



Key Determinants of German Banking Sector Performance

A. Nasserinia*, M. Ariff and Cheng Fan Fah

Faculty of Economics and Management, University Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

ABSTRACT

What drives banking performance is a little-explored research topic, despite the copious literature. This paper reports findings that offer new insights into what drives net interest margin, a key performance indicator (KPI) for the German banking sector. We consider the link between performance and a few carefully chosen critical bank-specific factors using the most up-to-date econometric methods such as panel regressions using a Generalized Method of Moments with data from 11 recent years. The results show that credit risk, income diversification and size have significant negative effects on net interest margin, as predicted by theory. Meanwhile, capital adequacy has a positive effect, as does the liquidity risk. The paper also finds that the effects of concentration and macroeconomic variables on net interest margin are weak and statistically insignificant. In this study, it was found that credit risk, income diversification, size, capital adequacy and liquidity risk are significant factors contributing to a new understanding of German banking performance.

Keywords: Net interest margin, credit risk, liquidity, capital, pooled regression, generalized moments method

INTRODUCTION

Net interest margin (NIM) is widely considered as a key performance measure for banks since it efficiently determines the intermediation between savers earning deposit rates and borrowers paying loan

rates, and thus determines how efficiently a bank operates. This study relies on a large number of key factors that correlate with banking performance in a major economy, Germany, in the most recent period that includes the years of the Global Financial Crisis. Data on NIM covering a period of over 11 years and ten theory-suggested factors were studied to identify the extent to which these factors correlate with Germany's banking performance. To do this, the current econometric models were employed to obtain reliable findings

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E-mail addresses:

naserinia@gmail.com (A. Nasserinia),

ariff13@upm.edu.my (M. Ariff),

chengfanfah@upm.edu.my (Cheng Fan Fah)

* Corresponding author

on the linkage between performance and key factors for a large model-industrial economy.

A competitive banking sector promotes efficiency that is reflected in narrower interest margins between lending and borrowing. High margins are an obstacle for intermediary institutions since lower deposit rates under high-margin banking tend to discourage savings being entrusted to the banks, while also shrinking the investment opportunities for banks, as well as their borrowers, as this requires the banks to resort to high lending rates (Fungáčová & Poghosyan, 2011). Unlike variables such as the returns on assets (around 2 per cent) and equity (about 15 per cent), which are indicators of managed variables, as well as how the accounting treatment of earnings flows is treated, NIM is of more economic significance in that any narrowing of that variable indicates a bank's high level of overall efficiency in order to be able to operate profitably with narrow margins. Hence, in this study, the use of this variable for performance is preferred over traditional ROI and ROE.

Ho and Saunders (1981) encapsulated the empirical studies carried out on determinants of bank margins in a theoretical framework referred to as the dealership model. The bank, in this model, is considered to be a risk-averse dealer in a credit market whose function as an intermediary between lenders and borrowers is to balance the asymmetry between loan demands and deposits by fixing interest rates for loans and deposits.

The model is then developed from the bid-ask prices of security-market traders. In this model, banks borrow (deposit interest) at one price and lend (loan interest) at a different price. Consequently, in an uncertain environment, banks have to bear the risks of fixing interest rates on loans and deposits, which they have to optimise in order to minimise the risk of interest-rate uncertainty when paying to borrow (deposits) while not dampening the demand for their deposits (loans) (Maudos & Fernandez de Guevara, 2004).

An alternative to the above model is Klein's (1971) or Monti's (1972) firm-theoretical models, which regard banking firms as playing an inactive role and simply allowing the supply and demand forces for deposits and loans to satisfy each market concurrently using the banking-firm micro-model approach (Zarruck & Madura, 1992; Wong, 1997).

Bank performance is assessed and understood using two broad approaches: non-structural and structural. The difference between them lies in the fact that the former employs a range of financial measures to assess different performance aspects, including factors such as the performance of the investment-strategies relationship while taking regulatory and governance features into account, and the latter is choice-theoretic that is dependent on a theoretical model of the banking firm and an optimization concept. For an example of that, see Panzar and Rosse (1987).

As the use of these theories is based on the motivation prompting investigations, there is no general theory of performance that can serve as a unifying framework. The structural approach, however, being such a narrowly focused theory of determinants, does not provide ample room to investigate the various suggestions in a single study as can be done when using potential determinants from a large number of theoretical papers on potential determinants. The literature is used to identify a set of ten variables as potential determinants of bank performance, narrowly defined as NIM.

