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What determines the interest margin? An analysis of the German banking system

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What determines the interest margin? An analysis of the German banking system.*

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Zusammenfassung

What determines the interest margin? An analysis of the German banking system.

This paper analyzes the determinants of the interest margin of German banks over the period 1995-2007, explicitly addressing differences among different bank groups. We use three empirical models to focus on the following aspects: the time evolution of the interest margin, the average differences across groups, and the presence of autoregressive effects. For each model our results show that the interest margin can be mainly explained by market power and inefficiency, the influence of which is particularly high for cooperative banks. The Winner's Curse phenomenon and the cross-subsidization strategy negatively influence the margin of private banks.

JEL-Klassifikation: G21
JEL-Schlüsselwörter: German banks, Interest margin, Market power, Winner's Curse, Germany

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*The manuscript had been prepared during a stay of the third author at Deutsche Bundesbank.

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Kredit und Kapital,
Manuskripteinreichung

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I. Introduction

The interest margin – defined as the ratio of a bank's net interest revenue to its average assets in one year – is a bank's most important income source and, thus, one of the driving factors for the formation and the volatility of profits (*Hanweck/Ryu* (2005)). This paper analyzes the determinants of the interest margin in the German banking system using a novel data set, explicitly distinguishing between commercial banks, savings banks, and cooperative banks. A second contribution of the paper to the literature is the analysis of the Winner's Curse phenomenon, i.e., the acceptance of lower interest rates by banks in order to attract new customers.[1]

Figure 1 shows the revenues those three bank groups make on average from the interest business and from fee and trading activities. It illustrates that the proportion of income earned from the interest business – despite a relative decrease from 90% in 1995 to 75% in 2007 – is in general decisive in the determination of bank revenues. However, remarkable differences among the different groups exist: While the proportion of the interest income is similar for savings and cooperative banks, it is on average 8% lower for private banks, which reflects the different focus banks pursue in their business. While saving and cooperative banks concentrate on classic banking activities, the proportion of earnings from fee and trading activities is generally higher for private banks.

[1] An analysis of the German banking system is also presented by *Saunders/Schumacher* (2000); however, they do not take group differences into account. *Hanweck/Ryu* (2005) consider different bank groups in their analysis of the interest margin in the United States.

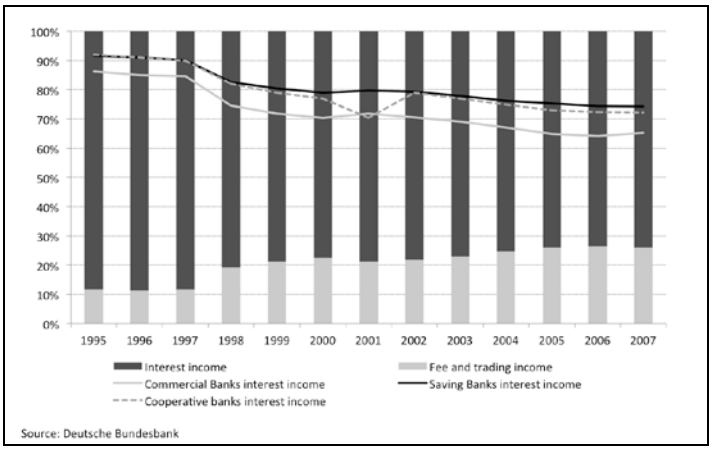


Figure 1: Composition of Bank Revenues in the German Banking System

Being an important income source, the evolution of the interest margin has direct consequences for a bank's earnings and its balance sheets. A (strong) decrease of the interest margin and of earnings may destabilize a bank and has thus potentially adverse effects on the whole banking system.

Our analysis shows that competition, the efficiency of banks, specialization in the fee business, as well as a lower interest rate risk and credit risk are driving factors to reduce the interest margin. Our results also show that granting more loans does not necessarily imply an increase in the interest margin as banks (mis)price loans to attract new customers, a phenomenon also known as the Winner's Curse. From these results, we deduce some suggestions for the supervising authority: an increase in competition would have positive effects on the efficiency of the banking system, both factors lessening the interest margin. A climate of financial stability would reduce the interest rate risk, contributing to a decrease of intermediation costs. Banking regulations need to be sensible to the different businesses in order to consider the peculiarities of each bank group. In particular, regulation should concentrate on the market structure of small institutes in order to increase their efficiency as well as competition among them. Furthermore the regulator should be aware of distorting expansion strategies as well as of an excessive cross subsidization of the fee business, especially among private banks. Those strategies decrease the income earned from traditional sources, i.e., the

interest income, potentially contributing to more income variability and thus a higher exposure to risk.

The rest of the paper is organized as follows. Section 2 briefly reviews the existing literature and presents the theoretical considerations. Section 3 discusses the data and presents the empirical analyses. Section 4 summarizes and concludes.

II. Literature Review and Theoretical Considerations

The interest margin of banks is subject to research since the beginning of the eighties. *Ho/Saunders* (1981) presented the first model based on the so-called *Dealership Approach*, integrating the hedging and expected utility approaches into the analysis of the determinants of banks' margins. *McShane*/*Sharpe* (1985) introduce the volatility of the money market interest rate as an explanatory variable and *Allen* (1988) extends the model of *Ho/Saunders* (1981) including different types of credits and deposits. Much later, *Angbazo* (1997) further extends the *Dealership Approach* modeling the credit risk and off-balance-sheet activities as other important explanatory variables of the interest margin. While these studies focus on the banking industry in the United States, *Saunders/Schumacher* (2000) were the first who analyzed the European market, in particular the influence of the regulatory environment. They show that restrictions on interest rates, on reserves, and on equity strongly influence the interest margin. *Maudos*/*De Guevara* (2004) additionally introduce operating costs and the Lerner Index as a direct measure of market power, as determinants of the interest rate margin. Finally, *Maudos/Solís* (2009) integrate all extensions of the *Dealership Approach* into a single model and analyze the interest margin in the Mexican banking system (*Maudos/Solís* (2009). Contrasting the *Dealership Approach*, *Zarruk* (1989), *Zarruk/Madura* (1992), and *Wong* (1997) propose an alternative, the so-called *Cost-of-goods-sold Approach*, in which the representative bank maximizes its expected utility from profits in the supply of deposits under uncertainty. *Hanweck/Ryu* (2005) criticize both approaches suggesting modeling the interest margin by focusing on the uncertainty of the interest rate and its influence on different types of assets.

