3. IDENTIFICATION OF DOMESTIC SYSTEMICALLY IMPORTANT BANKS IN LUXEMBOURG: THE ROLE OF BANKS' BUSINESS MODELS

By Gaston GIORDANA[44]

ABSTRACT

This study proposes, following the BCBS's principles, an indicator-based methodology for the assessment of the systemic importance of banks in Luxembourg and a bucketing approach for assigning each bank into a bucket of systemic importance. The main contribution of the paper is the method proposed for calculating the relative weights. We argue that the relative weights should be determined through data-driven methods, rather than based on normative precepts, and account for the characteristics of the banking business model most widely present in the domestic sector. On the basis of a classification of banks by their business model resulting from a statistical cluster analysis, the proposed methodology is applied using data for the population of Luxembourg's active banks in 2012q1.

I. INTRODUCTION

The Basel Committee on Banking Supervision (BCBS) has recently issued a document proposing a framework for dealing with domestic systemically important banks (D-SIBs) (BCBS 2012). Taking the global systemically important banks (G-SIBs) policy as a starting point, the D-SIB framework complements it by focusing on the consequences on the domestic economy of the failure of those systemically important banks (SIBs) which are not global.

The rationale for implementing policy measures to cope with SIBs is similar whether these are considered global or domestic. The failure of banks that are important at the domestic level is expected to generate similar externalities as the global ones but locally. Indeed, distress or failures of D-SIBs would certainly have a sizable impact on the local financial sector and the real economy. Moreover, they can generate cross-border externalities, even if the effects are not global in nature (see paragraph 3 in BCBS, 2012). Finally, moral hazard related externalities can be considerable domestically.

Despite sharing the same motivation, the frameworks differ fundamentally in their approach. While the BCBS put forward a prescriptive approach for G-SIBs, the D-SIBs framework is characterized by an ample degree of national discretion. This would allow national authorities to accommodate the structural characteristics of their financial sector. However, the BCBS is of the view that the D-SIB framework should contribute to the reduction of cross-border externalities induced by spillovers at the bilateral or regional levels (see paragraph 5 in BCBS, 2012). Consequently, the D-SIBs framework "*should establish a minimum set of principles, which ensures that it is complementary with the G-SIB framework, addresses adequately cross-border externalities and promotes a level-playing field*" (see paragraph 5 in BCBS, 2012).

The BCBS has developed 12 principles that can be classified into two groups. The first group addresses the assessment methodology for D-SIBs while the second group deals with Higher Loss Absorbency (HLA) requirements. In this paper we focus on the assessment methodology. The objective of the present study is to propose, following the BCBS's principles, an indicator-based methodology for the assessment of the systemic importance of banks in Luxembourg and a bucketing approach for assigning each bank into a bucket of systemic importance.

44 Financial Stability Department, Banque centrale du Luxembourg

The assessment methodology consists of an index resulting from the aggregation of a set of bank-level indicators reflecting the several dimensions of systemic importance. The authorities determine the set of indicators and the relative weights required for aggregating them into one index. Theoretical and normative concepts would guide the selection of indicators which should provide an approximative measure of the systemic-importance-related externalities that a bank potentially generates. Given that the theoretical foundations are well established, the set of indicators are expected to be similar across different jurisdictions even if their banking sectors fundamentally differ. The contribution of this paper is to propose a method for calculating the relative weights. We argue that the relative weights should be determined through data-driven methods and account for the characteristics of the banking business model most widely present in the domestic sector rather than being based on normative precepts.

The necessity of accounting for the diversity of business models has been raised in several studies on the European banking sector. For instance, Altunbas, Manganelli and Marques-Ibanez (2011) analyze potential differences in banks' risk across business models, Giordana and Schumacher (2012) study the role of banks' specialization in leverage dynamics, while Ayadi, Arbak and De Groen (2011) evaluate changes in the business lines induced by the 2007-2008 financial crisis, Ayadi, Arbak and De Groen (2012) propose a deeper analysis of the different business models and suggest regulatory changes. The empirical literature on the transmission of monetary policy in the Euro area, namely on the *bank lending channel*, also relies on banks' characteristics for identifying such a channel (e.g. Ehrmann, Gambacorta, Martínez-Pagés, Sevestre and Worms, 2002; Altunbas, Gambacorta and Marques-Ibanez, 2009; Altunbas, Gambacorta and Marques-Ibanez, 2010; Giordana and Schumacher, 2013). Among the statistical techniques applied, some studies made use of cluster analysis tools for the identification of different banks' business models (e.g. Ayadi et al., 2011; Ayadi et al., 2012; Ferstl and Seres, 2012).

We start off presenting the different components of the methodology in Section II. In particular, we introduce the dimensions of systemic importance and the corresponding indicators in Sub-section II-1.1. While the dimensions of systemic importance that should be considered are clearly suggested in the BCBS principles, the indicators to be included within each dimension as well as the relative weights assigned to them are to be determined by the local authorities. We provide a detailed description of the method employed for the calculation of the relative weights attached to each indicator in Sub-section II-1.2.

In particular, we resort to cluster analysis techniques to identify the alternative business models in Luxembourg's banking sector. The clustering algorithm used (i.e. *k-means*) as well as the procedures implemented for validating the result are presented in sub-section II-1.2.1. On the basis of the outcome of the cluster analysis we propose an estimation of the relative weights of indicators that would be representative of the predominant business model in the banking sector. Finally, in sub-section II-1.3 the method for distributing banks in groups of systemic importance (the bucketing approach) is outlined.

The remainder of the paper is organized as follows. In Section III we apply the suggested methodology to identify a list of D-SIBs in Luxembourg and analyze the drivers by using data for first quarter 2012. The results are compared with the outcome of alternative measures of systemic importance. We conclude that, given the set of indicators used for the assessment of systemic importance, the relative weights accounting for the predominant business line tend to convey limited additional information. Finally, section IV discusses the way forward.

II. THE ASSESSMENT METHODOLOGY

Given that models for the measurement of banks' systemic importance are at an early stage of development, the indicator-based measurement approach is seen to be more robust than model-based ones

(par. 12 in BCBS, 2011).[45] In addition, the complexity of model-based methodologies and the level of information that their implementation requires impedes individual institutions to assess their systemic importance and thus constraint the incentives introduced by policies (Drehmann and Tarashev, 2011b).

The BCBS's method for the identification of G-SIBs consists in the aggregation of a selection of indicators which *"are chosen to reflect the different aspects of what generates negative externalities and makes a bank critical for the stability of the financial system"* (par. 12 in BCBS, 2011). The principles proposed by the BCBS for guiding the D-SIB framework suggest the use of a similar methodology. More specifically, the D-SIB framework principles call for an assessment of the systemic importance of domestic banks (Principle 1) based on bank-specific indicators (Principle 5) which reflect the potential impact of a bank's failure (Principle 2) on the domestic economy (Principle 3). The bank-specific indicators are aggregated into an index of systemic importance which allows ordering domestic banks and then determining the systemically important ones from a domestic perspective. The HLA requirement imposed on D-SIBs will also be partially determined by the degree of systemic importance of such banks (Principle 9).

In general, we adopt a similar methodology as the one prescribed by the BCBS for the identification of G-SIBs (see paragraphs 15 to 17 in BCBS, 2011). However, we make use of a different scheme for setting the relative weights of indicators.

