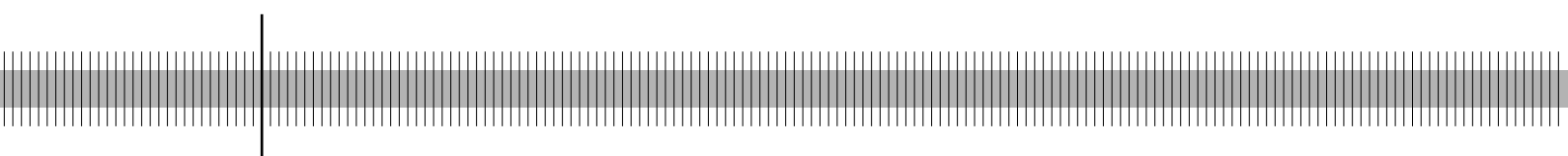# Income diversification in the German banking industry

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Income diversification in the German banking industry [*]

Ramona Busch, Thomas Kick [†]

Abstract

In the last few years it has been possible to observe decreasing interest margins for German universal banks. At the same time, institutions increasingly moved part of their business from interest to fee-earning activities. This study analyzes the determinants of non-interest income and its impact on financial performance and the risk profile of German banks between 1995 and 2007. We find empirical evidence that for all German universal banks risk-adjusted returns on equity and total assets are positively affected by higher fee income activities. Additionally, for commercial banks we show that a strong engagement in fee-generating activities goes along with higher risk. In order to analyze possible cross-subsidization effects between interest and fee business we also examine how banks' expansion in fee-based services has affected their interest margin. For savings and commercial banks we find that institutions with a strong focus on fee business charge lower interest margins when credit risk is controlled.

Non-technical summary

Previous diversification studies for the German banking market have examined the composition of banks' credit portfolios thoroughly. However, these studies neglected the aspect of income diversification. Bearing in mind the shrinking interest margins with which German banks are faced, the question becomes highly relevant of whether banks can take advantage of the diversification of their income sources, i.e. the combination of interest and fee-earning activities. Theoretically, banks would benefit from diversification when all income components are either negatively or only slightly correlated. On the other hand, however, latest experience from the current financial crisis has shown that boosting non-interest income activities could also destabilize individual banks as well as the banking system as a whole.

Our study focuses on banks' primary income sources: interest and fee-earning activities. In the academic literature, the feedback effect between a bank's profitability and its strategic decision to expand its fee business plays only a minor role. Hence, we would expect an increase in non-interest business to have two effects: First, a change in a bank's profitability and, second, that rather weak banks would try to develop alternative business opportunities.

This study is divided into two parts: First, we examine whether banks with a heavy involvement in the fee business can increase their returns, and whether this involvement goes hand in hand with higher risk taking. Owing to data considerations, we measure activity in this business unit by fee income as a ratio of interest income and fee income. Our database is a micro panel of supervisory balance sheet data (BAKIS) and information on banks' lending to industry sectors (borrowers' statistics) for the years 1995 to 2007. The second part of the paper focuses on banks' interest margins. Here, we control for credit risk using loan loss provisions to show that savings and commercial banks with a high share of fee income charge lower interest margins. We interpret this finding as an indication of subsidization between interest and fee business.

In sum, our analysis shows that banks with a large share of fee income exhibit a more favorable risk-return profile, i.e. they demonstrate a higher risk-adjusted return on equity (ROE) and total assets (ROA). Additionally, for commercial banks we find that strong activity in the fee business is accompanied by higher ROE/ROA volatility and, therefore, by greater risk. Finally, in the case of savings and commercial banks, we observe that institutions with a strong focus on fee business charge lower risk-adjusted interest margins.

Nichttechnische Zusammenfassung

In Diversifikationsstudien zum deutschen Bankenmarkt wurde die Zusammensetzung der Kreditportfolien von Banken untersucht. Aspekte der Einkommensdiversifizierung wurden bislang jedoch ausgeblendet. Dennoch erscheint gerade in Zeiten sinkender Zinsmargen die Frage relevant, ob Banken Vorteile durch die Diversifizierung ihrer Einkommensquellen, d.h. vor allem durch die Kombination von Zins- und Provisionsgeschäft, erlangen können. Aus theoretischer Sicht sind Diversifikationsvorteile dann zu erwarten, wenn sämtliche Einkommensströme entweder negativ oder nur gering miteinander korrelieren. Dem Diversifikationsargument stehen allerdings die jüngsten Erfahrungen aus der Finanzkrise entgegen, die gezeigt haben, dass der Versuch, die Einkommensströme durch vermehrte Einnahmen aus dem Provisionsgeschäft zu diversifizieren, auch destabilisierend auf Einzelbanken sowie das gesamte Bankensystem wirken kann.

Unsere Studie ist auf die beiden zentralen Einkommensquellen von Banken fokussiert: Das Zins- und das Provisionsgeschäft. In der akademischen Literatur findet hierbei der Feedbackeffekt zwischen der Ertragskraft einer Bank und deren strategischen Entscheidung zur Ausweitung des Provisionsgeschäfts wenig Beachtung. Hierbei ist zu erwarten, dass die Erhöhung des zinsunabhängigen Geschäfts einerseits die Ertragskraft einer Bank verändert und dass andererseits gerade ertragsschwächere Banken nach alternativen Geschäftsmöglichkeiten suchen werden.

In der vorliegenden Arbeit wird in einem ersten Schritt untersucht, ob Banken mit verstärktem Engagement im Provisionsgeschäft ihre Gewinne erhöhen können und ob dieses Engagement mit zusätzlichen Risiken verbunden ist. Wie stark ein Institut im Provisionsgeschäft engagiert ist, wird dabei als Anteil der Provisionserträge an der Summe von Zins- und Provisionserträgen gemessen. Als Datenbasis dient ein Mikro-Panel mit bankenaufsichtlichen Bilanzdaten (BAKIS) sowie Informationen zur Kreditvergabe der Banken in die einzelnen Wirtschaftssektoren (Kreditnehmerstatistik) für die Jahre 1995 bis 2007. In einem zweiten Schritt wird untersucht, inwieweit sich die wachsende Bedeutung des Provisionsgeschäfts auf die Zinsmargen der Banken auswirkt. Dabei können wir nachweisen, dass Banken mit einem hohen Anteil Provisionsgeschäft eine geringere Zinsmarge einfordern, wobei wir das Kreditrisiko mittels der Abschreibungsquote kontrollieren. Dieses Ergebnis deuten wir als Hinweis für eine Quersubventionierung von Zins- und Provisionsgeschäft.

Unsere Analyse zeigt, dass Banken, die einen höheren Anteil ihrer Erträge im Provisionsgeschäft erwirtschaften, eine günstigere Risiko-Ertragssituation (gemessen am ROE und ROA) aufweisen, d.h. deren risikoadjustierte Eigenkapitalrendite größer ist. Gleichzeitig lässt sich für die Privatbanken feststellen, dass ein stärkeres Engagement im Provisionsgeschäft auch mit einer höheren Volatilität der Eigen- und Gesamtkapitalrenditen und damit mit einem höheren Risiko verbunden ist. Für die Gruppe der Sparkassen und Privatbanken kann zudem gezeigt werden, dass Institute mit einem starken Fokus auf das Provisionsgeschäft geringere risikoadjustierte Zinsmargen einfordern.

