Banking Business Models Monitor 2015
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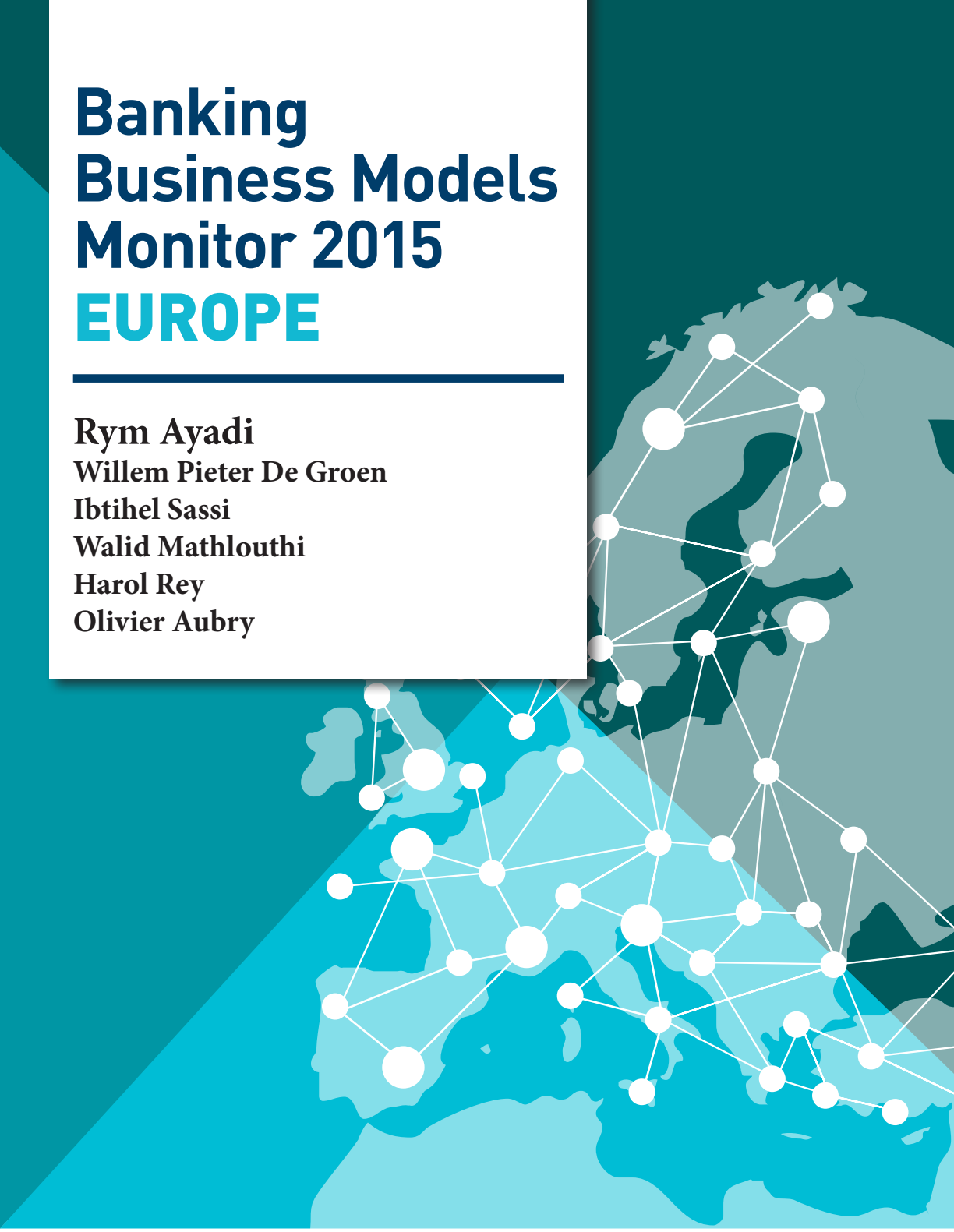

Alphonse and Dorimène Desjardins International Institute for Cooperatives
HEC MONTRÉAL

IRCCF
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The Banking Business Models (BBM) Monitor for 2015 is the first comprehensive edition for Europe of the International Research Centre on Cooperative Finance (IRCCF) of HEC Montreal's initiative to develop a Global Monitor of bank and credit union's business models. The Global Monitor covers Europe, United States of America and Canada. More countries will be added subject to data availability.

A pilot exercise was performed on a sample of 147 banks and published in December 2014, in cooperation with the Financial Institutions and Prudential Policy (FIPP) Unit of the Centre for European Policy Studies (CEPS) in Brussels, together with the financial support of HEC Montreal through its International Observatory on Financial Services Cooperatives.

The BBM Monitor is led and co-authored by Rym Ayadi, Professor at the Department of International Business at HEC Montreal and Director of the IRCCF and Alphonse and Dorimène Desjardins International Institute for Cooperatives. The BBM Monitor is co-authored by Willem Pieter de Groen, Associate Researcher at the IRCCF and Research Fellow at the FIPP Unit at CEPS, Ibtihel Sassi, Walid Mathlouthi, Harol Rey and Olivier Aubry, researchers at the IRCCF. The BBM Monitor extends the previous research under Ayadi et al (2011, 2012) and Ayadi & De Groen (2014a). The authors would like to thank Benoit Tremblay, Professor at HEC Montréal for his valuable comments, Michel Keoula, researcher at the IRCCF, for his assistance in thoroughly reviewing the Monitor and Rob Attree for the editing.

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Beyond Good and Evil

Among human beings, binary thinking undoubtedly dominates the way we approach logical reasoning. If we need any reminder of that, we only need to look at the box-office blockbuster "*The Force Awakens*", the seventh episode in the "Star Wars" saga, which provides an effective portrayal of the divide between right and wrong, light and dark, good and evil.

For the past eight years, the banking sector has found itself in the unenviable position of being considered by the vast majority of citizens as the true incarnation of evil. Or, to put it in more contemporary terms, it has been unquestionably viewed as the most prominent ambassador of the "dark force" on earth.

When looking at the picture from a macro-level perspective, one must acknowledge that the banking industry - especially in the EU - has done everything it could to become so unpopular. The huge losses it incurred, mainly as a result of purely speculative activities, forced Member States to implement very costly rescue plans: between October 2008 and December 2010, more than € 1,240 billion in State aid were granted to the financial sector. This, in turn, had a direct impact on public deficits, which led EU governments to implement harsh fiscal austerity plans. Rising unemployment and deepening inequalities were the price to pay to save "too big to fail" banks and prevent contagion throughout the financial system.

The worst part is that, despite these unprecedented efforts to support the banking sector, the structural vulnerabilities that were at the core of the financial crisis have not disappeared. Quite the contrary: although Europe's banking system has shrunk by about 10% in recent years, it remains not only abnormally large relative to the size of its economy (especially as compared to the US), but also much too concentrated. Furthermore, while banks have recently begun to increase their regulatory capital ratios, they have largely done so by reducing average risk-weights. Without risk-weighting, some EU banks would therefore still look thinly capitalised compared to their international peers. Finally, the EU banking system keeps providing insufficient finance for the real economy: just 31% of the aggregate balance sheet of euro area banks is indeed made up of lending to the euro area real economy[1].

If we were to consider these basic facts and figures in isolation, it would be difficult not to succumb to the temptation of throwing the whole EU banking industry into the burning fires of hell or, to put it in more contemporary terms, into a black hole in space.

However, the banking reality in Europe is much more complex than one may think at first glance. The monitoring exercise carried out by Dr. Rym Ayadi and her team since 2010 has indeed demonstrated the extent to which various business models - with specific risk behaviours attached to each one of them - do actually coexist within the EU financial system.

1. ESRB (2014).

This new Business Models Monitor - which for the first time covers the entire European banking sector - provides policy-makers with key findings that should contribute to better addressing the two major challenges ahead of them, namely: reducing systemic risk in the financial sector and introducing proportionality in bank regulation.

Concerning the former, the report provides new evidence that investment and wholesale banks tend not only to accelerate the accumulation of risk at system level, but also to be less resilient to extreme shocks. This key finding definitely helps to strengthen the position of those who are currently advocating structural reforms within the EU banking sector, which would imply forcing these banks to keep high-risk trading activities separate from their retail deposit-taking business. Alternatively, the implementation of a legally binding leverage ratio could also be considered.

As for the second challenge, the report highlights the fact that a large number of small and medium-sized banks, which are predominantly retail-oriented institutions, will most probably be facing (too) high compliance costs as a result of the implementation of the new banking regulations. This cautionary statement should convince all EU policy-makers to start adapting regulatory requirements to bank business models. Otherwise, there is a serious risk that the current one-size-fits-all approach to banking regulation will lead to further concentration within the EU financial sector. Experience has indeed shown that a diverse system is more resilient than a system dominated by one business model.

The current debate on banking regulation in Europe is gradually lapsing into a sterile confrontation between supporters and opponents of more prudential requirements, between black or white. The findings of this new global monitoring exercise suggest however that the truth most likely lies somewhere in between: that is to say, more stringent rules for those bank business models which tend to accelerate systemic risks and less regulation for those which are more resilient to extreme shocks and contribute more to the real economy.

Philippe Lamberts

Co-chair of the Greens/EFA group in the European Parliament

Foreword

Trust is of utmost importance for banking and credit institutions. The word 'credit' itself comes from the Latin verb 'credere', which means to believe, to trust. Banks must trust their borrowers to grant them loans or buy the liabilities they issue. And, before that, banks must be trusted by depositors and savers investing in the banks' liabilities. Unsurprisingly, the Great Financial Crisis (GFC) of 2008-2009 smashed savers' trust in banks. According to the Edelman Trust Barometer, trust in banking by the public before the GFC – during 2006-2007 – stood at 69% in the U.S., at 44% in the U.K., and at 39% in the Eurozone, as approximated by the population weighted mean of France and Germany[2]. So, before the GFC, trust in banking peaked on the Western shore of the Atlantic but not on the Eastern side. As a result of the GFC, by 2009-2010, trust collapsed to 27% in the U.S., 19% in the U.K., and 29% in the Eurozone. By 2014, trust in banking recovered to show a small majority in the U.S. (51%) but remained unacceptably low in the U.K. and the Eurozone (both at 32%). Thus, the U.S. managed to recover its trust in banking, while Europe didn't.

Europe was, in fact, no less active than the U.S. at deploying actions to repair banking via institutional building – for example creating the European Banking Authority and launching the Banking Union – as well as through stiffer regulations, e.g. passing the Credit Requirement Directive IV (CRD-IV). How can we explain this apparent puzzle? There are two likely explanations. First, in the Eurozone, economic recovery from the GFC was slow because of the sovereign crisis and move to austerity entangled fiscal policy while Quantitative Easing only came late in the day to relax monetary policy. Hence, in spite of improved regulation and supervision, Eurozone savers might still distrust banks, fearing that macroeconomic fragility could endanger them. This explanation would, however, fail to account for the U.K. case.

An alternative explanation to the puzzle is that new banking regulation and supervision was applied differently across the Atlantic. Indeed, while the E.U. stuck to a "one-size-fits-all" approach, the U.S. revealed itself to be much more flexible and pragmatic[3]. Thereby, European savers might still mistrust banks, either by perceiving all banks were equally involved in the GFC or by fearing that standardized regulatory treatment across all types of bank could be detrimental to stability.

And the one-size-fits-all issue is part of a more extensive set of problems associated with the mainstream approach to banking regulation. The GFC is a story of banks venturing out of their usual business comfort zones and taking excess financial risks. Thus, the crisis made it necessary to tame financial exposures and return banks to traditional activities. However, according to various scholars, traditional intermediation is de facto disfavoured

2. See Edelman (2015). See also the Trust barometer reports for the previous years.

3. For example, in the U.S. the Credit Unions and the Community Banks are exempt from Basel 3, while all banks in the E.U. are subject to it.

by the current regulatory approach[4]. Some authors even claim that we currently live in a banking regulatory bubble[5]. Indeed, they note that banking intermediation theory hinges on dealing with borrower-lender asymmetry of information while, instead, the presence of full information disclosure is the keystone of the finance theory. They document how finance theory prevailed over banking intermediation theory in shaping banking regulation and contend that this appalling contradiction is the true culprit behind lower credit standards, mounting systemic risk in banking and macroeconomic debt overhang. Others claim that the Risk-Weighted Assets (RWA) approach at the core of Basel 2 and 3 introduces crucial incentives for banks to turn from traditional intermediation to financial investment, compared to a simpler approach like a Leverage Ratio[6].

Though, by and large, choosing to stick to the mainstream approach, regulators did adopt significant corrections with respect to the Basel 2 era. For one, they introduced anti-cyclical capital buffers, liquidity ratios and leverage ratios. Next, showing awareness that bank internal risk models could be calibrated over optimistically and that the standard Value at Risk approach underestimated tail and systemic risks[7], regulators launched stress tests of banks.

Following a series of previous analyses along analogous lines, this Monitor offers new evidence that should be useful to regulators, scholars and the banking profession at large. The results reported hereafter have potential bearing on helping solve the European banking regulatory puzzle proposed above; namely, that since post-crisis European tightening of regulation and supervision was no less than in the U.S., why were concrete signs of recovery of trust in banks lacking in Europe, when they were evident in the U.S.?

This BBM Monitor brings fresh air to the debate. It shows that some bank business models produce more systemic risk, while some intensify other types of risk. Specifically, more financial market oriented banks develop risks linked to the financial cycle, while risks at retail oriented banks more closely follow the real economic cycle. Is there anything regulators and supervisors can learn from this evidence and method? Most probably, yes. It's true that the BBM analysis may appear less sophisticated than advanced risk metric methodologies. However, the GFC is there to demonstrate that fancy algorithms will always be incomplete and, at times, even deceptive. Had pre-crisis regulators monitored leverage ratios instead of Risk-Weighted Assets, the crisis might have been avoided! And even the possible critique, that banks may easily change their business model, looks rather weak. First, believing that such change may happen swiftly seems illogical. Second, this Monitor shows that transitions from one business model to another are uncommon, ranging from a maximum of 20% for Model 4 (wholesale) banks to a minimum of 10% for Model 1 banks (focused retail). In addition, bearing in mind that Model 1 and Model 2 (diversified retail (type 1)) are possibly the closest pair of the five business models, if one were to consider them together, the resulting Model 1+2 (focused retail plus diversified retail (type 1)) would have near zero transitions.

4. See Admati & Hellwig (2013), Blundell-Wignall & Roulet (2013), Boot & Ratnovski (2012), and Gehrig (2015).
5. See Ferri & Neuberger (2014).
6. See Haldane & Madouros (2012).
7. See Adrian & Brunnermeier (forthcoming), Arnold et al (2012), and Danielsson & De Vries (2000).

It is to be hoped that scholars and professionals devote increasing attention to bank business model analysis. Awareness of the mistakes of the past should also encourage policy makers and regulators to be more humble. Recognising that any single regulatory and supervisory tool will always be imperfect could lead policy makers and regulators to rely on more than one method. That would also open the door to paying attention to bank business models. After all, city cats are normally fancier than farm cats, but only the latter catch mice!

Giovanni Ferri
LUMSA University of Rome, Italy

1 Why do Business Models Matter in Banking?

Since the inception of the financial crisis of 2007-09, the banking sector in Europe has been undergoing fundamental changes. Following the major fallouts of large banking groups - in particular those with excessively risky business models combined with the trillions incurred in losses and subsequent taxpayer-funded government bailouts to keep the European banking sector afloat - a wave of re-regulation was undertaken to bring back eroded market confidence and to safeguard financial stability. This led to major re-structuring and waves of deleveraging with fundamental implications for the future of the European banking sector and financial intermediation.

In this changing context of evolving market structures and regulations, the banks' business models analysis can provide market participants, depositors, creditors, regulators and supervisors with a useful tool to better understand the nature of risk attached to each bank business model and its contribution to systemic risk throughout the economic cycle.

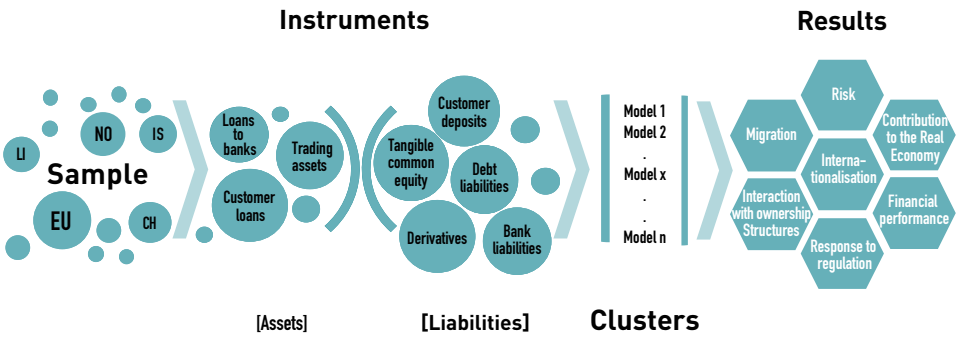
For this purpose, the business models analysis was first introduced by Ayadi et al (2010) in an initial attempt to identify the business models of 26 European banking institutions and to assess their performance between 2006 and 2009. The main finding indicated that the retail banking model has seemingly fared better through the crisis, compared to the other identified business models, namely investment and wholesale banks. Business models analysis also proved to be relevant in order to adapt the one-size–fits-all regulatory requirements. In their publication on "*Regulation of European banks and business models: Towards a new paradigm*", Ayadi et al (2011) shed light on the potential limitations of the Tier-1 capital ratio and, hence, the Basel II risk–weights system. The publication recommended the inclusion of a legally binding leverage ratio and confirmed that the regulatory requirements should be adapted to bank business models to ensure they are better aligned with the underlying risk profiles of banks. The authors further recommended an annual monitoring exercise of bank business models to better understand their evolution within macro and micro economic contexts. The first pilot exercise monitoring the business models of 147 banks was released in December 2014 in Ayadi & De Groen (2014a) to test the relevance of this approach. For the first time, a diverse dataset of banks of different sizes and ownership structures was analysed, based on a new analytical framework for assessing business models. The findings reinforced previous conclusions and prepared the ground for more generalisations with larger samples and more countries.

The Banking Business Models Monitor 2015 Europe is the first comprehensive global monitoring exercise. The European Monitor attempts to address the diversity of bank sizes and ownership structures in European countries and, hence, to identify the response function of each model in a crisis situation.

The **conceptual framework** (See Figure 1.1) is as follows: we first define and identify the bank business models of the sampled 2,542 banks that cover more than 95% of total assets of the European Union plus EFTA countries from 2005 to 2014, accounting for 13,040 bank-year observations; and second we assess the following seven dimensions: 1) interaction with ownership structures, 2) internationalisation, 3) migration, 4) financial

performance, 5) contribution to the real economy, 6) risk, and 7) response to regulation using a rich palette of indicators.

FIGURE 1.1 – Conceptual framework of the Banking Business Models Monitor



Source: Authors

The business models definition that is used distinguishes primarily between the key banking activities (i.e. retail versus market or mixed) and the funding strategies (i.e. retail versus market or mixed). Control is made for financial and risk exposures. To account for these factors collectively, without over-representing any particular factor, five instruments were used to form the clusters. These constitute the defining activity/funding features of a business model in banks from an asset and liability stand point.

To identify the business models, state of the art clustering analysis is used applying this unique definition. For each bank year observation, a business model is assigned.

This same exercise will be repeated annually to allow a better and more up-to-date understanding of the evolving business models of banks and their implications, in terms of the seven dimensions analysed and beyond (depending on the availability of data).

It is important to note that identifying business models in banking is not a trivial task because of the multi-faceted, ever changing nature and heavy reliance on granular data about bank activities and risks. For this reason, a choice has to be made, based on the available public data and the need to keep the definition as broad as possible, in order to allow comparisons between regions and countries.

In summary, the business model analysis contributes to a better understanding of the interaction with ownership structures, internationalisation, migration, financial and economic performance, risk behaviour, as well as response to legislation and supervision at a system level. This is necessary for market participants, depositors, creditors, regulators and supervisors to assess the accumulation of risk for certain pre-defined financial businesses and their evolution over time. It also serves to monitor bank behaviours and their contribution to systemic risk, which can be useful from regulatory, supervisory and market discipline perspectives.

From a regulatory perspective, as shown in Ayadi et al (2011, 2012) and Ayadi & De Groen (2014a), 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 so as to curb excessive risk taking at a system level.

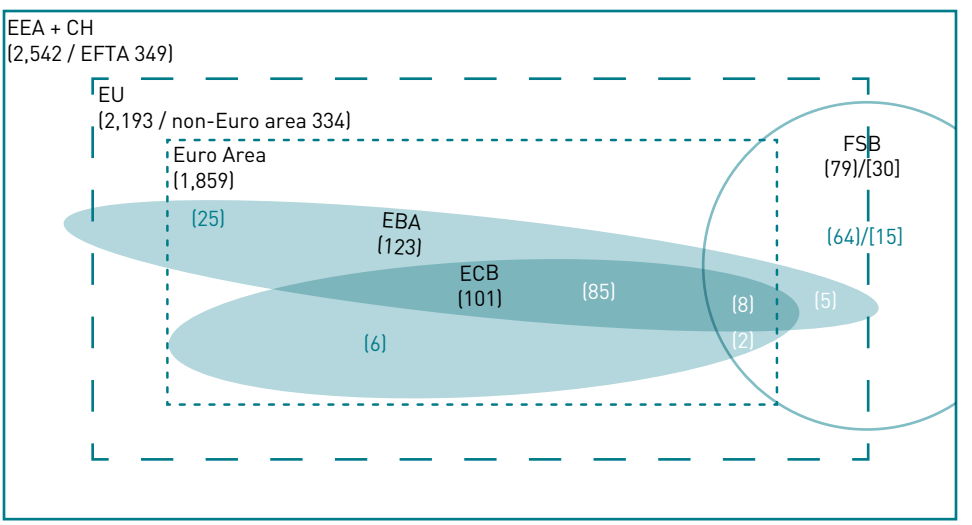
From a market discipline perspective, analysing business models requires more transparency from banks on their on-balance sheet and off-balance sheet risk exposures and funding structures, especially when the multi-dimensional analyses prove to be insufficient to explain the behavioural change of individual banks within the same business model. Monitoring bank business models provides a new elaboration on developing the missing link between regulatory and supervisory reviews undertaken on individual banks and at the macro level.

2 How are the Business Models Identified?

The European banking sector incorporates a rich array of banks with diverse business models and ownership structures. In this chapter, the sample and indicators used to identify the different business models are discussed, as well as how the models are being identified. The sample covers almost the entire banking sector, both in terms of assets and number of banking institutions. The business models are distinguished by the nature and scope of the activities and funding strategies they engage in.

The sample under study in this Monitor is comprised of 2,542 banking groups and subsidiaries in the European Economic Area (EEA) and Switzerland (CH)[8], see also Figure 2.1. This is a large increase compared to the 147 banking groups covered in the latest study, Ayadi & De Groen (2014a). The increase is primarily due to the addition of many small banks and the increase in the geographical scope. The banking institutions are unequally spread across the 32 countries in the EEA and Switzerland. More specifically, in the 19 countries of the Eurozone, 1859 institutions are considered, whereas in the nine non-Eurozone EU countries 334 institutions are covered. From the four EFTA countries (i.e. Switzerland, Norway, Iceland and Liechtenstein), in total, 349 banking groups and subsidiaries were included, see also Appendix II.

FIGURE 2.1 – Number of banking groups selected, by supervisor and area



Note: The analysis focused on consolidated banking groups, however, some non-EEA banks have several subsidiaries in the EEA that are directly owned by the parent company or non-EEA subsidiaries. The number of observations in the assessment are indicated in between brackets "(..)", while the number of distinct banking groups is shown between the special brackets "[..]". The EBA banks are the banks that have been subject to 2014 EU-wide stress test; the ECB banks are the banks subject to ECB banking supervision in November 2014; and the FSB banks are the G-SIBs and the subsidiaries on non-EEA and CH G-SIBs.
Source: Authors

8. The sample includes the EEA+CH banking groups and banking subsidiaries of institutions from outside this region.

The sample covers almost all the banking assets in the European Economic Area (EEA). The banks included in the study together account for more than € 40 trillion at the end of 2014, which represents more than 95% of the banking assets in the EEA. The sample includes 13,406 bank-year observations, of which 13,040 have data for all instruments required to adhere to the business models framework, as defined in this Monitor (up from 1,126 in Ayadi & De Groen, 2014a).

The database used for this exercise was gathered from private and public data sources by collecting accounting, market and other qualitative data, carefully reviewed and harmonised by the IRCCF team in a comprehensive datasheet for the business models analysis. The database covers the period from 2005 to 2014. The balance sheet and profit and loss statement data was retrieved from SNL for more than 2,500 banks, of which there has only been comprehensive coverage from 2010 onward. To improve the data entries before 2010 and limit the survivorship bias, the database was complemented with the data used in Ayadi & De Groen (2014a). This database included the financial statements of 147 large EEA banking groups and subsidiaries of non-EEA banking groups for the period from 2006 to 2013, as well as internationalisation information for all banking groups as of end-2012 together with EU based cooperative banking groups and central institutions included in the database of the International Observatory on Financial Services Cooperatives (IOFSC) at HEC Montreal. To further enable banks to be analysed at a group level, the immediate and ultimate owner data was complemented with information on the intermediate owner. Moreover, the database included newly collected information on ownership structures, which made it possible to categorize banks in five broad structures as of 2014. The market data was obtained from Bloomberg and Markit, the asset quality review and stress test data for systemic banks from both the European Banking Authority (EBA) and the European Central Bank (ECB) websites. The estimates on the cumulative peak losses during the financial crisis for 62 banks have been obtained from De Groen & Gros (2015).

The data collection exercise spanned over sixty variables (see Appendix I for a complete list). Whenever possible, preference was given to variables with the highest coverage ratio. Indicators on bank activities, financial position, international activities, ownership, financial performance, risk factors, as well as regulatory indicators and supervisory 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.

The activities and funding indicators cover almost the entire balance sheet and are considered as instruments for the clustering analysis. Hence, loans to banks, loans to customers and trading assets cover on average 97% of the assets side of bank balance sheets. In turn, on average 86% of the liabilities side is covered through debt to banks, deposits, debt liabilities, derivatives and tangible common equity. Cash, intangible assets and non-common equity are excluded from the clustering. Indicators of financial performance include income statement indicators (i.e. cost-to-income Ratio (CIR), net interest, commission and fees, trading, and other earnings), balance sheet indicators (i.e. growth of customer loans) and mixed ratios of the income statement and the balance sheet (RoA and RoE).

For ownership structures, the coverage is complete (100%). The data coverage for indicators of financial activities, financial performance and international activities is almost

complete, except for customer loans (80%), the coverage ranging between 95% and 100%. The situation is more contrasted for riskiness and regulatory indicators, the coverage ranging between 0.9% and 99%. In particular, some riskiness and regulatory indicators are covered in less than 5% of the entries. While one can argue that in many cases they are not applicable (i.e. only a small group of primarily systemic banks were subject to stress tests and received State aid) notwithstanding the low coverage in a number of observations, the indicators are still relevant, since they cover the large majority of banking assets. Moreover, the coverage for the market indicators was reduced in comparison to the previous Monitor, since many of the primarily smaller banks that were added are not dependent upon market funding.