Germany is an example of a country with universal banking that has experienced a relatively small number of banking crises in the past. Nevertheless, the global financial crisis has been far worse in Germany than in many of the advanced countries. Having the recent knowledge about the factors that affect net-interest margin are the most valuable, we can consider the efficiency trend of banks at the present time to devise a method for the determination of bank margin via the key variables identified in this study.

In this paper, the relevant literature to identify some determinants is briefly reviewed in Section 2, followed by a description of the data specification of the empirical model and methodology in Section 3, after which the results are presented and interpreted in Section 4, and then a conclusion is drawn at the end.

BANKING-PERFORMANCE LITERATURE

Internal Factors

Currently, there are a number of models developed in the attempt to explain the factors that can affect profit margins. Among these models are average operating costs, competition, market risk, credit risk and so on. Ho and Saunders (1981) considered assumed risk-averse intermediators to be involved in the financial market to collect deposits to provide loans. They demonstrated that pure-interest spread (NIM) is determined by factors such as the level to which bank managers seek to avoid risk; the magnitude of transaction operations undertaken; the structure of the bank market; and changes in interest rates. However, it should be noted that what precisely determines the NIM (i.e., whether these factors correlate with NIM) has not yet been studied thoroughly and systematically for any major economy, let alone for a group of countries.

The above model was extended by McShane and Sharpe (1985) by including operating costs and a measure for competition. Allen (1988) introduced various kinds of loans and deposits, while Angbazo (1997) added contained credit risk to the model and Maudos and De Guevara's (2004) model incorporated operation costs. Furthermore, the results reported by Saunders and Schumacher (2000) showed that interest rates, cost of opportunity, market power, bank's capital-to-assets ratio and fluctuations in interest rates have significant effects on NIM. It

should be noted that these are not, in our view, the main factors driving NIM. Thus, we propose direct internal (individual bank) and external (bank industry and country) factors, as follows:

Liquidity risk: One potential risk of bank failure comes from liquidity risk. According to the Basel Committee on Banking Supervision (1997), liquidity risk arises when banks are unable to meet their funding needs due to a reduction in liabilities or an increase in assets. The literature on bank performance shows that the two main functions of a bank, called the creation of liquidity and risk transformation, do not move in the same direction. This means that the amount of liquidity created may differ as a certain amount of risk is transformed by the bank. Therefore, it is important both to examine the role of banks and to make a distinction between them.

Deep and Schaefer (2004) devised a measure of liquidity transformation known as the “liquidity transformation gap”, calculated by the difference between liquid liabilities and illiquid assets scaled by total assets. They argued that banks do not create much liquidity. Berger and Bouwman (2009) reported that capital is positively and significantly associated with liquidity in large banks but it is less important for average-sized banks and always negative for small-sized banks.

Distinguin, Roulet and Tarazi (2013) reported that European and American commercial banks decrease their regulatory capital coincidence as they create liquidity,

i.e. they finance their assets with their liabilities. Horváth *et al.* (2012) confirmed a negative Granger-causality relationship for capital and liquidity creation in the case of small banks, although this could have a positive effect on large banks. Finally, Shen *et al.* (2010) examined the association between the risk of bank liquidity and bank performance and reported that because of the higher cost of funds, a liquidity risk might reduce a bank’s profits but increase its net interest margin due to the higher interest income arising from the level of loans.

Credit risk: Credit risk plays an essential role in NIM because the major portion of a bank’s earnings arise from loans and bank loans contribute to the main portion of the bank’s assets. According to insolvency theory, if banks’ liabilities exceed their assets, they may face failure. In the majority of cases, non-performing loans lead to fall in asset values. Ahmad and Ariff (2007) stated that an increase in the provision for loan losses is a significant determinant of potential credit risk, which means that the credit risk is the main risk for a bank.

Athanasoglou *et al.* (2008) suggest that the risks for banks have important and broadly relevant effects on their profitability. Demirgüç-Kunt and Huizinga (1999) reported positive effects from credit risks for NIM, while Kasman *et al.* (2010) found that credit risk is positively and significantly linked to banks’ NIM. Poghosyan and Cihak (2011) highlighted the importance of other sources of bank risks, besides leverage such as asset quality and earning profile for a bank’s soundness. Poghosyan and

Cihak (2011) emphasised the importance of resources other than bank-leverage risk such as asset quality and earnings profile for the soundness of a bank.

Capital adequacy: Based on the recent capital theories, more capital makes for better bank performance and is more predictable. Some theories propound that banks with more capital tend to have secure and sound assets and strongly monitor their borrowers because they seek to reduce the probability of default. Demircuc-Kunt and Huizinga (1999) and Garcia-Herrero *et al.* (2009) suggested a positive correlation between bank performance and capital, while Ben Naceur and Goaid (2008) reported a positive association between capital, high NIM and profitability. Beltratti and Stulz (2009) found that banks with relatively superior Tier-1 capital and more deposit financing indicate higher returns in times of crisis.