Contents

1 Introduction

The German banking sector comprises three pillars: privately-owned commercial banks, savings banks and their central institutions ("Landesbanken") and credit co-operatives with two central institutions. All banking groups are different in terms of ownership, geographical concentration and business model.[3]

In the last few years the German banking industry has experienced decreasing interest margins and profitability. At the same time the relevance of non-interest income has increased. Across all banking groups, between 1975 and 2007 the average ratio of fee surplus to interest and fee surplus increased from 12% to 26%. Graph 1 shows that fee-income relative to interest income increased in all banking sectors, whereby commercial banks traditionally create higher fee-income than cooperative and savings banks. In 2000 this ratio reached a peak due to the agile demand for investment share certificates and shares. In this paper we examine the relationship between earnings from the fee business and bank performance. Our study is based on a micro panel of supervisory balance sheet data (BAKIS) and information about banks' lending to industry sectors (borrowers' statistics) for the years 1995 to 2007.[4]
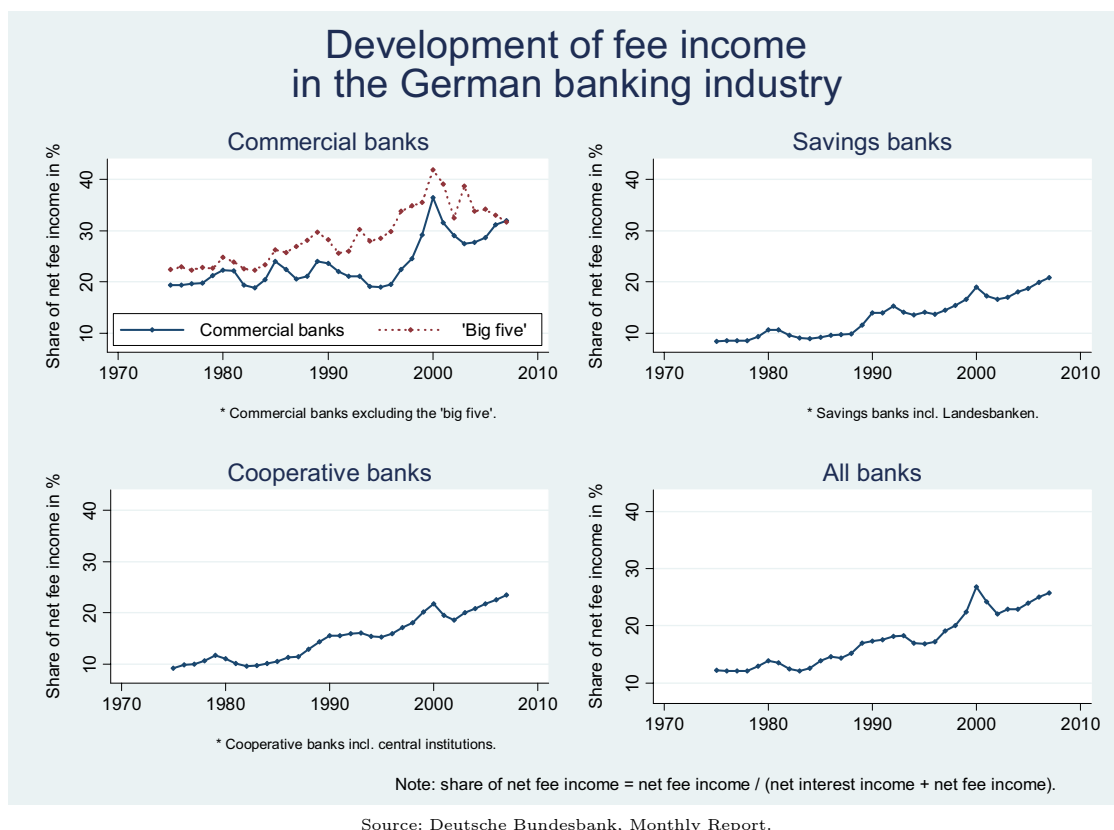
Figure 1: Development of fee income in the German banking industry

From the academic literature we notice that product diversification in general

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[3] For a detailed description of the structures of the German banking system see for example Koetter et al. (2004).

[4] The dataset excludes Landesbanken, two central cooperative banks, and the five largest commercial banks ("big five") on account of their different business models and different risk-return characteristics.

reduces a firm's exposures to any particular activity, which in turn leads to risk reduction. In the context of the banking industry, institutions reach disintermediation by expanding fee-earning activities. This strategy leads to greater diversification of income sources, which might help banks to reduce risks and stabilize profits, provided the different income components are imperfectly correlated. On the contrary, some fee income activities are associated with much higher risks than other income sources and, therefore, they could contribute to a destabilization of both individual banks and the whole banking system. For example, the importance of loan securitization and credit derivatives has drastically increased over the last few years, which allowed in particular larger banks to replace interest income by fee income. This development, however, goes along with higher risk taking mainly because of the complexity of such instruments.

2 Review of literature

Diversification in banking can take on different dimensions. While there are a variety of studies that analyze diversification within loan portfolio, diversification of income sources, more specifically interest and non-interest income, has attracted increasing attention in academic research. Generally, it is believed that diversification of income sources should reduce total risk, as diversification should stabilize operating income if income streams are negatively or imperfectly correlated. While this argument is clear from a traditional point of view, DeYoung and Roland (2001) provide three reasons why non-interest income may increase volatility. First, revenues from fee-based activities might be more volatile than interest income because the customer-bank relationship is stronger in the traditional lending business, i.e. for many of the new fee-based activities it is easier for customers to switch to another bank. Second, expanding into fee-based services can considerably increase fixed costs (e.g. by investments in technology and human resources) whereas, if a lending relationship is already established, the only cost of an additional loan are the bank's interest expenses. Third, in contrast to the lending business, fee-based activities require less regulatory capital, which suggests a higher degree of financial leverage and therefore leads to a higher earnings volatility. Indeed, DeYoung and Roland (2001) and Stiroh (2004a) find empirical evidence that reliance on non-interest activities increases the volatility of large U.S. banks. In general, only a few papers identify empirical evidence that combined lending and non-interest activities cause diversification benefits and therefore lead to risk reduction. By contrast, there are some studies (mainly for the US banking market) that have shown a positive and significant influence of diversification through non-interest income on earnings volatility.[5]

Stiroh (2004a) analyzes the potential benefit of income diversification for U.S. banks. Since the growth of net interest and net non-interest income in the period 1984-2001 is increasingly correlated, he concludes that the diversification benefits decreased during the period in question. Furthermore, he shows that at the bank level risk-adjusted returns are negatively associated with non-interest income shares.

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[5]See for example Stiroh and Rumble (2006), Mercieca et al. (2007), DeYoung and Roland (2001), Stiroh (2004a).

De Young and Rice (2004) suggest that there are differences between the European and the U.S. banking sector. They argue that universal banking has been the historic norm in many European banking systems, possibly based on experience as European banks are better informed as to how to exploit the diversification benefit of fee-based activities. Smith et al. (2003) likewise empirically confirm that European banks are able to seek diversification benefits through combining interest and non-interest income activities. In the case of European banks, the authors find that non-interest income is indeed more volatile than interest income but, in contrast to U.S. studies, there are negative correlations between these two income streams. Hence, they conclude that non-interest activities potentially stabilize bank earnings, a result that is also confirmed by Davis and Tuori (2000) for a number of European banks, including some in Germany.

Gischer and Jüttner (2003) find a weak negative relationship between ROA and the fee income to interest income ratio for 19 OECD countries. The results for the Australian banking sector are similar. Esho et al. (2005) show that for a sample of Australian Credit Unions the return on assets (ROA) is negatively associated with the increment of transaction fees. Against expectations, risk rises in line with a higher revenue share of this income source. Conversely, revenue shares of fees received for off-balance sheet facilities and fiduciary activities do not seem to have any influence on risk and return, possibly on account of the relatively small share of this income category. Lepetit et al. (2008) find that in the case of 602 European banks during the period 1996-2002 there was a negative correlation between interest margin and non-interest income. The authors assume that banks use loans as a loss leader to expand their non-interest income via cross-selling.

Stiroh and Rumble (2006), Stiroh (2004b), Mercieca et al. (2007) and Chiorazzo et al. (2008) differentiate between a "direct exposure" effect (a greater reliance on non-interest activity) and an "indirect diversification effect" (change of concentration between the two income streams), whereby the latter is measured by the Herfindahl Hirschmann Index (HHI). Indeed, Stiroh and Rumble (2006), Stiroh (2004a) and Mercieca et al. (2007) show that for small European banks, small U.S. community banks and U.S. financial holding companies higher concentration is accompanied by a lower degree of income volatility, while shifting into non-interest income creates an inefficient trade-off between risk and return. Furthermore, all three studies conclude that the banks' financial stability, measured through z-score, is negatively affected by reliance on non-interest income. In contrast to these papers, Chiorazzo et al. (2008) identify a positive relation between diversification and non-interest income activity and risk-adjusted performance for Italian banks between 1993 and 2003. Split samples, grouped by size classes, reveal that large banks, in particular, benefit from non-interest income activities while within the group of small banks only institutions with a low non-interest income share are able to benefit from expanding their non-interest business.

