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## Determinants of corporate debt ratios in Germany

Manuskripte aus den Instituten für Betriebswirtschaftslehre der Universität Kiel, No. 29

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Determinants  
of Corporate Debt Ratios  
in Germany

by  
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### 1. Introduction

Scientists and practitioners are interested in two major problems concerning the level of corporate debt ratios. The first problem has to do with the time behaviour of debt ratios. For German firms several empirical studies have been carried out resulting in more or less different time series (1), (4), (7), (10), (11), (21). The differences are due to sample composition and to the definition of debt ratios.

The development of debt ratios for about 1800 German joint-stock companies is given in Table 1; the computed averages are weighted by total assets. Comparing these figures internationally one can state a high debt level in Germany. One also recognizes a rise of debt ratios since 1969 which has continued up to now - see for instance (1), (9), (24), (25). Of course an exact inspection of Table 1 leads to the conclusion that this upward trend does not exist in two industry groups, i.e. agriculture and services. The rise of debt ratios may be in connection with rising rates of inflation (2, p. 95), but these problems of time behaviour shall not be investigated here.

Table 1: Development of Debt Ratios for German Joint-stock Companies 1962-1971 (%)

Classif. number	Industry	Year	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	Average number of firms
0	Agriculture		77.3	77.3	75.4	75.0	75.6	74.2	72.8	64.7	65.2	62.9	7
1	Electric utility, water supply, and mining		58.9	60.1	60.8	61.5	60.6	60.7	59.7	59.8	64.3	65.7	150
2	Manufacturing		63.0	63.6	63.4	63.4	63.3	62.9	62.5	64.6	66.2	66.9	1026
3	Construction		80.5	77.5	78.1	77.7	77.3	81.0	85.8	87.6	89.3	89.6	50
4	Wholesale and retail trade		71.3	72.6	72.4	70.5	68.3	65.9	65.3	65.7	67.6	68.4	123
5	Traffic		67.1	67.2	67.4	64.2	63.5	65.7	67.0	68.9	71.2	71.8	131
7	Services		85.7	85.5	85.3	85.5	84.6	83.6	81.7	80.9	80.6	78.8	337

Source: Own computations by figures published annually in "Statistisches Jahrbuch für die Bundesrepublik Deutschland".

The second problem is the determination of debt ratios at a given point of time leading to cross-section analysis. This problem shall be illuminated by our study. For German firms we only find studies of this problem by verbal, numerical, or graphical representation (7), (10) - but there is no application of quantitative methods. Foreign empirical studies have investigated several factors determining debt ratios by statistical methods (5), (8), (13), (16), (20), (22), (23). The international study of Remmers et al. (16) did not contain German firms. The first purpose of our study therefore is to overtake the investigation for Germany. Another purpose is to show the strong influence of other variables which can be generated by financial statement analysis. Finally canonical correlation is presented as a new method for explaining the simultaneous connection between assets and liabilities.

## 2. The Data

The data have been taken from two sources because we are interested in debt ratios of different industries (inter-industry approach) and of different firms within a given industry (intra-industry approach).

To follow up the inter-industry approach by cross-section analysis we need many observations; therefore we referred to the balance sheet statistics of the German Federal Statistics Office published annually in the Statistical Yearbook - see also (19). These data contain 26 industry groups of manufacturing and additional 16 industry groups of all other industries without banking and insurance. Because the balance sheet data are aggregated per industry group we can compute financial ratios as weighted averages only. For the years 1969 and 1971 23 positions were collected for each industry group allowing to compute more than 30 reasonable financial ratios.

To study intra-industry debt ratios and to execute analyses of variance between industries we need a lot of data for each industry group - see the discussion in (16). Here we referred to the microeconomic data bank of our institute at Kiel University - see (14). Though this data bank contains more than 2000 complete balances and profit and loss statements of about 300 firms, we had to add data in order to get about 20 to 40 firms in each industry for one year (1971). The selection of industries - see Appendix - took account of the different hypothesized business risks [see (16) for this point] and of different asset structures. We should remark that public utilities are not regulated in Germany; it seemed interesting to include this industry because of the relative stability of earnings and because of high ratios of fixed assets to total assets.

The completion of data was done by inspecting the list of joint-stock companies (18) and selecting firms by following the alphabetic order in this list. The selection was terminated when a number of about 30 firms per industry was reached; two industries - petroleum refining and auto manufacturing - were exhausted at a number of less than 20 firms. Firms which did not publish their sales numbers were excluded. To execute cross-section analyses correctly the data must refer to the same point of time. We included only firms with financial years ending with December, 31; because most of the German breweries finish their financial years by September, 30 - this date was taken for this industry.

By and large data of 249 firms from eight industries were available. A list of investigated firms is given in the Appendix. 224 out of these 249 firms are joint-stock companies, 25 remaining firms are limited companies publishing due to size since 1971. This allows to study the effects of a different legal firm basis. It was possible to compute the financial ratios for the 249 firms by the same definitions as done in the inter-industry approach, but the ratios were not weighted.