1.1 The dimensions and indicators of systemic importance

The systemic importance of a financial institution is a multidimensional notion. In particular, a bank can be designated as systemically important because of: (i) its relative size, (ii) its complexity -which makes resolvability a hardship-, (iii) its position as an important vector of contagion, and/or (iv) the difficulties to replace the services it provides which make it pivotal for the functioning of the financial system.

The size, interconnectedness and complexity of a bank contributes to a moral hazard problem. Indeed, institutions might be considered "too big to fail" or "too complex to fail" because their failure or resolvability could generate unpredictable negative consequences for the rest of the financial system and the broader economy of a country or region (i.e. negative externalities, for example through interconnectedness). Thereby, these institutions benefit from an implicit public guarantee which might encourage them to engage in more risky activities. Moreover, market participants discount this implicit guarantee and reduce the funding cost of systemic banks exacerbating the situation. The substitutability dimension of systemic importance addresses the significance of an institution as a provider of services. Indeed, the failure of such a bank can leave the financial system without supply of key services. This issue is close to the scope of competition policy.

The multidimensional nature of systemic importance should be reflected in the measurement methodology. Thus, several bank-level indicators related to the different dimensions of systemic importance must be aggregated into a single index. Hence, the BCBS principles recommend that the indicators must reflect the impact of banking distress on the domestic economy and that they should reflect the size, the level of connectivity, the potential substitutability and the degree of complexity (see Principle

45 Among them one can find the CoVaR (Adrian and Brunnermeier, 2011), the Marginal Expected Shortfall (e.g. Acharya, 2009; Acharya, Brownlees, Engle, Farazmand and Richardson, 2010), measures using the Shapley Value (e.g. Tarashev, Borio and Tsatsaronis, 2009; Drehmann and Tarashev, 2011a), methods based on network models (e.g. Chan-Lau, 2010) and others using conditional probabilities (e.g. Xisong and Nadal De Simone, 2012)

5). The dimensions are similar to the ones required in the G-SIB framework although the set of indicators retained here differs (for comparison see Table 1 in BCBS, 2011).[46]

Table 1 below summarizes the definitions of the selected indicators. While the indicators in the Size dimension are completely different from the ones used in the G-SIB methodology, those included in the other dimensions partially match them. In particular, the indicators from the cross-jurisdictional activities and complexity dimensions in the G-SIB method prescribed by the BCBS, have been merged and designated as the set of indicators for the *complexity* dimension in D-SIB methodology. While it might be striking that almost all the bank-level indicators considered in the G-SIB measurement are also included for the domestic assessment of systemic importance of banks, such a choice is fully justified by the particularities of the Luxembourg banking sector. On one hand, the financial sector represents a big share of the domestic GDP although these activities are mainly internationally oriented. This justifies the inclusion of indicators that signal global systemic importance. On the other hand, the part of the broad financial sector that serves the local real sector is relatively small and concentrated. Consequently, the identification of domestically systemic banks necessitates the inclusion of locally oriented indicators.

Table 1:

Individual indicators definitions

CATEGORY	INDICATOR	DEFINITION	WEIGHT
Size	Total exposure over GDP	It is intended to measure the relative size of the bank in terms of the domestic product. **Definition:** total assets plus given loan commitments, financial guarantees and other commitments divided by GDP (seasonally and working days adjusted).	0.0679
	Domestic total assets	It is intended to measure the footprint of the bank in the domestic economy independently of the specialization of the bank. **Definition:** Total assets with counterparts in Luxembourg.	0.0488
	Employment	It appraises the weight of the bank to the domestic financial-related services labor market. **Definition:** Total number of employees.	0.1332
Connectivity	Intra-financial system assets (IFSA)	Intra-financial activity indicators (assets and liabilities) measure the exposure to contagion of distress in the financial system without distinction between local shocks and those coming from abroad. **Definition:** Similar to the G-SIB framework, it is calculated as the sum of the lending to financial institutions (including un-drawn committed lines),the holdings of securities issued by other financial institutions, net mark to market reverse repurchase agreements, net mark to market securities lending to financial institutions, and net mark to market Over-the-Counter derivatives with financial institutions. **Assumptions:** it is assumed that all the derivatives related transactions are made with financial institutions.	0.0444
	Intra-financial system liabilities (IFSL)	**Definition:** Similar to the G-SIB framework, it is calculated as the sum of the deposits by financial institutions, securities issued by the bank that are owned by other financial institutions, net mark to market repurchase agreements, net mark to market securities borrowing from financial institutions, and net mark to market OTC derivatives with financial institutions. **Assumptions:** (i) it is assumed that all the derivatives related transactions are made with financial institutions and, (ii) that all issued debt securities are held by financial institutions.	0.0165
	Wholesale funding ratio	**Definition:** Similar to the G-SIB framework, it is calculated by dividing (total liabilities less retail funding) by total liabilities. Retail funding is defined as the sum of retail deposits.	0.1020
	Network centrality (Closeness)	It measures the importance of the bank within the domestic interbank network. **Definition:** The closeness of a node is defined as the inverse of the farawayness; the farawayness is the sum of the distances of a node to all other nodes. For details see Box 4.1 in BCL Financial Stability Review 2012 (Buisson 2012)	0.0871

46 An exception is the inter-jurisdictional activities dimension in the G-SIB methodology which is not explicitly included. However, it is suggested that the indicators therein might be included within the complexity dimension in the D-SIB framework.

CATEGORY	INDICATOR	DEFINITION	WEIGHT
Substitutability	Assets under custody	**Definition:** Similar to the G-SIB framework, it is defined as the value of assets that a bank holds as a custodian.	0.0653
	Loans to the domestic non-financial sector	It accounts for the role played by the institution in the provision of funding to the real economy. **Definition:** total loans granted to non-financial sector by counterpart (i.e NFC, retail, public sector). The set includes three indicators.	NFC: 0.0229; Retail: 0.0250; Public: 0.0059.
	Real estate loans	It approximates the market share regarding real-estate loans newly granted and thereby the part taken by the institution in feeding a potential price bubble in the real sector. **Definition:** amount of new loans for real-estate in Luxembourg divided by the sum, over the last 5 quarters, of new loans for real-estate in Luxembourg (by counterpart: Households, promoters, and local governments).	Hous.: 0.0051; Prom.: 0.0041; Loc.Gov.: 0.0020.
	Liabilities from domestic non-financial sector	It approximates the part of the financial services supplied to the non-financial sector. **Definition:** total liabilities from the non-financial sector by counterpart (i.e NFC, households, public sector). Then, the set includes three indicators.	NFC: 0.0347; Retail: 0.0472; Public: 0.0045.
	Spatial coverage	It is intended to estimate the geographical coverage of the institution in the Luxembourgish territory. **Definition:** Number of agencies.	0.0332
Complexity	Over-the-Counter (OTC) derivatives notional value	The focus is on the amount of OTC derivatives that are not cleared through a central counterpart. **Definition:** Similar to the G-SIB framework, it is calculated as the outstanding notional amount of OTC derivatives. **Assumption:** any derivative transaction is cleared through a central counterpart.	0.0496
	Level 3 assets	Assets whose fair value cannot be determined using observable measures, such as market prices or models (BCBS 2011). **Definition:** Similar to the G-SIB framework, it is calculated as the amount of total assets minus the total value of marketable securities (i.e. those with an ISIN code in the Security-by-Security reporting to the BCL). **Assumptions:** All assets but Level 1 and 2 as defined in the LCR rules.	0.0104
	Held for trading and available for sale value (TASV)	**Definition:** Similar to the G-SIB framework, it is calculated as the total value of the bank's holding of securities in the trading book and available for sale category.	0.0493
	Cross-jurisdictional claims	"Total *foreign claims in the terminology of the BIS statistics is the sum of two components (both measured on an ultimate risk basis): (i) international claims, which are either cross-border claims (from an office in one country on a borrower in another country) or local claims in foreign currency (from the local office of the bank on borrowers in that location in a currency other than the one of the location); and (ii) local claims in local currency (similar to the other local claims but in the currency of that location). Claims include deposits and balances placed with other banks, loans and advances to banks and non-banks, and holdings of securities and participations."* (BCBS 2011) **Definition:** total foreign assets plus total local assets denominated in foreign currency. **Assumption:** the statistical table s2.5 is not consolidated. Though, we have included data from foreign branches. The data includes intra-group claims.	0.0932
	Cross-jurisdictional liabilities	The indicator includes all liabilities to nonresidents of the home country and it ideally should net out intra-office liabilities (to match the treatment in the cross-jurisdictional asset indicator). **Definition:** total foreign liabilities plus total local liabilities denominated in foreign currency. **Assumption:** the statistical table S2.5 is not consolidated. Though, we have included data from foreign branches. The intra-group activities are not netted out.	0.0475