TABLE 2.1 – Description of indicators used in the Monitor

Variable	Coverage	Mean	Std. dev.	Min.	Max.
(FINANCIAL) ACTIVITIES					
Loans to banks (% of assets)	99%	0.118	0.142	0.000	1.000
Customer loans (% of assets)	99%	0.591	0.212	0.000	0.992
Trading assets (% of assets)	98%	0.257	0.167	0.000	1.000
Bank liabilities (% of assets)	99%	0.136	0.145	0.000	0.981
Customer deposits (% of assets)	99%	0.615	0.230	0.000	1.014
Debt liabilities (% of assets)	99%	0.154	0.184	0.000	3.427
Derivative exposure (% of assets)	100%	0.010	0.044	0.000	0.908
Tang. comm. eq. (% tang. assets)	98%	0.081	0.089	-2.427	1.000
(INTERNATIONAL) ACTIVITIES					
Nr. of unique EEA-countries	98%	1.553	2.166	1.000	22.000
Nr. of unique EEA-countries through subsidiaries	98%	0.257	1.227	0.000	16.000
Nr. of unique EEA-countries through branches	98%	0.295	1.189	0.000	12.000
OWNERSHIP					
Shareholder-value (dummy var.)	100%	0.308	0.462	0.000	1.000
Commercial (dummy var.)	100%	0.288	0.453	0.000	1.000
Nationalised (dummy var.)	100%	0.020	0.141	0.000	1.000
Stakeholder-value (dummy var.)	100%	0.692	0.462	0.000	1.000
Cooperative (dummy var.)	100%	0.400	0.490	0.000	1.000
Savings (dummy var.)	100%	0.258	0.438	0.000	1.000
Public (dummy var.)	100%	0.034	0.181	0.000	1.000
Listed on stock exchange (dummy var.)	100%	0.121	0.326	0.000	1.000
FINANCIAL PERFORMANCE					
Return on assets (RoA)	99%	0.004	0.044	-2.215	1.933
Return on equity (RoE)	99%	0.042	1.457	-104.545	53.040
Cost-to-income ratio (CIR)	99%	0.723	3.356	-40.810	350.782
Net interest income (% of total income)	99%	0.694	2.074	-18.788	226.188
Trading income (% of total income)	96%	0.015	2.236	-227.313	24.478

Variable	Coverage	Mean	Std. dev.	Min.	Max.
Commission & fee income (% of total income)	99%	0.219	0.268	-5.468	11.562
Other income (% of total income)	96%	0.072	0.529	-24.859	39.385
Customer loan growth (% change)	80%	5.531	413.734	-1.000	41154.9
RISKINESS					
Z-score (no. of std. dev. from default)	97%	69.790	98.380	-12.145	1786.205
Loan loss provisions (% of gross customer loans)	53%	0.013	0.166	-1.067	11.634
Stock returns (avg. daily returns)	11%	0.000	0.003	-0.011	0.067
Stock returns (std. dev. daily returns)	11%	0.026	0.0233	0.000	0.421
CDS spread (senior annual avg.)	6%	1.765	2.110	0.046	18.363
CDS spread (senior annual std. dev.)	6%	0.433	0.619	0	4.655
Government exposure (% of own funds)	0.9%	2.352	3.558	-5.677	31.734
Home country exposure (% of Government exp.)	0.9%	0.732	0.290	0.000	1.000
REGULATION					
Risk-weighted assets (RWA) (% of assets)	79%	1.046	14.991	0.000	721.687
Tier 1 capital ratio (% of risk-weighted assets)	70%	0.149	0.141	-0.165	4.739
AQR 2014/15 impact (% of RWA)	0.9%	-0.006	0.008	-0.039	0.002
Stress test 2014/15 impact (% of RWA)	0.9%	0.008	0.194	-0.152	0.962
Shortfall (% of RWA)	0.9%	0.008	0.022	0.000	0.135
Tangible common equity (% tang. assets)	99%	0.082	0.078	-0.129	1.000
Cumulative peak losses aided banks (% of total liabilities aided banks)[1]	2.5%	0.067	0.082	0.000	0.345

Note: [1]The cumulative peak losses cover multiple years; the coverage is, therefore, calculated as share of total number of banks instead of bank-year observations.

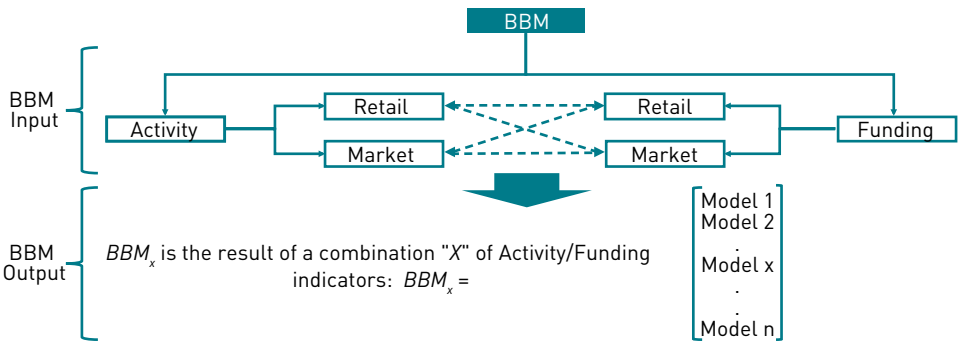
In line with the Monitor's prime aim of identifying the business models in banks in Europe and to assess their strengths and weaknesses, the analysis was conducted in two phases. In the first phase, several variables from Table 2.1 are used as a basis for the identification of distinct business models, based on a definition we have adopted. In the second phase, the business models and ownership structures are evaluated over time.

To identify the bank business models (BBM), state of the art clustering analysis is used applying a unique definition (see Figure 2.2. below). Cluster analysis is a statistical technique for assigning a set of observations into distinct clusters. In this case, a particular bank-year observation is assigned to a business model. By definition, observations that are assigned to the same cluster share a certain degree of similarity in the instruments, while the formation of the clusters ensures that they are distinct.

Hence, to create the clusters, the initial step is to determine a set of instruments (or the defining features of a business model) to identify any similarities or distinctions. The second step is to determine the method used to define the clusters, as well as the so-called 'stopping rule' for the appropriate number of clusters.

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 organisational structure, balance sheet and financial position and some of the risk indicators. 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 identification of the clusters.

FIGURE 2.2 – Bank business model identification



Source: Authors

The business models definition used in this Monitor distinguishes primarily between the key banking activities (i.e. retail versus market or mixed) and the funding strategies (i.e. retail versus market or mixed) (Figure 2.2). Control is made for financial and risk exposures. To account for these factors collectively, without over-representing any particular factor, five instruments, which constitute the defining activity/funding features of a business model in banks from an asset and liability stand point, were used to form the clusters[9]. These were:

1. *Loans to banks (as % of assets).* This indicator measures the scale of wholesale and interbank activities, which proxy for exposures to risks arising from interconnectedness in the banking sector.

9. Alternative instrument combinations were also considered. In many cases, using a different set of instruments this led to an unrealistically large number of clusters, with many comprising a single bank/year. Removing any one of the five 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 defined indicators were included.

2. *Customer loans (as % of assets).* This indicator identifies the share of customer loans to non-bank customers, indicating a reliance on more traditional banking activities.

3. *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.

4. *Debt liabilities (as % of assets).* These are defined as non-equity liabilities other than deposits and derivatives. Although 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.

5. *Derivative exposures (as % of assets)*[10]. 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.

More sub-instruments can be used depending on the level of granularity of data available under each of the five instruments chosen. More granular data will allow a better understanding of business models in banking. This exercise was, however, subject to data limitations but, yet, can offer a useful encompassing framework to do more research on this topic in the future, when data becomes available.

To form the clusters, Ward's (1963) procedure to calculate the distance between clusters was used. The procedure forms 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 methodology performs better than other clustering procedures for instruments that involve few outliers and in the presence of overlaps[11].

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 to other bank-year observations cannot be determined. The sample used in the Monitor contains such cases, despite efforts to choose indicators with high coverage ratios. In order to accommodate the entire sample of observations, when the 'intangible assets' and 'negative carrying values of derivative exposures' were not reported, they were assumed to be zero in the calculation of 'Trading assets', 'Debt liabilities' and 'Derivative exposures,' since banks are not required to report both balance sheet items unless significant.

All the clustering procedures were conducted using SAS's built-in and user-contributed functions.

To diagnose the appropriate number of clusters, Calinski & Harabasz's (1974) pseudo-F index was used as the primary 'stopping rule'. The index is a sample estimate of the

10. Total derivative exposures are defined as the summation of positive and negative fair values of all derivative transactions, including interest, currency, equity, OTC, hedge and trading derivatives.

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

ratio of between-cluster variance to within-cluster variance[12]. The configuration with the greatest pseudo-F value was chosen as the most distinct clustering. The results show that the pseudo-F indices attain a single maximum, pointing to the five-cluster configuration as the most distinct one (see Table 2.2). The number of clusters is confirmed by alternative stopping rules, namely the Semi Partial R-Squared measure, the Cubic Clustering Criterion and the Sum of Squares Between (see Appendix III).

TABLE 2.2 – Pseudo-F indices for clustering configurations

Number of clusters	Pseudo-F index (Calinski & Harabasz)	Number of clusters	Pseudo-F index (Calinski & Harabasz)
1	..	6	4,798
2	4,984	7	4,723
3	4,243	8	4,783
4	4,378	9	4,699
5	5,015	10	4,602

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

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 definition adopted, 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[13]. In choosing instruments, attention was given to testing a variety of alternative configurations. The five 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 the expectations. Despite these efforts, it is certainly true that the outcomes may change when using other configurations. Notwithstanding this qualification, using this Monitor configuration is useful for a continuous dynamic analysis of the business models in banks.

12. 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.

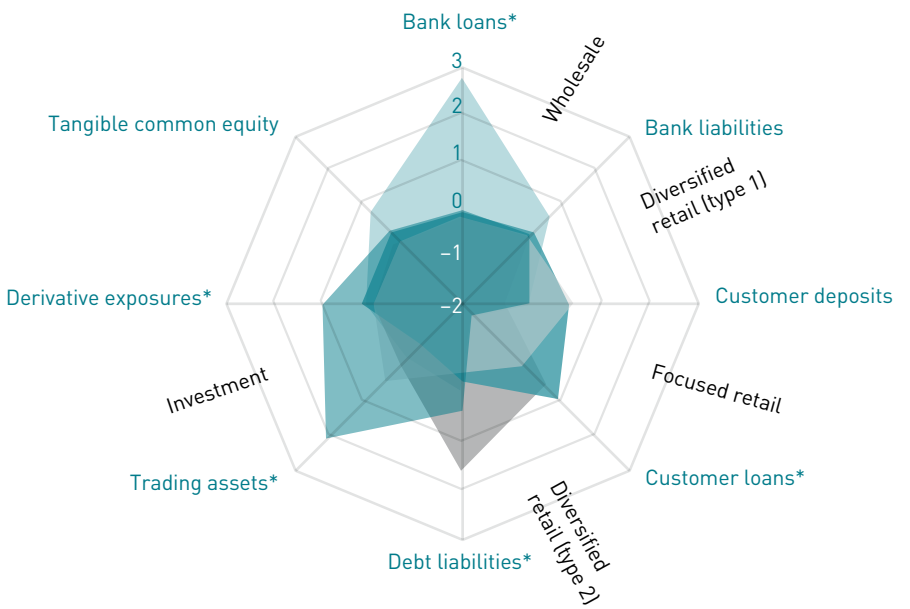
13. See Everitt et al. (2001) for a highly readable introduction to cluster analysis and some of the practical issues in the choice of technical procedures.

3 Which Business Models exist in European Banking?

The following chapter gives the details without the outcomes of the business models' identification, the interconnection with ownership structures[14] and emphasises specific characteristics related to the internationalisation and the migration of bank business models.

First, Table 3.1 and Appendix II give the descriptive statistics of the five models resulting from the cluster analysis on all the sample of banks in Europe during the overall period of analysis (2005-2014), based on the five instruments used to define them. Second, 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. Third, a complementary analysis is performed on the ownership structures of banks to better understand the interaction.

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,

14. The ownership structure dimension is an important factor that can shed light on the institutional diversity in the banking sector in Europe. Crossing the ownership structure and the business models in banks provides a better understanding on how banks do business and their underlying incentives.

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).

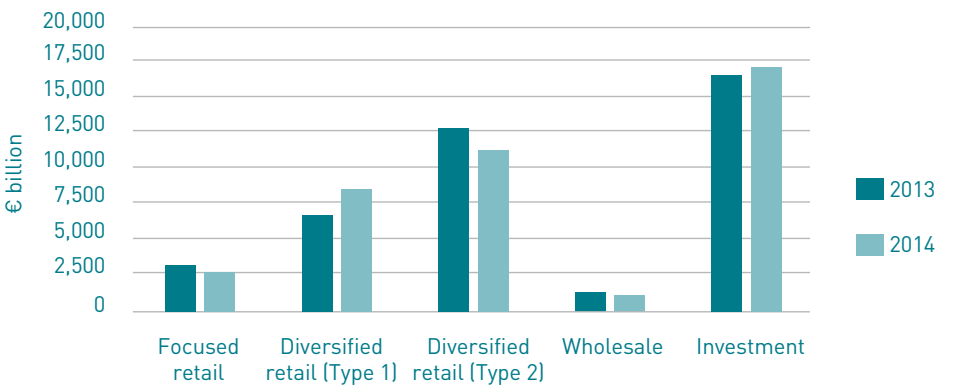
Source: Authors

Models 1, 2 and 3 represent the retail-oriented banks, which are relatively more active in lending to customers. Hence, customer loans account for 78.5%, 55.6% and 68.9% of the total assets, on average surpassing, or very close to, the sample averages.

Looking at the differences between the various retail-oriented banking models, Model 1-banks are, on average, most active in the classical deposit-loan intermediation. Customer deposits account for 69.5% of the total funding (i.e. liabilities incl. equity), while customer loans account for 78.5% of total assets. The remaining exposures, such as trading assets and bank loans are relatively limited with, respectively, 11.8% and 7.0%. Model 1 represents about a quarter of the sample and includes the smallest banks among the retail-oriented models, both in terms of total and average assets (see Appendix II). **Model 1** will be referred to as **focused retail**.

The other two retail models show a greater diversification in their activities and funding. Model 2 has relatively more trading assets and bank loans, 30.9% and 10.3% respectively. The funding is comparable to Model 1, with a relatively high dependence on customer deposits and limited reliance on both bank deposits and debt liabilities. Model 2 represents about 39% of the observations in the sample and, on average, less than 14% of the total assets. **Model 2** will be referred to as '**diversified retail (type 1)**'.

FIGURE 3.2 – Total size of business models, 2013-14



Source: Authors

Model 3 has more diverse assets and liabilities than Model 1. It has significantly more trading assets than Model 1, with trading assets accounting for 22.6% of the total assets. The main difference with the other retail-oriented models is, however, the funding. Among the different business models, Model 3 relies most on debt liabilities, 43.3% respectively,

although Model 3 represents only about 16% of the observations. **Model 3** will be referred to as '**diversified retail (type 2)**'.

Model 4 primarily includes banks that are active in the intermediation between banks, with a heavy reliance on interbank lending and funding. These banks are very active in non-traditional use of funds, including bank loans and trading assets (i.e. all assets excluding cash, loans and intangible assets). On average, interbank lending represents 52.2% of total assets and trading assets account for 17.1% of their balance sheets. These banks are substantially less leveraged than their peers, with the highest tangible common equity ratio of 14.1% among the four clusters studied, compared to less than 10% for all other models.

The Model 4 banks, which will henceforth be referred to as **'wholesale'**, are also more reliant on bank funding. Under this bank model, the liabilities of an average bank to other banks, including both deposits and other interbank debt, represent, on average, 22.4% of the total assets. In turn, customer loans account for only 20.7% of the total balance sheet. Other funds are primarily used for trading assets. The wholesale banks are the smallest group, both in terms of number and total assets of the banks.

Model 5 groups together large investment-oriented banks; these banks have substantial trading activities. The cluster averages for trading assets and derivative exposures—representing 60.2% and 5.2% of total assets respectively—stand between 2.1 and 0.9 standard deviations above the relevant sample means. In funding, the focus is on less stable and less traditional sources, such as debt liabilities.

In what follows, **Model 5** will be referred to as the cluster of **'investment** banks**'**. The investment banks are the largest banks, both in terms of total and average assets. The average size of a bank in this cluster, over the entire sample period, was approximately €123 billion. This was almost double the amount of a diversified retail bank (type 2), about ten times the size of an average wholesale or diversified retail bank (type 1), and about twenty times the size of a focused retail bank (See also Figure 3.2).

When looking at the shares of asset across countries (Appendix II), banks in eastern, central and southern European countries are predominately retail oriented, whereas in France, UK and Switzerland they are investment oriented. The trends from 2005 to 2014 are consistent and relatively stable, except for Belgium, where banks have migrated from investment and wholesale to retail oriented business models in 2008, following the fallout of Dexia and Fortis.

TABLE 3.1 – Descriptive statistics for business models

		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 - Focused retail	Mean	7.0%	78.5%	11.8%	12.3%	69.5%	10.1%	0.3%	7.6%
	St. dev.	0.057***	0.079***	0.071***	0.141**	0.153***	0.078***	0.008***	0.054***
	Min.	0.0%	54.9%	0.1%	0.0%	0.0%	0.1%	0.0%	-6.4%
	Max.	40.2%	99.2%	27.8%	92.3%	98.3%	34.5%	16.0%	95.5%
	Obs	3,877	3,877	3,877	3,877	3,877	3,877	3,877	3,877
Model 2 - Diversified retail (Type 1)	Mean	10.3%	55.6%	30.9%	14.0%	70.7%	7.3%	0.4%	7.5%
	St. dev.	0.073***	0.083***	0.087***	0.11**	0.142***	0.062***	0.015***	0.057***
	Min.	0.0%	14.4%	0.0%	0.0%	0.0%	0.0%	0.0%	-6.0%
	Max.	38.8%	71.4%	54.3%	89.3%	94.6%	34.4%	20.9%	96.7%
	Obs	5,048	5,048	5,048	5,048	5,048	5,048	5,048	4,982
Model 3 – Diversified retail (Type 2)	Mean	6.6%	68.9%	22.6%	10.6%	36.7%	43.3%	1.7%	7.4%
	St. dev.	0.061***	0.117***	0.099***	0.088**	0.165***	0.155***	0.031***	0.045***
	Min.	0.0%	31.2%	0.1%	0.0%	0.0%	22.9%	0.0%	-12.9%
	Max.	56.4%	97.2%	57.0%	59.8%	70.1%	99.3%	24.1%	68.8%
	Obs	2,023	2,023	2,023	2,023	2,023	2,023	2,023	1,964
Model 4 – Wholesale	Mean	52.2%	20.7%	17.1%	22.4%	51.8%	10.4%	0.8%	14.1%
	St. dev.	0.201***	0.151***	0.126***	0.265**	0.321***	0.193***	0.026***	0.152***
	Min.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
	Max.	100.0%	55.7%	52.7%	98.1%	97.5%	99.8%	38.4%	100.0%
	Obs	887	887	887	887	887	887	887	873

		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 5 – Investment	Mean	11.4%	23.5%	60.2%	14.9%	49.3%	19.9%	5.2%	9.8%
	St. dev.	0.092***	0.133***	0.158***	0.189**	0.311***	0.214***	0.125***	0.137***
	Min.	0.0%	0.0%	21.2%	0.0%	0.0%	0.0%	0.0%	-0.4%
	Max.	40.9%	48.0%	100.0%	97.7%	97.3%	100.0%	90.8%	99.9%
	Obs	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,184
All banks	Mean	11.7%	59.1%	25.7%	13.6%	61.8%	15.1%	1.0%	8.2%
	St. dev.	0.139***	0.212***	0.167***	0.143**	0.227***	0.172***	0.044***	0.078***
	Min.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-12.9%
	Max.	100.0%	99.2%	100.0%	98.1%	98.3%	100.0%	90.8%	100.0%
	Obs	13,040	13,040	13,040	13,040	13,040	13,040	13,040	12,850

Notes: The independence of clusters was tested using non-parametric Wilcoxon-Mann-Witney two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (*, **, ***, and ****) 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 and fourth (closest) ones. Variables in **bold** highlight the instruments used in forming the clusters.

Source: Authors

TABLE 3.2 – Descriptive statistics for ownership structures

		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)
Commercial	Mean	17.2%	48.8%	27.2%	15.1%	53.2%	17.6%	2.2%	11.2%
	St. dev.	0.206****	0.266****	0.222***	0.194***	0.277****	0.214****	0.072****	0.133****
	Min.	0.0%	0.0%	-87.7%	0.0%	0.0%	0.0%	0.0%	-233.3%
	Max.	100.0%	99.0%	100.0%	98.1%	101.4%	333.3%	90.8%	99.9%
	Obs	3,814	3,840	3,735	3,817	3,817	3,814	3,861	3,790
Cooperative	Mean	9.7%	63.0%	25.5%	12.9%	66.2%	13.7%	0.2%	6.8%
	St. dev.	0.09***	0.163****	0.142****	0.113***	0.19***	0.15***	0.011****	0.038***
	Min.	0.0%	0.0%	-6.8%	0.0%	0.0%	0.0%	0.0%	-2.2%
	Max.	100.0%	96.5%	98.0%	91.0%	98.3%	99.6%	22.0%	100.0%
	Obs	5,315	5,337	5,290	5,331	5,331	5,331	5,358	5,289
Nationalised	Mean	7.3%	57.6%	31.4%	16.2%	43.6%	32.1%	4.8%	1.7%
	St. dev.	0.061***	0.143****	0.129****	0.113****	0.208***	0.339***	0.084****	0.23****
	Min.	0.0%	11.8%	2.9%	0.0%	0.0%	2.0%	0.0%	-242.7%
	Max.	31.7%	86.7%	79.9%	61.2%	92.4%	342.7%	75.8%	22.7%
	Obs	270	270	270	268	268	268	271	253
Public	Mean	14.8%	62.2%	19.4%	14.5%	43.8%	30.8%	2.1%	8.9%
	St. dev.	0.199**	0.265****	0.173****	0.201***	0.304***	0.264***	0.036****	0.093****
	Min.	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.4%
	Max.	96.7%	95.6%	97.2%	98.1%	91.4%	92.7%	18.5%	72.8%
	Obs	454	454	450	457	457	457	457	422

		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)
Savings	Mean	8.8%	64.3%	24.8%	12.7%	67.4%	12.1%	0.4%	7.2%
	St. dev.	0.087**	0.162****	0.132***	0.113***	0.162***	0.14***	0.018****	0.043***
	Min.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-1.3%
	Max.	99.9%	99.2%	96.6%	94.8%	97.5%	99.3%	34.4%	94.2%
	Obs	3,389	3,427	3,335	3,402	3,402	3,400	3,459	3,370
All banks	Mean	11.8%	59.1%	25.7%	13.6%	61.5%	15.4%	1.0%	8.1%
	St. dev.	0.142	0.212	0.168	0.145	0.23	0.184	0.044	0.089
	Min.	0.0%	0.0%	-87.7%	0.0%	0.0%	0.0%	0.0%	-242.7%
	Max.	100.0%	99.2%	100.0%	98.1%	101.4%	342.7%	90.8%	100.0%
	Obs	13,242	13,328	13,080	13,275	13,275	13,270	13,406	13,124

Notes: The independence of the ownership structures was tested using non-parametric Wilcoxon-Mann-Witney two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (*, **, ***, and ****) stands for the statistical difference of any given ownership structure from that number of other ownership structures for that indicator. For example, two asterisks (**) implies that the ownership structures is statistically different from two other ownership structures but not the third and fourth (closest) ones.

Source: Authors

Looking at the ownership structure, in the European banking sector a rough distinction can be made between shareholder-value (SHV) and stakeholder-value (STV) banks, which accounts for the institutional diversity of the sector[15]. The main objective of the SHV is to maximise their profits, while STV have multiple objectives. Hence, these can be 'dual or multi bottom-line' institutions that have the combined requirement of making profits for the banks' continuation and adding value for their stakeholders in other ways. In this Monitor a distinction is made between the five largest ownership structures with different objectives. The key characteristics of the different ownership structures[16] are described below:

1. *Commercial banks (SHV).* The banks take many different forms, but have in common that they are in general privately owned by their shareholders. The commercial banks include banking groups as well as subsidiaries owned by non-EEA and CH entities.

2. *Cooperative banks (STV)*[17]. There are large differences between cooperative banks, which do not make it easy to place these institutions under a single definition. But, in general, the main distinguishing characteristic is that cooperative banks belong to their members that have equal voting power (one member one vote) and entitled to the nominal value of the shares. Moreover, the central institutions that are owned by the member-owned banks and are not reporting consolidated financial figures are also recognised as cooperative banks.

3. *Nationalised banks (SHV).* During the financial and economic crises, governments intervened to safeguard financial stability. Support came in the form of recapitalisations, asset relief measures, loans and guarantees. In return, the governments received fees and, in some cases, also shares. In cases where a government obtained control (i.e. more than 50% of the shares) and kept it at least until the summer of 2015, the bank was considered as being nationalised. The nationalised banks are either prepared to become commercial banks or are being liquidated. The value maximising orientation of these activities make these banks relatively more SHV.

4. *Public banks (STV).* Some public bodies (e.g. local-, regional-, central- governments) also have banks to support them in fulfilling their objectives. Hence, most of these banks raise funds and provide financing for the activities of the public bodies.

5. *Savings banks (STV)*[18]. The savings banks in Europe have many different characteristics; they can be owned by public bodies or foundations, but have in common that they originally focussed on providing access to financial services for the less wealthy amongst the population. Like the cooperative banks, the savings banks are in many cases supported by central institutions. In cases where the local savings banks and central institutions were not reporting consolidated financial figures, the central institutions are nevertheless recognised as savings banks. The savings banks are considered STV.

15. See Ayadi et al (2009 and 2010) for an extensive analysis on institutional diversity in banking in Europe.

16. The type of ownership structure is determined based on the situation of the banking group during the summer of 2015.

17. For a comprehensive account on cooperative banking in Europe, see Ayadi et al (2010).

18. For a comprehensive account on savings banks in Europe, see Ayadi et al (2009).

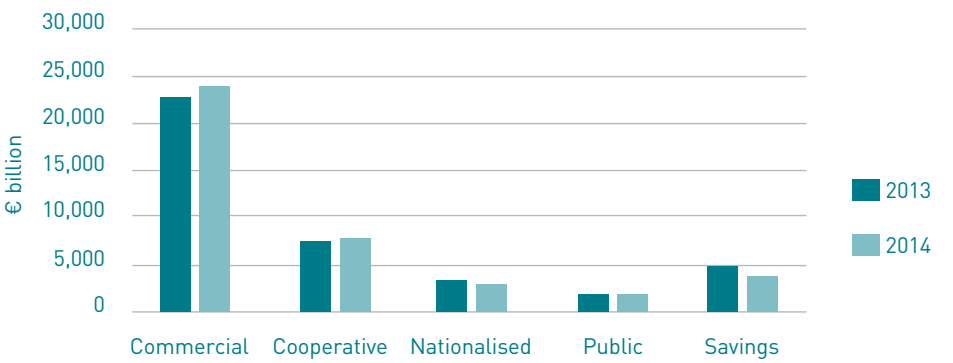
The descriptive statistics for the main variables describing the activities and funding strategies across ownership structures are provided in Table 3.2 for the whole period and in Appendix II for a dynamic analysis.