### 3. Univariate Analysis

#### 3.1. Relationships between Different Measures of Debt Ratios

The investigation of debt ratios can be carried out by using different definitions of debt. First there are so called "static" ratios based on the relationship between debt and (net) total assets: debt ratio 1 = total debt/total assets; debt ratio 2 = short-term debt/total assets; debt ratio 3 = long-term debt/total assets.

Second so called "dynamic" ratios establish a relationship between net debt - i.e. total debt minus cash and bank balances - and cash flow: dynamic debt ratio = net debt/cash flow.

Third it would be possible to compute debt ratios using market values. This could not be done in our study because of the sample composition: an investigation of quoted companies would have diminished the number of firms substantially. Table 2 reports on the correlations between different measures of static and dynamic debt ratios. Not only for the inter-industry sample (lower triangle of Table 2) but also for the 249 firms (upper triangle of Table 2) we can state:

1. There is a positive correlation between total and short-term debt ratios; in contrary the correlations between total and long-term debt ratios are not significant at the 0.05-level. That may mean that beyond some normal debt ratio higher debt is due to short-term financing.
2. There is a negative correlation between short-term and long-term debt ratios. This is due to a substitution effect.
3. The (absolute) correlations between static and dynamic ratios are much lower than the correlations between the static ratios. This shows the effects of changing cash flows due to the special conditions of business in the year studied.

Table 2: Strength of Correlation ( $r$ ) between Different Measures of Debt Ratios - Cross-section 1971 -

	Total debt to total assets	Short-term debt to total assets	Long-term debt to total assets	Net debt to cash flow
Total debt to total assets		0.725 ***	0.120	0.256 ***
Short-term debt to total assets		0.600 ***	-0.596 ***	0.181 **
Long-term debt to total assets		0.254	-0.621 ***	0.037
Net debt to cash flow		0.380 *	0.081	0.275

\*\*\* = level of significance 0.001

\*\* = level of significance 0.01

\* = level of significance 0.05

Sample of 249 firms: upper triangle

42 industry groups: lower triangle

Because of these differences and difficulties in the following we mainly restrict ourselves to the ratio "total debt to total assets".

### 3.2. Industry as a Determinant of Debt Ratios

Referring to the works of Schwartz and Aronson (17), Scott (20), and Remmers et al. (16) we performed a one-way analysis of variance to test the hypothesis that debt ratios vary by industry (all computations were carried out by a PDP-10 of the "Rechenzentrum der Universität Kiel"). The results are reported in Table 3.

Table 3: Industry as a Determinant of Debt Ratios in the Year 1971  
- Result of Analysis of Variance -

Sample composition		Total debt to total assets (%)	
Number of firms	Industry	Mean	Standard deviation
36	Electric utility	57.7	12.6
47	Chemicals	57.5	16.1
10	Petroleum refining	67.2	10.5
45	Machines	71.8	14.0
15	Auto and aircraft manufacturing	71.6	13.3
30	Electricals	64.9	13.7
37	Brewery	53.7	13.7
29	Construction	81.7	10.5
249	All firms	64.5	16.2
Computed univariate F-ratio and degrees of freedom		15.46(7;241)	
Level of significance		0.001	

The computed F-ratio exceeds the 0.001-level. Thus, the hypothesis that there are no differences with respect to the mean debt ratios can be rejected.

But the evidence that industry can be regarded as a proxy for business risk and thus determines debt ratios does not allow to explain intra-industry differences of debt ratios. We therefore are looking at other influences which are useful to describe inter- and intra-industry differences as well.

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### 3.3. Financial Ratios as Proxies for Business Risk

It is hypothesized that the risk of capital structure can be represented by adequate financial ratios. There is for instance one factor associated with debt-equity ratios which shall be demonstrated by an international comparison. Figure 1 contains data drawn from a booklet published by the Investment Research Group of European Banks International (12). Therefrom all firms which belonged to three industries (i.e. brewery, chemicals, public utility) were taken up so that in Figure 1 firms of different countries are represented. From this figure we see the clustering of industries in spite of different countries and the connection to debt ratios via net worth to total assets.

