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In 2007 all ECB publications feature a motif taken from the €20 banknote.

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CONTENTS

Abstract

This paper investigates the dynamics of the pass-through between market interest rates and bank interest rates in the euro area as a function of cyclical and structural differences in the financial system. We find that overall the speed of adjustment for loans is significantly faster than for deposits, and that the pass-through is especially sluggish for demand deposits and savings deposits. Bank soundness, credit risk and interest rate risk are found to exert a significant influence on the speed of pass through. We also find evidence of faster (slower) pass-through for loans (deposits) if the change in monetary policy was up (down). Overall, we find that competition among banks and competition from financial markets result in a faster bank interest rate pass-through. Finally, we find some evidence that financial innovation speeds up the pass-through for those market segments that are most directly affected by these innovations.

JEL codes: E43, G21

Key words: monetary transmission, banks, retail rates, financial structure

NON-TECHNICAL SUMMARY

In this paper, we analyse the dynamics of the bank interest rate pass-through of changes in policy rates taking into account cyclical and financial structural differences across the euro area countries. The dynamics of banks' interest rate setting behaviour to policy rate changes is a key element of the monetary policy transmission mechanism and hence our paper contributes to the understanding of the way monetary policy is affecting the financing conditions of households and non-financial corporations. While several studies on this issue have already been carried out, we attempt to deepen the understanding of the pass-through process by controlling for both cyclical developments and differences in financial structures across the euro area countries. Our contribution to the literature mainly concerns the modelling and estimation of the underlying factors driving the bank interest rate pass-through process.

Our analysis applies a panel econometric approach including bank and market rates for the individual euro area countries. We estimate the dynamic adjustment of bank spreads (that is, the difference between bank interest rates and market rates of corresponding period of rate fixation) for various bank loan and deposit categories. We control for various exogenous factors, such as competition from other banks and from non-bank sources, bank soundness and interest rate risk, and financial innovation.

In line with the previous literature we find that bank interest rates are sticky in the short run and only adjust gradually over time to changes in policy rates. The degree of sluggishness is furthermore found to vary across bank products with rates on consumer loans and on current account deposits being the slowest to adjust. Unlike most of the literature, these results are obtained by controlling for bank soundness, interest rate risk and the slope of the yield curve. Furthermore, and also consistent with the literature, we find that bank rates tend to adjust asymmetrically over the business cycle in the sense that loan rates are quicker to adjust when interest rates are increasing than when they are declining. Vice versa, deposit rates tend to adjust relatively quickly when interest rates are declining. The asymmetric pass-through is evidence that banks have some degree of market power. Indeed, we find that competition from other banks and from non-bank sources (i.e. financial markets) have a positive impact on the speed and degree of the bank interest rate pass-through. Finally, we find support for the notion that financial innovation (such as securitisation or the use of derivatives) increases the speed of pass-through to those retail bank interest rates directly related to the specific innovation. Financial innovation, however, does not appear to have effects more broadly on the speed of pass-through.

1. INTRODUCTION

A key aspect of the transmission mechanism of monetary policy is the extent to which policy rates affect market interest rates, in particular money market rates and eventually also government bond yields, and how these changes, in turn, affect bank interest rates (Borio and Fritz, 1995). This paper attempts to deepen the understanding of this mechanism. In particular, it aims at identifying the factors that determine the price-setting behaviour of banks in the loan and deposit markets. A thorough understanding of the bank interest rate pass-through process is crucial from a monetary policy decision-making point of view because changes in bank lending and deposit rates affect financial conditions of households and non-financial corporations.

The focus of the paper is the price setting behaviour of banks in euro area countries, more specifically the pass-through from changes in official policy rates over market rate changes to bank interest rates. Applying a panel econometric approach, we estimate the dynamic adjustment of bank spreads (i.e. the difference between the bank interest rate and its corresponding market rate) for various bank loan and deposit categories to changes in monetary policy as a function of various exogenous factors, such as bank competition, financial structures, and financial innovation.

Bank interest rates are often found to be "sticky" in the sense that they do not respond immediately or fully to changes in the corresponding reference market rates against which they are priced. This has monetary policy implications as changes in the monetary policy rate hence may not be fully reflected in the interest rates banks offer their customers. A variety of reasons has been put forward explaining the observed sluggishness in the bank interest rate pass-through. For loans, it has been suggested that loan rate stickiness may be a result of credit rationing of borrowers due to problems of asymmetric information.[3] According to this hypothesis, owing to adverse selection and moral hazard problems banks may choose not to adjust loan rates in response to a policy rate change (increase) and ration credit instead. Using micro data Berger and Udell (1992) do not find strong evidence that credit rationing can explain loan rate stickiness. Instead, they offer an alternative explanation that banks may offer their long-term borrowers "implicit interest rate insurance" by smoothing bank loan rates over the business cycle. Banks may thus offer below-market rates during periods of high interest rates only to be compensated by above-market rates in low-interest rate periods (see also Elsas and Krahnen (1998)).

[3] Jaffee and Russell (1976) and Stiglitz and Weiss (1981); and subsequent papers Blinder and Stiglitz (1993); Besanko and Thakor (1987a-b); Williamson (1987).

For deposits, Hannan and Berger (1991) argue that the degree to which banks' deposit rates are sticky depend on the elasticity of deposit supply and the costs of changing the price. The elasticity of supply may depend on structural factors, such as market concentration and the depositor base of the bank. They find that banks adjust deposit rates in an asymmetric fashion, as rates tend to be more rigid in the case of interest rate increases than in periods of decreasing interest rates. Similarly, Mester and Saunders (1995) find that commercial loan rates tend to be more rigid in the upward direction. Mojon (2001) finds similar results for six euro area countries and notes that the asymmetry in the pass-through process partly hinges on the degree of competition.

One strand of the empirical pass-through literature focuses on the systematic measurement of the extent to which changes in market interest rates are passed-on to changes in retail interest rates on loans and deposits. The methods used typically involve a dynamic econometric framework (e.g. Vector Error-Correction Models) that distinguishes between immediate adjustments and the long-term adjustment, i.e. after taking into account adjustment lags. In a second step, the estimated measure of the degree of pass-through are then related to the various determinants of the price-setting behaviour of banks (see, for example, Cottarelli and Kouralis (1994), Borio and Fritz (1995), Mojon (2001), de Bondt (2002, 2005), Sander and Kleimeier (2004), Kok Sørensen and Werner (2006) and Schwarzbauer (2006)). We adopt a slightly different approach by directly estimating the response of bank interest rates/spreads to changes in the policy rate permitting the speed of this adjustment to vary across differences in financial structure and financial innovation across countries.

The main results of our paper are the following: First, retail bank interest rates on deposits generally adjust only sluggishly to changes in monetary conditions, while the pass-through for lending rates is faster. Unlike most of the empirical literature, these results are obtained by controlling for bank soundness, interest rate risk, and the slope of the yield curve, the latter being an indication of the presence of credit risk premia in loan spreads. Second, the completeness of the pass-through varies substantially across different market segments. In particular, the interest rates on mortgage loans, loans to non-financial corporations (NFCs) and on time deposits tend to adjust quicker and more fully than rates on consumer credit and those on demand deposits and savings deposits. Third, competition, both among banks and from financial markets, matters significantly for the speed of adjustment. Fourth, we confirm previous evidence on the asymmetry in the interest rate pass-through. Fifth, we find support for the notion that financial innovation (such as securitisation or the use of derivatives) increases the speed of pass-through to those retail bank interest rates directly related to the specific innovation. Financial innovation, however, does not appear to have effects more broadly on the speed of pass-through.

The paper is structured as follows: Section 2 presents a theoretical overview of the factors underlying banks' price setting behaviour. Section 3 outlines the econometric framework for our investigation of the pass-through and its determinants. Section 4 describes the data used in the study. The estimation results are contained in Section 5 and Section 6 presents a number of extensions. Section 7 outlines some robustness checks and Section 8 concludes.

2. DETERMINANTS OF BANKS' PRICE-SETTING

The theoretical starting point of our analysis of banks' interest rate setting behaviour is based on the influential papers of Klein (1971) and Monti (1972).[4] In the Monti-Klein model of the banking firm, banks maximise profits in the current period and have the capacity to set the price in both loan and deposit markets. That is, banks have some pricing power in these markets. Banks cannot influence the interest rates in the interbank money market or bond market, to which they resort when seeking to borrow additional funds or a return on surplus liquidity. The market interest rate is expected to stand between the rate on loans and the rate on deposits. It is assumed to represent the funding costs of loans and the opportunity costs of deposits. The cost of funds is a primary component of the marginal cost of lending, and it is usually the only component of marginal cost that varies widely from quarter to quarter. The other components should be relatively stable in the short-run (Ausubel (1991)). The spread between the retail deposit rate and the market interest rate is the opportunity cost of deposits to depositors and profitability of deposits to a bank (Hutchinson (1995)).

The Monti-Klein set-up focuses upon the modelling of each side of the balance sheet separately. However, loan rates may be cross-subsidised from the deposit margin in order to attract borrowers, if deposit rates are regulated or if there are favourable consumer "lock-in" effects, once customers have been captured (Chiappori et al (1995), Freixas and Rochet (1997), ECB (2000)). Recognising the two-sided nature of the banking problem, several authors have modelled lending and deposit rates simultaneously. One of these models is the dealership approach, originally proposed by Ho and Saunders (1981) who use the financial literature on broker bid-and-ask spreads to explain bank spreads. The bank is viewed as a dynamic dealer (i.e., merely an intermediary between demanders and suppliers of funds) that sets interest rates on loans and deposits to balance the asymmetric arrival of loan demands and deposits supplies.

[4] For an overview of the theoretical literature, see e.g. Baltensperger (1980), Santomero (1984), and Freixas and Rochet (1997).

The Monti-Klein model and Ho and Saunders (1981) and the subsequent extensions of these models point to a variety of factors determining banks' interest rate setting behaviour, which we will consider in our modelling of the pass-through process.

An important determinant of the spread between lending rates and market interest rates is **credit risk**, reflecting the possibility that some loans will not be fully paid back. If banks are fully diversified, credit risk will simply be related to the aggregate state of economy; if banks are not, each individual loan may reflect idiosyncratic credit risk. As in this paper we are using interest rate data aggregated at the country level, we will focus on aggregate credit risk, as reflected in standard measures of the business cycle. The level of aggregate credit risk in the economy will determine the conditions for lending and, consequently, the reaction of the bank to changes in market conditions. Thus, in the absence of credit rationing, we expect that changes in credit risk will positively affect the lending spread.[5] However, banks also have other possibilities for managing credit risk, including tighter collateral requirements to back up the loan, restrictive covenants and other non-interest characteristics of the loan. In this paper, given data limitations, we will focus solely on interest rate effects of credit risk.[6]

Banks are also exposed to **interest rate risk** because they have to deal with demands for loans and supplies of deposits that reach them asymmetrically in time. If a deposit arrives at a different instant in time from a new loan demand, the bank will have to temporarily invest the funds in the money market at the short-term market interest rate. In doing so, the bank faces *reinvestment risk* at the end of the decision period should the market interest rate fall. Similarly, if the demand for a new loan is met by the bank without a contemporaneous inflow of deposits, the bank would have to resort to short-term borrowing in the money market to fund the loan, thereby facing *refinancing risk* if the short-term interest rate goes up. Volatility in the money market rates is therefore expected to lead to higher interest margins, as banks will require a higher premium to compensate for the interest rate risk.[7]

A further source of interest rate risk arises from the fact that banks typically seek to match the demand for long-term loans with the supply of short-term deposits.[8] This maturity transformation exposes the interest rate revenue of a bank to fluctuations in market interest

5 By contrast, in periods of credit rationing banks tend to restrict the supply of loans to riskier borrowers rather than adjusting their rates accordingly, thereby slowing down the speed of adjustment to changes in market rates and in this case we should not expect higher margins.

6 Note that since we are interested in the difference between market rates and bank rates to similar borrowers, this limitation may not be very severe, because both in bond issuance and bank loans non-interest characteristics may be changed along similar lines through a business cycle.

