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HOME BIAS IN INTERBANK LENDING AND BANKS' RESOLUTION REGIMES

by Michele Manna [*]

Abstract

In recent years, banks have become increasingly aware of the credit risk borne in lending in the interbank market and they select their counterparties accordingly. They may also fear that if they come across a bad borrower, rescue plans will be skewed towards domestic creditors; moreover, lenders may prefer to defend their rights in their own regulatory and legal jurisdiction. Using 2004-09 data, this paper argues that these elements, the "resolution edge" of the domestic creditor, contributed to the increase in the home bias of interbank lending by euro-area banks from mid-2007 on, while a more consistent downward pattern emerges in the home bias of banks from five non-euro-area countries (including the US and the UK). The intuition is that when the crisis broke out, euro-area banks reckoned that within-the-area cross-border interbank loans carried a distinct risk compared with domestic loans. By contrast, a large Swiss bank, for example, did not need to wait until 2007 to gauge that its business in New York was a very different matter from a deal in Zürich.

JEL Classification: C33, G11, G15, G21, K20.
Keywords: home bias, interbank market, euro area, banks resolution procedures.

Contents

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1. Introduction and objectives [1]

After the outbreak of the current market turmoil, home bias in the interbank lending of banks from twelve euro-area countries increased to an extent without parallel among banks operating in five relevant outside-the-area countries used for control purposes.[2] In June 2007, a normalized home bias indicator – taking values between -1 when banks lends only cross-border and +1 when they lend only domestically, with 0 signalling no specific preference towards domestic counterparties – stood at 0.45 on average across the twelve euro-area national banking systems, only marginally higher than the average of 0.41 recorded for the five non-euro-area countries. By September 2009 (the end-point of the data set of this research), the former measure had increased to 0.56, while the latter had fallen to 0.37. By this time, the degree of home bias within the area had erased the gains of the previous years, if one considers that in March 2004 (entry point of the data set) the indicator stood at 0.57, and 0.43 was the corresponding measure for the five control countries.[3]

The aim of the present work is to gather evidence on why home bias increased when tensions became more acute and why this was a distinct pattern of euro-area banks. The research is structured around the findings of the ample literature investigating investors' preference for holding less foreign assets than predicted by standard portfolio theory, a stylised fact which translates, in the context of the interbank market, into the question why banks lend proportionally less to foreign counterparties (for a few key references see French and Poterba 1991, Lewis 1999, and Sørensen, Wu and Zhu 2007; a full issue of the *Journal of International of Money and Finance*, 2007, was devoted to the themes of financial globalization and integration). The best known explanations of home bias, which tops a list of six major puzzles in applied macroeconomics (Obstfeld and Rogoff 2000), include hedging of currency risk, transaction costs, unevenness in information, as well as costs of trading goods internationally.[4] It is worth verifying how and whether these arguments fit into the decoupling of trends in interbank lending home bias.

At first glance, heightened currency risk would appear to be an acceptable reason for a decline in lending of interbank deposits denominated in foreign currency ("foreign" being the borrower's currency). Insofar as this hypothesis holds true – for a simple financial product such as an interbank deposit FX hedging is readily available in financial markets – home bias would tend to increase as such deposits are relatively more frequent in cross-border deals than in domestic ones.[5] However, the statistics do not bear this out. First, a breakdown of cross-border deposits according to the alternative of domestic versus foreign currency does not point to any significant difference in trends in home bias. Second, if such a cause-effect link were at play, it should have prompted a relative increase in the home

1 I would like to thank P. Angelini, D.J. Marchetti, A. Schiavone, L. Tornetta, F. Vergara Caffarelli and two anonymous referees for a number of suggestions. Several exchange of views with C.O. Gelsomino helped me develop the original idea of the paper. Special thanks are due to C. Iazzetta for compiling the data sets, S. Nobili for making available his estimates on money market risk premiums and C. Stamegna and C. Stone who helped to revise the text. The views expressed in this paper are my own and do not necessarily reflect those of the Bank of Italy. The usual disclaimers apply.

2 The two sets of countries are Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands and Portugal for the euro area and the United States, the United Kingdom, Denmark, Sweden and Switzerland for the control group.

3 Referring to the more conventional (but also somewhat less comparable) share of domestic lending in total interbank lending, this averaged 54.4% for the banks of the twelve euro-area countries in March 2004, falling to 43.0% in June 2007 and rising again to 53.5% in September 2009; the corresponding figures for the banks from the five control countries are 40.4%, 37.9% and 34.7%.

4 Additional references to these items can be found in Adler and Dumas (1983) and Cooper and Kaplanis (1994).

5 In the UK some 40% of the domestic cross-border interbank loans relate to the exchange of foreign-currency-denominated deposits, compared to a share of 90% in cross-border loans. In other countries, the gap is even wider.

bias of the non-euro-area countries' banks in the sample (which lend more foreign-denominated deposits over the border, in relative terms) compared with that of the ones in the euro area, contrary to what the data suggest.

Transactions costs are an even less plausible candidate. Thanks to the single settlement platform TARGET2, all banks in the European Union – irrespective of location – are offered the same high-quality services, facilities and interfaces, as well as a single price structure (http://www.ecb.int/paym/t2/features/html/index.en.html). It should be added that no serious incident in this platform has been recorded in recent years and, as such, there is also no obvious operational reason for banks to be cautious about transferring their funds cross-border (Flannery, 1996).

The third item of the taxonomy deals with information. There is ample empirical evidence that, *ceteris paribus*, investors prefer assets issued in their own constituency because they have better and more up-to-date information about them. Developments in technology may have weakened the (inverse) relationship between quality of information and investor-asset distance (Petersen and Rajan 2002, Felici and Pagnini 2008) but the thrust of the argument remains unchallenged. For example, in retail banking, recent studies confirm that applicants living closer to the bank are more likely to be granted a loan and be charged lower interest rates (Berger et al. 2005, Degryse 2004, Degryse and Ongena 2005, Felici and Pagnini 2008, Carey and Nini 2007). Even in financial markets where a wealth of data is available to any trader via standard news and data providers, distance remains associated with unevenness of information. Some news may be circulated by word of mouth and lose quality as the distance lengthens, which may explain the finding that traders tend to replicate the choice of other managers operating from the same financial centre (Hong, Kubik and Stein 2005). Alternatively, data may actually be available to any trader, but nonetheless domestic investors are better equipped to understand the information in local news (Dumas, Lewis and Osambela 2011). If this is true, then this argument may have become more relevant in recent years when the financial market turmoil made it more difficult to screen would-be borrowers. However, heterogeneity in information is at odds with the decoupling of trends in home bias of euro-area banks compared with non-euro-area ones. In other words, why should this heterogeneity have played a significant role only on the first pool of banks?

Finally, regarding the fourth argument put forward by the mainstream literature, if the concept of cost of trading internationally is understood narrowly, e.g. presence of trading fees and suchlike, then the remarks above about the role of TARGET2 apply again. Therefore, I would argue in favour of a broader interpretation, in which the cost includes the potential hurdles associated with recovering a credit from a foreign borrower, when things take a turn for the worse. The following quotations summarize the current state of affairs:

> *Bluntly, it is no good assuming that an internationally active bank can be regulated as a single unit if, when distress comes, differences in the insolvency or resolution regimes of the various countries in which it operates effectively split the bank into a series of de facto distinct, local entities.* (Haldane, 2009)
>
> *...cross-border banks are international in life, but national in death.* (Goodhart, 2009)
>
> *...national and regional authorities should review resolution regimes and bankruptcy laws in light of recent experience to ensure that they permit an orderly wind-down of large complex cross-border financial institutions.* (G20 Declaration of 15 November 2008).
>
> *...like it or not, that is a reality and such limitations [in international coordination] do arise for a couple of reasons. First, with public money injections, a government is in a position to pay more attention to taxpayers' interests, and naturally has incentives for ring-fencing interests of its own country. Second, bankruptcy legislation of financial institutions differs between countries.* (Shirakawa, 2009)

These quotes illustrate the point that banks' resolution procedures are still largely a national matter and, tellingly, the G20 declaration calls for greater harmonization. This echoes a point made in the academic literature, namely that there is no internationally agreed key standard in the area of insolvency (Arner and Norton 2009).

While this state of affairs is not new, as the crisis deepened its expected or perhaps simply perceived upshot on foreign lenders was magnified. Events such as the demise of Northern Rock and, even more resoundingly, that of Lehman Brothers made it clear that no bank is beyond the risk of default and that this could draw its lenders into a legal tangle. Accordingly, a number of recent papers (Cassola, Holthausen and Lo Duca 2008, Angelini, Nobili and Picillo 2009, for the euro money market; Taylor and Williams 2008 and Afonso, Kovner and Schoar 2010, for the US dollar market) lend support to the view that in the interbank market dealers now pay regular attention to the borrower's risk characteristics.

Against this background, the odds are that a risk-averse agent will be more concerned about credit recovery procedures when these take place in a foreign regulatory and legal jurisdiction (Banca d'Italia 2010). In fact, there may be more at play than simple uneasiness about dealing with a foreign legal setting. National authorities could be tempted to pay more attention to domestic stakeholders, in one way or the other, when they rescue a troubled bank, as authoritatively pointed out by Shirakawa (Governor of the Bank of Japan). Moreover, market participants may reasonably expect – especially when rampant uncertainty shocks the markets – that the likelihood of a bank's bail-out increases with its role in the domestic market and economy.[6] In the following I will refer to this basket of factors that tilt the balance in favour of domestic lenders as the "resolution edge" (or, more briefly, the edge).

The basic intuition derived from the analysis carried out in this paper is that the "edge" has played a significant role in increasing the home bias of euro-area national banking systems since 2007, although it is not necessarily the only explanation. This is not because the "resolution edge" is bound to be higher within the area than outside it. Instead, I argue in favour of different dynamics of the weight of the edge in the traders' decision-making process. Echoing an oft-repeated remark, before the crisis large banks in particular increasingly operated across the monetary union as if they were dealing in a domestic context. That is, they apparently considered any national "resolution edge" within the area marginal at best. Conversely, once the banks' risk of default became an issue of judgement, they weighed the national divide more cautiously. Possibly, the sheer novelty of the divide made it more difficult to price it in cross-border contracts and in this way it impaired the integration of the market. If the multinational structure of groups such as Unicredit and Deutsche Bank is a good example of the earlier mood, the management of the demise of Fortis in 2008 tells us something about the new situation, in which the Dutch, Belgian and Luxembourg authorities each effectively bailed out their own domestic parts of the embattled group.[7] From this standpoint, the crisis appears less of a turning point for banks from outside the area, since quite likely they always discounted the specific risks associated with cross-border transactions. Put simply, a large Swiss bank, for instance, did not need to wait for 2007 to realize that its business in New York was a very different matter from a deal in Zürich.

The rest of the paper is organized as follows. Section 2 deals with the data used in the analysis and presents some descriptive statistics. Section 3 introduces a micro-based optimization model on the choice of counterparties in the interbank market. Section 4 is about the econometrics of the home bias from 2004 to 2009. Section 5 concludes. A note to the reader may usefully end this introduction. This paper exploits a number of data sets and the reasoning flows across various sets of statistics; to avoid breaking up the text with data, while some key tables and charts are presented in the core part of the paper, others are shown only at the end.[8]

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6 The fact that the cost of the intervention is eventually borne by the taxpayer may warrant a decision by the political authority to provide more help when more domestic interests are at stake.

7 Press release of 29 September 2008 at http://www.dnb.nl/en/news-and-publications/news-and-archive/persberichten-2008/dnb188604.jsp). The fate of Fortis seems to be no exception to the rule and the failure of Bank of Credit and Commerce International (BCCI) in 1991 is a safe precedent on the complexity of crisis management of a conglomerate with global business and counterparts.

8 These tables and charts are coded with a capital A ("Table A.x").

2. The data and some descriptive statistics

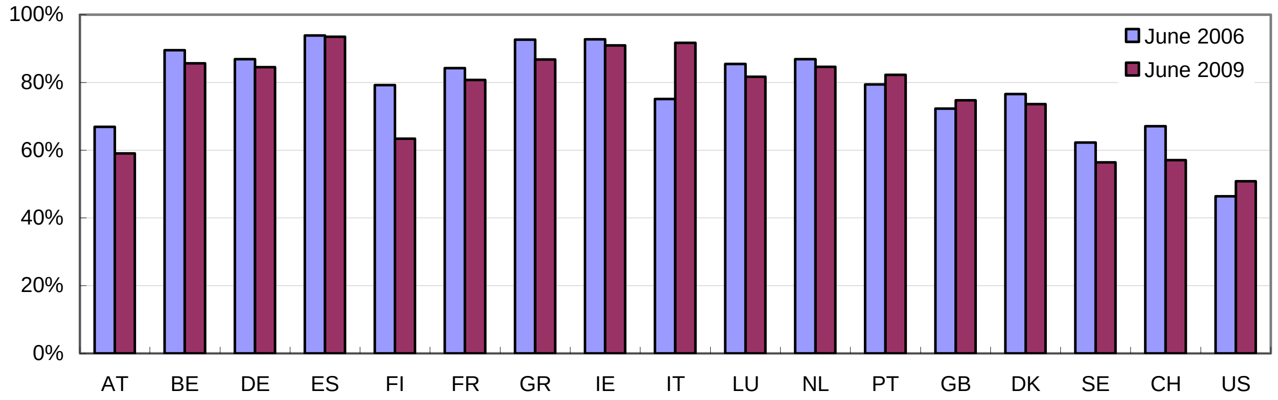
2.1 The data sets

The main data set used in the analysis is compiled with data on outstanding stocks of interbank loans (short-term maturity) exchanged amongst banks from seventeen countries, of which twelve are from the euro area (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Spain, the Netherlands and Portugal) and five from outside it (United States, United Kingdom, Denmark, Sweden and Switzerland). The sample chosen is broad enough to cover about 60% of the total interbank lending by US banks, a percentage that increases to 80-90% for most euro-area national banking systems (Chart 1). Data have quarterly frequency from 2004Q1 to 2009Q3 (23 quarters for a total of 391 data points).[9]

Chart 1

Coverage of selected interbank cross-border positions (1)

(per cent)



(1) Percentage ratio of the cross-border loans of each national banking system to the other 16 selected banking systems divided by the global cross-border interbank loans of that banking system.

