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TRACKING BANKS' SYSTEMIC IMPORTANCE BEFORE AND AFTER THE CRISIS

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Abstract

We develop a methodology to identify and rank 'systemically important financial institutions' (SIFIs). Our approach is consistent with that followed by the Financial Stability Board but, unlike the latter, it is free of judgment and it is based entirely on publicly available data, thus filling the gap between the official views of the regulator and those that market participants form with their own information set. We apply the methodology on three samples of banks (global, EU and euro area) for the years 2007-12.

JEL Classification: G21, G01, G18.
Keywords: G-SIFIs, systemic risk, too big to fail.

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1. Introduction[1]

The term 'systemic importance' has entered economic jargon fairly recently. It was the collapse of Lehman Brothers in 2008 that showed how the failure of a single financial institution, not necessarily a big one but deeply interconnected, could endanger financial stability worldwide. While the "too big to fail" problem had been already identified by both academics and regulators, the issue of defining, measuring and modelling systemic importance effectively gained attention only after the eruption of the crisis.

This paper proposes a procedure to measure banks' systemic importance that is consistent with regulatory views but based on public data and therefore transparent and easily replicable. It is mainly meant to provide regulators, practitioners and researchers with a shared operational definition of systemic importance. The methodology is then applied to a sample of large European and global banks to investigate how the nature and geographical distribution of systemic institutions changed between 2007 and 2012.

The main motivation behind our work is that the definition and measurement of systemic importance are crucial to policy makers. First, the methodology proposed by the Basel Committee on Banking Supervision (BCBS 2011) to identify global systematically important financial institutions (G-SIFIs) is different from the definition of systemic risk. Systemic importance relates to the damage that the failure of a financial institution may cause to global financial stability, whereas systemic risk relates to the probability of default of an institution. Second, the BCBS methodology has important practical implications because all banks identified as G-SIFIs will be subject to capital surcharges and enhanced prudential supervision starting from 2019. This decision applies one of the policy responses to the systemic importance issue: additional capital surcharges will make the default of a systemically important financial institution less likely. Thus a good understanding of the procedure is important for banks and market participants in general. The procedure raises concerns in terms of communication and transparency, however. Its main potential weakness is that it cannot be replicated owing to its reliance on supervisory data, the non-negligible

[1] The authors would like to thank Olivier de Bandt, Giorgio Gobbi, Giuseppe Grande and Stefano Siviero for helpful discussions and suggestions. The views expressed do not necessarily reflect those of Bank of Italy.

role played by supervisory assessment, and the incomplete disclosure of some important technical details.

To overcome some of these flaws Masciantonio (2013) implements the BCBS procedure using publicly available data only: the modified procedure replicates fairly closely the initial official G-SIFIs selection. The first contribution of this paper is thus of a methodological nature. Building on BCBS (2011) and Masciantonio (2013) we construct a systemic importance (SI) index using a non-judgmental procedure based exclusively on public data. We therefore provide a methodology by which market participants can directly assess banks' systemic relevance in a way that is consistent and directly comparable with the FSB assessment. We then exploit this methodology to study how systemic importance varied between 2007 and 2012 for a sample of large banks, looking separately at global, European and euro-area institutions. The comparison of pre- and post-crisis data integrates the (limited) information disclosed by the FSB, which covers only 2010, 2011 and 2012. Measuring systemic importance within specific regions as well as globally is important for at least two reasons. First, banks may have a significant impact on their domestic financial system even if they are not globally systemic, and national regulators have an obvious interest in monitoring systemic importance at the level they are most directly involved with. Second, bank failures may cause cross-border spillovers that turn the problem into an international one; in this sense the line between domestic and global importance is quite thin, particularly when dealing with large economic areas like the EU (BCBS 2012, EBA 2014).

Our results suggest that both the nature of systemic importance and its geographical distribution changed significantly after the crisis: systemic importance has shifted from developed to emerging markets, particularly China, and the most important determinant of systemic importance has become complexity instead of size.

The paper is organized as follows. Section 2 describes the approach used to compute systemic importance and single out the banks that are 'sufficiently systemic' to be labelled SIFIs. Section 3 implements the procedure on three samples of banks encompassing respectively the global economy, the EU and the euro area. Section 4 deals with the evolution of global and domestic SIFIs over the period 2007-2012 and Section 5 concludes.

2. How to measure systemic importance

According to the BCBS (2011) a financial institution is systematically important if its failure or malfunction causes widespread distress either as a direct impact or as a trigger for broader contagion. Despite its generality, this definition stresses the view that systemic importance has to be measured in terms of the impact and the consequences that a default may have on the financial system (and the wider economy) rather than of the risk of a failure occurring. The definition thus clearly distinguishes the concept of systemic importance (which is akin to loss given default, LGD) from that of probability of default (PD) on which many systemic risk measures are based (CoVaR, DIP, SRISK).

Relying on this tenet, the BCBS (2011) developed an assessment methodology that reflects the different sources of negative externalities, making banks critical for the overall financial system stability. The approach relies on twelve indicators from five main categories: size, interconnectedness, substitutability, complexity, and cross-jurisdictional activity. The scores of these categories are collected for the largest 75 banks in the world by total assets. The overall SI index is the simple average of the scores.

The rationale for the five categories is straightforward. As for size, the distress/bankruptcy of a financial institution is more likely to damage the global economy and to diminish confidence in the financial system if its activities encompass a large share of global activity. A bank's systemic influence is also positively related to its interconnectedness vis-à-vis other financial institutions owing to a broad network of contractual obligations. Besides, the systemic impact of a bank's distress is negatively related to its degree of substitutability (the lack of readily available substitutes) as both a market participant and a client service provider. Furthermore, the impact of distress is positively related to the bank's business, structural and operational complexity; the more complex the bank, the greater the cost and time involved in resolving it. Finally, when a large part of the bank's activities are located outside the home jurisdiction, systemic relevance is expected to be substantial and the resolution process will easily become long and cumbersome.

Every year the FSB computes the SI index, ranks banks, and identifies a set of systemically important banks (SIBs).[2] The SIBs are allocated to four buckets of increasing capital surcharge, the maximum being up to 2.5% of risk-weighted assets. Given the broad implications of the enhanced supervisory framework, it is of the utmost importance that the selection methodology be fully understood by the financial system. Yet, there are several issues of concern regarding the possibility of replicating the actual BCBS methodology. The value of the SI index has not been disclosed yet. In addition, the use of supervisory data and the recourse to supervisory assessment in several steps of the procedure might create a gap between market and regulatory information and even undermine public confidence in the methodology.

In what follows we address these shortcomings by making use exclusively of publicly available data and relying on statistical procedures to select the set of SIBs. A distinguishing feature of our analysis is that we apply the BSBC methodology to data that predates the FSB exercise. We run the exercise over the period 2007-2012 in order to cover the global financial crisis. We also replicate the analysis for three different populations of banks: the global economy, the EU, and the euro area. We can thus wear regulators' lenses in an ex-post assessment of the most critical moments of both the global financial crisis and the euro-area sovereign debt crisis.

The first step of the procedure is to identify the reference population of banks. Each year, the FSB list of G-SIFIs is drawn from a sample of the largest 75 banks from a given set of countries plus banks that were designated G-SIBs in previous years and possibly other banks added according to supervisory assessment. In order to make the criteria as objective and unbiased as possible, we include the largest 100 banks in the world, regardless of their geographical location. These banks account for approximately 70% of worldwide total banking assets and most likely encompass all banks of non-negligible systemic relevance.

For the EU and euro-area samples, following the BCBS (2012) document on domestic SIBs (D-SIBs), the top 100 banks are drawn from banks headquartered in the domestic areas and from subsidiaries of foreign banks. While it is straightforward to consider banks headquartered in the EU (euro area) from a consolidated perspective, the inclusion of foreign subsidiaries in the sample accounts for the fact that the failure of a

[2] We use the terms SIB and SIFI indifferently as the procedure is currently applied only to banks.

foreign banking group may impose costs on the economy hosting the subsidiary, especially when the foreign subsidiary plays an important role in the host financial system.

Data are collected from published end-of-year financial statements and, where available, from a broad set of data providers (SNL Financial, Bloomberg, Dealogic, Bankscope) for the financial years 2007-12. From the datasets for each sample and each year we compute the value of the 12 indicators and aggregate them to obtain the SI score for each bank. This score represents banks' actual systemic importance as defined by regulators, but measured by market data.[3]

The next step is to sort out the institutions that are to be labelled 'systemically important'. The result of this phase is a sub-set of the starting 100 banks for each sample (global, EU, euro area) and for each year (2007 to 2012). This phase is delicate as only the institutions deemed to be "systemic enough" will be subject to additional capital requirements. There are various ways to establish what "enough" means in this context. This poses a robustness issue: uncertainty about the relevant threshold, or a high degree of volatility in the list of institutions that are identified as systemic, could significantly complicate the implementation of the regulatory regime. We exploit the length of our dataset to gauge the importance of this problem.

