Modelling the Interaction of Portfolio Performance with the Economic Cycle and its application

Backtesting, Stress Testing, Long Run Probabilities of Default and Downturn LGDs

CRC 2009

informa
arvato services

*Use of long run Probabilities of Default and the interaction of these with economic cycle stress testing**

- […] exposures with similar default risk be allocated to the same rating grade […] default rate expected to be incurred in that grade over the long run […]
- […] not all rating approaches seek to measure risk in the same way […]: Point in Time (PiT) versus Through The Cycle (TTC)
- […] in practice […] we have […] "hybrids"[…]. The resulting challenge for a firm is […]therefore to identify where its rating systems are on this spectrum, as this is necessary for both:
  - Validation purposes – in particular comparing observed defaults against those that should have been expected […].
  - Stress-testing purposes – estimating the ratings migration likely to occur in a given stress testing scenario.

*Source: FSA – "Use of long run Probabilities of Default, counter-cyclical scaling factors, and the interaction of these with economic cycle stress testing"

Is it likely that economic condition influence unsecured retail Portfolio PDs ?

Reasons for over-indebtedness in Germany

reasons for over-indebtedness	%	potential correlation with economic conditions
unemployment	30%	++
low income	20%	++
extensive consumption	15%	+
separtion and divorce	15%	0
failed self-employed business	10%	+
others	10%	0

Source: Bundesministerium für Familie, Senioren, Frauen und Jugend; „Überschuldung privater Haushalte"

- As some 75 % of the reasons for over-indebtedness are potentially correlated with the economic conditions, a statistic analysis may add additional value for portfolio management and gives hope that results are significant.

Project approach

	Data time series	Characteristic generation	Factor analysis model development	Individual model deployment
Requirement	Generate a PD time series which is free of any other influences except the economic conditions as a basis for stress testing.	Use economic key indicators and generate predictive characteristics for 25 years. Ensure data integrity.	Analyse all relevant characteristics and check for plausibility and significance. Build a multi factor model.	Use adverse economic setting and calculate Stress Test Scenarios. Find scalar for TTC PD, calibrate PD model to integrate economic condition…
Approach	Take bank internal portfolio PD and discuss known effects. Benchmark against pool data and discuss potential deviations.	Economic key indicators are available for all European countries. Several derived characteristics were generated. External data can be used.	Use bank internal portfolio PDs and benchmark results against pool data. If time series of bank's internal data is short use best pool to extend data time series.	Use adverse economic setting and calculate Stress Test Scenarios. Find scalar for TTC PD, calibrate PD model to integrate economic condition . . .
Documentation	Document process and iteration to ensure reliability of PD time series.	All economic key indicators are described with reference to the sources used. Derived characteristics are explained. The expected interaction with the portfolio PD is provided.	Document single factor analysis and comment results. Provide reasoning for benchmark portfolio and ensure the pool is accepted by regulators.	Document all relevant steps and results in accordance with regulatory standards.

GIGO: Understanding data is key, again…

informa challenges the following areas:

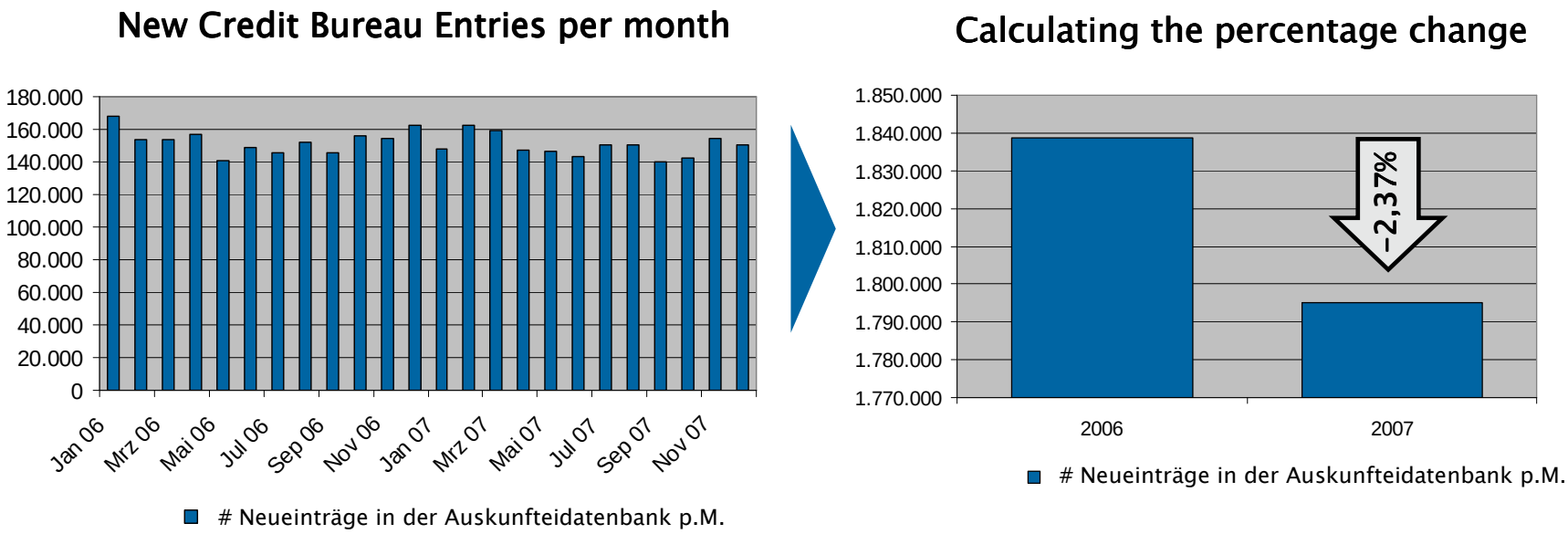
- New Acquisition and Distribution Channels
  As a portfolio comprises of several products which have different risks, a change of the portfolio structure due to new acquisitions would have an effect on the development of the portfolio PD.

- Changes in Risk Management and Credit Policy
  Changes in the appetite for risk of a bank and changes of standard procedures have an effect on the development of the portfolio PD.

- Debt Sales, Portfolio Acquisitions and Collection Management
  All back-end procedures such as intensive collection treatment or changes in the portfolio have an effect on the development of the portfolio PD.

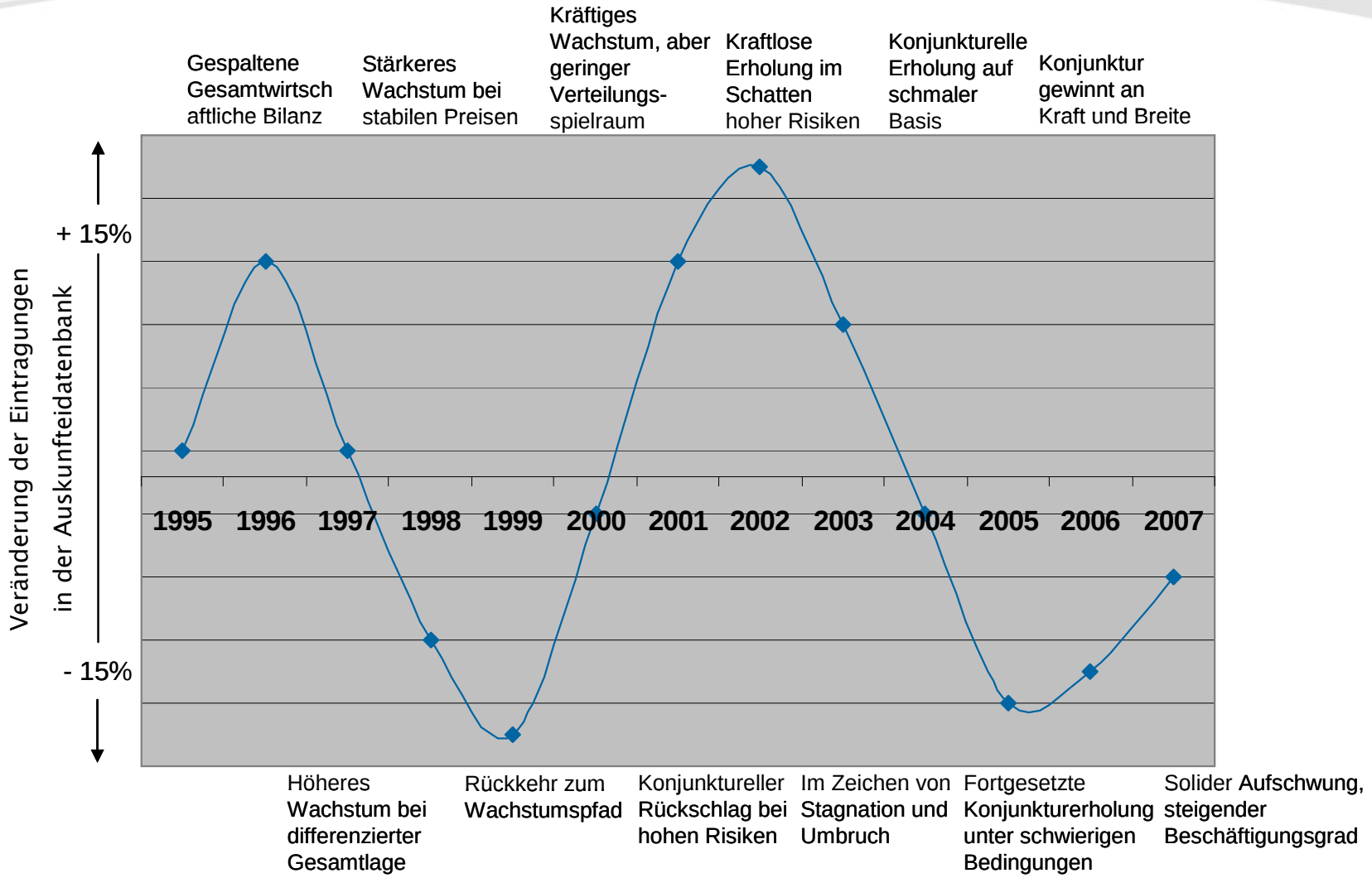
Benchmarking a bank's portfolio PD development with pooled data or individual portfolios adds tremendous value to our analysis.