If, indeed, there are only two income streams the question remains, however, as to whether the "direct exposure effect" can be separated from the "diversification effect". In this context, Petersen (2004) complains that in the binary case, where the bank chooses between lending and non-interest activities, the HHI is merely a non-linear form of the non-interest income share. In particular, if the bank's non-interest income share is less than 50%, which is true for most of the small banks,

the correlation between HHI and non-interest income share is extremely large and, hence, empirically separating these two effects might be impossible.

Until now academic literature has paid only little attention to the fact that non-interest activity and banks' performance are interrelated. On the one hand, there is the suspicion that banks suffering from declining or highly volatile profitability are inclined to expand their engagement in non-interest activities in order to earn a higher or more stable return. On the other hand, shifting banks' business towards non-interest income also has an impact on profitability.

In econometric analysis it is necessary to pay attention to the possible endogeneity of non-interest income activities, as otherwise the endogeneity of independent variables leads to inconsistent estimators. Endogeneity in the modeling of non-interest income is, for example, considered in De Young and Rice (2004), Laeven and Levine (2005) and Campa and Kedia (2002), whereas all studies use an instrumental variable approach to derive consistent estimators.

De Young and Rice (2004) demonstrate the empirical links between banks' non-interest income, business strategies, market conditions, technological change and financial performance for U.S. commercial banks between 1989 and 2001. They show that well managed banks, measured by a relative ROE measure, are less engaged in non-interest income while large banks and banks that focus more on relationship banking are more reliant on non-interest income. They also find that marginal increases in non-interest income engender higher, but more volatile profits, and a decline in risk-adjusted profits. Craigwell and Maxwell (2006) also find a positive impact of non-interest income on ROA and its volatility for Barbados banks between 1985 and 2001. In contrast to other studies, however, they find no evidence that relative performance helps to explain non-interest income. Surprisingly, in the Barbados study non-interest income - in relative terms - plays a larger role for smaller banks.

While most previous work on bank diversification was dedicated to U.S. banks there are only a few studies that analyze the relationship between the changing structure of bank income and risk in the European banking industry. To our knowledge, no study exists that explicitly analyzes the effect of non-interest income activities on German banks. In order to contribute to this area of banking literature, we analyze the effect of banks' fee generating activities on their risk-return profiles, with a special emphasis on banks' interest margins. Our database consists of a micro panel of supervisory balance sheet data and information on banks' lending to industry sectors between 1995 to 2007. We focus on the problem of endogeneity in two ways: first, we use a fixed effects panel with lagged variables to explain banks' return and risk-adjusted return and, second, we apply the two-stage least squares estimator to explain the volatility of bank returns. Our reasoning for this methodological approach is described in detail in section 4.

In section 3 we review the reasons for fee-income growth over the last few years while in section 4 we present a detailed data description and the empirical model. Our results are reported by banking group in section 5 and our final conclusions are contained in section 6.

3 Factors influencing banks' changing income and profit structure

German interest margins have constantly been declining since the mid eighties. This development has been accelerated by globalization but, on the other hand, globalization also leads to a rapid growth of international trade which in turn provides opportunities in the fee business[6] (Gischer and Jüttner, 2003). Hence, to compensate for the adverse development in the interest business banks looked for other income sources (Koetter et al., 2004). For some banks it has opened up new markets, particularly in trading, asset management and investment banking activities (Davis and Tuori, 2000). The introduction of new regulatory requirements (Basel I and Basel II) also impairs banks' non-interest income activities. Since regulatory requirements have affected compliance and the cost of capital, banks have to look more closely at different assets on their books and price them accordingly. In this context it is often argued that the increase in off-balance sheet activities, which can be observed in some European countries, largely results from lower capital requirements for off-balance sheet items, and not from on-balance sheet activities.[7]

Moreover, lower risk-weights for inter-bank loans lead to an increase in this balance sheet position. Since inter-bank loans have lower interest margins than loans to non-financial clients, non-interest income declined (Davis and Tuori, 2000). In addition, expanding consumer needs caused the creation of new types of bank activities. In response to demographic changes, growing wealth on the part of individuals and the expected loss in the pension system, a larger proportion of the population engages in portfolio investments. Furthermore, there has been a change in technology (e.g. automated teller machines and internet banking are now more common than years ago) which also affects banks' cost structure (Hawtrey, 2003).

Finally, the costs of collecting and processing information have decreased. This has, for example, lead to more efficient "production" of financial information and better techniques for evaluating and pricing risk. Some banks have even specialized in the monitoring of credit exposures (as agents rather than principals), e.g. in the context of loan securitization which increases the share of non-interest income. Innovation in financial products has facilitated a rearrangement of the income structure and the balance sheet of banks. In general, the possibility of removing risk from capital has caused an increase in off-balance sheet activities, as some banks have been encouraged to take part in the process of securitization by undertaking investment banking activities (Davis and Tuori, 2000).

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[6]E.g. letter of credit, international payment transfer, etc.

[7]Note that in Germany the off-balance sheet activities to total assets ratio rather decreased over the last few years.

4 Variables, data and the empirical model

4.1 Measures of different income sources, diversification and performance

In our analysis we consider a bank's total interest earnings (interest income, II), and total fee earnings (fee income, FI), from which we create a variable SHFEE to measure the share of fee generating activities:

$$SHFEE = (FI)/(FI + II)$$

As a profitability measure we consider return on equity (ROE) and total assets (ROA), which is the ratio of operating revenues to equity and total assets respectively. As risk measure we use the standard deviation (σ) of ROE and ROA, which is calculated over the entire period a bank is in the sample. Following Chiorazzo et al. (2008) we construct risk-adjusted returns (RAROE and RAROA) to risk-adjust profitability:

$$RAROE_{i,t} = ROE_{i,t}/\sigma_{ROE_i}$$

$$RAROA_{i,t} = ROA_{i,t}/\sigma_{ROA_i}$$

Interest margin (NIM) is calculated as interest surplus divided by total assets.

4.2 Data

For our empirical analysis we use data from the Bundesbank's prudential database BAKIS (BAKred Information System), which incorporates information derived from bank balance sheets and the supervisory reports of individual German banks. The second data source for our analysis is the Bundesbank's borrowers' statistics, which contain data about financial institutions' sectoral credit allocation. The third database we use is the credit register for loans of 1.5 million euro or more. The credit register gives us information to which regions banks gave loans of 1.5 million euro or more. We use this data to construct a competition measure (COMP). We also use the Deutsche Bundesbank MFI interest rate statistics. Our sample covers German savings, cooperative and private banks but excludes Landesbanken, cooperative central institutions, and the "Big Five" private banks. We also exclude affiliates of German banks abroad, affiliates of foreign banks in Germany, mortgage banks and special-purpose banks. Due to the restrictive nature of the data frequency we use annual, bank-specific observations from 1995 to 2007.

Over the observed period many bank mergers took place in Germany. When dealing with these mergers, we separate the merged bank from the two pre-merger banks, i.e. we ultimately have three independent observations in our sample. In order to avoid counting observations twice, we drop target banks in the year of the merger. Furthermore, a relatively moderate outlier treatment is applied to the dataset, in which we truncate selected variables, by banking group, at the 1st and 99th percentile. For commercial banks we truncate at the 2nd and 98th percentile, since commercial banks are more heterogeneous. We also consider only banks with at

least three time-series observations in our regressions as this ensures a more reliable measuring of banks' income variability. Finally, we apply both panel fixed-effects and cross-sectional two-stage least squares models. For the latter specification we average variables over time.

4.3 The empirical model

4.3.1 Performance and non-interest income

We use the following empirical specification to analyze the relationship between fee income and profitability:

$$
\begin{aligned}
Y_{i,t} = k + \alpha_t + \lambda_i &+ \beta_1 \cdot SHFEE_{i,t-1} + \beta_2 \cdot HHI_{i,t-1} + \beta_3 \cdot NPL_{i,t-1} \\
&+ \beta_4 \cdot SIZE_{i,t-1} + \beta_5 \cdot GROWTH_{i,t-1} + \beta_6 \cdot LOANS_{i,t-1} \\
&+ \beta_7 \cdot EQUITY_{i,t-1} + \epsilon_{i,t}
\end{aligned} \tag{1}
$$

In the regression model k is a constant, α is a time fixed effect, and λ is a bank fixed effect. To account for endogeneity we lag regressors by one period. The variable Y stands for ROE, ROA, RAROE, RAROA respectively.[8]

We use the following control variables:

1. *HHI* is the Herfindahl index for concentration in the banks' loan portfolios, i.e. this index measures diversification in the interest earning business. We differentiate between nine sectors: (1) agricultural, forestry and fishing products, (2) services, (3) manufacturing industry, (4) building sector, (5) housing market, (6) trade, maintenance and repair of motor vehicles, (7) deferred payment credits and non-deferred payment credits, (8) energy, water supply and mining, (9) communications services.