7 Maudos and Fernández de Guevara (2004) further suggest that a higher correlation between the two prime sources of risk (i.e. interest rate risk and credit risk) is likely to imply higher spreads.

8 Rate-sensitive assets may be variable-rate loans and short-term loans, and rate-sensitive liabilities may be short-term time deposits and variable-rate certificate of deposits. In practice, there are many sources of interest rate risk, depending on "structural" factors such as the variability of loans, the reference indices and re-pricing intervals.

rates. For example, if a bank holds more rate-sensitive liabilities than assets, a rise in market interest rates will reduce bank profits. To mitigate the effect of adverse changes in market interest rates, banks often take recourse to various forms of derivatives. The transfer of the risk will however entail a cost to the bank, which may be reflected in a higher bank spread. In addition, to the premium demanded by the hedge counterparty (i.e. the price of the derivative), the cost may also reflect a lost gain if, in the absence of the hedge, market interest rates had moved into a favourable direction.

The pricing behaviour of banks is also assumed to be affected by the degree of **competition** among banks, from financial markets and non-banks. As regards competition among banks, the impact of market concentration on the pricing behaviour of banks is generally summarised in the literature by two opposing hypothesis (see e.g. Corvoisier and Gropp, 2002). The "structure-conduct-performance" hypothesis asserts that higher market concentration leads to less favourable pricing to consumers due to some form of collusion among banks. In the related relative-market-power hypothesis, only firms with large market shares and well-differentiated products are able to exert market power in pricing deposits and loans and earn positive profits (Berger, 1995). In contrast, the "efficient-structure hypothesis" suggests that concentration would increase the overall efficiency of the sector. Concentration is conjectured to arise from more efficient banks growing more rapidly than less efficient banks, or more efficient banks taking over less efficient banks. If this is the case, banks might price their loans and deposits more competitively even in a highly concentrated market. In addition, the theory of contestable markets argue that banks may behave competitively also in a highly concentrated market if the barriers to entry are low. Corvoisier and Gropp (2006) argue that the ability of consumers to compare rates across a large number of banks in the internet may have increased contestability and reduced the importance of physical presence in a market.

An implication of the Monti-Klein model is that spreads will be adversely affected if substitutes to banking products are available in financial markets (Freixas and Rochet, 1997). Similarly, in the Ho and Saunders model, the bank spreads depend on the elasticity of the demand for loans and the supply of deposits. The less elastic the demand for loans or supply of deposits, the higher a premium the bank will be able to apply if it exercises market power. Therefore, also **competition from non-bank financial products** may matter. While most of the debt financing of households is bank-based, non-financial corporations may also borrow funds directly through the issuance of debt securities. In the case of lending rates to non-financial corporations, we would therefore expect that easier access to direct debt financing puts pressure on banks to narrow their spread (see e.g. Mojon, 2001; and Corvoisier and Gropp, 2002). Similarly, in the case of deposit rates, we would expect that easier access to direct investment in securities or indirectly through money market funds and investment funds (especially by households) puts pressure on banks to price their deposit rates more competitively.[9]

The subject of competition from non-bank financial products naturally leads to the much wider field in the economic literature of **financial innovation**. For example, in Thornton (1994) financial innovation, partly driven by deregulation, takes the form of an increased prominence of non-bank financial intermediaries relative to banks in supplying credit and an increased reliance on obtaining funds directly in the markets, rather than through traditional financial intermediaries. He points, in particular, to a widening of the array of financing options available to small and medium sized enterprises, the development of a commercial paper market, lending by non-bank finance companies (to businesses, consumers and real estate borrowers), the securitisation of loans, and the rising importance of mutual funds. More generally, financial innovation refers not only to technological advances which transform the access to information, trading channels and the means of payment, but also to the emergence of new financial instruments and services, and more developed and complete financial markets (González-Paramo, 2006). Tufano (2003) further observes that innovations are sometimes divided into product and process innovation, with product innovations exemplified by new derivative contracts, new corporate securities or new forms of pooled investment products.[10] Overall, this seems to suggest that bank spreads are likely to be affected not only by higher competition from non-bank financial intermediaries that provide a wider choice of financing and investment possibilities and, in some cases, address problems of incomplete markets, but also by other types of financial innovations such as advances in the management of risk, in addressing agency cost and information asymmetries, and in minimising transaction or search costs.

Liquidity risk is the risk of not having sufficient cash or borrowing capacity to meet deposit withdrawals or new loan demand, thereby forcing banks to borrow emergency funds at potentially higher cost (Angbazo, 1997). As the proportion of funds invested in cash or cash equivalents increases, the liquidity risk of the bank declines, which may reduce the liquidity premium in bank spreads. Similarly, by introducing liquidity risk into the Monti-Klein model (in the form of some randomness in the volume of loans or deposits), Prisman, Slovin and Sushka (1986) show that the cost of the bank's resources should increase, as it includes a premium to compensate for the expected cost of a liquidity shortage (see also Freixas and Rochet, 1997).

The level of **bank capital** may also affect the price-setting behaviour of banks. First, banks

9 Borio and Fritz (1995) point out that the relevance of the degree of competition in loan and deposit markets loses part of its force once a time dimension is explicitly considered. Demand curves are likely to be more inelastic in the short-run than in the medium-run. Fixed search and switching costs, for instance, hardly seem to justify a permanent limited response to changes in the market interest rates. The forces of arbitrage between different banks, or between banks and financial disintermediation become more powerful as time elapses. At the same time, in practice, it may be difficult to distinguish stickiness in the long-term (adjustments in equilibrium) from stickiness in the short-term (adjustments between equilibria).

10 Examples of process innovations include new means of distributing securities, processing transactions, or pricing transactions.

hold capital to insulate themselves against both expected and unexpected credit risk (Saunders and Schumacher, 2000). Specifically, while capital requirements constitute the minimum level, banks often endogenously choose to hold more capital against unexpected credit losses or market discipline may induce them to hold more capital (Flannery and Rangan, 2004). However, holding equity capital is a more expensive funding source than debt (because of tax and dilution of control reasons). Thus, banks that have a relatively high capital ratio for regulatory or credit reasons can be expected to seek to cover some of the increase in the average cost of capital by operating with higher interest rate spreads. Second, since capital is considered to be the most expensive form of liabilities, holding capital above the regulatory minimum is a credible signal of creditworthiness on the part of the bank (Claeys and Vander Vennet, 2003). When depositors exert "depositor market discipline", this may enable the bank to lower its deposit funding cost and, hence, increase the deposit spread. [11]

Several further extensions were made to the original Ho-Saunders model. Angbazo (1997) introduced the effect of **management efficiency** (or quality). As management decisions affect the composition of assets which are earning (high) interest, or conversely, liabilities which are low-cost sources, more efficient management should be reflected in higher interest spreads. Maudos and Fernández de Guevara (2004) incorporated the productive nature of the banking firm into the original Ho-Saunders model by including the production costs associated with the process of intermediation between deposits and loans. The average **operating costs** of the banking firm is expected to affect the pricing behaviour in the sense that banks that incur high average unit costs are likely to operate with higher interest margins. Below we use the asset weighted average distance to default of banks in a country as a combined measure of bank quality, which is largely motivated by the un-availability of quarterly balance sheet data for banks in Europe. Gropp et al. (2006) have shown that the distance to default may indeed be a consistent indicator of bank stability for European banks and potentially even the banking system (Gropp, 2004).

Berlin and Mester (1999) argue that core deposits (that is, demand and savings deposits) are usually relatively stable and cheap compared with borrowed funds. While they argue that access to these core deposits allows banks to smooth lending rates over the interest rate cycle, it may also be the case that a **stable pool** of core deposits provides banks with cheap funding thereby allowing them to operate with higher margins.

[11] Alternatively, holding excess capital may signal a stronger incentive for banks to efficiently monitor their borrowers (in a situation of scarce supply of high quality borrowers), e.g. Allen, Carletti and Marquez (2005).

3. ECONOMETRIC FRAMEWORK

We start from the following basic regression in levels:

$$(1) \qquad S_{tci} = \alpha_0 + \sum_{j=0}^{T} \alpha_j PR_{ct-j} + \Phi_c X_{ct} + \Phi_i X_{it} + \Phi_{ci} X_{cit} + \nu_c + \nu_i + \varepsilon_1 ,$$

where S_{tci} represents the spread of bank product i (demand deposits, savings deposits, time deposits, different types of loans) at time t in country c relative to a market instrument of comparable characteristics. PR_{ct-j} represents a measure of the policy rate in country c (one rate for the euro area after 1999) at time $t-j$, where j spans from 0 to T time periods (quarters). For the policy rate we use a 3-month money market rate which assumes a complete and immediate pass-through from the key monetary policy rate. In the econometric specification we will generally use two lags.[12] X_{ct}, X_{it}, and X_{cit} are country-specific, product specific and country/product specific control variables at time t, respectively and ν_c and ν_i are country-specific and product specific fixed effects, respectively. ε_i is the standard iid error term.

In order to better permit a test of the dynamic adjustments of spreads, S, in response to the level of the policy rate and permitting a better identification, we estimate equation (1) in first differences. This would take the form

$$(2) \qquad \Delta S_{tci} = \beta_0 + \sum_{j=0}^{T} \beta_j \Delta PR_{ct-j} + \Psi_c \Delta X_{ct} + \Psi_i \Delta X_{it} + \Psi_{ci} \Delta X_{cit} + \nu_c + \nu_i + \varepsilon_2 ,$$

where all symbols are defined as before, Δ denotes first differences and ΔPR_{ct-j} represents the innovation of the policy rate in period $t-j$. We will define the innovation in the policy rate by taking the first difference of a short-term money market rate, which means we would consider the expected and the unexpected component of monetary policy. We should note that estimating the model in first differences results in an elimination of structural control variables, leaving only cyclical and other time-varying variables as controls.[13]

Starting from this basic specification we test a number of more refined hypotheses. First, we examine whether different bank products exhibit different adjustment dynamics to policy rates. Towards this end we estimate

[12] We also estimated specifications with lags beyond two quarters but they were found to be insignificant.

[13] One could argue that by first differencing the country and product specific effects disappear as well; however, it seems sensible to retain them, given that even in first differences their may be unobserved country or product specific factors.

$$\text{(2a)} \qquad \Delta S_{tci} = \beta_0 + \sum_i \sum_{j=0}^{T} \beta_{ji} \Delta PR_{ct-j} + \Psi_c \Delta X_{ct} + \Psi_i \Delta X_{it} + \Psi_{ci} \Delta X_{cit} + \nu_c + \nu_i + \varepsilon_3 \, .$$

In equation (2a) we permit different effects of monetary policy innovation on the spread of different bank products. For example, if the insurance effect is important, one would expect the adjustment dynamics to be slower for small business loans than for large business loans. Furthermore, we are interested in the question whether downward adjustments in the policy rate exhibit different dynamics from upward adjustments. Hence we further estimate

$$\text{(2b)} \qquad \begin{aligned} \Delta S_{tci} = {} & \beta_0 + I^{up} \sum_i \sum_{j=0}^{T} \beta_{ji} \Delta PR_{ct-j} + (1 - I^{up}) \sum_i \sum_{j=0}^{T} \beta_{ji} \Delta PR_{ct-j} \, , \\ & + \Psi_c \Delta X_{ct} + \Psi_i \Delta X_{it} + \Psi_{ci} \Delta X_{cit} + \nu_c + \nu_i + \varepsilon_4 \end{aligned}$$

where the indicator variable I^{up} is equal to 1 if monetary conditions tighten. Specification (2b) permits different dynamics depending upon whether the last policy change was up or down. Hence, we test whether a downward change in the policy rate results in a slower adjustment for loan rates than for deposits rates and vice versa.

