Bank balance sheets, bank competition and monetary policy transmission

All credit institutions operating in Germany report data on their banking business to the Bundesbank. The Bundesbank aggregates those data to form variables of macroeconomic relevance, such as the money stock and the lending volume. The Bundesbank also uses such individual data, or collective data computed from them, for the purpose of carrying out econometric structural analyses. The fields of application of such analyses are diverse. In the present article, two such fields are described to serve as examples, and the findings of some econometric estimations are presented.

The first analysis concerns the field of monetary policy transmission, and shows that funds flow from large banks to small ones in Germany in the wake of a restrictive monetary policy measure. That might explain why in Germany – unlike other countries – the size of a bank, in itself, has only a minor bearing on its response to monetary policy measures. The second analysis examines the competitive behaviour of banks, and comes to the conclusion that competition on the German banking market has not changed significantly as a whole, despite a slight increase in concentration in the course of the consolidation process during the nineties. Then again, such consolidation can equally be construed as a reflection of competition.

Bank loans in the monetary policy transmission process

Transmission process highly complex

The central bank's monetary policy measures are applied to the money market, and ultimately affect – via the transmission process – non-banks' spending decisions and price decisions. Monetary transmission is, in reality, highly complex and insufficiently understood in its details (i.e. as regards the key variables and the precise timing). In economic theory, several different monetary transmission channels are distinguished.[1] For example, the "interest-rate channel" emphasises the fact that higher interest rates tend to reduce the attraction of investment, and increase the incentive to accumulate savings. Both effects have a dampening impact on expenditure. The "exchange-rate channel" takes account of the fact that, given floating exchange rates, a more restrictive monetary policy stance tends to revalue the domestic currency, which cheapens foreign goods and services for residents and makes domestic goods and services dearer for non-residents. That curbs net exports, and therefore the demand for home-produced goods.

"Credit channel" stresses the impact on the supply of funds

Besides the interest-rate and exchange-rate channels, there are, in economic theory, other potential transmission channels, each of which highlights different key variables (e.g. inflation expectations, real balances). In recent years, two approaches, in particular, have attracted greater attention – approaches which assign an active role to bank loans in the transmission process, and which are lumped together under the heading "credit channel": the "balance-sheet channel" postulates that monetary policy measures affect the value of assets, and thus generally alter non-banks' creditworthiness. The "bank-lending channel", on the other hand, is geared specifically to the effects of monetary policy measures on the supply of bank loans.

Dependence of the transmission process on the financial system

The keen interest shown in the credit channel in recent years owes much to the fact that it implies a dependence of the transmission process on the characteristics of the financial system. At the same time, this signifies that differences in financial systems may involve differences in transmission. Such problems might be of particular significance in the euro area, where countries with different financial systems are subject to a single monetary policy.[2] The dependence of monetary transmission on the structure of the financial system may, moreover, imply that the transmission of monetary measures changes in the event of structural adjustments to the financial markets – for instance, if there is a shift in the prevailing term structure, an increase in securitisation or an alteration in bank competition.

The bank-lending channel

"Bank-lending channel": monetary policy acts via the supply of bank loans

Unlike, for instance, the interest-rate and exchange-rate channels – in which monetary-policy-induced changes in bank loans are caused by the behaviour of non-banks, and

1 For an overview, see, for instance: European Central Bank, Monetary policy transmission in the euro area, Monthly Bulletin, July 2000, pp. 43 to 58.
2 See e.g. Cecchetti, S.G.: Legal Structure, Financial Structure and the Monetary Transmission Mechanism, Deutsche Bundesbank (ed): The Monetary Transmission Process – Recent Developments and Lessons for Europe, Palgrave Publishers, 2001, pp. 170 to 194.

thus merely reflect movements in bank-loan demand – the bank-lending channel relates to the supply of bank loans. Accordingly, a restrictive monetary policy measure tends to reduce the deposits held at banks, since non-banks switch to alternative types of assets in the wake of an interest-rate increase. In principle, the level of bank loans may remain unaffected if the bank raises enough additional funds (for example, by issuing bank bonds) and/or runs down other asset holdings (e. g., by selling securities or reducing interbank deposits). But if the withdrawn deposits and other forms of fund-raising, on the one hand, and the loans and other asset holdings, on the other hand, are not fully interchangeable – i. e. not perfectly substitutable – for the bank, then the reduction in deposits triggered by the monetary policy measure results in a decline in the supply of bank loans. That tends to dampen expenditure, unless the reduction in lending is accompanied by a corresponding expansion of alternative types of financing – unless, that is, non-banks can replace their borrowing from banks completely, and on the same terms, by other types of financing.

"Credit channel" based on imperfections in the financial markets

According to the credit-channel theory, such imperfect substitutability is due to imperfections in the financial markets. It mainly stresses, in this connection, the existence of costs of delegation, and of asymmetries in the distribution of information: as a general rule, a capital-seeker is likely to have more information about his motives, the prospects of the success of a financing project, and other circumstances relevant to the provision of the funds, than a capital-supplier. Moreover, the capital-supplier, after the transfer of the funds, normally cannot monitor and control completely the actions of the capital-seeker. That may give the capital-seeker an incentive to withhold disadvantageous information, and to perform actions which are of benefit to him, but detrimental to the capital-supplier. The capital-supplier is inclined to try to keep this risk as low as possible, for instance by obtaining more information, or by appropriate contractual provisions, such as a demand for collateral. As a rule, however, such adjustment, monitoring or incentive mechanisms boost costs. Thus they result, for example, in more time-consuming procedures, in constraints on the use of funds, or in inflexibilities in the deployment of the assets used as collateral. Since that is detrimental to the capital-seeker (as well), he has an interest in keeping the associated efficiency losses as low as possible.

Special feature of bank loans

A possible way of doing so consists, in particular, in establishing a closer relationship between capital-seeker and capital-supplier. That permits, on the one hand, the building of confidence and reputation and, on the other, the repeated use of information already obtained, and of experience previously gained. Compared, for instance, with (anonymous) types of financing, this is facilitated by bank loans, because they tie the contracting parties to one another, and enable individual provisions to be worked out. "Relationship banking" is a particularly close form of such an arrangement.[3] For that reason, bank

3 On this point, see also: Deutsche Bundesbank, The relationship between bank lending and the bond market in Germany, Monthly Report, January 2000, pp. 33 to 47.

loans are, for many non-banks, not interchangeable with any other method of financing. For banks, too, they have a different quality from their other assets. The same argument may be applied to the replacement of deposits by debt securities, where banks feature as borrowers.

