







FORECASTING THE MACROECONOMIC RISK OF INDUSTRIES AND THE PROBABILITY OF DEFAULT FOR COMPANIES IN EUROPE

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First EViews User Meeting, Frankfurt

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AGENDA

- 1** *Target: Connect a Generic Scorecard (SAS) with a Macroeconomic Model (EViews)* 
- 2** *Important terms: Scorecard, Risk of Industries (RI), Probability of Default (PD) and Rating* 
- 3** *Generic Scorecard for prediction of PD and Rating using SAS* 
- 4** *Macroeconomic Model for forecast of RI using EViews* 
- 5** *Connection between macroeconomic indicators and RI, PD, Rating* 
- 6** *Simulation of Scenarios and Stresstest* 

TARGET: CONNECT A GENERIC SCORECARD (SAS) WITH A MACROECONOMIC MODEL (EIEWS)

Scorecard for prediction of probability of default (PD)
with risk of industries (RI) using **SAS**

Risk of industries

Macroeconomic model (MEM) for forecasting
the risk of industries using **EViews**

Risk of industries = f (GDP, DAX, i ECB, Oil price, ...)

Final Raw Score for each company within a country
→ PD → Rating

IMPORTANT TERMS: WHAT IS RISK OF INDUSTRY (RI) AND PROBABILITY OF DEFAULT (PD) FOR A COMPANY?

Scorecard for prediction of PD and rating (SAS)

PROBABILITY OF DEFAULT FOR A COMPANY (USING SAS):

$$PD = F(\text{DEM}; \text{FIN}; \text{TRD}; \text{NEG}; \text{MEM});$$

- DEM_variables: legal form, number of employees, age of company etc.;
- FIN_variables: revenue, profit, liabilities, etc.;
- TRD_variables: late payment, sum of invoices, paydex etc.;
- NEG_variables: audit remarks, blocked accounts etc.;
- MEM_variables: RI (Bad Rate of industry) → $RI = F(\text{macroeconomic indicators})$

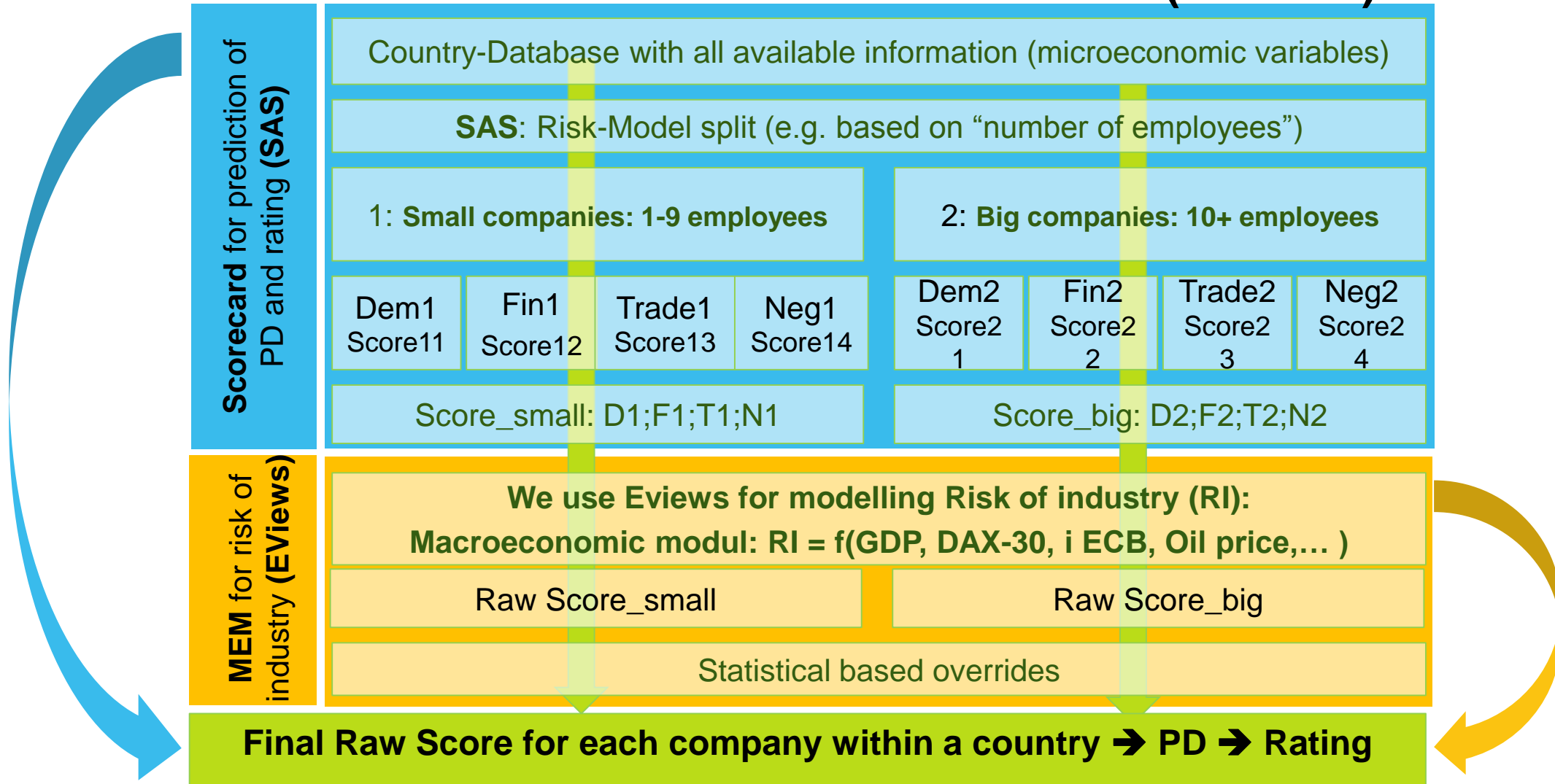
MEM for risk of industry (EViews)

FORECASTING THE RISK OF INDUSTRY PER QUARTER (USING EViews):

$$RI_q = \text{Bad_rate_q} = \text{bankruptcy in industry_q} / \text{active company_q} =$$

$F(\text{GDP}(t), \text{Interest Rate of ECB}(t), \text{Inflation rate}(t), \text{DAX-30}(t), \text{Euro/USD}(t); \text{Oil price}(t), \dots)$

TARGET: CONNECT A GENERIC SCORECARD (SAS) WITH A MACROECONOMIC MODEL (EViews)

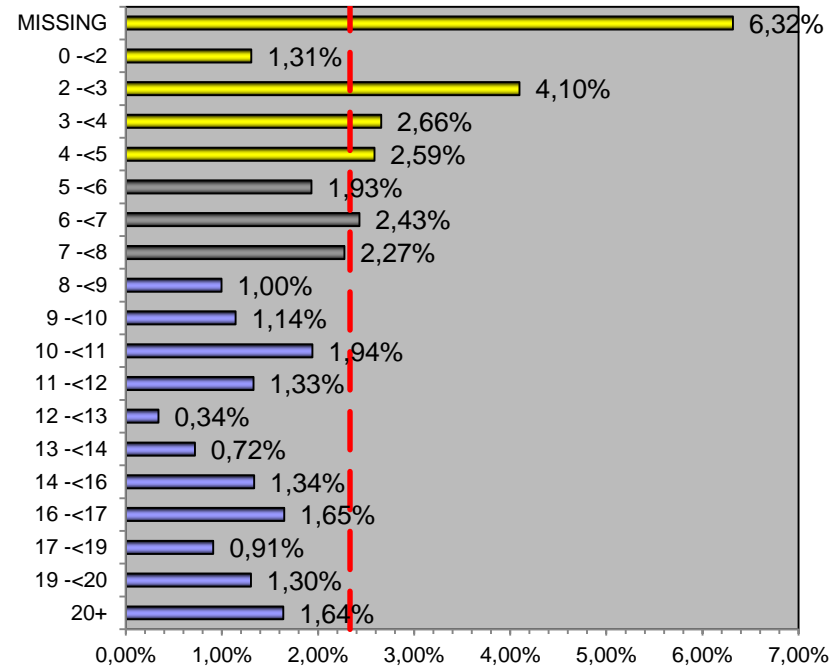


EXAMPLE-1: MICRO-ECONOMIC INDICATOR (E.G. AGE OF COMPANY) IN GENERIC SCORECARD:

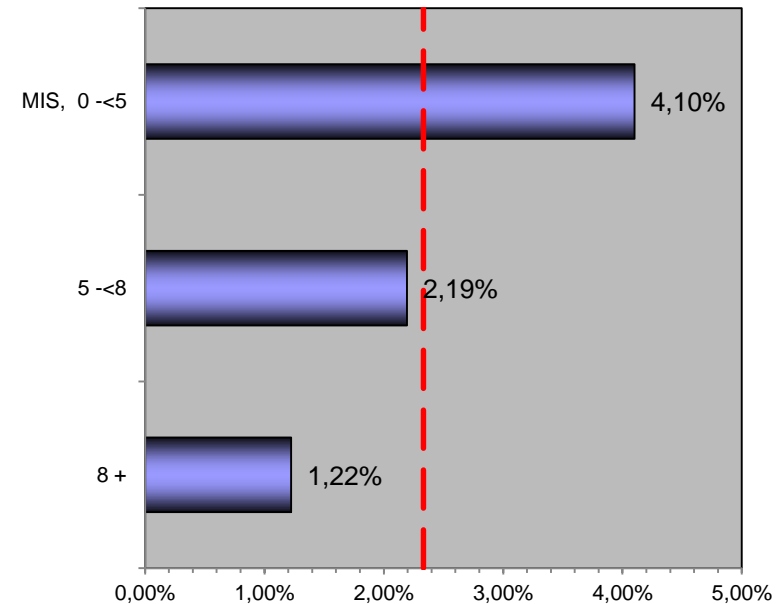
UNIVARIATE ANALYSIS FOR DEMOGRAPHIC INDICATOR - AGE OF COMPANY (YEARS)

Demographic Modul: age of company

% Bad Rate in small groups



% Bad Rate after grouping adjustment



➔ Failure risk decreases after 8 years in the market.