Athanasoglou *et al.* (2008) confirmed that capital is a prominent factor of bank profitability. Naceur and Omran (2011) argued that a bank's NIM and cost efficiency are affected by individual bank characteristics such as credit risk and capital. Berger and Bouwman (2013) cited evidence to support the importance of investing in small banks as this could help them to increase the probability of their continued existence and to maintain market share at all times, this being an important role played by investment banks in the performance of medium and large banks, mostly regarding the long banking crisis.

However, this approach is not without its flaws. It does not make active requests to take deposits, it is the least expensive source to finance the loans those banks can bear under different types of risk, while absorbing possible losses and keeping their debtors safe. It is also a strong individual bank factor in a time of crisis.

Asset quality: In some of the bank-performance literature, assets quality is proxied in the same way as credit risk or loan-loss provision, but asset quality is a factor which is achieved over time and through service. Thus, it is expected that older banks will have better-quality assets, resulting in a good reputation. Moreover, in some cases, loans are not key assets that create the main part of the income. A bank's profits may be determined by the quality of its loan portfolio and the risks that it carries. Therefore, non-performing loans being outweighed by sound loans indicates the high quality of a portfolio, and one of the most obvious concerns for banks is to ensure a low level of impaired loans.

Managerial efficiency: In the last two decades, numerous bank failures have occurred around the world. The empirical literature identifies two main reasons for these bank failures: a large number of impaired loans, and an adverse situation regarding cost efficiency. A fundamental dispute concerns whether or not poor administration increases the chances of bank collapse. Based on the poor-management assumption, cost efficiency has an impact on impaired loans due to the

lack of precise supervision of loans. In other words, low operational efficiency is a sign of poor management and this will affect credit decisions. In order to enhance bank's efficiency, it is necessary to have efficient cost control, along with a change in the workplace culture. In other words, banks will benefit greatly if they meaningfully improve their managerial practices.

Williams (2004) supports poor-management theory and explains that a decline in efficiency is usually followed by a decline in loan quality. Rossi *et al.* (2005) also demonstrated similar results over a longer time period. Goddard *et al.* (2013) reported that managerial efficiency appears to be a more important determinant of performance. Athanasoglou *et al.* (2008) argued that bank profits are closely and negatively related to operating expenses.

Size: In some studies, size and performance are closely and inversely related to each other. Basically, it is anticipated that large banks will have a higher level of loan quality and be able to diversify their services more than smaller banks, which reduces their risk. In addition, they benefit from economies of scale. Therefore, a reduction in risk because of diversity and benefits from economy of scale due to a larger size can lead to enhanced performance of a bank. Moreover, the recent global financial crisis has shown that the size of a bank is connected to substantial risk regarding financing the activities of society. Conversely, once banks have become very large, it may lead to a negative relation to performance due to some reasons such as an increase in overhead costs.

Demirgüç-Kunt and Huizinga (2011) logarithmically measured the size of banks according to total assets called "absolute size" and liabilities over GDP called "systemic size". They suggested that banks with a large absolute size are often much more profitable compared to banks with large systemic size profit less. Pasiouras and Kosmidou (2007) reported a negative association for size advantage, whereas Naceur and Goaid (2008) also mentioned similar findings. Others have suggested a weak or nonexistent correlation between size and bank performance (e.g., Goddard *et al.*, 2004; Micco *et al.*, 2007; Shih, Zhang, & Liu, 2007; Cornett *et al.*, 2010).

Income diversification: As a definition of non-interest revenues, we refer to so-called non-traditional activities. Besides the changes in the banking industry and increased competition, non-interest income has been the centre of attention for banks. In most income-related studies, diversification is considered as a non-interest income that increases over time. Most importantly, it is assumed that income diversification can, logically, reduce bankruptcy. Busch and Kick (2009) analysed the determinants of non-interest income in Germany and argued for the impacts of the cross-subsidisation of interest and fee-based business activities. Williams and Rajaguru (2007) examined the relationship between fee-based income and interest margin in Australia, and suggested that report-fee business income could serve as an alternative if there is a decline in interest income. However, a negative correlation was expected between

NIM and non-interest income. It should be noted that most previous studies have tested only one or two factors connected to profitability, while this study aims to demonstrate a multifactor model.

