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Banks' exposure to interest rate risk, their earnings from term transformation, and the dynamics of the term structure

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Discussion Paper
Series 2: Banking and Financial Studies
No 07/2010

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ISBN 978-3–86558–644–5 (Printversion)
ISBN 978-3–86558–645–2 (Internetversion)

Abstract

We use a unique dataset of German banks' exposure to interest rate risk to derive the following statements about their exposure to this risk and their earnings from term transformation. The systematic factor for the exposure to interest rate risk moves in sync with the shape of the term structure. At bank level, however, the time variation of the exposure is largely determined by idiosyncratic effects. Over time, changes in earnings from term transformation have a large impact on interest income. Across banks, however, the earnings from term transformation do not seem to be a decisive factor for the interest margin.

Keywords: Interest rate risk; term transformation; interest income

JEL classification: G11, G21

Non-technical summary

Normally, banks extend long-term loans and collect short-term deposits. This mismatch between the maturities of the assets and liabilities exposes the banks to interest rate risk. However, this maturity mismatch can also be a source of income (called the earnings from term transformation) because long-term interest rates tend to be higher than short-term interest rates.

In this paper, we investigate the banks' exposure to interest rate risk as well as their earnings from term transformation using a dataset on German banks' exposure to interest rate risk; the exposures in this dataset were derived from the banks' own internal risk models. The results of our empirical study can be summarized in four statements. (i) For the sample period September 2005 to December 2009, the systematic factor for the exposure to interest rate risk rises and falls in sync with the shape of the term structure. (ii) At bank level, however, the time variation of the exposure is largely determined by idiosyncratic effects (83%). The systematic factor and regulation, i.e. the quantitative limitation of interest rate risk in the Pillar 2 of Basel II, account for 9% and 8%, respectively. (iii) In the period 2005-2009, the earnings from term transformation were estimated at 26.3 basis points in relation to total assets for the median bank; this accounts for roughly 12.3% of the interest margin. However, we see large differences over time and across banking groups. For instance, the proportion of the earnings from term transformation relative to the interest margin ranges from 4.6% (in 2008) to 24.3% (in 2009). (iv) For savings and cooperative banks, changes in earnings from term transformation over time have a large impact on the interest margin. Across banks, however, exposure to interest rate risk does not seem to be a decisive factor for the interest margin.

Nichttechnische Zusammenfassung

Üblicherweise vergeben Banken langfristige Kredite und refinanzieren sich durch kurzfristige Kundeneinlagen. Diese Unterschiede zwischen den Laufzeiten auf der Aktiv- und der Passivseite führen dazu, dass die Banken Zinsänderungsrisiken ausgesetzt sind. Diese Laufzeitunterschiede können jedoch auch eine Einkommensquelle sein (so genannter Strukturbeitrag), weil gewöhnlich die langfristigen Zinsen höher sind als die kurzfristigen Zinsen. In diesem Papier untersuchen wir beides, das Zinsänderungsrisiko der Banken und deren Strukturbeitrag, d.h. deren Erträge aus der Fristentransformation. Wir verwenden dazu einen Datensatz in Bezug auf das Zinsänderungsrisiko der Banken in Deutschland, wobei die Daten aus den bankinternen Risikomodellen stammen. Die Ergebnisse der empirischen Untersuchung können in vier Kernaussagen zusammengefasst werden: 1. Der systematische Faktor für die Höhe des Zinsänderungsrisikos bewegt sich im Einklang mit der Zinsstrukturkurve. 2. Auf der Ebene der Einzelbank wird die zeitliche Änderung des Zinsänderungsrisikos aber weitgehend durch bankspezifische Effekte bestimmt (83%). Der systematische Faktor und die Regulierung, d.h. die quantitative Beschränkung des Zinsänderungsrisikos in Säule 2 von Basel II, sind für 9% und 8% der Variation verantwortlich. Für die Medianbank ergibt sich in der Periode von 2005 bis 2009 für den Strukturbeitrag ein Schätzwert von 26,3 Basispunkten bezogen auf die Bilanzsumme. Dies entspricht ungefähr 12,3% der Zinsmarge. Wir sehen jedoch große Unterschiede in den einzelnen Jahren und zwischen den Bankengruppen. Beispielsweise reicht der Anteil des Strukturbeitrags an der Zinsmarge von 4,6% (im Jahr 2008) bis zu 24,3% (im Jahr 2009). 4. Für Sparkassen und Kreditgenossenschaften gilt: Zeitliche Änderungen im Strukturbeitrag haben große Auswirkungen auf die Zinsmarge. Im Querschnitt der Banken scheint jedoch die Höhe des Zinsänderungsrisikos kein entscheidender Faktor für die Zinsmarge zu sein.

Contents

Banks' exposure to interest rate risk, their earnings from term transformation, and the dynamics of the term structure[1]

1 Introduction

For many banks, term transformation represents a substantial part of their interest income. This is especially true of small and medium-sized banks which are engaged in traditional commercial banking, i.e. granting long-term loans and collecting short-term deposits.

It is important to understand the opportunities and risks related to term transformation. Supervisors are especially concerned about banks' interest rate risk. From a financial stability point of view, they have to know what determines changes in banks' exposure to interest rate risk and whether the interest rate regulation has an impact on banks' behavior. By contrast, practitioners are more interested in the earning opportunities from term transformation. Both issues are addressed in this paper, and four questions guide our analysis: (i) Is there a relation between the systematic factor of the exposure to interest rate risk and the shape of the term structure? (ii) What factors determine (at bank level) the exposure to interest rate risk? (iii) How profitable is term transformation? (iv) Do banks with a large exposure to interest rate risk have a high interest margin?