Generating a PD time series for Germany (iiPD)



- The data time series (iiPD) starts in January 1994 and reaches until December 2008 (14 years). Therefore percentage changes can be calculated for 13 years. Analysis also have been carried out on semi annual and quarterly basis.

Movement of the iiPD within the economic cycle



Potential economic indicators

- The following “classic” indicators are used to describe the economic conditions:
  - GDP
  - Price and cost indices
  - Labour cost index
  - Interest rate
  - Unemployment rate
  - Consumer price index
  - etc.

- In addition to this raw data, several characteristics are derived in order to generate more predictive information. Furthermore, different time lags such as 6, 12, 18 or 24 months are used and their influences are analysed.

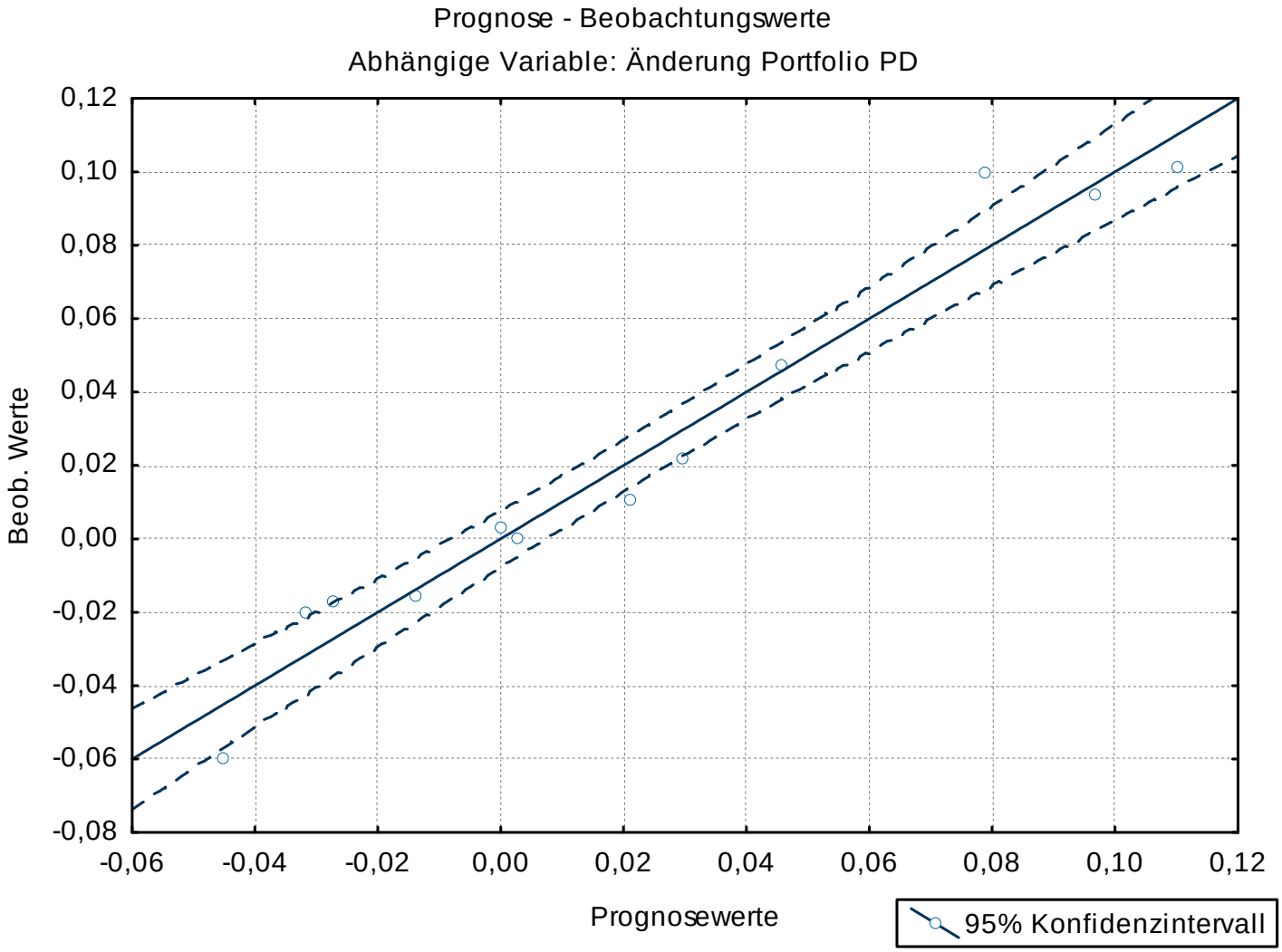
- Complementary indicators are available which do not belong to the “classic” ones mentioned above to add additional value to the analysis.

