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**Working Paper**

## Portuguese banks in the euro area market for daily funds

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**ECB WORKSHOP  
ON THE ANALYSIS OF  
THE MONEY MARKET**

**WORKING PAPER SERIES**

**NO 985 / DECEMBER 2008**

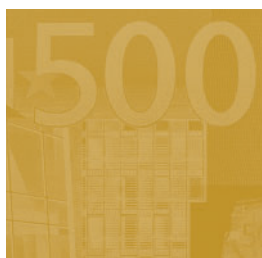
**PORTUGUESE BANKS IN  
THE EURO AREA MARKET  
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# PORTUGUESE BANKS IN THE EURO AREA MARKET FOR DAILY FUNDS<sup>1</sup>

by Luísa Farinha<sup>2</sup> and Vítor Gaspar<sup>3</sup>



In 2008 all ECB publications feature a motif taken from the €10 banknote.

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The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the European Central Bank, Banco de Portugal and the European Commission.

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## ECB WORKSHOP ON THE ANALYSIS OF THE MONEY MARKET

On 14 and 15 November 2007, Alain Durré, Huw Pill and Diego Rodriguez-Palenzuela of the ECB's Monetary Policy Stance Division organised a central bank workshop titled "The Analysis of the Money Market: Role, Challenges and Implications from the Monetary Policy Perspective". This workshop provided an opportunity for participating central bank experts to exchange views and foster debate, also in interaction with international organizations and academic institutions. The first day of the workshop addressed issues related to the macro-perspective of the money market, drawing on the experiences of a large number of countries. The second day adopted a micro-perspective on the money market, looking in particular at trading behaviour in the overnight money market and its implications for the evolution of spreads.

A first version of this paper was presented at this workshop. The papers presented at the time of the workshop did not consider the potential implications of the financial turmoil for the results of the paper, given that the tensions in money markets emerged in August 2007. The published version of these papers represents an update of the original paper, which incorporates the discussion which took place at the workshop and in most cases a discussion on the developments in the money markets since August 2007.

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## Abstract

In this paper, we use the Furfine (1999) statistical procedure to identify money market operations from Payments Systems data. Given the availability of an alternative data set, recording money market operations we could confirm the accuracy of the method. We examine evidence on integration of the money market in the euro area. We ask: “how do Portuguese banks participate in the market for daily funds?” and look for a possible hierarchical structure in the market. We find strong evidence of integration and mixed evidence on hierarchical structure.

**Keywords:** Money market, Furfine procedure, financial integration, hierarchical structure, Portuguese banks.

**JEL Classification:** E52, E58.

## Non-technical summary

In this paper, we use the Furfine (1999) statistical procedure to identify Money market operations from Payments Systems data. Given the availability of an alternative data set recording money market operations we could confirm the accuracy of the method. Specifically, excluding operations within the same bank group, that, frequently, are not in standardized amounts the procedure was able to correctly identify 95 per cent of the total of operations. The use of a similar methodology to build a representative sample of money market transactions would be invaluable for research on the market for daily funds. Such research would be relevant for both monetary policy and payments systems. Research on financial stability issues could also benefit from the availability of such data, as it could be used for assessing interbank contagion linked to the very short term interbank market and in particular to estimate how a short term liquidity shock would propagate in the system.

In the paper we ask a number of questions: How do Portuguese banks participate in the euro area wide market? Can we detect a hierarchical structure? What is the role of the largest institutions?

We have found strong evidence of integration. Focusing on price indicators (interest rates) there is high correlation (virtually one) between interest rates recorded in operations involving at least one Portuguese bank and EONIA interest rates. Average spreads are narrow. Moreover, there is also a strong association between dispersion of rates in the EONIA panel and dispersion in operations involving Portuguese banks. In particular, dispersion patterns within reserve maintenance periods are analogous, with dispersion increasing as the end of the reserve maintenance period approaches. Focusing on quantities, that is on measures of the relative importance of local vs. cross border transactions, the process of integration appears more gradual. Nevertheless, cross-border transactions represented already in 1999 almost 2/3 of all transactions involving at least one Portuguese bank. The share increased rapidly to 90% in 2002 and, at the end of our sample, it was almost 97%. The share of transactions involving one large and one small Portuguese bank declined steadily over time.

Not surprisingly larger Portuguese banks have a richer set of counterparties and are more active in the market. In the more recent years Portuguese banks have been mostly lenders in the market for daily funds. The largest Portuguese banks concentrated their lending activity cross-border and were not a significant source of funds for smaller Portuguese banks. The behavior of interest rates in operations involving small Portuguese banks can be distinguished from the remainder of recorded transactions. In particular, spreads were noticeable at the beginning of our sample period, but narrowed significantly thereafter.

## 1 Introduction

Monetary policy operates through the money market. This is the market where banks trade overnight deposits at the central bank. In this paper, we call it market for daily funds. Up to the end of 1998, the geographical region, which now corresponds to the euro area, was characterized by segmented money markets, reflecting different currencies, legal systems, operational frameworks, standard practices and much else. Hence, in the preparations for the start of operations of the single monetary policy, one of the priorities was to ensure smooth and integrated functioning of the interbank market for daily funds in the euro area. Proper functioning was clearly required for the effectiveness of the single monetary policy. In this context, it is important to refer to the payments infrastructure. TARGET, the European real time gross settlement system started operating on 4 January 1999, the first business day of Stage Three of Economic and Monetary Union. TARGET is the result of interlinking of Real Time Gross Settlement Systems, one for each European Union member state. Gaspar, Perez-Quirós and Sicilia (2001) document that after the introduction of the euro the national money markets integrated smoothly and rapidly. Moreover, they show that the transition to the new operational framework had no significant impact on the aggregate time series behavior of money market interest rates. Thus, it is legitimate to conclude that, from the viewpoint of monetary policy effectiveness, the transition to the euro was fully successful from its very start.

Padoa-Schioppa (2004, p. 22) argues that two changes in payments practices lie at the root of modern central banking. The first was the use of paper money to substitute for commodity money. The second, the use of bank deposits to substitute for banknotes and coin in ordinary transactions. Payment of transactions through the transfer of bank deposits (e.g. through checks) became dominant. Interbank deposits were transferred through clearing schemes among banks. In such a setting, the banking system provides liquidity on demand to the other sectors of the economy. In ideal conditions the banking system provides an elastic currency, that is payment services commensurate with the needs of business. The proper functioning of such system requires trust in the stability in the standard of value (a fiduciary regime must be based on price stability) and trust in the integrity and reliability of

payments mechanisms. Hence, the interbank money market is at the roots of central banking. It immediately leads to concerns with monetary stability and with financial stability.