The main contribution to the literature is to investigate the four questions from above with a unique dataset. This dataset includes the banks' exposure to interest rate risk, derived from their own internal models. In the previous literature, there are two methods of assessing the banks' exposure to interest rate risk: (i) One can use stock market data and analyze to what extent changes in the shape of the term structure affect the market value of the banks and (ii) one can estimate the interest rate risk exposure from the banks' balance sheets. Both methods are fraught with problems, because both methods provide only an approximation of the banks' true exposure to interest rate risk.

By contrast, we have data on banks' exposure to interest rate risk at our disposal and, therefore, need not rely on estimates. The data covers the period from September 2005

[1]We thank the discussant and participants at the 13th conference of the Swiss Society for Financial Market Research (2010) and the participants at the Bundesbank's Research Seminar. The opinions expressed in this paper are those of the author and do not necessarily reflect the opinions of the Deutsche Bundesbank.

to December 2009. With regard to term transformation, this period was very eventful: From 2005 to summer 2008, the term structure became more and more unadvantageous to term transformation; in summer 2008, the term structure even became nearly flat. Then, after the Lehman failure and the subsequent rapid reduction of short-term lending rates by the central banks, the steepness of the term structure increased considerably. From a supervisory point of view, this period was eventful, because the regulation for the interest rate risk in the banking book was introduced (which had previously not been regulated quantitatively).

The paper is structured as follows: In Section 2, we give a short overview of the literature in this field. Section 3 describes the methods. In Section 4, the dataset is presented. The results are given in Section 5, and Section 6 concludes.

2 Literature

Our paper is related to two strands of the literature of the banks' interest rate risk (See Staikouras (2003) and Staikouras (2006) for a survey). The first one is about the determinants of the banks' exposure to interest rate risk, and the second one deals with the relationship of the interest margin and the possible earnings from term transformation.

Fraser et al. (2002) for the U.S., Ballester et al. (2009) for Spain and Entrop et al. (2008) for Germany investigate the determinants of the banks' exposure to interest rate risk. They find that the belonging to certain banking groups, the banks' size, their earnings and balance composition, and the banks' application of derivatives have a significant impact on their exposure to interest rate risk. In this paper, however, we are not interested in the banks' level of interest rate exposure, but in the timely changes in the exposure.

English (2002) analyses the relationship of the (net) interest margin and the shape of the term structure. Using aggregate data for a cross section of countries, he finds little evidence that the possible earnings from term transformation (i.e. the slope of the term structure) have an impact on the interest margin. To some extent, our paper is related to Czaja et al. (2010). The authors extract the earnings from term transformation out of stock returns by analyzing a benchmark bond portfolio with the same exposure to interest rate risk as the underlying stocks. They find that a substantial part of the stock returns is due to term transformation. In our paper, we also choose a benchmark portfolio to infer a bank's earnings from term transformation.

As stated above, we can use data on the banks' exposure to interest rate risk, derived from the banks' internal models, and, therefore, do not have to estimate it. There is a large body of literature that deals with just this question, i.e. the question of how to estimate a bank's exposure to interest rate risk. Often banks' balance sheets are used, which are broken down into positions of relatively homogeneous repricing periods. For each position, a measure of interest rate sensitivity is assigned, for instance, the duration, and the weighted sum of the positions' duration is a measure of the bank's exposure to interest rate risk (See, for instance, Sierra and Yeager (2004)). The main problem of these approaches is that they yield a rather imprecise estimate of a bank's actual exposure, because the data from the balance sheet is often not detailed enough and off-balance sheet positions, especially interest rate swaps, are ignored. Entrop et al. (2008) use time series of balance sheet data and even their measure can only explain about 27% of the cross-sectional variation in the actual interest rate exposure of a sample of more than 1,000 German banks. Another method consists in inferring the banks' interest rate risk exposure from the banks' stock returns (See Yourougou (1990) and Fraser et al. (2002)). This approach, however, is only applicable to the listed banks and not to the unlisted ones, which account for the vast majority of banks in most countries.

3 Methods

3.1 Exposure in the course of time

As mentioned above, we do not need to estimate the banks' interest rate exposure from stock market returns or from balance sheet data, and yet the data analysis poses econometric challenges. The challenges arise owing to the characteristics of the dataset: The panel is highly unbalanced. On average, there is around one observation for each bank in each year, but the time difference between two observations differs widely, from one month to more than three years. The number of observations per bank is also widely different in the cross section of banks.

The variable $X_i(t)$ with $i = 1, \ldots, N$ and $t = 1, ..., T$ denotes the exposure to interest rate risk of bank i in month t. We model this exposure (normalized to the banks own funds) as follows:

$$X_i(t) = \alpha_i + \sum_{k=1}^{t} \mu(k) + \delta \sum_{k=0}^{t-1} out_i(k) + \sum_{k=1}^{t} \varepsilon_i(k), \tag{1}$$

where α_i is a time-invariant, bank-specific variable that captures the bank's attitude towards interest rate risk, for instance the banks' business model, its belonging to a specific banking sector and its economic environment. The variable $\mu(t)$ describes the general macroeconomic conditions in month t, in our case especially the shape of the (past and current) term structure of interest rates. We call this variable the change in the systematic factor of the exposure to interest rate risk. The variables $\mu(1), \ldots, \mu(T)$ are cross sectionally constant. $out_i(t)$ is a dummy variable that takes on the value one in month t, if there exists an exposure observation for bank i in this month and if this exposure is greater than the regulatory threshold of 0.2. $\varepsilon_i(t)$ is the banks' idiosyncratic change in the exposure to interest rate risk. It is assumed to be serially and cross-sectionally independent.

