Crash Testing German Banks

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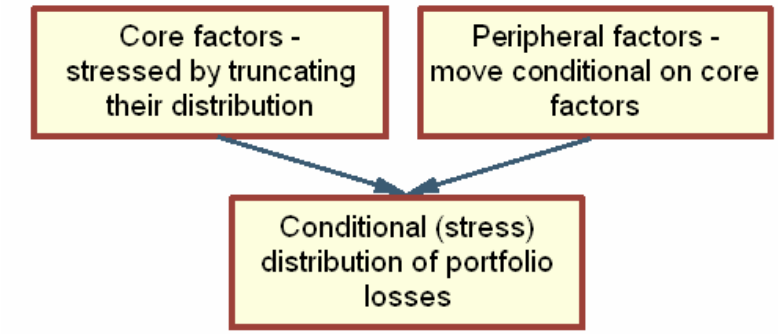
Motivation

- Apply CreditMetrics-type model, „best practice“ in the industry
- Spill-over to other sectors captured by inter-sector correlations Stress
- Sectoral and name concentrations automatically captured scenario
- More informative than a „point scenario“ because a range of industry downturns in a specific sector is considered
- Credit register of the Deutsche Bundesbank allows consistent application for a sample of banks‘ credit portfolios

Key idea: Stressing core factor(s)

- See Bonti, Kalkbrener, Lotz, and Stahl, Journal of Credit Risk, 2006



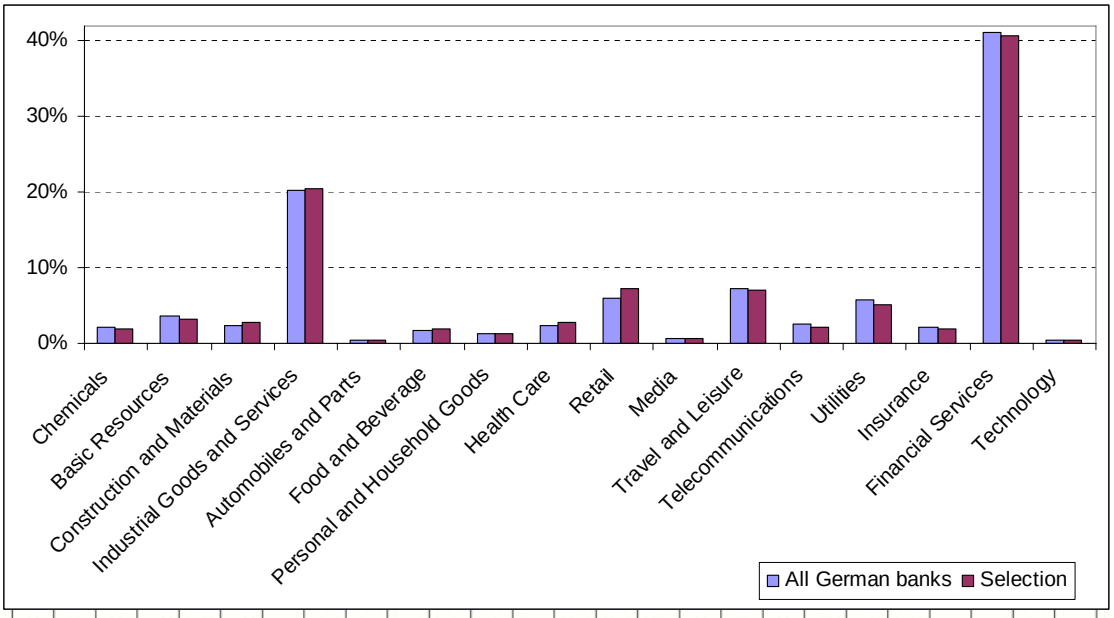
- Plausible scenario because based on economic forecast
- Consistent stress results because generated by using a model
- Reportable because only a single risk factor changed

