

Financial Supervision in an Integrating Europe: Measuring Cross-Border Externalities¹

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Abstract

Against the backdrop of an integrating Europe, the debate on the need for European arrangements for financial supervision and stability is intensifying in the literature as well as in the policy arena. While there is a consensus that the need for European arrangements ultimately depends on the intensity of cross-border spill-over effects or externalities within the EU, there has been no attempt to measure these cross-border externalities. The aim of this paper is to fill this gap.

A new data-set on cross-border penetration (as a proxy for cross-border externalities) of large banking groups is collected. It is found that cross-border penetration within the EU is currently limited: only seven banks out of the sample of 30 large EU banking groups are considered to be 'European' banks that have the potential to pose significant cross-border externalities. However, aggregate data show a gradual, though statistically significant, increase of cross-border penetration in the EU. Policy-makers may thus in the (near) future face the challenge of designing European structures for financial supervision and stability.

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1. Introduction

After the successful establishment of the European System of Central Banks, the debate on the need of a 'European System of Financial Supervisors' is intensifying. The key question is whether it would be desirable to move from the present national structure to a European structure for financial supervision and stability and, if so, when?

Ministers of Finance in the Ecofin Council have recently reviewed the arrangements for financial regulation, supervision and stability in the EU. They concluded that further co-ordination and convergence between national financial supervisors is necessary and sufficient at this moment in time (EFC, 2002). The possible need of moving supervision to the European level has also been extensively debated in the literature (e.g. Prati and Schinasi, 1999; Vives, 2001). Against a backdrop of an integrating Europe, it is generally argued that it is no longer possible to manage financial stability at the national level. The failure of a pan-European bank may give rise to cross-border spill-over effects or externalities. While there is a consensus that the need for European arrangements ultimately depends on the intensity of cross-border externalities, there has been no attempt so far to measure these cross-border externalities. The aim of this paper is to fill this gap.

Using the model of Freixas (2003), it is found that there is an undersupply of bailouts in a multi-country setting. Liquidity support for individual institutions in difficulties is under current arrangements given by the national central banks. As national authorities may naturally focus their efforts on solving problems in their national financial system, they may fail to take into account cross-border externalities caused by banks under their jurisdiction. The severity of these cross-border externalities is related to the level of cross-border business of banks. We present empirical evidence on the cross-border business of banks in the EU. While aggregate data on cross-border penetration are generally available, the existing data on the geographical segmentation of individual banks merely focus on a specific aspect of international banking activities.

The empirical investigation in this paper is based on a new dataset, comprising a cross-section of the top 30 banks in the EU. Using a broad set of indicators for geographical segmentation, it is found that only seven out of these 30 banks have a significant cross-border presence in the EU. "Significant" is defined as 50 per cent or more of a bank's business is conducted abroad and 25 per cent or more of a bank's business is conducted in other EU countries. These findings are consistent with a recent study by Berger, Dai, Ongena and Smith (2003), who focus on the global reach of banks' cash management services. Out of a sample of over 250 banks, they find that only eight banks have a broad coverage in Europe (defined as a presence in at least nine of the 20 European nations in their data-sample). Of these eight banks, five are head-quartered in the EU and three in the US.

These results suggest that the intensity of cross-border externalities is limited. However, aggregate data show a gradual, though statistically significant, increase of cross-border penetration of banks. While the nationally based arrangements for financial supervision and stability currently suffice, policy-makers may in the (near) future face the challenge of designing European structures.

The paper is organised as follows. In section 2, the institutional setting of the current supervisory system is explained followed by a review of the literature on financial supervision in Europe. Cross-border externalities appear to be undervalued by the nationally based supervisory system. In section 3, we look at two models of bailout: a single country and a multi-country model. Moreover, we develop a measure for cross-border externalities and provide a definition of 'significant' cross-border externalities. Next, we empirically investigate the presence of cross-border externalities in section 4. Empirical evidence on the trend as well as the current level of cross-border externalities is presented. Section 5 discusses the empirical findings. In the final section, we discuss the policy implications and draw conclusions.

2. Institutional framework and literature

2.1 Institutional setting

The Maastricht Treaty has separated monetary policy from financial supervision and stability. While monetary policy is centralised in EMU, responsibility for financial supervision and stability remains in the national domain with a subordinate role for the European System of Central Banks (ESCB). According to article 105(5) of the Treaty: "The ESCB shall contribute to the smooth conduct of policies pursued by the competent authorities relating to prudential supervision of credit institutions and the stability of the financial system". Padoa-Schioppa (2003) rightly notes that there is no precedent in history for the geographical separation of the monetary stability and financial stability functions of a central bank. In a similar vein, Thygesen (2003) argues that it might be difficult to achieve simultaneously a single financial market and stability of the financial system, while preserving nationally based prudential supervision.

The current system of prudential supervision in the EU is based on the principle of home country control combined with minimum standards and mutual recognition. A financial institution is thus authorised and supervised in its home country and can expand throughout the EU (via offering cross-border services to other EU countries or establishing branches in these countries) without additional supervision. The host country has to recognise supervision from the home country authorities. There are two arguments in favour of home country control. Firstly, it promotes the effectiveness of supervision, as the home supervisor is able to make a group-wide assessment of the risk profile and the required capital adequacy of financial institutions (i.e. the concept of consolidated supervision). Secondly, home country control promotes the efficiency of supervision, as financial institutions are not confronted with different supervisors, which could otherwise result in duplication of efforts and a higher regulatory burden.

Home country control is applicable to financial institutions that offer cross-border services to other EU countries or establish branches in these countries. However, financial institutions also operate through subsidiaries (separate legal entities) in other countries for reasons of taxation and limited liability

(Dermine, 2003). These subsidiaries are separately licensed and supervised by the host country authorities (*de jure* control). The scope for control by host countries of these subsidiaries is limited in practice, as key-decisions are often taken at the parent company in the home country and the financial health of the subsidiary is closely linked (via intra-group transactions and/or joint branding) to the well-being of the financial group as a whole. The effective control of large financial groups is primarily in the hands of the consolidated supervisor in the home country (*de facto* control).

While home country control may be useful for the effectiveness and efficiency of prudential supervision, home country authorities are not responsible for financial stability in host countries (Mayes and Vesala, 2000). Increasing integration within the EU can give rise to cross-border spill-over effects or externalities. This means that the failure of a financial institution in one country may cause problems in other countries (Schoemaker, 1997). Therefore, it is questionable whether home country control for supervision and host country responsibility for financial stability are sustainable in an integrating market.

