

# Banking Business Models Monitor 2014 Europe

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**Rym Ayadi**  
**Willem Pieter De Groen**

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With contributions from

**Marie-Josée Lapointe**  
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The Monitor offers an annual analysis on the evolving business models of the European banking sector since 2006. The Monitor is geared towards bank practitioners, policy makers, and academics who are interested in expert views on the banking sector in Europe.

The Monitor is co-authored by Rym Ayadi, Senior Research Fellow and Head of the FIPP Unit at CEPS and Professor of international banking and financial systems at HEC Montréal and Willem Pieter de Groen, Research Fellow at the FIPP Unit at CEPS. It extends the previous research of the authors under Ayadi, Arbak and De Groen (2011 & 2012). The authors acknowledge the contributions from the Observatory research team, in particular Marie-Josée Lapointe, André Michelet, Harol Rey, Ibtihel Sassi, and Cristina Tita and would like to thank Benoit Tremblay, Professor at HEC Montréal and Director of the Observatory for his valuable comments.

The views expressed in this Monitor are those of the authors writing in a personal capacity and do not necessarily reflect those of CEPS, HEC Montréal or any other institution with which they are associated.



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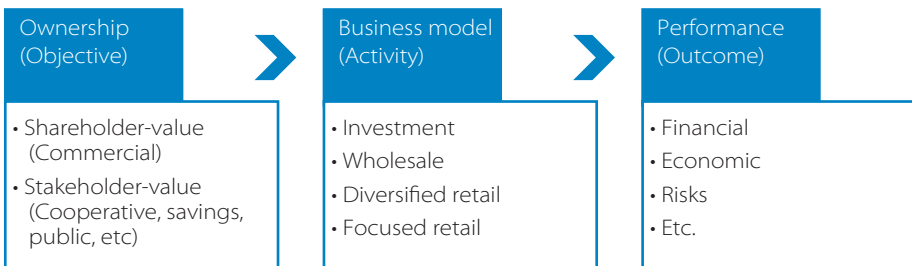
# 1 Why do Business Models Matter in Banking?

Since the onset of the financial crisis, the banking sector has been in the spotlight. The previous decades saw a frenetic race to high returns on equity coupled with excessive risk taking, encouraged by a lax monetary policy and accommodating banking regulations. This led to major changes in the way banks conduct business. A large number of banks stretched the conventional intermediating role up and beyond its limits and also extended their proprietary activities. This resulted in a ballooning banking sector that attached less value to financing the real economy and put systemic stability at risk. The failures of several of these banks with unsustainable business models, such as Lehman Brothers and Northern Rock to name a few, spurred contagion and contributed to the global financial and Eurozone economic crises. Crises episodes have been widely documented<sup>1</sup> and have sparked a fundamental overhaul of regulation and supervision.

However, not all types of banks are facing the same challenges or responding in the same way to crises. This Business Models Monitor attempts to address this diversity in banks and hence the response function of each category in a crisis situation. Defining and identifying business models in banking is not a trivial task because of its multi-faceted, ever changing nature and heavy reliance on granular data about banks' activities and risks.

Besides analysing the activities of the clusters of banks, the Monitor assesses two important dimensions that interact within the business models: ownership structure and the financial and risk implications (See Figure 1.1). Hence, the business models can be considered a means through which banks want to fulfil their objectives. These can be profit maximisation, as is the case for shareholder-value banks (SHV), or value creation for clients or other stakeholders, as is the case for stakeholder-value banks (STV). The activities in turn result in certain outcomes such as financial performance, risk profile, and contribution to financial (in) stability as well as the economy, which can change over time.

FIGURE 1.1 – Conceptual-framework of the bank Business Models Monitor



Source: Authors

1. See Acharya et al. (2013), Blundell-Wignall et al. (2008), Brunnermeier (2009), Dewatripont, et al. (2010), Gorton & Metrick (2012), Hellwig (2009), Reinhart & Rogoff (2009), etc.

In this way, the business model analysis contributes to a better understanding of financial and economic performance, risk behaviour, and governance at a system level. This is necessary for markets and regulators to assess the accumulation of risk for certain pre-defined financial businesses. It also serves to monitor banks' behaviours and their contribution to systemic risk, which can be useful from the regulatory and market discipline perspectives. From a regulatory perspective, as shown in Ayadi et al. (2011 and 2012), the potential for regulatory arbitrage through the underestimation of the levels of capital can be identified and mitigated. In addition, when a specific business model in banking tends to become a threat to systemic stability, macro-prudential regulators can act to prevent this threat through the use of appropriate mechanisms to curb excessive risk taking. From a market discipline perspective, analysing business models requires more transparency from banks on their on-balance sheet and off-balance sheet risk exposures, especially when the multi-dimensional analyses prove to be insufficient to explain the behavioural change of individual banks within the same business model. Monitoring banks' business models provides a new elaboration to develop the missing link between regulatory and supervisory review done on individual banks and at the macro level.

The EU Banking Business Models Monitor identified the business models of 147 banks that cover more than 80% of assets of the EU banking industry. Using a careful selection of multi-dimensional attributes and developing state-of-the-art clustering methodologies, the Monitor provides a coherent approach to analyse banks and monitor their behaviour over time (from 2006 to 2013) in terms of financial and economic performance and risk contribution to the financial system as a whole. The Monitor will be updated annually subject to data availability.<sup>2</sup>

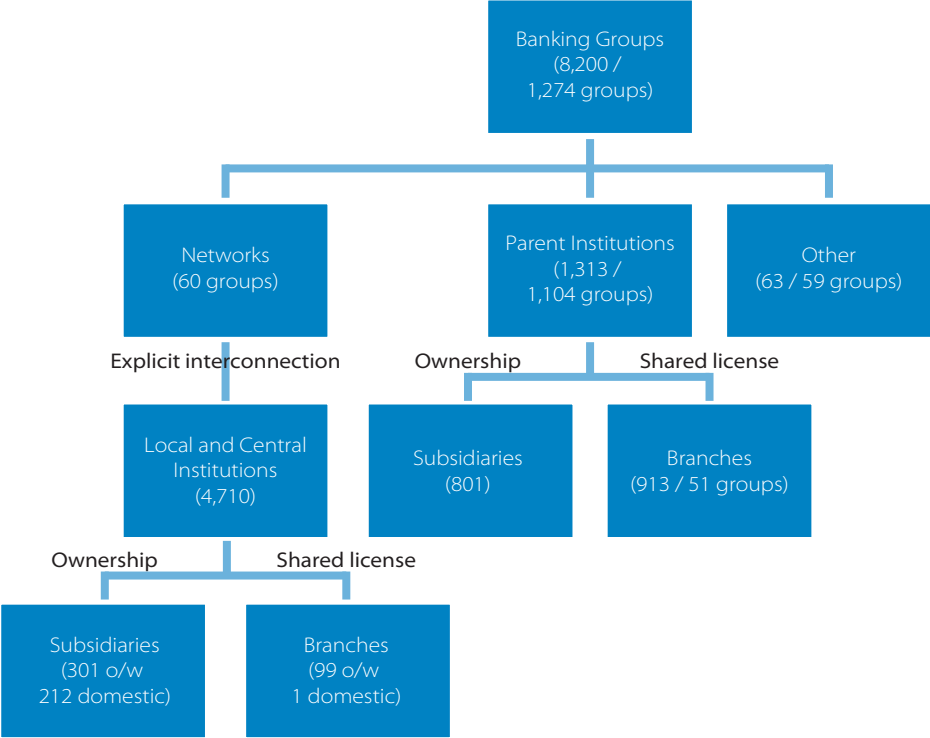
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2. A data module will accompany the Monitor, which mainly displays the categorisation of the 147 banks within each business model.

## 2 Identifying Business Models in Banking

The European banking sector incorporates a rich array of banks with diverse business models and ownership structures. Apart from the larger commercial banks, which mostly follow the SHV type, which focus on a broad mix of banking activities, a large number of STV institutions with different ownership structures (public banks, cooperatives, and savings institutions) co-exist in a diversified market (see also Figure 2.1).

FIGURE 2.1 – European banking sector structure (2012)



Note: The numbers in the figures are the number of unconsolidated credit institutions and/or branches in the EEA unless stated otherwise.

The figure shows the order in credit institutions and branches across the European Economic Area. In total there are 8,200 credit institutions and branches in this region. However, these are often strongly related through ownership (i.e. subsidiaries and branches) or networks (i.e. groups of credit institutions that are jointly liable for each others' losses and/or having integrated organisations). When taking this into account, the number of distinct banking groups in the EEA is 1,274.

Source: Authors



To a large extent, the business models can be distinguished by the nature and scope of the activities and funding strategies they engage in. Most retail-oriented banks, including commercial, savings and cooperative banks, provide traditional banking services to the general public.<sup>3</sup> Investment-oriented banks focus more on trading activities, relying on a variety of funding sources and often maintaining a retail network of their own. Other banks provide services to their institutional clients, including large and mid-sized corporations, real estate developers, international trade finance businesses, network institutions and other financial institutions.

The sample under study in this Monitor is comprised of 147 large EEA banking groups and subsidiaries of non-EEA banking groups (up from 74 covered in our earlier study, Ayadi et al, 2012) and of 26 covered in Ayadi et al, 2010. These banks together account for around 80% of the EU's banking assets (See also Figure 2.2 which indicates the coverage across banking groups).<sup>4</sup> The sample consists of the banks subject to at least one of the CEBS and EBA exercises conducted between 2010 and 2014<sup>5</sup>, the credit institutions identified for the comprehensive assessment of the ECB<sup>6</sup>, EU based banks identified by the FSB as global systemically important banks (GSIBs)<sup>7</sup>, and the EU based cooperative banking groups and central institutions included in the private Database on Institutions of the IOFSC at HEC Montréal. The sample covers the years 2006 to 2013 and includes 1,126 bank-year observations (up from 352 in Ayadi et al, 2012).

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3. Although most savings and cooperative institutions are local (leaving them outside the scope of this study), they nevertheless depend on the services of much larger central institutions, which typically provide their network institutions with liquidity and represent the group on a consolidated basis for supervisory purposes (Desrochers & Fischer, 2005). Ayadi et al. (2009 and 2010) have shown that the local institutions have comparable performance and efficiency characteristics to their commercial peers and have largely weathered the financial crisis unscathed. However, a number of Spanish savings banks and the German central institutions have been hit hard.

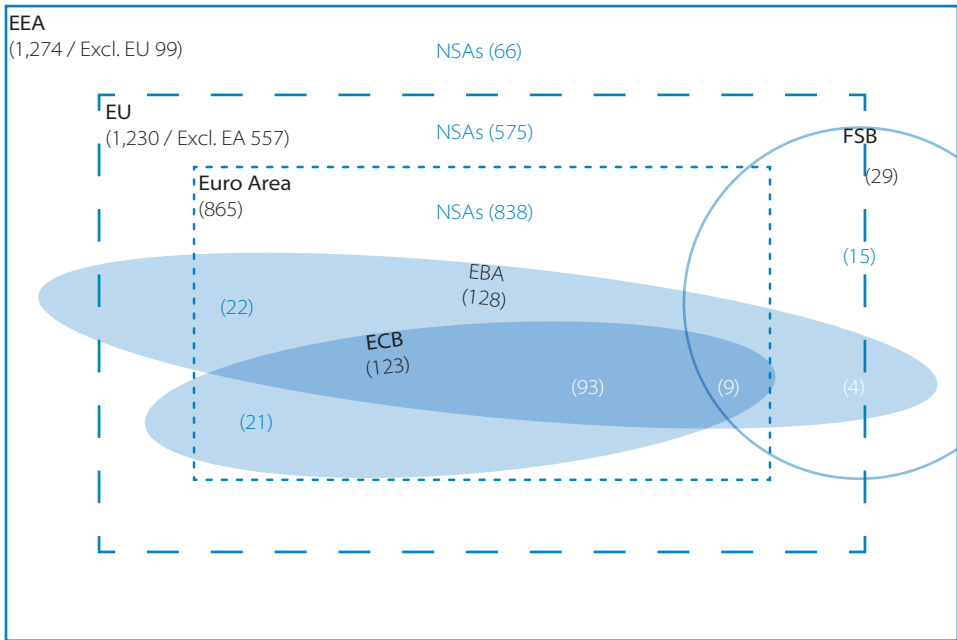
4. Except for Norwegian DnB NOR Bank, all banking groups and banks are domiciled in the EU. These EU banking groups and banks had total assets of €34.7 trillion in 2012. Hence, the sample represents around 80% of the EU total banking assets (€43.6 trillion), using ECB (2014) consolidated banking data. The sample covers at least 50% of the banking assets in each of the EU Member States.

5. See Ayadi et al (forthcoming) for a comprehensive overview of the banks subject to the CEBS EU-Wide Stress Testing Exercise in 2010 and the 2011 EU-wide stress test, EU Capital exercise 2011, and 2013 EU-wide transparency exercise conducted by EBA. See <https://www.eba.europa.eu/documents/10180/669262/Methodological+Note.pdf> for the sample of the 2014 EU-banks stress test.

6. See [http://www.ecb.europa.eu/pub/pdf/other/en\\_dec\\_2014\\_03\\_fen.pdf?21d953cb19106056a509a22888c646a8](http://www.ecb.europa.eu/pub/pdf/other/en_dec_2014_03_fen.pdf?21d953cb19106056a509a22888c646a8) for the full list of credit institutions that is subject to the first comprehensive assessment of the European Central Bank. The subsidiaries of banking groups included in the CEBS/EBA exercises are assessed at the group level, e.g. to avoid double counting.

7. See [http://www.financialstabilityboard.org/publications/r\\_131111.pdf](http://www.financialstabilityboard.org/publications/r_131111.pdf) for the GSIBs-list as of November 2013.

**FIGURE 2.2** – Banking groups active in EEA by supervisor and area (2012)



Note: The blue areas in the figure correspond with the banks covered in this report. The amounts behind NSAs provide the cumulative number of banking groups supervised by National Supervisory Authorities. The amounts in the left-hand corner express the consolidated number of banking groups in the total area. The remaining figures express the number of supervised institutions. Only an exact overlap is considered. Hence, the subsidiaries of EBA supervised banking groups are not considered as overlap. The list of ECB supervised banks includes 12 subsidiaries of EBA stress-tested banks (SEB AB (3x), DNB BANK, Swedbank (2x), Danske, Nordea, HSBC (2x) and RBS (2x)).

Source: Authors

The list of the sampled banks, their ownership structure, total assets and the growth of assets for recent years are given in Appendix IV. To account for mergers that have taken place in recent years, all of the large pre- and post-merger and acquired entities that qualify as the largest banks have been included in the database. In particular, the list covers the French Caisse d'Épargne and Banque Populaire, which merged in 2009 to form the BpCE Group, the Italian Banca Intesa and Sanpaolo IMI, which merged in 2007 to form the Intesa Sanpaolo and the British HBOS, which was acquired by Lloyds Banking Group in 2009. In addition, there is a large number of Spanish savings banks (or cajas de ahorro) that merged or were absorbed by other banks during and after the Spanish Banking Crisis that started in 2009.

Following the determination of the sample, a database of a large variety of variables was compiled to assess the business model, profitability, asset and liability structure, earnings performance, and stability aspects for each one of the sampled banks over the time period covered. The compilation exercise relied mostly on publicly available information obtained from the banks' annual reports and financial statements. When these reports were not published on the corporate website of the bank, the banks were asked to provide

the annual reports for this analysis. Except for the Luxembourgian Clearstream Banking and Cypriot Russian Commercial Bank,<sup>8</sup> all banks provided the requested reports. In addition, the European Commission's state aid approval documents analysed by Ayadi et al (2014)<sup>9</sup> were used for the public intervention variables. Lastly, the information on share prices and CDS spreads were obtained from Yahoo Finance and Thomson Reuters Datastream, respectively.

The data collection exercise spanned almost ninety variables for each bank/year observation (see Appendix I for a complete list). Following the collection exercise, a subset of the variables was selected based on data availability and relevance. Whenever possible, preference was given to variables with the highest coverage ratio, or the share of non-missing observations. Indicators on the banks' general structure, financial position, riskiness and crisis measures were constructed from this subset. The final set of indicators used in identifying and assessing the business models is given in Table 2.1.

In line with the study's aim of identifying different business models and screening for major strengths and weaknesses, the analysis was conducted in two phases. In the first phase, several instruments from Table 2.1 were used as a basis for the creation of distinct business models using cluster analysis tools. In the second phase, the business models were evaluated and compared based on their relative performance, riskiness and other relevant factors.

Loosely defined, cluster analysis is a statistical technique for assigning a set of observations (i.e. a particular bank in a particular year) into distinct clusters (i.e. business models). By definition, observations that are assigned to the same cluster share a certain degree of similarity, as measured by a set of instruments (that are considered relevant). The formation of clusters ensures that they are sufficiently dissimilar among themselves, identifying different distinguishing characteristics of the observations they represent. To create the clusters, the initial step is to determine a set of instruments to identify any similarities or distinctions. The second step – more technical in nature – is to determine the methods for measuring similarities, for partitioning the clusters, and for determining the appropriate number of clusters (i.e. the 'stopping rule').

One of the key problems often encountered in clustering is the presence of missing values. When a particular observation has one or more missing instrument values, it has to be dropped from the cluster analysis since the similarity measures cannot be computed. The sample used in the study contains some such cases, despite efforts to choose indicators with high coverage ratios. In order to accommodate the entire sample of observations, missing values were filled with 'regression method' estimates using the existing set of indicators as predictors. In addition, when the 'intangible assets' and 'negative carrying values of derivatives exposures' were not reported, they were assumed to be zero in the calculation of 'Trading assets' and 'Derivative exposures,' since banks are not required to report both balance sheet items unless significant.

8. Clearstream Banking is a subsidiary of German Deutsche Börse AG and Russian Commercial Bank is a subsidiary of the Russian VTB Group.

9. See [http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy\\_area\\_id=3](http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3) for the European Commission's database on state aid documents.