The identification problem is addressed by the BCBS (2011) using a clustering analysis, a statistical methodology that distributes the population items into different groups according to the statistical features of the initial population. After several approaches have been applied to our dataset (Table 1), the SIB sets do not appear to be sufficiently stable or robust. Often, banks with SI scores close to the selected threshold fall in or out the SIB sample just because of marginal changes in their scores but without changes in their ranking positions. Moreover, any clustering methodology fails to capture the importance of the ranking position and of the optimal level of systemic importance to be overseen by regulators. Therefore we move towards a different methodology that can properly address the selection issue.

Given that the systemic relevance concept covers aspects of both micro- and macro-prudential supervision, in the SIB identification we deal with both issues. The BCBS (2013) proposes including among the systemically relevant banks all the institutions with a weight

[3] The methodology is explained in Annex 1.

above 130bp (micro-prudential approach); but at the same time we must be sure that the selected set of SIBs represents a sufficiently large share of the global financial system (macro-prudential approach). We therefore choose to include in the SIB set all banks with an SI score above 1% (100bp) – the average score for our dataset – provided that a sufficiently large share of the global systemic relevance is taken into account. With this criterion, the SIB sets are definitely more stable than with any clustering methodology. In addition, the share of the selected systemic importance is satisfying from a macro-prudential point of view: the G-SIBs encompass at least 70% of the systemic importance of the overall sample, whereas for the two European sets the value is even higher (around 80%).

Table 1: Global and domestic SIFIs by clustering methodology

	Clustering Method	2007	2008	2009	2010	2011	2012
G-SIBs	SI above 1%	29 (70.3%)	28 (70.3%)	28 (70.2%)	30 (73.7%)	32 (75.0%)	32 (70.9%)
	Average Linkage	26 (67.1%)	24 (66.0%)	27 (69.2%)	27 (70.5%)	27 (69.8%)	24 (62.1%)
	Complete Linkage	23 (63.2%)	28 (70.3%)	27 (69.2%)	27 (70.5%)	25 (67.4%)	21 (57.9%)
	Median Linkage	26 (67.1%)	28 (70.3%)	20 (59.2%)	27 (70.5%)	21 (61.8%)	26 (64.5%)
	Chebychev Max Distance	26 (67.1%)	28 (70.3%)	27 (69.2%)	27 (70.5%)	17 (51.4%)	21 (57.9%)
	Minkowski Max Distance	26 (67.1%)	24 (66.0%)	27 (69.2%)	27 (70.5%)	17 (51.4%)	21 (57.9%)
	Clustering Method	2007	2008	2009	2010	2011	2012
EU-SIBs	SI above 1%	32 (80,4%)	30 (79,6%)	29 (78,1%)	31 (80,3%)	31 (81,7%)	32 (82,3%)
	Average Linkage	23 (69.7%)	17 (63.8%)	18 (63.6%)	35 (82.2%)	33 (83.6%)	32 (82,3%)
	Complete Linkage	27 (74.8%)	29 (78.6%)	29 (78,1%)	35 (82.2%)	33 (83.6%)	32 (82,3%)
	Median Linkage	23 (69.7%)	37 (85.7%)	29 (78,1%)	25 (74.6%)	33 (83.6%)	32 (82,3%)
	Chebychev Max Distance	23 (69.7%)	17 (63.8%)	29 (78,1%)	35 (82.2%)	33 (83.6%)	32 (82,3%)
	Minkowski Max Distance	23 (69.7%)	17 (63.8%)	18 (63.6%)	25 (74.6%)	33 (83.6%)	32 (82,3%)
	Clustering Method	2007	2008	2009	2010	2011	2012
EA-SIBs	SI above 1%	27 (80,9%)	26 (80,7%)	25 (77,7%)	24 (77,3%)	22 (76,8%)	24 (79,6%)
	Average Linkage	27 (80,9%)	27 (81.7%)	27 (79.7%)	30 (82.5%)	22 (76,8%)	21 (76.1%)
	Complete Linkage	26 (79.6%)	27 (81.7%)	19 (70.9%)	19 (71.4%)	22 (76,8%)	24 (79,6%)
	Median Linkage	27 (80,9%)	27 (81.7%)	19 (70.9%)	19 (71.4%)	22 (76,8%)	21 (76.1%)
	Chebychev Max Distance	27 (80,9%)	26 (80,7%)	19 (70.9%)	19 (71.4%)	22 (76,8%)	20 (74.6%)
	Minkowski Max Distance	27 (80,9%)	27 (81.7%)	27 (79.7%)	19 (71.4%)	22 (76,8%)	21 (76.1%)

As far as the number of banks in each set goes, while those at the global level gradually increased and those in the EU remained almost unchanged, the banks in the euro area decreased sharply, reaching a low point in 2011. This was the result of increased concentration within euro area, partly linked to the sovereign debt crisis, which spilled-over to the banking system. Instead, the increase in the G-SIB set was due to two different effects. First, we had a robust decrease in the SI score of the banks severely affected by the crisis, which nevertheless remained within the G-SIB set (e.g. Royal Bank of Scotland, Citigroup, ING). Second, there was an increase in the score of other banks that gradually acquired the critical SI weight needed to be included within the G-SIB set.

3. The geography of systemic importance

3.1 The global sample

A first striking feature of the banking system's evolution over time is that even the initial population of the largest banks has been reshaped by the financial crisis. For the 6 years from 2007 to 2012, 131 banks were selected from 25 countries, suggesting a significant turnover. Out of 100 banks in 2007 only 77 are still present in 2012. While the 23 missing institutions are all from the US and Europe, only 7 of the new entries are from those countries (3 and 4, respectively). With the exception of one bank from Brazil and one from Canada, the remaining institutions are all headquartered in Asian countries, with a robust increase for China and South Korea (5 and 4 banks, respectively). This rebalancing in favour of Asian countries and emerging market economies in particular does not come as a surprise given the steady increase in the economic development of many of them.

While the share of banks in the sample shrinks significantly for the US, the euro area and the UK, the reduction in total assets is more muted for the US and the UK, and the decline in the overall systemic relevance is even smaller (Table 2). At the same time, for the BRIC countries (Brazil, Russia, India, China) the increase in size is much larger than the increase in the share of banks, suggesting a rapid balance sheet expansion. Moreover, their contribution to systemic relevance increases more than proportionately, reaching 10.2% in 2012 from just 3.2% in 2007. A similar pattern characterizes Asian advanced countries (Singapore, South Korea and Japan), though less noticeably. The contribution from the Rest of the World is instead stable over the sample period.

