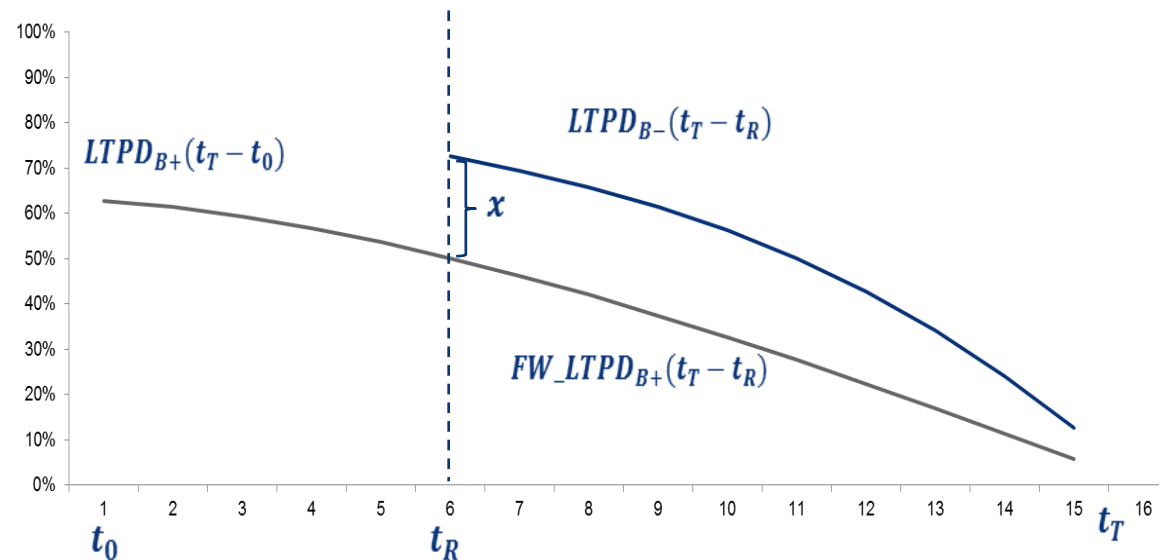
Transfer in stage 2 when lifetime PD significantly increases

- Determination by significance measure

$$x = \frac{LTPD_{B^-}(t_T - t_R)}{FW\_LTPD_{B^+}(t_T - t_R)}$$

- Transfer to stage 2 if  $x > q_{initial\ rating}$

- $t_0$  = loan origination
- $t_R$  = balance sheet due date
- $t_T$  = maturity
- $B^+$  = initial rating at  $t_0$
- $B^-$  = rating at  $t_R$



# IFRS 9 Modelling

## Lifetime Expected Credit Loss

### Common methodology in stage 1 and 2

The risk provisioning of a financial instrument in stage 1 and 2 has to be determined over different time horizons, but is considered as an unbiased and probability-weighted estimate.

By calculating in time slices, stage 1 and stage 2 are handled consistently.

For this purpose, the sum of all discounted future expected losses is weighted by the default probability in each time slice.