Recent literature on monetary policy implementation has extended the classical framework of Poole (1968) to account for implementation of monetary policy through a corridor system (see Woodford, 2003 and Bindseil, 2004, for reviews of the literature and extensive references). At the same time, recent theoretical literature on financial stability has related relationship lending in the money market with contagion and systemic risk (see, for example, Freixas, Parigi and Rochet, 2000).

Most of the empirical work on the money market has overlooked micro-structure aspects. There are, however, some notable exceptions. Furfine (1999) examined the Fed funds market. He used a unique database that included individual transactions data between banks. He characterized trading patterns and relationships in the interbank market. Hartmann et al. (2001) analyzed the intra-day behavior of the overnight interest rate in four countries of the euro area. They have related those patterns to the operational framework of monetary policy.

In this paper, we use a database similar to Furfine's, and also his statistical procedure, to describe patterns of interbank transactions, in the unsecured market for daily funds in euro, and their evolution, in the period 1999-2005. The data includes all transactions involving one Portuguese bank, as a lender or a borrower, either local (that is transactions with another Portuguese bank) or cross-border. Our database is unique in the sense that it records, for each individual transaction, information on timing, price, quantity and the identity of the trading parties. In this paper, we make a first step in a research program aiming at characterizing in detail the micro-structure of the interbank market and relationships in this market involving Portuguese banks. We found that the statistical procedure, proposed by Furfine, is successful in identifying interbank money market transactions with a high degree of accuracy, providing almost full coverage of the full set of relevant transactions.

Our study aims at answering questions like:

- Is the market for daily funds segmented? Is there evidence of an integration process? How do Portuguese banks participate in the euro area wide market?
- Can we detect a hierarchical structure? What is the role of the largest institutions?

The paper is organized as follows: in section 1 we describe the datasets made available for our study. We also describe the statistical process used to recover money market transactions and report on its accuracy. In section 2, we report results based price indicators (interest rates). In section 3, we report results based on transactions volumes. In section 4, we characterize structured relationships in the market. In section 5, we conclude.

## 2 Data and statistical procedure

In this paper, we have used three different datasets. The EONIA panel is constituted by large euro area banks. These banks contribute to the computation of EONIA interest rate. The rate corresponds to actual transactions, in which reporting banks participate as lenders. This dataset has been used in earlier research by, for example, Perez-Quirós and Rodriguez-Mendizábal (2006) and by Gaspar, Perez-Quirós and Rodriguez-Mendizábal (2007). It was provided by the European Banking Federation. The two other databases were provided by Banco de Portugal. Those were SITEME, the Market Electronic Payment System, provided by the Market and Reserves Department; and a Payments System database provided by the Payments Department. SITEME covers operations between Portuguese banks that choose to use the system. The Payments System database records all payments using the Real Time Gross Settlement System.

The SITEME and the Payments System Database are very rich databases. SITEME identifies the time of operation, the parties involved, the amount transacted, the interest rate practiced and the maturity of the operation. The *caveat* is coverage. It records only operations in which both parties involved are Portuguese banks. In turn, the Payments System Database identifies the time of operation, the parties involved and the amounts. The *caveat* is that it records payments only. It does not record the nature or the maturity of the operation.

Fortunately, the drawbacks of the Payments System Database may be circumvented using a statistical procedure, originally described in Furfine (1999). The Furfine procedure enables the identification of overnight operations automatically. The idea is very simple and it is based on two steps:

- In the first step, the procedure selects candidate operations by focusing on large round amounts. The justification is that money market operations are made, as a rule, in large (round) amounts.

- In the second step, the procedure searches, on the following day for payments involving the same parties, with funds flowing in the opposite direction, in which the amount is only slightly larger than the original amount (corresponding to the overnight interest accrued).

In our case, we consider multiples of 100000 euro in the first step. For the second step, we have considered interest rates below the maximum rate in the EONIA panel plus 50 basis points and above the minimum rate, in the same panel, minus 50 basis points. Since we have the data for all operations involving two Portuguese banks registered in the SITEME we were able to partially test the accuracy of the procedure. The test was done in two steps. In the first step, we found that all the operations involving two Portuguese banks identified through the procedure as overnight operations were also classified as overnight operations in the SITEME. In the second step, we found that, excluding from SITEME the operations within the same bank group, which are more frequently not standardized, the procedure was able to identify 95 per cent of the operations. We are not aware of reasons to believe that accuracy would be significantly different for the case of cross-border operations. Thus, we conclude that the procedure is able to provide an almost complete sample of operations, in the market for daily funds, involving Portuguese banks.

### **3 Empirical Evidence: Interest Rates**

As already said in the Introduction, the interbank market for daily funds integrated smoothly and rapidly in the euro area, shortly after the start of operations of the single monetary policy. This may be verified examining Chart 1. Before 1999, Chart 1 plots the overnight interest rates in the market for the DM and the escudo. After 1999, it plots the EONIA rate and the average rate of operations involving Portuguese banks. Visual examination makes clear that the two series are virtually identical from 1999 to the end of 2005. Confirming the visual impression the correlation between the two series is almost perfect.