I used also a data set compiled with gross bilateral deposits lent by six leading Italian banks to each other and to 21 leading foreign banks; the series have monthly frequency from January 2004 to December 2009 (72 months for a total of 432 data points). Banks in this data set meet the following criteria: the six Italian banks are listed, the 21 foreign banks are in the Euribor panel and for each bank in both groups there is a liquid own 5-year CDS contract. Jointly taken, these criteria should ensure that these banks are all well established in financial markets; in addition, the CDS premium is used as an explanatory variable in the fits. Each of the 27 banks belongs to a different banking group, so that no intra-group dealing is involved.[10]

The sources of the various data sets used in the analysis are listed in Annex A, while the list of banks sampled in the micro data set is in Annex B.

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[9] Deposits are denominated in one of the five leading international currencies (US dollar, euro, British pound, Swiss Franc and Japanese yen) and converted into dollars at end-quarter exchange rates; data on Danish and Swedish banks include deposits denominated in the respective domestic currency. Ideally, had the appropriate data sets been available, it would have been useful to carry out separate analyses for different buckets of maturity (say, overnight deposits, other one-day deposits, time deposits up to 3 months, etc.).

[10] Using the more granular data of the e-MID trading platform, I double checked that each of the six selected Italian banks is the treasury bank of its own group.

2.2 *The home bias indicator: algebra and measures*

Consider a simple world populated by 100 banks spread over two countries A and B in the proportion of 20 to 80. Each bank lends one unit of currency to its 99 counterparties, no matter what their country of origin, so that global interbank lending amounts to 9,900 units (=100×99). When data are aggregated at country level, one obtains the following representation:

Table 1

		Borrowers		
		A	B	Sum
Lenders	A	380 (20×19)	1,600 (20×80)	1,980
	B	1,600 (80×20)	6,320 (80×79)	7,920
	Sum	1,980	7,920	9,900

It would be misleading in terms of home bias to infer anything from the statistics that A banks direct 19.2% of their interbank loans within their own country, a much lower share than B's 79.8%, since by design in this world there is no specific preference for domestic banks. If this example supports the intuition that banks from larger countries tend to lend more domestically because they have more suitable counterparties, in the real world too a positive correlation can be established between the size of a banking system (as measured by the volume of its total interbank loans) and the associated 'of which' share of lending to domestic banks (Chart A.1).

Instead, a more appropriate indicator of home bias would be one that adjusts for the size of the national banking system, as the international trade literature predicts that such size matters in trade flows (Anderson and van Wincoop 2003). Moreover, this indicator should also highlight unambiguously whether banks in a given country lend more to their domestic counterparties than they ought to (positive home bias), *ceteris paribus,* or less (negative home bias). Using the above numerical example, this indicator should take positive values when domestic interbank lending in country A is more than 380 units (out of the total of 1,980). Finally, it renders all comparisons simpler if the indicator is normalized so that it takes value +1 if banks lends only domestically (maximum home bias) and -1 if they lend only overseas (minimum home bias).[11]

To set out the algebra of such an ideal indicator, let me introduce some notation. Consider a sample of n countries A, B, C, …, and let $D_{A,B}$ be the stock of loans granted by banks resident in A to those in B, $D_{A,C}$ that of loans from A to C and so on, while $D_{A,A}$ is the size of the domestic interbank market within A.[12] Symmetrically, $D_{B,A}$ is the stock of loans borrowed by A's banks from B's. Finally, $D_{A,\bullet}$ and $D_{\bullet,A}$ denote the total stock of interbank loans granted by and borrowed from the A banks (irrespective of the country of the counterparty) and $D_{\bullet,\bullet}$ is the total stock of interbank deposits exchanged among the banks in all n countries of the sample. The next step is to compile the $n \times n$ matrix of interbank lending (as a convention, I report the lending banking system row-wise and the borrowing one column-wise). A standard formula of contingency tables suggests that amounts are evenly distributed across the table if, say, the figure in the Bth-row / Cth-column cell is equal to $(D_{B,\bullet} \times D_{\bullet,C}) / D_{\bullet,\bullet}$; it thus seems natural to assume that A's banks display no home bias if $D_{A,A} = (D_{A,\bullet} \times D_{\bullet,A}) / D_{\bullet,\bullet}$ while there is

11 The recourse to a normalized home bias indicator taking value 0 if investors show no specific preference towards assets issued domestically is not new in the trade literature (Sørensen, Wu, Yosha and Zhu 2007 and Warnock 2002). The details of the algebra of the proposed indicator are adapted from Manna (2004).

12 To keep matters simple, at this stage I do not explicitly introduce the time reference into the notation.

positive home bias if $D_{A,A} > (D_{A,\bullet} \times D_{\bullet,A}) / D_{\bullet,\bullet}$. Finally, the total lending $D_{A,\bullet}$ acts as a variable of scale to yield relative measures. Putting all elements together, a baseline version of such an indicator is:

$$[1.a] \qquad HB^{\wedge}_{A} = \left(D_{A,A} - \frac{D_{A,\bullet} \times D_{\bullet,A}}{D_{\bullet,\bullet}} \right) \frac{1}{D_{A,\bullet}}$$

Where, of course, corresponding algebra can be used for the home bias of the banking system in B, C, etc. and the symbol ^ is only to highlight that, in fact, a variant of [1a] will eventually be used. It is straightforward to verify that

$$[1.b.1] \quad HB^{\wedge}_{A} = 0 \qquad \text{if} \qquad D_{A,A} = \frac{D_{A,\bullet} \times D_{\bullet,A}}{D_{\bullet,\bullet}} \quad \text{(neutral state)}$$

$$[1.b.2] \quad 0 < HB^{\wedge}_{A} = \frac{D_{\bullet,\bullet} - D_{\bullet,A}}{D_{\bullet,\bullet}} < 1 \qquad \text{if} \qquad D_{A,A} = D_{A,\bullet} = D_{\bullet,A} \quad \text{(maximum home bias)}$$

$$[1.b.3] \quad -1 < HB^{\wedge}_{A} = -\frac{D_{\bullet,A}}{D_{\bullet,\bullet}} < 0 \qquad \text{if} \qquad D_{A,A} = 0 \quad \text{(minimum home bias)}$$

That is, while [1.a] takes the "correct" zero value in the neutral state and the associated positive and negative signs when appropriate, it does not hit the desired +1/-1 boundaries. A simple alternative is to introduce an adjustment factor

$$[1.c] \quad HB_{A} = \left(D_{A,A} - \frac{D_{A,\bullet} \times D_{\bullet,A}}{D_{\bullet,\bullet}} \right) \frac{1}{D_{A,\bullet}} x \qquad x = \frac{D_{\bullet,\bullet}}{D_{\bullet,\bullet} - D_{A,A}} \qquad \text{if } D_{A,A} \geq \frac{D_{A,\bullet} \times D_{\bullet,A}}{D_{\bullet,\bullet}}$$

$$HB_{A} = \left(D_{A,A} - \frac{D_{A,\bullet} \times D_{\bullet,A}}{D_{\bullet,\bullet}} \right) \frac{1}{D_{A,\bullet}} y \qquad y = \frac{D_{\bullet,\bullet}}{D_{\bullet,A}} \qquad \text{otherwise}$$

where *x* and *y* serve to obtain $HB_A = +1$ and $HB_A = -1$ when appropriate.[13] In fact, even [1.c] would benefit from a further adjustment relating to the number of banks populating each banking system.[14] Since this is a minor refinement, I refer to Annex C for the related algebra and some results.

The empirical work deals also with lending by individual banks and a suitable adaptation of [1.c] for micro data is:

$$[2] \qquad hb_a = \left(d_a - d^*_a\right) / \left(1 - d^*_a\right) \qquad \text{if } d_a \geq d^*_a$$

$$\left(d_a - d^*_a\right) / d^*_a \qquad \text{otherwise}$$

where $d_a = \sum_{j \in Italy} d_{a,j} / (\sum_{j \in Italy} d_{a,j} + \sum_{f \notin Italy} d_{a,f})$, $d^*_a = \sum_{j \in Italy} asset_j / (\sum_{j \in Italy} asset_j + \sum_{f \notin Italy} asset_f)$, $d_{a,j}$ ($d_{a,f}$) is the deposit lent by *a* to *j* (*f*), *j* being any Italian bank in the sample other than *a* itself, $asset_j$ is *j*'s total assets, *f* is for

13 The lower and upper boundaries [1.b.2] and [1.b.3] tend to be asymmetric around 0 (e.g. if $D_{A,\bullet} = D_{\bullet,A} = 10$ and $D_{\bullet,\bullet} = 100$, then [1.b.2] yields 0.9 while [1.b.3] is -0.1. This requires *y* and *x* be different, though with only a negligible impact on the empirical analysis since the home bias is negative in just 1 out of the 391 data points of the aggregate dataset.

14 Referring back to the example in Table 1, one could think of [1.c] as an approach where the elements along the main diagonal are derived as 20×20 and 80×80 (instead of the more correct products 20×19 and 80×79).

foreign. The intuition is about comparing the share of lending by bank *a* to its domestic counterparties out of its total interbank lending vis-à-vis the corresponding share under neutrality conditions.

A set of descriptive statistics derived from [1.c] is in Table A.1. These include the average, minimum, maximum and standard deviation across the 23 quarters, a simple t-test on the change in the home bias indicator in 2007Q2 through 2009Q3, as well as the order of integration of these series. At the bottom of the table, summary results for the two areas are derived as weighted averages:

[3.a] average home-bias indicator across 12 banking systems of the area

$$\frac{\sum_{i \in \text{euro area}} D_{i,\bullet}\, HB_i}{\sum_{i \in \text{euro area}} D_{i,\bullet}}$$

[3.b] average home-bias indicator across the five non-area banking systems

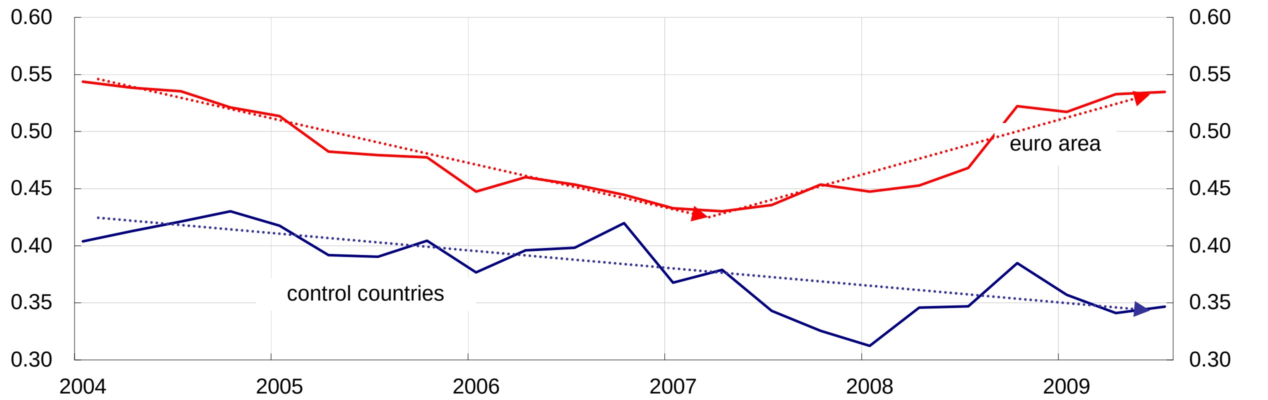
$$\frac{\sum_{i \in \{US,UK,CH,DK,SW\}} D_{i,\bullet}\, HB_i}{\sum_{i \in \{US,UK,CH,DK,SW\}} D_{i,\bullet}}$$

The quarterly time series of formulae [3.a] for the euro area and [3.b] for the non-area countries are shown in Chart 2 and convey the gist of this paper. Before the crisis, the degree of home bias in the area was decreasing rapidly and converging to the levels of the five external banking systems. From mid-2007, the two trends decoupled: while the home bias of the area banking systems trended up again, the control benchmark continued to move downwards, albeit more irregularly. Arguably, the fact that the former trend bounces bank is correlated to the outbreak of the crisis. At the same time, the crisis alone cannot be the only culprit because no similar rebound is observed worldwide. In other words, there should be something specific in the way the crisis affected the cross-border interbank lending of euro-area banks that cannot be explained only through a generic reference to an increase in risk aversion or to the financial market turmoil.

Chart 2

Home bias indicator, summary results for the euro area and the five control countries (1)

(quarterly data)



(1) The two times series are obtained using [3.a] and [3.b].

This key result is upheld by two additional statistics. Firstly, the surge in the home bias in recent years is broad based: from mid-2007 onwards, indicator [1.c] rose in each of the twelve banking systems of the area and, based on the sort of t-statistics shown in Table A.1, in eight of the countries it did so significantly.[15] If anything, within-the-area trends became more homogeneous. As summary statistics, I ranked result [1.c] for the twelve euro banking systems at each quarter and then worked out the

[15] On the contrary, the measured degree of home bias according to [1.c] fell in four of the five banking systems of the non-area countries, Switzerland being the exception although starting from a very low basis.

difference between the third and the tenth measure: the resulting wedge narrowed from 0.27 points in 2007Q1 to 0.22 in 2009Q3 (Chart 3). Secondly, the surge was due mainly to developments in within-the-area cross-border transactions, in a proportion of around two thirds. This lends further support to the view that the roots of the enhanced preference for domestic counterparties should be sought in some feature of the area itself (Chart 4).

