Fundación BBVA

Documentos de Trabajo 5

2009

Iván Arribas Fernández
Francisco Pérez García
Emili Tortosa-Ausina

Openness and Geographic Neutrality

How Do They Contribute to International Banking Integration?

Fundación BBVA

Openness and Geographic Neutrality

How Do They Contribute to International Banking Integration?

Iván Arribas Fernández [1,2]
Francisco Pérez García [1,2]
Emili Tortosa-Ausina [2,3]

[1] *UNIVERSITY OF VALENCIA*
[2] *VALENCIAN ECONOMIC RESEARCH INSTITUTE (Ivie)*
[3] *UNIVERSITY JAUME I*

Abstract

The aim of this article is to develop new international financial integration indicators together with their determinants: financial openness and regularity (balance) of bilateral financial flows. The study's contribution is based on the definition of the *Standard of Perfect Financial Integration (SPFI).* This standard characterizes the scenario attainable when financial flows are not geographically biased, and cross-border asset trade is not affected by home bias. We assess the gap between a hypothetical scenario of geographic neutrality and the current level of financial integration, along with both of its components. The empirical application to the banking systems of 18 countries—accounting for 83% of international banking markets—over the 1999-2006 period enables us to conclude that the level of financial integration has advanced rapidly over the last few years, and is close to 50% as of 2006, i.e., we are halfway to the SPFI. However, notable differences among countries are both persistent and growing, and the integration level achieved for each banking system differs when assessed from the financial inflows or outflows perspective.

Key words

Banking integration, financial globalization, geographic neutrality, network analysis.

Resumen

El objetivo de este documento de trabajo es desarrollar nuevos indicadores de integración financiera internacional junto con sus determinantes: apertura y regularidad (equilibrio) de los flujos financieros bilaterales. La contribución del estudio se basa en la definición del estándar de integración financiera perfecta *(Standard of Perfect Financial Integration [SPFI]).* Este estándar caracteriza el escenario alcanzable cuando los flujos financieros no están sesgados geográficamente y el comercio de activos financieros no se ve influido por el sesgo doméstico. El estudio mide también la distancia entre el escenario hipotético de neutralidad geográfica y el nivel de integración financiera actual, junto con sus dos componentes. La aplicación empírica se centra en los sistemas bancarios de 18 países, que suponen el 83% de los mercados financieros internacionales, entre 1999 y 2006, y los resultados permiten concluir que el nivel de integración financiera ha avanzado rápidamente durante los últimos años y está cercano al 50% en 2006, es decir, hemos recorrido la mitad del camino que nos separa del SPFI. Sin embargo, existen importantes diferencias entre países que son persistentes y crecientes, y el nivel de integración alcanzado para cada sistema bancario difiere cuando se valora desde la perspectiva de las entradas o salidas de capitales.

Palabras clave

Integración bancaria, globalización financiera, neutralidad geográfica, análisis de redes.

Openness and Geographic Neutrality:
How Do They Contribute to International Banking Integration?

EDITA / PUBLISHED BY
Fundación BBVA, 2009
Plaza de San Nicolás, 4. 48005 Bilbao

DEPÓSITO LEGAL / LEGAL DEPOSIT NO.: M-7.241-2009
IMPRIME / PRINTED BY: Rógar, S. A.

Impreso en España – *Printed in Spain*

La serie Documentos de Trabajo de la Fundación BBVA está elaborada con papel 100% reciclado, fabricado a partir de fibras celulósicas recuperadas (papel usado) y no de celulosa virgen, cumpliendo los estándares medioambientales exigidos por la legislación vigente.

The Working Papers series of the BBVA Foundation is produced with 100% recycled paper made from recovered cellulose fibre (used paper) rather than virgin cellulose, in conformity with the environmental standards required by current legislation.

El proceso de producción de este papel se ha realizado conforme a las normas y disposiciones medioambientales europeas y ha merecido los distintivos Nordic Swan y Ángel Azul.

The paper production process complies with European environmental laws and regulations, and has both Nordic Swan and Blue Angel accreditation.

C O N T E N T S

1. Introduction 5

2. Integration Indicators: Definitions and Properties 11
   2.1. Degree of financial openness 14
   2.2. Degree of regularity of direct financial connections 15
   2.3. Degree of regularity of total financial connections 16
   2.4. Degree of financial integration 18
   2.5. Other global indicators 19

3. Data 21

4. Empirical Evidence: The Integration of International Banking Systems 24
   4.1. Degree of financial openness 24
   4.2. Degree of regularity of financial connections 26
   4.3. Degree of financial integration 33
   4.4. Global indicators 37

5. On the Relative Positions between Bank Flows' Directions 39

6. Concluding Remarks 43

References 46

About the Authors 49

1. Introduction

IT is generally agreed that international integration is rapidly advancing in many economic activities, in particular finance. Capital markets are notable examples of the growing global interdependency, also evident in banking systems. At a regional level, it is also clear that monetary and financial integration acts as a starting point in the advance of economic and social integration processes. In the case of Europe, the monetary union and the plans to encourage the integration of financial services (Financial Services Action Plan [FSAP]) are considered important leverages for construction of the European Union financial space (European Central Bank, 2007).

The advantages of an integrated financial market are associated with the hypothesis that participants follow a single set of rules, have identical access, and are treated equally (Baele et al., 2004; European Central Bank, 2007; García-Herrero and Wooldridge, 2007). Expected results of integration would be price convergence between different geographic markets and increasing cross-border allocation of investment. Cross-border integration can proceed gradually, either globally or regionally, because geographical proximity is still an important determinant of trade and financial flows (Berger et al., 2000; Portes, Rey and Oh, 2001; Portes and Rey, 2005). However, the development of remote access technologies in financial activities has taken off and, in cooperation with integration policies, makes it possible to bypass the traditional requirement of geographical proximity between suppliers of services and their customers.

Under these circumstances, the evaluation of financial and banking integration has received a great deal of attention [1]. Most of the results indicate that the convergence of interest rates and the increase in the proportion of cross-border activities confirm the advance of financial integration. However, it is necessary to evaluate the integration level achieved, as well as

1. See the reviews by Adam et al. (2002), Cabral, Dierick and Vesala (2002), Adjouté and Danthine (2003), Lane and Milesi-Ferretti (2003), Baele et al. (2004), Dermine (2006), among others. On the premise that integration is advancing, literature has focused especially on the study of: *a)* the determinants of the degree of financial integration (Vo and Daly, 2007; Papaioannou, 2008); *b)* the consequences of integration, in particular on growth (Guiso et al., 2004); and *c)* the relationship between financial and commercial integration (Aviat and Coeurdacier, 2007).

its trend. Regarding this, the current scenario is ambiguous, as the results hinge crucially on the indicators used. The results are often carried out without using precise criteria on the maximum value attainable by integration, and are therefore unsatisfactory.

With the aim of improving the available indicators of financial integration, this study develops three new indices, focusing on quantities. Following a suggestion by Frankel (2000), we shall call the central reference the Standard of Perfect Financial Integration (SPFI). This standard corresponds to the state achieved when financial cross-border assets and liabilities show no geographical bias, and are not influenced by distance or barriers between countries [2] but only by the size of the financial systems. The SPFI does not have a normative value. That is, it solely represents a benchmark —which perhaps is currently unavailable—that not only requires countries to be more financially open, but also to obtain a full and geographically unbiased development of the network of connections linking economies. Thus, the most important contributions of the study are that, developing the SPFI, we can measure the gap between the current level of international financial integration and the scenario of complete financial globalization, so as to evaluate the evolution of the level of international financial integration, as a starting point to analyze its determinants.

Previous initiatives to measure financial integration based on prices are preferred by many scholars when considering an axiomatic criterion —the compliance with the law of one price (LOOP)—in different geographical markets. The literature on financial integration based on the LOOP has grown rapidly over the last few years, owing to the existing data on prices (see Cabral, Dierick and Vesala [2002], Baele et al. [2004], Flood and Rose [2005], Kleimeier and Sander [2006], or Vajanne [2006], among others). However, the key problem of this approach is the lack of a benchmark to measure integration in the absence of perfect competition conditions, which is the most common situation in the case of banking markets. A unique price would only exist for homogeneous financial products, and not for others that can be differentiated. In this sense, convergence of interest rates is to be expected in markets, such as interbank and government bonds. However, this is not the case in retail banking markets, which offer differentiated products for different investments and clients, in particular loans, credits and deposits.

2. Frankel (2000) indicates the need to define a Standard of Perfect International Integration (SPII), describing the conditions under which the world trade web would operate as a global village.

In addition, this literature considers that the existence of a unique price suffices for economic or financial integration. However, even if trade, capital and monetary barriers are lifted and price differentials vanish, economic integration may not arise naturally as we must also take into account other factors such as the incentives of economic agents to go abroad, the institutional conditions of both the source and destination countries—especially in terms of property rights and law enforcement—and the influence of regulation, which is crucial for banks (Pérez, Salas-Fumás and Saurina, 2005).

The measures based on volume data are generally considered less satisfactory. As indicated by Manna (2004), this area of research has flourished comparatively less than the more established literature on prices/interest rates (see Dermine, 2002). Nevertheless, when thoroughly examined, quantity-based measures could contribute significantly to achieving a precise picture of integration. According to a recent state-of-the-art survey on economic globalization indicators (Organisation for Economic Co-operation and Development [OECD], 2005), the current indicators are inordinately based on the old concept of market openness, which valuates the weight of external demand (export, import) in relation to national production (gross domestic product [GDP]). The objective of this is to understand whether a country and the rest of the world are given adequate attention in proportion to the importance of their economies. However, this approach has two important shortcomings.

The first one is that if the GDP is the denominator of the indicator for measuring the degree of financial openness, its meaning might be misleading because two separate processes are being convoluted: openness, and intensification of financial activities. Banking openness to the exterior could be measured as the weight of external assets when considering the balance sheet, foreign assets *(FA)/A*, while financial intensity measures the proportion between the volume of financial activities and the real activity *(A/GDP)*. Given that *FA/GDP = (FA/A) (A/GDP)*, and that the second term on the right-hand-side (r.h.s.) has grown remarkably over the last decade in many countries, the GDP-based indicators of financial openness might have actually grown strongly even if the weight of the FA did not increase remarkably in the balance sheet *(FA/A)*. Therefore, although some available measures (see Pérez, Salas-Fumás and Saurina, 2005) consider GDP-based indicators as valid, we will not consider them because of the variety of meanings they may actually convey.

A further constraint when measuring the advance of international integration using the degree of openness, is that international integration is not only a question of increasing the openness of countries but also of developing a *network* of direct and indirect relations between economies. From

the globalization perspective, the limitation of the degree of openness is that it completely disregards the architecture of financial trade connections that each country has with the rest of the world. In our objective to develop indexes of financial integration which take into account this complexity, two issues emerge as most relevant in the wide range of literature, and both are related to the geographic orientation of flows. First, the rationale for the biases observed in flows, at home or bilateral level; second, the analysis of the network of connections between countries.

At the beginning of the 21st century, several studies considered that, despite the forces that represent drastic reduction in global barriers to competition in the financial services industry (abolition of barriers, deregulation, improvements in information processing and telecommunications) the financial services industry, and retail banking in particular, currently remain far from globalized. The evidence suggests that borders continue to play an important role in the geographic orientation of financial flows, and that home bias is very relevant in the allocation of resources, as suggested by the equity home bias literature (see, for instance Levy and Sarnat, 1970). In particular, many banking services remain local, probably as a consequence of competitive advantages that the superior information of banks about local and non financial suppliers and customers represents (Berger et al., 2000; Berger et al., 2003; Berger and Smith, 2003). As found by Manna (2004), the share of cross-border banking activity is remarkably lower for the four largest euro-area countries (Germany, France, Italy and Spain) than for the other countries. This factor indicates that geographical proximity and common language are still providing rationale for a home bias in banking retail products, whereas the effect is less pronounced in the wholesale segments, especially interbank markets.

The literature on gravity equations represents the most widely used empirical approach to explain the rationale for geographic biases in trade flows. The gravity equation relates international flows to different types of distance, and to the economic dimension (GDP's) of the source and destination countries. The success of the gravity model explaining data, increases interest by giving the gravity equation a structural interpretation in different ways. Adopting the gravity equation framework to describe international asset flows is much more recent. The seminal paper by Portes and Rey (2005) merges elements of financial literature on portfolio composition, and international economics and asset trade literature. In their analysis, cross-border asset flows depend on market size in both source and destination country, as well as on trading costs, in which both information and transaction technology play a role. From this perspective, distance may also

be important in the financial cross-border activities because it may be regarded as a proxy for information costs, and should enable the modest decline observed in home or regional biases of flows to be explained. Thus, the geography of information emerges as a main determinant of the pattern of international financial transactions [3].

However, when geographic barriers disappear—because the importance of frontiers diminishes, and the cost of transport or information falls—, the effect of relative distance slowdowns and the shares of different countries in the financial inflows/outflows of a country ought to be closer to the GDP's shares. In an extreme scenario of eradication of every possibility of remoteness (Scholte, 2002), only the economic dimension of partners will matter.

The literature analyzing regionalism (and its effects on the intensity of intra-regional and extra-regional trade) also considers the problem of prioritizing some connections over others vs. no-country, or no-regional, preference situation. The concept of geographic neutrality (Summers, 1991; Krugman, 1991, 1996) may be defined as the absence of preferential directions in flows. That is, the geographic distribution of a country's trade is said to be neutral if the weight of every partner in the country's trade is equal to its weight in the world trade [4]. Following a similar approximation in the financial area, Manna (2004) develops eight statistical indicators of the integration of the euro area banking system, two of which estimate home bias and the distance of the actual distribution of cross-border positions from the distribution prevailing under the assumption of no-country preference.

The situations of no-geographic preferences in flows will be an important reference to our analysis of the level of financial integration. They can be considered equivalent to the so-called *zero gravity* scenario (see, for instance Eaton and Kortum, 2002), because distance does not matter and/or remoteness does not exist. In these scenarios, economies would be perfectly integrated through a complex network of connections, in which financial flows would be the vectors of a graph in which the nodes represent the countries, so it would be possible to analyze the degree of connectedness in the network. Although these techniques are

3. Some recent studies have used gravity equations to describe financial flows; see, for instance, Buch and Lipponer (2007), Lane and Milesi-Ferretti (2003), Papaioannou (2008), Buch (2005), or Aviat and Coeurdacier (2007).

4. See also the cited literature in Gaulier, Jean and Ünal Kesenci (2004), for a discussion on the measures of regional trade intensity and their limitations.

somewhat underused by economists in comparison with other social sciences, this approach is not new in international economics [5], and has attracted recent interest [6].

Our analysis of financial integration shares two characteristics with the network analysis approach. First it pays attention to the number of connections and the way they are distributed. Second, we judge as important not only first-order relationships (direct links) but also higher order relationships (indirect links), since assets might cross several economies before reaching their final destination. Our integration index considers these aspects to define the SPFI, and to measure how far/close financial systems, or the global financial system as a whole, are to this scenario.

On the basis of these premises, the rest of the study develops indicators of financial integration which take into account the degree of financial openness, as well as the regularity of the connections between countries' financial systems. The working paper is structured as follows. In section 2, we define the SPFI, and characterize the indicators of the degree of financial openness, the degree of financial regularity, and the degree of financial integration for each country and for the global financial markets as a whole. In section 3, we present the data used to apply our methodology to the case of banking systems, using available data on bilateral exchange of assets between a set of 18 countries, which represents 83% of the world financial assets in 2006. Sections 4 and 5 analyze the empirical evidence obtained on the integration of the banking systems. Section 6 concludes.

