R O M E
Research On Money in the Economy

No. 08-05 – July 2008

Interest Rate Pass-Through in Germany and the Euro Area

Julia von Borstel

ROME Discussion Paper Series

ISSN 1865-7052

Research On Money in the Economy

Discussion Paper Series
ISSN 1865-7052

No 2008-05, July 2008

Interest Rate Pass-Through in Germany and the Euro Area

Julia von Borstel

Julia von Borstel
Deutsche Bundesbank
Central Office, Economics Department
Wilhelm Epstein Str. 14
D-60431 Frankfurt am Main
e-mail: julia.von-borstel@bundesbank.de

Abstract

This paper analyzes the interest rate pass-through for Germany and the euro area using for the first time a fully harmonized data set on bank retail rates. In a vector error correction model, the speed and completeness of the pass-through from market rates to bank interest rates are estimated for the period January 2003 to September 2007. We find that time deposit and corporate loan rates other than overdrafts adapt relatively fast to changes in refinancing costs, followed by rates for private housing loans. On the contrary, especially longer term consumer lending rates and rates for savings deposits show the most sluggish pass-through behavior. In contrast to earlier studies, results for Germany and the euro area excluding Germany are similar by and large. We therefore conclude that differences in the pass-through behavior seem to be associated rather with certain banking products than with cross-country differences.

JEL-Classification: E43 G21, C32

Keywords: Monetary policy transmission, interest rate channel, vector error correction model

1 Introduction

The euro area economy, and the German economy especially, still very much depend on bank loans. Therefore, banks play a major role in the monetary policy transmission. In the empirical literature the interest rate channel is found to be of particular importance for the euro area, see amongst others Angeloni et al. (2003). Thus, the pass-through from official rates to bank interest rates is of special interest for the Eurosystem. Bank rates are typically found to be sticky. This finding has important monetary policy implications, since bank rates offered to bank customers do not fully reflect developments in market rates, and therefore lead to a lag in the impact of monetary policy transmission.

Much empirical literature exists on the interest rate pass-through in the euro area.[1] This paper contributes to it in two ways: For the first time, a fully harmonized data set is used in order to compare the speed and completeness of the interest rate pass-through for the euro area and Germany. Secondly, we use bank bonds instead of government bonds as the longer term market reference rate in order to capture the actual marginal pricing costs of banks. The reason for this choice of reference rate is that in standard banking sector models, banks set retail rates with a mark-up over the marginal cost of funding, see for example Freixas and Rochet (1997). Thus, bank retail rates should be tied to the market rate that most appropriately reflects the banks' maturity matching marginal cost for extending a loan or accepting a deposit. In this paper we therefore analyze the pass-through from money market rates and bank bond rates to bank retail rates of similar maturity. Overall, results do not change much if government bond rates are considered instead, as it is usually done in the literature. This is straightforward, as in normal times government bond rates and bank bond rates develop accordingly. Financial market turbulences in the second half of 2007, however, have shown that in crisis times these market rates could develop apart, leading to a misspecification of the pass-through process if government bond rates are considered instead. As a last distinction to earlier studies, our estimation period starts in 2003, hence containing no break due to the introduction of the single currency in 1999.

Our most important finding is that the pass-through in Germany seems to be

[1] See amongst others Borio and Fritz (1995), Toolsema et al. (2001), Sander and Kleimeier (2002), Angeloni and Ehrmann (2003), Hofmann (2006), Kok Sørensen and Werner (2006), Schwarzbauer (2006), Gropp et al. (2007).

quicker than what was found in earlier studies. Especially time deposit and loan rates to non-financial corporations adjust relatively quickly, followed by rates for housing loans, whereas consumer lending rates, overdrafts to non-financial firms and savings deposits react very sluggishly or virtually not at all to changes in refinancing costs. In the long run, in line with euro area results, only some loan and deposit categories fully adapt to changes in respective market rates. This latter finding, however, might be driven by the short time horizon at hand. Furthermore, pass-through differences seem to be associated rather to certain banking products than to cross-country differences. The differences between the euro area and Germany are minor, which is in clear contrast to earlier findings. This discrepancy could be due to a convergence process after the introduction of the single currency. It is, however, likely that this finding simply results from applying harmonized cross country data, since most German series in the former statistics, which was not harmonized, have been biased towards slower pass-through estimates.[2] In addition, in conflict with the convergence hypothesis, earlier studies such as Toolsema et al. (2001), Angeloni and Ehrmann (2003), and Hofmann (2006) analyzing the pass-through by means of the old RIR statistics before and after the introduction of the euro, cannot find any evidence for a convergence process in the case of Germany.

The approach chosen in this paper is very similar to de Bondt (2005). He estimates the speed and completeness of the pass-through from market rates of similar maturity to a variety of bank retail rates for the euro area. In line with our results, he finds a sluggish but often close to complete reaction of retail rates to changes in the respective market rates. Whereas loan rates show a relatively quick adjustment, overnight deposits and deposits redeemable at notice seem to be the most sluggish categories. On the whole, similar results are also obtained by Kok Sørensen and Werner (2006). They find that corporate and housing loans as well as time deposits react much more efficient to changes in refinancing costs than consumer loans or current account deposits. Furthermore, they detect strong heterogeneity in the pass-through behavior for different euro area countries, which is in contrast to our results. This latter finding, however, might be driven by the much longer period

[2]In the case of Germany, overdrafts for example have been collected in the former RIR statistics as the rate for short-term enterprize loans while other countries mostly reported rates for loans with interest rate fixation periods of up to one year. According to our pass-through estimates and in line with the empirical literature, these latter rates typically adapt significantly faster to changes in respective market rates than overdrafts, consequently leading to slower pass-through estimates for Germany while employing the non-harmonized RIR statistics.

of non-harmonized data in their sample, as compared to the period of harmonized data. Another recent study analyzing the interest rate adjustment behavior of European banks was conducted by Gropp et al. (2007). They find loans to react faster than deposits and, in line with our results, savings deposits and consumer lending rates to adapt slowest to changes in the respective market rates.

2 Empirical analysis

The pass-through process from the official rate set by the central bank to bank retail rates can be divided in two steps. In a first step, changes in the official rate are reflected in money market conditions and longer term capital market conditions. This process is typically found to be very efficient and complete, especially for shorter maturities (see e.g. Nautz and Offermanns (2007) and de Bondt (2005)). Hence, the analysis of the pass-through process from official rates to market rates will not be part of this paper.

In a second step, bank retail rates are adjusted according to changes in the respective refinancing costs. Under perfect competition, full information, and the absence of transaction costs, bank retail rates would immediately follow changes in market rates and the pass-through process would also be complete between financial markets and retail markets. Since banking markets, however, typically suffer from informational asymmetries and costs of changing prices and as banks have some market power, retail markets are far from perfect.[3] Hence, the reaction of bank retail rates to changes in market rates are as a matter of fact typically found to be sluggish and often incomplete. This has important implications for monetary policy, as bank rates directly affect the investment and saving decisions of firms and private households. Especially in a bank-based financial system like the German one, where bank rates offered to their customers play a dominant role in the transmission of monetary policy, this sluggishness and incompleteness leads to a lagged and reduced impact of monetary policy actions. It is therefore of particular importance for monetary policy authorities to monitor and analyze the pass-through process of market rates to bank rates.

[3]See amongst others Jaffee and Russel (1976), Akerlof and Yellen (1985), Stiglitz and Weiss (1981), Hannan and Berger (1991), Berger and Udell (1992), Cottarelli and Kourelis (1994), and Freixas and Rochet (1997).

2.1 Model

In this paper, the interest rate pass-through from market rates of respective maturity to bank retail rates is analyzed in a bivariate Vector Error Correction Model (VECM) of the following form:[4]

$$\begin{aligned} \Delta i_t &= \alpha_1(\beta_1 + \beta_2 r_{t-1} + \beta_3 i_{t-1}) + \sum_{j=1}^{p} \gamma_j \Delta i_{t-j} + \sum_{k=1}^{p} \delta_k \Delta r_{t-k} + \epsilon_{1t} \qquad (1) \\ \Delta r_t &= \alpha_2(\beta_1 + \beta_2 r_{t-1} + \beta_3 i_{t-1}) + \sum_{j=1}^{p} \phi_i \Delta i_{t-j} + \sum_{k=1}^{p} \lambda_k \Delta r_{t-k} + \epsilon_{2t}, \end{aligned}$$

where i_t represents the bank retail rate (overnight deposits, savings deposits, time deposits, consumer loans, housing loans and loans to non-financial corporations) and r_t the respective market rate, see Apppendix A, tables 1 and 2. Lags of both variables are included in the model up to order p. The error terms ϵ_1 and ϵ_2 are assumed to follow standard white noise processes.