The balance-sheet channel

"Balance-sheet channel": monetary policy acts via the value of assets

The "balance-sheet channel" is based on the perception that – because of the imperfections of the financial market – assets play an important role in lending decisions in the context of creditworthiness examinations, and as collateral. If the interest-rate level rises owing to a restrictive monetary policy measure, then the present value of future payment flows tends to drop on account of the associated increase in the discount factor. Moreover, the higher interest-rate level may have an adverse impact on the level of payment flows itself – for instance, via the interest-rate and exchange-rate channels. Both will reduce the value of the corresponding assets. That decline may mean that banks, on an average, rate their lending as more risky, and cut back their loan supply. As in the case of the bank-lending channel, therefore, monetary policy operates via a change in the supply of bank loans. However, the balance-sheet channel is not confined to bank lending; instead, it may also be applied in principle to other methods of financing, too, such as securities underwriting. Hence it is designated as a "broad credit channel" – unlike the bank-lending channel, which is therefore termed a "narrow credit channel".

Empirical analysis of the credit channel

The problem of identifying movements in the loan supply ...

The key problem posed by the empirical analysis of the credit channel is that of identifying, among the observed movements of the stock of loans, those which are caused by the loan supply, i.e. by the behaviour of the banks. After all, a possible decline in the stock of loans following a restrictive monetary policy measure need not necessarily have been caused by the credit channel, but might merely reflect a reduction in loan demand that was triggered, for instance, via the interest-rate or exchange-rate channel. Existing empirical studies based on aggregated macro data, which relate mostly to the United States, have been unable to resolve this identification problem satisfactorily.[4]

... and the use of disaggregated data as a possible solution

Hence the literature has switched to using disaggregated data and to exploiting, for the sake of identifying supply movements, the heterogeneity between individual (or groups of) enterprises and banks. The underlying idea is based on the supposition that, for a borrower, the procurement of funds is all the more costly and more difficult, the greater the problems are that beset him as a result of the imperfections of the financial market. For example, it is suspected that a borrower who is affected to a lesser extent than others by asymmetrical information will also have better access to funds. It follows from this that, if the credit channel is relevant, a restrictive monetary policy measure will not affect all

4 For an overview of such studies, see *inter alia:* Cecchetti, S.G.: Distinguishing Theories of the Monetary Transmission Mechanism, Federal Reserve Bank of St. Louis Review, May/June 1995, pp. 83 to 100.

borrowers equally, but will have a greater impact on some than on others.

Size as a determinant of the response to monetary policy measures among enterprises …

A borrower's size is often used as an indicator of the degree to which he is affected by the imperfections of the financial market. The reason for this is the belief that large-scale enterprises are scrutinised more closely by the general public than smaller ones. Hence banks can gather information about large enterprises more easily, and can more readily assume that they will "behave well". Based on this hypothesis, the empirical test of the credit channel boils down to identifying, as a response to a restrictive monetary policy measure, a steeper decline in lending to smaller enterprises than in lending to larger ones.[5] On the assumption that loan demand does not respond differently to monetary policy measures, depending on the size of the enterprise, potential size-specific divergences between individual loan responses are interpreted as indications of supply-side effects within the meaning of the credit channel.[6]

Empirical analyses based on disaggregated bank data

… and banks

On the basis of the hypothesis that any withdrawal of deposits due to monetary policy measures can be coped with better by large banks than by small ones, this argument is likewise applied to banks as "borrowers" in the financial market. The reason for this is the belief that big banks find it easier than small ones to take advantage of alternative financing facilities, since they are less exposed to financial market imperfections. Correspondingly, the hypothesis under test is that, in the wake of a restrictive monetary policy measure, smaller banks cut back their lending more than larger ones. This hypothesis has already been tested for the United States, and has largely been borne out.[7]

In itself, bank size an insufficient indicator in Germany …

To date, such studies for Germany have found no equally unequivocal results in favour of a size-dependent response to monetary policy measures on the part of banks.[8] The reasons for that can be analysed using individual bank data. For that purpose, each bank is assigned to a size category in accordance with its total assets (relative to the total assets of the other banks). Such aggregation of individual data to provide group data admittedly involves a certain loss of information, but it does have some advantages. First, size-specific differences in behaviour between banks emerge more clearly, which makes the differences more apparent. Second, time-series econometric methods can be applied without difficulty.

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5 On this point, see also the Annex to: Deutsche Bundesbank, West German enterprises' profitability and financing in 1995, Monthly Report, November 1996, p. 48 f.
6 See: Stöß, E.: *Die Finanzierungsstruktur der Unternehmen und deren Reaktion auf monetäre Impulse,* (Enterprises' financing structure and its response to monetary stimuli), Deutsche Bundesbank, Discussion Paper 9/96, November 1996. For the United States, see *inter alia* Gertler, M. and S. Gilchrist: Monetary policy, business cycles and the behavior of small manufacturing firms, Quarterly Journal of Economics 109, May 1994, pp. 309 to 340.
7 See: Kashyap, A. K. and J. C. Stein: What do a million observations on banks say about the transmission of monetary policy? American Economic Review, June 2000, pp. 407 to 428.
8 See *inter alia:* Favero, C. A., F. Giavazzi and L. Flabbi,: The transmission mechanism of monetary policy in Europe: Evidence from banks' balance sheets, NBER working paper No. 7231, July 1999. See also Ehrmann, M. and A. Worms, Interbank lending and monetary policy transmission: evidence for Germany, Deutsche Bundesbank, Discussion Paper 11/01, July 2001.

The size structure of the German banking system

Number of banks and percentage of the total assets of all banks in December 2000

	Aggregate		Size category 1					
			Small		Medium-sized		Large	
Type of bank	Number	% of assets	Number	% of assets	Number	% of assets	Number	% of assets
Savings banks	562	15.9	185	1.4	337	9.3	40	5.3
Land Banks	13	20.4	0		0		13	20.4
Cooperative banks	1,792	8.9	1,658	5.2	128	2.9	6	0.9
Central institutions of cooperative banks	4	3.8	0		0		4	3.8
All other banks	338	51.0	189	0.7	76	2.5	73	47.8
Total	2,709	100.0	2,032	7.3	541	14.7	136	78.2

1 Categories are based on the percentiles of the distribution of total assets across all banks (up to and including the 75th percentile: "small"; as from and including the 95th percentile: "large"; all others: "medium-sized").

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The above table contains data on the current size structure of German credit institutions (as at December 2000). The category of small banks comprises the 75 % of institutions with the smallest total assets, the category of large banks encompasses the 5 % of institutions with the largest total assets (all the banks in between are of medium size). To begin with, a marked inequality of distribution stands out: the 2,032 small banks hold no more than 7.3 % of total assets, while the 136 large banks hold 78.2 % thereof.