In addition to the theoretical literature, numerous studies discuss the determinants of the interest margin in an empirical analysis. The European Central Bank (*ECB* (2000)) investigates the factors affecting the interest

margin in European countries. *Drakos* (2003) as well as *Schwaiger/Liebeg* (2007) consider the banking systems of Eastern European countries focusing on the transition process and the impact of market entry by foreign banks. *Mays* (1999) analyses the change in the interest margin for the Savings & Loan Association in the United States. *Lepetit* et al. (2008) as well as *Busch/Kick* (2009) analyze how the expansion of the fee business affects the interest margin showing that institutions with a strong focus on the fee business have lower interest margins.

We adopt an extended version of the Dealership Approach, based on *Ho/Saunders* (1981) and *Maudos/Solís* (2009) to analyze the interest margin of German banks. This model assumes banks to be homogenous, risk-averse intermediaries that optimize utility from the interest margin. Incomplete information enables the bank to earn money from the intermediation process between the demand for credits and services and the supply of deposits, matching the times and quantities of different needs for its customers. Banks operate in a multiple-output environment and their portfolio is composed of credits *L*, deposits *D*, and services *N*. Interest rates for each portfolio component are set at the beginning of the period. The interest margin *IM* is defined as the sum of the spreads on deposits and loans over the money market interest rate *r*. It is determined by the operating costs *C(L)*, *C(D)*, and C(N), the bank's risk aversion *R*, the (growth of the) volume of loans *Q*, the interest rate risk σ^2_m and Slope, the credit risk σ^2_l, the cross-elasticity between demand for credit and services δ as well as by the bank's market power. The latter can be measured by the Lerner index, i.e., by the spread between prices and marginal costs. The following stylized equation summarizes the theoretical context:

$$(1) \quad IM = f\left(Lerner, C(L), C(D), C(N), R, Q, \sigma^2_m, Slope, \sigma^2_l, Controls\right)$$

We now present brief theoretical considerations with respect to the impact of each determinant on the interest margin *IM* and formulate corresponding hypotheses. Section III below and Table 1 describe the empirical implementation of each determinant as well as the data sources.

(H1): We expect a positive influence of a bank's market power measured by the Lerner Index, on the interest margin as the higher the market power of a bank, the stronger its intermediation position to gain from differences between credit and deposit rates, i.e., $\partial IM / Lerner > 0$.

(H2): The operating costs are an increasing function of the intermediation activity and constitute a measure for a bank's efficiency. Banks with higher operating costs are less efficient, all other things being equal, and thus need a higher interest margin to cover costs. An increase in operating costs thus increases the interest margin, i.e., $\partial IM / \partial C > 0$.

(H3): Risk aversion and the transaction volume are also two important components of the interest margin (*Ho/Saunders* (1981)). Assuming bank managers to be risk averse, their expected influence on the interest margin is positive. On the other hand, the transaction volume negatively influences the interest margin due to adverse selection in the process of granting new loans. *Shaffer* (1998) shows that, given the number of customers, the transaction volume increases with the number of banks operating in the market, if banks do not exchange information efficiently. Hence, less creditworthy customers will reapply for a loan more often, which increases the probability of being granted a loan despite insufficient level of creditworthiness. An increase of the transaction volume thus reduces the average quality (creditworthiness) of customers. New customers are attracted by offering lower rates or by mispricing the credit risk of new loans or both (*Hanweck* (2006)). The price the bank pays for the expansion of its business is the difference between the risk-adjusted rate the bank would ask for and that actually offered. This adverse phenomenon is referred to as the *Winner's Curse*: To successfully implement a strategy of credit growth, the interest margin has to decrease. In summary, $\partial IM / \partial Q < 0$ and $\partial IM / \partial R > 0$.

(H4): The credit risk was introduced only recently[2] and its influence is controversial. *Hanweck/Ryu* (2005) motivate a negative relationship through a portfolio adjustment strategy: an increase of the credit risk forces risk-averse bank managers to shift funds to less default-risky, lower-yielding assets with the consequence of a reduction of the interest margin. On the contrary, *Wong* (1997), *Maudos* et al. (2004), and *Schwaiger* et al. (2007) argue that the effect of a higher credit risk on the interest margin is positive. In a risk-adjusted pricing process, banks charge a higher interest rate for customers with a

[2] *Angbazo* (1997) was the first who considered this type of risk as a possible explanatory factor for the interest margin.

lower creditworthiness and this, in turn, increases the interest margin. In valuing the business-shift versus the risk-compensation argument, we follow the latter and expect a positive influence of the credit risk on the interest margin, i.e., $\partial IM / \partial \sigma_l^2 > 0$.

(H5): The interest rate risk arises as a consequence of money market volatility. Its expected influence on the interest margin is positive: a higher volatility increases the uncertainty about returns, which the bank can antagonize by either lowering the interest rate on deposits, raising the interest rate for loans, or doing both. In any case, the interest margin increases.[3] A higher uncertainty also changes the slope of the yield curve and thus directly influences the profitability of the maturity transformation pursued by banks.[4] In summary, $\partial IM / \partial \sigma_m^2 > 0$ and $\partial IM / \partial Slope > 0$.

(H6): The fee business is also an important determinant of the interest margin. The expected overall effect of the fee business on the interest margin is negative due to the bank's cross-subsidization strategy. With the aim to attract customers and enter a long-term relationship by granting credits and additionally selling profitable services, banks misprice the interest rate on credits, considering the risk factors only partly. This strategy increases the volume of the fee business, while the interest rate spread decreases, i.e., $\partial s / \partial \delta < 0$[5]

III. Empirical Analysis

1. Data

The sample includes annual data of 1276 German banks over the period 1995 to 2007. The data are taken from the Deutsche Bundesbank's database

[3] The literature mostly agrees on this interpretation. See e.g. *McShane/Sharpe* (1985) or *Saunders/Schumacher* (2000).

[4] Banks granting variable rate loans usually use an average of the long- and short-term rates as benchmark, while the benchmark for deposits is usually the short-term rate. A higher margin would in such a case (variable rates for loans as well as for deposits) be the result of maturity transformation, even without higher uncertainty. It is thus important to take into account the Slope of the yield curve.

[5] See e.g. *Angbazo* (1997), *Lepetit* et al. (2008) as well as *Busch*/*Kick* (2009).

BAKIS (BAKred Information System), which contains balance sheet information and supervisory reports of individual German banks. Table 1 summarizes the determinants of the interest margin, presents their definitions as well as empirical implementations, the expected signs for the empirical analysis and the data sources.

