

Competition in the German banking sector: An empirical analysis of the concentration of commercial loan origination

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Abstract

Over the last couple of years the banking industry has seen a remarkable trend towards concentration. The aim of this study is to examine this tendency and its consequences for the German market. We analyze commercial lending in Germany from 1970 to 2003 for all banks active on the German market, aggregated into 6 bank groups, and 8 broadly defined industries, covering most of the loan volume to domestic corporations.

Our paper extends previous studies on competition and concentration in banking in several respects. Firstly, we deviate from the commonly assumed homogenous product market assumption and treat loans made to different industries separately. Secondly, we introduce a new methodology, i.e. distance measures, to assess the loan market structure.

Overall, we find that concentration has increased and therefore competition decreased. Concentration of the bank groups' loan portfolios has also gone up except for the branches of foreign banks. The use of distance measures reveals that at the same time the bank groups' loan portfolios have become much more similar to the industry composition of the whole loan market. Concentration of the financing mixes of single industries has changed in different, while becoming closer to the market average.

Key words: Competition, concentration, loan origination, banking.

JEL classification: G11, G14, G21, C43.

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1 Introduction

Competition is one of the cornerstones of modern economies. Neoclassical economists usually praise it as being the driving force leading to an efficient resource allocation. Countries often have established agencies whose sole purpose it is to ensure that competition prevails within the nation and is not limited by cartels, collusion, monopolies, or the like. As an aside, however, one has to note that in the international arena free competition is commonly threatened by a number of efforts countries undertake in order to protect their own economy from outside competitors.¹

Our focus is an empirical analysis of competition within the German banking industry. Let us in turn provide reasons for the choice of industry and country. The banking industry over the last couple of years has seen a remarkable trend towards concentration (cf. Laderman (2003) and Kwan (2004)). Banking theorists should not really be surprised about this observation. The now classical paper by Diamond (1984) has made it perfectly clear that banks' advantage over capital market transactions may basically come from their holding of diversified portfolios. At first sight, this is not in line with the intuition that concentrating loan origination on similar lenders, e.g. from the same industry, should be beneficial due to superior monitoring. However, when banks become large enough, they are in a position to achieve the latter advantages without losing the former. Consequently, there exists the view that the banking industry, because of scale and scope economies, is a candidate for a natural monopoly.² This indeed has even been put forward as a reason why banks should be regulated,³ and some pieces of regulation actually seem to be motivated by this conviction. The empirical conclusions concerning scale and scope economies, however, are rather mixed.⁴

Why is Germany suitable for such an analysis? Aiming at an empirical analysis, data availability is a key issue. In the present case, German data allow an analysis which could not be performed, e.g., with U.S. data. All banks active on the German loan market must report their loan origination quarterly, broken down into industries. Aggregated over banking groups (cf. Section 3.1), this data is publicly available and will be used in our study ranging from 1970 through 2003. It allows to answer questions like the following:

- How have the market shares in commercial loans of the different banking

¹ Whether such measures are justified because these to-be competitors are, in contrast to what fair competition would require, illegitimately subsidized by their home countries or are just taken to shield home firms (and more generally jobs) from more efficient rivals is an interesting issue but nothing we will contribute to in this paper.

² For a more elaborate discussion of natural monopolies in general see, e.g., Train (1991).

³ Cf. Baltensperger (1990), p. 2.

⁴ Cf. Berger and Humphrey (1994) and Berger et al. (1996).

groups, including subsidiaries of foreign banks, changed over time?

- Are these changes similar in all industries or are there indications that banks have specialized?

The virtue of having a break-down of loan origination to industries lies in the opportunity to disentangle the big picture of changes in market shares into bits and pieces providing more insights into possible forces at work on the micro level. We will turn out to be able to support tentative explanations for some of the changes observed in the more disaggregated data. Among others, the results will match intuitive hypotheses about German banking groups having gained (or lost) market share in certain industries and will make transparent how foreign banks have approached the commercial loan market in Germany.

When answering the questions stated above, we always do this based on the presumption that market shares, and their changes, are revealing the degree of competitiveness. This view can be, and of course has been, challenged. Since we will be discussing this issue in more depth later (cf. Section 4), it may suffice for the moment to point out that, irrespective of its scientific appeal, calculating market shares and indices based on market shares (e.g., the Hirschman-Herfindahl index or the Gini index of the concentration curve) still seems to be the state-of-the-art applied by regulatory authorities. Therefore we find it certainly justified to follow this route at least for the moment.

The rest of the paper is organized as follows. In Section 2 we will provide, as our starting point, a brief review of some of the relatively scarce related literature. The data used in our empirical analysis is presented in Section 3, which begins with a rough description of the German banking system. Then Section 4 is devoted to a discussion of methodological issues, especially concerning different ways how competition can be measured. The empirical results follow (Section 5). We will wind up with our conclusions in Section 6, including a number of suggestions for further extensions and improvements of the analysis.

2 Related literature

The association between banking competition and market concentration is a controversial issue (cf. Shaffer (2004)). On one (the "traditional") side a more concentrated market represents a lower degree of competition (cf. Koutsomanoli-Fillipaki and Staikouras (2004)), i.e. in a concentrated market

banks can exercise undesirable market power.⁵ On the other side theories,⁶ such as the contestability theory,⁷ show that competition and concentration can coexist under certain circumstances. For example, market concentration does not imply market power of the operating firms, if no market (entry or exit) barriers exist, like it is assumed in the theory of contestability (cf. Baumol (1982)). In contestable markets firms price their products competitively due to the entry threat of competitors. Despite some liberalization, however, in our opinion financial markets are still highly regulated, implying that entry barriers exist and hence concentration does indicate market power of operating banks.⁸

Whether concentration actually implies market power of operating banks, can empirically be tested by examining the relationship between bank profitability and market concentration. A positive relationship would indicate non-competitive behaviour among operating banks in concentrated markets. The hypothesis of a positive relationship between profitability and market concentration is confirmed by several studies.⁹ However, we have to note that the Structure-Conduct-Performance paradigm, i.e. the interpretation of the observed positive relationships between profitability and concentration, is often criticized for the assumed causality from market structure to market performance and not vice versa (cf., e.g., Berger and Hannan (1989) and Hannan (1991b)).

While recently, a paper by Koutsomanoli-Fillipaki and Staikouras tries to cope with this concern when assessing the relationship between competition and concentration in the newly enlarged European banking landscape¹⁰, we extend previous studies on bank competition and market concentration basi-

⁵ The idea behind this argument is that there is a causal relationship running from market structure, e.g. market concentration, to firms' pricing behaviour and to firms' market power (cf. Northcott (2004)). This approach is called the Structure-Conduct-Performance paradigm. An early example which finds a positive relationship between bank concentration and bank loan pricing is, for example, Hannan (1991a).

⁶ These approaches can be categorized basically as New Empirical Industrial Organization approaches, since their main objective is to cope with the pitfalls of the Structure-Conduct-Performance paradigm.

⁷ Contestability refers to efficient competition.

⁸ Approaches to measure the competitive conduct of banks without explicitly using information about the market structure have been developed by, e.g., Bresnahan (1982) and Panzar and Rosse (1987). A recent example which applies the Panzar and Rosse technique and finds a positive relationship between concentration and contestability is Claessens and Laeven (2003).

⁹ Molyneux et al. (1996) and Staikouras (2001) review these studies.

¹⁰ They measure competition with a non-structural technique based on an evaluation of the elasticities of total interest revenues with respect to changes in banks input prices, i.e. the Panzar-Rosse test (cf. Koutsomanoli-Fillipaki and Staikouras (2004))

cally in two other directions.

- Firstly, we deviate from the commonly assumed homogeneous loan market assumption by allowing that even on a national level the banking market is heterogeneous. In our opinion different banks serve different industry segments and, hence, these segments should be treated separately when assessing market competition.
- Secondly, we introduce a new methodology, i.e. distance measures, to assess market structure. Distance measures enable us to compare ever market structure with any kind of benchmark and are therefore along with traditional concentration measures helpful to evaluate market conditions.

As we had pointed out earlier, the availability of a break down of an industry's total bank debt into bank groups is rather limited. Therefore there do not exist studies we could directly build on or refer to. A recent study which is at least somewhat close to our work is a paper by Acharya et al. (2004). Taking data from 105 Italian banks for 7 years they calculate the Hirschman-Herfindahl indices in order to find out the industry concentration of the banks' loan portfolios. The ultimate purpose of their study is to find out whether banks with less industry concentration of their loan portfolios are less risky and more profitable.¹¹ Competition is nothing they are directly addressing as such.

However, Acharya et al. (2004) emphasize several times that banks generally do worse when expanding their loan origination into industries which are particularly competitive.¹² In addition they include a control variable measuring competition in their regressions when trying to explain bank risk. They assume high competitiveness for a bank when its shares in the loan volumes of its five most important industries are low.¹³ It turns out that this control variable has a statistically significant effect on bank risk, "banks facing greater competition have riskier portfolios" (p. 32). The authors also observe that an increased focus in lending is the more risk reducing the higher competition is. Hence we should expect to see diversify banks expanding primarily into industries with relatively little lending competition (cf. Boot and Thakor (2000) and Hauswald and Marquez (2002)).

3 Data

The data on which our analysis is based is part of the German banking statistic. Each month the German Central Bank publishes a report about the

¹¹ The answer is basically no.

¹² Earlier papers which have stressed that competition may have an adverse effect on loan quality include, e.g., Gehrig (1998), Winton (1999) and Dell'Arricia et al. (1999). Shaffer (1998) empirically supports this hypothesis.

¹³ Actually, this is also, and maybe even more so, a measure of the size of the bank.

current financial and economic situation in Germany.¹⁴ Our loan data is part of these reports. We will be covering the period 1970 to 2003.

3.1 The German banking sector

The German banking sector is usually described as consisting of three distinct pillars: commercial banks, banks under public law, and cooperative banks. Table 1 gives a first overview about the number of banks in the three named categories, which are further broken down into groups, plus a category which collects all other banks. The figures for the shares total assets are intended to give a first indication of the (relative) sizes of each of the banking groups. Later on in our analysis we will, of course, refer to loan volumes as the relevant benchmark.

Table 1
Structure of the German banking sector^{15, 16}

June	1970 ... 1980	1981 ... 1990	1991 ... 2003
Total assets [billion €]	420 ... 1,131	1,228 ... 2,228	2,728 ... 6,511
Number of banks	3,605 ... 3,344	3,323 ... 4,155	4,462 ... 2,311
Commercial banks			
Share of total assets [%]	24.77 ... 23.53	22.97 ... 24.84	26.68 ... 28.53
Number of			
Big banks	6 ... 6	6 ... 6	4 ... 4
Regional banks and others	283 ... 184	179 ... 261	277 ... 181
Branches of foreign banks	25 ... 55	56 ... 58	61 ... 83
Banks under public law			
Share of total assets [%]	38.31 ... 38.73	38.52 ... 36.91	35.06 ... 35.77
Number of			
State banks ¹⁷	13 ... 12	12 ... 11	11 ... 14
Savings banks	833 ... 599	599 ... 580	757 ... 502
Cooperative banks			
Share of total assets [%]	11.48 ... 14.60	14.94 ... 16.07	14.79 ... 11.48
Number of			
Regional institutions of credit cooperatives	13 ... 10	10 ... 4	4 ... 2
Credit cooperatives ¹⁸	2,167 ... 2,285	2,271 ... 3,167	3,279 ... 1,456
Other banks			
Share of total assets [%]	25.44 ... 23.14	23.57 ... 22.18	23.47 ... 24.22
Number of other banks	265 ... 193	190 ... 68	69 ... 69

¹⁴ See, e.g., Deutsche Bundesbank (2004).

Most of the German banks would describe themselves as universal banks. In the remainder of this subsection we will, firstly, briefly characterize the three bank categories in turn.¹⁸ Secondly, we derive some implications of the given structure for measuring competition.

Yet before doing so, we should say a few words about the "other banks" that appear in Table 1 as well as in the German banking statistics as a fourth category. It is not analyzed in more detail in our paper, since it consists of very heterogeneous groups, e.g., mortgage banks and banks with special functions. These banks are sometimes related, by ownership, contracts, or legal status, to one of the three other categories. For example, the category includes commercial, state-owned, as well as cooperative mortgage banks, respectively building societies. Federal banks with the purpose of supplying credit to German firms in order to increase business activity and improve the economy's performance are also assigned to this category. We only refer to it when necessary to account for the total size of the banking system or noteworthy special effects.

Commercial banks

The category "commercial banks" consists of the leading big banks, as well as regional banks and other commercial banks including private bankers, and finally branches of foreign banks:

- The big banks, Deutsche Bank, Dresdner Bank, and Commerzbank, for a long time after World War II concentrated on supplying (large) corporations with credit. It was only much later that they extended their business lines by more active retail business. The initial count of six results from the fact that the Berlin subsidiaries were treated as separate entities until reunification. The fourth big bank was created in 1999 by a merger between two Bavaria-based banks, Hypobank and Vereinsbank for short, which were classified as

¹⁵ To keep the figures comparable with the following analysis, we deliberately state the figures reported for June of the respective year.

¹⁶ The numbers of credit cooperatives stated are the numbers of those such institutions reporting to the German central bank. A few very small ones need not do so.

¹⁷ In June 2003 the German central bank categorizes even 14 banks as state banks. To this bank group belong among other banks the DekaBank Deutsche Kommunalbank, the Hamburgische Landesbank, the Landesbank Nordrhein-Westfalen, the Landesbank Schleswig-Holstein as well as the WestLB AG. While the German central bank does not know exactly how the business activities of the former Westdeutsche Landesbank are divided among the Landesbank Nordrhein-Westfalen and the WestLB AG, both are considered separately as state banks. Furthermore, the merger of the Hamburgische Landesbank and the Landesbank Schleswig-Holstein to form the HSH Nordbank in June 2003 is not taken into account.

¹⁸ For a somewhat more complete description see International Monetary Fund (2004) and Krahen and Schmidt (2004).

regional banks until that merger.

- Regional banks, as the name suggests, restrict their activities to a more or less limited geographical area. The probably most noteworthy example are the former two Bavaria-based banks just mentioned. Private bankers, grouped together with regional banks in the German banking statistics, commonly offer somewhat limited financial services, often targeted at more wealthy private customers and medium-size businesses.
- Branches of foreign banks are often summarize with banks with majority foreign ownership to the category "foreign banks". However, we deviate from this approach and treat branches of foreign banks separately while including banks with majority foreign ownership in regional banks and other commercial banks. We do so, since in our opinion independent of banks' ownership banks based in Germany depend stronger on the German market development than banks based in foreign countries with national branches. Hence, foreign banks' national business activities are partly influenced by different aspects than the activities of domestic banks.
- The degree of market penetration by banks with majority foreign ownership as well as branches of foreign banks is very low in the German banking system in comparison with other European financial markets (cf. Buch and Golder (2002)).¹⁹

Banks under public law

The category "banks under public law" consists of savings banks and state banks. Owners of the savings banks are communities, cities, counties, or groups of such jurisdictions, the state banks are owned by one or more states. This explains why the banks under public law play an important role in the financing of the public sector at large. The savings and state banks are not publicly traded and are often not regarded as profit maximizing entities, although retained profits are basically their only source of equity. Apart from public sector financing, the strengths of the savings banks, which are more or less restricted to serve the region of their owners and therefore hardly ever compete with each other, are the private retail business and the service for small and medium-sized enterprises. State laws as well as by-laws require, among others, to support the regional economy by appropriate credit supply. The service to larger corporations, including out-of-country and more specialized securities transactions, is usually performed in conjunction with or left for the state banks, which among themselves have some but not very fierce competition.

¹⁹ With regard to the balance sheet total, foreign banks' market share is only around 4% and they are particular less successful in attracting business with non-banks (cf. Buch and Golder (2002)). Therefore, Buch and Golder raise the question whether domestic and foreign in Germany serve different market segment(s) and find that lending activities of domestic and foreign banks seem to be driven by different factors.