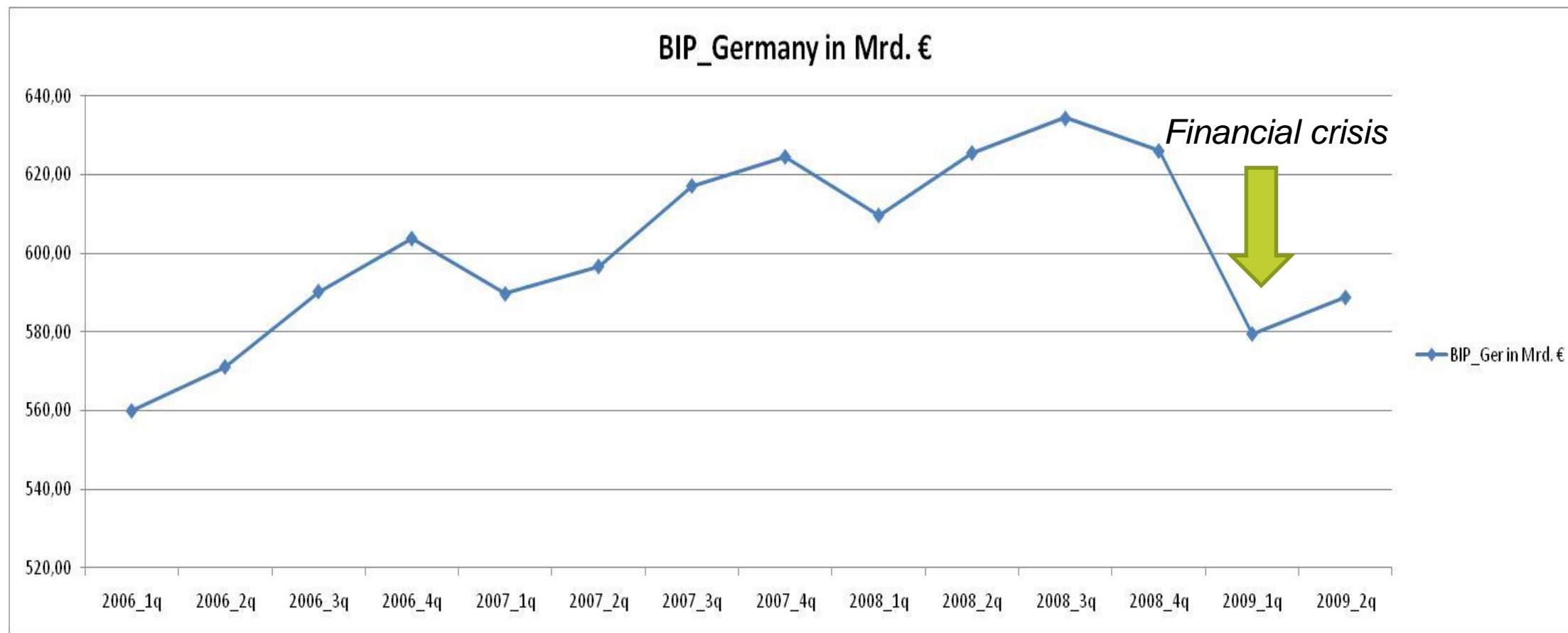
EXAMPLE 2 – GENERIC SCORECARD: RISK OF INDUSTRIES IN COUNTRY (CENTRAL EUROPE)

Industry NACE	Industry Description	GOODS	BADS	PGOODS	PBADS	BAD RATE	WOE	POP%	AVG_BR
A	Agriculture	3235	91	0.95%	0.72%	2.74%	0.28	0.95%	3.60%
B	Mining	335	4	0.10%	0.03%	1.18%	1.14	0.10%	
C	Manufacturing	46410	1379	13.70%	10.91%	2.89%	0.23	13.60%	
D	Energy	1679	39	0.50%	0.31%	2.27%	0.47	0.49%	
E	Water service	1087	43	0.32%	0.34%	3.81%	-0.06	0.32%	
F	Construction	54695	3045	16.14%	24.09%	5.27%	-0.40	16.43%	
G	Trade	68139	2322	20.11%	18.37%	3.30%	0.09	20.05%	
H	Transport & Logistic	23732	903	7.00%	7.14%	3.67%	-0.02	7.01%	
I	Hotels & Gastronomie	20683	898	6.10%	7.10%	4.16%	-0.15	6.14%	
J	Information and communication	15990	508	4.72%	4.02%	3.08%	0.16	4.69%	
K	Finance & Insurance	2972	163	0.88%	1.29%	5.20%	-0.39	0.89%	
L	Estate	6763	174	2.00%	1.38%	2.51%	0.37	1.97%	
M	Freelance	59171	1801	17.46%	14.25%	2.95%	0.20	17.35%	
N	Business Service	11684	501	3.45%	3.96%	4.11%	-0.14	3.47%	
R	Arts	5993	285	1.77%	2.25%	4.54%	-0.24	1.79%	
S	Other Services	16234	486	4.79%	3.84%	2.91%	0.22	4.76%	
TOTAL		338802	12642	1	1				

MEM: COLLECTION OF MACROECONOMIC INDICATORS ON 5 LEVELS

1. **INDUSTRY LEVEL (SIC OR NACE OR WZ):** INDUSTRY RISK, PRODUCTION INDEX, TURNOVER PER INDUSTRY, GROSS VALUE ADDED...
2. **STATE LEVEL:** BUNDESLAND IN GERMANY, WOJWODZTWO IN POLAND, KANTON IN SWITZERLAND, MEGYE IN HUNGARY;... e.g. UNEMPLOYMENT PER STATE;
3. **COUNTRY LEVEL: TIME SERIES ANALYSIS: TIME (t) = 42 QUARTERS** (the more the merrier:)
 - GDP(t);
 - DAX-30(t);
 - Inflation rate(t);
 - Government deficit(t) $\leq -3\%$ (Basel III)
 - unemployment(t);
 - etc.
4. **EUROPA LEVEL:** INTEREST RATE (t) OF EUROPE CENTRAL BANK (ECB)
5. **GLOBAL LEVEL:** EURO/USD (t), OIL PRICE (t), DOW JONES INDEX(t)...

EXAMPLE 3 – MEM: GDP FOR GERMANY IN BILLION € PER QUARTER



Source: German Statistical Office

EXAMPLE 4 – RISK OF INDUSTRY: FAILURE RATE (BR) PER YEAR FOR MINING & ENERGY IN GERMANY

SIC-CODES 10-14: MINING & ENERGY (OIL,GAS);