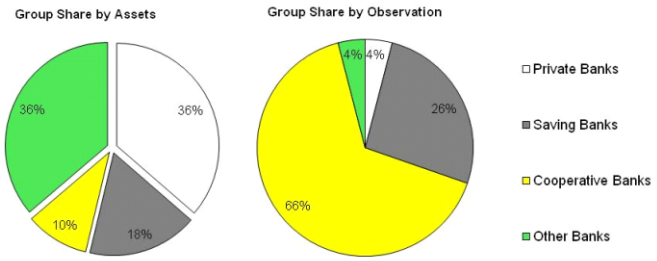
A first investigation of the sample reveals the heterogeneity present in the German banking system, which is due to the fact that different types of banks fulfill different tasks. Private banks are specialized in the corporate business; the focus of savings banks is retail banking, offering financial services for individuals as well as small- and medium-sized enterprises; cooperative banks are institutions that offer a wide range of banking and financial services to customers. The group of all other banks comprises public or semi-public institutions. Consequently, we split the sample into four groups, i.e., private, savings, cooperative and other banks. The latter group of public and semi-public banks is however excluded from the empirical analysis presented in section 3.3 because their business is typically more politically driven than economically.

Table 1

Description of Variables

Variable	Empirical implementation	Exp. sign	Definition
Market power	Lerner	+	Ratio of revenues – total cost to revenues; Deutsche Bundesbank BAKIS
Operative costs C(L), C(D), C(N)	Inefficiency	+	Cost-income-ratio defined as the ratio of operative expenses to total income; Deutsche Bundesbank BAKIS
Risk aversion R	Eq_ratio	+	Equity ratio defined as the ratio of equity to total assets; Deutsche Bundesbank BAKIS
Transaction volume Q	Growth_loans	-	Growth rate of total loans defined as $\ln(loans_t)$ minus $\ln(loans_{t-1})$; Deutsche Bundesbank BAKIS
Interest rate risk σ_m^2	Slope	+	Slope of the yield curve defined as interest rate (10 years) – interest rate (1 year) of German Government Bonds; Deutsche Bundesbank
	Sd_short	+/-	Standard deviation of Rate_short; Deutsche Bundesbank
Credit risk σ_i^2	PD	+	Probability of default defined as the ratio of adjusted credits prior to allowances for losses on individual bank loan accounts to credits to non-banks; Deutsche Bundesbank BAKIS
	Loans	+	Credit exposition of a bank defined as the ratio of total credits to non-bank to total earning assets; Deutsche Bundesbank BAKIS
Cross-elasticity δ	Fees (for services)	-	(fee + trading income) over (fee + interest + trading income); Deutsche Bundesbank BAKIS
Control	Rate_short	+	Interest rate of a German Government Bond (1 year maturity); Deutsche Bundesbank
Control	Inflation	+	Growth rate of the German HCPI; Federal Statistical Office Germany
Control	GDP_growth	+	German GDP growth rate; Federal Statistical Office Germany
Control	Opp_costs	+	Opportunity costs defined as the ratio of non interest bearing reserves to total assets; Deutsche Bundesbank BAKIS
Control	Year1998	+/-	Dummy; 1 in the year 1998, zero otherwise

The importance to distinguish different bank groups and to split the sample up can also be seen from Figure 2. It shows that private and other banks dominate in terms of assets; savings and cooperative banks play a minor role in this respect. Looking at the number of observations however, cooperative and savings banks have a prevalent position. To avoid biased estimates due to the domination of these two bank groups we apply a weighting factor in the regressions for the whole sample. The weighting factor taking into account the heterogeneity of the German banking system is the the number of observations for each bank group in the sample.



Source: Deutsche Bundesbank
Note: Period January 1995 to December 2007.

Figure 2: Group Shares by Assets and by Observations

Table 2 reports descriptive statistics for the whole sample as well as different sub-groups over the sample period. Interestingly, the variation of the interest margin for private banks is much higher than for any other group, indicating the high heterogeneity among private banks.

Table 2

Descriptive Statistics

Variable	Whole Sample				Private Banks				Savings Banks				Coop. Banks			
	Me	**p10**	**p90**	**SD**	**Me**	**p10**	**p90**	**SD**	**Me**	**p10**	**p90**	**SD**	**Me**	**p10**	**p90**	**SD**
Interest margin	0.03	0.02	0.03	0.01	0.03	0.01	0.05	0.02	0.03	0.02	0.03	0.00	0.03	0.02	0.03	0.01
Lerner	0.50	0.37	0.62	0.15	0.46	0.19	0.71	0.20	0.49	0.35	0.62	0.15	0.51	0.39	0.61	0.14
Inefficiency	0.36	0.27	0.45	0.08	0.34	0.15	0.55	0.15	0.32	0.26	0.39	0.05	0.38	0.30	0.47	0.07
Eq_ratio	0.08	0.06	0.10	0.03	0.10	0.05	0.17	0.07	0.07	0.05	0.09	0.01	0.08	0.06	0.10	0.02
Growth_ loans	0.06	-0.03	0.21	0.13	0.06	-0.13	0.27	0.19	0.05	-0.02	0.14	0.11	0.06	-0.03	0.22	0.13
Slope	1.43	0.50	2.30	0.77	1.40	0.50	2.30	0.75	1.43	0.50	2.30	0.77	1.43	0.50	2.30	0.77
Sd_short	0.32	0.13	0.55	0.16	0.32	0.13	0.55	0.16	0.32	0.13	0.55	0.16	0.32	0.13	0.55	0.16
PD	0.05	0.01	0.09	0.04	0.05	0.00	0.11	0.07	0.04	0.01	0.07	0.02	0.05	0.01	0.09	0.04
Loans	0.03	0.03	0.04	0.01	0.03	0.03	0.04	0.01	0.03	0.03	0.04	0.01	0.03	0.03	0.04	0.01
Fees	0.20	0.08	0.31	0.10	0.28	0.05	0.64	0.22	0.19	0.08	0.28	0.07	0.20	0.08	0.31	0.09
Inflation	94.6	88.6	104.	5.01	94.8	88.6	101.	4.97	94.6	88.6	101.	5.01	94.6	88.6	101.	5.01
Rate_short	3.41	2.26	4.60	0.79	3.40	2.26	4.60	0.80	3.41	2.26	4.60	0.79	3.42	2.26	4.60	0.79
GDP growth	1.58	0.00	3.16	1.02	1.57	0.00	3.16	1.04	1.58	0.00	3.16	1.02	1.58	0.00	3.16	1.02
Opp_costs	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00

Note: Table 2 shows the 10 and 90 percent percentiles instead of the minimum and maximum – denoted as p10 and p90 respectively – in addition to the mean (Me) and standard deviation (SD) as they are less sensitive to outliers.