Finally, we are interested in how different characteristics of the banking system and in financial sector development affect the dynamics of adjustment. For example we define a set of indicator variables which reflect countries with high degrees of concentration and low degrees of concentration in banking; one could define a set of indicator variables reflecting a relatively strong or weak banking system; or e.g. banking systems with a high degree of financial innovation (such as derivatives, securitisation). We will explore a multitude of such characteristics below. Hence, letting such an indicator be denoted as I^{high} and I^{low} and

$$\text{(2c)} \qquad \begin{aligned} \Delta S_{tci} = {} & \beta_0 + I^{high} \sum_i \sum_{j=0}^{T} \beta_{ji} \Delta PR_{ct-j} + I^{low} \sum_i \sum_{j=0}^{T} \beta_{ji} \Delta PR_{ct-j} \, . \\ & + \Psi_c \Delta X_{ct} + \Psi_i \Delta X_{it} + \Psi_{ci} \Delta X_{cit} + \nu_c + \nu_i + \varepsilon_4 \end{aligned}$$

4. THE DATA

4.1. Bank spreads

The bank spreads for the period from 1994 to 2002 are calculated on the basis of the National Retail Interest Rate dataset (NRIR) of the national central banks of the Eurosystem, which are in some cases complemented by other publicly-available national series. For the period starting in 2003, the spreads are calculated on the basis of the MFI interest rate (MIR) on new

business. While the NRIR sample covers a longer time period, the MIR sample is of a much higher quality. The latter is collected on the basis of harmonised definitions and methods across the euro area, and available with a much higher level of detail along a number of dimensions.[14] At the same time, some care should also be taken when interpreting the MIR, in particular when making comparisons across countries. Remaining influences not accounted for in the additional breakdown are, for example, differences in the fiscal and regulatory frameworks and differences in important product characteristics such as the typical maturity of the various banking products (period of initial rate fixation) and differences in the degree to which loans are secured (e.g. ECB (2002, 2004, 2005, 2006)).

The sample of quarterly data extends over the period 1994Q2 to 2004Q4 (i.e. 43 periods) covering eight product categories across nine countries. The total number of observations, i.e. 3,096 (=43*8*9) is not attained because of some data availability constraints. The detailed distribution of observations per country and product category summing to 2,579 is shown in Annex 1. There should be 42 observations in the case of one lag (=43-1), although in some cases a few data points are missing at the beginning of the sample period or data are not available.

The market interest rates are the national inter-bank deposit rates and national government bond yields for the NRIR period up to December 1998, and the corresponding euro area market interest rates thereafter.[15]

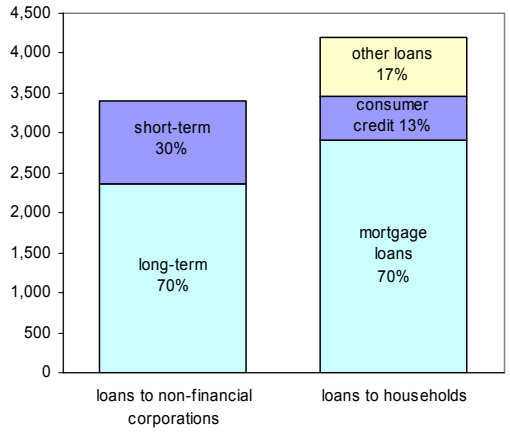
The spreads are calculated at the country level for eight different products: four types of loans (short-term and long-term loans to non-financial corporations, consumer credit, mortgage loans) and four types of deposits (demand deposits, savings deposits, short-term and long-term time deposits). The relative importance of these product categories is illustrated in Chart 1.

[14] This paper is one of the first to use the harmonised MIR statistics. Earlier contributions include Kok Sørensen and Werner (2006) and Affinito and Farabullini (2006).

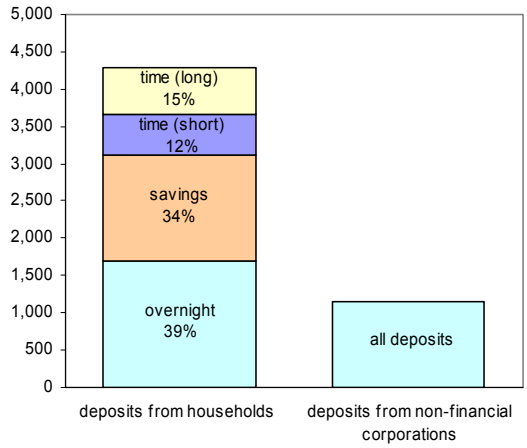
[15] In fact, Ausubel (1991) measures the cost of funds of loans as the market interest rate plus the bank bond yield spread. However, in the absence of data on bank bond spreads broken down by maturity, we use yields on government bonds as a proxy.

Chart 1. Amounts outstanding of MFI loans and deposits in the euro area (end-2004) (EUR millions)

(a) loans



(b) deposits from households



Source: ECB.

The calculation of the spreads follows a three-step procedure. First, the market interest rate of comparable maturity is selected. For the NRIR sample we use the information from the national descriptions made available by the NCBs. A detailed description of the bank interest rates in the NRIR sample and the selected reference market interest rates is provided in Annex 1. For the MIR sample, the selection of the market interest rates is more straightforward because the deposit and lending rates are broken down by different periods of initial rate fixation, or maturity (cf also Annex 1). Second, owing to the greater level of detail, the MIR spreads are aggregated to match the product categories of the NRIR spreads. This is straightforward for deposits because the outstanding amounts of the various deposit segments are available. Aggregation is somewhat trickier for loans because MFI interest rates are broken down by initial period of rate fixation, while the outstanding amounts are broken down by original maturity. We therefore use new business volumes as the weights, with two exceptions.[16] Third, in case that there is a level difference between the NRIR spread and the corresponding MIR spread, the former is adjusted upwards or downwards accordingly.

4.2. Explanatory variables[17]

In the period January 1999 onwards, **the policy rate** is proxied by the 3-month money market rate (Euribor). For the preceding period, the 3-month money market rates of the respective euro area countries have been used.

[16] These two exceptions are the following: (i) the weight of bank overdrafts to non-financial corporations is a percentage of total short-term loans to non-financial corporations; (ii) the rate on bank overdrafts to households is excluded from the consumer credit spread because bank overdrafts where usually not included in the NRIR sample.

[17] An overview of the explanatory variables together with their data sources and descriptive statistics is provided in Annex 2.

In the dealership model of the banking firm, interest margins vary positively with the instantaneous variance of the interest rates on deposits and loans, that is, the volatility of interest rates in these markets (Saunders and Schumacher (2000)). Following most of the empirical literature (e.g. Saunders and Schumacher (2000), Maudos and Fernández de Guevara (2004)), for **interest rate risk** we include a measure of the quarterly standard deviation of the daily 3-month money market rate for deposits and of the daily 5-year government bond yields for loans.

We use the distance-to-default of banks from Moody's KMV (weighted by total assets) as a combined measure of bank soundness, which may be interpreted as reflecting developments in **liquidity risk**, **bank capital,** and **management efficiency**, which should have an impact on bank spreads.[18] The distance-to-default is a measure of the value of the banks' assets and its liabilities. Default occurs when the value of the assets (A) falls below the value of the liabilities (L). The distance-to-default is thus the distance to the point on the asset return distribution where A<L.

The measurement of **credit risk** is not straightforward and limited by data availability considerations. Different studies have therefore used different measures. We have considered several alternative measures (each of which has benefits and drawbacks), and, in an attempt to capture the banks' assessment of the future ability of borrowers to reimburse their loans, selected the term structure risk given by the slope of the yield curve (difference in 5-year government bond yield and 3-month interbank deposit rate) as our preferred measure.[19] Following Hanweck and Rye (2004), we verify whether, for example, a flattening in the term structure indicates a greater likelihood of recession and a related increase in credit risk, which may be expected to increase interest margins.

The next three groups of explanatory variables are closely related. A basic determinant of price determination is the structure of that market and the degree of competition that prevails among its suppliers. Looking beyond the market itself, competitive conditions are further affected by other markets that offer similar or related products (substitutes). One important driver of competition both among banks and from non-banks is the rate of financial innovation which can either provide new process technologies (e.g. new risk management methods) or result in the introduction of new products into the market (e.g. securitisation or venture capital).

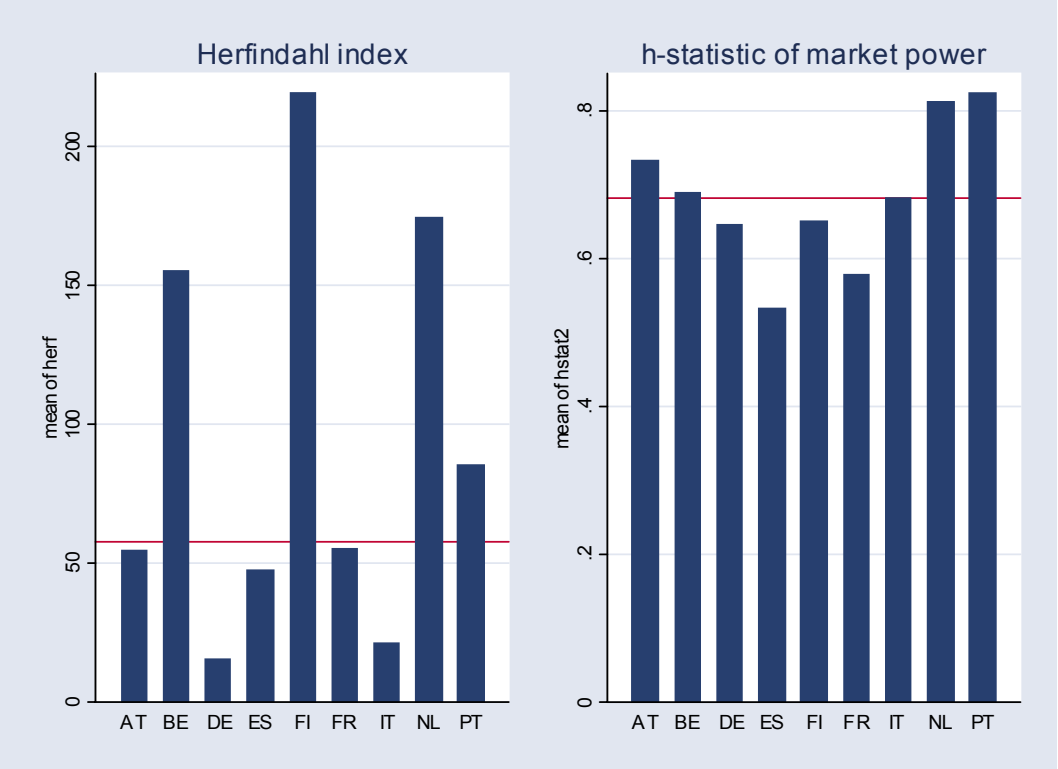
[18] As, for example, suggested by Angbazo (1997), Saunders and Schumacher (2000), and Maudos and Fernández de Guevara (2004).

[19] The alternative measures that we also considered include the following. First, we considered the ratio of loan write-offs, doubtful (or non-performing) loans or provisions to total loans. However, a common drawback of these measures is that they are backward-looking (reflecting realised defaults) rather than forward-looking proxies of credit risk (Brock and Franken, 2003). Second, we also considered the rate of unemployment, although like Berlin and Mester (1999), we have some concern that it is a lagging measure of economic conditions. Third, we considered the ratio of debt to quoted shares issued (for loans to non-financial corporations) and the ratio of debt to disposable income (for loans to households). Fourth, we also considered the non-financial corporate expected default frequencies (as derived from Moody's KMV).

As regards **competition** among banks, we measure the degree of market concentration by the Herfindahl indexes for different bank products, following Corvoisier and Gropp (2002). In contrast, to the market share of the five or ten largest banks, the Herfindahl index will reflect changes in the market structure also among smaller banks. However, in the literature it is contested whether concentration ratios provide valuable information on the degree of competition in the market. For example, an increase in concentration as a result of consolidation and market deregulation may reflect that more efficient and competitive banks are taking over less efficient ones. This could potentially increase rather than decrease competition.[20] For that reason, we complement the concentration measures with the Panzar-Rosse H-statistic, which is an alternative indicator of banking competition (see Chart 2). The H-statistic measures the extent to which changes in banks' costs and expenses are being reflected in changes in their revenues. In case of a one-to-one relationship (i.e. $H=1$), banks are operating in a perfectly competitive environment (in other words, their market power is low). Lower values of H thus indicate increasing degrees of bank market power ($H=0$ indicating monopoly). As the two indicators represent different ways to measure competition they do not necessarily provide the same results. In particular, Corvoisier and Gropp (2006) argue that the physical presence of a bank may no longer be a necessary condition for operating in that market, because households and firms may be able to obtain loans and make deposits through the internet. This would suggest that the H statistic, which is a measure based on bank behaviour rather than bank presence, should be a better measure of competition (this will to some extent be confirmed below). Chart 2 illustrates that the Herfindahl index and the H-statistics are not highly correlated. Given that there is no single accepted measure of competition we have estimated specifications with different measures and cross-checked the results obtained.