TABLE 2.1 – Description of indicators used in the report

Variable	Coverage	Mean	Std. dev.	Min.	Max.
<b>OWNERSHIP</b>					
Cooperative bank (dummy var.)	100%	0.186	0.389	0.000	1.000
Savings bank (dummy var.)	100%	0.232	0.422	0.000	1.000
State-owned bank (dummy var.) <sup>a</sup>	100%	0.199	0.399	0.000	1.000
Private block owners (% owned) <sup>b</sup>	100%	0.355	0.384	0.000	1.000
Listed on stock exchange (dummy var.)	100%	0.492	0.500	0.000	1.000
<b>(FINANCIAL) ACTIVITIES</b>					
Total assets (% of GDP)	100%	0.328	0.469	0.000	2.820
Customer loans (% of assets)	100%	0.549	0.195	0.000	0.919
Loans to banks (% of assets)	100%	0.114	0.151	0.001	0.967
Trading assets (% of assets) <sup>d</sup>	100%	0.306	0.158	0.004	0.995
Customer deposits (% of assets)	100%	0.429	0.239	0.000	0.962
Bank liabilities (% of assets)	100%	0.152	0.149	0.000	0.999
Derivative exposures (% of assets) <sup>e</sup>	91%	0.051	0.069	0.000	0.539
Debt liabilities (% of assets) <sup>f</sup>	100%	0.308	0.214	-0.402	0.994
Internationalisation (nr of countries) <sup>g</sup>	13%	5.23	5.239	1	22
<b>FINANCIAL PERFORMANCE</b>					
Net interest income (% of total income)	99%	0.792	3.207	-34.571	61.867
Commission & fee income (% of total income)	99%	0.224	0.884	-15.178	21.030
Trading income (% of total income)	99%	-0.120	4.436	-95.410	48.152
Other income (% of total income)	99%	0.097	1.356	-10.948	39.385
Return on assets (RoA) <sup>h</sup>	100%	0.003	0.017	-0.152	0.118
Return on equity (RoE) <sup>h</sup>	100%	0.056	2.503	-47.498	53.040
Cost-to-income ratio (CIR) <sup>i</sup>	100%	0.736	3.057	-38.829	78.134

## Notes:

- At least 50% owned by EU public authorities. This measure only takes account of government entities owning at least 5% of the bank.
- Private block owners are those that own more than a 5% stake, excluding the stakes of EU public authorities.
- Liquid assets are cash and balances at the central bank.
- Trading assets are total assets minus liquid assets (cash and deposits at central bank) minus total loans minus intangible assets.
- Negative carrying fair values of all derivative transactions.
- Debt liabilities are total liabilities minus customer deposits, bank liabilities and negative derivative exposures.
- Number of unique EEA-countries in which the bank had banking activities at year-end 2012, i.e. parent institution, subsidiaries and branches with credit institution licence or passport.
- Before-tax profits are used to calculate both RoA and RoE figures.
- CIR is defined as the ratio of total operating expenses divided by total income.

TABLE 2.1 – Description of indicators used in the report (continued)

Variable	Coverage	Mean	Std. dev.	Min.	Max.
<b>RISK</b>					
Z-score (no. of std. devs. from default) <sup>j</sup>	97%	21.023	35.903	-1.201	399.816
Risk-weighted assets (RWA) (% of assets)	83%	0.484	0.216	0.014	1.972
Risk costs (% of non-trading assets)	99%	-0.011	0.018	-0.040	0.262
CDS spread (annual avg., basis points)	27%	258.697	290.566	60.334	2426.777
Stock return volatility (std. dev. of daily returns)	37%	0.032	0.024	0.004	0.276
Tier 1 capital ratio (% of risk-weighted assets)	78%	0.120	0.109	-0.073	2.275
Tangible common equity (% of assets) <sup>k</sup>	100%	0.051	0.050	-0.063	0.941
<b>CRISIS</b>					
Government recapitalisation (dummy var.)	78%	0.078	0.269	0.000	1.000

Notes:

j. See Appendix II for details on the calculation of z-score.

k. Tangible common equity is common equity minus intangible assets (goodwill and other) minus treasury shares; common equity is defined as common stock plus additional paid-in capital plus retained earnings.

Source: Authors

Assuming that banks consciously choose their business models, any cluster analysis should be based on instruments over which the banks can have a direct influence. For example, a bank is likely to have a great degree of choice over its general structure, financial position and some of the risk indicators.<sup>10</sup> In turn, most of the performance indicators are related to instruments that are beyond the bank's control, such as market conditions, systemic risks, consumer demand, etc. This was one of the principal reasons why details on income sources (i.e. interest vs. non-interest income) were not used as instruments in the creation of the clusters.

The business models used in the study distinguish between the key banking activities, funding strategies, financial exposures, and risks. To account for these factors collectively, without over-representing any particular factor, six instruments were used to form the clusters.<sup>11</sup> These were:

1. *Loans to banks (as % of assets)*. The indicator measures the scale of wholesale and interbank activities, which proxy for exposures to risks arising from interconnectedness in the banking sector.
2. *Trading assets (as % of assets)*. These are defined as non-cash assets other than loans; a greater value would indicate the prevalence of investment activities that are prone to market and liquidity risks.

10. All of the instruments used for clustering were standardised so that each indicator had a mean of zero and a standard deviation of one. This was done to prevent any potential biases arising from the choice of units, i.e. use of percentages rather than basis points.

11. Alternative instrument combinations were also considered. In many cases, using a different set of instruments led to an unrealistically large number of clusters, with many comprising a single bank/year. Removing any one of the six indicators from the clustering exercise also led to an indistinct clustering. In turn, using a larger set did not change the results substantially, as long as the named indicators were included.

3. *Bank liabilities (as % of assets)*. This indicator identifies the share of liabilities of other banks, including deposits, issued debt, and funds obtained from central banks. Banks with greater interbank funding requirements, often due to an excessive reliance on short-term funding, faced severe problems in the earlier phases of the crisis.
4. *Customer deposits (as % of assets)*. This indicator identifies the share of deposits from non-bank and private customers, e.g. households or enterprises, in the total balance sheet, indicating a reliance on more traditional funding sources.
5. *Debt liabilities (as % of assets)*. Calculated by netting customer deposits, bank liabilities, total equity and negative fair values of all derivative transactions from total liabilities, this instrument is strongly (and negatively) correlated with customer deposit funding. While bank liabilities are comprised of short-term interbank debt, the broader debt liabilities indicator provides a general insight into the bank's exposure to market funding.
6. *Derivative exposures (as % of assets)*. This measure aggregates the carrying value of all negative derivative exposures of a bank, which are often identified as one of the key (and most risky) financial exposures of banks with heavy investment and trading activities.

Ward's (1963) procedure to calculate the distance between clusters was used to form the technical aspects. The procedure form partitions in a hierarchical manner, starting from the largest number of clusters possible (i.e. all bank/years in a separate cluster) and merging clusters by minimising the within-cluster sum-of-squared-errors for any given number of clusters. Several studies found that the Ward clustering methods perform better than other clustering procedures for instruments that involve few outliers and in the presence of overlaps<sup>12</sup>. Moreover, to diagnose the appropriate number of clusters, Calinski & Harabasz's (1974) pseudo-F index, i.e. the 'stopping rule', was used. The index is a sample estimate of the ratio of between-cluster variance to within-cluster variance.<sup>13</sup> The configuration with the greatest pseudo-F value was chosen as the most distinct clustering.

All of the multiple imputation and clustering procedures were conducted using SAS's built-in and user-contributed functions<sup>14</sup>.

It is important to highlight once again that cluster analysis is an inexact science. The assignment of individual banks to a specific cluster, or model, depends crucially on the choice of instruments and procedures, such as the proximity metric, procedures for forming clusters and the stopping rules used. Although the literature on the technical aspects of cluster analysis is relatively well-developed, there is little theory on why certain procedures perform better than others.<sup>15</sup> In choosing instruments, attention was given to testing a

12. See Milligan (1981) and references therein for an assessment of different clustering methods.

13. Evaluating a variety of cluster stopping rules, Milligan & Cooper (1985) single out the Calinski and Harabasz index as the best and most consistent rule, identifying the sought configurations correctly in over 90% of all cases in simulations.

14. The model was computed in close collaboration with HEC Montréal through its International Observatory on Financial Services Cooperatives and the International Initiative for Sustainable Financial Systems (ISFS) under the Alphonse and Dorimène Desjardins International Institute for Cooperatives.

15. See Everitt et al. (2001) for a highly readable introduction to cluster analysis and some of the practical issues in the choice of technical procedures.

variety of alternative configurations. The six indicators mentioned above led to the most consistent and distinct clustering. Dropping or adding variables resulted in a substantial worsening of the statistical measures of distinct clustering, which suggests that the chosen set adequately identifies the main distinguishing characteristics of the sampled banks. As the discussion below makes clear, the characteristics of the business models that are identified by the cluster analysis are by and large in line with expectations. Despite these efforts, it is certainly true that the outcomes may change with other configurations. For these reasons, the results of the present analysis should be interpreted with care.

### 3 Which Business Models exist in European Banking?

The following discussion gives the details of the outcomes of the first phase of analysis, which provides the results of the cluster identification. The clustering procedures summarised in the previous chapter lead to highly consistent results. In particular, the results show that the pseudo-F indices attain a single maximum, pointing to the four-cluster configuration as the most distinct one (see Table 3.1).

TABLE 3.1 – Pseudo-F indices for clustering configurations

Number of clusters	Pseudo-F index (Calinski & Harabasz)	Number of clusters	Pseudo-F index (Calinski & Harabasz)
1	..	6	279
2	269	7	270
3	281	8	268
<b>4</b>	<b>294</b>	9	271
5	292	10	269

Note: The Calinski & Harabasz (1974) pseudo-F index is an estimate of the between-cluster variance divided by within-cluster variance.  
Source: Authors

The descriptive details for the four clusters are given below in Table 3.2 and Figure 3.1. Keeping in mind the word of caution noted at the end of the previous chapter, the four business models can be characterised as follows.

The clustering analysis identified four models as the most distinct form of clustering. Table 3.2 gives the descriptive statistics for the four models resulting from the cluster analysis based on the six selected balance sheet indicators. Next, an overview of the main structural and financial attributes of the clusters is provided. It is important to highlight once again that the instruments used in the clustering are a subset of the entire set of variables in the sample.

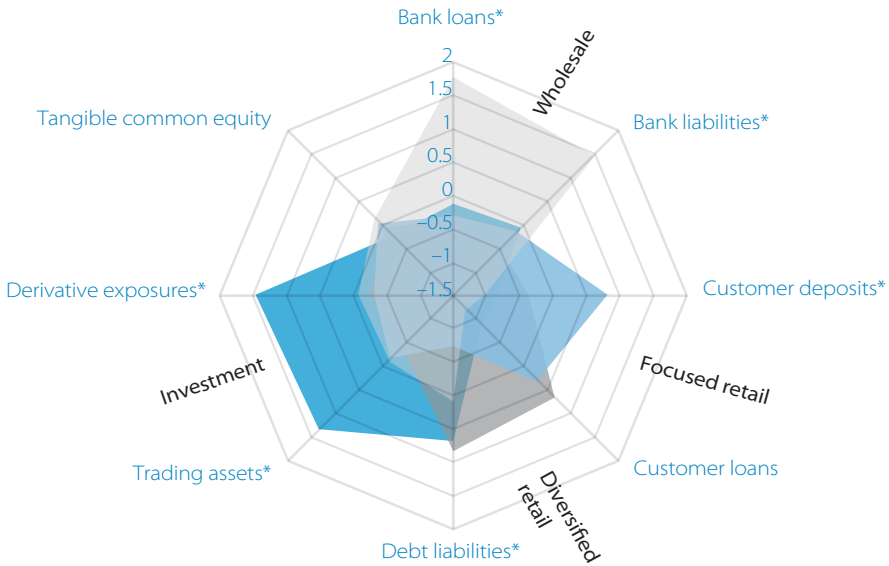
Model 1 groups together large investment-oriented banks and contains the largest banks, both in terms of total and average assets (see Table 3.3).<sup>16</sup> The average size of a bank in this cluster was approximately € 583 billion in 2013, about quadruple for an average wholesale or focused retail bank and almost double the amount of a diversified retail bank.

In what follows, Model 1 will be referred to as the cluster of ‘investment banks’. As is clear from the name, these banks have substantial trading activities. The cluster averages for trading assets and derivative exposures—representing 51.2% and 15.2% of total assets, respectively—stand between 1.3 and 1.5 standard deviations above the relevant sample means. In funding, the focus is on less stable and less traditional sources, such as debt

16. Three-quarters of the banks included in Ayadi et al. (2012) have been identified in the same cluster in this exercise. 85 to 90% of the banks identified as investment, diversified retail or focused retail in the previous study have been identified as such again. In turn, a large share of the formerly identified wholesale banks are now identified as investment banks.



FIGURE 3.1 – Comparison of clusters, standardised scores



**Notes:** Indicators marked with an asterisk (\*) were used as instruments in the cluster analysis. The figures represent the number of standard deviations from the sample mean. *Customer loans* and *customer deposits* represent the balance sheet share of deposits from and loans to non-bank customers, respectively. *Bank liabilities* and *bank loans* identify the share of liabilities of and loans to other banks, including bank deposits, issued debt, interbank transactions, and received funding from central banks. *Debt liabilities* are calculated by netting customer deposits, bank liabilities, total equity and negative fair values of all derivative transactions from total liabilities. *Derivative exposures* captures all negative carrying values of derivative exposures. *Trading assets* are defined as total assets minus liquid assets (cash & deposits at central bank) minus total loans and intangible assets. (*Tangible*) *common equity* is defined as common equity minus intangible assets and treasury shares as a share of tangible assets (i.e. total assets minus intangible assets).

Source: Authors

liabilities and, more importantly, repurchase agreements, which came under severe stress during the financial crisis (Gorton & Metrick, forthcoming). The investment banks also tend to be highly leveraged, with an average tangible common equity ratio of 3.9%.

Model 2 includes banks with a heavy reliance on interbank funding and lending.<sup>17</sup> The liabilities of an average bank under this bank model to other banks, including both deposits and other interbank debt, represent, on average, 37.4% of the total balance sheet, towering above the interbank liabilities of other bank models. In turn, traditional customer deposits represent only 16.0% of the total balance sheet—the lowest among the four groups. Other funding sources come from debt liabilities, which exclude traditional deposits and interbank funding.

17. The group of banks identified as wholesale banks have changed substantially from Ayadi et al. (2012). In particular, only 41% bank/year observations identified as wholesale banks in the earlier study were identically grouped here. An important explanation for this might be the fact that the number of banks and years covered have been increased, which has changed the composition of the sample.

TABLE 3.2 – Descriptive statistics for four clusters

		Bank loans (% assets)	Customer loans (% assets)	Trading assets (% assets)	Bank liabilities (% assets)	Customer deposits (% assets)	Debt liabilities (% assets)	Derivative exposures (% assets)	Tang. Comm. eq. (% tang. assets)
Model 1 - Investment (188 obs.)	Mean	9.5%	37.4%	51.2%	14.3%	23.1%	44.8%	15.2%	3.9%
	St. dev.	0.075***	0.163***	0.168***	0.088***	0.114***	0.185***	0.109***	0.076***
	Min.	0.5%	0.0%	13.8%	0.0%	0.0%	1.7%	0.0%	0.2%
	Max.	46.6%	77.2%	99.5%	44.7%	86.5%	99.4%	53.9%	94.1%
Model 2 - Wholesale (145 obs.)	Mean	38.4%	31.4%	28.1%	37.4%	19.1%	32.6%	4.5%	5.9%
	St. dev.	0.254***	0.168***	0.154**	0.255***	0.16***	0.22***	0.035***	0.083***
	Min.	1.0%	0.1%	0.4%	0.4%	0.0%	0.0%	0.0%	0.1%
	Max.	96.7%	63.2%	65.7%	99.9%	78.5%	84.4%	14.4%	50.8%
Model 3 – Diversified retail (303 obs.)	Mean	6.2%	67.5%	23.3%	8.5%	34.2%	48.0%	3.4%	4.7%
	St. dev.	0.046**	0.12***	0.102***	0.055***	0.159***	0.151***	0.033***	0.025***
	Min.	0.1%	38.7%	2.9%	0.0%	0.0%	22.7%	0.0%	0.6%
	Max.	28.0%	91.9%	56.6%	32.4%	66.4%	94.3%	15.5%	14.2%
Model 4 – Focused retail (490 obs.)	Mean	7.4%	60.8%	27.9%	13.1%	62.8%	14.3%	2.8%	5.5%
	St. dev.	0.068**	0.136***	0.112**	0.095***	0.154***	0.102***	0.034***	0.031***
	Min.	0.3%	0.9%	4.3%	0.0%	27.2%	-40.2%	0.0%	-6.3%
	Max.	43.2%	91.7%	94.3%	51.5%	96.2%	38.8%	16.0%	15.9%
All banks (1126 obs.)	Mean	11.4%	54.9%	30.6%	15.2%	42.9%	30.8%	5.1%	5.1%
	St. dev.	0.151	0.195	0.158	0.149	0.239	0.214	0.069	0.05
	Min.	0.1%	0.0%	0.4%	0.0%	0.0%	-40.2%	0.0%	-6.3%
	Max.	96.7%	91.9%	99.5%	99.9%	96.2%	99.4%	53.9%	94.1%

Notes: The independence of clusters was tested using non-parametric Wilcoxon-Mann-Whitney two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (\*\* or \*\*\*) stands for the statistical difference of any given cluster from that number of other clusters for that indicator. For example, two asterisks (\*\*) implies that the cluster is statistically different from two other clusters but not the third (closest) one. Variables in **bold** highlight the instruments used in forming the clusters.