5. Several studies highlight the importance of information flowing through cultural, political or economic ties (Rauch, 2001; Rauch and Casella, 2003; Pandey and Whalley, 2004; Combes, Lafourcade and Mayer, 2005). For recent banking applications, see McGuire and Tarashev (2006), or Von Peter (2007).

6. Other studies suggest applying complex network analysis concepts, topological properties and instruments from different sciences developed to study the structure and dynamics of international trade, using instruments such as centrality, network density, clustering, assortative mixing or maximum flow. See, for instance Kali and Reyes (2005).

2. Integration Indicators: Definitions and Properties

THE integration of international financial markets starts with the cross-border financial flows (foreign assets [FA] and liabilities). However, its effects and scope also depend on the structure of current relations between financial markets [7]. Relevant aspects of this structure include the number of countries each country is in contact with, and whether the relationships are direct or indirect, i.e., whether cross-border financial flows cross third economies. In addition, the volume of cross-border financial activity between them is also important, as well as the proportionality of this activity to the size of the financial markets.

If we consider financial globalization as synonymous of the highest possible level of financial integration, the flow from one country to another would only depend on their relative size because barriers to financial trade are lifted and there is no home bias effect. As suggested by the literature on home equity bias, investors should be able to exploit the benefits of international asset diversification, and not concentrate their investments in the assets of their home country (see, for instance Strong and Xu, 2003). Considering this global scenario, we will define the Standard Perfect Financial Integration (SPFI) as an extension of the concept of geographic neutrality (Krugman, 1996; Summers, 1991), and as a hypothetical benchmark that will not necessarily be reached if distance and other factors matter. Cross-country financial integration does not necessarily imply financial globalization according to the geographic neutrality criterion. A country whose cross-border financial flows are lower than those corresponding to the size of its total financial assets is as far from being integrated as another country

7. Although we perform an application to cross-border banking activity, we will refer to financial/banking assets and liabilities interchangeably, in order to ease the readability and understanding of this section.

whose financial flows are above that proportion. Both countries show an unbalanced situation, given that home (internal) financial flows and cross-border financial flows are not in accordance with the geographic neutrality criterion. Therefore, geographic neutrality implies that the proportion of home and FA held by domestic investors should be proportional to the relative sizes of each financial system. The absence of geographic neutrality would be equivalent to the equity home bias effect (Lewis, 1999), where individuals hold too little of their wealth in FA. However, the geographic neutrality concept is far more general, since deviations from equilibrium are explained away only by differences in the relative size of the financial systems.

Under the neutrality assumption, a balanced value for the cross-country financial activity exists, and the following property must be verified:

Home neutrality (P1). A country whose home financial assets are proportional to its share of the world financial market will have a higher level of financial integration.

Not only the total cross-border financial activity a country has is important, but also its distribution. In a global financial village, when there are no transaction (informational) costs or regional preferences, the distribution of the financial activity of a country between the destination countries should be characterized by their relative size. Under geographic neutrality, a country has no preferences of any kind (social, political, geographical, etc.) for the direction of its financial cross-border flows, and they are only determined by the size of the recipient financial systems, as stated by the following property (P2).

Direct international neutrality (P2). A country that balances its direct financial relationships with other individual countries, in proportion to the size of their financial systems, will have a higher level of financial integration.

Financial flows between countries reflect only first-order relationships. However, higher-orders may also be relevant. The set of relationships established between countries operates like roads between cities. First, they allow countries to be connected even when there is no direct relationship between them. Second, there are different ways in which flows can reach their final destination, depending on the intermediating countries they cross. Goods, services, and capital may move from one country to another several times before arriving at its final destination. This possibility enables the interconnectivity of the world to increase, and therefore its integration.

Indirect international neutrality (P3). A country that reinforces its financial links with other countries through balanced indirect relationships

which cross intermediating countries will have a higher level of financial integration.

A country can deviate from perfect financial integration due to some of the factors mentioned above. The impact of this deviation on financial globalization will depend on the size of every financial system. When a large economy departs from perfect integration, it reduces financial globalization to a larger extent than a small economy. For example, the influence of Germany on financial globalization is necessarily higher than, for instance, the influence of Greece. Thus, the integration index should also be weighted by the size of the financial systems.

Size (P4). The larger the financial market of a country, the more relevant its integration will be to the globalization of the world financial market system (global level of financial integration).

We say that the world achieves the SPFI if properties P1 to P4 are verified at the highest level, making this scenario an extension of the concept of geographic neutrality. Given its wider coverage, we name it geographic *superneutrality*.

In order to answer the question of how much countries meet the four properties above, we must define an integration index and assess the distance that sets the current level of integration apart from the SPFI. We will proceed in four stages, each one defining different indicators, which correspond to the next four subsections. Furthermore, the analysis of the four indicators is conducted on two levels. The individual level focuses on each country, and the global level corresponds to the analysis of all economies. On the second level, the weight of each financial system enters the aggregation analysis and allows us to define our *Integration Index*.

Let us start with some definitions. Let $N = \{1, ..., g\}$ be the set of countries and let i and j be typical members of this set. Let g be the number of countries in N, i.e., the number of economies in the analysis. Given a measurable relationship between economies, we define the flow X_{ij} as the intensity of this relationship from economy i to economy j. In each year and for each balance-sheet indicator, we avail of a $g \times g$ matrix of data. To keep the presentation simple we omit the time index, unless this might generate confusion. The financial market activity between countries can be evaluated through either the cross-country flows of assets or liabilities. Moreover, in general the flow will be asymmetric, so that X_{ij} will not necessarily be equal to X_{ji}, for all $i, j \in N$; and also assume that X_{ii} measures the home assets or liabilities for all countries $i \in N$.

Let $X_i = \Sigma_{j \in N} X_{ij}$ be the size of the financial system of country $i \in N$. We define a_i as the country i's relative weight with respect to the world economy, i.e., $a_i = X_i / \Sigma_{j \in N} X_j$.

2.1. Degree of financial openness

In the first stage we characterize the *degree of financial openness*. We start with the usual definition but corrected for home bias to take into account the differing sizes of the financial systems of the countries being compared. Thus, we are taking into account that domestic investors hold a proportion of home assets, and that its volume will vary depending on the size of each particular financial system [8]. In order to control for home bias, we define $\hat{X}_i$ as the foreign claims of country i (i.e., assets held abroad by banks of country i, in case we considered data on bank flows) taking into account the weight in the world financial system of the country under analysis, namely, $\hat{X}_i = X_i - a_i X_i$. We then define the relative flow (cross-border banking assets or liabilities) or *degree of financial openness* between countries i and j as $DFO_{ij} = X_{ij}/\hat{X}_i$.

Definition 1. *Given a country $i \in N$, we define its* degree of financial openness, DFO_i, *as*

$$DFO_i = \sum_{j \in N \setminus i} DFO_{ij} = \frac{\sum_{j \in N \setminus i} X_{ij}}{\hat{X}_i} . \tag{2.1}$$

By definition the degree of financial openness takes the value of 1 if and only if home neutrality is verified (P1). The degree of financial openness yields nonnegative results, where a value lower than 1 indicates that its cross-border bank flows are lower than the corresponding ones, given the country's share of the world banking assets. In the unlikely instances of values higher than 1, it would indicate that country i 's cross-border bank flows are higher than those it should have given the country's share of the world banking assets.

Differences in *DFO* among countries can be attributed to different barriers to financial integration (lack of information, regulations, political or cultural factors, economic riskiness, etc.). However, differences in the measure of financial openness cannot be caused by the bias due to country size, since we have corrected for home bias [9].

---

8. As documented by the literature on home equity bias, the proportion of domestic assets held by domestic investors is too big relative to the predictions of the standard portfolio theory (see Lewis, 1999). We consider that it should be proportional to the size of the home financial system.

9. We write *DFO* instead of DFO_i when general statements on the degree of financial openness are being made, or references to the variable itself, which do not hang on any specific country. The same rule will be applied to the other indicators.

2.2. Degree of regularity of direct financial connections

In this second stage we analyze whether the connection of one country with others is proportional to the differing financial systems' sizes, or whether this connection does not show geographical neutrality. The latter instance would contribute to widen the gap between the current level of financial integration and the scenario corresponding to a financially globalized world according to the direct international neutrality property (P2). Thus, we define the *degree of regularity of direct financial connections* to measure the discrepancy between the cross-border financial flows in the real world and those corresponding to the SPFI.

In the financial network, the relative flow from country to country in terms of the total financial flows of country i, α_{ij}, is given by,

$$\alpha_{ij} = \frac{X_{ij}}{\sum_{j \in N \setminus i} X_{ij}}, \tag{2.2}$$

where $i \neq j$ and $a_{ii} = 0$ (recall that $X_{ii} \neq 0$). Let $A = (\alpha_{ij})$ be the square matrix of relative flows: the component ij of matrix A is α_{ij}.

We consider that the global financial system is perfectly connected if the financial flows between two countries are proportional to the relative size of their financial systems. A country that is part of a perfectly connected world financial system will hold assets in other countries in proportion to the size of the destination countries.

On the other hand, if the world economy is perfectly connected, then the flow from country i to country j should be equal to $\beta_{ij} \hat{X}_i$, where,

$$\beta_{ij} = \frac{X_j}{\sum_{k \in N \setminus i} X_k}, \tag{2.3}$$

is the relative weight of country j in a world where country i is not considered.

Note that $\sum_{j \in N \setminus i} \beta_{ij} = 1$ and that β_{ij} is the degree of financial openness between countries i and j in the perfectly connected world, with $\beta_{ii} = 0$. Let $B = (\beta_{ij})$ be the square matrix of degrees of openness in the perfectly balanced connected world.

Starting from the previously defined matrices, we can define an indicator that measures the distance between the real distribution of financial flows and that corresponding to a perfectly balanced connected world. We

consider the cosine of the angle of the vector of relative flows with the vector of the flows in a perfectly connected world.

Definition 2. *Given an economy* $i \in N$ *we define the* degree of regularity of direct financial connections *of* i, $DRDFC_i$, *as*

$$DRDFC_i = \frac{\sum_{j \in N} \alpha_{ij} \beta_{ij}}{\sqrt{\sum_{j \in N} (\alpha_{ij})^2} \sqrt{\sum_{j \in N} (\beta_{ij})^2}}. \tag{2.4}$$

Although the cosine of two vectors ranges between –1 and 1, the degree of direct financial connections always takes nonnegative values given that both vectors have only nonnegative components. *DRDFC* measures whether financial systems meet P2, providing a single value that equals 1 if and only if a country meets the property of direct international neutrality, and approaches zero for a country whose cross-border financial flows are directed towards the smallest financial systems.

2.3. Degree of regularity of total financial connections

In the third stage, we consider the indirect relationships between countries along with their importance. In order to extend the analysis of financial market integration in this direction, we define the *degree of regularity of total financial connections*, which evaluates the importance of all direct and indirect relationships that countries establish with each other.

Both the real world matrix A and the perfectly connected world matrix B consider *direct* relative flows between countries. However, part of the flow from country i to country j may cross third countries, and those *indirect* flows also contribute to integration.

Let $A^n = A \cdot A \cdot \overset{n}{\ldots} \cdot A$ be the n-times product matrix of matrix A and let α_{ij}^n be the element ij of A^n. It is not difficult to show that α_{ij}^n is the relative flow that goes from i to j crossing $n-1$ intermediate countries. Moreover, it is verified that $0 \leq \alpha_{ij}^n \leq 1$ for all $n \geq 1$. In the same way we define B^n, the elements of which evaluate the flow passing through all countries in a perfectly connected world.

Let $\gamma_i \in (0,1)$ be the proportion of flow that country i receives from another country and remains invested in the first one, while $1-\gamma_i$ is the proportion of received flow that a country redirects to another country. For estimating γ_i, an additional assumption is needed. Let us assume that this proportion is equal to the proportion of financial flows of country i that re-

main as home financial investment. If country i verifies this assumption, then the following equality holds,

$$X_i^F = (1-\gamma_i)_i L_i^H + (1-\gamma_i) L_i^F = (1-\gamma_i)\ L_i,$$

where X_i^F is the country i assets issued from other countries and L_i^H are the home liabilities. Given that $L_i = X_i$ it implies that $1-\gamma_i = \Sigma_{j\in N\setminus i}\ X_{ij}/X_i$ or equivalently,

$$\gamma_i = X_{ii}/X_i. \tag{2.5}$$

Therefore, under our assumption γ_i is the proportion of financial flows that are internally invested in country i. Of course, the procedure to estimate γ_i will hinge on the flow considered—either inflow or outflow.

Let Γ be the square diagonal matrix of direct flow proportions, so that the element ii of Γ is γ_i and the element ij, for $i \neq j$, is zero. The matrix of total flows from one country to another is the sum of the direct and indirect flows and can be estimated as,

$$A^\Gamma = \sum_{n=1}^{\infty} \Gamma\ \ (I-\Gamma)^{n-1} A^n, \tag{2.6}$$

$$B^\Gamma = \sum_{n=1}^{\infty} \Gamma\ \ (I-\Gamma)^{n-1} B^n, \tag{2.7}$$

where I is the identity matrix of order g. Both expressions depend on matrix Γ.

Let α_{ij}^Γ be the element ij of the matrix A^Γ and β_{ij}^Γ be the element ij of the matrix B^Γ. Each element of these matrices is the weighted sum of the direct and indirect flows through any possible number of intermediate economies. We can verify that the above two series are convergent.

Definition 3. *Given an economy $i \in N$ we define the* degree of regularity of total financial connections *of i, $DRTFC_i^\Gamma$, as*

$$DRTFC_i^\Gamma = \frac{\Sigma_{j\in N}\,\alpha_{ij}^\Gamma\,\beta_{ij}^\Gamma}{\sqrt{\Sigma_{j\in N}(\alpha_{ij}^\Gamma)^2}\ \sqrt{\Sigma_{j\in N}(\beta_{ij}^\Gamma)^2}}. \tag{2.8}$$

The degree of financial regularity of total connections ranges in the (0,1) interval. It measures the distance of the direct and indirect financial flows of a country from what its financial flows would be in a perfectly connected world financial system. Similarly to the degree of financial regulari-

ty of direct connections, it should equal 1 when the financial flows of a country are proportional to the size of the recipient countries (indirect international neutrality). It should be close to zero if the largest countries do not receive any financial inflows and the smallest receive all of them.

We should bear in mind that if there are no indirect flows, i.e., $\gamma_i = 1$ for all countries, then expressions (2.6) and (2.7) yield $A^\Gamma = A$ and $B^\Gamma = B$ Thus, the degrees of regularity of total connections and regularity of direct connections coincide. The limit case $\gamma_i = 0$ (financial products and services go through an infinite number of transformations before reaching their final destinations) cannot be derived directly from the above expressions. The basic limit theorem of Markov chains [10] is needed to show that when $\gamma = 0$ the proportion of flow a country *j* receives from a country *i* is independent of *i*, i.e., all countries send the same proportion of flow to economy *j*.

2.4. Degree of financial integration

From the concepts above we define the *degree of financial integration,* which combines degrees of financial openness and financial regularity of total connection, provided that both set limits to the financial integration level achieved.