The commercial banks account for the majority of the banking assets (56%), while only accounting for 29% of the banks in the sample. The commercial banks are, on average, less active in retail activities than other ownership structures. Customer loans are 48.8% compared to the sample average of 59.1% and customer deposits are 53.2% compared to the average of 61.5%. In turn, these banks are relatively more active in market and inter-bank activities, with averages above the sample average. The main difference, however, is the high capital level; the tangible common equity is 11.2% which is significantly above the capital levels for the other ownership structures.

The cooperative banks are, at around 40% of the observations, the largest group of banks in the sample, while only accounting for 16% of the assets. The activities of cooperative banks are relatively more retail oriented. Customer loans and deposits are respectively 63.0% and 66.2%. Despite the retail orientation, the average inter-bank and trading activities are still sizable. Bank loans and trading assets are respectively 9.7% and 27.2%.

The nationalised banks are, in number, the smallest group, but on average size the largest. The median size of the nationalised banks is €67bn, compared to €1.2bn for the entire sample. The restrictions put on recapitalisation make it less likely that small banks are being nationalised[19]. The nationalised banks are relatively more active in market activities, i.e. highest average trading assets. The nationalised banks obtained relatively most funds from other banks after deduction of loans to other banks, which signals that bank liabilities are obtained from central banks instead of other banks. The funding is mostly market based, with the highest share in debt liabilities and derivatives, respectively twice and almost five times the sample average. The nationalised banks have, on average, the lowest capital level of all the ownership structures.

FIGURE 3.3 – Total size of ownership structures, 2013-14



Source: Authors

19. The state recapitalisations of EU banks are subject to State aid rules. When assessing State aid, the European Commission, the banks' viability and need for lending to the real economy are taken into account. Smaller banks are in particular less likely to deliver a material contribution to the financing of the real economy. OJ C 216 of 30.7.2013 (http: //eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX: 52013XC0730(01)&from=EN).

The public banks represent only a small part of the sample both in number of institutions and share of assets. The composition of the public banks' assets is comparable to the sample average. For their funding the banks rely more on debt liabilities (30.8% compared to 15.4% for the entire sample) and derivative liabilities (2.1% compared to 1.0%), while they depend less on customer deposits (43.8% compared to 61.5%).

The savings banks form a quarter of the banks in the sample, but only 12% as a share of the total assets (See also Figure 3.3). The savings banks are primarily active in retail-oriented activities, which are to a large degree similar to those of cooperative banks. The customer loans and deposits are respectively 64.3% and 67.4%. The average inter-bank and trading activities are still substantial, but slightly less than those of cooperative banks, at 8.8% and 24.8% respectively.

From a country perspective, there is a great dominance of commercial banking in Europe, in particular in Eastern Europe. Cooperatives and savings banks are active in countries like Austria, France, Germany, the Netherlands, and Norway[20].

TABLE 3.3 – Ownership attributes of business models (% of institutions)

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Commercial	23.9%***	18.3%****	26.7%***	73.1%****	55.2%****	28.4%
Nationalised	1.0%**	1.6%***	5.4%****	0.1%***	3.1%****	2.0%
Shareholder-value	24.9%****	19.9%****	32.1%****	73.2%****	58.3%****	30.4%
Cooperative	39.3%****	48.6%***	45.4%***	11.5%****	23.7%****	40.5%
Savings	30.6%***	30.7%***	16.8%***	8.3%****	15.4%***	25.6%
Public	5.2%**	0.8%****	5.6%**	7.0%**	2.6%****	3.5%
Stakeholder-value	75.1%****	80.1%****	67.9%****	26.8%****	41.7%****	69.6%
Listed on stock exchange	12.7%***	8.3%****	21.9%****	4.0%****	14.8%***	12.0%

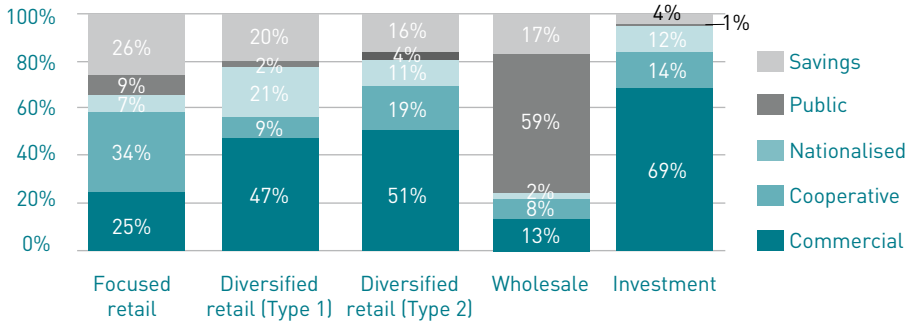
Notes: All figures are the average values for the year-end observations for the business models. The independence of cluster sub-samples was tested using the Wilcoxon-Mann-Whitney non-parametric two-sample tests at 5% significance. According to the results of these tests, the number of asterisks (*, **, ***, or ****) stands for the statistical difference of any given cluster from that number of other clusters for that indicator. Also, see in footnote 16 the precision about data on ownership structure.
Source: Authors

Turning to the variation in ownership structures in terms of number of institutions, Table 3.3 shows that wholesale and investment banks are mostly owned by profit-maximisers. In turn, retail banks are mostly stakeholder value banks, which is reflected in the highest share of cooperative and savings banks. Moreover, a relatively large share of the wholesale banks have public ownership, which is also reflected in the share of public listings. Hence,

20. In this Monitor, we do not include credit unions in the analysis.

only 4% of the wholesale banks are listed, while on average, 12% of the banks in the sample have publicly listed shares. The highest share of listed banks can be found among the diversified retail (type 2) banks.

FIGURE 3.4 – Distribution of ownership structures across business models (2005-14,% of assets)



Notes: See in footnote 16 the precision about data on ownership structure.
Source: Authors

In terms of assets the results are substantially different. As shown in Table 3.3 and Figure 3.4, the dominance of the commercial banks among the investment oriented banks is more apparent, while the share of wholesale bank assets is marginal. The commercial banks represent 73% of the wholesale banks in number, but only 13% of the assets. In turn, the public banks only represent 7% of the banks, but 59% of the assets. The savings banks that have relatively large shares for the retail-oriented banks also have a substantial share of the wholesale assets, while the share in investment bank assets is marginal. The cooperative banks have, like savings banks, relatively the largest share of the retail-oriented bank assets (mainly retail focused), except for retail diversified (type 1). Combined, the cooperative banks conduct more than three times as many investment banking activities as savings banks, while they are only a third larger in size. The 14% share of the investment assets is slightly below the 16% average weight of cooperative banks in the sample. The share in wholesale assets is half the sample average.

In terms of the internationalisation strategy, investment banks are the most internationally active, while they enjoy a large size in terms of total assets. Table 3.4 shows that the average banks in this model have credit institutions and/or branches in more than six European countries. This is significantly more than wholesale and focused retail banks that cover between one and two countries. Both types of diversified retail banks have international activities in between. Most of the non-domestic countries are served using branches. The average investment bank has 1.9 branches, while diversified retail (type 2) has 1.6, focused retail banks, diversified retail (type 1) and wholesale have less than one branch. The average investment and diversified retail (type 2) banks also have more than one subsidiary, which is often used to conduct more substantial international activities. The average investment bank has 3.6 subsidiaries, while the diversified retail has one. However, these numbers are not significantly different.

TABLE 3.4 – International activities

a) Business models

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
International activities (nr of unique EEA-countries)	1.5***	2.6***	3.8**	1.9*	6.4***	1.6
Internationalisation through subsidiaries (nr of unique EEA-countries)	0.3**	0.8**	1.2***	0.3*	3.6****	0.3
Internationalisation through branches (nr of unique EEA-countries)	0.2***	0.8***	1.6**	0.6	1.9**	0.3

b) Ownership structures

	Commercial	Cooperative	National-ised	Public	Savings	ALL
International activities (nr of unique EEA-countries)	2.3****	1.2****	4.2****	1.1***	1.2***	1.6
Internationalisation through subsidiaries (nr of unique EEA-countries)	0.5****	0.1****	1.8****	0.1****	0.1****	0.3
Internationalisation through branches (nr of unique EEA-countries)	0.7****	0.1***	1.5****	0.0***	0.1****	0.3

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 average values for the year-end observations for the respective business model or ownership structure. The independence of cluster subsamples was tested using the Wilcox-on-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.

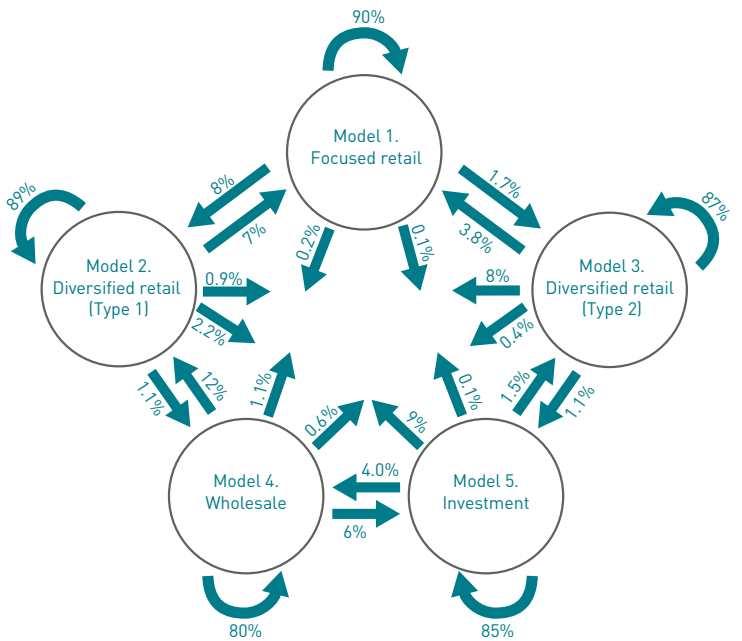
Source: Authors

The SHV banks are significantly more internationally active than STV banks. Hence, the commercial and nationalised banks are active in respectively 2.3 and 4.2 countries, whereas the other banks are only, almost exclusively, active in their home-market. The figures for the cooperative and savings banks need to be interpreted carefully. In fact, the international activities of these banks are often exclusively performed by the central institutions within a network of banks. When a bank does not have branches and subsidiaries abroad, it does not mean that the bank is not offering its clients international services.

Banks adapt their business models for the following reasons: a) to respond to market forces and competitive pressures (i.e. mergers and acquisitions, overall sector's restructuring movement); b) to respond to regulatory and government led decisions (i.e. increase of capital, changes in monetary policy, State aid decisions with a restructuring plan requirement, others); c) other non-obvious reasons (i.e. political or other excessive risk taking activities) which could be essential to understand banks' behaviours.

Moving from one business model to another, hereafter called "migration" in this Monitor, can provide a wealth of information to market participants, regulators, creditors and depositors about the strategy of banks and their behaviour in the markets where they are active and about their risk profiles and, over time, contribution to systemic risk.

FIGURE 3.5 – Model transition matrix, share of banks (%, 2005-14)



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

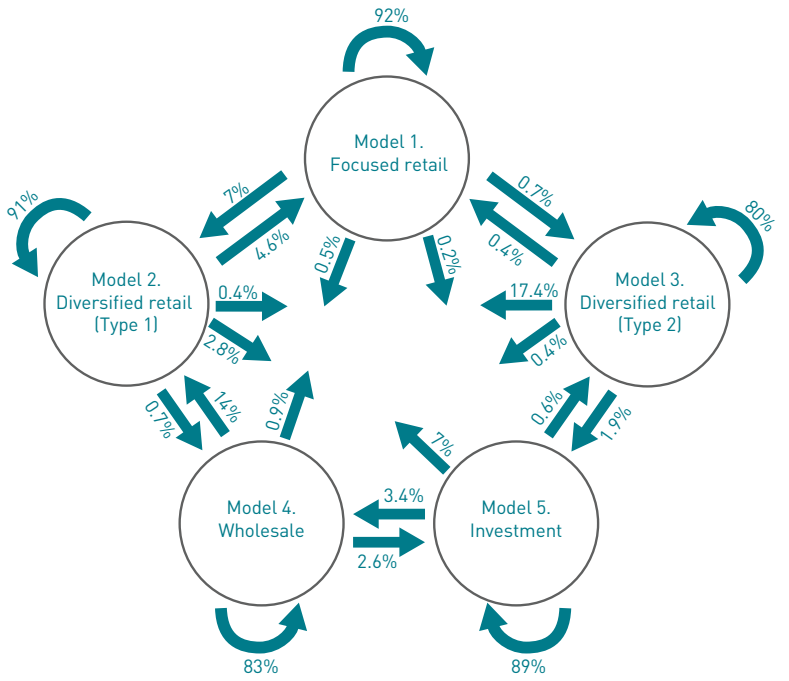
Although the composition of banks under the different models remains relatively steady over time, transitions do occur and more so in some models than in others[21]. Figure 3.5 provides the transition matrix for the five models during the years 2005 to 2014. The assignment of banks to the focused retail model shows the highest persistence; 90% of the banks remained the same from one year to the next. The vast majority of both the diversified retail, wholesale and investment banks remained within the same model throughout the

21. See Appendix VII for a list of systemic banks including their business models.

sampled years (89%, 87%, 80%, and 85% respectively). The remainder of migration was primarily to diversified retail (type 1), with flows ranging between 8% from focused retail to 12% from wholesale banks. The other large transition flows are between retail banks. Indeed, a large share of diversified retail (type 1) banks that migrated was to focused retail (7%) and 3.8% of banks migrated from diversified retail (type 2) to focused retail. Many wholesale oriented banks further migrated to investment banks and vice-versa; 5.9% of wholesale banks migrated to investment banks and 4.0% in the other direction.

As shown in Annexe II, on average, bank business models seem stable over time across countries, except in Belgium where banks displayed a relatively quick move from the investment/wholesale oriented to the retail oriented business model, due to the collapse of the two large Belgian banks, Dexia and Fortis.

FIGURE 3.6 – Model transition matrix latest year, share of banks (%, 2013-2014)



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

Looking only at the transitions in the latest examined year, the changes are largely the same (See also Figure 3.6). The persistence is slightly higher for all business models, except for diversified retail (type 2) banks. Almost all of these diversified retail (type 2) banks (17.4% out of 20%) migrated to diversified retail (type 1). The flow between diversified retail (type 1) and focused retail banks is lower; 7% for the entire period compared to 4.6% in the

TABLE 3.5 – Model transition matrix aided banks (2005 to 2014)

		Business model in 2014				
		Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment
Business model prior to intervention	Focused retail	90.3%	7.7%	0.2%	0.2%	1.7%
	Diversified retail (Type 1)	7.1%	88.6%	1.1%	2.3%	0.9%
	Diversified retail (Type 2)	1.1%	12.2%	80.3%	5.9%	0.6%
	Wholesale	0.2%	9.1%	3.9%	85.3%	1.5%
	Investment	3.7%	7.7%	0.4%	1.2%	86.9%

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 year before the first intervention and most recent year covered in the sample (i.e. 2014) are compared. A total of 68 banks are concerned. Only banks that have benefitted from recapitalisation measures are included. Hence, only banks that received capital support were bound to restructure their activities, while banks that only received liquidity support (i.e. credit guarantees and loans) were not.

Source: Authors

latest year. The remaining flows between the retail oriented business models are negligible. The interchange between the non-retail banks is also lower, especially the migration from wholesale to investment banks; 2.6% in 2013-2014 compared to 6% over the entire period.

Since the financial crisis erupted, many European governments have supported their banks in order to safeguard financial stability and to avoid disruption to the real economy. The banks in the EU that required capital support had to fulfil certain conditions in order to become economically sound, to prevent a distortion of the market and a break-up of the lending chain. Most of the conditions stipulated in the restructuring plans contained the bank specific conditions which, in general, foresaw a focus on more traditional banking activities, i.e. lending to the real economy using customer deposits[22]. For many of the banks, this meant the persistence or transition towards more retail-oriented business models. Table 3.5 shows that around 15% of the banks that were identified as wholesale and investment banks in the year before they received public capital support, changed business models. Most of these banks became diversified retail (type 1). The aided banks that were identified as focused or diversified retail banks before the intervention, changed in only around 10% of the cases. Most of the retail oriented banks that changed model turned into focused retail or diversified retail (type 1). About a fifth of the more market funded retail banks migrated. In fact, about 12.2% of the diversified retail (type 2) banks turned into diversified retail (type 1) banks, while 5.9% shifted to wholesale in the period up to 2014[23].

The results provided above give an insight into the main areas of activity and inherent characteristics of the five different bank business models and the same number of ownership types: on the one hand there are banks that engage in more market activities; on the

22. See Ayadi et al (2015).

23. An analysis of the year-by-year transitions (not provided here) shows that the transition to diversified retail (type 1) was particularly high in 2009 and from 2011 to 2014, at the midst of the crises and aftermath, when non-deposit funding was more difficult to attract and regulatory scrutiny more intense.

other hand there are banks which remain closer to their traditional roots, relying more on retail funding and engaging in customer loans.

The next three sections will consider whether these basic characteristics are confirmed by a detailed analysis of the financial, economic performance, risk attributes and response to regulation of the business models and ownership structures.

4 What is the Financial Performance and Contribution to the Real Economy?

The third phase of the analysis provides an overview of the performance and the contribution of banks to the real economy across different business models and ownership structures.

The diversified retail (type 1) banks reported both the highest return on assets and return on equity of all the business models. The median values are, however, significantly higher than the other retail oriented models. In turn, the diversified retail (type 2) banks reported the significant lowest returns. The results for ownership structures in Table 4.1 show that the median return on assets is significantly higher for commercial banks, while the nationalised banks report the lowest. The results for return on equity are relatively closer to one another, with the cooperative banks reporting the highest values.

The median efficiency scores for all the business models are relatively close to the median for all banks, with the diversified retail (type 2) reporting the lowest cost-to-income ratios and the wholesale banks the highest. The differences across ownership structures are larger, with the public banks appearing most efficient and the commercial and cooperative banks least efficient.

Turning to the median values for customer loan growth, the focused retail banks reported the highest loan growth. The loan growth is significantly higher than all other business models, except for wholesale banks. The diversified retail (type 2) banks reported the significant lowest loan growth. The differences between the ownership structures are, nevertheless, larger. The public banks reported the highest loan growth, while the nationalised banks were the only banks reporting a negative loan growth.

TABLE 4.1 – Performance, income and contribution to real economy indicators

a) Business models

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Return on assets (RoA)	0.47%**	0.50%**	0.40%****	0.49%*	0.46%*	0.48%
Return on equity (RoE)	7.64%***	8.09%***	5.39%***	6.15%***	8.04%**	7.60%
Cost-to-income (CIR)	64.5%****	66.7%**	61.9%****	69.8%**	68.0%**	65.6%
Net interest	75.1%****	73.6%****	65.4%****	40.7%****	54.0%****	72.3%
Commission & fees	18.4%****	20.6%****	19.7%****	38.4%****	21.9%****	20.2%

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Trading	1.4%****	0.0%****	4.0%**	3.8%**	4.4%**	0.4%
Other	3.0%****	3.8%***	6.9%****	2.2%****	3.5%***	3.8%
Customer loan growth	4.64%***	3.42%**	1.11%****	4.47%*	2.95%**	3.61%

b) Ownership structures

	Commercial	Cooperative	National-ised	Public	Savings	All
Return on assets (RoA)	0.62%****	0.47%***	0.14%****	0.49%**	0.45%***	0.48%
Return on equity (RoE)	7.07%**	7.97%****	3.98%****	6.75%***	7.53%***	7.59%
Cost-to-income (CIR)	66.8%***	66.4%***	60.0%****	56.9%****	64.5%****	65.6%
Net interest	58.9%****	73.6%***	66.9%****	73.1%**	74.7%***	72.3%
Commission & fees	23.9%****	19.8%**	18.3%*	17.3%***	19.6%**	20.2%
Trading	5.1%**	0.0%****	5.0%**	5.3%**	0.1%****	0.4%
Other	3.1%***	4.0%**	3.9%*	1.9%****	4.1%**	3.8%
Customer loan growth	4.51%**	3.83%***	-2.69%****	5.78%***	2.87%****	3.62%

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, three asterisks (***) implies that the cluster or ownership structure is statistically different from the three (furthest) clusters/ownership structure but not the fourth (closest) one.
Source: Authors

Diversified retail banks (type 1) appear to do relatively better out of the five models in return on assets (RoA) and return on equity (RoE), while their cost-to-income ratios (CIR) are not significantly worse than most other business models. In turn, the more market funded, diversified retail (type 2) banks appear to be on the other side of the spectrum, showing the significantly lowest RoA and RoE and significantly better CIR. The results of the other business models are more diffuse. The RoA are, for instance, not significantly different from wholesale and investment banks, while the results for RoE of investment banks are significantly higher than of wholesale banks, due to a lower leverage (i.e. total assets over [tangible common] equity). Moreover, the CIR is between those of the diversified retail banks and both the wholesale and investment banks. Lastly, due to a substantial

variability in RoE and CIR figures, the median values were used in the analysis in order to reduce the impact of outliers on the results.

Looking at the differences between ownership structures, the commercial banks clearly stand out in terms of RoA, while in terms of RoE and CIR they are worse than most other ownership structures. In turn, the other shareholder value type institutions do worst. Hence, the nationalised banks quoted both the lowest RoA and RoE. The RoA of the three stakeholder-value ownership structures is around the sample median. Due to differences in leverage, the cooperative banks are reporting significantly higher RoE than the public and savings banks. The public banks quote the significantly lowest CIR, while the cooperative and savings banks seem significantly less efficient.

The contribution to the real economy of the focused retail model has been significantly higher than other business models, except wholesale banks. The loan growth of the diversified retail (type 2) banks was significantly lower than any of the other types. The loan growth of the predominantly deposit funded diversified retail (type 1) and investment banks are clearly in between.

The loan growth of the nationalised banks has even been negative in the period from 2005 to 2014. The other government-owned type of banks - public banks - reported the highest loan growth. Yet, their reported contribution to the real economy is not significantly higher than that of commercial and cooperative banks.

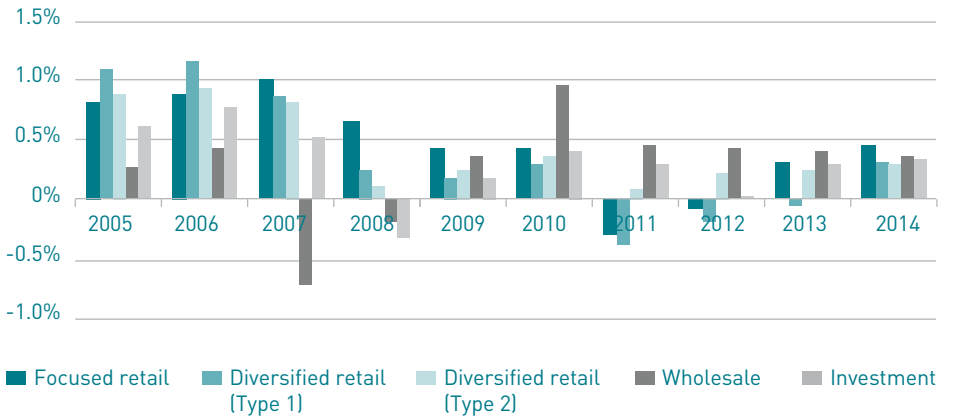
The median performances of the business models and ownership structures shown in Table 4.1 hide the evolution of profits over recent years, in particular in the crisis years of 2007 up to 2013. As depicted in Figures 4.1 and 4.2, when the time span of the profit indicators are considered, a distinction should be made between the financial crisis from 2007 to 2009 and the Eurozone economic crisis from 2010 to 2013.

Since the outbreak of the crises, the performance of banks across all business models has worsened. Indeed, in the period from 2008 to 2013, none of the business models quoted returns above the RoA levels in 2005 and 2006, except for wholesale banks in 2010. More specifically, in the run-up and during the financial crisis, wholesale and investment banks clearly lagged behind their peers, with profits turning to losses or close to break-even. Thereafter, during the Eurozone crisis, the profits of wholesale and investment banks recovered to levels well below pre-crises levels. On the other hand, the returns on retail banks only fell in 2008, turning the profits of focused and diversified retail (type 1) banks into negative territory during the economic crisis. Interestingly, only diversified retail (type 2) managed to obtain positive results for every year.

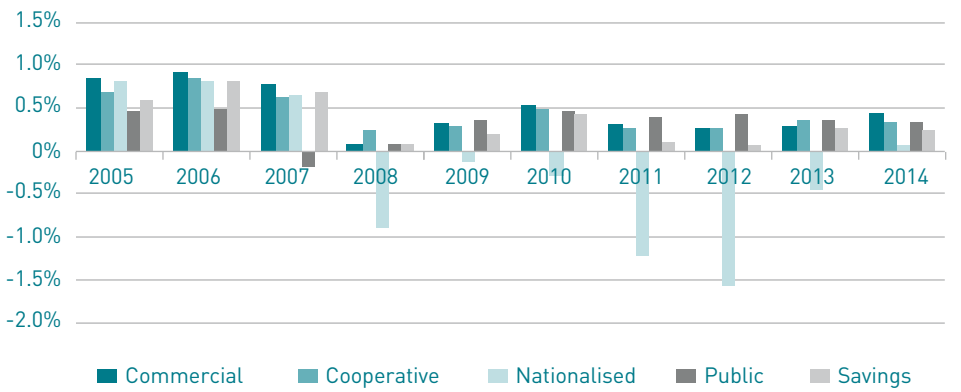
Looking across ownership structures, before the crises, the public and savings banks reported slightly lower profits than the other types of banks. During the first year of the crisis (i.e. 2007) banks across all ownership structures, except public banks, were able to continue making profits close to the pre-crises levels. Afterwards profits dropped to levels close to break-even, before recovering to slightly higher profit levels. The differences between ownership types are small, except for nationalised banks, which have been continuously loss-making between 2008 and 2013. In the most recent year, the nationalised banks were making a small profit for the first time since the onset of the crises.