... because of close interbank ties

Over 90 % of the small banks belong either to the savings-bank sector or to the cooperative bank sector. Some institutions from the category of large banks likewise belong to those sectors. Among the savings banks, these are the 13 Land Banks, among others, and among the cooperative banks, the four (from the start of 2001: three) central institutions of cooperative banks. Both savings banks and cooperative banks have very close ties with their central institutions (see the table opposite); on an average, savings banks lodge 65 % of their interbank balances with the Land Banks, 58 % in short maturities alone. Cooperative banks actually lodge, on average, 90 % of their interbank balances with their central institutions (67 % in the form of short-term balances). Against this, savings banks receive, on average, 59 % of their interbank loans from Land Banks. Among cooperative banks, the share of funds raised from cooperative central institutions in aggregate interbank loans averages very nearly 74 %. In both sectors, the loans from central institutions are predominantly at long

term (among savings banks: 54 %; among cooperative banks: 70 %). Hence the substructure mainly holds short-term balances with the superstructure, and chiefly obtains long-term loans from the latter.[9]

On account of these close ties, it may well be that, in the wake of a restrictive monetary policy measure, small banks do not necessarily cut back their lending more than large ones, since intra-sectoral funds may flow to and fro between banks of different size categories. As a matter of fact, an econometric analysis shows that, following a restrictive monetary policy measure, small banks withdraw funds from large ones (see Annex 1, p. 65 ff.). In principle, such funds may be used by small banks to cushion the effects of restrictive monetary policy measures on their lending to non-banks (at least for a time), for example, for the sake of an existing bank-customer relationship.

The relevance of the credit channel in Germany remains unclear

Hence banks' response to monetary policy measures apparently does not depend on their size in Germany, because their size reflects banks' (potential) access to funds only inadequately. It must not, however, be inferred from this that the credit channel is of no significance; the fact that bank size, in itself, is not a sufficient discriminatory variable in Germany – unlike the situation in the United States, for example – does not rule out the possibility that other factors account for differences between banks in their response to monetary policy measures – differences which might be interpreted as indications of a supply-side effect exerted by monetary policy. Possible examples here are a bank's liquidity and its capitalisation.

Savings banks' and cooperative banks' book claims on, and book liabilities to, their central institutions

As a percentage of their book claims on, or book liabilities to, all banks * in December 2000

Item	Savings banks	Cooperative banks
Balances held with central institutions (claims)		
Short-term [1]	57.8	66.8
Medium-term [2]	2.7	18.7
Long-term [3]	4.4	4.3
Loans received from central institutions (liabilities)		
Short-term [1]	4.6	3.0
Medium-term [2]	0.4	0.3
Long-term [3]	53.8	70.2

***** Unweighted average of the shares of the individual banks. — **1** Up to and including one year. — **2** More than one year but not more than five years. — **3** More than five years.

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The "Monetary Transmission Network" of the Eurosystem

The question of whether such differences between banks with respect to their response to monetary policy measures actually exist, and, if so, of how important the associated credit channel ultimately is for the monetary policy transmission process, is being addressed, *inter alia,* by the Eurosystem's "Monetary Transmission Network" (MTN). There, researchers from the ECB and the national central banks of the Eurosystem are likewise working to answer the question as to the role played by the supply of bank loans in the

9 On term transformation within the two sectors, see: Deutsche Bundesbank, The longer-term trend in German credit institutions' interbank operations, Monthly Report, January 2000, pp. 49 to 68.

monetary policy transmission process, i.e., as to whether or not the credit channel is empirically relevant. The MTN is not only using the individual data of banks, but is also analysing corporate balance-sheet data and macroeconomic time series. These studies relate both to the national level and to the entire euro area.

In point of fact, the investigations being carried out within the MTN on the basis of individual bank data have found evidence suggesting that banks in Germany, in response to a restrictive monetary policy measure, cut back their lending all the less, the more liquid they are. At the present time, however, these analyses are not quite completed. The MTN plans to present its preliminary findings, as a set, in December 2001.

Market structure and the degree of competitiveness on the German banking market

Changes in the banking landscape and their impact on competition

In view of the sustained consolidation in the German banking sector and the increasing integration and liberalisation of the financial markets, the question arises as to the impact of these developments on competition on the German banking market. The efforts to foster integration on the European markets in financial services (EU Single Market Programme) are, additionally, acting as a catalyst of further merging of banks beyond national borders. At the same time, however, technological advances and the liberalisation and integration of the markets are leading to greater market transparency, easier market access and therefore enhanced competitive pressure. In the following sections, the relationship between the degree of competitiveness and market conditions will be explained first. Thereafter, an account will be given of structural developments on the German banking market. Finally, in Annex 2 on p. 67 ff., the application of an empirical method of measuring competitive behaviour will be described.

The relationship between market structure and competitiveness in economic theory

The relationship between market structure or concentration (i.e. the number of banks, and the distribution of their market shares) and consequent competitive behaviour is not unambiguous, viewed in theoretical terms. On the one hand, economists have assumed, in line with the classic "structure-conduct-performance paradigm,"[10] that the market structure crucially affects the competitive behaviour of market players. According to that approach, a market with few suppliers fosters less competitive market behaviour (collusion), which results in a smaller volume of supply and higher prices than under conditions of perfect competition.

On the other hand, such an ineluctable correlation between market structure and competitive behaviour is denied by other approaches. Thus, the so-called "efficient structure hypothesis"[11] explains increasing concentration as being a consequence of the behaviour of the more efficient firms, which take advantage of their greater efficiency to

10 See: Bain, J., Relation of Profit Rate to Industry Concentration: American Manufacturing 1936–1940, Quarterly Journal of Economics 65, 1951, pp. 293 to 324.
11 See: Demsetz, H., Two Systems of Belief About Monopoly, in: Goldschmidt, H.J., H.M. Mann, and J.F. Weston (eds.), Industrial Concentration: The New Learning; Mass.: Little, Brown 1974.

enlarge their market shares. According to that approach, increasing concentration should be rated less as a competition-reducing development, and more as a redistribution of the market towards the more efficient suppliers, and thus towards a greater overall efficiency of that market.

The so-called "contestable market theory"[12] likewise argues against an ineluctable relationship between increasing concentration and decreasing competition. According to that theory, it is not the number of suppliers actually operating on the market that determines competitive behaviour, but rather the impending market entry of external suppliers. Compared with the classic approach, here it is the potential competitor that takes the place of the actual competitor. Hence, in assessing the competitive aspects of the concentration process that has been evident on the German banking market for some time, both efficiency considerations – especially in the light of very small credit institutions – and the findings of the contestable market theory should be taken into account.

Market structure and consolidation on the German banking market

Despite consolidation, a persistently large number of banks ...