Definition 4. *Given an economy* $i \in N$ *we define its* degree of financial integration, DFI_i^Γ, *as*

$$DFI_i^\Gamma = \sqrt{\min\{1/DFO_i, DFO_i\} \cdot DRTFC_i^\Gamma}\,. \tag{2.9}$$

The degree of financial integration of a given country is the geometric average of its deviation from the balanced degree of financial openness and financial regularity of total connections. Therefore, *DFI* depends on both the openness of the banking system and the balance in its direct and indirect flows with other financial systems. Moreover, if and only if the financial system verifies properties P1 to P4, then *DFI* will be equal 1.

If $DFI_i^\Gamma = \sqrt{\min\{DFO_i, 1/DFO_i\} \cdot DRTFC_i^\Gamma}$, then,

10. By definition we verify that $\Sigma_{j\in N}\alpha_{ij} = \Sigma_{j\in N}\beta_{ij} = 1$, thus both matrices *A* and *B* define Markov chains and it can be proved that they are recurrent irreducible aperiodic Markov chains.

$$1 = \sqrt{\frac{\min\{DFO_i, 1/DFO_i\}}{DFI_i^{\Gamma}}}\sqrt{\frac{DRTFC_i^{\Gamma}}{DFI_i^{\Gamma}}}, \tag{2.10}$$

and we can interpret each of these two factors as the weight that the degrees of openness and regularity of total connections have over the degree of integration. In a given economy, this can be useful to analyze changes over time in the weight of the factors.

2.5. Other global indicators

In the previous subsections we have defined several indicators that characterize the integration of each individual country and that, as the degree of financial integration, can also be summarized for the whole economy:

Degree of global financial openness:

$$DGFO = \sum_{i \in N} a_i DFO_i. \tag{2.11}$$

Degree of regularity of global direct financial connections:

$$DRGDFC = \sum_{i \in N} a_i DRDFC_i. \tag{2.12}$$

Degree of regularity of global total financial connections:

$$DRGTFC^{\Gamma} = \sum_{i \in N} a_i DRTFC_i^{\Gamma}. \tag{2.13}$$

To characterize the integration of the whole economy, we should consider the share of each economy in the world (property 4) to define the global indicator as follows (recall that $ai = X_i/\Sigma_{j \in N} X_j$).

Definition 5. *We define the* degree of financial integration (globalization) of the whole economy *as*

$$DGFI^{\Gamma} = \sum_{i \in N} a_i DFI_i^{\Gamma}. \tag{2.14}$$

The *DGFI* indicator is the most general quantitative approximation to the international financial market integration of countries, as it considers not only the degree of financial openness, but also the distribution of the

direct and indirect flows between countries, and the size of a country's financial system. In light of the different concepts included in this definition, the indicator will be considered as a Globalization Index for the world financial system, according to properties P1 to P4. The first three properties are an increasing function of *DGFI* for any country. Property P4 is verified because *DGFI* is a weighted average of the countries' degree of integration, where the weight of each country depends directly on its size. The degree of financial integration measures how close the world is to the SPFI, which should be equal to 1 when all countries are perfectly integrated and achieve their theoretical potential of integration in a world without any remoteness.

3. Data

OUR data set contains information on both total assets of the different banking industries under analysis, and bank foreign claims for both financial outflows and inflows. That is, assets held abroad by banks of a given country (outflows), and bank assets of a given country owned by foreign banks (inflows). The data on bilateral banking financial assets are provided by the Bank of International Settlements (BIS) (see http://www.bis.org/statistics/histstats10.htm), which issues quarterly the international claims of its reporting banks on individual countries, geographically broken down by nationality of the reporting banks. Our data contains information on the largest world economies, and also on some specific countries with large banking systems such as Switzerland, to the total of 18 countries. The data on total assets are provided by the European Central Bank for European Union countries, and by the central bank of each country, with some exceptions.

Our data set is also crucially determined by the available information, which was incomplete in terms of countries and sample years. Finally, only eighteen countries and eight years (1999-2006) were selected to perform the analysis. Stretching the sample period in both dimensions, i.e., countries selected and length of the period, led inevitably to incomplete data sets and difficulties for drawing conclusions on the dynamics of financial globalization. Furthermore, even if some additional countries for which information was available for some years were included in the sample [11], the gains in terms of total bank assets were not substantial, as the constrained sample accounted for more than 90% of the enlarged sample. Our data also refers to flows from consolidated banks, constituting a clear advantage to avoid double counting compared to using unconsolidated balance sheet data, which is the usual approach followed by many other studies on banking integration.

Table 3.1 provides information on these matters. As shown by columns 5 and 6, it is quite apparent that the U.S. financial system is far less

11. Australia, Brazil, Canada, Chile, Mexico, Panama and Taiwan.

TABLE 3.1: Data by country (1999 and 2006)

Country	Total bank assets[1]		Shares of the international banking markets		Total assets as % of GDP		Total consolidated foreign claims as % of GDP		Total consolidated foreign claims as % of total assets		Total consolidated foreign claims[1]		Total consolidated foreign claims of the sample countries as % of their total foreign claims		Total consolidated foreign claims of the sample countries as % of total assets	
	1999	2006	1999	2006	1999	2006	1999	2006	1999	2006	1999	2006	1999	2006	1999	2006
Austria	488,939	1,040,167	1.38	1.58	229.43	322.59	47.61	126.03	20.75	39.07	67,261	166,090	66.30	40.87	13.76	15.97
Belgium	718,791	1,480,967	2.03	2.25	283.19	377.80	151.66	283.46	53.55	75.03	318,891	944,370	82.84	84.99	44.36	63.77
Canada	1,120,339	2,285,461	3.17	3.48	172.04	182.62	44.85	50.19	26.07	27.48	250,845	528,463	85.89	84.14	22.39	23.12
Denmark	356,402	826,978	1.01	1.26	204.89	300.46	28.75	82.79	14.03	27.56	32,263	180,512	64.52	79.22	9.05	21.83
Finland	120,251	357,434	0.34	0.54	93.31	170.66	24.27	46.97	26.01	27.52	24,845	71,053	79.45	72.22	20.66	19.88
France	3,643,785	8,126,944	10.30	12.36	250.28	364.32	57.66	117.21	23.04	32.17	662,008	2,145,308	78.86	82.05	18.17	26.40
Germany	5,704,621	9,422,345	16.13	14.34	266.12	324.16	80.59	121.85	30.28	37.59	1,333,868	2,816,268	77.21	79.51	23.38	29.89
Greece	181,933	422,757	0.51	0.64	148.27	172.59	NA	25.36	NA	14.69	NA	16,996	NA	27.36	NA	4.02
Ireland	304,193	1,915,181	0.86	2.91	315.10	860.18	77.97	280.96	24.74	32.66	69,435	544,569	92.25	87.05	22.83	28.43
Italy	1,649,453	3,780,317	4.66	5.75	137.36	204.92	21.53	22.85	15.67	11.15	198,396	271,784	76.74	64.47	12.03	7.19
Japan	7,517,125	6,300,049	21.25	9.59	172.90	145.16	23.62	42.72	13.66	29.43	762,596	1,339,054	74.27	72.21	10.14	21.25
Netherlands	988,225	2,466,873	2.79	3.75	237.78	375.14	97.29	317.11	40.91	84.53	312,146	1,872,767	77.20	89.81	31.59	75.92
Portugal	250,547	524,034	0.71	0.80	205.94	272.12	37.12	64.14	18.03	23.57	30,082	89,103	66.60	72.13	12.01	17.00
Spain	1,048,501	3,313,309	2.96	5.04	169.68	270.70	41.30	80.73	24.34	29.82	194,915	898,526	76.37	90.93	18.59	27.12
Sweden	477,890	1,103,376	1.35	1.68	188.35	286.65	35.70	157.71	18.95	55.02	69,596	429,547	76.84	70.76	14.56	38.93
Switzerland	1,402,756	2,617,552	3.97	3.98	529.59	689.27	363.78	648.41	68.69	94.07	886,789	2,114,966	92.03	85.89	63.22	80.80
United Kingdom	3,802,069	9,992,567	10.75	15.20	259.55	426.12	59.14	132.04	22.78	30.99	565,207	2,253,219	65.25	72.77	14.87	22.55
United States	5,596,500	9,750,600	15.82	14.84	60.72	73.86	7.36	10.10	12.12	13.68	468,448	921,173	69.04	69.07	8.37	9.45

[1] In millions current US$.

bancarized than large European countries such as Germany, Italy, France, or Spain. As of 2006, the share of the U.S. banking system was quite small (14.84%), especially taking into account the size of the U.S. economy. As also indicated in table 3.1, the total assets of the U.S. banking system in terms of GDP are well below those of the other countries in the sample.

Cross-border claims have also been increasing sharply for all countries and, as documented by some authors, today they are over 30 times larger in absolute terms than thirty years ago (McGuire and Tarashev, 2006). This information is reported in columns seven through twelve. For all countries there has been a sharp increase in foreign claims from 1999 to 2006, not only in absolute terms (columns 11-12) but also as a % or GDP (columns 7-8) or as a % of total assets (columns 9-10). Finally, columns 13-16 report information on the representativeness of our sample, which varies depending on the country but is generally quite high.

The analysis performed in the ensuing sections will focus on both directions of foreign claims. That is, not only on bank assets held abroad by banks of a given country (cross-border bank outflows) but also on bank assets of each country owned by foreign banks (cross-border bank inflows). We will refer to each direction using the *out* and *in* superscripts, in order to refer to outflows and inflows, respectively. Table 3.1 contains information on outflows only, so as to save space and also because the information on total consolidated foreign claims of the sample countries either as a percentage of their total foreign claims or their total assets, i.e., the information reported by columns 13-16, is not available for inflows.

4. Empirical Evidence: The Integration of International Banking Systems

4.1. Degree of financial openness

Table 4.1 shows the results of the degree of financial openness for years 1999 and 2006, i.e., the initial and final sample years. The first two columns refer to assets held abroad by banks of each country listed, whereas columns three and four refer to bank assets of a given country owned by foreign banks. Results vary a great deal in several dimensions. Looking at country differences, we notice that the most open financial systems in terms of assets held abroad as of 2006 are those of Switzerland, the Netherlands, and Belgium, indicating that the assets held abroad by banks from these countries represent the 85.2, 75.8 and 66.0% of their total assets. These are important international financial centers, and therefore have large external portfolios (Lane and Milesi-Ferretti, 2008). Although these are small countries, we must take into account that when dividing by total assets we control for home bias. That is, the fact that the share of cross-border activity is markedly lower for the largest country (Manna, 2004), and therefore countries with the largest banking markets could have also high degrees of financial openness. In contrast, the Greek, Italian and U.S. banking markets are far less internationalized, as shown by degrees of financial openness of 4.0, 8.0 and 10.5% by 2006. Even if we control for home bias, the assets held abroad by banks in these countries are extremely low.

These results vary, not only across countries but also over time. Indeed, many countries show cross-border bank flows which have increased sharply. In some cases such as Denmark, the Netherlands, or Sweden they have more than doubled, while in others they have also been substantial but more moderate. Of special note is the case of some large European countries whose degrees of openness have increased a great deal. However, this is not entirely attributable to the effect of the euro, since some of the largest

TABLE 4.1: Degree of financial openness *(DFO)*
(percentages)

Country	DFO_i^{out}		DFO_i^{in}	
	1999	2006	1999	2006
Austria	13.77	16.17	16.90	18.22
Belgium	45.47	66.02	25.38	28.56
Canada	22.66	24.10	11.48	12.79
Denmark	9.24	22.39	15.02	30.60
Finland	20.42	20.02	30.29	44.88
France	21.62	33.34	11.83	15.95
Germany	32.03	39.75	11.45	16.05
Greece	NA	3.96	24.33	44.62
Ireland	23.10	30.17	35.15	34.11
Italy	12.20	7.99	24.98	28.93
Japan	15.29	24.53	8.20	11.01
Netherlands	29.05	75.80	28.36	32.83
Portugal	11.54	16.23	20.38	34.36
Spain	14.00	22.99	15.07	25.12
Sweden	14.76	39.79	16.60	18.72
Switzerland	66.86	85.16	7.98	9.00
United Kingdom	17.01	28.64	37.06	42.99
United States	9.23	10.49	47.10	80.17
Unweighted mean	21.01	31.53	21.53	29.38
Standard deviation	0.15	0.23	0.11	0.17
Coefficient of variation	0.73	0.72	0.51	0.58

increases have taken place in countries which have not yet adopted the single currency (basically Denmark and the United Kingdom).

These patterns vary when considering the international bank flows in the opposite direction, i.e., the bank assets of each country in the table owned by foreign banks. Results differ greatly, especially for the most extreme cases. Indeed, the correlation coefficient is –32.2% for year 2006, and this highly negative sign holds for all sample years. Some countries whose DFO^{out} was quite high, such as Switzerland, have now become much more closed. On the other hand, the U.S. is quite open in terms of bank assets in the U.S. held by foreign banks. Disparity in the results is the general tendency. Apart from the U.S. some countries have now become much more open—such as Finland, Greece, Italy, Portugal, or the United Kingdom—. In contrast, others become less financially open—Belgium, Canada, France, Germany, Japan, the Netherlands, Sweden and Switzerland.

These tendencies are summarized in graph 4.1, which contains information on different aspects of the distribution of the degrees of financial openness. The upper panels show the evolution of relevant summary statistics such as the mean—both weighted and unweighted—. Both statistics show a tight upward trend, for both DFO^{out} and DFO^{in}, which has increased by roughly 50%. It is also worth noting the similarities between the patterns found for both weighting schemes, suggesting that the enhanced internationalization has occurred regardless of the size of the banking markets in each country.

The lower panels in graph 4.1 provide information on the *entire* distributions of the variable under analysis via violin plots [12]. Accordingly, each graph contains both the box plot and the density trace, which is plotted symmetrically to the left and right of the vertical box plot. In our case, we provide information for both initial and final years, and both DFO^{out} and DFO^{in}. Both cases show a tendency in the distribution to become more spread, although asymmetrically. That is, *some* (very few) countries are becoming more open in both directions, but most of them remain in the lower tails of the distribution. However, violin plots do not offer information on the *relative* positions, or intra-distribution mobility over time. We do not know—unless we examine data individually—whether some countries are moving upwards in their financial openness rankings over time, leaving us with an apparently stable distribution.