FIGURE 4.1 – Evolution of return on assets (RoA)

a) Business models



b) Ownership structures



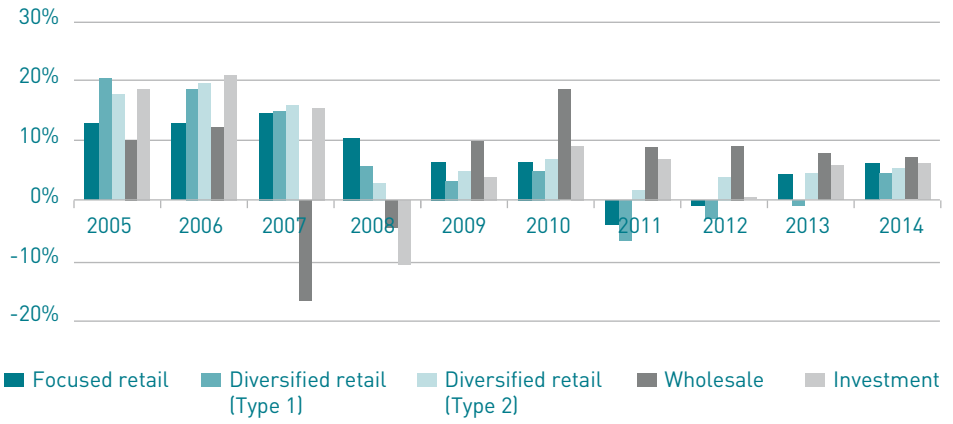
Notes: All figures are the weighted average values for each accounting year, by business model/ownership structure. The weighting scheme uses individual total assets.
Source: Authors

Turning to RoE, the results are broadly similar. Hence, only the distance between the business models changed, due to differences in leverage (i.e. total assets over [tangible common] equity). The diversified retail (type 2), wholesale and investment banks with higher leverage showed relatively higher profits/losses, while on the other hand, the less leveraged years for both focused retail and diversified retail (type 1) banks showed lower profits/losses.

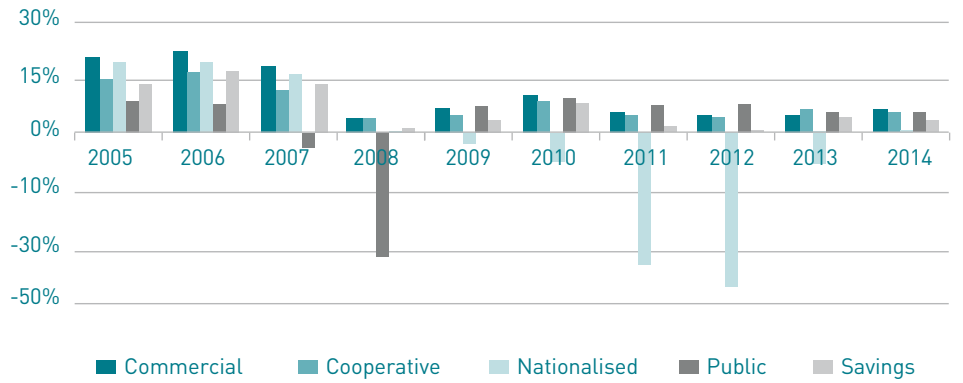
Also for ownership structures, the results are broadly similar. Since 2005, the leverage ratios of across ownership structures have converted, and with it the RoE ratios. In fact, the low leverage of the public and savings banks increased the gap with the commercial and cooperative banks with higher RoA. The losses of the nationalised banks are, however, most apparent during the crises. Hence, the nationalised banks were up to four times more leveraged during that period, compared to the other ownership structures.

FIGURE 4.2 – Evolution of return on equity (RoE)

a) Business models



b) Ownership structures



Notes: All figures are the weighted average values for each accounting year, by business model/ownership structure. The weighting scheme uses individual total equities.
Source: Authors

The operational efficiency is measured using the cost-income ratio (CIR). The efficiency across all of the business models has deteriorated in the past decade, from 58.8% to 65.3% for the entire sample. In particular, Figure 4.3 shows that investment and wholesale banks were especially inefficient at the height of the financial crisis and in the aftermath of the economic crisis. The retail banks saw their efficiency initially improve, before their CIR deteriorated between 2008 and 2012. The efficiency ratio of focused retail and diversified retail (type 2) improved over the last two years, while the diversified retail (type 1) improved in 2014.

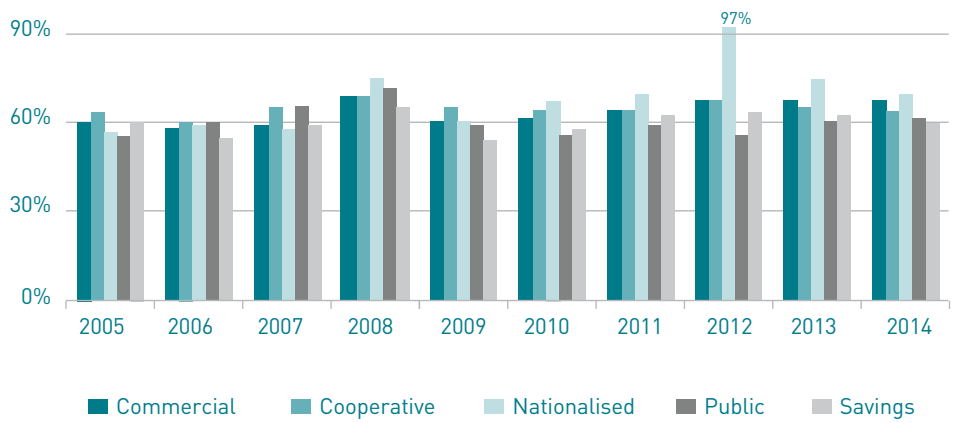
Also, across all the ownership structures, the CIR deteriorated. The nationalised banks scored initially among the most efficient banks, but turned out to be least efficient between 2008 and 2014. The worst years were at the height of the financial and economic crises,

with CIR of 76.3% in 2008 and 97.4% in 2012. The efficiency ratios of the other ownership structures were more stable over time. The commercial and cooperative banks appear less efficient than the public and savings banks.

FIGURE 4.3 – Evolution of cost-income ratio (CIR)

a) Business models

b) Ownership structures



Notes: All figures are the weighted average values for each accounting year, by business model/ownership structure. The weighting scheme uses individual total operational incomes.

Source: Authors

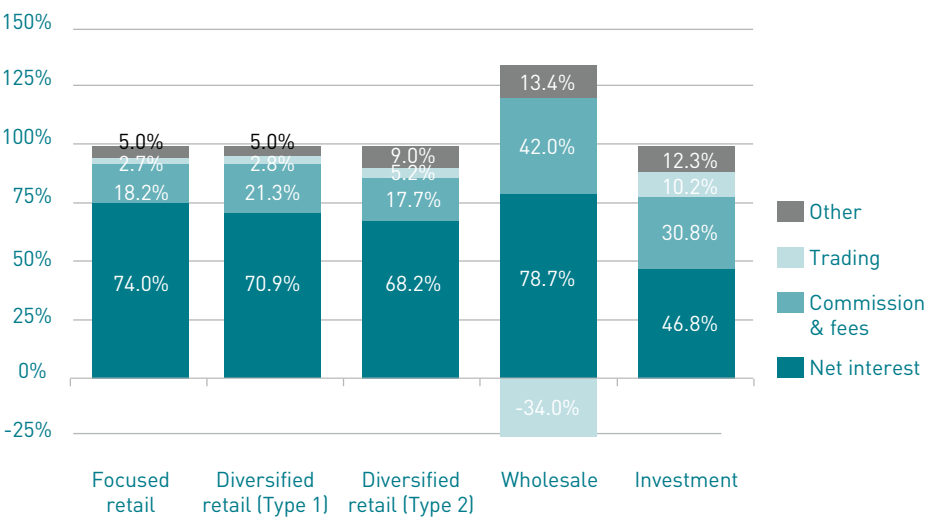
A more detailed analysis of the breakdown of incomes reveals a mixed picture. In particular, Figure 4.4 shows that investment banks clearly have substantial non-interest earnings, most notably from fees, trading, and other earnings (which includes insurance earnings). Meanwhile, the retail banks rely substantially more on interest income. In fact, interest income is most important to focused retail banks, followed by the primarily deposit funded diversified retail (type 1) and the debt liabilities reliant diversified retail (type 2) banks.

The figures also highlight several less straightforward results. In particular, all business models on average earn between 17.7% and 31.3%[24] 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 34.0% of total incomes. Albeit, looking at the median trading earnings displayed in Table 4.1, the net trading earnings of wholesale banks are positive, suggesting that the trading losses are concentrated in a small group of the banks. The aggregate net other earnings also show an important difference between the aggregate values and the median values. Hence, the retail oriented banks reported lower aggregate other earnings, while the median values are below those of the wholesale and investment banks, suggesting that the other earnings of the investment and wholesale banks are more varied.

Income varies across ownership structures. The stakeholder value banks rely relatively more on net interest income than commercial banks. For the commercial banks, commission and fee income are significantly more important than for other ownership structures. The trading income and other income are significantly lower for cooperative and savings banks. Yet, there is no clear distinction between the trading incomes of the commercial, nationalised and public banks for which the aggregates are relatively different from the medians shown in Table 4.1. In particular, the large aggregate net trading losses of public banks are not reflected in the median trading income of 5.3%. Remarkably, the aggregate and median net trading income of the worst performing banks - the nationalised banks - is positive.

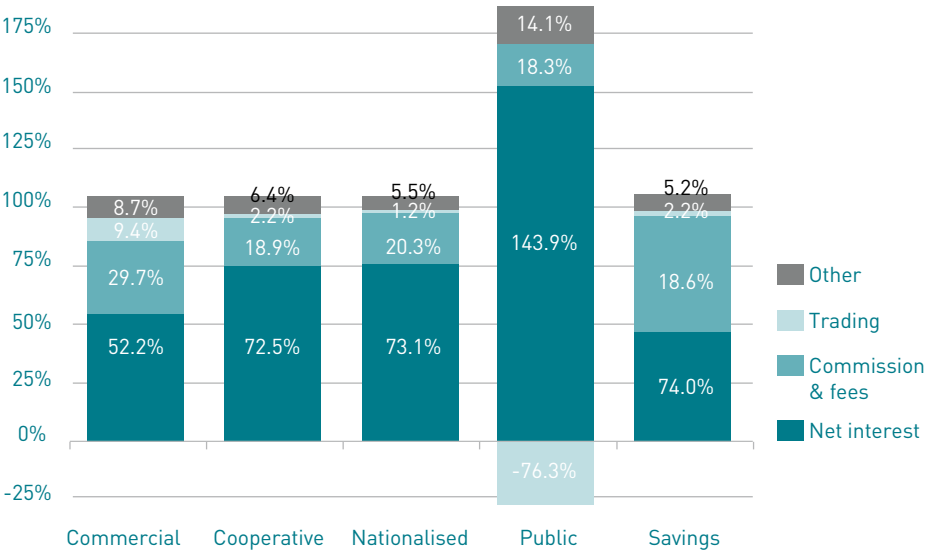
FIGURE 4.4 – Main income sources, 2005-2014

a) Business models



24. The negative net trading revenues are for comparison reasons excluded in the calculations.

b) Ownership structures



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/ownership structure for the period from 2005 to 2014.
Source: Authors

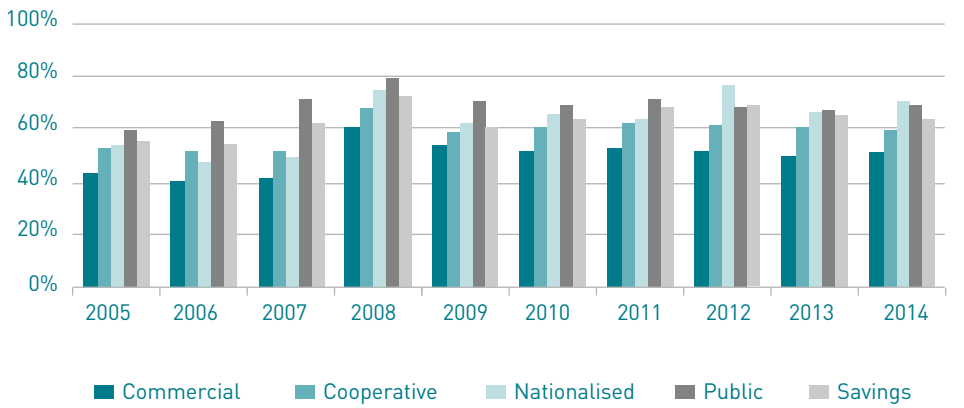
The net interest income has become relatively more important since the outbreak of the financial crisis. The net interest income of the focused retail banks has remained most stable between 2008 and 2014, whereas the diversified retail banks relied more on net interest income during the crises to shift back to alternative income sources in the aftermath. The net interest income levels remain, however, above the pre-financial crisis levels, as shown in Figure 4.5. The interest income of the wholesale and investment banks has been more volatile. The wholesale banks were, especially during the period from 2006 to 2009, heavily reliant on interest income, while afterwards the net interest income, as a share of the total, dropped to the pre-crisis level of around 50%. Net interest income accounted for up to 40.2% of the investment banks' income before it jumped to 59.4% in 2008. Afterwards, between 2009 and 2014, the share fell sharply, ranging between 44.1% and 48.9%.

The net interest income of the commercial banks has continuously been the lowest among the ownership structures. The development was similar to that of investment banks. In turn, the public banks relied most on net interest income. In the period after 2011, the shares of net interest income were similar to those of nationalised banks, which became more dependent on interest income after the governments took control. The savings and cooperative banks already predominantly relied on net interest rate income before the crisis, but the share of interest income increased substantially during the financial crisis and stabilised afterwards.

FIGURE 4.5 – Evolution of net interest income

a) Business models

b) Ownership structures



Note: Since annual results are substantially varied, the figures represent the average proportions obtained by dividing the net interest income by total income. The values are presented by business model/ownership structure and accounting year.
Source: Authors

An analysis of the evolution of trading incomes depicted in Figure 4.6 shows that the investment banks earned a substantially larger share of their income from trading and investment activities, except at the height of the financial crisis in 2008. In that particular year, the trading earnings of investment banks even turned negative. The trading earnings represented just up to a tenth of the wholesale banks' earnings before and after the 2007-2009 financial crisis. In 2007 and 2008, however, the wholesale banks showed high trading losses of respectively 52.2% and 147.2% of the total earnings. To a large extent,

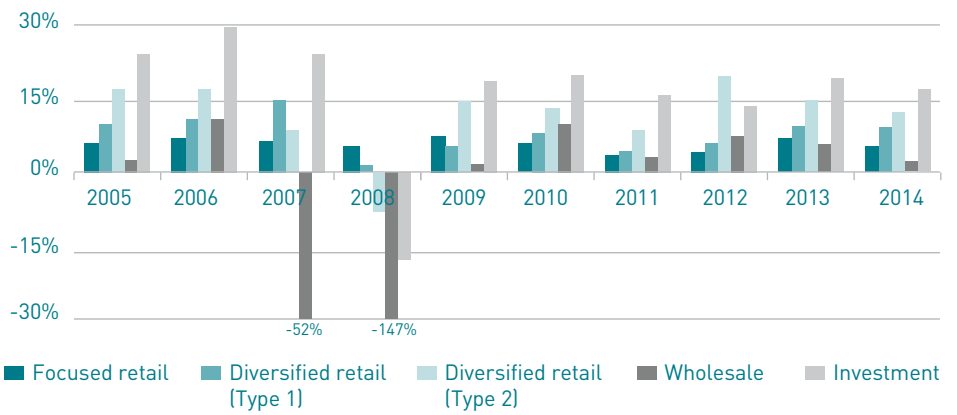
the concentrated losses in the wholesale banking sector were due to the write-downs on US subprime exposures in the early phases of the financial crisis in 2008, in some cases well before the fall of Lehman Brothers. The write-downs by the wholesale banking group that were made public by August 2008, 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[25].

Turning to ownership structures, the commercial banks reported the highest share of trading income, except for 2008 and 2009. In fact, banks across all ownership structures reported losses at the height of the financial crisis. The commercial banks lost relatively least, while the nationalised banks lost most. Albeit the latter were able to recover part of it in 2009, when the nationalised banks reported trading earnings above the pre-crisis level. The nationalised banks were the only ownership structure that also reported losses at the height of the economic crisis. However, the cooperative, savings and public banks, in most years, reported fairly low trading earnings (less than 10% of total earnings).

The volatility of earnings renders less reliable the assessment of business models and ownership structures using income characteristics. Indeed, the share of trading income would not be able to correctly identify the set of diversified retail, wholesale and investment-oriented banks, as already noted above. In addition, the results highlight the relative stability of retail-oriented banks, which appear to outperform their peers in terms of performance indicators.

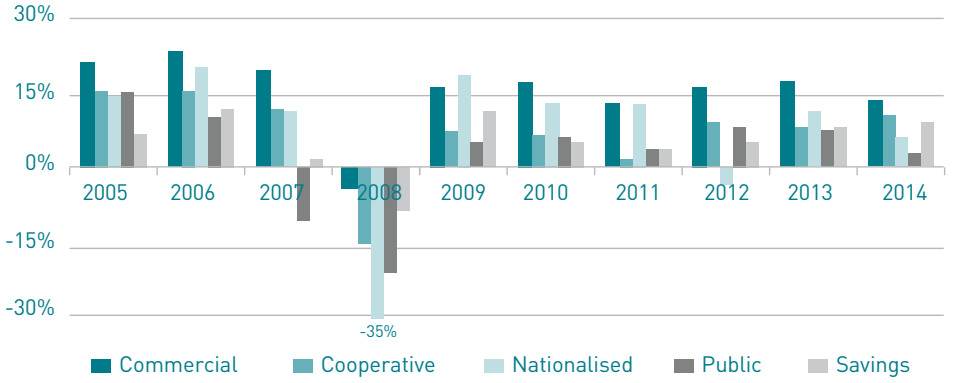
FIGURE 4.6 – Evolution of trading income

a) Business models



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

b) Ownership structures



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

An additional question that remains to be answered is the extent to which the different business models and ownership structures continued to contribute to economic activity by essentially providing loans to the private sector. Faced with eroding capital bases and higher capital requirements from regulators, supervisors and other market participants, banks had to improve their capital position. There are four broad ways in which banks have been able to improve their capital positions during financial and economic crises: i) internal resources (e.g. 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.)[26]. The state-aid rules connected to the government interventions make government funds *de facto* 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 falling 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 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

26. See Ayadi et al (2015) for a more comprehensive overview of channels used to improve the financial position of banks in recent years.

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[27].

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 4.7 shows that the growth of loans subsided substantially after 2007 across all business models, except for wholesale banks that already experienced a decline in 2007. In particular, the results confirm that outstanding customer loans shrank for investment banks during the financial crisis, turning negative in 2009. All groups managed to expand their outstanding loans in 2010. Thereafter, most business models continued to expand their loan books at gradually lower rates between 2011 and 2013, despite the crisis. Meanwhile, the debt liabilities dependent diversified retail (type 2) banks, reported negative growth of customer loans from 2012 onward. In the final year of the sample, 2014, the loan growth of all business models increased[28], which might indicate that loan growth is less responsive to changes in financial and economic conditions than trading income, for instance.

The ownership structures that expanded their loan portfolios most before the financial crisis, were the ones that contracted their loan portfolio most during the crisis and vice-versa. Hence the nationalised banks increased their loan portfolios annually by 18% to 24% between 2006 and 2008, while the loan portfolio shrank by 3% to 11% annually in the period that followed. In turn, the loan portfolios of public banks barely grew in the years before 2008, whereas they reported the highest growth figures during the crises. An important explanation might be the contribution of these banks to the expansionary policies of the governments that own these banks. The commercial, cooperative and savings banks have been able to continue lending at a slower pace during the crises, though the commercial and savings banks were more vulnerable during the financial and economic crises.

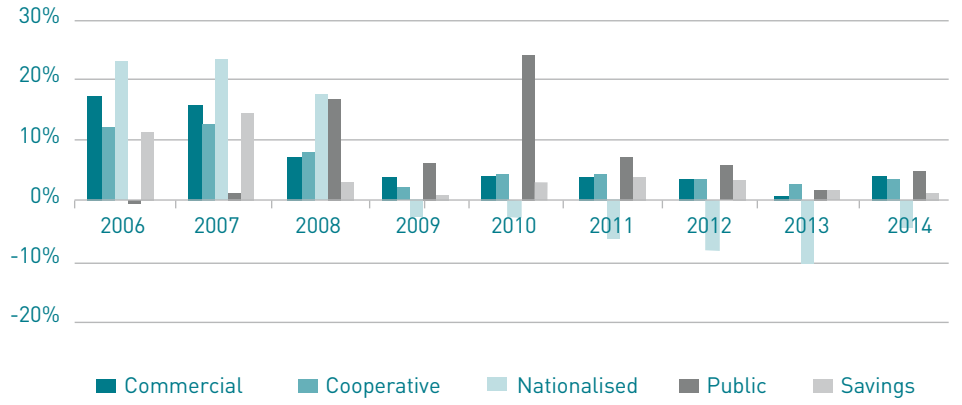
27. It should not be forgotten that a decline in credit growth may not necessarily be a negative outcome, but largely the result of a realignment of asset prices with fundamentals. Borio & Lowe (2002) and Reinhart & Rogoff (2009) show that rapid credit growth, in conjunction with rising real estate prices, 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 literary review of these issues.

28. 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.

FIGURE 4.7 – Growth of outstanding customer loans (% change from last year)

a) Business models

b) Ownership structures



Note: All figures are the median values for each accounting year, by business model/ownership structure.
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 2007-2009 financial crisis. The returns of the retail-oriented banks appeared to be most resistant in withstanding the financial crisis, while the wholesale and investment banks weathered better through the 2010-2012 economic crises. Afterwards, in 2013 and 2014, the profitability of the banks increased to levels below what the banks were used to before the crisis. Most ownership structures have been able to remain profitable during the crises, except for the public banks (2007) and the nationalised banks (2009 to 2014). One of the main drivers behind the lower returns during the financial crisis was the losses on trading assets and investments, while during

the economic crisis the loan losses seem to have been a more important determinant, in particular for the retail business models, as discussed in the next section.

The results of the cost-cutting measures that many banks have undertaken in the past years have been insufficient to avoid a deterioration in operational efficiency.

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 debt liabilities funded diversified retail (type 2) banks and the more leveraged investment banks. In turn, focused retail and diversified retail (type 1) have continued to extend credit, despite the financial and economic crises. Across ownership structures, the reverse trends of the two government owned types of banks are notable; the nationalised and public banks respectively reduced and increased lending during the crises. The customer loan portfolios of the commercial, cooperative and savings banks increased during the crises, but at a slower pace.

Lastly, the 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.

5 What are the Risks and How are they Mitigated?

Continuing the third phase of the analysis, this section provides a risk assessment of bank business models and ownership structures. The eight 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 suggested in Ayadi et al (2011, 2012) and Ayadi & De Groen (2014a). The deposit funded focused retail and diversified retail (type 1) banks have the greatest distance to default (i.e. less prone to default), whereas the more market funded diversified retail (type 2), wholesale and investment banks are closer to default. In turn, the markets perceive the default probabilities for the focused retail and diversified retail (type 1) to be higher than for the other business models. This is confirmed by the median values of the loan losses for diversified retail (type 1) banks that are also distinct from the other models. The default risks might be further aggravated by the high concentration in government exposures.

The results across ownership structures are more straightforward. The stakeholder value banks are farthest away from default, whereas the shareholder value banks are closest to default. In particular, the nationalised banks are risky, with the highest loan loss provisions, highest stock return volatility, highest credit default swap-rates (CDS) and large domestically concentrated government exposures. However, the latter feature is not statistically a distinguishing one across ownership structures. The commercial banks are doing considerably better on the different risk indicators and are within the range of the cooperative and savings banks. The public banks seem to benefit from the close ties with government. The loan loss provisions are close to zero and the CDS-rates are the lowest among all ownership structures.

TABLE 5.1 – Risk indicators

a) Business models

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	ALL
Z-score (std. dev. from default)	52.8****	59.8****	20.5****	26.6****	22.9****	43.7
Loan loss provisions (% of gross customer loans)	0.29%***	0.84%****	0.56%***	0.29%**	0.44%**	0.43%
Stock returns (avg. daily returns)	0.012%*	0.027%	0.035%**	-0.047%*	0.027%	0.021%
Stock returns volatility (std. dev. of daily returns)	1.9%*	2.2%**	2.0%	1.9%	2.0%*	2.0%

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	ALL
CDS spread (senior, annual avg.)	1.9%***	2.0%***	1.0%**	0.8%**	1.0%**	1.2%
CDS spread (subordinated, annual avg.)	3.7%***	2.8%***	1.6%**	0.2%**	1.6%**	1.8%
Government exposure (% of own funds)	117%	190.3%	187.6%	21.3%	152.2%	165.8%
Home country exposure (% of government exp.)	98%	86.8%	80.7%	51%	49.3%	84.7%

b) Ownership structures

	Commercial	Cooperative	National-ised	Public	Savings	All
Z-score (std.dev. from default)	18.1****	64.7****	2.5****	34.0****	54.7****	43.2
Loan loss provisions (% of gross customer loans)	0.49%***	0.54%**	0.77%***	0.05%****	0.26%****	0.43%
Stock returns (avg. daily returns)	0.022%	-0.022%	0.032%	0.012%	0.031%	0.022%
Stock returns volatility (std. dev. of daily returns)	2.1%****	2.7%****	3.8%****	0.9%****	1.9%****	2.0%
CDS spread (senior, annual avg.)	1.1%**	1.2%**	1.7%****	0.4%****	1.3%**	1.2%
CDS spread (subordinated, annual avg.)	1.6%	1.8%	2.5%	..	2.0%	1.8%
Government exposure (% of own funds)	137.5%	154.8%	222.9%	311.1%	190%	163.9%
Home country exposure (% of government exp.)	67.7%	84.8%	85.5%	84.8%	90.2%	84.7%

Notes: All figures are the median values for the relevant sub-sample. The independence of clusters and ownership structures 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/ownership structure from that number of other clusters/ownership structures 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 II for the assumptions pertaining to the construction of the net stable funding ratio (NSFR) measure.

Source: Authors

The first indicator, Z-score, is a balance sheet based indicator that provides an estimate of a bank's distance to default[29]. 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 probability of a default.

The weighted averages are largely in line with the median values shown in Table 5.1. The diversified retail (type 1) banks display the main exception, with substantially lower weighted figures. This suggests that the Z-scores of the larger diversified retail (type 1) banks are substantially lower than of the smaller banks. This might also explain the discrepancy between the Z-scores that are available for all banks and the market based risk-indicators that are available for banks that rely on markets, in particular larger banks. The focused retail banks appear safer, with a higher distance to default. The other business models seem quite similar. All business models have seen their distance to default increase during the financial and economic crises, in particular the focused retail and wholesale banks. Figure 5.1 shows that the differences in Z-scores across business models have primarily been created in the most recent years.