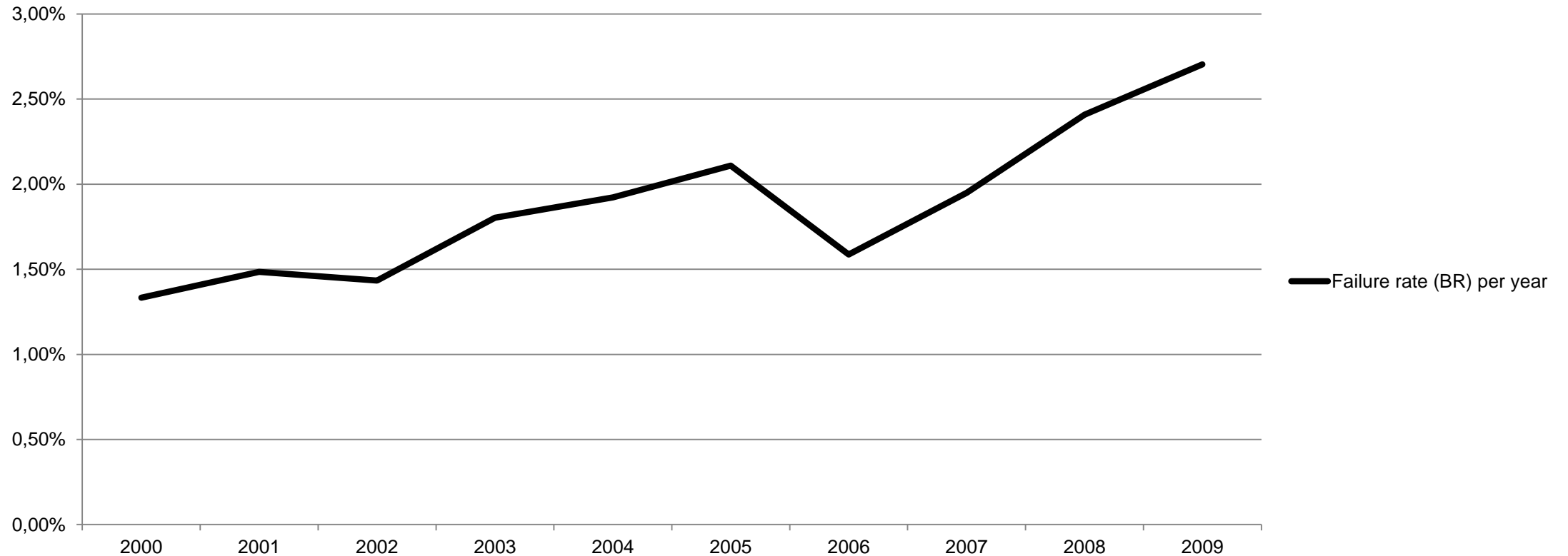
10..14	Mining
1011	Iron ores
1021	Copper ores
1031	Lead & zinc ores
1041	Gold ores
1044	Silver ores
1061	Ferroalloy ores exc. vanadium
1081	Metal mining services
1094	Uranium, radium & vanadium ores
1099	Miscellaneous metal ores N.E.C.
12	Coal Mining
1221	Bituminous coal & lignite surface mining
1222	Bituminous coal underground mining
1231	Anthracite mining
1241	Coal mining services
13	Oil and Gas Extraction
1311	Crude petroleum & natural gas
1321	Natural gas liquids

1381	Drilling oil & gas wells
1382	Oil & gas field exploration services
1389	Oil & gas field services N.E.C.
	Mining & Quarrying of Non-metallic Minerals exc.
14	Fuels
1411	Dimension stone
1422	Crushed & broken limestone
1423	Crushed & broken granite
1429	Crushed & broken stone N.E.C.
1442	Construction sand & gravel
1446	Industrial sand
1455	Kaolin & ball clay
1459	Clay, ceramic & refractory minerals N.E.C.
1474	Potash, soda & borate minerals
1475	Phosphate rock
1479	Chemical & fertilizer mineral N.E.C.
1481	Non-metallic mineral services exc. fuels
1499	Misc. non-metallic minerals exc. fuels

Source: Bisnode Data

EXAMPLE 4 – RISK OF INDUSTRY: FAILURE RATE (BR) PER YEAR FOR MINING & ENERGY IN GERMANY

SIC=10_14 = Mining & Energy
(Oil, Gas, without Electricity)



Source: Bisnode Data

➔ Risk of mining & energy industry has increased

EXAMPLE 4 – RISK OF INDUSTRY: FAILURE RATE (BR) PER YEAR FOR MINING & ENERGY IN GERMANY

**EXTRACTION
OF INDIVIDUAL
INDUSTRIES
POSSIBLE**



10..14	Mining
1011	Iron ores
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Source: Bisnode Data

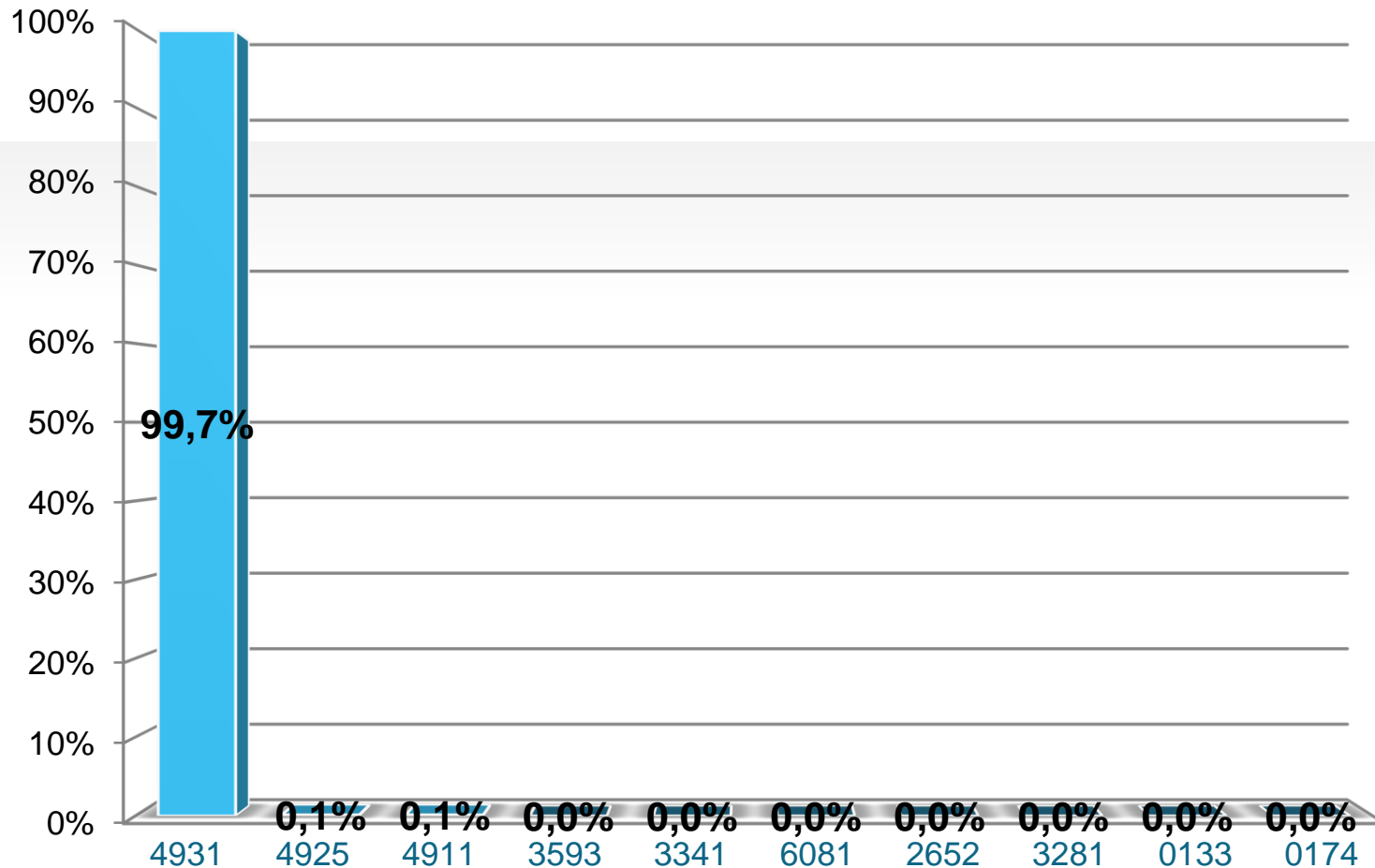
EXAMPLE 5: ELECTRICITY PROVIDERS IN GERMANY

Examples from SIC = 4931: WHAT IS THE POTENTIAL OF ELECTRICITY PROVIDERS IN GERMANY?