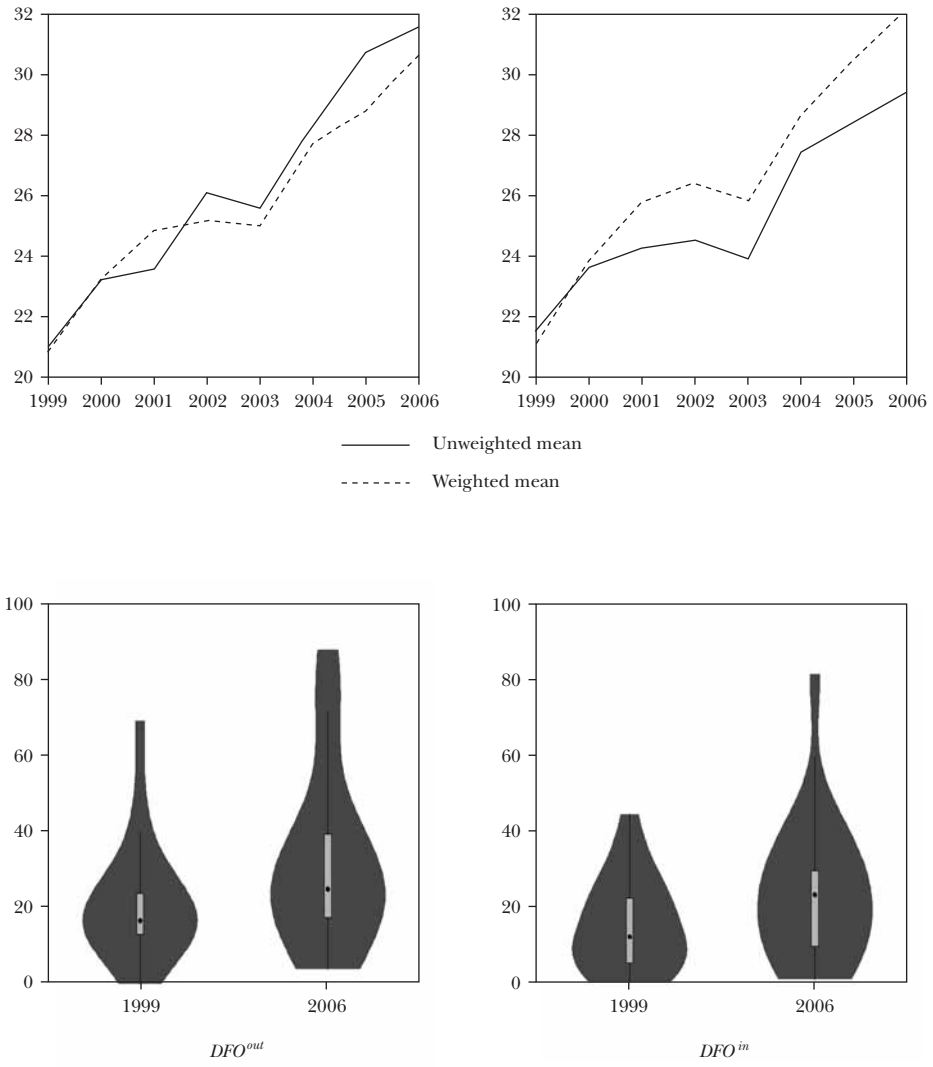
4.2. Degree of regularity of financial connections

As indicated in section 2, the *DRTFC* indicates whether cross-border bank flows are balanced in terms of the banking systems size of both the sending and recipient countries. According to the geographic neutrality idea, cross-border asset holdings of each country's banks should be directed preferably towards France, Germany, Japan, United Kingdom, or the U.S., whereas Denmark, Finland, Greece or Portugal should attract less cross-border flows (in absolute terms).

Table 4.2 reports information on individual degrees of regularity of financial connections *(DRTFC),* following the geographic neutrality idea. The information is split into eight columns following three criteria, namely, the direction of the flows *($DRTFC^{out}$* and *$DRTFC^{in}$),* the relevance of indirect

12. As indicated by Hintze and Nelson (1998), violin plots combine the box plot and the density trace into a single display that reveals structure found within the data. Therefore, it contains both the information provided by box plots (such as center, spread, asymmetry, and outliers), but also the distributional characteristics of data contained in nonparametric density estimation (Silverman, 1986).

GRAPH 4.1: Degree of financial openness *(DFO)* (1999-2006)
(percentages)



connections ($\gamma = 1$ and country-specific γ_i), and also the initial and final years. As suggested by the first two columns in table 4.2, some of the countries with lower levels of $DRTFC^{out}$, especially in 2006, are the Nordic countries in our sample—Denmark, Finland and Sweden—. These are countries with strong economic and financial ties, suggesting that the incentives of economic agents to go abroad might be geographically biased by these already established links. The apparently low values of *DRTFC* for these countries arise because they are small in terms of total assets. The only non-Nordic country with $DRTFC^{out} < 60\%$ as of 2006 is Canada, which shares a common

TABLE 4.2: Degree of regularity of total financial connections *(DRTFC)*
(percentages)

Country	Outflows				Inflows			
	$\gamma = 1$		$\gamma = \gamma_i$		$\gamma = 1$		$\gamma = \gamma_i$	
	1999	2006	1999	2006	1999	2006	1999	2006
Austria	80.98	84.71	82.53	88.29	66.93	66.64	71.36	71.68
Belgium	67.07	80.92	80.54	89.79	74.76	75.34	79.50	80.90
Canada	55.92	54.87	62.10	61.78	93.36	87.78	94.18	89.68
Denmark	58.67	59.64	62.20	67.86	74.78	42.92	78.16	55.56
Finland	53.89	32.65	62.40	42.33	60.17	26.03	71.40	49.12
France	90.50	86.72	90.59	88.77	82.69	85.45	83.35	85.99
Germany	86.86	90.19	86.95	90.31	85.57	83.67	86.07	84.80
Greece	NA	80.77	NA	81.41	83.07	67.18	86.23	79.51
Ireland	55.01	77.80	61.94	84.16	76.05	83.66	83.01	87.26
Italy	78.05	88.78	79.63	89.64	75.15	76.07	79.16	81.00
Japan	73.82	71.56	75.69	76.44	87.65	80.37	87.97	81.93
Netherlands	84.46	86.30	86.04	88.83	68.20	75.77	75.62	82.04
Portugal	70.09	72.47	73.47	78.90	64.03	61.25	70.68	74.19
Spain	76.41	70.79	78.85	76.29	77.73	81.58	79.99	84.20
Sweden	61.33	56.16	65.51	72.05	76.69	61.40	79.89	67.75
Switzerland	72.04	66.49	81.57	85.09	79.06	86.51	80.14	87.15
United Kingdom	75.16	70.83	76.86	74.37	77.74	85.82	82.45	87.73
United States	83.33	87.98	83.69	88.24	90.01	84.86	92.57	91.43
Unweighted mean	71.98	73.31	75.92	79.14	77.42	72.91	81.21	79.00
Standard deviation	0.12	0.15	0.10	0.12	0.09	0.17	0.07	0.12
Coefficient of variation	0.16	0.21	0.13	0.16	0.11	0.23	0.08	0.15

characteristic with these three countries, namely, the existence of strong links with the neighbors (the U.S., in spite of the border effect; see McCallum, 1995). In this case, although the size of the U.S. banking markets is big, it might be attracting too much of Canada's cross-border bank asset holdings, i.e., the cross-border flows are not *balanced*.

Should we control for the likely existence of indirect financial links, i.e., the instance in which the bank flows from country *i* to country *j* cross a third country *k*, considering a country-specific γ_i parameter, results change variedly. In general, we can observe that indirect connection play a role, increasing the level of connection between financial systems. Since the parameter controlling for this effect is country-specific, the gap between $DRTFC^{\gamma=1}$ and $DRTFC^{\gamma=\gamma i}$ also varies across countries to a great extent, and

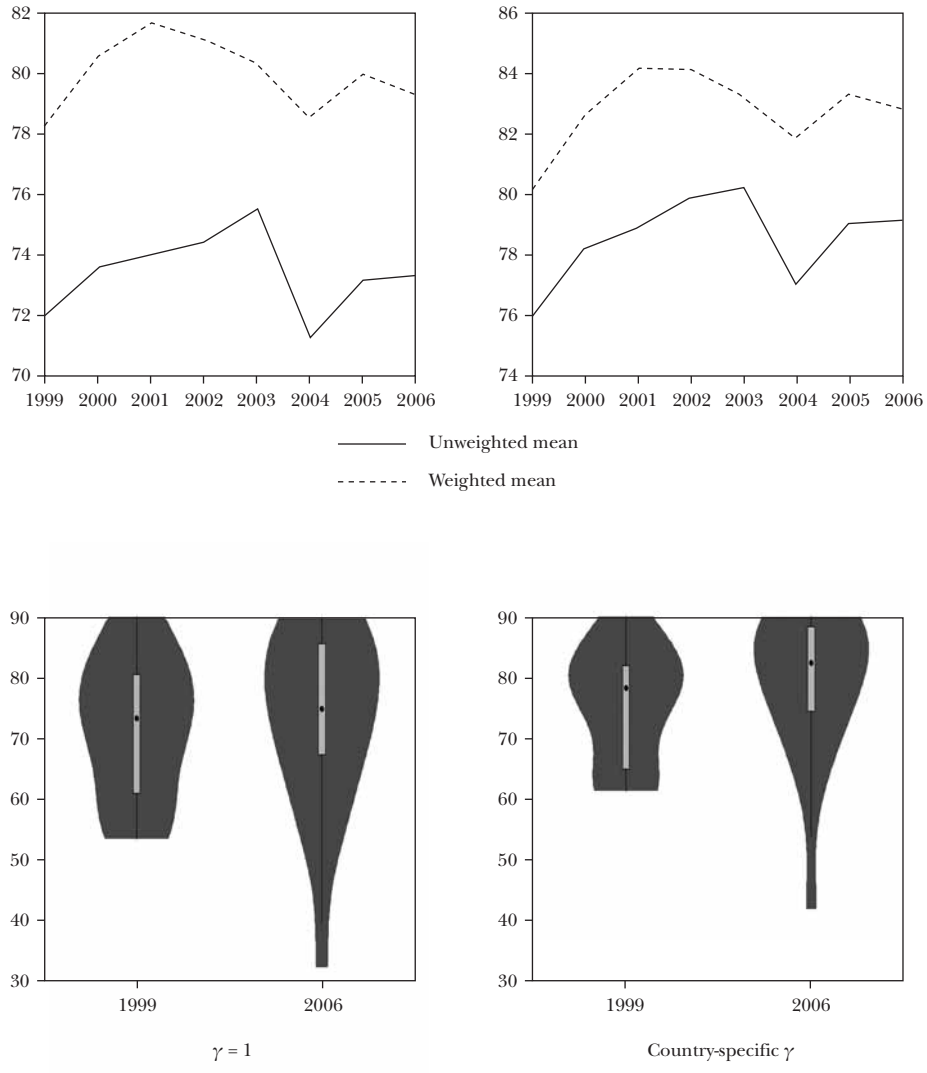
TABLE 4.3: Country-specific γ values
(percentages)

Country	γ_i^{out}		γ_i^{in}	
	1999	2006	1999	2006
Austria	86.61	84.33	83.56	82.35
Belgium	56.36	36.92	75.64	72.72
Canada	78.75	77.55	89.23	88.09
Denmark	90.95	78.17	85.28	70.17
Finland	79.72	80.20	69.91	55.60
France	82.60	74.40	90.48	87.75
Germany	77.47	70.83	91.95	88.22
Greece	NA	96.09	75.92	55.95
Ireland	77.29	71.57	65.45	67.85
Italy	88.91	92.90	77.30	74.31
Japan	90.52	79.95	94.92	91.00
Netherlands	72.55	29.79	73.20	69.58
Portugal	88.63	84.03	79.91	66.19
Spain	86.82	79.27	85.81	77.35
Sweden	85.63	61.54	83.85	81.91
Switzerland	38.33	21.48	92.64	91.70
United Kingdom	86.45	79.41	70.48	69.09
United States	93.46	92.39	66.62	41.85
Unweighted mean	80.06	71.71	80.68	73.98
Standard deviation	0.14	0.21	0.09	0.14
Coefficient of variation	0.17	0.30	0.12	0.19

it is wider for those countries with lower γ_i values (see table 4.3, which contain data on the specific values of γ_i) such as Belgium, the Netherlands or Switzerland (2006).

There are also some countries whose *DRTFC* does not overhang for being either too high or too low, which is the case of Ireland. However, Ireland's *DRTFC* exhibits the highest growth between 1999 and 2006, regardless of the γ considered. This increase reflects the fact that their cross-border financial flows have become more balanced, in terms of number and size of Ireland's financial partners: whereas by 1999 the United Kingdom and the U.S. accounted for more than 85% of Ireland's foreign claims (54.9 and 31.5%, respectively), by 2006 some of its largest European partners account for higher shares of its foreign assets (FA). Specifically, the United Kingdom and the U.S. have fallen in their relative importance (now

GRAPH 4.2: Degree of regularity of total financial connections *(DRTFC)*, outflows (1999-2006)
(percentages)



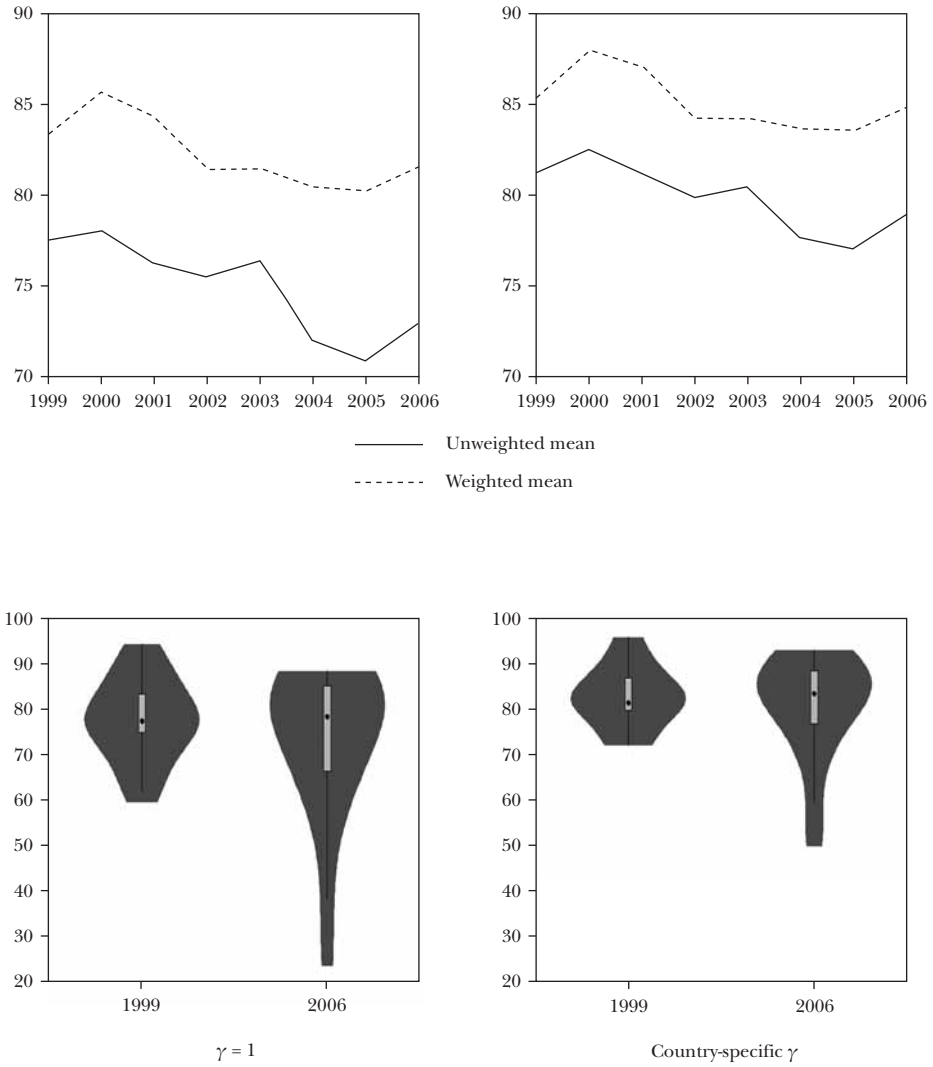
representing only the 42.2 and 10.3% of Irish foreign claims), whereas Germany, Italy, Spain and France account for 15.6, 9.6, 5.3 and 4.9%, respectively. This implies that, as suggested by the definition of the degree of regularity of the financial connections, now Ireland's cross-border flows are more *balanced*—both in terms of countries and volumes—. Explanations for this pattern may be manifold, such as the adoption of the euro, which might have constituted an incentive for Irish financial agents to go abroad and trade more intensely with countries sharing the same currency.