Given the objectives of our paper, we should add that the existence of savings banks is often supported (e.g., Koetter et al. (2004)) with the argument that they are intended to create competition throughout the country, in particular at locations where other banks, often except credit cooperatives (see below), do not offer readily accessible financial services.

Cooperative banks

The category "cooperative banks" includes regional institutions of credit cooperatives as well as the credit cooperatives themselves. The regional institutions, on the federal and the supra-state level, respectively, are more or less comparable to the state banks, but are a bit smaller in size. The same relation holds for credit cooperatives and savings banks. As far as regional restrictions, intra-group competition, and dominant lines of business are being concerned, the analogy also holds. Credit cooperatives have their origins as suppliers of credit to farmers and small businesses. The main differences with respect to savings banks are ownership and capital structure. The credit cooperatives are predominantly financed by large numbers of individuals, usually also their customers, who hold a small number of non-traded shares each. They are rewarded with dividends, which are kept fairly constant over time, have only one vote a person in the owners' annual meeting, and do not receive any capital gains when leaving the cooperative and returning their shares. Since it does not seem to be really important for this paper, we refrain from discussing the corporate governance issues involved (cf., e.g., Koetter et al. (2004)).

Implications for competition and its measurement

As always, reality does not completely match the idealized picture just plotted. Still, deliberately ignoring the little bit of competition prevailing within the categories banks under public law and cooperative banks, it is not much of a deviation to assume that these categories can be treated simply as two players on the national playing field. This is different when looking at commercial banks. There is a lot of competition amongst them, and even when focusing on the group of big banks alone this continues to be true. Ideally we therefore would have to analyze each of these banks as a separate player, maybe combining cooperating regional banks with little to no intersection of their service areas. However, without going into details about data sources and all that, we must acknowledge that this is not feasible because individual bank data, as sensitive as this, is not available for our analysis. Thus, we have to be content with using the following six "competitors": big banks, regional banks (including private bankers and other commercial banks), branches of foreign banks, banks under public law, cooperative banks and other banks.

3.2 *The German industry composition and loan data*

The industry composition and loan data used in our study can be found in a table entitled "lending to domestic enterprises and resident self-employed persons" (cf. Deutsche Bundesbank (2004)). It consists of outstanding loan volumes, excluding holdings of negotiable money market papers and securities, and is sorted by industries and bank categories, respectively bank groups. Although this data is collected on a quarterly basis, we have chosen to restrict ourselves to yearly data for simplicity, assuming that further data would not provide much more insight but add further complications due to conceivable seasonal effects. In order to exclude any year-end effects, which may occur due to accounting and tax rules as well as because of the way deposit insurance premiums are calculated, we are deliberately working with data for the month of June, i.e., our data covers June 1970 to June 2003.

Industries

Over our sample period from 1970 through 2003, the industry structure underlying the tables on which our analysis rests was changed several times. In order to cope with these structural breaks, we only examine those eight industries for which data exist for the whole sample period. These are: (i) electricity, gas and water supply, (ii) wholesale and retail trade, (iii) transport, storage, and communication, (iv) services industry, (v) construction, (vi) agriculture, hunting, and forestry, (vii) financial institutions and insurance (excluding banks), (viii) manufacturing. Table 2 provides an indication about their relative importance over time in terms of their contributions to GDP.

As is obvious from Table 2, the manufacturing industry unites the lion's share in the early years. Therefore, it was of so much particular interest initially that in fact data exists to split up this industry from 1970 onwards into 9 sub-industries. These sub-industries are: (viii.a) chemical industry, coke and petroleum, (viii.b) rubber and plastic products, (viii.c) other non-metallic mineral products, (viii.d) basic metals and of fabricated metal products, (viii.e) machinery, equipment and vehicles, (viii.f) electronic and optical equipment, (viii.g) wood as well as paper products and furniture, (viii.h) food and tobacco, (viii.i) textiles and leather.

This leaves us with a choice. We can work with the finer industry categorization (16 industries), naming this case "many industries", or with the more aggregated categorization into 8 industries ("few industries"). An analogous possibility to split-up the services industry, which experienced size changes opposite to those observed for the manufacturing industry, does not exist before 1989. Therefore our choice also means to treat the manufacturing and services industries symmetrically ("few industries") or asymmetrically ("many industries").

Table 2

Gross value added by German industries

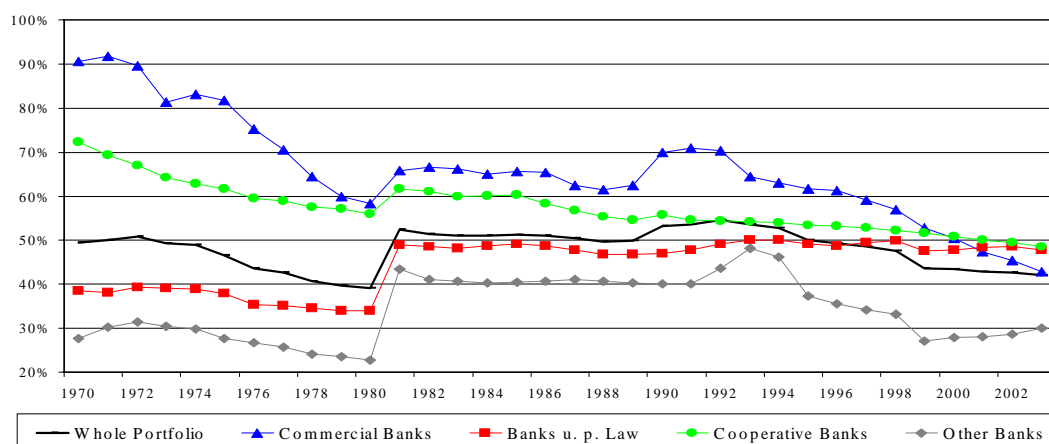
	1970	...	1980	1981	...	1990	1991	...	2003
Gross value added in current prices [billion €]									
All industries	312	...	624	653	...	1,038	1,459	...	1,979
Industry shares [%]									
EGW	5.77	...	5.20	5.23	...	4.39	3.02	...	2.24
Trade	11.46	...	11.55	11.50	...	10.47	10.11	...	10.70
TSC	6.34	...	7.00	7.02	...	6.61	5.87	...	6.17
SI	15.90	...	22.29	22.83	...	29.12	40.76	...	49.30
Con.	9.52	...	8.19	7.74	...	6.28	5.76	...	4.25
AHF	3.78	...	2.50	2.48	...	1.18	1.35	...	1.11
FII	3.47	...	5.44	5.90	...	5.74	5.36	...	4.07
Manu.	43.77	...	37.82	37.29	...	35.58	26.45	...	22.16

EGW $\hat{=}$ Electricity, Gas and Water Supply/Trade $\hat{=}$ Wholesale and Retail Trade/TSC $\hat{=}$ Transport, Storage and Communication/SI $\hat{=}$ Service Industry/Con. $\hat{=}$ Construction/AHF $\hat{=}$ Agriculture, Hunting and Forestry/FII $\hat{=}$ Financial Institutions and Insurance/Manu. $\hat{=}$ Manufacturing

Loan data

We focus on lending to domestic enterprises (excluding banks to avoid cross holdings) and resident self-employed persons in our analysis, or more precisely on such loans and advances to those borrowers that are not evidenced by certificates. This obviously leaves out a number of a bank's assets: inter-bank lending, government lending, securities (shares, bonds), non-financial assets. To get a first idea about the relevance of the loan volume examined here, it is helpful to inspect the relation between the analyzed portfolio and a portfolio consisting not only of loans but also including bonds and shares (cf. Figure 1).

Fig. 1. Loan volume analyzed in relation to total lending to non-banks (loans and advances not evidenced by certificates)



As is obvious from Figure 1, the lending analyzed accounts for approximately 50% of all bank lending (loans as well as advances not evidenced by certificates) to non-banks, with notable deviations across bank categories at the beginning of the sample period and smaller ones at the end. Recall, among others, that we had mentioned earlier that big banks much later than other banks went into retail business with private customers. We will return to the issue and what it means for competition below.

The significance of some structural breaks is also visible in Figure 1. Many structural changes in our data occur, most of them with minor importance. The more relevant ones are as follows:

- Between June 1980 and June 1981 the German Central Bank reorganized its industry classification.²⁰ The jumps in Figure 1 indicate that the general effect was an increase in loans assigned to industries which are part of our study. And indeed, the total loan volume analyzed in our study increased by almost 50% (cf. Table 3). The main reason for this effect was that corporate mortgage loans, previously a separate category not contained in our analysis, are now assigned to the borrower's industry.

The distortions caused by the 1980/1981 changes were neither the same for all industries nor for all bank groups. For example, the services industry's share of the total loan volume considered here jumped by more than 12 percentage points at the expense of all other industries except financial institutions and insurance; Table 3). The share of the same industry in the cooperative banks' loan exposure, as a close look at the underlying data reveals, only increased by 1 percentage point while the banks' under public law exposure experienced an increase by 10 percentage points.

- Another remarkable break is due to the German reunification. From July 1990 onwards the German Central Bank summarizes former East and West German banks in their statistics. This comes with an increase in the total loan volume considered here of about 10% (cf. Table 3). In terms of Figure 1, mainly commercial banks (and other banks) are affected. They must have experienced a more than proportional, but non-permanent increase in those loans that are analyzed here.
- The currency in which the outstanding loan volumes were quoted changed from DM to € over the sample period. For this paper, all values have been converted into €. In the absence of money illusion, this does not cause any difficulties for our analysis. Within-year ratios are unaffected by the choice of currency anyway.
- In 1999, two regional banks merged to become a big bank, as already mentioned.

For the moment we will ignore further breaks. They do not exhibit extraordinary impacts on the aggregated annual data. We also refrain in the

²⁰ For a detailed description see Deutsche Bundesbank (1981), in particular the explanations to the relevant Tables on pages 62 and 70.

Table 3

Loan market portfolio analyzed (few industries)

June	1970	...	1980	1981	...	1990	1991	...	2003
Total loan volume [billion €]									
All Industries	103	...	257	382	...	693	766	...	1,267
Industry shares [%]									
EGW	5.05	...	6.03	4.80	...	3.82	3.60	...	2.92
Trade	18.20	...	19.58	17.70	...	16.57	16.36	...	12.38
TSC	10.81	...	10.62	7.99	...	5.72	5.92	...	4.12
SI	9.90	...	20.27	32.66	...	38.13	38.76	...	56.75
Con.	5.57	...	5.48	5.15	...	4.94	4.91	...	4.96
AHF	9.53	...	6.92	4.56	...	4.08	3.39	...	2.56
FII	1.47	...	2.47	3.19	...	3.11	3.41	...	3.84
Manu.	39.47	...	28.63	23.95	...	23.63	23.65	...	12.46

EGW $\hat{=}$ Electricity, Gas and Water Supply/Trade $\hat{=}$ Wholesale and Retail Trade/TSC $\hat{=}$ Transport, Storage and Communication/SI $\hat{=}$ Service Industry/Con. $\hat{=}$ Construction/AHF $\hat{=}$ Agriculture, Hunting and Forestry/FII $\hat{=}$ Financial Institutions and Insurance/Manu. $\hat{=}$ Manufacturing

meantime from rigorous statistical tests for breaks because we are not convinced that they would have any major effect on our results. How we handle breaks on a case basis will be made clear when appropriate.

To complete our assessment of the relevance of our loan portfolio, we should like to point out the following numbers: The loan portfolio analyzed covers around (i) 15-24% of total assets, (ii) 16-26% of total lending (loans, shares, bonds) to banks as well as to non-banks, and finally, (iii) 26-42% of all lending (loans, shares, bonds) to non-banks in June 2003.

We complete our discussion of the data used with yet another table. Taking our most recent data point, June 2003, as an example, it shows the loan volumes of all the bank groups broken down into the industries analyzed (cf. Table 4). Such a table is available for each year. It is particularly useful for understanding the indices to be defined next.

Table 4
Loan matrix

June 2003 [billion €]	Big banks	Regional banks and others	Branches of foreign banks	Banks under public law	Coop- erative banks	Other banks	All banks
EGW	8.5	3.5	0.5	17.3	2.1	5.1	37.0
Trade	22.9	19.4	6.7	59.9	29.3	18.7	156.9
TSC	5.3	6.0	0.3	25.7	4.7	10.2	52.2
SI	100.8	74.8	5.6	291.7	84.5	161.7	719.1
Con.	5.0	5.1	0.6	25.4	14.0	12.8	62.9
AHF	1.5	1.9	0.6	10.6	15.2	2.7	32.5
FII	11.1	4.1	1.3	20.3	4.3	7.6	48.7
Manu.	32.6	14.1	4.5	62.7	27.0	16.9	157.8
<i>Manu. (a)</i>	<i>3.4</i>	<i>1.0</i>	<i>0.7</i>	<i>4.5</i>	<i>0.8</i>	<i>1.3</i>	<i>11.7</i>
<i>Manu. (b)</i>	<i>1.5</i>	<i>0.8</i>	<i>0.3</i>	<i>3.3</i>	<i>1.3</i>	<i>0.7</i>	<i>7.9</i>
<i>Manu. (c)</i>	<i>1.7</i>	<i>0.6</i>	<i>0.2</i>	<i>3.1</i>	<i>1.2</i>	<i>1.0</i>	<i>7.8</i>
<i>Manu. (d)</i>	<i>4.8</i>	<i>2.3</i>	<i>0.6</i>	<i>10.7</i>	<i>4.7</i>	<i>2.3</i>	<i>25.4</i>
<i>Manu. (e)</i>	<i>7.2</i>	<i>2.8</i>	<i>1.3</i>	<i>10.1</i>	<i>3.4</i>	<i>3.7</i>	<i>28.5</i>
<i>Manu. (f)</i>	<i>4.3</i>	<i>1.7</i>	<i>0.5</i>	<i>6.2</i>	<i>2.5</i>	<i>2.2</i>	<i>17.4</i>
<i>Manu. (g)</i>	<i>4.9</i>	<i>2.2</i>	<i>0.3</i>	<i>13.4</i>	<i>6.5</i>	<i>2.6</i>	<i>29.9</i>
<i>Manu. (h)</i>	<i>3.4</i>	<i>2.0</i>	<i>0.4</i>	<i>9.0</i>	<i>5.3</i>	<i>2.1</i>	<i>22.2</i>
<i>Manu. (i)</i>	<i>1.4</i>	<i>0.8</i>	<i>0.2</i>	<i>2.4</i>	<i>1.3</i>	<i>0.9</i>	<i>7.0</i>
All industries	187.7	128.9	20.1	513.6	181.1	235.7	1,267.1

EGW $\hat{=}$ Electricity, Gas and Water Supply/Trade $\hat{=}$ Wholesale and Retail Trade/TSC $\hat{=}$ Transport, Storage and Communication/SI $\hat{=}$ Service Industry/Con. $\hat{=}$ Construction/AHF $\hat{=}$ Agriculture, Hunting and Forestry/FII $\hat{=}$ Financial Institutions and Insurance/Manu. $\hat{=}$ Total Manufacturing/ Manu. (a) $\hat{=}$ Chemical industry, manufacturing of coke and petroleum/ Manu. (b) $\hat{=}$ Manufacturing of rubber and plastic products/ Manu. (c) $\hat{=}$ Manufacturing of other non-metallic mineral products/ Manu. (d) $\hat{=}$ Manufacturing of basic metals and of fabricated metal products/ Manu. (e) $\hat{=}$ Manufacturing of machinery, equipment and vehicles/ Manu. (f) $\hat{=}$ Manufacturing of electronic and optical equipment/ Manu. (g) $\hat{=}$ Manufacturing of wood as well as paper products and furniture/ Manu. (h) $\hat{=}$ Manufacturing of food and tobacco/ Manu. (i) $\hat{=}$ Manufacturing of textiles and leather

4 Methodology

How should competition be measured? A glance at the literature easily reveals that there are not just one but many, maybe in fact too many, suggestions available. A thorough survey (cf. Northcott (2004)) is far beyond the scope of the present paper. Some remarks, however, seem necessary and important to

put our analysis into the right perspective.