2. *NPL* is the share of non-performing loans relative to customer loans. This ratio measures risk in the credit portfolio.

3. *SIZE* is the natural logarithm of banks' total assets in million euro. We use this variable to capture bank size. Larger banks have more resources to build up know how and technologies for high-quality risk-management. Furthermore, a larger size allows the bank to exploit economies of scale. Small banks, on the other hand, might take advantage of the greater flexibility (Chiorazzo et al., 2008).

4. *GROWTH* is the growth rate of banks' total deflated assets. On the one hand this variable reflects a bank's growing business opportunities. On the other hand, however, it may also be viewed as a proxy for bank managers' preference for risk taking, assuming that risk-loving managers usually prefer fast growth.

5. *EQUITY* is the ratio of equity to total assets and describes the degree of total financial leverage. This variable also represents a proxy for bank managers'

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[8]Following Chiorazzo et al. (2008) we analyze the effects on RAROE and RAROA in a fixed effects framework, although volatility is time invariant. Interpreting the results one has to bear in mind that part of the risk-adjustment is absorbed by the fixed effects.

risk aversion, since risk averse bank managers tend to keep more equity than risk loving managers.

6. *LOANS* is the ratio of loans to total assets and is also a proxy for bank managers' risk aversion, assuming that a high degree of capitalization signals a high risk aversion and vice versa.

4.3.2 Risk and fee income

The ROE (ROA) standard deviation σ_{ROE} (σ_{ROA}) is explained in cross-sectional regressions, using the same covariates as in the fixed-effects panel regressions with dependent variables ROE (ROA) and risk-adjusted ROE (ROA). Since σ_{ROE} (σ_{ROA}) is calculated from annual panel data all of the explanatory variables are averaged over time (indicated by bars over the variables). Following Stiroh (2004b) we also include year dummies (YEAR) to capture time trends and unobservable macroeconomic effects.[9]

$$
\begin{aligned}
\sigma_i = \alpha &+ \beta_1 \cdot \overline{SHFEE_i} + \beta_2 \cdot \overline{HHI_i} + \beta_3 \cdot \overline{NPL_i} + \beta_4 \cdot \overline{SIZE_i} \\
&+ \beta_5 \cdot \overline{GROWTH_i} + \beta_6 \cdot \overline{LOANS_i} + \beta_7 \cdot \overline{EQUITY_i} + YEAR_i + \epsilon_i
\end{aligned}
\tag{2}
$$

To solve the endogeneity problem we use an instrumental variables approach, applying the two-stage least squares estimator with the following specification in the first stage[10]:

$$
\begin{aligned}
\overline{SHFEE_i} = \alpha &+ \beta_1 \cdot \overline{HHI_i} + \beta_2 \cdot \overline{NPL_i} + \beta_3 \cdot \overline{SIZE_i} + \beta_4 \cdot \overline{GROWTH_i} \\
&+ \beta_5 \cdot \overline{LOANS_i} + \beta_6 \cdot \overline{EQUITY_i} + \beta_8 \cdot \overline{DEPOSITS_i} + \\
&\beta_9 \cdot \overline{SERVICE_i} + \beta_9 \cdot \overline{COMMERCIAL_i} + YEAR_i + \epsilon_i
\end{aligned}
\tag{3}
$$

In the first stage we add three variables as excluded instruments: *COMMERCIAL*, *SERVICE*, and *DEPOSITS*. As proposed by DeYoung and Rice (2004) we include *COMMERCIAL*, the ratio of commercial and industrial loans relative to total loans. We assume that the cross-selling potential in the fee business is higher for banks serving a larger share of commercial customers. *SERVICE* is a measure of service intensity, assuming that banks with higher service capacity have more resources to perform fee-generating activities. We create *SERVICE* by dividing the number of full-time employees by deflated loan volume. *DEPOSITS* is the ratio of demand deposits, term deposits, and time deposits relative to total assets. This ratio is a proxy for traditional relationship banking, assuming that there is a certain cross-selling potential to the respective clients holding deposits (De Young and Rice, 2004). To summarize, all our instruments proxy a bank's ability to engage in the fee business through customer relations, service capacities and cross-selling opportunities.

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[9]Note that we base our study on an unbalanced panel as (mainly because of mergers) not all banks can be observed over the whole sample period 1995 - 2007.

[10]For the sake of consistency in the second stage of the model we do not use a tobit specification in the first stage (Angrist and Krueger, 2001).

4.3.3 Fee income and interest margins

In this section we examine the link between banks' interest rate setting and the shift towards fee generating activities. From the latter we would expect opportunities in the interest business, i.e. for the cross-selling of loans. We employ a dealership-based model of the bank which allows us to derive the determinants of the interest margin (Ho and Saunders, 1981). In this model banks are considered risk-averse intermediaries between lenders and borrowers. In doing so, banks are exposed to competitive pressures, as well as interest rate and credit risk which determine their interest margins. As proposed by Maudos and Fernández de Guevara (2004) we additionally control for managerial efficiency measured by the cost-income ratio, assuming that less efficient banks are obliged to charge higher margins. A bank's *net interest margin (NIM)* is defined by total interest income minus total interest expenses. The model setup is as follows:

$$NIM_{i,t} = k + \alpha_t + \lambda_i + \beta_1 \cdot SHFEE_{i,t} + \beta_2 \cdot R3M_{i,t} + \beta_3 \cdot BDR_{i,t} + \beta_4 \cdot EQUITY_{i,t} +$$
$$\beta_5 \cdot CIR_{i,t} + \beta_6 \cdot COMP_{i,t} + \epsilon_{i,t}$$

$$(4)$$

1. *R3M* is the 3-month interbank rate (EURIBOR)[11]. R3M is expected to have a positive effect on NIM, since the interest spread is expected to widen with increasing interest rates. Furthermore an increase in the risk-free rate implies higher opportunity costs.

2. *BDR* is a measure of borrower default risk, which is either presented by the ratio of loan loss provisions relative to customer loans (*LLP*) or by the share of non-performing loans relative to customer loans (*NPL*).

3. *EQUITY* is the ratio of equity to total assets. This variable has two interpretations: first, it is a proxy for the degree of banks' risk aversion and, second, it accounts for the effect of leverage on risk levels and the required risk premium.

4. *COMP* is a Herfindahl index for regional market concentration based on lending data from the Bundesbank credit register. The index is calculated as the average concentration across banks in each state ("Bundesland"), weighted by the bank's loan exposure in the state. The higher the share of *COMP*, the greater the concentration in this state and vice versa.[12]

5. *CIR* is the cost-income ratio, calculated as operating expenses relative to gross income. The literature provides mixed results on the expected coefficients. On the one hand, a lowering in the cost structure should decrease interest rate margins. On the other hand, screening and monitoring of borrowers require higher personnel costs, which could also result in an increase of CIR and a lowering in default risk premium charged on loans.

From a theoretical point of view, the average transaction size positively influences the interest margin. Since this variable can not be computed from our data, and is

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[11]Before 1998 FIBOR.

[12]Notice that the credit register reports exposures above 1.5 million Euro which leads to a certain bias towards large banks in this measure for regional market concentration.

also ignored in most of the other studies[13], we also disregard this indicator. In an extended version of the model we interact credit risk with the fee-income share. By including this indicator we test how credit pricing, assuming given credit risk, varies according to banks' share of fee business. This interpretation only holds provided fees are charged at an identical flat, meaning that the same conditions apply for any customer, or if fees are not risk dependent.

5 Regression results

5.1 Return and risk-adjusted return in the fee business

Table 1 reports the statistics for fixed-effects regressions by banking group. For each savings, cooperative, and commercial banks the share of fee earnings (FEE) has a positive and significant coefficient for risk-adjusted return on equity (RAROE) and risk-adjusted return on total assets (RAROA). Furthermore, in the ROE and ROA regressions the coefficient on FEE is also positive and significant for commercial and cooperative banks. These results are in line with Chiorazzo et al. (2008) and Smith et al. (2003) but differ from U.S. studies like those of Stiroh and Rumble (2006) and De Young and Rice (2004). Since universal banking has been the historic norm in Germany as well as many European Countries, these banks may be more experienced in generating fee income and exploiting diversification benefits (De Young and Rice, 2004).