Characteristic features of the German banking market are, in principle, its low overall degree of concentration, with just over 2,700 credit institutions (in December 2000), the relatively high market shares of the public sector and the cooperative banking sector, the considerable density of bank branches and the apparently wide dissemination of what is known as "relationship banking". Although a number of mergers, or intended mergers, between major private banks sometimes shape the public perception of the consolidation process, in terms of numbers that process is concentrated primarily in the cooperative banking and savings-bank sectors. Thus, the number of cooperative banks decreased from almost 2,800 at the end of 1993 to 1,800 at the end of 2000. During the same period, a decline from 717 to 575 institutions was recorded in the savings-bank sector. When considering the size categories (see the table on page 56), it will be seen that small institutions continue to dominate, especially among cooperative banks, so that the consolidation process must be viewed primarily from the point of view of enhancing efficiency, and less as a concentration process posing a threat to competition.

... high branch density ...

The reduction in the number of branches has proceeded somewhat more slowly, but quite steadily. Between 1998 and the end of 2000, the number of branches decreased by almost 2,000, to a thoroughly ample 39,600[13] (see the table on page 25). Relative to the population figure, bank density in Germany still works out at about 48 bank branches per 100,000 inhabitants. Added to these at the end of 2000 were some 13,600 branches of Postbank AG (against 14,700 at end-1998), which has likewise distinctly reduced its branch network in recent years. Accompanying the reduction in the branch network, at the same time the number of ATMs put up by

12 See: Baumol, W. J., Contestable Markets: an Uprising in the Theory of Industry Structure, American Economic Review 72, 1982, pp. 1 to 15.
13 Excluding Postbank AG, building and loan associations and investment companies.

banks rose from about 19,000 at the end of 1992, via just under 36,000 at the end of 1995, to 46,200 at end-1999. They enable customers to avail themselves, on a virtually nationwide basis, of a number of basic services, such as withdrawing cash, and also to perform credit transfers by using other automated machines.

... and low degree of concentration

As regards the distribution of market shares, a certain increase in concentration on the German banking market has been discernible in the course of the consolidation process of the past few years, although that increase must still be rated small by international standards. As measured by the balance-sheet total, the five biggest banks accounted for just over 21 % of the market at the end of 2000, against 16 % at end-1993 and 19 % at end-1998 (see the box opposite).[14] On a European comparison, Germany therefore remains at the bottom of the table. In Europe, the average market share of the five biggest banks came to 57 % at the end of 1999. In this connection, especially smaller countries with a small number of banks accounted for the highest figures.[15] The so-called Herfindahl-Hirschman Index (another yardstick of market structure that is often used) likewise indicates for Germany a slight increase in market concentration in recent years, but that, too, is running at a low level. When using such national yardsticks, which indirectly assume market delineations corresponding to national borders, it must, however, be borne in mind that, for parts of bank lending and deposit business, competition is often confined to smaller regional markets. Such national yardsticks of concentration give no indication of the structure of such regional markets, nor of any local market power wielded by individual banks.

Decline in banks' overall share in financial investment and financing operations

In recent years, however, banks' share in aggregate financial investment and financing operations has declined markedly in the wake of the increasing securitisation of financial relations.[16] For instance, the significance of bank loans in the financing of the non-financial sector (especially of enterprises) is continuing to diminish (see the table on page 62). While the share of bank loans in the total liabilities of the domestic non-financial sectors was almost 62 % at the beginning of the nineties, it was only 57 % at the end of 1999; in the same period, the share in the aggregate liabilities of enterprises decreased from just over 51 % to barely 43 %.[17] An even more pronounced decline was registered in financial assets. Whereas, at the beginning of the nineties, banks accounted for almost 42 % of the financial investments of the domestic non-financial sector in the form of bank deposits,[18] by the end of 1999 such deposits made up barely 30 % of the total; in the case of households' financial assets, banks' share fell from 46 % to 35 %. That

14 The figures do not include groups, and are confined to the domestic part. If non-resident or group figures were included, the share would be distinctly higher.
15 See: European Central Bank, Mergers and Acquisitions Involving the EU Banking Industry – Facts and Implications, December 2000, Table 4, p. 18.
16 See also: Deutsche Bundesbank, The relationship between bank lending and the bond market in Germany, Monthly Report, January 2000, pp. 33 to 47.
17 These figures from the financial accounts on the basis of ESA 95 relate to nominal values for securities. A computation at market rates for securities makes the shares of bank loans in external financing (particularly that of enterprises) turn out much lower, in part owing to the marked rise in share prices.
18 Excluding investment in bank bonds.

Measures of market structure

Among the measures of market structure most commonly used in connection with questions of competition are the so-called "Concentration Ratios" (CRs), which measure the market share, in per cent, of the biggest three, five or ten banks, relative to the entire market. The reference variables for that purpose are usually the balance-sheet total, the lending volume or the volume of deposits.

$$CR\ (m) = \sum_{i=1}^{m} MA_i$$

(*m* = number of the (e.g. 3, 5 or 10) biggest banks, *MA* = market share in percentage points)

To take account both of the total number of banks and of the distribution of market shares within a concentration ratio, the "Herfindahl-Hirschmann-Index" (HHI) **1** is likewise used. It represents the sum total of squared market shares of all banks on a market; larger market shares are weighted particularly heavily by the squaring. It thus takes account both of the total number of banks operating on a market and of the unequal distribution of market shares among them, even though, as regards competitive behaviour, there is no ineluctable correlation between the number of banks on a market or an unequal distribution of market shares and the market power exercised. (Its theoretical maximum value is 100 * 100 = 10,000 in the case of a monopoly).

$$HHI = \sum_{i=1}^{n} MA_i^{\,2}$$

(n = total number of banks)

In terms of the possibly prevailing competitive behaviour, both ratios must be rated only as preliminary rough indicators. On account of the simplicity of their calculation, and of the often limited availability of data, which did not always enable more detailed empirical investigations to be made, these ratios continue to be in widespread use. A problem is posed in this connection, however (as in all studies of competition), by the question of market delineation. Measures of market structure which describe an entire national market thereby indirectly assume that national boundaries mark out the competitive room for manoeuvre. As a matter of fact, however, markets in lending business and deposit business are often comparatively locally defined, with the result that national concentration ratios may not say much about the actually prevailing market structures.