Basically, the approaches to measure competition can be divided into two streams: structural and non-structural approaches.

Two famous examples of structural approaches are the Structure-Conduct-Performance paradigm and the efficiency hypothesis. The Structure-Conduct-Performance paradigm investigates whether a concentrated market causes non-competitive behaviour among operating banks resulting in superior bank performance (cf. Koutsomanoli-Fillipaki and Staikouras (2004)). On the other side, the efficiency hypothesis examines whether efficient firms increase their size and market share because of their ability to generate profits, resulting in growing market concentration.

Because of the structural models' theoretical as well as empirical deficiencies,²¹ non-structural approaches were developed (cf, e.g., Iwata (1974), Bresnahan (1982) and Panzar and Rosse (1987)). These New Empirical Industrial Organization approaches investigate market competition by examining banks' competitive conduct without considering information about market structure.

Due to data availability we can only follow the first stream, but before a few words on notation:²² .

- Let $X_i^{b,t}$ be nominal loan volume of banking group b , $b = 1, \dots, k$ ($k \geq 2$), at date t to industry i , $i = 1, \dots, n$ ($n \geq 2$). These are the entries in Table 4.
- By $X^{b,t} = X_1^{b,t} + \dots + X_n^{b,t}$ we will denote the sum of all loans of banking group b at time t , i.e. the sums of a column in Table 4, and by $X_i^t = X_i^{1,t} + \dots + X_i^{k,t}$ all loans to industry i at time t , i.e. the sums of a row in Table 4. $X^t = X_1^t + \dots + X_n^t = X^{1,t} + \dots + X^{k,t}$ is the total loan volume at time t included in our study, i.e. the number in the bottom right hand corner of Table 4 which is the sum of all entries.
- Then $Y^{b,t} = (X_1^{b,t}, \dots, X_n^{b,t})$ stands for the vector of loan volumes of banking group b at time t , i.e. a column in Table 4, and $y^{b,t} = (y_1^{b,t}, \dots, y_n^{b,t})$ denotes the vector of the shares of the industries in the portfolio of banking group b at date t , which is obtained by dividing by the column sum, i.e. $y_i^{b,t} = X_i^{b,t}/X^{b,t}$. The industry shares of total loans are given by the vector $y^t = (X_1^t/X^t, \dots, X_n^t/X^t)$, i.e. dividing the numbers of the last column of Table 4 by its sum.
- Similarly, we use $Z_i^t = (X_i^{1,t}, \dots, X_i^{k,t})$ for the vector of loan volumes to industry i at time t , i.e. a row in Table 4, and $z_i^t = (z_i^{1,t}, \dots, z_i^{k,t})$ denotes the vector of the shares of the banking groups in the financing of industry i at

²¹ The main problem of the structural approaches is how to interpret an observed positive relationship between profitability and concentration, i.e. does it support the Structure-Conduct-Performance paradigm or the efficiency hypothesis (cf. Berger and Hannan (1989) and Hannan (1991b)).

²² Later on, for convenience, we will drop sub- and superscripts whenever possible without creating confusion.

date t , obtained by dividing by the row sum, i.e. $z_i^{b,t} = X_i^{b,t}/X_i^t$.

- Given any vector $v = (v_1, v_2, \dots, v_n)$, the increasingly ordered version is denoted by a tilde, i.e., $\tilde{v} = (v_{(1)}, v_{(2)}, \dots, v_{(n)})$ such that $v_{(1)} \leq v_{(2)} \leq \dots \leq v_{(n)}$ holds.

4.1 Traditional concentration measures

When it comes to market shares, e.g. those of bank groups in the loan market in total or in the financing of single industries, simple measures like concentration ratios (cf. Koutsomanoli-Fillipaki and Staikouras (2004)) come to mind: They calculate the cumulative market shares of the largest 1, 2, 3, 4, ... suppliers, interpreting high numbers as much concentration and therefore little competition. Formally, for a vector v of market shares with $\sum_{i=1}^n v_i = 1$, the concentration ratio (CR) of degree c ($c = 1, 2, \dots$) is defined as

$$CR_c(v) = \sum_{j=0}^{c-1} v_{(n-j)}. \quad (1)$$

The concentration ratios are fairly crude measures. Apparently, given a fixed number of suppliers, also the more sophisticated Gini concentration index (GCI) can be used:

$$GCI(v) = \left(\sum_{i=1}^n \frac{2i-1}{n} v_{(i)} \right) - 1. \quad (2)$$

Abstracting from its normalization to the interval $[0, 1]$, the GCI measures the area between the Lorenz curve and the line of equal market shares.²³ It basically works just like the regular Gini index applied in inequality measurement (e.g., Atkinson (1970)). In passing note that all concentration ratios being higher for one distribution of market shares than for another is a sufficient, but not a necessary condition for the former distribution having a higher GCI than the latter.

Arguably the most widely applied concentration measure is the Hirschman-Herfindahl index (HHI):²⁴

$$HHI(v) = \sum_{j=1}^n v_j^2. \quad (3)$$

Unlike the GCI, which requires that v is of fixed length, the HHI can be applied and compared irrespective of the number of suppliers, say. If all

²³ $GCI(v) = 0$ indicates no concentration, i.e. no deviation from equal market shares, while $GCI(v) = 1$ indicates complete concentration.

²⁴ For a very recent example cf. Acharya et al. (2004).

supply comes from one source, the HHI and the GCI (with $n = 1$) become 1; if the supply is evenly spread across (all) n suppliers, the GCI becomes 0 and the HHI becomes $1/n$. If the HHI has the value h this can be interpreted as follows: competition is as if total supply was evenly spread across $1/h$ suppliers. Therefore the HHI can also indicate the number of suppliers. In our study this is no special advantage because the total number of suppliers is fixed ex-ante due to the choice of the competing bank groups we analyze.²⁵

4.2 Distance measures

Limitations of concentration measures

The GCI and the HHI both share the feature that, given a fixed number of suppliers, competition is maximized when market shares are all equal. This is appropriate and makes sense on a fairly general level of interest. In our case, however, it does not really catch everything we are interested in.

Suppose we want to assess the lender competition in, say, manufacturing. And to make the point let us suppose, contrary to the actual data in Table 4, that our fixed number of bank groups shared total lending to manufacturing firms equally. Then both indices would signal a maximum of competition in lending to manufacturing. However, as we had pointed out earlier, our data allows manufacturing to be split up into nine sub-industries. It is conceivable that lending is concentrated in each of these on one or few bank groups (but of course different ones in each case), i.e. concentration in sub-industries may cancel out in the aggregate manufacturing. Obviously, calculating concentration measures on the most disaggregated level available will make this visible.

Now suppose concentration were (almost) equal in all industries, on the most disaggregated level available, and let this degree of concentration be also (almost) equal to the overall concentration, i.e. the degree of concentration calculated using the bank groups' market shares of the total commercial loan market. This situation can come about by each bank group having about the same market share in each industry, which in terms of Table 4 would mean that all rows are multiples of each other. But other cases are conceivable. For example, the data may be such that two or three bank groups partially "exchange" their portfolios but still leave concentration basically unaffected in each market. There is no way to detect this when just looking at the concentration in industries. Calculating the concentration of the bank group's lending, i.e. applying concentration measures to the columns of Table 4, would also not work because those exchanges may hardly affect these numbers either.²⁶

²⁵ In all industries considered, all bank groups possess a non-zero market share.

²⁶ Even starting from the case with equal values for the HHI in all industries and for all bank groups, it is fairly easy to come up with examples where changes in

Properties of distance measures

What we suggest here instead is the use of distance measures. Unlike concentration measures, they do not automatically use the equal distribution of shares as their reference point, but require an explicit benchmark. In our study, two different applications make sense.

Firstly, we calculate the deviation of the industry composition of a bank group's loan portfolio from the market aggregate. An advantage of measuring the deviation between a bank group's column of Table 4 and the column on the very right,²⁷ i.e. the industry composition of the whole commercial loan market, and not just comparing the degrees of concentration inherent in these columns is the following: A concentration measure provides only information how *concentrated* the portfolio is. By measuring the deviation from a market benchmark, we do get an idea how *similar* the bank group's portfolio is to its market analogue. A decrease over time, for instance, will indicate that the bank group is becoming less specialized with respect to the market, i.e. has either lost or voluntarily given up some of its advantages in special industries.

Secondly, we calculate the deviation of the composition of an industry's financing mix, i.e. the break down of the loans to this industry by bank groups, from the shares the bank groups have in the whole commercial loan market. This amounts to comparing the industry's row in Table 4 with the bottom row.²⁸ It is a second way of detecting that bank groups are focusing on different industries in the sense of deviating in their lending to them from their shares in the market as a whole. And this can occur even when a concentration measure for this industry would exhibit the same degree of loan concentration as in the market as a whole.

In order for distance measures comparing two distributions to make sense, the measures must have certain properties. Firstly, *identity*, i.e., the measure should assign a value of zero, indicating that there is no deviation, to a pair of distributions (v, u) if and only if these are identical. It is convenient if the measures are positive otherwise, with larger deviations showing up as larger index values.²⁹ Secondly, it often makes sense to require *symmetry*, i.e., it should not matter which of the two distributions is used as the benchmark. This property is not required, however, if deviations are always measured from the same reference point.

A function D with the two properties named above is called a *quasi-metric*.

the ranking of banks according to their importance of creditors of certain industries occur while simultaneously having changes in the HHI at most in the third decimal.

²⁷ Both columns are divided by their respective sums in order to compare distributions of shares.

²⁸ Both rows are divided by their respective sums in order to compare distributions of shares.

²⁹ Notice, $\tilde{v} = \tilde{u}$ and $v \neq u$ then imply $HHI(v) = HHI(u)$ but $D(v, u) > 0$.

For D to be a *metric* it would also have to satisfy the triangular inequality $D(v, u) + D(u, w) \geq D(v, w)$. This property does not seem to have an immediate interpretation in our context and hence we do not require it here. However, we also see no reason *not* to require this property either and so some of our measures, e.g. the Euclidean distance, will have it. The measures we present below all are such quasi-metrics and have another nice feature. They are normalized to the interval $[0, 1]$, i.e., the deviation from the benchmark cannot exceed 1.

Examples

In order to quantify the distances between distributions of shares (of industries' shares in a bank portfolios or of bank groups' shares in an industry's loans), we suggest the following three measures:

Measure 1 *Maximum Absolute Difference*

$$D_1(v, u) = \max_i \{|v_i - u_i|\} ; \quad D_1 \in [0, 1]. \quad (4)$$

Measure 2 *Normalized Sum of Absolute Differences*

$$D_2(v, u) = \frac{1}{2} \sum_{i=1}^n |v_i - u_i| ; \quad D_2 \in [0, 1]. \quad (5)$$

Measure 3 *Normalized Sum of Squared Differences*

$$D_3(v, u) = \frac{1}{2} \sum_{i=1}^n (v_i - u_i)^2 ; \quad D_3 \in [0, 1]. \quad (6)$$

Before we start analyzing the given data, it is important to highlight some additional properties of our distance measures, although some of our readers have probably seen these or similar measures before. D_1 just gives the maximum absolute difference, $|v_i - u_i|$, between distribution v and distribution u that occurs in any one component, i.e. for a single bank group or industry. It is therefore insensitive with respect to the rest of the distribution. D_2 is the arithmetic mean of these component-wise absolute differences, transformed by multiplication with $\frac{n}{2}$ to achieve the desired normalization. It tells us the proportion of distribution v which has to be rearranged in order to achieve distribution u or vice versa. The (also slightly transformed) second moment of the absolute differences, D_3 , allows that two distributions with, e.g., big differences in two industries are considered "further apart" than two distributions with maybe more but generally smaller differences. This can be seen from a simple example. Assume $u = (1, 0, 0)$; $v = (0, 1, 0)$; $w = (0, \frac{1}{2}, \frac{1}{2})$ and then realize that $D_3(u, v) > D_3(u, w)$, whereas $D_1(u, v) = D_1(u, w)$ and $D_2(u, v) = D_2(u, w)$. Hence we are prepared to state that in this example D_3 better matches the intuition than both D_1 and D_2 .

4.3 Regression analysis

From time to time we will amend our analysis of concentration and distance measures by looking at particular regression models. We refrain from a more detailed outline of this standard technique here, but will provide additional methodological remarks when such issues come up.

5 Empirical results

Let us now turn to our empirical analysis and its results. We will proceed in a number of steps. Firstly, we provide an assessment of the competitiveness in the commercial loan market as a whole. We then examine, secondly, whether any changes in competitiveness have gone along with an increase in focus or an increase in diversification of the banking groups commercial loan portfolios. In a third step, we look at the financing of single industries, i.e., we analyze the apparent concentration in their loans.

5.1 Concentration of the commercial loan market as a whole

From Figure 1, we were able to see that the loan volume analyzed in our study as a percentage of the bank groups total lending underwent some changes. This may have had several reasons. As a tentative explanation for the decline of this ratio for big banks, we had already mentioned that an increase in other lending activities might have been the cause. Yet it is also conceivable that big banks have partially retreated from and other banking groups extended into the market analyzed here. Thus, it is obviously necessary to look into the data more deeply in order to come up with some reliable statements on the change in the competitiveness of the commercial loan market.

One way to get an additional insight into this issue is by looking at the bank groups' time series of the total volumes of loans analyzed here, i.e. by examining the evolution of $X^{b,t}$ over t for the bank groups b . We report three numbers for each bank group to describe the trend:

- The arithmetic means of the annual growth rates $((X^{b,t+1} - X^{b,t})/X^{b,t})$,
- the geometric growth rates over time, i.e. $(X^{b,2003}/X^{b,1970})^{1/33} - 1$,
- the slope coefficients of a simple OLS regression of $X^{b,t}$ on t .

The results are collected in Table 5.

These numbers can be interpreted as follows. All bank groups show solid increases in their commercial loan portfolios. Therefore, the changes in market shares have not arisen because some of them have reduced their exposure. As was suspected, however, the big banks' growth rate is among the smallest

Table 5
Loan market development

	Average growth rate	Geometric growth rate	OLS Slope coefficient (R^2)
Whole market	8.22%	7.91%	40.264 (0.96)
Big banks	7.72%	7.23%	6.180 (0.84)
Regional banks and others	8.56%	6.65%	4.932 (0.72)
Branches of foreign banks	9.95%	8.21%	0.488 (0.71)
Banks under public law	9.24%	8.85%	15.429 (0.94)
Cooperative banks	8.27%	8.11%	5.866 (0.97)
Other banks	8.51%	7.45%	6.619 (0.88)

two. Notice that without the enlargement of this group via the two previous regional banks mentioned earlier, the growth rate would be still lower. This loss of two large members in 1999 lets the geometric growth rate of the regional banks fall quite dramatically when compared with the average growth rate, the reason being that the former is fully affected, yet the latter only in one year. At the other end of the spectrum, the banks under public law's growth rate is among the top two. The branches of foreign banks have also grown much, pointing at an increased success in commercial lending in Germany.