SIC4	FIRMA	STRASSE	PLZ	ORT
4931 Elektrizitäts- u. andere öffentliche Versorgungsbetriebe	Premicon Bio-Raffinerie GmbH	Einsteinstr. 3	81675	München
	Stadtwerk Kilsheim GmbH	Am E-Werk 8	97900	Kilsheim
	Stadtwerke Zeulenroda GmbH	Markt 8	07937	Zeulenroda-Triebes
	Stadtwerke Forchheim GmbH	Haidfeldstr. 8	91301	Forchheim
	Stadtwerke Elbtal GmbH	Neubrunnstr. 8	01445	Radebeul
	Wärmeversorgung Bergstraße GmbH	Dammstr. 68	64625	Bensheim
	Stadtwerke Bad Vilbel GmbH	Theodor-Heuss-Str. 51	61118	Bad Vilbel
	Stadtwerke Aschersleben GmbH	Magdeburger Str. 26	06449	Aschersleben
	Stadtwerke Meinerzhagen Gesellschaft mit beschränkter Haftung	Bahnhofstr. 17	58540	Meinerzhagen
	Stadtwerke Bad Wildbad GmbH & Co. KG	Ladestr. 5	75323	Bad Wildbad

POTENTIAL FOR ELECTRIC & OTHER SERVICES COMBINED

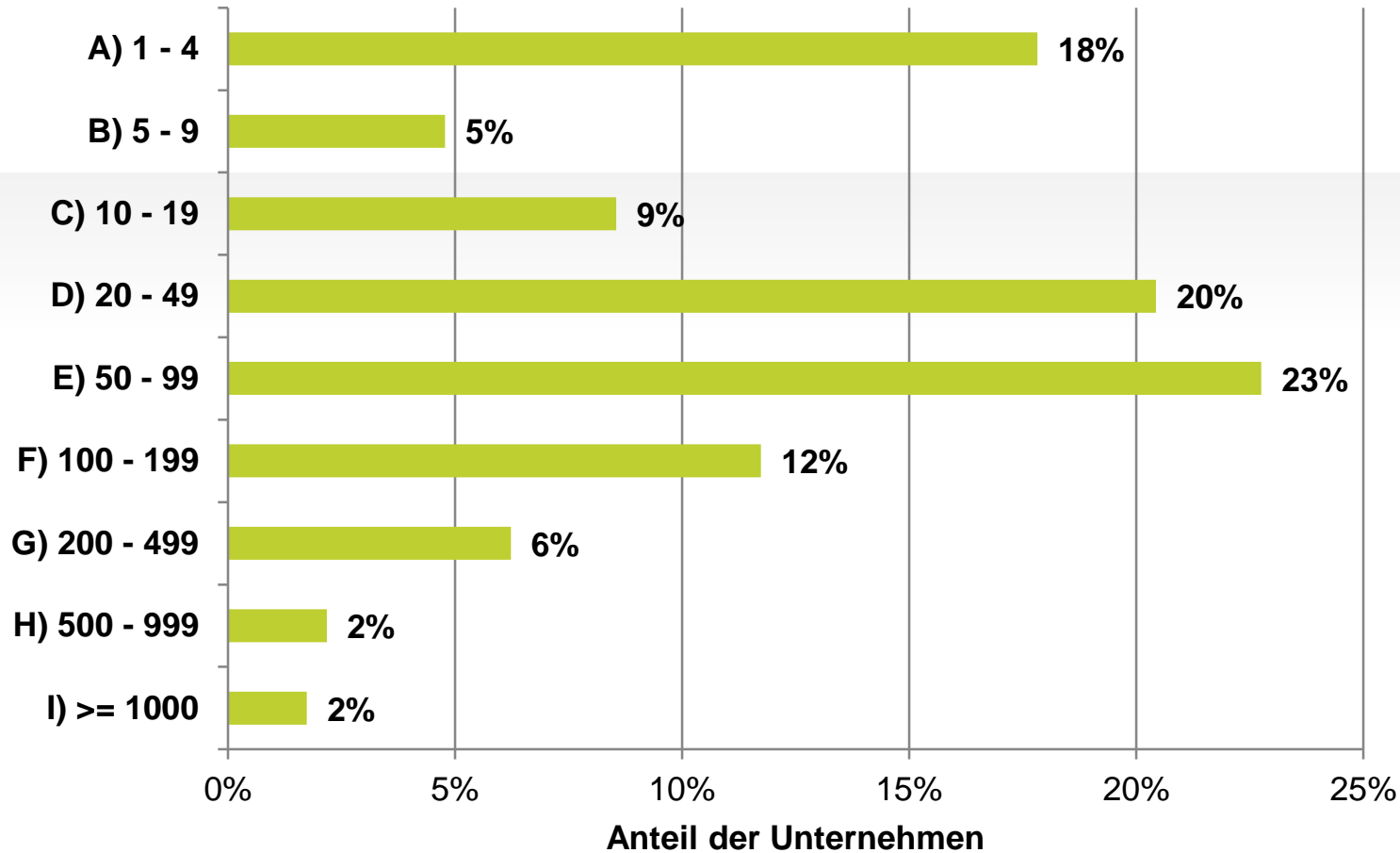
Example 5: Potential of Electricity Providers in Germany = 690 companies



SIC4	BEZEICHNUNG	ANZAHL
4931	Elektrizitäts- u. andere öffentliche Versorgungsbetriebe	688
4925	Erzeugung u. Verteilung von Misch-, Stadt- u. Flüssiggas	1
4911	Elektrizitätsgesellschaften u. -Systeme	1
3593	Zylinder, Stellantriebe	0
3341	Zweitschmelzen u. Läutern von Nichteisenmetallen	0
6081	Zweigstellen u. Vertretungen ausländischer Banken	0
2652	Zusammensetzbare Kartons	0
3281	Zugeschnittene Steine u. Steinprodukte, Kalkstein, Marmor	0
0133	Zuckerpflanzen (-rohr, -rüben)	0
0174	Zitrusfrüchte	0

DISTRIBUTION OF ELECTRIC COMPANIES PER EMPLOYEES

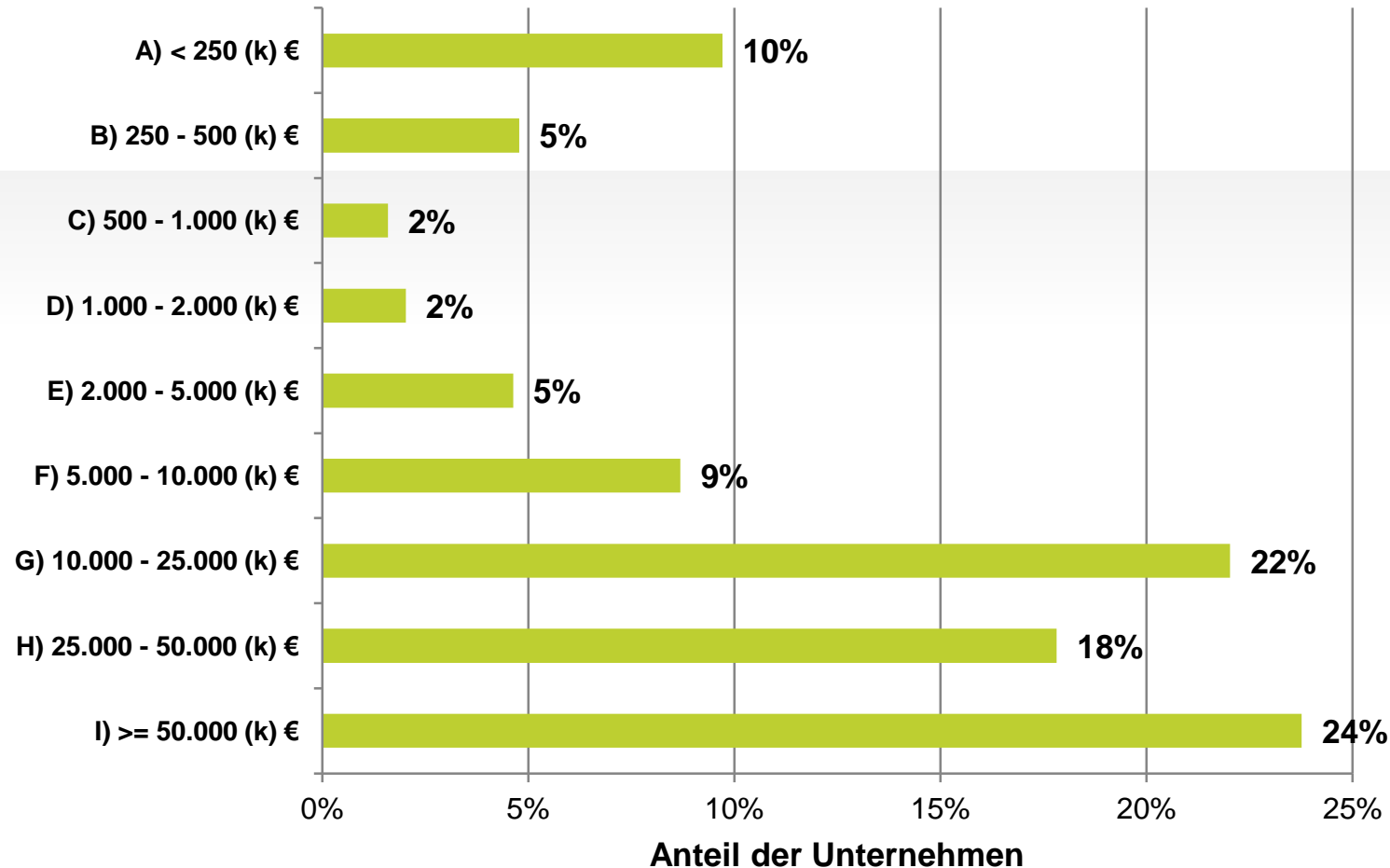
Example 5: Most Electricity providers in Germany have between 20 and 99 employees