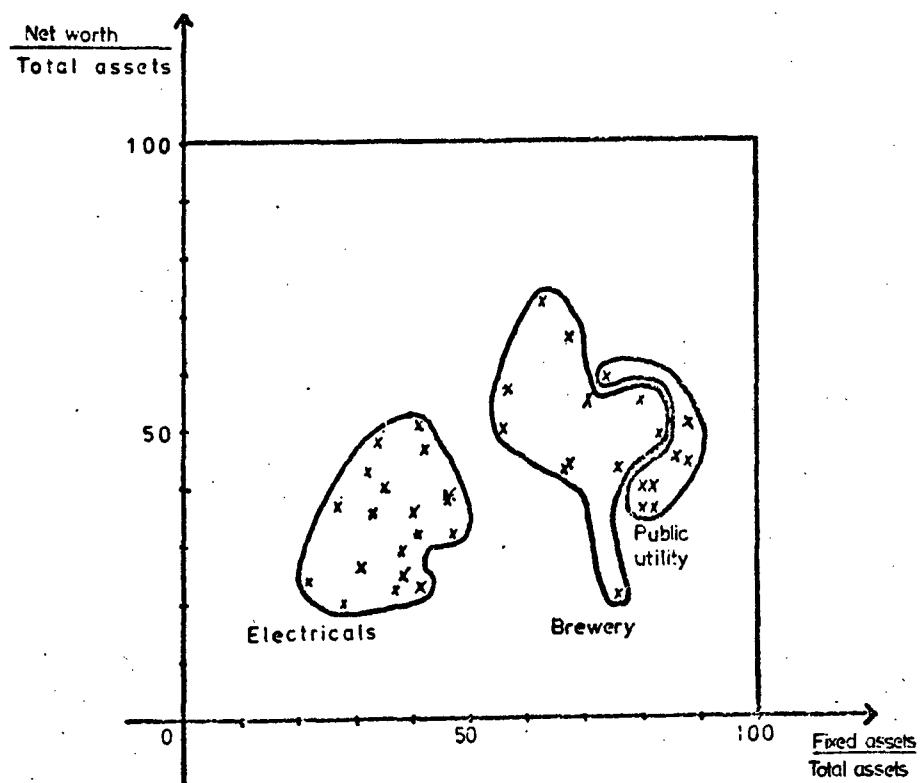


Figure 1: Relationships between Net Worth to Total Assets and Fixed Assets to Total Assets (Large European Corporations)

Widening the analysis we can include other financial ratios - combined to groups - which should be connected with debt ratios:

1. size [see (16)];
2. profitability [see (22); we for instance computed

$$\text{"leverage"} = \frac{\text{net income} + \text{taxes} + \text{interest}}{\text{total assets}} - \frac{\text{interest}}{\text{total debt}};$$

3. structure [i.e. asset structure];
4. financial rules [for instance target levels of the ratio net worth to fixed assets].

This grouping is due to the availability of data and could perhaps be reproduced by factor analysis [see (15) for this approach]. We then computed zero-order correlation coefficients which are presented in Table 4; this table only contains the coefficients significant at a level of 0.001, 0.01, 0.05, and 0.1 (the latter level has only been included to give insight into the tendencies of correlation). In Table 4 gross income is defined by earnings before interest and taxes.

Table 4: Correlation ( $r$ ) between Debt Ratios and Other Financial Ratios  
- Cross-section Analysis -

A. Profitability	Gross income to total assets	Net income to net worth	Net income to sales	"Leverage"
Sample				
42 industry groups 1969	-0.45 **	-0.40 **	-0.40 **	-0.44 **
42 industry groups 1971	-0.39 **		-0.52 ***	
249 firms	-0.47 ***	0.13 *	-0.39 ***	-0.45 ***
36 electric utilities		0.31		-0.30
47 chemicals	-0.48		-0.44	-0.51
10 petroleum refining	-0.64 *	-0.83 **		-0.56
45 machines	-0.31 *	0.29		-0.31 *
15 auto and aircraft manufacturing	-0.65 **	-0.44	-0.59 *	-0.60 *
30 electricals	-0.65 ***		-0.63 ***	-0.63 ***
37 breweries				-0.27
29 construction	-0.39 *		-0.46 *	-0.46 *

Table 4 (Continued): Correlation ( $r$ ) between Debt Ratios and Other Financial Ratios - Cross-section Analysis -

B. Financial rules	Net worth to fixed assets	Net worth plus long-term debt to fixed assets
42 industry groups 1969	-0.35 *	
42 industry groups 1971	-0.47 **	
249 firms	-0.38 ***	
36 electric utilities	-0.92 ***	-0.30
47 chemicals	-0.57	-0.39
10 petroleum refining	-0.82 **	
45 machines	-0.44 **	
15 auto and aircraft manufacturing		
30 electricals	-0.45 *	
37 breweries	-0.89 ***	
29 construction	-0.81 ***	-0.69 ***
C. Structure	Fixed assets to total assets	Inventories to total assets
42 industry groups 1969	-0.43 **	0.28
42 industry groups 1971	-0.34 *	0.32 *
249 firms	-0.47 ***	0.36 ***
36 electric utilities	0.32	-0.34 *
47 chemicals		0.40
10 petroleum refining		
45 machines	-0.68 ***	
15 auto and aircraft manufacturing	-0.89 ***	0.76 ***
30 electricals	-0.65 ***	0.51
37 breweries		0.39 *
29 construction		0.57 **
D. Size <sup>1)</sup>	Fixed assets	Inventories Sales Cash flow
249 firms		
15 auto and aircraft manufacturing	-0.61 *	-0.54 *
37 breweries	0.30	0.29
29 construction		0.33

\*\*\* = level of significance 0.001  
\*\* = level of significance 0.01  
\* = level of significance 0.05

<sup>1)</sup> Samples without significance  
have been left out.