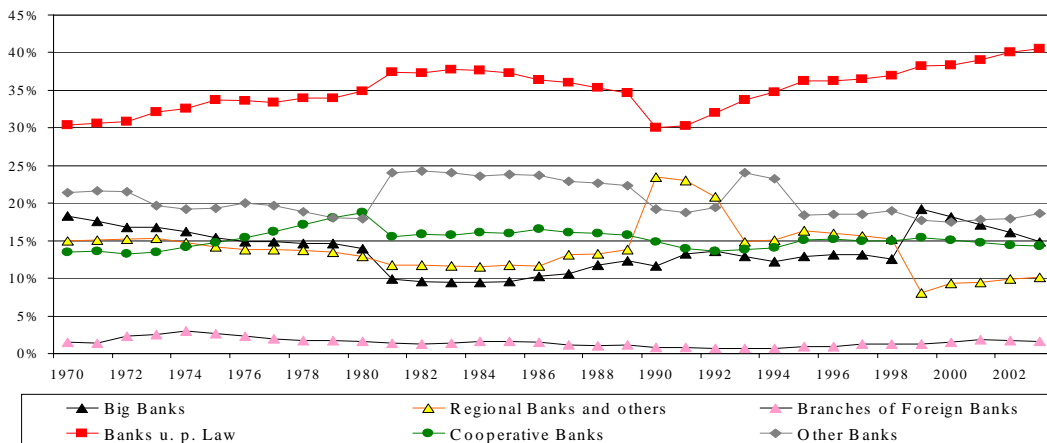
While the growth rates indicate the relative changes of the bank groups' loan exposures, the OLS slope coefficient measure the average absolute changes per annum. Consequently, the slope coefficients vary stronger among bank groups than the growth rates. The absolute changes of bank groups' loan exposures are significantly affected by bank groups' absolute loan exposure and the absolute changes of each bank group add up to the change of the whole market.³⁰

The observations from Table 5 imply changes in market shares. The relatively low growth rates of the big banks must go along with a declined market share, mitigated by the addition of a new member. In contrast the relatively high growth rates of banks under public law should yield a marked increase in market share. We can get more insight into these issues by explicitly looking at the bank groups' shares in the loan volume considered, i.e. $X^{b,t}/X^t$, over time. In Figure 2 the resulting curves are shown in comparison.

Obviously, there is indeed some change in the market shares. We have already mentioned the changes induced by the change in the loan classification 1980/1981 and by the merger of two regional banks to become a big bank in 1999. What is astonishingly time invariant is the other categories' internal structure, not shown explicitly in this paper. For banks under public law, approximately 60% of the loan volume comes from savings banks and the

³⁰ The R^2 stated indicate how good the OLS (linear) regression actually fits the development of bank groups' absolute loan exposure.

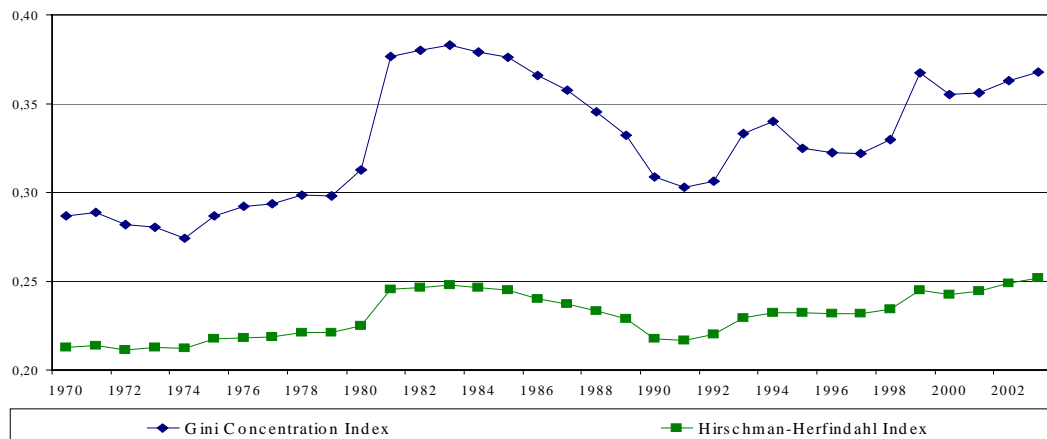
Fig. 2. Market shares of the examined bank groups



remaining 40% from state banks. More dispersed, but also almost time invariant, is the cooperative banks' internal division; credit cooperatives account for more than 80% of the loan volume and their regional institutions for the remaining part.

Banks under public law apparently have steadily increased their market share since reunification after an up and down before that. The effect on concentration is worth examining. CR_1 is implicitly contained in Figure 2 by selecting, for each t , the highest point and connecting all such points, i.e. the market share of banks under public law equals CR_1 and at the end this is higher than ever before. Taking the vector of the bank groups loan volume shares y^t for some t , the concentration of the loan volume at this point of time can be calculated for other measures, too. Figure 3 shows how GCI and HHI have changed over time. Both more or less confirm the observation based on CR_1 , which by no means is always the case, with the GCI being the most sensitive with respect to recent structural breaks.

Fig. 3. Concentration of the loan market among the examined bank groups



Concerning competitiveness on the commercial loan market as a whole, we may sum up our findings as follows. Basically, concentration has increased, and therefore competition decreased, over the last decade; there is slight disagreement amongst the measures whether the most recent degree of concentration is a new "all time high" or falls just short of the maximum reached in the early eighties.³¹

5.2 *Changes in the concentration of the bank groups' loan portfolios*

The observed changes in concentration on the macro level can result from very different underlying developments on the bank group level. For example, even when retaining a constant share of the loan market analyzed, a bank group may have focused its loan origination by increasing its exposure in industries in which it already had been stronger while decreasing it in other industries. But alternatively reducing focus and increasing diversification may eventually have lead to the same overall result. Hence it is the purpose of this section to find indications whether focus or diversification more likely were the drivers behind the observations of the previous section.

Obviously, the traditional concentration measures introduced earlier are sensible ways to measure how focused the bank groups were over time. Consequently, Figures 4, 5, 6, and 7 show the time series of $CR_1(y^{b,t})$, $CR_3(y^{b,t})$, $GCI(y^{b,t})$, and $HHI(y^{b,t})$ for the banking groups. Each of these figures also contains, as sort of a benchmark, the same index calculated for our whole loan portfolio y^t .

³¹ This observation is consistent with Koutsomanoli-Fillipaki and Staikouras (2004) finding that from 1998 to 2002 European banks operate under monopolistic competition.

Fig. 4. Concentration of bank groups' industry exposures – CR_1 (few industries)

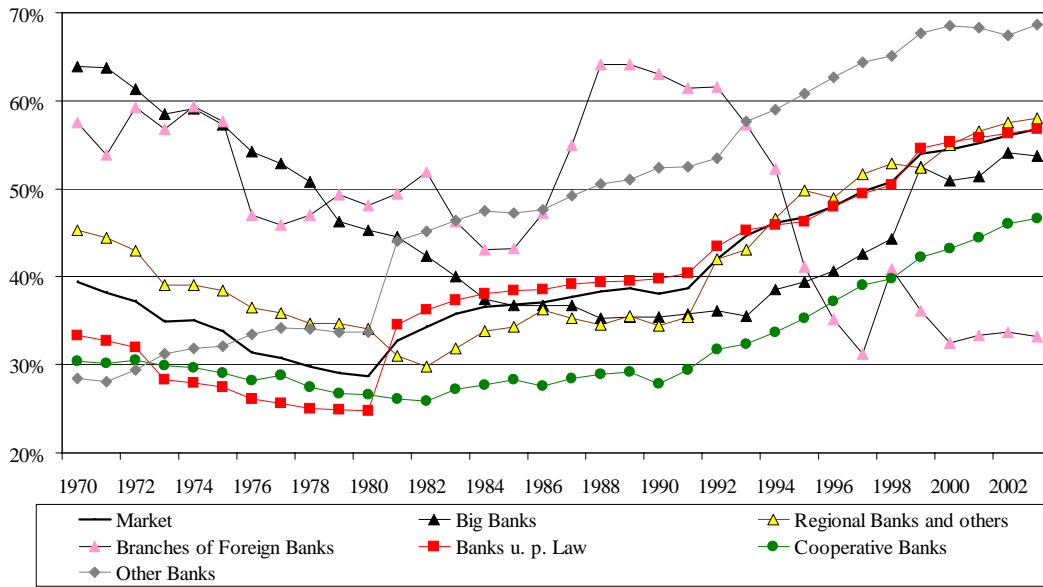


Fig. 5. Concentration of bank groups' industry exposures – CR_3 (few industries)

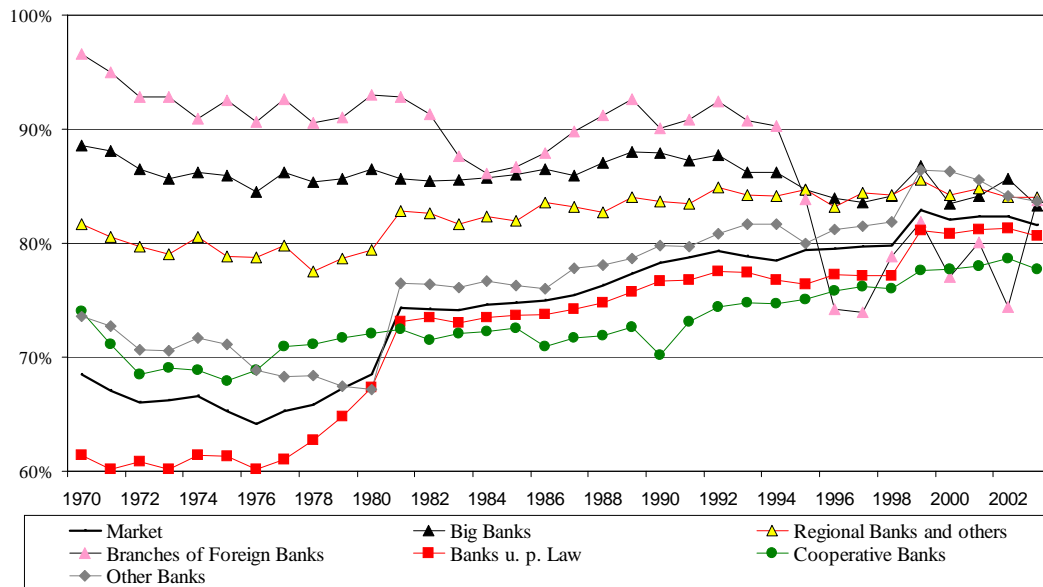


Fig. 6. Concentration of bank groups' industry exposures – GCI (few industries)

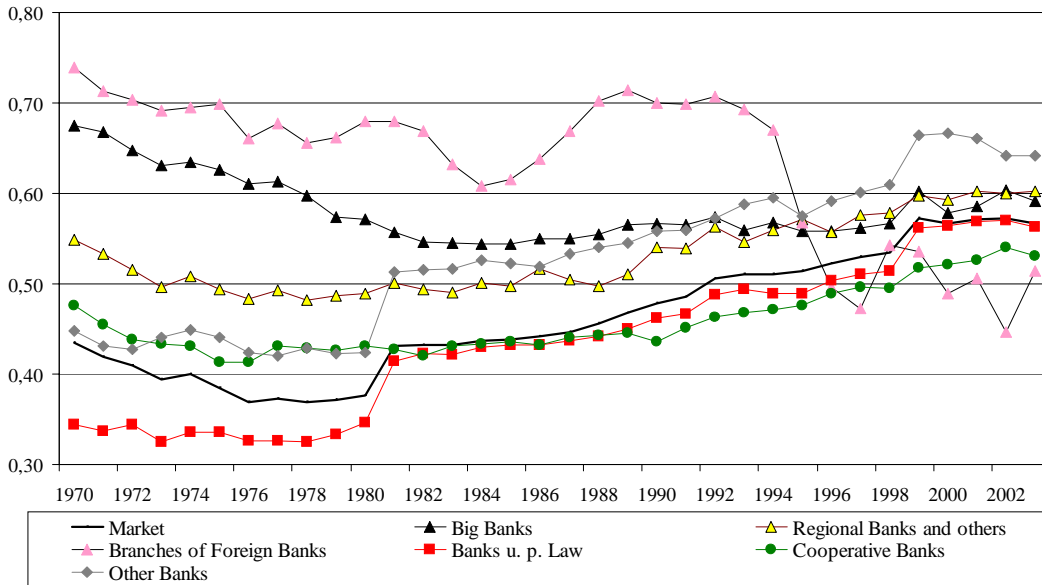
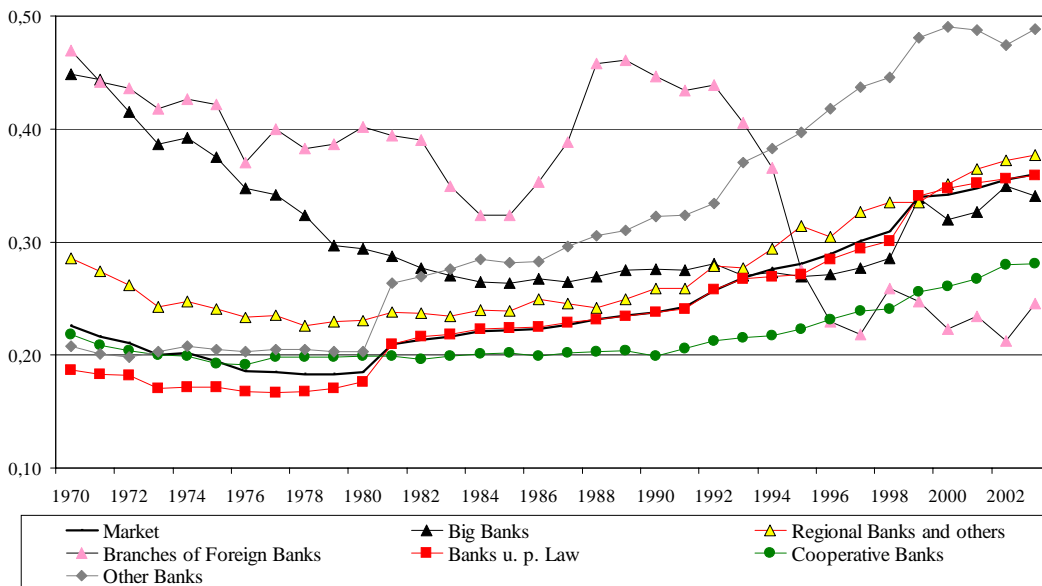


Fig. 7. Concentration of bank groups' industry exposures – HHI (few industries)



From these figures, the following insights emerge. CR_1 shows, for all bank groups except for the branches of foreign banks, clearly an upward trend in concentration since the early eighties. Alas, CR_1 in Figure 4 represents the share of the bank groups' loans in their largest industry and is therefore strongly driven by the way industries are classified. Looking at Table 3, the size of the services industry is dominating the market portfolio and is still

growing since 1981. Thus, the upward trend in CR_1 does not really come as a surprise, and we are prepared to argue that it does not necessarily represent a genuine case of more focus either. It is worth noting that (only) the branches of foreign banks seem to act differently by actually reducing the relative size of their largest industry.

Looking at Table 3 once again, the main observation for Figure 5 is also somewhat less dramatic. At the end of the period, only three of the eight industries have double-digit market shares which make up about 80% of the whole commercial loan market. It is therefore not surprising that, finally, all bank groups cluster around this value. The more dispersed industry compositions in the beginning are in line with the initially lesser importance of the then largest three industries, probably combined with an exposure of branches of foreign banks to only a very few customers. Noteworthy is, in addition, that big banks and regional banks have a very visible upward trend for CR_1 , but not for CR_3 . In their case, the increase in the share of the largest industry must have been compensated by decreases in the loan exposure to numbers two and three.

The above figures provide some indication whether increases or decreases in bank groups' portfolio concentration are underlying the changes in competitiveness. However, the indices used have a problem which can be explained quite clearly and easily for the HHI, but also affects the GCI and the CRs.

Suppose, a portfolio's concentration according to the HHI has strongly decreased. Then the new portfolio is much closer to an equal distribution of loans across industries. Suppose furthermore, as is typical for the whole sample period (cf. Tables 2 and 3), that the industries examined differ quite a bit in size. Then the same move towards less concentration would have been a move away from mimicking the industry composition of the whole market's loan portfolio. If the market is very competitive in the sense that bank groups lose specific advantages in industries, e.g. their superiority in monitoring, then we would expect to see an equalization of the industry compositions in the bank groups' (aggregated) portfolios, i.e. a change approaching the industry composition of the market's loan portfolio. This may mean an increase in the HHI for some bank groups, typically those who were weak in large industries, and a decrease for others; and it is precisely this reason why the traditional concentration measures alone do not supply sufficient information to answer our question.

Thus, we apply the distance measures suggested above to pairs of vectors of portfolio shares, $(y^{b,t}, y^t)$. Figures 8, 9, and 10 show how the distances from the industry composition of the whole market's loan portfolio have developed over time, for each of the banking groups, when using these measures.

