



EUROPEAN CENTRAL BANK

**WORKING PAPER SERIES**

**NO. 300 / JANUARY 2004**

BCE ECB EZB EKT EKP

1000

**DEVELOPING  
STATISTICAL  
INDICATORS OF THE  
INTEGRATION OF THE  
EURO AREA  
BANKING SYSTEM**



by Michele Manna



EUROPEAN CENTRAL BANK



## WORKING PAPER SERIES

NO. 300 / JANUARY 2004

# DEVELOPING STATISTICAL INDICATORS OF THE INTEGRATION OF THE EURO AREA BANKING SYSTEM<sup>1</sup>

by Michele Manna<sup>2</sup>

In 2004 all ECB publications will feature a motif taken from the €100 banknote.

This paper can be downloaded without charge from <http://www.ecb.int> or from the Social Science Research Network electronic library at [http://ssrn.com/abstract\\_id=515062](http://ssrn.com/abstract_id=515062).

*I would like to thank Ivan Alves, Stefano Borgioli, Antonio Matas Mir, Francesco Mongelli, Daniela Schackis, Richard Walton and his colleagues at the Bank of England, an anonymous referee, the participants to an internal ECB seminar and the members of the ESCB's working group on money and banking statistics for helpful comments and suggestions. I owe special thanks to Barbara Zupancic who contributed to an earlier version of this paper, to Isabel Kerner and Klára Simon for insights and practical help on the use of Bankscope and Loanware databases and to Andrea Enria for his inputs on the EU legislative framework. Excellent research assistance has been provided by Isabella Bosetti while Katherine Brandt offered a number of editorial suggestions. I am also grateful to Michel Stubbe and Steven Keuning for their support to this initiative. Of course, all remaining errors are my own responsibility.*

*While the ultimate scope of this paper is to support the institutional activities of the ECB in the field of statistics, the opinions expressed herein are those of the author and do not necessarily represent those of the European Central Bank or of the Eurosystem.*

<sup>2</sup> Banca d'Italia, via Nazionale 91, I-00184 Roma, Italy. email: manna\_m1966@libero.it.

© European Central Bank, 2004

**Address**

Kaiserstrasse 29  
60311 Frankfurt am Main, Germany

**Postal address**

Postfach 16 03 19  
60066 Frankfurt am Main, Germany

**Telephone**

+49 69 1344 0

**Internet**

<http://www.ecb.int>

**Fax**

+49 69 1344 6000

**Telex**

411 144 ecb d

*All rights reserved.*

*Reproduction for educational and non-commercial purposes is permitted provided that the source is acknowledged.*

*The views expressed in this paper do not necessarily reflect those of the European Central Bank.*

*The statement of purpose for the ECB Working Paper Series is available from the ECB website, <http://www.ecb.int>.*

ISSN 1561-0810 (print)

ISSN 1725-2806 (online)

# CONTENTS

Abstract	4
Non-technical summary	5
1 Introduction	7
2 The debate on the integration of the euro area banking system	9
3 Empirical literature on the integration of the euro area banking system	11
4 The data	13
5 The algebra of the proposed indicators	14
5.1 Some introductory notation	14
5.2 The eight indicators	15
6 The results	18
6.1 Indicators 1-2: Measures of the amount of cross-border activity within the euro area	18
6.2 Indicators 3-6: Measures of the distribution of cross-border activity within the euro area	23
6.3 Indicators 7-8: Which role for London?	24
7 Main conclusions	25
References	28
Annexes	31
Figures	37
European Central Bank working paper series	45

## Abstract

This paper discusses a wide range of indicators of the degree of integration of the euro area banking system. It is concerned with volume data, a less developed field of research compared with studies on prices/rates. We first set out a methodological framework, a mixture of elementary and more sophisticated statistics which can also be used in other contexts and datasets. We then apply this framework to unconsolidated balance sheet data of banks, aggregated at the national level. The paper offers three main empirical conclusions. First, within the euro area the gap between the cross-border banking activity in wholesale and retail markets is widening. Second, at the same time, with the exception of the home bias, even in retail markets there is increasing neutrality towards the location of the counterparty. Third, following a moderate decline in the wake of EMU, London is once again gaining market shares.

Key words: banking system, balance sheet, integration, euro area.

JEL-classification: C43, D40, G21, L11.

## Non-technical summary

The aim of this paper is to contribute to the development of statistical indicators of the degree of integration of the euro area banking system. The research has been carried out on volume data, e.g. outstanding stocks of deposits and loans, which is a less developed field of research than the more established literature on prices/interest rates. In order to put this research into context, the concept of the integrated market is enshrined in the law of one price and there is no immediate equivalent to this law in volume terms. For example, substantial cross-border trading activity may co-exist with many prices, and thus disprove the existence of a single market, while small volumes of activity may suffice to clear arbitrage gaps. One would expect, however, some degree of symmetry and, unless there is proof to the contrary, intense cross-border activity should be taken as a signal of a high degree of integration of the banking system.

Our main dataset comprises 14,520 data points, spanning from September 1997 to December 2002, and over six main items of the balance sheet of the euro area banks (more precisely, monetary financial institutions (MFIs) other than the Eurosystem). The six items are: retail deposits (i.e. deposits from non-MFIs), retail loans, interbank deposits, holdings of securities issued by MFIs, holdings of securities issued by non-MFIs and holdings of shares.

Since there is no volume equivalent to the law of one price, there is no single test run on volume data which by itself allows accepting or rejecting the null hypothesis of integration. Hence the need for a bouquet of statistical indicators of cross-border activity and implicitly the home bias. Some of the indicators proposed, e.g. the share of cross-border activity in total activity, are elementary descriptive statistics. Other indicators, such as the normalised distance from a neutral distribution of cross-border flows, the index of evenness in the access to the hub market and our variant of the  $\beta$ -indicator of convergence are more sophisticated. Our recommendation is to use a number of such indicators together when assessing integration in order to avoid over-simplistic conclusions.

The paper also offers a number of quantitative results on the state of integration of the euro area banking system. First, within the euro area the gap between cross-border banking activity in wholesale and retail markets is widening. At end-2002, the share of interbank deposits exchanged with counterparts located in the rest of the euro area (i.e. other than the own domestic territory) was 25%, five times the corresponding share for the retail deposits, close to only 5%. In 1998 the proportion was three to one.

Second, the share of cross-border activity is markedly lower for the four largest countries (Germany, France, Italy and Spain) than for the other

countries. At the same time, once due account is taken of the domestic demand for banking products, the home bias shows very little variation across the board and is rather high for large and small countries alike. Geographical proximity and language sharing provide a rationale for a home bias in retail products. Less obvious is why this bias is still so persistent in wholesale segments, notably the interbank market.

Third, very little variation can be observed in the concentration of cross-border activity after four years of EMU. The grip of the national banking systems acting as hubs has thus loosened only fractionally.

Fourth, with the exception of the home bias, there is increasing neutrality towards the geographical location of the counterparty, as it should be in a well-integrated market. If the distance between the actual distribution of cross-border flows and that which would prevail under the assumption of perfect neutrality is set to vary between 0 and 100, this distance is calculated at below 10 for the wholesale segments of the banking activity, and between 10 and 25 for the retail segments. It is reassuring to know that while in the former group a close distance to the case of neutrality was a reality even before the launch of the euro, in the latter group of segments the distance in question has shortened rapidly over recent years. Furthermore, there is now virtually no evidence of unevenness in the access to the national components of the interbank market, which plays a crucial role in the implementation of the monetary policy in the euro area.

When our second and fourth results are taken together, the picture that emerges is one of a persistently high home bias. At the same time, once banks decide to trade across borders, they are increasingly neutral as regards the euro area country in which the counterparty is located.

An analysis of this kind would not be complete without a reference to the role of London. Therefore, the fifth and final result was that following a moderate decline in the wake of EMU, London is once again gaining market shares, and has come close to the pre-1999 levels. The question of what would have happened had the United Kingdom joined the euro area in 1999 is unanswerable, one can only hazard a guess. The evidence presented here confirms, however, the resilience of the British banking system to the developments in the euro area.

The bulk of our analysis is conducted on the basis of unconsolidated balance sheets, i.e. data refer to individual banks rather than the banking group as a whole. In order to set out an agenda for further research in this field, it would be of interest to map the structure of banking groups as opposed to stand-alone banks in the euro area. A further item for research would be to model the persistence of the home bias in wholesale markets.

*There is something fascinating about science.  
One gets such wholesale returns of conjecture  
out of such a trifling investment of fact.  
Life on the Mississippi, chapter 17  
Mark Twain*

## 1. INTRODUCTION

The aim of this paper is to contribute to the development of statistical indicators of the degree of integration of the euro area banking system. The research has been carried out on volume data, e.g. outstanding stocks of deposits and loans, which is a less developed field of research than the more established literature on prices/interest rates (e.g. Dermine, 2002). In order to put this research into context, the concept of the integrated market is enshrined in the law of one price and there is no immediate equivalent to this law in volume terms. For example, substantial cross-border trading activity may co-exist with many prices, and thus disprove the existence of a single market, while small volumes of activity may suffice to clear arbitrage gaps. One would expect, however, some degree of symmetry and, unless there is proof to the contrary, intense cross-border activity should be taken as a signal of a high degree integration of the banking system.

Since there is no volume equivalent to the law of one price, there is no single test run on volume data which by itself allows accepting or rejecting the null hypothesis of integration. Furthermore, the home bias may be expected to prevail even in a well-integrated market due to the monitoring costs associated to geographical distance, which within the euro area are compounded by language diversity (but see Berger *et al.*, 2000, on the effects of global consolidation of the banking industry). Hence the need for a bouquet of statistical indicators of cross-border activity and implicitly the home bias. A concrete outcome of this approach is the distance of the actual distribution of the cross-border positions from the distribution prevailing in the case of neutrality as regards the country of location of the counterparty. Another outcome is an index of evenness in the access to the national banking system leading the cross-border business in the euro area. Finally, since an analysis of this kind would not be complete without a reference to the role of London, we present also some measures of the banking activity between the euro area countries and the UK.

The sentence “Integrated wholesale markets, fragmented retail markets” is how most mainstream analyses would probably summarise the state of the euro area banking business four years after the start of the Economic and Monetary Union (EMU). The sentence captures well the difference in the degree of integration of wholesale and retail markets, as confirmed by two basic statistics: at end-2002, the share of interbank deposits traded within the euro area on a cross-border basis was close to 25%, while the corresponding share for retail deposits stood at 5%.

At the same time, this sentence does probably no justice to the complexity of the developments in the euro area banking system. Three dimensions appear here to be especially of relevance. Firstly, within the euro area wholesale markets were already well integrated prior to the start of EMU and the literature we will quote below argues forcefully that the launch of the euro likely acted only as a catalyst for further integration. Secondly, this headline is based on the broad awareness of the two aforementioned statistics, but these are mute on how evenly the cross-border business is distributed. In an extreme case, cross-border trading could take place only between pairs of countries (e.g. Germany and Luxembourg, Portugal and Spain, etc.), a pattern which would not bode well for the integration of the euro area banking system. We will thus examine in detail the distribution of the cross-border activity. Thirdly, due to proximity and language sharing, the single market might in fact be the sum of several regional markets, with trading clustered along land borders.

The time elapsed since January 1999 endows researchers with series long enough to support empirical analyses of the integration of the euro area banking system. Research has thus far mainly concentrated on prices/rates (e.g. Quirós and Mendizábal, 2001), while less has been said on volumes. To our knowledge, the recent papers by Dermine (2002), Cabral, Dierick and Vesala (2002) and Angeloni and Ehrmann (2003) are the first attempts to offer a comprehensive empirical review of the cross-border activity measured on volumes exchanged.

Innovating with respect to this recent literature, this paper emphasises the need for a thorough look at the distribution of the bilateral cross-border positions, when integration is assessed on the basis of volume data. An example may help. In 1999, the first year of EMU, in the euro area the total retail deposits increased by 4.0%, of which the deposits held by domestic customers grew by 4.2% while the deposits by customers located in the rest of the euro area by a pale 2.4%. This is not exactly what would cheer up a europhile. However, the latter rate of growth turns out to be a brisk 9.9% if the deposits held by German non-banks with Luxembourg's banks are netted out. Indeed, the EMU brought along a common minimum reserve system to all euro area banks. In turn, this took away from German residents the incentive to place deposits with Luxembourg's banks to circumvent the minimum reserve system which used to be adopted in Germany. Arguably, this type of cross-border flows is not what one would regard as a positive sign of market integration!

Our main dataset is formed by balance-sheet data for the euro area monetary financial institutions (MFIs), mostly banks, other than the ECB and the national central banks (the Eurosystem). The sample runs from December 1997 to December 2002, and the data are available to us as national aggregates reported according to the host principle and with no consolidation.<sup>1</sup> As we will argue below,

---

<sup>1</sup> Foreign branches established within the euro area report their balance sheets to the local central bank. Subsidiaries report separately from the head bank, both when they are established in the same country or in a different country than the head bank.

the dataset is richer in breakdowns and more harmonised than alternative datasets (either based on official sources, such as TARGET, or on commercial sources, such as Bankscope).

Better does not necessarily mean enough. Ideally, one would like to measure cross-border business also using data consolidated at the level of banking group. Consider the non-unrealistic case where the activity in the wholesale markets is centralised at the head bank, which in turn taps the financing needs of the whole banking group by means of interbank transfers. Such transfers would be netted out in a consolidated balance sheet. Likewise, the holdings by the head bank of the shares issued by the subsidiaries would be cleared. Consolidation could also have an impact on retail loans: if the loan granted by a foreign subsidiary to a local firm/household is financed by the head bank, then the loan would better be reported as a cross-border position in a consolidated balance sheet.

We conjecture (see Annex 1) that the impact brought about by consolidation on the shares of cross-border activity varies with the type of business. In particular, we reckon that this impact is significant in respect to retail loans and more limited in respect to interbank deposits. That acknowledged, the use of unconsolidated data does not seem to affect the finding of a widening gap between the cross-border activity in retail and wholesale markets. Nor the evidence available to us suggests that the time patterns of cross-border shares would need to be redesigned. Yet a word of caution is in order in assessing the point estimates supported by our main dataset, especially in respect to retail loans.

The plan of the paper is as follows. Section 2 surveys the literature on the integration of the euro area banking system. Section 3 follows on, focusing on empirical works. Section 4 introduces the data used in the analysis. Section 5 outlines the algebra of the proposed indicators. Section 6 describes the main empirical results. Finally, Section 7 concludes the paper.