Table 2: Selected indicators by geographical area

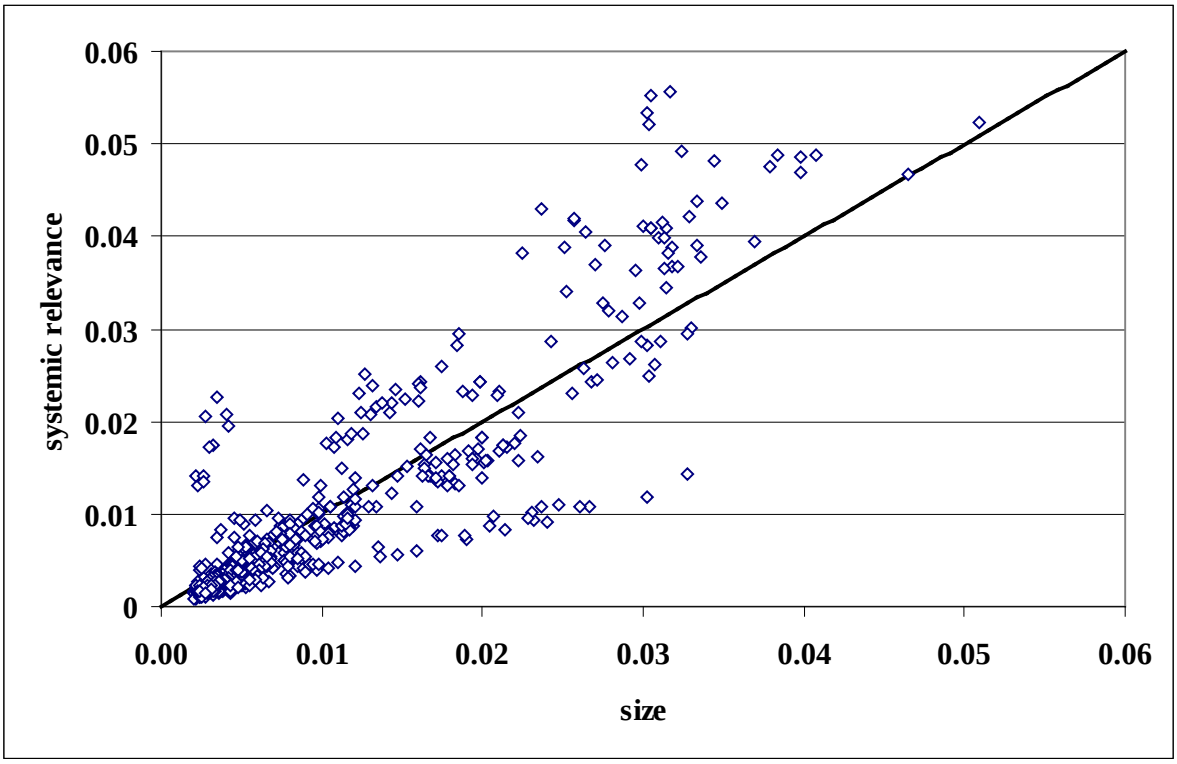
	share of banks					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
US	15.0	12.0	13.0	11.0	11.0	11.0
EA	38.0	39.0	38.0	34.0	30.0	29.0
UK	9.0	8.0	6.0	6.0	6.0	6.0
Ad-AS	8.0	8.0	9.0	13.0	14.0	15.0
BRIC	12.0	15.0	16.0	17.0	21.0	20.0
Ad-RW	18.0	18.0	18.0	19.0	18.0	19.0
	Size score					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
US	17.7	15.3	15.0	14.7	13.9	13.8
EA	39.3	38.4	37.3	33.5	30.2	29.2
UK	15.6	15.4	13.1	12.3	12.0	11.2
Ad-AS	7.6	8.8	9.5	10.5	12.1	12.0
BRIC	7.0	9.7	12.6	15.2	18.2	19.6
Ad-RW	12.9	12.4	12.5	13.7	13.6	14.1
	SI score					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
US	23.2	22.1	22.6	22.8	23.5	22.7
EA	38.5	37.4	35.9	33.5	31.5	29.0
UK	15.9	16.0	14.7	13.5	13.7	13.0
Ad-AS	5.6	7.1	8.0	9.0	9.0	10.8
BRIC	3.2	4.5	6.0	7.6	8.5	10.2
Ad-RW	13.6	13.0	12.8	13.6	13.9	14.3
	SI/Size					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
US	1.31	1.45	1.51	1.55	1.69	1.64
EA	0.98	0.97	0.96	1.00	1.04	0.99
UK	1.02	1.04	1.12	1.09	1.14	1.16
Ad-AS	0.74	0.80	0.84	0.85	0.74	0.90
BRIC	0.45	0.46	0.48	0.50	0.47	0.52
Ad-RW	1.05	1.04	1.03	1.00	1.02	1.01

The last panel of Table 2 shows the ratio between SI score and size, which can be interpreted as a measure of "systemic contribution per unit of asset". There is significant heterogeneity between regions: in 2012 the ratio is 0.5 for the BRICs, approximately 1 for the euro area, and 1.6 for the US. This in turn suggests that size cannot be taken as a sufficient statistic of systemic importance as there are profound differences between the underlying business models.

In order to provide more evidence on the size-SI nexus, Figure 1 plots the relationship between the two for the whole set of bank-year entries. While a strong positive correlation

(89.6%) is evident, the distribution with respect to the diagonal hints that when bank size is relatively small the driver of the SI score is indeed the dimension of the balance sheet, but after a given threshold is breached (around 0.025) the contribution of size is less than proportionate, suggesting that other factors of the business model determine overall systemic relevance. One likely interpretation is that many relatively complex activities, such as trading or cross-border lending, can be efficiently handled only by institutions that are sufficiently big. In addition, the annual correlation coefficient between size and SI score shows a significant downward trend: from 92.7% in 2007 to 85.4% in 2012. Over the same horizon, the correlation increases for substitutability (from 73.1% to 76.5%), is stable for complexity (95%) and cross-border activity (92%), and decreases for interconnectedness (from 94.8% to 90.6%).

Figure 1: Systemic relevance and size



Focusing on the 23 countries with at least one bank sampled in the top 100 in 2012, only 5 (France, Japan, Switzerland, UK, US) have an SI score for domestic banks that is larger than the share of banks in the sample (Table 3). With the exception of Japan, they all show values well above the sample share in each of the 5 categories. In particular, banks

from the US present the maximum aggregate value in 4 categories. The 5 economies, which have 32 banks in the top 100, represent almost 50% of the sample total assets and over 60% of aggregate systemic importance, suggesting that systemic relevance is geographically concentrated in few countries.

Table 3: Categories of systemic relevance by country (2012)

	Share	SI	Size	Inter	Sub	Comp	Cross
Australia	4.0	2.3	3.5	2.7	1.1	1.7	2.0
Austria	1.0	0.2	0.3	0.2	0.1	0.2	0.4
Belgium	2.0	1.1	0.9	0.9	0.5	1.8	1.3
Brazil	4.0	1.9	2.1	3.1	0.4	1.3	2.1
Canada	6.0	3.8	4.1	3.9	3.7	3.5	4.0
China	13.0	7.5	16.2	12.2	2.0	2.6	2.6
Denmark	2.0	1.1	1.0	1.2	0.3	0.7	2.1
France	5.0	11.1	10.8	13.1	10.0	12.3	9.0
Germany	8.0	7.7	6.6	8.5	5.6	9.5	7.7
India	1.0	0.2	0.5	0.2	0.1	0.0	0.2
Ireland	1.0	0.2	0.2	0.2	0.0	0.1	0.3
Italy	3.0	2.3	2.8	2.5	1.0	2.5	2.2
Japan	8.0	9.1	9.9	9.7	5.5	10.8	8.3
Korea	4.0	0.9	1.3	0.9	0.3	0.8	1.1
Netherlands	3.0	2.5	3.1	2.5	0.4	1.8	4.0
Norway	1.0	0.6	0.5	0.5	0.1	1.1	0.8
Russia	2.0	0.6	0.9	0.7	0.3	0.3	0.8
Singapore	3.0	0.9	0.9	0.5	0.2	0.4	2.1
Spain	6.0	3.9	4.5	3.8	1.5	3.6	5.2
Sweden	4.0	2.2	2.3	2.5	0.8	1.6	3.4
Switzerland	2.0	4.2	2.8	4.4	5.7	4.7	3.9
UK	6.0	13.0	11.2	11.6	10.3	14.0	17.0
US	11.0	22.7	13.8	14.3	49.9	24.7	19.6

Looking at other countries for which the value of the index is larger than the sample share in at least one category, China shows the maximum value for “size” with a share of 16.2% attributable to 13 banks. The 4 largest Chinese banks alone account for the striking share of almost 11% of the sample total assets. On the other hand, apart from the interconnectedness category for which the score is fairly high (12.2%), the value in the remaining categories (complexity, cross-jurisdictional activity and substitutability) is extremely low for China, at around 2%, which helps to bring down the overall SI score to just 7.5%.

3.2 Europe

The global financial crisis hit the European banking system severely, with many banks under stress being acquired by other sounder financial institutions, nationalized or dismantled. New banking groups have been created to better cope with the new financial environment (such as Bankia in Spain and BPCE Group in France). Thus, the geography of the European samples has been significantly re-shaped by the financial and sovereign debt crises.

Table 4: EU and euro-area banks by country

	2007		2008		2009		2010		2011		2012	
	EU	EA	EU	EA	EU	EA	EU	EA	EU	EA	EU	EA
Austria	5	5	5	5	6	6	4	7	4	6	3	5
Belgium	3	4	2	3	2	5 (1)	3 (1)	5 (1)	4 (1)	5 (1)	4	6 (1)
Cyprus			2	2	2	2	2	2		3		
Finland	1	3 (1)	1	3 (2)	1	3 (1)	1	3 (1)	1	3 (1)	1	3 (2)
France	6	8 (1)	7	8 (1)	6	7 (1)	6	8 (1)	6	9 (1)	5	6 (1)
Germany	22 (1)	23 (2)	21	23 (2)	19	22 (2)	18	22 (1)	16	21	16	22
Greece	4	5	4	5	4	5	4	5	4	5	4	4
Ireland	5 (1)	6 (2)	4 (1)	4 (1)	5 (1)	5 (1)	4 (1)	5 (1)	4 (1)	5 (1)	4 (1)	6 (2)
Italy	8	11	8	12	9	12	8	12	10	14	12	16
Luxembourg	1	2 (1)	1	2 (1)	1	2 (1)		1	1	2	1	1
Netherlands	3	7 (2)	3	5 (1)	3	5 (1)	4	5	4	5	4	6
Portugal	4	4	4	4	4	4	4	4	4	4	4	5
Spain	12	22 (1)	14	23 (1)	14	22 (1)	16	21 (1)	15	18 (1)	16	20 (1)
Denmark	2		2		2		2		2		2	
Poland							1		1		1	
Sweden	4		4		4		4		4		4	
UK	20 (9)		18 (8)		18 (9)		19 (10)		20 (10)		19 (9)	
Total	100 (11)	100 (10)	100 (9)	100 (9)	100 (10)	100 (9)	100 (12)	100 (6)	100 (12)	100 (5)	100 (10)	100 (7)

Subsidiaries of extra-sample banks in parentheses.