First the negative sign at the "profitability" variables seems to be of special importance. Table 4 contains the results for the wider sample of 42 industry groups, also for the year 1969 - a boom year: the negative sign does not alter. Thus our results are the same as those of Toy et al. (22). This may be interpreted differently - being dependent on the leverage effect. Low profitability firms run great risk of a negative leverage effect; they either have established growth as an objective - or they must grow and finance growth though having established profitability objectives. High profitability firms will generally show a positive leverage effect; if these firms avoid high debt ratios this may be a question of target debt ratios [see (13) for this].

Second the results for the factor "financial rules" are not obvious. The coverage of fixed assets by net worth may be an expression of perceived risks with respect to these fixed assets. There may be firms characterized by high risks and low proportions of fixed assets, on the other side there may exist firms having the opposite characteristics; in this case one could not expect a negative correlation between debt ratios and financial rules a priori.

The results for the factor "structure" show the strong influence of the assets side with respect to the liabilities side. The ratio fixed assets to total assets is of special importance. There is a negative correlation for the cyclical industries (machines, auto and aircraft manufacturing, and electricals, but not: chemicals)-showing the greater risks of these industries. In the case of construction the lacking correlation may be due to the low proportion of fixed assets.

Finally "size" cannot be regarded as a factor diminishing business risk. The weak or lacking correlations could be due to small ranges of size in our sample. But this statement is altered if we look at debt composition (see Table 5). There is a generally positive correlation between fixed assets or total assets and debt ratio 3 (long-term debt), on the other side we state a negative correlation with respect to debt ratio 2 (short-term debt). The access to the capital market by large firms may thus be demonstrated by Table 5.

Table 5: Correlation ( $r$ ) between Parts of Debt and Size

Size variable	Sample	Debt ratio 2 (short-term debt)	Debt ratio 3 (long-term debt)
Total assets	42 industry groups 1969	-0.216	0.279
	42 industry groups 1971	-0.228	0.311 *
	249 firms 1971	-0.123	0.144 *
Fixed assets	42 industry groups 1969	-0.349 *	0.378 *
	42 industry groups 1971	-0.362 *	0.390 *
	249 firms 1971	-0.190 **	0.171 **

\*\* = level of significance 0.01

\* = level of significance 0.05

#### 4. Multivariate Analysis

Basing on the results of the univariate analysis a multivariate analysis should lead to better results. We could have reported on multiple regressions performed by step-wise analysis. We prefer to stress two related other problems: the discrimination between high and low debt ratios and - referring to the importance of the "structure" factor - the relationships between assets and liabilities.

#### 4.1. Discrimination between Firms with High and Low Debt Ratios

Applying multiple discriminant analysis - MDA - [see for instance (3)] we tried to discriminate between firms showing high and low debt ratios. Instead of performing a step-wise multiple discriminant analysis we decided to pick up one variable out of each set of ratios in Table 4. The set of ratios concerning "size" was omitted after some computer runs; that can be explained by the remarks with regard to the bad univariate results above. A-priori groups did not exist for performing MDA in our case. We therefore decided to form two groups - one containing firms with lowest debt ratios (group "Low") and another combining firms with highest debt ratios (group "High"). The group size was varied containing more or less firms in both groups (a program-package of E. Faber, Deutsches Rechenzentrum, Darmstadt, was used and modified to insure flexibility in data management on a time-sharing dialogue basis). The results with regard to the maximum possible group sizes (i.e. one half of each sample) are reported in Table 6.

Looking at Table 6 one recognizes the group differences represented by the means of the three discriminating variables. With the exception of petroleum refining (only 10 observations) there has been reached a very high level of significance represented by the computed F-ratios. The classification procedure following MDA led to similar results. Thus we can conclude that there exist variables which explain differences in debt ratios between industries and within a given industry as well: profitability (gross income to total capital), importance of financial rules (net worth to fixed assets), and structure (fixed assets to total assets).