Results also vary if we reverse the direction of the flows and examine the assets of each country owned by foreign banks *(DRTFC^{in})*. This information is contained in the last four columns of table 4.2, for both γ schemes, and for both initial and final sample years. Results for $\gamma = 1$ suggest the Nordic countries are still at the bottom, i.e., they show geographic bias, regardless of the directions of their financial flows. However, Canada moves upwards in this ranking reaching the top, suggesting its financial links with the U.S. are asymmetric. In this case, both $DRTFC^{\gamma=1}$ and $DRTFC^{\gamma=\gamma i}$ are high for Canada because of Canada's bank assets owned by foreign banks (mostly U.S. banks). That is, the cross-border bank flows between Canada and its financial partners, are *balanced:* large countries own larger shares of Canadian bank assets.

Graphs 4.2 and 4.3 are graphical counterparts to the results reported in table 4.2, displaying analogous information like that reported in graph 4.1 in the case of the degree of financial openness. In contrast to the *DFO* case, the degrees of regularity of financial connections show a higher level yet rather fuzzy pattern—although it is difficult to uncover with only eight years—. Graph 4.2 suggests the pattern is slightly increasing for the total connections (country-specific γ), although it is rather unstable for the direct connections, with all three statistics in the upper panels sharing a this pattern. However, in both cases the values are much higher than those corresponding to the degree of financial openness, emerging as the main contributor to financial integration. The lower panels display 1999 and 2006 violin plots for the variables under analysis. We corroborate that the values for most countries are high—at least higher than the *DFO*—, and that we cannot conclude any clear tendency exists as to the central values of the distribution, but that the variety of behaviors is increasing, as shown by probability mass becoming more spread. However, the direction of the spread is not *positive*. In other words, it is not that the distribution is shifting rightwards (or upwards, if looking at the violin plot) but it is shifting towards lower values of regularity, and this finding is common to both γ schemes. Therefore, although the contribution of this indicator to the world financial integration is high, some countries—those shifting the distribution leftwards—are jeopardizing the advance of international financial integration.

Although this is a hypothesis that requires further testing, both distance and regional trade agreements might be playing a role. This finding has already been documented by Portes and Rey (2005) who found that distance, which proxies for information asymmetries, is a very large barrier to cross-border asset trade, and Aviat and Coeurdacier (2007). The latter, as we do, use data on cross-border bank asset holdings and find that a 10%

GRAPH 4.3: Degree of regularity of total financial connections *(DRTFC)*, inflows (1999-2006)
(percentages)



increase in bilateral trade raises bilateral asset holdings by 6 or 7%. Therefore, an increasing role of distance (cross-border financial activity is higher with neighbors, or between regional trade agreements' members) implies a decreasing role of geographic neutrality (only the size of the trading countries matters) and, ultimately, a declining contribution to international economic integration.

TABLE 4.4: Degree of integration *(DFI)*
(percentages)

Country	Outflows				Inflows			
	$\gamma = 1$		$\gamma = \gamma_i$		$\gamma = 1$		$\gamma = \gamma_i$	
	1999	2006	1999	2006	1999	2006	1999	2006
Austria	33.39	37.02	33.71	37.79	33.63	34.84	34.73	36.14
Belgium	55.22	73.09	60.52	76.99	43.56	46.38	44.92	48.07
Canada	35.60	36.36	37.51	38.59	32.74	33.50	32.89	33.86
Denmark	23.28	36.54	23.97	38.98	33.52	36.24	34.27	41.23
Finland	33.17	25.57	35.69	29.11	42.69	34.18	46.51	46.95
France	44.24	53.77	44.26	54.40	31.28	36.92	31.40	37.04
Germany	52.75	59.87	52.77	59.91	31.30	36.65	31.39	36.89
Greece	NA	17.89	NA	17.96	44.96	54.75	45.81	59.56
Ireland	35.65	48.45	37.83	50.39	51.70	53.42	54.02	54.56
Italy	30.86	26.63	31.18	26.76	43.33	46.91	44.47	48.40
Japan	33.60	41.90	34.02	43.30	26.80	29.74	26.85	30.03
Netherlands	49.53	80.88	49.99	82.05	43.98	49.88	46.31	51.90
Portugal	28.44	34.29	29.12	35.78	36.12	45.87	37.95	50.49
Spain	32.70	40.34	33.22	41.88	34.23	45.27	34.72	45.99
Sweden	30.09	47.27	31.10	53.54	35.68	33.90	36.42	35.61
Switzerland	69.41	75.25	73.85	85.13	25.11	27.91	25.28	28.01
United Kingdom	35.75	45.04	36.16	46.15	53.67	60.75	55.28	61.42
United States	27.74	30.38	27.80	30.42	65.11	82.48	66.03	85.61
Unweighted mean	38.32	45.03	39.57	47.17	39.41	43.87	40.51	46.21
Standard deviation	0.12	0.18	0.13	0.19	0.10	0.13	0.11	0.14
Coefficient of variation	0.31	0.39	0.33	0.40	0.26	0.30	0.26	0.30

4.3. Degree of financial integration

The degree of financial integration results from combining financial openness and regularity of financial connections, following equation (2.8). Results are reported analogously to the *DFO* and *DRTFC* cases. Table 4.4 provides results arrayed in eight columns which split the information according to three criteria, namely, the direction of the flows, the existence of indirect connections, and the initial and final years. The first four columns provide results for the assets held abroad by banks of each listed country. Since DFI^{out} combines DFO^{out} and *DRTFC*, its tendencies can be explained via the evolution of its components. Disparities among countries were more pronounced in the case of the

degree of financial openness, whereas the *DRTFC* values were more homogeneous. Thus, differences among countries are mainly determined by the degree of financial openness and, as such, those countries more financially integrated are Belgium, the Netherlands, or Switzerland. Of special note is the case of Sweden, whose *DRTFC* ranges amongst the lowest, whereas its high degree of financial openness pushes it upwards in the ranking ranging among the few countries with financial integration degrees above 50% as of 2006.

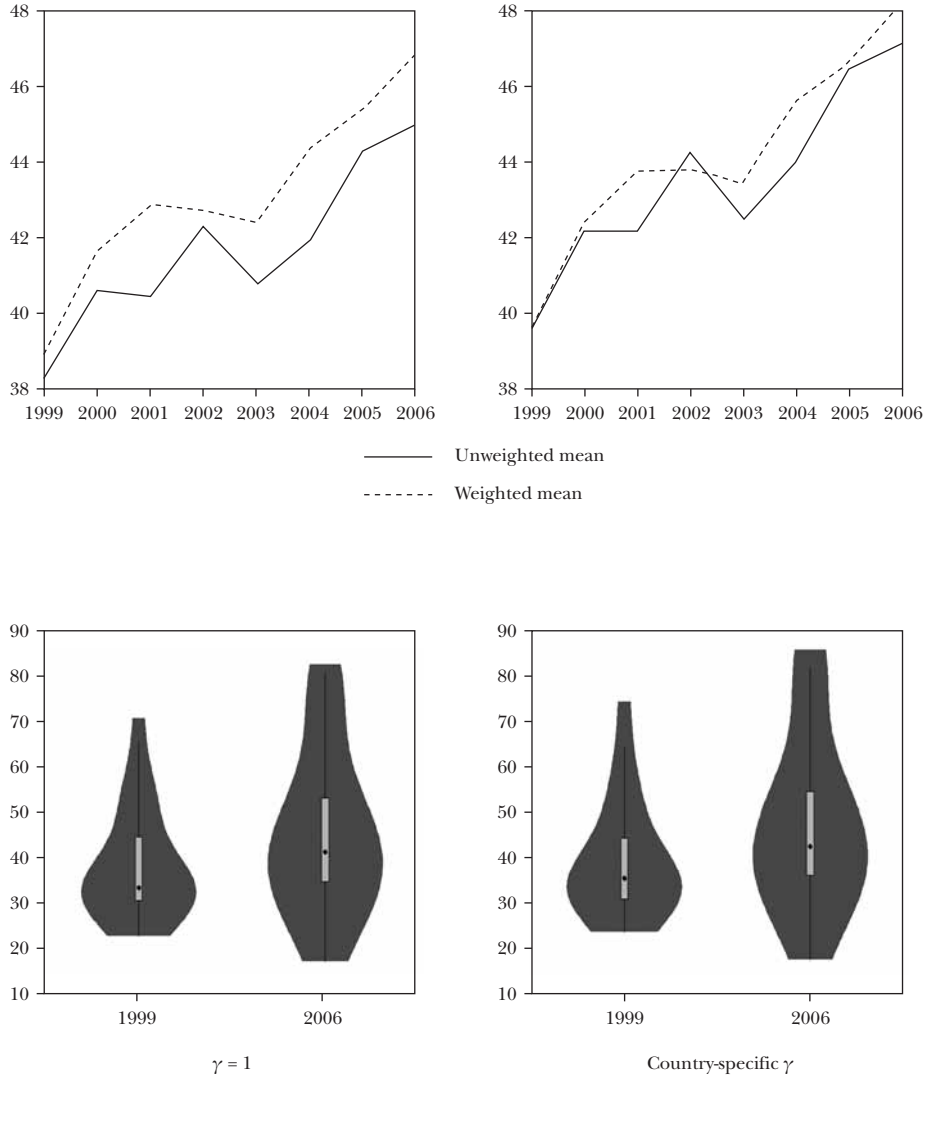
However, although the more financially integrated countries in the world are small, large countries have also participated in this process: both Germany and France have $DFI^{out} > 50\%$ by 2006, and Japan, the United Kingdom or Spain also go beyond the 40% line. Although some large countries still remain below these levels, if we extend the analysis to the cross-border bank flows flowing in the opposite direction, both Italy and particularly the U.S. become much more integrated. In contrast, some small countries such as Switzerland show a reversed pattern, as to be expected.

Graphs 4.4 and 4.5 provide graphical counterparts to table 4.4. In both cases (for DFI^{out} and DFI^{in}) the pattern is increasing, especially under DFI^{out}. The violin plots contained in the lower panels also show relevant patterns, suggesting disparity is increasing, especially for DFI^{out}. Therefore, although the world is more financially integrated today than eight years ago, the involvement of the different countries is unequal, and these inequalities are becoming more apparent over time.

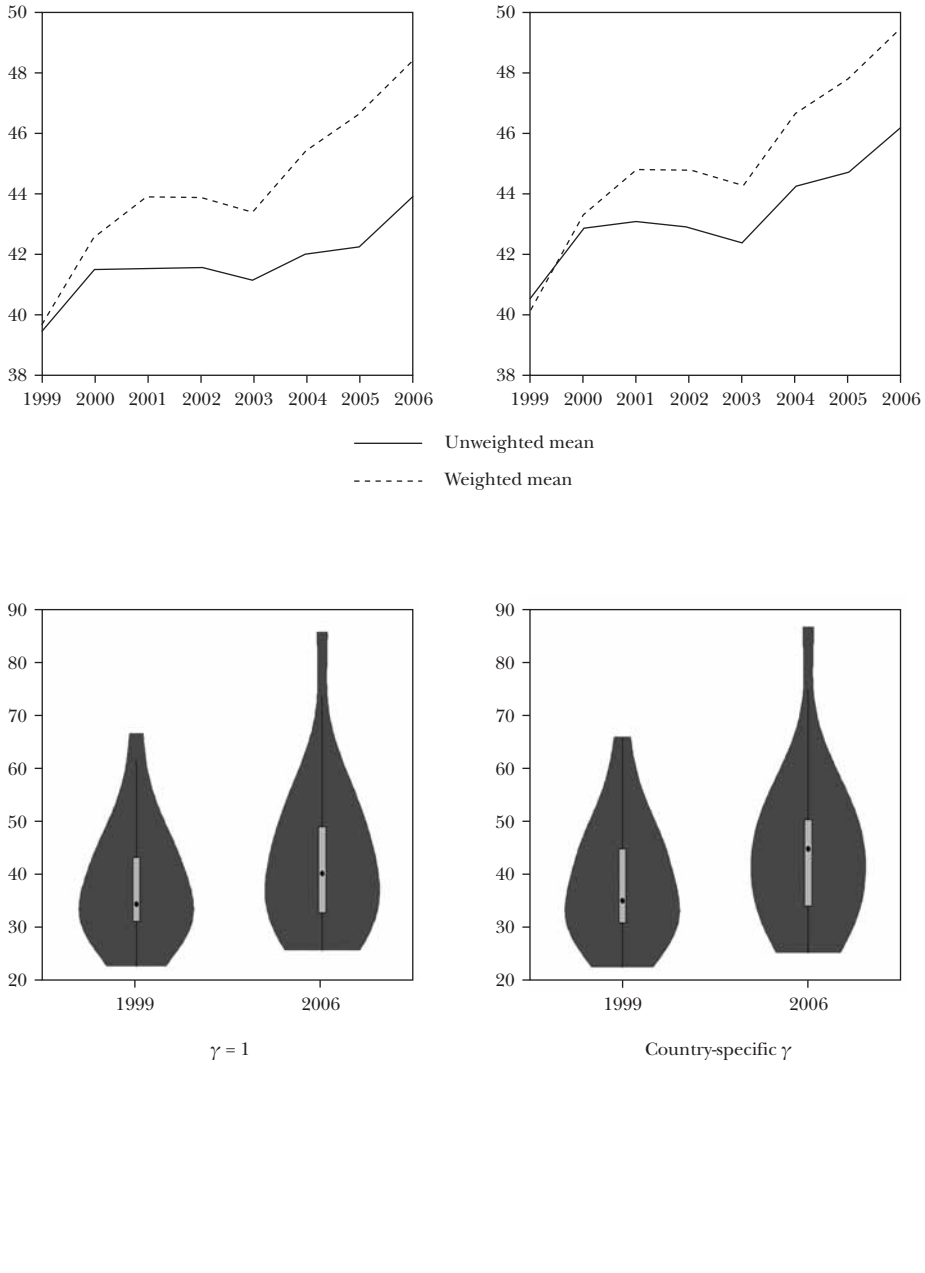
The relative contributions of both *DFO* and *DRTFC* to the international economic integration are shown in graph 4.6. As suggested earlier, the contributions are unequal, representing the degree of regularity of the total financial connections the largest share. However, the contribution of each component follows an opposite pattern. That is, whereas the contribution of openness to international financial integration is increasing, the contribution of the degree of regularity of the total financial connections is declining.

Therefore, the picture emerging is of a multiplicity of ways through which countries attain their levels of international financial integration. Both openness and balance in the volume and direction of cross-border flows are relevant, and their relevance has different angles. Whereas openness generates marked differences between countries, the degree of regularity of the total financial flows is more homogeneous, and higher. However, this indicator also shows differences across countries and over time, suggesting a geographical bias exists for the bilateral asset trading, as documented by previous literature. In addition, both home and foreign banks contribute differently to the integration level of each country, the extreme and opposite cases being represented by Switzerland and the U.S.