#### Stage 1

$$ECL_{1Y} = \sum_{t=0}^1 ECL_t$$

#### Stage 2

$$ECL_{LT} = \sum_{t=0}^{\infty} ECL_t$$

#### Stage 3

$$ECL_{LT} = ECL_0$$

with PD=1



# IFRS 9 Modelling

## Lifetime Expected Credit Loss

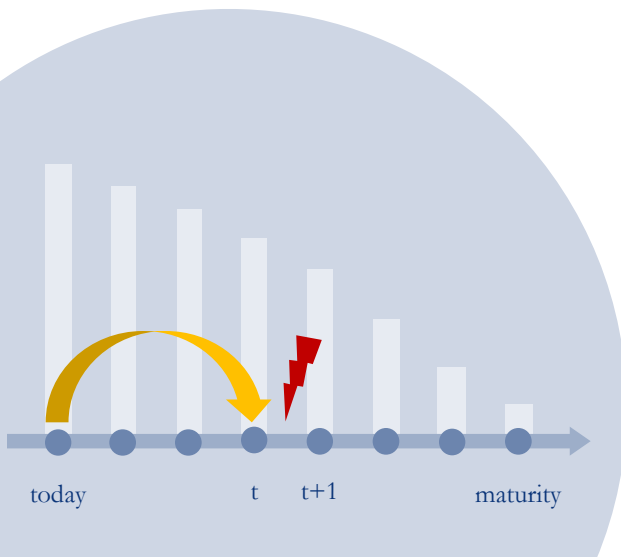
### Ingredients for an ECL time slice

How likely will a default in a time slice be?

- Predictions over very long periods of time can only be made by through-the-cycle estimates.
- Consideration of current and forward looking information requires point-in-time adjustment of PD.

What is the loss in a time slice (in case of default)?

- The maximum loss is the credit amount at the time of default.
- The actual loss depends mainly on cure rate and collateral.



$$ECL_t = \underbrace{pd_t}_{pd} \cdot \underbrace{loss_t}_{lgd \cdot ead}$$

# IFRS 9 Modelling

## Lifetime Expected Credit Loss

### Ingredients for an ECL time slice

How likely will a default in a time slice be?

- How likely is it not to default until time  $t$ ?
- How likely is a default between  $t$  and  $t+1$ ?

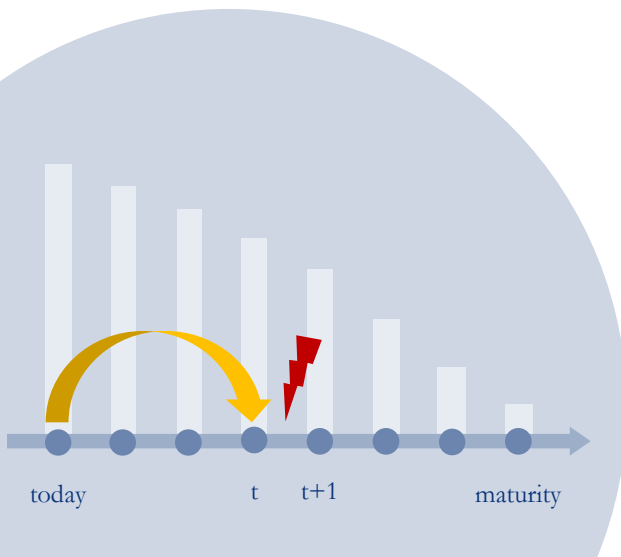
$$1 - PD_{0,t}$$
$$PD_{t,t+1}$$

What is the loss in a time slice?

- What is the credit amount in this time period?
- How much will be earned by recovery of collateral?
- What is the resolution probability and the amortization rate?
- What is the time value of money at  $t$ ?

$$EAD_t$$
$$REC_t$$
$$LGD_t$$
$$DF_{0,t}$$

$$ECL_t = pd_t \cdot loss_t =$$
$$\underbrace{(1 - PD_{0,t})PD_{t,t+1}}_{pd} \underbrace{DF_{0,t}LGD_t(EAD_t - REC_t)}_{lgd \cdot ead}$$