Single factor analysis

Single factor regression analysis

- Out of all characteristics (K) which are available for our analysis the most predictive ones have to be identified.
- Due to our expertise potential correlations are taken into account and we aim to determine sets of $2 \leq K \leq 5$ characteristics for the final model build.
- We check if the expected correlation matches the analytical observed correlation. If this is not the case we exclude the economic indicator from further analyses.
- The expected strength of a single factor is analysed in the context of a bank's risk management system. Example: Institutions with a conservative approach to calculate affordability measures will observe a weaker impact of some characteristics such as consumer price index.

Regression Summary. without 2005: R^2=0 ,9602; F(4,7)=42,280 p<0,00005 Stdf. der Schätzung: ,01313



1st Application: Backtesting

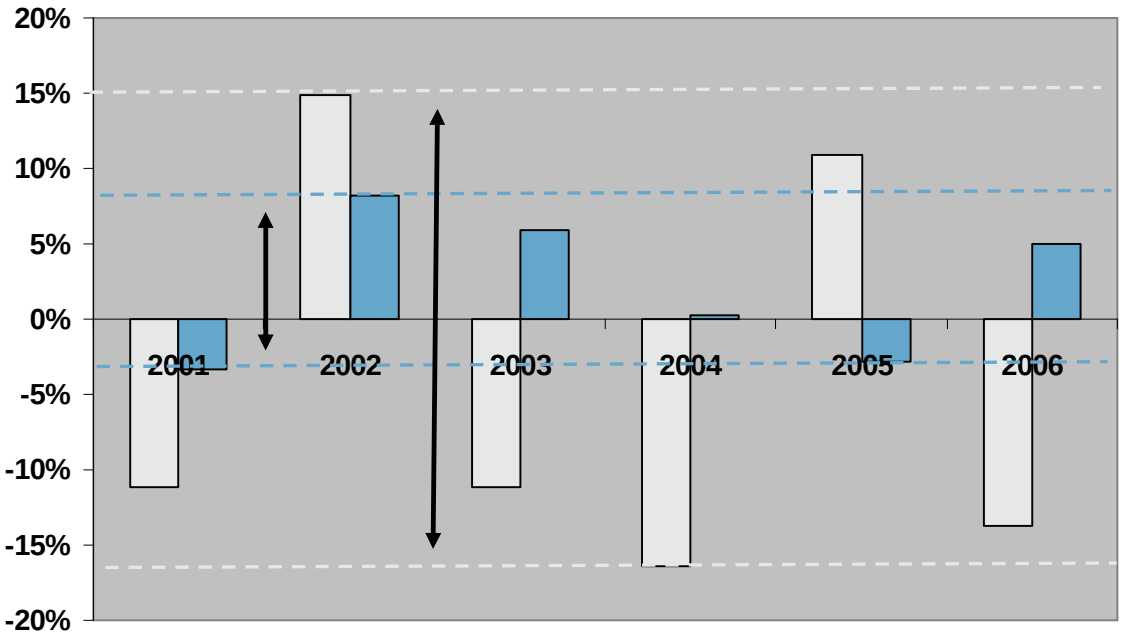
	Entwicklung auf Daten aus 2004 - 2007		Einsatz und Erwartungen für 2008		Beobachtung für 2008	
Rating Klasse	Erwartete PD Exp PiT PD	Aufschwung % Portfolio	Erwartete PD Exp PiT PD	Abschwung % Portfolio	Beobachtete PD Obs PiT PD	Abschwung % Portfolio
1	0,50%	10%	0,50%	5%	0,63%	5%
2	1,00%	30%	1,00%	20%	1,25%	20%
3	2,00%	30%	2,00%	20%	2,50%	20%
4	4,00%	20%	4,00%	35%	5,00%	35%
5	8,00%	10%	8,00%	20%	10,00%	20%
Portfolio PD		**2,55%**		**3,63%**		**4,53%**