Source: Authors

TABLE 3.3 – Evolution of the sizes across business models

	2006	2007	2008	2009	2010	2011	2012	2013
	<i>Sum of total assets (€ billion)</i>							
Model 1. 'Investment'	10,900	15,200	18,100	15,700	15,900	17,200	16,500	11,100
Model 2. 'Wholesale'	2,318	2,689	3,475	2,192	2,225	1,959	2,022	1,501
Model 3. 'Diversified retail'	9,528	10,300	8,486	7,683	10,500	8,899	8,265	9,529
Model 4. 'Focused retail'	4,162	4,227	4,700	6,467	5,298	7,319	8,143	9,358
All banks	26,900	32,400	34,800	32,100	33,900	35,400	35,000	31,500
	2006	2007	2008	2009	2010	2011	2012	2013
	<i>Total assets of average bank (€ billion)</i>							
Model 1. 'Investment'	496	726	726	629	690	638	636	583
Model 2. 'Wholesale'	122	128	165	115	117	115	119	125
Model 3. 'Diversified retail'	203	223	212	202	238	287	306	318
Model 4. 'Focused retail'	95	85	89	110	83	98	112	130
All banks	204	235	250	227	226	236	245	237

Note: All figures correspond to the year-end observations for the relevant sub-sample.

Source: Authors

The Model 2 banks, which will henceforth be referred to as 'wholesale', are also very active in non-traditional uses of these funds, including trading assets (i.e. all assets excluding cash, loans and intangible assets). On average, trading assets account for 28.1% of their balance sheets and interbank lending represents 38.4% of total assets. These banks are substantially less leveraged than their peers, with the highest tangible common equity ratio of 5.9% among the four clusters studied. The total size of the wholesale banking group, which is the smallest group, has declined over time, partly as a result of shrinking average sizes in the midst of the financial crisis in 2008 and partially due to a migration to other business models. Lastly, the expenditures on staff are the lowest in the wholesale banking group, with median personnel expenditures remaining at €3.0 per €1,000 of assets, less than half of the sample median.

Model 3 is composed of retail-oriented banks, which use relatively non-traditional funding sources. Hence, customer loans and debt liabilities account for 48.0% and 67.5% of the total balance sheet on average, surpassing the sample averages. The greater diver-

sification of funding sources is most likely an attempt to maintain a larger size. In line with this description, the Model 3 banks have, after a hic-up in 2009, continued to expand during the crisis, implying that the reliance on multiple sources of financing has reinforced the group's growth prospects.

Model 4 shares several similarities with Model 3. First, and foremost, the group is comprised of retail-oriented banks, with traditional customer loans representing on average 60% or more of the balance sheet totals in both groups. Moreover, the ratio of cash and cash-like liquid assets remains above the sample average. Models 3 and 4 also spend about twice as much as investment and wholesale banks on staff, with median personnel expenditures at €7.5 and €8.8 per €1,000 of assets, respectively. The higher staff costs may possibly reflect a larger geographical coverage through a larger number of branches and personnel.

However, the two models do differ in funding sources. While the Model 3 banks have a greater reliance on debt markets, Model 4 banks rely primarily on customer deposits. The average size of predominantly focused retail banks under Model 4, as measured by average total assets, tends to be around half of the sample average, the smallest banks in the sample. The quest for a larger size of Model 3 banks is also expressed in higher leverage ratios; the average tangible common equity ratios are 4.7 and 5.5 for Model 3 and 4 banks, respectively.

In order to distinguish between the two retail-oriented groups, models 3 and 4 will be referred to as the 'diversified retail' and 'focused retail' models, respectively.

TABLE 3.4 – International activities across business models

	Model 1 – Investment	Model 2 – Wholesale	Model 3 – Diversified retail	Model 4 – Focused retail	ALL
<i>International activities (nr of unique EEA-countries)</i>	7**	1**	7**	2**	3
<i>Internationalisation through subsidiaries (nr of unique EEA-countries)</i>	2**	0*	1*	0**	1
<i>Internationalisation through branches (nr of unique EEA-countries)</i>	3**	0**	3**	1**	1

Notes: Number of unique EEA-countries in which the bank had banking activities at year-end 2012, i.e. parent institution, subsidiaries and branches with credit institution licence or passport.

All figures are the median values for the year-end observations for the relevant sample. The independence of cluster subsamples was tested using the equality-of-medians two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (\*, \*\*, or \*\*\*) stands for the statistical difference of any given cluster from that number of other clusters for that indicator.

Source: Authors

Investment and diversified retail banks are the most internationally active. Table 3.4 shows that the median banks of these models have credit institutions and/or branches in seven EEA-countries. This is significantly more than wholesale and focused retail banks which cover, respectively, one and two countries. Most of the non-domestic countries are served using branches. The median investment and diversified retail banks have three

branches, while focused retail banks and wholesale banks have one or no branches, respectively. The median investment and diversified retail banks also have subsidiaries, which are often used to conduct more substantial international activities. The median investment bank has two subsidiaries, while the diversified retail has one. However these numbers are not significantly different.

TABLE 3.5 – Ownership attributes across business models

	Model 1 – Investment	Model 2 – Wholesale	Model 3 – Diversified retail	Model 4 – Focused retail	ALL
Shareholder value (SHV) banks	64.4%***	30.3%***	46.9%**	52.0%**	49.9%
Cooperative banks	11.7%***	33.8%***	23.1%**	20.4%**	21.4%
Savings banks	19.7%	19.3%	24.1%	25.1%	23.2%
State-owned banks <sup>a</sup>	18.6%**	31.7%***	11.6%***	22.0%**	19.9%
Private block owners <sup>b</sup>	34.1%*	51.9%***	34%*	31.7%*	35.6%
Banks listed on stock exchange	60.1%*	13.8%***	55.5%*	52.0%*	49.4%

Notes: a) At least 50% owned by public authorities;

b) Private block owners are those who own more than a 5% stake, excluding the stake of EU public authorities.

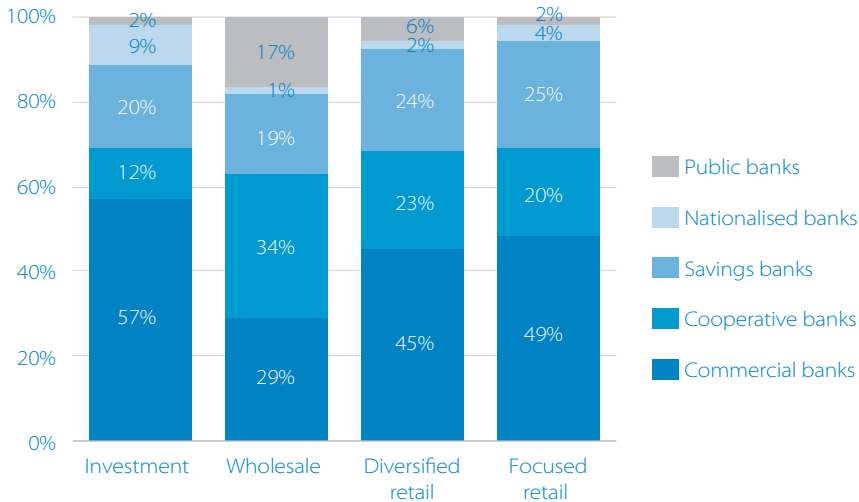
All figures are the mean values for the year-end observations for the relevant sample. The independence of cluster subsamples was tested using the Wilcoxon-Mann-Whitney non-parametric two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (\*, \*\*, or \*\*\*) stands for the statistical difference of any given cluster from that number of other clusters for that indicator.

Source: Authors

Turning to the variation in ownership structures, Table 3.5 shows that investment banks are mostly owned by profit-maximizers. In turn, wholesale banks are mostly stakeholder banks (STV), which is reflected in the highest share of cooperatives and state-owned banks. From all business models, block owners have the largest say. The shares are mostly privately held, since wholesale banks are less often listed. Hence, only 14% of the wholesale banks are listed, while on average, half of the banks in the sample have publicly listed shares. The retail banks are close to the sample average. Most of the diversified retail banks are not owned by public institutions.

Figure 3.2 shows that the wholesale banking business models category contains the most diverse types of banks. Most of the wholesale banks are cooperative banks, while of all other business models, about half or more are commercial banks. It has the least savings banks and nationalised banks among the models, while it has by far the largest share of public banks. Hence, some of the cooperative banks included in this Monitor are the central institutions of cooperative banking networks (See Box 1). These central institutions serve the local banks, which results in more interbank exposures that typically characterise the wholesale banks. On the other hand, many of the public banks also rely more on interbank funding, when they do not have access to deposits. In turn, cooperative and public banks rely relatively less on asset trading, which is reflected in low shares of these types of banks among investment banks. The largest share of nationalised banks is among investment banks. Lastly, all of the business models have more or less an equal share of savings banks.

**FIGURE 3.2** – Distribution of types of ownership across business models, (2006-2013)



Source: Authors

### Box 1 – Reporting by Cooperative banks

The European banking sector is a mix of different types of banks. Besides the most studied commercial banks, there are also public-, savings-, and cooperative banks. The cooperative banks might have the most diverse organisational model. However, there is no common model that fits all cooperative banks in Europe.

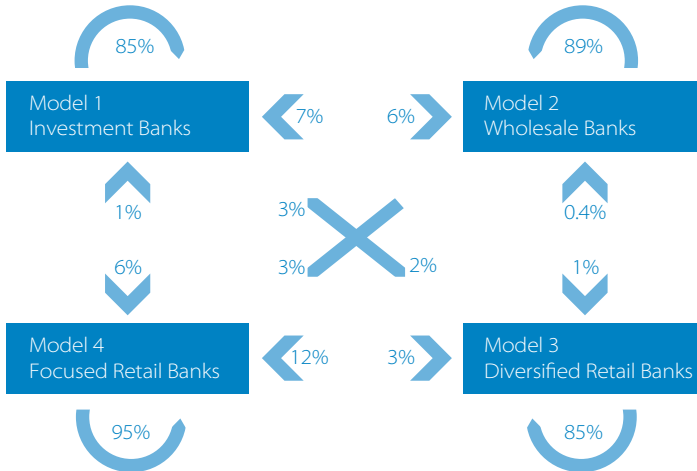
The cooperative banks are, in principle, client-owned. Clients own the nominal valued shares in a local cooperative bank, which usually owns, together with other local cooperatives, a regional or central institution. These central institutions mostly act as central service providers for the local cooperative banks and serve clients that are too large for the local bank or undertake cross-border activities.

Depending on the level of integration of the cooperative banking group, the local banks and the regional and central institutions either report consolidated figures or report separately. For example, the integrated cooperative banking groups in the Netherlands and Finland report consolidated figures for the whole group, including the local cooperatives and the central institution, while the central institutions and local cooperatives in Germany report separately.

This also has an impact on exercises like this Business Models Monitor, which records the largest banks. The consolidated cooperative banking groups are included as a whole, while of the less integrated groups, only the central- and regional- institutions are included. The exposures of the latter consist primarily of loans to and deposits from the local cooperative banks. The activities of the local banks affiliated to these central institutions itself are not analysed. Although these institutions are, in general, relatively small when assessed separately, taken together they are, in many cases, of systemic proportions.

The research on these local cooperatives, which often have similar characteristics, is relatively scarce. Ayadi et al. (2010) performed a comprehensive assessment on the performance of local cooperative banks in the years leading up to the 2007-2009 global financial crisis. But the impact of the period thereafter with the 2010-2012 Euro area sovereign debt crisis on local cooperative banks still needs to be studied. The research on these local cooperatives is more difficult due to data limitations, since local cooperatives have to comply with less extensive public reporting requirements than the larger banks.

FIGURE 3.3 – Model transition matrix, share of banks (%)



Note: The figures give the share of banks that belong to a specific model in one period switching to another model (or remaining assigned to the same model) in the next period.  
 Source: Authors

Although the composition of banks under the different models remains relatively steady over time, transitions do occur and more so in some models than in others.<sup>18</sup> Figure 3.3 provides the transition matrix for the four models during the years 2006 to 2013. The assignment of banks to the focused retail model shows a striking persistence. In particular, the vast majority of the focused retail banks remained within the same model throughout the sampled years (95%). Moreover, a large part of the remainder of the focused retail banks migrated to diversified retail, while no single bank became a wholesale bank from the entire sample. However, the transition probabilities are relatively high for the investment and diversified retail banks, with around 15% of all banks that start in one group moving to the other model in the subsequent period. While almost all migrating diversified retail banks have moved to focused retail, the majority of investment banks migrated to either wholesale or focused retail. Hence, only 3.2% of focused retail banks later became diversified retail, while 12.2% of all banks that started out as diversified retail moved to focused retail. In addition, approximately 1.5% of focused retail banks have moved to the investment model, while the opposite is true for 6.1% of investment banks. The migration between the investment bank and the wholesale model is more balanced. 7.0% of all banks that started out as investment banks become wholesale banks, while the opposite is true for 6.1% of wholesale banks.

18. See Appendix V for a complete list of banks surveyed, grouped by business model.

TABLE 3.6 – Model transition matrix aided banks (2006-2013)

		Business model in 2013				ALL
		Model 1 – Investment	Model 2 – Wholesale	Model 3 – Diversified retail	Model 4 – Focused retail	
Business Model in 2006	Model 1 – Investment	42%	8%	17%	33%	29%
	Model 2 – Wholesale	25%	25%	0%	50%	10%
	Model 3 – Diversified retail	0%	0%	31%	69%	32%
	Model 4 – Focused retail	8%	0%	17%	75%	29%
	ALL	17%	5%	20%	59%	

Note: The figures show the migration of banks that have received State aid in the period from 2007 up to August 2014. The business model in the pre-crisis year (2006) and most recent year covered in the sample (2013) are compared. Only banks that have benefitted from re-capitalisation measures are included. Only banks that received capital support were bound to restructure the activities, while banks that only received liquidity support (i.e. credit guarantees and loans) were not.

Source: Authors

Since the financial crisis erupted, many European governments have supported their banks in order to safeguard financial stability. These aided banks have had to fulfil certain conditions in order to become economically sound, prevent a distortion of the market, and break the lending chain. Most of the restructuring plans that contained the bank specific conditions foresaw a focus on more traditional banking activities, i.e. lending to the real economy using customer deposits. For many of the banks this meant a shift towards more focused retail-like business models. Table 3.6 shows that about two-thirds of the banks that were identified as wholesale-, investment-, or diversified retail banks in 2006 and received public capital support changed business models. Of the banks identified in 2006 as investment banks, a third became focused retail in 2013 and 17% became diversified retail. Half of the aided wholesale banks turned into focused retail banks in the period from 2006 to 2013. Moreover, of the diversified retail banks, two-thirds changed to retail focused. In turn only a quarter of the aided focused retail banks were identified as belonging to a different business model in 2013. Most of the focused retail banks that changed business models became diversified retail.

Overall, the number of focused retail banks has increased substantially, while the number of banks identified as investment, wholesale, and diversified retail has decreased from 2006 to 2013, also confirmed by the increase in the size of the focused retail group over time (see Table 3.3).<sup>19</sup>

19. An analysis of the year-by-year transitions (not provided here) shows that the transitions from the investment and diversified retail to the focused retail model were particularly high in 2011, in the midst of the Eurozone crisis when non-deposit funding was more difficult to attract.



The results provided above give an insight into the main areas of activity and inherent characteristics of the four different bank business models: on the one hand are banks that engage in more risky and less stable funding and trading activities; on the other hand are banks which remain closer to their traditional roots, relying more on retail funding and customer loans. The next two sections will consider whether these basic characteristics are confirmed by a detailed analysis of the financial, economic performance and risk attributes of the four models.

## 4 Performance and Contribution of Banks to the Real Economy

The second phase of the analysis provides an overview of the performance of banks and their contribution to the real economy of alternative business models. Comparative performances of the four business models are summarised in Table 4.1. As displayed in the figures, diversified retail banks appear to do relatively better out of the four models in return on assets (RoA) and return on equity (RoE), while the cost-to-income ratio (CIR) is not significantly worse than in the other business models. The results of the other business models are more diffuse. The return on assets of focused retail banks is, for instance, significantly higher than that of investment and wholesale banks, while the results for return on equity are similar and not significantly different due to a lower leverage. Moreover, the efficiency level is between that of the wholesale banks with the most efficient business models and the least efficient investment banks. The median level of the cost-to-income ratio of investment banks is significantly higher than from the other three business models. Lastly, due to substantial variability in return on equity and cost efficiency figures, the median values were used in the analysis in order to reduce the impact of outliers on the results.

TABLE 4.1 – Performance indicators across business models

	Model 1 – Investment	Model 2 – Wholesale	Model 3 – Diversified retail	Model 4 – Focused retail	ALL
Return on assets (RoA)	0.24%**	0.28%**	0.57%***	0.41%***	0.40%
Return on equity (RoE)	6.78%*	8.08%	9.54%**	6.74%*	8.02%
Cost-to-income (CIR)	62.9%***	54.6%**	58.5%*	60.1%**	59.3%

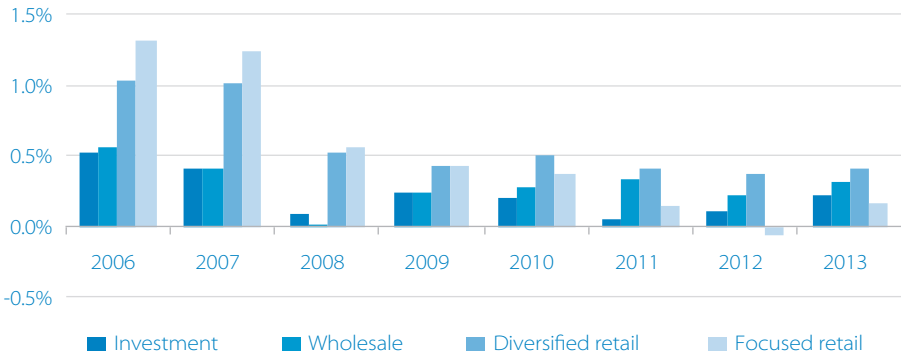
Notes: All figures are the median values for the year-end observations for the relevant sub-sample. The independence of clusters was tested using non-parametric equality-of-medians two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (\*, \*\* or \*\*\*) stands for the statistical difference of any given cluster from that number of other clusters for that indicator. For example, two asterisks (\*\*) implies that the cluster is statistically different from the two (furthest) clusters but not the third (closest) one.

