NOTES D'ÉTUDES

ET DE RECHERCHE

FINANCIAL SYSTEMS AND THE ROLE OF BANKS IN MONETARY POLICY TRANSMISSION IN THE EURO AREA

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November 2002

NER # 93

BANQUE DE FRANCE

DIRECTION GÉNÉRALE DES ÉTUDES ET DES RELATIONS INTERNATIONALES

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Financial systems and the role of banks in monetary policy transmission in the euro area

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Ce travail a été réalisé dans le cadre d'un réseau de recherche organisé par la Banque Centrale Européenne avec l'ensemble des Banques Centrales Nationales de la zone euro. Ce réseau intitulé « Monetary Transmission Network » a fonctionné du mois de juin 1999 au mois de décembre 2001, date à laquelle s'est tenue la conférence de clôture. Ces travaux seront publiés dans un ouvrage collectif à paraître chez Cambridge University Press.

This work is part of the production of a network including the European Central Bank and Central National Banks about "Monetary Transmission". This network has been active between June 1999 and December 2001, when a final conference was held in Frankfurt. All the papers are to be published in a collective volume forthcoming at Cambridge University Press.

[1] European Central Bank; [2] Banca d'Italia; [3] Banco de España; [4] Banque de France and Université Paris Val de Marne; [5] Deutsche Bundesbank. This paper represents the authors' personal opinions and does not necessarily reflect the views of the institutions they are affiliated to. We would like to thank the members of the Eurosystem's Monetary Transmission Network, as well as the participants of the monetary economics workshop at the NBER Summer Institute 2001 and the conference on "Monetary policy transmission in the euro area" for helpful discussions and feedback, and especially Ignazio Angeloni, Sophocles Brissimis, Ignacio Hernando, Carlos Robalo Marques, Skander van den Heuvel, Anil Kashyap, Claire Loupias, Benoit Mojon and Fred Ramb for their comments and suggestions.

Résumé :

Cet article propose une comparaison de la structure des marchés financiers et bancaires des économies de la zone euro. S'appuyant sur cette comparaison, plusieurs hypothèses relatives au rôle des banques dans la transmission de la politique monétaire à l'économie réelle sont développées. Plusieurs des conclusions relatives à l'économie américaine ne sont pas vérifiées en Europe. Ainsi, la politique monétaire affecte bien l'offre de crédits des banques, mais contrairement à ce que l'on observe aux Etats-Unis, la réaction de leur offre de crédit ne dépend pas de la taille des banques. Cet effet dépend essentiellement de leur liquidité. On montre aussi que la base de données Bankscope ne rend pas compte de façon satisfaisante de l'hétérogénéité des comportements bancaires. En effet, sur plusieurs points, les données issues de Bankscope suggèrent des réponses très différentes de celles obtenues à partir des bases de données plus complètes disponibles dans les banques centrales nationales.

Mots clés : transmission de la politique monétaire, structure financière, crédit bancaire

Abstract:

This paper offers a comprehensive comparison of the structure of banking and financial markets in the euro area. Based on this, several hypotheses about the role of banks in monetary policy transmission are developed. Many of the predictions that have been proposed for the U.S. are deemed unlikely to apply in Europe. Testing these hypotheses we find that monetary policy does alter bank loan supply, with the effects most dependent on the liquidity of individual banks. Unlike in the US, the size of a bank does generally not explain its lending reaction. We also show that the standard publicly available database, BankScope, obscures the heterogeneity across banks. Indeed, for several types of questions BankScope data suggest very different answers than more complete data that reside at national central banks.

Key words: monetary policy transmission, financial structure, bank lending

JEL classification system: C23, E44, E52, G21

1. Introduction

Following the macroeconometric analysis of the first part of this volume, this second part focuses on the microeconometric investigation of the role of banks in monetary transmission in the euro area. While theory offers a wide array of different transmission channels, those that attribute an important role to banks are of special interest here, mainly for two reasons.

First, most European countries rely much more heavily on bank finance than for example the US (see Table 1). Comparing the ratio of bank total assets to GDP across the four largest countries of the euro area[1] and the US it turns out that banks are much less important in the US than in any of the European countries. Accordingly, the financial structure of the corporate sector in Europe relies much more heavily on bank loans, with the mirror image of this being the larger stock market capitalisation and the more prominent role of debt securities issued by the corporate sector in the US.

Table 1: Financial structures in the euro area and the US (% of GDP), 2001

	Euro area	France	Germany	Italy	Spain	US
Bank total assets [1]	267.1	276.7	304.3	154.4	199.6	78.0
Bank loans to corporate sector	42.6	35.7	38.9	42.3	46.4	9.4
Outstanding debt securities of non-financial corporate sector	6.5	17.0	2.8	2.4	2.6	28.9
Stock market capitalisation	71.7	90.6	58.1	48.7	80.9	137.1

Source: Eurosystem, BIS, World Federation of Exchange, Federal Reserve Flow of Funds

[1] MFIs excluding the Eurosystem for the euro area; credit institutions and other MFIs for the countries of the euro area; commercial banks, savings institutions and credit unions for the US

Second, beyond the high overall level of bank dependence there are also some notable differences on the country-level. We document the differences in a comprehensive fashion in Table 2, and in what follows concentrate on the gaps that may have implications for the transmission of monetary policy.

We try to quantify the importance of these considerations by focusing on three questions: (1) what is the role of banks (i.e., bank loans) in monetary transmission in the euro area, (2) are there differences in this respect across the member countries of EMU, and (3) are there distributional effects of monetary policy on different types of banks?

These issues have already been addressed in several recent studies on the monetary transmission process at the aggregate level.[2] However, clear-cut conclusions can hardly be drawn from these studies, mainly because of the wide confidence intervals that are normally associated with such macro time-series estimates. By using the cross-sectional information of data on individual banks, we hope to get more precise estimates, thus allowing for better inference on differences across countries.

The central task in this effort is to identify the reaction of loan *supply* to monetary policy actions. This is important since bank loans are the main link between banks and private non-banks, and because bank loans very often cannot be easily replaced by other forms of finance on the borrower's side. There is ample evidence that aggregate bank loans decline following a monetary contraction.[3] However, such a decline can in principle be caused by both, loan demand and loan supply, and hence sorting out the cause is important.[4]

To discriminate among loan supply and loan demand movements, the recent literature has generally focused on cross-sectional differences between banks.[5] This identification strategy assumes that a monetary policy tightening leads to a drop in the availability of core deposits, which affects banks' ability to make new loans. If it is possible to single out bank characteristics that are related to a bank's ability to compensate for this drop of funds and at the same time determine its lending behaviour after a monetary tightening, loan supply effects can be identified. Of course, this assumes that a bank's loan demand is independent of these characteristics. The prior literature has proceeded by positing several differences that could shape loan supply sensitivity to monetary policy. One strand of this literature checks whether poorly capitalised banks have a more limited access to nondeposit financing and as such should be forced to reduce their loan supply by more than well capitalised banks do (e.g., Peek and Rosengren, 1995). The role of size has been emphasised, for example, in Kashyap and Stein (1995): small banks are assumed to suffer from informational

[1] These four countries, which form the group of countries studied in section 5, contribute approximately 80% to euro area GDP.
[2] E.g., Ciccarelli and Rebucci (2001); Clements et al (2001); Mihov (2001); Sala (2001). For a model which explicitly takes into account the effect of differences in the bank lending channel on monetary policy see Gambacorta (2001).
[3] Bernanke and Blinder (1992); for the euro area, see Peersman and Smets (this volume) and Mojon and Peersman (2001).
[4] For a definition of the bank lending channel see Bernanke and Blinder (1988).
[5] Contributions that use macro data are, e.g., Bernanke and Blinder (1992), Kashyap et al. (1993, 1996) or Brissimis and Magginas (2002).

asymmetry problems more than large banks do, and find it therefore more difficult to raise uninsured funds in times of monetary tightening. Again, this should induce them to reduce their lending relatively more when compared to large banks. Another distinction is often drawn between more and less liquid banks (e.g., Kashyap and Stein, 2000). Whereas relatively liquid banks can draw down their liquid assets to shield their loan portfolio, this is not feasible for less liquid banks.[6]

In the spirit of this approach, we investigate whether there are certain types of banks whose lending is more responsive to monetary policy impulses. In section 2 we will provide a description of the banking systems in the countries of the euro area. We will argue that these characteristics are important for the role of banks in monetary policy transmission, and that some of the results found for the US are not likely to be applicable to the euro area. Mainly, we believe that the size criterion is not necessarily a good indicator for distributional effects across banks. Our predictions will be tested in the empirical analysis, where we consider which bank characteristics, i.e., size, liquidity or capitalisation distinguish banks' responses to changes in the interest rates also in Europe. In this chapter, we will perform regressions for the euro area as a whole and for Germany, France, Italy and Spain, the four largest countries of the euro area, and furthermore draw on the results obtained in the other chapters of this section. The main aim of this chapter is to provide an overview of those results obtained at the national level, to produce an exactly comparable set of results by performing regressions in a harmonised approach, and to broaden the focus to the euro area as a whole. The other chapters in this part of the volume provide more detailed and country-specific analyses for nine of the twelve countries of the euro area.