We also record some interesting results regarding bank size. While private banks appear to gain from economies of scale, in the case of savings and cooperative banks size is negatively correlated with returns.[14] This finding might be explained by the role of small cooperative and savings banks in rural areas, where they face less competition than bigger savings and cooperative banks face in urban areas. Commercial banks, in contrast, operate mainly in urban areas with a higher potential to exploit economies of scale.

The banking groups also differ in terms of the effects of bank growth on the share of fee business. While for commercial banks ROE (ROA) and RAROE (RAROA) are not affected by growth, for savings and cooperative banks we find a positive association. Moreover, the positive sign on HHI suggests that ROE (ROA) and RAROE (RAROA) increase in line with a more concentrated loan portfolio. This may be due to the fact that small German banks are able to generate benefits from their core lending activities. This result is in line with Hayden et al. (2006) and Behr et al. (2007) who also find diseconomies of scope in the German banking sector. Such diseconomies can arise if a bank has insufficient monitoring expertise in new lending activities. The small number of significant coefficients on commercial banks result from the heterogeneity within this banking group.

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[13]See for example Gischer and Jüttner (2003) and Lepetit et al. (2008).

[14]Hayden et al. (2006) and Behr et al. (2007) also find negative correlations between size and return in a sample which is mainly dominated by cooperative banks.

Table 1: Fee business and bank returns

	Cooperative banks				Savings banks				Commercial banks			
	ROE	RAROE	ROA	RAROA	ROE	RAROE	ROA	RAROA	ROE	RAROE	ROA	RAROA
SHFEE	0.4157***	0.0586***	0.0238***	0.0624***	0.2459	0.0413**	0.0121	0.0467**	0.2225***	0.0163***	0.0307***	0.0209***
	(0.0910)	(0.0093)	(0.0047)	(0.0100)	(0.2207)	(0.0185)	(0.0090)	(0.0208)	(0.0839)	(0.0057)	(0.0095)	(0.0054)
NPL	-0.1518***	-0.0045	-0.0076***	-0.0059	-0.5953***	-0.0448***	-0.0319***	-0.0583***	0.0517	0.0037	-0.0090	0.0025
	(0.0416)	(0.0039)	(0.0021)	(0.0041)	(0.1013)	(0.0084)	(0.0041)	(0.0090)	(0.1135)	(0.0072)	(0.0129)	(0.0076)
EQUITY	-2.7413***	-0.3598***	-0.0639***	-0.1437***	-4.8296***	-0.5337***	-0.0841***	-0.2887***	0.1045	-0.0119	0.0072	0.0059
	(0.2495)	(0.0246)	(0.0144)	(0.0283)	(0.6328)	(0.0529)	(0.0263)	(0.0597)	(0.2224)	(0.0106)	(0.0296)	(0.0092)
LOANS	-0.0745***	-0.0049*	-0.0036**	-0.0043	-0.2934***	-0.0158***	-0.0109***	-0.0170***	0.0888	0.0032	0.0074	0.0037
	(0.0280)	(0.0025)	(0.0014)	(0.0027)	(0.0543)	(0.0047)	(0.0022)	(0.0051)	(0.0864)	(0.0040)	(0.0081)	(0.0038)
HHI	0.0444*	0.0059*	0.0025*	0.0075**	0.1180*	0.0044	0.0070**	0.0106	0.0175	0.0031	-0.0021	0.0024
	(0.026)	(0.0032)	(0.0013)	(0.0033)	(0.0685)	(0.0063)	(0.0030)	(0.0071)	(0.068)	(0.0044)	(0.0071)	(0.0045)
SIZE	-15.7709***	-1.6937***	-0.6747***	-1.4728***	-27.9200***	-2.6282***	-1.0953***	-2.5652***	7.9975**	0.3077**	0.6821**	0.2791**
	(3.0963)	(0.3064)	(0.1554)	(0.3152)	(4.0378)	(0.3229)	(0.1664)	(0.3389)	(3.3267)	(0.1206)	(0.3361)	(0.1169)
GROWTH	0.0624**	0.004	0.0017	0.0028	0.1167***	0.0074**	0.0033*	0.0050	0.0121	0.0005	-0.0007	0.0006
	(0.0277)	(0.0028)	(0.0014)	(0.0029)	(0.0432)	(0.0037)	(0.0017)	(0.0041)	(0.0253)	(0.0013)	(0.0021)	(0.0012)
Constant	107.8908***	12.7316***	4.4575***	10.5629***	249.4642***	23.6924***	9.3402***	22.3045***	-46.3037**	-0.7732*	-3.9596*	-0.7945*
	(15.5036)	(1.5399)	(0.7797)	(1.5938)	(29.1501)	(2.3728)	(1.2023)	(2.4760)	(23.1420)	(0.9072)	(2.2794)	(0.9049)
Observations	17700	17700	17700	17700	5910	5910	5911	5911	1480	1480	1482	1482
R²	0.21	0.238	0.161	0.174	0.421	0.422	0.360	0.348	0.085	0.099	0.075	0.097

Robust standard errors in parentheses. ***, **, * denote significance on a 1 percent, 5 percent or 10 percent level, respectively.

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5.2 Risk in the fee business

Risk is measured by the ROE (ROA) standard deviation (σ) and is explained in two-stage least squares regressions. "Good instruments" for FEE should be both relevant and valid, i.e. the instruments should be correlated with the endogenous repressors and, at the same time, be orthogonal to the residuals (Baum et al., 2003).One rule of thumb is that the F-statistic of excluded instruments should not be less than 10. If there are at least two instruments, overidentification restrictions can be tested with Hansen's J-Test (Sargan's statistic), where rejection of the null hypothesis suggests that at least one instrument is not exogenous (Wooldridge, 2003). In our regressions the conditions for relevant and valid instruments are satisfied. All instruments are significant, except for *COMMERCIAL* in the group of commercial banks. The F-statistic of excluded instruments is above 10. Furthermore, a comparison with Staiger and Stocks' critical values shows that the bias of IV-estimation is below 5 percent of the bias of OLS estimation. Hansen's J-statistics indicate that exogeneity can not be rejected at the 10% level. The results by banking group for the first-stage are reported in table 2.[15]

First, while for savings and commercial banks loan quality does not play a role in the first-stage regressions, cooperative banks that face a higher loan quality are more active in the fee business. The negative relationship seems to be reasonable as banks under good management should enjoy a higher loan quality and, at the same time, be better at generating fee income. Second, the negative sign on *LOANS* denotes that banks with intermediation-based strategies rely on interest income generating activities rather than on fee business. Third, bank size does not affect FEE for commercial and savings banks; larger cooperative banks, however, are more engaged in fee-based activities than smaller ones. We anticipated this sign, since larger banks have a greater capacity to generate fee income. Fourth, cooperative and savings banks differ with respect to the coefficient on loan portfolio diversification. More specialized savings banks exhibit a higher share of fee earnings, possibly because they offer precisely compatible products for their customers and have better cross-selling opportunities. On the other hand, cooperative banks with diversified loan portfolios are increasingly engaged in the fee business, too, possibly based on a comprehensive, bank-wide diversification strategy. Fifth, commercial and savings banks that hold a higher amount of equity per unit assets are more concentrated in the interest business. Banks with little interest income can afford to hold less equity as a bank's balance sheet is mainly affected by interest-generating activities. As with savings banks in our regressions, *EQUITY* could be negatively associated with *SHFEE*, as fee-generating activities require less regulatory capital.

The coefficients of the second-stage regression are presented in table 3. Here we find ROE (ROA) volatility is only significant for the commercial banks group. The positive coefficient implies that an increase in the share of fee income destabilizes profitability, i.e. σ_{ROE} (σ_{ROA}) increases. For savings and cooperative banks we find no significant influence on ROE (ROA) volatility. The different findings for banking

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[15]In the case of savings and cooperative banks, the first stage is identical for both σ_{ROE} and σ_{ROA} regressions as they are based on the same sample. For private banks we include one more observation in the regression on σ_{ROA} than we have in the regression on σ_{ROE}. Since this observation does not lead to relevant changes, we tabulate only the σ_{ROE} regression for the first stage.