Each of the indicators described in the previous subsection are normalized by the total of the sample. This transformation allows aggregating the indicators by setting them on a common scale and limiting the influence of outliers by bounding them to the interval [0,1]. However, some of the indicators considered are already defined in this interval (e.g. wholesale ratio, real-estate loans). Nevertheless, the transformation is still applied because it brings the transformed indicator to signal the relative importance of each bank in the sample. The G-SIB methodology prescribed by the BCBS employs this transformation for all the indicators except for the wholesale ratio.[47]

Table 3 in the appendix provides descriptive statistics of the untransformed indicators in the first quarter 2012.

47 The wholesale ratio is normalized by the sample average in the BCBS methodology. While they acknowledge that such a transformation is arbitrary, they argue that it renders the score in units that are comparable to the other indicators (see paragraph 34 and footnote 12 in BCBS, 2011).

1.2 The relative weights of indicators

The choice of vector of weights which would permit the aggregation of several indicators into one multidimensional index is far from being obvious. In what follows we discuss alternative ways to set the vector of relative weights and we provide a detailed description of the weighting scheme that we found to be the most adapted to the case of Luxembourg.

On the one end, the relative weights can be set following normative precepts in a rather ad-hoc manner which reflect the preferences of the regulator regarding the relative importance of indicators. One possibility would be to assign the same weight to every indicator in the index (i.e. equal weighting scheme). The equal weighting scheme is appealing because of its simplicity. However, even if they are equally set, the weights are not neutral in terms of the incentives introduced by the regulation. On the other end, the vector of relative weights can be set using data driven weighting schemes, meaning that the weights would depend on the characteristics of the statistical distribution of the indicators (for the population or a sample of banks). The motivation for using data driven weighting schemes relates to the fact that such weights convey information about predominant banks' business models and the degree of specialization in the banking sector. It is valuable that the assessment methodology integrates this information given that the final objective of the D-SIB regulation is not to alter practices but to make banks internalize the externalities generated by their SIB condition.

In the assessment methodology proposed in this study we make use of a particular vector of relative weights which differs from those of an equal weighting scheme. The construction of our vector of relative weights minimizes the employment of normative precepts. Rather, it is based on information contained in the dataset. The aim of such a weighting scheme is to grant higher weights to indicators heavily present in bank business models that count significantly forward the domestic real sector while avoiding to disregard the importance of banks that are less domestically oriented. In addition to the arguments provided in the introduction to this paper, the empirical rationale for this approach lies on several features of Luxembourg's financial system. These features concern the diversity of financial services provided by banks, the degree of specialization of some banks and the importance of the financial services sector for the economy while the part of those services that serves the local real sector is relatively small and concentrated.

We advocate that relative weights should tend to reflect the banks' business line which is predominant. Thus, the calculation of relative weights is done in two steps. First, banks are classified into different business specializations using cluster analysis techniques. Second, a vector of weights is calculated for each dimension of systemic importance as the ratio between the indicator total, across the banks within the concerned bank type, and the sum of all indicators totals in the corresponding dimension. Note that we impose the same weight for each one of the four dimensions (i.e. 0.25). The following subsections describe in detail the classification methodology.

1.2.1 The classification methodology

In order to classify banks by their business model we perform a cluster analysis. Cluster analysis allows us to group banks based only on information found in the data. The goal is that the banks within a group are similar to one another and different from the banks in the other groups. There are several clustering techniques available in well known statistical programs like Stata. In our study we make use

of a "K-means" clustering which is a partitional[48] technique aimed at finding a user-specified number of clusters (K) represented by their centroids, i.e. their means.[49]

It is worth noting that cluster analysis is not an exact science and, thereby, the results tend to depend strongly on the analyst's choices. In order to obtain results as consistent as possible we implement an algorithm which includes internal and external validation procedures.[50] The internal validation tools we use are the "Calinski-Harabasz pseudo F-statistic" (F_{CH}) and the *"Silhouette"* indicator.

The F_{CH} is defined as follows:

$$F_{CH} = \frac{\left(\frac{R^2}{k-1}\right)}{\left(\frac{1-R^2}{N-k}\right)}$$

where N is the total number of data points, k is the number of clusters and R^2=(SST-SSE)/SST. SST is the total sum of squared distances to the overall mean and SSE is the sum of squared distances of the data points to their own class means. The higher the "Calinski-Harabasz pseudo F-statistic" the better, as it would mean that on average points are closer to their class mean than to the overall mean.

The silhouette method combines measures of cohesion and separation of points. The cohesion measures the proximity between points within the same class. Then, if we consider the squared distance as a proximity measure (which is in fact a dissimilarity measure), the SSE defined above would be the cohesion. In such a case, the lower the SSE the better in terms of cohesion. The separation refers to the proximity between points of different classes. For example, it can be calculated as the sum of the squared distances between a point and the mean of the other classes. The higher the separation of points the better, as this would mean that clusters are clearly distinguishable.

The silhouette coefficient is given by:

$$s_i = \frac{\left(b_i - a_i\right)}{\max(a_i, b_i)}$$

where a_i is the average distance of bank *i* to all other banks in its cluster, b_i is the minimum separation value with respect to all clusters. In order to obtain b_i, first, one has to calculate the average distance to all the banks in clusters to which bank *i* does not pertain. Then, one has to take the minimum value with respect to all clusters. The value of the silhouette coefficient can vary between -1 and 1. The higher the silhouette the better as it would mean that on average banks are closer to the banks in their class than to the banks in the other classes.

48 While a "partitional clustering is simply a division of the set of data objects into non-overlapping subsets (clusters) such that each data object is in exactly one subset", a hierarchical clustering "is a set of nested clusters that are organized as a tree" (page 492 in Tan, Steinbach and Kumar, 2006).

49 The centroids can be represented by other centrality indicators like the median.

50 The internal validation consists in evaluating the goodness of the clustering structure without using more information than the one contained in the dataset. By contrast, the external validation compares the outcome of the classification algorithm with some external structure.