The advantage of the VECM is that it simultaneously models short run and long run dynamics. Hence, the parameter vector α contains the adjustment coefficients, giving insights into the speed of adjustment to a new equilibrium after interruptions. The parameter vector β is commonly known as the long run equilibrium vector. All parameters in the model are simultaneously estimated by the Johansen cointegration procedure, described in detail in Johansen (1995). We include a constant in the model, which is restricted to the cointegration space; it can be interpreted as the margin. All cointegration relations are normalized to the market rate (β_2 equals 1). A complete pass-through process in the long-run thus implies a parameters β_3 of -1, which can be tested by standard Likelihood Ratio tests. Incomplete pass-through estimates lead to parameter values of $\beta_3 < -1$.

2.2 Data

The data used in this paper exclusively consists of the new Monetary financial institutions Interest Rate (MIR) statistics of the Eurosystem, which is based on volume-weighted monthly averages. The MIR statistics are harmonized across euro area countries, making cross-country comparisons much more reliable than the former

[4]See for example Lütkepohl and Krätzig (2004) for a more detailed description of the VECM, and for the advantage of bivariate systems over higher order systems while adapting cointegration tests.

published Retail Interest Rate statistics.[5] The new statistics, however, are available only since January 2003. Linking the old RIR to the new MIR statistics does not lead to satisfactory results, at least not in the German case. One reason might be that the methodologies for the old and the new statistics are quite different. For the former RIR statistics, the mode of retail rates were reported by each bank, while the MIR statistics consist of volume weighted averages of all transactions in one category. Furthermore, the categories of retail products covered by the old and the new statistics are not congruent. For a more detailed description of differences between RIR and MIR statistics, we refer to Deutsche Bundesbank (2004). In addition, combing the new and the old statistics would lead to only partially harmonized data and therefore hinder the cross-country comparison.

The sample used in this paper ends in September 2007, yielding 57 observations altogether. Unfortunately, the short sample period renders the application of more advanced time series models impossible, taking for example asymmetries or non-linearities in the pass-through process into account, as it is done in Payne (2007) or Kleimeier and Sander (2006). Furthermore, the estimation results have to be interpreted with caution, as the period under consideration does not fully cover an interest rate cycle, even though periods of decreasing market rates (2003) as well as increasing market rates (2006-2007) are included. Nevertheless, the new data set enables us to draw some first conclusions on the pass-through behavior in Germany and the euro area for a variety of products and in a consistent cross-country comparison.

Retail products covered here are deposits to households and non-financial corporations, consumer credit, and housing loans, all broken down by initial rate fixation period. Furthermore, we include loans to non-financial corporations broken down by initial rate fixation period and by size. New business rates are considered throughout the analysis. An overview over the retail rates taken into account for Germany and the euro area can be found in Appendix A, table 1 and 2. Corresponding market rates have been chosen according to the initial rate fixation bands of the retail rates. In order to capture the actual marginal pricing costs of banks, money market rates were selected for maturities of up to 1 year. For maturities above 1 year, bank bonds are considered in the German case and, due to data limitations, bonds of financial corporations for the euro area as a whole. Corresponding market rates for

[5]For a detailed description of the statistics and the degree of harmonization we refer to ECB (2006) "Differences in MFI interest rates across euro area countries".

both regions are listed in the Appendix A, tables 1 and 2 as well. In addition, plots for all series employed here are presented in the Appendix B, figures 1 to 4.

Throughout the paper, results for Germany are compared to those for the euro area. In order to ensure that euro area results are not driven by exceptionally German developments – as the German economy is the biggest in the European Monetary Union – we construct artificial euro area bank interest rates including all euro area countries except for Germany. Since the MIR statistics consist of volume weighted averages, this can easily be done in a coherent way.[6] To simplify notation and the exposition in the course of the paper, whenever euro area results are mentioned we refer to the euro area results *excluding* the German impact. Descriptive statistics covering mean and standard deviation for all rates can be found in Appendix A, tables 3 and 4.

As a general remark we have to take into account that the method of aggregating the data weighted by volumes leads to the fact that changes in reported interest rates can be price-driven, volume-driven or both. As for pass-through analyses changes in prices only would be the relevant information, volume-related changes can be regarded as "noise". Thus, estimates based on the new statistics might be biased towards slower and less complete pass-through parameter compared to older studies applying the RIR statistics, which at least for Germany reported "pure" price information. According to our five years' experience with the new MIR statistics, volume-driven changes in the reported rates are relevant especially for some categories, as for example large volume loans to non-financial corporations. These loan contracts appear to be related very much to firm-specific factors. The effect of these individually-arranged contracts are amplified by the underlying large volumes. Furthermore, with only a small number of reporting banks being active in this market segment, resulting aggregate rates show very unusual and volatile time series patterns for retail rates, being characterized by high fluctuations from month to month, see Appendix B, figure 4. These changes in interest rates are not associated to changes in banks' refinancing costs but to the method of collecting and

[6] All series for the euro area without Germany have been calculated in the following way:

$$i_t^{EoG} = \frac{i_t^E v_t^E - i_t^G v_t^G}{v_t^E - v_t^G},$$

where i_t denotes bank interest rates, v_t the corresponding volumes. The relevant regions are labelled as follows: EoG euro area without Germany, E the euro area including Germany and G Germany.

aggregating the data, thus hampering the analysis of the interest rate pass-through process. Due to the lack of bank individual data for the euro area as a whole, we have to stick to the reported volume weighted averages for this region, calculating the series excluding Germany as stated above. In the German case, however, data availability makes it possible to partly overcome the problem of these undesired volume-driven fluctuations. Only for these categories, unweighted averages at the country level are considered instead of the volume weighted averages reported in the MIR statistics. The smoothing effect of the unweighted averages can be assessed from the differences in month-to-month fluctuation between the German rates for large volume enterprize loans in the Appendix B, bottom plot in figure 2, and the respective euro area rates in the Appendix B, bottom plot in figure 4.

2.3 Results

2.3.1 Time series properties

Since interest rates are often found to be persistent and therefore show non-stationary behavior, time series properties of all series are checked by means of standard Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests. Resulting test statistics are listed in the Appendix A, tables 5 and 6. For almost all series the null-hypothesis of a unit root cannot be rejected at ordinary significance levels. The only exemption is the German series for consumer credit with an initial rate fixation period of above 5 years, for which the hypothesis of non-stationarity has to be rejected at the 1%-significance level.

We therefore proceed testing for cointegration with the Johansen-cointegration test, as described in detail in Johansen (1995). In order to gain parsimonious models due to the low number of observations at hand, lag-length selection is done according to the Schwartz information criterium. Resulting optimal lag lengths are given in the Appendix A, table 7. All pass-through models are estimated including a constant restricted to the long-run relationship but no trend. Resulting λ_{max} and λ_{trace}-test statistics are collected in table 8.

For Germany, we find the expected cointegrating relationships between bank retail rates and the respective market rates for most deposit and loan categories. This encompasses time deposits for private households and for non-financial corporations (including overdrafts), short-term savings deposits, consumer loans with initial rate fixation period above five years, housing loans to private households for all interest

rate fixation periods above one year, and small and large volume loans to non-financial corporations for all fixation bands. Only weak evidence for a cointegration relationship can be found for longer-term savings deposits, consumer loans up to 1 year and housing loans up to 1 year. This might be attributed to the few number of observations at hand. Furthermore, no cointegration relationship can be found at ordinary significance levels for overnight deposits of private households and non-financial corporations, private households' overdrafts, and consumer lending rates of 1 to 5 years. For these categories, long run relationships between the respective market rates and bank retail rates seem to be hard to detect for the period under consideration. We therefore proceed by estimating Vector Autoregressions (VARs) in first differences for these categories in order to rule out the possibility of spurious regression. Resulting parameters for all VECMs / VARs are stated in the Appendix A, table 9.