Source: Authors

The median performance of the four business models shown in Table 4.1 hides the evolution of profits over recent years, in particular in the crisis years of 2008 up to 2012. As depicted in Figures 4.1 and 4.2, when the time series of the profit indicators are considered, a distinction should be made between the financial crisis of 2008 and 2009 and the Euro-zone economic crisis between 2010 and 2012. Since the crises, the performance of banks across all business models has worsened. Hence, in the period from 2008 to 2013, none of the business models quoted returns above the return on assets levels of 2006 and 2007. More specifically, in the run-up and during the financial crisis, wholesale and investment

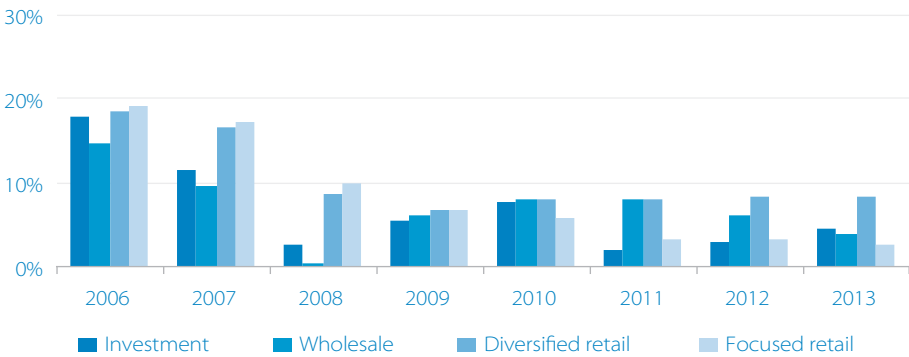
banks clearly lagged behind their peers, with profits turning to levels close to break-even in 2008. Thereafter, during the Eurozone crisis, the returns of the wholesale banks recovered to levels closer to the stable returns of diversified retail banks. On the other hand, the returns on investment continued lagging behind and the returns of focused retail banks worsened substantially. Interestingly, despite the heavy hit that many banks belonging to these business models have taken, most models managed to obtain positive results for all years. Only focused retail banks suffered negative results in 2012. Turning to return on equity, the results are broadly similar; the difference between wholesale and investment banks on the one side and both types of retail banks on the other was smaller and even negligible in 2009 and 2010.

FIGURE 4.1 – Evolution of return on assets (RoA)



Source: Authors

FIGURE 4.2 – Evolution of return on equity (RoE)

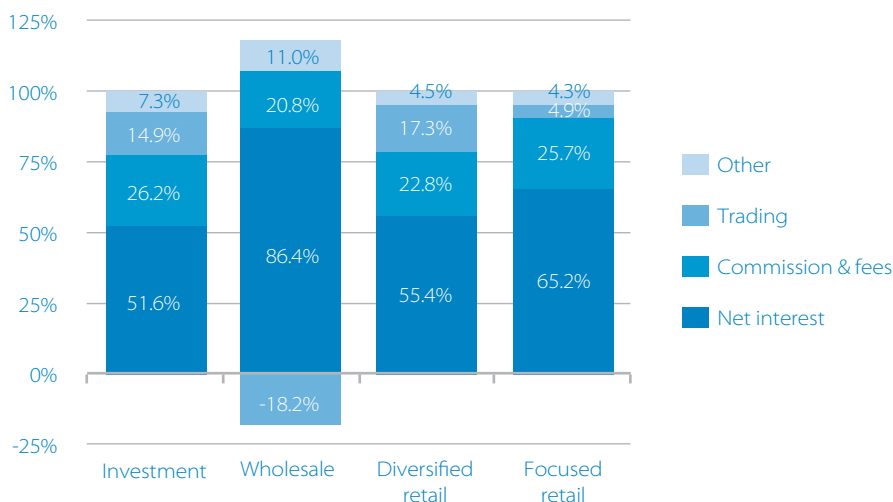


Source: Authors

A more detailed analysis of the breakdown of incomes reveals a mixed picture. In particular, Figure 4.3 shows that investment banks clearly have substantial non-interest earnings, most notably from fees, trading, and other earnings (which includes insurance earnings). Meanwhile, focused retail banks rely substantially more on interest income.

The figures also highlight several less straight-forward results. In particular, all business models on average earn between 20% and 26% of their net incomes in commissions and fees. Similarly, although wholesale banks have been shown to have substantial trading and derivative exposures, they achieve negative returns from those activities, with trading losses of 18.2% of total income. The net interest incomes are more stable for wholesale banks, which is paradoxical due to the lesser importance of traditional banking activities for this category of banks. Conversely, diversified retail banks, which have low trading and derivative exposures, appear to earn a relative amount from these activities that is even more than investment banks.

FIGURE 4.3 – Main income sources across business models, (2006-2013)



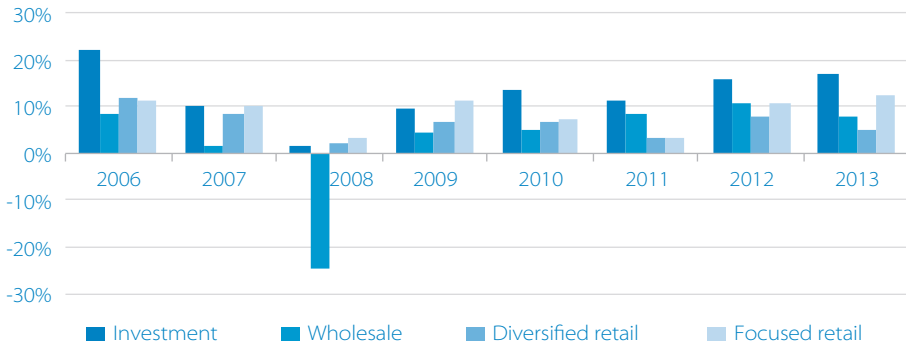
Note: Since annual results are substantially varied, the figures represent the aggregate proportions obtained by summing up the observations for each income item and business model for the period from 2006 to 2013.

Source: Authors

An analysis of the evolution of trading incomes depicted in Figure 4.4 shows that median investment banks earned a substantially larger share of their income from trading and investment activities, except during the financial crisis from 2007 to 2009. The pre-crisis figures show that the other business models, except the wholesale banks in 2007, earn around 10% of their income from trading. The shares changed considerably during the crisis, with more than half of the wholesale banks posting breath-taking losses of over 20% of aggregated net incomes in 2008. Investment banks' trading earnings also took a hit, albeit to a lesser extent. In contrast, diversified and focused retail banks experienced

less volatility in median-trading income, surpassing the performances of the other business models, including the wholesale and investment banks at the height of the financial crisis in 2008. The large volatility in the trading income of investment banks results in a period-median that is close to the less volatile diversified retail median.

FIGURE 4.4 – Evolution of trading income across business models



Note: Since annual results are substantially varied, the figures represent the median proportions obtained by dividing the trading and dividend income by total income. The values are presented by business model and accounting year.  
Source: Authors

To a large extent, the concentrated losses in the wholesale banking sector were due to the write-downs on US subprime exposures in the early phases of the financial crisis in 2008, in some cases well before the fall of Lehman Brothers. The write-downs by the wholesale banking group that were made public by August 2008, including, most notably, the state-owned German Landesbanken, added up to approximately €29 billion, nearly two-thirds of the year-end trading losses reported by all the wholesale banks.<sup>20</sup>

The previous results show that income characteristics may serve as a poor indicator for assessing bank business models. For example, the share of commissions and fees, often used to distinguish investment-oriented banks, is similar across the four models.<sup>21</sup> In addition, the volatility of earnings renders the assessment of business models using income characteristics less reliable. Indeed, the share of trading income would not be able to identify correctly the set of investment or diversified retail-oriented banks, as already noted above. In addition, the results highlight the relative stability of diversified retail-oriented banks, which appear to outperform their peers in terms of performance indicators.

An additional question that remains to be answered is the extent to which the different business models continued to contribute to economic activity by essentially providing loans to the private sector. Faced with eroding capital bases and higher capital requirements from

20. The data on losses were obtained from Bloomberg, *Banks' Subprime Losses*, 12 August 2008 (<http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a8sW0n1Cs1tY>).

21. See Stiroh (2004 and 2006) for the use of income characteristics to distinguish among the different business models.

regulators, supervisors and other market actor banks had to improve their capital position. There are four broad ways in which banks have been able improve their capital positions during financial and economic crises: i) internal resources (e.g. increasing retained earnings, improving operational margins, changing internal rating based models, etc.); ii) external market sources (e.g. issuing new capital instruments, changing asset mix, deleveraging, etc.); iii) government funds (e.g. recapitalisation, asset relief measures, guarantees, etc.); and iv) monetary facilities (e.g. low policy rates, cheap funding, etc.).<sup>22</sup> The state-aid rules connected to the government interventions make government funds *defacto* a last source of funds that are only accessible to larger banks when all other possibilities to improve the capital position have been exhausted. The monetary facilities are only indirect capital gains due to lower interest costs. Most of the monetary facilities are further limited in size and maturity and the possibility of issuing new capital instruments was limited during the periods of financial distress, limiting the potential contribution to capital from these types of measures. For most banks therefore the internal sources to increase capital and external market sources to deleverage were the prevailing option to improve the capital position. However, booked losses and dropping asset prices often make it difficult for banks with low levels of capital to raise further capital, making the reduction of balance sheet size the more optimal choice (Myers, 1977; Myers & Majluf, 1984). Moreover, crisis conditions increase credit costs across the board, leading to higher agency costs of lending and pushing the less-diversified banks to engage in ‘flight to quality’ in search of more stable securities than loans (Lang & Nakamura, 1995; Bernanke et al., 1996). Thus, due to various difficulties, banks may choose to shrink their balance sheets by rationing loans and other investments.<sup>23</sup>

The extent to which the slowing down of loan growth or deleveraging has occurred has depended crucially on the risk characteristics and capital levels associated with the different bank business models. Based on the arguments outlined above, there is reason to suspect that banks with less diversified credit risks (such as focused retail-oriented banks) and lower capital levels (such as investment banks) would slow their supply of credit more than others.

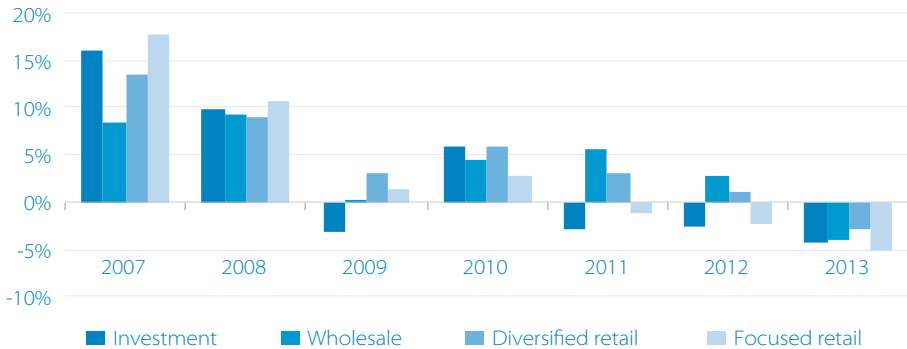
Figure 4.5 shows that the growth of loans subsided substantially after 2008 across all business models. In particular, the results confirm that outstanding customer loans shrunk dramatically for investment banks during the financial crisis, turning negative in 2009. All groups managed to expand their outstanding loans in 2010. Thereafter, the wholesale and diversified retail banks continued to expand their loan books at gradually lower rates in 2011 and 2012 despite the crisis. Meanwhile investment and focused retail banks reported negative growth of customer loans in the same two years. In the final year of the sample,

22. See Ayadi et al (2014) for a more comprehensive overview of channels used to improve the financial position of banks in recent years.

23. It should not be forgotten that a decline in credit growth may not necessarily be a negative outcome, largely the result of a realignment of asset prices with fundamentals. Borio & Lowe (2002) and Reinhart & Rogoff (2009) show that rapid credit growth, in conjunction with rising real estate prices, can lead to financial instability and are the primary drivers of crises. Several authors suggest that various macro-prudential and monetary policy tools should be used to respond to these challenges and to the build-up of risk over time. See Allen & Carletti (2011) for an excellent discussion and literature review on these issues.

2013, the loan growth of all business models decreased,<sup>24</sup> which might indicate that the loan growth is less responsive than, for instance, trading income to changes in financial and economic conditions.

FIGURE 4.5 – Growth in outstanding customer loans (% change from past year)



Source: Authors

To sum up, the results presented in this section show that the returns of banks across all business models have deteriorated since the financial crisis of 2008. The median returns of diversified retail-oriented banks appeared to be most resistant in withstanding the financial and Eurozone economic crises. In turn, wholesale banks, and, to a lesser extent, investment banks have suffered substantial trading losses amidst the crises, which has contributed to their less stable performances. Although the focused retail-oriented banks' performance was similar to diversified retail banks up to 2010, it worsened during the Eurozone crisis and in the years thereafter. The results also show that credit growth has slowed down for all banks and business models, in some cases leading to deleveraging. This is especially the case for the smaller focused retail banks and the inadequately capitalised investment banks. In turn, diversified retail banks have continued to extend credit despite the financial and economic crisis, except for 2013. Lastly, income characteristics are shown to be poor proxies for identifying the business models, largely due to the variability and responsiveness of earnings to market conditions.

24. Besides the supply factors summarised above, demand factors also play a role in credit growth. Hence, during the financial and economic crises, the demand for loans has, for example, decreased due to a reduction in profitable investment opportunities. Moreover, many projects require some preparation-time before credit is requested and granted, which is reflected in a delayed response to changes in economic conditions.

## 5 What are the Risks and How are they Mitigated?

The third phase of the analysis provides a risk assessment of banks' alternative business models. The key risk indicators are summarised in Table 5.1. For the most part, the results reconfirm earlier arguments on the risk attributes of various models (Ayadi et al., 2011 & 2012). In particular, the retail-diversified banks rely more on stable forms of funding and limit risky investments, while wholesale and investment banks tend to be better at resisting default risks. The diversified retail banking model does well under most measures, with low default risks, a level of capitalisation close to the sample median, and moderate liquidity risks. The focused retail banks face the highest default risks, although these risks appear to be shielded by relatively strong capital levels and limited liquidity mismatch risks.

TABLE 5.1 – Risk indicators across business models

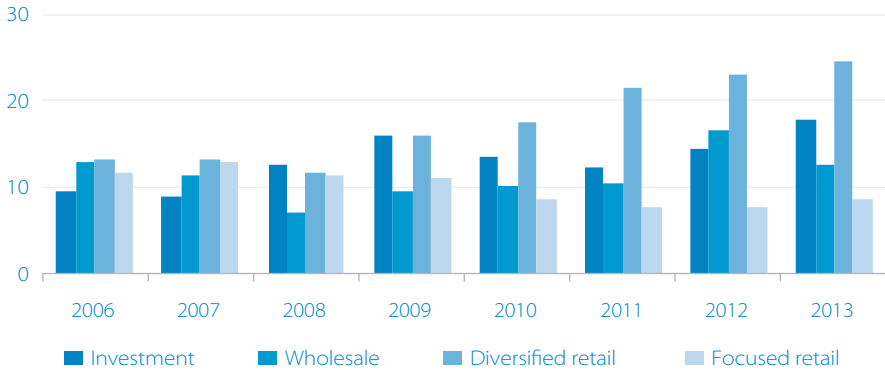
	Model 1 – Investment	Model 2 – Wholesale	Model 3 – Diversified retail	Model 4 – Focused retail	ALL
Z-score (std.dev. from default)	13.1**	10.8**	18.2**	9.5**	12.3
Risk-weighted assets (RWA) (% assets)	29.2%***	38.3%***	53.0%**	56.5%**	49%
Risk-costs (% of non-trading assets)	0.52%**	0.25%***	0.53%**	0.99%***	0.65%
CDS spread (senior, annual avg., bps.)	128.2*	122.2*	129.8*	263.7**	161.4
Stock returns volatility (std. dev. of daily returns)	2.7%	3.5%*	2.3%**	2.9%*	2.7%
Tier-1 capital ratio (% of RWA)	10.9%*	9.8%	9.7%**	10.5%*	10.4%
Tang. common eq. (% of tang. assets)	2.7%***	3.2%***	4.1%***	5.3%***	4.2%
NSFR (Avail./req. funding)	60.2%***	68.5%***	86.6%**	84.9%**	80.1%

Notes: All figures are the median values for the year-end observations for the relevant sub-sample. The independence of clusters was tested using non-parametric equality-of-medians two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (\*, \*\* or \*\*\*) stands for the statistical difference of any given cluster from that number of other clusters for that indicator. For example, two asterisks (\*\*) implies that the cluster is statistically different from two (furthest) clusters but not the third (closest) one. See Appendix III for the assumptions pertaining to the construction of the net stable funding ratio (NSFR) measure.

Source: Authors



FIGURE 5.1 – Evolution of Z-scores



Note: The amounts expressed in the figure are median values of distance to default. Since the standard deviation of returns as well as the mean returns are constant over time, the differences across years are due to changes in levels of equity as well as the composition of the business models.

Source: Authors

The first indicator, Z-score, provides an estimate of a bank's distance to default.<sup>25</sup> In essence, the risk measure uses historical earnings volatility and returns as well as current capital levels to construct the level of a (one-time) shock beyond the historical average that would lead to default. The greater the Z-score, the less probable is the likelihood of a default. The diversified retail banks appear safer, with a higher distance to default and a high level of net stable funding. The distribution of the Z-scores for diversified retail banks are significantly different from wholesale and retail-focused banks. In turn, focused retail banks have effectively lower Z-scores, implying the highest risks. Figure 5.1 shows that the differences in median Z-scores across business models have primarily been created in the most recent years.

The second indicator, the ratio of risk-weighted assets (RWA) to total assets, or the average risk-weights, provides a regulatory measure of risk. Banks with higher RWA are expected to be more sensitive to risks and are thus required to hold more regulatory capital to account for their risk-weighted balance sheet<sup>26</sup>, without counting the risk pertaining to the off-balance sheet. According to the statistical analysis, both investment and wholesale banks appear to be less risky, with distinct median risk weights of 29% and 38% respectively, which is substantially lower than the risk weights of the retail-oriented banks (between 53% and 57%). The finding that wholesale banks have less exposure to risks in their assets is intriguing and clearly inconsistent with the Z-score findings, which indicates higher default risks than diversified

25. See Appendix II for the calculation of the Z-score.

26. The off-balance sheet exposures could not be included in this monitor because of too few observations and insufficient comparability.