The arguably most striking feature obviously is found for the branches of foreign banks. For all the traditional concentration measures except CR_3 , this bank group has the least concentrated commercial loan portfolio in 2003.

At the same time, this bank group has the widest deviation, for all three distance measures and with a huge margin, from the industry composition of the market's loan portfolio. Apparently, the branches of foreign banks have exposures of relatively similar size to the industries, and it is exactly that what makes them so different from everybody else. Notice, again, that with industry shares in the whole commercial loan market as different as they are (cf. Table 3) it would not be possible that all bank groups have a low degree of concentration anyway.

Fig. 8. Deviation of bank groups' industry shares from the market – D_1 (few industries)

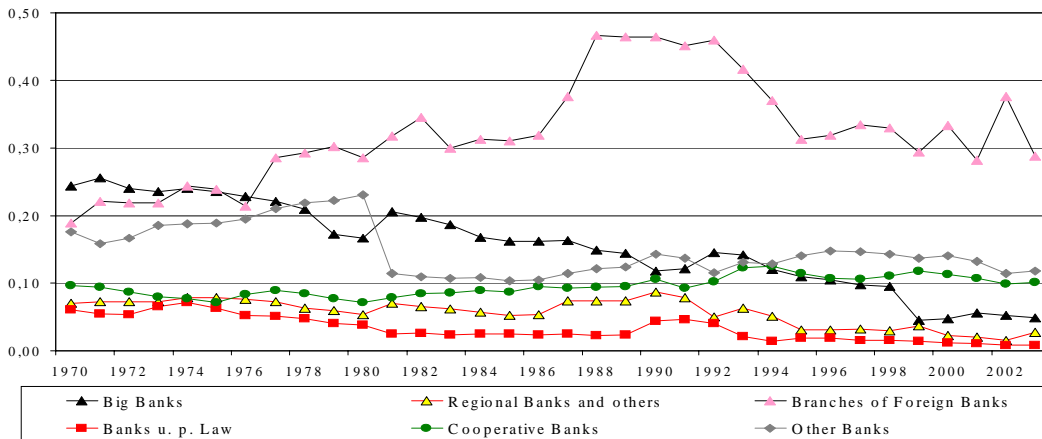


Fig. 9. Deviation of bank groups' industry shares from the market – D_2 (few industries)

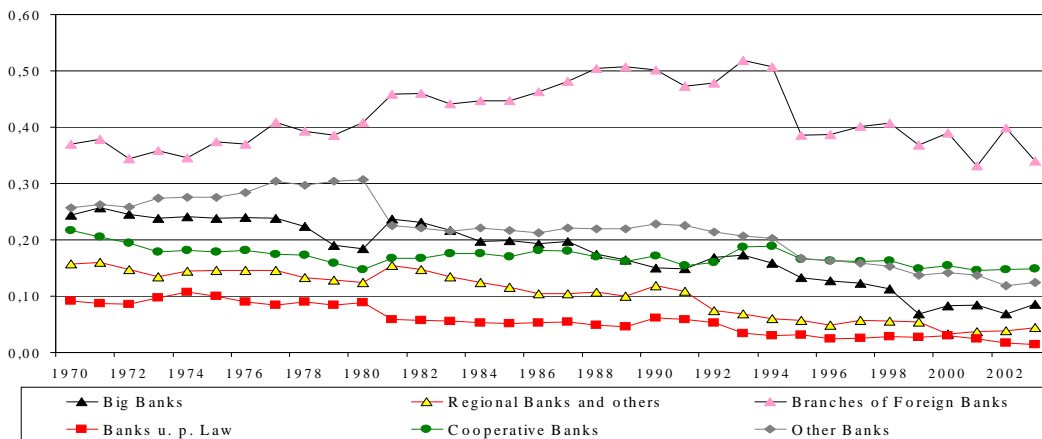
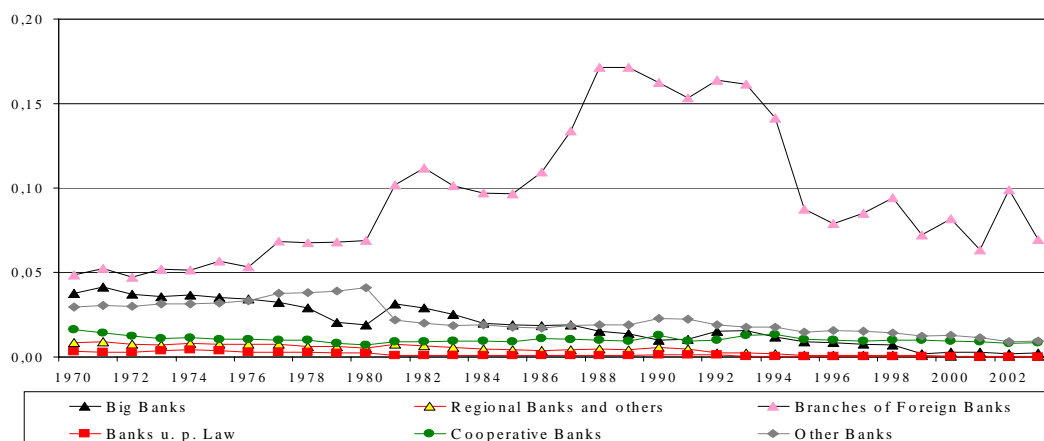


Fig. 10. Deviation of bank groups' industry shares from the market – D_3 (few industries)



We have already mentioned the huge deviation of branches of foreign banks from the market. The ranking of the other bank groups, starting with the closest to the market, has some relatively stable elements across measures and over time. Banks under public law and regional banks, in this order, usually are closest to the market.³² Cooperative banks and the other banks, sometimes interchanging ranks, are certainly farther away. A very notable change can be seen for the big banks: They were fifth in distance in 1981 (see below) but due to a very significant reduction of their deviation come in at about third rank in 2003.

The preceding observation directly hints at the next issue, the analysis of any trends in the distance measures over time. The time trends are almost identical across bank groups and distance measures, namely a more or less pronounced trend to hold the same industry composition as seen in the market. Our diagnosis of this development, of course, does not only rely on a visual inspection of Figures 8 through 10, but is backed by some descriptive statistics in Table A.1. There we provide for these distance measures, as well as for the traditional concentration measures which we only had discussed on the basis of the very transparent figures earlier, three numbers, two of which are characteristics of the trend:

- We perform simple OLS regressions of the concentration/distance measures on time. From the fitted values, \hat{y} say, we calculate $\gamma = \frac{\hat{y}_{2003} - \hat{y}_{1970}}{\hat{y}_{1970}}$. By

³² Those who are astonished that regional banks, including private bankers, both of which are typically limited in their geographical outreach, are so close to the German market average should remind themselves that we are using aggregates. If regional banks, including private bankers, are spread all across Germany sort of evenly, then the observation should not be so much of a surprise anymore.

this definition, γ is the percentage change in the value of the concentration/distance measure over the sample period, calculated from the fitted linear trend.³³ (R^2 is reported to show the goodness of fit of this simple linear regression.)

- RC is the Spearman rank correlation coefficient between the concentration/distance measures and the distance to date. It is used to check for monotonic trends which are not necessarily linear, which seems to make it particularly useful in our case. Positive values indicate a downward trend in the distance to the market over time.

The results are very clear. For branches of foreign banks, both characteristics agree for all three distance measures that the distance to the market has increased. For all other bank groups, both characteristics agree for all three distance measures, except for distance measure D_1 for cooperative banks, that the distance to the market has decreased over time. The reductions are often pretty large and the rank correlations generally fairly high. The goodness of fit of the indicative regressions, which should not be taken too serious as such, not surprisingly varies quite a bit.

The changes in the concentration of the bank groups' loan portfolios and their deviations from the industry composition of the whole commercial loan market can be summarized as follows. With the exception of branches of foreign banks, all bank groups increased the degrees of concentration, measured with traditional indices including HHI and GCI, of their commercial loan portfolio. But at the same time, the analysis using distance measures reveals that in fact the loan portfolios of these bank groups have all become much more similar to the industry composition of the whole loan market. In terms of competition this suggests that the bank groups have either not tried or not succeeded in exploiting superior monitoring abilities due to specializing in industries. The inability of traditional concentration measures, unlike distance measures, to detect this feature is quite obvious. In all, (increasingly) similar portfolio structures seem to indicate that focusing on single industries is not an important approach in the competition within commercial lending in Germany.

5.3 *Concentration in the lending to industries*

In order to realize one of the biggest advantages of working with aggregate data, we now change the perspective. So far the loan portfolios of bank groups were compared with the loan market structure trying to identify adjustments. In this section, the actual financing mix of an industry, i.e. the distribution of its loans across all bank groups is our key interest. This is, again, done in two steps, using concentration measures first and then applying distance

³³ Therefore the reduction is more than 100% in some cases.

measures.

Firstly, therefore, we calculate the concentration measures $CR_1(z_i^t)$, $CR_3(z_i^t)$, $GCI(z_i^t)$, and $HHI(z_i^t)$ for each industry i . Figures 11, 12, 13, and 14 show the resulting time series. Each of these figures also contains for comparison the corresponding time series for the whole loan portfolio z^t as a reference, which already was analyzed in Section 5.1.

Fig. 11. Concentration in the lending to industries – CR_1

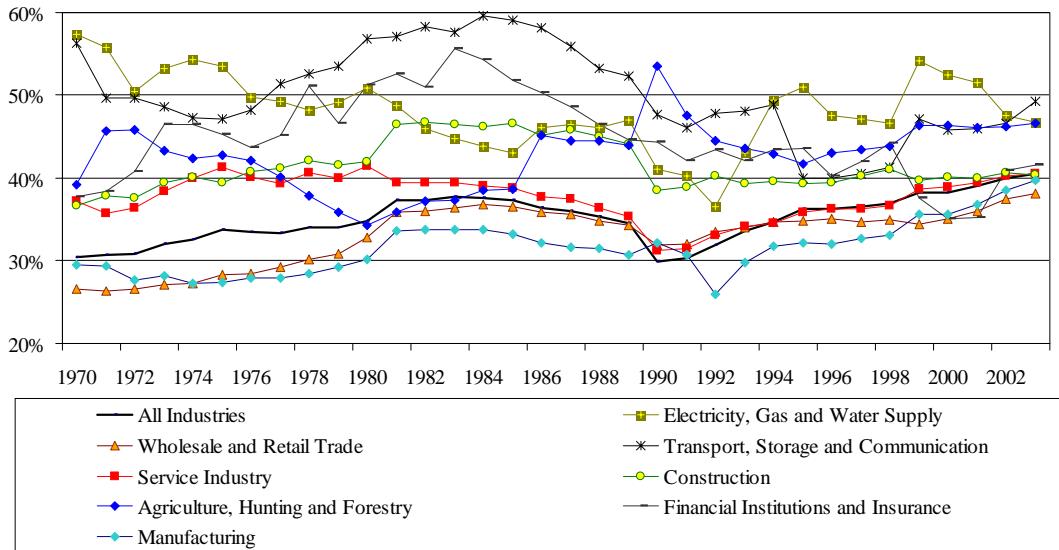


Fig. 12. Concentration in the lending to industries – CR_3

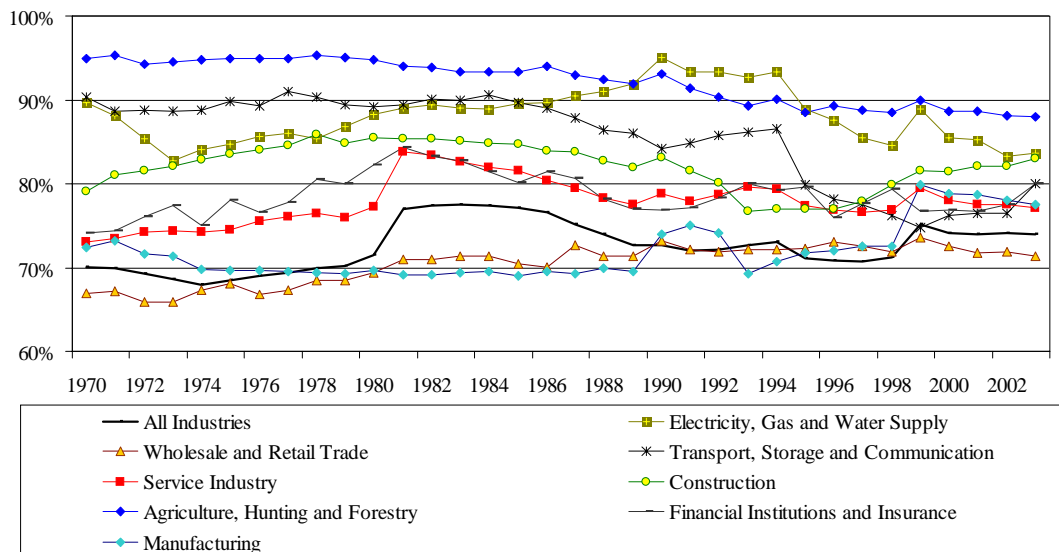


Fig. 13. Concentration in the lending to industries – *GCI*

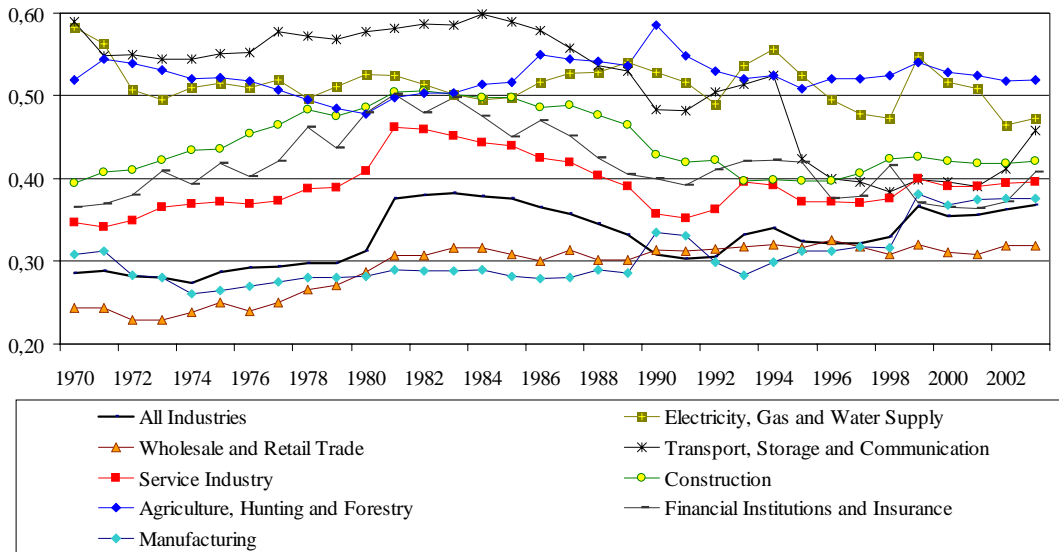
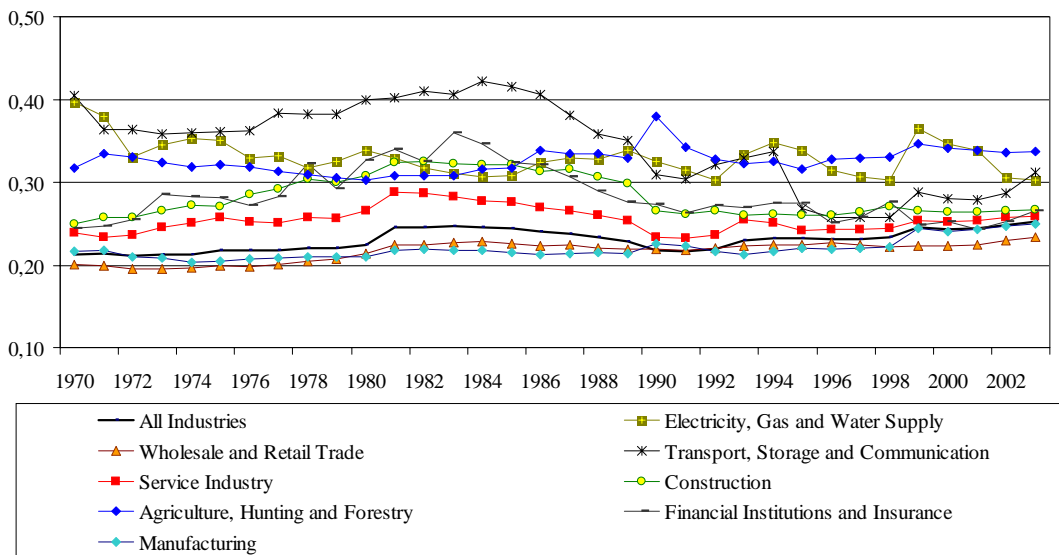


Fig. 14. Concentration in the lending to industries – *HHI*



The figures provide some indication whether the changes in the loan concentration when viewed from an industry viewpoint has increased or decreased over time. By comparing an industry time series with the market reference, one can also get an idea how correlated the changes in concentration are. The following insights emerge.