For the EU sample, 129 banks from 17 countries are selected in the6-year period under analysis. Out of the initial 2007 sample 79 banks are still active in 2012: Germany loses 6 banks while Italy and Spain add 4 banks each (Table 4). The UK is by far the top player: it has the highest value in the overall SI index (and in those for each category) every year (Table 5). However, the predominant role played by the UK is largely due to the concentration in its jurisdiction of several subsidiaries of non-EU banks: 5 from the US, 2 from Japan and 2 from Switzerland.

From a policy perspective the euro-area sample is more interesting because the launch of the SSM will most likely lead to a more integrated banking system with a single set of rules, uniform data reporting requirements, and greater cross-border banking activity.

Table 5: Categories of systemic relevance in the EU by country

	2007	2008	2009	2010	2011	2012
			SI Index			
EA	62.3	61.5	63.2	66.6	57.9	58.2
non-EA	37.7	38.5	36.8	33.4	42.1	41.8
UK	33.3	34.8	32.5	27.6	36.4	36.2
other	4.4	3.7	4.3	5.8	5.7	5.6
			Size			
EA	65.3	64.3	67.0	66.4	64.0	64.7
non-EA	34.7	35.7	33.0	33.6	36.0	35.3
UK	30.0	31.0	27.7	28.1	29.9	29.1
other	4.6	4.7	5.2	5.5	6.0	6.2
			Interconnectedness			
EA	65.7	60.0	64.9	66.9	62.5	60.5
non-EA	34.3	40.0	35.1	33.1	37.5	39.5
UK	30.3	36.1	30.3	27.6	32.0	33.8
other	4.0	3.9	4.8	5.5	5.5	5.8
			Substitutability			
EA	46.3	48.8	46.6	71.2	53.5	52.1
non-EA	53.7	51.2	53.4	28.8	46.5	47.9
UK	51.5	48.3	50.8	22.4	43.4	45.1
other	2.2	2.9	2.6	6.4	3.1	2.8
			Complexity			
EA	58.5	58.7	62.0	65.9	58.7	56.7
non-EA	41.5	41.3	38.0	34.1	41.3	43.3
UK	35.6	39.5	35.3	28.5	38.0	39.8
other	5.9	1.8	2.7	5.6	3.3	3.5
			Cross-jurisdictional			
EA	70.4	71.6	69.9	64.2	49.4	55.1
non-EA	29.6	28.4	30.1	35.8	50.6	44.9
UK	25.3	23.5	24.6	29.7	41.2	36.4
other	4.3	4.9	5.4	6.0	9.4	8.5

Actually, the euro-area sample shows more muted dynamics: over the period 2007-12 Germany loses only 1 bank among the top 100 and Spain does not increase its relative weight, France shows the 5 global banks plus the HSCB subsidiary. The only marked change is recorded by Italy: from 11 banks in 2007 to 16 in 2012. Although the subsidiaries are more widespread across countries, there are no representatives from Japan and Switzerland: in addition to the US there are only subsidiaries from other EU countries (Denmark, Sweden,

UK), depicting a somewhat less 'global' sample. In addition, out of the 12 countries that provide banks to the euro-area sample in 2012 only 8 are also listed in the global sample (Table 6).

Table 6: Systemic relevance of euro-area countries in 2012 across samples

	Global sample			EU sample			EA sample		
	Share	SI	size	Share	SI	size	Share	SI	size
Austria	1.0	0.2	0.3	3.0	0.8	1.2	5.0	1.4	1.9
Belgium	2.0	1.1	0.9	4.0	3.6	1.9	6.0	5.5	3.1
Finland	--	--	--	1.0	0.2	0.3	3.0	1.9	2.0
France	5.0	11.1	10.8	5.0	18.7	20.0	6.0	31.6	30.1
Germany	8.0	7.7	6.6	16.0	14.2	14.4	22.0	23.8	21.9
Greece	--	--	--	4.0	0.5	0.9	4.0	0.9	1.3
Ireland	1.0	0.2	0.2	4.0	2.2	2.0	6.0	4.5	3.1
Italy	3.0	2.3	2.8	12.0	5.2	7.0	16.0	8.7	10.8
Luxembourg	--	--	--	1.0	0.1	0.1	1.0	0.1	0.2
Netherlands	3.0	2.5	3.1	4.0	4.4	6.1	6.0	8.0	9.3
Portugal	--	--	--	4.0	0.7	1.0	5.0	1.2	1.5
Spain	6.0	3.9	4.5	16.0	7.5	9.9	20.0	12.4	14.8
Total EA	29.0	29.0	29.2	74.0	58.2	64.7	100	100	100

From a financial stability perspective there are two cases worth signalling. One is France, which in 2012 accounts for around 30% of both euro-area size and systemic importance, despite contributing only 6 banks to the sample (Table 6). This indicates an extremely concentrated banking system dominated by a 'universal banking' business model. The opposite case is that of Spain and Italy, which are considerably more represented (20 and 16 banks, respectively) but display aggregate systemic importance of only 12.4% and 8.7%: a clear sign of less concentrated banking systems and more traditional business models.

4. The SIBs during the crisis

4.1 Global SIFIs

Over time, the top G-SIBs show a relatively high degree of stability: the same 8 banks are ranked within the 10 most systemic in each year in 2007-12 (Table A2). However, out of

the 34 G-SIBs listed in 2012, 10 banks are not ranked as systemically important in 2007. A large part of this variability can be attributed to the effects of the financial crisis. In 2007 systemic importance stemming from Europe and the US accounts for 96% of the whole G-SIB set of 29 financial institutions, afterwards the share gradually decreases to 83% in 2012. This large reduction is offset by banks from countries that have been less affected by the crisis: the share of Japanese G-SIBs increases to 9% in 2012 and, even more strikingly, Chinese G-SIBs – which increase from 1 in 2010 to 4 in 2012 – increase their systemic importance from 1.4% in 2010 to 6.5% in 2012.

The crisis hampered the stability of the global financial system, with several banks facing financial distress or even bankruptcy. In the two years after the outbreak of the crisis 5 G-SIBs (Lehman Brothers, Merrill Lynch, Fortis Bank, Halifax Bank of Scotland, Dresdner Bank) were forced to file for bankruptcy or were acquired by stronger competitors because unable to continue on their own. A further 6 (RBS, Citigroup, UBS, ING, Lloyds, Commerzbank) needed capital injections by their sovereigns. Afterwards, only Dexia in 2011 faced financial distress. These widespread difficulties experienced by G-SIBs can be considered an ex-post rationale for closer supervision of systemically important banks.

It is worth assessing, therefore, whether ex-ante differences exist between failed and safe banks, in particular between G-SIFIs, which can serve as fragility indicators or at least provide an early warning. As a preliminary step we refer to all the 100 institutions selected in 2007: Table 7 compares some basic profitability and solvability indicators for the banks that experienced serious financial distress (failed, acquired, or bailed-out) and those that coped better with the crisis. In addition, it also reports some business model indicators and the SI, size and cross-jurisdictional activity scores.

The first indication suggests that size per se is not an indicator of fragility: while crisis banks are on average slightly larger than safe banks, the difference is not statistically significant. Also no sizeable difference between the two sets emerges from the overall SI index, hinting that the assessed level of systemic relevance cannot be used as an early warning of crisis (and was not intended for such a purpose). The cross-jurisdictional activity score is higher for crisis banks, suggesting a broader set of international connections, but at same time a likely fragility during the period of financial stress, possibly because free flows of cross-border liquidity were hampered.