External factors

There are many other determinants that affect the performance of a bank, such as taxes, quality of service and so on, that can be taken into account as an additional function. In our view, there are industrial and macroeconomic factors that have been studied (Demirguc-Kunt & Huizingha, 1999). For the study of a single country, such as this one, it would be irrelevant to include these factors in our test models. However, the model includes external variables as the control variables.

Market structure: There are two well-known theories regarding the relationship between bank concentration and net interest margin called “structure–conduct–performance (market power)” and “efficient-structure (ES)”. The first theory states that increased market power results in monopoly power, while the second theory attributes higher profit to superior efficiency. In support of the first theory, see Molyneux and Thornton (1992), Goddard *et al.* (2011) and Mirzaei *et al.* (2013). In contrast, studies by Staikouras and Wood (2004), Mamatzakis and Remoundos (2003), Athanasoglou *et al.* (2008), Ben Naceur and Goaid (2008) and Chortareas *et al.* (2012) did not find any evidence to support the market-power hypothesis.

GDP growth: There are no conclusive findings regarding the effects of economic growth on NIM. There are contrasting higher-growth scenarios indicating a greater demand for bank loans which can lead to higher charges by banks for their loans, increased competition and macroeconomic stability expectations for a lower spread associated with stronger growth. Again, in their study of Central and Eastern European countries (CEEC) and in comparison with Western European countries, Claeys and Vennet (2008) found higher economic growth to be associated with higher margins in the latter; however, no link was found for the former. Bank profitability being positively impacted upon by output growth has been reported by Kosmidou (2008) and Flamini *et al.* (2009), while an opposite negative effect is reported by Demirguc-Kunt *et al.* (2003), Sufian (2009), Liu and Wilson (2010) and Tan (2012).

Inflation: Empirical studies show that the effects of inflation on bank performance depend on whether operating expenses and revenue increase at a higher rate than inflation. In other words, the impacts of inflation on bank profitability depend on whether inflation is fully anticipated. Thus, inflation is one of the main ways in which it is possible to affect the operations and margins of banks through interest rates. Perry (1992) suggested that the effect of inflation on bank performance is positive if the rate of inflation is fully anticipated. This gives banks the opportunity to adjust interest rates accordingly and,

consequently, to make higher profits. A positive relationship between inflation and NIM is reported by Demirgüç-Kunt and Huizinga (1999) in a study of 80 developed and developing countries by Staikouras and Wood (2004) for European banks, Athanasoglou *et al.* (2008) for Greek banks and by Albertazzi and Gambacorta (2009) for ten industrialised countries. An opposite negative effect is reported by Afanasieff *et al.* (2002) for Brazil and by Kosmidou (2008) and Ben Naceur and Kandil (2009) in their studies of Greece and Egypt.

DATA, HYPOTHESES AND METHODOLOGY

Econometric Specification

This study used a dynamic panel data and panel data with a large cross-sectional dimension and short time series, an approach for examining the determinants of NIM in a large sample of commercial banks since testing, as well as the fine-tuning methodology, pointed to it as the most appropriate method and one that is efficient for such a study. This method enables: (a) both time and cross-sectional variations to be located in the model, (b) lag-dependent variables and unobserved individual specific effects to be included, and (c) individual specific dynamics to be captured as allowing the dynamics of the relationship across subjects and over time permits this to be done. Consequently, any bias rising from either time-series dynamics influences was avoided in the results. The specific approach employed is the GMM

dynamic panel data approach (see Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998).

Three potential sources of inconsistency (very persistent profits, endogeneity and omitted variables) arose in any empirical work were allowed for by using dynamic panel techniques in this study. As the literature shows panel data are not emendable by being treated with a fixed and/or random-effects model, a difficulty arises due to the influence of lagged dependent or independent variables, especially in cases of several periods or across a few banks.

As shown by Baltagi (1995), consistent estimates are not produced by estimators like Generalised Least Squares (GLS) or Fixed Effect in the presence of dynamic and endogenous influences. The following equation represents the linear dynamic-panel data model:

$$NIM_{it} = c + \delta NIM_{it-1} + \sum_{j=1}^J \beta_j X_{it}^j + \sum_{k=1}^K \beta_k Y_{it}^k + \sum_{l=1}^L \beta_l Z_{it}^l + \varepsilon_{it}$$

$$\varepsilon_{it} = v_i + u_{it}$$

Where, NIM_{it} is the one-period lag of the dependent variable; δ is the speed of adjustment to equilibrium; NIM_{it} is the net interest margin of bank i at time t , with $i=1\dots N$, $t=1,\dots,T$, c is a constant term; X_{it} is bank-specific variables; Y_{it} is industry-specific variables, Z_{it} is macroeconomic variables, ε_{it} is disturbance, with v_i the unobserved bank-specific effect and u_{it} idiosyncratic error. This is a one-way

error-component regression model, where $v_i \sim (\text{IIN}(0, \delta_v^2))$ and independent of $u_i \sim (\text{IIN}(0, \delta_u^2))$.