## **2. THE DEBATE ON THE INTEGRATION OF THE EURO AREA BANKING SYSTEM**

The integration of the euro area national banking systems into one is rooted in the EU Single Market Legislation and in world-wide patterns. Good surveys on the developments in the EU legal environment are easily available (e.g. Danthine *et al.*, 1999, and Dermine, 2002, and the references there provided). We will thus only recall the cornerstones of such developments.

On the EU front, a number of legislative measures defined the legal framework for a single financial (banking) market, starting with the First Banking Directive of 1977. This Directive established the right of establishment and the principle of home country control and set up the framework for the harmonisation of Member States' banking legislations. The Second Banking Directive, which set out the conditions for the single European passport of banks, contained a more far-

reaching program of minimum legislative harmonisation and established the principle of mutual recognition of national regulations. The Investment Services Directive addressed the cross-border activities of the investment firms. The Own Funds Directive, the Solvency Ratio Directive and the Capital Adequacy Directive defined the requirements for adequate capital ratios of banks and investment firms, relative to their respective credit and market risks. In a nutshell, the basics of this legal framework are the principles of mutual recognition ("single passport") and of home-country control. Outside the EU legislation, pressure from developments in the banking system was prodded by world-wide patterns, to be linked to more intense global competition, IT competition, the need to increase efficiency, etc.

The exact weight to be given to the EU legislation and to global trends is subject for debate. A school of thoughts argues that "it is hard to identify in the set of EU directives the origin of changes in the industry structure" (Cerasi, Chizzolini and Ivaldi, 1998) and "The practical impact of EU regulatory efforts to facilitate cross-border financial services has yet to become clear" (Hertig, 2000). In a more open way, Berger, DeYoung and Udell (2001) stress that "It might have been expected that international consolidation of financial institutions would be especially rapid across national boundaries in the EU, where the removal of restrictions on cross-border entry and the harmonisation or regulatory environments were intended to make it relatively easy for managers to cross national boundaries [...] The Single Market Programme and European Monetary Union reduce some but not all of these barriers for EU nations".

What is key for the present analysis is the consensus that has the integration of the euro area wholesale banking activities starting well before January 1999. For example, using a sample ending in 1994, Centeno and Mello (1999) concluded "money markets are closely linked across countries".

Common wisdom also has that the onset of the EMU acted as a catalyst for further integration. Again, it remains subject for debate the specific role played by the single currency. An articulated position is taken, for example, by Danthine, Giavazzi and von Thadden (2000) who conclude their review of the state of European financial markets after the start of EMU arguing that on "almost all counts EMU has either already drastically changed the European financial landscape or has the potential to do so in the future [...] this is less due to the well known direct effects of EMU, such as the elimination of intra-European currency risk, than a number of indirect consequences through feedback mechanisms that seem to have been triggered by EMU".

Two months after the start of the EMU, the ECB (1999a) published a comprehensive report on the "Possible effects of EMU on the EU banking systems in the medium to long term", of which one of the main conclusions was: "Overall competition in banking within the euro area is likely to increase considerably, but most probably to a different extent in wholesale and retail banking." Outside the central banking circles, same conclusion was reached, among others, by Dermine (2002), "the picture that emerges is one of a fully integrated market for

corporate/investment banking services and a fragmented retail market created, in part, by asymmetric information and the existence of significant switching costs.”.

The ECB (1999b) made once again its point a few months later, stressing that “The wholesale banking markets linked to interest rates and currencies are likely to become very closely integrated and highly competitive” while “In retail banking, the introduction of the euro can be expected to lead to a more gradual change, as the forces maintaining national segmentation remain for the most part intact.” Against this mainstream approach, it is of interest the differentiation suggested by De Bandt and Davis (1999), “competition for deposits may increase owing to the scope for cross border banking; competition for loans to smaller borrowers may remain weaker owing to the importance of idiosyncratic information”.

Mentioning limited integration is almost a byword for flagging the existence of a home bias, a topic often studied also in respect to US markets. A fully-fledged review of the American literature would bring us too far afield. We thus refer here to Petersen and Rajan (2002) and the seminal paper by Berger, Kashyap and Scalise (1995), and the literature there cited. It may nevertheless be of interest to bear in mind the main result by Petersen and Rajan (2002), who conclude that geographical proximity and direct communication play a diminishing role in the US lending market. By way of comparison, an empirical assessment of the conditions (economic, regulatory, supervisory and demographic) which underlie the home bias in Europe is presented in Lorenzo-Vivas, Pastor and Hasan (2001). Even within a national context, geographical proximity may play quite a role in Europe, as discussed by Degryse and Ongena (2003).

To recapitulate, the introduction of the euro was expected to strengthen a pre-existing push towards integration of the euro area banking system. At the same time, it was accepted that a number of practical obstacles stood (and still stand) in the way and the overall picture would not have changed dramatically immediately after the launch of the single currency in January 1999. The time dimension of this debate is quite relevant. As underlined by Danthine *et al.* (1999) and Hertig (2000), regulatory reforms need some time to have a practical impact on the provision of cross-border services. Hence, the interest to use some years of data after the start of the EMU to unveil a significant and measurable impact of the single currency on the integration of the euro area banking system.

### **3. EMPIRICAL LITERATURE ON THE INTEGRATION OF THE EURO AREA BANKING SYSTEM**

By way of completion of the survey on the literature, we present here a short guide to empirical works on the integration of the euro area banking system. Research with a genuine euro area span is gradually becoming available four years after the onset of the monetary union. The published research has so far mainly focused on *price/rates* aspects in specific wholesale markets (e.g. the equity market in



Fratzscher, 2002, the bond market in von Thadden, 2001 and De Bondt, 2002, the money market in Hartmann, Manna and Manzanares, 2001), while relatively little has been said on *volume* aspects of the cross-border activity.

It appears sensible to draw a line between studies on integration based on data pre-EMU and research which uses also post-1998 data. Besides the obvious aspect of measuring actual patterns, rather than predicting outcomes, there is also the operational aspect of the availability of (more) harmonised statistical series in later studies. A similar consideration suggests splitting studies on wholesale markets from those on retail markets. Indeed, academic researchers often find it easier to avail of good datasets for the wholesale markets, while the access to comprehensive and accurate datasets for the retail business is more limited. The results of our (admittedly not necessarily exhaustive) survey can thus be organised in a matrix form (for the literature “post-1998” we have added in italics the main subject of the paper).

The thrust of this literature is the high standard of integration reached in wholesale markets, which compares favourably against the segmentation of the retail business. We refer to Section 2 for a discussion of this gap. It may be enough to underline here the paucity of studies on *volume* indicators, for both market segments, and with the notable exception of the pioneering efforts by Cabral, Dierick and Vesala (2002) the lack of any major study for the retail market.

**Table 1**

**Selected empirical studies on integration of the euro area banking system**

(the main subject of the analysis is specified for studies using also after-1998 data)

	Wholesale/financial markets	Retail markets
Studies which use only pre-1999 data	<ul style="list-style-type: none"> <li>• Centeno and Mello (1999)</li> <li>• Groeneveld (1999)</li> </ul>	<ul style="list-style-type: none"> <li>• Corvoisier and Gropp (2002)</li> <li>• ECB (1999a)</li> <li>• Cerasi, Chizzolini and Ivaldi (1998)</li> </ul>
	<ul style="list-style-type: none"> <li>• Danthine, Giavazzi, Vives and von Thadden (1999)</li> <li>• De Bandt and Davis (1999)</li> </ul>	
Studies which use (also) after-1998 data	<ul style="list-style-type: none"> <li>• Danthine, Giavazzi and von Thadden (2000) (<i>prices</i>)</li> <li>• Fratzscher (2002) (<i>prices</i>)</li> <li>• Hartmann, Manna and Manzanares (2001) (<i>prices</i>)</li> <li>• Quirós and Mendizábal (2001) (<i>prices</i>)</li> <li>• von Thadden (2001) (<i>prices</i>)</li> </ul>	
	<ul style="list-style-type: none"> <li>• Dermine (2002) (<i>prices and penetration of foreign branches/subsidiaries</i>)</li> <li>• Cabral, Dierick and Vesala (2002) (<i>prices and volumes</i>)</li> <li>• Hartmann, Maddaloni and Manganelli (2003) (<i>mergers</i>)</li> </ul>	

#### 4. THE DATA

Our main dataset is composed of stock data on six items of the balance sheet of the euro area MFI sector, excluding the Eurosystem. The six items are: deposits held by non-MFIs (“retail deposits”), loans to non-MFIs (“retail loans”), interbank deposits, holdings of securities other than shares issued by MFIs, holdings of securities other than shares issued by non-MFIs, holdings of shares. We will use a quarterly version of the dataset in those parts of the analysis where we need the full country breakdown of the cross-border positions, otherwise a monthly dataset (which features the simpler domestic vs. foreign breakdown) comes in handy.

In this paper, we will focus on the data reported by MFIs other than the Eurosystem, the “banking system”, and for simplicity’s sake we will sometimes refer to the units of the MFI sector/banking system as the “banks”. The term “non-bank” will indicate any economic agent who is not an MFI. With the notable exception of the extension of the analysis to the United Kingdom in section 6.3, the work focuses on the banks’ business within the euro area. The term “foreign” will thus be used to refer to agents that are resident in a euro area country other than the one of the bank.

Unless otherwise noted, the sample used in the analysis spans from the third quarter 1997 to the fourth quarter 2002, 22 quarters in total. The data are available to us as national aggregates, i.e. sum over each country of the data of the individual banks. For each of the 132 (=6×22) combinations quarter/indicator, we avail of a 10×11 matrix, for a total of 14,520 data points. By row we have the reporting national banking sector (1-Belgium, 2-Germany, 3-Spain, 4-France, 5-Italy, 6-Luxembourg, 7-Netherlands, 8-Austria, 9-Portugal and 10-Finland) and by column the corresponding national counterparty sector (the ten countries just listed plus the United Kingdom).<sup>2</sup> For example, the cell of position (3,3) of the “retail deposits” corresponds to deposits held by Spanish non-banks with Spanish banks, while the cell (2,7) of the interbank deposits refer to deposits held by Dutch banks with German banks.

To our knowledge, alternative datasets which could support analyses of the integration of the euro area banking system are: 1) data collected in the framework of the TARGET payment system,<sup>3</sup> 2) the BIS consolidated banking statistics,<sup>4</sup> and 3) banking data made available by commercial sources such as The Banker or Bankscope.<sup>5</sup> Compared to these datasets, the one used in the present analysis

---

<sup>2</sup> The balance-sheet data for the Irish and Greek banking systems are available to us only as from 1999, and were not considered in this analysis.

<sup>3</sup> ECB statistics on TARGET are available at the page <http://www.ecb.int/target/stats/tast01.htm>.

<sup>4</sup> BIS (2003), downloadable at <http://www.bis.org/publ/rqt0309.htm>.

<sup>5</sup> <http://www.thebanker.com> and <http://www.bvdep.com> respectively.

features the availability of two key breakdowns: the EU country of residence of the counterparty of the reporting MFI and whether this counterparty is or not an MFI. We can thus identify the outstanding amount of deposits held by, say, German non-MFIs with Belgian MFIs as well as the holdings by Spanish MFIs of securities issued by Italian MFIs. As to its quality, our dataset shares the same statistical framework (i.e. harmonised definitions for balance-sheet concepts and reporting population) of the euro area monetary statistics, i.e. the single most important statistical indicator used by the ECB in its monetary policy strategy. Typically, other datasets support a more limited number of breakdowns and/or suffer from some lack of harmonisation.

As already flagged, our main dataset is based on unconsolidated balance sheet data. In the introduction we also hinted at the fact that different results for the cross-border shares could be worked out had consolidated data been used. We remain here somewhat indeterminate because we are not aware of any database based on consolidated balance sheets that competes favourably with the richness and harmonisation of our dataset. As a consequence, no firm conclusion can be reached on the difference between the results obtained with the two databases.

Some light can nevertheless be shed by crossing information from Loanware,<sup>6</sup> Bankscope and ECB sources, and using some working assumptions. As described in Annex 1, we assumed that a subsidiary deals in the interbank market only with its head bank. Based on this conservative assumption – if we relax it, our results on the impact of consolidation would be smaller –, we conjectured that consolidation could lift the share of cross-border loans by 2-3 percentage points (pp), up from a share of close to 3% calculated using unconsolidated data. Conversely, the cross-border share of interbank deposits would be calculated at 24%, down from 25%. Likewise, for the holdings of shares, we could be close to 12% from 14%. Changes would thus be important in relative terms for the retail loans and more marginal for the two wholesale segments. In any case, the distance between the retail and wholesale segments would not be altered significantly. Nor these findings point to any large impact of the consolidation on the time pattern of the cross-border shares. In the rest of the paper we will thus confidently refer to the results obtained using our unconsolidated dataset – still the best available source –, while bearing in mind the caveats just commented.

## **5. THE ALGEBRA OF THE PROPOSED INDICATORS**

### **5.1 Some introductory notation**

At each quarter and for each balance-sheet indicator, we avail of a  $10 \times 11$  matrix  $X^{\text{euro+UK}}$ . To keep the presentation simple we omit the time index, unless this might

---

<sup>6</sup> [http://www.dealogic.com/index\\_f.html](http://www.dealogic.com/index_f.html).

generate confusion. The superscript “euro+UK” follows from the fact that the 11<sup>th</sup> column of the matrix refers to positions with UK residents. We shall identify separately the first 10 columns from the 11<sup>th</sup> column, so that  $X^{\text{euro+UK}}$  will be the result of a square matrix  $X^{\text{euro}}$  and a vector  $x^{\text{UK}}$  stacked horizontally:

$$X^{\text{euro+UK}} = [X^{\text{euro}} ; x^{\text{UK}}] \quad [1]$$

We indicate totals by row/column/matrix as:

$$x_{i,\bullet} = \sum_{j=1}^n x_{i,j} \quad i = 1, \dots, n \quad [2a]$$

$$x_{\bullet,j} = \sum_{i=1}^n x_{i,j} \quad j = 1, \dots, n \quad [2b]$$

$$x_{\bullet,\bullet} = \sum_{i=1}^n \sum_{j=1}^n x_{i,j} = \sum_{i=1}^n x_{i,\bullet} = \sum_{j=1}^n x_{\bullet,j} \quad [2c]$$

$$x_{\bullet,\bullet}^{\text{euro+UK}} = \sum_{i=1}^n \sum_{j=1}^{n+1} x_{i,j} = x_{\bullet,\bullet} + \sum_{i=1}^n x_{i,n+1} \quad [2d]$$

where in our research  $n=10$ , and the  $n+1$ <sup>th</sup> country is the United Kingdom.