GRÖÖE NACH MITARBEITERN	ANZAHL	ANTEIL
A) 1 - 4	123	18%
B) 5 - 9	33	5%
C) 10 - 19	59	9%
D) 20 - 49	141	20%
E) 50 - 99	157	23%
F) 100 - 199	81	12%
G) 200 - 499	43	6%
H) 500 - 999	15	2%
I) >= 1000	12	2%
J) k.A.	26	4%

REVENUE DISTRIBUTION OF ELECTRICITY PROVIDERS

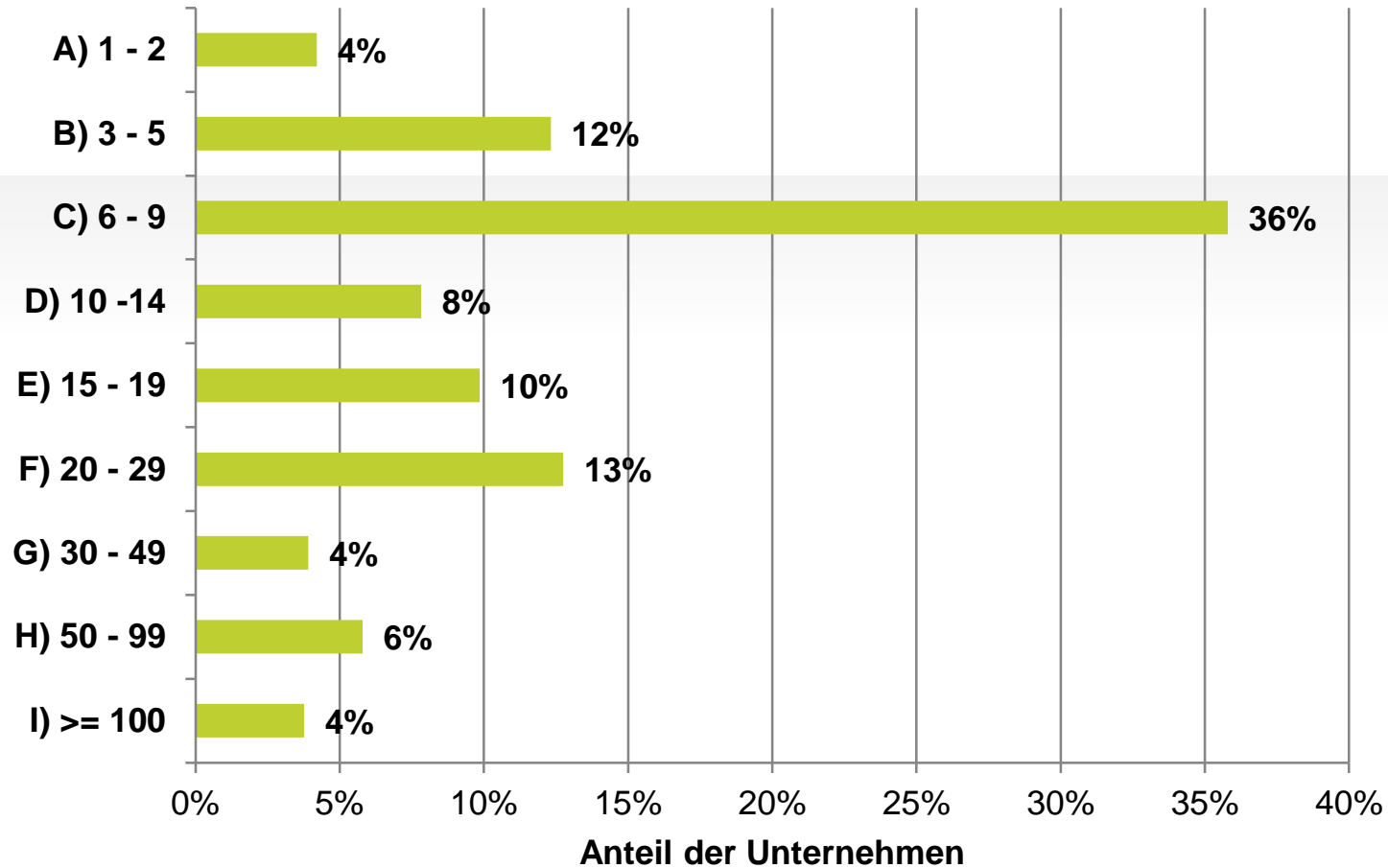
Example 5: 64% electricity providers in Germany have revenue more than 10 Mio. €



GRÖÖE NACH UMSATZ	ANZAHL	ANTEIL
A) < 250 (k) €	67	10%
B) 250 - 500 (k) €	33	5%
C) 500 - 1.000 (k) €	11	2%
D) 1.000 - 2.000 (k) €	14	2%
E) 2.000 - 5.000 (k) €	32	5%
F) 5.000 - 10.000 (k) €	60	9%
G) 10.000 - 25.000 (k) €	152	22%
H) 25.000 - 50.000 (k) €	123	18%
I) >= 50.000 (k) €	164	24%
J) k.A.	34	5%

AGE OF COMPANIES (ELECTRICITY PROVIDERS)

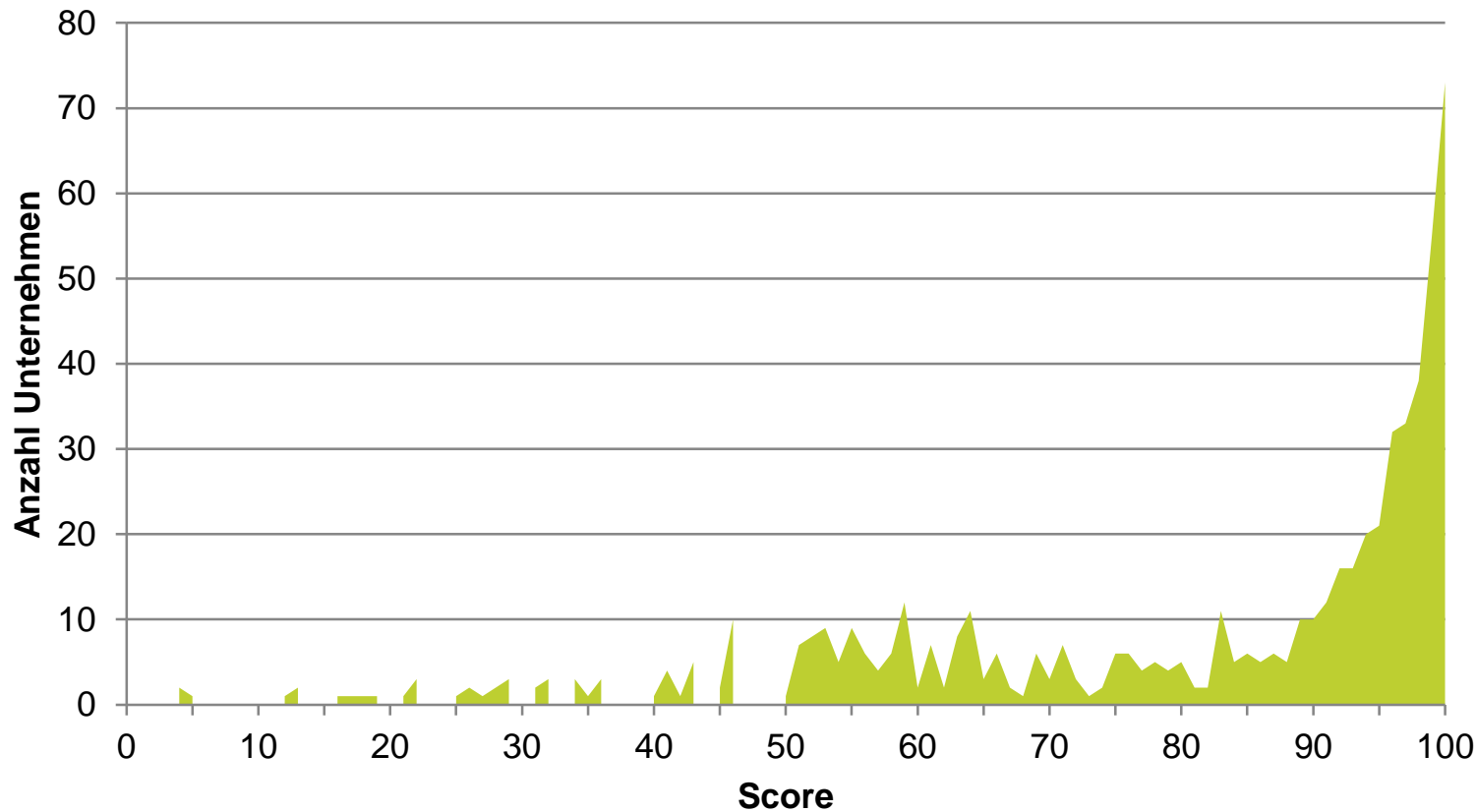
Example 5: 52% electricity providers have age of comp. between 1 and 9 years (Liberalization law => 2005)