[20] For some recent overview studies on banking competition see Bikker (2004), Berger et al. (2004) and Northcott (2004).

Chart 2. Competition
(average between 1994-2004)

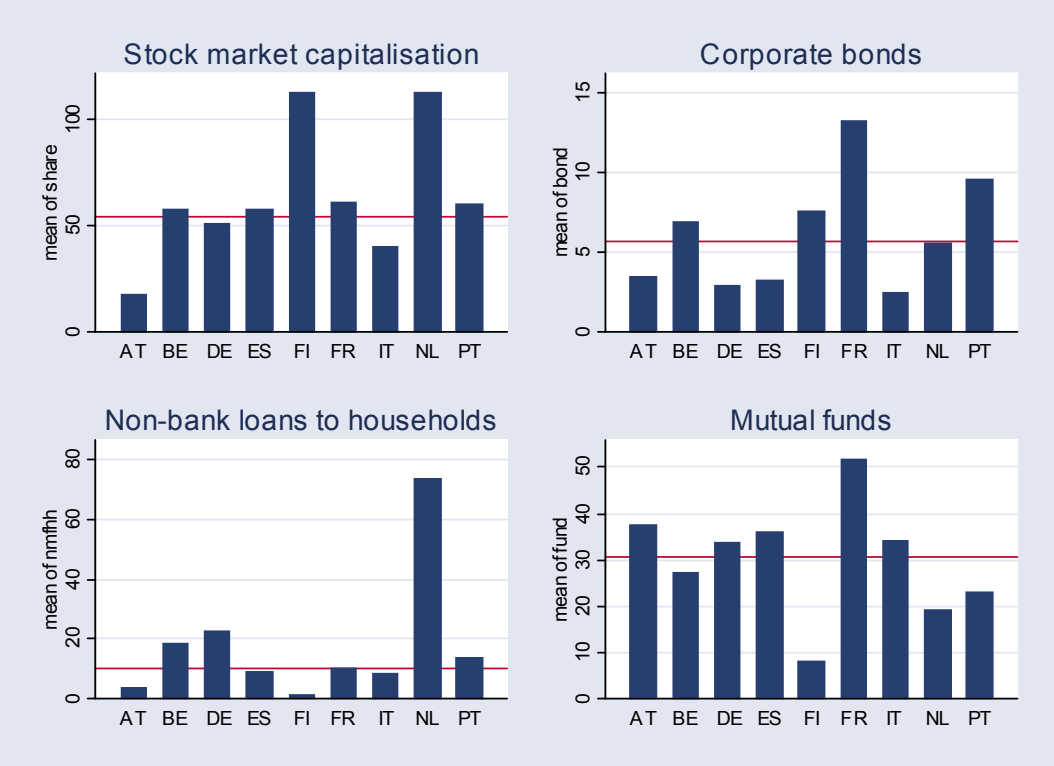


Sources: ECB, Eurostat, Claessens and Lieven (2003), Bikker (2004), Carbo et al (2005), authors' calculations.
Note: The horizontal line indicates the median across countries.

For **competition from market-based finance,** we first of all use the stock market capitalisation to GDP ratio as a measure for the overall degree of capital market orientation in the national financial system. Second, focusing on specific product segments, in the case of lending rates to non-financial corporations we employ the ratio of debt securities issued by non-financial corporations relative to MFI loans to non-financial corporations (see Chart 3). We would expect a negative relation with the lending spread. Similarly, we use the size of non-bank loans to the household sector as a proxy for the substitute means of financing for households. We would expect that the existence of this alternative financing source for households would have a negative effect on household loan spreads. In the case of deposit rates, we proxy competition from market finance by the ratio of assets of money market funds plus assets of investment funds to GDP.[21]

[21] Rosen (2002) argues that the pricing of deposits is affected by the degree of customer sophistication, where sophistication implies access to alternative investments providing similar services.

Chart 3. Non-bank substitutes
(percentage of GDP, average between 1994-2004)



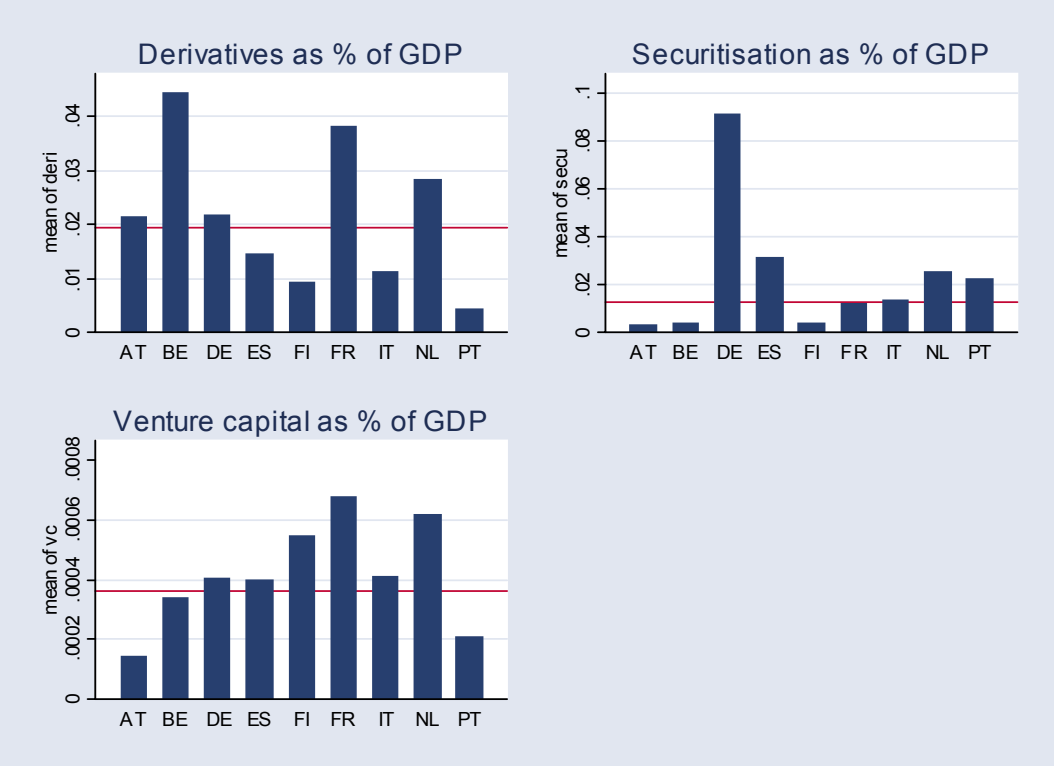
Sources: ECB, NCBs, FESE, authors' calculations.
Note: The horizontal line indicates the median across countries.

The number of quantitative studies of **financial innovation** is modest, and measures of the degree of financial innovation over time and across euro area countries have not been developed. Without having the pretension of filling this gap, we adopt a rather pragmatic approach for the purposes of this paper and measure financial innovation by a number of indicators (all as a percentage of GDP), the choice being essentially driven by data availability: (i) turnover in single-currency interest rate derivatives from the BIS Triennial Central Bank Survey[22]; (ii) securitisation and issuance of covered bonds from the European Securitisation Forum[23]; and (iii) venture capital investments from the European Venture Capital Association. These measures are illustrated in Chart 4.

22 Single-currency interest rate interest rate derivatives include forward rate agreements (FRA), interest rate swaps, options, warrants, caps, floors, collars, corridors and swap options (see BIS (2004)).

23 While covered bonds such as *Pfandriefe* or "*Realkreditobligationer*" have been used for several centuries in Germany and Denmark, they are nevertheless included as a financial "innovation" because these types of specific market-based funding instrument for mortgage loans have over recent years been introduced in other EU Member States (e.g. Lichtenberger (2001)).

Chart 4. Financial innovation indicators
(average between 1994-2004)



Sources: BIS (Triennial survey), European Securitisation Forum, European Venture Capital Association (EVCA), authors' calculations.
Note: The horizontal line indicates the median across countries.

5. RESULTS

As a starting point to the estimation of the dynamic adjustment of bank spreads in the euro area, we use a fairly parsimonious model in terms of the inclusion of control variables. Given that we estimate our model in first differences and include country specific fixed effects in the model, we do not need to control for structural characteristics that tend to remain broadly unchanged in the short-run. Hence, we only control for variables that are likely to change over the business cycle, such as credit risk, interest rate risk and bank soundness. Later on (when estimating model 2c), we will take into account the role of structural characteristics in the dynamic adjustment of bank spreads.

As our baseline model (**model 1)**, we estimate equation (2) allowing for different slopes with respect to the coefficients on the 3-month money market rate for loans and deposits. We find evidence at the one percent significance levels that changes in loan spreads are negatively related to changes in the 3-month market rate and positively related to the one-period lag of the changes in the 3-month money market rate (see Table 1). The converse applies to changes

in deposits spreads. This may be interpreted as a sluggish pass-through: An immediate and full adjustment of bank rates to changes in money market rates would imply that changes in bank spreads are not affected by changes in market rates, i.e. a coefficient of zero.[24] In that case, a given change in the market rate would be fully reflected in a change in bank rates, leaving the spread unchanged. In contrast, when lending rates adjust with a lag to a given one-off change in market rates (for example, an increase) we would expect to observe a decrease in the spreads this period (as bank rates adjust upwards more slowly), i.e. a negative relation between the change in the market rate and the change in the spread. As lending rates eventually rise there is, however, a positive relation between bank spreads and the lagged change in the market rate. Conversely, we would expect that deposit spreads are positively related to current changes in market rates and negatively related to the lagged change in market rates. Second, if bank rates after a lag adjust fully to changes in market rates then we would expect the sum of the response to current and lagged changes to equal zero.[25]

Against this background, we find that bank rates adjust sluggishly for both loans and deposits and that eventually the pass-through is more complete for lending rates than for deposit rates. Lending spreads are estimated to decrease by, on average, around 39 basis points following an increase of 100 basis points in market rates in the same quarter (suggesting that lending rates increased by only 62 basis points), and to increase by, on average, around 25 basis points in response to the one-quarter lagged increase of 100 basis point in market rates. This suggests an almost complete pass-through (86 basis points) two quarters after an increase of market rates by 100 basis points. Accordingly, as illustrated in Chart 5, the loan spread is almost equal to its original level after two quarters. Deposit spreads, in contrast, increase by, on average, 59 basis points following an increase of 100 basis points in market rates in the same period (suggesting that deposits rates increased by only 41 basis points), but decrease by, on average, only 17 basis points in response to the lagged increase of 100 basis point in market rates. The combined impact thus indicates that an increase of market rates by 100 basis point results in an upwards adjustment of deposit rates after two quarters of only 58%. Accordingly, as illustrated in Chart 6, the deposit spread remains substantially above its original level after two quarters.

[24] The approach abstracts from yield curve effects as the market rate used to calculate the spread has the same maturity as the bank retail rate.

[25] Our set-up does not allow testing for the extent to which bank rates are passed-through in a complete sense to their long-run equilibrium. To do this, we would have to apply, for example, a cointegration approach, such as a vector-error-correction model. However, since our focus goes beyond just examining the relationship between the market rate and bank rates, we have chosen to apply a somewhat more flexible approach (controlling for main determinants of spreads), which nevertheless provides some insights into the extent of sluggishness of bank rates.