## 5.2 The eight indicators

We review here eight statistical indicators of integration. For each indicator we present the formula(e), we specify the range of possible values and we provide a short interpretation of the min/max values, if this is not straightforward.

*Measures of the amount of cross-border activity within the euro area*

Indicator #1 - share of cross-border activity

$$I_1(i) = 1 - \frac{x_{i,i}}{x_{i,\bullet}} \in [0,1] \quad [3.1a]$$

$$I_1 = 1 - \frac{\sum_{i=1}^n x_{i,i}}{x_{\bullet,\bullet}} \in [0,1] \quad [3.1b]$$

Result [3.1a] is the share of cross-border activity of the banking system of country  $i$ , while [3.1b] is the corresponding result for the euro area as a whole. If  $I_1(i)=0$  the banking system of country  $i$  does not deal cross border, while if  $I_1(i)=1$  the business is wholly run cross border. Moreover, if  $I_1(i)=0$  for each  $i$  then  $I_1=0$ ; likewise, if  $I_1(i)=1$

for each  $i$  then  $I_1=1$ . Note however that under more general conditions  $I_1$  differs from the average of the  $n$  values  $I_1(i)$ .

### Indicator #2 - home bias

$$I_2(i) = \left( x_{i,i} - \frac{x_{i,\bullet} x_{\bullet,i}}{x_{\bullet,\bullet}} \right) \frac{1}{x_{i,\bullet}} = \frac{x_{i,i}}{x_{i,\bullet}} - \frac{x_{\bullet,i}}{x_{\bullet,\bullet}} \in \left[ -\frac{x_{\bullet,i}}{x_{\bullet,\bullet}}, 1 - \frac{x_{\bullet,i}}{x_{\bullet,\bullet}} \right] \geq 0 \quad [3.2a]$$

where a suitable equivalent for the euro area as a whole is

$$I_2 = \sum_{i=1}^n \left( x_{i,i} - \frac{x_{i,\bullet} x_{\bullet,i}}{x_{\bullet,\bullet}} \right) \frac{1}{x_{\bullet,\bullet}} = \frac{1}{x_{\bullet,\bullet}} \sum_{i=1}^n [x_{i,\bullet} I_2(i)] \geq 0 \quad [3.2b]$$

This indicator measures the excess of the actual domestic business compared with the domestic business carried out under the assumption of no-country preference. The ratio  $(x_{i,\bullet} x_{\bullet,i} / x_{\bullet,\bullet})$  is the conventional statistical result to replicate neutrality in bi-dimensional characters for the generic cell of position  $(i,j)$ . It follows that in [3.2a] and [3.2b]  $(x_{i,\bullet} x_{\bullet,i} / x_{\bullet,\bullet})$  measures the amount of domestic activity undertaken when there is neutrality with respect to the euro area country (domestic vs. foreign) of the counterparty.

### *Measures of the distribution of cross-border activity within the euro area*

#### Indicator #3 - concentration of cross-border trading

$$I_3 = \sum_{i=1}^n \left[ \frac{(x_{i,\bullet} - x_{i,i})}{\sum_{i=1}^n (x_{i,\bullet} - x_{i,i})} \right]^2 \in (0,1] \quad [3.3]$$

The concentration of the shares of cross-border trading is measured through a Herfindhal index. In [3.3] the numerator of the term between square brackets is the total cross-border activity of country  $i$  while the denominator is the corresponding euro area sum.

#### Indicator #4 - distribution of cross-border positions

$$I_4 = \frac{d(\mathbf{X}^{\text{euro}} - \mathbf{X}^{\text{euro:MIN}})}{d(\mathbf{X}^{\text{euro:MAX}} - \mathbf{X}^{\text{euro:MIN}})} \in [0,1] \quad [3.4]$$

This indicator is a normalised measure of the distance of the actual distribution of cross-border positions from the distribution prevailing under the assumption of no-country preference. In [3.4]  $\mathbf{X}^{\text{euro:MIN}}$  is the matrix derived under the assumption that cross-border positions are distributed proportionally to the size of each national banking market within the euro area, i.e. of no-country preference.  $\mathbf{X}^{\text{euro:MAX}}$  is the matrix derived under the opposite assumption of max preference,

e.g. country A deals only with country B, country C only with country D, and so forth. All measures are adjusted for the home bias. (Cfr. Annex 2 for further details.)

Indicator #4 takes value 0 if the actual distribution of cross-border positions mirrors the one predicted under the assumption of no country preference. Conversely, the indicator takes value 1 if each national banking system concentrates its cross-border activity with one foreign country.

Indicator #5 - distribution of cross-border positions (adjusted for land sharing)

This indicator replicates indicator #4 with the exception of the preliminary re-grouping of cross-border positions depending on whether the foreign counterparty is located or not in a country sharing a land border with the country of the reporting MFI. From  $X^{\text{euro}}$  we first derive a three-column matrix  $Y^{\text{euro}}$  as

$$Y^{\text{euro}} = [Y(,1) : Y(,2) : Y(,3)] \quad [3.5a]$$

$$Y(i,1) = x_{i,i} \quad i = 1, \dots, n \quad [3.5b]$$

$$Y(i,2) = \sum_{j \in K_i} x_{i,j} \quad i = 1, \dots, n \quad [3.5c]$$

$$Y(i,3) = \sum_{j \notin K_i} x_{i,j} \quad i = 1, \dots, n \quad [3.5d]$$

where  $K_i$  is the sub-set of euro area countries sharing a land border with country  $i$ . We then set the normalised indicator

$$I_5 = \frac{d(Y^{\text{euro}} - Y^{\text{euro};\text{MIN}})}{d(Y^{\text{euro};\text{MAX}} - Y^{\text{euro};\text{MIN}})} \in [0,1] \quad [3.5e]$$

The meaning of  $Y^{\text{euro};\text{MIN}}$  and  $Y^{\text{euro};\text{MAX}}$  corresponds to  $X^{\text{euro};\text{MIN}}$  and  $X^{\text{euro};\text{MAX}}$  above respectively, *mutatis mutandis*. (Cfr. annex 3 for further details.)

Indicator #6 – access to hub banking system

$$H = \sum_{j=[2]}^{[n]} (\rho_{j,[1]} - 1) \quad [3.6a]$$

$$I_6 = \frac{d(H - H^{\text{MIN}})}{d(H^{\text{MAX}} - H^{\text{MIN}})} \in [0,1] \quad [3.6b]$$

This indicator is a normalised measure of a co-graduation index (*à la* Kendall) of the bilateral ranks in the cross-border activity of the individual countries vis-à-vis the country with largest overall cross-border activity (“the hub”). In [3.6a]  $\rho_{j,[1]}$  is the rank of the cross-border activity of countries  $j$  and [1] out of the  $(n-1)$  cross-border

bilateral positions of country  $j$ , [1] is the hub country. (Cfr. annex 4 for further details.)

Indicator #6 takes value 0 if the hub country stands on top of each national ranking. Conversely, the indicator takes value 1 when the highest heterogeneity in the ranks is reached. Such an outcome may signal unevenness in the access to the national components of the euro area market.

### *Measures of the amount of cross-border activity with UK residents*

#### Indicator #7 - cross-border activity with UK residents (out of total activity)

$$I_7 = \frac{\sum_{i=1}^n X_{i,n+1}}{X_{\bullet,\bullet}^{\text{euro+UK}}} \in [0,1] \quad [3.7]$$

This indicator, that takes values in the range 0 to 1, compares the cross-border positions held by euro area MFIs with UK residents to the total positions held by euro area MFIs with residents in an euro area enlarged to the UK.

#### Indicator #8 - cross-border activity with UK residents (out of cross-border activity)

$$I_8 = \frac{\sum_{i=1}^n X_{i,n+1}}{X_{\bullet,\bullet}^{\text{euro+UK}} - \sum_{i=1}^n X_{i,i}} \in [0,1] \quad [3.8]$$

This indicator replicates indicator #7, with the exception that the denominator of the ratio includes only the cross-border positions within the euro area and the cross-border positions with the UK. The domestic positions held by euro area MFIs are thus excluded.

## **6. THE RESULTS**

### **6.1 Indicators 1-2: Measures of the amount of cross-border activity within the euro area**

An inspection of the shares of cross-border trading (Chart 1 and Table 2) for the euro area as a whole suggests the identification of three patterns. First, the share of cross-border activity for retail deposits and retail loans is still modest, at 5% or less, and displays no marked change after the start of EMU. A second group of balance-sheet items includes the interbank deposits, the holdings of securities issued by MFIs and the holdings of shares, items whose share of cross-border activity has been increasing in recent years and now accounts for 10%-25% of the total euro area activity. Finally, a third pattern has been followed by the holdings of

securities issued by non-MFIs, in which case since 1999 the cross-border share has markedly accelerated and is now above 35%.

These results are in line with the literature quoted in section 2, notably in respect to the more limited role of the cross-border activity in traditional retail banking businesses such as the collection of deposits from and the granting of loans to non-banks. In particular, our results support the conclusion by De Bandt and Davis (1999) on the weaker scope for the cross-border granting of loans compared to the deposit taking in the retail business (in fact, the share of cross-border loans might be higher than that of cross-border deposits if consolidated data were used; see Annex 1).

**Table 2**

**Shares of cross-border activity**

(average of end-quarter observations over the period indicated)

	1998	2002
Deposits from non-MFIs	6.0%	5.2%
Loans to non-MFIs	2.3%	3.2%
Interbank deposits	20.6%	25.2%
Holdings of securities issued by MFIs	12.1%	21.6%
Holdings of securities issued by non-MFIs	19.2%	35.9%
Holdings of shares	10.7%	13.8%

Notes. Entries are calculated using [3.1b].

We reported above as a consensus view that the integration of the wholesale banking business started well before January 1999. One aspect of this view which can be tested formally is whether cross-border shares have been increasing over time. To this end, for each balance sheet-item we ran fits of the type

$$\Delta s_t = \beta_0 + \beta_1 \text{trend} + (\alpha - 1) s_{t-1} + \varepsilon_t \quad [4]$$

where  $s_t$  is the share of cross-border activity for the euro area as a whole and the results for the coefficients  $\beta_0$  and  $\beta_1$  provide a quick tool to draw inference on the change of the share over time. Fits were run on monthly data from September 1997 to July 2003, for a total of 71 observations, and results can be summarised as follows:<sup>7</sup>

- on average, the share of cross-border activity has been increasing for all six balance-sheet items under examination (i.e.  $\beta_0$  was positive across the board);

<sup>7</sup> Following standard unit root inference, if in [4] the ADF test does not reject the null of  $\alpha=1$ , then  $\beta_1=0$ . As an additional remark, shares are all well below the upper bound of 100% (they stand below 50%). Nonetheless, it is generally preferable not to fit a (theoretically) upper bounded variable using a trend. We thus conducted the fits on the transformation  $y=[\Phi(s)]^{-1}$  where  $\Phi$  is the cumulated normal. It follows that if  $s \in [0,1] \Rightarrow y \in (-\infty, +\infty)$ . Finally, we used on this occasion a slightly longer sample to increase the robustness of the results.

- the pace of change has increased (i.e.  $\beta_1 > 0$ ) for the retail deposits, and decreased for the interbank deposits and the two categories of securities;
- a CUSUM test of the constant in the fits for retail deposits and retail loans suggests a break (a higher  $\beta_0$ ) after 1999.

A complementary angle of analysis is the distribution of the national cross-border shares (see Chart 2; the dotted line is the resulting trend line while the solid line is the 45° diagonal). As a first finding, national shares of cross-border activity vary significantly from country to country. Taking the example of the interbank deposits (chart 2c), in 2002 in Germany, France and Finland shares were close to 15%, in Italy, Spain and the Netherlands were close to 30% and finally in Belgium and Portugal exceeded 50% (Austria was close to 20%). Broadly speaking, unsurprisingly the larger is the domestic market, and thus the alternatives for a suitable business partner, the smaller is the share of cross-border activity. If 100 is the trading of interbank deposits with euro area counterparts, in 1998 the banking systems of the four largest countries (Germany, France, Italy and Spain) exchanged on average only 18.9 with counterparts located outside the own country (Table 3). This proportion rises to 35.0 on average across Belgium, the Netherlands, Austria, Portugal and Finland. Four years later both proportions had increased, to 22.6 and 38.0 respectively, but the relative distance had hardly changed.

**Table 3**

**Interbank deposits: Share of cross-border activity and the size of the country**  
(average of end-quarter observations)

	1998	2002
Large countries (DE, FR, IT, ES)	18.9%	22.6%
Other countries (BE, LU, NL, AT, PT, FI)	38.5%	40.3%
Other countries except LU	35.0%	38.0%

Notes. Entries are unweighted average of national shares calculated using [3.1a].

The derivation of a home bias using [3.2a] is a simple way to correct the shares of cross-border business for the difference in the size of the domestic market. With respect to the interbank deposits we calculated a home bias of 61.6% for the largest four countries and 57.5% for the other countries (64.2% if Luxembourg, which has a relatively low home bias, is excluded; Table 4). It follows that the home bias is high across the board, for large and small countries alike.<sup>8</sup> Looking at the home bias for other balance-sheet items, unsurprisingly this is higher for less-integrated retail segments, close to 80%, than for the holdings of securities, around 50%. In the latter case, we observe a decrease from 1998 to 2002, which may be taken as a sign of growing integration.

<sup>8</sup> Besides Luxembourg, [3.2(a)] returned a value below 50% only for Germany and Belgium.

**Table 4**

**Home bias**  
(average of end-quarter observations)

	1998	2002
Deposits from non-MFIs <sup>(a)</sup>	78.5%	78.9%
Loans to non-MFIs <sup>(a)</sup>	80.9%	80.2%
Interbank deposits <sup>(a)</sup>	58.5%	59.1%
of Large countries (DE, FR, IT, ES) <sup>(b)</sup>	62.8%	61.6%
which Other countries (BE, LU, NL, AT, PT, FI) <sup>(b)</sup>	55.6%	57.5%
Other countries except LU <sup>(b)</sup>	61.7%	64.2%
Holdings of securities issued by MFIs <sup>(a)</sup>	67.6%	52.0%
Holdings of securities issued by non-MFIs <sup>(a)</sup>	63.2%	49.8%
Holdings of shares <sup>(a)</sup>	73.5%	68.8%

Notes. (a) Entries are calculated using [3.2(b)]. (b) Entries are unweighted average of national results calculated using [3.2(a)].