For the nationally defined German banking market, the concentration ratios are as follows:

Concentration ratios (CR 3, 5 and 10), as measured by the balance-sheet total

	1993	1994	1995	1996	1997	1998	1999	2000
CR3	10.3 %	11.0 %	10.9 %	10.4 %	10.7 %	12.8 %	12.4 %	13.3 %
CR5	16.0 %	16.6 %	16.7 %	16.1 %	16.7 %	19.1 %	19.4 %	21,4 %
CR10	27.1 %	27.8 %	27.9 %	27.7 %	28.3 %	31.2 %	32.7 %	35.8 %

HHIs, as measured by the balance-sheet total, the lending volume and the volume of deposits *

	1993	1994	1995	1996	1997	1998	1999	2000
Balance-sheet total	111	113	115	115	119	140	146	158
Lending volume *	109	106	109	109	112	134	133	131
Volume of deposits *	91	80	83	89	90	99	107	123

Source: Computations based on internal statistics of the Deutsche Bundesbank. — * Transactions with non-banks; deposits, excluding bank bonds; loans.

1 Developed, independently of one another, by A.O. Hirschman: National Power and the Structure of Foreign Trade, Berkeley, University of California Press, 1945, and O.C. Herfindahl: Concentration in the US Steel Industry, Columbia University, unpublished dissertation, 1950.

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The role of MFIs in the context of overall financing

Year	Lending by MFIs [1]				Funds lodged with MFIs [2]			
	to domestic non-financial sectors		of which to non-financial enterprises [3]		by domestic non-financial sectors		of which by households [4]	
	DM billion	Share of liabilities [5] in %	DM billion	Share of liabilities [5] in %	DM billion	Share of financial assets [6] in %	DM billion	Share of financial assets [6] in %
1991	3,167	61.7	1,219	51.3	2,516	41.7	1,810	45.8
1992	3,349	59.7	1,265	49.6	2,634	41.2	1,943	45.5
1993	3,603	57.7	1,317	47.0	2,905	40.2	2,130	45.0
1994	3,819	57.5	1,289	44.2	2,929	38.7	2,138	43.4
1995	4,136	57.7	1,353	46.5	3,015	37.3	2,205	41.7
1996	4,446	58.2	1,431	46.6	3,193	36.6	2,307	40.9
1997	4,696	58.3	1,508	46.0	3,223	34.0	2,367	39.2
1998	4,958	57.9	1,606	45.8	3,343	32.7	2,457	38.1
1999	5,150	57.1	1,630	42.6	3,368	29.6	2,476	35.2

1 Excluding lending against securities. — **2** Excluding bank bonds and money-market funds. — **3** In accordance with ESA 95, including partnerships, excluding self-employed persons. — **4** Including commercial deposits held by self-employed persons. — **5** In relation to the entire external financing of the respective sector, including pension reserves; securities counted at nominal values. — **6** In relation to the financial assets of the respective sector, including claims in respect of pension reserves; securities counted at market prices.

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owed very much to the intensification of competition on account of the authorisation of money-market funds in 1994 and the growing acquisition of investment-fund certificates.

"Bank-assurance" – competition from non-banks

Funds and insurance firms have been competing more fiercely recently for the financial assets of households, in particular. New so-called "hybrid financial products", which combine the properties of different financial assets (such as fund certificates, savings pass-books and/or insurance benefits), step up the competitive pressure on banks. Such competition from the non-bank sector, in what is known as the "bankassurance" field, in which the borderlines between different forms of investment are becoming increasingly blurred, compels the banks to commit themselves more deeply in that area. The pension reform due to take effect in 2002, with its support for private provision for old age, will intensify that tendency even further.

Relationship banking and the financing of small and medium-sized firms

Banks' lending business is determined to a large degree by the structure of the German economy, with its many small and medium-sized businesses. Given the heavy costs involved in issuing bonds and shares, such small and medium-sized firms are highly dependent on bank lending for their external financing. Because of information asymmetries, which are particularly marked in those economic sectors, relationship banking[19] plays a com-

19 See also: Elsas, R. and J-P. Krahnen, Is relationship lending special? Evidence from credit-file data in Germany, Journal of Banking and Finance 22, 1998, pp. 1283 to 1316 and Fischer, K.-H., Acquisition of Information in Loan Markets and Bank Market Power – An Empirical Investigation, Mimeo, University of Frankfurt, 2000.

paratively important role in their financing operations. As can be seen from the adjacent chart, the significance of bank loans for small firms actually seems to have increased during the nineties, whereas it tended to decline among enterprises with a turnover of more than DM 100 million. In the field of the financing of small and medium-sized firms, it is often savings banks and cooperative banks that assume the role of principal bankers.

Limited role of foreign banks

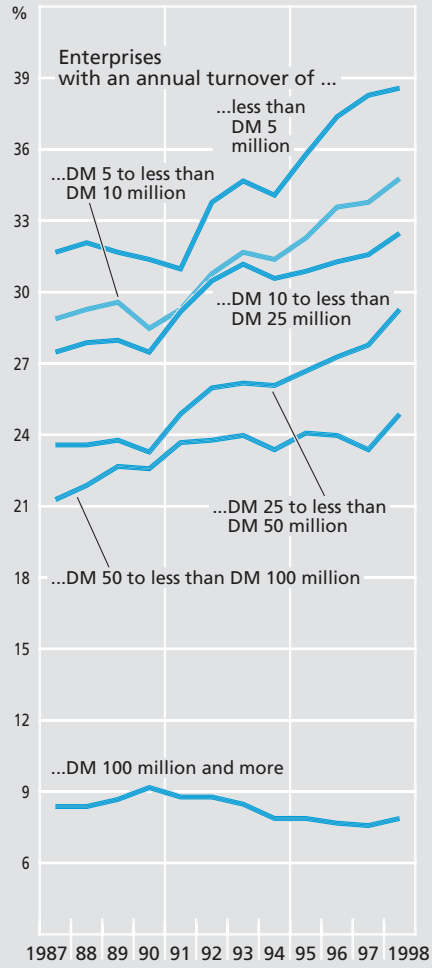
To date, domestic credit institutions have only sporadically felt competition from foreign banks in the field of classic deposit and lending business. Especially in the sphere of international payments, or securities, foreign exchange and derivatives trading, foreign banks are strongly represented, and there, as well as in investment banking (such as the areas of underwriting or counselling on mergers and takeovers), they compete directly with large domestic banks, in particular. By contrast, foreign banks – with a few exceptions – have so far made fewer inroads into business with private customers and retail business, even if, thanks to the new technologies, access to these markets by means of so-called direct banking, whereby the customer is in touch by telephone or Internet, is now distinctly easier, compared with the construction of a costly branch network.

E-banking – a new dimension of competition ...

The Internet, in particular, has crucially changed the face of banking in many respects, and thereby imparted a new dimension to competition in the area of financial services. The resultant new marketing channels facilitate the market access of "new" banks or financial-service providers, especially

Bank lending,
by size of enterprise*

as % of balance-sheet total



* A comparable group of enterprises from the producing sector, wholesale and retail trade and transportation.