Chart 5. Simulated effect on the loan spread from a 100 basis points rise in market rate
(x-axis: time, quarterly frequency; y-axis: percent)

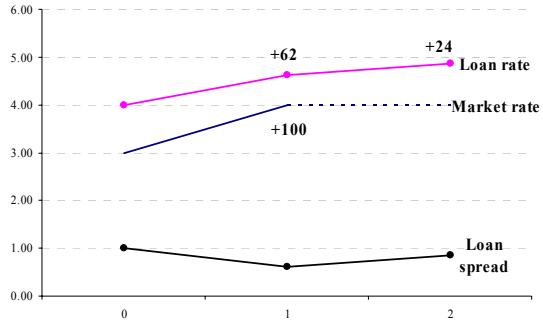
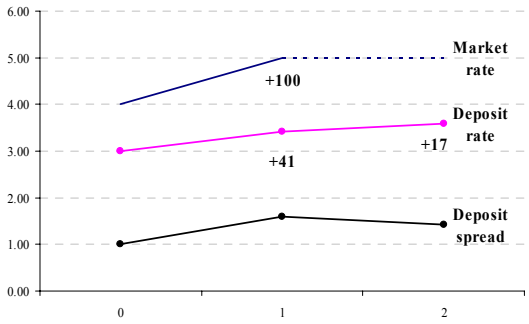


Chart 6. Simulated effect on the deposit spread of a 100 basis points rise in market rate
(x-axis: time, quarterly frequency; y-axis: percent)



As regards the control variables, we find that changes in banks' distance-to-default has a negative effect on bank spreads, which may suggest that as banks' financial health improves, they price their retail products more in line with the market. In addition, an increase in the interest rate risk facing banks, as measured by the change in the standard deviation of the 5-year government bond yield concerning loan spreads and the change in the standard deviation of the 3-month money market rate concerning deposit spreads, has a positive effect on bank spreads. That is, banks facing higher uncertainty with regard to interest rate developments tend to operate with higher spreads relative to market rates.[26] Finally, the slope of the yield curve, which is derived as the difference between the 5-year government bond yield and the 3-month money market rate, should among other things reflect market expectations to the economic outlook (e.g. Estrella and Mishkin, 1998). We find that an increase in the slope of the yield curve has a negative effect on loan spreads, which could be an indication that banks demand a lower spread on loans as the economic prospects brighten and presumably lead to lower credit risks.[27] Vice versa, a worsening of the credit risk facing banks induces lenders to demand higher spreads on their loans. By contrast, a steepening of the yield curve seems to be

[26] It may be argued that the size of and changes in bank spreads are affected by the general level of interest rates. We indirectly control for such an effect by including the standard deviation of interest rates (which arguably should be higher in absolute terms when the level of interest rates is high). However, to check the robustness of this assumption, as an alternative specification we included the level of interest rates as a control variable. The results obtained indicate, however, that the level of interest rates is not significant and that all the other coefficient estimates remain basically unchanged. We therefore exclude the level of interest rates in the subsequent regressions.

[27] With respect to credit risk we also ran the regressions including more direct measures of credit risk, such as expected default frequencies of non-financial corporations, debt-to-income ratios and loan write-offs. While these indicators usually had the expected sign they were often not significant.

related to higher deposit spreads. This may reflect that banks react to improved economic prospects, by competing more strongly for deposits.[28]

Table 1 Estimation results: baseline model

		Model 1 Country effects			Model 2 Country effects		
		PR(t)	PR(t-1)	Pass-through	PR(t)	PR(t-1)	Pass-through
Policy rate	loans	-0.39 ***	0.25 ***	0.86			
		(0.02)	(0.02)				
	deposits	0.59 ***	-0.17 ***	0.58			
		(0.02)	(0.02)				
	nfc loans (st)				-0.52 ***	0.23 ***	0.71
					(0.04)	(0.04)	
	nfc loans (lt)				-0.22 ***	0.11 ***	0.89
					(0.05)	(0.04)	
	consumer credit				-0.41 ***	0.35 ***	0.94
					(0.04)	(0.04)	
	mortgages				-0.36 ***	0.26 ***	0.91
					(0.04)	(0.03)	
	demand deposit				0.81 ***	-0.06 *	0.25
					(0.04)	(0.03)	
	savings deposit				0.86 ***	-0.13 ***	0.27
					(0.04)	(0.04)	
	time deposit (st)				0.50 ***	-0.20 ***	0.70
					(0.04)	(0.04)	
	time deposits (lt)				0.23 ***	-0.29 ***	1.06
					(0.04)	(0.03)	
Bank soundness	loans	0.02 ***	-0.05 ***		0.02 ***	-0.05 ***	
		(0.01)	(0.01)		(0.01)	(0.01)	
	deposits	-0.04 **	0.01 ***		-0.04 **	0.01 ***	
		(0.01)	(0.01)		(0.01)	(0.01)	
Yield curve slope	loans	-0.24 *	-0.01 ***		-0.24 *	-0.01 ***	
		(0.02)	(0.01)		(0.02)	(0.01)	
	deposits	0.11 *	0.01 ***		0.11 *	0.01 ***	
		(0.02)	(0.01)		(0.02)	(0.01)	
Interest rate risk	loans	0.23 ***	0.13 ***		0.24 ***	0.12 ***	
		(0.07)	(0.07)		(0.07)	(0.06)	
	deposits	0.10 ***	0.22 *		0.09 ***	0.21 *	
		(0.06)	(0.06)		(0.06)	(0.06)	
N		2579			2579		
Wald statistic		83.7***			68.1***		
R-sq (overall)		0.34			0.43		

Notes:

1) Models were estimated using fixed-effects across countries. Standard errors in parenthesis. *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

One standard result of the pass-through literature is that different bank products may react differently to changes in the policy rate. Hence, in **model 2** we disaggregate the effects of changes in market rates on bank spreads further and allow for different effects across individual market segments, not just product categories (see also Table 1 above). The results indicate that there are considerable differences depending on the loan or deposit segment, as

[28] It is clear that these interpretations have to be taken with great caution, as we are estimating a reduced form model and, hence cannot distinguish between demand and supply effects. The interpretation given suggests that supply (bank) factors dominate, which is only sensible if banks have at least some degree of market power.

well as between the total effect of pass-through after two quarters and the immediate and lagged responses. For loans, we find a more or less complete pass-through after two quarters for basically all loans, although the rates on loans to non-financial corporations up to one year seem to be somewhat more sluggish adjusting to only around 71% of the change in the market rate after six months. At the same time, there are significant differences in the immediate impact after one quarter. For example, short-term loans to NFC adjust only by around 50% after three months and consumer credit by 59%, while the immediate impact is between 65% to 80% for mortgages and long-term loans to NFC.

The pass-through is generally more sluggish and less complete for deposit rates, although the differences across product groups are even more striking than for loans. For overnight deposits and savings deposits the pass-through amounts to only around 25% to 30% even after six months. The pass-through after one quarter is less than 20% for these products, which in line with anecdotal evidence is likely to reflect a highly non-competitive market, the existence of non-interest adjustments (e.g. in case of checking accounts changes in fees), or rather unsophisticated customers. For both short-term and long-term time deposits the pass-through is considerably quicker amounting to some 70% for short term time deposits and 100% for long-term time deposits. The control variables retain the sign and econometric significance of the earlier specification.

6. EXTENSIONS

We carried out two types of extensions of the baseline model. First, we explore whether the pass-through is asymmetric, using equation (2b), by distinguishing periods of policy rate increases and decreases. Second, we test for the importance of various differences in the structure of financial markets across countries using equation (2c). We test in particular for the effect of competition, both within the banking market as well as from financial markets, and for the effect of some aspects of financial innovation. We split the structural indicators into "high" and "low" according to the time-specific median across countries. We have used this approach rather than using a constant cross-sectional median over the full sample in order to avoid splitting the data into fixed group of countries and to capture any structural changes over time.[29]

[29] The significance and magnitude of the control variables in these two types of extensions remain similar to those of the baseline models 1 and 2, and are therefore not discussed further.

6.1 Asymmetric pass-through

In order to investigate whether the pass-through is asymmetric we estimate equation (2b) where we allow for different slopes when market rates are increasing and when they are decreasing.[30] Pass-through to retail rates could be asymmetric if either the price elasticity of demand is low or if competition is less than perfect. In both cases banks would adjust loan rates quicker when interest rates are increasing than when they are decreasing – and vice versa for deposit rates. The results obtained indicate that there is some evidence of asymmetry in the pass-through. In the more parsimonious **model 3** (i.e. only distinguishing broadly between loans and deposits), we find that loan rates tend to adjust quicker to changes in market rates when the latter is moving upwards than when it is moving downwards (see Table 2). Although, statistically, we can not reject coefficient equality[31], economically the difference amounts to 3 points after one quarter and 10 points after two quarters. Conversely, deposit rates tend to adjust more completely after two quarters when interest rates are declining, which is in accordance with the findings of Hannan and Berger (1991). The differences are somewhat larger than in the case of loan rates and statistically significant.

[30] Over the sample period, the 3-month money market rate (PR_t) decreased in around 60% of the total number of quarters.

[31] According to standard Wald tests of coefficient equality.

Table 2. Estimation results: asymmetric model

		Model 3 Asymmetry			Model 4 Asymmetry		
		PR(t)	PR(t-1)	Pass-through	PR(t)	PR(t-1)	Pass-through
loans	up	-0.37 ***	0.29 ***	0.92			
		(0.05)	(0.04)				
	down	-0.40 ***	0.22 ***	0.82			
		(0.03)	(0.03)				
deposits	up	0.64 ***	-0.12 ***	0.48			
		(0.04)	(0.03)				
	down	0.56 ***	-0.20 ***	0.64			
		(0.03)	(0.03)				
nfc loans (st)	up				-0.58 ***	0.26 ***	0.68
					(0.07)	(0.06)	
	down				-0.49 ***	0.20 ***	0.71
					(0.05)	(0.04)	
nfc loans (lt)	up				-0.17 **	0.12 *	0.95
					(0.08)	(0.08)	
	down				-0.26 ***	0.10 **	0.85
					(0.05)	(0.05)	
consumer credit	up				-0.41 ***	0.41 ***	1.00
					(0.08)	(0.06)	
	down				-0.41 ***	0.31 ***	0.90
					(0.05)	(0.05)	
mortgages	up				-0.27 ***	0.28 ***	1.02
					(0.07)	(0.06)	
	down				-0.40 ***	0.25 ***	0.85
					(0.05)	(0.04)	
demand deposit	up				0.82 ***	0.12 ***	0.06
					(0.07)	(0.06)	
	down				0.81 ***	-0.15 ***	0.35
					(0.05)	(0.04)	
savings deposit	up				0.99 ***	-0.11 **	0.12
					(0.08)	(0.07)	
	down				0.80 ***	-0.15 ***	0.35
					(0.05)	(0.05)	
time deposit (st)	up				0.62 ***	-0.18 *	0.56
					(0.07)	(0.06)	
	down				0.44 ***	-0.21 ***	0.77
					(0.05)	(0.05)	
time deposits (lt)	up				0.20 ***	-0.34 ***	1.14
					(0.07)	(0.06)	
	down				0.24 ***	-0.27 ***	1.03
					(0.05)	(0.04)	
N		2579			2579		
Wald statistic		67.6***			44.5***		
R-sq. (overall)		0.35			0.44		

1) Models were estimated using fixed-effects across countries. Standard errors in parenthesis. *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Broadly the same results are observed when we allow for product-specific effects (**model 4**). With respect to loans we find asymmetric effects of economic importance, although statistical significance is only found in the case of mortgage loans. Notably, the difference in speed of

adjustment is more pronounced for long-term loans compared to short term loans. In particular, the immediate impact on loan rates is relatively strongest when interest rates are increasing with regard to long-term loans to enterprises and loans to households for both house purchase and for consumption, while there is no noticeable difference for short term loans to NFC.[32] The asymmetry is even stronger, and statistically more significant, for some deposit rates. For example, after three months, a downward change in interest rates results in a 20 points pass-through for savings deposits, but an upward change is virtually not passed on (1 point pass-through); even after six months the pass-through to savings rates is only 12 points in case of upward changes, as compared to 35 points pass-through for downward changes. There are also large differences for short-term time deposits, while interest rate changes are essentially symmetrically passed through in the case of long-term time deposits.