Data

The data for this study comprise unbalanced panel data over a period of 11 years up to 2012, from 64 commercial banks, sourced from published and widely used financial information included in the Fitch-IBCA BankScope database of bank-specific observations, namely, bank balance sheets and income statements which are translated into 668 years of observations. The banks in the study sample, limited to

commercial banks, account for 95 per cent of the total assets of commercial banks for that particular period. World development indicators are the source for data on concentration, inflation, money supply and GDP growth, from which these are computed. Nonetheless, the sample of this study only includes commercial banks.

Descriptive statistics for the sample data is shown in Table 1. NIM, the proxy variable for interest-rate spread, shows a mean value of 2.044 per cent. The average inflation rate in the country over the period under study is 1.748 per cent and average GDP growth is 1.129 per cent.

TABLE 1
Descriptive statistics for the Variables in the Model

Variables	Mean	Standard Deviation	Minimum	Maximum
NIM	2.044	2.048	-0.274	22.316
LR	-0.016	0.478	-3.435	0.997
CR	0.096	0.796	-0.571	10.600
CA	1.138	5.314	0.034	69.231
ID	0.021	0.040	-0.013	0.289
LTA	14.969	1.972	11.918	21.843
CONCEN	85.745	1.448	83.880	89.270
GDPG	1.129	2.482	-5.145	4.012
M2	180.846	6.183	171.965	193.432
INF	1.748	0.663	0.840	3.116

Notes: NIM = (interest-rate income – interest-rate expenses)/average total-earning assets; LR is the financing gap (ban loans-customer deposits)/ total assets; CR = loan-loss provisions/ total loans; CA = equity capital/ total loans; ID = is non-interest income/total assets; LTA = natural logarithm of total assets; CONCEN is 5-bank asset concentration for Germany (assets of the five largest banks /total commercial banking assets); GDPG is GDP growth (annual in %); M2 is money and quasi-money as % of GDP; and INF (inflation) is end-of-period consumer prices (% change).

EMPIRICAL RESULTS

The first part of this study covers an OLS analysis that keeps NIM as the dependent variable, while LR, CR, CA, ID, LTA, CONCEN, GDPG, M2 and INF as the independent variables. Table 2 shows the preliminary OLS regression results. The results indicate that only LR, CR, CA, ID and LTA are significant determinants of net

interest income. Thus, NIM in the German banking sector is affected by each of these five bank-specific variables, with a positive relationship with liquidity risk (LR), capital adequacy (CR) and income diversification (ID), whereas bank performance is negatively influenced by credit risk (CR) and size (LTA) (see Table 2).

TABLE 2
OLS regression (NIM as dependent variable)

Variables	OLS	VIF	1/VIF
Constant	11.091 (1.21)		
LR	1.419*** (11.31)	1.01	0.9869
CR	-1.001*** (-10.67)	1.57	0.6366
CA	0.253*** (16.06)	1.97	0.5067
ID	3.33*** (1.95)	1.33	0.7520
LTA	-0.152*** (-4.83)	1.09	0.7206
CONCEN	-0.054 (-0.72)	3.03	0.3297
GDPG	0.000 (-0.01)	1.77	0.5347
M2	-0.013 (-0.78)	3.05	0.3297
INF	0.007 (0.06)	1.87	0.5347
R ²	0.4423		
Adjusted R ²	0.4346		
F-statistic	57.98***		

Note: VIF is the variance inflation factor. Mean VIF is 1.86

As LR is the difference between bank loan and customers deposit to total assets, the higher the ratio the higher should then be NIM because more loans are given out to earn interest. CA is equity capital to total loans; the higher the equity capital, the higher NIM will be because more equity is utilised to provide loanable funds. Similarly, as ID is non-interest income on total assets, it shows a positive correlation with NIM while we expect a negative one. In a competitive market, banks enhance their profit by matching between interest income and non-interest income and plan their profit structure with a view of usual or recession state of economic. The positive relationship can be interpreted that banks have more incentive carry out the activities of non-traditional banking with a recession state compared to the growing period. In situations of low economic growth, banks may be more interested in having non-traditional activities because they will be able to enjoy a variety of additional incomes. In addition, within low economic growth, banks may be affected on credit risk when they try to get a higher credit risk of traditional activities. This relationship will be further explained as time variance is taken in model condition.