Our aim is to extract the systematic component $\mu(t)$ with $t = 1, .., T$ from the exposure data (See Equation (1)). One straightforward method is to calculate the change in the cross-sectional average exposure $\overline{X}(t)$ in month t (or the cross-sectional average exposure in a given quarter). The problem with this approach is that the dataset is highly unbalanced, i.e. not only does the number of banks for which there exist exposure data in a given month vary, the composition of the sample in a given month may also change systematically. For instance, it may be the case that there is a cluster of observations of banks with large exposure to interest rate risk in certain months. To show the problem with this approach, we write the change in the average cross sectional exposure as

$$\begin{aligned} \Delta\overline{X}(t) &= \overline{X}(t) - \overline{X}(t-1) \\ &= (\overline{\alpha}(t) - \overline{\alpha}(t-1)) + \mu(t) + \left(\overline{out}(t) - \overline{out}(t-1)\right) + (\overline{\nu}(t) - \overline{\nu}(t-1)), \quad (2) \end{aligned}$$

where $\overline{\alpha}(t)$ is the cross-sectional average of the bank-specific variable α_i of those banks for which there is an observation in month t. As the composition of this sample changes in the course of time, the cross-sectional average $\overline{\alpha}(t)$ of the time-invariant bank-specific effects α_i differs from month to month. $\overline{out}(t)$ is the share of those banks for which there exist data in month t and whose previous exposure was in excess of the regulatory threshold. $\overline{\nu}(t)$ is the average cross-sectional idiosyncratic change in the banks' exposure to interest rate risk for the banks for which there is an observation in month t. The average idiosyncratic change can be expected to cancel out in the event that the cross section is sufficiently large.

When investigating the changes in the average exposure (as described above), it remains unclear whether a change in the observed average exposure $\Delta\overline{X}(t)$ is due to changes in the systematic component of the exposure to interest rate risk $\mu(t)$ or whether the composition of banks in the sample $(\overline{\alpha}(t) - \overline{\alpha}(t-1))$ has changed, or whether changes in the supervisory pressure $\left(\overline{out}(t) - \overline{out}(t-1)\right)$ are responsible.

We choose the following method of mitigating the problem of changing sample composition: Instead of the exposure levels $X_i(t)$, we investigate the change in the exposure of the same bank, as stated in Equation (3). Let $T_i(j)$ with $j = 1, ..., n_i$ denote the jth observation for bank i. n_i is the number of exposure observations for bank i. We define

$$C_i(j) := X_i(T_i(j)) - X_i(T_i(j-1)) \quad j = 2, \ldots, n_i \tag{3}$$

as the change in bank's exposure, and

$$D_i(j) = T_i(j) - T_i(j-1) \quad j = 2, \ldots, n_i \tag{4}$$

as the time span during which this change occurs. Analysing the changes instead of the levels is accompanied by a loss of information; for instance, we can use only those banks for which there are at least two observations, i.e. $n_i \geq 2$.

To illustrate the notation, we give the following example. The interest rate risk exposure of Bank $i = 107$ be 0.11 in October 2006 ($j = 1$) and 0.07 in March 2007 ($j = 2$). The date is given in months since September 2005, i.e. October 2006 corresponds to $T_{107}(1) = 13$ and March 2007 is $T_{107}(2) = 18$. According to Equation (3), the change in exposure is $C_{107}(2) = -0.04$, the time span during which this change occurred is $D_{107}(2) = 5$ months (See Equation (4)).

Applying Equation (3) to Equation (1), we obtain

$$C_i(j) = \sum_{t=T_i(j-1)+1}^{T_i(j)} \mu_t + \delta \ out_i(T_i(j-1)) + \eta_i(j) \quad j = 2, \ldots, n_i \tag{5}$$

with

$$\eta_i(j) = \sum_{t=T_i(j-1)+1}^{T_i(j)} \varepsilon_i(t) \tag{6}$$

The variable $C_i(j)$ does not depend on the unobservable bank-specific effect α_i and the coefficients $\mu(t)$ with $t = 1, ..., T$ and δ can be estimated with an OLS regression. To see this, we rewrite Equation (5) as

$$C_i(j) = \mu(1) \ e_i(1, j) + \ldots + \mu(T) \ e_i(T, j) + \delta \ out_i(T_i(j-1)) + \eta_i(j) \tag{7}$$

with

$$e_i(t,j) = \begin{cases} 1 & T_i(j-1) < t \leq T_i(j) \\ 0 & otherwise \end{cases} \tag{8}$$

where $j = 2, \ldots, n_i$ and $i = 1, ..., N$. Note that, by assumption, the monthly idiosyncratic changes $\varepsilon_i(t)$ and thereby the idiosyncratic changes $\eta_i(j)$ themselves are cross-sectionally independent. In addition, the idiosyncratic changes $\eta_i(j)$ are also serially independent, because, by construction, the changes in exposure refer to non-overlapping periods, i.e. the monthly idiosyncratic change $\varepsilon_i(t)$ (for a given month t) appears exactly once in the idiosyncratic change $\eta_i(j)$ (in the event that $T_i(j-1) < t \leq T_i(j)$). However, the variance of $\eta_i(j)$ would not be constant even if the monthly idiosyncratic changes $\varepsilon_i(t)$ were homoskedastic. Even under this assumption, the variance of $\eta_i(j)$ would not be constant, but proportional to the time span $D_i(j)$ between the current and the previous observation. To account for this heteroskedasticity, we use White-corrected standard errors. The total number of observations that can be used in the regression (5) amounts to

$$Nobs = \sum_{i=1}^{N} n_i - N. \tag{9}$$

The approach above is comparable to a panel estimation with fixed effects: in both approaches, the bank-specific effect is removed by first differences (or, equivalently, by subtracting the time series average). In addition, this approach makes it possible to deal with a highly unbalanced panel.