6.2 Competition and pass-through

To examine the effect of competition on the dynamics of the bank spreads, we focused first on competition between banks, and then on the effect of competition coming from financial markets.

(i) Competition within the banking market. A main structural feature of the banking system that potentially exerts an impact on the spreads is the degree of competition in the banking system. We use the Panzar-Rosse **H-statistic of market power** using a composite H-statistics derived as an average of estimated H-statistics for the euro area countries by various recent studies: Carbo et al. (2005), Bikker (2004), and Claessens and Laeven (2003).[33] While the adjustment of spreads for the overall loan and deposit categories (**model 5**) does not differ markedly when the degree of competition (i.e. bank market power) is high or low, we do find, when allowing for product-specific slopes (**model 6**), that a higher degree of competition (i.e. lower bank market power) results in a faster and ultimately more complete pass-through for most loan categories (see Table 3). For example, for short-term loans in more competitive banking markets the pass-through after three months is 56%, in less competitive markets only 43%. After six months it is 76% in competitive markets and 67% in less competitive markets, although in this case the statistical test does not enable to reject that the coefficients are equal (see Table 3a). Overall, while the ultimate pass-through does not differ very much, the greatest differences are observed in the pass-through after one quarter, implying that

[32] We unfortunately cannot distinguish between loans to large versus small NFCs; however, the finding that the asymmetry is more pronounced for long-term loans compared to short-term loans is consistent with the notion that very large firms do not use much long-term financing from banks, but issue bonds instead. Hence, the market for long-term loans may be characterised by a lower price elasticity of demand compared to the market for short-term loans, in which we would expect both large and small firms to be active.

[33] The results were qualitatively similar when using only the Carbo et al. (2005) study.

competition in the banking system primarily affects the speed of pass-through in the short run. This is also reflected in the Wald tests of coefficient equality (Table 3a), which generally indicate that the immediate impact is statistically significantly stronger in more competitive banking sectors. In the subsequent quarter the less competitive countries "catch up" resulting in only minor (and statistically insignificant) differences in the overall long-run pass-through (column three, Table 3a). For deposit rates, the results tend to suggest that the difference between competitive banking markets and less competitive banking markets is small; we do, however, find a statistically significant effect in the case of long term time deposits, where the degree of pass-through differs by 16 points after one quarter, although after two quarters, the pass-through is complete both in competitive and less competitive markets.[34]

[34] We also considered alternative measures of concentration, such as the Herfindahl Hirschmann index or the market share of the three largest banks, but the results, while being broadly consistent with the efficiency hypothesis, were not as strong as for the H-statistic. Moreover, we examined the importance of country size (measured by the size of the population). The results suggest that pass-through to lending rates tends to be somewhat higher in smaller countries than in larger countries. While the difference is small, it may reflect a generally higher contestability of the banking markets in smaller countries. At the same time, these result may also suggest, as argued by Berlin and Mester (1999), that a stable pool of core deposits (in larger countries) allows banks to smooth lending rates over the interest rate cycle.

Table 3. Estimation results: Financial structure model – banking competition (H-statistic)

		Model 5 H-statistic of market power					Model 6 H-statistic of market power				
		PR(t)		PR(t-1)		Pass-through	PR(t)		PR(t-1)		Pass-through
loans	high	-0.33	***	0.22	***	0.89					
		(0.04)		(0.03)							
	low	-0.42	***	0.26	***	0.85					
		(0.03)		(0.03)							
deposits	high	0.56	***	-0.15	***	0.59					
		(0.04)		(0.03)							
	low	0.61	***	-0.19	***	0.58					
		(0.03)		(0.03)							
nfc loans (st)	high						-0.44	***	0.21	***	0.76
							(0.06)		(0.05)		
	low						-0.57	***	0.24	***	0.67
							(0.05)		(0.05)		
nfc loans (lt)	high						-0.06	*	-0.11	*	0.83
							(0.12)		(0.12)		
	low						-0.25	***	0.15	***	0.90
							(0.05)		(0.05)		
consumer credit	high						-0.32	***	0.27	***	0.95
							(0.06)		(0.06)		
	low						-0.48	***	0.42	***	0.94
							(0.05)		(0.05)		
mortgages	high						-0.30	***	0.27	***	0.97
							(0.06)		(0.05)		
	low						-0.39	***	0.26	***	0.87
							(0.05)		(0.05)		
demand deposit	high						0.91	***	-0.13	**	0.22
							(0.06)		(0.05)		
	low						0.74	***	0.00	*	0.26
							(0.05)		(0.05)		
savings deposit	high						0.85	***	-0.05	*	0.20
							(0.09)		(0.09)		
	low						0.87	***	-0.15	***	0.29
							(0.05)		(0.05)		
time deposit (st)	high						0.52	***	-0.18	***	0.66
							(0.06)		(0.05)		
	low						0.49	***	-0.23	***	0.74
							(0.06)		(0.06)		
time deposits (lt)	high						0.14	***	-0.18	**	1.04
							(0.06)		(0.05)		
	low						0.30	***	-0.37	***	1.07
							(0.05)		(0.05)		
N		2579					2579				
Wald statistic		67.3***					44.3***				
R-sq. (overall)		0.35					0.44				

1) Models were estimated using fixed-effects across countries. Standard errors in parenthesis. *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 3a. Wald tests of coefficient equality: Financial structure model – banking competition (H-statistic)

	PR(t)	PR(t-1)	Sum
		Ho: high=low	
Loans	3.59 *	0.92	0.84
Deposits	1.02	0.89	0.01
Short-term loans to NFC	2.79 *	0.27	1.25
Long-term loans to NFC	2.07	4.18 **	0.2
Consumer credit	3.84 **	4.07 **	0
Mortgage loans	1.81	0.01	1.84
Demand deposits	5.46 **	3.61 *	0.26
Savings deposits	0.04	1.22	0.71
Short-term time deposits	0.14	0.48	1.08
Long-term time deposits	4.54 **	6.99 ***	0.13

Note: The table reports the F-statistic; *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

(ii) Competition from financial markets. As a starting point, we use in **model 7** the **market capitalisation of the stock market** (in relation to GDP) as a proxy for the overall size of the financial markets. We expect that a larger size of the financial market would induce a more complete and rapid pass-through as a result of stronger competition from alternative products in particular to corporate bank loans (see Table 4). Indeed, we find that bank lending rates adjust quicker and more completely in countries where stock markets are relatively important, although the statistical hypothesis of coefficient equality can not be rejected (see Table 4a). As may be expected, the capitalisation of the stock market has no impact on the speed of pass-through to deposit rates.

Table 4. Estimation results: Financial structure model – stock market capitalisation and non-bank substitutes

		Model 7 Stock market capitalisation						Model 8 Non-bank substitutes					
		PR(t)		PR(t-1)			Pass-through	PR(t)		PR(t-1)			Pass-through
loans	high	-0.35	***	0.24	***		0.88						
		(0.03)		(0.03)									
	low	-0.41	***	0.25	***		0.84						
		(0.03)		(0.03)									
deposits	high	0.61	***	-0.17	***		0.56						
		(0.03)		(0.03)									
	low	0.57	***	-0.18	***		0.60						
		(0.03)		(0.03)									
nfc loans (st)	high							-0.51	***	0.23	***		0.72
								(0.05)		(0.05)			
	low							-0.53	***	0.22	***		0.70
								(0.05)		(0.05)			
nfc loans (lt)	high							-0.12	**	0.14	**		1.02
								(0.06)		(0.06)			
	low							-0.33	***	0.12	*		0.79
								(0.06)		(0.06)			
consumer credit	high							-0.50	***	0.33	***		0.84
								(0.06)		(0.06)			
	low							-0.36	***	0.36	***		1.00
								(0.05)		(0.05)			
mortgages	high							-0.21	***	0.20	***		0.99
								(0.06)		(0.05)			
	low							-0.47	***	0.32	***		0.86
								(0.05)		(0.04)			
demand deposit	high							0.80	***	-0.02	*		0.22
								(0.05)		(0.05)			
	low							0.81	***	-0.09	**		0.29
								(0.05)		(0.05)			
savings deposit	high							0.87	***	-0.16	***		0.29
								(0.05)		(0.05)			
	low							0.84	***	-0.09	**		0.25
								(0.07)		(0.06)			
time deposit (st)	high							0.50	***	-0.29	***		0.79
								(0.07)		(0.06)			
	low							0.51	***	-0.15	***		0.64
								(0.05)		(0.05)			
time deposits (lt)	high							0.30	***	-0.37	***		1.07
								(0.05)		(0.05)			
	low							0.16	***	-0.21	***		1.05
								(0.05)		(0.05)			
N		2579						2579					
Wald statistic		67.1***						44.5***					
R-sq. (overall)		0.35						0.44					

1) Models were estimated using fixed-effects across countries. Standard errors in parenthesis. *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 4a. Wald tests of coefficient equality: Financial structure model – stock market capitalisation and non-bank substitutes

	PR(t)	PR(t-1)	Sum	PR(t)	PR(t-1)	Sum
	Stock market capitalisation Ho: high=low			Non-bank substitutes Ho: high=low		
Loans	1.72	0.19	0.73			
Deposits	0.66	0.06	0.99			
Short-term loans to NFC				0.08	0.01	0.12
Long-term loans to NFC				5.87 **	0.03	6.34 **
Mortgage loans				12.58 ***	2.98 *	3.15 *
Short-term time deposits				0.01	3.31 *	3.69 *
Long-term time deposits				3.41 *	5.33 **	0.12

Note: The table reports the F-statistic; *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

In order to analyse the effect of competition coming from financial markets in more detail, we distinguish in **model 8** the various bank product segments and use three more specific measures of non-bank substitutes that may speed up the pass-through process. First, as an alternative means for non-financial corporations to obtain debt financing, we use the outstanding amounts of debt securities issued by non-financial corporations to GDP. Second, with respect to loans to households we use the amount of non-bank loans to the household sector. Third, we use the importance of mutual funds (as a percentage to GDP) as a savings instrument offering an alternative to deposits.

The results indicate that lending spreads on long-term loans to non-financial corporations react quicker and more completely to changes in market rates when the corporate bond market is relatively important (see Table 4). Likewise, lending rates on mortgage loans display a speedier pass-through when competition from non-bank lending is comparatively strong (complete pass-through after six months in countries where non-bank loans are relatively important against only 86% in the other group of countries). There is no such effect on the pass-through of consumer credit rates, which however may reflect that non-bank loans to households are primarily used to finance real estate. On the deposit side, the relative importance of mutual funds holdings seem mainly to impact on the pass-through of short-term time deposit rates (e.g. 79% after six months in the "high" group of countries against 64% in countries where this type of savings instruments is less important).

6.3. Financial innovation and pass-through

Financial innovation and developments in bank activities towards more market-oriented instruments, such as securitisation and derivatives, may potentially alter the pricing mechanisms related to traditional bank loans and deposits. We would expect *ceteris paribus* that banks are more exposed, and hence tend to react more swiftly, to movements in market interest rates in countries where securitisation techniques and derivatives business are well-developed.

We therefore examined the importance of the various financial innovation indicators, and the estimation results tended to indicate that much of the impact of financial innovation is transmitted through risk management considerations. This is, for example, examined in **model 9** using as a proxy the ratio of interest rate derivatives turnover to GDP. Interest derivatives are particularly important as a hedging device for long-term loans, but arguably should not have much of an impact on the pass-through to short-term loans or deposits. The rates on long-term loans to non-financial corporations and mortgages tend to adjust quicker and more completely in countries where derivatives turnover is relatively high (see Table 5). Thus, the pass-through to long-term loans to non-financial corporations is 35% higher and pass-through to mortgages is around 20 points higher if there is easy access to hedge against interest rate risk using derivatives. Differences in the coefficients are also statistically significant (see Table 5a). For consumer credit and short-term loans to non-financial corporations, on the other hand, we do not observe significant differences in the speed of pass-through.[35]

The potential impact of financial innovation transmitted through a greater completeness of the financial system is examined in **model 10** with respect to the size of securitisation as a percentage to GDP. A very large share of all securitisation transactions in the euro area involves mortgages. The securitisation of other loans or other types of assets by private banks or non-financial firms, while still relatively underdeveloped in the euro area, has been increasing fast over the past few years. Our estimation results indicate that in countries where securitisation is relatively widespread, the pass-through of market rates to long-term rates on loans to NFCs is around 15 basis points higher than in the other countries. The pass-through of market rates to mortgage rates is around 10 basis points higher (although coefficient equality can not be rejected) The larger impact for loans to NFCs, although somewhat surprising, may reflect that a large part of the MBS transactions are secured on commercial property (CMBS) rather than on residential property (RMBS).