Both ROA and ROE are larger for safe banks, pointing to less profitable management by crisis banks already in the years preceding the global financial crisis. The higher leverage of crisis banks suggests instead that they were more prone to indebtedness. Since ROE is the product of ROA and leverage, this result is in line with Haldane (2011), who suggests focusing on the latter measures rather than on ROE itself to evaluate banks' resilience. At the same time, the ratio of non-interest income to total income (NIIS) does not signal any difference between safe and crisis banks in their business model. In addition, balance sheet differences emerge only on the liability side: the deposit-to-asset ratio (DAR) is significantly smaller for crisis banks – underlining the importance of stable funding sources during turmoil – while the loan-to-asset (LAR) and loan-to-deposit (LDR) ratios do not display different values.

Table 7: Balance sheet indicators (2007)

	Size	Cross	SI	ROA	ROE	Leverage
All banks	0.0102	0.0102	0.0479	0.0075	0.1554	25.240
Safe banks (a)	0.0099	0.0090	0.0450	0.0084	0.1654	22.486
Crisis banks (b)	0.0108	0.0131	0.0545	0.0054	0.1319	31.697
Delta (b) - (a)	0.0009	0.0041 **	0.0094	-0.0030 ***	-0.0335 **	9.2111 ***
Observations	97 (29)	97 (29)	97 (29)	97 (29)	97 (29)	97 (29)
	NIIS	**LDR**	**LAR**	**DAR**	**T1**	**MTBV**
All banks	0.3139	0.9657	0.4839	0.5616	8.4654	9.4896
Safe banks (a)	0.3311	0.9691	0.4847	0.5777	8.6252	10.885
Crisis banks (b)	0.2736	0.9574	0.4819	0.5216	8.0394	6.2916
Delta (b) - (a)	-0.0575	-0.0117	-0.0028	-0.0561 *	-0.5858 *	-4.5935 ***
Observations	97 (29)	94 (27)	94 (27)	94 (27)	88 (24)	79 (24)

Distressed banks in parentheses.

The Tier 1 Capital Ratio (T1) is only marginally larger for safe banks, but distressed banks remain overall well capitalized (8%). Thus, raising the capital of G-SIBs is certainly a good way to improve their resilience, but the reported capital shortfall may not be enough to explain the failures in the sample. Actually, book capital measures during the crisis did not assure solvency even when the regulatory capital ratios were significantly above the market average (Kuritzkes and Scott 2009, Flannery 2014).

Finally, the market-to-book-value (MTBV) has a considerably lower value for crisis banks than for safe banks: the difference between the two groups points to a high correlation

between market perceptions of banks' resilience and future banking crises. Yet, this correlation might not be interpreted as causality. Indeed, either market agents were aware of the potential troubles faced by some banks in the sample (correctly assessing their true equity value), or the coordination of market agents on a bad (self-fulfilling) equilibrium outcomes led to the future distress of the banks.

Summing up, crisis banks highlight lower profitability, although positive on average, higher leverage, a lower reliance on stable sources of funding, and a higher share of cross-jurisdictional activity. While these indications could be considered a straightforward sign of weakness, the actual distress faced by each bank may well have been triggered by exogenous causes, such as the spikes in risk aversion or the collapse of cross-border interbank markets, which interplayed with existing weaknesses.

Further insights are gained by looking at the G-SIBs alone and focusing on the systemic importance categories. Complexity is the category that contributes the most in the SI scores of the G-SIBs, regardless of whether they faced distress or not. Thus it can be considered a distinctive feature of systemic banks, but still not an indicator of fragility. The second most important category for the 11 failed/distressed G-SIBs is cross-jurisdictional activity, and the two add up to 45% of the SI score in 2007, suggesting that some of these financial institutions were becoming too complex to manage (Haldane 2012). For the remaining G-SIBs, the second category is instead interconnectedness, which together with complexity represents 41% of the SI score, implying a more balanced business model. Surprisingly, the category that contributes the least in 2007 is substitutability.

The different weights of interconnectedness (most important for the safe G-SIBs) and cross-jurisdictional activity (most important for the distressed G-SIBs) can be interpreted as follows. In times of market turmoil, high interconnectedness is the main contagion channel for non-distressed banks, providing distorted incentives for banks' risk-taking decisions and creating the potential to capture regulators. Instead, a high score in cross-jurisdictional activity can harm bank performance and resilience and make it more prone to systemic liquidity risk, especially when regulators try to hamper the free flow of cross-border liquidity through the internal capital markets of banks (Cetorelli and Goldberg, 2012).

By looking at Lehman Brothers – the only bank in the sample allowed to file for bankruptcy – it emerges that its SI score is mainly driven by high levels of complexity and substitutability, adding up to 54% in 2007. This in turn suggests a business model even less

balanced than the rest of the distressed G-SIBs, and potentially one of the causes of its bankruptcy. Moreover, the failure of a highly complex but not easily substitutable institution could be at the root of the widespread market disruptions that followed Lehman Brothers' collapse and the main cause of the difficulty regulators had in handling it (Brunnermeier, 2009). The combination of complexity and substitutability as the top contributing categories to SI should therefore be considered particularly harmful. Complexity can make the bankruptcy of a G-SIFI particularly long and disruptive, increasing both the severity and the potential for contagion. The purpose of introducing 'living wills' for the G-SIFIs is to overcome – at least partially – the problem of excessive complexity and improve resolvability.

During the financial crisis, the acknowledged difficulties faced by several banks, now labelled systemic, prompted governments to intervene through capital injections and resolution/restructuring plans, and supervisory authorities through tighter and more effective prudential regulations (Panetta et al., 2009). These developments had three main effects on G-SIBs. First, out of the group of distressed banks, those that survived the crisis saw their SI score steadily decreasing in the following years. This reduction happened mainly through deleveraging, via the selling of non-core assets, which reduced the contribution of the size category. Second, most of dismantled or taken-over banks were acquired by other systemically important institutions, especially in the US. This development led to a rise in the acquirers' SI score and to an increase in the concentration of systemic importance within the hardest-hit countries (US, UK, Germany). Third, the increase in the SI score of several G-SIBs was due mainly to an increase in the contribution of complexity. Moreover, a distinctive consequence of the crisis is an increase in the combination of high complexity and low substitutability, much more rare at the onset of the crisis. Given the Lehman Brothers experience, this evolution is not entirely in line with a less risky financial framework: the threats posed to financial stability by these behemoths are potentially higher than those faced in 2007. Besides strengthening the capital base, G-SIBs should not be allowed to become more complex or less substitutable and particularly to grow in both categories at the same time.

4.2 Domestic European SIBs

The two sets of European systemically important banks appear even more stable than the global set throughout the crisis and beyond: 8 banks are always present among the top 10 for both the EU and the EA D-SIB set (Tables A3-A4). Moreover, the ranking is also quite stable: in the euro area the first 7 SIBs have had the same rank since 2009, with the exception of the switch at the top in 2011 from BNP-Paribas to Deutsche Bank.

The SI score of European SIBs appears to be more concentrated than the global sample. The average SI score for the first 10 banks increases steadily when moving from the global to the euro-area sample (Table 8). At the same time the range of the SI scores shows a remarkable value in the euro area, suggesting that even within the first 10 banks there is a significant difference in systemic relevance. Interestingly enough, the samples show similar average scores and ranges for the SIBs in the rest of the sample. These results suggest that the distribution of systemically important banks is skewed towards the top. The skewness is larger in the smaller EU and EA samples, showing that European supervisors should approach the supervision of the largest banks with particular care, given their greater weight with respect to the rest of the sample.

Table 8: SI scores and ranges (2012)

	G-SIBs	EU-SIBs	EA-SIBs
(1st -10th) average score	365.0	466.4	542.3
(1st -10th) score range	264.3	362.1	771.6
Rest of the sample average	156.2	162.3	181.3
Rest of the sample range	135.0	164.9	148.8

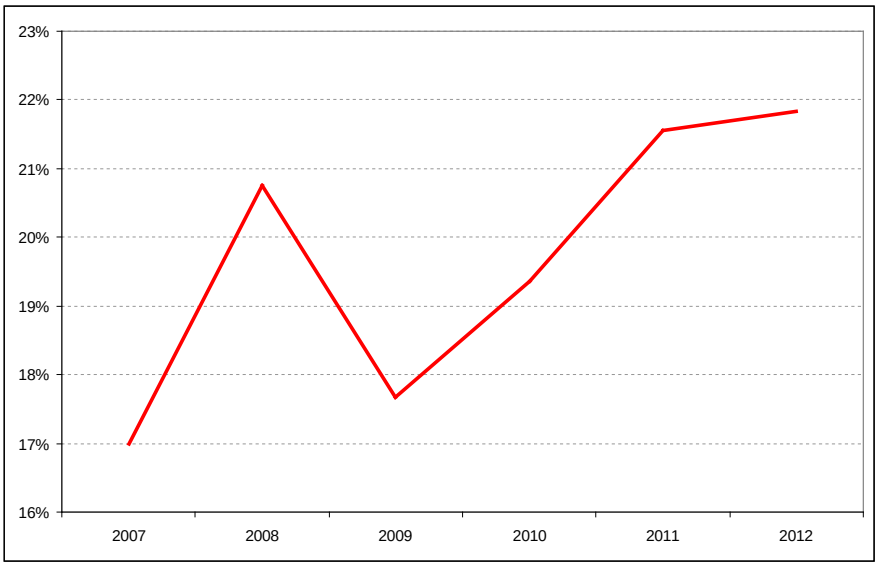
Basis points.