The first step of the classification procedure consists of determining the set of variables on which the clustering algorithm would run. We focus on balance sheet characteristics rather than taking variables from the profit-and-loss account as a way to minimize the influence of market conditions and other factors which are out of banks' direct control (for a similar approach see Ayadi et al., 2012). The choice of variables is then made on the basis of the different streams of the literature which make use of balance sheet characteristics to approximate banks' business line (e.g. Altunbas et al., 2009; Athanasoglou, Brissimis and Delis, 2008; Giordana and Schumacher, 2013) as well as on the specific objective of our clustering exercise. In particular, the aim is to differentiate between the banks oriented toward the domestic real sector and banks with other business models. The vector of balance sheet ratios seeks to characterize the funding and investment behavior of banks. In particular, we consider the ratios of local assets, of loans to retail counterparts, of loans to non-financial counterparts, of cross-jurisdictional assets over total assets. On the liability side, we compare the ratios over total assets of deposits from non-financial corporates and of cross-jurisdictional liabilities.

Given a set of variables characterizing the banks, the clustering algorithm goes as follows. First, the number of clusters are determined. A common rule of thumb for setting the number of clusters indicates that the maximum number of groups should not exceed eight.[51] Accordingly, with the purpose of determining the number of clusters we first classify banks into three to eight groups using the K-means algorithm. As this classification algorithm is sensitive to the initial values of the clusters' centroids, we have iterated the algorithm, given the number of groups, one hundred times using a different random draw of initial values each time. This makes a total of 600 hundred classifications. Second, in order to sort the alternatives out we choose those outcomes that have the highest F_{CH} statistic. Then, we select the one that has the lowest number of negative Silhouette values among them. As external validation we check if clusters are also distinguishable by other bank level indicators[52] than those used in the classification algorithm. Then, we run multi-comparison tests with the aim of evaluating if the typology results in significant differences in the average of these indicators.[53] Finally, if the result of the external validation exercise is satisfactory and there are some banks left with negative silhouette values, we relocate them into alternative clusters depending on our separation measure.

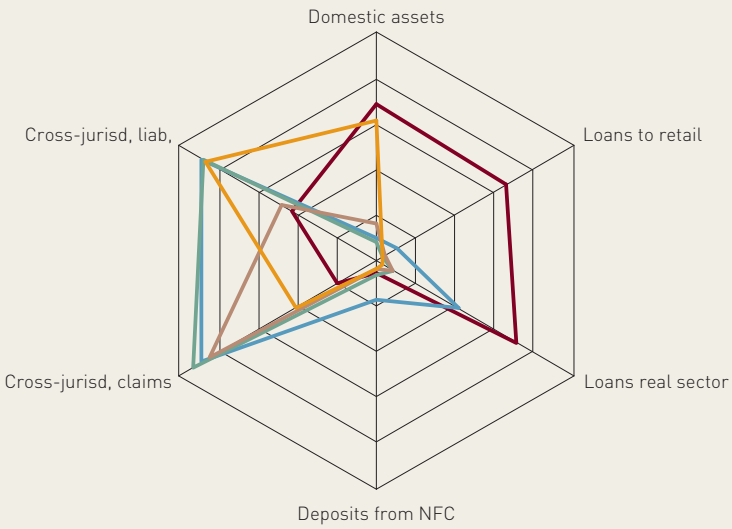
1.2.2 Characterizing the vector of relative weights

The cluster analysis results in a typology with five classes of banks: Savings, Cross-border corporate finance oriented, Cross-border banking oriented, Universal and Custodian. Figure 1 as well as Tables 4 and 5 show descriptive statistics by cluster of banks for several balance-sheet indicators including some of those considered for the assessment of domestic systemic importance.

It can be seen from figure 1 and the tables that the cluster of savings banks shows the highest median ratio of local assets over total assets and a retail oriented business line. The group of banks oriented toward cross-border corporate finance essentially contains subsidiaries and branches of international banking groups specialized in non-financial corporates. The banks in this cluster show elevated median ratios of non-financial corporate assets and liabilities while they manifest the highest mean ratios of cross-jurisdictional activities. Likewise, the cluster of cross-border intra-financial oriented banks occupies the second position in terms of cross-jurisdictional activities but their assets and liabilities are composed of financial sector counterparts.

51 The rule of thumb is given by: $k \approx N/2$ where k is the number of clusters and N the number of observations in the sample.
52 We consider all the indicators listed in Table XX plus the leverage and the liquidity ratios.
53 Given that the number of clusters exceeds two several pairs need to be compared. A simple t-test in such a situation increases the probability of error of type 1. Multi-comparison tests provide an upper bound on the probability that any comparison will be incorrectly found significant.

Figure 1
Comparison of cluster means



Custodian banks group is characterized by high median ratios of local assets which are likely constituted by shares of collective undertakings. The assets are mainly intra-financial (Table 4) and they are very active in the OTC derivatives market (Table 5). While they have a high level of cross-jurisdictional liabilities their wholesale ratio is among the lowest (Table 5).

Even if the cluster of Luxembourg's universal banks does not show any statistically significant differences with the other classes of banks in most of the variables (means comparison), the inspection of figure 1 and the tables highlights some differences. These banks distinguish themselves by the size of their trade book of securities and the ratio of liquid assets. On the liability side their distinctive feature is rather the quite elevated ratio of wholesale funding (Table 5).

The cluster of the cross-border intra-financially oriented banks represents the most generalized business model with 55 banks over the 127 in the sample and total assets averaging up to 8775 million euros. It is followed by the group of universal banks which is composed by 31 banks and the total assets average equals 7283 million euros. In spite of not being the predominant business model we focus on the later group in order to calculate the relative weights for the assessment of the systemic importance because the ratio of domestic assets is higher in this group.[54]

The third column in Table 1, already discussed in the previous sub-section, contains the relative weights assigned to each indicator. As can be seen, the employment indicator receives the highest weight within the size dimension.[55] As regards the connectivity dimension, the indicator of centrality in the domestic interbank network and the wholesale funding ratio receive the highest weights. The indicators with the highest relative weights within the substitutability dimension are: assets-under-custody, loans to and liabilities from domestic retail counterparts, and the spatial coverage indicator (i.e. number of

54 Additionally, in order to provide quantitative evidence for further guiding the choice of the vector of relative weights, we evaluate alternative weighting schemes in terms of the quality of the bucketing approach. The procedure through which the banks are designated as systemically important and then placed into buckets is fundamental. This would allow requiring banks to have a higher loss absorbency capacity commensurate with their degree of systemic importance. The appraisal is based on a specific bucketing rule aimed at generating the limits of the buckets of systemic importance and which was explained in the main text. The results of this appraisal supports our choice of weights and are available under request.

55 Such a weight might raise some concerns from a political point of view. It would tend to discourage systemically relevant banks to increase the number of employees. It can even encourage a reduction in the employment of SIBs. In order to avoid this pervasive effect the indicator might be eliminated from the index. Alternatively, a modification of the parameter related to the elasticity of substitution between indicators can also cope with this drawback.

agencies). In the complexity dimension the highest weight is attached to the cross-jurisdictional claims indicator.