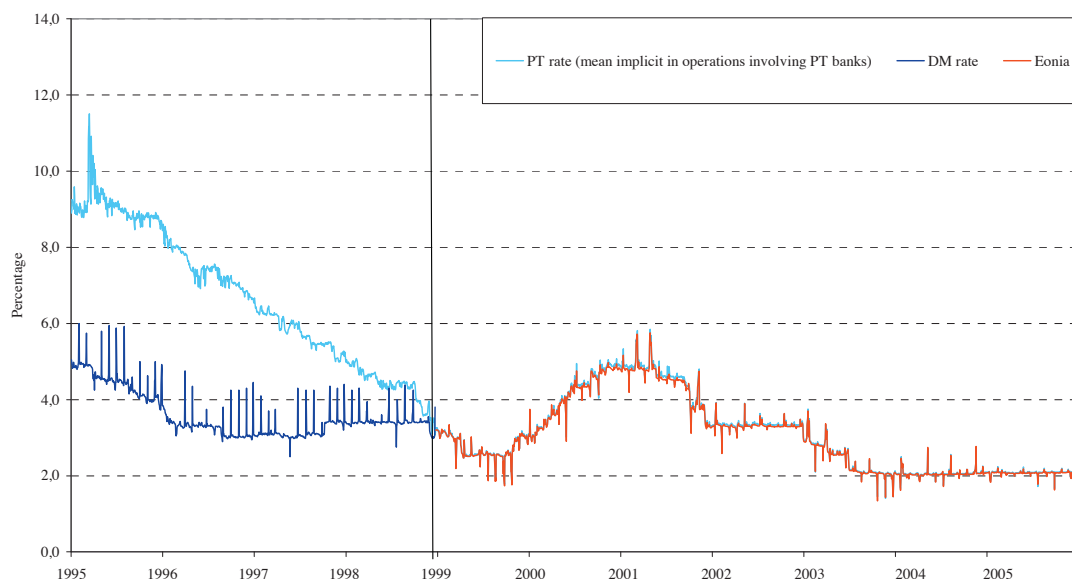


Chart 1 – Money market overnight interest rates

We can document interest rate convergence more precisely. In Chart 2, we report average interest rate spreads between EONIA rates and rates on operations involving Portuguese banks, both in cross-border operations and in local transactions<sup>2</sup>. The latter are operations involving only Portuguese banks. Spreads were relatively small already in the beginning of 1999. Perhaps surprisingly spreads in the cross border market increased in 2000 and 2001, in line with the increase in the reference ECB rates, before falling to very low levels in 2004 and 2005. Interestingly, a confrontation with Chart 1, suggests that a narrowing of spreads was associated with a reduction in the time series volatility of the EONIA. It is also noticeable from Chart 2 that, especially until 2001, the interest rate spreads were more volatile for operations where Portuguese banks were borrowers rather than lenders of daily funds.

<sup>2</sup> The computation of average interest rates in local transactions excludes operations within banking groups.

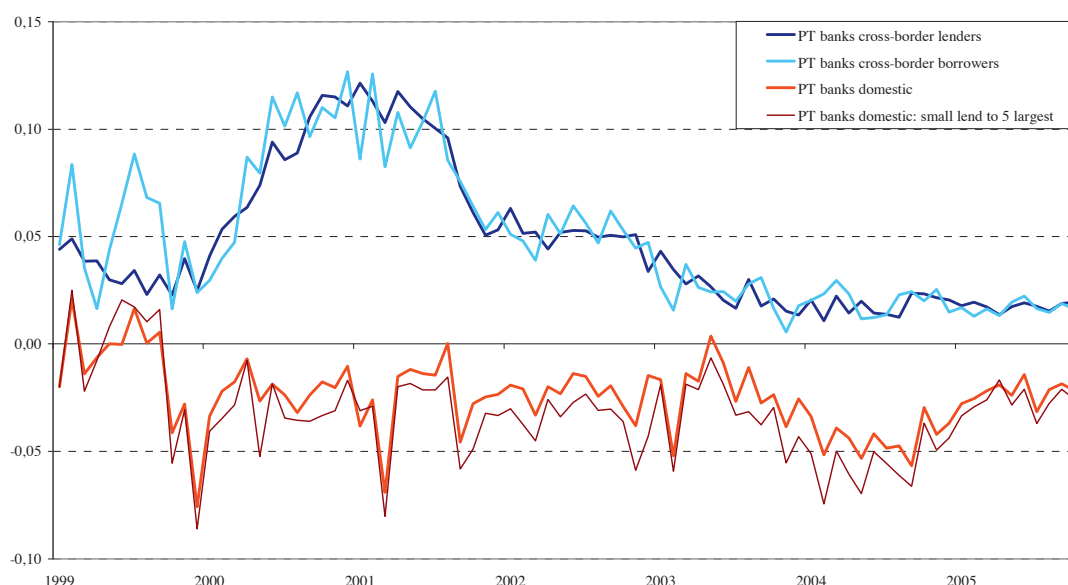


Chart 2 – Interest rates in operations involving Portuguese banks: spreads *vis à vis* the EONIA (average spreads during reserve maintenance periods)

The spreads in the operations involving only the Portuguese banks were also small in the beginning of 1999. Differently from the spreads in their cross-border operations they presented a negative sign. It is also apparent, from Chart 2, that, at times, interest rates on local operations differed visibly from interest rates on cross-border operations. It will be documented, in section 4, on relationships that, after 1999, most operations involving only Portuguese banks, the smaller financed the larger. On average these operations were effected with interest rates not only below the corresponding EONIA rates but also below the average rates on local operations (see Chart 2). Hence, the evidence suggests some hierarchical structure of banking relationships among Portuguese banks has prevailed in the first years of the monetary union.

As we will see in the next section, since 1999, operations with other Portuguese banks have been a small and decreasing proportion of total operations in the market for daily funds for the average Portuguese bank. However, this is not the case for smaller Portuguese banks. For the subset of small Portuguese banks, operations with other Portuguese banks are not negligible. It is interesting to point out that since

mid-2004, the spreads implicit in operations involving only the Portuguese banks have been narrowing. This suggests that the integration process has progressed, albeit at a slower pace, for smaller banks as well.

Plotting the cross-section standard deviation of interest rates shows that the patterns of interest rate volatility in cross-border operations involving Portuguese banks and in operations of the EONIA banks are very similar (Chart 3). The association holds irrespective of Portuguese banks being lenders or borrowers in the cross-border market. However, in some selected periods, the volatility of interest rates for local operations was visibly different (this was the case from the end of 2003 to the beginning of 2005).