In the opposite case, however, CR is defined as loan-loss provisions over total loans; the higher the loan-loss provision, the lower the net-interest

income. Finally, LTA is the logarithm of total assets and is used as an indication of bank size. Many studies have revealed that company profits are inversely related to size because large banks are more diversified and thus, they carry less risk than small banks. The OLS analysis carried out in this study yields consistent general findings with those of the literature, whereby the larger the bank, the lower NIM is, as observed for the German banking sector.

These OLS regression results are found to be reliable with an adjusted R-squared value of 0.4346 (43.46%), which provides a strong explanation for the variation in NIM. These five significant variables explained 44 per cent of the variations in NIM, a result which is seldom observed in the literature. The F-statistics of 57.98 shows that the model fit is significant. Finally, VIF (Table 2, column number 3) verification shows that there is no multicollinearity problem. White's correction is used for the regression to ensure that heteroskedasticity is controlled in the results.

The next part of this study involves further analysis to determine the bank's determinant by re-analysing the data with dynamic panel regression, as stated in Section 3 above. The results are given and explained below.

TABLE 3
GMM regression (NIM as the dependent variable)

Variable	Difference GMM			System GMM		
	One step	Two steps	Two steps with robust SE	One step	Two steps	Two steps with robust SE
constant	10.043 (1.63)	9.931*** (11.64)	8.481 (1.32)	9.576 (1.58)	9.720*** (24.03)	6.227 (0.98)
NIM_{it}	0.470*** (14.38)	0.469*** (339.28)	0.499*** (16.14)	0.486*** (16.99)	0.486*** (486.05)	0.556*** (11.08)
LR	0.148 (0.58)	0.187*** (4.60)	0.138 (0.63)	0.422** (1.75)	0.386*** (10.45)	0.172 (0.69)
CR	-0.920*** (-7.73)	-0.921*** (-599.99)	-0.751*** (-17.81)	-0.993*** (-8.55)	-0.996*** (-304.61)	-0.890*** (-5.03)
CA	0.264*** (22.26)	0.264*** (936.45)	0.227*** (17.11)	0.273*** (23.50)	0.273*** (1138.81)	0.246*** (14.28)
ID	-20.473*** (-6.53)	-20.66*** (-79.24)	-24.159 (-1.33)	-10.870*** (-5.55)	-11.00*** (-67.19)	-11.76*** (-2.24)
LTA	-0.462*** (-3.90)	-0.46*** (-24.84)	-0.594** (-1.76)	-0.475*** (-4.53)	-0.473*** (-46.91)	-0.504** (-1.68)
CONCEN	-0.025 (-0.47)	-0.02*** (-3.17)	0.024 (0.89)	-0.019 (-0.35)	-0.021*** (-5.61)	0.033 (1.28)
GDPG	0.001 (0.08)	0.003** (1.91)	0.004 (0.57)	-0.006 (-0.35)	-0.005*** (-5.40)	-0.001 (-0.06)
M2	0.001 (0.15)	0.002** (1.71)	-0.002 (-0.34)	0.001 (0.07)	0.001** (1.61)	-0.003 (-0.29)
INF	0.027 (0.41)	0.017*** (2.41)	0.033 (1.32)	0.065 (0.99)	0.058*** (13.38)	0.035 (0.99)
Wald χ^2	1225.64***	5160***	1973.34***	1891.46***	49200***	8170.18***
Hansen p-value	0.000	0.155		0.000	0.31	
AR(1) p-value		0.117	0.135		0.118	0.140
AR(2) p-value		0.308	0.364		0.313	0.351
Number of observations	604	604	604	604	604	604

Note: ***, ** and * indicate significance at 1, 5 and 10 per cent levels, respectively. Values in the parentheses are Z-statistics. The Hansen test is a test of overidentification restrictions. Arellano–Bond orders 1 and 2 are tests for first- and second-order correlation, respectively, which asymptotically $N(0, 1)$, test first-difference residuals in the system's GMM estimation. Two-step errors are computed according to Windmeijer's (2005) finite-sample correction.

The findings from a dynamic-panel data-regression analysis are shown in Table 3. A two-step GMM panel-data procedure was used with a correction for the possibility of downward-biased estimated asymptotic standard errors in the two-step GMM estimator from Windmeijer (2005).