The remainder of the chapter is organised as follows. Section 2 describes the structure of the banking sector in the euro area and the consequences it might have for the role of banks in monetary policy transmission. The theoretical model underlying our analysis is introduced in section 3. Section 4 presents results for the entire euro area using individual bank balance sheet data provided by BankScope. Section 5 presents evidence on a national basis using databases on the full population of banks collected by the respective national central banks. Section 6 summarises the main conclusions.

[6] Stein (1998); Ashcraft (2001); Kishan and Opiela (2000); Van den Heuvel (2001).

2. The structure of the banking system and monetary policy transmission

2.1 Characteristics of the banking system in the euro area

This section provides a short description of the structure of the banking system in the euro area. As a background, Table 2 reports a number of qualitative indicators on the banking market in the individual euro area countries, like e.g. the importance of bank finance for firms, measures of concentration, to the role of the government in banking and the importance of bank network structures. The table shows that bank finance, as stated in the introduction, is of primary importance in most countries of the euro area, and gives some indication as to the heterogeneity of banking structures.

We believe several features of national banking structures to be important for the response of bank lending to a monetary policy action, and for the assessment of the macroeconomic importance of such responses. In the following, we highlight the most distinctive patterns that might be relevant in this context and refer the interested reader to the subsequent chapters, which elaborate in more detail on the main features of the respective national banking systems.

Insert Table 2 around here

Importance of banks for firms' financing

As mentioned in the preceding section, banks play an important role in firms' financing. Market financing of the corporate sector is less developed than in the US. Even in France, where it is more important than in many countries of the euro area (see Table 1), only the largest firms can issue debt securities, and the role of banks in financing firms is still much more dominant than in the US. The business sector has therefore been heavily dependent on bank credit. This indicates that changes in bank loan supply affect firms relatively strongly, since they cannot easily find substitutes for the bank

finance. Table 2, which presents a qualitative ranking of the euro area countries, shows that banks are important in every single country.

Maturity of loans, collateralisation

The loans supplied by Italian banks are to a large extent short-term and come with variable interest rates. The same tendency is present in Spain. This can accelerate the transmission of monetary policy impulses to lending rates and thus borrowing costs. On the other hand, countries like Austria and the Netherlands have a longer maturity of loans and a higher share of fixed rate contracts.[7] In countries like Italy, where a high percentage of loans is backed by collateral, the response of bank loans to monetary policy could be furthermore accentuated through the so-called "balance sheet channel".[8] The ranking in table 2 shows considerable heterogeneity across the euro area countries in these two respects.

Relationship lending

In several European countries, the market for intermediated finance is characterised by relationship rather than arm's length lending. It is very common that bank customers establish long lasting relationships with banks, with a prominent example being the German system of "house banks", in which firms conduct most of their financial business with one bank only.[9] With most German banks operating as universal banks, and therefore supplying their customers with the full range of financial services, this implies a much closer linkage to a single bank than in many other countries. For the creditor, this could also imply an implicit guarantee to have access to (additional) funds even if the central bank follows a restrictive monetary policy, or that interest rate increases are not passed through immediately, thus leading to smoother interest rates variations on such loans.[10] In such a case, the reaction of bank loan supply to monetary policy should be at least muted. Typically, house bank relationships exist between relatively small banks – which due to their presence in local markets are able to entertain personal contacts and for which the loan business with non-banks is still a central

[7] Borio (1996).
[8] See, among others, Bernanke and Gertler (1989), Mishkin (1995), Oliner and Rudebusch (1996) and Kashyap and Stein (1997).
[9] See, e.g., Elsas and Krahnen (1998).
[10] See, e.g., Rajan and Zingales (1998).

activity – and their customers. Italy shows a similar pattern, where many small banks entertain close relationships with their customers, especially with small firms.[11] This is true for France as well, where most small firms have business relationships with one bank only. A qualitative ranking of the importance of networks is provided in table 2.

Market concentration and size structure

The banking markets in the countries of the euro area have been characterised by a steadily increasing concentration during the 1990s. It stands at different levels in the various countries, however. According to the Herfindahl index, Germany and Italy are at the lower end of market concentration in the euro area, as opposed to Belgium, Greece, the Netherlands, and especially Finland (for details, see the statistical appendix of this volume, for a ranking, see table 2).

Table 3 provides another detailed comparison of the size structure in the four largest countries of the euro area. Our samples of banks are split into small and large banks with respect to a relative national threshold.[12]

Insert Table 3 around here

For all countries, a small number of large banks holds a major share in both the loan and deposit market: the 75% smallest banks hold only around 8% to 15% of deposits, and account for around 5% to 12% of loans, whereas the 5% largest banks hold around 52% to 71% of deposits and have a market share of around 56% to 77% in loans. Table 3 reports similar data on the US as a benchmark. Also there, the 75% smallest banks account for a small market share in terms of total assets, loans and deposits, whereas the top 5% account for the lion's share in each respect.

The structure of these small banks varies considerably across countries. Whereas French, Italian and Spanish small banks are on average very liquid, there does not seem to be a systematic difference in

[11] Angelini, Di Salvo and Ferri (1998).

the degree of liquidity of banks of different size in Germany. Similarly with capitalisation, where small banks are on average better capitalised in France, Italy and Spain, whereas there is only a small difference in Germany.

German banks are the least capitalised. The low degree of capitalisation in Germany is usually explained by the low riskiness of the asset structure of German banks in an international comparison: on average, German banks hold more public bonds and other less risky assets, like e.g., interbank assets (see also Table 3 in the statistical appendix). It is interesting to note that in Italy, the small banks hold a much larger market share in the deposit market than in the loan market. This gap is much less pronounced in the other countries.

State influence and ownership structure

Although steadily declining over time,[13] the role of the government in banking markets is an important issue in Europe. State influence, exerted either through direct public ownership of banks, state control, or public guarantees, has been much more common than in the US, as is documented in La Porta et al. (2002). Public ownership of banks was, during the sample period studied, most widespread in Austria, but significant also in most other countries of the euro area. In Finland, the government issued a guarantee for all bank deposits following the banking crisis of the early 1990s, and maintained this until 1998. In Greece, the market share of the state-controlled banks is currently around 50%, down from 70% in 1995. In other countries, the influence of the state is rather limited, like for example in Spain, where state-owned banks represented 13% of total loans and 3% of total deposits at the start of the sample period (1988), but were completely privatised by the end of the sample. Savings banks in Spain are not publicly guaranteed, despite the involvement of some local governments in their control. This heterogeneity is shown in the qualitative comparison of table 2.

[12] A similar table with a split according to an absolute criterion in terms of the value of their total assets is provided in Ehrmann et al. (2001).

[13] For example, in Italy the share of total asset held by banks and groups controlled by the State passed from 68 per cent in 1992 to 12 per cent in 2000.

Deposit insurance

The degree of effective deposit insurance differs considerably across European countries during the sample period studied. Table 2 provides a cross-country comparison. Deposit insurance in Spain covered all deposits of non-financial entities up to a relatively modest amount (9,000 euros per depositor in 1990 and 15,000 euros in 1998). In Germany, on the other hand, the statutory deposit insurance system, a private safety fund as well as cross-guarantee arrangements in the savings banks' and in the co-operative banks' sectors, respectively, effectively amount to a full insurance of all non-bank deposits.[14] France appears to be in an intermediate position with a complete insurance for deposits up to 76,000 euros per depositor.

Bank failures

In most countries of the euro area, bank failures have been occurring much less frequently than in the US.[15] Around 1,500 bank failures are reported for the US for the period 1980-1994. Even between 1994 and 2000, i.e., in an economic boom, there were 7 bank failures per year on average.[16] This is a considerably higher fraction of the banking population than for example in Germany, where only around 50 private banks have failed since 1966. Also in Italy many fewer bank failures occurred.[17] In Spain, two banking crises occurred during the last 25 years. The first one (1978-1985) was more widespread, affecting 58 banks (accounting for 27% of deposits), while the second one (1991-1993) affected very few banks but involved one of the biggest institutions. In both cases, due to the potential systemic implications, most of the banks were either acquired by other solvent institutions, or the government intervened, so that depositors' losses were very limited. Besides these two periods, there was only one failure of a very small bank in Spain. A banking crisis was also experienced in

[14] See, for example, Deutsche Bundesbank (2000).
[15] A direct comparison of these numbers is complicated by the fact that the definition of bank failures might be different across countries. Especially numbers on prevented bank failures are difficult to obtain for the euro area countries. Some cases are listed in Gropp et al. (2001).
[16] See Federal Deposit Insurance Corporation (1998) for 1980-1994, and www.fdic.gov.
[17] In the period 1980-1997, 40 (in almost all cases very small mutual) banks were placed in administrative liquidation. The share of deposits of failed banks was always negligible and reached around 1% only three times, namely in 1982, 1987 and 1996 (see Boccuzzi, 1998).

Finland during the early 1990s. However, because of strong government intervention, only one bank failure materialised.