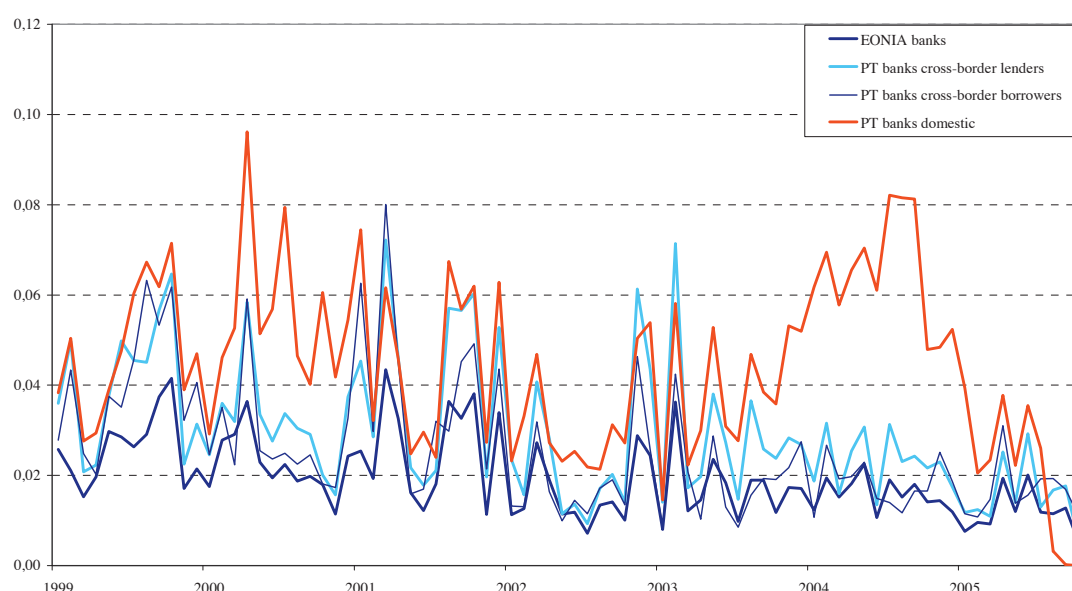


Chart 3 – Cross-section standard deviation of interest rates (averages within reserve maintenance periods)

The evolution of the annual average of the cross-section deviations of interest rates shows a decreasing pattern also in the case of the rates reported by the EONIA banks. This is consistent with the hypothesis of a gradual integration process.

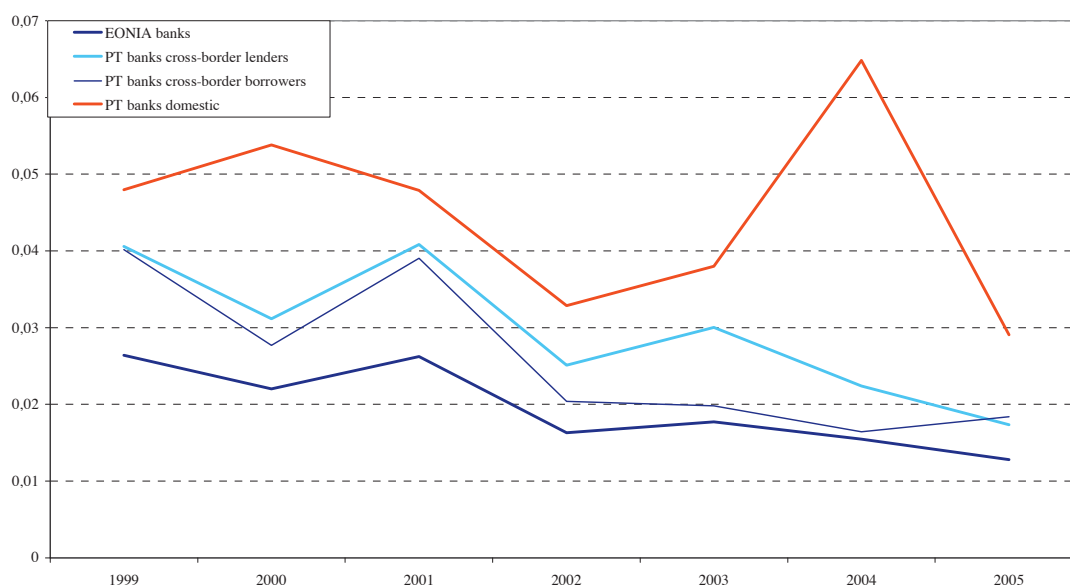


Chart 4 – Cross-section standard deviation of interest rates (annual averages)

Chart 5 documents patterns of volatility on different days of a reserve maintenance period. As documented elsewhere, on the basis of EONIA panel data (see, for example Gaspar, Perez-Quirós and Rodríguez-Mendizabal (2007)) dispersion of rates is very low at the beginning and increases towards the end of the reserve maintenance period. The same pattern clearly holds for operations involving Portuguese banks. Not surprisingly it is not relevant whether Portuguese banks are borrowers or lenders, nor whether the transactions take place locally or cross-border.

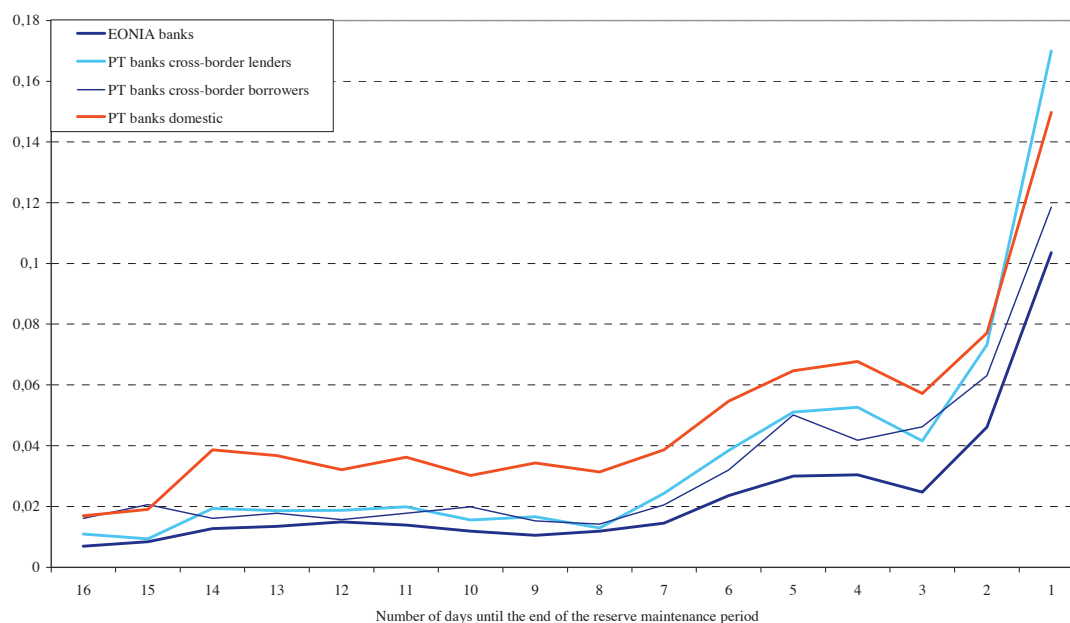


Chart 5 – Cross-section standard deviations of interest rates (averages according to the number of days until the end of the reserve maintenance period)

## 4 Empirical Evidence: Transactions Volumes

In section 2, we have documented that, according to price indicators, the interbank market for daily funds has integrated rapidly, right at the beginning of operations of the single monetary policy. This is also evident from the information reported in Chart 6 and Tables 1A and 1B. Immediately, in 1999, the amounts traded cross-border by Portuguese banks exceeded local transactions by a proportion of almost two to one. This is the case only excluding intra-group operations. Nevertheless, even including these operations, more than half of the operations involving Portuguese banks were cross-border. Interestingly, the proportions of amounts traded in the local market and traded cross-border show very gradual adjustment.