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in retail and brokerage business, despite the need for heavy IT investment, compared with the construction of a sizeable, personnel-intensive branch network. With growing market transparency, decreasing information costs and consequent higher mobility on the part of customers, the pace of market access has likewise quickened. Banks newly entering the market can capture market shares in a short space of time by offering favourable

terms. For banks already on the market, that greatly enhances the competitive pressure exerted by potential rivals, particularly in parts of retail banking.

... with great prospects

Furthermore, information technology facilitates the low-cost standardisation of financial products, and their adjustment to customers' particular needs, thus intensifying competition in those business areas. Correspondingly, expansion in that sphere, notably in Germany, is proceeding at lightning speed.[20] Last year alone, according to data supplied by the Federal Association of German Banks, the number of accounts carried on line rose from 10 million at the end of 1999 to 15 million at the end of 2000. Since, according to a survey carried out by the opinion research institution forsa, 27 million people in Germany already have access to the Internet, marketing via the Internet is likely to increase in popularity. In the course of the new developments in telecommunications technology, including mobile access to the Internet, further marketing opportunities will probably open up there in the not-too-distant future, and/or broader segments of that market will be tapped.

Conclusions as to competitive behaviour

No close relationship between market structure and market behaviour

When we consider structural changes on the German banking market, it becomes plain that they are not confined to mere consolidation. In view of the new marketing channels arising via the Internet, market access has become distinctly easier for banks and other financial service-providers. Enhanced market transparency and lower information costs afford customers greater opportunities for comparing terms and conditions, and increase their mobility. At the same time, the range of potential competitors for banks has grown continuously with the creation of the single European banking market and the advance of disintermediation. Overall, therefore, impending market entry is likely to have become a factor encouraging competition on the German banking market. Against that background, the manifest consolidation might also be viewed as a reflection of competition. Since these considerations contradict the close relationship between market structure and market behaviour suggested by the classic "structure-conduct-performance paradigm", the New Empirical Industrial Organisation (NEIO)[21] approach – rather than relying solely on some rather approximate market-structure ratios – is trying to assess competitive behaviour with the aid of empirical methods.

According to an empirical study, no decline in competition

The application of one of these methods to the German banking market[22] is described in

20 See also: Deutsche Bundesbank, Electronic banking from a prudential supervisory perspective, Monthly Report, December 2000, pp. 43 to 58.

21 On this point, see: Bresnahan, T., Empirical Studies of Industries with Market Power, in: Schalensee, R. and R. Willig (eds), Handbook of Industrial Organisation, Volume II, Elsevier Science Publishers B. V., The Netherlands, 1989.

22 Applications for Germany are to be found in several European multi-country studies, such as Molyneux, P. et al., Competitive conditions in European banking, Journal of Banking and Finance 18, 1994, pp. 445 to 459, or De Bandt, O. and P. E. Davis, Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU, Journal of Banking and Finance 24, 2000, pp. 1045 to 1066. For Germany alone, Lang, G. *Wettbewerbsverhalten deutscher Banken – Eine Panelanalyse auf Basis der Rosse-Panzar Statistik,* (The competitive behaviour of German banks – a panel analysis based on the Rosse-Panzar statistic), *Jahrbuch für Wirtschaftswissenschaften* – Review of Economics 48, 1997, pp. 21 to 38, was the first to make such a study.

Annex 2 to this article.[23] That method endeavours to draw conclusions as to banks' competitive behaviour indirectly by estimating banks' behavioural equations, taking advantage of the information available at the level of individual banks. The study is based on the disaggregated statistics of all credit institutions in Germany reporting for the monthly balance-sheet statistics, over the period from 1993 to 1998. On balance, despite a slight increase in concentration on the German banking market, as measured by market-structure indices, during the nineties, the study finds no evidence of a reduction in competitiveness accompanying this structural change. At the same time, differences are noted in the competitive behaviour of the various categories of banks and of several size categories.

23 Comprehensive findings will be presented in a discussion paper which will appear towards the end of the year: Hempell, H. S., Testing for Competition among German Banks, Economic Research Centre of the Deutsche Bundesbank.

Annex 1

Interbank operations in the wake of monetary policy measures

The response of interbank variables to monetary policy measures is ascertained in this annex with the help of a vector autoregressive (VAR) model.[24] First, the common dynamic behaviour of a group of variables is estimated. Second, on the basis of the findings of that estimation, we compute whether, and if so how, an exogenous monetary policy measure affects the variables included. The development of these effects over time is then presented graphically in the form of "Impulse-response functions".

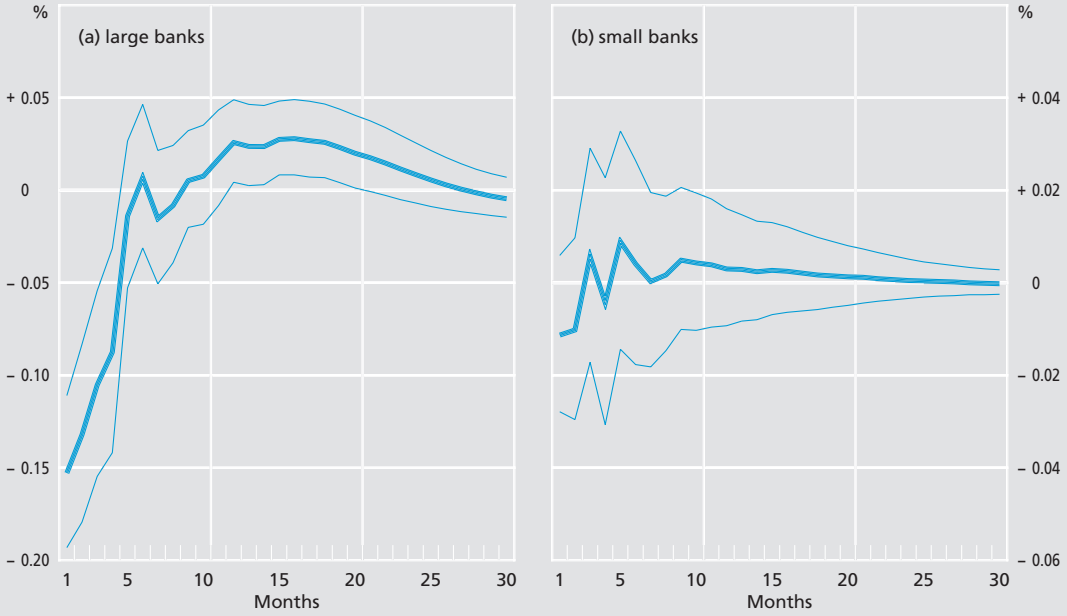
To examine how the interbank operations of large and small banks respond to a monetary policy measure, credit institutions are subdivided into size categories, as in the table on page 56. For that purpose, data must be available at the level of individual banks, since only then can the distribution of total assets among all banks be calculated, and a corresponding categorisation based on two ratios of that distribution (the 75^{th} and 95^{th} percentiles) be effected.