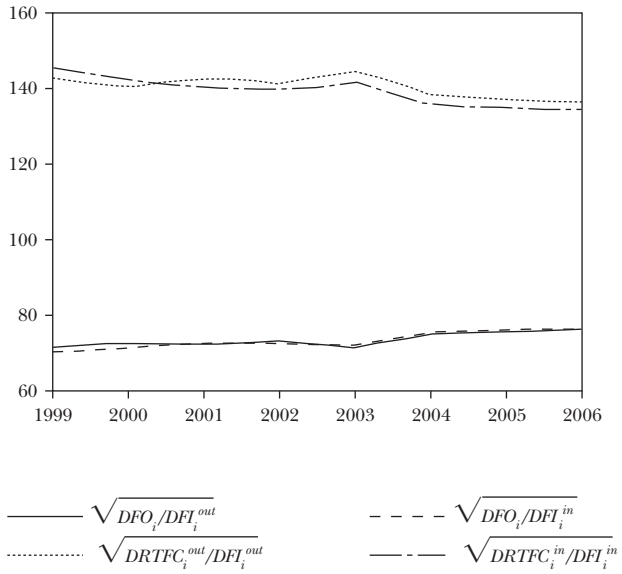
GRAPH 4.4: Degree of financial integration *(DFI)*, outflows (1999-2006)
(percentages)



GRAPH 4.5: Degree of financial integration *(DFI)*, inflows (1999-2006)
(percentages)



GRAPH 4.6: Evolution of $\sqrt{DFO_i/DFI_i}$ versus $\sqrt{DRTFC_i/DFI_i}$, country-specific γ (means) (1999-2006)
(percentages)



4.4. Global indicators

The previous sections have focused mainly on the individual analysis of the three indicators, as well as providing some summary statistics. One of the summary statistics provided was the weighted mean, which was computed for all three indicators, considering the role of indirect links, and also taking into account the direction of the cross-border flows. This result is relevant, since it indicates the gap between the current level of international financial integration and its theoretical full potential, the latter defined by the Standard of Perfect Financial Integration (SPFI).

Given this importance, which is one of the most important goals of the study, we report this information explicitly in table 4.5, where we provide information on all global indicators and consider the weight of the total bank assets in each country. These indicators have been computed following expressions (2.14), (2.11) and (2.12) for the degree of global financial integration, the degree of global financial openness, and the degree of regularity of the total financial connections. Results indicate that, regardless of the direction of the asset flows, the level of global integration attained as of 2006 is quite similar in terms of outflows or inflows. Graphs range between 46.9 and 49.5%, depending on whether indirect links are considered,

TABLE 4.5: Global degrees *(DGO, DGDC, DGTC, DGI)* (1999-2006)
(percentages)

Year	Outflows					Inflows				
	DGO	*DGTC*		*DGI*		*DGO*	*DGTC*		*DGI*	
		$\gamma = 1$	$\gamma = \gamma_i$	$\gamma = 1$	$\gamma = \gamma_i$		$\gamma = 1$	$\gamma = \gamma_i$	$\gamma = 1$	$\gamma = \gamma_i$
1999	20.85	78.23	80.15	38.95	39.55	21.13	83.32	85.38	39.58	40.19
2000	23.22	80.44	82.67	41.69	42.41	23.84	85.63	88.04	42.57	43.31
2001	24.84	81.50	84.16	42.86	43.76	25.79	84.34	87.15	43.88	44.80
2002	25.18	81.03	84.20	42.72	43.80	26.41	81.42	84.30	43.87	44.81
2003	24.99	80.17	83.22	42.43	43.47	25.81	81.45	84.27	43.36	44.29
2004	27.71	78.41	81.91	44.37	45.62	28.65	80.40	83.78	45.41	46.62
2005	28.78	79.88	83.33	45.41	46.67	30.48	80.25	83.52	46.64	47.83
2006	30.61	79.20	82.84	46.89	48.21	32.15	81.55	84.82	48.35	49.53

or the direction of the flows. Therefore, although the pace is rapid (by 1999, the *DGFI* was mostly below 40%), we are still not halfway to the theoretical full potential of international financial integration, i.e., to the SPFI. The increase in *DGI* has been mostly driven by the increase in the degree of global financial openness, whose advance has been proportionally higher. In contrast, the contribution of the *DRTFC* has even been small for $DRTFC^{out}$ and negative for $DRTFC^{in}$, although this finding was partly to be expected because the values of *DRTFC* were already high by 1999.

5. On the Relative Positions between Bank Flows' Directions

IN the previous section it has become apparent that the direction of cross-border financial flows is crucial in assessing each country's degree of financial integration. The extreme cases are represented by Switzerland and the U.S., whose *DFO* shows opposite patterns when evaluating them through either inflows or outflows.

The aim of this section is to show visually this type of evidence for all countries in the sample. The information provided is decomposed into two graphs. First, graph 5.1 provides information on the relative positions for each country, for *DFO* (first row in the graph), *DDC* (second row), and *DFI* (bottom row), and also for 1999 (first column), 2006 (second column) and all sample years (pooled, third column). Second, graph 5.2 displays how countries have transited from their positions in 1999 to those as of 2006.

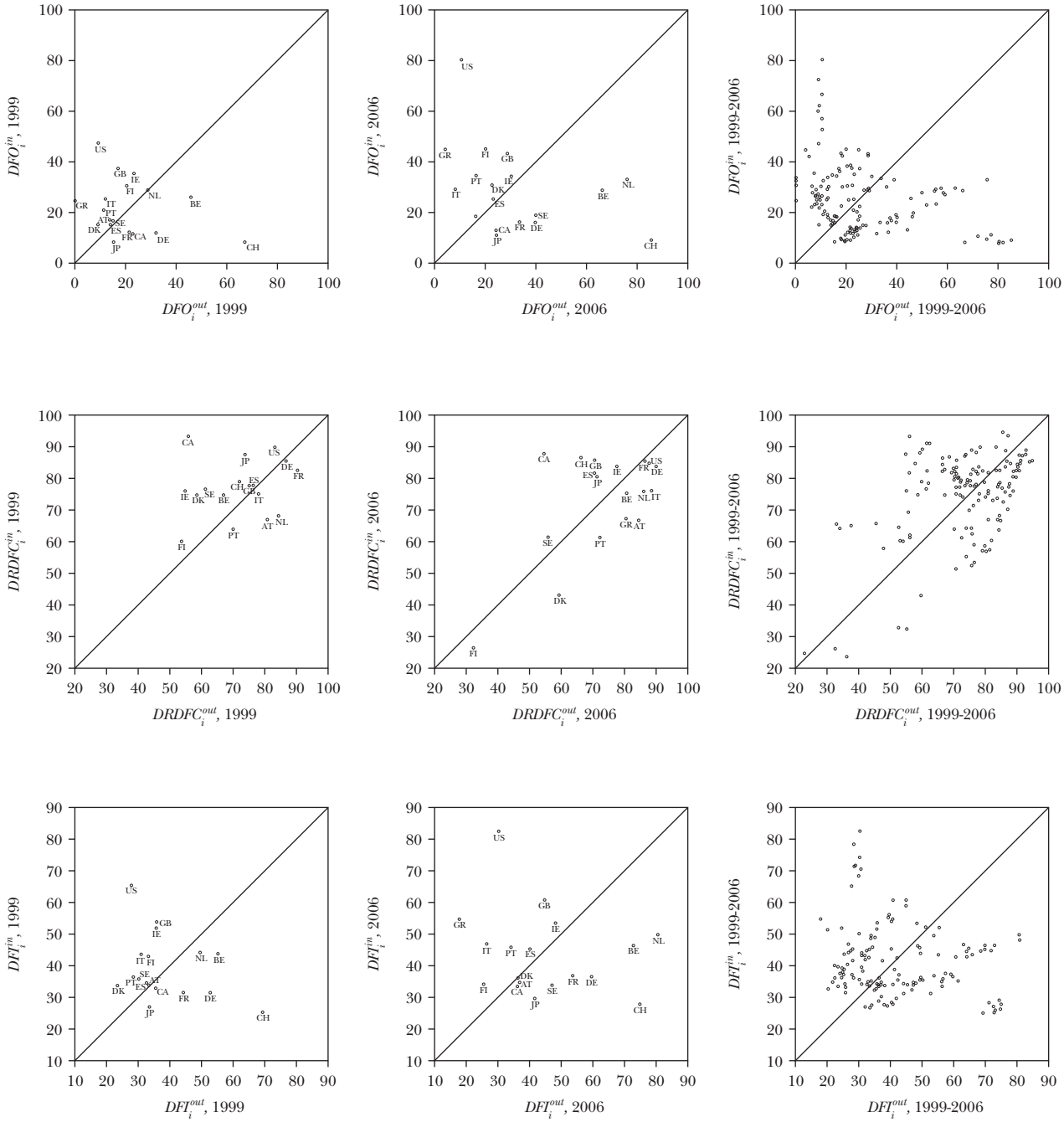
As shown by the first row sub-graphs in graph 5.1, some countries show opposite behaviors which, in addition, are getting more extreme over time. Those countries above the 45-degree diagonal are more open regarding their inflows, whereas those below that diagonal are more financially open on the outflows side. The general tendency is to deepen, or at least to remain, in their preferred orientation. Those countries below the 45-degree diagonal tend to shift rightwards when comparing 1999 and 2006, i.e., their DFO_i^{out} increases, whereas those above the main diagonal tend to shift upwards, i.e., their DFO_i^{in} increases. Therefore, it seems there is a tendency towards *specialization within increased financial integration*. That is, although countries become, in general, more financially open, the enhanced openness does not generally occur both via inflows and outflows simultaneously but rather countries focus increasingly on their relative specializations. When evaluating the sample years altogether, these tendencies become even more apparent, since observations tend to scatter in both two directions.

The second row in graph 5.1 presents analogous information for the *DRDFC* [13]. In this case, the tendency for most countries is to shift in both possible directions, i.e., both cross-border inflows and outflows are much more balanced by 2006 that they were by 1999. However, some notable exceptions exist such as Denmark and Sweden—two of the non euro-area European countries in our sample—together with one of their most important economic and financial partner, i.e., Finland. These three countries show an opposite behavior with respect to that by countries which have joined the euro. While the flows of euro-area countries are now slightly more balanced, the Nordic countries in our sample perform more poorly in this respect. This behavior could not only be related to their traditionally strong links, but also to the openness of some Eastern European countries such as the Baltic republics or Russia, which are not included in our sample.

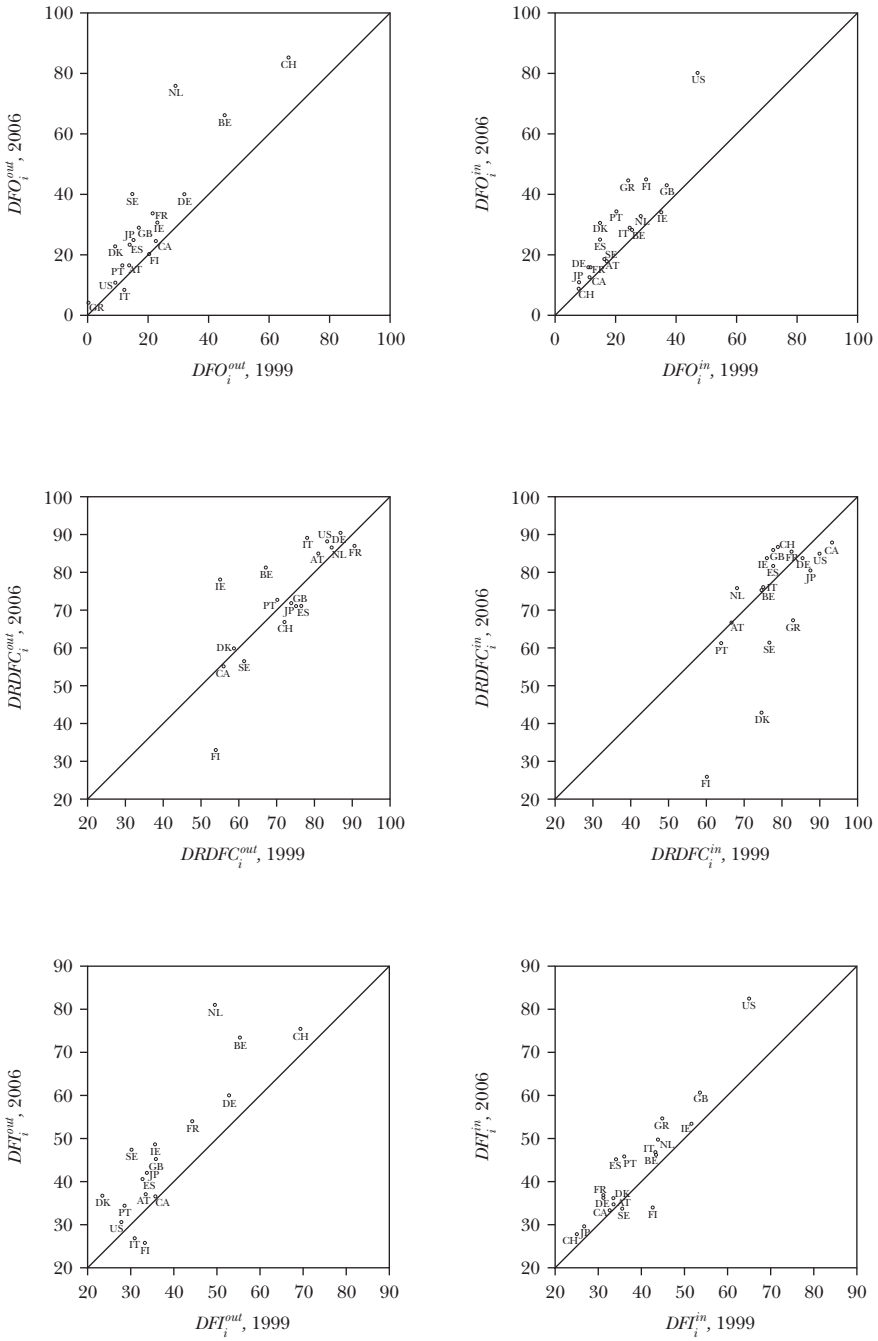
Graph 5.2 provides information as to how countries' have evolved in the indicators under analysis, i.e., it is the graph counterpart to tables 4.1, 4.2 and 4.4. The general tendency has been to move upwards, for both flows' directions, and for the degree of financial openness and the degree of financial integration. However, as mentioned in the previous paragraph, not only has the *DRDFC* remained rather stagnant but it has decreased for some specific countries, as shown by several countries below the 45-degree line—especially for cross-border inflows—. As a final result, although financial integration is affecting most countries worldwide, some of them have participated less intensively in this process (when comparing 1999 versus 2006), namely, Italy (outflows), Sweden (inflows) and Finland (inflows and outflows).

13. We do not provide information on indirect cross-border flows, in order to save space. These results are available from the authors upon request.

GRAPH 5.1: Relative positions between inflows and outflows *(DFO, DRDFC* and *DFI)*
(percentages)



GRAPH 5.2: Relative positions between 1999 and 2006 *(DFO, DRDFC* and *DFI)*
(percentages)



6. Concluding Remarks

THE aim of the article has been to develop new indicators of the degree of international financial integration along with its determinants, taking into account not only financial openness but also the regularity in the network of bilateral cross-border flows. The contribution of the study consists of defining a Standard of Perfect Financial Integration (SPFI) for characterizing the scenario in which the links between financial systems were established as if they made up a *global financial village*. In such a case, cross-border financial flows would not show geographical bias, and home bias should also vanish for international financial flows. They should only hinge on the relative size of the financial system, as would be the case for a gravity model in which distance were irrelevant.