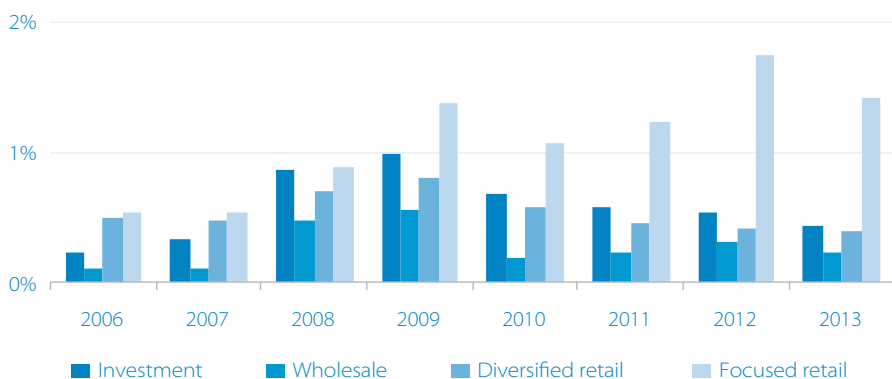
retail banks.<sup>27</sup> Moreover, Figure 5.2 shows that the median level of risk weighted assets across all business models has gradually been declining. The largest change was observed in diversified retail banks, which decreased the median risk weight from above the focused retail banks in 2007 to a level close to or below wholesale banks in 2011.

FIGURE 5.2 – Evolution of RWAs (% of total assets)



Note: The amounts expressed in the figure are median values of risk weighted assets as a share of total assets.  
Source: Authors

FIGURE 5.3 – Evolution of risk-costs (% of non-trading assets)



Note: Expenses on depreciation, amortisations, provisions and write-downs as well as recovered credit losses on non-trading assets as a share of non-trading assets. Non-trading assets include cash and balances with central banks, loans to banks, loans to customers and intangible assets.  
Source: Authors

27. See below for a deeper inquiry into why the regulatory and estimated risk measures may differ so radically.

The third indicator, risk-costs as a share of non-trading assets, is a proxy-measure for the credit losses. Since there is no harmonised definition of credit losses reported and the separation between credit losses and losses on other types of assets is often opaque, the measure also includes other non-trading assets (besides loans to banks and other customers). The results displayed in Figure 5.3 show that the pre-crisis risk-costs of investment and wholesale banks were substantially lower than those of retail banks. During the financial crisis of 2008 and 2009, all business models posted higher risk-costs. Afterwards, during the economic crisis, the credit losses of most business models dropped, with the exception of focused retail. The difference might be explained by a difference in the composition of the credit portfolio. The wholesale and, to a lesser extent, investment banks have relatively more credit outstanding to banks compared to other customers. Notwithstanding some high-profile cases like the collapse of Lehman Brothers, the losses on loans to banks have historically been lower than on loans to other customers. Even during the crisis, the banks were largely shielded from bearing losses on loans to banks, primarily due to the various government- and central bank-interventions that prevented banks from going bankrupt and limited the burden sharing to equity holders and junior debt holders.

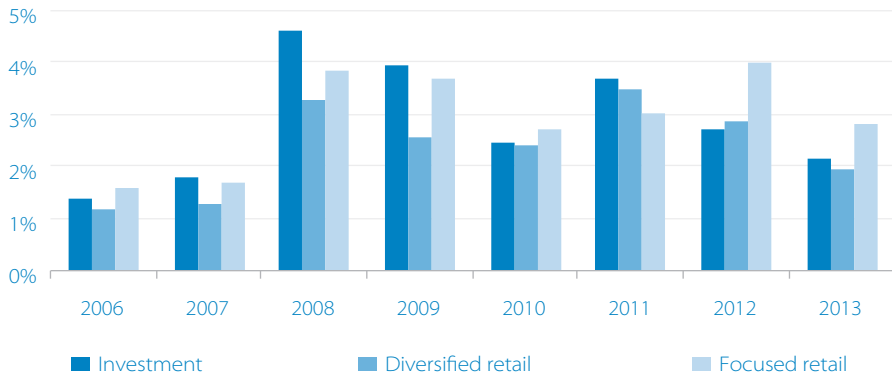
FIGURE 5.4 – Evolution of CDS spreads



Note: The figure presents the median annual average CDS spreads on senior bonds in basis points.

Source: Authors

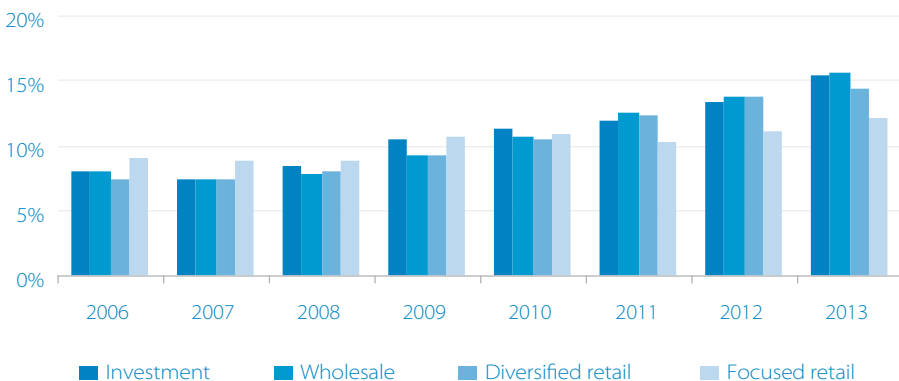
The fourth indicator, the median CDS spreads for senior securities, displays a significant higher CDS spread for the small and least financially integrated focused retail banks than all other banking business models (see also Figure 5.4). The difference between the investment-, wholesale-, and diversified retail banks is not significant, implying that the underlying distributions may be identical. Echoing the results in Ayadi et al. (2011 and 2012), the market participants do not appear to distinguish among these three models in terms of their inherent risks. Provided that other indicators do find substantial differences for the underlying risks, it is likely that the market participants have already factored in the likelihood of government interventions, resulting in the comparability of the markets' perception of default risks. Once again, these findings give support to the elevation of moral hazard risks due to the dilution of market discipline in the eventuality of bank bail-outs or state guarantees (Calomiris & Kahn, 1991).

**FIGURE 5.5** – Evolution of stock returns volatility

Note: The amounts expressed in the figure are median values of standard deviations of daily stock returns. For the primarily stakeholder-oriented wholesale banks, there were too few observations.

Source: Authors

The fifth indicator, the annual standard deviations in daily stock returns, measures the risk sensitivity of listed banks. In contrast to the notes underlying the CDS-measure above, the shares underlying this measure do not remain unaffected by government interventions. However, at the moment that the government obtains all the shares, trading is suspended and the changes in value no longer appear in the volatility figures. The results are largely in line with the Z-score measure, but the differences are only partially significant. Only the listed diversified retail banks are significantly less sensitive to risks than wholesale and focused retail banks. The differences between the volatilities of investment-, wholesale- and focused-retail banks are reciprocally insignificant. Moreover, Figure 5.5 shows that the volatility in stock returns increased after the burst of the financial crisis in 2008 and has remained at a higher level across all business models.

**FIGURE 5.6** – Evolution of Tier 1 capital ratios

Note: The amounts expressed in the figure are median values of Tier-1 capital ratios, tier 1 capital as percentage of risk weighted assets.

Source: Authors

The sixth indicator measures the loss-absorption capacity of banks under the Basel capital rules (See also Figure 5.6). For any given level of risk, holding more capital could imply greater stability. The results show that Tier 1 ratios have been gradually increasing since 2007. However, the ratios are statistically almost indistinguishable among the four banking groups, implying a more or less identical absorption capacity. Only the Tier 1 ratio of diversified retail banks is significantly lower than that of investment- and retail-focused banks. The fact that the differences in risk and absorption capacity are not reflected in the Tier 1 ratios is intriguing and invites the possibility that the main regulatory instrument currently in use may not be adequate for capturing (or signalling) the loss-absorption capacity of a bank.

FIGURE 5.7 – Evolution of leverage ratios

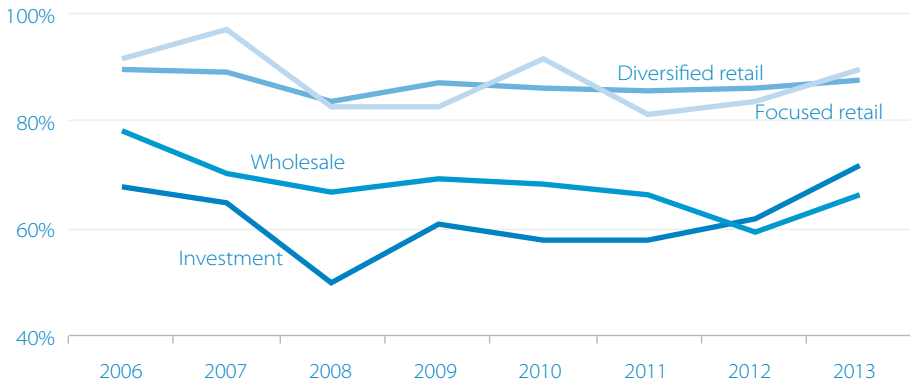


Note: The leverage ratios in the figure above are median tangible common equity as a share of tangible assets.  
Source: Authors

The seventh indicator measures the loss-absorption capacity using a simple leverage ratio. The tangible-common equity ratios are statistically distinct for all business models. Retail banks hold substantially more tangible common equity, which made them able to absorb more losses (at least for the period of observation under investigation). Moreover, the results suggest that wholesale banks can absorb significantly more losses than investment banks. Figure 5.7 shows that banks across all business models, except for focused retail banks, have increased the tangible-common equity ratios.

The eighth indicator, the net stable funding ratio (NSFR), is an estimate of the proposed long-term liquidity risk measure proposed under the Basel III rules, (BCBS, 2010a). Expressed simply, the measure gives an estimate of the available stable funding sources as a share of required stable funding, which is constructed with available data. Although the measure should be interpreted with caution, a greater value should point to lower liquidity risks.<sup>28</sup> Figure 5.8 shows that the retail oriented banking models face relatively lower

28. See Appendix II for a detailed description of the measure used in this study. Note that the developed indicator suffers substantially from the unavailability of detailed information. In particular, the disclosure requirements that are currently applicable do not require banks to distinguish between different maturities, secured transactions and many specific asset and liability classes that are relevant for determining liquidity in an institution.

**FIGURE 5.8** – Evolution of net stable funding ratio (NSFR)

Note: See Appendix II for the assumptions pertaining to the construction of the net stable funding ratio (NSFR).  
Source: Authors

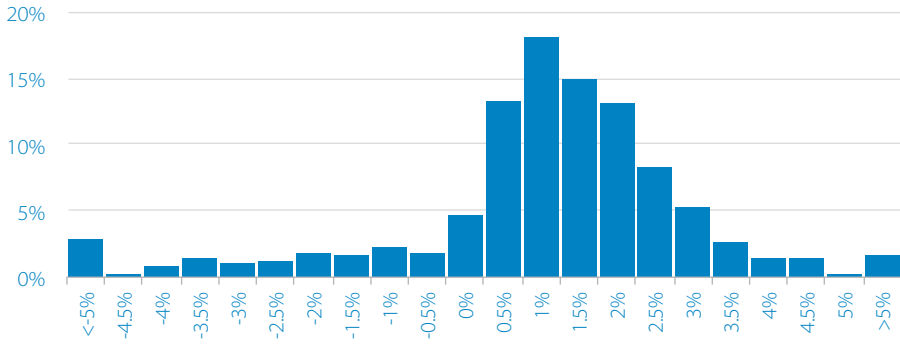
liquidity risks, while wholesale and investment banks may face higher risks. It is important to note that no single model satisfies the 100% funding requirement, as proposed under Basel III. Moreover, Figure 5.8 shows that liquidity conditions have gradually worsened for most models up to 2012, particularly for the investment and focused retail banks that took severe liquidity hits in 2008.

An alternative assessment of default risks follows the ‘top-down’ approach to calibrating regulatory minimum capital requirements under stress conditions, as described in BCBS (2010b). More specifically, the quantiles of the return to risk-weighted assets (RoRWA) are used to construct expected losses that banks may face under a stress scenario. If the most loss-absorbing parts of equity (i.e. the tangible common capital ratio) remain below or close to such a measure, then the likelihood of a default would be equally higher under those stress conditions.

As an illustrative example, consider a bank that achieves 3% RoRWA in normal years. Let us assume that in a bad year, which occurs randomly once every 20 years, the bank faces a 7% loss. Note that the loss corresponds precisely to the 5th percentile of the distribution function. Although average earnings (2.5% RoRWA) may be considered healthy, the bank will nevertheless default if its risk-adjusted capital level is below 7% in a bad year. Assuming a similar distribution for other banks, the regulators should ensure that the banks have at least this amount of capital at all times to cope with stress when needed.

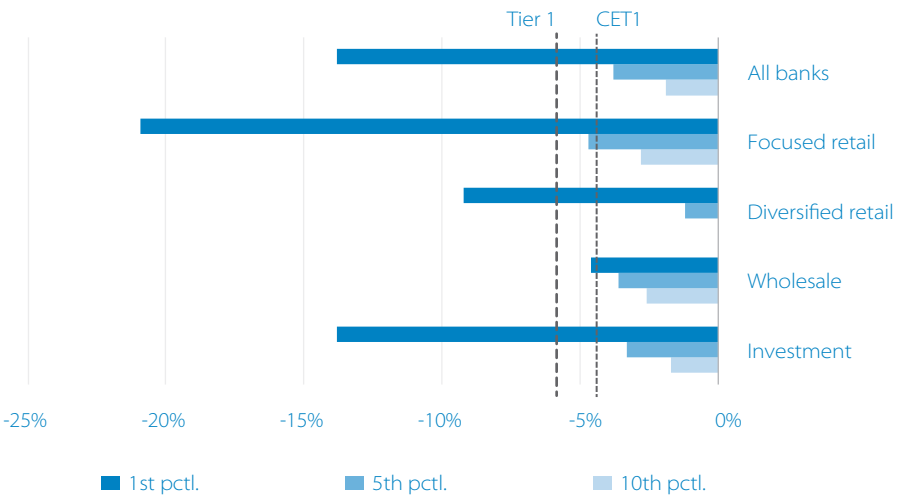
Naturally, the distribution of returns of actual banks is substantially more varied than the example above. In particular, Figure 5.9 provides an illustration of the distribution of the risk-weighted returns for all banks and years in the sample. The highest frequency of the distribution is around 1% RoRWA, implying healthy returns for most banks in normal years. Assuming that a bad year is defined as a once in a 10-year event, i.e. lower 10<sup>th</sup> percentile losses, banks face RoRWA losses of 1.9% (see also Figure 5.10). If a bad year is

**FIGURE 5.9** – Distribution of risk-weighted returns (RoRWA)



Note: This figure depicts the distribution for all banks covered in the study for the years 2006 to 2013.  
Source: Authors

**FIGURE 5.10** – Return on risk-weighted assets (top percentiles)



Note: This figure depicts the RoRWA of the top percentiles (1<sup>st</sup>, 5<sup>th</sup>, and 10<sup>th</sup>) for all banks covered in the study for the years 2006 to 2013. The dotted lines show the minimum regulatory requirements under CRDIV, common equity Tier 1 (CET1) requirement of 4.5% and Tier 1 requirement of 6% respectively.  
Source: Authors

defined to be a rarer and thus a more destructive event, i.e. lower 5<sup>th</sup> percentile, the potential losses increase to 3.8%.<sup>29</sup>

Using such estimates for different business models, one can assess the adequacy of the capital requirements to cope with stress conditions.

For our sample, the number of observations is insufficient to produce consistent estimates for the 1<sup>st</sup> and 5<sup>th</sup> percentiles, especially for individual business models. The limited sample size thus increases the likelihood of estimation errors. Moreover, the relevant order statistics may be substantially biased if the underlying distribution is not normal. In order to address the latter concern, the distribution-free quantile estimator first proposed by Harrell & Davis (1982) was used to generate alternative estimates for the lower percentiles, in addition to the statistics obtained from the original sample.<sup>30</sup> The estimation results should nevertheless be interpreted with caution due to potential estimation errors.

The lower percentile estimates depicted in Table 5.2 provide an insight into the losses that banks have faced in recent years. When the entire sample is considered, the risk-adjusted losses, as measured by RoRWA, are approximately 13.8% at the 1<sup>st</sup> percentile.<sup>31</sup> However, the depicted period had a large impact on returns. Losses were substantially greater during the 2010-12 Eurozone crisis years than during the financial crisis years, with the pooled sample of banks having faced risk-adjusted 1<sup>st</sup> percentile losses of respectively 20.9% and 4.1%.<sup>32</sup>

The distinction between the sample statistics and the Harrell-Davis estimates hint that concerns over the consistency of estimates could be well-placed for some of the sub-samples. Especially the business model results in the more extreme periods show depicted percentile estimates that differ from the original figures. In particular, the estimated RoRWA loss at the 1<sup>st</sup> percentile diverts.

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29. Assuming that earnings are randomly and independently distributed, the estimates would imply that a bank with risk-adjusted capital less than 1.9% would face a default likelihood of 5% at any given point in time. However, the earnings distributions of different banks are typically highly correlated, especially when interbank activities and common exposures are substantial. It is also assumed that losses are not correlated over time, which is also not likely to be the case. Based on these shortcomings, the actual default likelihoods are likely to be much higher than the levels implied by the percentile estimates.

30. Harrell & Davis (1982) provide a kernel quantile estimator in which the order statistics (i.e. smallest observations) used in traditional nonparametric estimators are given the greatest weight.

31. The pooled sample statistics for the 1<sup>st</sup> percentile were largely in line with the 4% provided in BCBS (2010b) for the first four years in the sample. However, the peak losses increased substantially in the years thereafter.