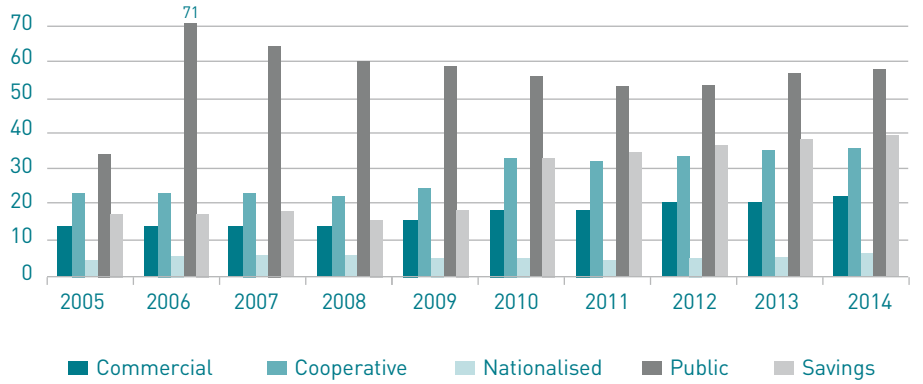
The weighted average Z-scores confirm differences between the median values, except for public banks. As with the diversified retail (type 1) banks, there is a discrepancy between the median Z-scores and the market risk indicators of public banks. Looking at the substantially higher weighted average Z-scores, the different coverage for the indicators might also explain the difference between the median Z-scores and the market indicators. The Z-scores of the cooperative, savings and, to a lesser extent, commercial banks increased over time, due to deleveraging. Contrary to most other banks, the Z-scores of the public banks declined over time. The Z-scores of the nationalised banks remained close to zero throughout the sample period 2005-2014.

FIGURE 5.1 – Evolution of Z-scores

a) Business models

29. See Appendix V for the calculation of the Z-score.

b) Ownership structures



Note: The amounts expressed in the figure are asset weighted averages 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

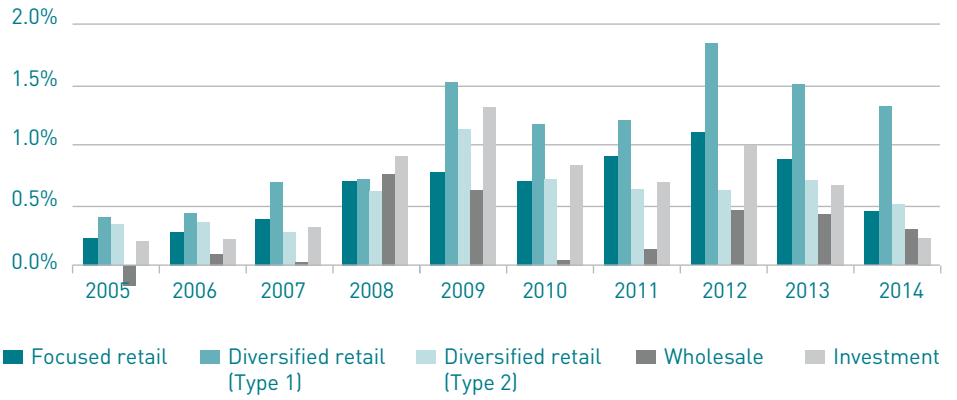
The second indicator, loan loss provisions as a share of gross customer loans, is a proxy-measure for the credit losses. The loans to banks are excluded, since the losses on loans to banks have historically been lower than on loans to other customers. Notwithstanding some high-profile cases, like the collapse of Lehman Brothers, even during the crisis, the banks were largely shielded from bearing losses on loans to banks. This was 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. This might change under the new resolution regime, which is discussed in the regulation section.

The results displayed in Figure 5.2 show that the pre-crisis risk-costs of wholesale banks and, to a lesser extent investment banks, were lower than those of retail banks. During the financial crisis, in particular in 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 the deposit funded focused retail and diversified retail (type 1) banks. 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 larger corporates and public bodies, compared to other customers.

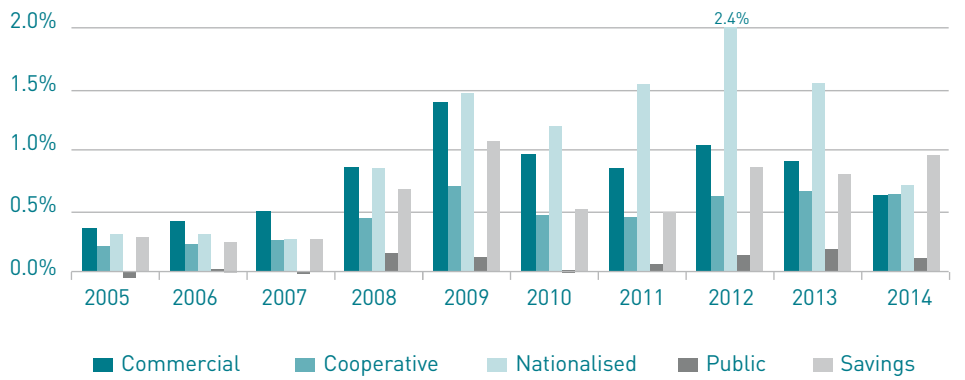
Turning to results across ownership structures, in the pre-crisis period, the commercial banks took the highest loan loss provision, while the public banks even released provisions. During the financial and economic crises, the shareholder value banks (i.e. commercial and nationalised banks) took the highest provisions, while the savings and, to a lesser extent, cooperative banks also booked higher loan loss provision.

FIGURE 5.2 – Loan loss provisions (% of gross customer loans)

a) Business models



b) Ownership structures



Note: The amounts expressed in the figure are the total loan loss provisions as share of the total gross customer loans.
Source: Authors

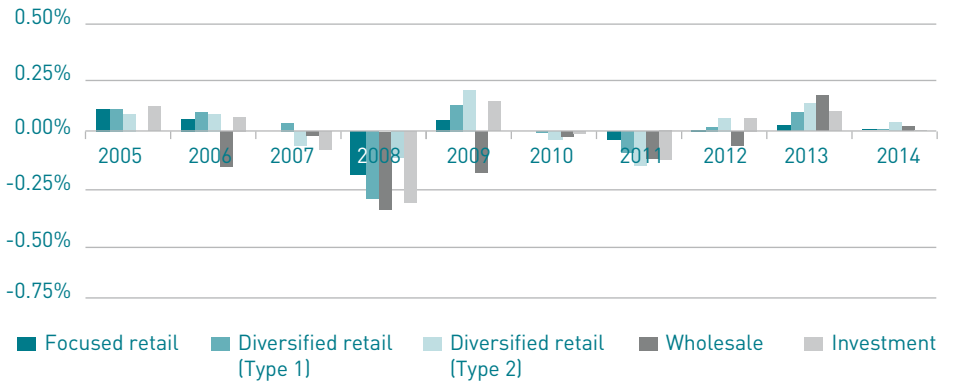
The third indicator, **average daily stock returns**, is a rough proxy-measure for the evolution of the market values. Only part of the assets of the banks are accounted at fair value, while the equity markets are considered to value the entire bank according to market principles. The changing economic circumstances are, therefore, considered to impact on the market values faster than the book values. The share-based indicators have, however, an important limitation in that they are only available for the listed banks. For example, only a few of the stakeholder value cooperative and savings banks are listed.

The results displayed in Figure 5.3 show that, pre-crisis, the shares increased in value across all business models, except for wholesale banks. This changed during the financial crisis, when banks across all business models quoted negative returns on their shares. These financial crisis-losses were partially recovered in 2009. During the economic crisis, the average returns were close to zero or negative; only afterwards, in 2013 and 2014, were the shareholders able to recover part of the losses.

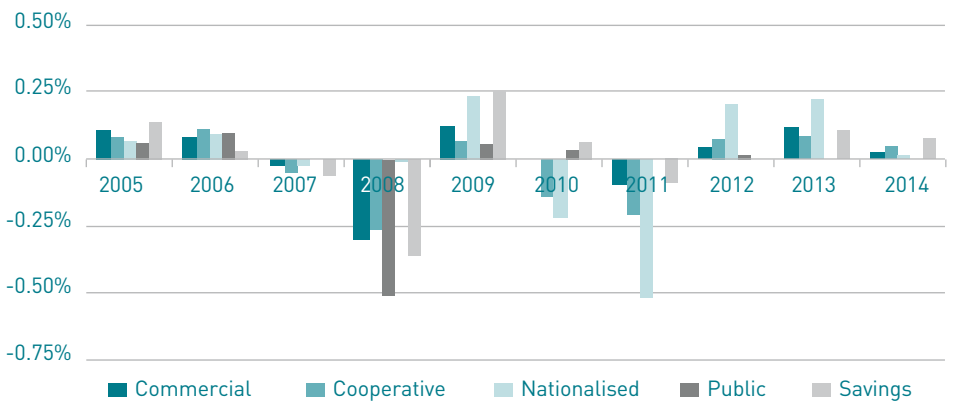
The results across ownership structures show a large consistency in the direction of the returns, except for 2010, in which the cooperative and nationalised banks lost and the public and savings banks gained in value. The nationalised banks lost most during the financial and economic crises, but recovered also most afterwards.

FIGURE 5.3 – Evolution of stock returns (avg. daily returns)

a) Business models



b) Ownership structures



Note: The figure shows the median values of annual average daily returns on publicly listed shares. There are no observations for wholesale banks in 2005.
Source: Authors

The fourth indicator, annual standard deviations in daily stock returns measures the risk sensitivity of listed banks. The shares underlying this are affected 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.

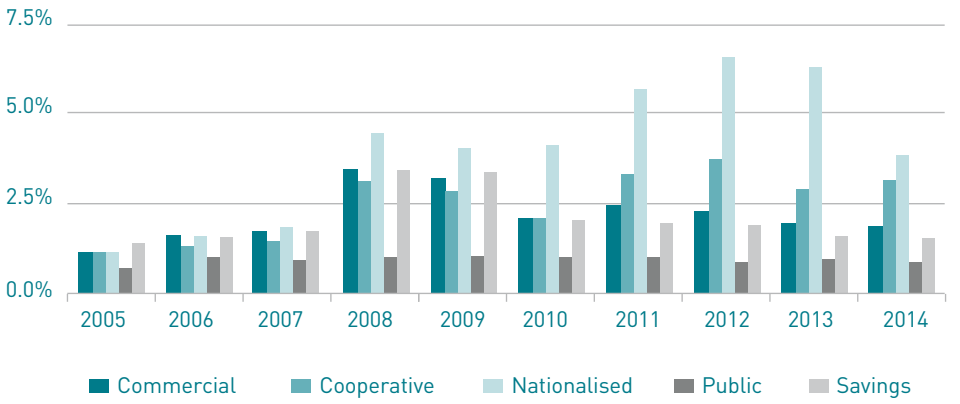
The volatility of the stock returns has been similar across most business models, except for wholesale banks in 2006 and investment banks in 2008. The volatility increased substantially during the financial crisis, to return to the pre-crisis levels in 2014. The differences between the volatilities of investment, wholesale and focused-retail banks are reciprocally insignificant.

Figure 5.4 shows also that the differences between ownership structures are more substantial. Before the financial crisis, the volatility was fairly similar, except for the public banks. The share returns of the public banks were less volatile throughout the sample period. The volatility of all the other ownership structures increased during the financial crisis. The volatility of commercial and savings banks decreased afterwards to pre-crisis levels, while the share returns of nationalised and cooperative banks remained more volatile.

FIGURE 5.4 – Evolution of stock return volatility

a) Business models

b) Ownership structures

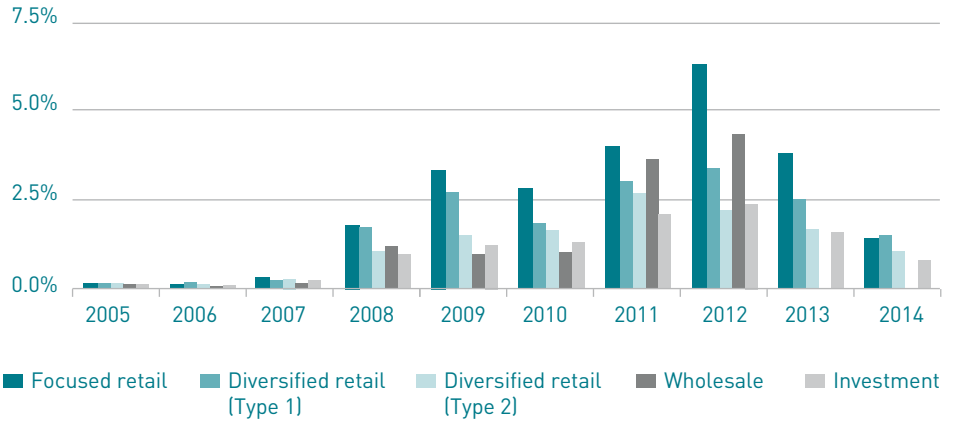


Note: The amounts expressed in the figure are median annual standard deviations of daily stock returns. There are no observations for wholesale banks in 2005.
Source: Authors

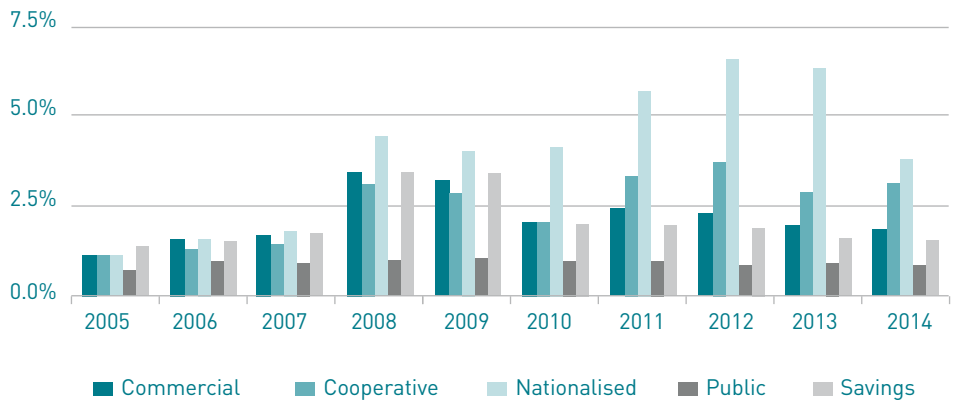
The fifth indicator, **median CDS spreads for senior securities**, displays a significant higher CDS spread for the deposit funded focused retail and diversified retail (type 1) banks than all other banking business models (see also Figure 5.5). The difference between the investment, wholesale, and diversified retail (type 2) banks is not significant, implying that the underlying distributions may be similar. Echoing the results in Ayadi et al. (2011, 2012 and 2014), the market participants do not appear to distinguish among these three models in terms of their inherent risks. The comparison across ownership structures shows that, except for the government owned banks, the CDS-rates are not significantly different. In particular, the nationalised banks and public banks respectively quoted the highest and the lowest CDS-rates. 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 significance 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 CDS spreads (senior)

a) Business models



b) Ownership structures

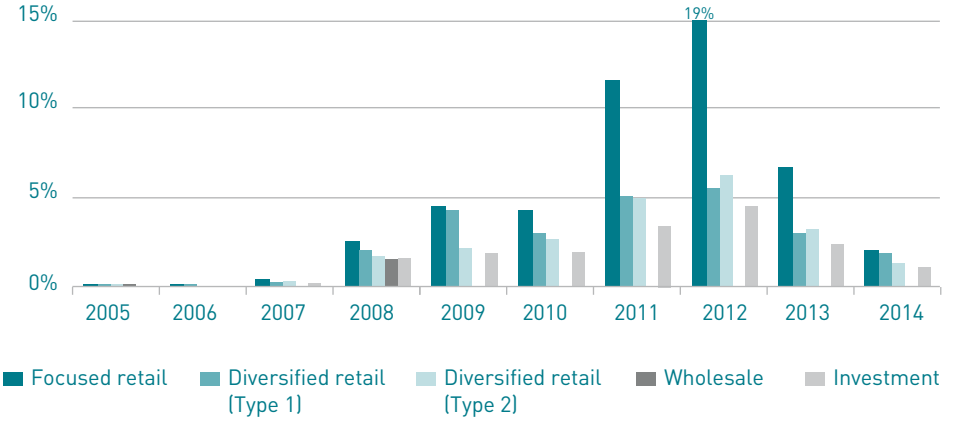


Note: The figure presents the median annual average CDS spreads on senior bonds.
Source: Authors

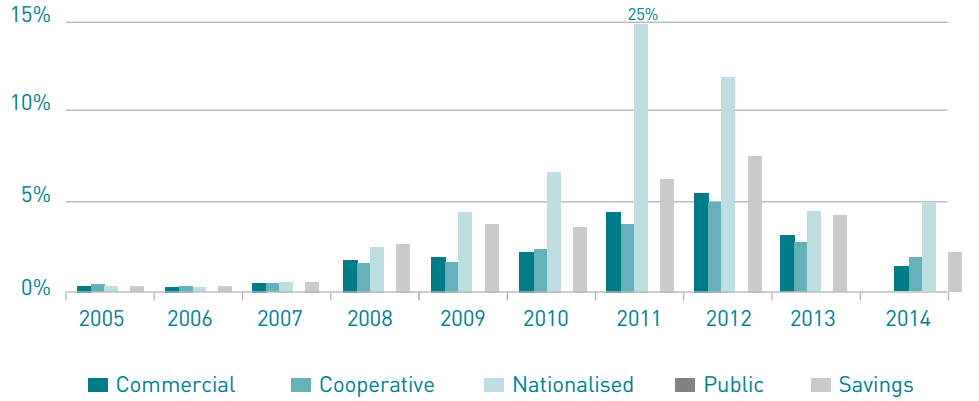
The sixth indicator, median CDS spreads for subordinated securities are clearly higher than the rates for senior securities. Hence, contrary to the senior securities, the subordinated ones were in some extraordinary cases subject to bail-ins during the financial and economic crises. The number of observations for subordinated securities is, however, much lower than for CDS-rates on senior securities. Figure 5.6 displays a substantially higher CDS spread for the small and least financially integrated focused retail banks than all other banking business models. The difference between the investment and diversified retail banks is not significant. Notwithstanding much higher CDS-rates for nationalised banks during the financial and economic crises, the difference is not significantly different from the other ownership types.

FIGURE 5.6 – Evolution of CDS spreads (subordinated)

a) Business models



b) Ownership structures



Note: The figure presents the median annual average CDS spreads on subordinated bonds. There are no CDS-rates available for subordinated bonds issued by wholesale banks after 2008 and public banks.
Source: Authors

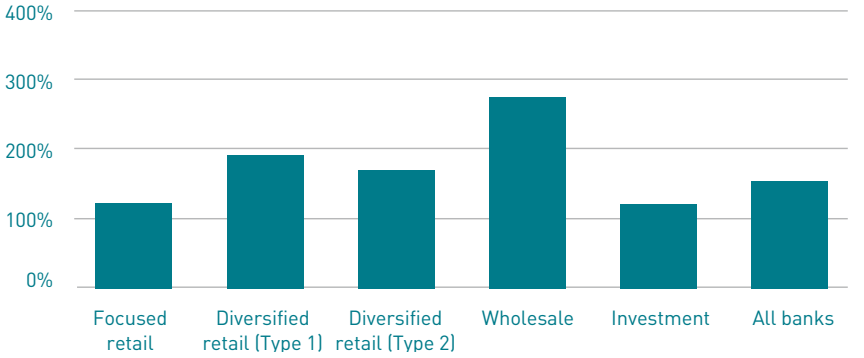
The **seventh** and **eighth indicators** respectively assess the **size** and **concentration** in **government exposures**. Banks do not have to hold any capital against most of the government exposures and there is no restriction on the exposures. The write-down on the Greek government bonds through the Private Sector Involvement (PSI) in early 2012 showed, however, that Euro area sovereign debt is not actually risk-free. The probability of defaults on Euro-area sovereign debts is relatively low, while the loss given default is likely to be substantial (De Groen, 2015). Large and concentrated government exposures might thus form a risk for the solvency position, which is not anticipated.

Figure 5.7 shows the total exposures to the European Economic Area (EEA) as share of total own funds for the 114 EEA-banking groups and subsidiaries of non-EEA banking

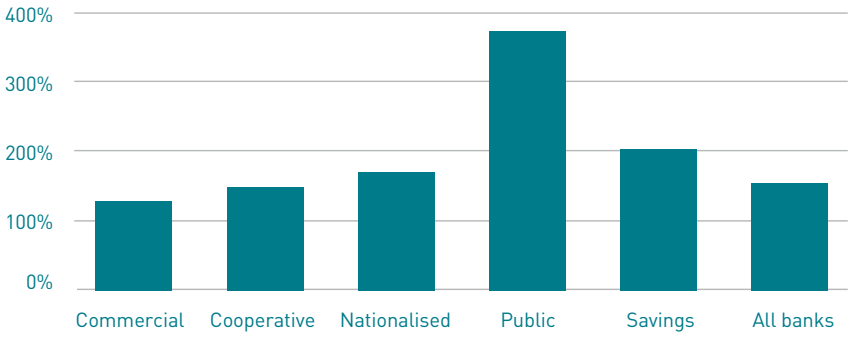
groups that were subject to the ECB's comprehensive assessment in 2014 or 2015. The figures show that banks had, in general, about 1.5 times their own funds in government exposures. The exposures of wholesale banks seem substantially higher, though the differences are not significant. The same is true for the results across ownership structures, where the public banks stand out with 3.75 times their own funds in government exposures.

FIGURE 5.7 – Total government exposures (% of total capital)

a) Business models



b) Ownership structures



Note: The figure presents the total exposure to EEA-governments as share of the total regulatory capital at the end of 2013 for the banks subject to the ECB's comprehensive assessments in 2014 and 2015.
Source: Authors

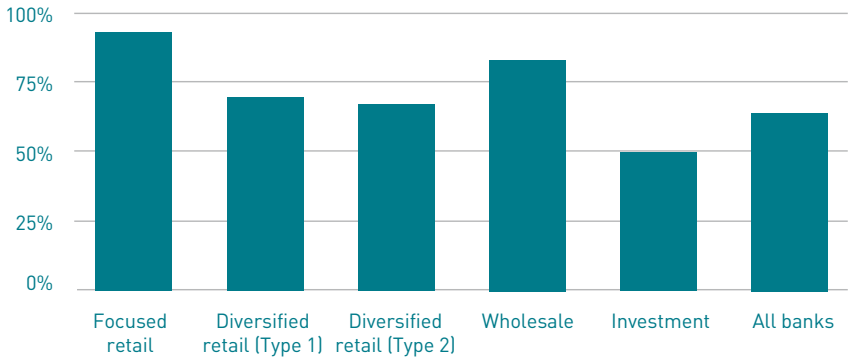
Figure 5.8 shows the home bias in the government portfolio, which is proxied by the domestic share in the total exposure to EEA-governments. At the end of 2013 and 2014, on average, 64% of the government portfolio consisted of loans to and bonds from the domestic government. Overall, the more internationally active business models (i.e. investment and diversified retail) also seem to have more diversification in their government portfolios. The differences are, however, insignificant. The same is true for the different ownership structures, where the commercial and nationalised banks have the most diverse portfolios.

Taking size and concentration together, the banks have, on average, an exposure to their own government equal to their own funds. This is about four times the maximum exposure allowed for exposures to a single debtor subject to the large exposure requirements. Moreover, the default of a Euro-area government could potentially wipe out the capital of the domestic banking sector.

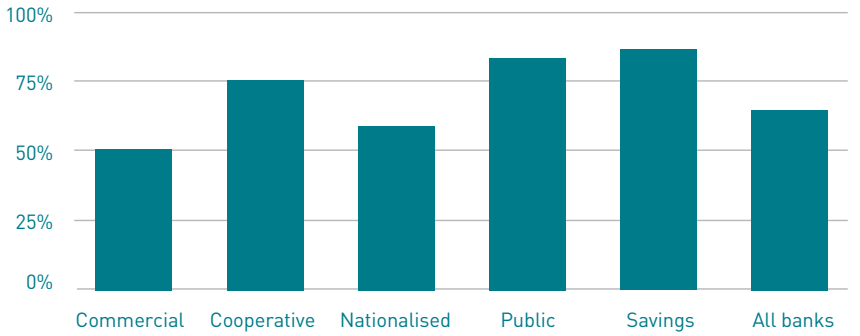
The public disclosure of the more detailed exposures of the most systemic banks in the EEA only started in the aftermath of the crisis. The repetition and expansion of the disclosure exercise should allow improvement in the robustness of this part of the Monitor.

FIGURE 5.8 – Exposure to home government (% of total gov. exp.)

a) Business models



b) Ownership structures



Note: The figure presents the exposure to the home government as share of the total exposure to EU plus Norwegian, Icelandic and Liechtenstein governments at the end of 2013/14 for the banks subject to the ECB's comprehensive assessment in 2014 and 2015.
Source: Authors

To sum up, this section assessed the risks associated with the different business models. Using a rich palette of risk measures, the focused retail banks appear to be the safest.

Wholesale and investment banks were more exposed to the 2008-09 financial crisis, while the retail banks suffered more during the 2010-12 economic crisis.

Looking at results across the ownership structures, the public banks appear to be the safest, both based on the balance sheet and market indicators. In turn, the other type of government owned banks, the nationalised banks, appear to be the most risky ones. The cooperative banks, furthermore, seem to be safer than the commercial banks.

In addition, some of the risk indicators largely fail to distinguish between business models. This is the case for the more volatile stock related indicators, but also the CDS-rates. In fact, the CDS spreads only distinguish the focused retail banks as they are smaller and less significant banks. This can be the consequence of the realisation of the moral hazard. The new resolution mechanism discussed in the next section might change this.

6 How do Bank Business Models respond to Regulatory and Supervisory Measures?

Regulators and supervisors increasingly influence the behaviour of banks. This section assesses the robustness and resilience across business models and ownership structures using the evolution of the different regulatory and supervisory indicators. Robustness and resilience refer to the capacity of banks to withstand stress conditions respectively at a point in time and over time. The key regulatory and supervisory indicators and analysis are summarised in Table 6.1.

The regulatory capital ratios suggest that the retail oriented banks have significantly higher median risk weights than the wholesale and investment banks. In turn, these have significantly higher Tier 1 ratios. Taken both indicators together, the wholesale banks have the least leverage (i.e. total assets over [tangible common] equity) and the investment banks the highest. Among the ownership structures, the median average risk weights are close to the sample median, except for the public banks. The latter, however, have the highest capital ratios. Overall, the nationalised banks have the weakest capital position and the commercial banks are least leveraged.

The results of the supervisory capital assessments, like the asset quality review and stress test, show higher adjustments and provisions for risks for the retail-oriented banks. The median values are, however, not significant. Also, across ownership structures, the results are mostly insignificant, though nationalised banks seem to have incurred significantly higher stress test provisions than the public banks.

The liquidity ratios of the market-oriented business models are significantly higher than the retail-oriented models. The differences across ownership structures are less apparent. Except for the nationalised banks, the median values are all above the future requirement of 100%.

Lastly, the preliminary calculation of the potential bail-in contribution, shows that the market-oriented and state owned banks are likely to be able to absorb higher losses before they would receive a contribution from the resolution fund. Yet, looking back at the government interventions during the recent crises, the retail-oriented and public banks would have posted the highest losses. Hence, if the resolution funds had already existed in the past few years, focused retail and publicly owned banks would have seen the largest shares of their losses covered.