Table 2: First stage regression: determinants of fee income

	Cooperative banks	Savings banks	Commercial banks
EQUITY	0.2294***	-0.1619**	0.2553*
	(0.0564)	(0.0678)	(0.1421)
NPL	-0.0405**	-0.0397	0.0705
	(0.0160)	(0.0269)	(0.1018)
LOANS	-0.0080	-0.0144**	-0.2488***
	(0.0060)	(0.0061)	(0.0417)
HHI	-0.0801***	0.0629***	-0.0071
	(0.0088)	(0.0137)	(-0.0539)
SIZE	0.6654***	0.0284	1.2494
	(0.0563)	(0.0658)	(0.0539)
GROWTH	-0.1221***	-0.0990***	0.1265*
	(0.0264)	(0.0368)	(0.0763)
SERVICE	0.1046***	0.1100***	0.2225**
	(0.0066)	(0.0120)	(0.0984)
COMMERCIAL	0.0274***	0.0368***	-0.0329
	(0.0056)	(0.0060)	(0.0540)
DEPOSITS	0.0185***	0.0204**	0.2267***
	(0.0072)	(0.0100)	(-0.0541)
CONSTANT	3.6448**	3.3226*	-6.6878
	(0.9278)	(1.2335)	(12.9685)
Observations	3150	702	213
KP-F-Test	94.982	41.25	14.326

Robust standard errors in parentheses. ***, **, * denote significance on a 1 percent,
5 percent or 10 percent level respectively

groups can be explained by the fact that commercial banks are already much more involved in fee business than savings and cooperative banks. Assuming that banks perform risk-return oriented ABC analyses to evaluate opportunities in the fee business, an already high level of fee business implies additional C-class engagements, as A/B-class opportunities are already exhausted. Hence, for commercial banks, risk increases in line with expanded in fee-generating activities. Another explanation is that commercial banks run other types of fee-business than savings and cooperative banks. While savings and cooperatives tend to have fees from insurance etc., more volatile lines of fee-business matter for private banks, e.g. asset management and loan securitization.

As the results in section 5.1 indicate the increase in ROE (ROA) volatility is outweighed by the increase in ROE (ROA). Hence, the fee income share positively influences risk-adjusted return, i.e. the coefficient of SHFEE is positive in the RAROE (RAROA) regressions.

With regard to loan portfolio diversification, we also record different results across banking groups from the two-stage least squares regressions. According to portfolio theory returns should be more volatile for banks with specialized loan portfolios; as far as cooperative banks are concerned this theorem is confirmed by our analysis. Finally, we find that well capitalized banks and banks with less risky loan portfolios enjoy more stable returns. [16]

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[16]Robustness checks are performed. First we use a tobit model in the first stage. Second we include a variable "number of years in the sample", to account for the case that a bank which is observed for a shorter time horizon would have a higher volatility of return. The results remain stable.

Table 3: Second stage regression: determinants of risk in the fee business

	Cooperative banks		Savings banks		Commercial banks	
	σ_{ROE}	σ_{ROA}	σ_{ROE}	σ_{ROA}	σ_{ROE}	σ_{ROA}
SHFEE	-0.0043	0.0015	0.2459	0.0031	0.3923***	0.0356**
	(0.0765)	(0.0038)	(0.3880)	(0.0116)	(0.1513)	(0.0166)
EQUITY	-0.8810***	0.0164***	-1.4335***	0.0079	-0.3909***	0.0468**
	(0.0823)	(0.0044)	(0.3305)	(0.0104)	(0.1371)	(0.0236)
NPL	0.6088***	0.0309***	0.9460***	0.0330***	0.1744	0.0198*
	(0.0403)	(0.0019)	(0.2101)	(0.0057)	(0.1263)	(0.0119)
LOANS	-0.0057	0.0006	0.0235	0.0014	0.0147	0.0001
	(0.0090)	(0.0004)	(0.0304)	(0.0009)	(0.0534)	(0.0056)
HHI	0.0515***	0.0028***	-0.0817	-0.0020	0.0408	0.0046
	(0.0140)	(0.0007)	(0.0667)	(0.0021)	(0.0466)	(0.0048)
SIZE	-0.2578**	-0.0161***	-0.2171	-0.0132	-0.8121	-0.1308
	(0.1003)	(0.00479	(0.2836)	(0.0088)	(0.7564)	(0.0998)
GROWTH	-0.0319	-0.0010	-0.0416	0.0027	0.1553	0.0259**
	(0.0530)	(0.0025)	(0.2167)	(0.0062)	(0.0953)	(0.0123)
Constant	7.6873***	0.0211	10.6544*	0.1775	11.9654	0.9764
	(1.3682)	(0.0723)	(4.8764)	(0.1574)	(10.2341)	(1.3709)
Observations	3150	3150	702	702	213	214
Hansen's J-Statistic	3.953	3.871	0.136	0.440	1.135	0.293
Hansen's P-Value	0.1386	0.1443	0.9344	0.8026	0.5669	0.8636
R-squared	0.2500	0.2261	0.2650	0.1831	0.1800	0.3459

Robust standard errors in parentheses. ***, **, * denote significance on a 1 percent 5 percent or 10 percent level, respectively.

5.3 Interest margin and non-interest income

In the income diversification literature we uncover evidence of a relationship between banks' non-interest activities and their loan pricing. This relationship is justified by possible cross-subsidization (or cross-selling) effects, as banks might just charge a lower interest margin when they expect increased revenues from fees and commissions in the non-interest business (Lepetit et al., 2008). To analyze possible cross-subsidization effects between interest and fee income in the German banking industry we specify a bank loan pricing model. In this model we explain banks' net interest margins (interest income minus interest expenses) using a vector of prevailing variables in the literature to specify this kind of model. Table 4 shows the results from the fixed effects panel regressions by banking group. As expected, the fee income variable (SHFEE) has a significant negative coefficient suggesting possible cross-selling of lending and fee generating activities. In order to detail this finding we control for the interaction of fee income and credit risk, where the latter is measured by non-performing loans (NPL) and loan loss provisions (LLP). While we obtain only for the group of cooperative banks significant results for the first credit risk variable, the LLP · SHFEE interaction term indicates a lower interest margin for savings and commercial banks, given LLP, when the share of fee income increases. In other words, we find that savings and commercial banks charge a lower risk premium for a given level of borrower default risk (measured by LLP), when they are more engaged in fee generating activities. In summary, we find that institutions from those two banking groups underprice credit risk when they have additional opportunities to generate income from fees and commissions and interpret this finding as an indication of some cross-subsidization (or cross-selling) effects between interest and fee business.[17]

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[17]Cross-subsidization effects should be examined in more detail by explaining loan-specific pricing. In the supervisory balance sheet data for Germany, however, interest margins as well as fees and commissions can only be calculated as bank averages, a limitation that is also mentioned in the paper of Lepetit et al. (2008).

The remaining control variables also confirm expected signs. A higher credit risk, measured by LLP, is associated with larger interest margins. Also, higher money market rates increase interest margins, as opportunity costs rise. As stated in subsection 4.3.3, theoretically coefficients on CIR can have different signs. While the sign on CIR is negative for commercial banks, the impact is positive for cooperative banks and insignificant for savings banks. Market concentration plays a role in the cases of cooperative and savings banks because, as one would expect, institutions which operate in more concentrated markets charge higher interest margins. Finally, as EQUITY focuses on the effect of leverage on risk levels and the required risk premium its coefficients are strongly significant for all banking groups.