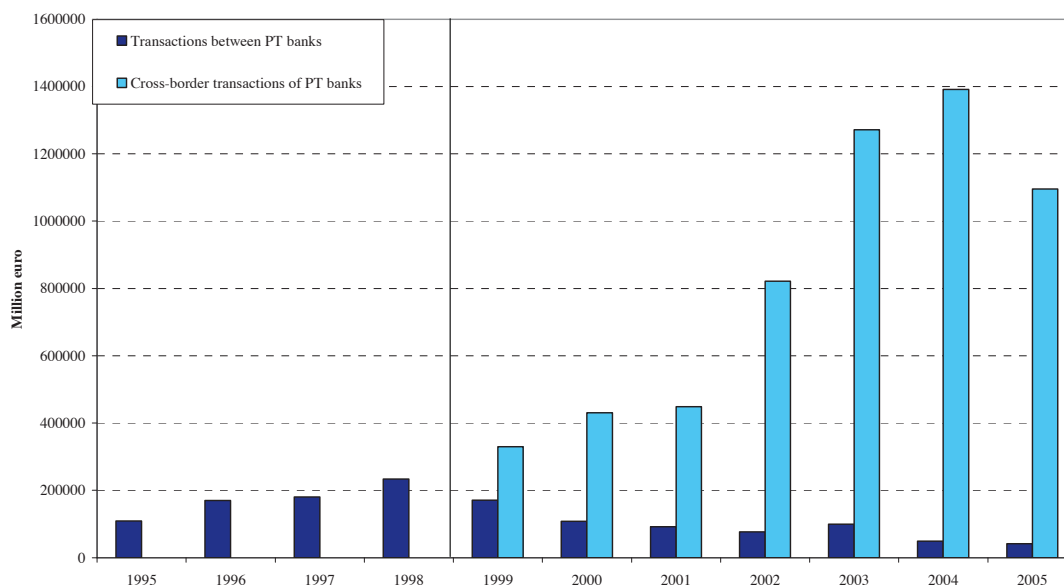


Chart 6 – Transactions of the Portuguese banks in the market for daily funds

The share of cross-border operations increased continuously over time. Already in 2000 (excluding intra-group operations), it amounted to about 4/5 of all transactions involving Portuguese banks. And the increase still continued for some years. Only very recently, in 2004 and 2005, it seems to have stabilized. In both years the share of cross-border operations was about 97 per cent. In other words, the percentage of transactions involving only local institutions declined to only slightly more than 3 per cent of total transactions<sup>3</sup>.

In Table 1B we see the same process of integration in progress, in the period 1999-2005, looking at transactions including intra-group operations. The main difference is that the share of cross-border operations is now significantly smaller with the corresponding share stabilizing at more than 80 per cent of the total in the period 2003-2005. In 2005, the share of local transactions was still 16.6 per cent.

<sup>3</sup> It is curious to point out that the percentage of Portuguese institutions, in the total number of eligible counterparties for monetary policy operations is also slightly above 3 per cent (3.1 per cent), suggesting that the probability that an overnight transaction involves two Portuguese banks is similar to the weight of the Portuguese banks in the market for the euro.

Table 1 – Transactions of Portuguese banks in the market for daily funds (10<sup>6</sup> euro)

A - Excluding intra-group operations							
	1999	2000	2001	2002	2003	2004	2005
<b>Transactions between PT banks</b>	171063,5	108739,8	92115,2	77022,6	99240,8	49313,5	41334,9
as a percentage of transactions involving a PT bank	<b>34,1</b>	<b>20,2</b>	<b>17,0</b>	<b>8,6</b>	<b>7,2</b>	<b>3,4</b>	<b>3,6</b>
<b>SITEME (excluding intra-group operations)</b>	170992,5	108679,8	92065,2	76972,6	99240,8	48967,5	39274,7
as a percentage of transactions involving a PT bank	100,0	99,9	99,9	99,9	100,0	99,3	95,0
<b>Non-SITEME (excluding intra-group operations)</b>	71,0	60,0	50,0	50,0	0	346,0	2060,2
as a percentage of transactions involving a PT bank	0,0	0,1	0,1	0,1	0,0	0,7	5,0
<b>Cross-border transactions of PT banks</b>	329982,8	430818,1	448952,7	821879,1	1271520,8	1391611,5	1095965,3
as a percentage of transactions involving a PT bank	<b>65,9</b>	<b>79,8</b>	<b>83,0</b>	<b>91,4</b>	<b>92,8</b>	<b>96,6</b>	<b>96,4</b>
<b>TOTAL transactions involving a PT bank</b>	501046,3	539557,9	541067,9	898901,7	1370761,6	1440925,0	1137300,2
B - including intra-group operations							
	1999	2000	2001	2002	2003	2004	2005
<b>Transactions between PT banks</b>	250369,1	189153,2	141406,1	170189,1	193936,9	213141,0	218587,6
as a percentage of transactions involving a PT bank	43,1	30,5	24,0	23,8	13,2	13,3	16,6
<b>SITEME (including intra-group operations)</b>	247123,3	183712,0	128043,5	158348,6	169938,2	181107,1	191566,0
as a percentage of transactions involving a PT bank	98,7	97,1	90,6	93,0	87,6	85,0	87,6
<b>Non-SITEME (including intra-group operations)</b>	3245,8	5441,2	13362,6	11840,5	23998,7	32033,9	27021,6
as a percentage of transactions involving a PT bank	1,3	2,9	9,4	7,0	12,4	15,0	12,4
<b>Cross-border operations of PT banks</b>	329982,8	430818,1	448952,7	546170,7	1271520,8	1391611,5	1095965,3
as a percentage of transactions involving a PT bank	56,9	69,5	76,0	76,2	86,8	86,7	83,4
<b>TOTAL transactions involving a PT bank</b>	580351,9	619971,3	590358,8	716359,8	1465457,7	1604752,5	1314552,9

It is important to add that almost all banks active in the money market are also active cross-border. Thus, globally, cross-border activity became clearly dominant for Portuguese banks. Transactions involving local banks have ceased to assume any special significance. There is one important qualification. Since 2003, the Portuguese banks tend to participate in the market, as lenders. In that year, the proportion of total cross-border transactions involving a Portuguese bank in which it is a lender increased from 64 to 81 per cent (38 per cent in 1999). More recently, in 2004 and 2005, this proportion increased to approximately 90 per cent. Thus, the Portuguese banks had to find suitable trading counter-parties cross-border.