For each category, net interbank claims (interbank claims less interbank liabilities) are computed.[25] For every savings bank and cooperative bank, the individual figures also include the interbank claims on and interbank liabilities to the central institutions of their respective associations. For each of these central institutions, in turn, the interbank claims on and liabilities to the affiliated institutions of their respective associations are known. For each bank in either of these sectors, in other words, the net interbank claims can be subdivided into claims on affiliated banks within the sector ("intra-sectoral" claims), and claims on other banks.

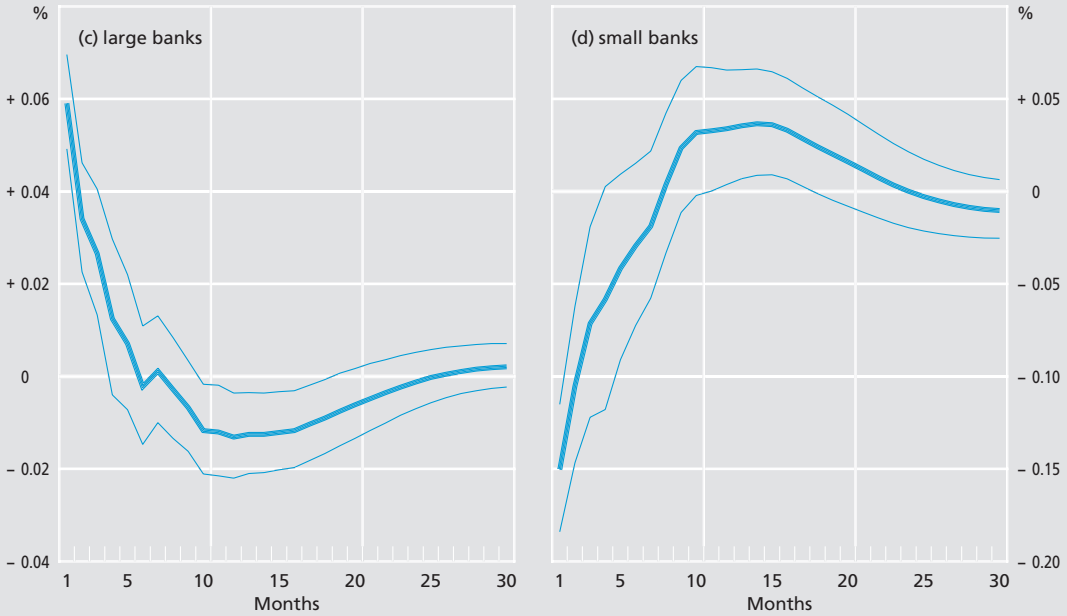
24 The results presented here are taken from: Ehrmann, M. and A. Worms, Interbank lending and monetary policy transmission: evidence for Germany, Deutsche Bundesbank, Discussion Paper 11/01, July 2001.
25 In this annex, interbank claims comprise the balances with other banks, and interbank liabilities the advances from other banks.

Impulse-response functions of an interest-rate shock*

Net interbank claims on banks outside a bank's own sector



Net interbank claims on banks in a bank's own sector



* Interest-rate shock amounting to 2.5 basis points (equivalent to a standard deviation of interest-rate shocks); confidence interval: 90%. The estimate is based on monthly data from 1992 to 1998 (from 1999, new definitions in the banking statistics). The vector of the variables is $X = [i, \pi, y, l_G, l]$: i = three-month interest rate, π = annualised monthly producer-price inflation (is less subject to distortions due to German reunification than, say, consumer-price inflation), y = logarithmed index of industrial output (because of monthly recurrence), l_G = net intra-sectoral interbank claims of large banks, l = other net interbank claims of interest. If l_G is the interbank variable of interest, X consists only of i, π, y and l_G, (then there are, correspondingly, only three cointegration vectors). The net interbank claims l and l_G are expressed here as a percentage of the corresponding total net assets.

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The VAR model contains the following variables, at monthly frequency: a short-term interest rate *i,* an inflation variable π and a variable for real output *y.* In addition, the intra-sectoral net interbank claims of large banks l_G are also included. To be able to assess the response of various other interbank variables to a monetary shock, the model is enlarged by an additional interbank variable *l*. Hence, a VAR model is estimated for each of these interbank variables *l*. The net interbank claims of large banks l_G are to be found in each of these estimates, since that ensures their mutual comparability.

Possible non-stationarities of the time series included are taken into account by means of co-integration relationships:[26] the first one expresses *i* as a function of π and *y*, and may be interpreted as a monetary policy reaction function; the second one describes the relationship between *i* and π, and constitutes a real interest-rate equation. The third and fourth describe the relationship between *i* and either of the interbank variables l_G and *l*.

Exogenous interest-rate changes ("monetary policy shocks") are identified by two assumptions: (1) in the long run, all variables return to their initial value and (2) interest-rate shocks do not affect inflation and output as early as the same month.

Chart 1 includes four impulse-response functions of an exogenous increase in the short-term interest rate. Figure 1a indicates that, after the shock, the net claims of large banks on banks outside their own sector drop significantly. This implies that the category of large banks either raises loans from other banks and/or reduces its balances held with other banks. A more precise analysis shows that these funds come primarily from foreign banks. In the case of small banks, no significant response of net claims on banks outside their own sector can be discerned (Figure 1b). However, their intra-sectoral net interbank claims decrease (Figure 1d). A more detailed analysis shows that this is mainly because small banks run down their short-term balances (maturities of up to 3 months) held with the large institutions of their own sector. As a mirror image, that reduction is accompanied by a rise in the intra-sectoral net interbank claims of large banks, above all because their interbank liabilities decrease correspondingly (Figure 1c).

Annex 2

Empirical study of competitive behaviour on the German banking market[27]

Besides pure market-structure ratios, whose relationship with actual market behaviour is not unambiguous, the so-called New Empirical Industrial Organisation (NEIO) approach offers a number of empirical methods of examining the competitive situation on markets – methods which are being used in the economic literature in the field of banking competition, too. As well as labour input and real capital, bank deposits are interpreted as input factors of the production technology of banks in the context of what is known as the "intermediation approach". One of these empirical approaches was developed by Panzar and

26 On the method, see King, R. G., C. I. Plosser, J. H. Stock and M. W. Watson, Stochastic Trends and Economic Fluctuations, American Economic Review 81, 1991, pp. 819 to 840.
27 The detailed study will be published as a Discussion Paper towards the end of this year. Hempell, H. S., Testing for Competition among German Banks, Economic Research Centre of the Deutsche Bundesbank.