The Lerner index (*Lerner*), defined as the spread between prices and marginal costs, is used to measure the market power of a particular bank.[6] It

[6] The literature acknowledges that even in national markets issues such as the distance of the bank from the customer or the distance of banks between each other play an important role. With respect to the interest margin, the influence of the bank size could be an important determinant. *Valverde/Fernández* (2007) use the Herfindahl index as measure of concentration to analyze this issue. We also test the

ranges between 0 and 1; the higher the values of this index, the more market power a bank has. Empirically, besides revenues as the respective price variable, a bank's total costs will be taken into account by including the components of the interest business and the fee business as well as labor and administration cost. The expected influence of market power, i.e., the Lerner index, on the interest margin is positive as more market power allows the bank to obtain more favorable conditions.[7]

The variable *Inefficiency*, approximated by the cost-income-ratio, measures the operating costs. Its distribution shows that cooperative banks are on average less efficient than banks of other groups, which may be due to their smaller size and, consequently, lower economies of scale. We use the equity ratio (*Eq_ratio*) to implement risk aversion empirically and expect a higher risk aversion to call for a higher interest margin as compensation for the risk taken. The effect of the equity ratio on the interest margin is however subject to controversial debate in the literature. Using the equity ratio as an indicator for risk aversion, *Gischer/Jüttner* (2003) discuss that Basel II and the strong development of the fee business have weakened the connection between the equity ratio and the interest margin. Due to the lack of better data we nevertheless use the equity ratio as proxy for risk aversion following the view that more equity, being an expensive source of capital for a bank, indicates a higher degree of risk aversion (*Angbazo* (1997)). We use the growth rate of loans (*Growth_loans*) to proxy the volume of transactions of a particular bank following our theoretical considerations in hypothesis (H3).

In addition, we consider different risk factors. The interest rate risk is implemented using different empirical specifications in order to capture its different aspects. The variable *Slope* is the slope of the yield curve, representing a bank's earnings from its fundamental function of maturity transformation (*English* (2002)). The expected influence of this variable on the interest margin is positive. In addition, it is important to take into account the absolute level of the interest rate, as the margin a bank can set

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impact of the bank size using the Herfindahl index and obtain the same positive influence on the interest margin. Due to the strong assumption of an exogenous market structure made by the Herfindahl index, we decided to report the results for the Lerner index only. The results for the Herfindahl index are available upon request.

[7] One may argue that the causality runs in the opposite direction. However, as the Lerner index is estimated taking into account not only the costs and revenues of interest-bearing activities but labor costs, administrative costs as well as other operating expenses, it has hardly any impact on the interest margin.

is probably different in a low interest rate environment compared to a high interest rate environment. For example, banks may face difficulties to pass high interest rates on to customers, especially in long-term 'Hausbank' relationships. We thus control for the influence of the absolute level of the interest rate on the interest margin using the one-year interest rate (*Rate_short*) of German government bonds (*ECB* (2002)). We also include the standard deviation of the one-year interest rate (*Sd_short*) to study the response of assets and liabilities to changes of the interest rate. Its influence depends on the ability of a bank to adopt the optimal strategy: a rising slope of the yield curve, due to a faster increase of the interest rate on loans than on deposits, increases the interest yields of a bank. In this case, *Sd_short* has a positive influence on the interest margin (*Hanweck/Ryu* (2005)). The credit risk is empirically implemented using the probability of default (*PD*), defined as adjusted credits prior to allowances for losses during a particular year. Since higher collateral values imply lower adjustments and thus potentially lower *PDs*, this variable also partly controls for collateralization effects.[8] We expect the *PD* to be positively correlated to the interest margin. The mean value and the standard deviation of the PDs are smaller for savings banks than for private and cooperative banks. This feature might be due to the social function of the former group, granting more credits to medium-sized companies and to publicly owned businesses.

We include the variable *Fees*, defined as the ratio between fee revenues and total revenues, to study the validity of the cross-subsidization hypothesis. This variable also approximates the evolution of the banking business, which has been quite different for different bank groups during the last years. While private banks have concentrated more on the fee business and consequently show higher values of the variable *Fees*, savings and cooperative banks have behaved in a more conservative way, gaining more revenue from traditional banking activities (*Busch/Kick* (2009)). We also include the net credit position of a bank (*Loans*), defined as total credits granted to non-banks to total earning assets, to control for – at least in some way – for a bank's portfolio composition. Banks that have a higher proportion of interbank lending will have lower margins than banks that have a low proportion and hence a relatively high exposure to the non-banking sector. Controlling for the portfolio composition through the

[8] Unfortunately, direct data on collateralization is not included in the dataset we had access to, which is why we use this approximation.

variable *Loans* may alleviate the omitted variable bias.

Finally, we use a number of additional controls in the empirical models. First, we take into account the opportunity cost of holding non-interest bearing excess reserves through the variable *Opp_cost*.[9] Since these reserves do not produce revenue, the interest margin is expected to increase in order to compensate the opportunity cost. The opposite case of diminishing margins may appear when increased liquidity holdings result due to non-existing credit business opportunities rather than risk considerations. Additionally, we control for the state of the economy using the inflation rate (Inflation) and the growth rate of German GDP (*GDP_growth*). The impact of the inflation rate on the interest margin is a priori undetermined, because high inflation rates lead to higher prices and interest rates as well as a higher interest rate risk that can finally cause an increase of the interest margin. The final effect however depends on the adjustment process of the interest rates on assets and liabilities.[10] Similarly, the influence of the GDP growth rate is a priori undetermined and we aim to study the pro- or anti-cyclicality of the interest margin in the empirical analysis.[11] If the interest margin is pro-cyclical, one would observe an increasing interest margin in periods of economic growth, while an increase will be observed during recessions if the interest rate behaves anti-cyclical. All models include a dummy for the year 1998 (Year1998) as data for 1998 may be distorted because the Deutsche Bundesbank changed its data measurement method in the same year.

2. Empirical models

The empirical analysis investigates the influence of different explanatory variables on the interest margin *IM*, i.e., on the sum of the spreads on deposits and loans over the money market rate r, which is operationalized using the Euribor. Using income statement and balance sheet data of

[9] Since this variable has some elements in common with *Eq_ratio*, we use the first difference of this variable in the regressions in order to avoid a multicollinearity problem.

[10] If short-term interest rates rise, it may happen that banks raise their lending rates faster than deposit rates. It might, however, be more difficult for banks to increase lending rates than lowering them and, hence, the pass-through might remain imperfect (see *ECB*, 2000).

[11] See also *Maudos/Solís* (2009).