3.2 Earnings from term transformation

We cannot directly observe which part of the banks' interest income is due to term transformation. Therefore, we use an indirect method and we estimate the bank's earnings from term transformation by analyzing a bond portfolio which has the same exposure to interest rate risk as the bank under consideration. We assume that the same exposure to interest rate risk yields the same earnings from term transformation. If this assumption holds and if the bank's exposure to interest rate risk is known (as in our case), we are able to obtain a precise estimate of the bank's earnings from term transformation.

The bond portfolio above is based on an investment strategy that consists of revolvingly investing in ten-year par-yield bonds and of revolvingly selling par-yield bonds with one year of maturity.[2] The basis point value (BPV) of this strategy is around $BPV_S = 0.372$

[2]See Memmel (2008) for details of these investment strategies.

euro per 1,000 euro of volume (See the appendix). The BPV of a bank is

$$BPV_i(t) = \frac{X_i(t)\ E_i(t)}{130}, \tag{10}$$

where $E_i(t)$ is the regulatory capital (own funds) of bank i in month t, and $X_i(t)$ is, as defined above, the exposure to interest rate risk. Note that $X_i(t)$ is the loss in present value due to a parallel upward shift of 130 basis points in the term structure in relation to the bank's own funds $E_i(t)$ (which explains the multiplication with $E_i(t)$ and the division by 130).

The variable $k_i(t)$ states the ratio of the bank's interest rate exposure to the interest rate risk exposure of the bond portfolio, i.e.

$$k_i(t) = \frac{BVP_i(t)}{BVP_S}. \tag{11}$$

If the same exposure to interest rate risk translates into the same earnings from term transformation, the scaling factor $k_i(t)$ concerning the exposure should also apply to the earnings from term transformation, i.e.

$$k_i(t) = \frac{F_i(t)}{F_S(t)}, \tag{12}$$

where $F_i(t)$ and $F_S(t)$ are the earnings from term transformation of bank i and of the bond portfolio, respectively. Combining (11) and (12), we see that a bank's earnings from term transformation depend multiplicationally on two factors: the bank's exposure to interest rate risk $X_i(t)$ and the market conditions $F_S(t)$.

We are not primarily interested in the absolute earnings from term transformation, but in their relation to total assets $TA_i(t)$ (*Margin from term transformation* variable: $TM_i(t)$) and the bank's interest income $R_i(t)$ (variable: $share_i(t)$). Note that total assets $TA_i(t)$ and interest income $R_t(t)$ are reported only once a year (and, in the case of the interest income, for the whole 12 previous months), i.e.

$$TM_i(t) = \frac{\sum_{k=t-11}^{t} F_i(k)}{TA_i(t)} \quad t = 3,\ 15,\ 27,\ 39,\ 51 \tag{13}$$

and

$$share_i(t) = \frac{\sum_{k=t-11}^{t} F_i(k)}{R_i(t)} \quad t = 3,\ 15,\ 27,\ 39,\ 51 \tag{14}$$

where the points in time correspond to the year-ends of 2005 to 2009.

For this analysis, the assumption *Same interest rate risk, same earnings from term transformation* is crucial. To our mind, this assumption can be justified because interest rates of different maturities are highly correlated. With respect to, for instance, the stock market, we would feel less comfortable if we made such an assumption.

Next, we define the interest margin $IM_i(t)$ as (net) interest income over total assets and we estimate the following panel model:

$$IM_i(t) = \alpha_i + \beta\ TM_i(t) + \nu_i(t) \quad t = 3,\ 15,\ 27,\ 39,\ 51 \tag{15}$$

Note that this panel does not suffer so much from gaps in the data, because we are now looking at yearly data (instead of monthly data as in the analyses before). Consequently, the $\Delta-$operator means the difference to the previous year, i.e. a lag of 12 months.

We estimate Equation (15) twice, once as a fixed effects model and once as a between-group model. The fixed effect model

$$\Delta IM_i(t) = \alpha_w + \beta_w \Delta TM_i(t) + \Delta\nu_i(t) \quad t = 15,\ 27,\ 39,\ 51 \tag{16}$$

gives information on how changes in a bank's earnings from term transformation affect the bank's interest margin. If changes in the earnings from term transformation do not affect other components of the interest income, we expect the coefficient β_w to equal one. By contrast, the between group model

$$\overline{IM}_i = \alpha_b + \beta_b\ \overline{TM}_i + \overline{\nu}_i \tag{17}$$

gives evidence as to whether banks with higher interest rate risk exposure tend to have higher interest margins. If β_b equals one, earnings from term transformation are an additional source of interest income (which do not compete with other income sources for limited risk budgets). This assumption is not so farfetched as it seems, because interest rate risk in the banking book need not be backed with regulatory capital. By contrast, if the coefficient β_b is zero, then term transformation competes with other income sources for limited internal risk budgets. If term transformation is more profitable (in terms of units of risk budget) than the competing sources of interest income, we will expect β_b in the interval between zero and one.