UNTERNEHMENS- ALTER	ANZAHL	ANTEIL
A) 1 - 2	29	4%
B) 3 - 5	85	12%
C) 6 - 9	247	36%
D) 10 - 14	54	8%
E) 15 - 19	68	10%
F) 20 - 29	88	13%
G) 30 - 49	27	4%
H) 50 - 99	40	6%
I) >= 100	26	4%
J) k.A.	26	4%

EXAMPLE 5: RISK DISTRIBUTION FOR ELECTRICITY PROVIDERS IN GERMANY

Score Verteilung

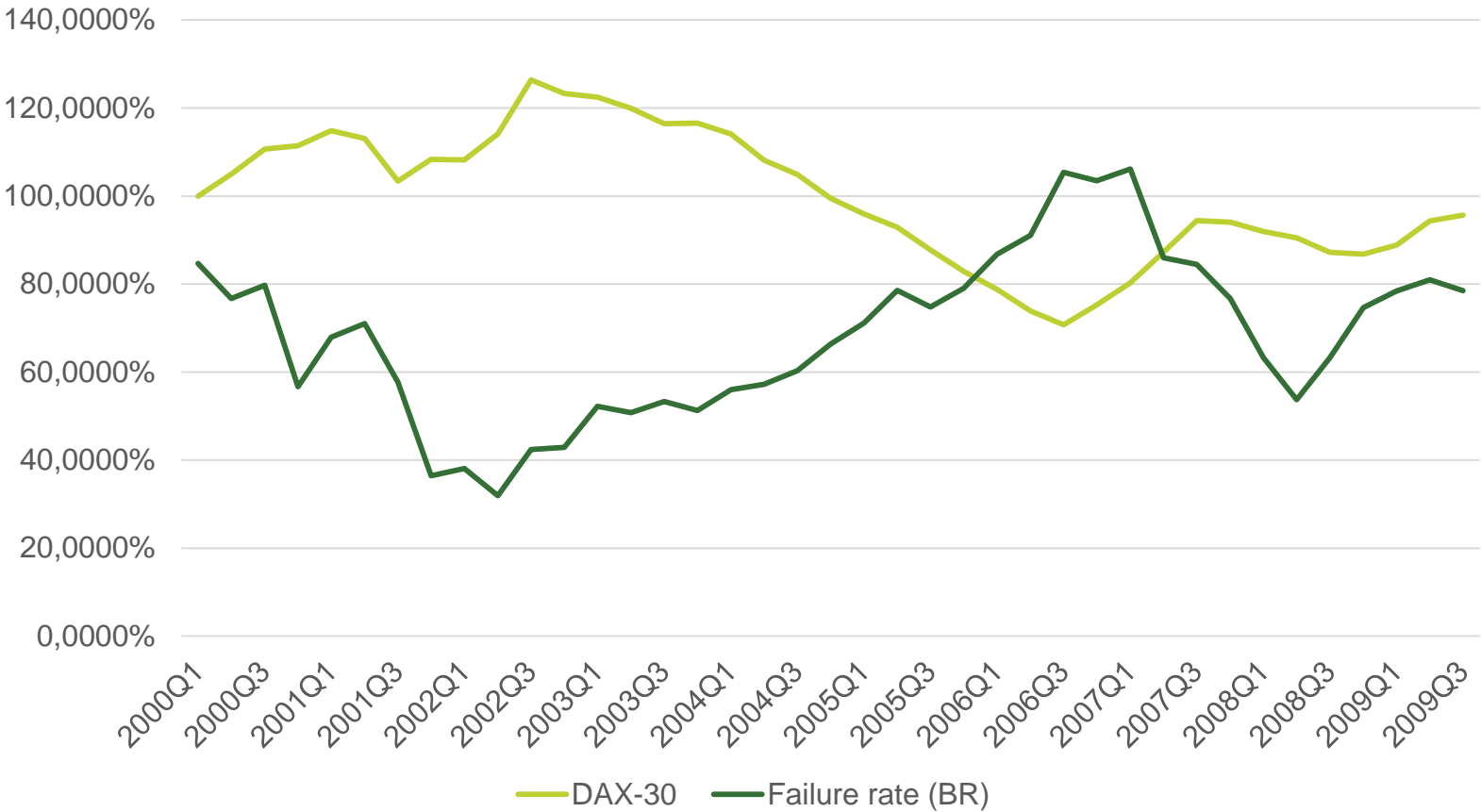


	ANZAHL	ANTEIL
OHNE SCORE	77	11,2%
SCORE 0 - INSOLVENT	12	1,7%
MIT SCORE	601	87,1%

■ Anzahl Unternehmen

EXAMPLE 6 - CONNECTION BETWEEN MACROECONOMIC INDICATOR (DAX-30) AND INDUSTRY RISK (BAD RATE) OF CONSTRUCTION

Risk (BR) of construction industry in Germany and DAX-30:



EXAMPLE 7: GOVERNMENT DEFICIT (IN %) FROM INSOLV. RATE (AVG IN %) FOR ALL COMPANIES IN GERMANY

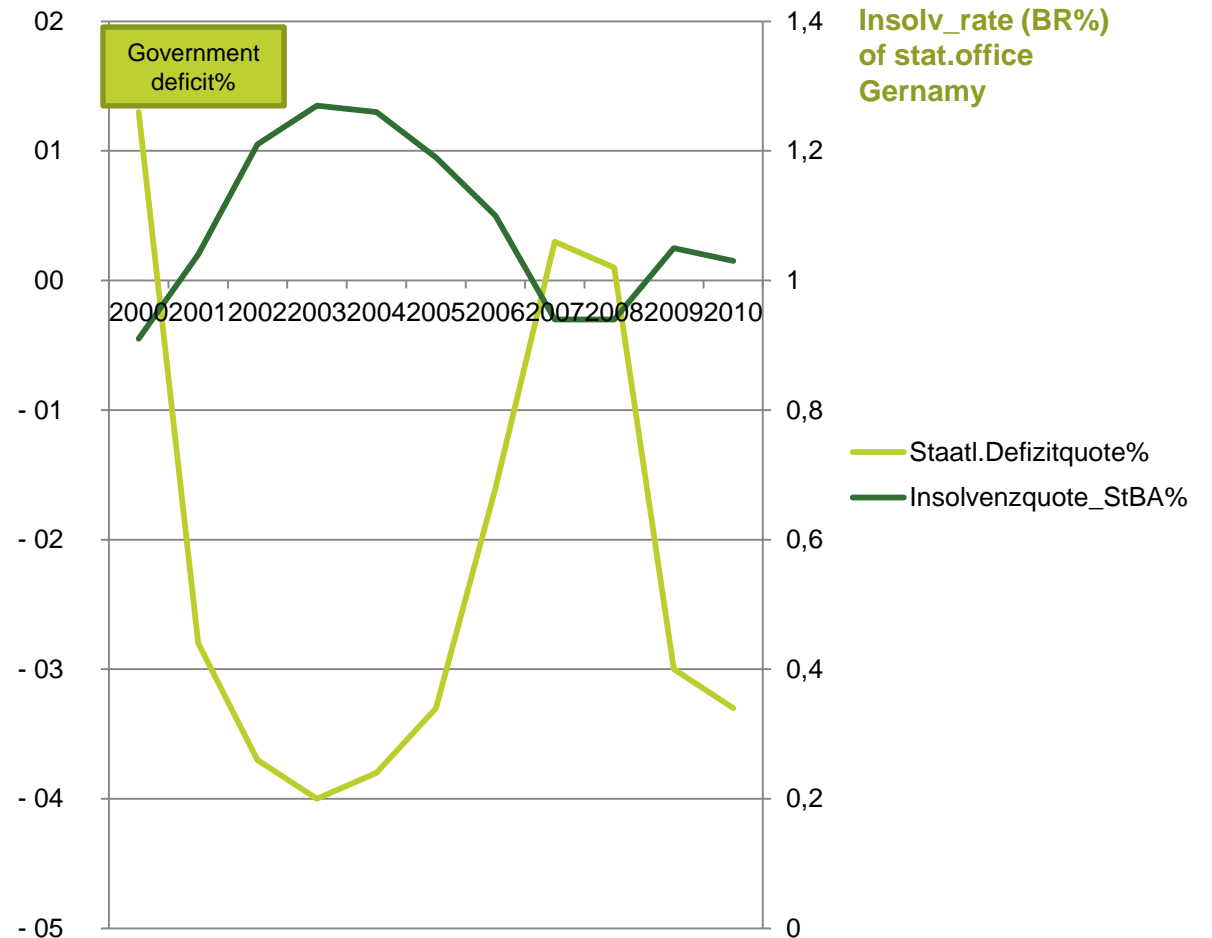
Year	Government deficit% of GDP*	Insolv_rate_of stat.office**
2000	1.3	0.91
2001	- 2.8	1.04
2002	- 3.7	1.21
2003	- 4.0	1.27
2004	- 3.8	1.26
2005	- 3.3	1.19
2006	- 1.6	1.1
2007	0.3	0.94
2008	0.1	0.94
2009	- 3.0	1.05
2010	- 3.3	1.03