The present organisational structure of crisis management in the EU has been reviewed in the 'Report on Financial Crisis Management' (EFC, 2001). The guiding principles are that the instruments of crisis resolution are available at the national level and that costs are born at the national level. As regards the instruments for crisis management, there is a strong preference for private sector solutions as opposed to public intervention tools (e.g. bailout). In line with the allocation of supervisory responsibilities, the responsibility for the decision-making in crisis situations regarding an individual institution and its branches rests with the home country authorities. However, home country authorities are not responsible for the financial stability of host countries (it is the responsibility of the host country to monitor the stability of its financial system).¹ Moreover, the home country taxpayer may not be prepared to pay for cross-border spill-over effects of a failure. The Report therefore calls for enhanced co-operation between home and host countries for crisis-management.

2.2 *Literature on European financial supervision*

The pros and cons of moving supervision to the European level have been extensively debated in the literature (e.g. Prati and Schinasi, 1999; Favero, Freixas, Persson and Wyplosz, 2000; Vives, 2001; Goodhart, 2003). Prati and Schinasi (1999) argue that national authorities are not well placed for managing a crisis involving pan-European banks. As pan-European banking groups emerge, supervisors with national orientations are less likely to be able to assess bank soundness and systemic risk adequately. Moreover, recent experience demonstrates in their view that the sharing of responsibilities between home and host supervisors has not been uniformly successful among the Group of Ten Countries (witness BCCI, Barings, Diawa and others). They conclude that the ECB should assume a more ambitious role in crisis management.

¹ Host countries are responsible for the externalities of subsidiaries in their country. However, in particular in a crisis situation, the financial health (and the quality of the assets) of a subsidiary may be difficult to separate from that of the financial group (e.g. funds may be channelled to the parent company). Host countries may thus be reluctant to contribute to a possible bailout.

Favero *et al* (2000) also observe that the emergence of trans-national financial institutions raises new questions. They argue that the growing interbank transactions create a web of exposures capable of transmitting financial failures across Europe in domino-like fashion. As a centralised solution is, in their opinion, not politically viable in the near future, they recommend measures to reduce interbank exposures by conducting, for example, secured interbank lending (repo transactions) rather than unsecured interbank lending. Moreover, they recommend fostering market discipline by introducing mechanisms for prompt corrective action and orderly closure of failing financial institutions.

Vives (2001) also raises the question of conflict of interest between home and host authorities in a trans-national crisis. The central bank and the national supervisors will, in principle, take into account the consequences of failure only in their national market, even though the failure of the institution may have adverse consequences in other countries. Next, Vives wonders whether there will be sufficient help in a general crisis. In a liquidity crisis, a shortage of eligible collateral may prevent the unlimited liquidity supply necessary to avoid a crisis. Furthermore, the failure of a large domestic institution may spread abroad through interbank commitments, thereby making the emergency assistance of the relevant national central banks insufficient to contain the crisis. His solution to these problems is centralised supervision that will internalise the external effects between countries.

Taking a broader view of financial supervision and stability, Goodhart (2003) argues that not only the national supervisors and central banks (which can provide immediate liquidity support), but also the national fiscal authorities are involved. Fiscal authorities ultimately bear the potential cost of recapitalisation. The modalities of handling financial crises at the European level can thus be complicated, as up to three parties (assuming independent supervisors) are drawn in from each country involved. While a European supervisory mechanism would be desirable to deal with such financial crises, Goodhart considers the real problem the lack of a European-level fiscal mechanism to pay for a potential bailout.

In sum, there is consensus that the determining factor for moving to European arrangements for financial supervision and stability is the presence of cross-border externalities. But there is no empirical evidence on the intensity of cross-border externalities.

3. Methodology: Modelling cross-border externalities

As discussed in section 2, national authorities (central banks and finance ministries) have a mandate for financial stability in their national financial system. They may be reluctant to provide liquidity or solvency support for solving problems in other EU countries and thus not take into account cross-border externalities caused by financial institutions under their jurisdiction. Current nationally based arrangements may therefore undervalue externalities related to the cross-border business of financial institutions. To formalise this issue, we look at two different models of bailout: a single country and a multi-country model.

3.1 *Single country model of bailout*

Freixas (2003) presents a model of the cost and benefits of a bailout. The model considers the ex post decision whether to bail out or to liquidate a bank in financial distress. The choice to continue or to close the bank is a variable x with values in the space $\{0, 1\}$. Moreover, q denotes the social benefits of a bailout and C its costs. Among other things, the benefits of a bailout may include those derived from avoiding contagion and maintaining financial stability. The costs are net of the costs of bank closure. If the cost of continuing the bank activity is denoted by C_c and the cost of stopping its activities by C_s , then Freixas (2003) only deals with the difference, $C = C_c - C_s$. The case $C < 0$ is obviously possible, but is a case where continuing the bank's operations are cheaper than closing it down, so that continuation is preferred and the bailout decision is simplified. In this situation private sector solutions are possible and the central bank can play the role of 'honest broker'.

According to Freixas (2003), the optimal decision for the authorities will be to maximise:

$$x^* (q - C)$$

so that x^*

$$\begin{cases} x^* = 1 & \text{if } q - C > 0 \\ x^* = 0 & \text{if } q - C < 0 \end{cases}$$

This simple model shows that a bank will be bailed out whenever the total benefits of an intervention are larger than the net costs. In the case of bailout, the authorities will contribute C .

3.2 *Multi-country model of bailout*

In the multi-country model, Freixas (2003) considers the case where the mechanism is set in such a way that the bank is bailed out only if a sufficient contribution from the different countries can be collected. This is an interpretation of improvised co-operation²: the different countries meet to find out how much they are ready to contribute to the bailout, denoted by t . If the total amount they are willing to contribute is larger than the cost, the bank is bailed out.

² The term 'improvised co-operation' has been coined to convey the view of an efficient, although adaptive exchange of information and decision taking. It relies on the idea that financial stability is a goal of every individual country is interested in achieving, so that there are good grounds for co-operation (Freixas, 2003). In our opinion improvised co-operation corresponds to the current situation in the EU.