German banks provided by the Deutsche Bundesbank, we estimate three different empirical models.[12] Each model has its own peculiarity, which enables us to examine different aspects. We use a fixed effects model to explain how changes of the explanatory variables over time influence the interest margin *IM* of bank i. This model is given by:

$$\begin{aligned} &\Delta IM_i(t) = \alpha + \beta \Delta X_i(t) + \omega \Delta Z_i(t) + \Delta u_i(t), \\ &t = 1,2,....,13 \;\; and \;\; i = 1,2,...,1276 \\ &\quad with \quad u_i(t) = v_i + e_i(t) \Rightarrow \Delta u_i(t) = \Delta e_i(t) \end{aligned} \tag{2}$$

where X_t is the vector of the explanatory variables, Z_t the vector of controls, $u_i(t)$ the error term composed of the residual component $e_i(t)$ and the individual time invariant component v_i; Δ refers to the deviation of the respective variable from its mean. This model thus examines how deviations of the explanatory variables from their average values influence the deviation of the interest margin from its average value. The individual component for each bank v_i included in the fixed effect model allows a potential correlation between v_i and the explanatory variables providing considerable results. However, the assumptions of independence of the error term from the explanatory variables and absence of autocorrelation in the error term need to hold. We test these assumptions and thus the applicability of the fixed effects model against the random effects models performing the Hausman test.[13]

The disadvantage of the fixed effects model is that time invariant variables or variables that show little variation over time such as *Opp_costs* and *Eq_ratio* are swept away by the within estimator. For this reason, we compare the results of the fixed effects model (within estimator) with those obtained from the between group model (between estimator) which is based on average values rather than on the time series evolution of the explanatory variables. This allows us to examine the influence of time invariant variables and long-term, time independent differences across bank groups. Using the between estimator however results in a loss of information as it omits first the time variation of the explanatory variables and second variables without an individual specific component v_i.[14] The

[12] In order to reduce the heterogeneity in the sample, we apply an outlier treatment, truncating the 1st and the 99th percentile of the variables.

[13] For details see *Wooldridge* (2002).

[14] For that reason, macroeconomic and dummy variables cannot be considered in the between group model due to the absence of individual specific effects.

between group model is given by:

$$\overline{IM}_i = \alpha + \beta\overline{X}_i + \omega\overline{Z}_i + \bar{v}_i, \quad i = 1,2,...,1276 \tag{3}$$

where X is the vector of explanatory variables, Z the vector of controls, and v_i the individual specific component. The bank's average interest margin is thus explained by the average values of the explanatory variables.

Estimation of the fixed effects model crucially depends on the assumption of no autocorrelation in the error term. The evolution of the interest margin between 1995 and 2007 however suggests that previous values influenced subsequent ones as banks had to match the supply of deposits, the demand for credits and non-traditional banking services across periods (*Maudos/Solís* (2009)).[15] Testing for the presence of autocorrelation first, we estimate a dynamic model using the Arellano-Bover/Blundell-Bond estimator in order to avoid a possible estimation bias. This model is given by:

$$IM_i(t) = \sum_{j=1}^{p} \alpha_j IM_i(t-j) + \beta X_i(t) + \omega Z_i(t) + u_i(t), \quad t = 1,2,....,13 \ \textit{and} \ i = 1,2,...,1276 \quad \textit{with} \quad u_i(t) = v_i + e_i(t) \tag{4}$$

In addition to the vector of explanatory variables X_t, the vector of controls Z_t and the error term $u_i(t)$, this model includes the autoregressive component $IM_i(t-j)$ with the order of autoregression *p*.[16] We also include the lagged values and lagged differences of the independent variables as instrumental variables, aiming to address possible endogeneity and different behavior of bank groups over the business cycle. A further advantage of the Arellano-Bover/Blundell-Bond estimator is that one yields consistent results even if the assumption of strict exogeneity between future values of the explanatory variables and the error term is violated (*Wooldridge* (2002)). The disadvantage of this model however is the exponentially increasing number of variables in the model reducing its explanatory power in the presence of short time series.

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[15] *English* (2002) as well as *Hanweck/Ryu* (2005) also claim that lagged values of the interest margin need to be considered in the empirical analysis.

[16] We apply the Arellano/Bond test to determine the order of autoregression p (see *Arellano/Bond* (1991) and *Valverde/Fernández* (2007)).

3. Estimation results

Table 3 first presents the results of the three empirical models (equations 2, 3, and 4) for the whole sample where the weighting of bank groups applies to account for sample heterogeneity. The fixed effects model shows that the variable *Lerner*, measuring market power, has positive significant coefficients confirming our expectations: the higher the market power of a bank, the higher the interest margin. The stark integration into the European banking market and the reinforcement of competition reduced the market power of German banks as well as their interest margin. Since 1997 the margin had remained relatively stable at low levels. This is true for all groups of banks. The variables *Inefficiency* and *Eq_ratio* show the expected positive coefficients.[17] The significance of the variable *Growth_loans* confirms that an expansion of activities by attracting new customers has a negative impact on the interest margin.

Concerning the influence of the various risk factors, we find that the variables *Rate_short* and *Sd_short* – measuring the interest rate risk – are not significant. The variable *Slope* however has a positive significant influence on the interest margin providing further evidence for our hypothesis that banks, facing a higher interest rate risk, set a higher interest margin. The influence of the variable *PD*, measuring the credit risk, is significant and positive except for the between model, in which the coefficient is dominated by the savings banks (compare also table 4). We nevertheless take this result as an indication for the existence of an risk-adjusted pricing processes. Also the influence of the variables *Loans* and *Fees* confirms our hypothesis on potential cross-subsidization strategies: specialization in the fee business has a negative impact on the interest margin.

With respect to the controls, the variable *Inflation* is not statistically significant; the variable *GDP_growth* has a negative significant coefficient indicating that the interest margin behaves in an anticyclical way.[18] The first difference of the variable *Opp_costs* has a small positive influence indicating that banks take into account the opportunity costs from non-

[17] As banks typically learn about changes in costs during a year and adapt their credit policy in regular intervals, we use the lagged value of the variable *Inefficiency* to model its influence on the interest margin.

[18] In contrast to our results, *Schwaiger/Liebeg* (2007) find a procyclical behavior of the interest margin for banks in Eastern Europe.

interest bearing reserves when setting the interest margin. In the between model however we observe a high negative coefficient; a finding which might be driven by the private banks and due to the aggregation of all bank groups into one relatively heterogeneous sample. In general, the model fits the data very well. The R^2_{within} is 0.33. The Hausman test rejects the null in favor of the alternative hypothesis, i.e., it rejects the assumption that the random effects are orthogonal to the regressors indicating that the random effects model is inconsistent.