Table 6: Discrimination of Firms with High Debt Ratios  
and Low Debt Ratios by Three Financial Variables

Industry	Size of debt ratio	Number of firms	Means of discriminating variables (%)			F-ratio for overall discrimination and degrees of freedom	Percentage of correct classification	
			Gross income to total capital	Net worth to fixed assets	Fixed assets to total assets		Group High/Low	Industry
Electric utility	High	18	7.9	38.2	86.1	20.56 ** (3;32)	83.3 **	91.7 **
	Low	18	9.7	66.8	79.4		100.0 **	
Chemicals	High	23	8.7	71.1	46.9	10.59 ** (3;42)	82.6 **	84.8 **
	Low	23	13.7	141.8	49.2		87.0 **	
Petroleum refining	High	5	4.6	41.0	66.0	1.80 (3;6)	80.0	90.0 *
	Low	5	8.5	55.0	73.5		100.0 *	
Machines	High	22	6.1	88.5	21.3	19.04 ** (3;40)	90.9 **	85.4 **
	Low	22	10.4	126.9	33.9		81.8 **	
Auto and aircraft manufacturing	High	7	3.0	70.3	27.8	19.40 ** (3;10)	85.7 *	92.9 **
	Low	7	12.9	75.2	53.4		100.0 *	
Electrics	High	15	9.5	91.7	26.6	13.37 ** (3;26)	93.3 **	96.7 **
	Low	15	14.8	129.2	41.1		100.0 **	
Brewery	High	18	13.4	53.5	67.2	20.59 ** (3;32)	94.4 **	94.4 **
	Low	18	17.4	87.2	67.0		94.4 **	
Construction	High	14	5.2	50.9	23.1	11.15 ** (3;24)	92.9 **	85.7 **
	Low	14	8.4	91.3	32.7		78.6 *	
All firms	High	120	7.5	70.8	38.0	77.25 ** (3;236)	80.8 **	83.8 **
	Low	120	12.9	97.5	59.6		86.7 **	

\*\* = level of significance 0.01

\* = level of significance 0.05

#### 4.2. Canonical Correlation Analysis of Assets and Liabilities

The strong influence of "structure" (see Table 4) induces an approach of simultaneous comparison between various forms of assets on one side and various forms of liabilities on the other side. It is hypothesized that the composition of assets strongly determines the composition of liabilities. We can apply canonical correlation analysis as a method of opposition of two sets of data [see (3) for this method]. There is an economic application of canonical correlation analysis (6): the relationships between a set of performance measures and a set of financial variables are investigated. Our approach differs from this: we define the composition of assets as one data-set and the composition of liabilities as the other data-set.

Each side of the balance-sheet is divided into parts related to finance and investment, i.e. six on the liabilities side and four on the assets side:

1. net worth, provisions for pensions, long-term debt, other provisions, current liabilities, proposed dividend;
2. fixed assets, inventories, accounts receivable, cash and bank balances.

The numbers of variables in each data-set are due to availability of data and due to the fact that some aggregation should be of importance with respect to the results. All positions of the two data-sets were divided by total assets. We than applied the CANON-program by Cooley and Lohnes (3). The results are reported in Tables 7 and 8.

In Table 7 we present the factor structure for the (first) extracted factor and the corresponding canonical correlation coefficient. We can interpret this factor as the financing of fixed assets by long-term capital. In Table 7 we find the results of five canonical analyses. Though these results refer to different samples and years the stability of the factor structure is very impressive. One may relate these results to the stability of financial patterns detected by Pinches, Mingo, and Caruthers (15).

Table 7: Results of Canonical Correlation Analyses - Factor Structure  
for the First Factor -

Sample		26 industry groups		42 industry groups		249 firms
Year		1969	1971	1959	1971	1971
Liabilities	Net worth	0.738	0.666	0.494	0.410	0.644
	Provisions for pensions	0.403	0.321	0.142	0.344	-0.046
	Long-term debt	0.476	0.559	0.702	0.640	0.622
	Other provisions	-0.573	-0.519	-0.448	-0.274	-0.452
	Current liabilities	-0.788	-0.845	-0.860	-0.884	-0.848
	Proposed dividend	0.329	0.210	-0.002	-0.166	0.139
Assets	Fixed assets	0.852	0.834	0.969	0.978	0.996
	Inventories	-0.398	-0.661	-0.696	-0.828	-0.075
	Accounts receivable	-0.459	-0.357	-0.739	-0.703	-0.601
	cash and bank balances	-0.825	-0.626	-0.470	-0.564	-0.338
Canonical correlation coefficient		0.9084	0.8920	0.9085	0.8682	0.7349
Computed $\chi^2$ and degrees of freedom		51.32 (24)	43.70 (24)	74.87 (24)	69.99 (24)	242.60 (24)
Level of significance		0.001	0.01	0.001	0.001	0.001

Besides the first canonical factor we found a second significant factor in some cases (see the last column of Table 8). This factor in most cases can be interpreted as the existence of cash and bank balances (assets) in order to diminish provisions and proposed dividend (liabilities).