The decision is therefore:

$$\begin{cases} x^* = 1 & \text{if } \sum_j (t_j - C_j) > 0 \\ x^* = 0 & \text{if } \sum_j (t_j - C_j) < 0 \end{cases}$$

and the j-country objective will be to maximise:

$$x^* (q_j - t_j)$$

Freixas (2003) observes that this game may have a multiplicity of equilibria, and, in particular, the closure equilibrium $t_j = 0, x^* = 0$ will occur provided that for no j we have:

$$q_j - \sum_j C_j > 0$$

that is, no individual country is ready to finance the bailout itself. Obviously, if this equilibrium is selected, the bailout policy is inefficient as banks will almost never be bailed out.

The fact that in most cases the closure equilibrium will occur can be explained by the following equation in which the total social benefits (q , which is equal to $\sum_j q_j$) consists of the social benefits in the home country ($h \cdot q$, which is equal to q_h), the rest of Europe ($e \cdot q$, which is equal to q_e) and the rest of the world ($w \cdot q$, which is equal to q_w):

$$q = h \cdot q + e \cdot q + w \cdot q$$

In this equation h, e and w are indexes for the externalities caused by the possible failure of a financial institution in the home country, the rest of Europe and the rest of the world. The sum of h, e and w is 1. When the total social benefits are close (or equal) to the social benefits of the home country (q close to $h \cdot q$, so h is close to 1), the home country will be willing to bailout the entire financial institution. In all other cases ($h < 1$), the home country will only deal with the social benefits within its territory, while host countries expect the home country to pay for (a part of) the costs in the host country.³ Current nationally based arrangements undervalue externalities related to the cross-border business of financial institutions. As a result insufficient capital will be contributed and the financial institution will not be bailed out. This model pinpoints the public good dimension of collective bailout

³ We assume that the country with the highest social benefits of a bailout is the home country. This assumption is consistent with the post-BCCI Directive that stipulates that banks have to be headquartered in the country where most of their business is conducted.

and shows why improvised co-operation will lead to underprovision of public goods, that is, to an insufficient level of bailouts.

To avoid an insufficient level of bailouts, other -more centralised- coordination mechanisms may be explored. While a global jurisdiction does not exist, the member states of the European Union have the possibility to extend the jurisdiction to the European level in order to incorporate the social benefits in other European countries (e.g. a European supervisor). The need for European arrangements ultimately depends on the intensity of cross-border spill-over effects or externalities within the EU.

3.3 *Measure for cross-border externalities*

This paper focuses on the externalities of European financial institutions in the home country (h) and the rest of Europe (e). We argue that the level of cross-border business of financial institutions is the relevant measure of cross-border externalities.⁴ Our hypothesis is the following: *If the social benefits of bailing out the activities of financial institutions in the rest of Europe are sufficiently high, then a move to European bailout arrangements may be optimal.* It should be noted that a final decision to move to European arrangements depends on an overall assessment. Centralised supervision would also come at a cost due to a loss of flexibility. Within the framework of minimum harmonisation of standards incorporated in the financial services directives, there is some, though limited, flexibility for national supervisors to set standards and to conduct supervision (Dell’Ariccia and Marquez, 2001).

In order to investigate whether the benefits of bailing out the activities of financial institutions in the rest of Europe is sufficiently high, we develop a tool that enables us to make a distinction between the activities in the home market (h), the rest of Europe (e) and the rest of the world (w). We define financial institutions (in particular banks) that have the potential to pose significant cross-border externalities in the European context as follows:

- 1) *50 per cent or more of their business is conducted abroad ($h \leq 0.5$), and*
- 2) *25 per cent or more of their business is conducted in other EU countries ($e \geq 0.25$).*

The first criterion makes a distinction between domestic and international banks. Banks that conduct more than half of their business abroad are regarded to be “international”. In this case of $h < 1$, there is an insufficient level of bailouts. The second criterion identifies European banks among the international ones. International banks that conduct a quarter or more of their business in the rest of Europe are regarded to be “European”. In the case of $e > 0$, a large part of the cross-border externalities (measured by $e + w$) are in the rest of Europe and can be internalised by moving the bailout decision to the European level.

⁴ In the literature on financial stability, there is a distinction between general liquidity crises and institution-specific crises. In the European context, general liquidity crises (such as the stock market crash of 1987; see Bernanke, 1990) can be resolved by the ECB via injecting liquidity into the financial system without a need for detailed supervisory information. Liquidity support for individual institutions in difficulties is given by the national central banks, which need detailed supervisory information (see Goodhart, 1987; Summers, 1991). Individual institutions are thus the relevant group when discussing arrangements for financial supervision in Europe.

4. Empirical evidence: Measuring cross-border externalities

The aim of the empirical investigation of cross-border business of banks is twofold. First, what is the trend in cross-border banking? More particularly, has cross-border business increased since the establishment of EMU in 1999? Secondly, what is the current level of cross-border business of individual banks? How many “European” banking groups have emerged? In order to answer the first question we look at time series regarding the cross-border penetration of banks in Europe. The second question can be answered by examining a cross-section of individual banks in a given year.

4.1 Aggregate data (time series)

So far only aggregate data on cross-border penetration of banks are available (e.g. ECB, 2003). An indicator to measure the degree of cross-border penetration is the geographical segmentation of banking assets. While assets are an often used indicator, there is a drawback as off-balance sheet activities are not included in this indicator.

Table 1 gives an overview of the cross-border penetration of banking assets in the EU for the period from 1997 until 2002. The first column (h) shows the assets of domestic credit institutions as a percentage of total assets of credit institutions of a EU country. The second column (e) shows the assets of branches and subsidiaries of credit institutions from other EEA countries as a percentage of total assets of credit institutions of a EU country.

Table 1 illustrates that the average market share of the branches and subsidiaries established by banks from EEA countries is approximately 13 per cent in 1997 and slowly increases to 16 per cent in 2002. In some countries, the cross-border penetration is substantially larger. In Luxembourg, Sweden and Ireland the market share from EEA countries is sizeable (94 per cent, 59 per cent and 37 per cent in 2002). In particular in Luxembourg and Ireland, the presence of assets from EEA banks is primarily driven by a favourable tax regime. Furthermore, Belgium, Portugal and the United Kingdom have a rather stable market share of over 20 per cent from EEA countries. Austria and Denmark have only recently experienced an increased market share from other EEA countries (21 and 12 per cent) resulting from cross-border mergers of respectively the HypoVereinsbank with Bank Austria and the Nordea Group with Unidanmark.