In order to investigate the long-term relationship between the explanatory variables and the interest margin, we confront the results of the fixed effects model with those of the between group model. While showing similar results for the major part of explanatory variables, the variable *Growth_loans* loses significance in the between model. Looking at the overall effect of average group behavior it seems that the business-shift argument of increasing *PD*s decreasing margins outweighs the risk-compensation argument of the overall impact of PD changes for individual banks. In the light of table 4, this pattern is mainly attributable to the savings-banks' specific behavior as being opposed to the corporate-banks' specific reaction of standard risk-compensation considerations. Similar arguments of sample heterogeneity hold in explaining the sign reversal for the component *Opp_costs* which, according to table 4, is attributable to the private-banks' specific behavior of higher liquidity holdings resulting in lower interest margins. The $R^2_{between}$ is 0.47 pointing to a good fit of the between group model.

The test for autocorrelation indicates the presence of autoregressive effects in the empirical model. We therefore apply a dynamic model obtaining interesting features. The lagged value of the interest margin is significant at the 1% significance level and its coefficient is 0.7, i.e., the actual value of the interest margin strongly depends on its past value. The Arellano-Bond test however rejects second order autocorrelation. The results are basically the same as in the fixed effect model besides for the lagged variable *Inefficiency*. Its switch from a positive to a negative sign may be explained by the positive impact this newly introduced lagged dependent variable has on actual *IM* values: the negative coefficient somewhat dampens the dynamics of the estimated interest margin.

Table 3

Estimation Results Based on the Whole Sample

Variable	Fixed Effects Model	Between Model	Arell./Bond Model
Dependent variable (t-1)			0.7030*
			(73.43)
Lerner	0.0072*	0.0212*	0.0052*
	(5.03)	(20.8)	(19.77)
Inefficiency	0.0046*	0.0362*	-0.0048*
	(2.7)	(15.84)	(-6.04)
Eq_ratio	0.0413*	0.1000*	0.0228*
	(5.13)	(15.69)	(18.01)
Growth_loans	-0.0006**	0.0022	-0.0012*
	(-2.89)	(0.7)	(-6.4)
Slope	0.0009*		0.0002*
	(15.72)		(8.12)
SD_short	0.0110		0.0123
	(0.72)		(1.50)
PD	0.0026***	-0.0094**	0.0150*
	(2.01)	(-2.04)	(8.15)
Loans	0.1380*	0.8679*	0.0678*
	(2.49)	(2.57)	(6.26)
Fees	-0.0055*	-0.0198*	-0.0003
	(-3.18)	(-9.24)	(0.48)
Inflation	0.0011		0.0008
	(0.54)		(0.78)
GDP_growth	-0.0003*		-0.0005*
	(-4.22)		(-13.1)
Rate_short	0.0013		0.0014
	(-0.05)		(0.92)
Opp_costs	0.0702*	-11.891*	0.0272*
	(2.99)	(-2.77)	(6.61)
Year1998	-0.0014*		-0.0022*
	(-6.84)		(-23.95)
Constant	0.0209*	0.0004	0.0077*
	(12.07)	(0.05)	(16.86)
Number of observations	20173	20173	20173
R^2 within	0.330		
R^2 between		0.469	

Dependent variable: Interest margin. The t-statistics based on robust standard errors are reported in parentheses. System GMM results (Arellano-Bover/Blundell-Bond estimator) are two-step estimates. *, **, and *** = significance at the 1, 5, and 10% significance level. We use the first difference of the variable *Opp_costs* in all three models to avoid multicollinearity problems. The p-value are: 0.00 for the Hausman test, 0.00 for the test of serial correlation, 0.00 for the Arellano-Bond test of order 1, and 0.10 for the Arellano-Bond test of order 2.

The estimation results for the different bank groups are presented in Table 4. A first inspection shows that private banks are different from the other groups in many ways. The variable *Lerner* has a higher coefficient confirming our hypothesis that cooperative and savings banks are less prone to competition. Hence, market power is not as important a determinant for those banks as for private banks. The coefficients of the variables *Inefficiency* and *Eq_ratio* are insignificant for private banks, which might be due to the fact that, compared to the other two groups, the proportion of the fee business is higher, strongly determining the evolution of the interest margin and reducing the influence other explanatory variables, like *Inefficiency* and *Eq_ratio*, have in determining private-bank business. The variables *Growth_loans* and *Loans* have a negative significant influence on the interest margin of private banks. This confirms the presence of the Winner's Curse: in order to attract new customers and to sell them services in the future, as also indicated by the variable *fees*, private banks reduce the interest rate on loans and, consequently, the interest margin.[19] The negative coefficient of the variable *Opp_cost* points more to the effect of higher liquidity holdings due to missing credit opportunities reducing the margin rather than risk buffering considerations.

For cooperative banks, the coefficient of the variable *Slope* is somewhat lower than for the other two groups. This reflects the fact that cooperative banks use the money market less frequently as refinancing instrument. The credit risk has a positive and significant influence for cooperative banks only.

For savings banks, the negative coefficient of the variable *PD* confirms our hypothesis of their specific characteristics, which allow them to shift business when the private credit perspective worsens. This banking group also seems to exert a pricing strategy that is less driven by the default risk – thereby maybe less discriminating among clients – and less exposed to business fluctuations, as the smaller coefficient of the variable *Loans* and the insignificance of the variable *Gdp_growth* indicate.

[19] See also *Lepetit* et al. (2002) and *Busch/Kick* (2009).

Table 4

Estimation Results of the Fixed Effects Model for Bank Groups

Variable	Private Banks	Savings Banks	Cooperative Banks
Lerner	0.0269*	0.0048*	0.0077*
	(5.78)	(8.18)	(11.63)
Inefficiency	0.0034	0.0078*	0.0064*
	(0.56)	(4.5)	(6.63)
Eq_ratio	0.0243	0.0668*	0.0469*
	(0.91)	(9.82)	(9.31)
Growth_loans	-0.0037**	0.0001	-0.0001
	(-2.34)	(-0.36)	(-0.45)
Slope	0.0024**	0.0015*	0.0006*
	(3.11)	(22.25)	(18.5)
SD_short	0.0104	0.0083	0.0135
	(0.74)	(0.98)	(-0.45)
PD	-0.0035	-0.0040***	0.0026**
	(0.34)	(-2.04)	(2.47)
Loans	-0.3471**	0.1337*	0.2182*
	(2.89)	(9.95)	(7.8)
Fees	-0.0187*	-0.0066*	-0.0020**
	(-3.17)	(-4.2)	(-2.51)
Inflation	0.0007	0.0005	0.0011
	(0.85)	(1.06)	(1.14)
Rate_short	-0.0030	0.0003	0.0011
	(-0.63)	(1.18)	(0.56)
GDP_growth	-0.0007***	0.0000	-0.0005*
	(-1.94)	(-0.80)	(-5.33)
Opp_costs	-0.2725***	0.0329**	0.1010*
	(2.04)	(2.89)	(4.22)
Year1998	0.0005	-0.0001	-0.0021*
	(-0.19)	(0.42)	(-7.84)
Constant	0.0511*	0.0152*	0.0178*
	(15.49)	(14.59)	(13.9)
Number of observations	604	5344	13742
R^2 within	0.253	0.535	0.452
P-value of the Hausman test	0.00	0.00	0.00

Dependent variable: Interest margin. The t-statistics based on robust standard errors are reported in parentheses. *, **, and *** = significance at the 1, 5, and 10% significance level. We use first difference of opportunity costs to avoid multicollinearity problems as this variable has some elements in common with the variable *Eq_ratio*.