After revising the related literature, section 2 established the properties for characterizing the concept of geographic neutrality, and defined the indicators of degree of financial openness, degree of regularity of direct financial connections (both direct and indirect), and degree of financial integration, for each country and for the world economy. For all of them we set precise intervals, ranging between [0,1]. Compared with the corresponding benchmark to a scenario of geographic neutrality, it is possible to assess the degree of financial integration achieved, and assess the relative contributions of each of its determinants.

In comparison with previous measures proposed by the literature, our indicators have some interesting features. First, we consider a network approach in which not only financial openness is relevant but also where we can describe the direction and intensity of financial connections. This distinction is relevant, since the distinguishing between financial openness and financial integration has been an issue not sufficiently stressed by the literature. Second, although our measures are quantity-based, they have an interesting feature which so far has been virtually confined to price-based indicators, namely, we set a benchmark—the SPFI—describing the theoretical full potential of economies in terms of financial integration. Accordingly, we can measure the gap between the current level of integration and that level achievable should perfect financial integration exist. As we may easily infer, the SPFI constitutes the quantity-based counterpart to the

LOOP, according to which the prices for the products in question would be the same irrespective of the geographical domicile of the seller or the buyer of the product. As suggested by some authors (Cabral, Dierick and Vesala, 2002), this law is especially difficult to hold in the banking field due to the lack of data.

The empirical application performed in the second half of the study analyzes the banking integration for 18 countries, accounting for the 83% of international banking markets over the 1999-2006 period. According to the results obtained, the degree of financial integration advances rapidly, and has increased from 40 to 50% over the eight years analyzed. However, we are barely halfway to the theoretical full potential of complete international financial integration. The level of financial globalization achieved is the result of a moderate openness (around 30%) yet strongly increasing (it has increased by 50% in eight years time), and a network of bilateral bank flows which attains a high level of regularity (close to 80%, on average), which is slightly reinforced by factoring indirect connections, but is quite stable over time.

Therefore, we might conclude that the highest barrier for financial integration is that separating each specific banking system from the exterior, i.e., the border effect, setting limits for the degrees of financial openness. However, this barrier, along with the home bias (which is still high), is losing relevance slowly. Once financial flows have crossed borders, they follow a variety of different directions with no special preferences, i.e., geographical bias is not too high *on average*. Nevertheless, we must bear in mind that although our sample is highly representative in terms of total foreign claims of the world banking system, it is only made up of matrices of bilateral financial flows for a limited number of countries which, because of their level of financial development may contribute to geographic neutrality.

However, results vary markedly from country to country, and differences tend to increase over time, as shown by the violin plots corresponding to all three indicators. In addition, the levels corresponding to each banking system indicators tend to differ strongly when assessed from either the perspective of foreign assets (FA) or liabilities. Ideally, the study should be extended to developing countries in order to corroborate the findings by some authors such as Lane and Milesi-Ferretti (2008), according to whom financial integration advances rapidly among advanced economies, whereas trade integration advances more rapidly among emerging economies. Unfortunately, the available data (which requires data on both FA and liabilities for each trading country pair) sets a limit difficult to cross.

In contrast to what one might sometimes find in the literature, higher (lower) sizes do not explain lower (higher) degrees of financial openness. In

the case of bank FA, we may find a myriad of examples including small countries which are either very open (Belgium, the Netherlands, Switzerland) or very closed (Greece, Austria, Portugal). In addition, some countries' behavior reverses when reversing the direction of the financial flow. This is the case of the U.S. (Switzerland), which is very closed (open) when considering bank FA, but very open (closed) when considering liabilities.

Regarding the regularity of connections, some countries excel because of the higher geographical bias of their cross-border bank flows. This is the case of Canada and the Nordic countries in the sample—for both bank FA and liabilities. In the Canadian case, a likely explanation could be derived from the strong ties with the U.S. (despite the relevance of the border effect; see McCallum, 1995), whereas the geographical bias affecting Nordic countries might be explained by the intensity of the flows between them. While one must look directly at the data to corroborate these facts, the degree of regularity provides us with an index containing this type of information. Another interesting case is represented by Ireland, whose degree of regularity has increased sharply from 1999 to 2006 because both the United Kingdom and the U.S. now account for lower volumes of foreign claims, whereas euro-area countries (Germany, Italy, Spain and France) have gained importance. In other words, Ireland's cross-border flows are now more *balanced*, contributing positively to its international financial integration.

The interpretation of the determinants of the differences between countries in their degrees of openness and regularity calls for a deeper analysis following the research lines suggested here, in order to delve into the likely causes of the failure to meet the geographic neutrality criterion. One of the hypothesis to be tested relates to distance (either geographical, cultural, political, or informational), which still matters as suggested by gravity models recently developed to interpret cross-border asset flows. However, the asymmetries detected for the degrees of openness and regularity when shifting the perspective from bank FA to liabilities indicate that integration levels vary a great deal depending on the adopted perspective. This event might suggest that the distances between banking systems do not offer satisfactory explanations for the different integration levels achieved, given that the causes would be the same while the effects would vary depending on the perspective adopted. In relation to this, the network analysis literature distinguishes between symmetric and asymmetric networks. Financial connections would fall into the latter category, because the direction of flows matters when assessing financial integration, as indicated by Rodrik (1999) when referring to the relevance of looking not only at exports but also at imports when analyzing international trade integration.

References

Adam, K., T. Jappelli, A. Menichini, M. Padula and M. Pagan (2002): "Analyse, Compare, and Apply Alternative Indicators and Monitoring Methodologies to Measure the Evolution of Capital Market Integration in the European Union", Working Paper, Centre for Studies in Economics and Finance, Department of Economics and Statistics, University of Salerno, Salerno, Italy.

Adjouté, K. and J. P. Danthine (2003): "European Financial Integration and Equity Returns: A Theory Based Assessment", in V. Gaspar, P. Hartmann and O. Sleijpen (ed.), *The Transformation of the European Financial System*, Second ECB Central Banking Conference, European Central Bank, chapter 5, 185-246.

Aviat, A. and N. Coeurdacier (2007): "The Geography of Trade in Goods and Asset Holdings", *Journal of International Economics,* 71(1), 22-51.

Baele, L., A. Ferrando, P. Hordahl, E. Krylova and C. Monnet (2004): "Measuring European Financial Integration", *Oxford Review of Economic Policy*, 20 (4), 509-530.

Berger, A. N., S. Ongena, D. Smith and Q. Dai (2003): "To what Extent Will the Banking Industry Be Globalized? A Study of Bank Nationality and Reach in 20 European Nations", *Journal of Banking & Finance*, 27 (3), 383-415.

— R. DeYoung, H. Genay and G. F. Udell (2000): "Globalization of Financial Institutions: Evidence from Cross-Border Banking Performance", Finance and Economics Discussion Series 04, Board of Governors of the Federal Reserve System.

— and D. C. Smith (2003): "Global Integration in the Banking Industry", *Federal Reserve Bulletin,* 89 (11), 451-460.

Buch, C. M. (2005): "Distance and International Banking", *Review of International Economics,* 13 (4), 787-804.

— and A. Lipponer (2007): "FDI versus Exports: Evidence from German Banks", *Journal of Banking & Finance,* 31 (3), 805-826.

Cabral, I., F. Dierick and J. Vesala (2002): "Banking Integration in the Euro Area", ECB Occasional Paper Series 6, European Central Bank, Frankfurt.

Combes, P.-P., M. Lafourcade and T. Mayer (2005): "The Trade-Creating Effects of Business and Social Networks: Evidence from France", *Journal of International Economics,* 66, 1-29.

Dermine, J. (2002): "European Banking, Past, Present and Future", Working Paper, INSEAD, Fontainebleau, France.

— (2006): "European Banking Integration: Don't Put the Cart before the Horse", *Financial Markets, Institutions & Instruments,* 15 (2), 57-106.

EATON, J. and S. KORTUM (2002): "Technology, Geography, and Trade", *Econometrica,* 70 (5), 1741-1779.

EUROPEAN CENTRAL BANK (2007): "Financial Integration in Europe", Technical report, ECB, Frankfurt.

FLOOD, R. P. and A. K. ROSE (2005): "Financial Integration: A New Methodology and an Illustration", *Journal of the European Economic Association,* 3 (6), 1349-1359.

FRANKEL, J. A. (2000): "Globalization of the Economy", Working Paper 7858, NBER, Cambridge, Massachusetts.

GARCÍA-HERRERO, A. and P. WOOLDRIDGE (2007): "Global and Regional Financial Integration: Progress in Emerging Markets", *BIS Quarterly Review,* 57-70, September.

GAULIER, G., S. JEAN and D. ÜNAL KESENCI (2004): "Regionalism and the Regionalisation of International Trade", Working Paper 16, Centre d'Études Prospectives et d'Informations Internationales (CEPII), Paris.

GUISO, L., T. JAPPELLI, M. PADULA and M. PAGANO (2004): "Financial Market Integration and Economic Growth in the EU", *Economic Policy,* 19 (40), 523-577.

HINTZE, J. L. and R. D. NELSON (1998): "Violin Plots: A Box Plot-Density Trace Synergism", *The American Statistician,* 52 (2), 181-184.

KALI, R. and J. REYES (2005): "Financial Contagion on the International Trade Network", University of Arkansas.

KLEIMEIER, S. and H. SANDER (2006): "Regional versus Global Integration of Euro-Zone Retail Banking Markets: Understanding the Recent Evidence from Price-Based Integration Measures", *Quarterly Review of Economics and Finance,* 46 (3), 353-368.

KRUGMAN, P. R. (1991): "The Move to Free Trade Zones", in Federal Reserve Bank of Kansas City (ed.), *Policy Implications of Trade and Currency Zones,* Federal Reserve Bank of Kansas City, Kansas City (MO), 7-41.

— (1996): "Regionalism versus Multilateralism: Analytical Notes", in J. de Melo and A. Panagariya (ed.), *New Dimensions in Regional Integration,* CEPR, Cambridge, Cambridge University Press, chapter 3, 58-89.

LANE, P. R. and G. M. MILESI-FERRETTI (2003): "International Financial Integration", Staff Papers 50, IMF, Washington.

— (2008): "The Drivers of Financial Globalization", *American Economic Review Papers and Proceedings* [forthcoming].

LEVY, H. and M. SARNAT (1970): "International Diversification of Investment Portfolios", *American Economic Review,* 60 (4), 668-675.

LEWIS, K. (1999): "Trying to Explain Home Bias in Equities and Consumption", *Journal of Economic Literature,* 37 (2), 571-608.

MANNA, M. (2004): "Developing Statistical Indicators of the Integration of the Euro Area Banking System", Working Paper Series 300, European Central Bank, Frankfurt.

MCCALLUM, J. (1995): "National Borders Matter: Canada-US Regional Trade Patterns", *The American Economic Review,* 85 (3), 615-623.

McGUIRE, P. and N. TARASHEV (2006): "Tracking International Bank Flows", *BIS Quarterly Review,* 27-28, December.

OECD (ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT) (2005): *Measuring Globalisation. OECD Handbook on Economic Globalisation Indicators,* Statistics, Paris, OECD Publishing.

PANDEY, M. and J. WHALLEY (2004): "Social Networks and Trade Liberalization", Working Paper 10769, National Bureau of Economic Research, Cambridge, Massachusetts.

PAPAIOANNOU, E. (2008): "What Drives International Bank Flows? Politics, Institutions and other Determinants", *Journal of Development Economics* [forthcoming].

PÉREZ, D., V. SALAS-FUMÁS and J. SAURINA (2005): "Banking Integration in Europe", *Moneda y Crédito* (220), 105-144.

PORTES, R. and H. REY (2005): "The Determinants of Cross-Border Equity Flows", *Journal of International Economics,* 65 (2), 269-296.

— H. REY and Y. OH (2001): "Information and Capital Flows: The Determinants of Transactions in Financial Assets", *European Economic Review,* 45 (4-6), 783-796.

RAUCH, J. E. (2001): "Business and Social Networks in International Trade", *Journal of Economic Literature,* 39, 1177-1203.

— and A. CASELLA (2003): "Overcoming Informational Barriers to International Resource Allocation: Prices and Ties", *The Economic Journal,* 113, 21-42.

RODRIK, D. (1999): *The New Global Economy and Developing Countries: Making Openness Work,* in *Policy Essays,* Overseas Development Council, number 24, Washington, DC.

SCHOLTE, J. A. (2002): "What is Globalization? The Definitional Issue-Again", Working Paper 109, Centre for the Study of Globalisation and Regionalisation (CSGR), University of Warwick, Coventry.

SILVERMAN, B. W. (1986): *Density Estimation for Statistics and Data Analysis,* Chapman and Hall, London.

STRONG, N. and X. XU (2003): "Understanding the Equity Home Bias: Evidence from Survey Data", *Review of Economics and Statistics,* 85 (2), 307-312.

SUMMERS, L. (1991): "Regionalism and the World Trading System", in *Policy Implications of Trade and Currency Zones,* Federal Reserve Bank of Kansas City, Kansas City (MO), 295-301.

VAJANNE, L. (2006): "Integration in Euro Area Retail Banking Markets Convergence of Credit Interest Rates", Working Paper 8, Bank of Finland.

VO, X. and K. DALY (2007): "The Determinants of International Financial Integration", *Global Finance Journal,* 18 (2), 228-250.

VON PETER, G. (2007): "International Banking Centres: A Network Perspective", *BIS Quarterly Review,* 33-45, December.

*ABOUT THE AUTHORS**

IVÁN ARRIBAS FERNÁNDEZ graduated in mathematics (statistics and operation research) and holds a PhD in economics from the University of Valencia, and is a professor in the Department of Economic Analysis of the said university. He has also taught on the MBA of the National University of Mar del Plata (Argentina) and has lectured in the Central Bank of the Dominican Republic (analysis and modelling of time series to forecast main economic outcomes, training in mathematical models focused on macroeconomics, etc.). His specialized fields are game theory and network games. He has published various articles in international specialized journals. He has participated in many Spanish and international congresses.
E-mail: ivan.arribas@uv.es

FRANCISCO PÉREZ GARCÍA holds a PhD in economics from the University of Valencia where he is currently professor of fundamentals of economic analysis. He has also been research director at the Valencian Economic Research Institute (Ivie) since the time of its foundation. His specialist fields are financial economics, banking and public finance, economic growth, regional economics and economics of education. He has published more than twenty books and over a hundred articles in Spanish and international journals.
E-mail: francisco.perez@ivie.es

Any comments on the contents of this paper can be addressed to Emili Tortosa-Ausina at tortosa@uji.es.

* This working paper is a result of the BBVA Foundation and Valencian Economic Research Institute (FBBVA-Ivie) Research Program. We thank Gordon Roberts, Nicole Allenspach, Rainer Haselmann, Stefanie Kleimeier and other participants of the 6th INFINITI Conference on International Finance held in Dublin, 9-10 June 2008. All authors acknowledge financial support from the Spanish Science and Education Ministry SEJ2004-07554, SEJ2005-02776 and SEJ2005-01163, respectively. Emili Tortosa-Ausina also acknowledges the financial support of the Valencian Regional Government GV2007/110. The authors are also grateful for excellent research assistance by Rodrigo Aragón and Juan Fernández de Guevara Radoselovics.