If there is no preference for the country of location of the counterparty, cross-border shares should be equal once due account is taken of the size of the domestic market. A framework to test more formally the convergence of the shares of cross-border activity can be derived as a variant of the  $\beta$ -indicator proposed in integration studies by Goldberg and Verboven (2001) and Adam *et al.* (2002). This is a unit root type of test of the convergence equation

$$\Delta p_{i,k,t} = \alpha_{i,k} + \beta_k p_{i,k,t-1} + \sum_{l=1}^L \gamma_l \Delta p_{i,k,t-1} + \varepsilon_{i,k,t} \quad [5]$$

where the  $\varepsilon$ 's are serially uncorrelated shocks and  $p_{i,k,t}$  is the difference between the market shares of country  $k$  and country  $i$  (chosen as basis) and at time  $t$ , corrected for the different size of the domestic markets

$$p_{i,k} = \left[ \left( 1 - \frac{X_{k,k}}{X_{k,\bullet}} \right) - \left( 1 - \frac{X_{i,i}}{X_{i,\bullet}} \right) \right] - \left[ \left( 1 - \frac{X_{\bullet,k}}{X_{\bullet,\bullet}} \right) - \left( 1 - \frac{X_{\bullet,i}}{X_{\bullet,\bullet}} \right) \right] = \quad [6a]$$

$$= \left( \frac{X_{i,i}}{X_{i,\bullet}} - \frac{X_{k,k}}{X_{k,\bullet}} \right) - \left( \frac{X_{\bullet,i}}{X_{\bullet,\bullet}} - \frac{X_{\bullet,k}}{X_{\bullet,\bullet}} \right) \quad [6b]$$

In [6a] the term in the first squared parenthesis on the right-hand side – time indexes are not shown for simplicity's sake – measures the difference between national cross-border shares, and the second term is the adjustment for the difference in size of the national markets for banking products.

The null hypothesis subject to test is  $\beta=0$ , no convergence, against the unilateral alternative hypothesis  $\beta<0$  of convergence. The estimates of  $\beta$  are

compared to the t-bar statistics calculated by Im, Pesaran, Shin (2003).<sup>9</sup> Fits have been run against Belgium and Germany as base country for the “small” and “large” countries respectively – the Netherlands have been tried in both groups (Table 5). The estimate of  $\beta$  appears always with the expected negative sign, but the null hypothesis could be rejected only in a limited number of cases: 18 out of the 54 fits of [5]. The only segments for which the null hypothesis could be accepted in a majority of cases are the retail loans and the holding of shares.

**Table 5**

**Convergence of national cross-border shares**

(probability associated to the null of  $\beta=0$  in  $\Delta p_{i,k,t} = \alpha_{i,k} + \beta_k p_{i,k,t-1} + \sum_{l=1}^L \gamma_l \Delta p_{i,k,t-l} + \varepsilon_{i,k,t}$ )

	1% or less	1% - 5%	5% - 10%	higher than 10%
<i>Base country: Belgium. Countries tested: Austria, Finland, Luxembourg, the Netherlands, Portugal</i>				
Deposits from non-MFIs				All countries
Loans to non-MFIs	NL, LU	FI	PT	AT
Interbank deposits		NL		AT, FI, LU, PT
Holdings of securities issued by MFIs			FI	AT, LU, NL, PT
Holdings of securities issued by non-MFIs				All countries
Holdings of shares	PT, NL, LU			AT, FI
<i>Base country: Germany. Countries tested: France, Italy, the Netherlands, Spain</i>				
Deposits from non-MFIs	NL			ES, IT, FR
Loans to non-MFIs	NL			ES, IT, FR
Interbank deposits	NL			ES, IT, FR
Holdings of securities issued by MFIs	FR			ES, IT, NL
Holdings of securities issued by non-MFIs	ES		IT	NL, FR
Holdings of shares	IT, FR			NL, ES

Notes.  $p_{i,k}$  is the difference between the cross-border share of country  $k$  and country  $i$ , where the latter is the “base country”, corrected for the size of the national markets for banking products. Fits have been carried out using least squares and lag  $L=2$ . Probability is based on values tabulated by Im, Pesaran and Shin (2003) for  $N=10$  and  $T=60$ .

<sup>9</sup> Levin and Lin (1992) propose alternative values of the t statistics. The conditions of applicability of their test are generally found rather restrictive, and tests with broader application were tabulated by Im, Pesaran, Shin (1997, 2003). In fact, as noted by Maddala and Wu (1999), the two classes of tests are not directly comparable because in the work by Im, Pesaran and Shin the  $\beta$  parameter is not kept constant, while Levin and Lin refer to pooled data. Maddala and Wu also show that there exist other classes of test with larger power. At the same time, they acknowledge that the test by Im, Pesaran, Shin is “easy to use because there are ready tables”. For the same reason, this test is used here.

## 6.2 Indicators 3-6: Measures of the distribution of cross-border activity within the euro area

Values of [3.3] did not change significantly from 1998 to 2002, with the exception of the holding of securities issued by MFIs (table 6; the table also presents the sum of the two largest national shares, countries are listed in decreasing order). This signals that the introduction of the euro has had no much bearing on the market structure, as confirmed by the finding that in 10 out of 12 cases the same countries appear in the first two ranks.

**Table 6**

### Concentration of shares of cross-border activity (average of end-quarter observations over the period indicated)

		1998	2002
Deposits from non-MFIs	Herfindhal index	23.9%	19.9%
	Sum of 2 largest shares	65.7% (LU, DE)	57.5% (DE, LU)
Loans to non-MFIs	Herfindhal index	22.6%	22.4%
	Sum of 2 largest shares	63.1% (LU, DE)	62.7% (DE, LU)
Interbank deposits	Herfindhal index	15.2%	16.9%
	Sum of 2 largest shares	65.7% (BE, DE)	46.9% (DE, LU)
Holdings of securities issued by MFIs	Herfindhal index	29.3%	20.0%
	Sum of 2 largest shares	70.7% (LU, FR)	52.9% (LU, FR)
Holdings of securities issued by non-MFIs	Herfindhal index	18.2%	17.3%
	Sum of 2 largest shares	46.1% (FR, LU)	47.8% (DE, FR)
Holdings of shares	Herfindhal index	19.1%	17.5%
	Sum of 2 largest shares	50.7% (DE, FR)	49.8% (DE, FR)

Notes. Entries for the Herfindhal index are calculated using [3.3].

One of the core issues we investigated relates to the distance of the actual distribution of the cross-border positions from the distribution prevailing when banks are fully neutral about the euro area country of location of the counterpart. Using [3.4] we worked out the distance at below 10% at end-2002 for the four wholesale segments: the interbank deposits, the holdings of securities issued by MFIs and by non-MFIs, and the holdings of shares (Charts 3). Such low levels were however largely well established already before the start of the EMU. Conversely, it is with respect to the retail deposits and loans that the distance, while still standing at levels close to 25% and 15% respectively, has shortened more markedly after the start of the EMU. Given the modest dimension of the cross-border market for retail banking, it seems far-fetched to conclude that, say, a Dutch household

has no preference over whether her funds (if these are not placed with Dutch banks) should be deposited with German or Finnish banks. That said, our results point to increasing neutrality.

Subsequently, by means of [3.5e] we repeated the exercise for the case where the bilateral cross-border positions are preliminarily grouped according to whether countries share or not a land border. This offers an insight about the possibility that the euro market is in fact the sum of several regional markets. Results are uncontroversial: the distance from the null of no region-preference is close to only 5% if not well below for all six balance-sheet items under examination (Charts 4).

If indicators #4 and #5 look at the distribution of volumes, indicator #6 provides evidence on the potential unevenness in the access to the national components of the euro area market. Let us consider a simple four-country (A to D) example where A leads the cross-border activity, and B follows. Under these conditions, one would expect that both C and D trade first (most) with A, and only residually with B. An inversion of ranks – e.g. C trades first with A and then B while the opposite holds true for D – may signal that A and B do not offer the same conditions to C and D. It is thus rationale for the latter two countries to make different choices.

The results we calculated using [3.6b] for interbank deposits provide a reassuring outcome. The distance from the case of full concordance has shrunk to less than 1% in 2002 from 24.1% in 1998 (Table 7). In other words, there is now virtually no evidence of unevenness in the access conditions to the national banking systems in respect to the interbank dealing, a crucial element of the chain of implementation of the single monetary policy.

**Table 7**

**Ranks vis-à-vis the hub: relative distance from the case of full concordance**

(average of end-quarter observations over the period indicated)

	1998	2002
Deposits from non-MFIs	26.0%	22.6%
Loans to non-MFIs	0.8%	0.3%
Interbank deposits	24.1%	0.7%
Holdings of security issued by MFIs	8.5%	14.8%
Holdings of security issued by non-MFIs	8.2%	4.2%
Holdings of shares	6.9%	13.8%

Notes. Entries are calculated using [3.6(b)].

**6.3 Indicators 7-8: Which role for London?**

Given the stated objective of this work – to analyse the integration of the euro area banking system –, the role of London as financial centre has purposely been left out of the picture thus far. An analysis of this type would however be incomplete without a reference to the activity between euro area MFIs and agents located in the United Kingdom. For reasons which will become immediately clear, it is of

special interest to report also the results in 1999, besides the by now “reference” years of 1998 and 2002.

Overall, London plays a limited role when this is measured out of the total activity of the euro area banking system (Table 8). In turn, this owes to the fact that most business is still run domestically. However, if the focus is restricted to cross-border positions, London turns out to play a key role in respect to interbank deposits, retail deposits and retail loans (Table 9). In particular, more than one-third of the total cross-border dealing of interbank deposits which is not carried out domestically has an UK counterpart. The question of what would have happened had London joined the euro area in January 1999 is unanswerable. The evidence we gathered shows however that four years after the start of EMU, the position (sometimes the leadership) of London emerges strengthened, if anything. Over a medium-term perspective this result is even more telling, given that in 1999, in the wake of EMU, the UK market share fell somewhat. Subsequently, a recovery took place and the market share is now at approximately the same levels enjoyed in 1998 (a reverse pattern holds only in respect of the MFI holdings of shares).

**Table 8**

**Activity of euro area MFIs with UK counterparts**  
(average over the four quarters ending in the period shown)

	end-1998	end-1999	mid-2002
Deposits from non-MFIs	1.2%	1.4%	2.4%
Loans to non-MFIs	1.3%	1.0%	1.5%
Interbank deposits	n.a.	9.9%	12.2%
Holdings of security issued by MFIs	n.a.	1.8%	2.5%
Holdings of security issued by non-MFIs	1.5%	1.8%	2.9%
Holdings of shares	1.4%	1.7%	1.3%

Notes. Entries are calculated using [3.7].

**Table 9**

**Activity of euro area MFIs with UK counterparts (only cross border)**  
(average over the four quarters ending in the period shown)

	end-1998	end-1999	mid-2002
Deposits from non-MFIs	16.5%	18.8%	29.7%
Loans to non-MFIs	25.4%	18.2%	22.1%
Interbank deposits	n.a.	28.5%	36.8%
Holdings of security issued by MFIs	n.a.	9.8%	10.3%
Holdings of security issued by non-MFIs	7.4%	6.5%	7.7%
Holdings of shares	4.2%	5.2%	3.3%

Notes. Entries are calculated using [3.8].

## 7. MAIN CONCLUSIONS

We analysed the integration of the euro area banking systems using a dataset of 14,520 data points, ranging from September 1997 to December 2002 and over six main items of the balance sheet of the euro area banks (more precisely, monetary financial institutions other than the Eurosystem). Our dataset is based on unconsolidated balance sheets, where subsidiaries and foreign branches report separately from the head bank. Additional insights could be obtained if a comparable dataset, based on consolidated balance sheets, were available. In our reckoning, resulting trends and “stylised facts”, e.g. the gap between the wholesale and retail segments, are however robust to consolidation procedures.

The paper sets out a methodological framework to analyse integration on volume data. Some of the indicators proposed, e.g. the share of cross-border activity in total activity, are elementary descriptive statistics. Other indicators, such as the normalised distance from a neutral distribution of cross-border positions, the index of evenness in the access to the hub market and our variant of the  $\beta$ -indicator of convergence are more sophisticated. Our recommendation is to use a number of such indicators together when assessing integration in order to avoid over-simplistic conclusions. To set out an agenda for further research in this field, it would be of interest to map the structure of the banking groups (and within them, head banks vs. subsidiaries) as opposed to stand-alone banks in the euro area.

The paper also offers a number of quantitative results on the state of integration of the euro area banking system. First, within the euro area the gap between the cross-border banking activity in wholesale and retail markets is widening. At end-2002 the share of interbank deposits exchanged with banks located in the rest of the euro area (i.e. other than the own domestic territory) was 25%, five times the corresponding share for the retail deposits, close to only 5%. In 1998 the proportion was three to one.

Second, the share of cross-border activity is markedly lower for the four largest countries (Germany, France, Italy and Spain) than for the other countries. However, once due account is taken of the demand for banking products in each country, the home bias shows very little variation across the board, and is rather high for large and small countries alike. Geographical proximity and language sharing provide a rationale for the home bias in retail products. Less obvious is why this bias is still so persistent in wholesale segments, notably the interbank market. Again, this may set an agenda for further research.

Third, very little variation can be observed in the concentration of the cross-border activity after four years of EMU. The grip of the national banking systems acting as hubs has thus loosened only fractionally.

Fourth, with the exception of the home bias, there is increasing neutrality towards the geographical location of the counterparty, as it should be in a well-integrated market. If the distance between the actual distribution of cross-border

positions and that which would prevail under the assumption of perfect neutrality is set to vary between 0 and 100, this distance is calculated at below 10 for the wholesale segments of the banking activity, and between 10 and 25 for the retail segments. It is reassuring to know that while in the former group a close distance to the case of neutrality was a reality even before the launch of the euro, in the latter group of segments the distance in question has shortened rapidly over recent years. Furthermore, there is now virtually no evidence of unevenness in the access to the national components of the interbank market, which plays a crucial role in the implementation of the monetary policy in the euro area.

When our second and fourth results are taken together, the picture that emerges is one of a persistently high home bias. At the same time, once banks decide to trade across borders, they are increasingly neutral as regards the euro area country in which the counterparty is located.