Chart 3

Dispersion in the measures of home bias across euro-area national banking systems (1)

(quarterly data)

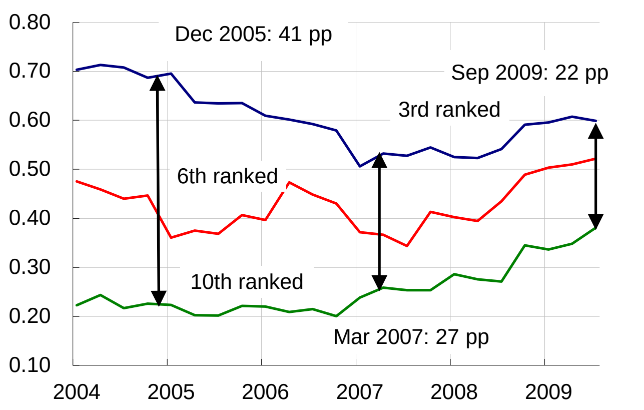
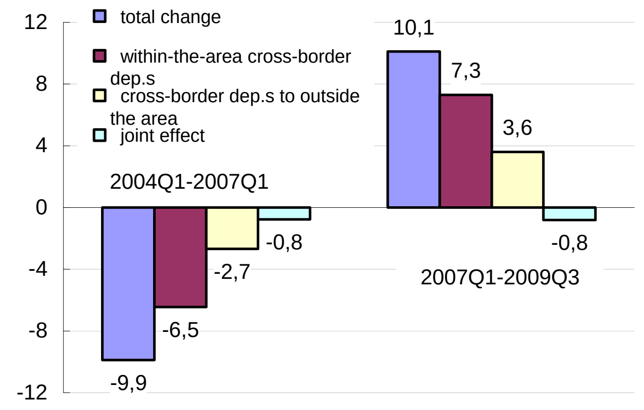


Chart 4

Sources of change in the share of domestic interbank lending of euro-area national banking systems (2)

(per cent; changes over specified quarters)



(1) Third, sixth and tenth highest measure of the home bias at each quarter across the twelve euro-area banking systems based on [1.c]. – (2) The contribution of within-the-area cross-border deals has been obtained through [1.c], and in turn [3.a], on a parallel dataset where bilateral loans from euro-area banks to non-area ones are kept constant, in relative terms, to their 2004Q1 levels; switching roles, the same procedure has been followed to obtain the contribution of cross-border loans to non-area banks; the joint effect has been obtained as a residual.

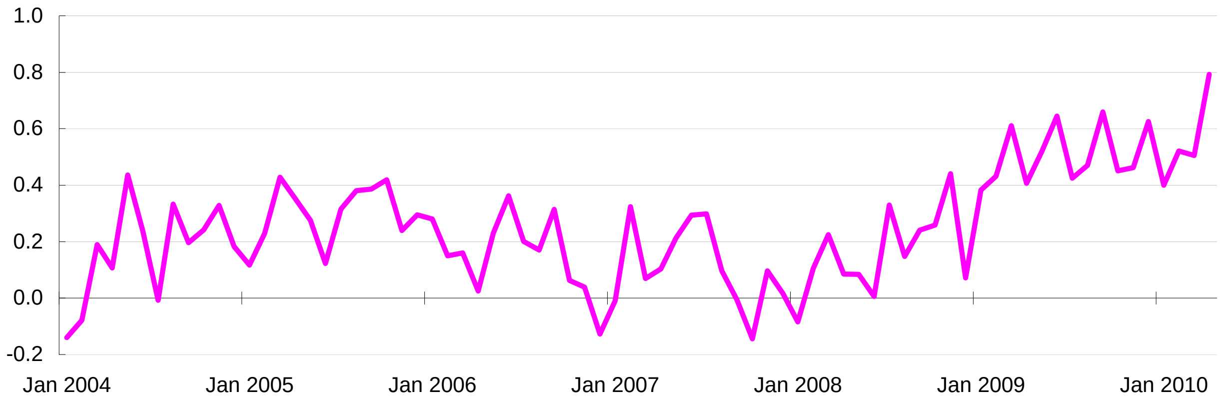
As to the micro data set, a handy summary statistic is the weighted average of [2] for the six selected Italian banks, following the same procedure adopted to yield [3.a] and [3.b] (Chart 5, results for individual banks are in Table A.2). A first finding is that until 2007 this statistic usually fluctuated in the range 0-0.4, with some occasional dips into negative territory (that is, in a few quarters these banks lent proportionally more deposits to banks outside Italy than to their domestic fellows). It is worth noting that even the upper boundary of this range is well below the lower boundary of the corresponding range for aggregated figures for the Italian banking system as a whole (0.6-0.8). This is in agreement with a well-known micro-structural element of the interbank market: bigger banks tend to carry out more cross-border transactions than medium-sized ones.[16] As an additional feature, the higher home bias emerges also from the micro data set, although the take-off point seems to be more mid-2008 (but this is in line with the aggregate result for Italy based on [1.c]; see country data in Chart A.2).

[16] A word of caution is in order, although the aggregated and micro-based measures are related to each other, they are not fully comparable in their algebra.

Chart 5

Average home bias of the six Italian banks in the micro data set (1)

(*monthly data*)



(1) The time series has been obtained as the weighted average of [2], where weights are proportional to the total assets of each bank

2.3 Some candidate explanatory variables of home bias

One thing that is certain about the home bias is the wide range of values it takes across the various national banking systems, from 0.09 (average 2004Q1 through 2009Q3) for Belgium and 0.11 for Switzerland to 0.64 for the US, 0.69 for Austria and 0.70 for Italy (Table A.1 and Chart A.2). The fact that the level of the bias tends to be higher in some countries than in others can be ascribed to economic and financial key variables such as the openness of the economy, the size of its financial markets and the penetration of foreign banks in the national banking system. As empirical equivalent of these variables I use the following series: the sum of exports and imports of goods (a variant with both goods and services was also tried out with similar results), the capitalization of the domestic stock market, and the degree of penetration of foreign banks in the national banking system gauged by the difference between the total cross-border interbank lending by banks operating in a country and the like statistics derived from data consolidated at banking group level.[17] The country yearly GDP acted as a variable of scale.

Across countries, the home bias is negatively correlated with all three series (Chart 6). For the purposes of the ensuing econometric analysis, it is important that the coefficients of correlations are large in absolute value (they take values from -0.30 down) and relatively stable over time, with some limited variability only in the correlation vis-à-vis the stock market / GDP ratio. It is also telling that no swings of significant size occurred in the series of the correlation coefficients at around mid-2007. This supports the interpretation that the increase in the euro-area home bias since 2007 was not brought about by changes in any of these structural variables.[18]

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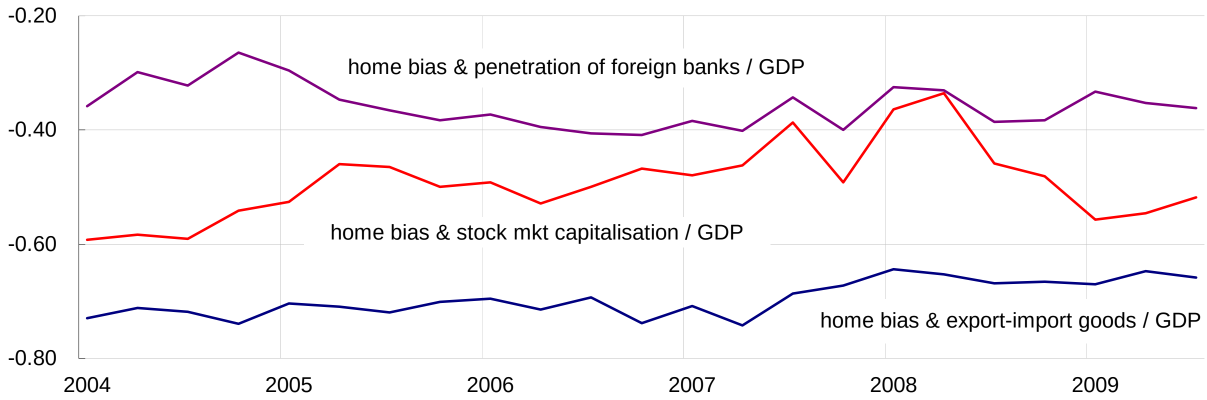
[17] BIS data on locational (cross-border transactions between entities in different countries) and the twin consolidated banking statistics (cross-border transactions between entities of different banking groups) proved to be handy.

[18] The level of the home bias in a given country could also depend on the organization of the banking groups. The more the groups are fragmented into separate legal entities, the more the intra-group exchange of liquidity adds to the measured turnover in the interbank market. In turn, this upward bias is likely to affect domestic trades proportionally more than cross-border ones as banking groups tend to consist of a larger number of entities in their own domestic turf. This hypothesis could not be verified directly due to the lack of suitable harmonized data sets for all seventeen countries (a point which is partly catered for by the micro data set; see fn. 33).

Chart 6

Coefficients of correlation across countries between home bias and selected variables (1)

(quarterly data)



(1) The three time series are compiled using the coefficient of correlation, at each quarter, between the measure [1.c] of home bias of the seventeen banking systems in the sample and their country ratio to GDP of the penetration of foreign banks, the capitalization of the domestic stock market and the sum of imports and exports of goods.

A scatter analysis of country-level data helps to identify the relative positions of the individual banking systems in terms of their home bias based on [1.c] and the three GDP ratios (Chart A.3). In each figure, dots below the trend line correspond to banking systems whose home bias is lower than predicted by, in turn, the country's foreign trade, stock market capitalization and foreign banks' penetration. Notably, when comparing the charts displaying 2009 data (right-hand column) with those with 2004 and 2007 data (left-hand and central column), the dots corresponding to the non-area banking systems tend to shift south-west (with the notable exception of the US). Put plainly, in recent years the home bias of these banking systems has decreased compared with the average across the whole sample of seventeen banking systems, once the structure of these economies is taken into account.[19]

3. A loan portfolio allocation model

A loan portfolio optimisation model may yield insights into the way the "resolution edge" may affect the distribution of interbank loans. I consider a population of *z* risk-averse price-taker banks *a*, *b*, *c*, … distributed over *n* countries A, B, C, with at least two banks per country. Given two banks *i* and *j*, let $\{i,j\} \in X$ denote the circumstance that both are from country X. Each bank solves a portfolio allocation problem to maximize its expected utility from lending a total of one unit of wealth (the budget constraint) across the other *t-1* participants, where $\alpha_{i,j}$ is the weight of the loan by *i* to *j*, no short positions are allowed and the entire initial wealth is invested:

$$[4] \qquad \alpha_{i,j} \geq 0 \quad \text{for } i,j = a, b, c, .. \qquad \text{where } \alpha_{i,i} = 0 \text{ and } \sum_{j=1}^{z} \alpha_{i,j} = 1 \text{ for every } i$$

The expected return of the loan granted by *i* to *j* depends on the exogenous market interest rate *m,* the probability of default (PD) $\pi_{i,j}$ of *j* as assessed by *i*, as well as a recovery ratio $r_{i,j}$ if *j* defaults. To keep the model as flexible as possible, $\pi_{i,j}$ and $r_{i,j}$ are written out in a way that caters for the alternatives that *i* to *j* are from the same country or not. Starting off with $\pi_{i,j}$, this is conceived as the sum of a baseline component π_j, which is invariant to such alternative, and a second component which conversely takes different values depending on whether *j* is domestic to *i* or not. One may think of them as, respectively, a score gauged from publicly-available information on traded instruments (say, the premium on *j*'s

[19] This is not an obvious result as the UK and US economies in particular have been hard hit by the crisis.

CDS), which is invariant to the distance between *i* and *j*, and a premium σ which, for the sake of prudence, *i* adds to the consensus assessment on *j* if he is aware that he may lack some information (e.g. that circulated by word of mouth) or may not be able to fully exploit that available.[20] For the sake of simplicity, the latter component enters the summation through a binomial parameter $\delta_{i,j}$ which is 1 if $\{i,j\} \notin X$ and 0 otherwise:

[5] $\pi_{i,j} = \pi_j + \delta_{i,j}\,\sigma$ where π_j and $\sigma \in (0,1)$, $\delta_{i,j} = 1$ if $\{i,j\} \notin X$ and 0 otherwise

Along a similar (but reverse) structure, the recovery ratio $r_{i,j}$ is conceived as the sum of a baseline component *r*, homogeneous across all pairs *i* and *j*, plus an additional component *k* if the two banks are from the same country:

[6] $r_{i,j} = r + \lambda_{i,j}\,k$ where $r \in (0,1)$, $k \in (0,1\text{-}r], > 0$, $\lambda_{i,j} = 1$ if $\{i,j\} \in X$ and 0 otherwise.

The agent's optimization problem is solved analytically through an HARA utility function with $\gamma = 2$:

[7] $\max U = -0.5\,(p\,x - q)^2$

$$\text{where } x = \sum_{j=1}^{z} \left\{ \alpha_{i,j} \left[(1+m)(1-\pi_{i,j}) + r_{i,j}\,\pi_{i,j} \right] \right\},\ p, q > 0$$

constraints [4] apply and parameters *p* and *q* are both strictly positive; the larger *p* is relative to *q*, the more risk averse is the investor. Compared with other utility function, the quadratic specification should yield more balanced portfolio solutions (Chadha and Schellekens 1999).

To keep the algebra tractable, this maximization problem can be tackled for the case where $z = 3$, which caters for the basic choice between a domestic and a foreign counterparty, say, *a* lends to *b* and *c* in the proportion of α and 1-α, where $\{a,b\} \in X$ and $\{a,c\} \notin X$. Referring the reader to Table A.3 and Annex D for additional details, the solution $\hat{\alpha}$ of [7], the optimal share of domestic lending[21], is

[8] $$\hat{\alpha} = \frac{\pi_{a,b}(1-\pi_{a,c})(p + pm - q)(1+m-r-k) - \pi_{a,b}\,\pi_{a,c}(pr+q)k - (1-\pi_{a,b})\pi_{a,c}(pr-q)(1+m-r)}{p\left[(1-\pi_{a,b})\pi_{a,c}(1+m-r)^2 + \pi_{a,b}(1-\pi_{a,c})(r+k-1-m)^2 + \pi_{a,b}\,\pi_{a,c}\,k^2\right]}$$

It is straightforward to verify that if $k = 0$ and $\pi_{a,b} = \pi_{a,c}$, [8] yields $\hat{\alpha} = 0.5$ always: *a* treats *b* and *c* equally (and there is no reason why it should do otherwise) when these two banks do not differ in terms of the recovery ratio and probability of default. Taking partial derivatives

[9a] $$\frac{\partial}{\partial(\pi_{a,c} - \pi_{a,b})}\hat{\alpha}(k=0) > 0$$

[9b] $$\frac{\partial}{\partial k}\hat{\alpha}(\pi_{a,b} = \pi_{a,c} = \pi) > 0$$

where [8a] shows that $\hat{\alpha}$ increases with the relative riskiness of *c* to *b* (as assessed by *a*) as well as with the "resolution edge" *k*.