Results of fixed-effects regressions for categories of banks

(t-values, computed from robust standard errors, in brackets below the estimated coefficients)

Item	All banks 1	Credit cooperatives 2	Savings banks 2	Commercial banks 2	Foreign banks 3
Factor prices					
Deposits	0.501** (32.1)	0.387** (28.2)	0.457** (18.0)	0.541** (14.5)	0.661** (17.5)
Labour	0.173** (11.9)	0.138** (14.3)	0.183** (8.0)	0.260** (5.0)	0.202** (7.8)
Fixed assets	0.004** (2.7)	0.006** (4.8)	0.004 (1.5)	– 0.003 (– 0.4)	– 0.037* (– 2.5)
***H*-value**	**0.68****	**0.53****	**0.64****	**0.80****	**0.83****
p-value (F-test)	0.00	0.00	0.00	0.00	0.00
R^2 overall	0.79	0.78	0.85	0.54	0.85
Banks	3,473	2,573	624	185	34
Observations	20,025	14,829	3,671	1,023	177

** Significance level of 1 %, * significance level of 5 % (robust standard errors). — **1** Comprises all banks reporting both to the monthly balance-sheet statistics and to the profit-and-loss statistics and recording more than three annual observations during the specified period, less a number of outliers (for the details, see the Discussion Paper). — **2** In each case, excluding central institutions of credit cooperatives, Land Banks and big banks. — **3** Branches of foreign banks.

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Rosse.[28] It is based on the estimation of the reduced form of a revenue function

$R\,(z, t, w)$ with z exogenous variables of the revenue function

t exogenous variables of the cost function

w factor prices

and $$H = \sum_{j=1}^{m}\left(\frac{\partial R \cdot w_j}{\partial w_j \cdot R}\right)$$

with m = number of factor prices (w_j)

The authors demonstrate that the following conclusions can be drawn as to the nature of the prevailing competition from the sum total of the factor-price elasticities *(H)* of that function:

$H = 1$ perfect competition

$H < 1$ monopolistic competition

$H \leq 0$ monopoly or perfect collusion

The intuition behind this approach is as follows: given perfect competition, the banks, in line with the assumptions, produce in the area of minimum long-term average costs, and a rise in marginal costs is therefore identical to an increase in average costs. Revenues *(R)* are precisely equal to costs, and the price is equal to the marginal cost of one additionally produced unit, with the result that, if factor prices go up, earnings are bound to increase to the same extent for an individual bank, provided that the quantity produced remains constant. Adjustment to the reduced demand as prices

28 Panzar, J.C., and J.N. Rosse, Testing for Monopoly Equilibrium, Journal of Industrial Economics 35, 1987, pp. 443 to 456.

Results of fixed-effects regressions with interaction terms for the respective periods, by size category

Item	By size category				By category of bank		
	All banks	Small banks [1]	Medium-sized banks [1]	Large banks [1]	Cooperative banks [2]	Savings banks [2]	Commercial banks [3]
1993–1995							
***H*-value (H_1)**	**0.68****	**0.64****	**0.76****	**0.81****	**0.54****	**0.68****	**0.76****
p-value (F-test)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996–1998							
***H*-value (H_2)**	**0.68****	**0.64****	**0.78****	**0.87****	**0.51****	**0.59****	**0.82****
p-value (F-test)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H_0: $H_1 = H_2$							
p-value (F-test)	0.97	0.97	0.65	0.08	0.02	0.00	0.08

****** Significance level of 1% (robust standard errors). — **1** Small banks with a balance-sheet total of DM 1 billion or less, medium-sized banks, (between DM 1 billion and DM 5 billion), and large banks (over DM 5 billion). — **2** Excluding central institutions of cooperative banks or Land Banks. — **3** Excluding large banks and branches of foreign banks.

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rise is effected by certain banks quitting the market.

In the event of a monopoly, or of perfect collusion by the banks operating on the market, those banks produce just so much that the marginal revenue of one additional unit is precisely equal to the marginal costs. Given a constant quantity produced, the marginal costs go up owing to the raising of factor prices, but not the marginal revenues. Hence the banks reduce the quantity to such an extent that the additional revenues again tally with the higher marginal costs on account of the simultaneous price increase. Since the higher prices cannot offset the decline in revenues owing to the quantity effect, aggregate revenues fall and therefore $H < 0$.

As the third case, Panzar and Rosse distinguish the situation of monopolistic competition, in which, although banks behave like monopolists, the market entry or exit of other enterprises that offer imperfect rival products makes them always generate precisely zero profits. In that case, as the authors show, the sum total of factor-price elasticities is $H < 1$, and may actually be smaller than zero in the case of rival products that are conspicuously poor substitutes. In the literature, moreover, a higher H statistic is sometimes interpreted as an indicator of a higher degree of competitiveness.

For an analysis of competitive behaviour on the German banking market using this method, a sizeable data record was available, consisting of individual data on balance-sheet statistics and on the profit-and-loss accounts of all banks operating in Germany from 1993 to 1998. On that basis, with

the aid of panel-econometric estimates of the reduced form of the banks' revenue function *(R)*,

$$\ln R_{i,t} = a_1 + b_1 \ln w1_{i,t} + b_2 \ln w2_{i,t} + b_3 \ln w3_{i,t} + c_1 z1_{i,t} + c_2 z2_{i,t} + c_3 z3_{i,t} + c_4 t1_{i,t} + d_1 t + \lambda_t + \mu_i + u_{i,t}$$

(where *ln* = natural logarithm, *w* = variables of factor prices, see footnote [29])

the hypotheses of perfect competition ($H = 1$) and perfect collusion ($H \leq 0$) were rejected. For the individual categories of banks, significant differences were found between savings banks and cooperative banks, on the one hand, and commercial banks, on the other, as well as for several size categories. (Selected results are shown in the table on page 68; further results will be found in the research paper cited.)

In order to be able to monitor any changes in competitive behaviour, given the persistent consolidation process in the banking sector, estimates were likewise made for two different periods of time. However, no significant change could be detected for the totality of banks. For individual categories of banks, too, the estimated changes were only slight, and only in the case of savings banks did they actually appear to be significant in the context of an additional test for robustness (see the Table on page 69).

29 *R* = total revenues to balance-sheet total, *w1* = interest expenses to total deposits, *w2* = personnel expenses to balance sheet total, *w3* = fixed capital expenses to total fixed assets, *z1* = customer loans to total loans, *z2* = maturity structure of customer loans, *z3* = cash flow to business volume by sector of the borrower, weighted with the portfolio of loans to enterprises, *t1* = interbank deposits to total deposits, *t* = linear time trend, λ and μ = unobservable time effects and individual effects, respectively, *u* = error term.