Bank networks

In several countries of the euro area bank networks exist. Especially the savings banks and credit co-operatives are frequently organised in networks, although with a varying degree of collaboration in the different countries. To give an example, in Germany most banks (the vast majority of small banks) belong to either the co-operative sector (in the 1990s about 70% of all banks) or the savings banks' sector (almost 20%). Both sectors consist of an "upper tier" of large banks serving as head institutions. The "lower tier" banks generally entertain very close relationships to the head institutions of their respective sector, leading to an internal liquidity management: on average, the "lower tier" banks deposit short-term funds with the "upper tier" banks, and receive long-term loans in turn.[18]

Similar structures can be found in many countries of the euro area (for an overview, see table 2). In Austria, 750 of 799 banks in 1996 belonged to either the savings banks' or the credit co-operatives' network, which have structures comparable to those described for Germany. In Finland, co-operative banks are organised in the OKO Bank group, which has a centralised liquidity management. In Spain, on the other hand, savings and co-operative banks' networks exist, but their central institutions play only a relatively minor role.

2.2 Some conjectures on the role of banks in monetary policy transmission

The structure of the banking markets in the individual countries is likely to determine the response of bank lending to monetary policy. Several features of European banking markets are significantly different from those found in the US. It is therefore most likely that the distributional effects across banks that have been documented for the US will not be identical to those we can expect for the

[18] See Upper and Worms (2001) and Deutsche Bundesbank (2001, p. 57).

countries of the euro area. Additionally, there are significant differences across European countries, such that we would not necessarily expect results to be identical for the various countries.

One important issue is the relevance of informational frictions in the banking markets. If depositors and players in the interbank markets face strong informational asymmetries, then distributional effects are likely to occur between banks that are informationally opaque to different degrees. This would suggest the use of the size, liquidity and capitalisation criteria as in the existing literature. However, several of the features mentioned above are capable of reducing significantly the extent to which informational frictions exist. A first indication that in general, informational asymmetries are less pronounced is the relatively low risk involved in lending to banks, given the few numbers of bank failures experienced in many countries.

The role of governments in the banking markets similarly reduces the risk of depositors: An active role of the state in the banking sector may obviously reduce the amount of informational asymmetries. Publicly owned or guaranteed banks are therefore unlikely to suffer a disproportionate drain of funds after a monetary tightening, and distributional effects in their loan reactions are hence unlikely to occur.

Under a government guarantee, it is also possible that weaker banks engage in a "gamble for resurrection" by extending their loan portfolio despite potential increases in its riskiness. Evidence for this is provided in Virhiälä (1997), who detects such a pattern among co-operative banks in Finland during the early 1990s. He finds that, the lower the degree of capitalisation of a bank, the more expansionary was its loan supply.

There are also factors that offset the importance of a bank's asset size. One example is deposit insurance. The extensive degree of effective deposit insurance in countries like Germany and Italy makes it furthermore difficult to believe that deposits at small or less capitalised banks are riskier than deposits held at large or better capitalised banks.

The network arrangement between banks can also have important consequences for the reaction of bank loan supply to monetary policy. In networks with strong links between the head institutions and

the lower tier, the large banks in the upper tier can serve as liquidity providers in times of a monetary tightening, such that the system would experience a net flow of funds from the head institutions to the small member banks. Ehrmann and Worms (2001) show that in Germany, indeed, small banks receive a net inflow of funds from their head institutions following a monetary contraction. This indicates that the characteristics of a single member bank need not be a good proxy to assess distributional effects of monetary policy across banks, but that the position of the network as a whole, or of the head institution might become more relevant. [19]

Additionally, banking networks frequently contain mutual assistance agreements, as is the case for example for the Austrian and German credit co-operative sectors. These help to diminish informational asymmetries for a single bank, since it is the sector as a whole rather than the single bank that determines the riskiness of a financial engagement with a member bank.

Lastly, under the assumption that relationship lending implies that banks shelter their customers from the effects of monetary policy to some degree, we would expect that those banks show a muted reaction in their lending behaviour. Since it is often small banks which maintain these tight lending relationships, it might very well be that smaller banks react less strongly to monetary policy than large banks (which would be the opposite to the findings for the US). At least, size does not always need to be a good indicator for distributional effects across banks. However, this notion is at odds with the usual assumption that smaller banks find it more difficult to maintain their loan portfolio after a monetary tightening. Relationship lending can explain why these banks have an incentive to maintain the portfolio, but it does not explain how this can be achieved in case informational asymmetries are present. Small banks do therefore need to have the necessary sources of funds at hand to maintain their loan portfolio even in times of monetary tightenings. This can be either achieved through a higher degree of liquidity of those banks like, e.g., in Italy or in France, through the liquidity provisions within the bank networks as, e.g., in Germany, and/or thanks to a better capitalisation as in France, Italy and Spain.

[19] A related idea has been documented for the US in Campello (2002). He shows that internal capital markets in financial conglomerates can dampen bank lending channel effects to some extent.

Tests of the bank lending channel do therefore have to be interpreted in the light of the institutional peculiarities of each country.[20] Doing so leads us to several conjectures on the role of banks in monetary policy transmission. Overall, we would expect informational frictions to be less important in most countries of the euro area than they are in the US. Several institutional features could imply that banks can shield their loan portfolio from monetary policy shocks. The reaction of a bank's lending might thus depend much more on the importance it attributes to maintaining a lending relationship than on the necessity to fund a certain loan portfolio. In most European countries, size and capitalisation need not be bank characteristics that explain differential loan supply reactions to monetary policy. However, there may still be distributional effects, which depend on other factors. For example, in some European countries, some groups of small banks have traditionally acted as collectors of retail deposits to the whole banking system. Consequently, those banks tend to be more liquid on average. It may be the case that these banks react differently to monetary policy changes.

3. The model

The basic idea of our empirical test can be illustrated with a simple model of a profit-maximising bank; a more elaborate model of the bank lending channel has been developed, for instance, in Stein (1998). The balance sheet identity of bank i is defined as:

$$L_i + S_i = D_i + B_i + C_i \tag{1}$$

where L_i is the volume of loans, S_i securities, D_i the volume of (secured) deposits, B_i the level of non-secured funding and C_i the capital of bank i. Bank i acts on a loan market characterised by monopolistic competition. The demand for (nominal) bank loans L^d_i is given by:

$$L_i^d = -a_0 \cdot r_{L,i} + a_1 \cdot y + a_2 \cdot p \tag{2}$$

[20] Several papers have already ranked countries with respect to the effectiveness of a bank lending channel (Kashyap and Stein (1997), Cecchetti (2000), DNB (2000)). They rely on indicators from three main categories: the importance of small banks, bank health, and the availability of alternative finance. Despite differences with respect to some countries, the rankings reach relatively similar conclusions. For the four largest economies, both Kashyap and Stein (1997) and Cecchetti

The bank-individual loan rate is given by $r_{L,i}$. y denotes aggregate real output, p the price level. All coefficients are assumed to be positive: $a_0, a_1, a_2 > 0$.

For simplicity, we assume that bank capital is linked to the level of loans (as in the Basle requirements) and bank's holding of securities to the level of deposits (liquidity risk):

$$C_i = k \cdot L_i \tag{3}$$

$$S_i = s \cdot D_i \tag{4}$$

Deposits D_i are secured, but do not bear interest. They are demanded because of their role as a means of payment. Deposit demand is therefore, according to a "money demand"-type function, negatively related to the interest rate of an alternative risk-free asset, r_S, which we take to be the monetary policy rate:

$$D = -b_0 \cdot r_S \tag{5}$$

where $b_0 > 0$. Since banks do not remunerate these deposits, they cannot influence the amount of deposits held at the single bank, D_i. This is exogenous to the bank and it will drop after a monetary tightening (i.e., after an increase in r_S).

However, banks have access to an alternative source of funds, which is unsecured and for which the bank has to pay interest. Banks are perceived to be risky, and the suppliers of unsecured finance to banks therefore ask for an external finance premium. The interest rate they pay, $r_{B,i}$, is thus the risk-free rate r_S plus this premium. The external finance premium depends on a signal of bank's health, x_i, which can be observed by all market participants. The higher the x_i, the lower the external finance premium:

(2000) rank Italy as the strongest, France and Germany in the mid range, and Spain as the country with the least exposure to a bank lending channel.

$$r_{B,i} = r_S \cdot (\mu - c_0 \cdot x_i), \tag{6}$$

where $\mu - c_0 \cdot x_i \geq 1 \; \forall \; i$. Bank i cannot raise unsecured funds if it offers less than $r_{B,i}$, whereas it can raise any amount of funds if it pays at least $r_{B,i}$. Given $r_{B,i}$ is a cost factor, bank i will not be ready to pay more than $r_{B,i}$.