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20 Freixas and Holtahusen (2004) draw a model of interbank market integration whose key assumption is that cross-border information about banks is less precise than home country information.

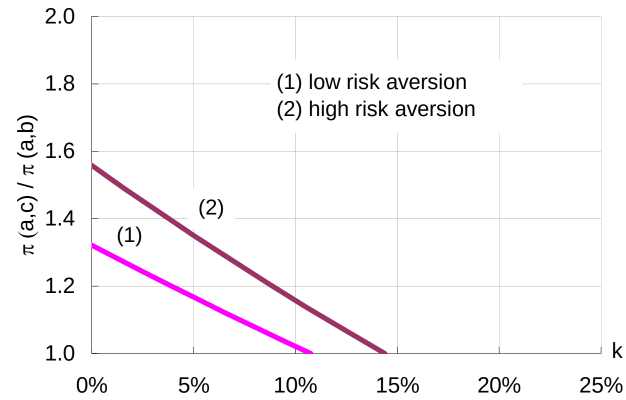
21 In this setting, banks are endowed with same initial wealth (one unit) and they all choose between an equal number of domestic and foreign counterparties (one each in this instance). As a result, the share α of domestic lending is as good a measure of the home bias as the more advanced indicator [1.c].

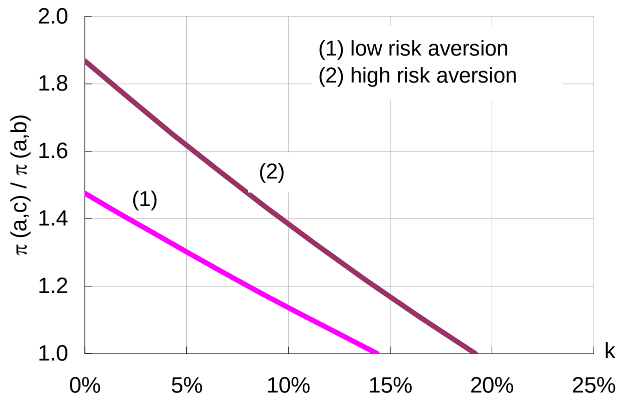
To derive reasonable calibrations of the model, I set out assuming $\hat{\alpha}$ equal to 68 or 75%, i.e. the share of domestic interbank lending in the euro area at 2007Q1 and 2009Q2 respectively. The ratio between the parameters *p* and *q* of the utility function is set at 0.67 and 0.83, corresponding to instances of lower and higher risk aversion. The market interest rate *m* is equal to 1%, in line with the then ECB policy rate, bank *b*'s PD at 0.6% and the baseline component *r* of the recovery ratio at 40%, which is an industry standard. Based on these assumptions, one can find the locus of solutions of the pairs $\{\pi_{a,c} / \pi_{a,b}; k\}$ which yields [8] for different combinations of $\hat{\alpha}$ and of the ratio *p/q* (Charts 7a-b).

A first finding is that the resulting lines are negatively sloped: there is a trade-off between higher relative levels of riskiness of foreign banks and more "resolution edge" in obtaining a given level of domestic interbank lending. Secondly, when $\hat{\alpha} = 75\%$ (right-hand chart), solution lines lie above and to the right compared with those for $\hat{\alpha} = 68\%$ (left-hand chart): our representative risk-averse agent accepts to deviate from the fifty-fifty neutral allocation only against the backdrop of more riskiness of foreign banks (as measured by the ratio $\pi_{a,c} / \pi_{a,b}$), more "edge" *k* or both. Note that the more *a* is risk averse, the larger do both the ratio $\pi_{a,c} / \pi_{a,b}$ and *k* need to be in order to achieve a given level of $\hat{\alpha}$, as suggested by the fact that in the two charts line (2), corresponding to higher values of the ratio *p/q*, lies above and to the right of line (1).

Charts 7a-b

Simulations of the model: the relationship between credit risk and k, given α and risk aversion (1)





(1) The lines on the left-hand chart describe the solutions that verify [7] for $\hat{\alpha} = 68\%$, m = 1%, r = 40%, $\pi_{a,b} = 0.6\%$ and p / q = 0.67 in line (1) and p / q = 0.83 in line (2). The same sets of parameters are used in the right-hand chart except $\hat{\alpha} = 75\%$.

A second and even more noticeable finding is that the intercepts of the various lines with the vertical axis do provide acceptable solutions of [8] with *k* = 0. However, such solutions imply stringent requirements on the other parameters of the model: for example, when $\hat{\alpha} = 75\%$, as in 2009, the ratio $\pi_{a,c} / \pi_{a,b}$ needs to be in the order of 1.5 when risk aversion is relatively low and 1.9 when risk aversion increases. What is the likelihood that foreign banks are so much riskier than domestic ones? To gather some insights, I looked into a data set of monthly measures of the expected default frequency (EDF) of the banks in the Euribor panel, which I subdivided according to whether the bank is from the euro area or not.[22] The median value of the EDFs across the two sub-groups in 2009 was respectively 0.40% and 0.39% for the euro-area and non-euro-area banks, so that the resulting ratio $\pi_{a,c} / \pi_{a,b}$ is well below the 1.5 threshold (in fact, it is even marginally lower than 1). In turn, this implies that real-world data bear out a solution close to the intercept along the horizontal axis, that is with *k* in the order of 15-20%.

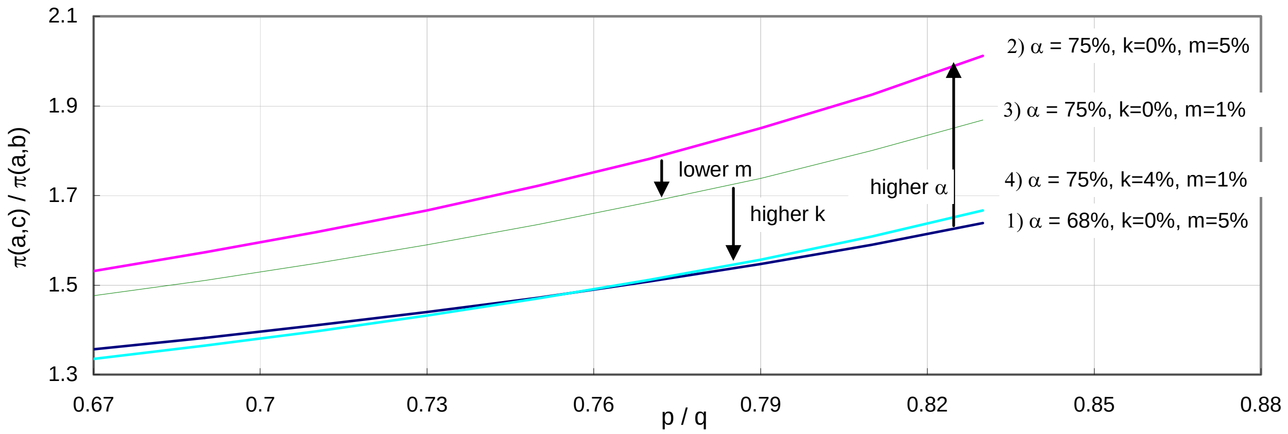
[22] The data set included 30 banks, of which 22 from the euro area.

Before calling the case closed in favour of a non-negligible *k*, there remains the tricky task of establishing a quantitative measure of the parameter σ from proposition [5]. Exploiting again the EDF data, I considered the following rule of thumb: a risk-averse agent measures the EDF of fellow banks using the median value of the distribution while, in a conservative approach, he relies on a higher percentile for foreign counterparties. Proceeding in a reverse way, I thus managed to get results for $\pi_{a,b}$ and $\pi_{a,c}$ that stand in the desired 1.5 ratio when $\pi_{a,c}$ is taken on the 66th percentile, while the 1.9 ratio requires the procedure to escalate to the 70th. To put numbers in perspective, this implies that a euro-area bank in the Euribor panel may classify 4 out of its 22 fellow area banks in the panel as less risky than the median non-area bank from the panel, on the grounds of commonality, although the available EDFs would point to the opposite conclusion.

In fact, the model suggests that changes in the value of $\hat{\alpha}$ from 68% to 75% may be achieved without foreign banks suddenly becoming that much riskier. In Chart 8, line (1) identifies a locus of solutions for the ratios $\pi_{a,c}$ / $\pi_{a,b}$ and *p*/*q* which resembles pre-crisis conditions. Line (2) is the new line obtained once $\hat{\alpha}$ goes up to 75%, while *m* is kept constant at 5% and *k* is omitted. The new equilibrium requires a substantially higher $\pi_{a,c}$ / $\pi_{a,b}$ ratio when the crisis unfolds, which real-world data from the Euribor panel do not seem to confirm. However, if simulations are re-run with *m* = 1% one obtains line (3), where the increase in the $\pi_{a,c}$ / $\pi_{a,b}$ ratio is cut by around one third. Finally, if one adds *k* = 4%, the resulting line (4) overlaps the starting line (1). The tale of these simulations is that the higher share of domestic interbank may be described by the model, once stock is taken of the decline in interbank interest rates and one accepts a small dose of *k*. The resulting rather narrow wedge between the baseline 40% component of the recovery ratio and its overall 44% value for the domestic investor may perhaps help to reconcile the actual patterns in home bias, the "resolution edge" hypothesis and some protestations to the contrary that national interests played no role in banks' rescue decisions (Bernanke 2009).

Chart 8

Simulations of the model: how α increases from 68% to 75%, also changing k and m (1)



(1) The four lines describe the locus of solution of the ratios .π (a,c) / π (a,b) and p/q coherent with the specified values of parameters α, *k* and *m* (r = 40% in all examples), given [8].

The joint impact of the various forces at play – the structural variables driving the level of home bias, banks' riskiness, risk aversion, market interest rates and the recovery ratio – may be assessed through a linearized version of [8]:

[10] $HB_{i,t} = \theta_0 + \theta_1 X_{i,t} + \theta_2 (\pi^F - \pi^D)_{i,t} + \theta_3 \text{risk\_aversion}_{i,t} + \theta_4 m_t + \theta_5 k + u_{i,t}$

where $X_{i,t}$ is the matrix where the structural variables examined in Section 2.3 (the ratio to GDP of the sum of exports and imports, foreign banks' penetration, stock market capitalization) are stacked in, while $(\pi^F - \pi^D)$ is the spread in riskiness between foreign and domestic banks. Against this framework, the main issue raised in the introduction – the crisis would have magnified the "resolution edge" in cross-border transactions across the euro area while it had a smaller impact on those transactions originated by banks from the control countries – can be tested by checking whether the estimate of the *k* coefficient increased after the start of the crisis significantly more when *i* is a banking system from a euro-area country than otherwise.

4. The econometric analysis

4.1 *The analysis of the aggregated banking system data*

The fits on the aggregated banking-system-level (country) data on the determinants of home bias were run on the following baseline function:

$$[11] \quad HB_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 (\pi^F - \pi^D)_{i,t} + \beta_3 \text{risk\_aversion}_t + \beta_4 \text{dummy}_{i,t} + \beta_5 \text{trend}_t + u_{i,t}$$

$$i = 1, ..,17; \; t = 2004Q1, .., 2009Q3 \text{ (23 quarters)}$$

which differs from the preliminary model-based specification [10] as it omits the market interest rate *m* while it includes a trend variable. The former (measured by one-year Euribor) was not generally employed in the fits due to its correlation, in the order of 0.50, with measures of risk aversion (see next), while the latter caters for the decreasing trend visible e.g. in Chart 2, were this not wholly captured by other explanatory variables.[23]

In running the fits, $X_{i,t}$ included at most two of the three GDP ratios described in Section 2.3 at a time, again to fend off possible multicollinearity.[24] The spread in the two probability-of-default π's parameters was proxied by the premium on the 5-year CDS on, respectively, an average of foreign sovereign issuers and own sovereign issuers.[25] For example, given country 1 in the sample from 1 to 17, the former was worked out as the average of this premium on countries 2 to 16.[26]

As to the market risk aversion item, a number of time series were examined: (1) Euribor – Overnight Index Swap (OIS) spread at the one-year maturity, a standard in empirical studies on the money market during the crisis[27]; (2) a measure of the premium on the liquidity risk inferred from the Euribor index; (3) an index of global risk aversion, obtained as a normalized weighted average of various measures of volatility of widely traded financial instruments, and (4) an estimate of expected losses on banks in the Euribor panel, inferred from the OIS spread and the premium on their own 5-year CDS (Chart A.4).[28] Note that while all such measures tell us something about the more tense conditions in the money market during the crisis, they do so from different angles: the spread and the premium relate to the quantity of (market) liquidity risk, the index is a general measure of risk aversion, and the final estimate

23 A possible economic interpretation of this downward trend is the push to trade more cross-border due to the global integration of financial markets. Additionally, as the process of consolidation makes inroad in the banking system, top banks need to look more and more abroad to find adequate peers for their trading.

24 The average of the coefficients of correlation between the country measures of the stock market to GDP ratio and the export + import to GDP ratio was measured at 0.50.

25 Levy and Zaghini (2010) show that during the crisis the cost of the (guaranteed) debt taken on by banks was correlated to the riskiness of their own country. The alternative of measuring $PD_{i,t}$ on some average of CDS premiums on banks looked less robust since in some countries of the sample liquid CDS contracts are available only for a few banks and any summary statistic is bound to take on idiosyncratic factors.

26 Both linear and weighted (using as weights at time t the country breakdown in the volume of cross-border deposits lent at time t-1 by *i*'s banks) averages were examined, with no meaningful differences.

27 Results changes very little if Libor is used in lieu of Euribor.

28 Data for the series (2) and (4) are from Nobili (2009).

is about the quantity of credit risk. Overall, they should cater for a fairly complete representation of the various facets of strains in the interbank market during the crisis.