TABLE 6.1 – Regulatory & supervisory indicators

a) Business models

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	ALL
Risk-weighted assets (RWA) (% assets)	62.3%***	56.9%****	62.8%***	42.3%****	37.9%****	57.6%
Tier-1 capital ratio (% of RWA)	12.5%**	12.6%***	12.2%***	18.6%****	15.2%****	12.8%
Tang. common eq. (% of tang. assets)	6.7%****	6.2%****	7.2%****	9.7%****	5.7%****	6.5%
AQR 2014/15 impact (% of RWA)	-0.7%	-0.4%	-0.4%	-0.0%	-0.1%	-0.3%
Stress test 2014/15 impact (% of RWA)	-3.0%	-2.3%	-2.4%	-0.9%	-1.7%	-2.3%
Shortfall (% of RWA)	0.0%*	0.0%	0.0%	0.0%	0.0%*	0.0%
NSFR (Avail./req. funding)	106.9%****	119%****	93.3%****	241.8%****	131.9%****	111.1%
Bail-in contribution (% of total liabilities)	3.1%***	3.5%****	3.0%***	4.6%****	5.0%****	3.5%
Cumulative peak losses (% of total liabilities aided banks)	7.4%*	2.3%	3.3%	..	0.3%*	3.1%
Max. contribution SRF (% of losses)	37.0%*	9.2%	2.6%*	..	0.0%	18.4%

b) Ownership structures

	Commercial	Cooperative	National-ised	Public	Savings	All
Risk-weighted assets (RWA) (% assets)	58.5%**	58.7%**	56.4%*	49.9%****	57.1%***	57.7%
Tier-1 capital ratio (% of RWA)	13.3%***	12.3%****	9.9%****	14.7%****	13.1%***	12.8%
Tang. common eq. (% of tang. assets)	8.2%****	6.3%****	3.7%****	7.6%****	6.1%****	6.5%
AQR 2014/15 impact (% of RWA)	-0.2%	-0.6%	-0.4%	-0.2%	-0.2%	-0.3%
Stress test 2014/15 impact (% of RWA)	-1.9%	-2.8%	-5.6%*	-1.0%*	-1.8%	-2.3%
Shortfall (% of RWA)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	Commercial	Cooperative	National-ised	Public	Savings	All
NSFR (Avail./req. funding)	119.4%****	110.7%****	91.6%****	105.5%****	109.7%****	111.1%
Bail-in contribution (% of total liabilities)	3.3%**	3.4%**	3.7%*	4.1%****	3.5%***	3.5%
Cumulative peak losses (% of total liabilities aided banks)	3.0%	0.1%	..	20.3%	3.3%	3.2%
Max. contribution SRF (% of losses)	18.3%	38.9%	..	25.7%	2.6%	18.4%

Note: All figures are the median values for the relevant sub-sample. The independence of clusters/ownership structures 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/ownership structure from that number of other clusters/ownership structures for that indicator. For example, two asterisks (**) implies that the cluster/ownership structure is statistically different from two (furthest) clusters/ownership structures but not the two (closest) ones. See Appendix II for the assumptions pertaining to the construction of the net stable funding ratio (NSFR) measure.
Source: Authors

The first indicator, 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/less regulatory capital to account for their risk-weighted balance sheet, without counting the risk pertaining to the off-balance sheet[30].

According to the statistical analysis of this indicator, both investment and wholesale banks appear to be less risky, with distinct median risk weights of 38% and 42% respectively, which is substantially lower than the risk weights of the retail-oriented banks (between 53% and 63%). The finding that wholesale banks have less exposure to risks in their assets is intriguing and clearly inconsistent with the Z-score previous findings, which indicate higher default risks than retail-oriented banks[31]. Moreover, results up to the end of 2014 (Figure 6.1) shows that the average risk weights across all business models have gradually been declining during the financial and economic crises, while levelling off or even slightly increasing in the most recent years. The largest change was observed in diversified retail (type 2) banks, which decreased the average risk weights from close to the other retail banks in 2005, to a level similar to the wholesale and investment banks in 2014.

The differences between the ownership structures are in general rather limited, except for public and savings banks. In fact, the average risk weights of commercial, cooperative and nationalised banks range between 33.3% and 46.2%. The savings banks reported the highest risk weights, albeit the distance to the other ownership structures declined over time. In turn, the distance between the other structures and the public banks that reported the lowest risk weights, increased over time.

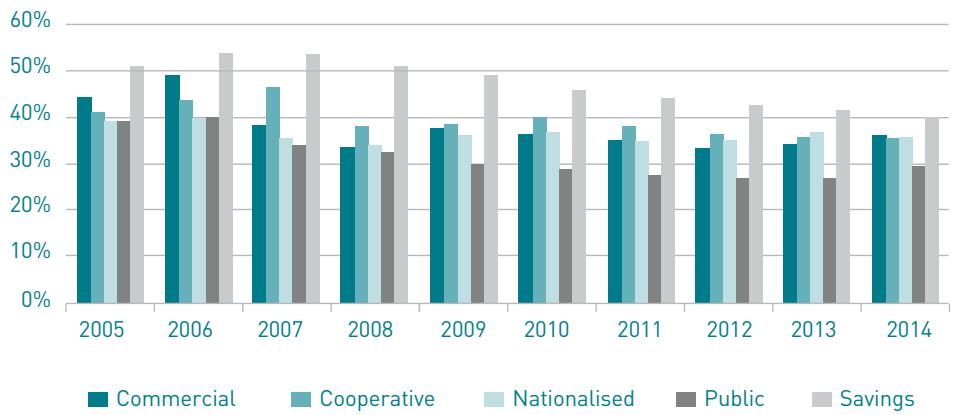
30. The off-balance sheet exposures could not be included in this Monitor because of too few observations and insufficient comparability.

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

FIGURE 6.1 – Evolution RWAs (% of total assets)

a) Business models

b) Ownership structures



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

The second indicator measures the **loss-absorption capacity of banks under the Basel capital rules** (i.e. the Tier-1 capital ratio). For any given level of risk, holding more capital could, in principle, imply a greater stability.

The results in Figure 6.2 show that Tier-1 ratios have been gradually increasing since the financial crisis. However, the ratios are statistically almost indistinguishable among the five business models in most years, implying a more or less identical absorption capacity. Only the Tier-1 ratios of the wholesale and investments banks are significantly higher than those of the retail-oriented banks, particularly during the economic crisis. In 2014, the Tier-1 ratios converged again.

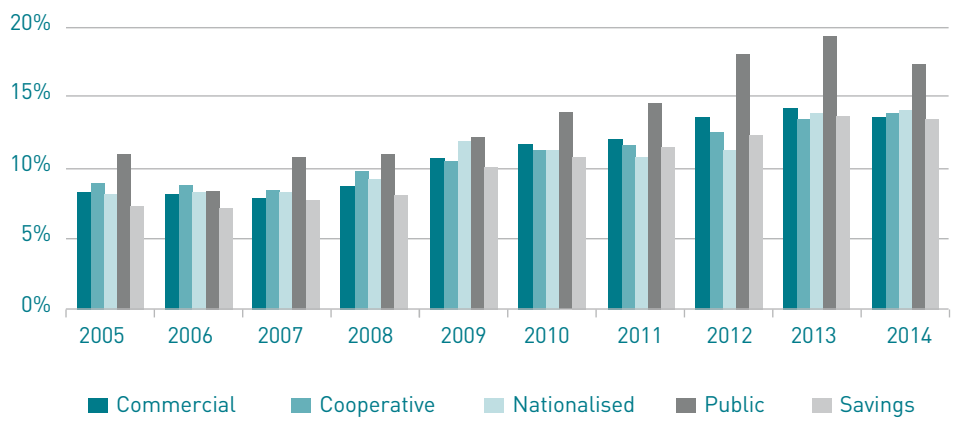
The results across ownership structures show a similar pattern. Banks across all the structures showed an increase in Tier-1 ratios. The ratios are statistically almost indistinguishable for the ownership structures, except for public banks that have significantly higher capital ratios (more than 15% since 2012).

The fact that the differences in risk and absorption capacity are barely reflected in the risk weights and Tier-1 ratios is intriguing and suggests the possibility that either the main regulatory instruments currently in use may not be adequate for capturing (or signalling) the loss-absorption capacity of a bank, in particular for investment and wholesale banks, or there is potential evidence of misallocation of capital, particularly for public banks.

FIGURE 6.2 – Evolution of Tier-1 capital ratios

a) Business models

b) Ownership structures



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

The third indicator measures the loss-absorption capacity using a simple **leverage ratio**[32] (i.e. tangible common equity over total assets). The tangible common equity ratios are statistically distinct for all business models. Figure 6.3 shows that banks across all business models have increased their tangible common equity ratios. Focused retail banks hold substantially more tangible common equity than all the other business models (i.e. more than 5%), which made them able to absorb more losses (at least for the period of observation under investigation). Similarly, the diversified retail banks have continued to increase their ratio since the 2008 crisis, yet the deposit funded diversified retail banks seem more robust than the diversified retail market funded banks. Moreover, the results suggest that wholesale banks can absorb relatively more losses than investment banks. The ratio has more than doubled for investment banks since 2008, while the leverage ratio has been volatile for wholesale banks, in particular during the financial crisis.

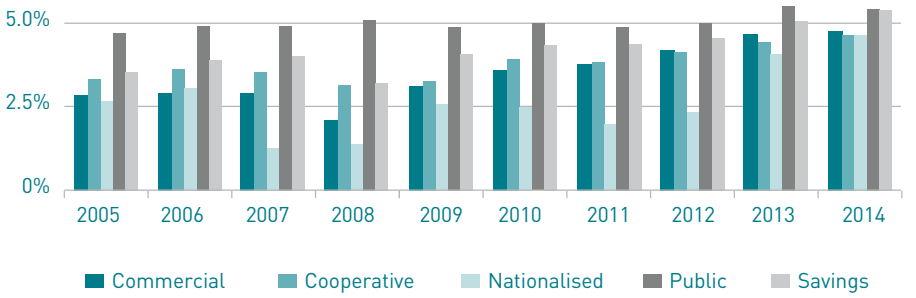
The tangible common equity ratios are also statistically distinct for all ownership structures. Although the tangible common equity ratios have converged in the most recent years, the public banks still hold more tangible common equity than any other ownership structures. This finding reconfirms the previous one for public banks. Moreover, since the outbreak of the financial crisis the tangible common equity across all ownership structures has increased, whilst during the economic crisis, it was only the nationalised banks that experienced a substantial drop.

FIGURE 6.3 – Leverage ratios (tangible common equity)

a) Business models

32. Ayadi et al (2012) recommended a legally binding leverage ratio in order to curb excessive leverage in the banking sector.

b) Ownership structures

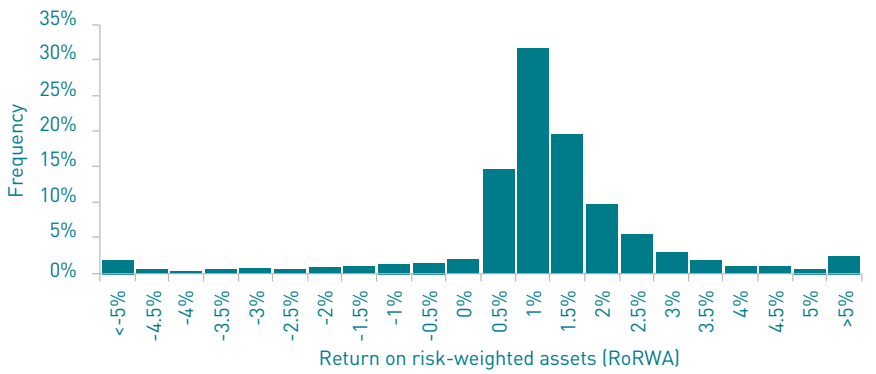


Note: The leverage ratios in the figure above are total tangible common equity as share of total tangible assets.
Source: Authors

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). This method allows for assessing the resilience of banks per business model to external shocks. More specifically, the quantiles of the return on 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 effective average earnings of 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 conditions when needed.

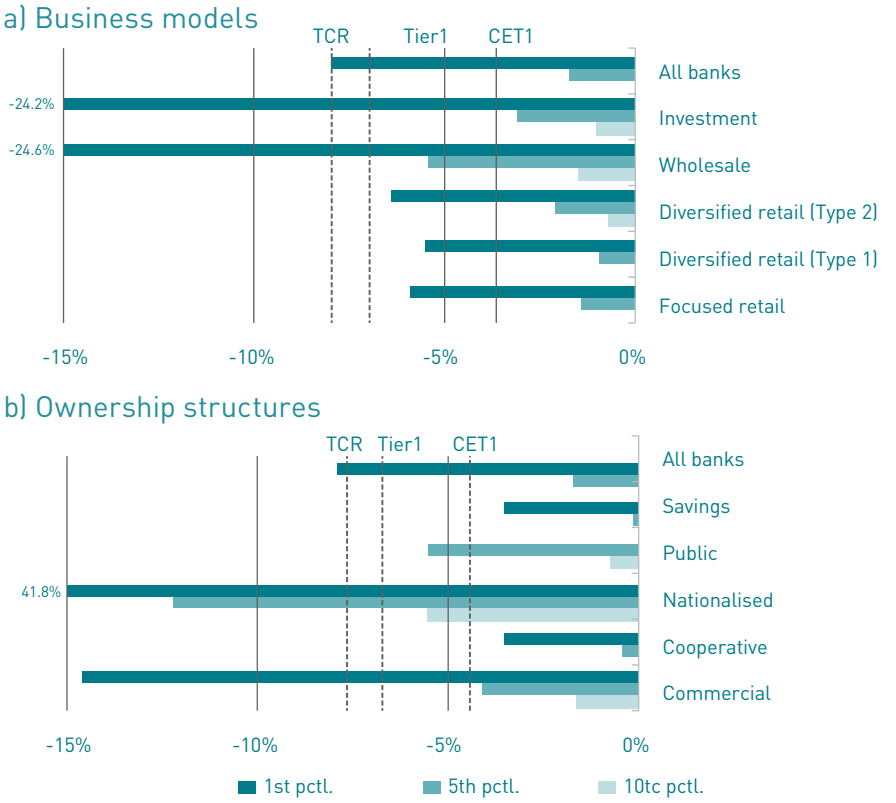
FIGURE 6.4 – Distribution of risk-weighted returns (RoRWA)



Note: This figure depicts the distribution for all banks covered in the study for the years 2005 to 2014.
Source: Authors

Naturally, the distribution of returns of actual banks is substantially more varied than the example above. In particular, it 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 10th percentile losses, banks face RoRWA no losses (see also Figure 6.4). If a bad year is defined to be a rarer and, thus, a more destructive event, i.e. lower 5th percentile, the potential losses increase to 1.7%[33].

FIGURE 6.5 – Return on risk-weighted assets (top percentiles)



Note: This figure depicts the RoRWA of the top percentiles (1st, 5th, and 10th) for all banks covered in the study for the years 2005 to 2014. The dotted lines show the minimum regulatory requirements under CRDIV, common equity Tier 1 (CET1) requirement of 4.5%, Tier 1 requirement of 6% and Total Capital requirement (TCR) of 8% respectively.

Source: Authors

33. Assuming that earnings are randomly and independently distributed, the estimates would imply that a bank with risk-adjusted capital less than 1.7% 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.

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

Both the extension of the sample size and the period make it possible to produce more consistent estimates for the 1st and 5th percentiles than in previous editions (Ayadi et al (2011, 2012) and Ayadi & De Groen (2014a)). Nevertheless, 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[34]. The estimation results should, nevertheless, be interpreted with caution due to potential estimation errors.

The lower percentile estimates depicted in Table 6.2 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 8.0% at the 1st percentile. However, the depicted period had a large impact on returns. Losses were substantially greater during the financial and economic crises years than during the pre-crises period, with the pooled sample of banks having faced risk-adjusted 1st percentile losses of respectively 8.1% and 0.9%[35].

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. Significantly, results in the more extreme periods for the business models and ownership structures depicted percentile estimates that differ from the original figures. In particular, the estimated RoRWA loss at the 1st percentile diverts during the pre-crisis period and financial crisis.

Looking at results by business models, it is shown that, following the financial crisis, both wholesale and investment banks are suffering greater losses at the 1st percentile, as compared to the retail-oriented banks, regardless of the statistical procedure used[36]. This leads to question the resilience of these two business models when they are facing extreme stress conditions. In the most recent years of this analysis, i.e. 2013-2014, it seems that the investment banks fare relatively better than wholesale banks in terms of their capacity to withstand extreme shocks, although both are driving the overall sample to levels of losses much above retail-oriented banks all together. However, such a finding must be closely monitored annually to form a view on the long-term resilience of business models in banks.

As for the ownership structures, commercial banks and, understandably, nationalised banks are subject to more losses than others in extreme stress conditions (See also Figure 6.5). This result may suggest that these types of banks are intrinsically more risky and less resilient than other types of banks such as saving banks and cooperatives banks,

34. 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.

35. 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.

36. It is difficult to make a firm statement due to the low data coverage before 2007.

which exhibit much lower losses in extreme stress conditions.

These results are important evidence showing that during this period of investigation, retail-oriented banks, cooperative and savings banks are more resilient than wholesale, investment and commercial banks. Nationalised banks are, understandably, not resilient and hence should be dealt with by the respective governments or resolution authorities to avoid future detrimental impact on financial stability.

TABLE 6.2 – Lower percentile estimates for return on risk-weighted assets (RoRWA)

a) Business models

		Sample statistics			Harrell-Davis estimates		
	Obs.	1st	5th	10th	1st	5th	10th
ALL YEARS (2005-14)							
Model 1 – Focus. retail	2,728	-5.9%	-1.4%	0.1%	-6.0%	-1.4%	0.1%
Model 2 – Div. retail (T1)	3,958	-5.5%	-0.9%	0.2%	-5.7%	-0.9%	0.2%
Model 3 – Div. retail (T2)	1,920	-6.4%	-2.1%	-0.7%	-6.6%	-2.1%	-0.7%
Model 4 – Wholesale	588	-24.6%	-5.4%	-1.5%	-29.7%	-6.0%	-1.6%
Model 5 – Investment	896	-25.9%	-3.1%	-1.0%	-24.5%	-3.1%	-1.0%
All banks	10,254	-7.9%	-1.7%	0.0%	-8.0%	-1.7%	0.0%
PRE-CRISIS (2005-06)							
Model 1 – Focus. retail	92	-2.4%	0.5%	0.9%	-1.9%	0.3%	0.9%
Model 2 – Div. retail (T1)	79	-0.6%	0.5%	1.0%	-0.3%	0.5%	1.0%
Model 3 – Div. retail (T2)	163	0.1%	0.5%	0.7%	0.1%	0.5%	0.7%
Model 4 – Wholesale	18	-24.6%	-24.6%	-24.5%	-24.3%	-21.9%	-15.8%
Model 5 – Investment	39	0.3%	0.3%	0.9%	0.3%	0.5%	0.8%
All banks	410	-0.9%	0.4%	0.8%	-4.2%	0.4%	0.8%
FIN. CRISIS (2007-09)							
Model 1 – Focus. retail	314	-3.8%	-1.6%	0.0%	-4.3%	-1.5%	-0.1%
Model 2 – Div. retail (T1)	174	-5.7%	-2.7%	-0.9%	-7.2%	-2.7%	-1.0%
Model 3 – Div. retail (T2)	330	-4.7%	-1.9%	-0.3%	-7.1%	-1.9%	-0.4%
Model 4 – Wholesale	47	-15.5%	-12.1%	-4.1%	-15.2%	-11.6%	-5.4%
Model 5 – Investment	92	-8.5%	-1.9%	-1.5%	-7.7%	-2.8%	-1.5%
All banks	988	-7.1%	-2.0%	-0.7%	-7.1%	-2.1%	-0.7%
ECON CRISIS (2010-12)							
Model 1 – Focus. retail	1,414	-6.4%	-1.5%	0.1%	-6.7%	-1.5%	0.1%
Model 2 – Div. retail (T1)	2,199	-5.5%	-0.5%	0.3%	-5.8%	-0.6%	0.3%
Model 3 – Div. retail (T2)	953	-4.7%	-2.0%	-0.6%	-5.4%	-1.9%	-0.6%
Model 4 – Wholesale	337	-14.0%	-5.3%	-2.2%	-15.1%	-5.1%	-2.0%
Model 5 – Investment	435	-29.6%	-3.5%	-1.2%	-32.9%	-4.5%	-1.3%

	Obs.	Sample statistics 1st	5th	10th	Harrell-Davis estimates 1st	5th	10th
All banks	5,404	-8.1%	-1.7%	0.0%	-8.4%	-1.7%	0.0%
FIN+ECON CRISES (2007-12)							
Model 1 – Focus. retail	1,728	-6.2%	-1.5%	0.1%	-6.4%	-1.5%	0.1%
Model 2 – Div. retail (T1)	2,373	-5.5%	-0.8%	0.2%	-5.8%	-0.9%	0.2%
Model 3 – Div. retail (T2)	1,283	-4.7%	-1.9%	-0.5%	-5.2%	-1.9%	-0.6%
Model 4 – Wholesale	384	-14.7%	-5.4%	-2.2%	-15.3%	-5.8%	-2.1%
Model 5 – Investment	527	-25.9%	-3.5%	-1.3%	-28.1%	-3.8%	-1.4%
All banks	6,392	-8.1%	-1.9%	-0.1%	-8.1%	-1.8%	-0.1%
POST-CRISIS (2013-2014)							
Model 1 – Focus. retail	908	-5.6%	-1.7%	0.1%	-5.8%	-1.5%	0.1%
Model 2 – Div. retail (T1)	1,506	-6.0%	-1.0%	0.2%	-6.0%	-1.0%	0.2%
Model 3 – Div. retail (T2)	474	-11.3%	-3.2%	-1.6%	-20.2%	-3.3%	-1.6%
Model 4 – Wholesale	186	-76.9%	-3.8%	-0.7%	-100.4%	-6.7%	-0.8%
Model 5 – Investment	330	-21.9%	-2.9%	-0.6%	-23.9%	-2.8%	-0.6%
All banks	3,452	-8.4%	-1.8%	-0.1%	-8.6%	-1.8%	-0.1%

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

b) Ownership structures

	Obs.	Sample statistics 1st	5th	10th	Harrell-Davis estimates 1st	5th	10th
ALL YEARS (2005-14)							
Commercial	2,994	-14.6%	-4.1%	-1.6%	-15.2%	-4.1%	-1.6%
Cooperative	4,109	-3.5%	-0.4%	0.2%	-3.5%	-0.4%	0.2%
Nationalised	252	-41.8%	-12.2%	-5.5%	-38.8%	-13.2%	-6.0%
Public	373	-5.5%	-0.7%	0.2%	-7.3%	-0.9%	0.2%
Savings	2,526	-3.5%	-0.1%	0.2%	-3.3%	-0.1%	0.2%
All banks	10,254	-7.9%	-1.7%	0.0%	-8.0%	-1.7%	0.0%
PRE-CRISIS (2005-06)							
Commercial	211	-2.4%	0.5%	0.9%	-14.4%	0.4%	0.9%
Cooperative	53	0.2%	0.3%	0.5%	0.2%	0.3%	0.6%
Nationalised	40	-1.4%	0.0%	0.7%	-1.2%	-0.2%	0.5%
Public	20	0.1%	0.2%	0.5%	0.1%	0.2%	0.4%
Savings	86	0.2%	0.5%	0.7%	0.2%	0.5%	0.7%
All banks	410	-0.9%	0.4%	0.8%	-4.2%	0.4%	0.8%
FIN. CRISIS (2007-09)							
Commercial	470	-10.8%	-2.7%	-1.0%	-11.4%	-2.8%	-1.0%

		Sample statistics			Harrell-Davis estimates		
	Obs.	1st	5th	10th	1st	5th	10th
Cooperative	143	-2.2%	-1.1%	0.1%	-2.1%	-1.0%	0.0%
Nationalised	76	-7.1%	-3.5%	-2.7%	-6.6%	-3.9%	-2.7%
Public	73	-4.1%	-0.3%	0.3%	-3.5%	-0.6%	0.2%
Savings	226	-4.7%	-1.1%	-0.1%	-4.5%	-1.2%	-0.2%
All banks	988	-7.1%	-2.0%	-0.7%	-7.1%	-2.1%	-0.7%
ECON. CRISIS (2010-12)							
Commercial	1,412	-14.4%	-4.8%	-2.2%	-16.0%	-4.9%	-2.2%
Cooperative	2,395	-2.8%	0.0%	0.3%	-2.8%	0.0%	0.3%
Nationalised	86	-49.0%	-21.9%	-12.2%	-45.9%	-24.0%	-13.0%
Public	167	-6.5%	-1.2%	0.2%	-6.8%	-1.5%	0.1%
Savings	1,344	-3.5%	-0.1%	0.2%	-3.4%	-0.1%	0.2%
All banks	5,404	-8.1%	-1.7%	0.0%	-8.4%	-1.7%	0.0%
FIN+ECON CRISES (2007-12)							
Commercial	1,882	-14.3%	-4.5%	-1.8%	-14.4%	-4.4%	-1.8%
Cooperative	2,538	-2.6%	0.0%	0.3%	-2.7%	0.0%	0.3%
Nationalised	162	-45.8%	-12.2%	-6.1%	-40.9%	-14.0%	-6.6%
Public	240	-4.1%	-0.6%	0.2%	-5.6%	-1.0%	0.2%
Savings	1,570	-3.8%	-0.3%	0.1%	-3.7%	-0.3%	0.1%
All banks	6,392	-8.1%	-1.9%	-0.1%	-8.1%	-1.8%	-0.1%
POST-CRISIS (2013-2014)							
Commercial	901	-19.1%	-4.1%	-1.7%	-21.8%	-4.1%	-1.7%
Cooperative	1,518	-4.9%	-1.1%	0.2%	-5.1%	-1.1%	0.2%
Nationalised	50	-41.8%	-21.9%	-9.4%	-38.6%	-22.2%	-12.1%
Public	113	-5.5%	-1.8%	0.1%	-37.4%	-1.7%	0.0%
Savings	870	-2.4%	0.0%	0.3%	-3.0%	0.0%	0.3%
All banks	3,452	-8.4%	-1.8%	-0.1%	-8.6%	-1.8%	-0.1%

Note: The figures correspond to the 1st, 5th, and 10th percentile estimates of the distribution of the RoRWA, conditional on the ownership structures and time periods across the sample.
Source: Authors

A more dynamic analysis shows that the order in peak-losses differs substantially for the different sub-periods in the sample. During the pre-crisis years 2005 and 2006, losses occurred only for the 1st percentile, while during the crises, losses were observed in the 10th percentile and below. The losses climbed gradually during the crises. During the 2007-09 financial crisis, the losses were less than during the 2010-12 Eurozone economic crisis.

The order of the business models also shifted. Looking at the 1st percentile, the investment banks reported losses below those of the wholesale banks during the financial crisis, while the investment banks reported the highest losses during the economic crisis. The focused retail banks, furthermore, clearly lost more during the economic crisis than during the financial

crisis, while the losses of the diversified retail banks were fairly similar during both crises. As expected, the losses of all business models deteriorated in the aftermath of the crises.