4 Data

According to section 24 of the Banking Act, banks in Germany must immediately notify BaFin and the Bundesbank if their banking book losses exceed 20% of their own funds owing to a standardized interest rate shock. The ratio of losses in present value over own funds is called *Basel interest rate coefficient*. To be able to fulfill the notification requirement, banks have to calculate at regular intervals how much the present value of their banking book goes down owing to this standardized interest rate shock. Currently, the standardized interest rate shock consists of two parts: a parallel upward shift of 130 basis points (bp) in the entire term structure and a parallel downward shift of 190 basis points. The relevant shock for the banks is the one which leads to the larger losses. Nearly all of the banks will gain if the term structure shifts downward and lose if the term structure moves upward, because banks tend to grant long-term loans and take in short-term deposits. For the few banks for which the 190-bp-upward shift is the relevant shock we proceed as follows: Their exposure is multiplied by -130/190 to account for their *negative* term transformation and to rescale their exposure. Observations of parallel shifts of other than 130 basis points are rescaled accordingly. When calculating the effects of the interest rate shock, banks have to include all on-balance and all off-balance positions in their banking book.

Our dataset concerning the Basel interest rate coefficient consists of two sources: the notifications in the event that the losses exceed 20% of the own funds, and the information gathered in regular on-site inspections. Our data cover the period from September 2005 to December 2009. In Table 1, we report summary statistics of the banks' change in exposure to interest rate risk $C_i(j)$, the time between two observations $D_i(j)$, and the number of observations per bank n_i. For confidentiality reasons, we cannot report descriptive statistics about the exposure $X_i(t)$ itself or the regulatory dummy $out_i(t)$. The dataset consists of 4,014 observations of changes in the interest rate risk exposure. On average, the change in the Basel interest rate coefficient is close to zero. The 25 percent largest change is 3.02 percentage points, the 25 percent lowest change is -2.42 percentage points. The time between two observations is, on average, 14 months, i.e. on average, there is one observation for 13 gaps. The sample covers 1,562 banks, i.e. for these banks, there are at least two observations available ($n_i \geq 2$). Given a bank is in the sample, there are, on average, about 3.5 exposure observations (and one observation fewer when we refer to observations of changes in the exposure). The sample is biased towards the small and medium-sized savings and cooperative banks. In December 2009, savings banks and cooperative banks accounted for 22.2% and 59.7% of all banks in Germany, respectively. For the variable *change in the interest rate exposure* $C_i(j)$ in our sample, the respective figures are 28.5% and 67.8%.

As outlined above, we analyze a passive investment strategy for government bonds. The government bond yields are taken from Deutsche Bundesbank which uses the Svensson (1994) approach to estimate the term structure from government bonds (See Schich (1997)). Data concerning the banks' balance sheets, their interest income and their own funds is taken from Bundesbank's database BAKIS (See Memmel and Stein (2008) for details). Table 1 also gives the information on the interest margin in the period 2005-2009. On average, this margin is around 225 basis points in relation to total assets.

5 Empirical results

5.1 Exposure to interest rate risk

As described in Subsection 3.1, we run the regression (5) to estimate changes in the systematic component of the exposure to interest rate risk $\mu(1), \ldots, \mu(T)$. As stated above, to account for possible deviations from the OLS assumptions concerning the covariance matrix of the residuals, we make use of the heteroscedasticity consistent covariance matrix estimation according to White (1980). In addition to the variable $out_i(t)$, which measures supervisory pressure as a dummy variable for banks exceeding the regulatory threshold, we introduce another variables for the regulation: the dummy variable $out2_i(t)$ which takes on the value one in the event that a bank is far above the regulatory threshold, i.e. that the banks' Basel interest rate coefficient is larger than 0.3.

In Table 2, we report the regression results. Owing to lack of space, the 51 coefficients $\mu(1), \ldots, \mu(51)$ are not reported in this table, but graphically displayed in Figure 1. In this figure, the cumulative estimated change is plotted, i.e. $SC(T) = \sum_{t=1}^{T} \mu(t)$. Up until late summer 2008, we see a declining trend in the systematic factor. From autumn 2008 onwards, the systematic factor rises steeply. For comparison purposes, we also plot the earnings of the benchmark bond portfolio. Qualitatively, both variables show the same pattern. This finding gives evidence that the systematic factor of changes in the exposure to interest rate risk is closely related to the (past and present) steepness of the term structure.

The results shown in Table 2 make it possible to gauge the impact of different factors, at bank level, on the exposure to interest rate risk. Above, we investigated the systematic factor that drives the banks' exposure to interest rate risk, i.e. $\mu(t)$. Now, we are investigating, at bank level, how far the systematic factor, regulation and idiosyncratic effects impact the exposure to interest rate risk. As before, we measure the systematic factor with the coefficients $\mu(t)$, the regulatory pressure with $out_i(t)$ and $out2_i(t)$, and the idiosyncratic factor with $\eta_i(j)$. By analysing the coefficient of determination R^2 in different specifications, it is possible to assess the contribution of the different variables.

In Table 2, we show the coefficient of determination for different regression models: the full model (column 2), the model without the regulation variables (column 3) and the model with only the regulation variables (column 4). The R^2 of the full model is 17.24%, i.e. the combined contribution of the systematic factor and the regulation to the total timely variation of the exposure is 17.24% and, therefore, 82.76% of the variation is due to idiosyncratic effects. These effects may be changes in the bank's business model, speculation about abrupt changes in the interest rates, and changes in the bank's own funds. Note that we consider the exposure relative to the bank's own fund. That is why the relative exposure changes in the event that the absolute exposure remains constant and the own funds decrease or increase.