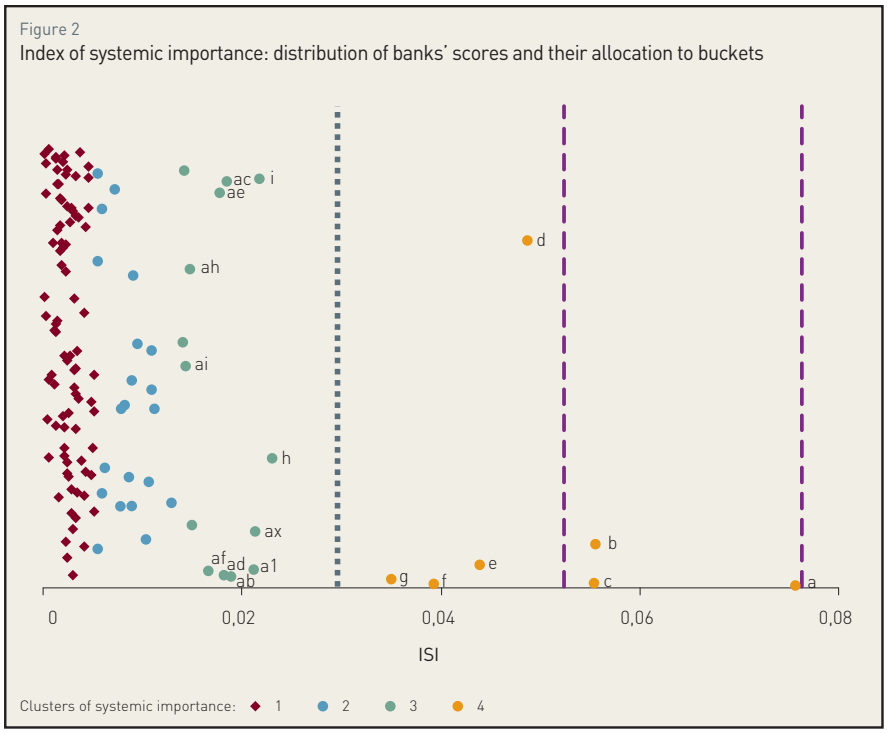
1.3 The bucketing approach

In order to require banks to have a HLA capacity which would be commensurate with their degree of systemic importance, the distribution of the Index of Systemic Importance (ISI) scores must be separated in buckets. The BCBS bucketing methodology for G-SIBs separates banks into equally sized groups. The banks in the first bucket, the widest one, are not required to hold additional loss absorbency capacity. The following, equally sized buckets require increasing levels of HLA. Finally, there is an empty bucket on top with an even higher capital requirement aiming at discouraging banks from further increasing their degree of systemic importance.

On the basis of the G-SIB methodology implemented by the BCBS, we propose the following rule to calculate the buckets' limits. First, we classify the banks into four categories of systemic importance. The category number one is composed by the banks with the lowest ISI and, conversely, the fourth category by banks with the highest scores. The cut-off level (i.e. the minimum ISI score that triggers HLA requirements) is fixed at the maximum score in the third category plus two standard deviations. The width of the buckets is set to three quarters of the cut-off level.

The main advantage of the proposed rule is its transparency. However, the proposed bucketing rule is just one among several alternatives. The limits of the buckets are to some extent determined on an ad-hoc basis and can be modified based on judgment without altering the nature of the methodology.

Figure 2
Index of systemic importance: distribution of banks' scores and their allocation to buckets



III. SYSTEMICALLY IMPORTANT BANKS IN LUXEMBOURG

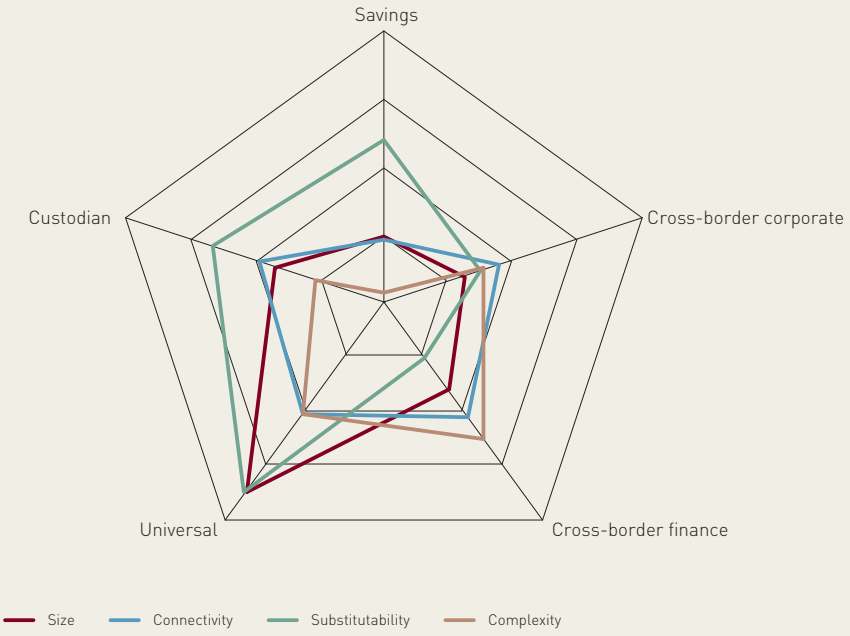
Based on the indicators and relative weights depicted in Table 1, we calculate the index of systemic importance for each active bank in the first quarter of 2012.[56] The result is shown in Figure 2. The score ranges from 0 to 1. The implementation of the bucketing approach described above provides the buckets' limits and separates the banks in four groups. The first three groups, those on the left-hand side of cut-off level (i.e. the blue dashed line in Figure 2), are the non systemically important banks according to the adopted approach. To the contrary,

56 In order to perform the calculations we made use of the user-made Stata module MDEPRIV (Pi Alperin and Van Kerm, 2009).

the fourth group, those banks on the right-hand side of the cut-off level, are the systemically relevant ones and might be subject to HLA requirements. The SIBs are moreover separated in two additional buckets.

1.1 Dimensions of systemic importance and bank types

Figure 3
Index of systemic importance: scores by dimension and bank



We analyze the score obtained in each dimension of systemic importance by the different bank types. Figure 3 shows a radar plot of the scores obtained in each of the four categories of indicators. Some features should be noted. The size dimension is fully dominated by the group of universal banks while the savings banks group has the lowest average score. Likewise, universal banks dominate the substitutability dimension. Custodian and savings banks also rank highly on this dimension while the cross-border banking oriented group shows the lowest score. Regarding the connectivity dimension, savings banks group represents a unique outlier with a rather low score on this dimension which is under the control of the cross-border corporate oriented group of banks. The cross-border banking oriented group clearly prevails in the complexity dimension while saving banks score zero in this dimension.