Regarding the cointegration tests for the euro area, we find similar results. Deposits to private households are a remarkable exception, since for the euro area overnight deposits show a close relationship to money market rates but time deposits do not, which reverts the above results obtained for Germany. Furthermore, consumer lending rates and capital market rates seem to be even more disconnected than in the German case. Finally, for large volume loans to non-financial corporations no cointegration relationship can be detected. This might however be related to the problem of undesired volatility in these series due to the relevance of volume-related changes in prices.[7]

2.3.2 Speed of adjustment

In line with the huge empirical literature we find the vast majority of interest rates to be sticky, leading to a lag in the effect of monetary policy impulses. Furthermore, there exist huge differences in the short term adjustment to changes in market rates between different product categories. The adjustment coefficients after one month range between 0% and 146% for Germany and 0% and 89% for the euro area, see table 9 in the Appendix A. Changes in market rates are fastest reflected in time deposit rates for non-financial firms for both regions (indicating even some over-

[7] As described in section 2.2, for Germany these problems are partly overcome by including unweighted averages on the country level. Unfortunately, comparable unweighted averages cannot be computed for the euro area. Thus, the importance of volume-related changes in interest rates presumably leads to the rejection of a cointegration relationship for these categories.

shooting in the German case), followed by short-term large volume enterprize loan rates for the euro area and all large volume loan contracts to non-financial corporations for Germany, with an adjustment coefficient of around 50%. In addition, relatively high adjustment parameter estimates are also obtained for all other loans to non-financial corporations and housing loans, for which roughly 30% of the deviation from the long run equilibrium are adjusted for in the first month in Germany and around 25% in the euro area. The exemptions are overdrafts to non-financial corporations (about 12% in both regions), consumer lending rates of interest rate fixation periods above 1 year (about 15% in Germany and about 20% in the euro area) and rates for overnight and savings deposits to private households (about 10% in both regions). For consumer lending rates between 1 and 5 years, bank rates do not adjust to changes in market rates at all according to our estimates for Germany. The same holds for short term savings deposits in the case of Germany and long term savings deposits as well as short term housing loan rates and longer term large volume enterprize loan rates for the euro area.

Measures for the quality of the regressions are listed in table 7. Taken altogether, the explained variation in bank retail rates by our models can be considered satisfactory for nearly all banking products and for both regions under consideration. The only exceptions are, as one might expect, categories for which already no pass-through could be detected (consumer lending rates with initial rate fixation period of 1 to 5 years in the German case and longer term savings deposits as well as large volume loans to non-financial corporations with initial rate fixation period of 1 to 5 years for the euro area). The pass-through models estimated here are not able to capture the development for these few retail rates over time. Thus, we can conclude that the considered market rates have no explanatory power for these bank retail rates at all.[8]

Comparing our results to the recent pass-through literature for the euro area, we find that the order of adjustment speed in the different product segments is roughly in line, see e.g. de Bondt (2005), Kok Sørensen and Werner (2006), and Gropp et al. (2007). The main difference compared to earlier studies is the relatively quick pass-through of changes in market rates to bank retail rates in Germany. Whereas earlier studies such as Borio and Fritz (1995), Toolsema et al. (2001) and Hofmann

[8]For the euro area large volume enterprize loan rate, this finding presumably is related to the problem of undesired month-to-month volatility in this series due to the importance of individual contracts along with the volume weighted averaging, see explanations above.

(2006) – using the old RIR statistics – or such as Kok Sørensen and Werner (2006) – applying a combination of RIR and MIR statistics – typically observe relatively low pass-through estimates for Germany especially for short-term loans to enterprizes, in our analysis differences in the speed of adjustment between Germany and the euro area are minor. Taken altogether, German rates appear to adjust somewhat faster than respective euro area rates with the exception being consumer lending rates. These differences, however, should not be taken too literally, as for instance capital market rates chosen for the analysis here are not fully comparable across the two regions, see section 2.2.

2.3.3 Long-run relationship

Regarding the long-run parameter, the estimated German interest rate pass-through seems close to complete for time deposits to private households and non-financial firms and short-term, large volume enterprize loans. This is very much in line with the euro area results. The only exception are time deposits to private households, where no cointegration relation could be detected for this latter region. In addition, very short term housing loans appear to be adjusted in the long run correspondingly to changes in market rates in the euro area but not in Germany.

We proceed by testing for the completeness of the pass-through in the long run. The test results of the Likelihood ratio test of $\beta_3 = -1$ are given in the Appendix A, table 10. The completeness hypothesis cannot be rejected for German time deposits and long term savings deposits to private households, short term consumer lending rates, long term housing loans and most longer term enterprize loans. With the exception of short term consumer lending rates, pass-through in Germany is found to be complete in the long run only for longer term retail rates. For the euro area excluding Germany, in contrast, bank retail rates seem to fully reflect changes in the respective market rates in equilibrium even for some short term loan categories, except for overdrafts. Taken altogether, complete pass-through in the euro area region is detected for nearly all housing loan categories as well as the majority of loans to non-financial corporations.

To sum up, according to our estimates complete pass-through in the long run can only be revealed for less than half of the banking products under consideration. This might, however, be a problem of the short sample. It is therefore worthwhile exploring the completeness of interest rate pass-through for Germany and the euro

area again when a whole interest rate cycle of harmonized data is available. Already with the observations at hand, however, we can conclude that retail rates fully adapt to changes in market rates for longer term contracts in Germany and even some short-term contracts in the euro area.

2.3.4 Explanations for differences in the pass-through

In order to shed some light on the importance of different banking products in Germany and the euro area, table 11 in the Appendix A lists the shares of new business volumes for each category.[9] Reported shares indicate that the German banking system is still characterized by *long termism*. This is especially true for housing loans to private households, with the majority of contracts having an initial rate fixation period of above 5 years in Germany, and below 1 year for the euro area excluding Germany. The same holds for deposits to private households, consumer loans and loans to non-financial corporations, with average interest rate fixation periods in Germany clearly exceeding those in the euro area. Only interest rate fixation periods for non-financial firms' deposits seem to be relatively similar across the two regions under consideration.

The importance of longer term contracts in Germany compared to the euro area leads to stronger competition in these market segments. This could be an explanation for the outcome of an often complete pass-through found for longer term contracts in Germany, while for the euro area even some short term loan rates are found to fully reflect changes in market rates in the long run, as for example housing loans with initial rate fixation periods below one year and small volume enterprize loans with interest rate fixation agreements between 1 and 5 years. Taken altogether, market segments with a high degree of competition as indicated by the relative importance of retail products show a comparatively fast and often complete or close to complete adaption to changes in refinancing costs. The clear exemptions are long term saving deposit rates in Germany and short term housing loans in the euro area, for which changes in refinancing costs are passed-through completely but very slow. The sluggish reaction of savings deposits, though, seems to be a stylized

[9] While interpreting these shares based on new business volumes one has to take into account that the importance of short term contracts is overstated simply due to the fact that short term contracts are rolled over more often. In a cross-country comparison, however, as long as the same interest rate fixation bands are applied, the reported shares help in assessing the relative importance of retail products.

fact in the empirical literature. Consumer preferences might be the explanation behind.

While completeness and often the speed of adjustment seems to be closely connected to the level of competition in certain market segments, changes in the degree of competition can hinder the analysis of the interest rate pass-through. In the German case, this seems to be the relevant explanation behind the very low pass-through estimates obtained for consumer lending rates. Increasing competition due to new market participants, as for example direct banks, presumably have diminished margins and, thus, counteracted increasing market rates in the last years. The German Bank Lending Survey results, for which on a quarterly basis senior loan officers are asked to indicate important factors affecting their bank's credit supply conditions, support this view. Since 2005 increasing competition from other banks led to a continued easing of credit standards. Throughout the same period, margins for average loans were considerably lowered.