Results

Table 1 shows that cross-border penetration is relatively low, but gradually increasing. To test whether this increase is statistically significant, a test statistic proposed by Lehmann (1975) is applied. This test indicates that the upward trend is significant at the 5% level (see Annex 1). Nevertheless, the results do not pass our test of significant cross-border business in Europe (50 per cent or more abroad and 25 per cent or more in the rest of Europe). As argued in section 3, data on individual banks rather than banking systems as a whole are needed to test for an insufficient level of bailouts.

Table 1. Cross-border penetration of banks: assets in the EU (in %)

Country	1997		1998		1999		2000		2001		2002	
	<i>h</i>	<i>e</i>	<i>h</i>	<i>e</i>	<i>h</i>	<i>e</i>	<i>h</i>	<i>e</i>	<i>h</i>	<i>e</i>	<i>h</i>	<i>e</i>
Austria	97	3	97	2	97	2	97	2	80	19	79	21
Belgium	70	23	73	21	76	20	76	22	75	23	76	22
Denmark	96	4	94	6	96	4	95	5	89	11	88	12
Finland	92	8	92	8	91	9	93	7	93	7	92	8
France	86	7	88	7	89	6	79	12	81	11	82	11
Germany	96	2	96	3	95	3	96	3	95	3	94	5
Greece	81	11	86	9	86	10	80	14	81	14	79	17
Ireland	46	46	44	47	41	50	40	50	38	49	49	37
Italy	93	6	92	8	93	7	93	6	94	5	96	4
Luxembourg	7	83	6	88	5	88	8	86	6	87	0	94
Netherlands	93	5	93	5	94	4	89	9	89	10	90	9
Portugal	85	13	79	19	85	13	78	21	75	24	75	24
Spain	88	9	88	9	91	7	91	7	91	8	90	9
Sweden	84	15	66	32	69	29	57	41	46	53	39	59
United Kingdom	46	25	45	28	48	26	47	26	48	25	53	23
European Union	77	13	77	14	78	13	75	15	74	16	75	16

Source: ECB (2003), own calculations.

Notes: Assets from the "Home" country (denoted by *h*) and "Rest of Europe" (denoted by *e*) are measured as a percentage of the total assets of a country's banking system. "Home" is defined as domestic institutions; "Rest of Europe" is defined as branches and subsidiaries from EEA countries exclusive of the home country; "Rest of world" is defined as branches and subsidiaries from non-EEA countries (figures not shown). These three categories add up to 100 per cent. The total for the EU is calculated as a weighted average for the 15 EU countries with total assets of credit institutions as weights. The abbreviation n.a. means 'not available'.

From a financial stability perspective, banking system data on the country level are illustrative. It needs to be pointed out that the extent of cross-border penetration is a scale of magnitude greater in the accession countries than in the existing EU countries, except for Luxembourg and Sweden (the share of foreign banks in total assets is 94% and 59% in table 1). For example in countries like the Czech Republic, Hungary, Poland and Slovakia the share of foreign banks in total assets is between 50-80%. Although aggregate data illustrate that cross-border penetration within existing EU countries (with a few exceptions) is relatively low, the problem of managing financial stability in the domestic market will immediately appear once the accession countries have linked up. This falls outside the scope of this paper, but is an issue for further research.

4.2 Data on individual institutions (cross-section)

The next step is to investigate the cross-border business of a cross-section of financial institutions. Financial institutions can be divided in banking groups, financial conglomerates and insurance groups. Because of the relatively high liquidity risks resulting from short term funding and the potential contagion risks through exposures on the interbank market, only the banking activities of a financial institution are in extreme circumstances eligible for liquidity support. Therefore, only the first two

categories of financial institutions (banking groups and financial conglomerates) are included in our sample. Furthermore, banking groups can be divided into small, medium-sized and large banks. In particular small and medium-sized banks tend to be largely domestically oriented. To investigate cross-border penetration in Europe, we focus on the cross-border activities of large banking groups (and financial conglomerates).

In order to measure the degree of 'Europeanisation' of individual banking groups, this paper composes an index which is based on a broad set of indicators: (i) assets, (ii) revenue and (iii) employees. To analyse how these indicators are allocated between the home market and the rest of Europe, we examine the consolidated income statements and balance sheets of the 30 largest banking groups in the EU. The top 30 EU banks used in this paper are based on the top 300 European banks in 2001 published by *The Banker* (2002). *The Banker* ranks these banks according to the strength of their Tier 1 capital as of year-end 2001.

Our source of information is the geographical segmentation of revenue, assets and employees provided in the annual report over 2001 of the banking groups in this study. The indicators are constructed as follows:

- *Assets* This indicator is composed of loans to banks, loans to corporate and retail customers and securities. If the group is involved in insurance activities, insurance investments and other insurance assets are included. It should be noted that off-balance sheet items are not included in this indicator.
- *Revenue* This indicator is based either on gross or net income, depending on which standard is used in the geographical analysis of the annual report. Gross income includes interest income and similar revenues, dividend income, commission income, income on financial transactions and other operating income. If the group is also involved in insurance activities, general insurance premium income and income from long-term assurance business is included. Net income is obtained by deducting all relevant costs. However, a major drawback of net income is that this indicator may be biased, as foreign operations can, in particular in the starting phase, be less profitable than domestic operations. Moreover, net income is more volatile than gross income.
- *Employees* This indicator measures the (average) number of employees in 2001. Due to technological developments like the Internet, the allocation of employees does not necessarily give a correct view on the cross-border activities of a bank. However, the ECB (2003) provides evidence that the use of the Internet as a vehicle to develop cross-border banking remains relatively rare so far. One of the main reasons for this is that the Internet is often used as a complementary channel to the branch network, which is by definition local.

The available data for assets, revenues and employees are provided in annex 2. Table 2 gives an overview of the index for the cross-border business of each of the 30 banking groups. This index is composed of the above mentioned indicators. If data on more than one indicator is available, the index is the average distribution of these indicators. Averages are used, as there does not exist a 'true'

indicator for the degree of cross-border business of a banking groups.⁵ Moreover, the more indicators are used, the more precise our assessment of the ‘Europeanisation’ of banking groups will be.