Table and Charts of BSG, Bisnode Holding Germany

*Europe Commission, Eurostat 8.07.2011

** Statistical office of Germany, 30.03.2011

Year	Insolvency companies of st.office	Active companies =3,1 Mio. IR=Insolv.comp./Active comp.	comments
2010	31998	1.03%	
2009	32687	1.05%	Fin.crisis 2
2008	29291	0.94%	
2007	29160	0.94%	the best year
2006	34137	1.10%	
2005	36843	1.19%	
2004	39213	1.26%	
2003	39320	1.27%	Fin.crisis 1
2002	37579	1.21%	
2001	32278	1.04%	
2000	28235	0.91%	



EXAMPLE-8: MEM WITH ARIMAX FÜR BR_BAU_Q MIT BWS_BAU_NPB (GROSS VALUE ADDED FOR CONSTRUCTION INDUSTRY GERMANY)

Dependent Variable: D(BR_BAU_Q)				
Method: Least Squares				
Date: 11/05/10 Time: 19:17				
Sample: 2001Q3 2010Q2				
Included observations: 36				
Convergence achieved after 8 iterations				
MA Backcast: 2000Q2 2001Q2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001656	0.001135	-1.459249	0.1546
BWS_BAU_NPB	8.11E-05	4.68E-05	1.732961	0.0930
AR(4)	0.948425	0.070077	13.53399	0.0000
MA(1)	-0.625636	0.133684	-4.679971	0.0001
SMA(4)	-0.913311	0.088705	-10.29601	0.0000
R-squared	0.674478	Mean dependent var	-4.34E-05	
Adjusted R-squared	0.632475	S.D. dependent var	0.001081	
S.E. of regression	0.000655	Akaike info criterion	-11.69507	
Sum squared resid	1.33E-05	Schwarz criterion	-11.47514	
Log likelihood	215.5113	Hannan-Quinn criter.	-11.61831	
F-statistic	16.05790	Durbin-Watson stat	1.751428	
Prob(F-statistic)	0.000000			
Inverted AR Roots	.99	.00+.99i	-.00-.99i	-.99
Inverted MA Roots	.98	.63	.00+.98i	-.00-.98i
	-.98			

EXAMPLE-9: MEM WITH VECTOR AUTOREGRESSION (VAR)

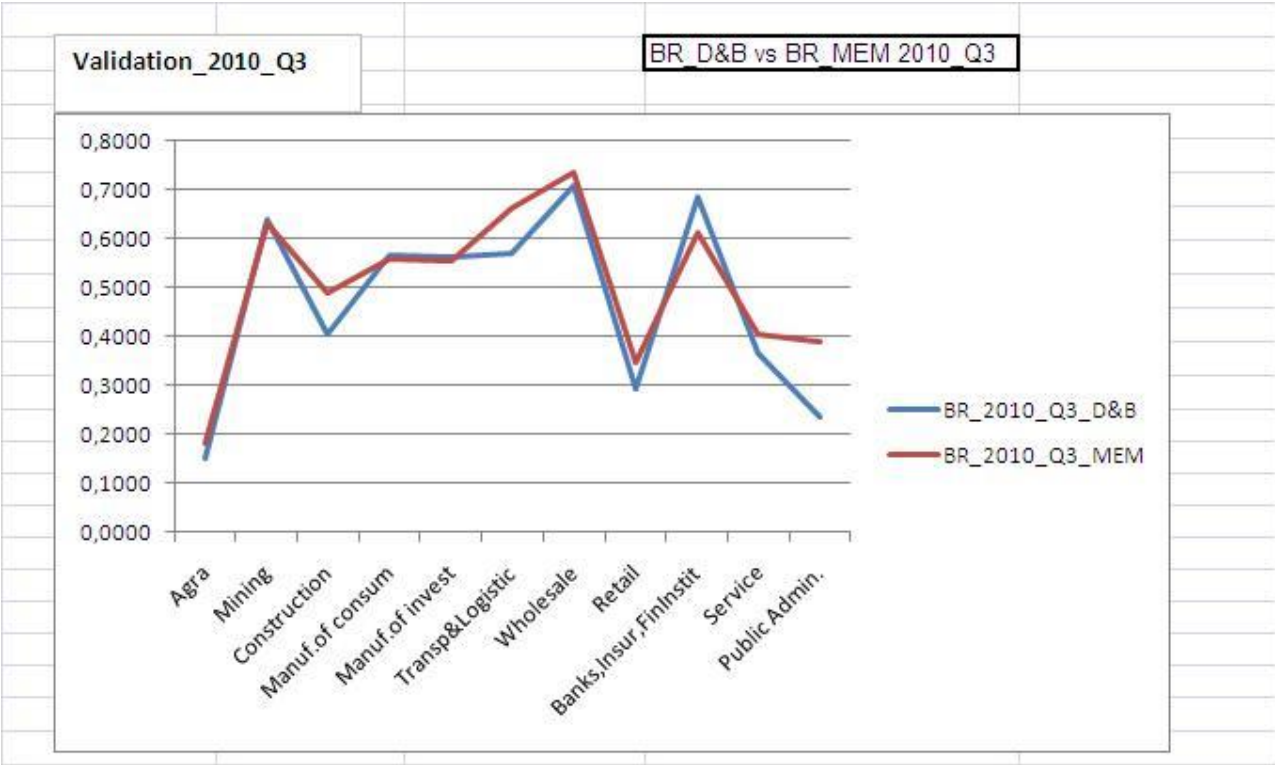
BR_FIN_Q, BWS_FIN, DAX30, BIP, ZINSEN_EZB, EURO/USD