The profit of bank i, π_i, is given by[21]:

$$\pi_i = L_i \cdot r_{L,i} + S_i \cdot r_S - B_i \cdot r_{B,i} - \Psi_i, \tag{7}$$

where Ψ_i captures bank-specific administrative costs and the remuneration costs for the required capital holdings. Inserting equations (1) to (5), and assuming equilibrium in the loan market, yields:

$$\pi_i = L_i \cdot \left(-\frac{1}{a_0} \cdot L_i + \frac{a_1}{a_0} \cdot y + \frac{a_2}{a_0} \cdot p \right) + s \cdot D_i \cdot r_S - \left((1-k) \cdot L_i - (1-s) \cdot D_i \right) \cdot r_{B,i} - \Psi_i \tag{8}$$

Setting the first order condition to zero, and inserting (6) yields:

$$L_i = \frac{a_1}{2} \cdot y + \frac{a_2}{2} \cdot p - \frac{a_0 \cdot \mu \cdot (1-k)}{2} \cdot r_S + \frac{a_0 \cdot c_0 \cdot (1-k)}{2} \cdot x_i \cdot r_S - \frac{a_0}{2} \cdot \frac{\partial \Psi_i}{\partial L_i}. \tag{9}$$

In the traditional "money view" there are no informational asymmetries and, hence, no external finance premia. $r_{B,i}$ is equal to r_S for all banks and there are no differences in the response to monetary policy across banks. A monetary policy tightening (i.e., an increase in r_S) leads to a reduction in deposits according to equation (5). Banks can keep the asset side of their balance sheet unchanged only if they increase other sources of funding B_i accordingly. But, the interest rate a bank has to pay for these funds was increased by the monetary policy tightening according to (6). Banks pass at least part of this higher cost to their loan rate ($r_{L,i}$), which in turn reduces loan demand. In our model, this implies a negative coefficient of r_S in equation (9).

[21] We are also assuming $B_i > 0$.

However, if a bank lending channel is at work, the costs for raising nonsecured funds faced by a bank should depend on the degree to which it suffers from informational frictions in financial markets. In the model, this implication is mirrored by the assumption that different banks face different costs for raising non-secured deposits (i.e., $c_0 > 0$). This differentiation would force some banks to reduce their lending by more, namely those that face higher costs of raising non-secured deposits because they have a low value of the bank characteristic x_i. If, as we assume in the model, loan demand is homogeneous across banks, regardless of their value of x_i, a differential loan reaction to monetary policy identifies a loan supply movement. Whether such a differential reaction is present, can be seen by looking at the coefficient on the interaction term $x_i \cdot r_S$,

$$\frac{a_0 \cdot c_0 \cdot (1-k)}{2}$$

If this coefficient is significantly positive, the assumptions of the model imply that monetary policy affects loan supply.

The assumption of a homogeneous reaction of loan demand across banks is therefore crucial for the identification of loan supply effects of monetary policy. It excludes cases where, for example, large or small banks' customers are more interest rate sensitive. Given that bank loans are the main source of financing for firms in the euro area, and readily available substitutes in times of monetary tightenings are very limited even for relatively large firms, we see this as a reasonable benchmark for most countries.[22]

For the cases of size and liquidity, we will furthermore estimate a model with double interactions, i.e. we include both bank characteristics $x_{1,i}$ and $x_{2,i}$, the single interaction with the interest rates, $x_{1,i} \cdot r_s$ and $x_{2,i} \cdot r_s$, and furthermore a double interaction $x_{1,i} \cdot x_{2,i} \cdot r_s$, as well as the interaction of the bank characteristics, $x_{1,i} \cdot x_{2,i}$. With this extended model, it is possible to test whether the effect of liquidity depends on the size of banks (and vice versa). The underlying idea is similar in spirit to

Kashyap and Stein (2000), and assumes that the relief a bank gets from additional liquidity should be the larger, the smaller the bank.

Our regression model is based on equation (9), with slight modifications. Beyond interacting the bank characteristic with interest rates, we furthermore interact it with GDP and prices. This way, we allow banks with different values of the bank characteristic x_i to respond differently to the business cycle. Furthermore, we assume that once we have controlled for other cyclical effects through the inclusion of GDP and prices, the estimated effects of the interest rate truly capture monetary policy effects.[23] We also introduce some dynamics and estimate the model in first differences.[24] The regression model is therefore specified as in equation (10):

$$\begin{aligned}\Delta \log(L_{it}) = a_i &+ \sum_{j=1}^{l} b_j \Delta \log\left(L_{it-j}\right) + \sum_{j=0}^{l} c_j \Delta r_{t-j} + \sum_{j=0}^{l} d_j \Delta \log\left(GDP_{t-j}\right) + \sum_{j=0}^{l} e_j infl_{t-j} \\ &+ f\, x_{it-1} + \sum_{j=0}^{l} g_{1j} x_{it-1} \Delta r_{t-j} + \sum_{j=0}^{l} g_{2j} x_{it-1} \Delta \log\left(GDP_{t-j}\right) + \sum_{j=0}^{l} g_{3j} x_{it-1} infl_{t-j} + \varepsilon_{it}\end{aligned} \tag{10}$$

with $i = 1,...,N$ and $t = 1,...,T_i$ and where N denotes the number of banks and l the number of lags. L_{it} are the loans of bank i in quarter t to private non-banks. Δr_t represents the first difference of a nominal short-term interest rate, $\Delta \log(GDP_t)$ the growth rate of real GDP, and $infl_t$ the inflation rate. The bank specific characteristics are given as x_{it}. The model allows for fixed effects across banks, as indicated by the bank specific intercept a_i.[25]

[22] Several of the subsequent chapters improve on this identification issue by including bank specific loan demand proxies that allow for differences in loan demand across banks. The results seem to be rather robust to these changes (see, e.g., the chapter on Germany).

[23] As a robustness check, we estimate a second model with a complete set of time dummies instead of macro variables. The results are robust to this alternative model specification. They are presented in Ehrmann et al. (2001).

[24] The underlying idea is that banks react to a change in the interest rate by adjusting new loans. Since the average maturity of loans in Europe is longer than one year, the level of loans approximates the stock of loans for both quarterly and annual data, whereas the flow can be approximated by the first difference. In the estimates below, the exact specification may change from country to country, depending on the empirical properties of the data (see appendix for the exact specification in each case).

[25] We have chosen not to interact the lagged endogenous variables with the bank characteristics. Such an interaction would be justified if either the serial correlation in the disturbances or the average duration of a bank's loans were systematically linked with the bank characteristics, which we do not necessarily believe to be a realistic assumption.

A negative coefficient on the interest rate implies that loans fall after a monetary contraction. For tests of distributional effects, we would expect positive coefficients on the interaction term of the bank specific characteristic with the monetary policy indicator.[26]

This model has been used in slight modifications in most of the subsequent chapters, whereas others (Brissimis et al., Farinha and Robalo Marques) opted for a more structural approach. Since the latter is more demanding in terms of data requirements, it has not been chosen as the standard specification. Other chapters consider extensions of (10), like, e.g., Kaufmann, who additionally tests for the existence of asymmetries over time. Again, such a test has not been performed in most other studies due to the data requirements this creates.[27]

As a monetary policy indicator, we use the short-term interest rate. Following the literature, we consider three measures for bank characteristics: size (*S*), liquidity (*Liq*) and capitalisation (*Cap*). Size and capitalisation are obvious measures of bank's health that can affect the external finance premium. Liquidity may also be, but even if it is not, to the extent that it allows the bank to draw on it instead of going to the market, it reduces the increase in the marginal cost of funds after a monetary tightening. They are defined as follows:

$$S_{it} = \log A_{it} - \frac{1}{N_t}\sum_i \log A_{it}$$

$$Liq_{it} = \frac{L_{it}}{A_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_i \frac{L_{it}}{A_{it}} \right)$$

$$Cap_{it} = \frac{C_{it}}{A_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_i \frac{C_{it}}{A_{it}} \right)$$

[26] However, a non-significant coefficient for the interaction term may indicate either the absence of a bank lending channel or that our chosen characteristic does not appropriately discriminate banks according to their external finance cost.

[27] Note also that our model assumes only linear effects of the underlying bank characteristics on the lending decisions. Of course, non-linearity effects could exist. For example, it is possible that there are threshold effects: once a bank has reached a certain level of capitalisation, the market perceives it to be well capitalised. Or, similarly, once a bank has passed a certain size threshold, it is not subject to higher informational asymmetry problems than any other bank of that size class. Such hypotheses would have to be tested with grouped data, or by explicitly modelling threshold effects.

Size is measured by the log of total assets, A_{it}. Liquidity is defined as the ratio of liquid assets L_{it} (cash, interbank lending and securities) to total assets,[28] and capitalisation is given by the ratio of capital and reserves, C_{it}, to total assets.

All three criteria are normalised with respect to their average across all the banks in the respective sample in order to get indicators that sum to zero over all observations. The average of the interaction term $x_{it-1}\Delta r_{t-j}$ is therefore zero, too, and the parameters c_j are directly interpretable as the overall monetary policy effects on loans. In case of size, we normalise not just with respect to the mean over the whole sample period, but also with respect to each single period. This removes unwanted trends in size that arise because size is measured in nominal terms.

Due to the inclusion of lags of the dependent variable, we use the GMM estimator suggested by Arellano and Bond (1991). This ensures efficiency and consistency of our estimates, provided that instruments are adequately chosen to take into account the serial correlation properties of the model (the validity of these instruments is tested for with the standard Sargan test). To ensure econometrically sound estimates for each country, the harmonised model needs to be amended slightly for each country, e.g., by choosing the appropriate treatment of seasonality, lag structure and an adequate set of instrumental variables. The actual regression models for each country are therefore slight modifications of (10).