A significant dynamism is found in the sub-set of foreign subsidiary SIBs. After falling significantly in 2009, the share of systemic importance attributed to foreign subsidiaries among the EU-SIBs starts to rise, reaching a maximum in 2012 (Figure 2). This increase reflects the growing role played by foreign banks in European wholesale markets. Most of the foreign subsidiary SIBs play this role from London, despite the UK being severely hit by the global financial crisis. The share of EU-SIBs headquartered in the UK, irrespective of

their ultimate parent nation, grew from 37.8% to 42.1% during the years 2007-12, although most of this was due to foreign subsidiaries, with the share of SI explained by domestic SIBs remaining stable at around 23%. The role of the euro-area foreign subsidiaries is much more limited: in 2012 they account for only 10.5% of the overall systemic importance of the EA-SIBs sample. Moreover, if we do not consider foreign subsidiaries of banks headquartered in other non-euro EU countries, the role of foreign SIBs diminishes even further (6.1%).

It is also worth noting that several national champions (Commerzbank, Rabobank, BBVA, IntesaSanPaolo) are less systemically important than several subsidiaries of global and investment banks for most of the time. This is due to the more conservative and less complex business model of these banks, but it may also reflect a bias of the methodology towards the riskiest activities operated by investment banks. While the approach of giving greater weight to riskier and more complex activities is no doubt correct, our evidence suggests that the notion of systemic importance should also include, at least for smaller economic areas, some variables such as each bank's share of deposits -to-GDP in order to measure the potential disruptions caused to the wider domestic economy by the distress of a financial institution.

Figure 2: SI weight of foreign subsidiary D-SIBs



The EA-SIB sample provides an interesting view of the impact of the sovereign debt crisis. Considering the countries most affected by the crisis, only a small set of Spanish and Italian banks are included in the SIB set for most of the years (Santander, BBVA, Unicredit,

IntesaSanPaolo). The sample share of the total systemic importance of Italy and Spain, although quite low compared with their GDP shares, increases from 12.9% in 2007 to 18.1% in 2012. The increase is mainly due to the consolidation of the Spanish banking sector and the fact that it was less involved in the type of activities hardest hit during the 2007-09 financial crisis (securitization, derivatives dealing, etc.). However, the severity of the sovereign debt crisis suggests that non-systemically important banks can also cause wide market disruptions through the vicious bank-sovereign link (Black et al., 2013).

Looking at the SIBs that faced significant distress during the crisis, three main facts emerge. First, EU and EA SIBs include several German banks that were heavily involved in ABCP securitization in the run-up to the crisis: the SI score of these banks decreased steadily during the following years, together with the overall weight of Germany (Acharya and Schnabl, 2010). Second, as a response to financial distress and capital shortage, banks were mostly bailed out by governments. Third, none of the banks that underwent financial distress during the euro-area sovereign debt crisis was identified as systemically important. The bank that came closest to the EA-SIB sample is Bankia, which ranked 25th in 2010 and 2011 (slightly below the SIB identification threshold). However, even though Bankia was not systemically important in the euro-area-wide framework, its financial distress in 2012, caused by the vicious bank-sovereign link, generated a widespread confidence crisis.

5. Conclusions

In this paper we develop a methodology to evaluate the systemic importance of financial institutions and identify those that can be considered systemically important. Our aim is to fill the gap between the official assessment by the FSB, which is based on expert judgment and confidential supervisory data, and the evaluation that markets can form with publicly available data. To achieve our goal we follow the guidelines of the Basel Committee on Banking Supervision but rely on objective statistical procedures and make use exclusively of public data. We apply our procedure to annual data from 2007 to 2012, covering a period that goes from the US sub-prime mortgage crisis to the euro-area sovereign debt market turmoil, and distinguish between global and European banks.

We find that size is not a sufficient statistic for systemic relevance at either the global or the domestic level. Size and SI tend to overlap in the case of small and medium banks, but

the correlation breaks down for larger institutions typically engaged in complex activities (derivatives origination, prime brokering, cross-border lending). This suggests that systemic relevance should be treated differently from the well-known issue of too big to fail (Völz and Wedow 2011, Bertay et al. 2013, Zaghini 2014).

We document a significant change in the international landscape. The concentration and complexity of G-SIBs has increased. Systemic importance has migrated from Europe towards emerging economies, most notably China. The number of US banks in the global top 100 sample has decreased somewhat but their aggregate share of systemic importance is fairly stable, suggesting an increased concentration of systemic importance in relatively fewer institutions within the country.

For Europe, we report an increasing weight in extra-EU foreign subsidiaries, whose share of systemic importance has been rising steadily since 2010. This increase reflects the growing role of foreign banks in European wholesale markets and a relatively more pronounced deleveraging process by domestic SIFIs compared with their foreign peers. Several national champions appear to be consistently down-weighted, reflecting a methodological bias towards the riskiest activities operated by investment banks. While the idea of giving greater weight to risky, complex activities is no doubt sensible in a global context, our evidence suggests that the notion of systemic importance should also include, at least for smaller 'domestic' areas, measures of the size of a bank relative to its national banking system or the domestic economy as a whole.

Several banks identified as systemic by our procedure faced serious financial distress during the global crisis. In principle, this provides an ex-post case for tighter supervision of complex institutions at the global level. Looking at balance sheet data, we find no evidence that basic profitability and solvency ratios could have served as early warnings: distressed banks appear ex-ante similar to their peers. While our (admittedly basic) analysis offers no practical clues to supervisors tasked with disciplining SIFIs as to what they should monitor closely, it does suggest that some of the indicators devised might not be fit for purpose and further research is warranted.

Annex 1

This annex provides a brief description of the methodology used to calculate the SI scores as in Masciantonio (2013). The starting point is the identification of the 100 bank sample according to the region considered. Excluding government-owned special purpose institutions (e.g. Fannie Mae, KfW, CdP), the largest 100 banks by assets are included, based on end-of-year consolidated data. For the EU and the euro area, subsidiaries of foreign banks are included.

For each bank, the score of each indicator is calculated by dividing the individual bank amount by the aggregate amount summed across all banks in the sample:

(1) $$I_{i_{|i=1,..,5}} = \frac{X_{ij}}{\sum_{j=1}^{n} X_{ij}};$$

where I_i is the indicator i, X_{ij} is the individual bank amount for that indicator, and n is the sample size. Given that the score obtained for each indicator is multiplied by 10,000 to express it in basis points, the maximum possible total score is 10,000 (100%). Table A1 shows the categories employed and their relative weight.

Table A1: Categories and indicators of systemic relevance

1. **Size:**
   a) Total exposures as defined for use in the Basel III leverage ratio (20%);
2. **Interconnectedness:**
   a) Intra-financial system assets (6.67%);
   b) Intra-financial system liabilities (6.67%);
   c) Total marketable securities (6.67%);
3. **Substitutability:**
   a) Assets under custody (6.67%);
   b) Payments cleared and settled through payments systems (6.67%);
   c) Values of underwritten transactions in debt and equity markets (6.67%);
4. **Complexity:**
   a) OTC derivatives notional value (6.67%);
   b) Level 3 assets (6.67%);
   c) Held for trading and available for sale value (6.67%);
5. **Cross-jurisdictional activity:**
   a) Cross-jurisdictional claims (10%);
   b) Cross-jurisdictional liabilities (10%).

Relative weights in parentheses (BCBS 2011).

In the interconnectedness category, intra-financial assets are proxied by summing 'loans and advances to banks', 'reverse repos and cash collateral', '"trading and at-fair-value securities', and 'cash and due from banks'. Intra-financial liabilities are proxied by summing 'deposits from banks', 'repos and cash collateral', 'other deposits and short-term borrowings', 'other funding', and 'trading liabilities'. Total marketable securities are calculated by subtracting 'total deposits' and 'money market and short-term funding' from 'total liabilities'.

In the substitutability category, assets under custody and underwritten transactions are collected from industry league tables, while values of underwritten transactions have been left blank as it was not possible to collect data with reliable assumptions. However, the impact on the final score is limited, accounting for less than 7% overall.