The model performs best for savings banks (R^2_{within} = 0.535), and for cooperative banks (R^2_{within} = 0.452) better than for private banks (R^2_{within} = 0.253), which is potentially due to the higher heterogeneity in the sub-sample of the latter group including small as well as very big banks. For all groups the Hausman test prefers the fixed effects model over the random effects model.

In order to evaluate the economic impact of the significant explanatory variable, we calculate the elasticities at the mean. The advantage of this approach compared to the evaluation of regression coefficients is that one obtains comparable statistics independent of the explanatory variables' absolute values.

Table 5

Elasticities in the Whole Sample

Variable	Fixed Effects Model	Between Model	Arell./Bond Model
Lerner	0.1186*	0.3759*	0.0857***
Inefficiency	0.0609*	0.5094*	0.0645***
Eq_ratio	0.1218*	0.3072*	0.0676***
Growth_loans	0.0015**	0.0042	0.0027*
Slope	0.0480*		0.0098*
PD	0.0036***	0.0164**	0.0211**
Fees	0.0432*	0.1766*	0.0026*
Loans	0.1704*	10.529*	0.0839***
GDP_growth	0.0171*		0.0279**
Opp_costs	0.0005*	0.3205*	0.0002*

The elasticities are reported as absolute values. *, **, and *** = significance at the 1, 5, and 10% significance level.

The elasticities calculated using the results of the whole sample regression are reported in Table 5. They confirm the importance of the variable *Lerner*, which is also indicated by the large regression coefficients in all estimations. For example, an elasticity of 0.12 in the fixed effects model means that an increase of a bank's market power by 10% increases the interest margin by 1.2%. The higher elasticities for the variables *Lerner*, *Fees*, and *Inefficiency* in the between group model suggest that the role of these determinants is more important to explain the differences between

different bank groups than the evolution of the interest margin over time. The variable *Loans* has the biggest influence on the interest margin in both the fixed effects and the between group models, indicating that the amount of credits granted is a very important determinant of the interest margin.

In the Table 6 we report the elasticities for the different bank groups calculated from the fixed effects model. For private banks, the variable *Lerner* shows the highest value equal to 0.49, which again confirms its importance. The high elasticity of the variable *Fees* for private banks validates our regressions results regarding the high influence of non-traditional banking activities. An increase of these activities by 10% reduces the interest margin by 2.05%. For savings banks, the elasticity of the equity ratio (*Eq_ratio*) dominates, which may be the result of a change in risk aversion during the last years or due to increasing capital requirements following Basel II. In any way, higher equity holdings increase the costs and thus require a bank to adapt its pricing strategy by increasing the interest margin. The elasticities for cooperative banks are similar to those of the fixed effects model presented in Table 5.

Table 6

Elasticities for the Different Bank Groups (Fixed Effects Model)

Variable	Private Banks	Savings Banks	Cooperative Banks
Lerner	0.4931*	0.0892*	0.1173*
Inefficiency	0.0971***	0.0997*	0.0880*
Eq_ratio	0.1106	0.1878*	0.1383*
Growth_loans	0.0082**	0.0002	0.0002
Slope	0.1015**	0.0799*	0.0304*
PD	0.0027	0.0047***	0.0039**
Fees	0.2053*	0.0528*	0.0152**
Loans	0.2892***	0.1763*	0.2623*
GDP_growth	0.0236	0.0022	0.0274*
Opp_costs	0.0018***	0.0002**	0.0007*

The elasticities are reported as absolute values. *, **, and *** = significance at the 1, 5, and 10% significance level

IV. Summary and Conclusion

This paper tests the determinants of the interest margin using high-quality data of German banks that allow performing the empirical analysis separately for private, savings, and cooperative banks. Our empirical analysis presents interesting results that may provide suggestions for the future development of the banking supervision policy. The strong influence of the *Lerner* index highlights the importance of market power. The significance of the cost-income-ratio (*Inefficiency*) reveals that efficiency is an important determinant of the interest margin, which might be particularly important during a crisis, when banks face many problems; an higher efficiency can help the bank to recover faster. The results also confirm the important impact of the two major risk factors banks face. The interest rate risk may be reduced through a climate of financial stability, while improvements in the monitoring process potentially reduce the credit risk. Fewer risks should contribute to a lower interest margin and thus better conditions for customers, which lowers the cost of financial intermediation and should help the real economy to recover faster. However, if margins reduce for the wrong reasons, i.e., excessive competition and risk taking, it may well increase costs by fostering distortions in the real economy and endangering financial stability.

Furthermore, we show that an expansion of business activities by granting more loans does not necessarily imply an increase in the interest margin, as one would expect if banks use risk-adjusted pricing. The reason is that banks deliberately (mis)price newly granted loans and willingly accept lower rates in order to attract new customers. This phenomenon is also known as the Winner's Curse. Cross-subsidization leads to a reduction of the interest margin as indicated by the negative coefficient of the fee business variable (*Fees*). It is however a risky strategy because cross-subsidization decreases the income earned from traditional sources, i.e., the interest income and increases income variability.[20] An excessive reduction of the interest margin may distort the intermediation process and negatively affect the stability of a bank. The high relevance of the fee business for private banks thus makes them particularly vulnerable.

The group analysis highlights the differences in the determination of the interest margin between private, savings and cooperative banks. Private

[20] See also *Busch/Kick* (2009).

banks are characterized by the importance of market power, which strongly influences their interest margin. Furthermore, they make a strong use of the cross-subsidization as well as the Winner's Curse pricing strategies, which increase their income volatility. Cooperative banks are particularly interesting for supervisory intervention for two reasons. On the one hand they have – thanks to their focus on the traditional interest business in form of relationship banking and their regional orientation – a high degree of market power. On the other hand their small-scale structure does not permit them to achieve a higher grade of efficiency as attested by the high value of the Cost-Income-Ratio, as shown by our descriptive statistics. Nevertheless their limited use of the interbank market reduces the sensitivity of the interest margin to the interest rate risk. With respect to savings banks the negative influence of the default risk and the insignificance of the business cycle suggest the fulfillment of a social function: they are able to shift business to less risk driven projects and to smooth the impact of business cycles through a stable interest margin.