We have estimated model (10) using two different datasets. The first is BankScope, a commercially distributed database provided by the rating agency Fitch Ibca that covers balance sheet data on banks in all the euro area countries, although not the full population in each. This data is available on an annual basis only. It has been used in all previously published papers for the euro area that are based on microdata on banks. The second dataset consists of bank balance sheet data collected by the national central banks of the euro area. These data are likely to be of a better quality, because they are available at least on a quarterly basis and initially cover the full population of banks in a country. To provide a comprehensive picture and to enable an assessment of the adequacy of BankScope for this

[28] Alternatively, liquidity may also be measured by the ratio of liquid assets to liquid liabilities. We do not consider this variant in our econometric analysis, since it turned out to have an excessive variability in the short-term.

type of exercise, we will make parallel use of both types of datasets. This will give an indication as to the representativeness of the BankScope results.

4. Evidence from BankScope data

The existing studies on the euro area show rather inconclusive results. Whereas Favero et al. (2001) do not find evidence for a bank lending channel in Europe, De Bondt (1999a), King (2000) and Altunbas et al. (2002) do. However, the latter studies report conflicting findings: whereas King's results support the existence of the bank lending channel in France and Italy, the evidence on these two countries appears particularly weak in de Bondt. Altunbas et al. (2002), on the other hand, show that undercapitalised banks tend to respond more to monetary policy in the euro area as a whole – however, looking at single countries, they find the bank lending channel to be at work only in Italy and Spain

Table 4: Comparison of the coverage of the BankScope data with the full population of banks (1998)

		France	Germany	Italy	Spain
Number of banks	BankScope	456	2021	576	159
	Eurosystem datasets	*1191*	*3246*	*918*	*396*
Average total assets (in mio euros)	BankScope	9997	3413	3657	8422
	Eurosystem datasets	*2365*	*1583*	*1671*	*2283*
Median total assets (in mio euros)	BankScope	1180	364	216	1599
	Eurosystem datasets	*164*	*182*	*141*	*302*

Note that the use of consolidated balance sheet data in BankScope, by counting also bank holdings abroad, leads to the sum of total assets for some countries to exceed the actual sum of total assets within that country.

Beyond the differences in specification, these contrasting results may be attributed to two intrinsic weaknesses of the BankScope data. First, the data are collected annually, which might be too infrequent to capture the adjustment of loans following a change in interest rates. Second, the sample of banks available in BankScope is biased toward large banks. This is shown for the four largest countries of the euro area in Table 4. The coverage of the population of banks ranges from about 40% in France and in Spain to a little bit more than 60% in Italy and in Germany. However, the median and average bank size is several times larger in BankScope than in the actual population.

In terms of market share this poses less of a problem, since, as described in section 2.2, the larger banks make up a disproportionately larger fraction of the total loans. The biases are, however, stronger for the beginning of the sample, since the coverage of BankScope has improved markedly over the years.

BankScope data offer the choice between consolidated and unconsolidated balance sheets. For the purposes of this paper, we opted for consolidated balance sheets whenever available, and unconsolidated balance sheets otherwise. In order to assess financial constraints and informational asymmetries of a bank, it is important to know whether a bank is in fact a subsidiary of another, potentially larger or better capitalised, bank. In such a case, using the subsidiary's unconsolidated balance sheet would lead to a biased measurement of the informational problems of the bank. However, this choice is not without drawbacks. Consolidated balance sheets can potentially exaggerate the size of a bank, especially if a bank is internationally oriented, and has bank holdings abroad. This might create problems when looking at individual countries, where the mismeasurement due to international operations of domestic banks is larger than when looking at evidence on the euro area aggregate level.

To assess the role of banks in monetary transmission at the euro area level, we begin by estimating model (10) with the full BankScope dataset, making no distinction based on the nationalities of the banks. However, in order to proxy loan demand and the monetary policy changes for each bank as closely as possible, we regress the loan growth of a bank on its national GDP growth, inflation rate and the interest rate change.

Table 5: Long-run coefficients, BankScope data for the euro area

	Models estimated with the following bank characteristic variables									
	Size		Liquidity		Capitalisation		Size Liquidity Capitalisation		Size Liquidity	
Monetary policy	**-1.321*** ***0.000***		**-0.527** ***0.040***		**-0.309** ***0.151***		**-1.539*** ***0.000***		**-1.494*** ***0.000***	
Real GDP	**1.881*** ***0.000***		**0.885** ***0.023***		**1.369*** ***0.002***		**1.689*** ***0.000***		**1.550*** ***0.000***	
Prices	**1.947*** ***0.000***		**0.105** ***0.812***		**0.642** ***0.111***		**0.846** ***0.083***		**0.861** ***0.047***	
Char1*MP	**0.231** ***0.050***		**-5.105*** ***0.003***		**4.293** ***0.167***		**0.416*** ***0.004***		**0.408*** ***0.003***	
Char2*MP							**-1.392** ***0.430***		**-1.686** ***0.398***	
Char3*MP							**3.875** ***0.248***			
Char1*Char2*MP									**0.422** ***0.605***	
p-val Sargan	0.069		0.631		0.753		0.558		0.320	
p-val MA1, MA2	0.000	0.453	0.000	0.325	0.000	0.948	0.000	0.860	0.000	0.897
No of banks, obs.	3029	9662	2637	7963	2990	9507	2474	7370	2579	7766

*/**/*** denotes significance at the 10%/5%/1% level. Numbers in italics are p-values.

The main results are summarised in Table 5. Each column presents the results from one of the specifications – first models with one of the bank characteristics each, then one model with all three characteristics simultaneously, and last a specification where size and liquidity enter, both in single and double interactions.

We report the estimated long-run coefficients only. These are calculated as the sum of the coefficients of the various lags of the indicated variable, divided by one minus the sum of the coefficients on the lagged endogenous variable.

The model with size as the only bank characteristic performs best – size dominates all other characteristics, both in the specification with all three of them and in the one with double interactions. The average bank reduces lending after a monetary tightening by 1.3% following a 100 basis point increase in interest rates. Smaller banks, however, reduce their lending by more than large banks do.

Whereas capitalisation does not enter the models significantly, liquidity at first sight seems to be a good discriminatory device to trace the differential loan response of banks, too, given the highly

significant interaction term; but this coefficient has an unexpected negative sign. Moreover, this model is not robust to replacing the macro variables by time dummies.[29]

5. Evidence from Eurosystem datasets

In this section, we employ the Eurosystem datasets for national models for France, Germany, Italy and Spain, the four largest countries of the euro area. Due to confidentiality restrictions, it was not possible to pool the data, so that we are limited to a country by country analysis. The results are presented in Tables 6a-6d.[30]

The long-run effects of monetary policy on loans of an average bank are negative in all countries, indicating that restrictive monetary policy reduces bank lending in the long run. As we had conjectured in section 2, size does not emerge as a useful indicator for the distributional effects of monetary policy. In the specifications with size only, we find it to be insignificant in France, Germany and Italy, but with a negative coefficient in Spain.[31] Hence, the role of size as an indicator of informational asymmetries appears irrelevant in all countries. This is consistent with the conjectures raised in section 2.2, that several features of the banking markets in the euro area decrease the degree of informational frictions, and as such the usefulness of size as an indicator for the bank lending channel. The same applies to capitalisation, which does not play an important role in distinguishing banks' reactions. Its interaction with the monetary policy indicator is insignificant in all countries, both when used by itself as well as in the complete specification with all three criteria.

This could, however, also be caused by several reasons not specified in section 2.2. For example, the measure of capitalisation we use could be too crude to capture the riskiness of a bank, and is thus not indicative for the informational asymmetry problems. This concern arises because our capitalisation variable is derived from balance sheets without considering the structure of the loan portfolio or its

[29] This result might be driven by the fact that a liquidity measure is provided only for relatively few banks in some countries covered in BankScope. For example, only one third of observations are available in the Italian case.
[30] A description of the sample periods, the outlier detection methods and the exact specifications can be found in the appendix.
[31] For Italy, this is consistent with previous work analysing lending rates, e.g., Angeloni et al. (1995) and Cottarelli et al. (1995).

risk characteristics. It might therefore not be capturing a risk-based measure that is compatible with the Basle capital requirement.[32]

An alternative explanation could be that all banks are operating at levels of capitalisation sufficiently high to prevent market participants' doubts on the soundness of a bank. As mentioned above, in such a case capitalisation does not determine a bank's reaction to monetary policy any longer. Loupias et al. (this volume) have estimated a model with a double interaction of size and capitalisation with monetary policy. This is a way to check whether, after a monetary policy tightening, small and under-capitalised banks restrict their loan supply by more than large banks do. The paper does not find any significant coefficient, thus confirming that capitalisation does not affect bank loan supply in a significant way in France. Moreover, when comparing the level of capitalisation of European banks with those in the US (see Table 3), it can easily be seen that (with the notable exception of Germany where, as stated in section 2, the asset structure of banks is less risky), banks in Europe are much better capitalised.