This global pattern is dominated by the largest Portuguese banks. However, as already mentioned in the previous section, for the set of small Portuguese banks, operations with other Portuguese banks are not negligible. This is evident from the inspection of Charts 7, 8 and 9. A few small banks do not trade cross-border, but their transactions represent only a tiny fraction of the market for daily funds. In the

case of the small banks that also trade cross-border the penetration in the cross-border market has apparently been more gradual than for the largest banks.

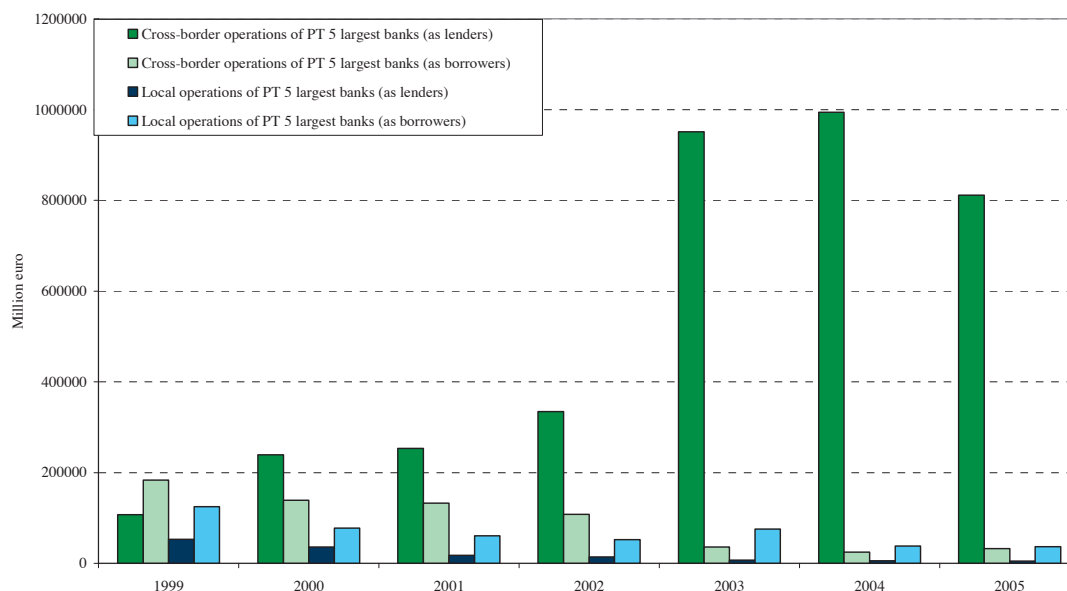


Chart 7 – Transactions in the market for daily funds involving one of the 5 largest Portuguese banks

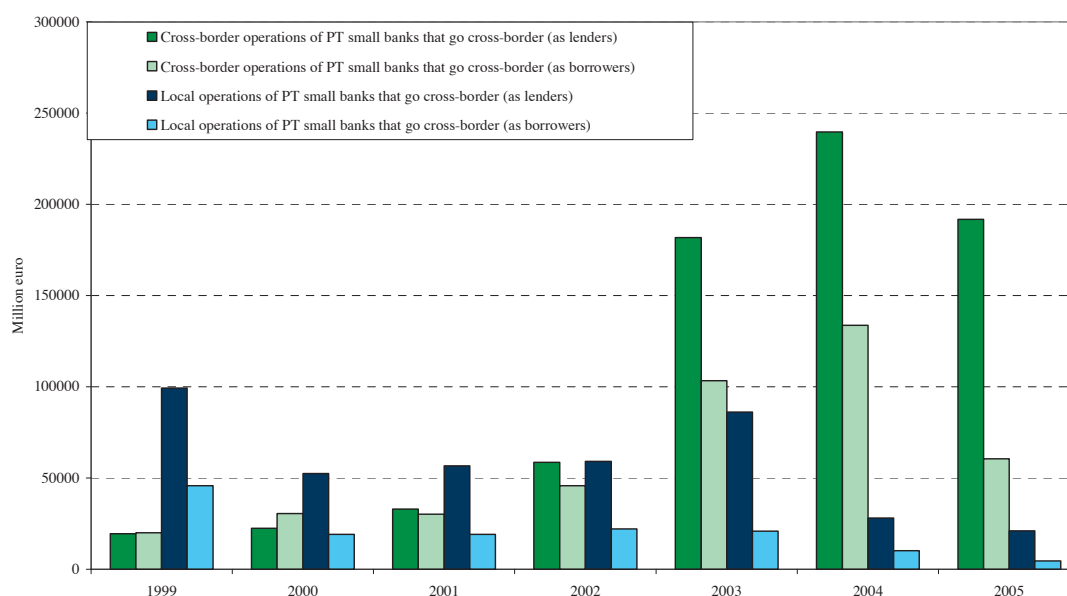


Chart 8 – Transactions involving one of the smaller Portuguese banks that go to the cross-border market