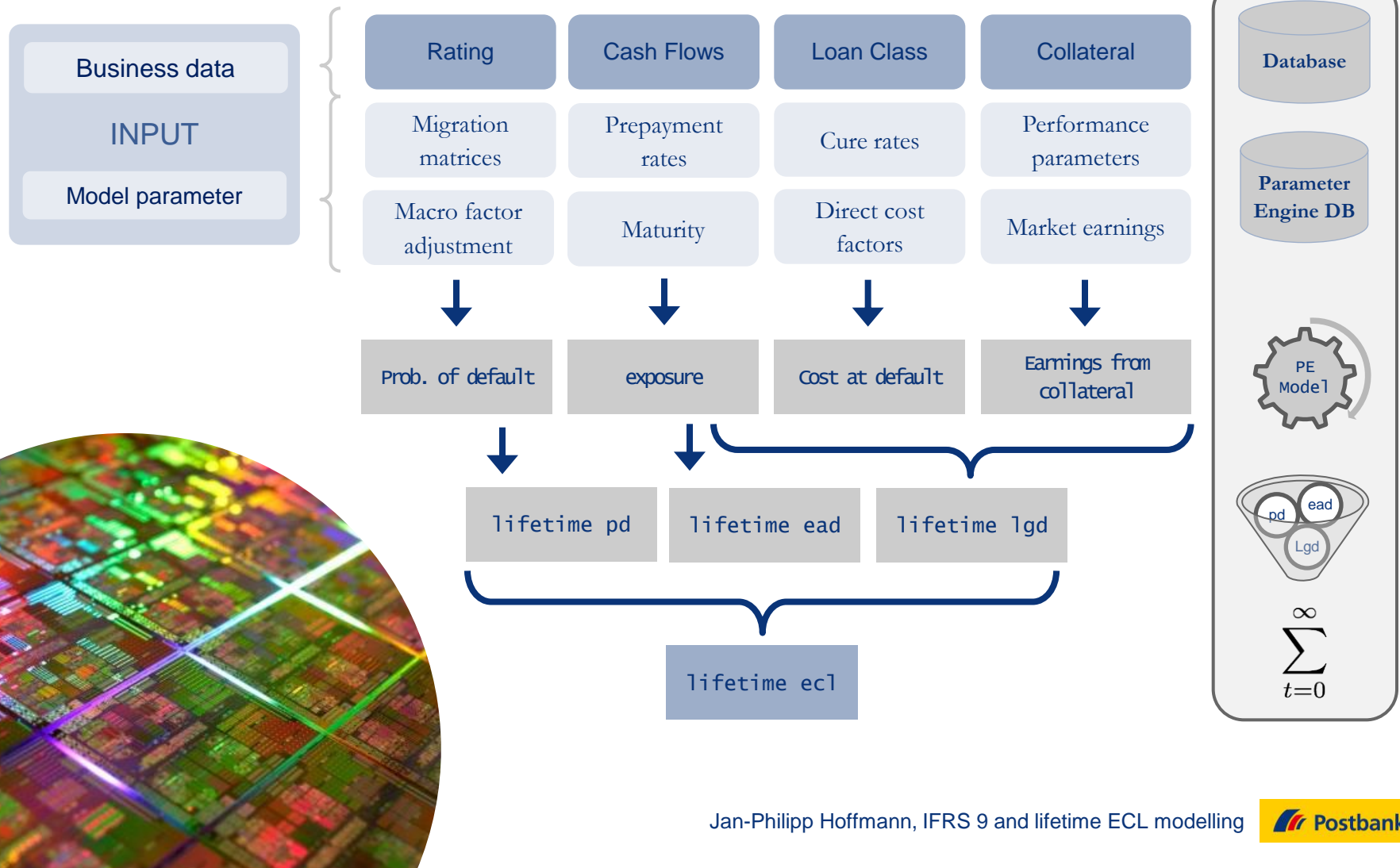




# IFRS 9 Modelling

## Lifetime Expected Credit Loss

### Ingredients to determine ECL in time slices



# IFRS 9 Modelling

## Lifetime Expected Credit Loss

$$ECL_t = pd_t \cdot loss_t =$$
$$\underbrace{(1 - PD_{0,t})PD_{t,t+1}}_{pd} \underbrace{DF_{0,t}LGD_t(EAD_t - REC_t)}_{lgd \cdot ead}$$



# IFRS 9 Modelling

## Lifetime Expected Credit Loss

$$ECL_t = pd_t \cdot loss_t =$$
$$\underbrace{(1 - PD_{0,t})PD_{t,t+1}DF_{0,t}LGD_t}_{pd}(EAD_t - REC_t)$$