Table 6a: Long-run coefficients, national datasets: France

	Models estimated with the following bank characteristic variables									
	Size		Liquidity		Capitalisation		Size, Liq. Capitalisation		Size Liquidity	
Monetary policy	**-1.564****		**-2.131*****		**-1.823*****		**-1.969*****		**-2.221*****	
	0.765		*0.736*		*0.701*		*0.566*		*0.697*	
Real GDP	**3.239*****		**3.999*****		**3.788*****		**2.975*****		**2.523*****	
	0.578		*0.493*		*0.503*		*0.374*		*0.470*	
Prices	**-2.850*****		**-4.173*****		**-3.701*****		**-3.678*****		**-3.147*****	
	0.742		*0.692*		*0.689*		*0.512*		*0.644*	
Char1*MP	**-0.458**		**4.030**		**3.547**		**-0.063**		**-0.184**	
	0.553		*4.734*		*15.236*		*0.218*		*0.235*	
Char2*MP							**8.106*****		**7.070*****	
							1.931		*2.010*	
Char3*MP							**2.304**			
							7.007			
Char1*Real GDP	**-0.262**		**-1.255**		**-16.48**					
	0.785		*7.508*		*25.648*					
Char1*Prices	**-0.070**		**-1.637**		**5.303**					
	0.714		*6.143*		*24.351*					
Char1*Char2*MP									**0.390**	
									1.228	
p-val Sargan	0.142		0.233		0.111		0.231		0.075	
p-val MA1, MA2	0.014	0.451	0.006	0.326	0.017	0.542	0.000	0.387	0.000	0.450
No of banks, obs.	312	5327	312	5327	312	5327	312	5327	312	5327

*/**/*** denotes significance at the 10%/5%/1% level. Numbers in italics are standard errors.

[32] The BIS ratio measure cannot be obtained from the available datasets for all the four largest countries over the same sample period. Using a similar framework over the period 1992-2001, Gambacorta and Mistrulli (2002) find that capital holdings in excess of the minimum required by prudential regulation standards enable Italian banks to contain the effect of a deposit drop on lending; well-capitalised banks can better shield their lending from monetary policy shocks as they have, consistently with the "bank lending channel" hypothesis, an easier access to non-deposit funds.

Table 6b: Long-run coefficients, national datasets: Germany

	Models estimated with the following bank characteristic variables									
	Size		Liquidity		Capitalisation		Size, Liq. Capitalisation		Size Liquidity	
Monetary policy	**-1.662*** ***0.737***		**-0.857*** ***0.238***		**-0.695*** ***0.239***		**-0.526*** ***0.202***		**-0.679*** ***0.205***	
Real GDP	**0.071** ***0.296***		**0.119** ***0.163***		**-0.034** ***0.167***		**0.079** ***0.135***		**0.008** ***0.138***	
Prices	**3.120*** ***0.803***		**2.039*** ***0.347***		**1.965*** ***0.350***		**1.662*** ***0.280***		**1.842*** ***0.286***	
Char1*MP	**-0.117** ***0.127***		**3.547*** ***1.100***		**1.935** ***6.300***		**-0.044** ***0.036***		**0.003** ***0.045***	
Char2*MP							**3.936*** ***0.883***		**4.689*** ***0.885***	
Char3*MP							**-0.469** ***5.340***			
Char1*Real GDP	**0.167** ***0.167***		**-2.960*** ***1.398***		**1.533** ***10.293***					
Char1*Prices	**-0.561*** ***0.252***		**2.872** ***2.405***		**9.328** ***14.320***					
Char1*Char2*MP									**-1.082*** ***0.551***	
p-val Sargan	1.000		1.000		1.000		1.000		1.000	
p-val MA1, MA2	0.000	0.184	0.000	0.421	0.000	0.276	0.000	0.351	0.000	0.344
No of banks, obs.	2689	48402	2693	48474	2708	48744	2651	47718	2659	47862

*/**/*** denotes significance at the 10%/5%/1% level. Numbers in italics are standard errors.

Table 6c: Long-run coefficients, national datasets: Italy

	Models estimated with the following bank characteristic variables									
	Size		Liquidity		Capitalisation		Size, Liq. Capitalisation		Size Liquidity	
Monetary policy	**-0.703*** ***0.103***		**-0.529*** ***0.102***		**-0.695*** ***0.102***		**-0.825*** ***0.127***		**-0.675*** ***0.113***	
Real GDP	**1.363*** ***0.175***		**1.879*** ***0.162***		**1.419*** ***0.173***		**1.389*** ***0.213***		**1.084*** ***0.175***	
Prices	**0.230** ***0.302***		**-1.931*** ***0.307***		**0.101** ***0.308***		**-0.622** ***0.386***		**-0.264** ***0.338***	
Char1*MP	**-0.009** ***0.025***		**2.593**** ***1.284***		**4.226** ***1.499***		**0.079** ***0.054***		**-0.046** ***0.073***	
Char2*MP							**2.278*** ***0.831***		**2.058*** ***0.574***	
Char3*MP							**3.616** ***3.099***			
Char1*Char2*MP									**-1.238** ***0.845***	
p-val Sargan	0.196		0.079		0.186		0.077		0.062	
p-val MA1, MA2	0.000	0.110	0.000	0.246	0.000	0.116	0.000	0.128	0.000	0.156
No of banks, obs.	587	25241	587	25241	587	25241	587	25241	587	25241

*/**/*** denotes significance at the 10%/5%/1% level. Numbers in italics are standard errors.

Table 6d: Long-run coefficients, national datasets: Spain

	Models estimated with the following bank characteristic variables									
	Size		Liquidity		Capitalisation		Size, Liq. Capitalisation		Size Liquidity	
Monetary policy	**-0.993****		**-1.862*****		**-1.314*****		**-1.510*****		**-1.593*****	
	0.453		*0.441*		*0.487*		*0.433*		*0.422*	
Real GDP	**2.022*****		**1.689*****		**1.878*****		**1.695*****		**1.818*****	
	0.359		*0.347*		*0.357*		*0.326*		*0.327*	
Prices	**-1.092*****		**-1.979*****		**-0.985*****		**-2.074*****		**-2.066*****	
	0.315		*0.465*		*0.368*		*0.387*		*0.414*	
Char1*MP	**-0.253****		**6.061*****		**0.365**		**-0.214***		**-0.153**	
	0.114		*2.072*		*8.393*		*0.128*		*0.109*	
Char2*MP							**3.986****		**5.277*****	
							1.905		*1.879*	
Char3*MP							**-11.304**			
							9.112			
Char1*Char2*MP									**2.010***	
									1.161	
p-val Sargan	0.852		0.838		0.888		1.000		1.000	
p-val MA1, MA2	0.374	0.952	0.264	0.770	0.130	0.967	0.458	0.913	0.499	0.880
No of banks, obs.	210	4012	210	4012	210	4012	210	4012	210	4012

*/**/*** denotes significance at the 10%/5%/1% level. Numbers in italics are standard errors.

The third bank characteristic, the degree of liquidity, turns out to be a highly significant indicator for distributional effects across banks in Germany, Italy and Spain. In the specifications with all three bank characteristics, it dominates the other characteristics for those countries, and also emerges as the significant and dominant characteristic also for France.

Looking at the more detailed analysis in the subsequent chapters, the results for Spain (Hernando and Martínez-Pagés, this volume) appear to be less robust than in the case of the other countries. Indeed, the liquidity effect disappears when looking at the response of different types of loans and at the response of loans to an exogenous shock to deposits. Therefore, in the case of Spain, the distributional effects across banks with different degrees of liquidity do not appear to be related to loan supply effects.

On the other hand, the results for the other countries are very robust. For Germany, it turns out that the result is driven by the short-term interbank deposits that many small banks with a network affiliation hold with their head institutions (Worms, this volume). For Italy, the analysis is extended to the role of deposits and liquidity. It is shown that deposits drop sharpest for those banks that have fewer incentives to shield their deposits, like, e.g., small banks with a deposit to loan ratio larger than one. The analysis supports the idea that banks use their liquidity to maintain their loan portfolio

(Gambacorta, this volume). For France, too, this conclusion appears to be robust, both to different measures of the liquidity ratio and to the specific treatment of mutual and co-operative banks networks (Loupias et al., this volume).

The positive coefficient on the interaction of the monetary policy indicator with the degree of liquidity in France, Germany and Italy means that less liquid banks show a stronger reduction in lending after a monetary tightening than relatively more liquid banks do. The underlying reasoning is that banks with more liquid balance sheets can use their liquid assets to maintain their loan portfolio and as such are affected less heavily by a monetary policy tightening. The robustness of these results can be checked through the last column of Table 6 that includes the double interaction between size and liquidity. The double interaction has the expected negative sign only for Germany and Italy, but is insignificant in the case of Italy and only weakly significant for the case of Germany. Hence, there is no strong evidence that the effect of liquidity is stronger for smaller banks; the conclusion that size is not the dominant characteristic that distinguishes banks' responses to monetary policy does therefore obtain further support.

In order to see whether an analysis with BankScope data leads to results that are consistent with those obtained with the more comprehensive databases used in this section, we have performed a set of country by country regressions with those data.[33] The results do generally not coincide. For most of the estimated BankScope models, a tightening of monetary policy leads to the expected decrease of loans. However, with the exception of Germany, the results lack significance and robustness. The most extreme case is France, where not a single coefficient turns out to be significant and several coefficients even change sign across different model specifications. Also in Spain and Italy, the coefficients on the macro variables depend on the exact model specification, and frequently change sign.