Furthermore, it is interesting to note that rates for overdrafts to non-financial firms react quite slow to changes in respective refinancing costs, especially if compared to overdrafts to private households, even though overdrafts play an important role in the financing of non-financial firms in both regions. This finding might, however, be related to relationship lending, still an important feature of the banking system in some euro area countries and in Germany. Overdrafts are the most important source of easy liquidity provision. Housebanks might provide this easy liquidity, while protecting their customers from changes in interest rates via interest rate smoothing, presumably at the cost of higher overall interest rates.

Taken altogether, competition seems to be a strong driving factor behind differences in the pass-through behavior across products, but not the only one. The design of financial systems as well as consumer preferences might be relevant as well.

3 Conclusion

In this paper, the speed and completeness of the interest rate pass-through behavior of German banks were analyzed and compared to the behavior of banks in the euro area excluding Germany. Cross-country comparisons on interest pass-through patterns have been conducted before. In contrast to earlier studies, however, we used a fully harmonized data set. Our most important finding is that the adaption of interest rates to changes in market rates in Germany is faster than what

was found before, even though the new methodology of collecting the harmonized data introduces a bias towards lower interest rate pass-through estimates. Furthermore, differences in the pass-through behavior are associated rather with certain banking products than with cross-country differences. Taken altogether, our results accentuate the importance of harmonized data sets for cross-country comparisons.

In line with earlier studies, the majority of bank retail rates in Germany and the euro area were found to be sticky. Adaption in the short run is found to be very slow or even not traceable for saving rates and longer term consumer lending rates. On the contrary, lending rates to non-financial firms other than overdrafts and rates for housing loans to private households adapt relatively fast to changes in the respective market conditions, as indicated by the estimation results. A complete pass-through in the long run was detected for most longer term contracts in Germany and nearly all housing loan and loans to non-financial corporations in the euro area despite the small sample. Differences in the pass-through behavior seem to be related primarily to competition. The design of financial systems, however, as well as consumer preferences, might be driving forces behind the observed differences as well.

Appendix A: Tables

List of Tables

Table 1: Bank interest rates and corresponding market rates for Germany

Bank interest rate	Corresponding market rates
Household deposits	
Overnight	Eonia
With an agreed maturity of up to 1 year	Euribor (3 months)
Redeemable at notice of up to 3 months	Euribor (3 months)
Redeemable at notice over three months	Bank bonds with maturity 3 to 4 years
Non-financial corporations' deposits	
Overnight	Eonia
With an agreed maturity of up to 1 year	Euribor (3 months)
Loans to households	
Overdrafts	Eonia
Consumer credit with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Consumer credit with initial rate fixation of over 1 and up to 5 years	Bank bonds with maturity 3 to 4 years
Consumer credit with intital rate fixation of over 5 years	Bank bonds with maturity 7 to 8 years
Housing loans with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Housing loans with initial rate fixation of over 1 and up to 5 years	Bank bonds with maturity 3 to 4 years
Housing loans with initial rate fixation of over 5 and up to 10 years	Bank bonds with maturity 7 to 8 years
Housing loans with initial rate fixation of over 10 years	Bank bonds with maturity 9 to 10 years
Loans to non-financial corporations	Bank bonds with maturity 9 to 10 years
Overdrafts	Eonia
Loans up to euro 1 million with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Loans up to euro 1 million with initial rate fixation over 1 and up to 5 years	Bank bonds with maturity 3 to 4 years
Loans up to euro 1 million with initial rate fixation over 5 years	Bank bonds with maturity 7 to 8 years
Loans over euro 1 million with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Loans over euro 1 million with initial rate fixation over 1 and up to 5 years	Bank bonds with maturity 3 to 4 years
Loans over euro 1 million with initial rate fixation over 5 years	Bank bonds with maturity 7 to 8 years

Source: Deutsche Bundesbank.

Table 2: Bank interest rates and corresponding market rates for the euro area

Bank interest rate	Corresponding market rate
Household deposits	
Overnight	Eonia
With an agreed maturity of up to 1 year	Euribor (3 months)
Redeemable at notice of up to 3 months	Euribor (3 months)
Redeemable at notice over three months	Financial corporations bonds with maturity 3 to 5 years
Non-financial corporations' deposits	
Overnight	Eonia
With an agreed maturity of up to 1 year	Euribor (3 months)
Loans to households	
Overdrafts	Eonia
Consumer credit with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Consumer credit with initial rate fixation of over 1 and up to 5 years	Financial corporations bonds with maturity 3 to 5 years
Consumer credit with intital rate fixation of over 5 years	Financial corporations bonds with maturity 5 to 7 years
Housing loans with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Housing loans with initial rate fixation of over 1 and up to 5 years	Financial corporations bonds with maturity 3 to 5 years
Housing loans with initial rate fixation of over 5 and up to 10 years	Financial corporations bonds with maturity 5 to 7 years
Housing loans with initial rate fixation of over 10 years	Financial corporations bonds with maturity 7 to 10 years
Loans to non-financial corporations	Financial corporations bonds with maturity 7 to 10 years
Overdrafts	Eonia
Loans up to euro 1 million with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Loans up to euro 1 million with initial rate fixation over 1 and up to 5 years	Financial corporations bonds with maturity 3 to 5 years
Loans up to euro 1 million with initial rate fixation over 5 years	Financial corporations bonds with maturity 5 to 7 years
Loans over euro 1 million with floating rate or initial rate fixation of up to 1 year	Euribor (3 months)
Loans over euro 1 million with initial rate fixation over 1 and up to 5 years	Financial corporations bonds with maturity 3 to 5 years
Loans over euro 1 million with initial rate fixation over 5 years	Financial corporations bonds with maturity 5 to 7 years

Sources: Deutsche Bundesbank and Datastream.

Table 3: Descriptive statistics for the bank rates

	Germany		Euro area	
	mean	std.	mean	std.
Household deposits				
Overnight	1.29	0.21	0.60	0.12
Time deposit up to 1 year	2.39	0.65	2.41	0.66
Savings deposit up to 3 months	2.14	0.12	2.09	0.24
Savings deposit over 3 months	2.74	0.34	1.55	0.85
Non-financial corporations' deposits				
Overnight	1.45	0.39	1.06	0.30
Time deposit up to 1 year	2.48	0.69	2.52	0.68
Loans to households				
Overdrafts	10.71	0.47	9.65	0.27
Consumer credit up to 1 year	5.41	0.38	7.64	0.48
Consumer credit 1 to 5 years	6.03	0.45	7.27	0.27
Consumer credit over 5 years	8.82	0.30	7.39	0.25
Housing loans up to 1 year	4.79	0.49	3.80	0.57
Housing loans 1 to 5 years	4.53	0.37	4.05	0.38
Housing loans 5 to 10 years	4.73	0.33	4.50	0.36
Housing loans over 10 years	4.77	0.32	4.41	0.33
Loans to non-financial corporations				
Overdrafts	6.33	0.35	5.43	0.37
Loans up to 1 million up to 1 year	4.88	0.59	4.34	0.57
Loans up to 1 million 1 to 5 years	5.03	0.34	4.86	0.40
Loans up to 1 million over 5 years	4.88	0.32	4.45	0.33
Loans over 1 million up to 1 year	3.97	0.66	3.44	0.68
Loans over 1 million 1 to 5 years	4.41	0.41	3.67	0.72
Loans over 1 million over 5 years	4.72	0.30	4.09	0.47

Sources: Deutsche Bundesbank and own calculations.

Table 4: Descriptive statistics for the market rates

	Germany		Euro area	
	mean	std.	mean	std.
Eonia			2.56	0.67
Euriobor (3 months)			2.70	0.76
Bank bonds with maturity 3-4 years	3.39	0.56		
Bank bonds with maturity 7-8 years	3.90	0.42		
Bank bonds with maturity 9-10 years	4.07	0.39		
Fin. corp. bonds with maturity 3-5 years			3.70	0.59
Fin. corp. bonds with maturity 5-7 years			4.01	0.49
Fin. corp. bonds with maturity 7-10 years			4.34	0.48

Sources: Deutsche Bundesbank and Datastream.