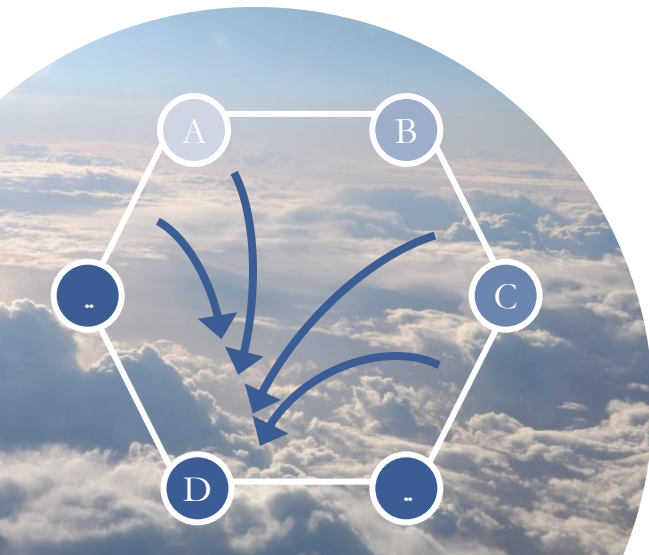
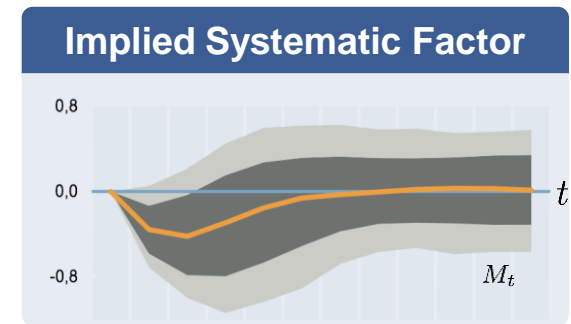
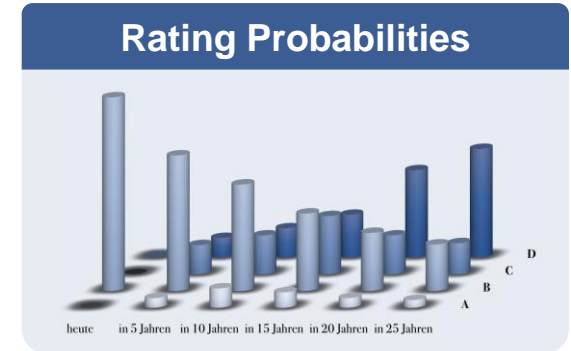


# IFRS 9 Modelling

## Lifetime Probability of Default

How likely is it to default in a time slice?

- lifetime PD are derived by simulating rating migrations starting
  - starting at current internal rating
  - moving time-homogeneous as implied by migration
  - all assumptions are seen as through-the-cycle
- point-in-time adjustment of lifetime PD based on
  - industry standard firm value model approach using
  - forecasts of future economic as long as observed