Firstly, the spread in the share of the largest creditor in an industry, CR_1 , is

greatly reduced from between about 25% to 60% to about 40% to 50%. That means the differences between the creditor concentration in industries have become smaller according to this measure. The feature of a reduced spread in concentration across industries exists for the other traditional concentration measures, too, albeit to a (numerically) lesser extent.

For a better understanding of the values for CR_1 , recall from Figure 2 that the largest bank group, banks under public law, has increased its market share from 30% to 40%. As we will see below, this bank group does not have its average share in all industries, but it certainly makes sense that its increase by 10 percentage points puts an upward trend on the minimum of CR_1 . The reduction in the spread of CR_1 fits very nicely into the picture generated by our distance measures because the increased similarity of the bank groups portfolios tends to require a reduction of deviations in the single sectors.

At any point of time there are several industries with a higher concentration in terms of CR_1 than the whole commercial loan market and other, fewer industries with a lower degree of concentration (cf. the respective line for the market, i.e. for all industries, in Figure 11). This feature also basically holds for the other traditional concentration measures as well.

Secondly, the above figures also give an impression which are the industries with a fairly highly concentrated credit supply and which industries have a more evenly split debt structure. Leaving temporary deviations from the general picture and slight differences between the measures aside, one can say that (i) electricity, gas and water supply, (iii) transport, storage and communication, and (vi) agriculture, hunting and forestry generally have a more concentrated credit supply, whereas wholesale and retail trade as well as manufacturing are on the less concentrated side.

Thirdly, the concentration measures' trends over time for the single industries can be deduced from these figures. As they are not always very clear from these pictures, however, we are better off deriving the basic messages from Table A.2. Recalling that positive values for γ and negative values for RC indicate an increase in concentration, a number of observations emerges.

Overall, i.e. for all industries, concentration has gone up according to all four traditional concentration measures and both characteristics.

However, this clear picture does not at all result from unambiguous changes on the industry levels. It is mainly driven by the initially largest industries, trade and manufacturing, and is not screwed up by the now largest industry, services, because that has mixed results. A small industry, transport, storage, and communication, has the strongest opposite trend (decreased concentration); this trend is also unambiguous, but less pronounced, for construction.

The concentration measures tell us something about the size distribution of the shares of creditors in financing an industry. But we are basically left without a clue whether the big players are the same in each industry or not. This

again can be picked up by distance measures. We calculate the deviation of an industry's true loan composition from the hypothetical composition assuming that each bank group holds a proportion according to its overall market share. This is done for all industries and all three distance measures.

Fig. 15. Deviation of the industries' financing mix from the market average – D_1

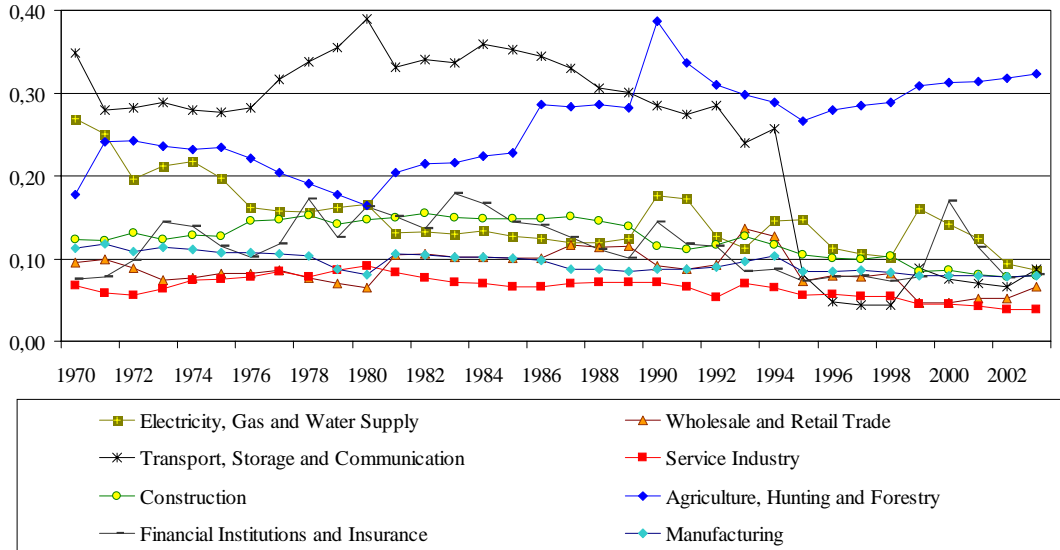
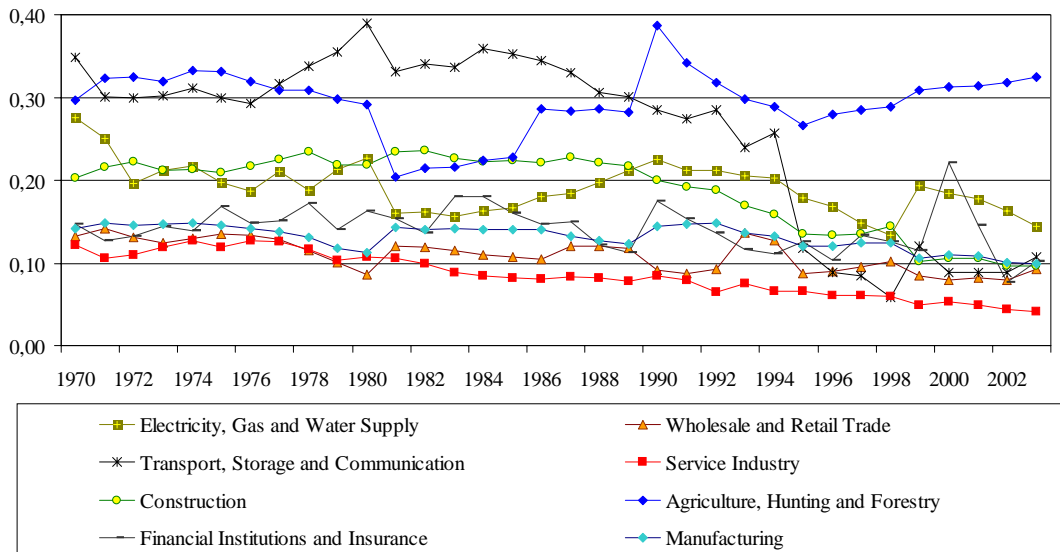
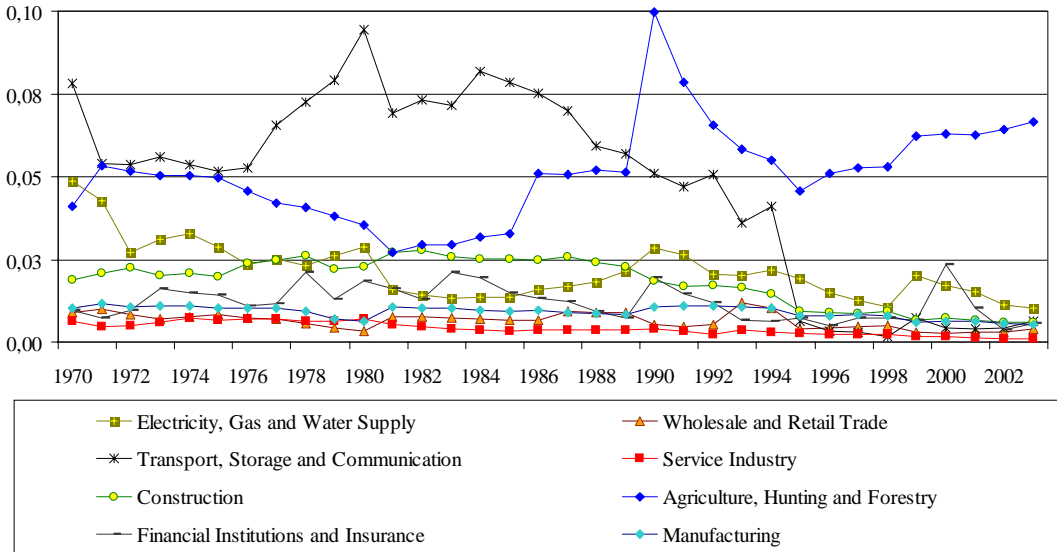


Fig. 16. Deviation of the industries' financing mix from the market average – D_2



A number of observations emerge from these figures. Financing in three industries starts being relatively more different from the market average than in others: (i) transport, storage and communication; (ii) agriculture, hunting

Fig. 17. Deviation of the industries' financing mix from the market average – D_3



and forestry; (iii) electricity, gas and water supply. This observation holds for all distance measures. The industries are the same that had a more concentrated financing mix than the others according to the traditional concentration measures. By additionally looking at the distance measures, we learn that the higher concentration was accompanied by a farther distance from the bank groups' shares in the whole commercial loan market. Note that it could have been the opposite: the less concentrated industry financing mixes could have been farther away from the market average.

For D_1 , taking into account only the bank group with the largest deviation, we see the following:³⁴ While the deviation in electricity, gas and water supply started dropping right away and is fluctuating since, in transport, storage and communication it has only dropped in the mid nineties; the deviation of the loan origination to agriculture, hunting and forestry from the market average, however, has not really declined at all over time, but seems to follow longer cycles. Again, the picture for the other distance measures is fairly similar.

Our description of the development over time has been a bit vague in the preceding paragraph. This is because an interpretation is clearly more difficult

³⁴ While the bank group responsible for the development of D_1 in the electricity, gas and water supply industry changes often through out our sample period, in the transport, storage and communication industry basically through out the whole sample, i.e. from 1970 till 1997, other banks are responsible for the D_1 development. During the last 5 years of our sample banks under public law cause the highest deviation. In the agriculture, hunting and forestry industry also other banks possess the highest deviation from the market average from 1970 till 1980, while cooperative banks are responsible from 1981 onwards.

than when we had applied the distance measures to bank groups. This not just because of the greater number of lines shown, but also because trends, if they exist, are generally less obvious. In other words, the movements of these time series of distance measures for the industry financing mix seem to be much more erratic than the series obtained when comparing bank groups' portfolio compositions with the loan market structure. Thus, we again refer for observable trends to Table A.2.

The table, fortunately and maybe even somewhat surprisingly, sends an extremely clear message. The financing mix in all industries except agriculture, hunting and forestry moves towards the market average. The result in the seven other sectors does neither depend on the chosen distance measure nor on the chosen characteristic for trend evaluation (γ or RC). For agriculture, hunting and forestry, the move away from the market's financing mix, mentioned above based on the graphs, can be diagnosed from the numbers for the distance measures D_1 and D_3 , too, whereas the trend of D_2 is ambiguous.³⁵

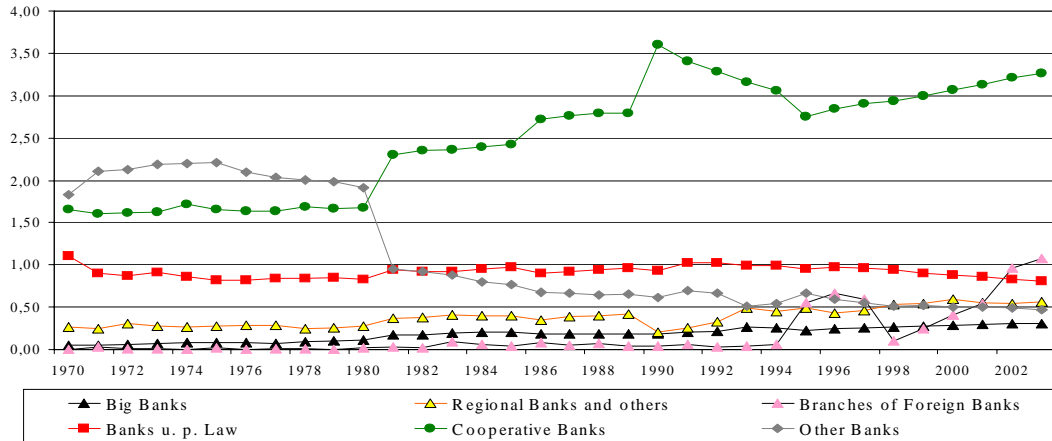
Let us now turn once more to the three industries featured above due to their higher concentration in lending and their greater deviation from the average financing mix. They are also interesting with regard to the origin of their loans. This can be pointed out in more detail by another type of graph. We calculate for each bank group the relation between its *actual industry share* and its *hypothetical share*, i.e. its share in the whole commercial loan market, and plot it against time (cf. Figures 18, 19, 20). If the ratio for a bank group is larger (smaller) than 1, the bank group's share in loans to this industry is higher (lower) than its share in the total loan market examined. If competition was such that the bank groups are losing superior standing in single industries, these ratios should tend towards 1.

Since shares by their very definition add up to 1, two facts must be true at each point of time when examining the relation between the actual industry shares and the hypothetical shares. Firstly, if one bank group has a value greater than 1 in one industry, it will have a value less than 1 in some other industry. Secondly, this argument also applies within an industry. If one bank group has a value greater than 1 in this particular industry, there must be some other bank group with a value below 1.

Figure 18 shows that the industry share of cooperative banks in agriculture, hunting and forestry was always above their share of the loan market and is rising from 1981 onwards. This trend, which perfectly fits with the changes in the distance measures analyzed above, may be due to the *Raiffeisenbanken*, which are a subgroup of cooperative banks. They were founded to support rural communities and seem still to be sticking to their original roots and having competitive advantages there. Knowing the German banking market,

³⁵ This specific constellation suggests that the trend is driven by those bank groups having the largest deviations from their market average to start with.

Fig. 18. Ratio of actual vs. hypothetical share - Agriculture, hunting and forestry



it is likely that the market share of credit cooperatives (and hence of the whole group) is systematically higher in regions where agriculture, hunting and forestry are particularly important. It is not clear, however, whether other bank groups did not want to contest cooperative banks in these rural areas or simply have not succeeded very much. In this respect note that the importance of agriculture, hunting and forestry has increased for commercial banks, but decreased for the other banks.

Table 6 provides more insight into the underlying dynamics of this industry by showing the growth rates for the bank groups' loan exposures. Apart from the gigantic growth rates of branches of foreign banks, which started into the sample period with almost no loan exposure in this industry, the big banks are ranked first, followed by the cooperative banks. Therefore it seems as if in this industry, which is growing less than the economy as a whole, big banks have successfully executed a diversification strategy whereas other bank groups, except branches of foreign banks but including banks under public law, have not been able to reduce the cooperative banks' competitive advantage.