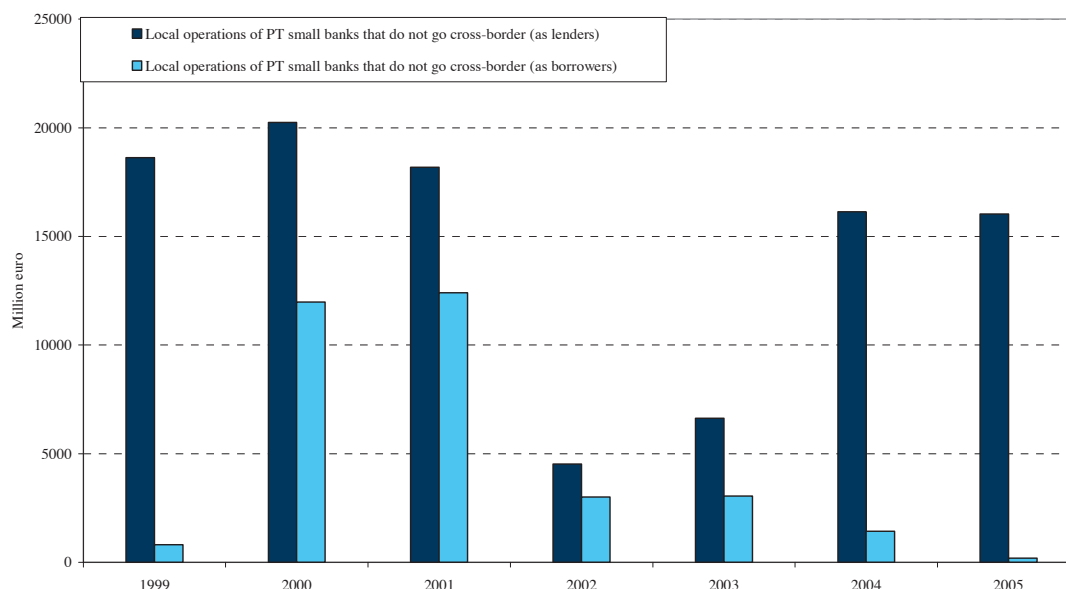


Chart 9 – Transactions involving one of the smaller Portuguese banks that do not go to the cross-border market

## 5 Empirical evidence: hierarchies and relationships

Looking at relationships in the market for daily funds it appears that, as a rule, Portuguese banks are active cross-border. For example, in 2005, in a set of 30 bank groups, 22 participated in the daily funds market as lenders (21 participated as borrowers). In 2005, all five large banks went frequently cross-border, mostly as lenders (in 80 per cent of the number of their cross-border transactions, corresponding to 96 per cent of the amounts they traded cross-border, the largest banks were lenders). Additionally, 11 of the smaller went cross-border as lenders and 6 as borrowers. They went cross-border as lenders 86 per cent of the times they traded (corresponding to 76 of the amount they traded cross-border).

Most of the time during the 1999-2005, Portuguese banks participated in the euro area inter-bank money market as lenders. As documented in charts 7 and 8 in the previous section, in terms of the yearly accumulated amounts of cross-border transactions, only in 1999 the proportion of transactions in which the Portuguese banks were borrowers was larger than the proportion in which they were lenders (72 per cent, that is 65 per cent of the number of transactions).

Tables 2A and 2B present a matrix with the relative importance of transactions, where Portuguese banks act, respectively, as lenders and borrowers. We may start by looking first at transactions with Portuguese banks participating as lenders (Table 2A). There are a number of striking facts.

Table 2 – Transactions of Portuguese banks in the market for daily funds according to the nature of relationships (%)

A - Portuguese banks are lenders					
Borrower	Lender	Small PT bank that goes			
		Large PT bank	cross border	Other small PT bank	PT bank
<b>1999</b>					
PT large bank		13,25	22,61	3,98	39,83
PT small bank		4,64	10,74	2,28	17,67
Foreign bank		35,97	6,54		42,50
		53,85	39,89	6,26	100,00
<b>2000</b>					
PT large bank		7,27	10,39	3,30	20,96
PT small bank		2,48	3,75	2,17	8,40
Foreign bank		64,60	6,04		70,64
		74,34	20,19	5,47	100,00
<b>2004</b>					
PT large bank		0,17	1,66	1,09	2,92
PT small bank		0,21	0,52	0,17	0,90
Foreign bank		77,50	18,68		96,18
		77,88	20,86	1,25	100,00
<b>2005</b>					
PT large bank		0,28	1,70	1,37	3,35
PT small bank		0,05	0,31	0,06	0,42
Foreign bank		77,84	18,39		96,23
		78,17	20,40	1,43	100,00
B - Portuguese banks are borrowers					
Lender	Borrower	Small PT bank that goes			
		Large PT bank	cross border	Other small PT bank	PT bank
<b>1999</b>					
PT large bank		7,05	3,44	3,71	14,20
PT small bank		16,96	8,75	5,73	31,45
Foreign bank		49,00	5,35		54,35
		73,01	17,54	9,45	100,00
<b>2000</b>					
PT large bank		9,68	2,16	1,14	12,97
PT small bank		18,23	4,74	3,15	26,12
Foreign bank		49,93	10,98		60,91
		77,84	17,88	4,28	100,00
<b>2004</b>					
PT large bank		1,04	1,20	0,11	2,35
PT small bank		17,05	3,69	0,58	21,32
Foreign bank		11,69	64,63		76,33
		29,79	69,52	0,69	100,00
<b>2005</b>					
PT large bank		2,25	0,26	0,11	2,62
PT small bank		24,20	2,87	0,03	27,10
Foreign bank		24,51	45,77		70,28
		50,96	48,90	0,14	100,00

First, the overall volume of transactions is (predictably) dominated by the five largest Portuguese banks. Second, when the largest Portuguese banks lend, on the inter-bank market for daily funds, they typically go cross-border. Already in 1999 about 67 per cent of these operations were cross-border (about 87 per cent in 2000). In 2004 and 2005 their importance expanded to cover almost the totality of lending operations for these banks (and almost 78 per cent of all lending operations of Portuguese banks). Third, the situation is different when the lender is a Portuguese bank not active cross-border. In such a case the most likely borrower is one of the five largest Portuguese banks. Such pattern was already present in 1999. Over time it became more pronounced, with, in 2005, large Portuguese banks absorbing almost the totality of funds traded by small banks. The importance of the values traded, however, has declined significantly over time. Fourth, and perhaps the most interesting case, is that of small Portuguese banks that are active cross-border. Until 2002, most lending transactions of these banks were effected with larger local banks (see Chart 8 in the previous section). In that year the percentage was still around 50 per cent. However, over time, the importance of cross-border transactions increased sharply. In fact the importance cross border transactions for this subset of the Portuguese smaller banks was over 90 per cent in 2005.

Turning to borrowing operations of Portuguese banks affords us some interesting insights as well. First, when the largest Portuguese banks borrow they rely both on local and cross-border transactions. In 1999 and 2000, already almost 2/3 of their borrowing transactions were cross-border. However, the proportions were smaller, both in 2004 and 2005, with values under 50 per cent on both years. Second, in the early stages, small Portuguese banks active cross-border would rely both on local and cross-border transactions when borrowing. In 1999 and 2000, the proportion of funds they obtained from other small Portuguese banks exceeded the funds they got from the five largest, in a proportion of 2 to 1. Over time these patterns changed noticeably. Small Portuguese banks, active cross-border, relied, to a very large extent, in the last years, on cross-border transactions to satisfy their daily liquidity needs. In fact the proportion of cross-border operations was about 93 per cent in both years. For the remainder they relied on transactions with other small Portuguese banks. The share of operations with the five large Portuguese banks

dried out almost completely. Lastly, it is interesting to point out that the smaller Portuguese banks that do not trade actively cross border hardly borrowed in the inter-bank market for daily funds both in 2004 and 2005.