1.2 A comparison with other indicators

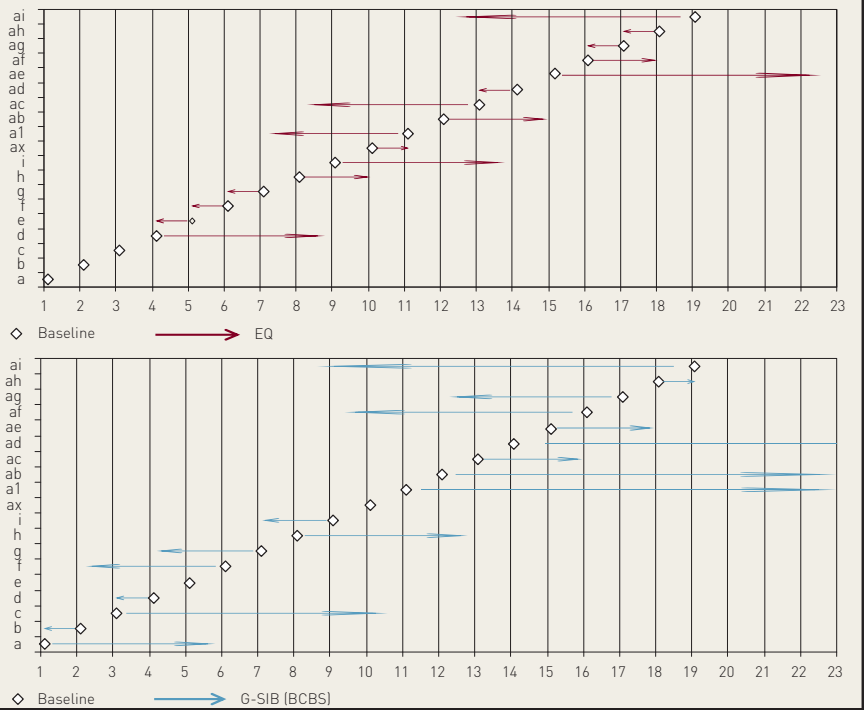
From a practical point of view, it is useful to check whether the ISI of banks are related to other indicators. In a first step, we compare the classification of banks obtained using the methodology presented above with those resulting from two alternative indicator-based methods: (i) against the results obtained using the same set of indicators but an equal weighting scheme, (ii) against the classification of banks resulting from the the G-SIBS methodology which is based on an equal weighting scheme and a set of indicators globally oriented (BCBS, 2011). The first comparison allows us to assess the importance of adjusting the vector of weights to reflect differences in the business line of banks. The second one provides an indication of the role played by the indicators introduced to measure the impact of banks activities on the domestic economy. Finally, in a second set of comparisons we contrast the proposed measure of domestic systemic importance against simple balance sheet indicators.

1.2.1 Alternative measures of systemic importance

In order to evaluate as how the ordering that results from the alternative measures changes, we make use of Figure 4. At the ordinate axis the figure lists the highest ranked banks resulting from the baseline method. The listed banks are those that have entered the top 10 ranking in at least one of the three measures that are considered. The horizontal axis gives the order. The arrows indicate the change in the order of each of these banks. The green arrows start at the order obtained by a bank in the baseline and indicate the change induced by assigning the same weight to every indicator. Then, the red arrows indicate the changes in order triggered by using the G-SIB methodology for the assessment of systemically important banks.

Two issues come out from Figure 4. First, accounting for business lines of banks in the relative weights of indicators does not introduce sensitive changes in the ordering of banks. Indeed, for those banks included among the top ten ranked ones the changes in the order are marginal. Exceptions are bank *a1* which was placed at the eleventh position in the baseline method and is promoted to the seventh place once weights are set equally, and bank *ac* which jumped from the thirteenth place to the eighth one. Second, modifying the considered indicators to include a more globally oriented set radically modifies the top ten ranking of banks.

Figure 4
Alternative measures of systemic importance: impact on the ordering



The analysis leads us to conclude that what matters most for identifying systemic banks whose business models are domestically oriented, is the choice of the set of indicators. A calibration of the weights aimed at reflecting those business lines that are relevant for the domestic economy does not seem to add information which was not already captured by the indicators. Moreover, an important potential drawback of business model based weights relies on the incentives that such a scheme introduces to those banks concerned by additional capital requirements. Indeed, it is likely that those banks would tend to adjust more strongly the most heavily weighted indicators.

1.2.2 Individual bank-level indicators

We analyse the correlation between our measure of the domestic systemic importance of banks and some balance sheet indicators, namely, total assets, and the ratios to total assets of deposits from domestic retail and non-financial corporate counterparts, of total deposits from domestic counterparts,

domestic and foreign interbank deposits, domestic and foreign interbank loans, the off-balance sheet activities ratio, the ratios of short and long-term funding and the leverage ratio[57]. From Table 6 one can see that there is a linear and positive relationship between ISI and total assets. Conversely, while there is no significant relationship between ISI and the deposits from domestic non-financial sector counterparts, a significant linear relationship between ISI and interbank domestic deposits appears. As regards the interbank loans, those with domestic counterparts do not seem to show any relationship but a negative one exist between foreign interbank loans and ISI although not significant statistically speaking. The table shows rather clear relationships between ISI, leverage and the short-term funding ratios.

In addition, we perform a multivariate regression analysis. We regress the ISI score against the balance sheet indicators discussed in the previous paragraph. As can be seen in Table 2 the coefficient of total assets is the highest and is highly significant; a one percent increase in total assets enhances the systemic importance by 0.6 percent. As expected from the correlation analysis the coefficients of deposits from non-financial counterparts are not significantly different from zero. Conversely, indicators of intra-financial activities have the expected sign and are statistically significant. In particular, domestic (respectively foreign) intra-financial loans and deposits are positively (respectively negatively) related to the index of systemic importance. The presumed relationships between ISI, leverage and long-term funding ratios are not supported by the regression analysis. Conversely, the coefficient of the short-term funding ratio is positive and statistically significant.

Table 2:

Index of Systemic Importance and simple indicators: OLS estimation result

VARIABLE	COEFF.	ST. ERRORS
log(Total Assets)	0.622***	(0.0318)
log(OBS)	-0.0203	(0.0113)
log(DepositsRET)	0.0490	(0.0245)
log(DepositsNFC)	0.00260	(0.0120)
log(IFLoansDOM)	0.0503***	(0.0109)
log(IFLoansFOR)	-0.0743***	(0.0166)
log(IFDepositsDOM)	0.0298**	(0.00847)
log(IFDepositsFOR)	0.0257*	(0.0108)
log(LEV)	0.0912	(0.0702)
log(STFund.)	0.0910*	(0.0440)
log(LTFund.)	0.00516	(0.0153)
Cons.	0.916*	(0.371)
N	82	
R-sq	0.902	
Adjusted R-sq	0.887	

*p < 0:1, **p < 0:05, *** p < 0:01

57 The leverage ratio is defined as total assets over equity.

IV. CONCLUSION AND WAY FORWARD

In this paper we propose, following the BCBS principles, an indicator-based methodology for the identification of D-SIBs in Luxembourg. This implies the selection of a set of bank-specific indicators and a vector of relative weights. Additionally, a procedure for separating banks into buckets of systemic importance - a bucketing approach - is also suggested. Finally, we bring up a tentative list of D-SIBs in Luxembourg and we analyze potential drivers of the degree of systemic importance.

The set of bank-level indicators that we consider target the footprint of the banking sector on the real economy and compounds those from the G-SIB methodology. The vector of relative weights, which is applied to the indicator set, tends to assign more importance to indicators that more closely characterize universal banks. The vector of weights is chosen on the basis of the results of an experiment aimed at assessing alternative weighting schemes in terms of two criteria. First, we evaluate the stability of the ordering of banks (in terms of their systemic relevance). Second, the ability of the bucketing rule to separate banks into the distinct buckets of systemic importance is also tested. The details of the experiment are not included in this note but are available upon request. We implemented the methodology using data for almost all active banks in Luxembourg in the first quarter 2012.

This paper is a first step toward the implementation of a D-SIB policy in Luxembourg. There are still several analytical and governance issues that should be treated. First, a deep understanding of the incentives that are introduced by this policy is necessary. For instance, while the geographical coverage is certainly a relevant indicator of the domestic importance of a bank, the regulator might not want that systemic banks give priority to a reduction in the number of agencies in order to manage their degree of systemic importance. Rather, the regulator might prefer that SIBs first tackle their level of complexity. One possibility is that the regulator assigns more weight to the indicators in the complexity dimension or eliminates controversial indicators from the index. However, in the case of Luxembourg, this might impede the assessment methodology to identify as systemically important those banks that are the most relevant for the domestic real sector.