Table 8: Results of Canonical Correlation Analyses - Overall Measures of Connection between Assets and Liabilities -

Sample composition	Year	Total redundancy for liabilities, given assets (%)	Total redundancy for assets, given liabilities (%)	Number of factors with level of significance = 0.05
26 industry groups	1969	34.8	55.9	1
26 industry groups	1971	29.1	44.4	1
42 industry groups	1969	28.9	50.4	1
42 industry groups	1971	27.5	50.6	1
249 firms	1971	19.9	24.3	2
36 electric utilities	1971	32.5	46.4	2
47 chemicals	1971	22.9	32.2	2
45 machines	1971	23.3	31.8	2
15 auto and aircraft manufacturing	1971	50.7	61.0	0
30 electricals	1971	22.7	31.5	1
37 breweries	1971	18.9	24.6	1
29 construction	1971	43.3	49.8	2

Cooley and Lohnes [3, p. 171] point at the fact that the canonical correlation coefficient is only one measure of overlap between the two batteries. Another measure is the redundancy of the battery "liabilities" given the availability of the battery "assets". This measure shows which proportion of variance in the vector variable "liabilities" is found to be redundant to the variance in the vector variable "assets", if one establishes a canonical correlation [3, p. 171]. The redundancy for the battery "assets" can be interpreted in an analogous manner. Table 8 shows the results of twelve canonical correlation analyses with respect to redundancy.

The fact that the total redundancies are higher with respect to assets than to liabilities can be interpreted: investing is followed by financing. We conclude that there exists a distinct behaviour of firms with respect to relationships between finance and investment.

### 5. Conclusions

The purpose of this study was to explain corporate debt ratios in Germany via cross-section analysis. Though we mainly investigated the year 1971, the good significance levels and the economic interpretation of results should not lead to substantially different results when performing the analysis for other years. We have shown that there exist differences between firms exhibiting high and low debt ratios. These differences are explained by the influences of industry, profitability, structure, and the importance of financial rules. The application of canonical correlation analysis leads to the conclusion that firms strongly look at the assets side when forming their capital structures.

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Appendix

List of Investigated Corporations

1. Electric Utility

10002 Gebrüder Bauer AG  
10003 Bayerische Elektricitäts-Lieferungs-Gesellschaft AG  
10004 Bayerische Elektrizitäts-Werke  
10005 Bayerische Wasserkraftwerke AG  
10008 Donaukraftwerk Jochenstein AG  
10009 Donau-Wasserkraft AG  
10010 Elektrizitäts-AG Mitteldeutschland  
10011 Elektrizitätswerk Mittelbaden AG  
10012 Elektrizitätswerk Rheinhessen AG  
10013 Elektrizitätswerk Weißenhorn AG  
10014 Energieversorgung Ostbayern AG  
10015 Energie-Versorgung Schwaben AG  
10016 Fränkische Licht- und Kraftversorgung AG  
10017 Fränkisches Überlandwerk AG  
10019 Großkraftwerk Mannheim AG  
10021 Harpener Bergbau AG  
10022 Innwerk AG  
10025 Kommunales Elektrizitätswerk Mark AG ELEKTROMARK  
10026 Kraftübertragungswerke Rheinfelden  
10027 Kraftversorgung Rhein-Wied AG  
10029 Kraftwerk am Höllenstein AG  
10030 Kraftwerke Haag AG  
10031 Kraftwerk Reckingen AG  
10032 Kraftwerk Reutlingen-Kirchentellinsfurt AG  
10041 Obere Donau-Kraftwerke AG  
10042 Oesterreichisch-Bayerische Kraftwerke AG  
10043 Paderborner Elektrizitätswerk und Straßenbahn AG  
10044 Pfalzwerke AG  
10045 Preußische Elektrizitäts-AG  
10050 Rheinkraftwerk Säckingen AG  
10100 Badenwerk AG  
10117 Großkraftwerk Franken AG  
10119 Hamburgische Electricitäts-Werke  
10135 Mittelschwäbische Überlandzentrale AG  
10137 Neckarwerke Elektrizitätsversorgungs-AG  
10156 Ueberlandwerk Jagstkreis AG

2. Chemicals

20001 Agfa-Gevaert AG  
20003 C.F. Asche & Co. AG  
20004 Asta-Werke AG, Chemische Fabrik  
20006 Badische Anilin- & Soda-Fabrik AG  
20010 Bohlen Industrie AG  
20012 Cassella Farbwerke Mainkur AG  
20014 Chemische Fabriken Oker und Braunschweig AG  
20015 Chemische Fabrik Helfenberg AG, vorm. Eugen Dieterich  
20016 Chemische Fabrik Marktredwitz AG  
20020 Chemische Werke Hüls AG  
20021 CIBA-GEIGY AG