Data

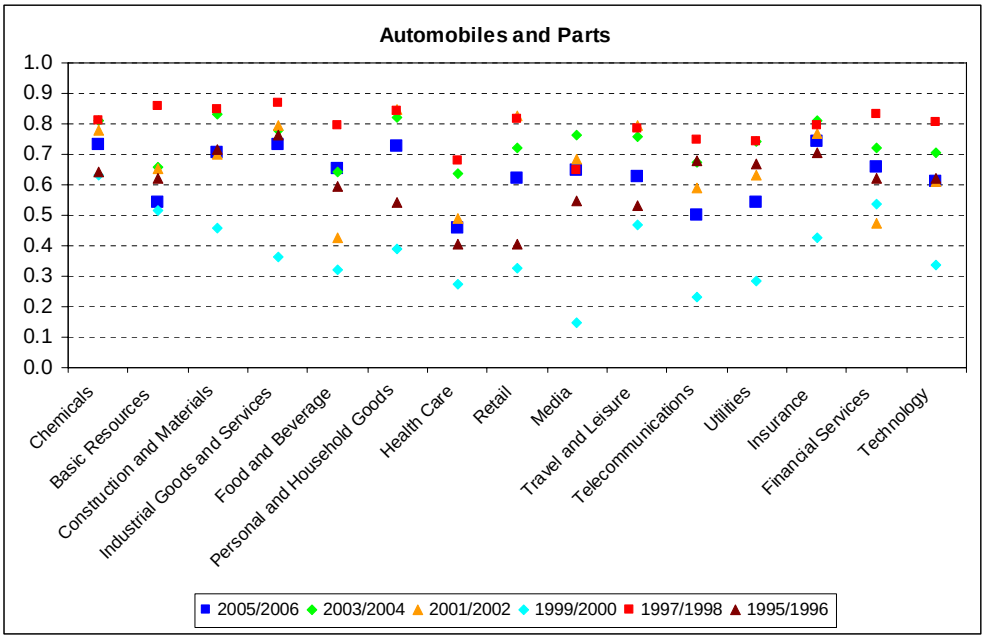
- Source: German credit register of loans ≥ 1.5m €
- Select corporate loans
- Borrowers are considered on a „borrower unit“ basis
- Sample of 28 banks
  - 12 private banks
  - 13 public sector banks (8 Landesbanken)
  - 3 cooperative sector banks
- Every bank has at least 1,200 borrowers included in credit register
- Sample covers more than 75% of total exposure in the credit register
- Market capitalization 1.4 bn € - 50 bn €

Sectoral breakdown...

... of bank sample and total credit register; Industry Classification Benchmark (ICB)

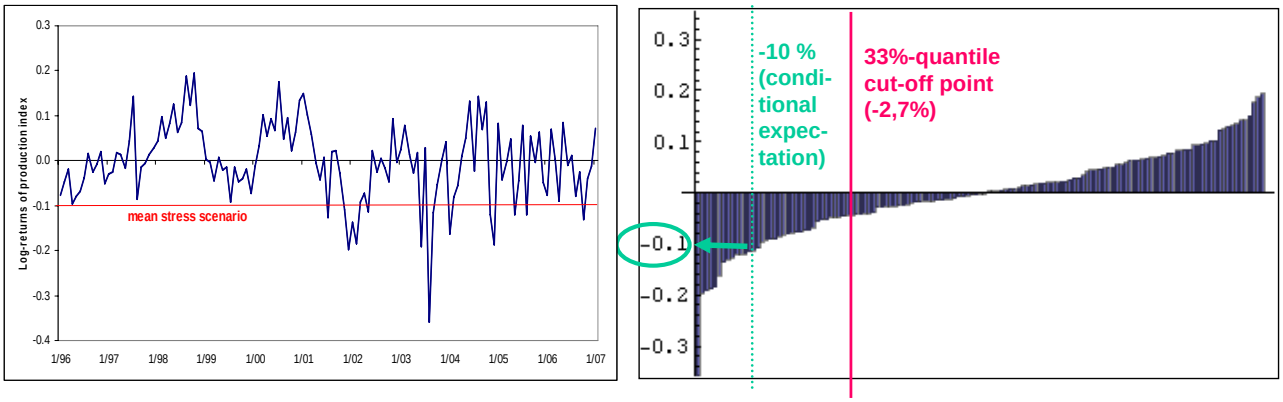


Correlation with automobile sector



Definition of stress events

- Input: de-trended log returns of automobile production index
- Stress forecast: production index return of -10%