EMILI TORTOSA-AUSINA graduated in economics from the University of Valencia and holds a PhD in economics from the University Jaume I (Castelló de la Plana), where he is currently a lecturer in applied economics. He has also taught in the Department of Economic Analysis at the University of Alicante (1994-1995) and has received scholarships from various institutions (Fundación Caja Madrid, among others). He has recently held posts as visiting researcher in the Business Economics Department of the Autonomous University of Barcelona, the School of Economics of the University of New South Wales (Sydney, Australia), and the Department of Economics of Oregon State University (Corvallis, Oregon, USA). His specialized fields are banking economics and the analysis of efficiency and productivity. He has published various books in collaboration with others and his articles have appeared in specialized journals. He has participated in many Spanish and international congresses and is an associate researcher of the National Research Project *Reestructuración productiva y movilidad en la Nueva Economía.*
E-mail: tortosa@uji.es

Fundación **BBVA**

DOCUMENTOS DE TRABAJO

NÚMEROS PUBLICADOS

DT 01/02 *Trampa del desempleo y educación: un análisis de las relaciones entre los efectos desincentivadores de las prestaciones en el Estado del Bienestar y la educación*
Jorge Calero Martínez y Mónica Madrigal Bajo

DT 02/02 *Un instrumento de contratación externa: los vales o cheques. Análisis teórico y evidencias empíricas*
Ivan Planas Miret

DT 03/02 *Financiación capitativa, articulación entre niveles asistenciales y descentralización de las organizaciones sanitarias*
Vicente Ortún-Rubio y Guillem López-Casasnovas

DT 04/02 *La reforma del IRPF y los determinantes de la oferta laboral en la familia española*
Santiago Álvarez García y Juan Prieto Rodríguez

DT 05/02 *The Use of Correspondence Analysis in the Exploration of Health Survey Data*
Michael Greenacre

DT 01/03 *¿Quiénes se beneficiaron de la reforma del IRPF de 1999?*
José Manuel González-Páramo y José Félix Sanz Sanz

DT 02/03 *La imagen ciudadana de la Justicia*
José Juan Toharia Cortés

DT 03/03 *Para medir la calidad de la Justicia (I): Abogados*
Juan José García de la Cruz Herrero

DT 04/03 *Para medir la calidad de la Justicia (II): Procuradores*
Juan José García de la Cruz Herrero

DT 05/03 *Dilación, eficiencia y costes: ¿Cómo ayudar a que la imagen de la Justicia se corresponda mejor con la realidad?*
Santos Pastor Prieto

DT 06/03 *Integración vertical y contratación externa en los servicios generales de los hospitales españoles*
Jaume Puig-Junoy y Pol Pérez Sust

DT 07/03 *Gasto sanitario y envejecimiento de la población en España*
Namkee Ahn, Javier Alonso Meseguer y José A. Herce San Miguel

DT 01/04 *Métodos de solución de problemas de asignación de recursos sanitarios*
Helena Ramalhinho Dias Lourenço y Daniel Serra de la Figuera

DT 01/05 *Licensing of University Inventions: The Role of a Technology Transfer Office*
Inés Macho-Stadler, David Pérez-Castrillo y Reinhilde Veugelers

DT 02/05 *Estimating the Intensity of Price and Non-price Competition in Banking: An Application to the Spanish Case*
Santiago Carbó Valverde, Juan Fernández de Guevara Radoselovics, David Humphrey y Joaquín Maudos Villarroya

DT 03/05 *Sistemas de pensiones y fecundidad. Un enfoque de generaciones solapadas*
Gemma Abío Roig y Concepció Patxot Cardoner

DT 04/05 *Análisis de los factores de exclusión social*
Joan Subirats i Humet (Dir.), Ricard Gomà Carmona y Joaquim Brugué Torruella (Coords.)

DT 05/05 *Riesgos de exclusión social en las Comunidades Autónomas*
Joan Subirats i Humet (Dir.), Ricard Gomà Carmona y Joaquim Brugué Torruella (Coords.)

DT 06/05 *A Dynamic Stochastic Approach to Fisheries Management Assessment: An Application to some European Fisheries*
José M. Da-Rocha Álvarez y María-José Gutiérrez Huerta

DT 07/05 *The New Keynesian Monetary Model: Does it Show the Comovement between Output and Inflation in the U.S. and the Euro Area?*
Ramón María-Dolores Pedrero y Jesús Vázquez Pérez

DT 08/05 *The Relationship between Risk and Expected Return in Europe*
Ángel León Valle, Juan Nave Pineda y Gonzalo Rubio Irigoyen

DT 09/05 *License Allocation and Performance in Telecommunications Markets*
Roberto Burguet Verde

DT 10/05 *Procurement with Downward Sloping Demand: More Simple Economics*
Roberto Burguet Verde

DT 11/05 *Technological and Physical Obsolescence and the Timing of Adoption*
Ramón Caminal Echevarría

DT 01/06 *El efecto de la inmigración en las oportunidades de empleo de los trabajadores nacionales: Evidencia para España*
Raquel Carrasco Perea, Juan Francisco Jimeno Serrano y Ana Carolina Ortega Masagué

DT 02/06 *Inmigración y pensiones: ¿Qué sabemos?*
José Ignacio Conde-Ruiz, Juan Francisco Jimeno Serrano y Guadalupe Valera Blanes

DT 03/06 *A Survey Study of Factors Influencing Risk Taking Behavior in Real World Decisions under Uncertainty*
Manel Baucells Alibés y Cristina Rata

DT 04/06 *Measurement of Social Capital and Growth: An Economic Methodology*
Francisco Pérez García, Lorenzo Serrano Martínez, Vicente Montesinos Santalucía y Juan Fernández de Guevara Radoselovics

DT 05/06 *The Role of ICT in the Spanish Productivity Slowdown*
Matilde Mas Ivars y Javier Quesada Ibáñez

DT 06/06 *Cross-Country Comparisons of Competition and Pricing Power in European Banking*
David Humphrey, Santiago Carbó Valverde, Joaquín Maudos Villarroya y Philip Molyneux

DT 07/06 *The Design of Syndicates in Venture Capital*
Giacinta Cestone, Josh Lerner y Lucy White

DT 08/06 *Efectos de la confianza en la información contable sobre el coste de la deuda*
Belén Gill de Albornoz Noguer y Manuel Illueca Muñoz

DT 09/06 *Relaciones sociales y envejecimiento saludable*
Ángel Otero Puime, María Victoria Zunzunegui Pastor, François Béland, Ángel Rodríguez Laso y María Jesús García de Yébenes y Prous

DT 10/06 *Ciclo económico y convergencia real en la Unión Europea: Análisis de los PIB per cápita en la UE-15*
José Luis Cendejas Bueno, Juan Luis del Hoyo Bernat, Jesús Guillermo Llorente Álvarez, Manuel Monjas Barroso y Carlos Rivero Rodríguez

DT 11/06 *Esperanza de vida en España a lo largo del siglo XX: Las tablas de mortalidad del Instituto Nacional de Estadística*
Francisco José Goerlich Gisbert y Rafael Pinilla Pallejà

DT 12/06 *Convergencia y desigualdad en renta permanente y corriente: Factores determinantes*
Lorenzo Serrano Martínez

DT 13/06 *The Common Agricultural Policy and Farming in Protected Ecosystems: A Policy Analysis Matrix Approach*
Ernest Reig Martínez y Vicent Estruch Guitart

DT 14/06 *Infrastructures and New Technologies as Sources of Spanish Economic Growth*
Matilde Mas Ivars

DT 15/06 *Cumulative Dominance and Heuristic Performance in Binary Multi-Attribute Choice*
Manel Baucells Alibés, Juan Antonio Carrasco López y Robin M. Hogarth

DT 16/06 *Dynamic Mixed Duopoly: A Model Motivated by Linux versus Windows*
Ramon Casadesus-Masanell y Pankaj Ghemawat

DT 01/07 *Social Preferences, Skill Segregation and Wage Dynamics*
Antonio Cabrales Goitia, Antoni Calvó-Armengol y Nicola Pavoni

DT 02/07 *Stochastic Dominance and Cumulative Prospect Theory*
Manel Baucells Alibés y Franz H. Heukamp

DT 03/07 *Agency Revisited*
Ramon Casadesus-Masanell y Daniel F. Spulber

DT 04/07 *Social Capital and Bank Performance: An International Comparison for OECD Countries*
José Manuel Pastor Monsálvez y Emili Tortosa-Ausina

DT 05/07 *Cooperation and Cultural Transmission in a Coordination Game*
Gonzalo Olcina Vauteren y Vicente Calabuig Alcántara

DT 06/07 *The* Extended *Atkinson Family and Changes in Expenditure Distribution: Spain 1973/74 – 2003*
Francisco J. Goerlich Gisbert, María Casilda Lasso de la Vega Martínez y Ana Marta Urrutia Careaga

DT 07/07 *Análisis de la evolución de la dependencia en la tercera edad en España*
David Casado Marín

DT 08/07 *Designing Contracts for University Spin-offs*
Inés Macho-Stadler, David Pérez-Castrillo y Reinhilde Veugelers

DT 09/07 *Regional Differences in Socioeconomic Health Inequalities in Spain*
Pilar García Gómez y Ángel López Nicolás

DT 10/07 *The Evolution of Inequity in Access to Health Care in Spain: 1987-2001*
Pilar García Gómez y Ángel López Nicolás

DT 11/07 *The Economics of Credit Cards, Debit Cards and ATMs: A Survey and Some New Evidence*
Santiago Carbó-Valverde, Nadia Massoud, Francisco Rodríguez-Fernández, Anthony Saunders y Barry Scholnick

DT 12/07 *El impacto comercial de la integración europea, 1950-2000*
Luis Fernando Lanaspa Santolaria, Antonio Montañés Bernal, Marcos Sanso Frago y Fernando Sanz Gracia

DT 13/07 *Proyecciones de demanda de educación en España*
Andrés M. Alonso Fernández, Daniel Peña Sánchez de Rivera y Julio Rodríguez Puerta

DT 14/07 *Aversion to Inequality and Segregating Equilibria*
Antonio Cabrales Goitia y Antoni Calvó-Armengol

DT 15/07 *Corporate Downsizing to Rebuild Team Spirit*
Antonio Cabrales Goitia y Antoni Calvó-Armengol

DT 16/07 *Maternidad sin matrimonio: Nueva vía de formación de familias en España*
Teresa Castro Martín

DT 17/07 *Immigrant Mothers, Spanish Babies: Childbearing Patterns of Foreign Women in Spain*
Marta Roig Vila y Teresa Castro Martín

DT 18/07 *Los procesos de convergencia financiera en Europa y su relación con el ciclo económico*
José Luis Cendejas Bueno, Juan Luis del Hoyo Bernat, Jesús Guillermo Llorente Álvarez, Manuel Monjas Barroso y Carlos Rivero Rodríguez

DT 19/07 *On Capturing Rent from a Non-Renewable Resource International Monopoly: A Dynamic Game Approach*
Santiago J. Rubio Jorge

DT 20/07 *Simulación de políticas impositivas medioambientales: Un modelo de equilibrio general de la economía española*
Antonio Manresa Sánchez y Ferran Sancho Pifarré

DT 21/07 *Causas del crecimiento económico en Argentina (1990-2004): Otro caso de «tiranía de los números»*
Ariel Alberto Coremberg

DT 22/07 *Regional Financial Development and Bank Competition: Effects on Economic Growth*
Juan Fernández de Guevara Radoselovics y Joaquín Maudos Villarroya

DT 23/07 *Política fiscal e instituciones presupuestarias en los países de la reciente ampliación de la Unión Europea*
Carlos Mulas-Granados, Jorge Onrubia Fernández y Javier Salinas Jiménez

DT 24/07 *Measuring International Economic Integration: Theory and Evidence of Globalization*
Iván Arribas Fernández, Francisco Pérez García y Emili Tortosa-Ausina

DT 25/07 *Wage Inequality among Higher Education Graduates: Evidence from Europe*
José García Montalvo

DT 26/07 *Governance of the Knowledge-Intensive Firm*
Vicente Salas Fumás

DT 27/07 *Profit, Productivity and Distribution: Differences Across Organizational Form*
Emili Grifell-Tatjé y C. A. Knox Lovell

DT 28/07 *Identifying Human Capital Externalities: Theory with Applications*
Antonio Ciccone y Giovanni Peri

DT 01/08 *A Multiplicative Human Development Index*
Carmen Herrero Blanco, Ricardo Martínez Rico y Antonio Villar Notario

DT 02/08 *Real Exchange Rate Appreciation in Central and Eastern European Countries: Why the Balassa-Samuelson Effect Does Not Explain the Whole Story*
José García Solanes

DT 03/08 *Can International Environmental Cooperation Be Bought?*
Cristina Fuentes Albero y Santiago J. Rubio Jorge

DT 04/08 *On the Dynamics of Globalization*
Iván Arribas Fernández, Francisco Pérez García y Emili Tortosa-Ausina

DT 05/08 *Los motores de la aglomeración en España: Geografía versus historia*
Francisco J. Goerlich Gisbert y Matilde Mas Ivars

DT 06/08 *Sobre el tamaño de las ciudades en España: Dos reflexiones y una regularidad empírica*
Francisco J. Goerlich Gisbert y Matilde Mas Ivars

DT 07/08 *Managing Waiting Lists in a Fair Way*
Carmen Herrero

DT 08/08 *Estimación del capital social en España: Series temporales por territorios*
Francisco Pérez García, Lorenzo Serrano Martínez
y Juan Fernández de Guevara Radoselovics

DT 09/08 *Estimation of Social Capital in the World: Time Series by Country*
Francisco Pérez García, Lorenzo Serrano Martínez
y Juan Fernández de Guevara Radoselovics

DT 10/08 *Capabilities and Opportunities in Health*
Carmen Herrero y José Luis Pinto Prades

DT 11/08 *Cultural Transmission and the Evolution of Trust and Reciprocity in the Labor Market*
Gonzalo Olcina Vauteren y Vicente Calabuig Alcántara

DT 12/08 *Vertical and Horizontal Separation in the European Railway Sector: Effects on Productivity*
Pedro Cantos Sánchez, José Manuel Pastor Monsálvez y Lorenzo Serrano Martínez

DT 01/09 *How Effective Are Rewards Programs in Promoting Payment Card Usage?: Empirical Evidence*
Santiago Carbó-Valverde y José Manuel Liñares-Zegarra

DT 02/09 *Comparative Advantage Across Goods and Product Quality*
Francisco Alcalá

DT 03/09 *El transporte ferroviario de alta velocidad: Una visión económica*
Javier Campos Méndez, Ginés de Rus Mendoza e Ignacio Barrón de Angoiti

DT 04/09 *¿En qué circunstancias está justificado invertir en líneas de alta velocidad ferroviaria?*
Ginés de Rus Mendoza y Chris Nash

Documentos de Trabajo 5

Fundación BBVA

Plaza de San Nicolás, 4
48005 Bilbao
España
Tel.: +34 94 487 52 52
Fax: +34 94 424 46 21

Paseo de Recoletos, 10
28001 Madrid
España
Tel.: +34 91 374 54 00
Fax: +34 91 374 85 22

publicaciones@fbbva.es
www.fbbva.es