20024 Deutsche Balamundi AG  
20028 Ewald Dörken AG  
20030 Dynamit Nobel AG  
20032 Farbwerke Hoechst AG, vorm. Meister Lucius & Brüning  
20033 GÖDECKE AG  
20035 Guano-Werke AG  
20038 Hoffmann-La Roche AG  
20041 Jünker & Gebhardt AG  
20042 Kali-Chemie AG  
20045 Knoll AG Chemische Fabriken  
20046 Koepp AG  
20047 Kores-Bürochemie AG  
20053 Pino AG, Chemische Fabrik  
20056 Riedel-de Haen AG  
20058 RUBEROIDWERKE AG  
20059 Rütgerswerke AG  
20062 Saline Ludwigshalle AG  
20063 "Sandoz" AG  
20064 Süd-Chemie AG  
20065 Süddeutsche Kalkstickstoff-Werke AG  
20066 Scheidemandel AG  
20067 Schering AG  
20071 Togal-Werk Gerhard F. Schmidt AG  
20074 Wolff Walsrode AG  
20075 ZYMA-BLAES AG, Arzneimittelfabrik  
20349 Beiersdorf AG  
20363 DLW AG  
20368 Farbenfabriken Bayer AG  
20372 Th. Goldschmidt AG  
24005 C.F. Böhringer u. Söhne GmbH  
24035 Du Pont de Nemours (Deutschland) GmbH  
24037 Rheinische Olefinwerke GmbH  
24039 Röhm GmbH  
24042 Deutsche Solvay Werke GmbH  
24050 Dr. Karl Thomae GmbH  
24057 Wacker Chemie GmbH

### 3. Petroleum Refining

30003 Erdölraffinerie Ingolstadt AG  
30004 Erdölwerke Frisia AG  
30007 Union Rheinische Braunkohlen-Kraftstoff AG  
30008 Veba-Chemie AG  
30530 BP BENZIN UND PETROLEUM AG  
30531 Deutsche Shell AG  
30534 ESSO AG  
30537 SÜDPETROL AG für Erdölwirtschaft  
34008 Caltex Deutschland GmbH  
34009 Deutsche Marathon Petroleum GmbH

4. Machines

- 40002 Adlerwerke vorm. Heinrich Kleyer AG  
40003 Eduard Ahlborn AG  
40004 Albert-Frankenthal AG  
40005 Alexanderwerk AG  
40006 Allweiler AG  
40008 Anker-Werke AG  
40009 J. Banning AG  
40010 Barmag Barmer Maschinenfabrik AG  
40011 C. Behrens AG  
40012 Benteler Werke AG  
40013 Berliner Maschinenbau-AG vorm. L. Schwartzkopff  
40015 Braunschweigische Maschinenbauanstalt  
40017 Butzke-Werke AG  
40018 C.F.C. Kettenförderanlagen AG  
40020 Demag AG  
40023 Diskus Werke Frankfurt am Main AG  
40027 Eisenwerk Weserhütte AG  
40029 J. Engelsmann AG  
40030 Enzinger-Union-Werke AG  
40031 Eumuco AG für Maschinenbau  
40033 Fortuna-Werke Maschinenfabrik AG  
40037 Hansa Metallwerke AG  
40039 Heidelberger Druckmaschinen AG  
40040 Gebr. Heinemann AG, Werkzeugmaschinenfabrik  
40042 Fr. Hesser Maschinenfabrik-AG  
40044 Industrie-Werke Karlsruhe-Augsburg AG  
40045 Jagenberg-Werke AG  
40049 Kochs Adler AG  
40050 Körting AG  
40052 Kraftwerk Union AG  
40054 Gebr. Krüger & Co. AG  
41124 Klein, Schanzlin & Becker AG  
41125 Klöckner-Humboldt-Deutz AG  
41129 Krauss-Maffei AG  
41137 Linde AG  
41141 Maschinenbau-AG Balcke  
41163 Orenstein & Koppel AG  
41174 Roland Offsetmaschinenfabrik Faber & Schleicher AG  
41197 Westfalia Separator AG  
44024 Mahle Gesellschaft mbH  
44027 Messer Griesheim GmbH  
44028 Motoren- u. Turbinen-Union Friedrichshafen GmbH  
44041 SKF Kugellagerfabriken GmbH  
44052 Friedrich Uhde GmbH  
44072 Zeppelin-Metallwerke GmbH

5. Auto and Aircraft Manufacturing

50001 Audi NSU Auto Union AG  
50006 Fichtel & Sachs AG  
50007 FORD-WERKE AG  
50009 Henschel Flugzeug-Werke AG  
50010 Adam Opel AG  
50013 Waggonfabrik Jos. Rathgeber AG  
51301 Bayerische Motoren Werke AG  
51303 Daimler-Benz AG  
51307 Goetzewerke Friedrich Goetze AG  
51313 VOLKSWAGENWERK AG  
51316 Zahnradfabrik Friedrichshafen AG  
54026 Messerschmitt-Bölkow-Blohm GmbH  
54029 Motoren- und Turbinen-Union München GmbH  
54062 Vereinigte Flugtechnische Werke GmbH  
54071 Dornier Verwaltung GmbH