[35] In addition, the long-term deposit rate pass-through is unaffected by the ability to hedge. This suggests that in this case, the depositors who do not have access to derivative markets bear the interest rate risk.

Finally, a further feature of the breadth of the financial system and which could potentially affect banks' price-setting behaviour is the importance of venture capital.[36] We expect venture capital to have a strong effect on the speed of pass-through to long-term loans to NFC, as venture capital and long-term loans may to some extent be substitutes. Other bank product categories should not be affected. This is what we find in **model 11,** where we compare the pass-through between countries with respectively a relatively high and low developed venture capital market. No systematic effects of the development of venture capital markets can be detected, but the pass-through to retail rates on long-term loans to NFCs is significantly sped up in particular in the first quarter by around 25 points.

Table 5. Estimation results: Financial structure model – financial innovation indicators

		Model 9 Interest rate derivatives						Model 10 Securitisation						Model 11 Venture capital					
		PR(t)		PR(t-1)		Pass-through		PR(t)		PR(t-1)		Pass-through		PR(t)		PR(t-1)		Pass-through	
nfc loans (st)	high	-0.52	***	0.13	***	0.62		-0.57	***	0.22	***	0.65		-0.52	***	0.09	*	0.57	
		(0.06)		(0.06)				(0.06)		(0.06)				(0.06)		(0.06)			
	low	-0.52	**	0.29	***	0.76		-0.46	***	0.23	***	0.77		-0.53	***	0.30	***	0.77	
		(0.05)		(0.05)				(0.06)		(0.05)				(0.05)		(0.05)			
nfc loans (lt)	high	-0.10	*	0.13	**	1.03		-0.22	***	0.19	***	0.97		-0.13	**	0.09	*	0.96	
		(0.06)		(0.06)				(0.07)		(0.06)				(0.06)		(0.06)			
	low	-0.36	***	0.14	**	0.78		-0.22	***	0.04	*	0.82		-0.38	***	0.19	**	0.81	
		(0.07)		(0.07)				(0.07)		(0.06)				(0.08)		(0.08)			
consumer credit	high	-0.41	***	0.31	***	0.90		-0.60	***	0.51	***	0.91		-0.42	***	0.31	***	0.89	
		(0.06)		(0.06)				(0.06)		(0.06)				(0.06)		(0.06)			
	low	-0.42	***	0.39	***	0.97		-0.25	***	0.23	***	0.97		-0.40	***	0.39	***	0.99	
		(0.06)		(0.06)				(0.06)		(0.05)				(0.06)		(0.06)			
mortgages	high	-0.22	***	0.24	***	1.02		-0.30	***	0.26	***	0.96		-0.28	***	0.20	***	0.92	
		(0.06)		(0.06)				(0.06)		(0.06)				(0.06)		(0.06)			
	low	-0.46	***	0.30	***	0.84		-0.40	***	0.27	***	0.87		-0.42	***	0.32	***	0.90	
		(0.05)		(0.05)				(0.05)		(0.05)				(0.05)		(0.05)			
N		2579						2579						2579					
Wald statistic		47.6***						47.9***						47.4***					
R-sq. (overall)		0.36						0.36						0.36					

1) Models were estimated using fixed-effects across countries. Standard errors in parenthesis. *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 5a. Wald tests of coefficient equality: Financial structure model – financial innovation indicators

	PR(t)	PR(t-1)	Sum	PR(t)	PR(t-1)	Sum	PR(t)	PR(t-1)	Sum
	Interest rate derivatives Ho: high=low			Securitisation Ho: high=low			Venture capital Ho: high=low		
Long-term loans to NFC	7.56 ***	0.02	6.66 ***	0	2.76 *	2.48	6.32 **	1.07	2.4
Mortgage loans	9.52 ***	0.7	4.64 **	1.59	0	1.32			

Note: The table reports the F-statistic; *, **, *** indicates significance at the 10%, 5% and 1% level, respectively.

[36] Although venture capital only constitutes a small portion of euro area capital markets, it represents an important alternative source of financing for small and medium–sized, in particularly start-ups, companies with exceptional growth potential.

7. ROBUSTNESS CHECKS

We undertook a number of robustness checks of our baseline model to ensure the consistency of our results across a variety of model specifications (see Annex 3). We ran the regressions using fixed effects across countries plus product dummies for broad markets (model R1) and for individual product segments (model R2), a two-way random effects model (model R3), and separately for loans and deposits using a seemingly unrelated regression model with country dummies (model R4). The results obtained with these alternative specifications were essentially the same as with the results obtained with our baseline models 1 and 2.

8. CONCLUSION

This paper has investigated the dynamics of the pass-through between market interest rates and bank interest rates in the euro area controlling for cyclical and structural differences in the financial system. The analysis of this process provides a main contribution to a better understanding of the effectiveness of monetary policy.

In accordance with previous empirical literature, we find that euro area banks only sluggishly adjust their rates on loans and deposits in response to changes in market interest rates. We also find substantial differences in the pass-through process across various bank products; in particular, rates on demand deposits and on savings deposits display a high degree of rigidity. Unlike most of the empirical literature, these results are obtained by controlling for bank soundness, interest rate risk, and the slope of the yield curve, the latter being an indication of the presence of credit risk premia in loan spreads. Our results further provide evidence of asymmetry in the pass-through process, as banks tend to adjust loan rates quicker to changes in policy rates when rates are going up than when they are going down – and vice versa for deposit rates. This finding suggests, in line with the theoretical literature, that banks hold some degree of pricing power in the markets for loans and deposits. To explore this in more detail, we directly estimate the effect of various elements of competition facing banks on their interest-rate setting behaviour. As expected, we find that competition from other banks and competition from non-banks (including financial markets) tend to speed up the adjustment of bank rates to changes in policy rates. Finally, we use our empirical model to provide some first tentative evidence that recent financial innovations-by extending the set of financial instruments available to banks and their customers-have strengthened the bank interest rate pass-through.

In terms of monetary policy implications these findings point to the beneficial effects on the bank interest rate pass-through process, and hence on the monetary policy transmission mechanism, from deeper and more competitive financial systems. Efforts to strengthen bank competition and enhancing the availability of alternative capital market-based instruments for financial investment, access to financing (e.g. for start-ups and other types of small and medium enterprises) and risk management should therefore be expected to improve and amplify the effects of monetary policy changes on bank interest rates.

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ANNEX 1. DESCRIPTION OF THE NRIR AND MIR SAMPLES

Table A1.1. Retail interest rates up to December 2002

(a) Overnight deposits

	Data description (up to 2002)	Additional information	Source	Market rate
BE	Sight-deposits.		NCB website	1-month
DE	Sight-deposits to households (higher-yielding).		NCB website	1-month
GR	Sight deposits.		NRIR	1-month
ES	Sight deposits.		NRIR	1-month
FR	-	In general, no remuneration of euro-denominated overnight deposits. (Certain professional depositors are required by law to make deposits with the Caisse des depots et consignations, which offers (some) interest.)	-	-
IE	-	In general, no remuneration of euro-denominated overnight deposits.	-	-
IT	Current account.		NRIR	1-month
LU	Current account and other sight deposits.			
NL	Ordinary demand deposit.		NRIR	1-month
AT	Current account deposits (period of notice = sight).		NRIR	1-month
PT	Transferable deposits (euro).		NCB website	1-month
FI	Transaction account subject to withholding tax.		NRIR	1-month

(b) Deposits from households redeemable at up to 3 months notice

	Data description (up to 2002)	Additional information	Source	Market rate
BE	Savings deposits.	Stock and new business.	NRIR	Three-month
DE	Notice period of 3 months, no agreed maturity; mostly at variable-rate following 3-month Euribor.	Deposits over EUR 10,000 and up to EUR 25,000.	NRIR	Three-month
GR	Savings accounts.	Commercial banks	NRIR	-
ES	Savings accounts.	Banks and savings banks (simple average)	NCB web	Three-month
FR	Weighted average of stocks of seven different types of instruments: six non-taxable savings passbooks (livrets A et livrets blues, CEL, CODEVI, LEP, Livret jeune) and one taxable savings product (livret soumis à l'impot).	The rates on the non-taxable savings passbooks used to be administred. Since August 2003, the interest rate applied to livret A, livret bleue and CODEVI equals the simple average of the twelve-month change of the consumer price index published by the INSEE and the monthly average of three-month Euribor. The rate on the LEP equals three-quarters of the rate on livret A and the rate on CEL two-thirds of the livret A. The calculation is carried out in January and July every year by the Banque de France.	NRIR	Three-month
IE	Clearing banks demand deposits under IEP 5,000/household.	Stock and new business	NRIR	-
IT	Savings deposits.	Stocks		Three-month
LU	NA	-	-	-
NL	Savings deposits.			Three-month
AT	NA	-	-	-
PT	NA	-	-	-
FI	Other deposits subject to withholding tax.	Stocks		-

(d) Deposits from households with agreed maturity up to 1 year

	Data description (up to 2002)	Additional information	Market rate
BE	Agreed maturity of 3 months.		Three-month
DE	Agreed maturity of 3 months.		Three-month
GR	Agreed maturity of 12 months.		Twelve-month
ES	Agreed maturity over 6 and up to 12 months.		Twelve-month
FR	n.a.		-
IE	n.a.		-
IT	Certificate of deposit up to 6 months.		Three-month
LU	Other short-term debts.		Three-month
NL	Agreed maturity up to 2 years minus 20 basis points.		Twelve-month
AT	Agreed maturity up to 12 months.		Six-month
PT	Agreed maturity between 181 days and 1 year.		Six-month
FI	Term deposits subject to withholding tax	Interest rate on amounts outstanding	Three-month

(e) Deposits from households with agreed maturity over 2 years

	Data description (up to 2002)	Additional information	Market rate
BE	5-year cash bond ("bon de caisse")		Five-year
DE	Original maturity of 4 years ("*Sparbriefe*").	Excludes Bausparkassen.	Five-year
GR			-
ES	Deposits over 2 years.		Five-year
FR	Weighted average of rate on PEL (typically original maturity over 4 years) and 5-year government bond yield, as a proxy for the other products.	Regulated rate on "*plan épargne-logement (PEL)*"	Five-year
IE			-
IT	Bonds	Interest rate on outstanding amount	Five-year
LU	Other term debt		-
NL	6-year fixed term time deposit.		Five-year
AT	Original maturity over 1 year.		Five-year
PT	Deposits with agreed maturity over 2 years		Five-year
FI	Term deposits subject to withholding tax.	Interest rate on outstanding amount	-

(f) Loans with original maturity up to 1 year to non-financial corporations

	Data description (up to 2002)	Additional information	Source	Market rate
BE	6-months term loan.	Loans between EUR 250,000 and 375,000 (to most solvent customers). [excludes overdrafts]	NRIR	3-month
DE	Wholesale current account credit, floating rate, usually secured.	Loans between EUR 0.5 to 2.5 million.	NRIR	3-month
GR	Original maturity up to one year, floating rate; unsecured.		NRIR	3-month
ES	Commercial discount up to 3 months.		WEB	3-month
FR	Discounts, overdrafts and other short-term loans		NRIR	3-month
IE	Overdrafts and term loans up to 1 year (AA rate), floating rate; usually secured.		NRIR	3-month
IT	Rate on outstanding loans with original maturity up to 18 months (50% assumed to relate to non-financial corporations).		NRIR	3-month
LU	n.a.		-	-
NL	Bank base rate to enterprises, floating rate.	[excludes overdrafts]	NRIR	3-month
AT	Loans to enterprises floating rate.		NRIR	3-month
PT	Original maturity up to 1 year.		WEB	3-month
FI	n.a.		-	-