MAIN PROBLEM IS RELATIONSHIP BETWEEN HISTORY SAMPLE (E.G. 42 Q), 6 VARIABLES AND TERMS IN VAR-MODEL

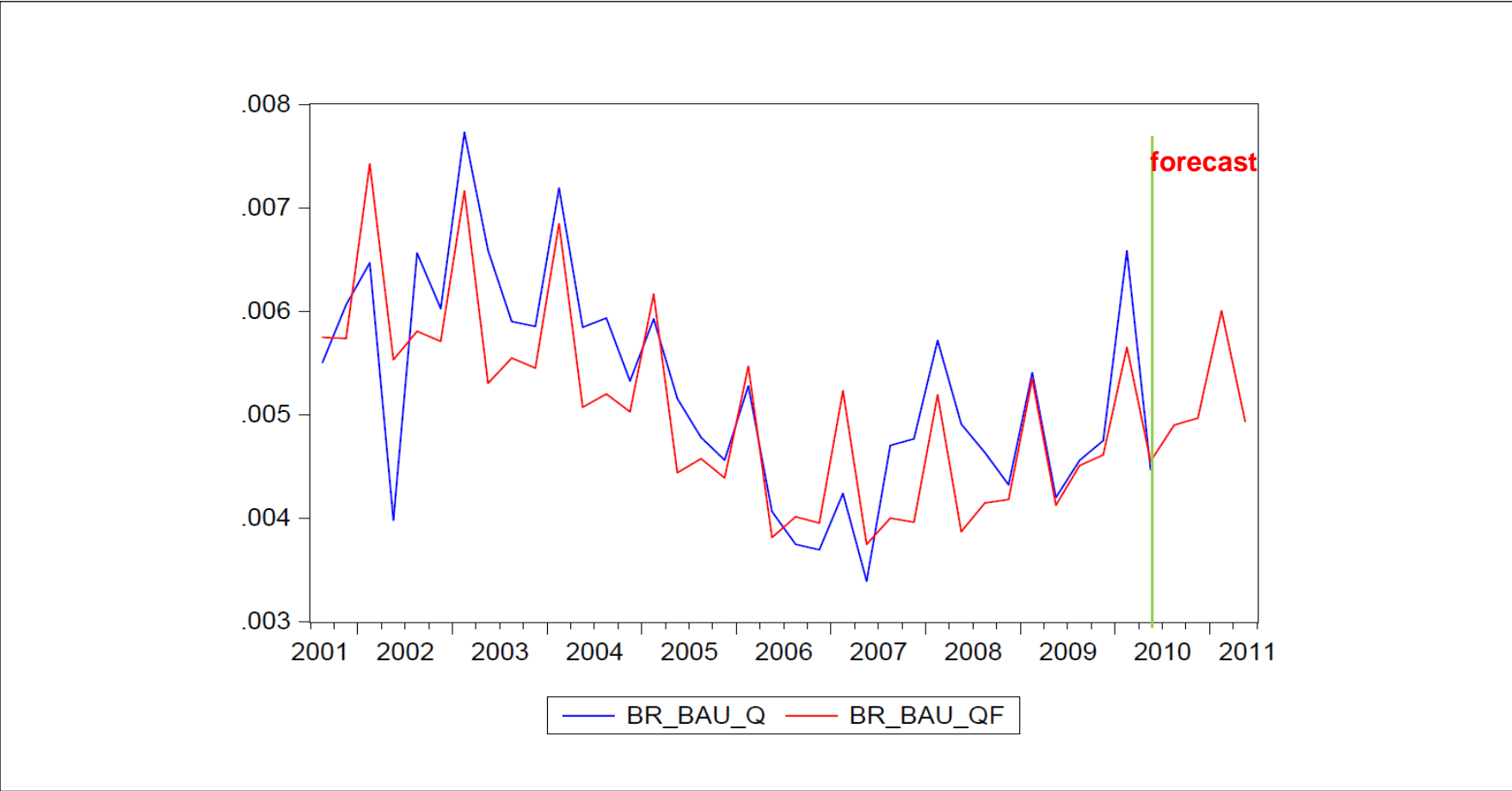
Vector Autoregression Estimates

	BR_FIN_Q	BWS_FIN	DAX30	ZINSEN_EZB	BIP	EURO_USD
Vector Autoregression Estimates Date: 11/18/10 Time: 14:05 Sample (adjusted): 2000Q3 2010Q2 Included observations: 40 after adjustments Standard errors in () & t-statistics in []						
BR_FIN_Q(-1)	0.245545 (0.206969) [1.18625]	251.9318 (802.907) [0.31377]	301081.0 (251088.) [1.19911]	23.18431 (110.083) [0.21061]	1545.606 (2943.98) [0.52500]	-0.977307 (27.0502) [-0.03613]
BR_FIN_Q(-2)	-0.283600 (0.19815) [-1.43122]	1951.423 (768.622) [2.53886]	-169559.5 (240366.) [-0.70542]	-59.53470 (105.382) [-0.56494]	4400.020 (2818.28) [1.56124]	-26.94213 (25.8951) [-1.04043]
BWS_FIN(-1)	-0.000105 (3.3E-05) [-3.23032]	0.308145 (0.12636) [2.43864]	57.15407 (39.5156) [1.44637]	0.000734 (0.01732) [0.04234]	3.687668 (0.46332) [7.95927]	0.009284 (0.00428) [2.18072]
BWS_FIN(-2)	0.000109 (5.0E-05) [2.18142]	0.595594 (0.19344) [3.07902]	-78.19796 (60.4921) [-1.29270]	-0.008364 (0.02652) [-0.31536]	0.401761 (0.70927) [0.56645]	0.002660 (0.00652) [0.40824]
DAX30(-1)	-9.11E-08 (1.6E-07) [-0.56628]	-0.000183 (0.00062) [-0.29398]	1.081109 (0.19513) [5.54033]	0.000254 (8.6E-05) [2.96582]	-0.000188 (0.00229) [-0.08226]	2.80E-05 (2.1E-05) [1.33111]
DAX30(-2)	8.11E-10 (1.7E-07) [0.00468]	0.000412 (0.00067) [0.61243]	-0.060958 (0.21038) [-0.28975]	-6.22E-05 (9.2E-05) [-0.67404]	0.002753 (0.00247) [1.11592]	-3.76E-05 (2.3E-05) [-1.65719]
ZINSEN_EZB(-1)	-0.000493 (0.00038) [-1.28514]	-0.158224 (1.48934) [-0.10624]	-454.7403 (465.751) [-0.97636]	1.065990 (0.20420) [5.22042]	20.55310 (5.46090) [3.76368]	0.022260 (0.05018) [0.44363]
ZINSEN_EZB(-2)	0.000366 (0.00031) [1.17726]	0.401396 (1.20578) [0.33289]	221.9980 (377.076) [0.58874]	-0.257766 (0.16532) [-1.55920]	-10.95576 (4.42119) [-2.47801]	0.019869 (0.04062) [0.48910]
BIP(-1)	2.94E-05 (1.2E-05) [2.40571]	0.010636 (0.04745) [0.22414]	7.773421 (14.8390) [0.52385]	-0.002150 (0.00651) [-0.33045]	-0.087919 (0.17399) [-0.50532]	-0.001787 (0.00160) [-1.11807]
BIP(-2)	-2.26E-06 (1.3E-05) [-0.17255]	-0.022930 (0.05087) [-0.45076]	-11.54045 (15.9081) [-0.72545]	-0.004909 (0.00697) [-0.70380]	-0.580582 (0.19652) [-3.11268]	-0.001014 (0.00171) [-0.59189]
EURO_USD(-1)	0.002408 (0.00163) [1.47542]	9.812330 (6.32967) [1.55021]	1432.507 (1979.44) [0.72369]	1.690681 (0.86783) [1.94817]	37.36081 (23.2088) [1.60977]	1.137968 (0.21325) [5.33635]
EURO_USD(-2)	-0.000316 (0.00173) [-0.18330]	-16.95410 (6.69158) [-2.53365]	-648.1726 (2092.62) [-0.30974]	-0.726760 (0.91745) [-0.79215]	-33.45356 (24.5358) [-1.36346]	-0.196403 (0.22544) [-0.87119]
C	-0.012690 (0.00300) [-4.23004]	19.50294 (11.6371) [1.67593]	4115.490 (3639.20) [1.13088]	3.597016 (1.59551) [2.25446]	265.3922 (42.6694) [6.21974]	-0.062445 (0.39206) [-0.15928]
R-squared	0.921458	0.982346	0.863401	0.958795	0.970675	0.924249
Adj. R-squared	0.886551	0.974499	0.802691	0.940481	0.957641	0.890582
Sum sq. resids	7.26E-06	109.2942	10688553	2.054503	1469.398	0.124053
S.E. equation	0.000519	2.011948	629.1838	0.275849	7.377138	0.067783
F-statistic	26.39722	125.1969	14.22161	52.35439	74.47548	27.45261
Log likelihood	253.6717	-78.86083	-306.6736	2.619372	-128.8321	58.76099
Akaike AIC	-12.03359	4.493041	15.98368	0.519031	7.091606	-2.288049
Schwarz SC	-11.48470	5.041927	16.53257	1.067917	7.640492	-1.739164
Mean dependent	0.004688	149.9880	5237.975	2.823750	569.3255	1.213861

EXAMPLE-11: MEM VALIDATION FOR 11 INDUSTRIES IN GERMANY: BR_BISNODE VS. BR_MEM



EXAMPLE-12: THE FORECAST BR FOR SIC = CONSTRUCTION FROM Q3_2010 UNTILL Q2_2011 WITH MACROECONOMIC MODEL



EXAMPLE-13: GENERIC SCORECARD WITH MICRO- AND MACRO-ECONOMIC INDICATORS

FINAL MODEL CONSISTS OF THE FOLLOWING VARIABLES:

PD_COMPANY = F(SCORE_TOTAL) =
 (BASED ON **MICRO-ECONOMIC INDICATORS**: AGE, EMPLOY., REVENUE, PROFIT, TRADE, NEG. REM)

RISK OF INDUSTRY (BR OR WO E)
 STATE UNEMPLOYMENT, ECT.

Macro-economic indicators
 (GDP, DAX-30, Oil prise...)

Analysis of Maximum Likelihood Estimates						Significan. criteria
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	t-statistic
Intercept	1	-19,5011	0,34830	3135,41	<.0001	-55,99
score_total	1	0,0172	0,00026	4237,70	<.0001	65,15
SIC/Risk (WoE)	1	0,5878	0,04650	159,52	<.0001	12,64
unemployment/state	1	-0,0043	0,00061	49,12	<.0001	-7,02

signific.
signific.
signific.

EXAMPLE 14: SIMULATION OF SCENARIOS AND STRESSTEST

SCENARIO 1

WHAT WILL HAPPEN TO PD AND RATING OF
A TRANSPORT COMPANY

IF STRESSTEST (SHOCK):

OIL PRICE DECREASES TO \$60 PER BARREL?

OIL PRICE = \$60 → VAR-MODEL → RI →

SCORECARD → PD → RATING OF COMPANY

→ RISK MIGRATION MATRIX FROM NOW TO

→ 4 QUARTERS FORWARD

SCENARIO 2

WHAT WILL HAPPEN TO PD AND RATING OF
A FINANCIAL COMPANY

IF STRESSTEST (SHOCK):

THE ECB INTEREST RATE INCREASES TO 4%?

INTEREST RATE = 4% → VAR-MODEL → RI
→ SCORECARD → PD → RATING OF COMP.

→ RISK MIGRATION MATRIX FROM NOW TO

→ 4 QUARTERS FORWARD

„FIGURES FIRST, WORDS SECOND“ ☺

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THANK YOU