The dummy variable is a 23×17 matrix filled in with 1s in quarters from 2007Q2 onwards in the columns corresponding to *i* being a banking system from the euro area and 0 otherwise (a vector representation was also tried out; see below).

Pooled estimates of [11] were run with cross-section SUR weights, a feasible GLS specification which corrects for cross-section heteroskedasticity and contemporaneous correlation, both on levels and on first differences, with and without cross-section fixed effects. The expected signs of the estimated coefficients are as follows: $\beta_1 < 0$, owing to the negative correlations shown in Chart 6; $\beta_2 < 0$, from derivative [9a]; $\beta_3 > 0$, as gauged from the above simulations of the model; $\beta_4 > 0$, this is the "resolution edge" hypothesis; and $\beta_5 < 0$, from the downwards trend in Chart 2. Selected results are in Table A.4.[29]

Overall, the chosen specifications yield an adequate explanatory power, with an adjusted R^2 (weighted) in the range of 0.95-0.99 and highly significant F tests. Residuals look reasonably well-behaved both in terms of autocorrelation and heteroskedasticity structure; a token graphical representation is in Chart A.5. In the selected fits, estimated coefficients are mostly significantly different from zero at 1% probability and take the expected sign. One relevant exception concerns β_3, which in some but not all fits is significantly higher than zero.[30]

As regards the overall robustness of the analysis, reassuringly, the results of the different fits differ only marginally depending on whether one or the other time series of the structure of the economy and of the interbank market strains are considered. Crucially, the results for the dummy variable suggest that, having controlled for developments in the other explanatory variables, the level of home bias of euro-area banks was higher by some 0.1-0.2 than the home bias of non-euro countries from mid-2007. This increase is not only statistically significant but is also non-negligible in absolute value as the average level of the indicator itself is close to 0.4-0.5 with a standard deviation in the order of 0.05 (Table A.1).

The dummy was tested also in the form of a 23×1 matrix (a vector), this time imposing cross-specific restrictions on the related coefficient so as to obtain 17 estimates $\beta_{4,i}$: when *i* is a euro-area country, 9 out of 12 such estimates turned out significantly above zero, while the ratio when i is a non-euro country falls to 1 out of 5 (the US being the only exception).

Further, fits were tried with and without fixed effects, tested using an F-family test, and the impact of their inclusion can be gauged by comparing columns (l.7) and (l.8) of Table [A.4] in the specification that uses the goods / GDP ratio and the Euribor-OIS spread.[31] All estimates confirm their signs and overall no large explanatory power is added (bear in mind that the more parsimonious version without fixed effects already achieved an R^2 of 0.99) but noticeably the estimated coefficient β_4 of the *k* parameter decreases from 0.17 to 0.06. Incidentally, the latter figure is not far above the 4% examined in the simulations of the analytical model (Chart 8).

Likewise, when estimates are run on the first differences $\Delta HB_{i,t}$ in the home bias indicator,[32] there is a systematic quarter-on-quarter increase in the measure of home bias by euro-area banks compared with their non-euro country peers in the order of 0.02 (Table A.5). This yields a cumulative amount of around 0.2 in the ten quarters from 2007Q2 through 2009Q3, matching the results on the level.

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29 Additional results are available on request.

30 This may signal the difficulty of measuring the riskiness of a banking system as a whole on the basis of publicly available market-based measures.

31 Fits were also run with seasonal effects, without meaningful changes in results.

32 Most individual national series of this indicator are integrated of order 1 (Table [A.1]).

4.2 *The analysis of the individual banks data*

Based on the model put forward in section 2.2, the dummy variable employed in the fits of [11] could be related to the "resolution edge" parameter *k* or to the premium σ which is meant to capture less accurate information on foreign banks (or both). Given the economic rationale for the latter component – some news may be passed on by word of mouth and locals are better equipped to extract information from news that is otherwise publicly available – it seems to be a tall order to have a time series of σ to be used directly in standard econometric fits. As an alternative route, the micro data set introduced in Section 2.1 is compiled using data on deposits exchanged among banks in the Euribor panel, hopefully so as to minimize any unevenness in information due to borders. Hence, the premium σ should carry only a smaller weight, if any.[33]

That said, the baseline model fit with pooled techniques on monthly data on individual loans is:

[12] $$hb_{j,t} = \gamma_0 + \gamma_1 X_{ITALY,t} + \gamma_2 (\pi_t^F - \pi_t^{D,j}) + \gamma_3 \text{ risk\_aversion}_t + \gamma_4 \text{ dummy}_t + u_{i,t}$$

j = 1, ..,6; t = 2004JAN, .., 2009DIC (72 months)

where the dependent variable is the home bias of the j-th Italian bank in the sample, $X_{ITALY,t}$ follows on from above remarks with the proviso that only the time series for Italy are considered, π_t^F is the average of the premium on the 5-year CDS from end-month *t* over the 21 non-Italian banks in the sample, $\pi_t^{D,j}$ is the corresponding average over the 5 Italian banks other than bank *j* itself, risk_ aversion takes the meaning introduced above and the dummy variable takes value 1 from June 2007 onwards and 0 otherwise. No trend variable is introduced because of the high correlation with the dummy.

Fits were run using Pooled IV/Two-stage EGLS (Cross-section SUR).[34] Selected fits on [12] are shown in Table [A.6] and refer to the level $hb_{j,t}$ measure of the indicator (no results were selected for the model on the first difference $\Delta hb_{j,t}$ in which the explanatory power model did not prove to be adequate[35]). Fits (b.1) through (b.6) mirror like specifications examined in the macro data, while (b.7) and (b.8) are somewhat different and will be commented below.

As to fits (b.1)-(b.6), estimates mostly take the expected sign although not all of them are significantly different from zero. Across the board, the overall explanatory power of the fits is lower than in the aggregate estimates, a finding which is conceivably due to the larger idiosyncratic component that almost unavoidably affects individual banks' data compared with aggregated data. That being acknowledged, home bias increases the wider the spread in average CDS premiums between foreign and domestic (Italian) banks. It remains confirmed that the dummy adds a significantly positive contribution to the level of home bias. In fit (b.7) I introduced the dummy also in a multiplicative way before the risk spread and virtually no difference emerged in the result.

Put more simply, the creditworthiness of available counterparties became a staple of the lending decision in the interbank market when the crisis broke out. This result looks consistent with the findings of Angelini, Nobili and Picillo (2009) and Afonso, Kovner and Schoar (2009). In fit (b.8) I split the average premiums on the CDS of Italian counterparties from that of foreign banks, where both series are pre-multiplied by the dummy. The estimated coefficients of the two products keep the expected signs (respectively, negative and positive) and are comparable in absolute terms. The news is that while the foreign component π_t^F is statistically different from zero, the domestic item $\pi_t^{D,j}$ is not.

33 It is worth adding that the loans surveyed in this data set are exchanged by banks of different banking groups, i.e. no intra-group transfers of liquidity are involved.

34 This specification does not allow a direct F test on the fixed effects. A way round was to re-run the fits without fixed effects while introducing cross-section restrictions on the constant (this yields the same results except for a shift between the estimated coefficient of the constant in the former specification and the average of the country results in the latter) and then conducting an F test on whether all cross-specific constants are nil.

35 One should bear in mid that only three out of the six time series of the individual home bias are integrated of order 1, while the other three are integrated of order 0.

This is a noteworthy difference given that no dramatic differences arise in the riskiness of Italian and foreign banks in the sample, as measured by the CDS premiums (Chart A.6). Thus, the issue seems to lie with the way banks weigh on this input, which seems to matter less when the counterparty under assessment is a domestic fellow bank. It is tempting to read this finding as a further hint of the "resolution edge": from the point of view of the lender, domestic counterparties would be deemed intrinsically less risky for reasons that go beyond measures based on standard approaches.

When significantly different from zero, the estimated coefficient γ_3 of the risk aversion proxies is negative. Finally, the estimate of γ_4 of the additive dummy variables takes the expected positive sign. That is, after having controlled for the variables now described, there remains a significant component of extra increase in the home bias of Italian banks in the interbank market.

Arguably, this is just a cut of the euro-area interbank market, insofar as it is about the lending behaviour of six leading Italian banks and ideally one would like to run similar tests on data relating to loans granted by banks from other countries as well. Two elements suggest, however, that the results now presented may have a more general bearing. First, the average home bias of these six banks (Chart 5) appears consistent with a number of other statistics examined throughout the paper. Hence, the six banks would appear to be a reasonably representative sample from the broader pool of large euro banks. Second, the measures enacted in Italy to support the banking system throughout the crisis were certainly not massive compared with those adopted in other developed countries, both in terms of commitments and outlays (Panetta et al. 2009). If anything, this suggests that in other countries banks should have perceived an even larger advantage in lending to their domestic counterparties as a way of eschewing credit losses. Hence, fits of [12] on similar micro data sets for such countries should return even stronger results for the dummy.

5. Concluding remarks

According to one indicator – taking values between -1 when banks lends only cross-border and +1 when they lend only domestically, with 0 signalling no specific preference towards domestic counterparties – the interbank lending home bias of banks based in 12 euro-area countries (the starting members of the Monetary Union plus Greece) fell from 0.57 in 2004Q1 to 0.45 in 2007Q2, bouncing back to 0.56 in 2009Q3. For the same dates, the corresponding bias of banks from the five non-euro countries (US, UK, Denmark, Sweden and Switzerland) moved downwards from 0.43, to 0.41 and then 0.37. What emerges is a decoupling in trends at the outbreak of the current ongoing crisis between the banks' home bias in the two sets of countries. Two additional patterns are worth noting: first, these trends are broad based, with the bias rising in all 12 euro banking systems while decreasing in 4 out of 5 non-area systems; second, the upward slope of the area banks' bias was due mainly to developments in within-the-area cross-border interbank deals.

Having provided statistical evidence describing these facts, the second part of the research set out to seek the underlying causes. On a cross-section dimension, the drivers of the country-level interbank home bias are identified in a trio of series meant to gauge the openness of the economy, the size of its financial market and the penetration of foreign banks in the national banking system. While this is not necessarily an exhaustive list and additional variables (or alternative specifications of the same variables) could be tried out, an R^2 in the order of 95% in the fits of the level of the home bias indicator suggests that nothing really big has been left out of the picture.

As to the time dimension, a number of candidate explanatory items have been examined. The econometric fits control for heightened market strains using four alternative spreads / indicators inferred from interbank market interest rates. Yet, even accounting also for the aforementioned drivers, as well as a spread in creditworthiness of foreign vis-à-vis domestic banks and a trend variable, there remains a significant unexplained increase in the bias of euro banks from the onset of the crisis.

A number of educated guesses can be made regarding the rationale of this residual component. To start with, one could relate it to the information advantage a bank may have on its fellow domestic banks regarding foreign ones, where the heightened uncertainty clouding market developments during the crisis should have widened this advantage. Hence, the finding of more home bias could be interpreted as the rational behaviour of a risk averse agent. However, this argument looks at odd with both a logical and an empirical element. First, increasing heterogeneity in information should have created a similar incentive for the banks from the non-euro countries, while their home bias actually decreased further in the most recent years. Second, the rise in home bias is also detected in an ancillary micro data set compiled with interbank loans exchanged across banks in the Euribor panel, that is banks which are well established in financial markets and on which domestic peers are less likely to have any specific information advantage compared with foreign big banks.

Exploiting the large literature on home bias in international finance, another obvious candidate explanation is represented by FX market volatility. Alas, most of the cross-border interbank lending by euro-area banks takes place within the area and involves euro-denominated deposits. If anything, concerns about exchange rate risks should have prompted a rise in the home bias of banks from the control countries, more than the other way around.

Another recurring item in this literature concerns the cost of trading internationally. If this is taken literally, and thus in term of the fees due in trading deposits through the single settlement platform TARGET2, one could hardly make a case for lending more to domestic banks than to other banks within the area from 2007 on. I therefore suggest a broader interpretation of the trading cost item, which includes also the advantage of being a creditor when your embattled borrower is a fellow domestic bank, the "resolution edge". National authorities could be tempted to decide more favourably whether or not to rescue a bank, the larger the share of domestic creditors; if they eventually decide to intervene, they could design the support operation in a way that shelters domestic creditors better than foreign ones. Even when none of these elements plays a role, creditors may feel uneasy about claiming their rights before a foreign regulatory and legal jurisdiction.

The crux of the matter is not that the "resolution edge" is necessarily higher within the area than outside it. Rather, the issue lies with its dynamics: before the crisis, banks (especially large ones) increasingly regarded a cross-border within-the-area transaction as tantamount to a domestic one in terms of legal risk, with the plus that the former allowed more diversification across borrowers; afterwards, banks reckoned that overall risk considerations were significantly advantageous for the domestic creditor compared with the foreign one. From this standpoint, the outbreak of the crisis was less of a watershed for banks operating from the non-euro countries: say, a large Swiss bank did not need to wait until 2007 to appreciate the difference between running a business in Zürich and in New York.

To conclude, when looking for the smoking gun, at the current stage the lack of suitable data makes it impossible to test directly the link between home bias and "resolution edge" and due caution should be used even when this link appears consistent with a number of data and anecdotal findings. Arguably, and this creates an agenda for future research, any competing hypothesis on the interbank lending home bias needs to cater simultaneously for the V-shaped pattern of the bias of euro-area banks and the more consistent downward trend of non-euro-area banks throughout the crisis. It should also be of definite interest to examine whether, over time, the strength of the "resolution edge" disappears in cross-border transactions within the area; or, as traders become accustomed to it, the extent to which it is factored into the terms of contracts.