# IFRS 9 Modelling

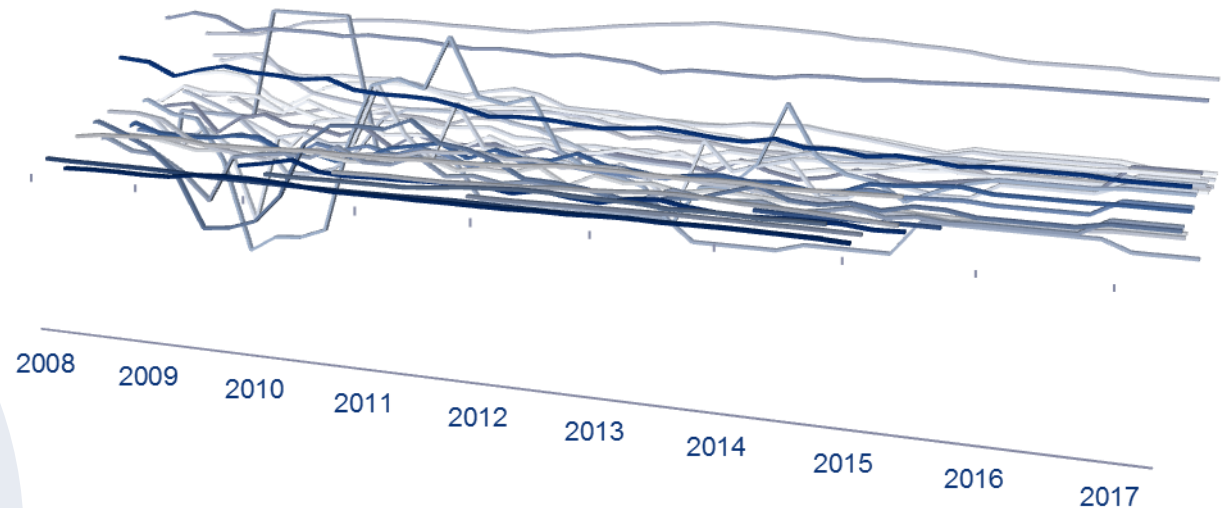
## Macro economic forecasts

### How are macro factor adjustment determined?

From various macro factor time series we choose such that showed best estimation performance in the past.

These time series are written into future of 3-5 years by internal research departments prediction.

Point-in-time adjustments are performed by classical credit modelling (via  $R^2$  formula) and accounting for prediction uncertainty, too.



# IFRS 9 Modelling

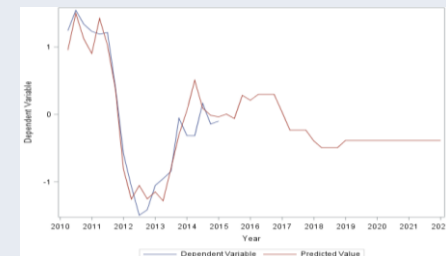
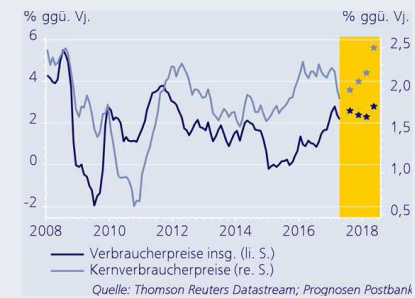
## Macro economic forecasts

### Postbank Research

- Single source of economic predictions for whole bank
- Information about past events, current conditions and future economic predictions, e.g.
  - GDP
  - Unemployment rate
  - Yield structure (3M, 10Y and spread)
  - Inflation rate



#### Factor selection



# IFRS 9 Modelling

## Macro economic adjustment

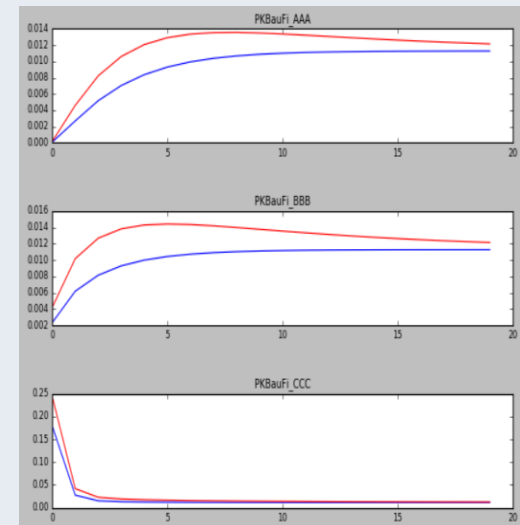
### How is the macro factor adjustment determined?

- Modelling  $M_t$  as  $\sum \omega_i F_{i,t}$  weighted sum of macro economic factors  $F_i$ .
- Evolution of  $M_t$  as autoregressive process  
$$M_t = M_{t-1}b + \epsilon_t$$
- $M_0$  determined by forecast of current economic conditions. Autoregressive coefficient  $b$  is estimated from future economic predictions companied by expert judgments (0.6).