Table 5: ADF and Phillips-Perron unit root tests for bank rates

	Germany		Euro area	
	ADF-Test	PP-Test	ADF-Test	PP-Test
Household deposits				
Overnight	3.32	2.81	0.96	-0.18
Time deposit up to 1 year	3.22	1.70	3.77	1.93
Savings deposit up to 3 months	-1.14	-1.27	0.33	0.05
Savings deposit over 3 months	-0.88	-0.84	1.33	1.76
Non-financial corporations' deposits				
Overnight	2.64	1.64	3.51	1.71
Time deposit up to 1 year	2.74	1.36	2.77	1.44
Loans to households				
Overdrafts	2.74	2.25	-1.28	-1.53
Consumer credit up to 1 year	-0.72	-1.56	0.49	-1.38
Consumer credit 1 to 5 years	-2.08	-1.94	-2.55	-2.42
Consumer credit over 5 years	-5.33***	-5.37***	-0.58	-0.59
Housing loans up to 1 year	-0.29	-0.46	-0.13	0.67
Housing loans 1 to 5 years	-0.66	-0.78	-0.26	-0.98
Housing loans 5 to 10 years	-1.63	-1.97	-1.05	-2.10
Housing loans over 10 years	-1.63	-1.90	-1.23	1.38
Loans to non-financial corporations				
Overdrafts	0.09	-0.35	1.03	0.05
Loans up to 1 million up to 1 year	1.20	0.97	0.72	1.07
Loans up to 1 million 1 to 5 years	0.43	-0.02	0.76	0.52
Loans up to 1 million over 5 years	-1.26	-1.33	-1.25	-1.00
Loans over 1 million up to 1 year	1.49	1.65	2.87	1.97
Loans over 1 million 1 to 5 years	0.20	-0.29	2.07	1.69
Loans over 1 million over 5 years	-1.32	-1.36	0.62	-0.77

Critical values for the ADF-Tests and the Phillips-Perron Tests were taken from MacKinnon (1996). ***(**,*) denotes significance at the 1%- (5%-, 10%-)critical value.

Table 6: ADF and Phillips-Perron unit root tests for market rates

	ADF-Test	PP-Test
Eonia	-0.93	0.78
Euriobor (3 months)	2.10	2.45
Bank bonds with maturity 3-4 years	-0.86	-0.52
Bank bonds with maturity 7-8 years	-1.56	-1.40
Bank bonds with maturity 9-10 years	-1.44	-1.55
Fin. corp. bonds with maturity 3-5 years	0.11	0.19
Fin. corp. bonds with maturity 5-7 years	-0.41	-0.35
Fin. corp. bonds with maturity 7-10 years	-0.02	-0.12

Critical values for the ADF-Tests and the Phillips-Perron Tests were taken from MacKinnon (1996). ***(**,*) denotes significance at the 1%- (5%-, 10%-)critical value.

Table 7: Optimal lag lengths and estimation quality of bank interest rate equation

	Germany			Euro area		
	Lag length	Adj. R^2	F-test	Lag length	Adj. R^2	F-test
Household deposits						
Overnight	1	0.33	14.49***	1	0.62	22.51***
Time deposit up to 1 year	1	0.63	45.23***	2	0.64	16.14***
Savings deposit up to 3 months	1	0.25	8.57***	1	0.36	14.43***
Savings deposit over 3 months	2	0.89	98.92***	1	0.00	0.28
Non-financial corporations' deposits						
Overnight	1	0.22	8.76***	2	0.46	12.13***
Time deposit up to 1 year	2	0.68	26.10***	1	0.66	49.74***
Loans to households						
Overdrafts	1	0.24	9.54***	2	0.43	9.30***
Consumer credit up to 1 year	1	0.30	11.19***	1	0.14	5.35***
Consumer credit 1 to 5 years	1	0.00	0.22	1	0.23	8.90***
Consumer credit over 5 years	1	0.37	15.01***	1	0.24	9.46***
Housing loans up to 1 year	3	0.59	13.44***	2	0.85	68.43***
Housing loans 1 to 5 years	1	0.73	69.05***	1	0.50	25.64***
Housing loans 5 to 10 years	1	0.70	61.99***	1	0.66	27.05***
Housing loans over 10 years	1	0.49	25.29***	1	0.52	28.10***
Loans to non-financial corporations						
Overdrafts	1	0.37	15.03***	1	0.42	18.86***
Loans up to 1 million up to 1 year	1	0.41	17.89***	1	0.76	82.84***
Loans up to 1 million 1 to 5 years	1	0.45	21.45***	1	0.38	15.95***
Loans up to 1 million over 5 years	1	0.44	20.43***	1	0.58	35.31***
Loans over 1 million up to 1 year	1	0.61	40.64***	1	0.63	44.12***
Loans over 1 million 1 to 5 years	1	0.52	27.84***	1	0.05	2.37*
Loans over 1 million over 5 years	1	0.48	23.98***	1	0.19	7.28***

Lag lengths have been chosen according to the Schwartz information criterium. ***(**) denotes significance at the 1%- (5%-)critical value. Adjusted R^2 and F-test are stated for the bank retail rate equation of the VECM / VAR in first differences, if no cointegration relation could be detected.

Table 8: Johansen test for cointegration

	Germany					Euro area				
	λ_{max}		λ_{trace}			λ_{max}		λ_{trace}		
	r=0	r=1	r=0	r=1	CI-rank	r=0	r=1	r=0	r=1	CI-rank
Household deposits										
Overnight	13.30	4.98	8.32	4.98	0	40.87***	4.21	36.66***	4.21	1
Time deposit up to 1 year	29.59***	4.86	24.73***	4.86	1	11.73	3.91	7.82	3.91	0
Savings deposit up to 3 months	24.00**	4.47	19.53**	4.47	1	25.99***	5.88	20.11***	5.88	1
Savings deposit over 3 months	19.92*	2.22	17.70**	2.22	0-1	15.36	2.39	12.97	2.39	0
Non-financial corporations' deposits										
Overnight	13.10	4.90	8.20	4.90	0	14.26	2.35	11.92	2.35	0
Time deposit up to 1 year	36.62***	6.52	30.10***	6.52	1	30.47***	7.59*	22.88***	7.59**	1-2
Loans to households										
Overdrafts	17.75	4.50	13.24	4.50	0	21.56**	6.27	15.29*	6.27	0-1
Consumer credit up to 1 year	19.60*	5.18	14.42*	5.18	0-1	17.41	6.82	10.59	6.82	0
Consumer credit 1 to 5 years	8.75	2.67	6.07	2.67	0	17.84	1.49	16.34*	1.49	0-1
Consumer credit over 5 years	19.95*	2.63	17.32**	2.63	0-1	15.50	0.89	14.61*	0.89	0-1
Housing loans up to 1 year	19.71*	6.76	12.96	6.76	0-1	18.55*	4.08	14.47*	4.08	0-1
Housing loans 1 to 5 years	23.57**	1.28	22.29***	1.28	1	31.67***	2.00	29.67***	2.00	1
Housing loans 5 to 10 years	28.25***	2.16	26.09***	2.16	1	16.87	2.1	14.77*	2.1	0-1
Housing loans over 10 years	18.26*	2.33	15.93**	2.33	0-1	37.71***	1.07	36.64***	1.07	1
Loans to non-financial corporations										
Overdrafts	28.94***	3.85	25.09***	3.85	1	23.08**	4.41	18.67**	4.41	1
Loans up to 1 million up to 1 year	26.50***	3.57	22.94***	3.57	1	36.67***	8.19*	28.48***	8.19*	1-2
Loans up to 1 million 1 to 5 years	23.88**	1.70	22.18***	1.70	1	25.89***	2.16	23.73***	2.16	1
Loans up to 1 million over 5 years	25.29***	1.53	23.75***	1.53	1	44.68***	0.83	43.85***	0.83	1
Loans over 1 million up to 1 year	29.97***	5.82	24.15***	5.82	1	21.21**	5.48	15.73*	5.48	1
Loans over 1 million 1 to 5 years	22.37***	1.33	21.04***	1.33	1	11.54	4.02	7.52	4.02	0
Loans over 1 million over 5 years	23.84**	2.51	21.32***	2.51	1	8.58	1.53	7.05	1.53	0

The Johansen cointegration tests have been conducted taking into account a constant restricted to the cointegration space and no trend. Critical values have been taken from MacKinnon et al. (1999). ***(**,*) denotes significance at the 1%- (5%-, 10%-)critical value.