Portfolio credit risk model

- CreditMetrics-type model
- Y_i: Unobservable default trigger variable

$$Y_i = r \cdot X_{s(i)} + \sqrt{1-r^2} \cdot \varepsilon_i$$

Systematic risk — Idiosyncratic risk

$Y_i, \varepsilon_i \sim N(0,1)$

$X \sim N(0,\Omega)$

$\forall s,i: \; cor(X_s, \varepsilon_i) = 0$

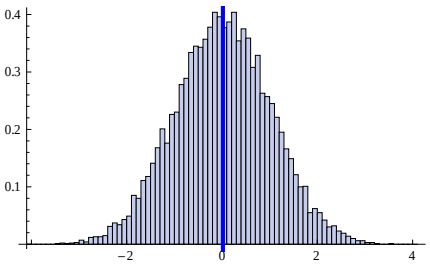
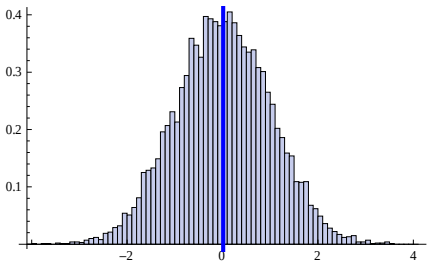
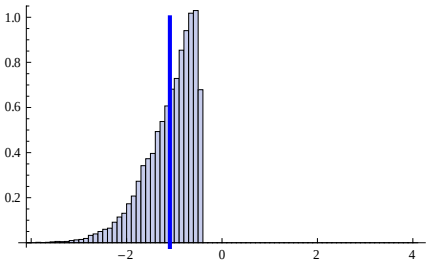
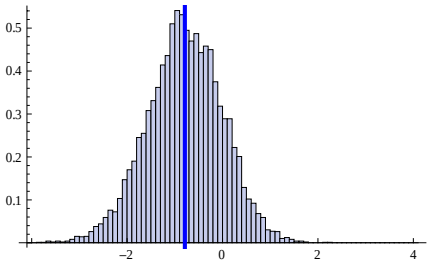
Ω: Covariance matrix of sectoral risk factors

r: systematic factor weight

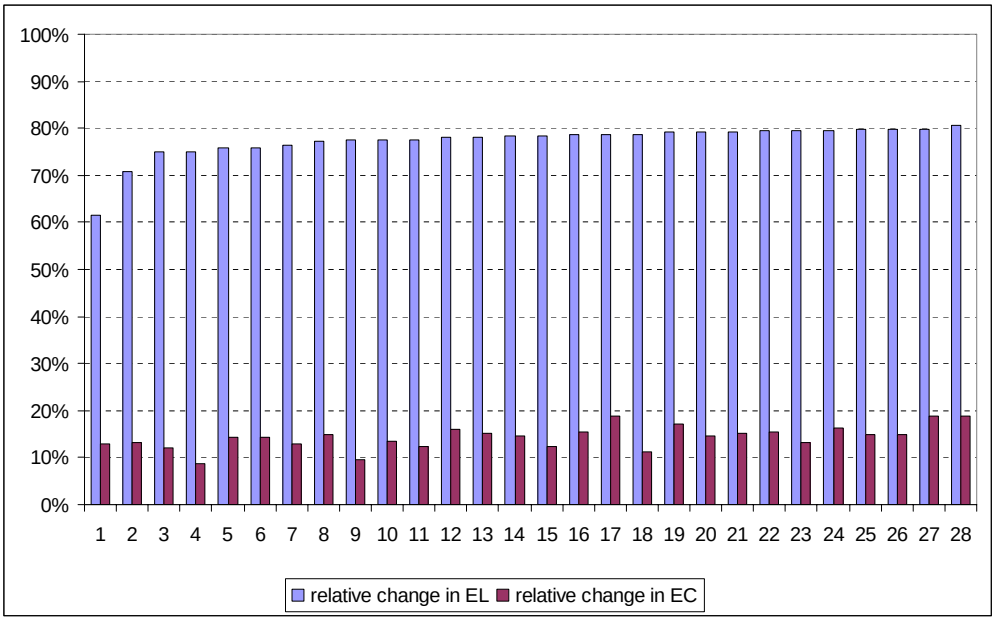
- Default probability: $P(Y_i < c_i) = N(c_i)$ where c_i is default barrier
- Portfolio loss L_n:

$$L_n = \sum_{i=1}^{n} w_i \cdot LGD_i \cdot 1_{\{Y_i \le c_i\}}$$

Stress impact on risk factors

	Automobile sector (core factor)	Capital goods and servicing (peripheral factor)
Before Stress		
After Stress		

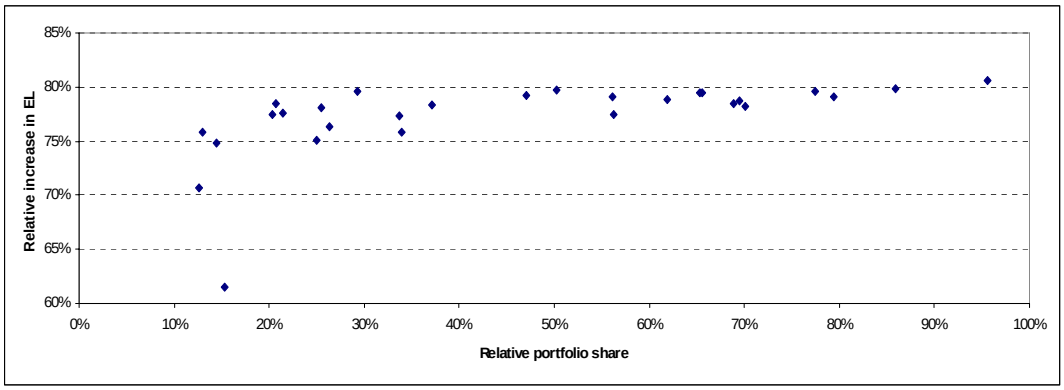
Relative impact of sectoral stress on Expected Loss (EL) and Economic Capital (EC)



UL based on 99.9%-quantile

Impact of inter-sector correlation

- Average portfolio share of financial services sector: 40 %
- Relatively high correlation with automobile sector: 66 %



→ Increase of economic capital mainly driven by inter-sector correlations

Results

- Risk measures increase
  - EL by **70 – 80%**
    - But increase below 2.5% if only impact on stressed sector considered
  - Economic capital by **10 – 20%**

- Capital ratios CR reduced on average from **12%** to **11.6%** under stress conditions

$$CR^{Stress} = \frac{\text{Capital} - EL_{in\%}^{Stress} \cdot \text{total exposure}}{\text{Risk weighted assets} + 12.5 \cdot \text{market risk VaR}}$$

Sensitivity analysis

- Portfolio infinitely granular in every sector
  - Only marginal impact on EL results
  - Economic capital on average 16% lower than in original portfolio but relative increase due to stress quite similar
- Highest asset corelations estimated over 2 years from 1995 - 2006
  - Higher relative increase in EL (78-93%)
  - Lower increase in economic capital (6-16%)
  - Moderately lower capital ratios (on average 11.5%)

Outlook

- Main lessons
  - Inter-sector correlations play key role in measuring impact of single-sector stress on credit portfolio
  - Increase in EL swamps increase in economic capital under stress
  - Capital ratios under stress on average still well above regulatory minimum level
- Further research
  - Refinement of stress scenario
  - Impact of heterogeneity in default probabilities
  - Impact of sector scheme