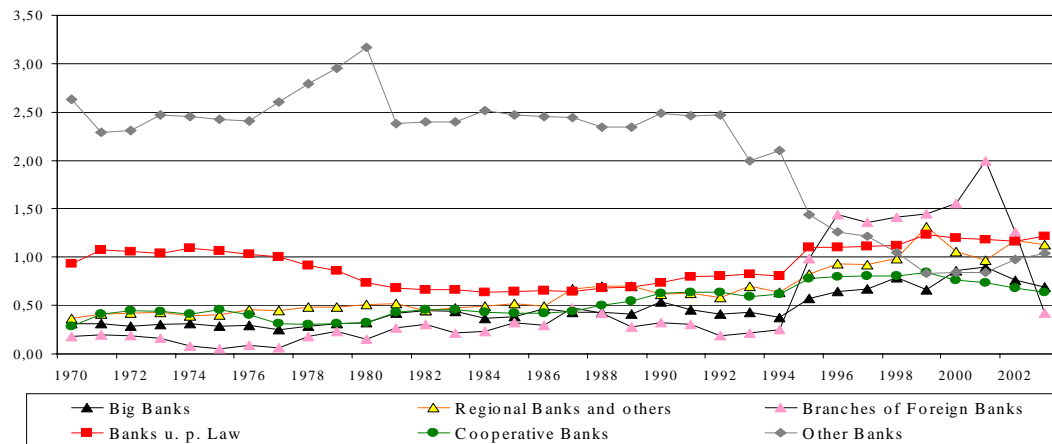
Table 6

Development of the absolute loan exposures in the agriculture, hunting and forestry industry

	Average growth rate	Geometric growth rate	OLS slope coefficient (R^2)
Whole industry	3.83%	3.70%	0.735 (0.98)
Big banks	8.99%	8.52%	0.047 (0.87)
Regional banks and others	5.98%	4.83%	0.057 (0.82)
Branches of foreign banks	114.67%	23.59%	0.009 (0.46)
Banks under public law	3.74%	3.62%	0.271 (0.96)
Cooperative banks	6.58%	6.05%	0.439 (0.94)
Other banks	-0.46%	-0.89%	-0.089 (0.71)

We can perform the same exercises for the other two featured industries. The striking feature of the transport, storage and communication industry (cf. Figure 19) is the massive downward trend for the other banks at the benefit of, in particular when starting from about 1981, basically all other bank groups.

Fig. 19. Ratio of actual vs. hypothetical share - Transport, storage and communication



This observation is backed by the bank groups' growth rates (cf. Table 7) which are fairly similar, except for the average growth rate of the branches of foreign banks, which is much higher (driven mainly by a few extremely large increases in the mid nineties), and the growth rates for the other banks, which are much lower. It seems that the competitive positions of the two bank groups have changed quite a bit. How important events like the privatization of Deutsche Telekom were, including a substitution of debt by equity raised via an initial public offering in November 1996, is yet to be determined.

Table 7

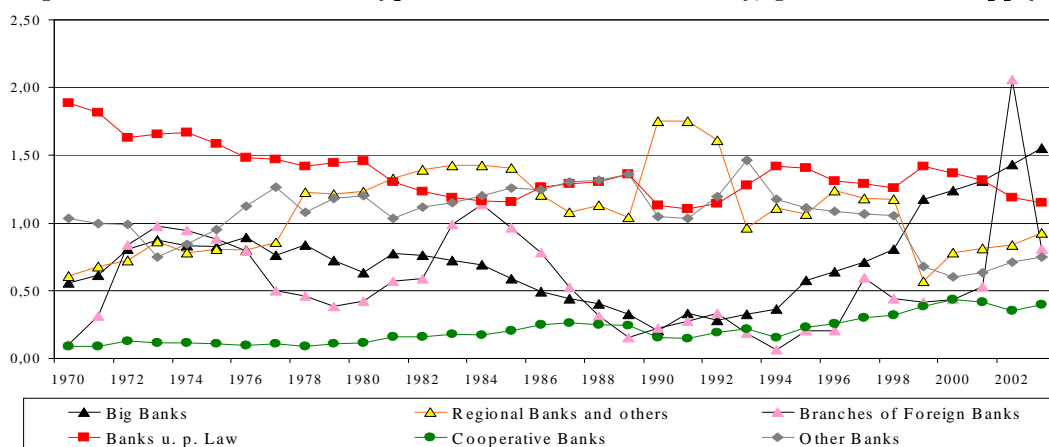
Development of the absolute loan exposures in the transport, storage and communication industry

	Average growth rate	Geometric growth rate	OLS slope coefficient (R^2)
Whole industry	5.48%	4.80%	1.133 (0.79)
Big banks	7.88%	6.63%	0.172 (0.70)
Regional banks and others	8.57%	7.12%	0.184 (0.80)
Branches of foreign banks	19.90%	7.86%	0.029 (0.46)
Banks under public law	7.25%	6.58%	0.551 (0.78)
Cooperative banks	8.72%	7.56%	0.162 (0.92)
Other banks	3.35%	1.46%	0.035 (0.00)

Last but not least, since cooperative banks possess more than a proportional share in the agriculture, hunting and forestry industry, this has to be compensated in some other industries. In the electricity, gas and water supply

industry, for example, cooperative banks are significantly under-represented (see Figure 20). This industry has nearly always been dominated by banks under public law. This may be due to a very significant ownership by jurisdictions in this industry that implies a financing bias towards banks likewise owned by these or other jurisdictions. Additionally, a number of the banks with special functions, belonging to the group of other banks, is also owned by states or the federation. Moreover, utility firms in Germany are told to be rather large on average and to have significant real estate. Since the group of other banks also includes banks like mortgage banks specializing in real estate finance and since large commercial banks are generally much larger than large cooperative banks, it does not come as a big surprise that cooperative banks have a particularly hard time competing in this industry.

Fig. 20. Ratio of actual vs. hypothetical share - Electricity, gas and water supply



Knowing that the banks under public law are the largest of the bank groups and observing their downward trend, starting from an exposure far above their market average it is clear that they must have below average growth rates. Table 8 reveals that this is indeed the case. The table also shows that cooperative banks were the winners in this relatively fast growing industry, having brought their relative exposure much closer to their market average. In the case of regional banks and branches of foreign banks, the average and geometric growth rates look a bit strange and do not give a very good description of what has happened because they are influenced by several spikes which would deserve further examination.

What have we learned about the lending to industries? Concentration in commercial lending as a whole has increased, but the changes in single industries are different and often not conclusive. However, looking at distance measures there is little doubt that in all industries, with the exception of agriculture, hunting and forestry, there is a common feature: The financing mixes in all of these industries have over time come closer to the market average. This development, achieved by above average growth rates for previously

Table 8

Development of the absolute loan exposures in the electricity, gas and water supply industry

	Average growth rate	Geometric growth rate	OLS slope coefficient (R^2)	
Whole industry	6.62%	6.13%	0.928	(0.97)
Big banks	12.23%	8.79%	0.168	(0.47)
Regional banks and others	15.39%	6.26%	0.130	(0.25)
Branches of foreign banks	49.33%	13.31%	0.003	(0.09)
Banks under public law	5.79%	5.48%	0.436	(0.91)
Cooperative banks	13.36%	11.33%	0.059	(0.83)
Other banks	6.50%	4.64%	0.132	(0.46)

less exposed bank groups, suggests that competitive advantages in industries which are above the general market standing have increasingly been lost (or been sacrificed for the sake of diversification). In the following section we will check whether this is true irrespective of the granularity of the industry disaggregation.

5.4 Robustness check

As has been described in Section 3, our data offers the opportunity to split-up the manufacturing industry into 9 sub-industries. See Table 9 for the development of the loan exposures in the 9 sub-industries during our sample period.

Table 9

Development of loans to the manufacturing industry

	Average growth rate	Geometric growth rate	OLS Slope coefficient (R^2)	
Manu.	4.54%	4.20%	4.716	(0.89)
Manu. (a)	4.25%	2.92%	0.241	(0.61)
Manu. (b)	5.98%	5.58%	0.248	(0.93)
Manu. (c)	5.42%	4.99%	0.279	(0.88)
Manu. (d)	6.06%	5.14%	0.726	(0.86)
Manu. (e)	4.15%	3.45%	0.774	(0.59)
Manu. (f)	3.54%	2.89%	0.492	(0.49)
Manu. (g)	6.95%	6.66%	1.026	(0.94)
Manu. (h)	5.41%	5.15%	0.762	(0.93)
Manu. (i)	1.97%	1.44%	0.167	(0.38)

Manu. $\hat{=}$ Total Manufacturing/ Manu. (a) $\hat{=}$ Chemical industry, manufacturing of coke and petroleum/
 Manu. (b) $\hat{=}$ Manufacturing of rubber and plastic products/ Manu. (c) $\hat{=}$ Manufacturing of other non-metallic mineral products/
 Manu. (d) $\hat{=}$ Manufacturing of basic metals and of fabricated metal products/
 Manu. (e) $\hat{=}$ Manufacturing of machinery, equipment and vehicles/ Manu. (f) $\hat{=}$ Manufacturing of electronic and optical equipment/
 Manu. (g) $\hat{=}$ Manufacturing of wood as well as paper products and furniture/ Manu. (h) $\hat{=}$ Manufacturing of food and tobacco/
 Manu. (i) $\hat{=}$ Manufacturing of textiles and leather

Since not only, as obvious from Table 9, the development in each sub-industry differs (more or less) from the development of the whole manufacturing industry but also the exposure of each bank group varies among these sub-industries, it is necessary to examine whether the results obtained so far by analyzing "few industries" depend on the chosen industry categorization or not.

Fortunately, all our results based on the analysis of "few industries" are confirmed when examining "many industries". As becomes obvious when comparing the results for "few industries" (Tables A.1 and A.2) with the results for "many industries" (Tables A.3 and A.4), the same time trends are observable for both industry categorizations. Moreover, the underlying tendencies seem to be even clearer when examining the finer industry categorization.

6 Conclusions and future research

This study is aimed at an assessment of the status and time trend of the competitiveness in Germany's commercial loan market. Analyzing all bank groups and a large part of all commercial loans from 1970 through 2003, a number of important insights emerge.

Concentration has increased, and therefore competition decreased, in the

commercial loan market as a whole over the last decade. There is slight disagreement amongst different measures whether the most recent degree of concentration is a new "all time high" or falls just short of the maximum reached in the early eighties, but the big picture is beyond all doubt.

The same change basically has occurred in the concentration of the bank groups' loan portfolios. With the exception of branches of foreign banks, all bank groups increased the degrees of concentration, measured again with traditional indices including HHI and GCI, of their commercial loan portfolio. But this is only part of the story. The use of distance measures, an innovative feature of this study, reveals that in fact the loan portfolios of these bank groups have all become much more similar to the industry composition of the whole loan market. In terms of competition this suggests that the bank groups have either not tried or not succeeded in exploiting superior monitoring abilities due to specializing in industries. The inability of traditional concentration measures, unlike distance measures, to detect this feature are quite obvious. In all, increasingly similar portfolio structures seem to indicate that focusing on single industries is not an important approach in the competition within commercial lending in Germany.

Turning to the financing mix of industries, i.e. the allocation of their loan exposures across bank groups, concentration in commercial lending as a whole has increased, again. But the changes in single industries are quite different and often not conclusive. However, looking at distance measures from this perspective, too, there is a common feature in all industries, with the exception of agriculture, hunting and forestry: The financing mixes in all of these industries have over time come closer to the market average. This development is achieved by above average growth rates for previously less exposed bank groups.

Certainly, more analysis is required for a still more complete picture of competitiveness. Among a number of things we would like to do in the future, the most important but also most difficult (and maybe even unfeasible) task would be trying to discover the motives behind the changes observed. Eventually we would like to discriminate between two conceivable interpretations of our finding and answer the following question: Have advantages in industries have increasingly been lost due to increased competition in these markets or have they been sacrificed for the sake of diversification.

A Appendix

Table A.1

Bank groups' loan portfolio concentration and deviation from the market (few industries)

	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Market							
June 1970	39.48%	68.48%	0.4348	0.2254	n.a.	n.a.	n.a.
June 2003	56.75%	81.59%	0.5668	0.3601	n.a.	n.a.	n.a.
Average	40.52%	74.43%	0.4625	0.2463	n.a.	n.a.	n.a.
γ	82.04%	29.79%	56.85%	98.78%	n.a.	n.a.	n.a.
R^2	0.72	0.89	0.85	0.80	n.a.	n.a.	n.a.
RC	-0.81	-0.95	-0.92	-0.90	n.a.	n.a.	n.a.
Big Banks							
June 1970	63.88%	88.59%	0.6751	0.4489	0.2441	0.2442	0.0376
June 2003	53.72%	83.26%	0.5919	0.3407	0.0490	0.0860	0.0025
Average	46.18%	85.90%	0.5838	0.3137	0.1557	0.1777	0.0194
γ	-25.65%	-2.35%	-10.20%	-26.09%	-79.87%	-67.79%	-100.72%
R^2	0.19	0.22	0.28	0.28	0.95	0.90	0.94
RC	0.41	0.39	0.34	0.39	0.98	0.96	0.97
Regional Banks and other							
June 1970	45.30%	81.72%	0.5488	0.2856	0.0696	0.1577	0.0086
June 2003	58.00%	84.03%	0.6019	0.3768	0.0268	0.0444	0.0007
Average	41.52%	82.34%	0.5315	0.2745	0.0567	0.1033	0.0044
γ	56.66%	7.78%	22.28%	55.21%	-62.57%	-77.54%	-100.00%
R^2	0.42	0.69	0.64	0.60	0.59	0.90	0.91
RC	-0.53	-0.86	-0.76	-0.71	0.69	0.95	0.95

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Branches of Foreign Banks							
June 1970	57.50%	96.59%	0.7393	0.4696	0.1897	0.3699	0.0483
June 2003	33.25%	83.73%	0.5145	0.2461	0.2885	0.3394	0.0694
Average	48.81%	87.86%	0.6337	0.3599	0.3223	0.4187	0.0954
γ	-32.57%	-16.81%	28.20%	-43.45%	54.79%	7.45%	75.95%
R^2	0.32	0.60	0.57	0.54	0.29	0.03	0.16
RC	0.51	0.80	0.64	0.64	-0.59	-0.18	-0.49
Banks under public Law							
June 1970	33.35%	61.41%	0.3437	0.1863	0.0612	0.0913	0.0035
June 2003	56.80%	80.67%	0.5633	0.3592	0.0089	0.0148	0.0001
Average	39.35%	71.92%	0.4356	0.2384	0.0326	0.0572	0.0015
γ	129.74%	38.70%	88.84%	136.54%	-89.01%	-85.57%	-112.98%
R^2	0.86	0.89	0.94	0.90	0.74	0.89	0.79
RC	-0.93	-0.97	-0.96	-0.95	0.91	0.93	0.93
Cooperative Banks							
June 1970	30.37%	74.04%	0.4766	0.2185	0.0967	0.2165	0.0160
June 2003	46.66%	77.76%	0.5315	0.2805	0.1009	0.1484	0.0086
Average	32.23%	73.03%	0.4579	0.2159	0.0953	0.1705	0.0103
γ	65.83%	12.42%	23.48%	36.22%	44.84%	-19.75%	-18.67%
R^2	0.59	0.74	0.63	0.60	0.55	0.46	0.13
RC	-0.63	-0.85	-0.75	-0.75	-0.76	0.66	0.33

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Other Banks							
June 1970	28.40%	73.62%	0.4477	0.2078	0.1760	0.2567	0.0295
June 2003	68.60%	83.70%	0.6419	0.4884	0.1184	0.1245	0.0095
Average	48.45%	76.99%	0.5299	0.3137	0.1476	0.2192	0.0223
γ	172.97%	24.93%	63.76%	220.19%	-37.43%	-54.56%	-72.55%
R^2	0.98	0.82	0.92	0.94	0.30	0.81	0.72
RC	-0.99	-0.92	-0.94	-0.96	0.44	0.89	0.87

$\gamma = \frac{\hat{y}_{2003} - \hat{y}_{1970}}{\hat{y}_{1970}}$ = Development over whole sample in percentage according to regression; RC = Rank correlation coefficient (with distance-to-date)