Table 9: Short term adjustment and long run parameter

	Germany				Euro area			
	adj. coeff./ impact after 1 month		long run parameter		adj. coeff./ impact after 1 month		long run parameter	
Household deposits								
Overnight	0.17***	(4.07)	-	-	0.10***	(6.94)	-5.36***	(-29.47)
Time deposit up to 1 year	0.44***	(5.43)	-1.03***	(-34.7)	0.74***	(6.18)	-	-
Savings deposit up to 3 months	0.02	(1.18)	-4.61***	(-5.62)	0.14***	(4.23)	-2.57***	(-12.16)
Savings deposit over 3 months	0.05***	(4.01)	-1.06***	(-6.91)	0.04	(0.40)	-	-
Non-financial corporations' deposits								
Overnight	0.28***	(3.38)	-	-	0.11**	(2.19)	-	-
Time deposit up to 1 year	1.46***	(5.87)	-1.02***	(-115.16)	0.81***	(5.18)	-1.04***	(-64.79)
Loans to households								
Overdrafts	0.48***	(4.10)	-	-	0.48***	(3.15)	-	-
Consumer credit up to 1 year	0.23***	(3.59)	-1.42***	(-4.30)	0.89**	(2.02)	-	-
Consumer credit 1 to 5 years	0.07	(0.38)	-	-	0.12***	(3.91)	-2.25***	(-4.32)
Consumer credit over 5 years	0.11***	(4.38)	-6.50***	(-4.45)	0.18***	(3.88)	-1.58***	(-4.96)
Housing loans up to 1 year	0.15***	(3.56)	-1.47***	(-8.01)	0.04	(1.46)	-1.07***	(-13.24)
Housing loans 1 to 5 years	0.27***	(5.10)	-1.37***	(-17.17)	0.24***	(6.02)	-1.36***	(-13.56)
Housing loans 5 to 10 years	0.31***	(4.52)	-1.16***	(-22.06)	0.17***	(3.92)	-1.18***	(-10.53)
Housing loans over 10 years	0.26***	(3.58)	-1.18***	(-11.93)	0.18***	(6.78)	-1.12***	(-9.79)
Loans to non-financial corporations								
Overdrafts	0.12***	(4.65)	-1.52***	(-7.82)	0.12***	(3.76)	-1.49***	(-9.12)
Loans up to 1 million up to 1 year	0.35***	(3.75)	-1.12***	(-22.51)	0.27***	(5.88)	-1.09***	(-25.40)
Loans up to 1 million 1 to 5 years	0.19***	(4.72)	-1.20***	(-7.47)	0.27***	(5.20)	-1.18***	(-10.20)
Loans up to 1 million over 5 years	0.31***	(4.86)	-1.16***	(-9.52)	0.23***	(7.96)	-1.11***	(-11.12)
Loans over 1 million up to 1 year	0.83***	(4.83)	-1.07***	(-43.89)	0.53***	(3.92)	-1.02***	(-41.00)
Loans over 1 million 1 to 5 years	0.50***	(4.44)	-1.30***	(-17.25)	0.04	(0.38)	-	-
Loans over 1 million over 5 years	0.35***	(4.52)	-1.21***	(-10.78)	0.11	(0.85)	-	-

All cointegration relations are normalized on market rates. t-values are given in parantheses. ***(**,*) denotes significance at the 1%- (5%-, 10%-)critical value. If no cointegration relation could be detected, VARs are estimated in first differences and the impact of changes in money market rates on bank retail rates after one month is stated instead.

Table 10: Test for completeness of pass-through in the long run

	Germany		Euro area	
	LR-Test	p-value	LR-Test	p-value
Household deposits				
Overnight	-	-	32.12***	0.00
Time deposit up to 1 year	0.87	0.35	-	-
Savings deposit up to 3 months	9.3***	0.00	11.26***	0.00
Savings deposit over 3 months	0.14	0.70	-	-
Non-financial corporations' deposits				
Overnight	-	-	-	-
Time deposit up to 1 year	5.5**	0.02	3.35*	0.07
Loans to households				
Overdrafts	-	-	-	-
Consumer credit up to 1 year	1.19	0.28	7.13**	0.01
Consumer credit 1 to 5 years	-	-	5.76**	0.02
Consumer credit over 5 years	9.51***	0.00	-	-
Housing loans up to 1 year	4.71**	0.03	0.31	0.58
Housing loans 1 to 5 years	10.79***	0.00	9.63***	0.00
Housing loans 5 to 10 years	6.59**	0.01	2.56	0.11
Housing loans over 10 years	2.56	0.11	1.09	0.30
Loans to non-financial corporations				
Overdrafts	5.8**	0.02	4.93**	0.03
Loans up to 1 million up to 1 year	3.01*	0.08	2.75	0.10
Loans up to 1 million 1 to 5 years	1.18	0.27	1.95	0.16
Loans up to 1 million over 5 years	1.58	0.21	1.32	0.25
Loans over 1 million up to 1 year	4.12**	0.04	0.37	0.54
Loans over 1 million 1 to 5 years	7.81***	0.01	-	-
Loans over 1 million over 5 years	2.31	0.13	-	-

***(**,*) denotes significance at the 1%- (5%-, 10%-)critical value.

Table 11: Shares of new business volumes by market segments

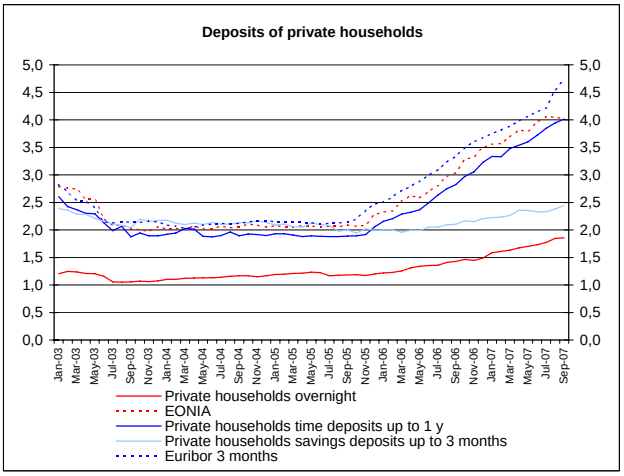
	Germany	Euro area
Household deposits		
Overnight	44.18	52.70
Time deposit up to 1 year	4.81	6.28
Savings deposit up to 3 months	41.19	40.89
Savings deposit over 3 months	9.82	0.13
Non-financial corporations' deposits		
Overnight	74.33	76.04
Time deposit up to 1 year	25.67	23.96
Loans to households		
Overdrafts	85.74	90.42
Consumer credit up to 1 year	2.20	3.36
Consumer credit 1 to 5 years	6.86	3.49
Consumer credit over 5 years	5.20	2.73
Housing loans up to 1 year	15.18	50.22
Housing loans 1 to 5 years	15.66	11.57
Housing loans 5 to 10 years	37.81	9.58
Housing loans over 10 years	31.35	28.62
Loans to non-financial corporations		
Overdrafts	47.42	66.36
Loans up to 1 year	42.78	30.41
Loans 1 to 5 years	3.76	1.62
Loans over 5 years	6.04	1.60

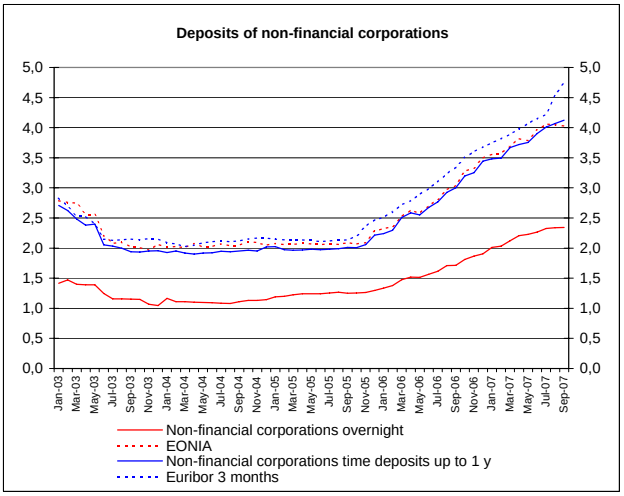
Shares of new business volumes by market segments calculated as yearly average.