(g) Loans with original maturity over 1 year to non-financial corporations

	Data description (up to 2002)	Additional information	Source	Market rate
BE	5-year investment credit, fixed-rate.	mostly unsecured	NRIR	5-year
DE	Rate fixed for 4 years or more (up to Dec. 1998) and for over 5 years (since Jan. 1999).	mostly secured	NRIR	5-year
GR	Long-term loan, floating-rate.	secured	NRIR	3-month
ES	Loans with original maturity over 1 up to 3 years.	unsecured	NRIR	3-month
FR	Loans with original maturity over 2 years, variable-rate (effective rate including non-interest income).		NRIR	3-month
IE	Term loans over 1 and up to 3 years (AA rate), floating-rate	usually secured	NRIR	3-month
IT	Rate on outstanding loans with original maturity over 18 months.		NRIR	3-month
LU	n.a.		-	-
NL	n.a.		-	-
AT	n.a.		-	-
PT	n.a.		-	-
FI	Lending to enterprises, floating-rate.	secured	NRIR	3-month

(h) Loans to households for house purchase

	Data description (up to 2002)	Additional information	Source	Market rate
BE	Mortgage loans, fixed-rate, revisable after 5 years.		NRIR	5-year
DE	Mortgage loans, 5-year fixed rate.		NRIR	5-year
GR	Mortgage loans with original maturity over 5 years, fixed-rate. (According to information from the EMF, loans with original maturity of 15 years with 1 year initial rate fixation: 30% of new business in 2000; with 5 years initial rate fixation: 50% of new business in 2002.		NRIR	5-year
ES	Mortgage loans with original maturity over 3 years; fixed and variable, the share of the later has increased during the 1990s (85% at end-1997 to 98% at end-2002 of amount outstanding); variable rates mostly linked to 12-month MIBOR.		NRIR	12-month
FR	Housing loans to households, fixed-rate.		NRIR	5-year
IE	Mortgage loans, floating-rate (rates offered by building societies).		NRIR	3-month
IT	Loans to households over 1.5 years, fixed and floating-rate (around 80% refer to housing loans and 20% to consumer credit).		NRIR	3-month
LU				
NL	Mortgage loans to households, rate fixed for 5 years.		NRIR	5-year
AT	Housing loans, floating-rate, includes also some unsecured loans.		NRIR	3-month
PT	Loans for house purchase with original maturity over 5 years; fixed and floating rate, includes also some unsecured loans.		NRIR	3-month
FI	Housing loans to households, floating-rate.		NRIR	3-month

(j) Loans to households for consumption

	Data description (up to 2002)	Additional information	Source	Market rate
BE	[Loans with original maturity over 1 year, fixed-rate for 3 years (links with 1-5 ipf).]	Loans for new car purchase.	NRIR	2-year
DE	Instalment credit, rate fixed for 3 to 5 years, presumably mostly secured.	Loans between EUR 5,000 and 15,000.	NRIR	4-year
GR	Personal loans with original maturity over 1 year, fixed-rate, unsecured.		NRIR	2-year
ES	Personal loans (mostly to households).		WEB	2-year
FR	Personal loans and other loans over EUR 1,524 [Original maturity over 3 months; at end-2003, residual maturity up to 1 year (41%), over 1 up to 5 years (52%) and over 5 years (6%); prêts personnels and crédits affectés at fixed-rate (around 75% of stocks between 1999 and 2003) and credits renouvlables at variable-rate (25%)].	Loans up to EUR 21,500 (generally).	NRIR	2-year
IE	Overdrafts and term loans A rate/lending to consumers, floating-rate, unsecured.		NRIR	1-month
IT	n.a.		-	-
LU				
NL	n.a.		-	-
AT	Consumer credit (usually long-term), secured.		NRIR	2-year
PT	Consumer credit to households with original maturity between 2-5 years, fixed and floating-rate, secured and unsecured.		NRIR	2-year
FI	Consumer credit to households, floating-rate, secured.		NRIR	2-year

Table A1.2. MFI interest rates on new business as from January 2003

Market	Segment	Market rate
Deposits	Overnight	1-month
	Redeemable at notice up to 3 months	3-month
	With agreed maturity up to 1 year (households)	6-month
	With agreed maturity over 2 years (households)	5-year
Loans	Bank overdrafts	1-month
	Floating rate and up to 1 year initial rate fixation	3-month
	Over 1 and up to 5 years initial rate fixation	3-year
	Over 5 years initial rate fixation	7-year
	Over 5 and up to 10 years initial rate fixation (mortgages only)	7-year
	Over 10 years initial rate fixation (mortgages only)	10-year

Table A2.3. Number of observations per country and per product category

	Loans				Deposits				
	To non-financial corporations		To households		Overnight	Redeemable at notice	With agreed maturity		
	up to 1 year	over 1 year	consump-tion	house purchase		up to 3m	up to 1y	over 2y	
Belgium	42	42	42	42	42	42	42	42	*336*
Germany	42	32	42	42	32	42	42	42	*316*
Spain	42	42	42	42	42	42	42	42	*336*
France	42	42	42	42	42	42	0	42	*294*
Italy	42	39	0	39	42	39	39	39	*279*
Netherlands	42	0	0	42	42	42	42	42	*252*
Austria	38	0	38	38	35	0	38	33	*220*
Portugal	42	0	42	42	42	0	42	42	*252*
Finland	0	42	42	42	42	42	42	42	*294*
	332	*239*	*290*	*371*	*361*	*291*	*329*	*366*	**2579**

Note: Shaded cells indicate that a few observations are missing.

ANNEX 2. DESCRIPTION OF THE EXPLANATORY VARIABLES

Table A2.1. Descriptive and data sources

Variable	Measurement (proxy)	Abbr.
Policy rate	Three-month money market rate.	NCBs, Reuters, Bloomberg.
Bank soundness	Distance-to-default of banks.	KMV Moody's.
Slope of the yield curve	5-year government bond yield minus 3-month interbank deposit rate: Hofmann and Mizen (2004), Brock and Franken (2003).	NCBs, Reuters, Bloomberg.
Interest rate risk	Quarterly standard deviation of daily interest rates in money and bond markets (e.g. Saunders and Schumacher (2000), Maudos and Fernandez de Guevara (2004)).	NCBs, Reuters, Bloomberg.
Competition (banks)	H-statistic of market power.	Claessens and Lieven (2003), Bikker (2004) and Carbo et al (2005).
Competition (market finance)	Ratio of outstanding quoted shares as a percentage of GDP	ECB, FESE, Eurostat.
	Ratio of outstanding debt securities issued by non-financial corporations as a % of GDP	ECB, Eurostat.
	Mutual fund shares as a % of GDP.	ECB, Eurostat.
	Non-MFI loans as a % of GDP.	ECB, Eurostat.
Financial innovation	Overall index: combination of securitisation, derivatives and venture capital	Authors' calculations.
	Gross issues of securitisation as a % of GDP.	Euopean Securitisation Forum.
	Single-currency interest rates derivatives as a % of GDP.	BIS (Triennial Survey)
	Venture capital investment as a % of GDP.	European Venture Capital Association (EVCA)

Table A2.2. Descriptive statistics

Variable	Abbr.	Mean	Std. Dev.	Min	Max
Changes					
3-month market rate	d3m	-0.11	0.41	-1.65	1.64
distance-to-default	ddd	0.00	0.53	-2.52	2.49
standard deviation of daily 3-month market rates	dsdev	0.00	0.14	-0.79	0.95
standard deviation of daily 5-year market rates	dsd5y	0.00	0.14	-0.63	0.56
slope (5-year minus 3-month)	dslope	0.03	0.48	-1.53	2.00
Levels					
h-statistic	hstat	0.79	0.21	0.23	1.13
stock market capitalisation (% of GDP)	share	63.07	41.59	12.31	331.44
corporate bonds outstanding (% of GDP)	bond	6.10	3.88	1.64	17.62
non-mfi loans to households (% of GDP)	nmfhh	17.93	21.96	0.62	108.69
mutual funds (% of GDP)	fund	30.08	12.94	3.01	66.07
securitsation (% of GDP)	secu	0.02	0.03	0.00	0.10
interest-rate derivatives (% of GDP)	deri	0.02	0.02	0.00	0.09
venture capital	vc	0.00	0.00	0.00	0.00

ANNEX 3: ROBUSTNESS CHECKS

Table A3.1. Baseline model

		Model R1 Fixed-effects across countries plus product dummies					Model R2 Fixed-effects across countries plus product dummies				
		PR(t)		PR(t-1)		Pass-through	PR(t)		PR(t-1)		Pass-through
Policy rate	loans	-0.40 ***		0.24 ***		0.84					
		(0.02)		(0.02)							
	deposits	0.60 ***		-0.17 ***		0.56					
		(0.02)		(0.02)							
	nfc loans (st)						-0.54 ***		0.21 ***		0.67
							(0.04)		(0.04)		
	nfc loans (lt)						-0.24 ***		0.11 ***		0.88
							(0.05)		(0.04)		
	consumer credit						-0.42 ***		0.35 ***		0.93
							(0.04)		(0.04)		
	mortgages						-0.37 ***		0.26 ***		0.90
							(0.04)		(0.04)		
	demand deposit						0.82 ***		-0.05		0.23
							(0.04)		(0.04)		
	savings deposit						0.89 ***		-0.12 ***		0.23
							(0.04)		(0.04)		
	time deposit (st)						0.52 ***		-0.20 ***		0.67
							(0.04)		(0.04)		
	time deposits (lt)						0.23 ***		-0.30 ***		1.07
							(0.04)		(0.04)		
Bank soundness	loans	0.02 ***		-0.05 ***			0.02		-0.05 ***		
		(0.02)		(0.02)			(0.01)		(0.01)		
	deposits	-0.04 ***		0.01 ***			-0.04 ***		0.01		
		(0.01)		(0.01)			(0.01)		(0.01)		
Yield curve slope	loans	-0.24 ***		0.01 ***			-0.24 ***		0.01		
		(0.02)		(0.01)			(0.02)		(0.01)		
	deposits	0.11 ***		0.00 ***			0.11 ***		0.00		
		(0.02)		(0.01)			(0.02)		(0.01)		
Interest rate risk	loans	0.23 ***		0.13 ***			0.24 ***		0.13 **		
		(0.07)		(0.07)			(0.07)		(0.06)		
	deposits	0.10 ***		0.21 ***			0.09		0.20 ***		
		(0.06)		(0.06)			(0.06)		(0.06)		
N		2579					2579				
Wald statistic		59.0***					55.1***				
R-sq. (overall)		0.35					0.43				

Table A3.2. Baseline model

		Model R3 Two-way random effects					Model R4 SUR plus country dummies				
		PR(t)		PR(t-1)		Pass-through	PR(t)		PR(t-1)		Pass-through
Policy rate	loans	-0.37	***	0.25	***	0.88	-0.38	***	0.24	***	0.86
		(0.02)		(0.02)			(0.02)		(0.02)		
	deposits	0.64	***	-0.18	***	0.54	0.60	***	-0.17	***	0.57
		(0.02)		(0.02)			(0.01)		(0.01)		
Bank soundness	loans	0.01		-0.05	***		0.02		-0.05	***	
		(0.01)		(0.01)			(0.01)		(0.01)		
	deposits	-0.04	***	0.01			-0.04	***	0.01		
		(0.01)		(0.01)			(0.01)		(0.01)		
Yield curve slope	loans	-0.16	***	-0.01			-0.24	***	-0.01	**	
		(0.02)		(0.01)			(0.02)		(0.01)		
	deposits	0.03		0.01			0.11	***	0.00		
		(0.01)		(0.01)			(0.01)		(0.01)		
Interest rate risk	loans	0.18	***	0.08			0.23	***	0.12	***	
		(0.07)		(0.07)			(0.05)		(0.05)		
	deposits	0.13	***	0.24	***		0.10	**	0.21	***	
		(0.05)		(0.05)			(0.04)		(0.04)		
N		2579					2579				
Wald statistic		2044.2***									
R-sq. (loans)							0.27				
R-sq. (deposits)							0.42				

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