Table 3 reports information on cross-border relationships of Portuguese banks. Table 3A reports information on lending operations of Portuguese banks. Table 3B does the same for borrowing operations. Table 3 makes it clear that the largest Portuguese banks trade cross-border with a number of counterparties, while smaller Portuguese banks trade with only a few. Moreover, in general, Portuguese banks have had fewer relationships when acting as borrowers. It also evident that cross-border transactions are concentrated. Transactions are more concentrated, as expected, for smaller banks. In fact, the largest counterparty, for smaller Portuguese banks, in 2005, had a weight of about 31 per cent of the total volume of operations, in the case of lending operations, and of more than 90 per cent for borrowing operations. For the largest Portuguese banks the corresponding numbers are, naturally, lower with, again for 2005, almost 17 per cent and 36 per cent, respectively.

Table 3 – Number of relationships of Portuguese banks in the cross-border market

<b>A - Lending relationships</b>							
	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
<b>Average number of relationships</b>							
Large banks	79,0	83,8	89,6	86,2	101,8	85,6	76,0
Small banks	11,3	14,4	14,7	17,7	20,1	20,4	17,1
<b>Weight of largest relationship (%)</b>							
Large banks	17,9	18,2	13,4	11,3	12,4	16,1	16,8
Small banks	46,0	49,8	33,1	24,6	30,9	27,8	31,2
<b>B - Borrowing relationships</b>							
	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
<b>Average number of relationships</b>							
Large banks	105,5	79,0	65,6	45,0	27,6	25,6	24,6
Small banks	4,7	6,6	6,4	7,0	2,9	2,6	2,3
<b>Weight of largest relationship (%)</b>							
Large banks	20,5	23,6	30,2	28,6	36,7	42,6	35,6
Small banks	85,3	75,0	71,5	75,2	83,7	84,1	90,2

## 6 Conclusions

In the Introduction we listed a set of questions, which we proposed to answer in this paper. We will now collect the answers:

- **Is the market for daily funds segmented, as far as Portuguese banks are concerned? Is there evidence of an integration process? How do Portuguese banks participate in the euro area wide market?**

Concerning average interest rates in operations involving Portuguese banks, we found that they were very close to EONIA rates since the beginning of 1999. In other words, integration, measured by convergence of interest rates, occurred almost instantaneously, right at the beginning of the third stage of EMU. The correlation between average interest rates involving Portuguese banks and the EONIA average has been virtually one and average spreads have been small. In 2005, the average difference was only 1.7 basis points. We also found that there is also a very strong association between the dispersion of interest rates, measured in the EONIA panel, and the dispersion of interest rates across Portuguese banks. In particular, we have found that the dispersion of interest rates increases as the end of the reserve maintenance period approaches.

Using transactions volumes, we confirm a strong integration story. In fact, in 2004 and 2005, the share of transactions, involving two Portuguese banks, on the total of transactions in which at least one of the counterparties was a Portuguese bank, stabilized at about only 3.5 per cent.

Focusing on transactions volumes the process appears more gradual. In any case, already in 1999, almost 2/3 of the transactions volumes corresponded to cross-border operations, with only 1/3 corresponding to transactions between Portuguese banks. The latter share declined rapidly. Already in 2002 less than 10 per cent of transactions volumes were locally traded. The same gradual process is apparent

when we focus on interest rate spreads for operations involving local counterparties, in particular on operations involving small Portuguese banks with a larger local counterparty. The share of these operations declined steadily over time. Moreover, even for these operations, it is the case that spreads, in 2005, at the end of our sample period, were very low.

Almost all Portuguese banks that are active on the money market are also active cross-border. We interpret the evidence as strongly supporting the view that the relevant market is euro area wide. During the period 1999-2004 cross-border operations increased steadily from around 2/3 right at the time of the introduction of the euro, to about 97 per cent in 2004 and 2005.

**- Can we detect a hierarchical structure? What is the role of the largest institutions?**

Patterns of banking relationships in the inter-bank market for daily funds are seen as evolving over time. It is, however, clear that larger Portuguese banks have a richer set of counterparts cross-border and are more active in the market. Moreover, the behavior of interest rates in operations involving small Portuguese banks is visibly different from the rest of the operations in our data sample. Spreads were noticeable at the beginning of our sample period. In 2005 spreads for operations involving small Portuguese banks narrowed noticeably. At the end of our sample period the largest Portuguese banks concentrated their lending activity cross-border and were not a significant source of daily financing for smaller banks.

The evidence on a hierarchical structure can be considered mixed. It is interesting to notice that spreads between local and cross-border transactions have been visibly and systematically negative since the early 2000s. Freixas and Holthausen (2005) would predict such a pattern for a country which supplies liquidity, on balance, in the market for daily funds. The spread would reflect first, superior local information on counterparty risk; second, the dominance of non-secured transactions cross-border. Nevertheless, in the model the excess liquidity country would never

borrow<sup>4</sup>. We conjecture that a more detailed modeling of market structure and the consideration of residual payments uncertainty (like in Poole, 1968) may provide adequate theory.

One last contribution of the paper is methodological and relates to the fact that the procedure proposed by Furfine (1999) is successful identifying daily market operations, when applied to European RTGS data. Such dataset is very rich because it permits the recovery, for each individual transaction, of information on price, quantity and the identification of the trading parties.

Therefore, it is clear that the methodology by Furfine may be used for any other country where a similar database could be made available. It would be particularly interesting to look at cases of larger countries, where the share of transactions among local banks could be non-negligible and the market share of the largest banks smaller. In such a case, it would be more likely to find a hierarchical structure in local transactions. Research prospects would be greatly enhanced if it were possible to obtain a representative sample for the euro area. In such a case one could test the empirical implications from equilibrium models of the money market. Such a rich database would allow testing for implications for the distribution of equilibrium prices, quantities traded and for the use of standing facilities.

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<sup>4</sup> We are grateful to Xavier Freixas for this important remark.

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