Fifth and finally, after a moderate decline in the wake of EMU, London is once again gaining market shares, and has come closer to, when not overtaken the pre-1999 levels. The question of what would have happened had the United Kingdom joined the single currency in 1999 is unanswerable, one can only hazard a guess. The evidence presented here confirms, however, the resilience of the British banking system to the developments in the euro area.

## References

- Adam K., T. Jappelli, A. Menichini, M. Padula and M. Pagano, 2002, Analyse, Compare and Apply Alternative Indicators and Monitoring Methodologies to Measure the Evolution of Capital market Integration in the European Union, Centre for Studies in Economics and Finance, University of Salerno.
- Alessandrini P. and A. Zazzaro, 2000, L'evoluzione dei sistemi finanziari locali nell'era dell'euro, *Moneta e Credito*, 211, 279-99.
- Adjaouté K., L. Bottazzi, J.-P. Danthine, A. Fischer, R. Hamoui, R. Portes and M. Wickens, 2000, EMU and Portfolio Adjustment, *CEPR Policy Papers*, no. 5.
- Adjaouté K. and J.-P. Danthine, 2002, European financial integration and equity returns: a theory-based assessment. Paper presented at the Second ECB Central Banking Conference, Frankfurt am Main, 24-25 October.
- Angeloni I. and M. Ehrmann, 2003, Monetary Policy Transmission in the Euro Area: any changes after EMU?, *ECB working paper*, no. 240.
- Banque de France, 1999, L'adaptation des banques françaises au nouveau cadre opérationnel de la politique monétaire, *Bulletin de la Banque de France*, 68, 64-73.
- Banquemagazine, 2000, L'Europe bancaire et financière existe-t-elle?, 615, 17-37.
- Bekaert G., C.R. Harvey and R.L. Lumsdaine, 2002, The dynamics of emerging market equity flows, *Journal of International Money and Finance*, 21, 295-350.
- Belaisch A., L. Kodres, J. Levy and A. Ubide, 2001, Euro-Area Banking at the Crossroads, *IMF Working paper*, no. 40.
- Berger A.N., R. DeYoung, H. Genay and G.F. Udell, 2000, Globalisation of Financial Institutions: Evidence from Cross-Border Banking Performance, *Brooking-Wharton Papers on Financial Services*, 3, 23-120.
- Berger A.N., R. DeYoung and G.F. Udell, 2001, Efficiency barriers to the consolidation of the European financial services industry, *European Financial Management*, 7:1, 117-130.
- Berger A.N., A.K. Kashyap and J. Scalise, 1995, The Transformation of the US Banking Industry: What a Long, Strange Trip It's Been, *Brooking Papers on Economic Activity*, 2, 55-218.
- Bikker J.A. and J.M. Groeneveld, 1998, Competition and concentration in the EU banking industry, *Kredit und Kapital*, 33:1, 62-98.
- Bank for International Settlements (BIS), 2003, *Quarterly Review: international banking and financial market developments*, September, Basle.
- Borgioli S., I. Kerner and M. Manna, 2003, Enhancing the statistical indicators of the balance sheet of the euro area banking system, submitted at the IMF conference on "Financial Soundness Indicators", Frankfurt am Main, 28-29 April.
- Buch C.M., 2001, Cross-Border Banking and Transmission Mechanisms: The case of Europe, *Kiel Working Paper*, no. 1063.
- Cabral I., F. Dierick and J. Vesala, 2002, Banking integration in the euro area, *ECB Occasional Papers*, no. 6.

- Centeno M. and A.S. Mello, 1999, How integrated are the money market and the bank loans market within the European Union?, *Journal of International Money and Finance*, 18, 75-106.
- Cerasi V., B. Chizzolini and M. Ivaldi, 1998, Sunk costs and competitiveness of European banks after deregulation, *LSE Financial Markets Group Discussion Paper*, no. 290.
- Corvoisier S. and R. Gropp, 2002, Bank concentration and retail rates, *Journal of Banking and Finance*, 26:11, 2155-89.
- Danthine J.P., F. Giavazzi, X. Vives and E.-L. von Thadden, 1999, The Future of European Banking, CEPR, 9, *Monitoring European Integration series*.
- Danthine J.P., F. Giavazzi and E.-L. von Thadden, 2000, European financial markets after EMU: A first assessment, *CEPR Discussion Papers*, no. 2413.
- De Bandt O. and E.P. Davis, 1999, A cross-country comparison of market structures in European Banking, *ECB Working Papers*, no. 7.
- De Bondt G., 2002, Euro area corporate debt securities market: first empirical evidence, *ECB Working Papers*, no. 164.
- De Bonis R., F. Farabullini and R. Piazza, 2000, L'attività internazionale delle banche italiane: una sintesi degli ultimi 10 anni, *Moneta e Credito*, 212, 417-446.
- Degryse H. and S. Ongena, 2003, "Distance, Lending Relationships and Competition", *Tilburg University CentER Discussion Paper Series*.
- Dermine J., 2002, European banking: Past, present and future. Paper presented at the Second Central Banking Conference, ECB, 24-25 October 2002.
- Deutsche Bundesbank, 2000, Die Integration des deutschen Geldmarkts in den einheitlichen EuroGeldmarkt, *Monatsberichte der deutschen Bundesbank*, Januar, 15-32.
- Dufey G., 1998, The changing role of financial intermediation in Europe, *International Journal of Business*, 3:1, 51-67.
- ECB, 1999a, Possible effects of EMU on the EU Banking Systems in the Medium to Long Term, Frankfurt, February.
- ECB, 1999b, Banking in the euro area: structural features and trends, *ECB Monthly Bulletin*, April, 41-52.
- ECB, 2001, Consolidation in central counterparty clearing in the euro area, *ECB Monthly Bulletin*, August, 69-77.
- Encyclopedia of Statistical Sciences, John Wiley & Sons, New York.
- European Commission, 1997, Impact on services: credit institutions and banking, *The Single Market Review*, 2:4.
- Fischbach M., E. Perée and C. Hurst, 1999, On the road to wonderland? Bank restructuring after EMU, *EIB papers*, 4, no. 1.
- Fratzscher M., 2002, Financial Market Integration in Europe: On the effects of EMU on stock markets, *International Journal of Finance and Economics*, 7:3, 165-93.
- Goldberg P.K. and F. Verboven, 2001, Market integration and convergence to the law of one price: evidence from the European car market, *NBER working paper series*, no. 8402.
- Griffin J.M., F. Nardari and R.M. Stulz, 2002, Daily cross-border equity flows: pushed or pulled?, *NBER Working Paper series*, no. 9000.

- Groeneveld J.M., 1999, The Forces Behind the Consolidation Trend in the European Banking Industry, *Kredit und Kapital*, 3, 363-92.
- Hamilton J.D., 1996, The daily market for federal funds, *Journal of Political Economy*, 104:1, 26-56.
- Hartmann P., A. Maddaloni and S. Manganeli, 2003, The euro area financial system: Structure, integration and policy initiatives, *ECB Working Paper*, no. 230.
- Hartmann P., M. Manna and A. Manzanares, 2001, The Microstructure of the Euro Money Market, *Journal of International Money and Finance*, 20:6, 895-948.
- Hertig G., 2000, Regulatory Competition for EU financial services, *Journal of International Economic Law*, 3:2, 349-375.
- Hurst C., E. Perée and M. Fischbach, 1999, On the road to wonderland? Bank restructuring after EMU, *EIB papers*, 4:1, 83-103.
- Kaufman G. ed., 1992, Banking Structures in major Countries, Kluwer Academic Publishers, Boston.
- Im, K.S., M.H. Pesaran and Y. Shin, 1997, Testing for Unit Roots in Heterogeneous Panels, mimeo, Department of Applied Economics, University of Cambridge.
- Im, K.S., M.H. Pesaran and Y. Shin, 2003, Testing for unit roots in heterogeneous panels, *Journal of Econometrics*, 115, 53-74.
- Leti, G., 1983, *Statistica descrittiva*, Ed. Il Mulino, Bologna.
- Levin A. and C.F. Lin, 1992, Unit Root Test in Panel Data: Asymptotic and Finite Sample Properties, *University of California at San Diego discussion Paper*, No. 92-93.
- Maddala G.S. and S. Hu, 1999, A comparative study of unit root tests with panel data and a new simple test, *Oxford Bulletin of Economics and Statistics*, Special issue, 61, 631-652.
- Lozano-Vivas A., J.T. Pastor and I. Hasan, 2001, European Bank Performance Beyond Country Borders: What Really Matters?, *European Finance Review*, 5, 141-165.
- Padoa-Schioppa T., 2000, Is a euroland banking system already emerging?, Lecture at the Société Universitaire Européenne de Recherches Financières, SUERF, Vienna, 29 April.
- Petersen M.A. and R.G. Rajan, 2002, Does distance still matter? The Information Revolution in Small Business Lending, *The Journal of Finance*, 57:6, 2533-2570.
- Quirós G.P. and H.R. Mendizábal, 2001, The daily market for funds in Europe: has something changed with the EMU?, *ECB Working Paper*, no. 67.
- Santillán J., M. Bayle and C. Thygesen, 2002, The Impact of the Euro on Money and Bond Markets”, *ECB Occasional Papers*, no. 1.
- Scheherazade S.R., 2001, The euro’s impact on the European Union financial markets and banks, published in *European Monetary Union banking issues: Historical and contemporary perspectives*, JAI Press.
- von Thadden E.L., 2001, L’impact de l’UME sur le marchés financiers Européens, *Revue d’Economie Financiere*, 0:62, 83-108.

## **Annex 1: Inference on the role of consolidation**

We followed the sequence of steps outlined below to gauge how much shares of cross-border activity could change had we calculated them on consolidated balance-sheet data, instead of unconsolidated data. (Unless otherwise noted, all data refer to end-2000.)

### Retail loans

- i. We gathered an initial sample of 3464 euro area banks meeting two conditions: 1) their balance sheet could be retrieved in Bankscope, and 2) they were included as credit institutions in the MFI list run by the ECB.
- ii. We used information from Loanware to identify whether the bank included in the sample could be classified as “head bank of a banking group”, “domestic subsidiary”, “foreign subsidiary of euro area bank”, “foreign subsidiary of non-euro area bank” and “stand-alone bank”. The classification could be determined in 2969 out of the 3464 cases, covering 74% of the total assets of the credit institution sub-sector as measured against official ECB data. In particular, we counted 121 foreign subsidiaries, which accounted for 9.0% of deposits, 6.5% of loans and 8.0% of total assets. We also identified 150 domestic subsidiaries within the sub-sample, the corresponding percentages were 9.4%, 14.0% and 12.4%. We will use these results later on.
- iii. For each of ten largest head banks, we selected the largest foreign subsidiary located in the euro area. We then assumed that all interbank deposits (net of interbank loans) reported in the balance sheet of the subsidiary were a transfer made by the head bank. The resulting amount was finally compared to the total deposits of the subsidiary. This ratio of “external funding” turned out on average equal to 45.5%.<sup>10</sup>
- iv. We applied this “external funding ratio” to the share of loans granted by the foreign subsidiaries we had sampled:  $45.5\% \times 6.5\% = 2.9\%$ . One could argue that this is an estimate of the share of loans effectively funded by the head bank and which should better be reported as cross-border positions in a consolidated balance sheet, rather than as domestic positions as in our dataset with unconsolidated balance sheets. When repeated on data for 2001, the procedure yields a “consolidation share” of 2.4pp.
- v. Note that the estimate of 2.9pp is likely to be biased upward. In particular, it assumes that the only bank the foreign subsidiary deals with is its head bank.

### Interbank deposits

- vi. The ratio of net interbank deposits out of total deposits was calculated at 32.0% for the foreign subsidiaries and 56.6% for the domestic subsidiaries.
- vii. It was further assumed that all net interbank trading was carried out by the subsidiaries (either domestic or foreign) with their head bank and would thus be netted out in the consolidation.
- viii. The share of interbank deposits traded cross-border is calculated in  $25.2/100$ , using unconsolidated data (see table 2). Consolidation would transform this ratio into:  
$$\frac{[25.2 - (\text{deposits with foreign subsidiaries})]}{[100 - (\text{deposits with foreign subsidiaries} + \text{deposits with domestic subsidiaries})]} =$$
$$\frac{[25.2 - (32.0\% \times 9.0)]}{[100 - (32.0\% \times 9.0 + 56.5\% \times 9.4)]} = 24.3 / 100$$

---

<sup>10</sup> The ratio was constrained between 0 and 100%, when it would otherwise have been calculated outside this range (e.g. the interbank deposits of the subsidiaries exceeded the interbank loans).

Consolidation would thus lower the share of cross-border interbank deposits by 0.9pp to 24.3% from 25.2%.

- ix. If data for 2001 are used, the impact is calculated in a reduction of 0.3pp for a share of 24.9%.

#### Holding of shares

- x. We assumed that consolidation would net out all shares of the subsidiaries, i.e. we assumed that head bank is the single owner of the subsidiary.
- xi. Holdings of shares issued by MFIs account for 31.1% of total holdings of shares by MFIs.
- xii. As noted above, foreign and domestic subsidiaries account for 8.0% and 12.4% respectively of total assets. Lacking any reliable direct information, we assumed that same proportions hold for shares.
- xiii. The ratio of holdings of cross-border shares is calculated in  $13.8/100$ , using unconsolidated data (table 2). Consolidation would transform this ratio into:  
 $[13.8 - (\text{holdings of shares of foreign subsidiaries})] / (100 - (\text{holdings of shares of foreign subsidiaries} + \text{holdings of shares of domestic subsidiaries})) =$   
 $[13.8 - (31.1\% \times 8.0)] / [100 - (31.1\% \times 8.0 + 31.1\% \times 12.4)] = 12.1/100$   
 Consolidation would thus lower the share of cross-border interbank deposits by 1.7pp to 12.1%, from 13.8%.

Consolidation should have a limited impact in respect to retail deposits. One notable exception may be the case where for tax reasons a head bank addresses its customers to a foreign subsidiary. In a consolidated balance sheet, these deposits would be classified as domestic, from cross border at present. Assuming this is the case for all funds held by German residents with Luxembourg's banks, we estimated the resulting impact of the consolidation in a share of cross-border retail deposits lower by up to 1pp. Again this estimate is likely to be a ceiling for the actual bias. Finally, there does not seem to be a very obvious scope for intra-group holdings of securities other than shares.