Some general comments about the test results are as follows. First, the most stable results are found in our regression. Second, the Wald chi2 test is statistically significant in different regression models at a 1 per cent probability. Third, the Hansen tests for over-identifying restrictions showed that at a 5 per cent significance level the instruments are appropriately orthogonal to the error. Arrelano–Bond AR (2) tests showed no second-order serial correlation was detected, which is important for GMM estimator consistency. Finally, the significance found for the lagged dependent variable validates the use of the dynamic-panel data model.

From the test statistics in Table 3, it is seen that the lagged dependent variable (NIM) is positive and significant, which can be inferred as proof of the persistence of NIM in commercial banks. The liquidity risk (LR) and net interest margin relationship, although not statistically significant, was found to be positive. These results, consistent with the literature, showed the propensity of banks to pass their liquidity risk on to consumers via an increase in the interest-rate margin. As the effect of credit risk (CR) is negative on net-interest margin, this is taken as an indication of banks having lower

profitability with higher credit risk. These results, therefore, indicate that German commercial banks need to focus on their credit-risk management.

Impaired assets pose a problem and are dealt with by creating a write-off reserve. The correct credit-risk measures improve banks' efficiency and help to avoid or protect them from moral-hazard exposure. Capital adequacy (CA) is statistically significant, positive and related to NIM. Our findings are consistent with an entrenched belief in the banking sector that healthy capitalised banks have a lower risk of insolvency, thus reducing the financing cost. Saunders and Schumacher (2000a) explained that higher capital ratios might be interpreted as a form of tax on bank profits, thus forcing banks to charge an additional premium for NIM. Another possible reason is that well-capitalised banks have lower expected bankruptcy costs and lower financing costs.

In terms of managerial efficiency (ME), both variables were not put in our model at the same time because of a multicollinearity problem with income diversification (ID) in the data set. Instead, separate regressions were run by including the ME variable without the ID variable.

Although the results show that managerial efficiency, based on operating expenses to total assets and non-interest expenses to total asset, affects NIM negatively, these are not statistically significant. The finding is consistent with the bad-management hypothesis of Berger and DeYoung (1997), with low profitability being a signal of poor management

practices. Obviously, proper management sees the need to improve the efficiency of the banking sector everywhere.

In relation to income diversification, previous research shows contrary results, DeYoung and Rice (2004) and Mercieca *et al.* (2007) suggested that better performing banks use less non-interest income. On the other hand, other research reports such as those by Baele *et al.* (2007) argue that non-interest income can increase the efficiency of a bank. The results of our study showed a negative and statistically significant relationship between income diversification (ID) and NIM. These results indicate that managed banks proceed to non-interest income more slowly and are consistent with the findings of many other studies. However, given our finding of a strong negative correlation, this might be interpreted as commercial banks pursuing purposes other than profits. However, given our findings, a strong negative correlation might be interpreted as commercial banks seeking higher than normal profits.

The relationship between the size and performance of banks is more complex, as found in the research, as many additional factors such as economic growth, market discipline, country etc. come into play. Although a recent study made a distinction between absolute size based upon the logarithm of total assets and systemic size based on the liabilities-to-GDP ratio, the empirical results of these studies are mixed. On the one hand, banks of large systemic size showed a tendency to be less profitable (Demirgüç-Kunt & Huizinga,

2011), and what are economies of scale and scope for smaller banks are diseconomies for larger financial institutions (Pasiouras & Kosmidou, 2007), with size impacting on profitability negatively (Ben Naceur & Goaid, 2008), while positive relationships by contrast found by Kosmidou (2008) and Beltratti and Stulz (2009).

In our study, bank size was computed as a logarithm of total assets. A negative and statistically significant relationship was found between bank size (LTA) and NIM for the commercial banks. One important reason for this might be that commercial banks are forced to increase their size in order to compete in the market, as this country is an example of universal banking. Another reason might relate to the level of consolidations through mergers and acquisitions in this region during the financial-crisis years.

As the concentration is not statistically significant and able to explain NIM, this does, in a sense, provide a rationalisation for rejecting both the Structure-Conduct-Performance (SCP) and Relative-Market-Power (RMP) hypotheses. The evidence for correlation between macroeconomic variables and net-interest margin is also very feeble. Macroeconomic control variables such as inflation undoubtedly affected the performance of the banking sector when, for instance, the 1990s interest-margin reduction in Europe correlated to economic growth that reduced costs (Maudos and Guevara, 2004). Angelini and Cetorelli (2003) are of the opinion that, in the case of European banks, GDP growth and NIM are negatively associated.

In addition, considering the effects of time as much as possible in our study, we included a dummy variable in the model and tested it. However, no time effect was found during the period of our study.