Table 4: Interest margin

	Cooperative banks				Savings banks				Commercial banks			
SHFEE	-0.0156*** (0.0023)	-0.0132*** (0.0027)	-0.0166*** (0.0023)	-0.0162*** (0.0026)	-0.0243*** (0.0052)	-0.0192*** (0.0060)	-0.0241*** (0.0052)	-0.0145** (0.0060)	-0.0242*** (0.0063)	-0.0210*** (0.0061)	-0.0169** (0.0069)	-0.0103* (0.0054)
NPL	0.0035*** (0.0011)	0.0083*** (0.0029)			0.0047** (0.0023)	0.0147** (0.0070)			0.0059 (0.0074)	0.0143 (0.0116)		
NLP*SHFEE		-0.0004* (0.0002)				-0.0011 (0.0007)				-0.0004 (0.0003)		
LLP			0.0612*** (0.0051)	0.0665*** (0.0138)			0.0505*** (0.0090)	0.1289*** (0.0291)			0.0816** (0.0391)	0.1986*** (0.0483)
LLP · SHFEE				-0.0005 (0.0012)				-0.0088*** (0.0030)				-0.0044*** (0.0016)
EQUITY	0.1057*** (0.0079)	0.1055*** (0.0079)	0.1058*** (0.0078)	0.1057*** (0.0078)	0.1483*** (0.0134)	0.1461*** (0.0135)	0.1521*** (0.0135)	0.1492*** (0.0135)	0.0627*** (0.0129)	0.0623*** (0.0127)	0.0332*** (0.0103)	0.0364*** (0.0098)
CIR	0.0005 (0.0009)	0.0007 (0.0009)	0.0018** (0.0009)	0.0018** (0.0009)	-0.0014 (0.0018)	-0.0014 (0.0018)	-0.0008 (0.0018)	-0.0009 (0.0017)	-0.0079 (0.0055)	-0.0075 (0.0055)	-0.0105** (0.0045)	-0.0118*** (0.0044)
R3M	0.1632*** (0.0082)	0.1643*** (0.0082)	0.1626*** (0.0081)	0.1626*** (0.0081)	0.2172*** (0.0109)	0.2175*** (0.0108)	0.2193*** (0.0109)	0.2201*** (0.0109)	0.1214* (0.0628)	0.1226* (0.0629)	0.1291** (0.0585)	0.1276** (0.0580)
COMP	0.0126*** (0.0022)	0.0124*** (0.0022)	0.0123*** (0.0022)	0.0123*** (0.0022)	0.0062 (0.0038)	0.0069* (0.0038)	0.0075* (0.0038)	0.0090** (0.0039)	0.0132 (0.0255)	0.0117 (0.0257)	0.0198 (0.0248)	0.0173 (0.0243)
Constant	1.9505*** (0.0779)	1.9167*** (0.0804)	1.8766*** (0.0774)	1.8721*** (0.0786)	1.5762*** (0.1126)	1.5358*** (0.1132)	1.4972*** (0.1126)	1.4191*** (0.1140)	2.5558*** (0.4608)	2.4867*** (0.4562)	2.5018*** (0.4485)	2.3423*** (0.4231)
Observations	22725	22725	23169	23169	6861	6861	6909	6909	1803	1803	2207	2207
R^2	0.489	0.489	0.492	0.492	0.638	0.638	0.642	0.643	0.172	0.175	0.133	0.154

Robust standard errors in parentheses; ***, **, * denote significance of a 1 percent, 5 percent or 10 percent significance level, respectively.

6 Conclusion

In this study we focus on the primary income sources of banks: interest and fee business. Our database is a micro panel of supervisory balance sheet data (BAKIS) and information about banks' lending to industry sectors (borrowers' statistics) for the years 1995 to 2007. An essential aspect of our analysis is the treatment of endogeneity between banks' risk-return-characteristics and their activity in fee income generating operations. For the treatment of endogeneity we specify two models: one is a fixed-effects panel model with regressors lagged by one year and, the second is a two-stage least squares estimator. The latter approach also allows us to analyze the factors determining a banks' participation in the fee income business.

In our analysis, we show that banks with a large share of fee income exhibit a more favorable risk-return profile, i.e. they enjoy a higher risk-adjusted return on equity (ROE) and total assets (ROA). Additionally, we find that for commercial banks strong involvement in the fee business is accompanied by higher ROE- and ROA-volatility and, therefore, with increased risk. In particular for commercial banks some fee income activities are associated with much higher risks than other income sources and, therefore, they could contribute to destabilize both individual banks as well as the whole banking system.

In the regression statistics we show that both return measures, ROE and ROA, show robust results, not only in the fixed effects panel models but also in the two-stage least squares estimator.

The second part of the paper focuses on banks' interest margins. In order to analyze possible cross-subsidization effects between interest and fee business we specify a bank loan pricing model. In this model we explain banks' net interest margins (interest income minus interest expenses) by a vector of variables which are standard for this kind of model specification. Here we find that for savings and commercial banks institutions with a strong focus on fee business charge lower interest margins when credit risk is controlled by loan loss provisions. The examination of cross-subsidization effects, however, is limited by data constraints, as for Germany loan-specific interest rates are not available, i.e. interest margins can only be calculated as bank averages.

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Appendix: Variable description and additional statistics

Figure 2: **Variable description**

Proxy for Variables	Variable Name	Description	Source
		Dependent Variables	
Business Structure	SHFEE	Fee Income as a Share of Interest Income and Fee Income	BAKIS
	ROE	Return on Equity	BAKIS
	ROA	Return on Assets	BAKIS
Profitability/ Profitability Risk	σ_{ROE}	Standard Deviation of Return on Equity	BAKIS
	σ_{ROA}	Standard Deviation of Return on Assets	BAKIS
	NIM	Net Interest Revenues to Total Assets	BAKIS
	RAROE	Risk-adjusted Return on Equity (ROE over ROE Volatility)	BAKIS
	RAROA	Risk-adjusted Return on Assets (ROA over ROA Volatility)	BAKIS
		Instruments	
Instruments for Fee Income	DEPOSITS	Demand Deposits, Term Deposits, and Time Deposits to Total Assets	BAKIS
	SERVICE	No of Employees to Total Credit (Deflated, in Mio EUR)	BAKIS
	COMMERCIAL	Commercial Loans as a Share of Total Loans	Borrowers' Statistics
		Control Variables	
Business Growth	GROWTH	Growth of (Deflated) Total Assets	BAKIS
	SIZE	Ln of Total Assets in Mio EUR	BAKIS
Heterogeneity Across Banks in Size, Asset Structure, and Equity	NPL	Non-performing Loans (Classified Loans to Customer Loans)	BAKIS
	LLP	Loan Loss Provisions to Customers Loans	BAKIS
	LOANS	Customer Loans to Total Assets	BAKIS
	EQUITY	Equity to Total Assets	BAKIS
Diversification	HHI	HHI of Sectoral Loan Concentration, Calculated Over 9 Sectors	Borrowers' Statistics
Regional competition	COMP	Average Across Bank Concentration in Each State (Weighted by the Loan Exposure of the Bank in Each State)	Credit Register
Cost of Capital	R3M	Three-month FIBOR (Until 1998) / EURIBOR (From 1999 on)	Deutsche Bundesbank MFI Interest Rate Statistics

* BAKIS is the Deutsche Bundesbank's Prudential Database

Table 5: Summary statistics - commercial banks

Variable	Mean	Std.	Min	Max
SHFEE	19.38	18.67	0.24	88.26
NPL	7.13	10.51	0.03	53.92
EQUITY	9.03	7.70	2.06	59.59
LOANS	53.93	26.41	0.53	98.29
HHI	43.70	23.48	14.74	100.00
SIZE	6.32	1.71	1.90	10.37
GROWTH	8.14	25.14	-37.28	151.02
ROE	9.18	20.25	-69.01	71.79
RAROE	1.36	1.82	-2.31	6.46
ROA	0.64	1.98	-9.72	7.10
RAROA	1.38	1.88	-2.53	6.62
σ_{ROE}	14.81	18.41	1.34	120.35
σ_{ROA}	0.47	1.56	-6.88	5.09
SERVICE	28.28	23.80	2.22	157.43
DEPOSITS	44.20	21.71	1.31	88.49
COMMERCIAL	63.23	31.42	0.04	100.00
NIM	2.76	2.00	0.24	10.16
LLP	1.29	1.52	0.00	6.18
CIR	32.78	14.32	6.60	77.24
R3M	3.38	0.79	2.11	4.53
COMP	5.70	1.66	2.42	10.39

Table 6: Summary statistics - cooperative banks

	Mean	Std.	Min	Max
SHFEE	10.56	4.04	1.57	22.06
NPL	5.19	3.92	0.11	21.83
EQUITY	5.39	1.25	3.08	9.92
LOANS	59.46	11.38	25.73	80.83
HHI	22.54	9.23	12.36	98.36
SIZE	4.91	1.06	2.764	7.86
GROWTH	2.56	4.31	-8.82	15.18
ROE	12.58	9.26	-23.64	34.72
RAROE	2.41	2.23	-1.66	15.66
ROA	0.69	0.49	-1.11	1.84
RAROA	2.61	2.36	-1.63	16.27
σ_{ROE}	7.17	5.12	0.42	33.23
σ_{ROA}	0.35	0.24	0.02	1.53
SERVICE	35.18	11.94	9.13	90.41
DEPOSITS	38.67	7.96	21.11	64.55
COMMERCIAL	58.26	13.45	7.92	88.56
NIM	2.84	0.45	1.44	4.07
LLP	0.80	0.62	0.00	2.87
CIR	35.48	6.77	15.16	54.07
R3M	3.44	0.76	2.11	4.53
COMP	5.07	1.70	2.05	10.07