#### **Annex 2: Derivation of indicator #4**

In the  $10 \times 10$  square matrix  $X^{\text{euro}}$  the characters "euro area country of reporting MFIs" and "euro area country of the counterparty of the reporting MFIs" are organised by rows and by columns respectively. The theory of connections between phenomena which can be represented as entries in a two-dimensional matrix – as it is the case at hand –, describes the two characters as independent if, recalling the notation introduced in section 5 of the main text, the following equality holds:

$$x_{i,j} = \frac{x_{i,\bullet} \cdot x_{\bullet,j}}{x_{\bullet,\bullet}} \quad i, j=1, \dots, n \quad [\text{A.1}]$$

The row-wise and the column-wise characters are fully (perfectly) dependent if within each row all entries are nil bar one (e.g. the one corresponding to column  $k$  for row  $i$ ).

$$x_{i,j} = \begin{cases} x_{i,\bullet} & \text{if } j=k \\ 0 & \text{otherwise} \end{cases} \quad [\text{A.2}]$$

The application of these standard statistical results<sup>11</sup> to our problem requires a little roundabout, to account for the domestic trading. In fact, we want to verify

<sup>11</sup> See, for example, Leti (1983), chapter II, fourth part.

here whether the two characters in question are independent only in respect to cross-border flows, i.e. if [A.1] and [A.2] hold in respect to the elements outside the main diagonal of the matrix  $X^{\text{euro}}$ . We thus preliminarily define two matrices C (for cross-border) and D (for diagonal) -we will omit for simplicity's sake the superscript "euro"- such that  $X = C + D$  where

$$d_{i,j} = \begin{cases} x_{i,i} & \text{if } j=i \\ 0 & \text{otherwise} \end{cases} \quad [\text{A.3}]$$

$$c_{i,j} = x_{i,j} - d_{i,j} \quad [\text{A.4}]$$

We will introduce below the matrix  $C^{\text{MIN}}$  with obvious parallelism to  $X^{\text{MIN}}$ . Totals by row/column/matrix are defined with notation corresponding to results [2]. In turn, we derive the value  $a_{i,j}$  corresponding to the case of independence, using the following little two-step procedure:

$$c_{i,j}^{\text{min}} = \begin{cases} a_{i,j}^{\text{min}} + b_{i,j}^{\text{min}} & \text{if } j \neq i \\ 0 & \text{if } j = i \end{cases} \quad [\text{A.5a}]$$

$$a_{i,j}^{\text{min}} = \frac{c_{i,\bullet} \cdot c_{\bullet,j}}{c_{\bullet,\bullet}} \quad [\text{A.5b}]$$

$$b_{i,j}^{\text{min}} = a_{i,j}^{\text{min}} \left( \frac{a_{i,i}^{\text{min}}}{c_{i,\bullet} - a_{i,i}^{\text{min}}} \right) \quad [\text{A.5c}]$$

where  $b_{i,j}^{\text{min}}$  caters for the quantity which the algorithm [A.5b] would otherwise assign to the elements along the main diagonal, and  $c_{i,j}^{\text{min}}$  is the generic element of the matrix  $C^{\text{MIN}}$ . Turning to the case of full dependence, the algorithm used is:

$$c_{i,j}^{\text{max}} = \begin{cases} a_{i,j}^{\text{max}} + b_{i,j}^{\text{max}} & \text{if } j \neq i \\ 0 & \text{if } j = i \end{cases} \quad [\text{A.6a}]$$

$$a_{i,j}^{\text{max}} = \begin{cases} c_{\bullet,i} & \text{if } j \neq i \text{ and } c_{i,j} = \max\{c_{1,j}, c_{2,j}, \dots, c_{n,j}\} \\ 0 & \text{otherwise} \end{cases} \quad [\text{A.6b}]$$

$$b_{i,j}^{\text{max}} = \begin{cases} a_{i,j}^{\text{max}} \times \left( c_{\bullet,j} / \sum_{j=1}^n a_{i,j}^{\text{max}} - 1 \right) & \text{if } a_{i,j}^{\text{max}} > 0 \\ 0 & \text{otherwise} \end{cases} \quad [\text{A.6c}]$$

where [A.6c] caters for the possibility of multiple maxima. We now "plug in" again the main diagonal elements:

$$X^{\text{euro,MIN}} = C^{\text{MIN}} + D \quad [\text{A.7a}]$$

$$X^{\text{euro,MAX}} = C^{\text{MAX}} + D \quad [\text{A.7b}]$$

As a next step, the distance between the actual distribution defined by  $X^{\text{euro}}$  and the one represented by  $X^{\text{euro:MIN}}$  can be measured using any suitable metric, e.g. the quadratic distance

Finally, this distance is normalised using the ratio described by [3.4], where

$$d(X^{\text{euro, MAX}} - X^{\text{euro, MIN}}) = \sum_{i=1}^n \sum_{j=1}^n (x_{i,j}^{\text{max}} - x_{i,j}^{\text{min}})^2 \quad [\text{A.8}]$$

Note that in [A.6b] the maximum is searched across the  $n$  columns. The procedure was repeated conducting the search also row-wise and a new value of the ratio between [A.8a] and [A.8b] was worked out. Finally, the largest of the two ratios calculated column-wise and row-wise has been taken as value of  $I_4$ .

### Annex 3: Derivation of indicator #5

The procedure followed to derive the indicator #5 is similar to the one just described for indicator #4, except for a preliminary re-arrangement of the matrix  $X$  into a three-column matrix  $Y$ .

**Table A.1**

#### Grouping of euro area countries according to border sharing

	Own country	Border-sharing countries	Other countries
BE	BE	DE, FR, LU, NL	ES, IT, AT, PT
DE	DE	NL, BE, LU, FR, AT	ES, IT, PT
ES	ES	FR, PT	BE, DE, IT, LU, NL, AT
FR	FR	ES, IT, DE, LU, BE	NL, AT, PT
IT	IT	FR, AT	BE, DE, ES, LU, NL, PT
LU	LU	FR, DE, BE	ES, IT, NL, AT, PT
NL	NL	BE, DE	ES, FR, IT, LU, AT, PT
AT	AT	IT, DE	BE, ES, FR, LU, NL, PT
PT	PT	ES	BE, DE, FR, IT, LU, NL, AT

Notes. Besides Greece and Ireland, the table does not include Finland, which does not share land borders with any other euro area country.

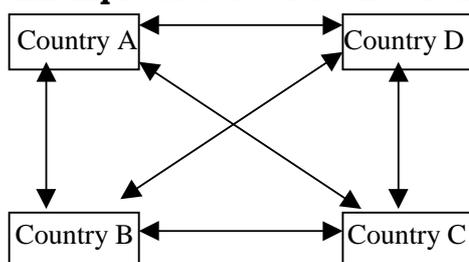
The steps described above for indicator #4 are now replicated, *mutatis mutandis*, to verify how close is the actual distribution of the amounts in the second and third column to the case of neutrality.

### Annex 4: Derivation of indicator #6

An integrated market can be conceived as a forum where “everybody-does-business-with everybody-else”.

**Chart A.1**

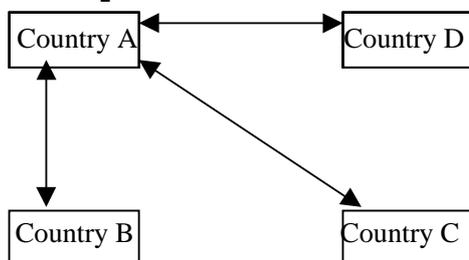
#### Example of web-structure of cross-border activity



The market may be well integrated even if some of the arrows (directions of cross-border flows) are not operational in Chart A.1. At one extreme, one national banking system may ensure the clearing and no cross-border business disintermediates the hub.

**Chart A.2**

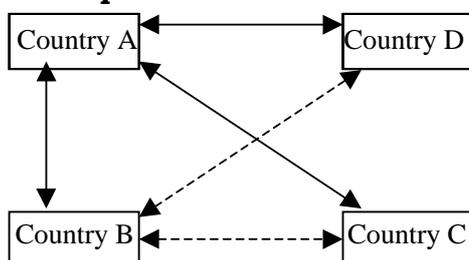
**Example of hub-structure of cross-border activity (one hub)**



We may refer to these two models as web-structure and hub-structure respectively.<sup>12</sup> In practice, due to credit lines and ultimately to counterparty risk management<sup>13</sup>, neither the supply of cross-border activity from country A has infinite elasticity, nor is such the demand for cross-border activity with country A by agents resident in the other euro area countries. The purest one-hub model is therefore unlikely to prevail in the real world. A relaxed version of it is presented in Chart A.3, which assumes the existence of a second hub, country B.

**Chart A.3**

**Example of hub-structure of cross-border activity (two hubs)**



Note: dotted lines: residual trading with second hub.

Irrespective of whether the web-structure or the hub-structure prevails, what should not happen in an integrated market is an inversion of ranks. With reference to Chart A.3, let us assume that the banking system of A offers a more favourable business environment (no matter why) than B and leads the cross-border activity, i.e. it holds the largest total amount of cross-border positions. It should then follow that the residents in all other euro area countries find it preferable to run business with the banking system of A first. Only subsequently, in a logic of portfolio (counterpart) diversification, they should deal with the banking system of B.

<sup>12</sup> The terms “perfect competition” and “single counterparty” are used in an application to consolidation models to clearing systems, ECB (2001). Buch (2001) defines the type of trading described by Chart A.1 as “complete financial integration”, and the structure defined by charts A.2 and A.3 as “incomplete financial integration”.

<sup>13</sup> See Hamilton (1996) for an analysis of the implications of the credit lines on the US Fed Funds market. A more specific application of the implications of the diversification of credit risks in the allocation of trading across countries is in Darmine (2002, p. 10).

Conversely, the case where this holds true for residents in C but residents in D finds it preferable to approach first banks in B may be taken as a sign of uneven access to the national banking systems. In other words, C and D make different choices because what is more convenient for C (better to deal first with A and then with B) is reversed for D (better to deal first with B and then with A).

Hence, by measuring the concordance or co-graduation of ranks, indicator #5 measures the unevenness in the access to the various national components of the euro area market. In a limit case, for each country  $j$  other than [A], the largest share of cross-border business is the one with [A]. In that case, [A] would not only leads the cross-border activity as a total over the whole euro area, but also vis-à-vis each of the single countries.

Coming to the algebra of indicator [5], we preliminarily define as hub country the country  $i$  which verifies

$$\sum_{j \neq i, j=1}^n x_{i,j} = \max \left( \sum_{j=1}^n x_{1,j}, \sum_{j=2, j=1}^n x_{2,j}, \dots, \sum_{j=n, j=1}^n x_{n,j} \right) \quad [\text{A.9}]$$

$H^{\text{MIN}}$  corresponds to the case where  $\rho_{j,[1]}=1$  for all  $j$ 's and [1] is the hub country. As a result,  $H^{\text{MIN}}=0$ . The opposite case is one where A manages to snatch the top overall position, while standing on average only fourth in each of the bilateral rankings.<sup>14</sup> Under those circumstances,  $H^{\text{MAX}}=(4-1) \times 9$ . It follows

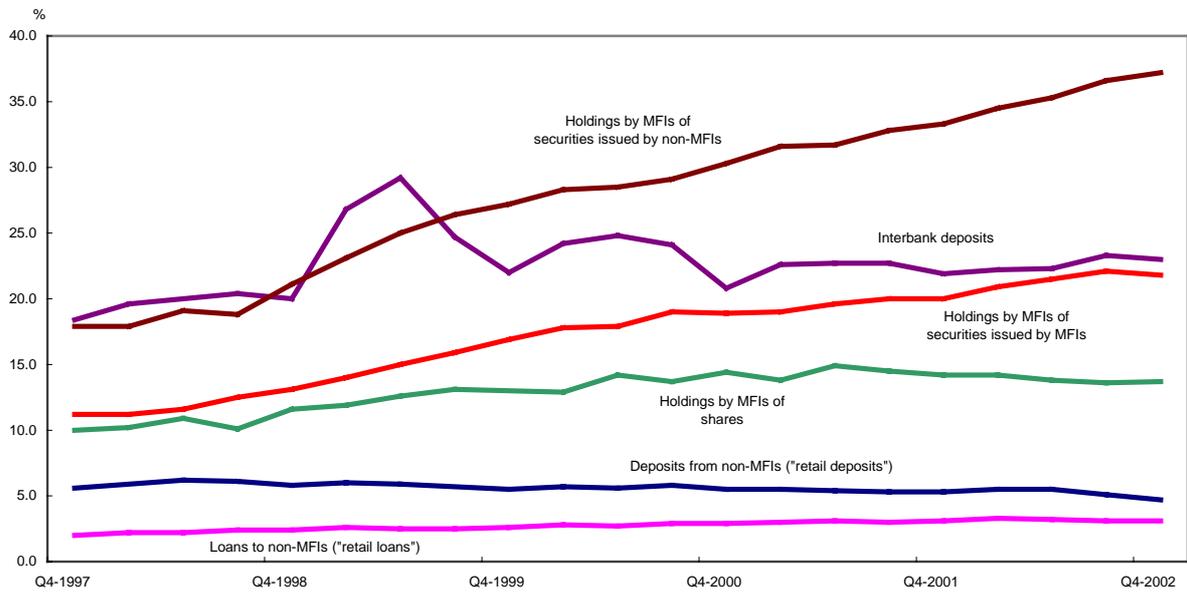
$$I_6 = \left( \frac{H}{(4-1) \times 9} \right)^2 \quad [\text{A.10}]$$

---

<sup>14</sup> Four is the largest integer that allows the banking system of country A retaining the lead over the whole euro area.