Table 2. Index for the cross-border business of top 30 EU banking groups in 2001

Banking group	<i>h</i> (in %)	<i>e</i> (in %)	Capital strength (in €bn)
HSBC Holdings	33	8	31.2
Crédit Agricole Groupe	81	10	25.7
Deutsche Bank	39	30	19.5
Royal Bank of Scotland	74	7	19.5
BNP Paribas	46	24	19.1
HypoVereinsbank	50	29	17.0
HBOS	93	4	16.1
Barclays	71	7	16.0
ABN Amro	33	34	15.1
Santander Central Hispano	38	7	13.6
ING Group	27	23	
<i>Banking activities</i>	43	45	13.4
<i>Insurance activities</i>	19	7	
Rabobank	76	8	13.3
Société Générale	64	13	12.0
Lloyds TSB Group	84	8	11.8
Banco Bilbao Vizcaya Argentaria	34	10	11.7
IntesaBci	67	14	11.6
Fortis Group	41	43	
<i>Banking activities</i>	52	45	10.2
<i>Insurance activities</i>	24	43	
Crédit Mutuel	n.a.	n.a.	9.7
Commerzbank	72	21	9.6
Abbey National	92	6	9.5
Dresdner Bank	64	22	9.1
Groupe Caisse d’Épargne	n.a.	n.a.	8.9
Nordea Group	18	79	7.8
UniCredito Italiano	68	7	7.6
Dexia	56	40	7.6
Groupe Banques Populaires	n.a.	n.a.	7.5
Westdeutsche Landesbank	49	32	7.4
Bayerische Landesbank	65	28	6.9
KBC Bank	51	36	6.9
Crédit Lyonnais	76	8	6.5

Sources: Annual reports over 2001 and own calculations (see annex 2) for column 1 and 2; The Banker (2002) for column 3.
Notes: “Home” is defined as a bank’s business in its home country (denoted by *h*); “Rest of Europe” is defined as a bank’s business in other European countries (denoted by *e*); “Rest of the world” is defined as a bank’s business outside Europe (figures are not shown). The three categories add up to 100 per cent. Banks are ranked according to “capital strength” (Tier 1 capital as of year-end 2001) as reported by The Banker (2002). The abbreviation n.a. means ‘not available’.

Results

To interpret the data in table 2, we first make a distinction between domestic and international banking groups. As defined in section 3.3, a bank is ‘international’ when 50 per cent or more of its business is conducted abroad ($h \leq 0.5$). Based on this definition the following banking groups are regarded as ‘international’: HSBC Holdings, Deutsche Bank, BNP Paribas, HypoVereinsbank, ABN Amro,

⁵ Although ‘assets’ seems to be the most significant indicator from a financial stability perspective.

Santander Central Hispano, ING Group, Banco Bilbao Vizcaya Argentaria, Fortis Group, Nordea Group and Westdeutsche Landesbank.

In order to identify 'European' banking groups among the international sample, we examine the allocation of activities in the rest of Europe. As defined in section 3.3, a bank is 'European' when in addition 25 per cent or more of its business is conducted in other EU countries ($e \geq 0.25$). Based on this definition the following international banking institutions are regarded as a 'European' institution: Deutsche Bank (30 per cent of its business is conducted in the rest of Europe), HypoVereinsbank (29 per cent), ABN Amro (34 per cent), ING Bank (45 per cent), Fortis Group (43 per cent), Nordea (79 per cent) and Westdeutsche Landesbank (32 per cent).

The fact that ING Bank is seen as 'European' needs some explanation. The (average) distribution of ING Group shows that 23 per cent of its business is allocated in the rest of Europe, as a result of which it does not satisfy our definition of a European institution. However, the annual report (2001) shows that insurance activities make up the largest portion (85 per cent) of the revenues of ING Group. Furthermore, as 74 per cent of insurance revenues are earned outside of Europe (especially in the United States), the overall percentage of revenues earned in 'the rest of Europe' is relatively low (12 per cent, see annex 2). When we solely look at the banking activities of ING (which may be justified by the fact that ING Bank is the number 11 bank in the EU by The Banker, 2002), the annual report (2001) shows that 43 per cent of the revenues is earned in the home country and 45 per cent is earned in the rest of Europe. ING Bank can thus be classified as a European bank.

Table 3 divides the 30 largest EU banking groups into three categories: (i) European banks, (ii) international banks and (iii) domestic banks. The table shows that seven banking groups can be regarded as 'European', another four banking groups are labelled 'international', while the remaining 19 banking groups are 'domestic'. For three French banking groups no data are available. It is clear from their annual report that these three groups are primarily domestically oriented.

Sensitivity analysis

Although the criteria to classify banks into European, international and domestic banks are intuitive, they are somewhat arbitrary as well. We have therefore conducted a sensitivity analysis. To see whether more banks have the potential to pose 'significant' cross-border externalities in the European context, the criteria are lowered by 10 per cent and 20 per cent. An "international" bank is then defined as a bank that conducts more than 45 respectively 40 per cent of its business abroad ($h \leq 0.55; h \leq 0.6$). A "European" bank is an international bank that conducts more than 22.5 respectively 20 per cent of its business in the rest of Europe ($e \geq 22.5; e \geq 0.2$). In the case of a 10 per cent decrease (moving to the 45/22.5 per cent criteria), two more banks (BNP Paribas and KBC Bank) would be regarded as "European". In the case of a 20 per cent decrease (moving further to the 40/25 per cent criteria), one more bank (Dexia) would become "European". Concluding, a substantial relaxation of our criteria (to 40 and 25 per cent) would add three banks to our sample of seven

“European” banks. This would suggest that our results are somewhat, though not excessively, sensitive to the choice of the criteria.

Table 3. Categories of banking groups (top 30 EU banks in 2001)

Category	Banking group	<i>h</i> (in %)	<i>e</i> (in %)
European	1. Nordea Group	18	79
	2. ABN Amro	33	34
	3. Deutsche Bank	39	30
	4. Fortis Group	41	43
	5. ING Bank	43	45
	6. Westdeutsche Landesbank	49	32
	7. HypoVereinsbank	50	29
International	1. HSBC Holdings	33	8
	2. Banco Bilbao Vizcaya Argentaria	34	10
	3. Santander Central Hispano	37	7
	4. BNP Paribas	46	24
Domestic	1. KBC Bank	51	36
	2. Dexia	56	40
	3. Dresdner Bank	64	22
	4. Société Générale	64	13
	5. Bayerische Landesbank	65	28
	6. IntesaBci	67	14
	7. UniCredito Italiano	68	7
	8. Barclays	71	7
	9. Commerzbank	72	21
	10. Royal Bank of Scotland	74	7
	11. Crédit Lyonnais	76	8
	12. Rabobank	76	8
	13. Crédit Agricole Groupe	81	10
	14. Lloyds TSB Group	84	8
	15. Abbey National	92	6
	16. HBOS	93	4
	17. Crédit Mutuel	n.a.	n.a.
	18. Groupe Banques Populaires	n.a.	n.a.
	19. Groupe Caisse d'Épargne	n.a.	n.a.