While this paper provides some insights about the determinants of and their impact on the interest margin in Germany, additional aspects may be analyzed in future research. For example, it would be of great interest to compare the results derived for Germany in a broader analysis of the banking industry in Europe elaborating potential similarities as well as differences. Such an analysis could help to draw more complete pictures of the integration process, how the banking sector in Europe has evolved and which additional measures need to be taken to complete its consolidation. Expanding the time series would allow analyzing the interest margin as well as its determinants during the European financial and debt crisis, focusing on the influence of crucial factors such as the credit risk, the equity ratio and of the macroeconomic environment during that period. This may help to develop the necessary policies in order to avoid future crises and to improve the stability of the banking system further.

References

Allen, L. (1988): The Determinants of Bank Interest Margins: A Note, in: Journal of Financial and Quantitative Analysis, Vol. 23, No. 2, pp.231-235. - *Angbazo*, L. (1997): Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking, in: Journal of Banking & Finance, Vol. 21, pp. 55-87. - *Arellano*, M./ *Bond*, S. (1991): Some test of specification for panel data: Monte Carlo evidence and

application to employment equations, in: Review of Economic Studies, Vol. 2, No. 58, pp. 277–297. - *Busch*, R./ *Kick*, T. (2009): Income diversification in the German banking industry, in: Discussion Paper, Series 2: Banking and Financial Studies, No. 09/2009. - *De Guevara*, J. F./ *Maudos*, J. (2004): Measuring welfare loss of market power: an application to European banks, in: Applied Economics Letters, Vol. 11, pp. 833–836. - *Drakos*, K. (2003): Assessing the success of reform in transition banking 10 years later: an interest margins analysis, in: Journal of Policy Modeling, Vol. 25, pp. 309-317. - *English*, W. B. (2002): Interest rate risk and bank net interest margins, in: BIS Quarterly Review, December 2002, pp. 67-80. - *ECB* (2000): EU Banks´ Margins and Credit Standards, December 2000. - *Fischer*, K. H./ *Hempell*, H. S. (2005): Oligopoly and conduct in Banking – An Empirical analysis-, forthcoming. - *Freixas*, X./ *Rochet*, J. C. (1999): Microeconomics of Banking , 4. Edition, Cambridge (1999). - *Gischer*, H./ *Jüttner*, D. J. (2003): Global Competition, Fee Income and Interest Rate Margins of Banks, in: Kredit und Kapital, Vol. 36, Heft 3, S. 368-394. - *Hanweck*, G./ *Ryu*, L. (2005): The Sensitivity of Bank Net Interest Margins and Profitability to Credit, Interest-Rate, and Term-Structure Shocks Across Bank Product Specializations, in: Working Paper 2005–02, Federal Deposit Insurance Corporation. - *Hausman*, J. A. (1978): Specification Tests in Econometrics, in: Econometrica, Vol. 46, No. 6, pp. 1251-1271. - *Hill*, R. C./ *Griffiths*, W. E./ *Lim*, G. C. (2008): Principles of Econometrics, 3. Edition, San Francisco. - *Ho*, T. S. Y./ *Saunders*, A. (1981): The determinants of bank interest margins: Theory and empirical evidence, in: Journal of Financial and Quantitative Analysis, Vol. XVI, No. 4, pp. 581-600. - *Lepetit*, L./ *Nys*, E./ *Rous*, P./ *Tarazi*, A. (2008): The expansion of services in European banking: Implications for loan pricing and interest margins, in: Journal of Banking & Finance, Vol. 32, pp. 2325-2335. - *Lerner*, E. M. (1981): Discussion: The determinants of banks interest margins: Theory and empirical evidence, in: Journal of Financial and Quantitative Analysis, Vol. XVI, No. 4, pp. 601-602. - *Maudos*, J.; *De Guevara*, J. F. (2004): Factors explaining the interest margin in the banking sectors of the European Union, in: Journal of Banking & Finance, Vol. 28, pp. 2259-2281. - *Maudos*, J.; *Solís*, L. (2009): The determinants of net interest income in the Mexican banking system: An integrated model, in: Journal of Banking & Finance, Vol. 33, pp. 1920-1931. - *Mays*, E. (1999): A Statistical Analysis of the Factors Affecting S&Ls' Net Interest Margins, in: Risk Management Series, Office of Thrift Supervision. - *McShane*, R.W./ *Sharpe*, I. G. (1985): A time series/cross section analysis of the determinants of Australian trading bank loan/deposit interest margins: 1962-1981, in: Journal of Banking and Finance, Vol. 9, pp. 115-136. - *Memmel*, C. (2008): Which interest rate scenario is the worst one for a bank? Evidence from a tracking bank approach for German savings and cooperative banks, in: International Journal of Banking, Accounting and Finance, Vol. 1, No. 1, pp. 85–104. - *Merton*, R. C. (1974): On the Pricing of Corporate Debt: The Risk Structure of Interest Rates, in: Journal of Finance, Vol. 29, Issue 2, pp. 449-470. - *Pyle*, D. H. (1971): On the Theory of Financial Intermediation, in: The Journal of Finance, Vol. 26, No. 3, pp. 737-747. - *Schwaiger*, M. S./ *Liebeg*, D. (2007): Determinanten der Zinsspannen zentral- und osteuropäischer Banken, in: Finanzmarktstabilitätsbericht, Vol. 14, Österreichische Nationalbank, S. 74-93. - *Shaffer*, S. (1998): The Winner's Curse in Banking, in: Journal of Financial Intermediation, Vol. 7, pp. 359-392. - *Stata Press* (Editor) (2007):

Longitudinal-Data/Panel-Data Reference Manual, Texas (2007). - *Thaler*, R. H. (1988): The Winner's Curse, in: Journal of Economic Perspectives, Vol. 2, No. 1, pp. 191-202. - *Valverde*, S. C./ *Fernández*, F. R. (2007); The determinants of bank margins in European banking, in: Journal of Banking & Finance, Vol. 31, pp. 2043-2063. - *Wong*, K. P. (1997): On the determinants of bank interest margins under credit and interest rate risks, in: Journal of Banking & Finance, Vol. 21, pp. 251-271. - *Wooldridge*, J. M. (2002): Econometric Analysis of Cross Section and Panel Data, Cambridge (2002). - *Zarruk*, E. R. (1989): Bank Spread with uncertain deposit level and risk aversion, in: Journal of Banking and Finance, Vol. 13, pp. 797-810. - *Zarruk*, E. R./ *Madura*, J. (1992): Optimal Bank Interest Margin under Capital Regulation and Deposit Insurance, in: Journal of Financial and Quantitative Analysis, Vol. 27, No. 1, pp. 143-149.