32. Although the estimates for different years can clearly not be used to build the scenarios, the substantial differences highlight the need for balanced data. The extent to which the crisis years are included in the dataset has a substantial impact on the severity of the stress scenarios and the relevant capital requirements.



TABLE 5.2 – Lower percentile estimates for return on risk-weighted assets (RoRWA)

	Obs.	Sample statistics			Harrell-Davis estimates		
		1 <sup>st</sup>	5 <sup>th</sup>	10 <sup>th</sup>	1 <sup>st</sup>	5 <sup>th</sup>	10 <sup>th</sup>
<b>ALL YEARS (2006-13)</b>							
Model 1 - Investment	168	-13.8%	-3.3%	-1.7%	-16.2%	-3.4%	-1.6%
Model 2 - Wholesale	106	-4.6%	-3.6%	-2.6%	-5.5%	-3.6%	-2.4%
Model 3 – Divers. retail	286	-9.2%	-1.2%	0.0%	-9.4%	-1.2%	-0.1%
Model 4 – Focus. retail	375	-20.9%	-4.7%	-2.8%	-21.3%	-4.7%	-2.9%
All banks	935	-13.8%	-3.8%	-1.9%	-14.9%	-3.6%	-1.9%
<b>PRE-CRISIS (2006-07)</b>							
Model 1 - Investment	40	-1.4%	0.2%	0.5%	-1.2%	-0.1%	0.4%
Model 2 - Wholesale	27	-4.1%	0.1%	0.2%	-3.8%	-1.8%	-0.1%
Model 3 – Divers. retail	86	-2.2%	0.1%	1.0%	-1.5%	0.3%	0.9%
Model 4 – Focus. retail	62	0.1%	0.9%	1.1%	0.2%	0.8%	1.1%
All banks	215	-1.4%	0.2%	0.8%	-2.0%	0.3%	0.7%
<b>FINANCIAL CRISIS (2008-09)</b>							
Model 1 - Investment	44	-6.3%	-1.9%	-1.7%	-5.9%	-3.5%	-1.8%
Model 2 - Wholesale	30	-6.2%	-3.8%	-3.0%	-5.9%	-4.6%	-3.3%
Model 3 – Divers. retail	74	-3.9%	-0.6%	-0.2%	-3.5%	-1.0%	-0.3%
Model 4 – Focus. retail	91	-3.9%	-2.3%	-1.9%	-3.8%	-2.6%	-1.8%
All banks	239	-4.1%	-2.6%	-1.9%	-5.1%	-2.7%	-1.7%
<b>EUROZONE CRISIS (2010-12)</b>							
Model 1 - Investment	67	-25.9%	-4.0%	-3.2%	-22.5%	-6.9%	-2.8%
Model 2 - Wholesale	39	-4.6%	-4.2%	-3.2%	-4.5%	-3.8%	-2.2%
Model 3 – Divers. retail	98	-5.7%	-1.5%	-0.3%	-4.6%	-1.7%	-0.5%
Model 4 – Focus. retail	163	-25.6%	-6.1%	-3.9%	-31.4%	-8.4%	-4.1%
All banks	367	-20.9%	-4.6%	-2.9%	-22.0%	-4.6%	-2.8%
<b>FIN+EUR CRISES (2008-12)</b>							
Model 1 - Investment	111	-13.8%	-4.0%	-1.9%	-19.6%	-4.3%	-2.2%
Model 2 - Wholesale	69	-6.2%	-3.8%	-3.2%	-5.7%	-4.0%	-3.0%
Model 3 – Divers. retail	172	-3.9%	-1.2%	-0.2%	-4.2%	-1.3%	-0.3%
Model 4 – Focus. retail	254	-20.9%	-5.0%	-3.1%	-24.5%	-5.0%	-3.1%
All banks	606	-13.8%	-3.9%	-2.2%	-15.7%	-3.8%	-2.2%
<b>POST-CRISIS (2013)</b>							
Model 1 - Investment	17	-9.2%	-9.2%	-2.4%	-8.9%	-7.0%	-4.2%
Model 2 - Wholesale	10	-0.4%	-0.4%	-0.1%	-0.4%	-0.3%	-0.1%
Model 3 – Divers. retail	28	-19.4%	-13.6%	-9.2%	-18.9%	-14.5%	-8.2%
Model 4 – Focus. retail	59	-22.9%	-8.9%	-4.4%	-21.2%	-10.3%	-4.8%
All banks	114	-19.4%	-9.2%	-4.1%	-20.7%	-9.5%	-4.2%

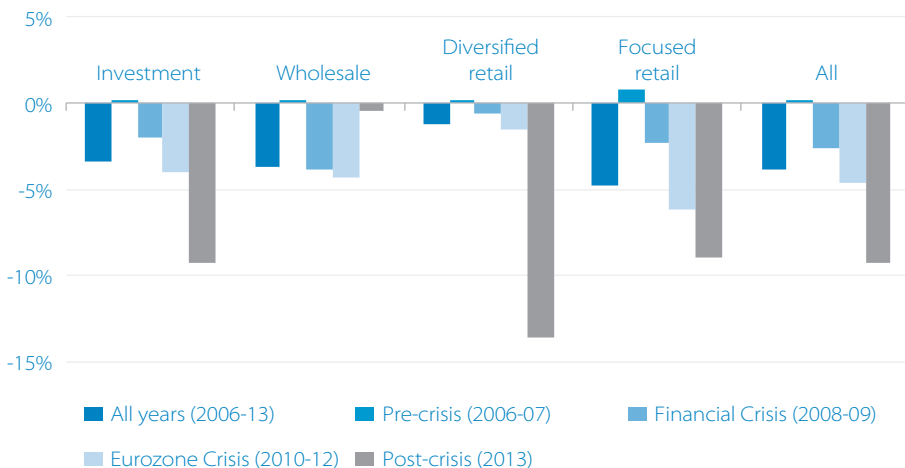
Note: The figures correspond to the 1<sup>st</sup>, 5<sup>th</sup>, and 10<sup>th</sup> percentile estimates of the distribution of the RoRWA, conditional on the business models and time periods across the sample.

Source: Authors

Turning to the comparison of different business models, the figures show that diversified retail banks faced the least peak-losses over the whole sample period (935 observations). It is the only model that posted a break-even RoRWA for the 10<sup>th</sup> percentile. Moreover, the losses for the 5<sup>th</sup> percentile were less than those of the other business models. Only in the 1<sup>st</sup> percentile were losses of wholesale banks above those of the diversified retail banks. The 5<sup>th</sup> and 10<sup>th</sup> percentile losses of wholesale banks were higher than those of investment banks. The focused retail banks posted the deepest losses in all three estimated percentiles, 1<sup>st</sup>, 5<sup>th</sup>, and 10<sup>th</sup>, respectively.

The order in peak-losses differs substantially for the different sub-periods in the sample (See also Figure 5.11). During the pre-crisis years 2006 and 2007, losses occurred only for the 1<sup>st</sup> percentile, while during the crises, losses were observed in the 10<sup>th</sup> percentile and below. The losses climbed gradually during the crises. During the 2008-09 financial crisis, the losses were less than during the 2010-12 Eurozone economic crisis losses. The order of the business models also shifted. While the focused retail banks reported losses below those of the wholesale banks and similar to investment banks during the financial crisis, the focused retail banks reported the highest losses during the Eurozone crisis. The returns of the investment banks worsened more than wholesale banks, resulting in similar peak-losses for the 5<sup>th</sup> and 10<sup>th</sup> percentiles.

FIGURE 5.11 – Return on risk-weighted assets (5th percentile)

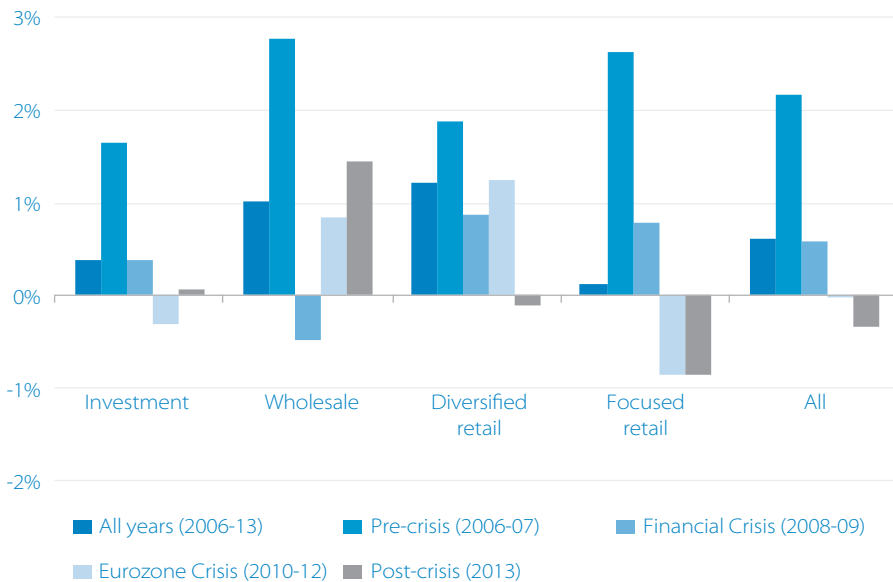


Note: The figures correspond to the 5<sup>th</sup> percentile estimates of the distribution of the RoRWA, conditional on the business models and time periods across the sample.

Source: Authors

A comparison of the mean values for RoRWA (Figure 5.12 and Table 5.3) shows that the distinctions between clusters are only clear for diversified retail banks when tested using Wilcoxon-Mann-Whitney non-parametric two-sample tests. The results for all years show that the diversified retail banks, on average, reported distinctly higher RoRWAs than banks belonging to one of the three other models. Although the same is true for all crises years (2008-12), the results for the financial and Eurozone crises on a stand-alone basis are only partially significant. On average, both types of retail banks reported significantly higher returns than wholesale banks during the 2008-09 financial crisis. During the 2010-12 Eurozone crisis, the returns of both diversified retail banks were distinct from the returns of investment and focused retail banks.

FIGURE 5.12 – Mean RoRWA across business models



Notes: All figures are the mean values for all banks in the sample.  
Source: Authors

The findings show clear distinctions across business models in terms of riskiness which suggests that the average risk weights are not a good indicator of the underlying risks. In particular, wholesale banks and focused retail banks faced severe default risks during the financial and economic crises. Nevertheless, these differences appear in the underlying risks, not in the average risk weights.

TABLE 5.3 – Mean RoRWA across business models

	Model 1 - Investment	Model 2 - Wholesale	Model 3 - Diversified retail	Model 4 - Focused retail	ALL
All years (2006-13)	0.4%*	1%*	1.2%***	0.1%*	0.6%
Pre-crisis (2006-07)	1.6%*	2.8%**	1.9%**	2.6%***	2.2%
Financial Crisis (2008-09)	0.4%	-0.5%**	0.9%*	0.8%*	0.6%
Eurozone Crisis (2010-12)	-0.3%*	0.8%*	1.3%**	-0.8%**	0.0%
Crisis years (2008-12)	0.0%*	0.3%*	1.1%***	-0.3%*	0.2%
Post-crisis (2013)	0.1%	1.5%*	-0.1%*	-0.8%**	-0.3%

Notes: All figures are the mean values for all banks in the sample. The independence of clusters was tested using Wilcoxon-Mann-Whitney non-parametric two-sample tests at 5% significance. The number of asterisks (\*, \*\*, or \*\*\*) stands for the statistical difference of any given cluster from that number of other clusters for that indicator. For example, a single asterisk (\*) implies that the cluster is statistically different from the furthest cluster but not the other two.

Source: Authors

One explanation for the finding that regulatory measures appear to be misaligned with underlying risks is the possibility that greater risk-weights are associated with more capital. If banks with greater RWA also hold more capital, partly to fulfil the binding regulatory requirements, they may face lower default risks, possibly explaining the distorted relationship.

An alternative explanation is that banks may be engaging in 'risk optimisation' to reduce their risk-weights (and the implied capital charges) without shedding any risks. Indeed, despite sound arguments for making capital requirements risk-sensitive, the complexity and flexibility of these rules have led to concerns over the potential for regulatory arbitrage.<sup>33</sup> Since raising capital is not always possible during the crisis periods, some banks choose to respond to regulatory shortfalls by decreasing their risk-weighted assets. This can be done through deleveraging or changing the calibration of the risk-weights (i.e. changing from standard to internal models with lower average ratios or changing the internal models) or by changing the composition of the assets to assets with lower risk-weights. There is a concern among researchers, supervisors and policy makers about the usage of internal models, which implies that the risk-weights and thus capital requirements are reduced without reducing the underlying risks (i.e. regulatory arbitrage).<sup>34</sup>

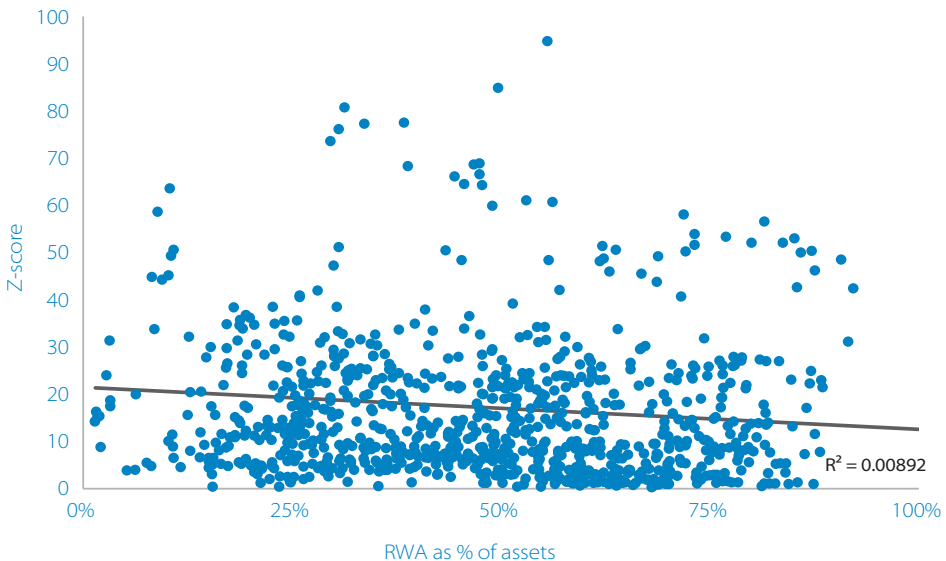
33. The theoretical literature provides a simple argument for making capital requirements risk-sensitive. Faced with purely linear (i.e. risk-insensitive) capital requirements, banks may shift their portfolios towards riskier assets, offsetting their losses from higher capital levels by increasing their portfolio risks (Kahane, 1977; Koehn & Santomero, 1980; Kim & Santomero, 1988; Rochet, 1992). Empirical studies have confirmed that fixed capital requirements may increase risks, conditional on the size and the adequate capitalisation of the bank (Furlong & Keeley, 1989; Gennotte & Pyle, 1991; Calem & Rob, 1999).

34. Jones (2000) discusses several forms of 'cosmetic' adjustments that banks can undertake to reduce risk weights, including the concentration of assets in the highest risk classes for a given risk weight, various forms of credit enhancements, remote-origination, and structured transactions. More recently, some observers note that the introduction of the IRB approach under Basel II has effectively enlarged the opportunities of the more sophisticated banks to engage in regulatory arbitrage, (Blundell-Wignall & Atkinson, 2010; Dewatripont et al., 2010; ICB, 2011). More specifically, there is substantial evidence from the financial crisis of 2007-09 that losses from off-balance sheet asset-backed commercial paper (ABCP) conduits have remained with the originating banks (Acharya et al., 2010).

Empirical evidence on the potential misalignment of risk-sensitive capital requirements is growing. Ayadi et al. (2011) provide evidence of a negative relationship between average risk weights and a number of risk factors for the EU's top banks in recent years, including estimates of default likelihood, Tier 1 ratio and earnings volatility. Supplemental evidence from the study also shows that investment-oriented banks may have found ways to take on more risk than their regulatory risk measures would reflect. More recently, Das & Sy (2012) have shown that banks with lower average risk-weights (measured by the risk-weighted-assets to asset ratio) do a poor job in predicting market measures of risk, especially during the crisis. The Basel Committee on Banking Supervision (2013) conducted a benchmarking exercise using data for more than 100 banks, which showed that there are large differences between the internal models used to determine the risk weighted assets. They found, for example, a large variance in the models used to estimate the probabilities of defaults and loss given defaults.

In this Monitor, the univariate regressions of Ayadi et al. (2012) are repeated. Table 5.4 provides the results of censored regressions to assess whether the average risk weights explain distance from default (Z-Score). To be a good regulatory risk measure, there should be a strong relation between the risk weighted assets and the underlying risk. Notwithstanding differences in capital levels, the relationship between Z-score and RWA to assets should be negative, which implies that banks with a higher RWA are closer to default.

FIGURE 5.13 – Relation between Z-score and RWA



Notes: The business models to which the different observations are expressed with the first letter of the models: Investment (I), Wholesale (W), Diversified retail (D), and Focused retail (F). The axes have been cut at a Z-score of 100 and RWA 100% of assets to make it easier to visualize the large majority of the observations.

Source: Authors

The estimation results for the pooled sample as well as for retail banks show a persistent significant negative relation between the regulatory risk measure and distance to default (See also Figure 5.13 for a scatter plot of the observations). In turn, the results for wholesale banks show a significant positive relation, which implies that RWA are inversely related to underlying risks. The estimates for investment banks are also positive but insignificant at the 10% level. The relationship becomes stronger and more negative when capital is controlled, except for wholesale banks. This implies that banks with greater RWA are holding more capital, which can partly offset their lower risk profile.

These results are slightly different than Ayadi et al (2012), which found a negative relation for wholesale banks and a positive relation for investment banks significant at, respectively, the 10% and 5% levels. The migration between clusters might explain the differences in estimation results. The extension of the number of banks included in the monitor has caused a large minority of the wholesale banks in the previous study to turn into investment banks. The other results have become more robust, which might be explained by the nearly three times larger sample that was used for this monitor.