Source: Annual reports over 2001 and own calculations (see annex 2).

Notes: “Home” is defined as a bank’s business in its home country (denoted by *h*); “Rest of Europe” is defined as a bank’s business in other European countries (denoted by *e*); “Rest of the world” is defined as a bank’s business outside Europe (these figures are not shown). The three categories add up to 100 per cent. Banks in each category are ranked according to the share of their international business. The abbreviation n.a. means ‘not available’.

Related studies

Berger, Dai, Ongena and Smith (2003) and Van der Zwet (2003) have also analysed cross-border data of individual financial institutions. While this paper employs a broad set of indicators, Berger *et al* (2003) investigate a specific aspect of international banking: cash management services. They model two dimensions of bank globalisation: bank nationality (which refers to the location of a bank’s headquarters relative to the host nation where the affiliate operates and the affiliate’s corporate home) and bank reach (which refers to the geographic scope and size of the chosen bank) in 20 European nations. Their data set covers over 2000 foreign affiliates of multinational corporations operating in 20 European nations and over 250 banks that serve them. Out of the sample of 255 banks, eight banks

are found to be recognisable as true global banks in terms of coverage and size in Europe (global banks are defined as banks that provide cash management services to sample firms in at least nine out of the 20 European nations and have at least \$100 billion in worldwide assets as of year-end 1995). As is shown in table 4, five of the global banks are based in Europe and the other three are from the US. Berger *et al* (2003) conclude that the extent of future bank globalisation may be significantly limited as many corporations continue to prefer local or regional banks for at least some of their services (such as cash management).

Table 4. Global banks in cash management

Bank name	Headquarters nation	Number of survey nations in which the bank operates	1995 worldwide assets (\$ billions)	American Banker rank, by 1995 worldwide assets
Deutsche Bank	Germany	10	502.3	1
ABN Amro	Netherlands	19	339.4	12
Crédit Lyonnais	France	9	337.6	13
Société Générale	France	19	324.8	17
BNP	France	12	323.5	18
Citibank	US	20	255.3	28
Bank of America	US	18	230.2	34
Chase Manhattan Bank	US	19	120.5	62

Source: Berger, Dai, Ongena and Smith (2003).

Notes: The table lists the global banks in their sample of over 250 banks. These banks provide cash management services to sample firms in at least nine of the 20 European nations in their sample and had at least \$100 billion in worldwide assets as of year-end 1995.

Van der Zwet (2003) examines the geographic distribution of revenues of the 38 largest financial groups world-wide in 2000. European financial groups (26 out of the total sample of 38) earn on average 45 per cent of their revenues in their home country, 25 per cent in other European countries and 30 per cent in foreign non-European countries. However, the reported data do not provide a breakdown to individual financial groups. Although our paper focuses on banking groups in the EU, it is interesting to note that Van der Zwet (2003) shows that insurance companies are significantly more internationally oriented than banks. Whereas the banks in her world-wide sample have a clear home country bias, insurance companies have a foreign bias. Taken together, the largest financial groups appear to focus equally on home and foreign markets. Furthermore, Van der Zwet (2003) argues that European financial groups are most strongly internationally diversified.

5. European dimension in perspective

Our hypothesis in section 3.3 is that *if the social benefits of bailing out the activities of financial institutions in the rest of Europe are sufficiently high ($q_e > 0$), then a move to European bailout arrangements may be optimal*. The previous section shows that cross-border penetration within the EU is currently limited: only seven banks out of the sample of 30 large EU banking groups are

considered to be 'European' banks and have the potential to pose significant cross-border externalities.

It should be noted that not all of the 'European' institutions in table 3 are pan-European. There are some banks that focus on a specific region in the Europe and can be regarded as 'regional' European banks. HypoVereinsbank has merged with Bank Austria in Austria and the overriding part of its business is conducted in Germany and Austria. Fortis primarily operates in Belgium and the Netherlands (52 per cent of total assets of Fortis is allocated in Belgium, 23 per cent in the Netherlands). Moreover, the Nordea Group primarily operates in the Nordic countries, it holds 40 per cent of banking assets in Finland, 25 per cent in Denmark, 20 per cent in Sweden and 15 per cent in Norway. Therefore, Nordea can also be seen as a regional 'European' financial institution. Supervision of these 'regional' European banks requires the co-ordination between the various national authorities within the region (through for example MoU's) rather than a centralised European supervisor. In this way, the cross-border externalities (q_e) of regional European banks are internalised through regional co-ordination arrangements.

Moving to the "pan-European" banks, table 4 confirms our finding that both Deutsche Bank and ABN Amro have spread their activities throughout Europe. Deutsche Bank operates in 10 European countries, while ABN Amro operates in 19 European countries. The geographical segmentation of loans in the annual report 2001 of ING Bank shows that 49 per cent of total loans have been granted in the Netherlands (home country), 22 per cent in Belgium and 18 per cent in the rest of Europe, also making it a pan-European firm. The Westdeutsche Landesbank also operates throughout Europe (including Eastern European countries and Turkey). Next, combining table 3 and 4, BNP Paribas (labelled in table 3 as 'international') could be regarded as 'European' as well. While BNP is a borderline case in table 3 (24 per cent of business -slightly less than the cut-off point of 25 per cent- is conducted in the rest of Europe), its cash-management business covers 12 European countries.⁶ To internalise the cross-border externalities (q_e) of pan-European banks, a centralised European supervisor is needed.

Turning to the "international" banks, HSBC Holdings, Santander Central Hispano and Banco Bilbao Vizcaya Argentaria can truly be labelled as 'international' ($q_w > 0$). HSBC Holdings has 43 per cent of assets allocated in Europe (primarily in the United Kingdom), 26 per cent in Hong Kong, 20 per cent in North America and the rest in Asia and Latin America. Annex 2 shows that Santander Central Hispano and Banco Bilbao Vizcaya Argentaria earn respectively 7 and 10 per cent of their revenue in 'the rest of Europe'. The annual reports of these banks show that their primary focus is (Latin) America; Santander Central Hispano earns 56 per cent of its revenues in this continent, Banco Bilbao

⁶ Berger *et al* (2003) also regard Crédit Lyonnais and Société Générale as banks with a broad coverage in Europe, while in our point of view these banks are too domestically oriented to be labelled "international" or "European" (they do not have the potential to pose "significant" cross-border externalities). This is due to different definitions. Berger *et al* investigate a single aspect of international banking (cash management), while our paper investigates a broad set of indicators (assets, revenues and employees).