### PIT PD adjustment formula

$$PD^{PIT}(t) = \Phi \left( \frac{\Phi^{-1}(PD^{TTC}(t)) - \mathbb{E}(M_t)\sqrt{R^2}}{\sqrt{1 - R^2 + \mathbb{V}(M_t)R^2}} \right)$$

### PIT PD adjustment





# IFRS 9 Modelling

## Lifetime Expected Credit Loss

$$ECL_t = pd_t \cdot loss_t =$$
$$(1 - PD_{0,t}) PD_{t,t+1} DF_{0,t} \underbrace{LGD_t (EAD_t - REC_t)}_{\text{lgd} \cdot \text{ead}}$$





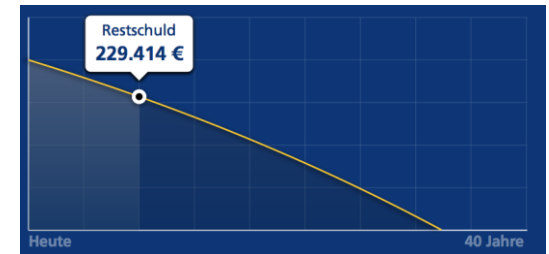
# IFRS 9 Modellierung

## Lifetime Expected Exposure at Default

### standard loan

future exposure value (EAD) as current amortized cost reduced by contractual redemptions

and expected pre-payments as well as cancellations or prolongation weighted by probability.



### commitments and revolving loans

Expected future utilization of unused limits via credit conversion factors.

Limiting expected maturity to one year for perpetual contracts if deterioration of credit quality admits cancellation.



# IFRS 9 Modellierung

## Lifetime Expected Credit Loss given Default

### Two scenarios after default

Estimation of expected credit loss amount in default by two probability-weighted scenarios:

- a) Recovering from default
- b) Resolution of collateral.

- direct cost

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*Cost of Restructuring*

- current credit amount  
- withdraws after default  
- direct costs  
+ earnings from collateral  

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*Loss in resolution*

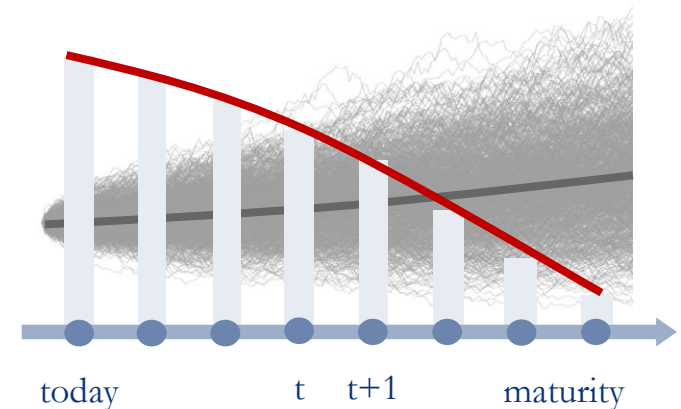


# IFRS 9 Modelling

## Macro modelling of collateral valuations

### What is the expected earning from collateral?

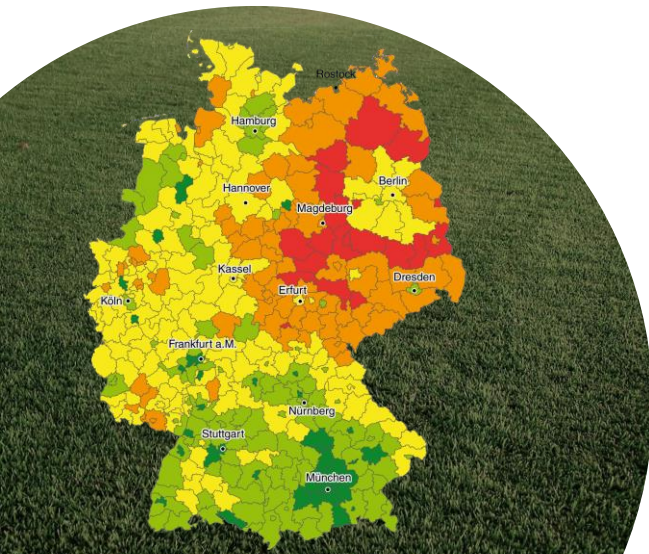
- Long time forecasts of mortgage market values require stochastic modeling.
- Values  $S_t$  are modelled as geometric Brownian motion (GBM) with
  - return  $\mu$  is given by forecasts of mortgage prices
  - volatility  $\sigma$  reflecting future price uncertainty
- Capped claim on collateral leads to nonlinear payoff, derived by classical option value theory.