6. Electricals

60001 Accumulatorenfabriken Wilhelm Hagen AG  
60004 Bayerische Kabelwerke AG  
60005 Bergmann Kabelwerke AG  
60007 Brown, Boveri & Cie AG  
60008 Calor-Emag Elektrizitäts-AG  
60009 Deutsche CARBONE AG  
60010 Deutsche Telephonwerke und Kabelindustrie AG  
60013 Felten & Guilleaume Dielektra AG  
60014 Felten & Guilleaume Kabelwerke AG, Land- und See-Kabelwerke  
60016 Gottfried Hagen AG  
60017 Hartmann & Braun AG  
60018 Heemaf S.K.A. Motorenwerk AG  
60019 Himmelwerk-AG  
60022 Kabelwerk Rheydt AG  
60023 Kräcker AG  
60024 Langbein-Pfanhauser Werke AG  
60025 Leonische Drahtwerke AG  
60028 Norddeutsche Seekabelwerke AG  
60029 Ritter AG  
60033 Transformatoren Union AG  
60034 VARTA AG  
60037 Wickmann-Werke AG  
61350 ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT AEG-TELEFUNKEN  
61739 Standard Elektrik Lorenz AG  
64006 Robert Bosch GmbH  
64018 IBM Deutschland Internationale Büromaschinen GmbH  
64040 SIEMENS-ELEKTROGERÄTE GmbH  
64049 Telefonbau und Normalzeit GmbH  
64516 W.C. Heraeus GmbH  
64565 Deutsche ITT Industrie GmbH

7. Brewery

71960 Adlerbrauerei Balingen AG  
71963 Actien-Brauerei Dormagen  
71965 Aktienbrauerei Feldschlößchen  
71966 Aktienbrauerei Kaufbeuren  
71969 Aktienbrauerei Simmerberg  
71970 Aktienbrauerei Zum Hasen Augsburg  
71972 Auerbräu AG  
71973 Badische Staatsbrauerei Rothaus AG  
71974 Bärenbrauerei AG  
71975 Bavaria- und St. Pauli-Brauerei  
71977 Bayerische Brauerei-Schuck-Jaénisch AG  
71985 Brau-AG Nürnberg  
71986 Brauerei Beckh AG  
71988 Brauerei Cluss  
71989 Brauerei Durlacher Hof AG  
71990 Brauerei Feldschlößchen AG  
71991 Brauereigesellschaft vormals Meyer & Söhne  
71995 Brauerei Isenbeck AG  
71997 Brauerei Robert Leicht AG  
71998 Brauerei Moninger  
72004 Brauerei zur Walkmühle H. Lueck AG  
72005 Brauhaus Amberg AG  
72008 Bürgerliches Brauhaus Ravensburg  
72011 Dortmunder Actien-Brauerei  
72012 Dortmunder Hansa-Brauerei AG  
72014 Dortmunder Stiftsbrauerei Carl Funke AG  
72017 Einbecker Brauhaus AG  
72018 Elbschloß-Brauerei  
72019 Engelhardt-Brauerei AG  
72020 Erste Kulmbacher Actien-Exportbier-Brauerei  
72021 Frankenthaler Brauhaus AG  
72025 Grüner-Bräu AG  
72040 Hürnerbräu AG  
72043 Kaiser-Brauerei AG  
72056 Löwenbrauerei AG  
72075 Gabriel Sedlmayr Spaten-Franziskaner-Bräu AG  
72083 Schwanenbrauerei Kleinschmitt AG

8. Construction

80001 AHI-Bau Allgemeine Hoch- und Ingenieurbau-AG  
80003 Appel & Zahn AG  
80004 C. Baresel AG  
80009 Julius Berger - Bauboag AG  
80010 Berliner Asphalt AG  
80011 Beton- und Monierbau AG

80014 Boswau & Knauer AG  
80015 Christiani & Nielsen Ingenieurbau AG  
80017 Dyckerhoff & Widmann AG  
80020 Grün & Bilfinger AG  
80021 Grünzweig & Hartmann AG  
80022 Paul Hammers AG  
80023 Heilmann & Littmann Bau-AG  
80025 Held & Francke Bauaktiengesellschaft  
80027 Hochtief AG für Hoch- und Tiefbauten vorm.  
Gebr. Helfmann  
80028 Philipp Holzmann AG  
80029 Huta-Hegerfeld AG  
80030 Gebrüder Kiefer AG  
80032 Karl Kübler AG  
80035 Friedrich Mehmel AG  
80037 Philipp Bau KGaA  
80038 Wilhelm Radmer Bau und Beton KGaA  
80041 Strabag Bau-AG  
80043 Thormann & Stiefel AG "Thostti"  
80045 Überland Hoch-, Tief- und Straßenbau AG  
80046 Ed. Züblin AG, Bauunternehmung  
82279 Bohr-, Brunnenbau- und Wasserversorgungs-AG  
82282 Glückauf-Bau-AG  
82292 H. Klammt AG