Vizcaya Argentaria 54 per cent. These international cross-border externalities (q_w) cannot be internalised by European supervisory arrangements, as they fall outside the EU jurisdiction.

The need for a centralised response could be even greater when a trans-European bank is headquartered outside the EU. If banks like Citibank, Bank of America, Credit Suisse or UBS (the last two banks belong to the top 30 banks in Europe, but Switzerland is not a member of the EU) run into difficulties, how would handling that crisis be organised in the EU, especially when there are differing bankruptcy laws in the various EU countries? This is a highly relevant question for further research but falls outside the scope of this paper, which deals with arrangements within the jurisdiction of the EU.

6. Policy implications and conclusions

For crisis management, there is a strong preference for private sector solutions (including liquidation) as opposed to public intervention (bailout). However, a bailout may be desirable to prevent undue systemic risk. This is the case when the social benefits of a bailout are higher than the cost. The model of Freixas (2003) pinpoints the public good dimension of collective bailout and shows why improvised co-operation between home and host countries -a situation that corresponds to the current situation in the EU - leads to an undersupply of bailouts. The reason is that under national arrangements cross-border externalities are not taken into account, when a home country is faced with the decision to bail out a financial institution or not. Therefore, we argue that if the social benefits of bailing out the activities of financial institutions in the rest of Europe are sufficiently high, a move to European arrangements (to incorporate domestic and cross-border externalities) may be optimal. But what is the level of cross-border business in Europe?

Our data-set of the top 30 EU banking groups illustrates that there is still a strong home country-bias. Nevertheless, there is a limited number of banking groups (seven) that can be regarded as 'European', when strictly applying our criteria of 50 per cent or more of their business is conducted abroad ("international") and 25 per cent or more of their business is conducted in other EU countries ("European"). These 'European' banks have the potential to pose significant cross-border externalities in the European context. Softening our criteria to 60 per cent respectively 20 per cent, three more banking groups would be regarded as 'European'. Taking the seven banks that satisfy the strict criteria, four are "pan-European" banks with coverage throughout Europe and three are "regional European" banks with a more limited coverage (one or more neighbouring countries). Next, aggregate data suggest a clear, and statistically significant, trend of increasing cross-border penetration of banks in the EU. Cross-border penetration of banking assets in the EU has increased from 13 per cent in 1997 to 16 per cent in 2002.

What do we conclude from our empirical findings? Cross-border externalities appear to be limited at present. This would suggest that the current nationally based arrangements for financial supervision and stability suffice. However, we also show that cross-border penetration of financial institutions is gradually increasing. European structures for decision-making between home and host countries

during crisis situations may therefore need to be explored in the future (e.g. Vives, 2001; Kremers, Schoenmaker and Wierds, 2003). In addition to financial supervisors, these European structures should include central banks, which can provide immediate liquidity support, as well as fiscal authorities, which ultimately bear the potential cost of a bailout (Goodhart, 2003).

When cross-border penetration increases through 'regional' European financial institutions, coordination between home and host countries for crisis management can be enhanced through Memoranda of Understanding (MoU's) between the national authorities involved (in the case of Fortis, for example, Dutch and Belgian authorities have signed an MoU covering supervision and crisis management). But when more pan-European financial institutions emerge, policy-makers may need to consider European solutions for financial supervision and stability to deal effectively with potential cross-border externalities.

Finally, this paper provides a static overview of cross-border externalities in the EU. Supervisory structures should also be capable to accommodate the dynamics of financial markets. As European financial markets become more integrated, further research on the propagation of financial crises (e.g. via cross-border interbank linkages) may be useful.

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Annex 1: Lehmann test

Table 1 of the main text reflects the increase in cross-border penetration of banking assets in the EU from 1997 until 2002. In order to test whether this increase is statistically significant, a test statistic

proposed by Lehmann (1975) is applied. This statistic is $D = \sum_{i=1}^6 (T_i - i)^2$, where i indicates the year and T_i is the rank of the score of year i .

Year	i	Score	T_i
1997	1	12.8	1
1998	2	13.8	3
1999	3	13.4	2
2000	4	15.1	4
2001	5	16.0	6
2002	6	15.7	5

$D = 4$
 $p = 0.017$

This test shows that the upward trend is significant at the 5% level.

Annex 2: Data on individual institutions

The figures in table 2 and 3 of the main text are based on the following geographical segmentation of assets, revenue and employees. The data on these indicators have been gathered from the annual report over the year 2001 of the 30 largest banking organisations in the EU based on their capital strength as of year-end 2001 (The Banker, 2002).

The figures in table 2 and 3 are the arithmetic average of the distribution of assets, revenue and employees of the 30 largest banking organisations in the EU. However, if data on one (or two) indicator(s) is available, only this indicator is used. An indicator can only be utilised if the available data can be divided into a home country component and a “rest of Europe” component. However, in several cases (in particular on employees) the available data can only be divided into a “home” and a “non-domestic” component. This problem has been solved by dividing the “non domestic” component into two equal parts: “rest of Europe” and “rest of world”. These data have only been used when no proper data on other indicators of the banking organisation is available. Another method would be to use the number of subsidiaries in the “rest of Europe” and the “rest of the world” as weights. However, this does not improve the final results.

Assets

The indicator 'assets' is composed of loans to banks, loans to customers and securities. If the group is involved in insurance activities, insurance investments and other insurance assets are included. Home country assets (denoted by *h*), assets in the rest of Europe (denoted by *e*) and assets in the rest of the world (denoted by *w*) are measured as a percentage of total assets of the banking group.