Confirmation of the dynamic character of the model specification is given by the significant coefficient for the lagged dependent variable. In this study, δ , with a value of about 0.55, indicates that the net-interest margin remains at a moderate level and paints a picture of a level of adjustment to an equilibrium appropriate for a perfectly competitive market structure in the German banking sector.

CONCLUSION

The net interest margins of German banks were studied to identify key determinants that correlate with banking performance as the dependent variable. Since the global financial crisis, structural reforms of banks have affected costs as well as interest income in different ways. Net-interest margin is the most significant indicator as it is a good proxy assessor of performance. This dropped by 41.7 per cent during the 11-year test period (see Fig.1). Interestingly, Fig.2 shows that the difference between total interest income and total interest expenses, as seen in 92 selected commercial banks in Germany, increased. There is a consensus that high intermediation costs hamper economic growth while low intermediation costs can contribute to it. Germany is a developed country that was affected by the financial crisis and has a universal banking industry.

This paper has investigated bank-specific and some macroeconomic determinants of interest in relation to NIM. This is the first study to model a large number of factors that are potentially correlated to performance (NIM). The results show that the most significant variables are bank-specific factors in multi-country tests using GMM. The results showed a negative association between credit risk, income diversification and size, while capital adequacy has a positive effect. Capital has a significant impact on a bank's NIM. This is taken as substantiation of the role of capital in the financial system to reduce bank risk and keep the confidence of depositors. Liquidity risk and managerial efficiency have a positive and a negative impact, respectively; these are not statistically significant. The findings on concentration in this study support neither the structure-conduct-performance (SCP) hypothesis nor the relative-market-power (RMP) hypothesis.

A significant coefficient for the lagged dependent variable confirms the need to take into account the dynamic character of the model's specification, as we did with GMM. In this study, δ takes a value of about 0.55, which means that the net-interest margin continues at moderate level in adjustments to the equilibrium of the sector to the level of an almost perfect competitive market structure in the German banking sector. Further research in a multi-country setting would reveal the industry and macroeconomic factors that are also important in banking performance.

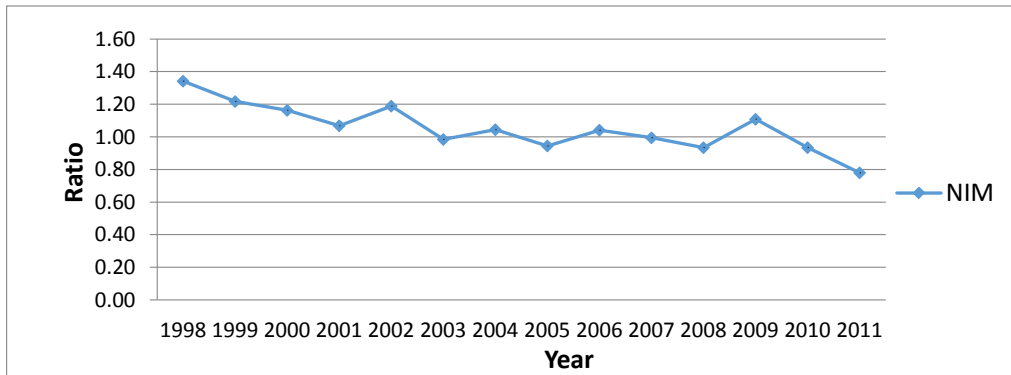


Fig. 1: Net-interest margin for the banking industry in Germany from 1998 to 2011

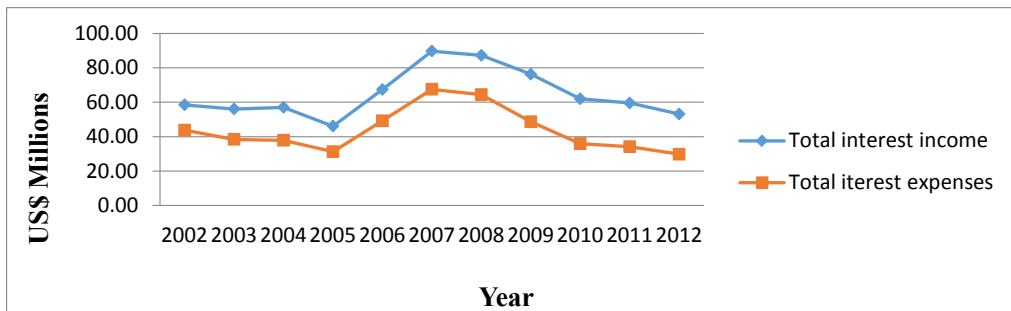


Fig. 2: Total-interest income and total-interest expenses for 92 selected commercial banks in Germany from 2002 to 2012

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