With the help of the two other specifications, it is possible to disentangle the contributions of the systematic factor and of the regulation. One can expect some correlation between the regulatory variables $out_i(t)$ and $out2_i(t)$ on the one hand, and the variables $e_i(t)$ on the other: In the event that the bank's exposure is above the supervisory threshold, it can be expected that there will be more observations (because, in this case, the bank is likely to report its interest rate exposure to the supervisor more frequently). In fact, it turns out that the sum of the R^2s of the two incomplete models is slightly larger than the R^2 of the full model, i.e. $10.08\% + 8.63\% > 17.24\%$. To sum up the shares of explained variation to 0.1724, we scale them. The share of explained variation due to the systematic factor is 9.29% (= 10.08% x 17.24/(10.08+8.63)), the share due to regulation is 7.95%.

When extracting the systematic factor for the exposure to interest rate risk, we see a strong co-movement. But, when we look at the bank level, the systematic factor accounts for a bit more than 9% of the timely variation in the interest rate risk exposure. Regulation accounts for slightly less than 8% of the timely variation. Banks with exposure above the regulatory threshold of 20% reduce their exposure on average by 3.31 percentage points between two reports. If the exposure is above 30%, the reduction is even higher and amounts to 7.96 (=3.31+4.65) percentage points.

5.2 Earnings from term transformation

To calculate the earnings from term transformation as outlined in Subsection 3.2, we need the information on the banks' exposure $X_i(t)$ in each month t. However, the dataset includes around 13 gaps for each observation. We determine intermediate gaps by linear interpolation. Gaps at the beginning and at the end are filled in with the bank's first and last exposure, respectively.

In Table 3, we show the banks' estimated earnings from term transformation normalized to total assets (the ratio $TM_i(t)$ as defined in Equation (13)). We give the results for the median bank and we break down the results into banking groups and years.

Over the whole period 2005-2009 and over all banking groups, the median bank earned 26.3 basis points (in relation to total assets and per annum). There are, however, large differences across the years and across the banking groups. In 2005, when term transformation was quite profitable, the median bank earned more than 56 basis points from term transformation, whereas in 2008, when the term structure was nearly flat, the median bank earned barely more than nine basis points. The results illustrate that earnings from term transformation are quite volatile in the course of time, depending on the current and past shape of the term structure.

Savings banks and cooperative banks are said to rely heavily on earnings from term transformation. And, in fact, the earnings from term transformation for the median savings bank (29.2 bp) and for the median cooperative bank (30.2 bp) are much higher than the ones for the median private commercial bank (6.9 bp) and for the median other bank (6.8 bp). This reliance on term transformation among savings banks and cooperative banks can be also seen when we look at the share of earnings from term transformation in relation to interest income (See Table 4). For the median savings bank and cooperative bank, this share is around 15% and 13%, respectively, for the median private commercial bank it amounts to less than 5%.

These results are consistent with earlier findings for the German banking sector. Entrop et al. (2008) find that German savings and cooperative banks have a significantly higher exposure to interest rate risk than other banks, and practitioners gauge that German banks earnings from term transformation amount to between 10% and 35% of the banks interest income.[3]

In Table 5, we show the results of the panel regression, the fixed effect or within-model (Equation (16)) and the between-group model (Equation (17)). This table reads as follows, for instance, for the savings banks: When a savings bank's earnings from term transformation increase by 1 basis point (as compared to the previous year), the interest income (normalized to total assets) goes up by 0.51 basis points. The timely variation of the earnings from term transformation accounts for 30.48% of the timely variation in the savings bank's interest margin. The second row concerns the cross-sectional relationship between earnings from term transformation and interest margin. If two savings banks differ by 1 basis point in the time average of the earnings from term transformation, the time average interest margin is 0.59 basis point higher for the savings bank with the higher average earnings from term transformation. The results are based on 2,217 observations of 458 savings banks, i.e. for each savings bank, there are on average 4.8 (out of five possible) observations.

The results of the within estimation, at least for the savings and cooperative banks (which account for more than 90% of all observations in our sample), are consistent with expectations: Although the two β_w-coefficients are significantly smaller than 1 (around 0.5), the interest income of savings and cooperative banks rises and falls in accordance with the respective earnings from term transformation. The fact that a 1 basis point increase in the earnings from term transformation does not translate in a 1 basis point increase in the interest income may be due to a negative correlation between the earnings from term transformation and the risk premia on loans. In times of a boom the term structure tends to be steep and the risk premia (and thereby the mark-up) tend to be low. According to the coefficients of determination R^2, the timely variation in the earnings from term transformation accounts for roughly one-third of the variation in the interest margin (for savings and cooperative banks).

The results of the between-group model do not indicate that banks with high interest rate exposure tend to have a high interest margin. It appears that the interest margin is not much determined by the banks' exposure to interest rate risk. To be fair, for the

[3]See *Frankfurter Allgemeine Zeitung*, 17 June 2009.

savings banks we see a significantly positive coefficient, however the explanatory power, measured by the R^2, is relatively low (4.08% compared to the R^2 of the corresponding within- regression of 30.48%), for the other banking groups (apart from the regression with all banks) we do not find any significant coefficient. One possible explanation of this finding is that banks take the interest rate risk into account when they allocate the budgets to the different sorts of risk and that the risk from term transformation yields approximately the same return as, for instance, credit risk, measured in terms of risk units.