Estimate the Deviation with sys model

- Common reaction: A deviation is observed and therefore the calibration is re-aligned with a new ct. BUT this may occur again next year. Instead of re-aligning every year the sys risk should be integrated in the calibration of the model.

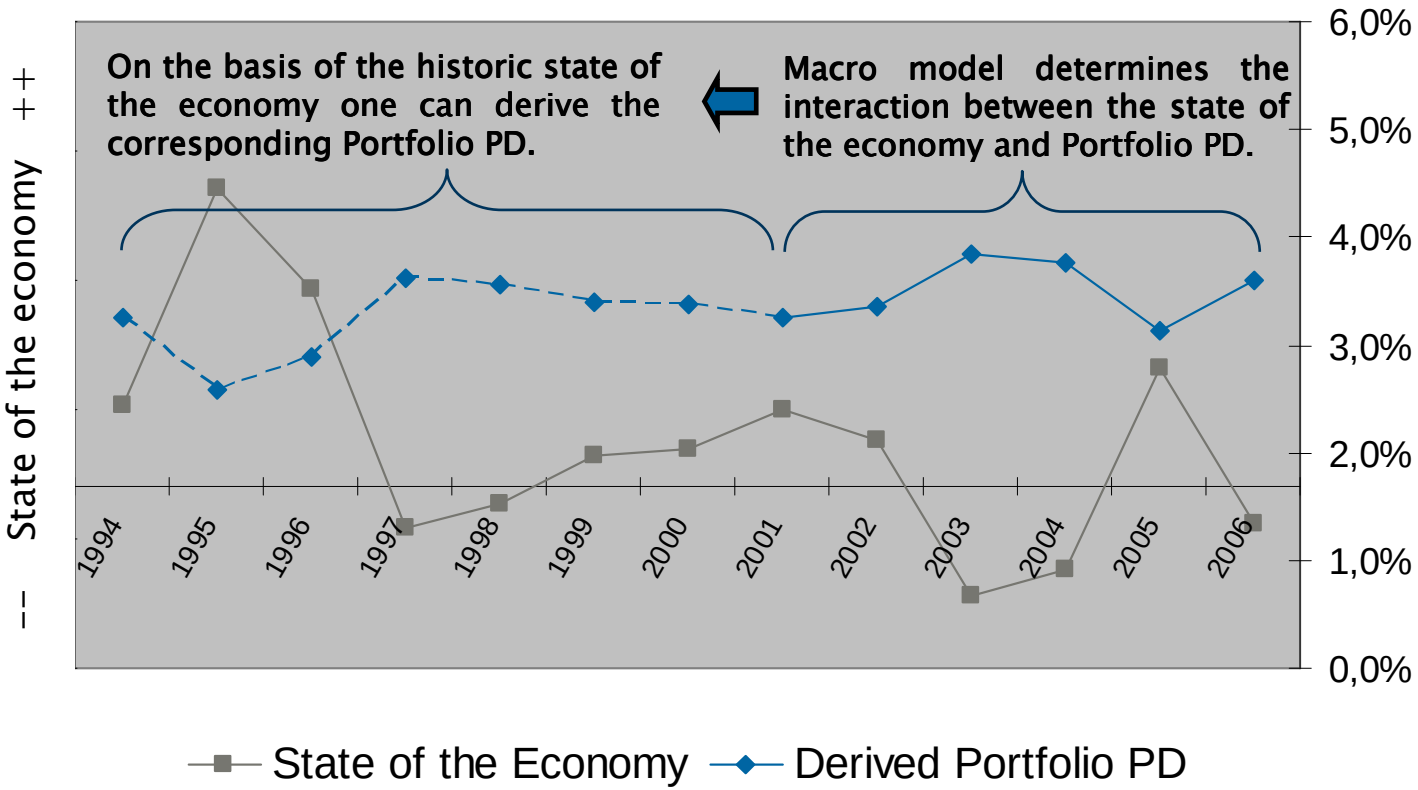
Considerable improvement of the prediction quality