The lack of robustness and of significance of the estimates and especially the few cases of results that are consistent with those reported in this section cast some doubt on the adequacy of BankScope to capture the *distributional* effects of monetary policy across banks. The Eurosystem datasets, through

their much larger variation both across banks and time, and because they do not suffer from BankScope's composition bias towards large banks, seem, in this respect, to be superior to the BankScope data. However, when estimating the *macroeconomic* importance of the bank loan response, this bias is less important: since the coverage of large banks is relatively good, both the estimates with BankScope and those with the complete population of banks arrive at quantitatively similar conclusions.[34]

The results presented in the chapters devoted to the other countries are also compatible with the conjectures of section 2 that national banking structures matter for the reaction of banks to monetary policy. De Haan (this volume) finds for the Netherlands that interest rate increases reduce unsecured bank lending, and provides evidence that size, degree of liquidity and capitalisation all matter for a bank's reaction in this market segment. Another split according to bank types shows that wholesale banks react more strongly to monetary policy than retail banks. Looking at Table 2, these findings are compatible with the weak role of the government in the Netherlands, such that banks cannot rely on government guarantees to attract financing. There are also no important bank networks in the Netherlands. Thus, the Netherlands appears to be a case where the usual informational asymmetry problems might play a bigger role than in many other countries of the euro area. Interestingly, the split according to retail and wholesale banks can be reconciled with the fact that relationship lending is important in this country.

The paper on Portugal (Farinha and Robalo Marques, this volume) finds similarly that monetary policy tightenings reduce bank lending. Here, the capitalisation of banks plays an important role for the way banks respond to interest rate changes, whereas size and liquidity do not. They report furthermore, that the models are subject to a structural break when Portuguese banks had the possibility to access funds from foreign EU banks. Interestingly, during this period the growth rate of loans increased relative to the growth of deposits, suggesting that this improved availability of funds matters for the growth rate of lending.

[33] The detailed regression results can be found in the working paper version, Ehrmann et al. (2001).
[34] For details see the working paper version Ehrmann et al. (2001).

Brissimis et al. (this volume) investigate the Greek case, and conclude that both the size and the liquidity of a bank determine distributional effects. Despite a strong government involvement, proxies for informational asymmetries seem to be important in Greece. This is consistent with the absence of bank networks, so that each bank's own creditworthiness is relevant.

Kaufmann (this volume) looks at Austrian data, and detects distributional effects across banks only for subperiods of the sample. When they are found, it is the degree of liquidity that matters rather than size. This is in line with our results for Germany, and consistent with the similarity of the two banking systems as revealed in Table 2. Interestingly, monetary policy is effective only in times of economic slowdowns, as opposed to times of high growth.

Looking at the case of Finland, an extremely concentrated market (see table 2 in the statistical appendix)), Topi and Vilmunen (this volume) find that bank lending contracts after interest rate increases. Monetary policy does seem to affect all banks alike, however. Only liquidity is marginally significant in its interaction with monetary policy. This is in line with our conjecture of section 2, that the state guarantees in the aftermath of the banking crisis, which were maintained in parts of the sample period they study, change the lending behaviour of banks. The authors provide further evidence in this direction: a dummy variable for the state guarantees enters significantly in their regressions, indicating that these measures themselves might have contributed to the increase in the growth rate of loans.

6. Conclusions

This chapter has investigated the role of banks in monetary policy transmission in the euro area. It has been shown that bank lending contracts significantly after a monetary tightening both on the euro area aggregate as well as on the country level.

Using micro data on banks, it is found that factors like the size or the degree of capitalisation of a bank are generally not important for the way a bank adjusts its lending to interest rate changes. This is opposed to findings for the US, where small and less capitalised banks show a disproportionately

strong response to monetary policy. We explain the absence of size and capitalisation effects with a lower degree of informational asymmetries: the role of the government, banking networks, as well as the low number of bank failures in the countries of the euro area contribute to a reduction in informational frictions. Proxies for informational asymmetry are therefore less informative in the European case than they are in the US.

Whereas size and capitalisation do not shape the response of a bank to monetary policy, liquidity does. Banks with a relatively low share of liquid assets reduce loan supply by more than more liquid banks do on average. Obviously, they draw on their liquid assets to maintain their loan portfolio. A reason for doing this could be the existence of relationship lending in several euro area countries, where bank customers are shielded from monetary policy effects to some extent.

We have worked with two different types of datasets. The publicly available database BankScope, used in prior studies, suffers from a composition bias. Since small banks are not covered adequately, the *microeconomic* distributional effects are estimated on a biased sample of banks. This might explain the contradictory findings in the previous literature as well as in some of the analysis in this study. When estimating the *macroeconomic* importance of the bank loan response, this bias is less important, however: since the coverage of large banks is relatively good, both the estimates with BankScope and those with the complete population of banks arrive at quantitatively similar conclusions.

Several issues deserve further study at this point. The estimated models assume a linear relationship between bank characteristics and the effects of monetary policy. It would be useful to assess the robustness of our findings with respect to this assumption. Furthermore, as more data become available, it will be interesting to update the analysis with more observations after the formation of EMU. Finally, the macroeconomic importance of the bank lending channel merits further study, with the aim of gaining a sense of its contribution to the overall effects of monetary policy.

APPENDIX: Databases and estimation methods

A) The samples

1) Data sources

Eurosystem datasets for France, Italy and Spain: respective national banks supervisory reports. Eurosystem dataset for Germany: Bundesbank banks' balance sheets statistics. BankScope: Fitch Ibca. The Eurosystem datasets are on a quarterly basis while BankScope provides annual data. BankScope data are consolidated balance sheets when available (84% of all banks in the sample), and unconsolidated balance sheets otherwise (16%).

2) Merger treatment

For all countries, mergers have been treated by a backward aggregation of the entities involved in the merger. Other kinds of treatments (like ignoring the merger, or eliminating the merging banks from the sample following the merger, and considering the merged bank as a new bank) have shown to have little impact on the econometric results. No merger treatment with the BankScope data.

3) Criteria defining banks and sample initial coverage

Credit specialised financial institutions are excluded from the sample in France, Italy and Spain. For Spain, also branches of foreign banks are excluded from the sample. For France, each mutual bank network (except for one of them) is considered as an aggregate bank. For France, banks with less than 10 % deposits (which are mostly foreign banks) are discarded from the sample, as well as banks with less than 1 % loans. Before the necessary trimming of the samples, but after the merger treatment, the coverage is as follows:

Table A1: Initial sample coverage

	Period	Number of banks
BankScope	1992 – 1999	4425
France	1993:Q1 to 2000:Q3	496
Germany	1993:Q1 to 1998:Q4	3281
Italy	1986:Q4 to 1998:Q4	785
Spain	1991:Q1 to 1998:Q4	264

4) Trimming of the sample/outlier elimination

For Italy and Spain, only banks with both non-zero loans and deposits are kept in the sample. Given the focus on loans in this paper, this positivity condition only applies to loans for Germany and the BankScope data.

Table A2: Criteria defining outliers

	1st difference in logs is, for each period, below (above)	1st difference in the ratio of liquidity and capitalisation over total assets is, for each period, below (above)
BankScope	4th (96th) percentile for loans, deposits and total assets	4th (96th) percentile
France	2nd (98th) percentile for loans, deposits and total assets	1st (99th) percentile
Germany	2nd (98th) percentile for loans and 1st (99th) percentile for total assets	1st (99th) percentile of the ratios level
Italy	1st (99th) percentile for loans	
Spain	2nd (98th) percentile for total assets and 3rd (99th) percentile for loans	2nd (98th) percentile or 3rd (99th) percentile of the ratios level

NB: For Germany and Italy, banks with one outlier or more are completely removed from the sample. Moreover, for Germany and BankScope, different samples have been built for size, liquidity and capitalisation.

5) Number of consecutive lags required:

Due to the model specification as well as the estimation methods requiring numerous lags, we required a minimal number of consecutive observations of the first difference of the log of loans (and correspondingly for the other variables in the model): 2 lags for BankScope, 5 for France, 4 for Germany, 12 for Italy, and 9 for Spain.

The final composition of the samples used for econometric estimations is thus:

Table A3: Sample coverage

	Estimation period	Number of banks	Number of observations
BankScope	1993 – 1999	Around 3000	Around 9700
France	1994:Q3 to 2000:Q3	312	5327
Germany	1994:Q1 to 1998:Q4	Around 2700	Around 48000
Italy	1988:Q1 to 1998:Q4	587	28763
Spain	1991:Q1 to 1998:Q4	210	4012

B) Variable definitions

1) Loans

For all countries, loans are those to the non-financial private sector. For statistical reasons, bad loans are excluded in Italy and France.

2) Liquidity

The liquidity ratio is computed by dividing liquid by total assets. The precise definition of liquidity changes a bit from country to country, due to differences in the available information: In France, it is constructed as cash and interbank deposits. In Germany, it includes cash, short-term interbank deposits and government securities. In Italy, it comprises cash, interbank deposits and securities and repurchase agreements at book value. In Spain, liquid assets include cash, interbank lending and government securities. For BankScope, it generally includes cash, short-term interbank deposits and government securities. For all countries, the ratio liquidity/total assets is centred with respect to its overall sample mean.