6 Conclusion

Using a unique dataset of German banks' exposure to interest rate risk, we can address questions about the banks' behavior concerning this sort of risk and about their earnings from term transformation. We see that the systematic factor of the exposure to interest rate risk indeed moves in accordance with the possible earnings from term transformation. At bank level, however, bank specific and regulatory effects are far more important. For savings and cooperative banks, earnings from term transformation are an important source of interest income, and timely changes in earnings from term transformation strongly affect their interest income. However, in the cross-section, the interest margin is not much determined by the exposure to interest rate risk.

The results apply especially to the small and medium-sized banks in the German savings and cooperative bank sector, which are engaged in traditional commercial banking. These results could be transferred to similarly structured banks in other countries.

Appendix

Considering a flat term structure with continuously compounded interest rate r, a bond with a residual maturity of M [in years] and a continuously paid coupon c, we can express the present value of this bond as

$$PV = \int_{t=0}^{M} c \exp(-rt)dt + \exp(-rM) \tag{18}$$

$$= \frac{c}{r}\left(1 - \exp(-rM)\right) + \exp(-rM). \tag{19}$$

The modified duration for par-yield bonds, i.e. $c = r$, is

$$D_{mod}(M) = \frac{1}{r}\left(1 - \exp(-rM)\right). \tag{20}$$

The duration of a strategy that consists in revolvingly investing in par-yield bonds of maturity M, i.e. the case when the residual maturity is equally distributed in the interval [0,M], amounts to

$$\overline{D_{mod}(M)} = \int_{t=0}^{M} \frac{1}{M} D_{mod}(t)dt \tag{21}$$

$$= \frac{M - 1/r\ \left(1 - \exp(-rM)\right)}{M\ r}. \tag{22}$$

We investigate two durations, $M = 1$ year and $M = 10$ years. For $M = 1$ year, we set $r = 4.42\%$ p.a., for $M = 10$ years, we set $r = 5.40\%$ p.a.[4] The corresponding average modified durations are $\overline{D_{mod}(1)} = 0.4927$ and $\overline{D_{mod}(10)} = 4.2093$, respectively. The basis point value (BVP) of a strategy that is long in the 10-year bonds and short in the 1-year bonds is (per 1,000 Euro of volume):

$$BVP_S = \frac{1,000}{10,000}\left(\overline{D_{mod}(10)} - \overline{D_{mod}(1)}\right) \tag{23}$$

$$= 0.1\,(4.2093 - 0.4927) = 0.3716 \tag{24}$$

[4]For the period 1990-2008, the average one-year and ten-year interest rates were 4.52% and 5.55%, respectively. To calculate the durations, we use the corresponding continuously compounded interest rates.

References

Ballester, L., R. Ferrer, C. Gonzales, and G. M. Soto (2009). Determinants of interest rate exposure of Spanish banking industry. Working Paper of University of Castilla-La Mancha.

Czaja, M.-G., H. Scholz, and M. Wilkens (2010). Interest rate risk rewards in stock returns of financial corporations: Evidence from Germany. *European Financial Management 16*, 124–154.

English, W. B. (2002). Interest rate risk in the bank net interest margins. BIS Quarterly Review. December 2002.

Entrop, O., C. Memmel, M. Wilkens, and A. Zeisler (2008). Analyzing the interest rate risk of banks using time series of accounting-based data: Evidence from Germany. Discussion Paper Deutsche Bundesbank, Series 2, 01/2008.

Fraser, D. R., J. Madura, and R. A. Weigand (2002). Sources of bank interest rate risk. *The Financial Review 37*, 351–368.

Memmel, C. (2008). Which interest rate scenario is the worst one for a bank? Evidence from a tracking bank approach for German savings and cooperative banks. *International Journal of Banking, Accounting and Finance 1(1)*, 85–104.

Memmel, C. and I. Stein (2008). The prudential database BAKIS. *Schmollers Jahrbuch 128*, 321–328.

Schich, S. T. (1997). Schätzung der deutschen Zinsstrukturkurve. Discussion Paper Deutsche Bundesbank Series 1, 04/1997.

Sierra, G. E. and T. J. Yeager (2004). What does the Federal Reserve's economic value model tell us about interest rate risk at U.S. community banks. *Review/Federal Reserve Bank of St. Louis 86*, 45–60.

Staikouras, S. K. (2003). The interest rate risk exposure of financial intermediaries: A review of the theory and empirical evidence. *Financial Markets, Institutions and Instruments 12*(4), 257–289.

Staikouras, S. K. (2006). Financial intermediaries and interest rate risk: II. *Financial Markets, Institutions and Instruments 15*(5), 225–272.

Svensson, L. E. O. (1994). Estimating and interpreting forward interest rates: Sweden 1992 - 94. IMF Working Paper 114.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and direct test for heteroskedasticity. *Econometrica 48*, 817–838.

Yourougou, P. (1990). Interest-rate risk and the pricing of depository financial intermediary common stock. *Journal of Banking and Finance 14*, 803–820.

Tables and Figures

Variable	Nobs	Mean	p25	p50	p75
Change in exposure $C_i(j)$ [$\times$ 100]	4014	0.19	-2.42	0.24	3.02
Time between two obs. $D_i(j)$ [months]	4014	14.25	10	12	17
Number of obs. per bank n_i	1562	3.57	3	3	4
Interest margin [basis points]	8816	224	192	226	256

Table 1: Descriptive statistics; p25, p50, p75 denote the 25th, 50th, 75th percentile, respectively.