Chart 1

Share of cross-border activity, euro area totals



**Charts 2a-2f**

**Share of cross-border activity, national totals**

(yearly averages of end-quarter observations)

Chart 2a: Deposits from non-MFIs

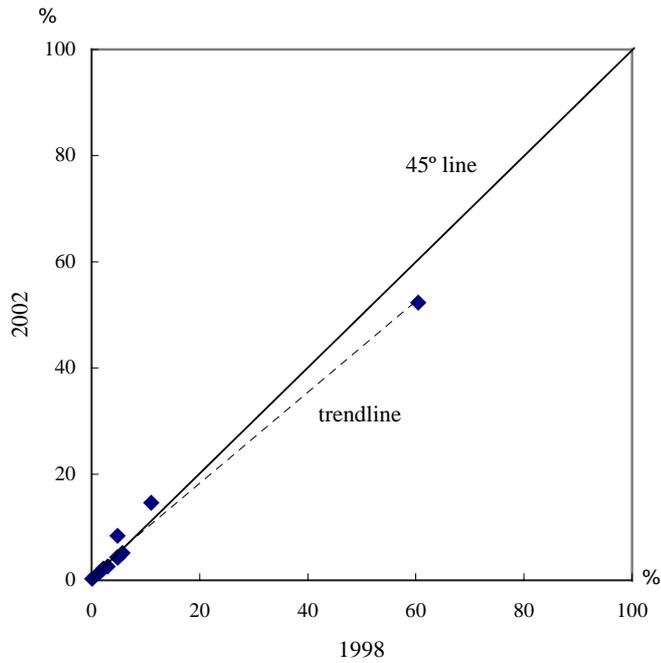


Chart 2b: Loans to non-MFIs

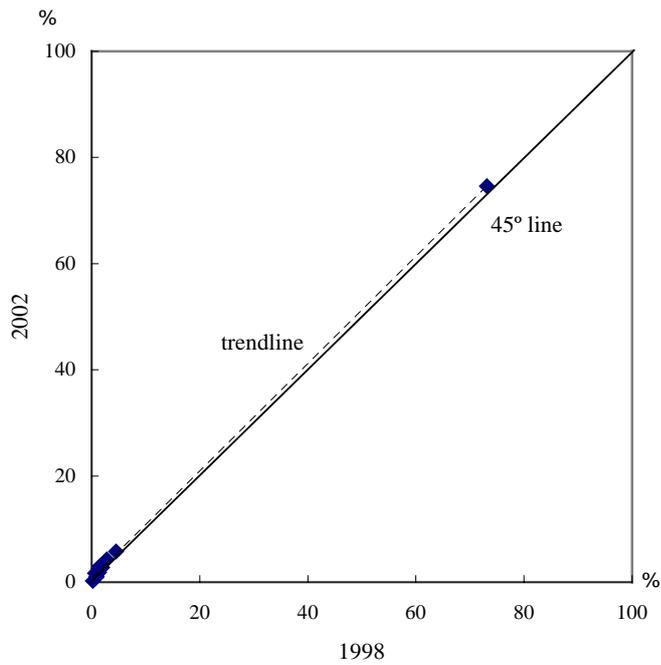


Chart 2c: Interbank deposits

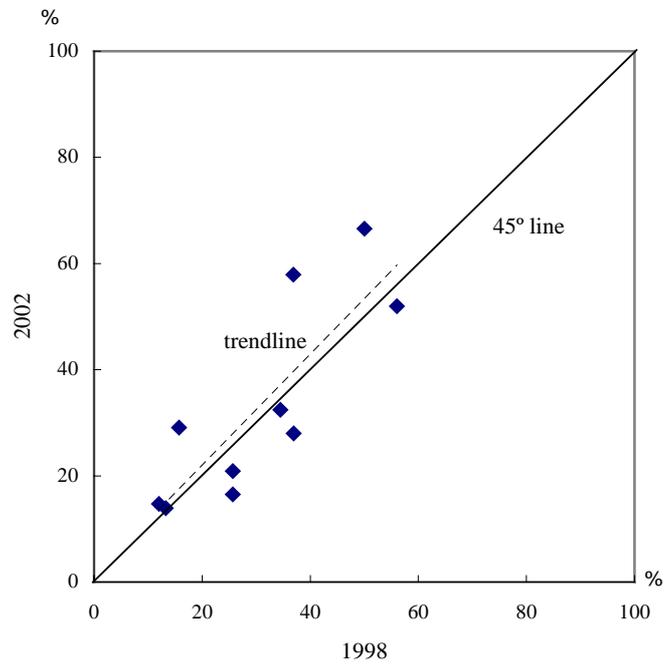


Chart 2d: Holdings of securities issued by MFIs

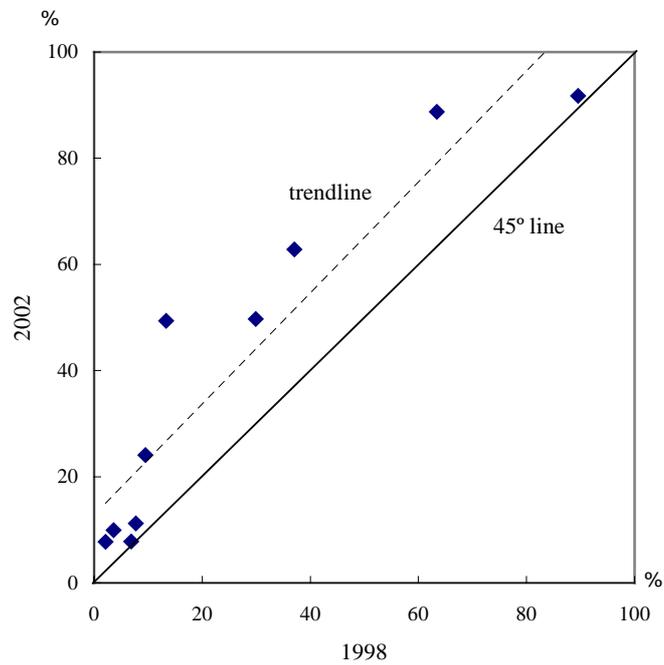


Chart 2e: Holdings of securities issued by non-MFIs

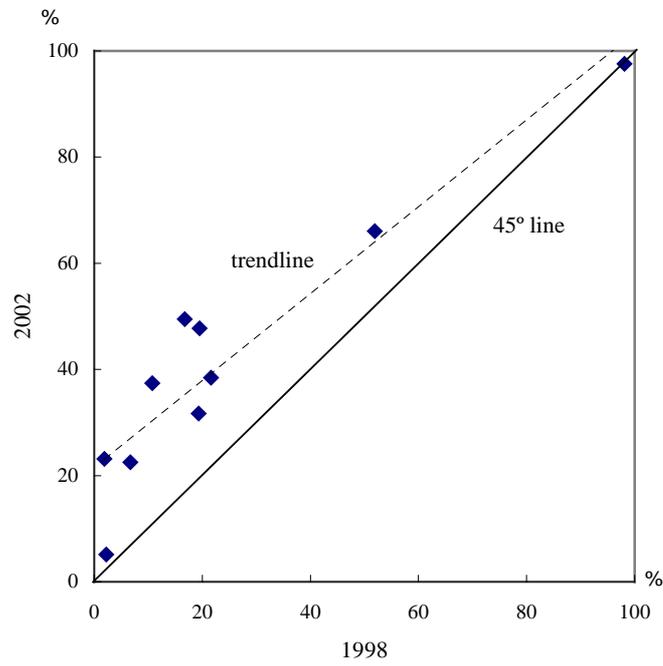
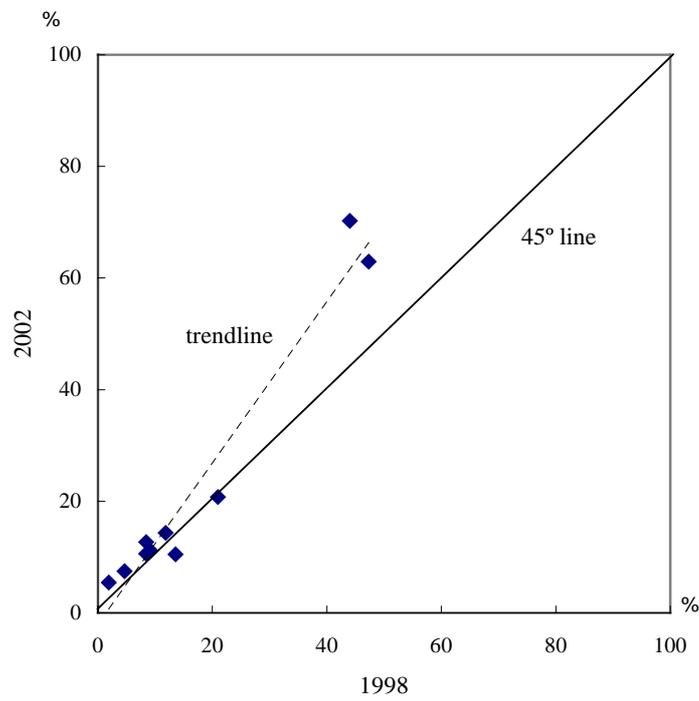


Chart 2f: Holdings of shares and other equity



Charts 3a-3b

Distribution of cross-border activity: normalised distance from neutrality towards location of counterparty

Chart 3a: Retail deposits, retail loans, interbank deposits

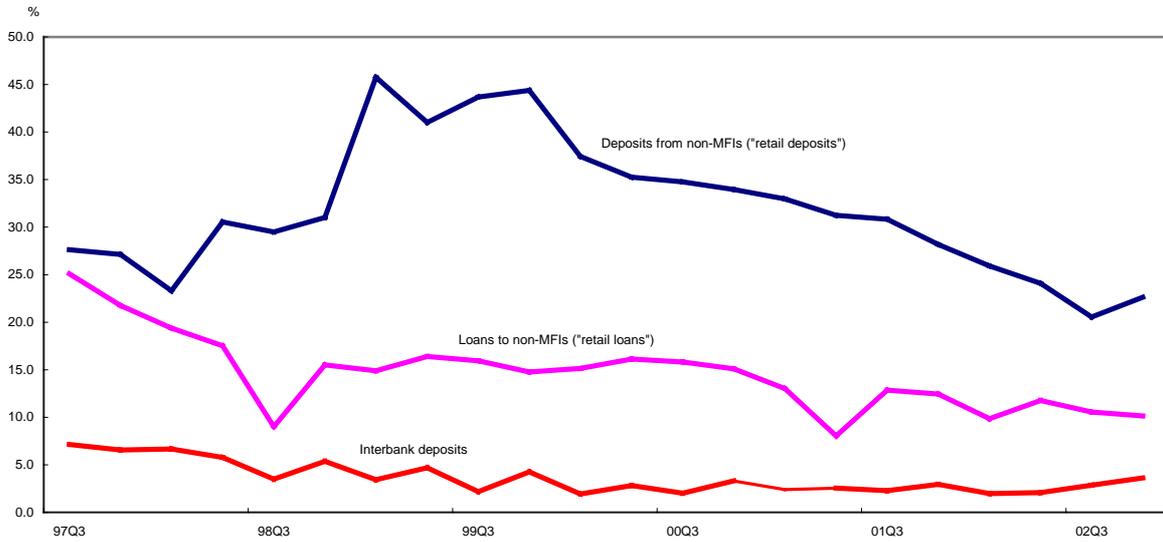
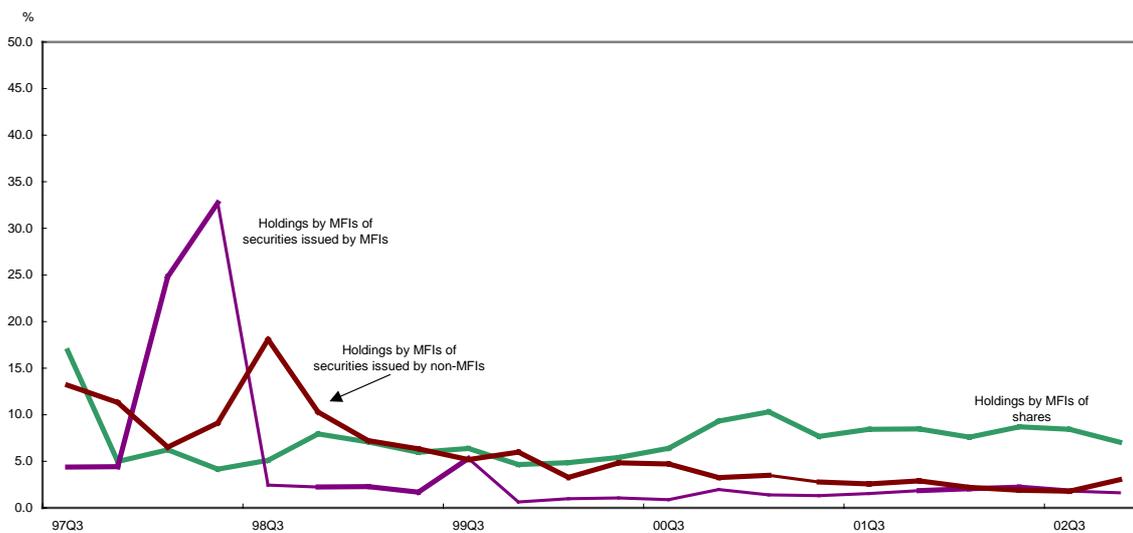


Chart 3b: Holdings of securities issued by MFIs, holdings of securities issued by non-MFIs, holdings of shares



**Charts 4a-4b**

**Distribution of cross-border activity: normalised distance from neutrality towards location of counterparty depending on whether countries share land border or not**