3) Capitalisation

For all countries, capitalisation is defined as the sum of capital and reserves divided by total assets. For BankScope, it is defined as the ratio of capital to total assets. Also capitalisation has been centred with respect to its overall sample mean.

4) Size

For all countries and BankScope, size is defined as the log of total assets. This variable is centred with respect to each period's mean.

5) Monetary policy indicator

In each country but Italy, the monetary policy indicator is the 3 months interest rate. In Italy, it is the interest rate on repurchase agreements between the central bank and credit institutions.

C) Model specification and estimation methods

For France, the model is directly estimated with the contemporaneous value and four lags of the macro variables and interaction terms. Instruments are second and third lags of the 1st difference of log of loans, second lags of the characteristics included in the equation: size and/or liquidity and/or capitalisation, and the monetary policy indicator which is assumed exogenous. All these instruments are multiplied by time dummies "à la Arellano-Bond".

For Germany, all bank specific variables have been seasonally adjusted on a bank individual basis (multiplicative seasonal adjustment with seasonal factors based on a moving average). The first difference operator has been applied to the model before estimation. The model has 4 lags. Instruments are the macro variables themselves, lags t-2 to t-5 of the 1st difference of the log of loans, and lags 2 to 5 of all other (interaction) variables in the model. No contemporaneous variables enter the models. Seasonal dummies are included.

For Italy, the model is directly estimated. Instruments are lags of the 1st difference of log of loans and of the characteristics included in the equation. Inflation, GDP growth and the monetary policy indicator are considered as exogenous variables. The model has 4 lags, and no contemporaneous variables.

For Spain, the model is estimated in 4th differences of the 1st differences. This eliminates the seasonal individual effects existing in the model in 1st differences. Estimation is done in a model with

contemporaneous values and 4 lags, with the GMM method proposed by Arellano and Bond, using as instruments lags 5 through 8 of the 1st difference of loans and bank characteristics. Macroeconomic variables are instrumented by themselves and their interactions with bank characteristics are instrumented by the same macro variable interacted with the characteristic at time t-5.

For BankScope, the model is estimated with one lag of the endogenous variable, and either the contemporaneous values or one lag (if contemporaneous values are not significant) for the other explanatory variables. Estimation is performed in first differences. Instruments are the second and consecutive lags of the 1st difference of log of loans, the bank characteristics and the interaction terms.

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Table 2: The structure of national financial systems

	AT	BE	FI	FR	DE	GR	IE	IT	LU	NL	PT	ES
Importance of banks for firms' financing[1]	Very important	Important	Important	Important	Very important	Very important	Important	Very important	Important	Important	Important	Very important
Fraction of short-term loans[2]	Average	Average	Low	Low	Low	High	Low	High	N.A.	Low	Low	High
Fraction of loans at variable interest rates[3]	Low	High	High	Average	Low	High	High	High	N.A.	Low	High	High
Relationship lending	Very important (house banks)	Not very important (many SMEs, family-owned, less prone to traditional relationship lending)	Important, but declining	Not important except for small firms	Very important (house banks)	Not important any more	Very important for commercial lending	Very important	N.A.	Important	Not important (firms often initially borrow from a single bank, but then switch to borrowing from several banks[7])	Not important
Market concentration[4]	Medium	High	High	Medium	Low	High	High	Low	Low	High	High	Medium
State influence[5]	Strong (public guarantees for most savings banks)	Medium	Strong (blanket public guarantee in the aftermath of the banking crisis)	Medium	Strong (public guarantees in the savings banks' sector)	Strong	Weak	Strong, but declining	Weak	Weak	Medium	Weak (no public guarantees of savings banks)
Deposit insurance[6]	Average (approx. 15,000 euros in 1990, 20,000 in 1998)	Average (approx. 12,500 euros per depositor until 1998, 15,000 in 1999, 20,000 euros since)	High initially, average now (practically complete in 1990, approx. 25,000 euros in 1998)	High (76,000 euros since 1999; at a similar level, but not unified across banks before)	Effectively complete	Average (20,000 euros, complete for deposits with the Postal Savings bank)	Average (20,000 euros)	High (103,000 euros; until 1996 also 75% coverage between 103,000 and 516,000 euros)	Average (approx. 12,500 euros per account)	Average (approx. 18,000 euros in 1990, 20,000 since 1995)	Average (15,000 euros fully insured, second 15,000 euros 75%, third 15,000 euros 50%)	Modest (9,000 euros per depositor in 1990, 15,000 euros in 1998, 20,000 euros now)

Table 2 (ctd): The structure of national financial systems

	AT	BE	FI	FR	DE	GR	IE	IT	LU	NL	PT	ES
Bank networks of independent banks	Very important (most banks are in a network, with very strong links to the head institution)	Not important (Credit Agricole consists of two member banks, Credit Professionnel has weak links)	Very important (the vast majority of banks is organised in groups with very close ties between banks)	Important	Very important (most banks are in a network, with very strong links to the head institution)	Not important (no networks)	Very important (for retail banks)	Very important (most banks are in a network, with links to the head institution)	Not important (network of mutual agricultural credit banks supplies data on the aggregate level)	Not important (bank groups like, e.g., ABN Amro, Rabo or ING have consolidated balance sheets, and can thus be regarded as one bank)	Not important (network of mutual agricultural credit banks supplies data on the aggregate level)	Not important (they exist but weak links between member banks and head institution)

1 See Ehrmann et al. (2001), table 2. The ranking is based on 1997 data. Countries ranked "very important" are those that comply with all of the following four conditions: debt securities to GDP <4%, debt securities to bank loans <10%, stock market capitalisation to GDP <60% and funds raised through securities issuance <50%. Countries that fail to comply with at least one of those conditions are ranked "important". No country was ranked as "less important", which would apply for example for the US.

2 Source: Borio, 1996. "low": fraction of short term loans <20%; "high": >35%

3 Source: Borio, 1996. "low": fraction of loans at variable interest rates <40%; "high": >50%. Source in case of Germany: Bundesbank internal paper, based on survey data for 1997.

4 Concentration is ranked low when Herfindahl index and the market share of the five largest banks (Source: Corvoisier and Gropp, 2001) are in the range of 30 or below. It is ranked high when the Herfindahl index stands at around 100, and the market share of the five largest banks does not give conflicting evidence. It is ranked medium for intermediate cases.

5 Countries are ranked according to the percentage of the assets of the top 10 banks controlled by the government (Source: La Porta et al., 2002): "strong" (>30%), "medium" (between 10% and 30%) and "weak" (<10%). This is checked to be consistent with other available information on public guarantees or ownership. The evaluation refers roughly to the first half of the 1990s. State influence declined steadily during the sample period in almost all countries. Therefore, the present ranking is based on a rough average for the sample period considered in the estimates and does not necessarily reflect the ranking at the end of the sample period.

6 Source: Eurosystem. "Average" for values around 20,000 euros.

7 See Farinha and Santos, 2000.

Table 3: Data description with respect to relative size* – December 1998

	France			Germany			Italy			Spain			US (1993)		
	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total
Number of banks	249	16	332	2405	160	3207	578	36	759	182	12	243	8404	561	11206
Mean assets (billion of euros)	0.770	92.33	6.398	0.161	24.49	1.591	0.138	28.90	1.863	0.498	43.67	3.612	0.045	4.82	0.32
Share of total assets	0.090	0.695	1	0.076	0.768	1	0.057	0.736	1	0.103	0.597	1	0.105	0.755	1
Mean deposits	0.492	44.89	3.393	0.123	7.311	0.628	0.070	9.705	0.646	0.292	18.70	1.773	0.039	3.44	0.24
Market share of total deposits	0.109	0.638	1	0.147	0.581	1	0.083	0.713	1	0.123	0.521	1	0.12	0.72	1
Mean loans	0.343	37.91	2.576	0.095	7.673	0.588	0.055	12.31	0.762	0.246	17.65	1560	0.024	2.84	0.19
Market share of total loans	0.100	0.709	1	0.121	0.651	1	0.055	0.766	1	0.118	0.559	1	0.10	0.77	1
Liquid assets/total assets	0.416	0.294	0.401	0.337	0.333	0.342	0.421	0.257	0.399	0.424	0.337	0.407	0.44	0.36	0.37
Loans/total assets	0.411	0.358	0.403	0.580	0.394	0.563	0.387	0.405	0.388	0.450	0.466	0.459	0.53	0.59	0.58
Deposits/total assets	0.581	0.438	0.585	0.781	0.423	0.747	0.550	0.346	0.508	0.625	0.490	0.614	0.88	0.71	0.75
Capital and reserves/total assets	0.106	0.037	0.089	0.059	0.041	0.055	0.122	0.068	0.112	0.154	0.049	0.132	0.10	0.07	0.08

* Source: Eurosystem data, Kashyap and Stein (2000). The datasets are corrected for corrupt observations, like banks with total assets smaller or equal to zero. A "small" bank is situated below the third quartile of the distribution of total assets, while a "large" bank is situated above the 95th percentile. Data for the US refer to 1993 and are expressed in billion US dollars. Liquid assets for the US are calculated as cash, securities and federal funds lent. Note that the table does not report numbers for medium sized banks, such that the total is not equal to the sum of the reported figures for small and large banks.

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