Table 7: Summary statistics - savings banks

	Mean	Std.	Min	Max
SHFEE	8.94	2.38	4.26	16.09
NLP	3.90	2.60	0.28	14.01
EQUITY	4.45	0.94	2.57	7.52
LOANS	58.88	11.83	23.41	80.13
HHI	20.85	4.26	13.49	55.79
SIZE	6.93	0.90	4.94	9.38
GROWTH	2.59	3.95	-7.86	14.23
ROE	16.54	10.90	-15.12	48.38
RAROE	2.09	1.50	-1.11	7.95
ROA	0.73	0.45	-0.64	1.86
RAROA	2.30	1.61	-1.15	8.37
σ_{ROE}	9.58	6.78	0.69	51.32
σ_{ROA}	0.37	0.21	0.02	1.37
SERVICE	29.48	6.54	14.09	63.41
DEPOSITS	31.11	5.53	18.89	47.11
COMMERCIAL	66.39	8.52	40.41	89.64
NIM	2.58	0.39	1.71	3.56
LLP	0.84	0.54	0.00	2.91
CIR	29.40	4.63	18.93	40.91
R3M	3.39	0.79	2.11	4.53
COMP	5.01	1.66	2.06	9.87

Table 8: Returns regression - commercial banks

	SHFEE	NLP	EQUITY	LOANS	HHI$_9sec$	SIZE
SHFEE	1					
NLP	0.0560	1				
EQUITY	0.2262	0.1448	1			
LOANS	-0.3417	-0.2742	-0.0732	1		
HHI	0.1409	0.0754	0.2235	-0.0021	1	
SIZE	-0.1345	-0.1407	-0.3951	0.0084	-0.0175	1
GROWTH	0.0899	-0.1333	-0.0138	-0.0295	0.1714	0.0072

Table 9: Returns regression - cooperative banks

	SHFEE	NLP	EQUITY	LOANS	HHI$_9sec$	SIZE
SHFEE	1					
NLP	0.0534	1				
EQUITY	0.1971	-0.0913	1			
LOANS	-0.0576	0.0171	0.0720	1		
HHI	-0.3053	-0.1777	-0.0356	-0.1667	1	
SIZE	0.2351	0.0459	-0.2179	0.0948	0.0396	1
GROWTH	-0.3423	-0.2107	-0.1946	0.0047	0.1396	-0.0946

Table 10: Returns regression - savings banks

	SHFEE	NLP	EQUITY	LOANS	HHI$_9sec$	SIZE
SHFEE	1					
NLP	0.0113	1				
EQUITY	0.1531	-0.3007	1			
LOANS	-0.2425	-0.2061	0.3618	1		
HHI	0.3183	-0.0021	0.0306	-0.0246	1	
SIZE	0.0738	-0.1846	-0.0243	-0.0428	0.2485	1
GROWTH	-0.4353	-0.0693	-0.2499	0.0104	-0.2024	-0.0883

Table 11: Mean regression - private banks

	EQUITY	NPL	LOANS	HHI	SIZE	GROWTH	SERVICE	DEPOSITS	COMMERCIAL
EQUITY	1								
NPL	0.1215	1							
LOANS	-0.1121	-0.2164	1						
HHI	0.1505	0.1258	-0.0938	1					
SIZE	-0.4971	-0.1939	0.0428	-0.0284	1				
GROWTH	0.1034	-0.1995	-0.1714	0.1757	-0.0546	1			
SERVICE	0.2937	0.0174	0.1654	0.0538	-0.5317	0.0609	1		
DEPOSITS	-0.0370	-0.1330	-0.1595	-0.0189	-0.0791	0.1561	0.1410	1	
COMMERCIAL	-0.0705	0.1863	-0.2070	-0.4141	0.0803	-0.1511	-0.2388	-0.2562	1
SHFEE	0.2226	0.0167	-0.4033	0.0966	-0.1512	0.2876	0.2600	0.4028	-0.1479

Table 12: Mean regression - cooperative banks

	EQUITY	NPL	LOANS	HHI	SIZE	GROWTH	SERVICE	DEPOSITS	COMMERCIAL
EQUITY	1								
NPL	-0.1146	1							
LOANS	0.0486	-0.0249	1						
HHI	-0.0098	-0.2124	-0.1759	1					
SIZE	-0.1840	0.0155	0.1265	-0.0259	1				
GROWTH	-0.1661	-0.2954	0.1168	0.2033	-0.1983	1			
SERVICE	-0.1111	0.1264	-0.3391	-0.1147	-0.3318	0.0139	1		
DEPOSITS	-0.0012	0.0450	-0.4012	0.0948	0.0334	-0.1395	0.1213	1	
COMMERCIAL	0.0147	0.2544	0.0725	-0.5020	0.3730	-0.2508	-0.0704	0.1368	1
SHFEE	0.1454	0.0671	-0.0950	-0.3280	0.3193	-0.4238	0.1258	0.1678	-0.3766

Table 13: Mean regression - savings banks

	EQUITY	NPL	LOANS	HHI	SIZE	GROWTH	SERVICE	DEPOSITS	COMMERCIAL
EQUITY	1								
NPL	-0.3717	1							
LOANS	0.3657	-0.2598	1						
HHI	-0.0777	-0.0255	-0.0886	1					
SIZE	0.0147	-0.2317	-0.0495	0.3434	1				
GROWTH	-0.1673	-0.0366	0.1405	-0.2233	-0.2182	1			
SERVICE	-0.1805	0.2970	-0.3771	-0.2501	-0.4398	0.0838	1		
DEPOSITS	0.0909	0.0235	-0.3901	0.1287	0.0797	-0.2476	0.1220	1	
COMMERCIAL	-0.0337	0.0680	-0.1660	0.2958	0.3232	-0.3359	-0.1163	0.0885	1
SHFEE	-0.0129	0.0435	-0.3454	0.2759	0.1657	-0.5562	0.1202	0.3251	-0.3289

Table 14: Interest margin regression - commercial banks

	NIM	SHFEE	NPL · SHFEE	NPL	EQUITY	CIR	R3M
NIM	1						
SHFEE	-0.2551	1					
NPL · SHFEE	-0.0498	0.4703	1				
NPL	0.0556	0.0402	0.6929	1			
EQUITY	0.252	0.1965	0.1769	0.1707	1		
CIR	0.0953	0.4892	0.1719	0.0261	0.2583	1	
R3M	0.0099	-0.0817	-0.0349	-0.0049	-0.0282	-0.0975	1
COMP	-0.0384	0.0488	0.0036	0.0221	-0.0368	0.0989	-0.0078

Table 15: Interest margin regression - cooperative banks

	NIM	SHFEE	NLP*FEE	NLP	EQUITY	CIR	R3M
NIM	1						
SHFEE	-0.0321	1					
NPL · SHFEE	0.049	0.4153	1				
NPL	0.1071	0.0232	0.8536	1			
EQUITY	0.1653	0.2109	-0.0686	-0.1188	1		
CIR	0.2061	0.6177	0.2864	0.0384	0.2398	1	
R3M	0.0488	-0.233	-0.1247	-0.022	-0.1455	-0.2443	1
COMP	-0.124	0.0949	0.0999	0.0571	-0.0767	0.1051	-0.0273

Table 16: Interest margin regression - savings banks

	NIM	SHFEE	NPL · SHFEE	NPL	EQUITY	CIR	R3M
NIM	1						
SHFEE	-0.2446	1					
NPL · SHFEE	0.1261	0.3348	1				
NPL	0.2337	-0.0373	0.8942	1			
EQUITY	-0.0497	0.1805	-0.2588	-0.3305	1		
CIR	-0.0435	0.7119	0.2643	0.0076	0.1936	1	
R3M	0.0732	-0.2863	-0.1335	-0.0176	-0.149	-0.2964	1
COMP	-0.1238	0.1547	0.0599	-0.0201	-0.0978	0.0317	0.0118

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