Second, the higher loss absorbency requirements should be specified. This, as the BCBS requires, should be done on the basis of quantitative analyses. With this aim, a study of the cost and benefits of this policy must be developed. Such work requires, on the one hand, linking the level of capitalization of a SIB with its contribution to the probability of occurrence of a systemic event. On the other hand, the long-term economic cost of stronger capital requirements on D-SIBs needs to be estimated.

Finally, all the aspects related to the governance of this policy should be addressed. There are three which are particularly important and may need the development of an specific communication strategy. First, the policy should be transparent. All the details and parameters of the assessment methodology should be public in order to encourage banks to manage their degree of systemic importance. Second, the timing of reassessment and publication of the list of D-SIBs needs to be established. Finally, the timing for revising the assessment methodology and the bucketing approach also needs to be determined. Indeed, the methodology for the measurement of systemic importance should evolve while, a relatively long period during which the method remains immovable is required to ensure some stability and visibility of the incentives in the medium term.

REFERENCES

Acharya, V.V., "A theory of systemic risk and design of prudential bank regulation", *Journal of Financial Stability*, 2009, *5* (3), 224–255.

Acharya, V.V., C. Brownlees, R. Engle, F. Farazmand, and M. Richardson, *Measuring systemic risk*, Wiley Online Library, 2010.

Adrian, T. and M.K. Brunnermeier, "CoVaR," 2011.

Alperin, M. N. Pi and P. Van Kerm, "mdepriv: Synthetic Indicators of Multiple Deprivation, v1.0", Stata program, CEPS/INSTEAD, Esch-Belval, Luxembourg 2009.

Altunbas, Y., L. Gambacorta, and D. Marques-Ibanez, "Bank risk and monetary policy", *Journal of Financial Stability*, 2010, *6* (3), 121–129.

Altunbas, Y., L. Gambacorta, and D. Marques-Ibanez, "Securitisation and the bank lending channel", *European Economic Review*, 2009, *53* (8), 996 – 1009.

Altunbas, Y., S. Manganelli, and D. Marques-Ibanez, "Bank risk during the financial crisis: do business models matter?", *ECB Working Paper Series*, November 2011, *1394*.

Athanasoglou, P.P., S.N. Brissimis, and M.D. Delis, "Bank-specific, industry-specific and macroeconomic determinants of bank profitability", *Journal of International Financial Markets, Institutions and Money*, 2008, *18* (2), 121–136.

Ayadi, R., E. Arbak, and W.P. De Groen, *Business Models in European Banking: A pre-and post-crisis screening*, CEPS Paperbacks, September 2011.

Ayadi, R., E. Arbak, and W.P. De Groen, *Business Models in European Banking: A pre-and post-crisis screening*, CEPS Paperbacks, June 2012.

BCBS, "Global systemically important banks: assessment methodology and the additional loss absorbency requirement", *Rules text*, November 2011.

BCBS, "A framework for dealing with domestic systemically important banks", *Final text*, October 2012.

Buisson, B., "Les canaux interbancaires de contagion au Luxembourg: l'apport des analyses de réseaux", mimeo, Banque centrale du Luxembourg 2012.

Chan-Lau, J., "Balance sheet network analysis of too-connected-to-fail risk in global and domestic banking systems", *IMF Working Paper*, 2010, (10/107).

Drehmann, M. and N. Tarashev, "Measuring the systemic importance of interconnected banks", *BIS Working Paper No. 342*, 2011.

and , "Systemic importance: some simple indicators", *BIS Quarterly Review*, March 2011, p. 13.

Ehrmann, M., L. Gambacorta, J. Martínez-Pagés, P. Sevestre, and A. Worms, "Financial systems and the role of banks in monetary policy transmission in the euro area", *ECB Working Paper No. 105*, 2002.

Ferstl, R. and D. Seres, "Clustering Austrian Banks' Business Models and Peer Groups in the European Banking Sector," Financial Stability Report 24, Oesterreichische Nationalbank December 2012.

Giordana, G. and I. Schumacher, "Bank specialization and leverage dynamics in Europe", mimeo, Banque centrale du Luxembourg February 2012.

Giordana, G. and I. Schumacher, "Bank Liquidity Risk and Monetary Policy: Empirical Evidence on the Impact of Basel III Liquidity Standards", *International Review of Applied Economics*, September 2013, *27* (5) (forthcoming).

Tan, P.-N., M. Steinbach, and V. Kumar, *Introduction to Data Mining*, first ed., New York: Addison-Wesley, 2006.

Tarashev, N., C. Borio, and K. Tsatsaronis, "The systemic importance of financial institutions", *BIS Quarterly Review*, 2009, *75*, 87.

Xisong, J. and F. Nadal De Simone, "An Early-warning and Dynamic Forecasting Framework of Default Probabilities", *Banque centrale du Luxembourg, WP 75*, 2012.

APPENDIX OF TABLES

Table 3:

The untransformed indicators

INDICATORS	MEAN	MIN	P10	P25	P50	P75	P90	MAX
Size								
Total exposure to GDP [a]	0.704	0.000	0.015	0.054	0.199	0.723	1.766	11.233
Domestic assets [b]	1.215e+09	29,317.8	5.054e+06	2.760e+07	1.517e+08	7.065e+08	2.671e+09	2.310e+10
Employment	198.712	0	5	15.5	44	187	567	2,784
Connectivity								
IFSA [b]	5.071e+09	965872	8.698e+07	2.907e+08	1.303e+09	5.570e+09	1.219e+10	8.876e+10
IFSL [b]	3.970e+08	0.000	0.000	0.000	4.577e+06	1.451e+08	9.676e+08	8.072e+09
Wholesale funding [c]	0.926	0.188	0.830	0.918	0.995	1.000	1.000	1.000
Closeness	0.252	0.000	0.000	0.000	0.344	0.382	0.421	0.577
Substitutability								
Assets under custody [b]	8.217e+10	0.000	0.000	3.655e+06	1.418e+09	1.910e+10	8.114e+10	6.250e+12
Loans to NF [b]								
to retail	3.041e+08	0.000	0.000	0.000	6.118e+06	1.230e+08	5.525e+08	9.493e+09
to NFC	5.396e+08	0.000	0.000	0.000	7.945e+06	1.763e+08	2.005e+09	1.367e+10
to public sector	7.227e+07	0.000	0.000	0.000	0.000	1.390	7.631e+07	4.542e+09
Total	9.147e+08	0.000	0.000	1.318e+06	5.955e+07	5.557e+08	2.503e+09	1.439e+10
New loans for real-state [c]								
Households	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.548
Promotors	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.402
Non residential	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.492
Local government	0.008	0.000	0.000	0.000	0.000	0.000	0.000	1.000
Liabilities [b]								
Retail	4.20e+08	0	0	0	0	3.82e+07	2.13e+08	7.34e+08
NFC	2.762e+08	0.000	0.000	269.269	1.250e+07	2.459e+08	7.577e+08	6.583e+09
Public sector	4.723e+07	0.000	0.000	0.000	0.000	2,235.735	2.972e+07	3.354e+09
Nr. of agencies	1.894	0.000	0.000	0.000	0.000	0.000	1.000	74.000
Complexity								
Complex OTC [b]	6.177e+09	0.000	0.000	0.000	3.772e+08	4.886e+09	2.380e+10	1.057e+11
Level 3 assets [b]	1.421e+07	0.000	0.000	0.000	0.000	0.000	785023.64	3.851e+08
Held for trading & available for sale assets [b]	6.876e+08	0.000	0.000	120.665	2.727e+07	4.177e+08	1.523e+09	1.881e+10
Cross-jurisdictional claims [b]	4.834e+09	119478	6.588e+07	2.318e+08	1.323e+09	5.065e+09	1.289e+10	8.886e+10
Cross-jurisdictional liabilities [b]	4.684e+09	1.041e+06	6.942e+07	2.618e+08	1.151e+09	5.079e+09	1.251e+10	8.874e+10