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The order of the ownership structures remained the same, except for nationalised and public banks. In fact, the peak-losses of both ownership structures increased substantially between the financial and economic crises. Moreover, the peak losses diverged in the aftermath of the crises. The peak losses of the commercial banks with higher losses during the financial crisis, increased during the first two years after the crisis, while the peak losses of the savings banks with the lowest RoRWA during the crises decreased.

The dynamic analysis of the different crisis periods shows that diversity of business models and ownership structures can be a factor of resilience, as the capacity of different business models and ownership structures to withstand extreme stress conditions differ, depending on the nature of the crisis and, hence, the overall banking system remains afloat. In this analysis and at least in this period of investigation, retail-oriented banks, savings and cooperatives banks have provided systemic resilience to the European banking sector. Conversely, investment, wholesale and commercial banks have dragged the overall banking system to levels of losses in extreme stress conditions.

Another dimension is the comparison of the mean values for RoRWAs (Table 6.3), which shows that the distinctions are fairly insignificant for the pre-crisis and financial crisis period when tested using Wilcoxon-Mann-Whitney non-parametric two-sample tests. Indeed, for the period between 2005 and 2009, far fewer observations were available. The results for all years show that the wholesale and investment banks, on average, reported distinctly higher RoRWAs than banks belonging to one of the retail-oriented models. Looking at all the crises years (2007-12), the wholesale banks are still significantly better performing, while the diversified retail (type 2) banks reported the average lowest RoRWAs. In the aftermath of the crisis, both wholesale and diversified retail (type 2) banks were performing significantly worse than the other three business models.

The averages for the different ownership structures show that the nationalised banks were the only ones reporting losses for the entire sample period. In turn, the public and savings banks reported the significantly highest returns. The remaining results are, except for the nationalised banks, in most cases not significant.

The findings show clear distinctions across business models and ownership structures in terms of peak losses, which suggests that the average risk weights do not reflect the underlying risks of certain banks. In particular, wholesale and investment 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 6.3 – Mean RoRWA

a) Business models

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	All
All years (2005-14)	0.89%***	0.82%***	0.62%****	1.5%***	1.15%***	0.87%
Pre-crisis (2005-06)	1.6%**	2.51%***	1.79%**	2.49%*	3.09%**	2.05%
Financial Crisis (2007-09)	1%	0.98%	0.8%	0.98%	1.52%	0.98%
Economic Crisis (2010-12)	0.76%****	0.78%****	0.61%****	2.37%***	0.69%***	0.84%
Crises years	1.9%***	2.0%***	1.0%**	0.8%**	1.0%**	1.2%
(2007-12)	0.81%****	0.79%****	0.66%****	2.2%***	0.84%***	0.86%
Post-crisis (2013-14)	0.98%***	0.78%***	0.11%****	-0.05%***	1.41%***	0.76%

b) Ownership structures

	Commercial	Cooperative	National-ised	Public	Savings	All
All years (2005-14)	0.88%***	0.88%****	-1.59%****	1.15%***	1.06%****	0.88%
Pre-crisis (2005-06)	2.32%**	1.73%*	1.71%	2.12%	1.73%*	2.05%
Financial Crisis (2007-09)	1.03%*	0.90%*	0.22%**	1.48%**	0.94%	0.96%
Economic	2.1%****	2.7%****	3.8%****	0.9%****	1.9%****	2.0%
Crisis (2010-12)	0.72%*	0.97%**	-4.06%****	1.31%***	1.01%**	0.85%
Crises years	1.6%	1.8%	2.5%	..	2.0%	1.8%
(2007-12)	0.80%**	0.97%***	-2.05%****	1.36%***	1.00%**	0.86%
Post-crisis (2013-14)	0.73%**	0.71%***	-2.74%****	0.54%*	1.11%**	0.76%

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

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, which leads banks to report lower RWA to avoid matching it with additional capital. If banks with greater RWA also hold more capital, partly to fulfil the binding regulatory requirements, they should face lower default risks. This may possibly explain 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 or transferring the risk off balance sheet. Indeed, despite sound arguments for making capital requirements risk-sensitive, the complexity and flexibility of these rules has led to concerns over the potential for regulatory arbitrage[37]. 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)[38].

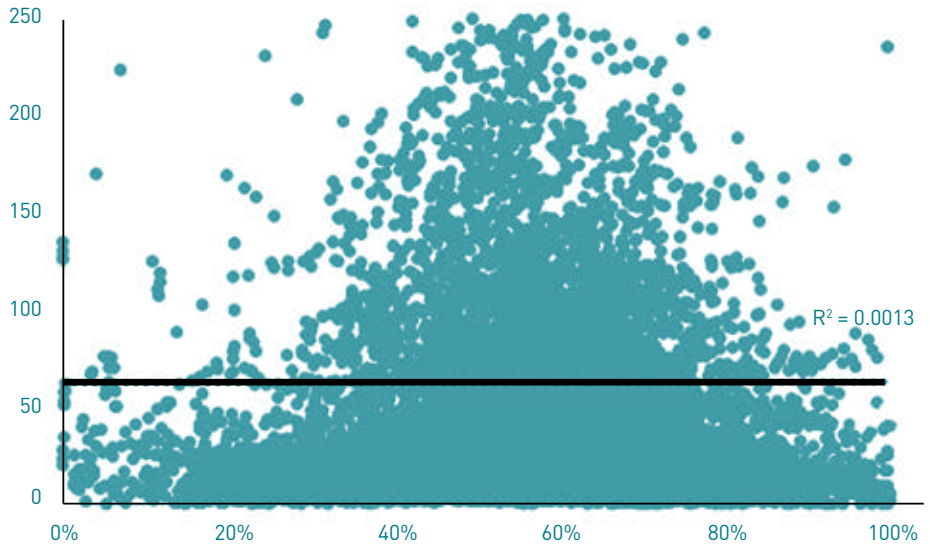
Empirical evidence on the potential misalignment of risk-sensitive capital requirements is growing. Ayadi et al. (2011, 2012) and Ayadi & De Groen (2014a) provide evidence of a negative relationship between average risk weights and a number of risk factors for the EU's top banks in recent years, including 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 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 (see BCBS (2013)). 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. (2014a) are repeated. It 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.

37. 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 (Keeley & Furlong, 1990; Gennotte & Pyle, 1991; Calem & Rob, 1999).

38. 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 Independent Commission on Banking (Acharya et al., 2010).

FIGURE 6.6 – Relation between Z-score and RWA



Note: The axes have been cut at a Z-score of 250 and RWA 100% of assets to make it easier to visualize the large majority of the observations.
Source: Authors

The estimation results for the retail oriented banks show a persistent, significantly negative relation between the regulatory risk measure and distance to default. The results for the entire sample also show a negative relation, albeit insignificant at the 10% level (See also Figure 6.6 for a scatter plot of the observations). In turn, the results for wholesale and investment banks show a positive relation, which implies that RWA are inversely related to underlying risks. But these result are also insignificant at the 10% level. The relationship is weaker than when capital is controlled for, except for diversified retail (type 1) and wholesale banks (See Table 6.4). This implies that banks with greater RWA are holding more capital, which can partly offset their lower risk profile.

The estimations for the ownership structures are more in line with the expectations. Hence, that the risk-weights for all ownership structures seem to be negatively related to the Z-score. The results for most ownership structures are insignificant. Only the risk-weights for the nationalised and savings banks have a significant negative relation with Z-score at the 10% level. Furthermore, the capital levels have the expected significantly positive effect for all structures, except for cooperative and savings banks (See Table 6.4). In fact the capital level actually even has a significantly negative impact on the Z-score of savings banks.

Overall, RWA does appear to be able to capture the underlying risks for the business models having most exposures in loans to customers (i.e. retail oriented banks), as well as the shareholder value banks. In turn, it fails to do so for wholesale and investment banks, as well as commercial, cooperative and public banks. The relationship between the two measures of risk is ambiguous for these business models and ownership structures, even

after controlling for capital levels. The findings suggest that the risk-weighted assets of these banks are not well calibrated. Hence, this implies that the risk-weights of certain assets or activities conducted primarily by these banks might be incorrect. The wholesale and investment banks, for example, engage more in interbank and trading activities. The effective risk-weights for these activities are rather low, due to the possibility of lowering the exposures (e.g. derivative exposures are reduced using compression, hedging, offsetting and netting), which is particularly attractive to banks with larger market activities that can benefit from scale advantages.

TABLE 6.4 – Relationship between Z-score and RWA, 2005-14

a) Business models

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	All
RWA/TA	-75.7***	-25.8***	-61.2***	1.9	0.5	-1.5
	(19.1)	(7.9)	(11.9)	(11.1)	(0.8)	(2.3)
Tangible Common Equity	120.2**	-58.9*	576.8***	-46.0*	74.2	10.6
	(50.9)	(34.1)	(90.6)	(23.8)	(59.4)	(17.7)
Cons.	117.8***	91.3***	33.8***	50.8***	33.6***	63.1***
	(11.9)	(4.5)	(5.1)	(9.5)	(4.7)	(2.0)
Obs.	2,658	3,840	1,839	557	863	9,912
Log L.	-16,564	-21,692	-9,999	-3,291	-4,946	-58,619
F statistic	8.317	10.23	20.38	1.985	5.681	0.308
p-value	0.000251	3.69e-05	1.76e-09	0.138	0.00354	0.735
Nb. obs. left censored.	16	15	13	2	6	52
Nb. obs. right censored.	0	0	0	0	0	0
Pseudo R2	0.00132	0.000706	0.00869	0.000353	0.000767	1.04e-05

b) Ownership structures

	Commercial	Cooperative	National-ised	Public	Savings	All
RWA	-0.6	-4.7	-10.6***	-29.8	-37.2***	-1.5
	(1.4)	(8.3)	(1.2)	(23.4)	(13.7)	(2.3)
TCE	98.1***	65.5	74.6***	491.0*	-171.0***	10.6
	(22.9)	(43.2)	(7.7)	(252.6)	(35.4)	(17.7)
Cons.	26.7***	75.7***	6.3***	64.7***	107.7***	63.1***
	(2.4)	(4.9)	(0.6)	(14.5)	(9.2)	(2.0)
Obs.	2,860	3,995	237	354	2,466	9,912
Log L.	-16,570	-22,938	-575.5	-2,113	-15,160	-58,619
F-stat.	9.479	1.155	53.70	1.909	16.73	0.308

	Commercial	Cooperative	National-ised	Public	Savings	All
p-value	7.88e-05	0.315	0	0.150	6.07e-08	0.735
Nb. obs. left censored.	28	1	13	5	5	52
Nb. obs. right censored.	0	0	0	0	0	0
Pseudo R2	0.000914	5.45e-05	0.111	0.00382	0.00107	1.04e-05

Notes: Regressions present results for Tobit 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

In what follows, the previous analysis is supplemented with the assessment of the impact of the most recent supervisory reviews by the ECB of the solvency position of banks across business models and ownership structures. Hence, multiple supervisory exercises have been undertaken since 2009, with different objectives, bases and stresses (Ayadi & De Groen, 2014b). To allow for a fair comparison between the different business models, the most recent cross-country exercise, at the moment that this study was conducted, has been used for the assessment. The ECB's comprehensive assessment in 2014 and 2015 consisted of two key components; (i) an asset quality review[39] (AQR) assessing the value of the assets at the cut-off point and (ii) the stress test (ST) assessing whether the banks would be able to withstand an adverse macro-economic scenario. The exercises covered 114 banks and subsidiaries that are included in this exercise.

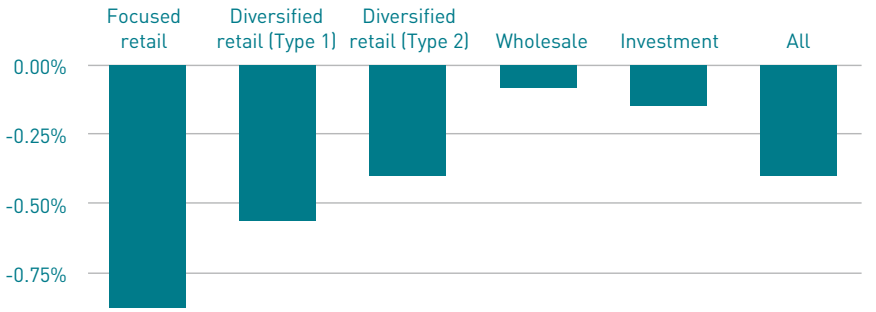
The expectation based on our previous analysis is to have the AQR and ST capturing the level of robustness and resilience of different business models and ownership structures. This means that wholesale, investment-oriented and commercial banks are expected to be equally sensitive to the AQR and ST, i.e. supposedly having to make large adjustments. However, because of the shorter period of analysis under the AQR and ST, the level of sensitivity to the risk profile of bank business models before and after the crisis might be hampered. This would suggest a careful interpretation of the results of the AQR and ST, as they are largely dependent on the timing where the reviews are undertaken.

As for the impact of **the AQR in terms of risk-weighted assets**. The results in Figure 6.7 suggest that retail-oriented banks had to make larger adjustments than the more market-oriented banks i.e. wholesale and investment banks. Although the results based on just a couple of observations are not significantly distinct at 5% level, they support the intuition that banks with less market or fair valued assets are likely to incur the largest write-downs in these kinds of exercise. The differences between the ownership structures are also insignificant. However, the results also support the intuition that banks which incur solvency problems are likely to try to postpone losses, as well as banks that do not have to comply with the more stringent listing requirements. In particular, the bailed-out nationalised banks incurred the largest valuation adjustments, followed by the cooperative and savings banks.

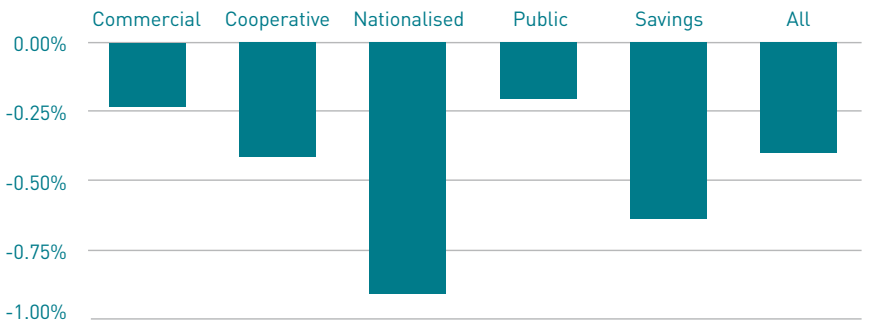
39. The ECB, together with the national supervisors, carries out financial health checks of the banks it supervises directly. These comprehensive assessments help to ensure that the banks are adequately capitalised and can withstand possible financial shocks.

FIGURE 6.7 – Impact of Asset Quality Review (% of RWA)

a) Business models



b) Ownership structures



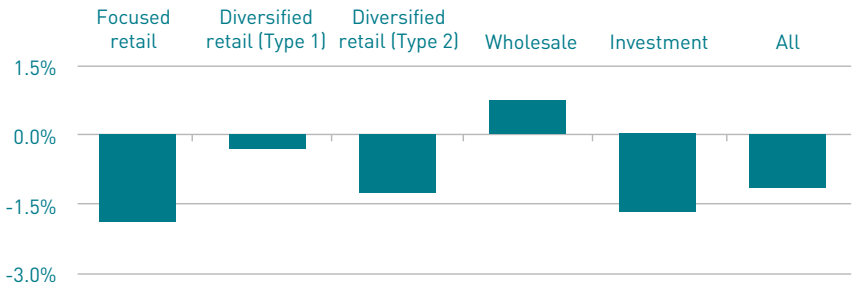
Note: The figure presents the total capital charge of the asset quality review as share of the total risk-weighted assets at the end of 2013/14 for the 114 banking groups and subsidiaries of non-EEA banking groups subject to the ECB's comprehensive assessment in 2014 and 2015.
Source: Authors

Furthermore, **the impact of the stress test on the regulatory capital** is assessed. The distribution of the stresses across the banks largely depends on the chosen scenario. As the risk-indicators demonstrated, the retail-oriented banks are shown likely to be more responsive to scenarios foreseeing an economic slowdown, while the wholesale and investment banks are more vulnerable respectively to banking and financial crises.

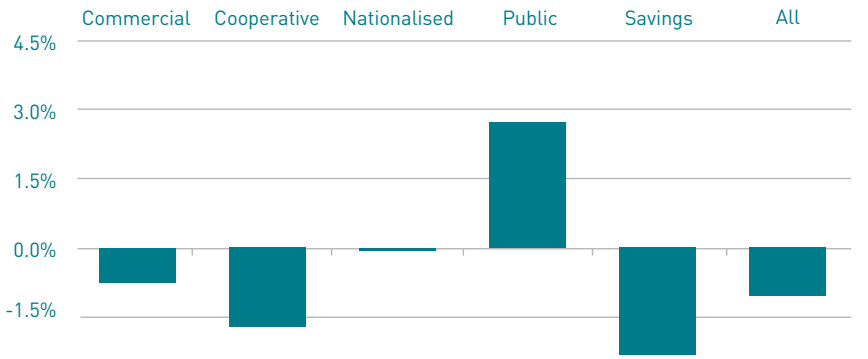
The results suggest that the wholesale banks would be able to withstand the economic headwind, as assumed under the adverse scenario, while the focused retail and investment bank would be confronted with the highest losses (See also Figure 6.8). The results for business models are not significantly distinct at 5% level. Looking at the ownership structures, the impact of the stress test on public banks is significantly less than on nationalised banks. The weighted averages of both the public and nationalised banks are, however, substantially higher than the median values, suggesting that there were some banks for which the stress test improved the capital position among the public and nationalised banks.

FIGURE 6.8 – Impact of Stress Test (% of RWA)

a) Business models



b) Ownership structures



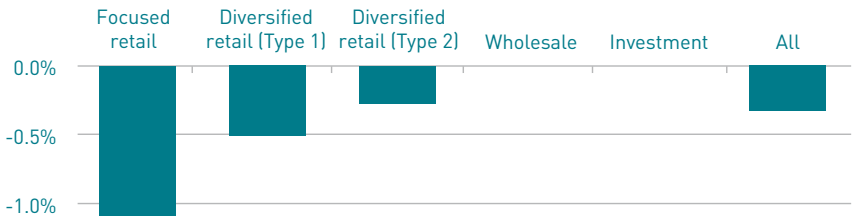
Note: The figure presents the total cumulative capital impact of the adverse scenario in the stress test as share of the total risk-weighted assets after the adjustment for the asset quality review at the end of 2013/14 for the 114 banking groups and subsidiaries of non-EEA banking groups subject to the ECB's comprehensive assessment in 2014 and 2015.
Source: Authors

The assessment continues to examine **the capital shortfalls.** Hence, taking both the impact of the asset quality review and the stress test into account, the banks had to meet a regulatory capital threshold of 5.5%, which is 1% above the 4.5% CET1 regulatory capital requirement. The shortfalls are concentrated in just a couple of banks. The median values of the shortfalls are therefore zero and, in most cases, insignificant.

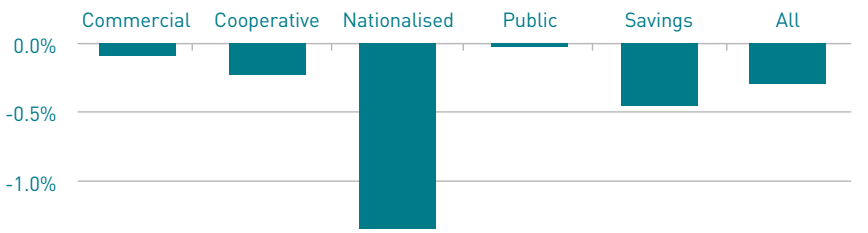
The results for business models during the period of analysis 2013/2014 post-crises shown in this Monitor reveal that all the shortfalls were concentrated in the retail-oriented banks, and, in particular, the focused retail banks that incurred the largest adjustments under the AQR and expected losses under the adverse stress test scenario (See Figure 6.9). Banks across all ownership structures fell short on the capital threshold. Unsurprisingly, the largest shortfalls were noted for nationalised banks, which had small capital cushions and faced the largest impact of AQR and stress test.

FIGURE 6.9 – Capital shortfall (% of RWA)

a) Business models



b) Ownership structures



Note: The figure presents the total cumulative capital shortfall anticipating the cumulative impact of both the asset quality review and the stress test as share of the total risk-weighted assets at the end of 2013/14 for the 114 banking groups and subsidiaries of non-EEA banking groups subject to the ECB's comprehensive assessment in 2014 and 2015.
Source: Authors

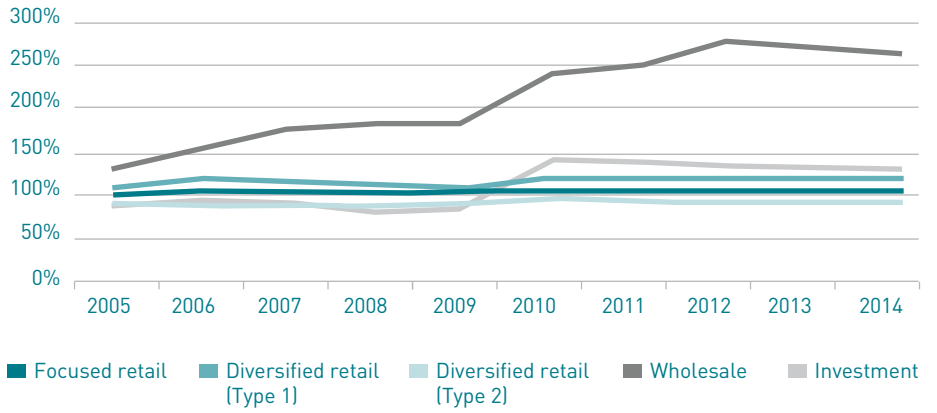
The fourth indicator, the **net stable funding ratio (NSFR),** is an estimate of the proposed long-term liquidity risk measure proposed under the Basel III rules, (BCBS, 2010a). Expressed simply, the measure gives an estimate of the available stable funding sources as a share of required stable funding, which is constructed with the available data. Although the measure should be interpreted with caution, a greater value should point to lower liquidity risks[40]. Figure 6.10 shows that the wholesale and investment banking models face relatively lower liquidity risks, while the retail-oriented may face higher risks. It is important to note that all models satisfy the 100% funding requirement, as will be required by 2018. Moreover, the liquidity conditions have gradually improved for most models, particularly for the wholesale and investment models. The differences between the ownership structures are much smaller. The NSFR increased in all ownership structures since 2005 and even the nationalised banks, that reported the lowest ratios throughout the sample period, quoted a ratio above the funding requirement.

Finally, in what follows we supplement the Monitor analysis with the resolution capacity per bank business model and ownership structure.

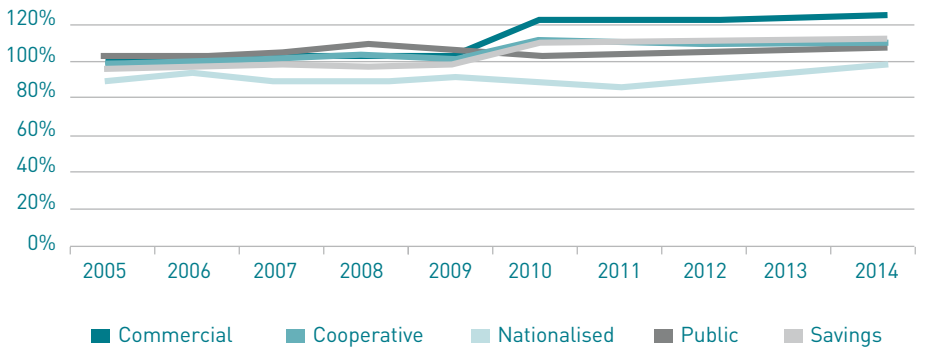
40. See Appendix VI for a detailed description of the measure used in this study. Note that the developed indicator suffers substantially from the unavailability of detailed information. In particular, the disclosure requirements that are currently applicable do not require banks to distinguish between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

FIGURE 6.10 – Evolution of net stable funding ratio (NSFR)

a) Business models



b) Ownership structures



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

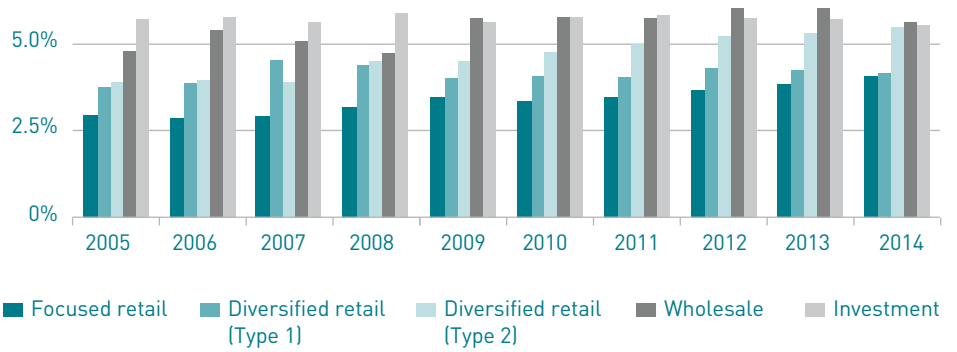
When the bank is unable or unlikely to meet the capital requirements, the recovery and resolution mechanism will need to ensure that the bank will either be orderly resolved or viably restored. The following indicators assess various aspects of the Bank Recovery and Resolution Directive and the Single Resolution Mechanism that are currently being phased-in.

The first indicator, the bail-in contribution, is an estimate of the minimum bail-in under the resolution mechanism as share of total liabilities incl. own funds before resolution funds can be tapped. The legislation prescribes that banks need to have at least 8% of bail-in-able liabilities, which is equal to the minimum amount that needs to be bailed-in before an amount up to 5% of liabilities can be contributed from the resolution fund. However, since the banks need to hold at least 8% of risk-weighted assets to fulfil the total regulatory capital requirement, the minimum losses that can be covered under the bail-in is the difference between the minimum total capital requirement and the minimum bail-in requirement.

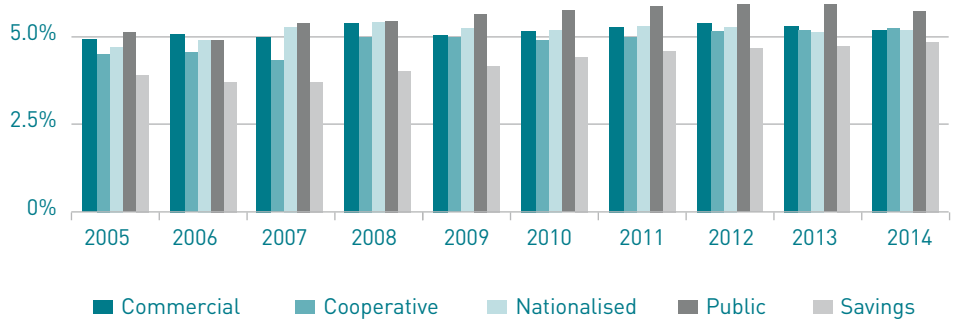
Figure 6.11 shows the banks' minimum contribution to a potential resolution. The bail-in contribution of the retail-oriented banks is significantly less than the wholesale and investment banks, though the focused retail banks, that previously had the lowest bail-in contribution, converged in the aftermath of the economic crisis to diversified retail (type 1) banks. As well, the diversified retail (type 2) banks converged to the wholesale and investment banks after the financial crisis. Most of the differences across ownership structures are insignificant, except for the public banks, which have a significantly higher bail-in capacity than all the other ownership structures. In fact, the bail-in contribution has a reverse relation with the average risk weight shown above. Since the average risk weight is gradually increasing, the bail-in contribution capacity is decreasing in recent years, which might mean that the resolution fund would need more funds.