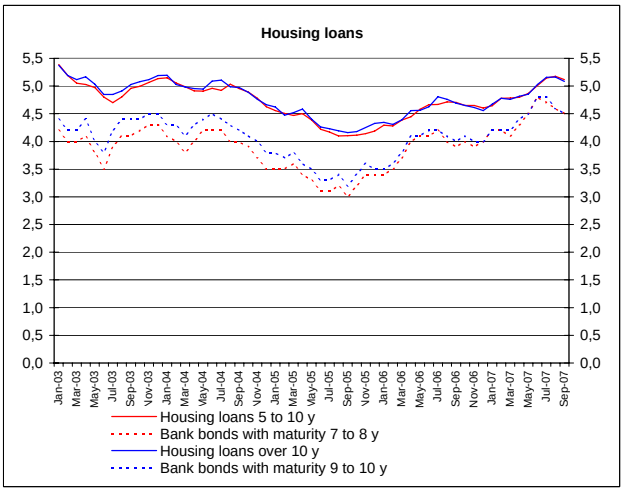
Appendix B: Figures

List of Figures

Figure 1: German rates for deposits and housing loans

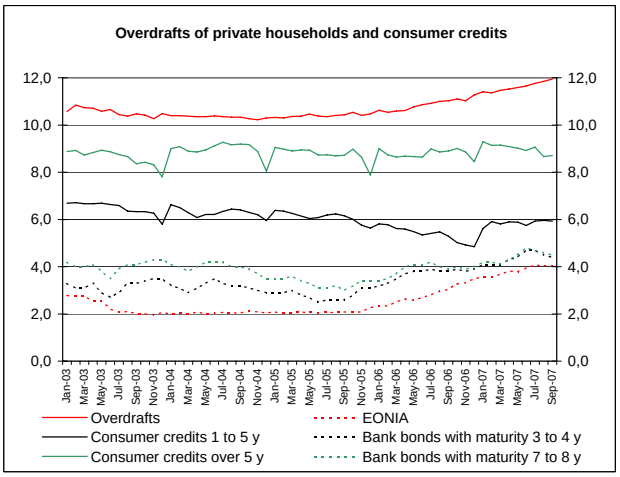


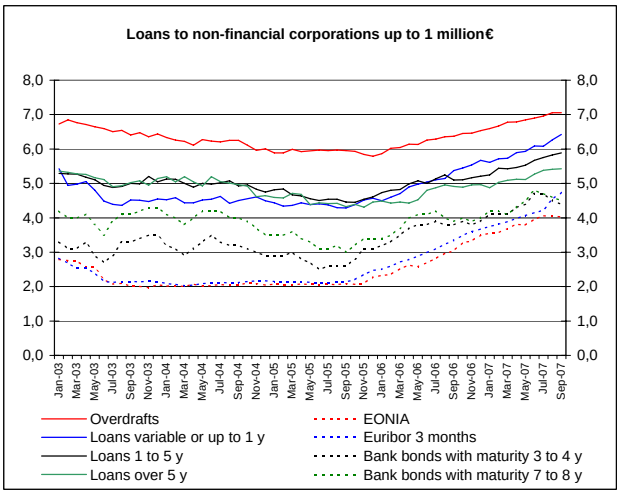


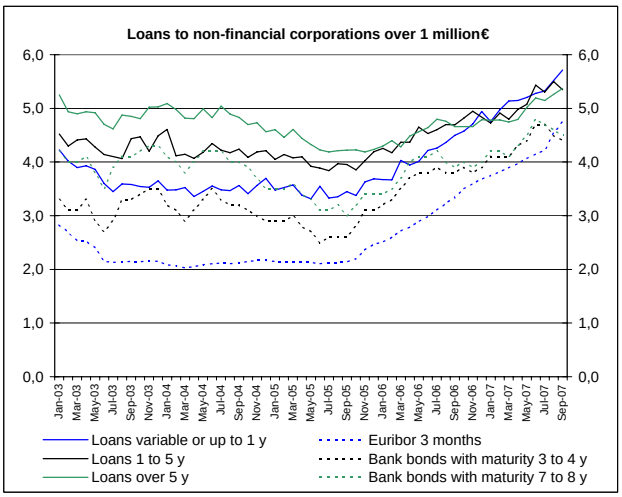


Source: Deutsche Bundesbank.

Figure 2: German rates for loans to non-financial corporations and consumer loans