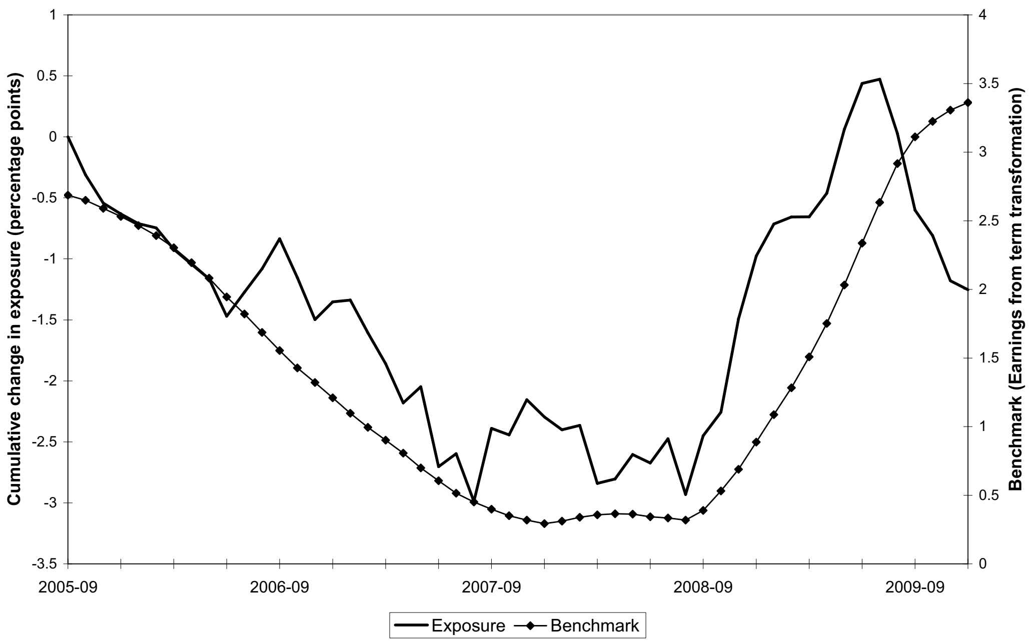

Figure 1: Systematic factor of the exposure to interest rate risk, derived from time dummies as explained in Table 2 (smoothed by moving averages) (right axis); earnings (in % p.a.) from term transformation of the benchmark bond portfolio (left axis)

Variable	Dep. var. $C_i(j)$		
$\mu(1)$			
$\vdots$	included	included	
$\mu(51)$			
$out_i(t)$	-0.0331***		-0.0354***
	(0.0025)		(0.0026)
$out2_i(t)$	-0.0465***		-0.0479***
	(0.0166)		(0.0173)
const.	0.0097***	-0.0030	0.0085***
	(0.0021)	(0.0018)	(0.0007)
R^2	0.1724	0.1008	0.0863
$Nobs$	4014	4014	4014

Table 2: Dependent variable: change in the exposure to interest rate risk $C_i(j)$. Regressors: time dummies $\mu(1), \ldots, \mu(51)$, dummies $out_i(t)$ ($out2_i(t)$) for banks with exposure (significantly) above the regulatory threshold; White (1980)-adjusted standard errors in parentheses. ***, ** and * denote significance on the 1%-, 5%- and 10%-level, respectively.

Banking group	2005	2006	2007	2008	2009	2005-2009
Private com. banks	20.2	12.6	3.7	2.6	16.2	6.9
Savings banks	54.2	36.2	11.6	8.5	51.8	29.2
Cooperative banks	61.0	40.8	13.3	10.1	59.4	30.2
Other banks	16.8	11.6	3.5	2.2	11.9	6.8
All banks	56.1	37.7	12.3	9.2	54.9	26.3

Table 3: Earnings from term transformation over total assets [basis points and per annum] ($TM_i(t)$); median bank

Banking group	2005	2006	2007	2008	2009	2005-2009
Private com. banks	11.2%	6.2%	1.8%	1.4%	8.7%	4.6%
Savings banks	25.8%	18.2%	6.5%	4.8%	24.9%	14.6%
Cooperative banks	23.5%	16.8%	5.9%	4.7%	24.8%	12.7%
Other banks	21.3%	15.4%	5.6%	2.9%	13.5%	8.7%
All banks	23.8%	16.9%	5.9%	4.6%	24.3%	12.3%

Table 4: Earnings from term transformation over interest income [per annum]($share_i(t)$); median bank

Banking group	Model	Coeff. β	Stand. Dev.	R^2	Obs. / banks
Private com. banks	Within	-0.01	0.10	0.0000	395
	Between	0.30	0.74	0.0020	85
Savings banks	Within	0.51***	0.02	0.3048	2217
	Between	0.59***	0.13	0.0408	458
Cooperative banks	Within	0.54***	0.01	0.3601	5859
	Between	0.14	0.09	0.0018	1217
Other banks	Within	-0.17	0.18	0.0072	342
	Between	-0.01	1.12	0.0000	72
All banks	Within	0.48***	0.01	0.2205	8816
	Between	0.52***	0.12	0.0107	1834

Table 5: Results for the regression: $IM_i(t) = \alpha_i + \beta\ TM_i(t) + \nu_i(t)$, where $IM_i(t)$ is the interest margin and $TM_i(t)$ are earnings (over total assets) from term transformation of bank i in t. Only the coefficient β is given. Yearly data from 2005 to 2009. *Within* is the fixed-effects estimation, *between* is the between-group estimation. ***, ** and * denote significance on the 1%-, 5%- and 10%-level, respectively.

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