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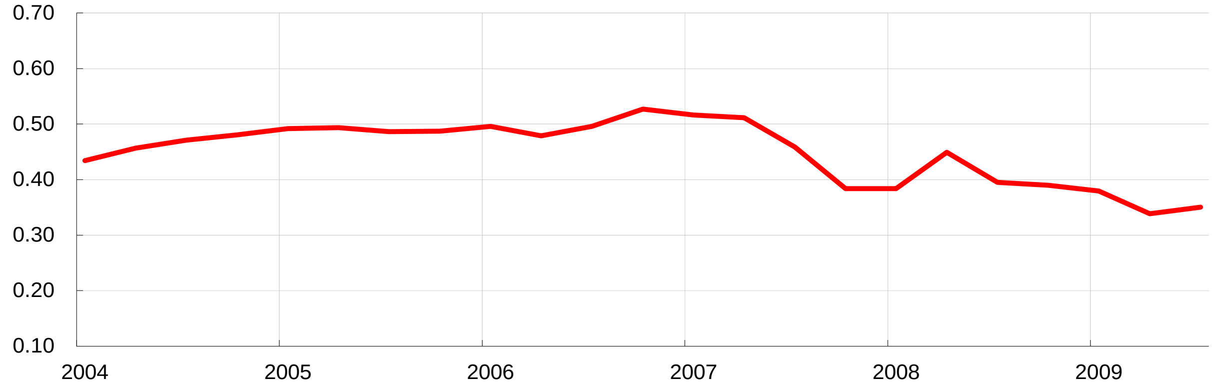
ADDITIONAL TABLES AND CHARTS

(the order of presentation follows their reference in the text)

Chart A.1

Correlation between the share of domestic interbank loans by 17 national banking systems and the weight of their interbank loans in the total (1)



(1) The time series shown in the chart is compiled with the correlation, at each data point (each quarter), between the share of domestic interbank lending in the total for the 17 banking systems in the sample and the weight of their interbank lending (both domestic and foreign) in the total of the sample.

Table A.1

Home bias indicator, country results, summary statistics (1)

(quarterly data, 2004_Q1-2009_Q3)

	Average	Min	Max	St.dev.	[HB(2009Q3)-HB(2007Q2)]/ St.dev.	Order of integration
			Euro-area banking systems			
Austria	0.69	0.60	0.79	0.05	2.6	I(1)
Belgium	0.09	-0.10	0.17	0.05	1.7	I(1)
Germany	0.50	0.46	0.54	0.02	2.4	I(1)
Spain	0.58	0.49	0.67	0.05	0.8	I(1)
Finland	0.34	0.28	0.43	0.04	1.7	I(1)
France	0.56	0.48	0.64	0.05	2.1	I(1)
Greece	0.38	0.24	0.58	0.10	2.3	I(1)
Ireland	0.40	0.34	0.49	0.04	1.7	I(1)
Italy	0.70	0.66	0.78	0.04	3.3	I(1)
Luxembourg	0.25	0.20	0.38	0.05	2.3	I(2)
Netherlands	0.12	0.08	0.21	0.04	3.2	I(2)
Portugal	0.36	0.29	0.48	0.05	3.3	I(1)
			Banking systems of the non-euro-area countries			
Great Britain	0.15	0.02	0.25	0.07	-1.5	I(1)
Denmark	0.26	0.23	0.32	0.02	0.2	I(0)
Sweden	0.19	0.15	0.30	0.04	-1.7	I(1)
Switzerland	0.11	0.07	0.15	0.03	2.0	I(1)
USA	0.64	0.59	0.70	0.03	-1.3	I(1)
			Summary results for the two areas			
Euro area	0.48	0.43	0.54	0.04	2.6	I(1)
Non-euro-area countries	0.38	0.31	0.43	0.03	-1.0	I(1)

(1) Results are obtained on the basis of [1.c]. The level of integration is derived using ADF tests, at 1% probability.

Table A.2

Home bias indicator, individual banks' results, summary statistics (1)

(*monthly data, 2004_JAN - 2009_DEC*)

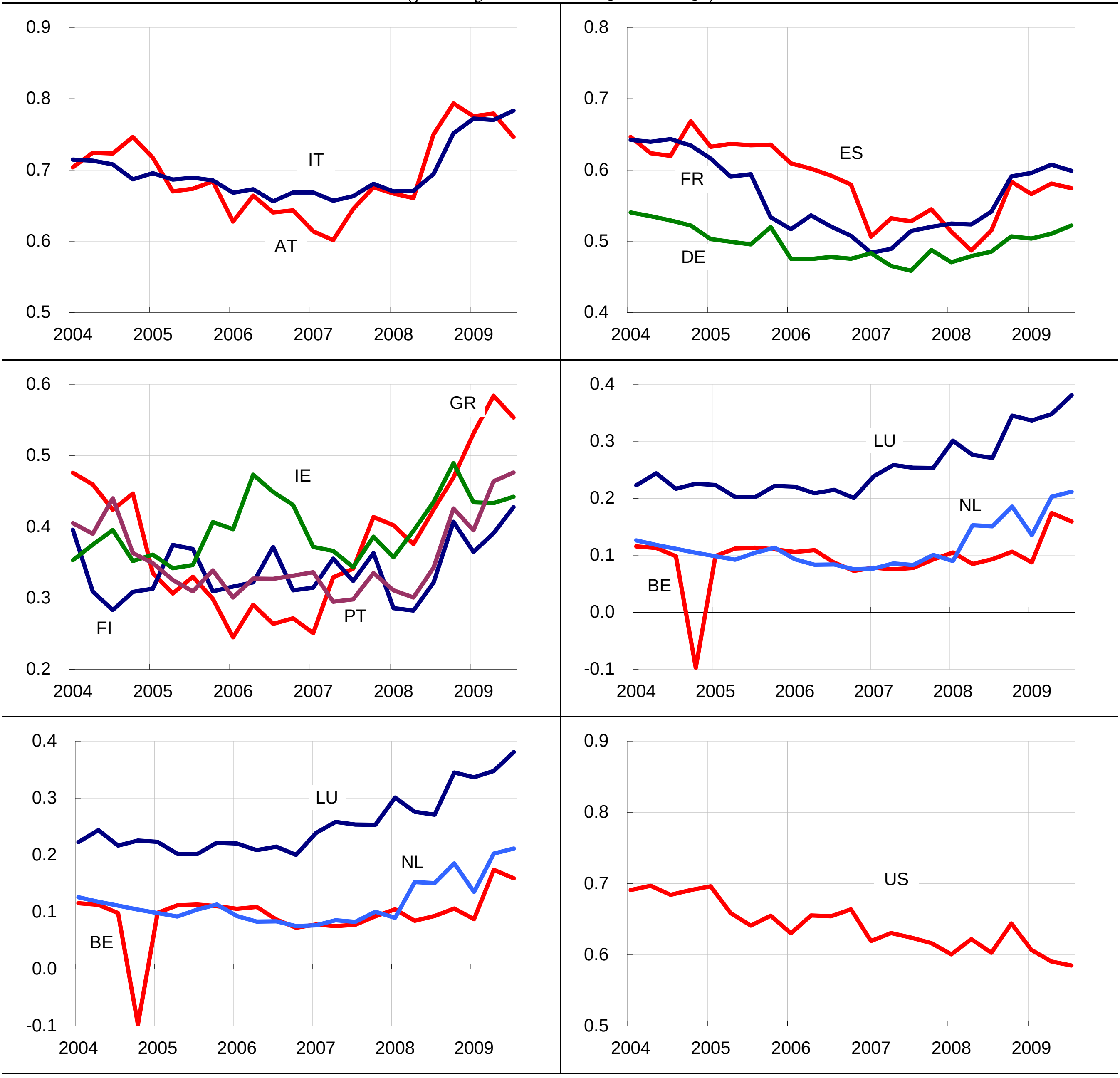
	Average	Min	Max	St.dev.	[hb(2009DEC)-hb(2007JUN)]/ St.dev.	Order of integration
Bank A	0.24	-0.99	0.86	0.46	1.0	I(1)
Bank B	0.24	-0.77	0.99	0.43	2.2	I(1)
Bank C	0.17	-1.00	0.99	0.55	0.6	I(0)
Bank D	0.10	-1.00	0.98	0.61	-1.0	I(0)
Bank E	0.37	-0.22	0.94	0.27	-0.5	I(0)
Bank F	0.29	-0.54	0.78	0.23	2.6	I(1)
Total	0.23	-0.35	0.66	0.19	1.4	I(0)

(1) Results are obtained on the basis of [2]. The level of integration is derived using ADF tests, at 1% probability. Banks A-F correspond, in random order, to the six Italian banks listed in Annex B.

Chart A.2

Home bias indicator, individual country results (1)

(quarterly data, 2004_Q1-2009_Q3)



(1) Results are obtained using formula [1.c]

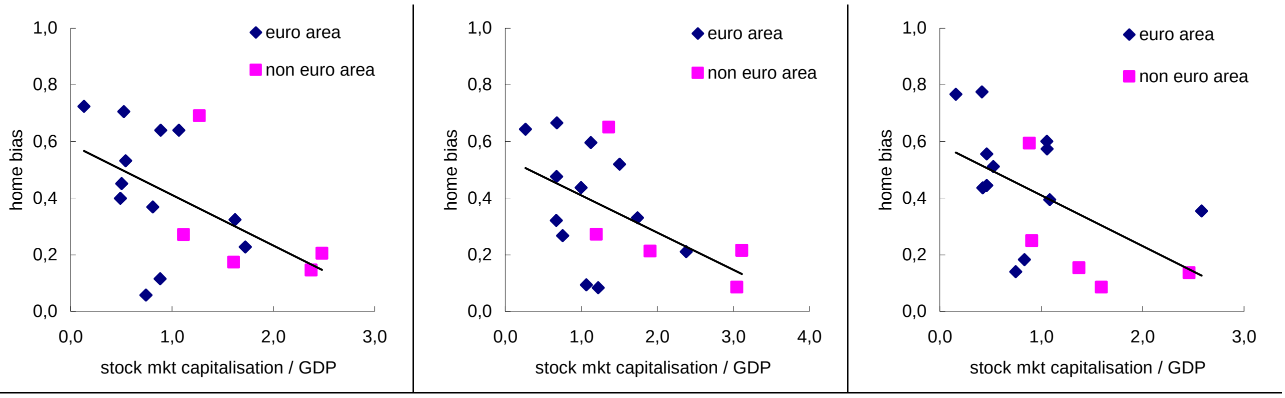
Chart A.3

Home bias vis-à-vis stock market capitalization, foreign banks' penetration and foreign merchandisetrade: Results for individual countries

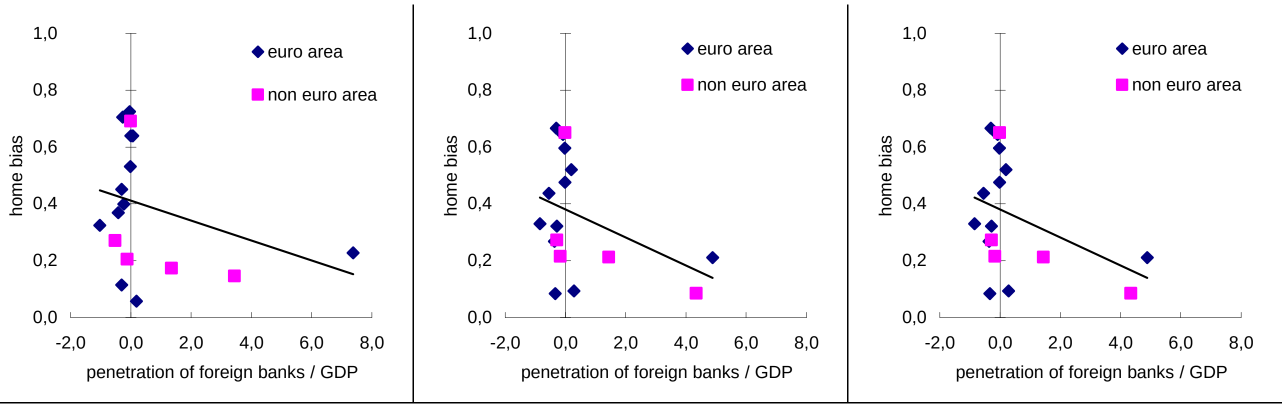
(average of quarterly data over the year specified) (1)

2004	2006	2009

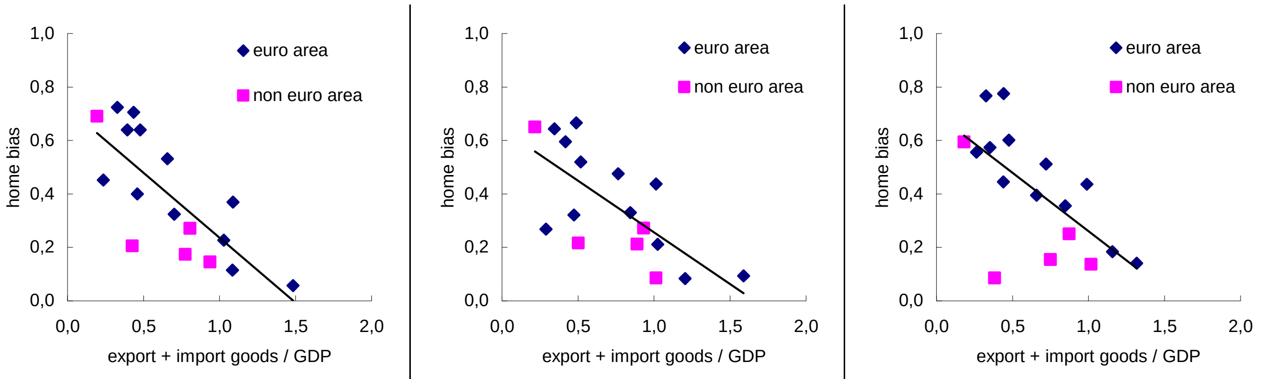
(1) Home bias and stock market capitalization / GDP



(2) Home bias and foreign banks' penetration / GDP



(3) Home bias and export+import of goods / GDP



(1) In the charts, on the left-hand column, the x-coordinate is the average over the four quarters of 2004 of the specified GDP ratio at country level and the y-coordinate is the average over the same quarter of [1.c]. Charts in the middle and on the right do the same for 2006 and 2009.