[a] *Takes values in [0, +∞).*
[b] *In euros.*
[c] *Takes values in [0,1]*

Table 4:

Balance-sheet indicators by bank type

CLUSTERS		TOTAL ASSETS	LIQ. ASS.	LOCAL ASS.	IFSA	CUSTODIAN	LOANS TO NF COUNTERPARTS				LEVEL 3	TBAS	CROSS-JUR.
							TOTAL	RETAIL	NFC	PUBLIC	ASSETS	VALUE	CLAIMS
	N	7	7	7	7	7	7	7	7	7	7	7	7
Saving banks	Mean	1624.811	0.045	0.681	0.294	0.057	0.706	0.660	0.042	0.004	0.000	0.041	0.202
	Median	593.773	0.000	0.805	0.315	0.005	0.678	0.638	0.017	0.000	0.000	0.000	0.195
	St.D.	2491.351	0.061	0.249	0.092	0.090	0.089	0.123	0.063	0.010	0.000	0.052	0.086
	N	18	18	18	18	18	18	18	18	18	18	18	18
Cross-border corporate	Mean	6485.508	0.066	0.103	0.563	1.202	0.423	0.096	0.323	0.007	0.001	0.051	0.942
	Median	1888.191	0.002	0.071	0.577	0.608	0.394	0.037	0.331	0.000	0.000	0.006	0.939
	St.D.	1.0e+04	0.112	0.078	0.117	1.352	0.142	0.137	0.212	0.021	0.003	0.078	0.073
	N	55	55	55	55	55	55	55	55	55	55	55	55
Cross-border finance	Mean	8774.726	0.162	0.084	0.910	14.825	0.076	0.029	0.040	0.008	0.001	0.089	0.928
	Median	3233.907	0.059	0.050	0.929	0.531	0.059	0.002	0.005	0.000	0.000	0.024	0.969
	St.D.	2.1e+04	0.224	0.089	0.106	42.313	0.083	0.054	0.065	0.031	0.007	0.138	0.096
	N	31	31	31	31	31	31	31	31	31	31	31	31
Universal banks	Mean	7282.772	0.162	0.159	0.900	107.113	0.079	0.046	0.029	0.003	0.001	0.126	0.851
	Median	1840.548	0.028	0.148	0.933	3.642	0.042	0.012	0.004	0.000	0.000	0.047	0.898
	St.D.	1.2e+04	0.215	0.120	0.145	529.014	0.102	0.072	0.042	0.009	0.006	0.168	0.143
	N	16	16	16	16	16	16	16	16	16	16	16	16
Custodian banks	Mean	4141.019	0.039	0.610	0.969	61.961	0.035	0.024	0.010	0.001	0.003	0.057	0.405
	Median	1160.498	0.001	0.631	0.982	5.851	0.006	0.000	0.001	0.000	0.000	0.016	0.418
	St.D.	7105.142	0.065	0.246	0.100	144.712	0.065	0.050	0.022	0.003	0.011	0.088	0.203

Table 5:

Balance-sheet indicators by bank type (continuation from Table 4)

CLUSTER		LEVERAGE	SH.T. FUNDING	WHOLESALE	IFL	LIABILITIES BY NF COUNTERPARTS			CROSS-JUR. LIAB.	COMPLEX OTC
						RETAIL	NFC	PUBLIC		
	N	7	7	7	7	7	7	7	7	7
Savings banks	Mean	0.036	0.289	0.430	0.000	0.002	0.053	0.016	0.423	0.012
	Median	0.039	0.170	0.338	0.000	0.000	0.050	0.000	0.197	0.000
	St.D.	0.025	0.334	0.345	0.001	0.006	0.057	0.031	0.385	0.033
	N	18	18	18	18	18	18	18	18	18
Cross-border banks	Mean	0.166	0.339	0.782	0.019	0.003	0.174	0.001	0.941	0.449
	Median	0.085	0.331	0.929	0.002	0.000	0.134	0.000	0.954	0.500
	St.D.	0.196	0.207	0.319	0.036	0.007	0.162	0.003	0.085	0.442
	N	55	55	55	55	55	55	55	55	55
Cross-border finance	Mean	0.101	0.390	0.611	0.050	0.002	0.063	0.002	0.876	1.143
	Median	0.047	0.312	0.855	0.003	0.000	0.005	0.000	0.909	0.135
	St.D.	0.181	0.289	0.430	0.119	0.007	0.121	0.006	0.102	3.468
	N	31	31	31	31	31	31	31	31	31
Universal banks	Mean	0.071	0.262	0.632	0.044	0.005	0.033	0.004	0.475	1.080
	Median	0.063	0.237	0.778	0.012	0.000	0.014	0.000	0.494	0.269
	St.D.	0.059	0.222	0.405	0.079	0.013	0.040	0.015	0.163	1.446
	N	16	16	16	16	16	16	16	16	16
Custodian banks	Mean	0.142	0.188	0.445	0.020	0.002	0.038	0.002	0.869	1.089
	Median	0.066	0.065	0.375	0.001	0.000	0.001	0.000	0.934	0.039
	St.D.	0.243	0.318	0.464	0.050	0.005	0.098	0.006	0.155	2.355

Table 6:

Index of Systemic Importance and simple indicators: correlation coefficients

	ISI	TOTAL ASSETS[A]	OBS	RETAIL DEPOSITS	NFC DEPOSITS	DOMESTIC DEPOSITS	IB DOM. DEPOSITS	IB FOR. DEPOSITS	IB DOM. LOANS	IB FOR. LOANS	LEVERAGE	SH.TERM FUNDING
ISI	×											
Total assets	0.8870*	×										
OBS	0.2410*	0.3006*	×									
Retail deposits	-0.0885	-0.1801	0.1290	×								
NFC deposits	-0.0415	-0.0969	-0.0958	0.2969*	×							
Domestic deposits	0.0434	-0.0612	0.0700	0.4679*	0.5916*	×						
IB dom. deposits	0.2230*	0.2592*	0.1205	-0.1896	-0.0555	-0.1242	×					
IB for. deposits	0.1896	0.2484*	0.1932	0.1346	-0.0305	-0.2076	0.1552	×				
IB dom. loans	-0.0013	-0.1344	0.0103	0.1662	0.0081	0.0174	0.1712	0.0064	×			
IB for. loans	-0.1519	-0.1284	-0.1296	-0.1580	-0.0890	-0.0985	-0.0505	0.0664	0.0120	×		
Leverage	0.3476*	0.4600*	0.1695	-0.1332	-0.0400	0.0237	0.1189	0.1570	-0.1881*	-0.0291	×	
Sh.term funding	0.2823*	0.2750*	0.2379*	0.1955	0.4469*	0.0857	0.1030	0.3682*	-0.0955	-0.0140	0.2079*	×
L.term funding	0.1821	0.2122*	0.2108	-0.1817	0.0973	0.0890	0.2049	0.2274	0.0285	-0.2272*	0.0218	0.1000

* The stars indicates that the p-values of the t-test (H0: no correlation) are lower than 0.05 which implies a correlation significantly different from zero