In the complexity category, data on OTC derivatives are rarely available. The notional values of total derivatives positions are considered as a proxy of OTC derivatives. The sum of derivatives held on both the asset and the liability sides of the balance sheet is considered. In addition, since derivatives holdings of American and Japanese banks are several times smaller than their competitors' in other regions of the world – owing to different accounting standards – the former are scaled up to equal the average share of derivatives holdings across different regions of the world. The HFT + AFS indicator is easily calculated collecting data from banks' financial statements. The same applies for level-3 assets.

Cross-jurisdictional activity – both the claim and liability components – is calculated from BIS Total Foreign Claims data (Table 9C:S). First, BIS data are rearranged to calculate the total foreign claims of the world against a given country. Then data are attributed to each bank in the sample as a share of the value of country-level data, according to each bank's share of its cross-jurisdictional revenues or total assets. The same procedure applies for the EU and the EA, but relying on BIS locational banking statistics.

Once all the indicators have been computed, it is possible to calculate the overall score of every bank simply by adding up scores in each category and scaling up the score by 10,000 to express it in basis points. It is then possible to rank all the selected banks according to their overall systemic importance and to identify the G-SIFI sub-set as explained in the text.

Annex 2

Table A2: G-SIBs and bank scores

	2007		2008		2009		2010		2011		2012	
Rank	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score
1	Royal Bank of Scotland	522.7	JP Morgan	491.2	JP Morgan	521.7	JP Morgan	537.1	JP Morgan	559.6	JP Morgan	534.7
2	Citigroup	476.8	BNP Paribas	488.8	BNP Paribas	469.2	Deutsche Bank	477.1	Deutsche Bank	489.2	Deutsche Bank	418.3
3	Deutsche Bank	475.1	Deutsche Bank	487.7	Citigroup	416.6	BNP Paribas	456.8	Citigroup	435.6	Barclays	392.1
4	Barclays	420.4	Barclays	485.6	Barclays	411.2	Barclays	436.9	HSBC	415.6	HSBC	382.4
5	BNP Paribas	391.1	Royal Bank of Scotland	466.6	Deutsche Bank	397.9	Citigroup	426.9	Barclays	413.9	Citigroup	382.3
6	JP Morgan	389.2	Citigroup	403.8	Royal Bank of Scotland	394.8	HSBC	409.5	BNP Paribas	405.1	BNP Paribas	364.2
7	UBS	370.0	HSBC	377.1	HSBC	389.1	Bank of America	335.7	Bank of America	324.3	Bank of America	328.0
8	HSBC	344.9	UBS	340.0	Bank of America	367.3	Royal Bank of Scotland	329.3	Royal Bank of Scotland	318.0	Royal Bank of Scotland	289.9
9	Crédit Agricole	248.3	Crédit Agricole	301.2	Crédit Agricole	295.3	UBS AG	304.5	UBS	299.4	Crédit Agricole	287.5
10	Credit Suisse	242.2	Bank of America	256.5	Mitsubishi UFJ	263.1	Crédit Agricole	290.6	Crédit Agricole	290.7	Mitsubishi UFJ	270.5
11	Goldman Sachs	241.1	Mitsubishi UFJ	242.7	UBS	259.4	Société Générale	247.0	Mitsubishi UFJ	265.6	UBS	236.2
12	Société Générale	232.5	Credit Suisse	234.3	Société Générale	242.4	Goldman Sachs	245.5	Goldman Sachs	253.5	Goldman Sachs	230.6
13	Bank of America	231.2	Société Générale	229.0	Credit Suisse	215.2	Credit Suisse	241.9	Société Générale	235.2	Société Générale	229.4
14	Merrill Lynch	224.4	Goldman Sachs	209.0	Goldman Sachs	207.8	Mitsubishi UFJ	237.3	Credit Suisse	223.6	Mizuho Financial Group	212.1
15	Morgan Stanley	221.4	Morgan Stanley	180.7	Morgan Stanley	187.1	Morgan Stanley	209.3	Bank of New York Mellon	211.6	Bank of New York Mellon	195.6
16	Bank of New York Mellon	205.0	Bank of New York Mellon	174.1	Lloyds Banking Group	183.8	Bank of New York Mellon	202.4	Morgan Stanley	206.2	Credit Suisse	187.0
17	Lehman Brothers	177.1	Merrill Lynch	172.4	BPCE Group	183.2	Banco Santander	194.2	Banco Santander	187.0	Morgan Stanley	182.3
18	ING Bank	159.4	ING Bank	168.8	Mizuho Financial Group	176.5	Mizuho FG	168.6	Wells Fargo	172.2	Wells Fargo	182.3
19	Mitsubishi UFJ	157.5	Mizuho Financial Group	168.7	Banco Santander	171.8	ING Bank NV	162.8	Mizuho Financial Group	163.9	Banco Santander	169.8
20	Fortis	156.6	Unicredit	159.0	Bank of New York Mellon	171.4	Unicredit	154.3	BPCE Group	155.6	BPCE Groupe	159.3
21	Unicredit	155.7	Banco Santander	152.7	Commerzbank	153.7	BPCE Group	154.2	ING Bank	155.1	Sumitomo Mitsui	158.1
22	Banco Santander	141.1	Wells Fargo	140.2	Dexia	149.3	Wells Fargo	148.2	Unicredit	144.1	Lloyds Banking Group	140.2
23	Danske Bank	137.0	Dexia	139.6	UniCredit	141.2	Dexia	144.9	State Street Corporation	143.9	ICBC	139.6
24	Mizuho Financial Group	132.4	State Street	130.4	Wells Fargo	141.1	Lloyds Banking Group	140.4	Sumitomo Mitsui	140.1	State Street Corporation	135.0
25	HBOS	130.8	Groupe Caisse d'Epargne	116.3	State Street	140.7	State Street Corporation	136.0	Lloyds Banking Group	132.5	Unicredit	122.5
26	Dexia	126.2	Sumitomo Mitsui	107.5	ING Bank	138.0	Sumitomo Mitsui FG	133.5	ICBC	121.2	Royal Bank of Canada	118.0
27	Groupe Caisse d'Epargne	109.4	HBOS	107.5	Sumitomo Mitsui	135.1	Commerzbank	131.8	Nordea Bank	119.7	Bank of China Limited	108.7
28	Commerzbank	107.2	Commerzbank	102.7	Nordea Bank	100.5	Royal Bank of Canada	107.2	Commerzbank	109.6	ING Bank	107.9
29	Dresdner Bank	105.8					ICBC	103.7	Dexia	106.2	Nordea Bank	107.8
30							Nordea Bank	101.2	Bank of China Ltd	102.4	Agricultural Bank of China	107.1
31									Royal Bank of Canada	101.8	China Construction Bank	105.6
32									Rabobank	100.7	Commerzbank	101.2