Overall, RWA does appear to be able to capture the underlying risks for the two retail business models. In turn, it fails to do so for wholesale and investment banks. The relationship between the two measures of risk is ambiguous for investment banks and the reverse for wholesale banks, even after controlling for capital levels. The findings suggest that the risk weighted assets of wholesale and investment banks are not well calibrated. Hence, this implies that the risk weights of certain assets or activities conducted primarily by wholesale and investment banks are incorrect. The wholesale and investment banks, for example, engage more in trading activities. The effective risk-weights for these activities are rather low due to the possibility of lowering the exposures (e.g. compression, hedging, offsetting and netting), which is particularly attractive to banks with larger market activities that can benefit from scale advantages.

To sum up, this section assessed the risks associated with the different business models. Using a rich palette of risk measures, diversified retail banks appear to be safest, while the other business models show a more diverse pattern. Wholesale and investment banks were more exposed to the 2008-09 financial crisis, while the focused retail banks suffered more during the 2010-12 economic crisis.

These results provide some justification for imposing stricter regulatory requirements on both wholesale and investment banks, for which the regulatory risk measure does not seem to capture the underlying risks. However, more research and monitoring are required to continue estimating effective ratios.

In addition, some of the risk indicators largely fail to distinguish between business models. This is the case for the binding regulatory capital ratio (Tier 1), with which most banks keep a similar margin. The CDS spreads only distinguish the smaller focused retail banks, which could be due to a realisation of the moral hazard, since smaller, less significant banks are less likely to be bailed-out.

**TABLE 5.4** – Relationship between Z-score and RWA across business models (2006-2013)

	Model 1 - Investment		Model 4 – Wholesale		Model 3 – Diversified retail		Model 2 – Focused retail		All banks	
	I	II	III	IV	V	VI	VII	VIII	IX	X
RWA	0.8 -5.1	2.1 -6.5	20.1*** -5.5	15.5** -6	-21.3*** -6.7	-36.4*** -5.1	-14.8*** -3.7	-30.4*** -4.3	-8.9*** -2.9	-19.9*** -3.5
TCE		-16.4 -73		60.1* -32.8		248.0*** -65.5		235.3*** -34.8		157.2*** -36.3
Cons.	14.3*** -2.6	14.3*** -2.7	5.9*** -1.9	4.8** -1.9	34.5*** -4.6	30.5*** -5.4	22.4*** -2.4	18.6*** -2.2	21.3*** -1.8	19.3*** -1.9
Obs.	163	163	106	106	281	281	368	368	918	918
Log L.	-675.7	-675.7	-398.3	-394.3	-1328	-1323	-1513	-1487	-4031	-4012
F-stat.	0.0279	0.0537	13.41	9.117	10.15	33.85	16	29.55	9.415	17.01
p-value	0.868	0.948	0.000	0.000	0.002	0.000	0.000	0.000	0.002	0.000

Notes: Regressions present results for Tobit univariate regressions with the Z-score as the dependent variable and left-censored at zero. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* signify significance at 1%, 5%, and 10% p-values. RWA: risk-weighted-assets as% of total assets; TCE: tangible common equity as% of tangible assets; Log L.: log likelihood ratio.

Source: Authors

## 6 Conclusions

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The 2014 Business Models Monitor of the European banking sector assesses the banking sector structure in light of the establishment of different new international supervisors. It also attempts to get better insights into the impact of different types of corporate structures. Moreover, it analyses the profitability, asset and liability structure, earnings performance, and risk and stability aspects of the largest and most significant banking institutions through four broad clusters.

Focusing on the large and systemic banking groups that are supervised by the international supervisors, the Business Models Monitor covers 147 banking groups, that account for around 80% of the EU banking assets, and uses a novel clustering model using SAS programming. For the analysis, the 1,126 bank-year observations were clustered into four broad categories: investment, wholesale, diversified retail and focused retail banks. Table 6.1 summarises the main observations of these four business models.

The banks identified as investment-oriented are, on average, the largest and most internationally oriented banks among the four models. The investment banks also include the largest share of profit-maximising banks, i.e. the highest share of shareholder value banks. The banks are among the most leveraged (i.e. low proportion of tangible common equity to total assets) and engage extensively in trading activities while relying on debt securities and derivatives for funding. Yet, the average trading income is below that of diversified retail banks that have substantially less trading activities, but a more stable trading income. Moreover, the share of net interest income is below that of the other business models, while a larger share is obtained from commissions and fees.

The investment banks' performance fluctuated substantially during the 2008-09 financial crisis and the 2010-12 Eurozone economic crisis. The median return on assets was below that of the other models, though close to that of wholesale banks. During the financial crisis, the banks suffered from high risk-costs that put pressure on returns. Nevertheless, due to a higher leverage, the gap with retail banks was smaller for return on equity. The deleveraging that was used by investment banks to improve their capital position and address the less stable funding was funnelled through to the real economy in the form of lower customer loans. The investment banks were the only banks that posted four years of negative customer loan growth in the past five years.

Wholesale banks have, on average, the smallest and most domestically oriented models. The banks primarily engage in interbank lending and borrowing and are primarily categorised as stakeholder value banks. These include, among others, central institutions of cooperative- and savings banks that provide liquidity and other services to local banks. Hence, the wholesale banks include most cooperative and state-owned banks. Moreover, the model contains the least listed and the largest shares of block-ownership. The bank-to-bank intermediation model depends mostly on net interest income and is traditionally characterised by low loan losses. Despite the extra-ordinary losses during the financial crisis, the wholesale bank still had the lowest median risk-costs. In addition, the banks were also more efficient than their peers.



The wholesale banks' returns have been rather stable, except for during the financial crisis. The median return on assets has been below that of the retail models and close to that of investment banks. The wholesale banks suffered substantial trading losses in 2008, but were able to recover swiftly in the period thereafter. Like investment banks, the gap between the return on equity was smaller than the return on assets due to a higher leverage. Unlike investment banks, the capital improvement of wholesale banks was not accompanied with consecutive years of declines in loans. Hence, median levels of loans to customers grew in four of the past five years.

Diversified retail banks have a modest size and are internationally oriented. The ownership structure is close to the sample average, with the exception of the lowest share of state-owned banks. In particular, the diversified retail banks lend to customers using primarily debt liabilities and customer deposits. Notwithstanding that the largest share of assets are allocated to customer loans, the diversified retail banks obtained the largest share of income from trading activities. In fact, the trading income is more stable than that of investment banks, which have most trading activities. The diversified retail banks are relatively the least risky based on various reporting and market risk indicators. The banks have the largest median distance to default and lowest volatility in stock returns. In turn, the diversified retail banks score relatively low on regulatory risk indicators, i.e. relatively high average risk-weights and low regulatory Tier 1 ratios.

The diversified retail banks' returns have been the most stable. The median return on assets and equity have been the highest. The diversified retail banks only suffered a slightly lower trading income and slightly higher risk-costs. The returns were partially funnelled through to the real economy in the form of higher customer loans. The banks posted slightly positive customer loan growth during the financial crisis, which declined during the economic crisis.

Focused retail banks have an ownership structure that is close to the sample average. About half of these small domestically oriented institutions are shareholder-value (SHV) banks, while about a fifth are cooperative- and a quarter savings banks. Most institutions providing traditional services such as customer loans are funded by customer deposits. This is also reflected in the income, which consists mostly of net interest income and commission and fees, while trading income is only a minor component.

The number of banks that were identified as focused retail increased during the crises. Most of the banks that received state aid have, for example, reoriented towards focused retail, which was in many cases supported by the conditions for obtaining capital support.

The focused retail banks have performed remarkably worse than their peers during the Eurozone crisis. Interestingly, the focused retail banks suffered the highest risk-costs, which resulted in median returns on assets close to zero; The median return was even negative in 2012. Although the focused retail banks are least leveraged, the model is closest to default. The riskiness of the model is also reflected in the market at regulatory risk measures. The CDS-spreads on senior debt of the focused retail banks is substantially higher and the average risk-weights are the highest of the entire sample. The customer loans have been declining for the past three years.

TABLE 6.1 – Main observations on European bank business models (2006-2013)

	Ownership	(Financial) activities	Financial and economic performance	Risk
<b>Model 1 – Investment (188 obs.)</b>	Largest share of shareholder value banks. Mostly listed. Barely any cooperatives.	Largest banks. Primarily holding trading assets and funded through debt securities and negative derivative positions. Internationally oriented.	Least dependent on net interest income. Low earnings during crises. Declining customer loans. Relatively inefficient.	Average distance to default. Most leveraged. Lowest average risk-weight. High loan losses during fin. crisis. Least stable funding.
<b>Model 2 – Wholesale (145 obs.)</b>	Primarily stakeholder value banks. Few listed banks. Largest share in private block-owners. Most cooperative and state-owned banks.	Among smallest banks. Most active in interbank lending and borrowing. Least funding from customer deposit. Domestically oriented.	Most dependent on net interest income. Exposed to large trading losses during fin. crisis. Relatively efficient.	Average distance to default. Low risk-weight. Least risk costs. High leverage. Limited stable funding.
<b>Model 3 – Diversified retail (303 obs.)</b>	Least share of state owned banks.	Average sized. Most customer loans outstanding and debt liabilities for funding. Internationally oriented.	Most profitable. Relatively stable returns during the crises. Receiving largest share from trading income. Average efficiency.	Largest distance to default. High risk-weight. Moderate leverage and loan losses. Lowest reg. capital. Low volatility in share returns. Stable funding.
<b>Model 4 – Focused retail (490 obs.)</b>	All ownership indicators around sample average.	Among smallest banks. Primarily providing customer loans funded by customer deposits. Domestically oriented.	Least profitable and decline in cust. loans during Euro crisis. Trading income relatively unimportant. Average efficiency.	Limited distance to default. Highest risk-weight. Low leverage. Highest loan losses and market risk (ie. CDS), especially during Euro crisis. Stable funding.

Source: Authors

Finally, the transparency and public disclosure practices remain an important concern. Ayadi, Arbak and De Groen (2011 & 2012) already concluded that the disclosure practices of banks, which are of fundamental importance to reviewing and comparing banks across borders, were largely incomplete and incomparable. They offered many examples focusing on differences in definitions, limited disclosure, and thresholds to obtain the data. The transparency and disclosure issues are largely comparable across business models. Since the previous two studies, the situation has not changed much. Taking into account that the sample has been extended with some smaller banks that are subject to less extensive reporting requirements, during the collection of the data for this report almost the same differences in definitions were found and a slightly larger share of the data was available. In addition, the extension of the sample with several banks owned by other institutions that do not publish the financial reports of their banking subsidiary on their corporate website made it even more complicated to obtain the data for the Business Models Monitor. The public dissemination of supervisory as is already done in the US and the implementation of standard disclosure formats, i.e. XBRL, could solve most of the data related issues. However, there might still be an issue with the application of different accounting standards as well as the coverage and depth of the information.

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## List of Abbreviations

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ABCP	Asset-backed commercial paper
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CDS	Credit default swap
CEBS	Committee of European Banking Supervisors
CEPS	Centre for European Policy Studies
CIR	Cost-to-income ratio
EBA	European Banking Authority
ECB	European Central Bank
EEA	European Economic Area
EU	European Union
FIPP	Financial Institutions and Prudential Policy
FSB	Financial Stability Board
GSIBs	Global Systemically Important Banks
IOFSC	International Observatory on Financial Services Cooperatives
ISFS	International Initiative for Sustainable Financial Systems
NSA	National Supervisory Authority
NSFR	Net stable funding ratio
OTC	Over-the-counter
RoA	Return on assets
RoE	Return on equity
RWA	Risk-weighted assets
SHV	Shareholder-value
STV	Stakeholder-value
XBRL	eXtensible Business Reporting Language

## Appendix I.

### List of Variables Collected

No.	Variable	Coverage	No.	Variable	Coverage
1	Country (headquarter location)	100%	24	Intangible assets	100%
2	Reporting currency	100%	25	Goodwill	84%
3	Accounting method	100%	26	Other intangible assets	86%
4	Ownership (SHV/STV)	100%	27	Liabilities (total)	100%
5	Ownership (cooperative, savings...)	100%	28	Deposits (banks)	100%
6	Public ownership (EU27%)	95%	29	Deposits (customers)	100%
7	Public ownership (EU27 name)	24%	30	Repurchase agreements (liabilities)	50%
8	Largest shareholder (% ownership)	92%	31	Derivatives (total - fair value - negative)	91%
9	Largest shareholder (name)	73%	32	Capital (equity - total)	100%
10	Block holder ownership (>5%)	92%	33	Capital (equity - shareholders)	96%
11	Block holder ownership (>5% name)	73%	34	Capital (equity - minority interest)	96%
12	Listed (YES/NO)	100%	35	Capital (tangible common equity)	100%
13	Internationalisation (total - nr of countries)	13%	36	Capital (common equity)	100%
14	Internationalisation (subsidiaries - nr of countries)	13%	37	Capital (common stock)	74%
15	Internationalisation (branches - nr of countries)	13%	38	Capital (additional paid-in capital)	72%
16	Assets (total)	100%	39	Capital (retained earnings)	76%
17	Assets (% of GDP)	100%	40	Capital (treasury shares)	49%
18	Cash (and balances with central banks)	100%	41	Capital (non-recognised losses)	73%
19	Loans to banks (total)	100%	42	Income (total)	99%
20	Loans to customers (gross)	79%	43	Income (interest - net)	99%
21	Loans to customers (loan loss provision)	78%	44	Income (interest - income)	98%
22	Loans to customers (net)	100%	45	Income (interest - expenses)	98%
23	Derivatives (total - fair value - positive)	91%	46	Income (non-interest)	99%
			47	Income (commissions - net)	99%
			48	Income (commissions - expenses)	94%



No.	Variable	Coverage	No.	Variable	Coverage
49	Income (trading - net)	99%	71	State aid (Received - YES/NO)	78%
50	Income (dividend)	70%	72	State aid (Liquidated/Resolved - YES/NO)	78%
51	Income (insurance - net)	49%	73	State aid conditionality (General minimum lending target – YES/NO)	78%
52	Income (insurance - income)	41%	74	State aid conditionality (SME minimum lending target – YES/NO)	78%
53	Income (insurance - expenses)	40%	75	State aid conditionality (General price leadership ban– YES/NO)	78%
54	Income (other)	97%	76	State aid conditionality (SME price leadership ban – YES/NO)	78%
55	Expenses (operating - total)	100%	77	Rating (Fitch)	46%
56	Expenses (operating - administrative)	100%	78	Rating (Moody's)	55%
57	Expenses (operating - personal)	99%	79	Rating (S&P)	49%
58	Expenses (operating - other)	99%	80	CDS spread (senior, year-end)	30%
59	Expenses (operating – restructuring)	9%	81	CDS spread (senior, average)	27%
60	Expenses (operating - depreciations)	97%	82	CDS spread (senior, volatility)	27%
61	Expenses (operating – risk costs)	98%	83	CDS spread (subordinated, year-end)	25%
62	Profit (before tax)	100%	84	CDS spread (subordinated, average)	25%
63	Income tax	100%	85	CDS spread (subordinated, volatility)	25%
64	Profit (after tax)	100%	86	Share price (year-end)	26%
65	Risk-weighted assets (total)	83%	87	Share price (average)	38%
66	Capital (regulatory capital)	78%	88	Share price (volatility)	37%
67	Capital (Tier I - total)	79%			
68	Capital (Core Tier I - total)	36%			
69	Applicable Basel Standards (I/II)	67%			
70	Basel approach (SA/IRB)	65%			

## Appendix II.

### Calculation of Z-score

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The Z-score used in the study is the one derived in Boyd & Runkle (1993), which is a simple indicator of the risk of failure or the distance to default. To derive the measure, it is assumed that default occurs when the one-time losses of bank  $j$  in year  $t$  exceed its equity, or when

$$\pi_{jt} + E_{jt} < 0. \quad (\text{A1})$$

Then, assuming that the bank's return on total assets (RoA), or  $\pi_{jt} / TA_{jt}$ , is normally distributed around the mean  $\mu_j$ , and standard deviation  $\sigma_j$ , the probability of failure is given as

$$pr(\pi_{jt} < -E_{jt}) = pr(\pi_{jt}/TA_{jt} < -E_{jt}/TA_{jt}) = \int_{-\infty}^{D_{jt}} \phi(r) dr, \quad (\text{A2})$$

where  $\phi$  represents the standard normal distribution,  $r$  is the standardised return on assets and  $D$  is the default boundary that separates a healthy bank from an unhealthy one, described as the normalised equity ratio:

$$D_{jt} = \frac{-(E_{jt}/TA_{jt}) - \mu_j}{\sigma_j}. \quad (\text{A3})$$

Note that a greater  $D$  implies a greater probability of default and therefore, a greater risk for the bank. The average and standard deviation calculations were obtained using available data for the years 2006-09.

Since  $D$  admits negative values in most cases, the Z-score is set to be represented as a positive number, or as

$$Z_{jt} = -D_{jt}. \quad (\text{A4})$$

This implies that a greater Z-value implies a lower probability of default.

## Appendix III.

### Assumptions on NSFR

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The assumptions for the net stable funding ratio (NSFR) are similar to those put forward by the IMF (2011). Introduced by the Basel Committee on Banking Supervision (BCBS, 2010), the NSFR aims to restrict banks from having an excessive reliance on short-term funding in an attempt to promote more balanced mid- to long-term financial resources to support the assets through stable funding sources. More specifically, the measure requires the available stable funding to exceed the required stable funding.

Available stable funding sources include total Tier 1 and Tier 2 capital as well as reserves that count as part of equity. Stable forms of funding, including customer deposits and other liabilities with more than one-year maturities, are also included. Lower maturity liabilities, including term deposits and retail deposits from non-financial institutions, enter as available funding after the application of various haircuts. Short-term liabilities to financial institutions and secured wholesale funding are generally not included as available, due to substantial rollover risks and potential margin calls that may materialize in times of market stress.