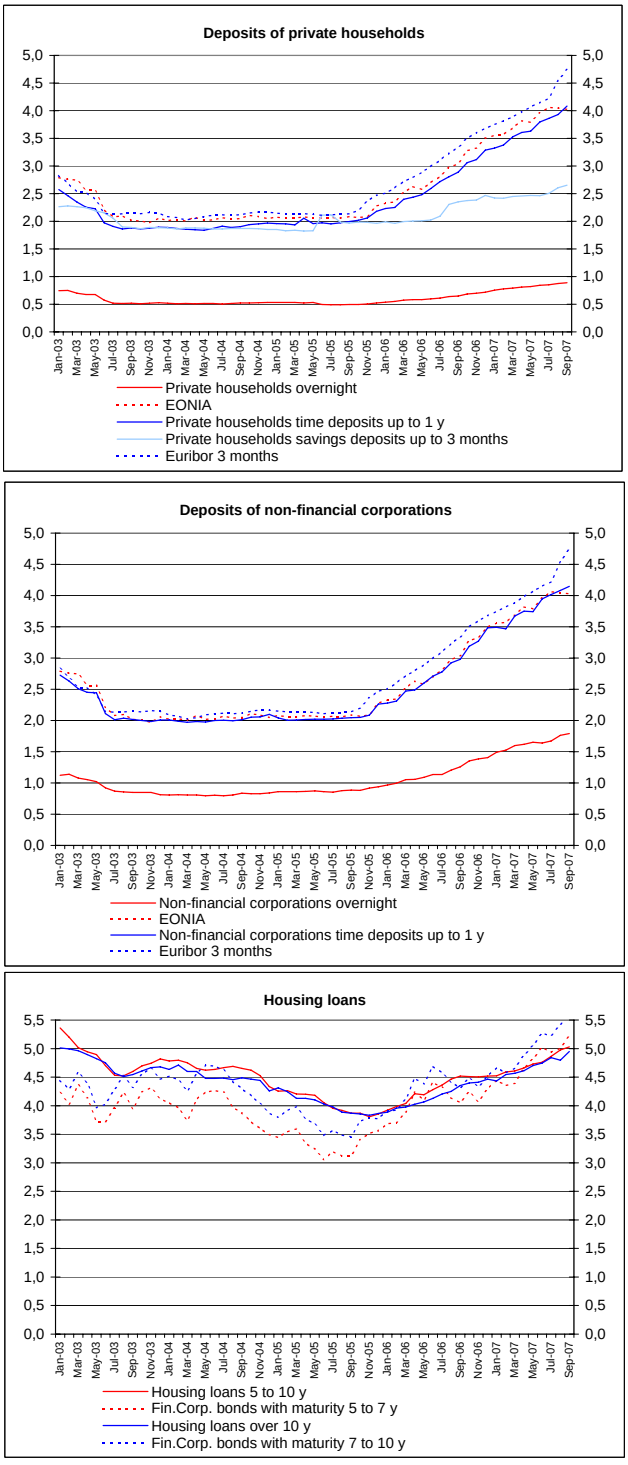






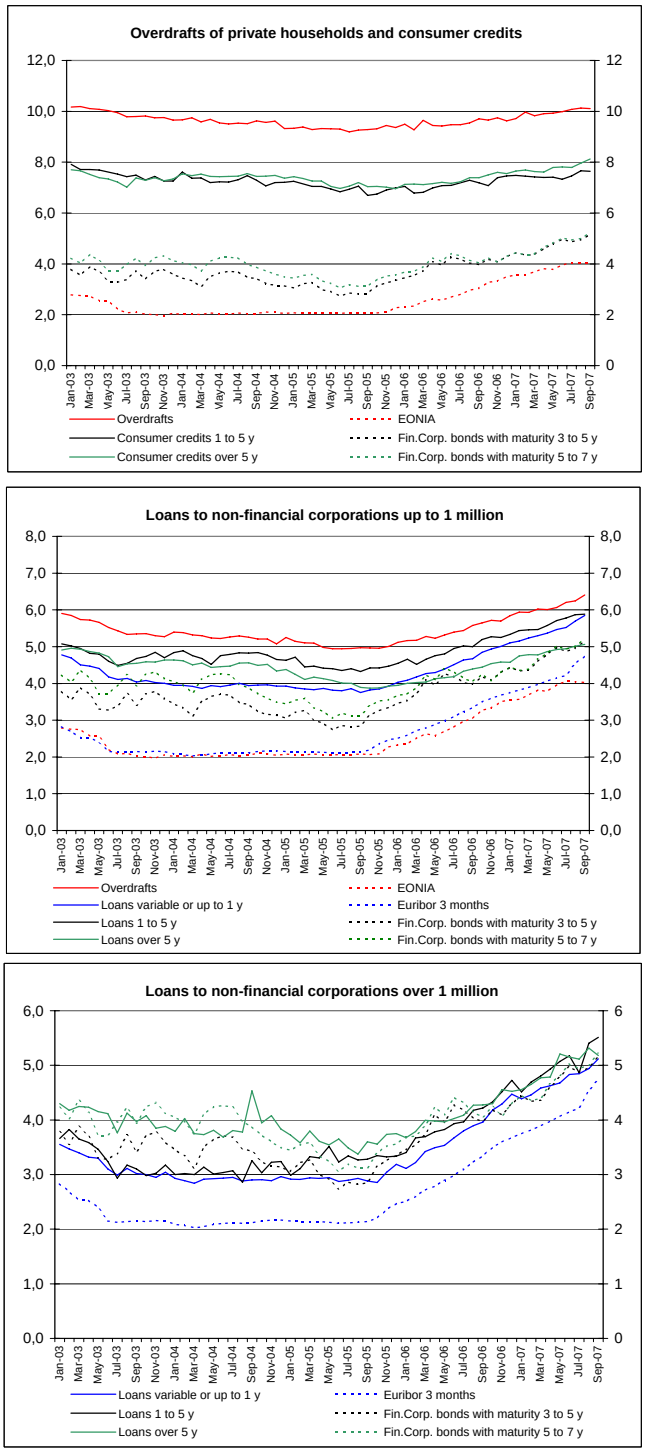
Source: Deutsche Bundesbank.

Figure 3: Euro area rates for deposits and housing loans



Sources: Deutsche Bundesbank and Datastream.

Figure 4: Euro area rates for loans to non-financial corporations and consumer loans



Sources: Deutsche Bundesbank and Datastream.

References

[1] Angeloni, I. and M. Ehrmann (2003), "Monetary Policy Transmission in the Euro Area: Any Changes after EMU?", ECB Working Paper No. 240.

[2] Angeloni, I., A.K. Kashyap, B. Mojon, D. Terlizzese (2003), "Monetary Transmission in the Euro Area: Does the Interest Rate Channel explain all?", NBER Working Paper No. 9984.

[3] Berger, A.N., G.F. Udell (1992), "Some evidence on the empirical significance of credit rationing", *The Journal of Political Economy*, 100, 1047-1077.

[4] Borio, C.E.V. and W. Fritz (1995), "The response of short-term bank lending rates to policy rates: A cross-country perspective", BIS Working Paper No. 27.

[5] De Bondt, G. (2005), "Interest Rate Pass-Through: Empirical Results for the Euro Area", *German Economic Review*, 6, 37-78.

[6] Deutsche Bundesbank (2004), "The new MFI interest rate statistics - methodology for collecting the German data", Monthly Report January 2004.

[7] European Central Bank (2006), "Differences in MFI Interest Rates across Euro Area Countries", http://www.ecb.int/pub/pdf/other/differencesmfiinterestrates2006en.pdf.

[8] Freixas, X, J.-C. Rochet (1997), *Microeconomics of Banking*, MIT Press.

[9] Gropp, R., C. Kok Sørensen, J.-D. Lichtenberger (2007), "The Dynamics of Bank Spreads and Financial Structure", European Central Bank Working Paper No. 714.

[10] Hannan, T.H., A.N. Berger (1991), "The rigidity of prices: Evidence from the banking industry", *American Economic Review*, 81, 938-945.

[11] Hofmann, B. (2006), "EMU and the Transmission of Monetary Policy: Evidence from business lending rates", *Empirica*, 33, 209-229.

[12] Jaffee, D.M., T. Russell (1976), "Imperfect information, uncertainty, and credit rationing", *Quarterly Journal of Economics*, 90, 651-666.

[13] Johansen, S. (1995), *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*, Oxford University Press.

[14] Kleimeier, S., H. Sander (2006), "Expected versus unexpected monetary policy impulses and interest pass-through in euro zone retail markets", *Journal of Banking and Finance*, 30, 1839-1870.

[15] Kok Sørensen, C., T. Werner (2006), "Bank Interest Rate Pass-Through in the Euro Area – A Cross-Country Comparison", European Central Bank Working Paper No. 580.

[16] Lütkepohl, H., M. Krätzig (2004), *Applied Time Series Econometrics*, Cambridge University Press.

[17] MacKinnon, J.G. (1996), "Numerical Distribution Functions for Unit Root and Cointegration Tests", *Journal of Applied Econometrics*, 11, 601-618.

[18] MacKinnon, J.G., A.A. Haug, L. Michelis (1999), "Numerical Distributions of Likelihood Ratio Tests for Cointegration", *Journal of Applied Econometrics*, 14, 563-577.

[19] Nautz, D., C.J. Offermanns (2007), "The dynamic relationship between the euro overnight rate, the ECB's policy rate and the term spread", *International Journal of Finance and Economics*, 12, 287-300.

[20] Payne, J.E. (2007), "Interest rate pass through and asymmetries in adjustable rate mortgages", *Applied Financial Economics*, 17, 1369-1376.

[21] Sander, H., S. Kleimeier (2002), "Asymmetric adjustment of commercial bank interest rates in the euro area: An empirical investigation into interest rate pass-through", *Kredit und Kapital*, 35, 161-192.

[22] Schwarzbauer, W. (2006), "Financial structure and its impact on the convergence of interest rate pass-through in Europe: A time-varying interest rate pass-through model", http://www.ihs.ac.at/publications/eco/es-191.pdf.

[23] Stiglitz, J.E., A. Weiss (1981), "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, 71, 393-410.

[24] Toolsema, L. A., J.-E. Sturm and J. de Haan (2001), "Convergence of monetary transmission in EMU - New evidence", CESifo Working Paper No. 465.

The following ROME Discussion Papers have been published since 2007:

1	2007	Quo vadis, Geldmenge? Zur Rolle der Geldmenge für eine moderne Geldpolitik	Egon Görgens Karlheinz Ruckriegel Franz Seitz
2	2007	Money and Inflation. Lessons from the US for ECB Monetary Policy	Ansgar Belke Thorsten Polleit
3	2007	Two-Pillar Monetary Policy and Bootstrap Expectations	Heinz-Peter Spahn
4	2007	Money and Housing – Evidence for the Euro Area and the US	Claus Greiber Ralph Setzer
5	2007	Interest on Reserves and the Flexibility of Monetary Policy in the Euro Area	Ulrike Neyer
1	2008	Money: A Market Microstructure Approach	Malte Krueger
2	2008	Global Liquidity and House Prices: A VAR Analysis for OECD Countries	Ansgar Belke Walter Orth Ralph Setzer
3	2008	Measuring the Quality of Eligible Collateral	Philipp Lehmbecker Martin Missong
4	2008	The Quality of Eligible Collateral and Monetary Stability: An Empirical Analysis	Philipp Lehmbecker
5	2008	Interest Rate Pass-Through in Germany and the Euro Area	Julia von Borstel