Table A3: EU-SIBs and bank scores

	2007		2008		2009		2010		2011		2012	
Rank	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score
1	Royal Bank of Scotland	690.5	BNP Paribas	751.5	BNP Paribas	780.2	BNP Paribas	729.1	Deutsche Bank	701.0	HSBC	639.2
2	Deutsche Bank	673.3	Deutsche Bank	632.0	HSBC	561.5	Deutsche Bank	633.6	HSBC	659.2	Deutsche Bank	627.4
3	BNP Paribas	623.6	Barclays	565.1	Deutsche Bank	529.2	HSBC	620.5	Barclays	631.1	BNP Paribas	604.3
4	Barclays	531.5	Royal Bank of Scotland	560.5	Barclays	511.8	Barclays	574.3	BNP Paribas	610.7	Barclays	589.8
5	HSBC	494.5	HSBC	507.4	Royal Bank of Scotland	508.9	Crédit Agricole	465.3	Royal Bank of Scotland	500.7	Credit Agricole	466.2
6	Crédit Agricole	385.1	Crédit Agricole	465.5	Crédit Agricole	476.4	Royal Bank of Scotland	455.3	Crédit Agricole	452.1	Royal Bank of Scotland	446.9
7	Société Générale	370.9	Goldman Sachs International	426.3	Société Générale	403.0	Société Générale	410.9	Société Générale	366.3	Société Générale	398.4
8	Citigroup Global Markets	254.0	Société Générale	356.5	JP Morgan Securities	325.0	JP Morgan Securities	292.0	Goldman Sachs International	288.6	JP Morgan Securities	328.5
9	UniCredit	248.7	Credit Suisse International	320.2	Banco Santander	289.7	Banco Santander	289.0	Banco Santander	283.6	Banco Santander	285.8
10	JP Morgan Securities	243.0	JP Morgan Securities	276.0	BPCE Group	285.8	UniCredit	245.1	JP Morgan Securities	280.2	BPCE Group	277.1
11	Fortis Bank	234.5	UniCredit	245.5	UniCredit	235.3	BPCE Group	244.1	BPCE Group	233.6	Goldman Sachs International	272.0
12	Banco Santander	229.2	Banco Santander	242.3	Lloyds Banking Group	232.5	ING Bank	226.5	Credit Suisse International	232.6	Lloyds Banking Group	232.9
13	ING Bank	221.0	Merrill Lynch International	232.9	Dexia	222.9	Goldman Sachs International	210.9	Merrill Lynch International	213.3	Credit Suisse International	215.7
14	Goldman Sachs International	198.8	ING Bank	218.1	Commerzbank	221.4	Lloyds Banking Group	207.4	Lloyds Banking Group	212.1	Unicredit	215.4
15	Dexia	197.0	Dexia	204.5	Citigroup Global Markets	211.8	Commerzbank	194.6	Nordea Bank	206.9	Citigroup Global Markets	189.2
16	Danske Bank	186.8	Citigroup Global Markets	204.1	ING Bank	198.6	Dexia	188.3	ING Bank	200.1	ING Bank	179.4
17	Merrill Lynch International	185.5	Groupe Caisse d'Epargne	171.7	Goldman Sachs International	190.1	Credit Suisse International	186.1	Unicredit	195.7	Morgan Stanley International	172.1
18	Morgan Stanley International	176.8	Commerzbank	137.7	Credit Suisse International	180.6	Merrill Lynch International	170.5	Citigroup Global Markets	164.7	Nordea	170.5
19	Credit Suisse International	175.6	Intesa Sanpaolo	136.4	Intesa Sanpaolo	157.2	UBS Limited	159.4	UBS	164.1	Bank of New York Mellon	168.9
20	Groupe Caisse d'Epargne	171.1	Groupe Banques Populaires	128.6	Nordea Bank	144.8	Nordea Bank	147.5	Commerzbank	159.6	Commerzbank	166.4
21	HBOS	164.6	HBOS	126.8	Credit Mutuel	142.4	Morgan Stanley International	142.4	Morgan Stanley International	156.0	Merrill Lynch International	160.5
22	Dresdner Bank	160.4	Morgan Stanley International	125.2	BBVA	136.3	Bank of New York Mellon	138.6	Danske Bank	147.6	Nomura International	159.2
23	Commerzbank	152.2	UBS Limited	124.6	Merrill Lynch International	133.9	Rabobank	137.4	Rabobank	136.1	Rabobank	155.9
24	LBBW	135.5	Credit Mutuel	123.8	LBBW	131.9	Intesa Sanpaolo	137.1	Bank of New York Mellon	135.0	Danske Bank	138.6
25	DZ Bank	128.3	DZ Bank	119.0	Morgan Stanley International	130.6	Citigroup Global Markets	135.9	Dexia	133.9	BBVA	136.1
26	Intesa Sanpaolo	124.3	LBBW	117.0	DZ Bank	125.2	BBVA	122.7	BBVA	131.2	Intesa SanPaolo	135.8
27	Credit Mutuel	123.8	Dresdner Bank	115.8	Rabobank	116.7	Danske Bank A/S	119.3	Nomura International	125.6	Dexia	127.8
28	Rabobank	113.8	BBVA	114.2	Nomura International	113.1	Credit Mutuel	119.1	Standard Chartered	125.2	Credit Mutuel	125.9
29	Groupe Banques Populaires	113.8	Nordea Bank	108.1	UBS Limited	111.8	Nomura International	116.9	LBBW	110.8	LBBW	117.1
30	Lehman Brothers International	113.1	Rabobank	101.7			LBBW	107.6	Intesa Sanpaolo	110.6	Standard Chartered	116.7
31	BBVA	112.1					DZ Bank	101.5	DZ Bank	101.7	UBS Limited	108.0
32	Bayerische Landesbank	106.4									DZ Bank	107.1

Table A4: EA-SIBs and bank scores

	2007		2008		2009		2010		2011		2012	
Rank	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score	Name	SI Score
1	Deutsche Bank	1025.2	BNP Paribas	1212.5	BNP Paribas	1165.7	BNP Paribas	1108.9	Deutsche Bank	1044.6	Deutsche Bank	1035.5
2	BNP Paribas	960.8	Deutsche Bank	988.5	Deutsche Bank	799.6	Deutsche Bank	966.1	BNP Paribas	1029.9	BNP Paribas	960.9
3	Société Générale	569.1	Crédit Agricole	719.5	Crédit Agricole	704.8	Crédit Agricole	725.8	Crédit Agricole	728.5	Crédit Agricole	733.7
4	Crédit Agricole	562.5	Société Générale	569.3	Société Générale	608.8	Société Générale	645.9	Société Générale	630.5	Société Générale	632.1
5	UniCredit	364.0	UniCredit	371.7	Banco Santander	417.9	Banco Santander	437.0	Banco Santander	450.9	Banco Santander	445.4
6	ABN AMRO	351.6	Banco Santander	366.9	BPCE Group	412.2	BPCE Group	378.7	BPCE Group	387.9	BPCE Group	433.6
7	Banco Santander	341.8	ING Bank	325.6	UniCredit	346.1	UniCredit	340.6	Unicredit	353.9	Unicredit	350.1
8	Fortis Bank	327.6	Dexia	306.3	Commerzbank	325.8	ING Bank	310.9	ING Bank NV	344.6	ING Bank	293.7
9	ING Bank	310.3	ABN AMRO	269.3	Dexia	321.0	Commerzbank	297.9	Merrill Lynch International	287.2	Merrill Lynch International	274.0
10	Dexia	291.6	Groupe Caisse d'Epargne	254.4	ING Bank	285.2	Dexia	248.7	Commerzbank	245.8	Commerzbank	264.0
11	Groupe Caisse d'Epargne	259.7	Merrill Lynch International	249.9	Intesa Sanpaolo	231.8	Merrill Lynch International	241.6	Rabobank	227.5	Rabobank	260.1
12	Dresdner Bank	243.1	Commerzbank	207.9	Merrill Lynch International	211.8	Rabobank	212.9	Dexia	220.6	Bank of New York Mellon	216.8
13	Commerzbank	221.1	Intesa Sanpaolo	206.9	Credit Mutuel	199.9	Intesa Sanpaolo	197.2	BBVA	208.9	BBVA	211.9
14	Merrill Lynch International	215.6	Groupe Banques Populaires	192.9	LBBW	196.1	Bank of New York Mellon	191.0	Intesa SanPaolo	197.2	Intesa SanPaolo	211.8
15	LBBW	200.7	Credit Mutuel	183.1	BBVA	195.7	BBVA	183.1	Bank of New York Mellon	190.4	Dexia	209.1
16	DZ Bank	185.8	DZ Bank	181.9	DZ Bank	183.6	Credit Mutuel	174.8	Landesbank BW	179.3	HSBC France	200.9
17	Intesa Sanpaolo	181.3	Dresdner Bank	180.7	Rabobank	165.5	LBBW	166.8	Credit Mutuel	170.3	Credit Mutuel	194.9
18	Credit Mutuel	172.4	LBBW	179.5	HSBC France	163.2	DZ Bank	158.9	ABN AMRO Bank NV	165.6	LBBW	188.9
19	Groupe Banques Populaires	172.2	BBVA	167.9	Bank of New York Mellon	158.9	HSBC France	158.1	DZ Bank	163.7	ABN AMRO Bank	174.4
20	BBVA	160.7	HSBC France	154.3	Bayerische Landesbank	133.1	Hypo Real Estate	129.5	Nordea Bank Finalnd Plc	160.4	DZ Bank	173.3
21	Rabobank	160.1	Rabobank	148.5	Hypo Real Estate	123.0	Bayerische Landesbank	122.6	HSBC France	155.8	Nordea Bank Finland	146.3
22	Bayerische Landesbank	151.6	Bayerische Landesbank	144.1	KBC Bank	111.7	Nordea Bank Finland	118.7	Bayerische Landesbank	138.3	Bayerische Landesbank	124.5
23	HSBC France	137.7	Portigon AG	125.9	NordLB	105.2	KBC Bank	115.4			Banco de Sabadell	114.0
24	Helaba	136.6	Hypo Real Estate	125.5	Portigon AG	102.5	ABN AMRO Group	103.0			La Caixa	111.2
25	Portigon AG	130.0	KBC Bank	120.8	ABN Amro	101.6						
26	Hypo Real Estate	128.2	Helaba	116.6								
27	KBC Bank	127.7										

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