Table A.3

Outcome of lending when z = 3 banks (1)

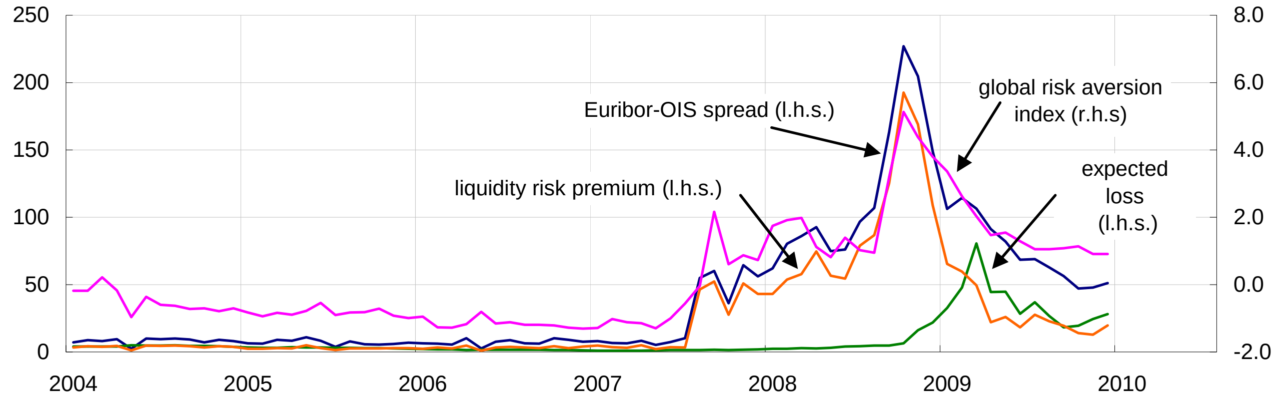
Outcome	Return	Probability
Both b and c pay	1 + m	$(1-\pi_{a,b}) \times (1-\pi_{a,c})$
b pays, c defaults	α (1+m) + (1-α) r	$(1- \pi_{a,b}) \times \pi_{a,c}$
b defaults, c pays	α (r+k) + (1-α) (1+m)	$\pi_{a,b} \times (1- \pi_{a,c})$
Both b and c default	α (r+k) + (1-α) r	$\pi_{a,b} \times \pi_{a,c}$

(1) The table describes the possible outcomes of the loans by *a* to *b* and *c* in the proportion of α and 1-α.; *m* is the market interest rate, *r* and *k* form the recovery ratio, $\pi_{a,b}$ and $\pi_{a,c}$ are the probability of default of, respectively, *b* and *c* as assessed by *a*.

Chart A.4

Interbank spreads and measures of credit and liquidity risk (1)

(*monthly data*)



Sources: BIS, ECB, national central bank websites, Datastream, Nobili (2009) and author's calculations.

(1) The Euribor-OIS spread refers to contracts denominated in euros at 1-year maturity, the index of global risk aversion is a normalized weighted average of various measures of volatility of widely-traded financial instruments; the measure of expected loss refers to banks in the Euribor panel and is inferred from CDS premiums; the measure of liquidity risk is inferred from the Euribor-OIS spread and CDS premiums. lhs: left-hand scale, rhs: right-hand scale.

Table A.4

Fits on aggregated data on home bias (levels)

$$HB_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 (\pi^F - \pi^D)_{i,t} + \beta_3 \text{ risk\_aversion}_t + \beta_4 \text{ dummy}_{i,t} + \beta_5 \text{ trend}_t + u_{i,t}$$

(quarterly series; t = 2004Q1 to 2009Q3 for 23 observations; i = 1 to 17 countries; fixed effects apply unless specified otherwise)

		(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)	(1.7)	(1.8)
	Constant	0.50 ** (0.002)	0.50 ** (0.003)	0.51 ** (0.003)	0.41 ** (0.003)	0.40 ** (0.004)	0.66 ** (0.003)	0.67 ** (0.003)	0.45 ** (0.01)
economic-financial structure	$(\text{stock market / GDP})_{i,t}$	-0.09 ** (0.001)	-0.09 ** (0.001)	-0.09** (0.001)					
	$(\text{weight foreign banks/ GDP})_{i,t}$				-0.04 ** (0.0004)	-0.04** (0.0004)			
	$(\text{exp.+imp. goods / GDP})_{i,t}$						-0.39 ** (0.002)	-0.39 ** (0.002)	-0.10 ** (0.01)
foreign vs. domestic credit risk	$(\pi^F - \pi^D)_{i,t}$	0.01 ** (0.003)	0.01 ** (0.003)	0.01 * (0.003)	-0.03 ** (0.003)	-0.03 ** (0.003)	-0.01 (0.003)	-0.005 (0.003)	-0.03 ** (0.002)
market proxies of risk aversion	$(\text{Euribor – OIS})_t$	-0.08 ** (0.004)			-0.05 ** (0.004)			-0.05 ** (0.01)	-0.02 ** (0.005)
	$(\text{liquidity risk})_t$		-0.06 ** (0.007)						
	$(\text{expected loss})_t$			-0.09 ** (0.01)					
	$(\text{global risk})_t$					-0.65 ** (0.12)	-1.36 ** (0.27)		
	dummy_t	0.13 ** (0.002)	0.12 ** (0.002)	0.10 ** (0.002)	0.11 ** (0.005)	0.11 ** (0.005)	0.18 ** (0.01)	0.17 ** (0.01)	0.06 ** (0.004)
	trend_t	-0.12 ** (0.02)	-0.23 ** (0.02)	-0.26 ** (0.02)	-0.32 ** (0.03)	-0.39 ** (0.03)	-0.39 ** (0.04)	-0.36 ** (0.03)	-0.13 ** (0.03)
	R^2 adj. (weighted /unweighted)	0.96/0.99	0.95/0.99	0.95/0.99	0.97/0.99	0.97/0.99	0.99/0.99	0.99/0.99	0.99/0.99
	D.W.	1.73	1.72	1.71	1.70	1.71	1.75	1.76	1.87
	F-test on overall fit	1,663 **	1,552 **	1,522 **	2,355 **	2,358 **	9,560 **	9,562 **	3,967 **
	F-test on fixed effects	without fixed effects							2,785 **

Pooled EGLS (cross-section SUR) estimates. White cross-section standard errors & covariance (d.f. corrected). Standard errors in parentheses. */** estimates are significant at 5% and 1% level. The estimated coefficient of the relative risk spread and of the trend are multiplied by 100. The redundant fixed-effect test is about the hypothesis that the estimated fixed effects are jointly significant using and LR test statistics.

Chart A.5

Residual of fit (1.8) from table [A.4], aggregated data on home bias (levels)

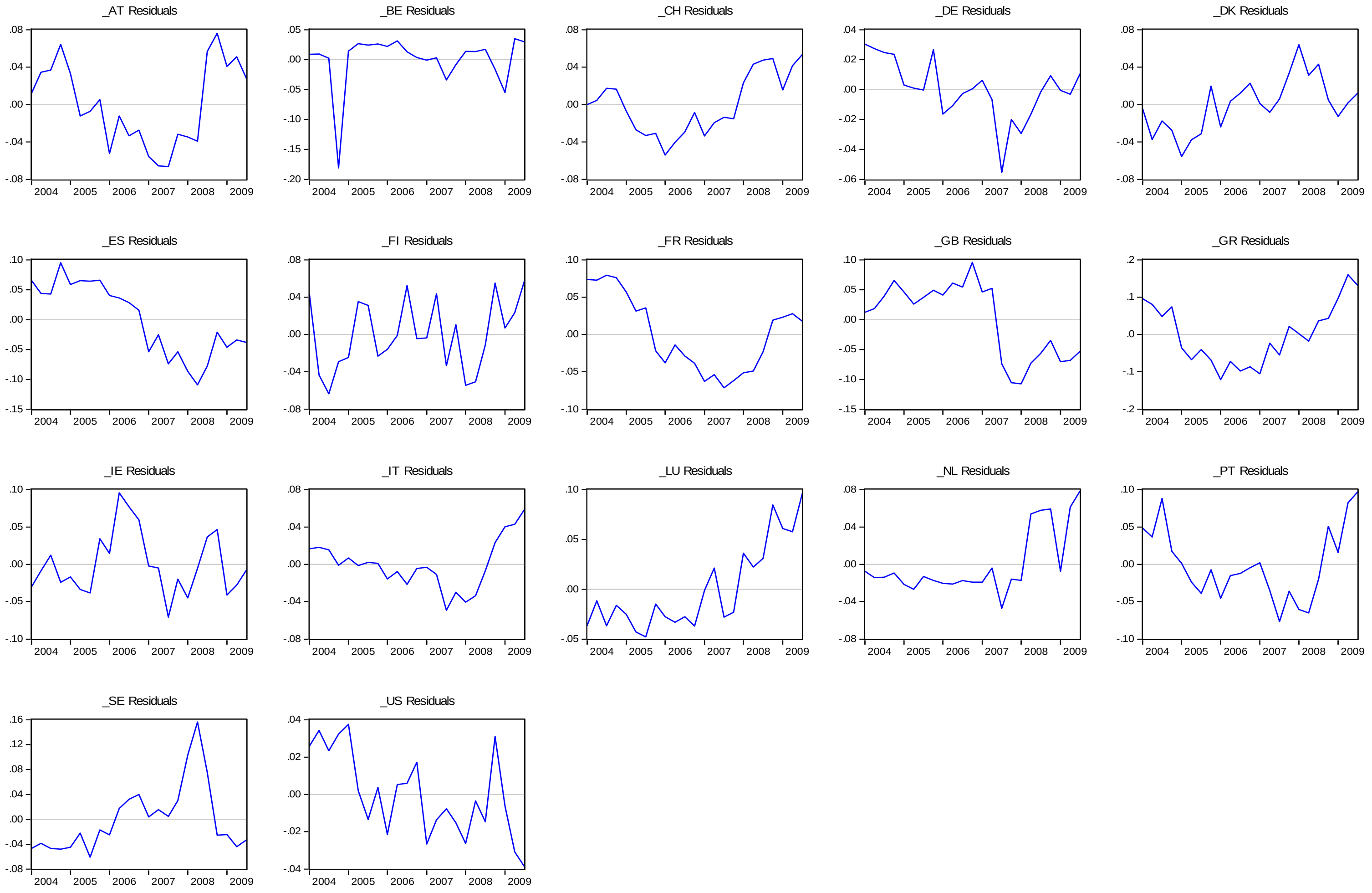


Table A.5

Fits on aggregated data on home bias (first differences)

$$\Delta\, HB_{i,t} = \beta_0 + \beta_1\, \Delta\, X_{i,t} + \beta_2\, \Delta\, (\pi^F - \pi^D)_{i,t} + \beta_3\, \Delta\, risk\_aversion_t + \beta_4\, dummy_{i,t} + u_{i,t}$$

(quarterly series; t = 2004Q2 to 2009Q3 for 22 observations; i = 1 to 17 countries; with fixed effects)

		(d.1)	(d.2)	(d.3)	(d.4)	(d.5)	(d.6)	(d.7)
	Constant	-0.04 ** (0.01)	-0.04 ** (0.01)	-0.04 ** (0.01)	-0.04 ** (0.01)	-0.04 ** (0.009)	-0.04 ** (0.009)	-0.04 ** (0.009)
economic-financial structure	(stock market / GDP)$_{i,t}$	-0.08 ** (0.02)	-0.07 ** (0.02)	-0.04 * (0.02)				
	(weight foreign banks/ GDP)$_{i,t}$				-0.04 * (0.02)	-0.05 ** (0.02)		
	(exp.+imp. goods / GDP)$_{i,t}$						-0.42 ** (0.07)	-0.43 ** (0.07)
foreign vs. domestic credit risk	$(\pi^F - \pi^D)_{i,t}$	0.02 (0.01)	0.02 (0.01)	0.01 (0.01)	0.01 (0.10)	0.01 (0.01)	0.002 (0.01)	0.003 (0.01)
market proxies of risk aversion	(Euribor – OIS)$_t$	-0.07 ** (0.01)			-0.04 ** (0.02)		-0.04** (0.02)	
	(liquidity risk)$_t$		-0.02 * (0.01)					
	(expected loss)$_t$			-0.33 ** (0.09)				
	(global risk)$_t$					-0.07 (0.54)		-0.17 (0.54)
	dummy$_t$	0.18 ** (0.01)	0.18 ** (0.01)	0.17 ** (0.01)	0.18 ** (0.01)	0.18 ** (0.01)	0.17 ** (0.01)	0.17 ** (0.01)
	R^2 adj. (weighted /unweighted)	0.41/0.99	0.42/0.99	0.45/0.99	0.35/0.99	0.35/0.99	0.40/0.99	0.45/0.99
	F-test on overall fit	12.3 **	12.6 **	14.9 **	9.6 **	9.8 **	13.7 **	14.3**
	F-test on fixed effects	3.39 **	3.40 **	3.35 **	3.24 **	3.24 **	3.53 **	3.54 **

Pooled IV/Two-stage EGLS (Cross-section SUR) estimates. White cross-section standard errors & covariance (d.f. corrected). Standard errors in parentheses. */** estimates are significant at 5% and 1% level. Estimated coefficients are multiplied by 10, those of relative risk and market risk by 1000. Δ is the difference operator which applied to a variable z_t yields $z_t - z_{t-1}$. The redundant fixed-effect test is about the hypothesis that the estimated fixed effects are jointly significant using and LR test statistics.