	t-6	t-5	t-4	t-3	t-2	t-1
Observed Portfolio PD	3,3%	2,7%	3,4%	3,6%	3,8%	3,4%
Expected Portfolio PD	3,0%	3,2%	3,1%	3,1%	4,3%	3,0%
Observed Deviation in %	-11,2%	14,9%	-11,1%	-16,4%	10,9%	-13,7%
Expected Portfolio PD with Macro-Model	3,2%	2,9%	3,6%	3,7%	3,7%	3,6%
Observed Deviation in %	-3,4%	8,2%	5,9%	0,2%	-2,9%	5,0%



Considering the macro economic development, significantly reduces the deviation between expected and observed Portfolio PDs.

2nd Application: Through the Cycle PD



- On the basis of the "macro model" one can derive corresponding portfolio PDs for a complete economic cycle. By this means one is able to calculate "Long Run Probabilities of Default" and "Through the Cycle PD" on portfolio level.

Estimating the ratings migration for TtC PDs

- For all retail exposures* the correlation with the economic factor is determined as follows:

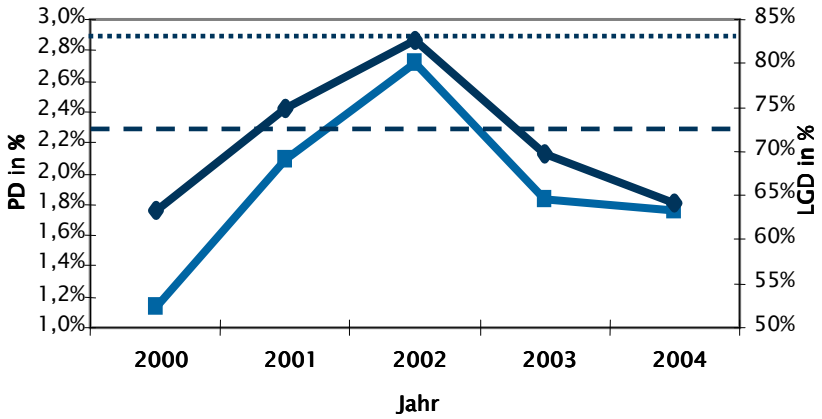
  $$Correlation\ (R) = 0.03 \times (1 - EXP(-35 \times PD)) / (1 - EXP(-35)) + 0.16 \times [1 - (1 - EXP(-35 \times PD))/(1 - EXP(-35))]$$

- The formula assigns higher correlation to low PD grades as the portion of unexpected loss in these grades is significantly higher.

- In accordance with that approach, one can use the formula to distribute the effect of the economic environment on the Portfolio PD (quantified on portfolio level as demonstrated before) on each rating grade.

*not *Residential mortgage exposures and not Qualifying revolving retail exposures*