Required stable funding includes assets that cannot be quickly sold off without substantial costs during adverse market conditions lasting up to one year. Most customer loans are assumed to have long-term maturities and will thus face liquidation costs. All encumbered securities that are posted as collateral enter directly into the calculation of required stable funding as they cannot be sold off without changing the original contract. Shorter maturity retail loans are also treated as required funding, albeit with an appropriate haircut. In turn, more liquid unencumbered assets, such as cash or marketable securities, receive lower factors, as they are typically readily available for sale without substantial potential losses.

Since the available data are quite restricted in nature, assumptions regarding many specific items were made. The following table provides the assumptions and the relevant multiplicative factors that were used to build the NSFR measure used in the study. Although comparable to the measure developed by the IMF (2011), the validity of the results is likely to depend on the assumptions on certain factors more than others. This is particularly the case for the debt liabilities and trading assets, which make up more than one-third of the balance sheets of most banks, especially the investment and wholesale banking models.

Balance sheet items	Factors
<b>AVAILABLE STABLE FUNDING</b>	
Customer deposits	85%
Deposits from banks	0%
Derivative liabilities (negative, fair-value)	0%
Repurchase agreements	0%
Debt liabilities	50%
Equity & reserves	100%
<b>REQUIRED STABLE FUNDING</b>	
Cash	0%
Customer loans	80%
Loans to banks	0%
Derivative assets (positive, fair-value)	90%
Trading assets	50%

## Appendix IV.

### List of Banks Examined

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% , first-last year)	Coverage (period, years)	Business Model(s)
1	HSBC	UK	Commercial Bank	1,937,001	37%	2006-13	I, D, F
2	BNP Paribas	FR	Commercial Bank	1,800,139	25%	2006-13	I
3	Deutsche Bank	DE	Commercial Bank	1,611,400	2%	2006-13	I
4	Barclays	UK	Commercial Bank	1,574,028	6%	2006-13	I
5	Crédit Agricole S.A.	FR	Cooperative bank	1,536,873	31%	2006-13	I
6	Société Générale	FR	Commercial Bank	1,235,262	29%	2006-13	I
7	The Royal Bank of Scotland	UK	Nationalised	1,232,911	-5%	2006-13	I, F
8	BPCE Group	FR	Cooperative bank	1,123,520	..	2009-13	D
..	Caisse D'Epargne	FR	Savings Bank	649,756	..	2006-08	D
..	Banque Populaire	FR	Cooperative bank	403,589	..	2006-08	I
9	Banco Santander	ES	Commercial Bank	1,115,638	34%	2006-13	D, F
10	ING	NL	Commercial Bank	1,080,624	-12%	2006-13	D
11	Lloyds Banking Group	UK	Commercial Bank	1,015,989	99%	2006-13	D, F
..	HBOS	UK	Commercial Bank	724,322	..	2006-08	D
12	UniCredit	IT	Commercial Bank	845,838	3%	2006-13	F
13	Rabobank	NL	Cooperative Bank	674,139	21%	2006-13	D, F

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% , first-last year)	Coverage (period, years)	Business Model(s)
14	Crédit Mutuel Group	FR	Cooperative Bank	658,618	19%	2007-13	D
15	Nordea	SE	Commercial Bank	630,434	82%	2006-13	I, D
16	Intesa Sanpaolo	IT	Commercial Bank	626,283	9%	2007-13	D
..	Banca Intesa	IT	Commercial Bank	291,781	..	2006	F
..	Sanpaolo IMI	IT	Commercial Bank	288,551	..	2006	D
17	BBVA	ES	Commercial Bank	582,575	41%	2006-13	D, F
..	Unnim	ES	Nationalised	29,288	..	2010-11	F
18	Commerzbank	DE	Commercial Bank	549,661	-10%	2006-13	I, F
19	Standard Chartered	UK	Commercial Bank	489,000	142%	2006-13	F
20	KfW Group	DE	Public Bank	464,755	39%	2006-13	W
21	Danske Bank	DK	Commercial Bank	432,622	18%	2006-13	I
22	DZ Bank	DE	Cooperative bank	386,978	-8%	2006-13	I, W
23	ABN Amro	NL	Nationalised	372,022	-62%	2006-13	I, D
24	La Caixa	ES	Savings Bank	351,269	82%	2006-13	D, F
..	Grupo Banca Civica	ES	Savings Bank	71,827	..	2010-11	F
25	Merrill Lynch International Bank Limited	IE	Commercial Bank	294,414	67%	2007-13	I
26	DnB NOR Bank	NO	Savings Bank	285,715	78%	2006-13	D
27	Svenska Handelsbanken	SE	Savings Bank	281,045	42%	2006-13	D
28	Skandinaviska Enskilda Banken	SE	Commercial Bank	280,484	31%	2006-13	I, D, F
29	Landesbank Baden-Württemberg	DE	Savings Bank	273,523	-34%	2006-13	I, W, F

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% first-last year)	Coverage (period, years)	Business Model(s)
30	Bayerische Landesbank	DE	Savings Bank	255,601	-26%	2006-13	I, W, F
31	BFA-Bankia	ES	Savings Bank	251,472	..	2010-13	F
32	KBC	BE	Commercial Bank	241,306	-26%	2006-13	D, F
33	Banque Centrale de Compensation	FR	Commercial Bank	238,758	251%	2006-13	W
34	Dexia	BE	Nationalised	222,936	-61%	2006-13	I, W
35	Swedbank	SE	Commercial Bank	205,530	37%	2006-13	D
36	Norddeutsche Landesbank	DE	Savings Bank	200,845	-1%	2006-13	W
37	La Banque Postale	FR	Commercial Bank	200,232	78%	2006-13	F
38	Erste Bank	AT	Commercial Bank	199,876	10%	2006-13	F
39	Banca Monte Dei Paschi Di Siena	IT	Savings Bank	199,106	26%	2006-13	D, F
40	Nykredit	DK	Savings Bank	190,020	48%	2006-13	D
41	Belfius	BE	Nationalised	182,777	..	2011-13	I
42	Helaba	DE	Savings Bank	178,083	12%	2006-13	I
43	Banco Sabadell	ES	Savings Bank	163,442	125%	2006-13	D, F
..	Caja Mediterráneo	ES	Savings Bank	70,805	..	2006-11	I, D
44	Banco Popular Español	ES	Commercial Bank	147,852	61%	2006-13	D, F
..	Banco Pastor	ES	Savings Bank	31,135	..	2006-10	I, D, F
45	Raiffeisen Zentralbank Österreich AG	AT	Cooperative Bank	147,324	27%	2006-13	F
46	NRW.BANK	DE	Savings Bank	145,350	7%	2006-13	I, W
47	Bank of Ireland	IE	Commercial Bank	132,137	-19%	2006-13	D, F
48	Bank Nederlandse Gemeenten NV	NL	Public Bank	131,183	46%	2006-13	D

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% , first-last year)	Coverage (period, years)	Business Model(s)
49	Banco Popolare	IT	Cooperative Bank	126,043	-2%	2007-13	D, F
50	SNS Reaal	NL	Nationalised	124,574	56%	2006-13	D
51	UBI Banca	IT	Cooperative Bank	124,242	67%	2006-13	D, F
52	Hypo Real Estate	DE	Nationalised	122,454	-24%	2006-13	I, W
53	Allied Irish Banks	IE	Nationalised	117,734	-26%	2006-13	F
54	Dekabank	DE	Savings Bank	116,073	11%	2006-13	I, W
55	Caixa Geral de Depósitos	PT	Savings Bank	112,963	17%	2006-13	D, F
56	National Bank of Greece	GR	Nationalised	110,930	45%	2006-13	F
57	HSH Nordbank	DE	Savings Bank	109,022	-44%	2006-13	W, F
58	Landesbank Berlin	DE	Savings Bank	102,437	-28%	2006-13	I, W, F
59	OP-Pohjola	FI	Cooperative Bank	100,961	70%	2006-13	D
60	Piraeus Bank	GR	Nationalised	92,010	197%	2006-13	F
61	Volkswagen Financial Services AG	DE	Commercial Bank	90,992	107%	2006-13	D
62	WGZ Bank	DE	Cooperative bank	90,926	12%	2006-13	W
63	Espírito Santo Financial Group	PT	Commercial Bank	84,850	37%	2006-13	D, F
64	Millennium BCP	PT	Commercial Bank	82,007	4%	2006-13	D, F
65	Landwirtschaftliche Rentenbank	DE	Public Bank	81,932	-1%	2006-13	W
66	Société de Financement Local	FR	Public Bank	80,017	..	2012-13	D
67	EFG Eurobank Ergasias	GR	Nationalised	77,586	44%	2006-13	F
68	Wüstenrot & Württembergische AG	DE	Savings Bank	75,043	7%	2006-13	D



Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% first-last year)	Coverage (period, years)	Business Model(s)
69	Alpha Bank	GR	Nationalised	73,697	48%	2006-13	F
70	Nederlandse Waterschapsbank NV	NL	Public Bank	73,006	108%	2006-13	D
71	Mediobanca SpA	IT	Commercial Bank	72,841	58%	2006-13	I
72	L-Bank	DE	Public Bank	70,682	36%	2006-13	W
73	IberCaja	ES	Savings Bank	63,118	68%	2006-13	D, F
..	Grupo Caja3	ES	Commercial Bank	20,725	..	2010-11	F
74	Catalunya Banc	ES	Nationalised	63,062	..	2010-13	F
75	Banca popolare dell'Emilia Romagna	IT	Cooperative Bank	61,758	36%	2006-13	D, F
76	Kutxa	ES	Savings Bank	60,762	192%	2006-13	F
..	Grupo BBK	ES	Savings Bank	42,570	..	2006-11	F
..	CajaVital	ES	Savings Bank	8,327	..	2006-11	F
..	Caixa Ontinyent	ES	Savings Bank	914	..	2006-11	D, F
77	Bankinter	ES	Savings Bank	55,136	20%	2006-13	I, D, F
78	The Co-operative Banking Group	UK	Cooperative Bank	54,068	184%	2006-13	F
79	Bank of New York Mellon SA/NV	BE	Commercial Bank	53,982	..	2009-12	W
80	Caisse de Refinancement de l'Habitat	FR	Commercial Bank	53,134	..	2011-13	I
81	NCG Banco	ES	Savings Bank	52,687	..	2010-13	F
82	Banca Popolare di Milano SCaRL	IT	Cooperative Bank	49,353	23%	2006-13	D, F
83	PKO Bank Polski	PL	Savings Bank	47,958	80%	2006-13	F
84	Grupo BMN	ES	Nationalised	47,518	..	2010-13	F
85	Banca Popolare di Vicenza	IT	Cooperative Bank	45,235	90%	2006-13	D, F
86	Liberbank	ES	Savings Bank	44,546	..	2010-13	D, F

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% first-last year)	Coverage (period, years)	Business Model(s)
87	Aareal Bank AG	DE	Commercial Bank	42,981	12%	2006-13	D, F
88	Banco BPI	PT	Commercial Bank	42,700	20%	2006-13	D, F
89	Banca Carige SpA	IT	Commercial Bank	42,156	67%	2006-13	D
90	CAJAMAR	ES	Cooperative Bank	42,104	117%	2006-13	F
91	Unicaja Banco	ES	Commercial Bank	41,243	49%	2006-13	F
92	Banque Et Caisse D'Epargne De L'Etat	LU	Savings Bank	40,714	0%	2006-13	I, F
93	HASPA Finanzholding	DE	Savings Bank	40,521	17%	2007-13	F
94	Iccrea	IT	Cooperative Bank	40,045	139%	2006-12	W
95	AXA Bank Europe	BE	Commercial Bank	39,217	84%	2007-12	I, D, F
96	Permanent TSB	IE	Nationalised	37,604	-51%	2006-13	I, F
97	Raiffeisenlandesbank Oberösterreich AG	AT	Cooperative Bank	37,431	69%	2006-13	W
98	BAWAG PSK Group	AT	Commercial Bank	36,402	-28%	2006-13	D, F
99	Caja España	ES	Savings Bank	35,684	..	2010-13	F
100	Argenta	BE	Commercial Bank	35,416	21%	2007-13	I, F
101	Jyske Bank	DK	Commercial Bank	35,124	63%	2006-13	F
102	OTP Bank	HU	Commercial Bank	34,948	24%	2006-13	F
103	MünchenerHyp	DE	Commercial Bank	34,899	9%	2006-13	I, D
104	ApoBank	DE	Cooperative Bank	34,695	5%	2006-13	I, D, F
105	Precision Capital	LU	Commercial Bank	34,548	..	2011-12	F

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% first-last year)	Coverage (period, years)	Business Model(s)
106	Cyprus Popular Bank	CY	Nationalised	33,762	48%	2006-11	F
107	Banca Popolare di Sondrio	IT	Commercial Bank	32,770	104%	2006-13	F
108	Portigon	DE	Nationalised	31,865	-89%	2006-13	I
109	CREDEM	IT	Commercial Bank	31,531	..	2009-13	D, F
110	Veneto Banca	IT	Cooperative Bank	31,391	262%	2006-13	W, D, F
111	Agricultural Bank of Greece	GR	Savings Bank	31,221	..	2006-10	F
112	BPI-Groupe	FR	Public Bank	30,756	..	2009-12	I
113	Bank of Cyprus	CY	Savings Bank	30,342	20%	2006-13	D, F
114	RCI Banque	FR	Commercial Bank	29,505	17%	2006-13	D
115	Raiffeisenlandesbank Niederösterreich-Wien AG	AT	Cooperative Bank	29,070	76%	2006-13	W
116	IKB Deutsche Industriebank AG	DE	Commercial Bank	27,617	-48%	2006-13	I, W, F
117	Gruppo bancario Credito Valtellinese	IT	Cooperative Bank	27,199	83%	2006-13	D, F
118	Banque PSA	FR	Commercial Bank	25,117	-8%	2006-13	D
119	Oesterreichische Volksbank	AT	Cooperative Bank	20,904	-69%	2006-13	I, W
120	Sydbank	DK	Commercial Bank	19,827	29%	2006-13	F
121	Hellenic Postbank	GR	Nationalised	16,566	..	2006-10	F
122	Banca March	ES	Savings Bank	15,393	46%	2006-13	F
123	GETIN NOBLE BANK	PL	Commercial Bank	15,314	11,749%	2006-13	W, F
124	Grupo Crédito Agrícola	PT	Cooperative Bank	15,113	50%	2006-12	F
125	Nova Ljubljanska Banka	SI	Nationalised	12,490	-13%	2006-13	D, F

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% , first-last year)	Coverage (period, years)	Business Model(s)
126	RBC Investor Services Bank S.A.	LU	Commercial Bank	11,692	..	2012	F
127	Bank Handlowy w Warszawie	PL	Commercial Bank	10,928	16%	2006-13	F
128	UBS (Luxembourg) SA	LU	Commercial Bank	9,334	-29%	2006-12	W
129	Landshypotek	SE	Cooperative Bank	8,801	89%	2006-13	D
130	Bank BPH S.A.	PL	Commercial Bank	7,945	..	2008-13	D
131	State Street Bank Luxembourg	LU	Commercial Bank	7,541	3,797%	2006-12	I, W
132	Bank of Valletta	MT	Commercial Bank	7,258	34%	2006-13	F
133	Hellenic Bank Public Company Limited	CY	Commercial Bank	6,384	-3%	2006-13	F
134	Banque Raiffeisen	LU	Cooperative Bank	6,354	72%	2006-13	F
135	ALIOR BANK	PL	Commercial Bank	6,150	..	2009-13	F
136	Nova Kreditna Banka Maribor	SI	Nationalised	4,811	13%	2006-13	D, F
137	Co-operative Central Bank Ltd	CY	Cooperative Bank	4,553	..	2006-11	F
138	BPS Bank	PL	Cooperative Bank	4,446	95%	2006-12	W
139	Bank Ochrony Środowiska	PL	Public Bank	4,433	108%	2006-13	F
140	SID	SI	Commercial Bank	3,940	320%	2006-13	W
141	FHB Bank	HU	Commercial Bank	2,483	16%	2006-13	I, D
142	ABLV Bank	LV	Commercial Bank	2,331	100%	2006-13	F
143	Banque CPH	BE	Cooperative Bank	2,314	62%	2006-13	I, F

Rank	Name	Country	Type of ownership (as of year-end, latest available year)	Total assets (€ million, latest available year)	Change in assets (% , first-last year)	Coverage (period, years)	Business Model(s)
144	Central Cooperative Bank	BG	Cooperative Bank	2,033	251%	2006-13	F
145	Sammenslutningen Danske Andelskasser	DK	Cooperative Bank	1,518	-14%	2006-13	F
146	Panellinia Bank	GR	Cooperative Bank	749	20%	2006-13	F
147	Colonya Caixa Pollença	ES	Savings Bank	436	40%	2007-13	F

Note: The banks that are not ranked (“.”) were acquired or merged into the ranked bank presented straight above the unranked bank during the period from 2006 to 2013. The business models to which the banks belong for different years are indicated in the most right column. The business models are expressed with the first letter of the business models: Investment (I), Wholesale (W), Diversified retail (D), and Focused retail (F). When the bank is assigned to two or more business models this means that the bank has migrated from one business model to the other over time.

Source: Authors

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The Monitor offers an annual analysis on the evolving business models of the European banking sector since 2006, with a focus on three concepts: contribution to the real economy, performance, resilience and robustness. The Monitor is geared towards bank practitioners, policy makers, and academics who are interested in expert views on the banking sector in Europe.

The business model analysis contributes to a better understanding of financial and economic performance, risk behaviour, and governance of banks at a system level. This is necessary for markets and regulators in order to assess the accumulation of risk for certain pre-defined financial businesses. It also serves to monitor banks' behaviours and their contribution to systemic risk, which can be useful from the regulatory and market discipline perspectives. From a regulatory perspective, the potential for regulatory arbitrage through the underestimation of the levels of capital can be identified and mitigated. In addition, when a specific business model in banking tends to become a threat to systemic stability, macro-prudential regulators can act to prevent this threat through the use of appropriate mechanisms to curb excessive risk taking. From a market discipline perspective, analysing business models requires more transparency from banks on their on-balance sheet and off-balance sheet risk exposures, especially when the multi-dimensional analyses prove to be insufficient to explain the behavioural change of individual banks within the same business model.

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