Table A.6

Fits on data on individual banks' home bias (levels)

$$hb_{j,t} = \gamma_{0,j} + \gamma_1 X_{ITALY,t} + \gamma_2 (\pi_t^F - \pi_t^{D,j}) + \gamma_3 \text{ risk\_aversion}_t + \gamma_4 \text{ dummy}_t + u_{i,t}$$

(*monthly series; t = 2004_Jan to 2009_Dec for 72 monthly observations, i = 1 to 6 banks; with fixed effects*)

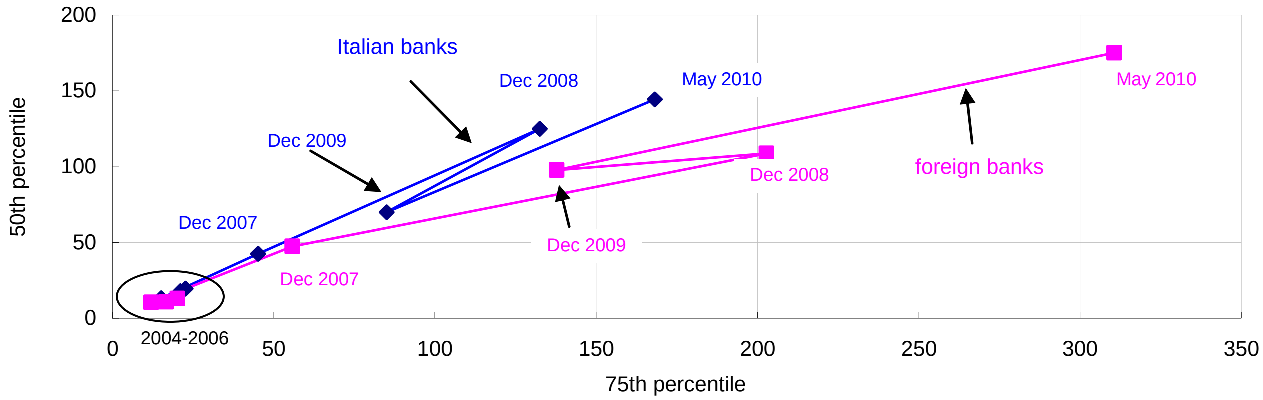
		(b.1)	(b.2)	(b.3)	(b.4)	(b.5)	(b.6)	(b.7)	(b.8)
	Constant	0.59 ** (0.12)	0.44 ** (0.11)	0.52 ** (0.12)	1.06 ** (0.49)	0.88 ** (0.20)	0.89 ** (0.18)	0.89 ** (0.18)	0.73 ** (0.21)
economic-financial structure	(stock market / GDP) $_{ITALY,t}$	-0.63 ** (0.19)	-0.40 ** (0.10)	-0.73 ** (0.22)					
	(weight foreign banks/ GDP) $_{ITALY,t}$				3.04 ** (1.73)				
	(exp.+imp. goods / GDP) $_{tITALY,t}$					-1.49 ** (0.43)	-1.68 ** (-0.41)	-1.68 ** (0.41)	-1.10 ** (0.39)
foreign vs. domestic credit risk	$(\pi_t^F - \pi_t^{D,j})$	0.11 ** (0.03)	0.11 ** (0.03)	0.04 (0.06)		0.11 ** (0.03)	0.10 ** (0.04)		
	$\text{dummy}_t \times (\pi_t^F - \pi_t^{D,j})$							0.10 ** (0.03)	
	$\text{dummy}_t \times \pi_t^F$								0.13 ** (0.03)
	$\text{dummy}_t \times \pi_t^{D,j}$								-0.09 (0.07)
market proxies of risk aversion	(Euribor – OIS)$_t$	-0.48 ** (0.19)				-0.27 (0.17)			
	(liquidity risk)$_t$		-0.35 ** (0.14)		-0.59 ** (0.18)				
	(global risk)$_t$			-0.14 (0.14)			-0.07 ** (0.04)	-0.07 ** (0.04)	0.03 (0.02)
	dummy_t	0.39 ** (0.14)	0.28** (0.10)	0.42** (0.14)	0.67 ** (0.19)	0.37 ** (0.13)	0.38 ** (0.14)	0.39 ** (0.14)	
	R^2 adj. (weighted /unweighted)	0.09/0.83	0.11/0.84	0.11/0.84	0.04/0.81	0.11/0.83	0.13/0.84	0.13/0.84	0.17/0.85
	F-test on overall fit	8.2 **	8.4 **	5.1**	6.7 **	8.6 **	8.9 **	8.9 **	9.3 **
	F-test on fixed effects	7.7 **	6.1 **	7.9 **	3.5 **	6.4 **	7.2 **	7.2 **	5.6 **

Pooled EGLS (cross-section SUR) estimates. Standard errors in parentheses. */** estimates are significant at 5% and 1% level. The estimated coefficient of the relative risk spread and of the trend are multiplied by 100. Δ is the difference operator which applied to a variable z_t yields $z_t - z_{t-1}$

Chart A.6

Premiums on 5-year CDS on Italian and non-Italian banks in the Euribor panel

(50th and 75th percentile across the two groups at specified dates)



Source: Bloomberg.

ANNEXES

ANNEX A **The sources of the data**

Data on interbank deposits

Cross-border interbank lending at banking system level

- BIS locational statistics: http://www.bis.org/statistics/bankstats.htm; quarterly data on international financial claims and liabilities of bank offices in the reporting country
- BIS consolidated banking statistics http://www.bis.org/statistics/consstats.htm; quarterly lending and borrowing by the head office and all its branches and subsidiaries on a worldwide consolidated basis

Domestic interbank lending at banking system level

- ECB, national aggregated balance-sheets of the MFI sector, tem 1.1.1, http://www.ecb.int/stats/money/aggregates/bsheets/html/outstanding_amounts_2009-06.en.html; lending from euro-area monetary financial institutions (MFIs) located in the euro area to euro-area MFIs located in the euro area, where the Eurosystem is excluded on both the lending and borrowing side. In general, the concept of MFIs covers credit institutions (which for most practical purposes coincide with the "banks" considered by the BIS) and money market funds
- US Federal Reserve: http://www.federalreserve.gov/paymentsystems/coreprinciples/default.htm, average daily volume of transfers in Fedwire,
- Bank of England: http://www.bankofengland.co.uk/mfsd/iadb/NewIntermed.asp. Monthly outstanding amount of UK resident banks' (excl. central bank) sterling loans to UK resident banks (excl. central bank), and monthly amounts outstanding of UK resident banks' (excl. central bank) total foreign currency loans to UK resident banks (inc. central bank) (in million sterling); series RPMTBG and RPMTBIH
- National Bank of Denmark: http://nationalbanken.statistikbank.dk/statbank5a/SelectVarVal/Define.asp?MainTable=DNSEKT1&PLanguage=1&PXSId=0&ShowNews=OFF, banks' lending to monetary financial institutions
- Sveriges Riksbank: http://www.ssd.scb.se/databaser/makro/Visavar.asp?yp=tansss&xu=C9233001&omradekod=FM&huvudtabell=BankBalMA1&omradetext=Financial+markets&tabelltext=Banks%2C+assets+and+liabilities+by+bank%2C+item+and+currency%2E+Monthly&preskat=O&prodid=FM0401&deltabell=+&deltabellnamn=Bankernas+tillg%E5ngar+och+skulder+efter+bank%2C+kontopost+och+valuta%2E+M%E5nad&innehall=Stallning&starttid=1998M01&stopptid=2009M06&Fromwhere=M&lang=2&langdb=2, lending to Swedish banks and lending to foreign banks´ branches in Sweden; series 1030112 and 1030113
- Swiss National Bank: http://www.snb.ch/ext/stats/bstamon/xls/en/bstamon_MB_AktivenIA_M1.xls claims against banks

All series are converted in US dollars using end-period exchanges rates, by Bloomberg.

Interbank lending of individual Italian banks

- Data reported monthly by Italian banks to the Bank of Italy for supervisory purposes.

Data on GDP ratios used in the fits

- OECD: http://stats.oecd.org/Index.aspx?DataSetCode=CSP2009. GDP, import and export of goods and services
- World Federation of Exchanges: http://www.world-exchanges.org/statistics/ytd-monthly. Stock market capitalization
- Euronext: http://www.euronext.com/editorial/wide/ editorial-1803-EN.html. Breakdown of data relating to national exchanges merged in Euronext (Amsterdam, Brussels, Lisbon and Paris)
- NASDAQ OMX Nordic Exchange http://www.nasdaqomxnordic.com/about_us/. Breakdown of data relating to national exchanges merged in NASDAQ OMX (Stockholm, Helsinki, Copenhagen, Iceland, Tallinn, Riga and Vilnius).

Data on number of banks

- ECB : http://www.ecb.int/stats/money/mfi/general/html/mfis_list_2010-05.en.html, ECB, number of credit institutions in euro-area countries, and:http://www.ecb.int/stats/money/mfi/general/html/mfis_list_nea_2010-05.en.html, ECB, number of credit institutions in non-euro-area countries
- US Federal Reserve, http://www.federalreserve.gov/releases/lbr/current/default.htm, number of large commercial banks
- Swiss National Bank: http://www.snb.ch/ext/stats/bankench/pdf/deen/Stat03.pdf, number of banks

The measures of market risk

Bloomberg and author's calculations: Euribor-OIS spread; Nobili (2009): the expected loss is inferred from an aggregate series of premiums on 5-year CDS on the panels of the EURIBOR banks; the premium on the liquidity risk in the euro money market is inferred from the EURIBOR-OIS spread at the 3-month maturity; the series of global risk aversion is a normalized weighted average of various measures of volatility of widely-traded financial instruments.

ANNEX B

Banks included in the micro dataset

<u>Italian banks</u>

(1) Monte dei Paschi di Siena; (2) Banca Popolare di Milano; (3) IntesaSanPaolo; (4) Mediobanca; (5) UniCredit and (6) Unione di Banche Italiane (UBI).

<u>Foreign banks</u>

(1) Abn Amro Bank (NL); (2) Crédit Agricole (FR); (3) Allied Irish Banks (IE); (4) Anglo Irish Bank (IE); (5) Banco Bilbao Vizcaya Argentaria (ES); (6) Banco Comercial Portugues (PT); (7) Banco Espirito Santo (PT); (8) BNP Paribas (FR); (9) Bank of Ireland (IE); (10) Banco Santander Central Hispano (ES); (11) Bayerische Landesbank (DE); (12) Natixis (FR); (13) Commerzbank (DE); (14) Deutsche Bank (DE); (15) Dresdner Bank (DE); (16) DZ Bank (DE); (17) Dexia Group (BE-FR); (18) IKB Deutsche Industriebank (DE); (19) Banco Popular Español (ES); (20); Banco Pastor (ES); (21) Rabobank (NL).

ANNEX C

Further details on the home bias indicator

Result [1.c] leads to a minor underestimation of the home bias. Elaborating on the example introduced at the beginning of Section 2.2, consider a world populated by n banks of which n_A are resident in country A and n-n_A in the "rest-of-the-world". Then, assume that each A's bank lends 1 unit to any of these n-n_A foreign counterparties and $k \geq 1$ units to its n_A-1 domestic fellows, while for the sake of simplicity all other banks lend 1 unit to any other counterparty. Under these settings, simple algebra yields:

$D_{AA} = n_A (n_A - 1)\, k$

$D_{A,\bullet} = D_{\bullet,A} = n_A (n_A - 1)\, k + n_A (n - n_A) = n_A [n + (k-1)\, n_A - k]$

$D_{\bullet,\bullet} = n (n - 1) + n_A (n_A - 1)(k - 1)$

Hence,

$$HB_A \propto \left(D_{A,A} - \frac{D_{A,\bullet} \times D_{\bullet,A}}{D_{\bullet,\bullet}} \right) = n_A (n_A - 1) k - \frac{n_A^2 [n + (k-1) n_A - k]^2}{n(n-1) + n_A (n_A - 1)(k-1)}$$

When k = 1, the term on the right, and the resulting measure of HB_A, should be 0. In fact,

$$HB_A\,(k=1) \propto n_A\left(n_A-1\right)-\frac{n_A^2\left[n-1\right]^2}{n\left(n-1\right)}=\frac{n_A\left(n_A-1\right)n\left(n-1\right)-n_A^2\left(n-1\right)^2}{n\left(n-1\right)}=\frac{n_A\left(n_A-1\right)n-n_A^2\left(n-1\right)}{n}$$

while the full expression is

$$HB_A\,(k=1)=\frac{n_A\left(n_A-1\right)n-n_A^2\left(n-1\right)}{n}\times\frac{1}{n_A\left(n-1\right)}\times\frac{n\left(n-1\right)}{n\left(n-1\right)-n_A\left(n_A-1\right)}=\frac{\left(n_A-1\right)n-n_A\left(n-1\right)}{n\left(n-1\right)-n_A\left(n_A-1\right)}=$$

$$=-\frac{n-n_A}{n\left(n-1\right)-n_A\left(n_A-1\right)}$$

which amounts to -1.0% if, say, n = 100 e $n_A = 2$. More results on the magnitude of this underestimation are in the following table:

		n_A			
		5	10	50	100
	100	-0.96%	-0.92%	-0.67%	
n	1000	-0.10%	-0.10%	-0.10%	-0.09%
	5000	-0.02%	-0.02%	-0.02%	-0.02%

That is, the underestimation is larger, but still marginal, when both n and n_A are small. This is because ultimately this small bias is due to the fact that [1.c] does not take into consideration that, given a population of n banks, each of them uses n-1 counterparties, not n. Obviously, the larger the overall population in proportion to the overall sample, the smaller is the impact of this difference by one unit.

Measured on the actual data of the banking systems of the 17 countries, this population-bias takes values between 0.009-0.011%, depending on the specific national banking system.

ANNEX D

Absolute risk aversion in the quadratic function

Given the HARA function with parameter $\gamma = 2$

[A.1] $$U\left(w\right)=-\frac{1}{2}\left(a\,w-b\right)^2 \qquad a, w > 0$$

The absolute risk aversion is

[A.2] $$R_A\left(\gamma=2\right)=-\frac{U''}{U'}=a\left(\frac{a\,w}{1-\gamma}+b\right)^{-1}=\frac{a/b}{1-a/b\,w}\equiv\frac{g}{1-g\,w} \qquad g\equiv a/b$$

where

[A.3] $$\frac{\partial}{\partial g}R_A\left(\gamma=2\right)=\frac{1}{\left(1-g\,w\right)^2}>0 \text{ always.}$$

That is, the absolute risk aversion increases with the ratio a/b, where the agent is risk averse ($R_A > 0$) so long as $g < 1/w$. Note that given two values w_1 and w_2 s.t. $w_2 > w_1$, then

$\frac{\partial}{\partial g}R_A\left(\gamma=2; w_2\right)>\frac{\partial}{\partial g}R_A\left(\gamma=2; w_1\right)$ provided both $R_A\left(\gamma=2; w_2\right)$ and $R_A\left(\gamma=2; w_1\right)>0$.

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