### Call Option Spread

$$REC_t = \mathbb{E}[\max(0, \min(q_s S_t - V_t, EAD_t))]$$

- $REC_t$  = recovery at  $t$
- $S_t$  = geometric Brownian motion
- $q_s$  = market earnings rate
- $V_t$  = external claim



# Thank you!

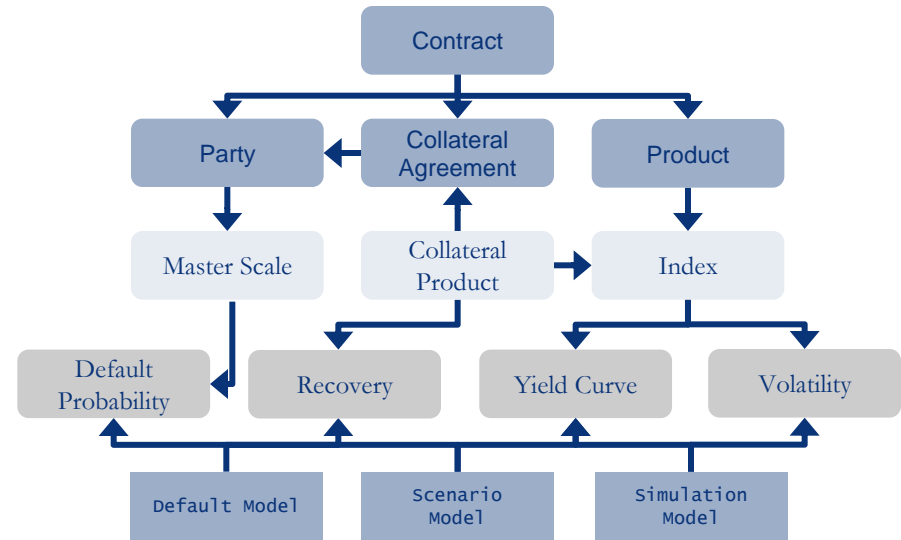


# IFRS 9 Modelling

## Modular method library

How can we implement revised expectations on models quickly?

- By a modular design, all library methods can be quickly and flexibly extended.
- Different modeling approaches can be tested, e.g.
  - PD models based on PIT adjusted migration matrices
  - LGD models based on constant LGD factor
  - deterministic collateral valuation



# IFRS 9 Modelling

## Model parameter calibration

### How are model parameters determined?

- Calibration of parameter based on internal data, segmentations and external data.
- Yields of real estate and their volatilities from time series are determined by external data.
- Macroeconomic predictions based on Postbank Research publications.



#### During the calibration process

approx. 70  
approx. 125 m  
approx. 100 k

approx. 30 k  
approx. 300 pages

new models and portfolios were calibrated  
data points in time series were analyzed  
yields of real estate for different regions were examined  
rows of source code were written  
of documentation were created



# IFRS 9 Modelling

## Scrum - Agile Project Management

How can we implement revised expectations on models quickly?

- Modular design and portfolio-specific priority in sprints (several mini-project-phases of approx. 4 weeks).
- Even after finishing the IFRS 9 project, sprints will be used for further model development.
- Cooperation between bank and our IT service provider by
  - Pair programming and testing
  - Teamwork at one location creating confidence to be able to perform effectively and constructively especially in stressed situations.