Table A.2

Concentration in the lending to industries and deviation from the market average

	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
All Industries							
June 1970	30.42%	70.10%	0.2867	0.2126	n.a.	n.a.	n.a.
June 2003	40.54%	73.95%	0.3676	0.2519	n.a.	n.a.	n.a.
Average	35.08%	72.56%	0.3291	0.2303	n.a.	n.a.	n.a.
γ	18.80%	5.32%	21.44%	12.67%	n.a.	n.a.	n.a.
R^2	0.40	0.15	0.31	0.41	n.a.	n.a.	n.a.
RC	-0.61	-0.48	-0.56	-0.62	n.a.	n.a.	n.a.
Electricity, Gas and Water Supply							
June 1970	57.31%	89.61%	0.5830	0.3961	0.2689	0.2760	0.0488
June 2003	46.75%	83.64%	0.4732	0.3030	0.0865	0.1442	0,0102
Average	48.20%	88.13%	0.5145	0.3304	0.1498	0.1912	0,0215
γ	-10.62%	1.31%	-5.42%	-8.82%	-52.17%	-24.76%	-64.54%
R^2	0.13	0.01	0.11	0.17	0.57	0.29	0.49
RC	0.33	-0.06	0.21	0.37	0.73	0.50	0.69
Wholesale and Retail Trade							
June 1970	26.65%	66.88%	0.2433	0.2004	0.0953	0.1329	0.0090
June 2003	38.16%	71.38%	0.3195	0.2331	0.0662	0.0925	0.0040
Average	33.05%	70.45%	0.2927	0.2167	0.0874	0.1095	0.0064
γ	32.24%	9.86%	36.37%	16.01%	-19.86%	-35.54%	-48.29%
R^2	0.60	0.75	0.72	0.68	0.07	0.55	0.26
RC	-0.67	-0.84	-0.84	-0.71	0.25	0.73	0.57

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Transport, Storage and Communication							
June 1970	56.30%	90.33%	0.5894	0.4048	0.3487	0.3487	0.0780
June 2003	49.27%	80.06%	0.4584	0.3119	0.0873	0.1075	0.0064
Average	50.24%	85.47%	0.5144	0.3459	0.2465	0.2570	0.0474
γ	-16.19%	-16.15%	-31.65%	-31.21%	-73.73%	-50.35%	-87.04
R^2	0.23	0.73	0.65	0.56	0.58	0.63	0.58
RC	0.52	0.81	0.74	0.71	0.64	0.72	0.70
Service Industry							
June 1970	37.20%	73.06%	0.3470	0.2389	0.0678	0.1216	0.0064
June 2003	40.57%	77.07%	0.3958	0.2595	0.0388	0.0414	0.0011
Average	37.70%	77.82%	0.3910	0.2549	0.0652	0.0858	0.0040
γ	-5.31%	4.04%	3.34%	-1.07%	-38.29%	-65.57%	-83.12%
R^2	0.05	0.11	0.01	0.00	0.46	0.92	0.84
RC	0.22	-0.42	-0.27	-0.01	+0.65	+0.96	+0.92
Construction							
June 1970	36.74%	79.14%	0.3941	0.2496	0.1227	0.2027	0.0188
June 2003	40.44%	82.97%	0.4212	0.2673	0.0799	0.0965	0.0059
Average	41.46%	82.16%	0.4439	0.2826	0.1243	0.1878	0.0183
γ	-0.53%	-4.44%	-8.27%	-6.85%	-37.07%	-51.07%	-66.98%
R^2	0.00	0.17	0.09	0.06	0.49	0.68	0.59
RC	-0.01	0.40	0.29	0.18	0.64	0.69	0.67

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Agriculture, Hunting and Forestry							
June 1970	39.20%	94.95%	0.5193	0.3170	0.1778	0.2966	0.0412
June 2003	46.65%	88.02%	0.5199	0.3371	0.3236	0.3249	0.0666
Average	42.68%	92.21%	0.5229	0.3262	0.2604	0.2943	0.0510
γ	15.11%	-8.46%	2.34%	7.39%	66.94%	1.14%	60.26%
R^2	0.19	0.89	0.03	0.21	0.57	0.00	0.23
RC	-0.52	0.94	-0.17	-0.53	-0.77	0.10	-0.62
Financial Institutions and Insurance							
June 1970	37.72%	74.15%	0.3649	0.2445	0.0755	0.1475	0.0095
June 2003	41.61%	80.03%	0.4073	0.2652	0.0805	0.1026	0.0055
Average	44.83%	78.62%	0.4181	0.2841	0.1165	0.1417	0.0120
γ	-13.20%	0.68%	-7.80%	-10.79%	-26.13%	-18.52%	-40.04%
R^2	0.13	0.00	0.06	0.09	0.10	0.10	0.12
RC	0.40	-0.07	0.24	0.35	0.32	0.39	0.43
Manufacturing							
June 1970	29.54%	72.47%	0.3090	0.2169	0.1129	0.1416	0.0102
June 2003	39.75%	77.52%	0.3765	0.2502	0.0795	0.0995	0.0054
Average	31.60%	71.92%	0.3047	0.2192	0.0949	0.1315	0.0090
γ	28.22%	9.92%	32.22%	15.12%	-30.54%	-23.11%	-35.24%
R^2	0.52	0.39	0.55	0.59	0.72	0.49	0.41
RC	-0.69	-0.50	-0.73	-0.77	0.87	0.67	0.59

$\gamma = \frac{\hat{y}_{2003} - \hat{y}_{1970}}{\hat{y}_{1970}}$ = Development over whole sample in percentage according to regression; RC = Rank correlation coefficient (with distance-to-date)

Table A.3

Bank groups' loan portfolio concentration and deviation from the market (many industries)

	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Market							
June 1970	18.20%	38.90%	0.3575	0.0914	n.a.	n.a.	n.a.
June 2003	56.75%	74.10%	0.6858	0.3467	n.a.	n.a.	n.a.
Average	35.29%	59.24%	0.5306	0.1939	n.a.	n.a.	n.a.
γ	368.94%	87.74%	98.52%	466.37%	n.a.	n.a.	n.a.
R^2	0.95	0.96	0.96	0.96	n.a.	n.a.	n.a.
RC	0.99	0.99	0.99	1.00	n.a.	n.a.	n.a.
Big Banks							
June 1970	18.21%	47.42%	0.4375	0.1058	0.0900	0.2454	0.0142
June 2003	53.72%	71.83 %	0.6574	0.3148	0.0303	0.0860	0.0015
Average	30.85%	56.92%	0.5123	0.1683	0.0755	0.1780	0.0079
γ	365.25%	74.63%	70.99%	359.68%	-57.30%	-67.74%	-93.89%
R^2	0.95	0.94	0.95	0.88	0.54	0.91	0.89
RC	0.98	0.98	0.98	0.98	-0.77	-0.96	-0.94
Regional Banks and other							
June 1970	23.80%	46.60%	0.4028	0.1090	0.0696	0.1577	0.0072
June 2003	58.00%	77.69%	0.7157	0.3664	0.0268	0.0450	0.0006
Average	35.99%	62.45%	0.5530	0.2044	0.0532	0.1078	0.0037
γ	270.84%	72.31%	89.24%	395.36%	-69.08%	-73.26%	-100.00%
R^2	0.95	0.96	0.98	0.93	0.73	0.88	0.94
RC	0.97	0.98	0.99	0.98	-0.80	-0.93	-0.97

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Branches of Foreign Banks							
June 1970	37.16%	68.69%	0.6730	0.2070	0.1897	0.4449	0.0426
June 2003	33.25%	67.75%	0.5986	0.2034	0.2885	0.3461	0.0658
Average	44.00%	67.62%	0.6475	0.2533	0.3103	0.4608	0.0916
γ	8.44%	10.98%	3.01%	18.90%	88.16%	-5.27%	101.30%
R^2	0.01	0.13	0.01	0.02	0.35	0.02	0.19
RC	0.07	0.32	0.06	0.10	0.58	-0.11	0.47
Banks under public Law							
June 1970	15.95%	38.53%	0.3626	0.0896	0.0446	0.0964	0.0022
June 2003	56.80%	73.46%	0.6891	0.3464	0.0089	0.0184	0.0001
Average	36.49%	59.89%	0.5492	0.1998	0.0236	0.0593	0.0010
γ	308.41%	82.42%	87.41%	406.14%	-8.87%	-84.49%	-110.55%
R^2	0.96	0.95	0.97	0.96	0.94	0.89	0.86
RC	1.00	1.00	1.00	1.00	-0.97	-0.93	-0.95
Cooperative Banks							
June 1970	27.87%	54.49%	0.5410	0.1414	0.0967	0.2728	0.0155
June 2003	46.66%	71.20%	0.6684	0.2618	0.1009	0.1570	0.0084
Average	30.53%	60.18%	0.5692	0.1664	0.0953	0.1961	0.0105
γ	117.36%	39.34%	32.57%	119.60%	44.84%	-38.89%	-26.75%
R^2	0.81	0.94	0.90	0.83	0.55	0.83	0.30
RC	0.91	0.98	0.96	0.96	0.76	-0.91	-0.50

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Other Banks							
June 1970	28.40%	55.94%	0.5282	0.1433	0.1760	0.2567	0.0236
June 2003	68.60%	81.97%	0.7720	0.4840	0.1184	0.1245	0.0084
Average	48.46%	71.15%	0.6635	0.2931	0.1477	0.2193	0.0187
γ	173.24%	52.39%	47.88%	367.11%	-37.22%	-54.52%	-70.04%
R^2	0.98	0.88	0.94	0.96	0.30	0.81	0.60
RC	1.00	0.97	0.99	0.99	-0.43	-0.89	-0.85

$\gamma = \frac{\hat{y}_{2003} - \hat{y}_{1970}}{\hat{y}_{1970}}$ = Development over whole sample in percentage according to regression; RC = Rank correlation coefficient (with distance-to-date)

Table A.4

Concentration in the lending to the manufacturing industry and deviation from the market average

	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Total Manufacturing							
June 1970	29.54%	72.47%	0.3090	0.2169	0.1129	0.1416	0.0102
June 2003	39.75%	77.52%	0.3765	0.2502	0.0795	0.0995	0.0054
Average	31.60%	71.92%	0.3047	0.2192	0.0949	0.1315	0.0090
γ	28.22%	9.92%	32.22%	15.12%	-30.54%	-23.11%	-35.24%
R^2	0.52	0.39	0.55	0.59	0.72	0.49	0.41
RC	-0.69	-0.50	-0.73	-0.77	0.87	0.67	0.59
Manufacturing of chemical industry, coke and petroleum (Manu. (a))							
June 1970	38.96%	81.26%	0.4249	0.2654	0.2070	0.2348	0.0321
June 2003	38.18%	78.05%	0.3806	0.2584	0.1427	0.1879	0.0172
Average	33.27%	75.07%	0.3353	0.2351	0.1687	0.2435	0.0286
γ	-1.38%	1.35%	0.85%	6.18%	-17.49%	-20.21%	-30.63%
R^2	0.00	0.00	0.00	0.01	0.04	0.14	0.06
RC	0.09	-0.09	-0.02	-0.06	0.28	0.58	0.57
Manufacturing of rubber and plastic (Manu. (b))							
June 1970	28.63%	74.64%	0.3109	0.2170	0.1038	0.1741	0.0121
June 2003	41.37%	76.83%	0.3784	0.2560	0.0800	0.0861	0.0046
Average	33.04%	73.06%	0.3169	0.2242	0.1079	0.1372	0.0107
γ	30.66%	7.47%	31.64%	17.31%	-25.39%	-46.71%	-59.71%
R^2	0.45	0.25	0.49	0.49	0.36	0.49	0.48
RC	-0.61	-0.41	-0.65	-0.62	0.59	0.66	0.73

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Manufacturing of other non-metallic mineral products (Manu. (c))							
June 1970	30.06%	71.54%	0.3077	0.2203	0.0730	0.0889	0.0053
June 2003	39.20%	76.21%	0.3786	0.2491	0.0645	0.0839	0.0038
Average	33.27%	73.09%	0.3288	0.2281	0.0952	0.1102	0.0075
γ	4.84%	4.05%	11.26%	5.33%	14.84%	2.24%	11.05%
R^2	0.02	0.30	0.24	0.12	0.05	0.00	0.01
RC	-0.13	-0.52	-0.43	-0.33	-0.25	-0.07	-0.04
Manufacturing of basic metals and fabricated metal products (Manu. (d))							
June 1970	32.65%	75.17%	0.3503	0.2318	0.0763	0.1093	0.0058
June 2003	42.21%	79.89%	0.3991	0.2655	0.0985	0.1101	0.0069
Average	36.20%	75.42%	0.3530	0.2395	0.0939	0.1288	0.0089
γ	19.23%	6.55%	19.52%	12.43%	6.42%	-26.78%	-21.91%
R^2	0.28	0.17	0.38	0.47	0.01	0.23	0.05
RC	-0.53	-0.36	-0.49	-0.65	-0.14	0.51	0.26
Manufacturing of machinery, equipment and vehicles (Manu. (e))							
June 1970	33.77%	74.48%	0.3419	0.2303	0.1551	0.1807	0.0190
June 2003	35.54%	73.77%	0.3367	0.2325	0.1040	0.1344	0.0090
Average	30.56%	71.32%	0.2974	0.2168	0.1217	0.1662	0.0140
γ	7.12%	5.96%	15.95%	9.13%	-15.78%	-20.04%	-25.90%
R^2	0.05	0.12	0.11	0.17	0.14	0.27	0.14
RC	-0.16	-0.28	-0.33	-0.41	0.36	0.60	0.44

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Manufacturing of electronic and optical equipment (Manu. (f))							
June 1970	34.29%	73.58%	0.3298	0.2255	0.1603	0.2025	0.0203
June 2003	35.78%	74.60%	0.3494	0.2349	0.0970	0.1123	0.0077
Average	29.51%	71.06%	0.2874	0.2129	0.1292	0.1713	0.0157
γ	1.05%	6.96%	15.94%	6.64%	-24.08%	-16.28%	-24.22%
R^2	0.00	0.24	0.17	0.17	0.40	0.19	0.17
RC	0.02	-0.47	-0.40	-0.33	0.63	0.38	0.42
Manufacturing of wood as well as paper products and furniture (Manu. (g))							
June 1970	31.83%	71.03%	0.3114	0.2207	0.0931	0.1029	0.0060
June 2003	44.99%	83.03%	0.4506	0.2890	0.1010	0.1339	0.0094
Average	36.24%	74.91%	0.3589	0.2407	0.0947	0.1137	0.0078
γ	19.80%	11.37%	26.14%	15.92%	-3.67%	10.08%	25.50%
R^2	0.37	0.49	0.45	0.40	0.00	0.04	0.05
RC	-0.57	-0.64	-0.62	-0.63	0.05	-0.20	-0.27
Manufacturing of food and tobacco (Manu. (h))							
June 1970	28.19%	71.64%	0.3038	0.2165	0.1475	0.1654	0.0181
June 2003	40.48%	79.67%	0.4061	0.2616	0.0952	0.1037	0.0087
Average	33.85%	76.05%	0.3629	0.2404	0.1356	0.1489	0.0160
γ	26.13%	7.85%	21.53%	13.31%	-41.36%	-41.12%	-59.41%
R^2	0.60	0.38	0.44	0.38	0.82	0.79	0.79
RC	-0.73	-0.54	-0.59	-0.61	0.90	0.87	0.88

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	CR_1	CR_3	GCI	HHI	D_1	D_2	D_3
Manufacturing of textiles and leather (Manu. (t))							
June 1970	28.73%	74.49%	0.3115	0.2191	0.1047	0.1656	0.0128
June 2003	34.66%	73.50%	0.3199	0.2243	0.0647	0.1234	0.0064
Average	30.42%	72.33%	0.3095	0.2197	0.1060	0.1622	0.0131
γ	15.58%	-1.09%	1.58%	1.39%	-27.99%	-16.46%	-33.23%
R^2	0.25	0.01	0.00	0.01	0.24	0.12	0.12
RC	-0.53	0.22	-0.02	-0.04	0.41	0.48	0.44

$\gamma = \frac{\hat{y}_{2003} - \hat{y}_{1970}}{\hat{y}_{1970}}$ = Development over whole sample in percentage according to regression; RC = Rank correlation coefficient (with distance-to-date)

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