Chart 4a: Retail deposits, retail loans, interbank deposits

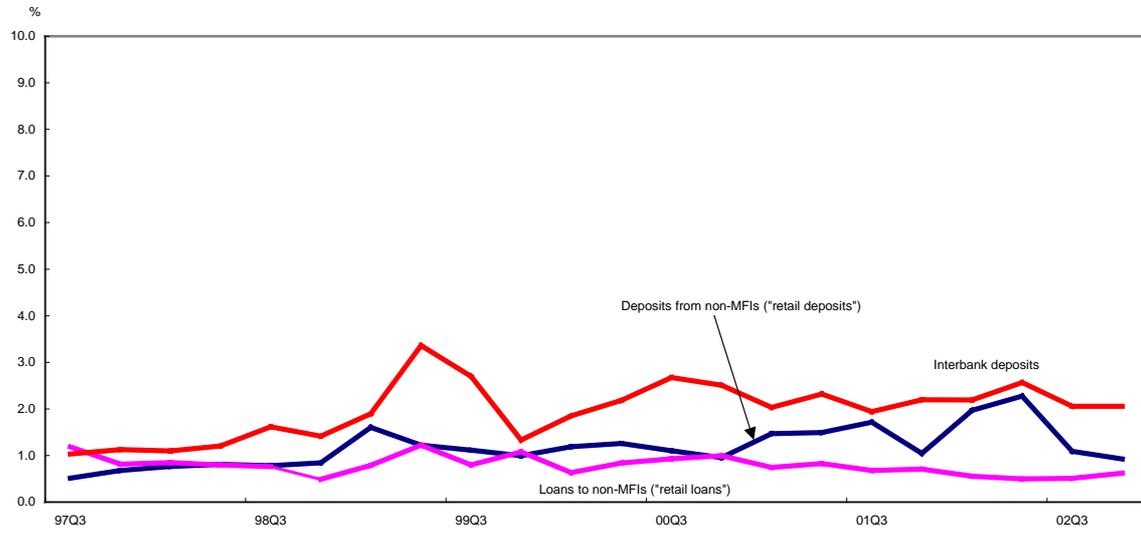
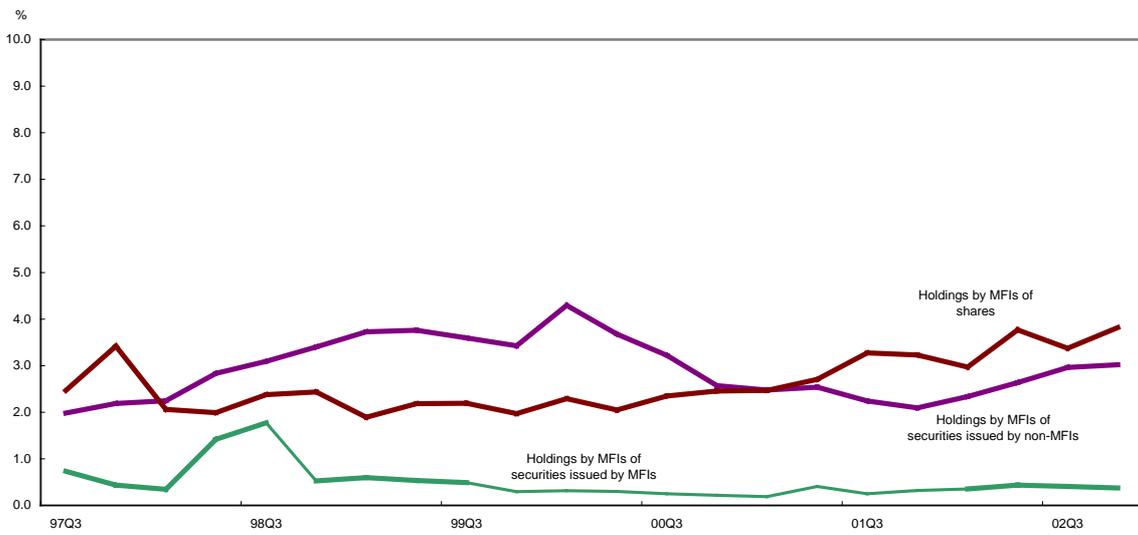


Chart 4b: Holdings of securities issued by MFIs, holdings of securities issued by non-MFIs, Holdings of shares



## European Central Bank working paper series

For a complete list of Working Papers published by the ECB, please visit the ECB's website (<http://www.ecb.int>).

- 202 "Aggregate loans to the euro area private sector" by A. Calza, M. Manrique and J. Sousa, January 2003.
- 203 "Myopic loss aversion, disappointment aversion and the equity premium puzzle" by D. Fielding and L. Stracca, January 2003.
- 204 "Asymmetric dynamics in the correlations of global equity and bond returns" by L. Capiello, R.F. Engle and K. Sheppard, January 2003.
- 205 "Real exchange rate in an inter-temporal n-country-model with incomplete markets" by B. Mercereau, January 2003.
- 206 "Empirical estimates of reaction functions for the euro area" by D. Gerdesmeier and B. Roffia, January 2003.
- 207 "A comprehensive model on the euro overnight rate" by F. R. Würtz, January 2003.
- 208 "Do demographic changes affect risk premiums? Evidence from international data" by A. Ang and A. Maddaloni, January 2003.
- 209 "A framework for collateral risk control determination" by D. Cossin, Z. Huang, D. Aunon-Nerin and F. González, January 2003.
- 210 "Anticipated Ramsey reforms and the uniform taxation principle: the role of international financial markets" by S. Schmitt-Grohé and M. Uribe, January 2003.
- 211 "Self-control and savings" by P. Michel and J.P. Vidal, January 2003.
- 212 "Modelling the implied probability of stock market movements" by E. Glatzer and M. Scheicher, January 2003.
- 213 "Aggregation and euro area Phillips curves" by S. Fabiani and J. Morgan, February 2003.
- 214 "On the selection of forecasting models" by A. Inoue and L. Kilian, February 2003.
- 215 "Budget institutions and fiscal performance in Central and Eastern European countries" by H. Gleich, February 2003.
- 216 "The admission of accession countries to an enlarged monetary union: a tentative assessment" by M. Ca'Zorzi and R. A. De Santis, February 2003.
- 217 "The role of product market regulations in the process of structural change" by J. Messina, March 2003.

- 218 “The zero-interest-rate bound and the role of the exchange rate for monetary policy in Japan” by G. Coenen and V. Wieland, March 2003.
- 219 “Extra-euro area manufacturing import prices and exchange rate pass-through” by B. Anderton, March 2003.
- 220 “The allocation of competencies in an international union: a positive analysis” by M. Ruta, April 2003.
- 221 “Estimating risk premia in money market rates” by A. Durré, S. Evjen and R. Pilegaard, April 2003.
- 222 “Inflation dynamics and subjective expectations in the United States” by K. Adam and M. Padula, April 2003.
- 223 “Optimal monetary policy with imperfect common knowledge” by K. Adam, April 2003.
- 224 “The rise of the yen vis-à-vis the (“synthetic”) euro: is it supported by economic fundamentals?” by C. Osbat, R. Ruffer and B. Schnatz, April 2003.
- 225 “Productivity and the (“synthetic”) euro-dollar exchange rate” by C. Osbat, F. Visselaar and B. Schnatz, April 2003.
- 226 “The central banker as a risk manager: quantifying and forecasting inflation risks” by L. Kilian and S. Manganelli, April 2003.
- 227 “Monetary policy in a low pass-through environment” by T. Monacelli, April 2003.
- 228 “Monetary policy shocks – a nonfundamental look at the data” by M. Klaeffing, May 2003.
- 229 “How does the ECB target inflation?” by P. Surico, May 2003.
- 230 “The euro area financial system: structure, integration and policy initiatives” by P. Hartmann, A. Maddaloni and S. Manganelli, May 2003.
- 231 “Price stability and monetary policy effectiveness when nominal interest rates are bounded at zero” by G. Coenen, A. Orphanides and V. Wieland, May 2003.
- 232 “Describing the Fed’s conduct with Taylor rules: is interest rate smoothing important?” by E. Castelnuovo, May 2003.
- 233 “The natural real rate of interest in the euro area” by N. Giammarioli and N. Valla, May 2003.
- 234 “Unemployment, hysteresis and transition” by M. León-Ledesma and P. McAdam, May 2003.
- 235 “Volatility of interest rates in the euro area: evidence from high frequency data” by N. Cassola and C. Morana, June 2003.

- 236 “Swiss monetary targeting 1974-1996: the role of internal policy analysis” by G. Rich, June 2003.
- 237 “Growth expectations, capital flows and international risk sharing” by O. Castrén, M. Miller and R. Stiegert, June 2003.
- 238 “The impact of monetary union on trade prices” by R. Anderton, R. E. Baldwin and D. Taglioni, June 2003.
- 239 “Temporary shocks and unavoidable transitions to a high-unemployment regime” by W. J. Denhaan, June 2003.
- 240 “Monetary policy transmission in the euro area: any changes after EMU?” by I. Angeloni and M. Ehrmann, July 2003.
- 241 “Maintaining price stability under free-floating: a fearless way out of the corner?” by C. Detken and V. Gaspar, July 2003.
- 242 “Public sector efficiency: an international comparison” by A. Afonso, L. Schuknecht and V. Tanzi, July 2003.
- 243 “Pass-through of external shocks to euro area inflation” by E. Hahn, July 2003.
- 244 “How does the ECB allot liquidity in its weekly main refinancing operations? A look at the empirical evidence” by S. Ejerskov, C. Martin Moss and L. Stracca, July 2003.
- 245 “Money and payments: a modern perspective” by C. Holthausen and C. Monnet, July 2003.
- 246 “Public finances and long-term growth in Europe – evidence from a panel data analysis” by D. R. de Ávila Torrijos and R. Strauch, July 2003.
- 247 “Forecasting euro area inflation: does aggregating forecasts by HICP component improve forecast accuracy?” by K. Hubrich, August 2003.
- 248 “Exchange rates and fundamentals” by C. Engel and K. D. West, August 2003.
- 249 “Trade advantages and specialisation dynamics in acceding countries” by A. Zaghini, August 2003.
- 250 “Persistence, the transmission mechanism and robust monetary policy” by I. Angeloni, G. Coenen and F. Smets, August 2003.
- 251 “Consumption, habit persistence, imperfect information and the lifetime budget constraint” by A. Willman, August 2003.
- 252 “Interpolation and backdating with a large information set” by E. Angelini, J. Henry and M. Marcellino, August 2003.
- 253 “Bond market inflation expectations and longer-term trends in broad monetary growth and inflation in industrial countries, 1880-2001” by W. G. Dewald, September 2003.

- 254 "Forecasting real GDP: what role for narrow money?" by C. Brand, H.-E. Reimers and F. Seitz, September 2003.
- 255 "Is the demand for euro area M3 stable?" by A. Bruggeman, P. Donati and A. Warne, September 2003.
- 256 "Information acquisition and decision making in committees: a survey" by K. Gerling, H. P. Grüner, A. Kiel and E. Schulte, September 2003.
- 257 "Macroeconomic modelling of monetary policy" by M. Klaeßling, September 2003.
- 258 "Interest rate reaction functions and the Taylor rule in the euro area" by P. Gerlach-Kristen, September 2003.
- 259 "Implicit tax co-ordination under repeated policy interactions" by M. Catenaro and J.-P. Vidal, September 2003.
- 260 "Aggregation-theoretic monetary aggregation over the euro area, when countries are heterogeneous" by W. A. Barnett, September 2003.
- 261 "Why has broad money demand been more stable in the euro area than in other economies? A literature review" by A. Calza and J. Sousa, September 2003.
- 262 "Indeterminacy of rational expectations equilibria in sequential financial markets" by P. Donati, September 2003.
- 263 "Measuring contagion with a Bayesian, time-varying coefficient model" by M. Ciccarelli and A. Rebucci, September 2003.
- 264 "A monthly monetary model with banking intermediation for the euro area" by A. Bruggeman and M. Donnay, September 2003.
- 265 "New Keynesian Phillips Curves: a reassessment using euro area data" by P. McAdam and A. Willman, September 2003.
- 266 "Finance and growth in the EU: new evidence from the liberalisation and harmonisation of the banking industry" by D. Romero de Ávila, September 2003.
- 267 "Comparing economic dynamics in the EU and CEE accession countries" by R. Süppel, September 2003.
- 268 "The output composition puzzle: a difference in the monetary transmission mechanism in the euro area and the US" by I. Angeloni, A. K. Kashyap, B. Mojon and D. Terlizzese, September 2003.
- 269 "Zero lower bound: is it a problem with the euro area?" by G. Coenen, September 2003.
- 270 "Downward nominal wage rigidity and the long-run Phillips curve: simulation-based evidence for the euro area" by G. Coenen, September 2003.
- 271 "Indeterminacy and search theory" by N. Giammarioli, September 2003.

- 272 "Inflation targets and the liquidity trap" by M. Klaefferling and V. López Pérez, September 2003.
- 273 "Definition of price stability, range and point inflation targets: the anchoring of long-term inflation expectations" by E. Castelnuovo, S. Nicoletti-Altimari and D. Rodriguez-Palenzuela, September 2003.
- 274 "Interpreting implied risk neutral densities: the role of risk premia" by P. Hördahl and D. Vestin, September 2003.
- 275 "Identifying the monetary transmission mechanism using structural breaks" by A. Beyer and R. Farmer, September 2003.
- 276 "Short-term estimates of euro area real GDP by means of monthly data" by G. Rünstler, September 2003.
- 277 "On the indeterminacy of determinacy and indeterminacy" by A. Beyer and R. Farmer, September 2003.
- 278 "Relevant economic issues concerning the optimal rate of inflation" by D. R. Palenzuela, G. Camba-Méndez and J. Á. García, September 2003.
- 279 "Designing targeting rules for international monetary policy cooperation" by G. Benigno and P. Benigno, October 2003.
- 280 "Inflation, factor substitution and growth" by R. Klump, October 2003.
- 281 "Identifying fiscal shocks and policy regimes in OECD countries" by G. de Arcangelis and S. Lamartina, October 2003.
- 282 "Optimal dynamic risk sharing when enforcement is a decision variable" by T. V. Koepl, October 2003.
- 283 "US, Japan and the euro area: comparing business-cycle features" by P. McAdam, November 2003.
- 284 "The credibility of the monetary policy 'free lunch'" by J. Yetman, November 2003.
- 285 "Government deficits, wealth effects and the price level in an optimizing model" by B. Annicchiarico, November 2003.
- 286 "Country and sector-specific spillover effects in the euro area, the United States and Japan" by B. Kaltenhaeuser, November 2003.
- 287 "Consumer inflation expectations in Poland" by T. Łyziak, November 2003.
- 288 "Implementing optimal control cointegrated I(1) structural VAR models" by F. V. Monti, November 2003.
- 289 "Monetary and fiscal interactions in open economies" by G. Lombardo and A. Sutherland, November 2003.

- 290 “Inflation persistence and robust monetary policy design” by G. Coenen, November 2003.
- 291 “Measuring the time-inconsistency of US monetary policy” by P. Surico, November 2003.
- 292 “Bank mergers, competition and liquidity” by E. Carletti, P. Hartmann and G. Spagnolo, November 2003.
- 293 “Committees and special interests” by M. Felgenhauer and H. P. Grüner, November 2003.
- 294 “Does the yield spread predict recessions in the euro area?” by F. Moneta, December 2003.
- 295 “Optimal allotment policy in the eurosystem’s main refinancing operations?” by C. Ewerhart, N. Cassola, S. Ejerskov and N. Valla, December 2003.
- 296 “Monetary policy analysis in a small open economy using bayesian cointegrated structural VARs?” by M. Villani and A. Warne, December 2003.
- 297 “Measurement of contagion in banks’ equity prices” by R. Gropp and G. Moerman, December 2003.
- 298 “The lender of last resort: a 21st century approach” by X. Freixas, B. M. Parigi and J.-C. Rochet, December 2003.
- 299 “Import prices and pricing-to-market effects in the euro area” by T. Warmedinger, January 2004.
- 300 “Developing statistical indicators of the integration of the euro area banking system” by M. Manna, January 2004.