Table A. Geographical segmentation of assets in 2001

	<i>h</i> (in %)	<i>e</i> (in %)	<i>w</i> (in %)
HSBC Holdings	n.a.	n.a.	n.a.
Crédit Agricole Groupe	76	12	12
Deutsche Bank	34	34	32
Royal Bank of Scotland	66	7	27
BNP Paribas	37	27	36
HypoVereinsbank	n.a.	n.a.	n.a.
HBOS	93	7 (RoE/Row)	
Barclays	68	6	26
ABN Amro	n.a.	n.a.	n.a.
Santander Central Hispano	n.a.	n.a.	n.a.
ING Group	n.a.	n.a.	n.a.
<i>banking activities</i>	n.a.	n.a.	n.a.
<i>insurance activities</i>	n.a.	n.a.	n.a.
Rabobank	67	33 (RoE/Row)	
Société Générale	n.a.	n.a.	n.a.
Lloyds TSB Group	85	15 (RoE/Row)	
Banco Bilbao Vizcaya Argentaria	n.a.	n.a.	n.a.
IntesaBci	65	16	19
Fortis Group	52	39	9
<i>banking activities</i>	59	36	5
<i>insurance activities</i>	29	48	22
Crédit Mutuel	n.a.	n.a.	n.a.
Commerzbank	n.a.	n.a.	n.a.
Abbey National	87	8	5
Dresdner Bank	62	23	15
Groupe Caisse d'Épargne	n.a.	n.a.	n.a.
Nordea Group	n.a.	n.a.	n.a.
UniCredito Italiano	62	7	31
Dexia	n.a.	n.a.	n.a.
Groupe Banques Populaires	n.a.	n.a.	n.a.
Westdeutsche Landesbank	n.a.	n.a.	n.a.
Bayerische Landesbank	64	36 (RoE/Row)	
KBC Bank	54	21	25
Crédit Lyonnais	n.a.	n.a.	n.a.

Source: Annual reports over 2001 and own calculations.

Notes: Figures for Crédit Agricole Groupe are taken over the year 2000. The abbreviation n.a. means 'not available'.

Revenue

The indicator 'revenue' is based either on gross or net income, depending on which standard is used in the geographical analysis of the annual report. Gross income includes interest income and similar revenues, dividend income, commission income, income on financial transactions and other operating income. If the group is also involved in insurance activities, general insurance premium income and income from long-term assurance business is included. Net income is obtained by deducting all relevant costs. Home country revenue (denoted by *h*), revenue in the rest of Europe (denoted by *e*) and revenue in the rest of the world (denoted by *w*) are measured as a percentage of total revenue of the banking group.

Table B. Geographical segmentation of revenue in 2001

	<i>h</i> (in %)	<i>e</i> (in %)	<i>w</i> (in %)
HSBC Holdings	n.a.	n.a.	n.a.
Crédit Agricole Groupe	85	8	7
Deutsche Bank	31	32	37
Royal Bank of Scotland	81	7	12
BNP Paribas	54	20	26
HypoVereinsbank	50	34	16
HBOS	92	8 (RoE/Row)	
Barclays	74	7	19
ABN Amro	n.a.	n.a.	n.a.
Santander Central Hispano	38	7	55
ING Group	23	12	65
<i>banking activities</i>	43	45	12
<i>insurance activities</i>	19	7	74
Rabobank	76	8	16
Société Générale	64	13	23
Lloyds TSB Group	81	19 (RoE/Row)	
Banco Bilbao Vizcaya Argentaria	34	10	56
IntesaBci	68	12	20
Fortis Group	32	46	22
<i>banking activities</i>	45	52	3
<i>insurance activities</i>	27	44	29
Crédit Mutuel	n.a.	n.a.	n.a.
Commerzbank	72	21	7
Abbey National	96	3	1
Dresdner Bank	66	20	14
Groupe Caisse d'Épargne	n.a.	n.a.	n.a.
Nordea Group	n.a.	n.a.	n.a.
UniCredito Italiano	73	7	20
Dexia	49	51	0
Groupe Banques Populaires	n.a.	n.a.	n.a.
Westdeutsche Landesbank	49	32	19
Bayerische Landesbank	65	19	16
KBC Bank	n.a.	n.a.	n.a.
Crédit Lyonnais	72	10	18

Source: Annual reports over 2001 and own calculations.

Notes: Figures for Crédit Agricole Groupe are taken over the year 2000. The abbreviation n.a. means 'not available'.

Employees

The segmentation of employees is based on the distribution of the (average) number of employees. Employees in the home country (denoted by *h*), in the rest of Europe (denoted by *e*) and in the rest of the world (denoted by *w*) are measured as a percentage of total employees of the banking group.

Table C. Geographical segmentation of employees in 2001

	<i>h</i> (in %)	<i>e</i> (in %)	<i>w</i> (in %)
HSBC Holdings	33	8	59
Crédit Agricole Groupe	92	8 (RoE/Row)	
Deutsche Bank	51	25	24
Royal Bank of Scotland	n.a.	n.a.	n.a.
BNP Paribas	59	41 (RoE/Row)	
HypoVereinsbank	50	24	26
HBOS	n.a.	n.a.	n.a.
Barclays	n.a.	n.a.	n.a.
ABN Amro	33	67 (RoE/Row)	
Santander Central Hispano	35	65 (RoE/Row)	
ING Group	30	33	37
<i>banking activities</i>	n.a.	n.a.	n.a.
<i>insurance activities</i>	n.a.	n.a.	n.a.
Rabobank	91	9 (RoE/Row)	
Société Générale	57	43 (RoE/Row)	
Lloyds TSB Group	86	14 (RoE/Row)	
Banco Bilbao Vizcaya Argentaria	32	68 (RoE/Row)	
IntesaBci	n.a.	n.a.	n.a.
Fortis Group	40	43	17
<i>banking activities</i>	52	47	1
<i>insurance activities</i>	17	37	46
Crédit Mutuel	n.a.	n.a.	n.a.
Commerzbank	80	20 (RoE/Row)	
Abbey National	n.a.	n.a.	n.a.
Dresdner Bank	79	21 (RoE/Row)	
Groupe Caisse d'Épargne	n.a.	n.a.	n.a.
Nordea Group	18	79	3
UniCredito Italiano	n.a.	n.a.	n.a.
Dexia	63	29	8
Groupe Banques Populaires	n.a.	n.a.	n.a.
Westdeutsche Landesbank	69	31 (RoE/Row)	
Bayerische Landesbank	88	12 (RoE/Row)	
KBC Bank	48	50	2
Crédit Lyonnais	79	6	15

Source: Annual reports over 2001 and own calculations.

Notes: Figures for Crédit Agricole Groupe are taken over the year 2000. The abbreviation n.a. means 'not available'.