3rd Application: Downturn LGDs



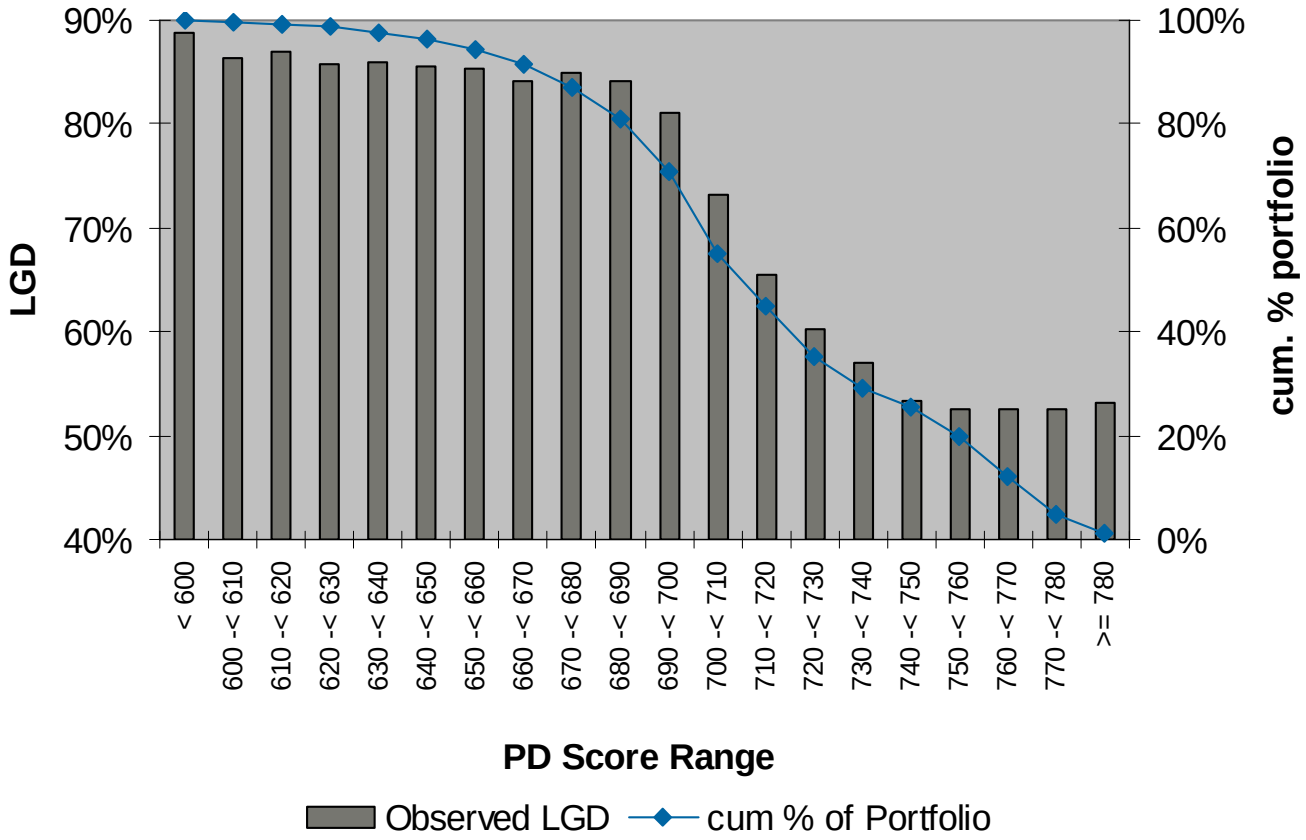
Year	Default Rate (%)	LGD (%)
2000	1,1	65
2001	2,0	75
2002	2,6	82
2003	1,8	70
2004	1,7	65
Simple Average		71,4
Weighted average		73,0
Downturn factor		1,1

Periods in which observed historical default rates have been elevated for a portfolio of exposures serve as an indicator for downturn LGDs.

Calculate the weighted average and put it into relation with the worst case to derive the downturn factor. Then, calibrate the LGD model with the downturn factor.

(a) […] periods of negative GDP growth […]. Identification of adverse dependencies, if any, between default rates and recovery rates*

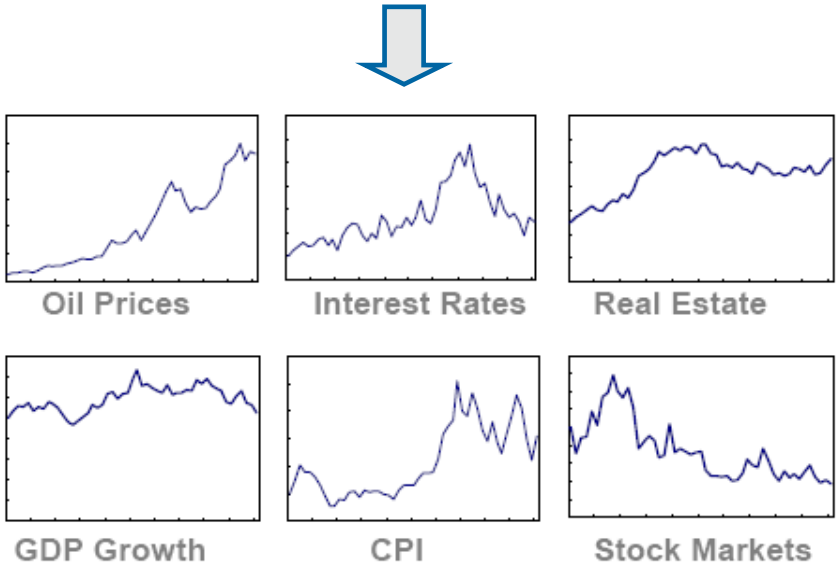
- A stationary comparison of average recovery rates with recovery rates observed during appropriate downturn periods identified according to (a).



*Source: Basel Committee on Banking Supervision: Guidance on Paragraph 468 of the Framework Document, July 2005

4th Application: Stress Testing

Qualitative Scenario



Defining a Quantitative Scenario

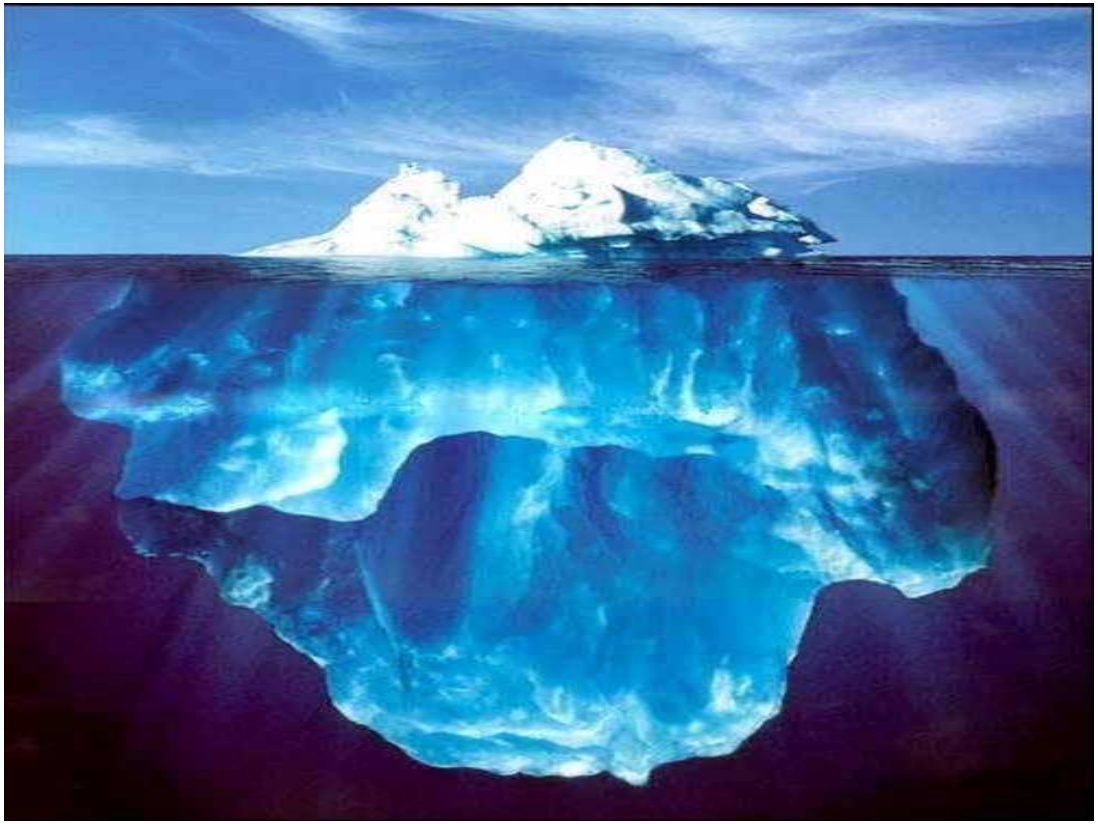
Applying the sys model

Stressed Portfolio PD

The visible hint…

non sys

sys



Thank you for your attention!

arvato infoscore
Informationsmanagement

Thomas Hoffmann
SBD Manager
Berliner Str. 207–211
D–65205 Wiesbaden

Phone +49 (0) 6 11/97 85 – 45
Fax +49 (0) 6 11/97 85 – 39

thomas.hoffmann@bertelsmann.de
www.arvato-infoscore.de

informa
arvato services