FIGURE 6.11 – Bail-in contribution (share of total liabilities)

a) Business models



b) Ownership structures



Note: The bail-in contribution is the potential contributions of creditors to the recapitalisation of distressed banks, i.e. difference between the minimum bail-in and capital requirement as share of total liabilities. The minimum bail-in is 8% of total liabilities incl. own funds and the required recapitalisation level is equal to the total capital requirement of 8%.

Source: Authors

The second and third indicators, the **size and distribution of peak losses of Aided banks**, are estimates of the losses and the share of the losses that the Single Resolution Fund might have covered, in the event that the resolution mechanism would already have been fully implemented during the sample period. The estimates for the cumulative losses, as well as the distribution across resolution tools, are based on the methodology of De Groen and Gros (2015).

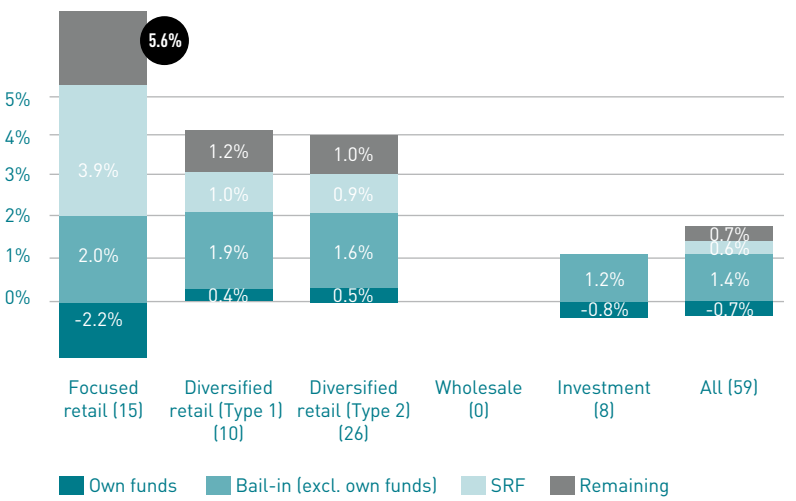
The focused retail banks that received capital support during the past crises reported the highest cumulative peak losses as a share of total liabilities (See Figure 6.12). The losses are, however, only significantly higher than the investment banks as well as wholesale banks, amongst which there were no banks that received capital support. Due to the limited bail-in contribution, a large share of the losses might have been covered through the Single Resolution Fund and an additional bail-in of other creditors. In turn, the investment bank losses would all have been absorbed through bail-in.

The public banks recorded the highest losses among the ownership structures, while the other types of banks recorded substantially lower losses. For the other four types, the share of losses that might have been covered through the resolution fund are not significantly different.

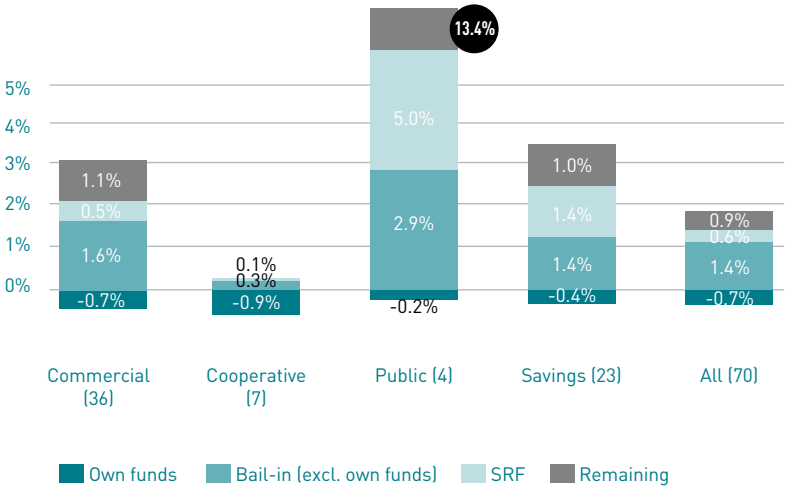
To conclude, this section assessed the response of banks to prudential requirements and supervisory exercises across the different business models and ownership structures. In the aftermath of the financial and economic crises, the legislative and supervisory framework has been totally revised. In short, the capital requirements have been strengthened and complemented with a non-binding leverage requirement and liquidity requirements, as well as the introduction of a recovery and resolution framework to deal with banks that have problems meeting the capital requirements. In addition, bank supervision has been concentrated and the toolkit has been extended (e.g. stress tests).

FIGURE 6.12 – Distribution of peak losses of Aided banks (share of total liabilities)

a) Business models



b) Ownership structures



Note: The figure above shows the distribution among creditors of cumulative peak losses of Euro-area banks that received capital support between 2007 and 2014, would require a minimum bail-in of 8% and maximum SRF of 5% of total liabilities (incl. own funds) as foreseen under the new resolution mechanism and recapitalisation up to 8% of risk-weighted would already have been applied during the sample-period. The ownership structures in this figure are based on the structure before the intervention. The numbers between the brackets express the number of observations.
Source: De Groen and Gros (2015)

Some of the indicators are distinct, while others fail to distinguish between business models and ownership structures. This is the case for the binding regulatory capital ratio (Tier-1), with which most banks keep a similar margin. 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.

The liquidity ratios are still under construction. The existing public reporting falls largely short on information about maturity of both assets and liabilities, to enable exact estimates to be made for the liquidity ratios. The rough estimates for this Monitor showed that the median values have increased in the most recent years and are, in 2014, all above the future requirement of 100%.

Lastly, based on a preliminary assessment of the bail-ins and losses, the capital legislation and resolution framework might, to some extent, work against one another. Hence, the most risky banks should have a higher average risk-weight and thus capital requirement, while the banks with the highest risk-weights have the lowest minimum bail-in contribution. More research is required to assess how the resolution mechanism works out in practice.

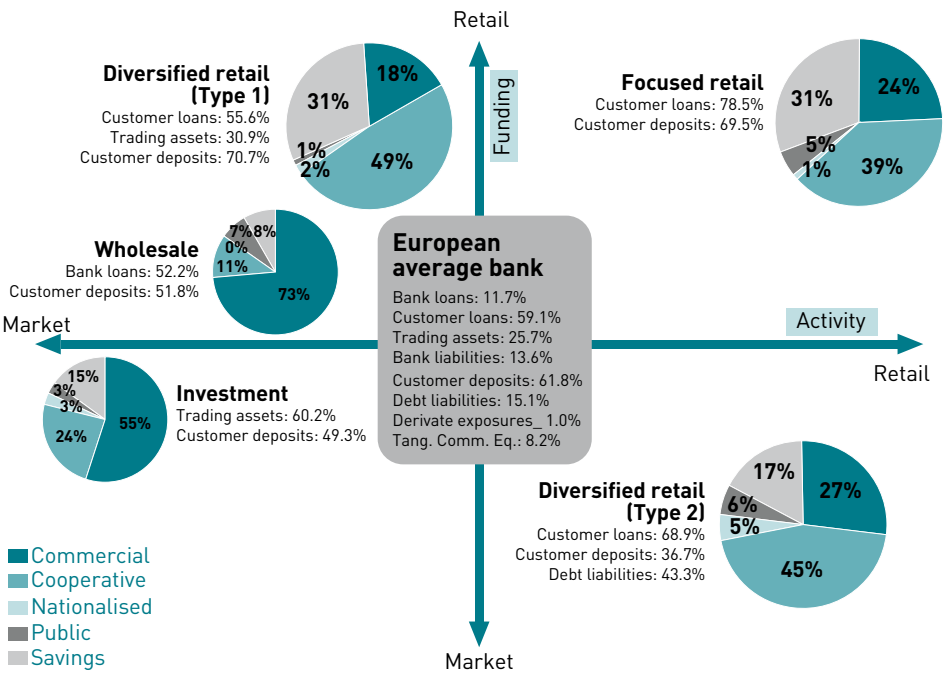
7 Conclusions

The 2015 Business Model Monitor of the European banking sector assesses the banking sector structure in light of the changing economic, legislative and supervisory environment. It also attempts to gain better insights into the impact of different types of corporate structures. In particular, it analyses the interaction between business models and ownership structures as well as the internationalisation, migration, financial performance, contribution to the real economy, risk, and response to banking regulation and supervision through five broad clusters and five ownership structures.

With the objective of covering the entire European banking sector, the 2015 Business Model Monitor includes 2,542 banking groups and subsidiaries of non-European banks that account for more than 95% of EEA and Swiss banking assets, and uses a unique definition and a novel clustering model involving SAS programming. For the analysis, the 13,040 bank-year observations were clustered into five broad categories: focused retail, diversified retail (type 1), diversified retail (type 2), and wholesale and investment banks.

The results of the business model identification are summarised in Figure 7.1 and the key findings per bank business model in Table 7.1.

FIGURE 7.1 – Business models and ownership structures in European banking



Note: The shares of banks across ownership structures are based on the share of bank-year observations.
Source: Authors

Focused retail banks have an ownership structure that is slightly skewed towards stakeholder value banks. About 25% of the small domestically oriented institutions are shareholder-value (SHV) banks, while about 40% are cooperative and 31% 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 and other income are only minor components. The share of the banks that were identified as focused retail remained fairly similar during the crises.

The focused retail banks have performed rather well, compared to their peers between 2005 and 2014. With the exception of the economic crisis, they reported among the highest return on assets. Albeit, in terms of return on equity, the returns were just about average, due to a relatively low leverage, compared to the other business models. The focused retail banks reported the best operational efficiency measured in terms of cost-to-income ratio. Interestingly, the focused retail banks suffered significantly lower loan losses than the diversified retail banks and reported the most stable loan growth, confirming their undeniable role in the real economy. The focused retail banks are least leveraged and distant from default, i.e. high Z-score, and they seem more resilient to extreme stress conditions, compared to other business models. Conversely, the regulatory (i.e. Tier 1 and additional AQR and ST analysis) and market risk measures suggest that the focused retail banks are significantly more risky than most of the other business models. The CDS-spreads on subordinated debt of the focused retail banks are substantially higher and the risk-weights are the highest of the entire sample. This leads to the view that market perception is more aligned to the regulatory viewpoint.

Diversified retail (type 1) banks have a modest size. The ownership structure is slightly skewed towards stakeholder value banks, with the exception of public banks. In particular, the diversified retail banks (type 1) combine lending to customers with a moderate percentage of trading activities (i.e. 31% on average) primarily using customer deposits.

It seems to be the closest model to the focused retail model, with the highest level of interchange between all models. More precisely, many wholesale, investment and diversified retail (type 2) banks shifted to diversified retail (type 1), but only a few banks made the reverse shift. Most of the banks that received state aid have, for example, reoriented towards diversified retail (type 1), which was in many cases supported by the conditions for obtaining capital support.

The other activities are barely reflected in the income, with the largest share of the income being obtained from net interest. The commission and fees income, as well as trading income, are only slightly higher than for the focused retail banks. Moreover, the trading income of the retail-oriented banks is more stable than of investment banks, which have the most trading activities. The diversified retail (type 1) banks' risk factor seems moderate based on various reporting and market risk indicators. Although the banks have the largest median distance to default, the CDS-spreads are similar to the other retail-oriented business models, but above the wholesale and investment banks. In turn, the diversified retail banks score relatively low on regulatory risk indicators, compared to the other retail models, i.e. relatively higher average risk-weights and lower regulatory Tier-1 ratios.

TABLE 7.1 – Results across business models, 2005-14

	Model 1 - Focused retail (3,877 obs.)	Model 2 – Diversified retail (Type 1) (5,048 obs.)	Model 3 – Diversified retail (Type 2) (2,023 obs.)	Model 4 – Wholesale (887 obs.)	Model 5 – Investment (1,205 obs.)
Ownership structures	Skewed towards stakeholder value types (e.g. cooperative, savings and public banks)	Skewed towards stakeholder value banks (i.e. small cooperatives and savings)	Relatively large share of nationalised and cooperative banks	Predominantly commercial banks, but largest share of public banks among all BMs, which have the largest share of the assets	Predominantly commercial banks, but substantial share of cooperative and savings banks
Internationa-lisation	Predominantly domestic; less than 1 subsidiary and 1 branch on average	Predominantly domestic; less than 1 subsidiary and 1 branch on average	Moderately international; more than 1 subsidiary and 1 branch on average	Predominantly domestic; less than 1 subsidiary and 1 branch on average	Most international; about 3 to 4 subsidiaries and 2 branches on average
Migration	Most stable business model (90%); migration almost exclusively to diversified retail (type 1)	Highly stable business model (89%); largest migration to focused retail and main receiver from other models	Highly stable business model (87%); migration to other retail oriented models	Least stable business model (80%); migration to diversified retail (type 1) and exchange with investment	Stable business models (85%); migration to diversified retail type 1 and exchange with wholesale
Financial performance & operational efficiency	Relative high returns, except for econ. crisis and best operational efficiency	Returns as well as operational efficiency deteriorated during the fin. and econ crises	Returns most stable and only model not posting a loss in a single year	Returns stable, except for losses during fin. crisis, and less efficient	Returns rather stable, except for fin. crisis, and less efficient
Contribution to the real economy	High stable customer loan growth	High customer loan growth (but lower than focused retail)	Low customer loan growth during fin. crisis and negative during/after econ. crisis	Relatively high customer loan growth during crises	The loan growth deteriorated relatively more during the fin. and econ. crises

	Model 1 - Focused retail (3,877 obs.)	Model 2 – Diversified retail (Type 1) (5,048 obs.)	Model 3 – Diversified retail (Type 2) (2,023 obs.)	Model 4 – Wholesale (887 obs.)	Model 5 – Investment (1,205 obs.)
Risk	Highest distance to default; lowest loan loss provisions among retail banks; high home country exposure	High distance to default; highest loan loss provisions; large government exposure and home bias	Low distance to default; moderate loan loss provisions; large government exposure	Low distance to default; lowest loan loss provisions; limited government exposure	Low distance to default; average loan loss provisions; sizable but diverse government portfolio
Response to regulation	Among highest risk weights; moderate Tier-1 cap. and high tangible equity; highest impact AQR/ST; low bail-in contribution	Among highest risk weights; low Tier-1 cap. and moderate tan. eq.; moderate impact AQR and low impact ST; low bail-in contribution	Decreasing risk weights; low Tier-1 cap. and moderate tan. eq. as well as AQR/ ST-impact; high bail-in contr.; least liquid	Low risk weights; sharply increasing Tier-1 cap. and tan. eq.; low impact AQR/ST; high bail-in contribution	Low risk weights; high Tier-1 cap. and low tan. eq.; low impact AQR and high impact ST; high bail-in contribution

Source: Authors

The diversified retail (type 1) banks' returns deteriorated during the crises. The returns on assets and equity have been the highest pre-crisis, but marginalised during the financial crisis and turned negative during the economic crisis. The diversified retail (type 1) banks suffered the highest loan losses. The banks, nevertheless, reported customer loan growth during the crises, except for 2009.

Diversified retail (type 2) banks are relatively large in size and internationally active as compared to the other retail-oriented banks. Among these banks are the nationalised, cooperative and public banks. It has, nevertheless, the highest share of listed banks, which might be explained by the average size of the banks. Although the diversified retail (type 2) is the smallest among the retail-oriented models based on number of banks, these banks possess the highest assets. The activities of the second type of diversified retail banks consist primarily of lending to customers using mainly debt liabilities and customer deposits. Notwithstanding that the largest share of assets are allocated to customer loans, the diversified retail (type 2) banks obtained twice as much from trading activities than the other retail-oriented banks. The diversified retail (type 2) banks are relatively risky based on various reporting indicators. The banks have the lowest median distance to default among the retail-oriented banks. In turn, the diversified retail (type 2) banks scored gradually higher on the regulatory risk indicators, i.e. the relatively high average risk-weights decreased from a level similar to the retail-oriented banks to the wholesale and investment banks over time.

The diversified retail (type 2) banks' returns have been the most stable. It has been the only model where the returns on assets and equity have not turned negative in any single year, despite the high provisions of customer loans. The returns were not funnelled through to the real economy in the form of higher customer loans but, instead, to improve the capital position. The banks posted slightly positive customer loan growth during the financial crisis and negative loan growth during most years of the economic crisis.

Wholesale banks are among the smallest and most domestically oriented group. These banks primarily engage in interbank lending and borrowing and are primarily categorised as shareholder value banks. However, these also include central institutions of cooperative and savings banks that provide liquidity and other services to the local banks as well as public banks. Hence, the wholesale banks include the lowest share of cooperative and nationalised banks, but the highest share of public banks. These public banks make-up the largest share of the assets. 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, as well as commission and fees income. The wholesale banks, however, incurred the highest trading losses. The wholesale banks are traditionally characterised by low loan losses. Despite the extraordinary losses during the financial crisis, the wholesale banks still had the lowest loan loss provisions. In addition, the wholesale banks operational efficiency has been worse than the retail-oriented banks.

The wholesale banks' returns have been reasonably stable, except during the financial crisis. The wholesale banks suffered substantial trading losses in 2007 and 2008, but were able to recover in the period thereafter. The gap between the return on equity was smaller than the gap between the return on assets in the early years due to a higher leverage. Unlike

investment banks, the capital improvement of wholesale banks was not accompanied by consecutive years of declines in loans. Hence, the loans to customers grew throughout the crises years.

Among the five models, the banks identified as **investment-oriented** are relatively small in number, but the largest in size and most internationally-oriented banks. The investment banks primarily engage in trading activities while relying on debt securities and derivatives for funding. The investment banks also include the largest share of profit-maximising banks in terms of assets, i.e. the highest share of shareholder value banks. Yet, it is the only model, which relies for less than half of its income on net interest income. The commissions and fees form the largest share of the remaining income and the investment banks also have the highest level of trading income.

Like the wholesale banks, the investment banks primarily suffered during the financial crisis. The return on assets was below that of the retail-oriented models. During the financial and economic crises, the banks suffered from high risk-costs that put pressure on returns. Nevertheless, due to a higher leverage, the gap with retail banks was closed for return on equity. The operational efficiency has been similar to that of the wholesale banks. 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. Despite the deleveraging, the leverage of the investment banks is still relatively high, which is likely to reflect in a higher bail-in contribution under the new resolution regime.

Turning to the results across ownership structures, the **commercial banks** account for more than half of all the banking assets, while representing only about 30% of the number of institutions. The commercial banks are conducting relatively more international, trading and inter-bank activities. This is also reflected in their income structure, which consists substantially of commission and fees income. The profits of the commercial banks deteriorated after the onset of the crisis. Nevertheless, the banks were, on average, able to report relatively stable and high returns.

The commercial banks suffered moderate loan losses and reported stable loan growth. The commercial banks had, especially during the first years of the sample period (i.e. from 2005 to 2008), relatively low capital ratios. The relatively low capital levels and high volatility in earnings reflected in a rather close distance to default, i.e. Z-score. Over time, these low capital ratios have substantially increased, similar to what happened for the other ownership structures. In turn, the regulatory and market risk measures suggest that the commercial banks are moderate, looking at both the CDS-spreads and the risk-weights.

The **cooperative banks** account for about 40% of the observations, but only 16% of the assets. The activities of the cooperative banks are, on average, domestically and retail-oriented. Hence, the operational income consists primarily of net interest revenues. The cooperative banks reported stable returns, which were among the highest in terms of return on assets and rather moderate in terms of return on equity, due to a lower leverage.

The cooperative banks suffered moderate loan losses and reported stable loan growth. The cooperative banks were relatively moderately leveraged which, combined with the low volatility in earnings, reflected in a considerable distance to default. In turn, the

regulatory and market risk measures suggest that the cooperative banks are risky, looking at the higher CDS-spreads and the risk-weights.

The **nationalised banks** are the smallest group of banks, but with the largest average size. The nationalised banks, in particular, include investment banks that make up the largest share of the assets (i.e. 42%), while in relative terms the largest share of the diversified retail (type 1) banks (i.e. 21%) is a nationalised bank. These most internationally active banks, on average, depend most on market activities, with relatively high trading assets and debt liabilities. Despite the trading assets the income of the nationalised banks consists, for the largest part, of net interest. The nationalised banks reported the worst performance during both the financial and economic crisis, with losses between 2008 and 2013. These were partially due to trading losses at the height of both crises, as well as the loan losses during both crisis, but in particular the economic crisis. The negative returns were funnelled through in the form of a decline in the customer loan portfolio. The volatility and bad performance of the banks were also reflected in a low distance to default. The poor performance based on the reporting measures was mimicked by market risk measures. Hence, the CDS-spreads and share volatility was significantly higher than any of the other ownership structures. In turn, the regulatory measures were slightly worse than the other banks, looking at both the average risk-weights and Tier-1 capital ratios.

The **public banks** form only a small part of the sample. The domestically focused activities of these state-owned banks are similar to the sample average, with the exception of funding, which is more reliant on debt liabilities. The public banks primarily depend on net interest income and reported negative net trading income, due to high trading losses during the financial crisis. The latter led to lower and negative returns, from which the public banks partially recovered afterwards. The operational efficiency of the public banks, measured through cost-to-income ratio, is higher than all the other structures.

The public banks suffered the least loan losses and reported the highest loan growth, particularly at the height of both the financial and economic crises. The larger capital levels also led to the relative furthest distance to default based on the reporting measure, i.e. asset weighted Z-score. This was supported by the regulatory and market risk measures, because the CDS-spreads and average risk-weights were the lowest among the ownership structures. Hence, this also means that the public banks are likely to need to contribute most in case of resolution, before resolution funds can be tapped.

The **savings banks** are responsible for only 12% of the assets in the sample, but about a quarter of the institutions. The activities of these predominantly domestically active banks are skewed towards retail. This is also reflected in the income structure, which consists primarily of interest revenues. The returns of the savings banks have been continuously lower than the other ownership structures, with the exception of nationalised banks – despite slightly lower loan loss provisions than those of commercial and nationalised banks.

The savings banks' lower returns and higher loan losses during the crises were reflected in the relatively low loan growth figures. Despite all this, the distance to default was fairly similar to cooperative banks, as well as the market and regulatory risk measures.

The findings provide new evidence about the role of different business models and ownership structures in European banking, in terms of financial performance & operational efficiency, contribution to the real economy, contribution to systemic risk and impact on financial (in)stability. It is clear that the shareholder value banks, which are more of an investment and wholesale nature, are more oriented towards financial performance, while tending to accelerate the accumulation of risk at a system level and being less resilient to extreme stress conditions. In turn, retail-oriented banks, which are more stakeholder-oriented institutions, are more inclined to contribute to the real economy, while maintaining equivalent levels of financial performance and contributing at a lesser level to the accumulation of risk at a system level and being more resilient to extreme stress conditions.

Overall, the findings also show that a diverse system is seemingly more resilient than a system that tends to converge towards one business model. The case of Belgium is revealing. Before the crisis the investment bank business model was dominant. At the onset of the financial crisis the banking system would have virtually collapsed, should it not have been for a massive government intervention.

Across countries, France, Switzerland and the United Kingdom must be on the watch list to prevent dealing with cases similar to Belgium. Regulation must align as much as possible with the underlying risk profiles of the investment banks. This means that a comprehensive review of their balance sheet and off balance sheet is an essential step before adapting the regulatory requirements to this type of banks.

The Monitor findings also shed light on the continuing misalignment of the regulatory indicators, in particular the risk weights and the Tier-1 capital ratio to the underlying risks of European banks. This means that further improvements on the risk weights ought to be made to ensure that this misalignment is dealt with.

Moreover, it seems that market perceptions are more aligned to the viewpoints of the regulators rather than to the intrinsic risk quality of the bank. Market makers do not seem to be able to take account of the business model risk factors associated with banks. As a consequence, this can be largely explained by the fact that the results are skewed to the listed and larger banks, which are required to provide more data to the market. Smaller and non-listed banks do not provide market data allowing judgment on their business models and risk quality based on market indicators. Such misalignment is bound to stay if the transparency of small and non-listed banks does not improve.

Continued monitoring of bank business models is essential to improve the understanding of this concept and, ultimately, to detect the accumulation of risk at a system level. The nationalised banks were predominantly a mix of investment and diversified retail (type 2). This subset of banks under these two business models seems to have taken excessive risks, to be highly leveraged and poorly capitalised and simply not resilient to extreme stress conditions. These characteristics have triggered massive and unprecedented bail-outs. Based on our analysis, it seems that in each business model, there are worse and better performing cases, depending on the overall macro and micro economic conditions in which banks are operating. Further research is being conducted, based on this Monitor sample, definition and analytical framework in order to shed light on the characteristics of the best performing bank within each business model, to which worse performing banks should converge with in the long run.

The business model analysis can prove useful in the recent debate on proportionality in bank regulation and structural reforms of the EU banking sector. As a matter of fact, a large number of small and medium-sized banks, which were identified as predominantly retail-oriented institutions (in particular focused retail and diversified retail type 1) seem to concentrate on traditional financial intermediation. There is a presumption that for these banks the complexity of Basel regulation would drive compliance costs upward, which might in the long run hamper their prime role of financing the real economy. Further research on this matter is needed to make viable assertions. In turn, for large investment banks, which grew too complex and too large because of their market oriented and international nature, our evidence shows that the worse performing institutions might accelerate the accumulation of systemic risk and because of their rather weak resilience to extreme shocks, they could be subject to further bailouts if bail-ins prove to be insufficient. For these latter cases, structural reforms might prevent this risk from happening, although in the long run it is unclear whether this will be a viable solution.

The business model analysis also has a predictive power that is essential for regulators and supervisors to detect the excessive risk accumulation at a system level over a period of time and, especially, when external shocks are simulated. One scenario that should not be underestimated relates to a change of monetary policy in Europe and an increase in interest rates. Our prediction is that bank business models would respond differently to this shock and some might be more resilient than others. Moreover, understanding the systemic risk accumulation process is paramount to achieving a targeted macro-prudential regulation. Clustering the institutions per business model that tend to drive systemic risk upward, and acting accordingly with the appropriate regulatory and supervisory measures, would be the beginning of a new dynamic and targeted regulatory framework. This would complement the current framework, which when improved (as discussed earlier), would work together in tandem.

Finally, the transparency and public disclosure practices remain an important concern. Ayadi et al. (2011, 2012 and 2014a) 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 undertaking the previous three studies, the situation has slightly changed, but primarily for the larger banks. Taking into account that the sample has been extended, with a lot of smaller banks that are subject to less extensive reporting requirements, during the collection of the data for this Monitor, almost the same differences in definitions were found and a slightly larger share of the data was available. The public dissemination of supervisory data, which already happens 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

ABCP	Asset-backed commercial paper
AQR	Asset quality review
BBM	Banking Business Model
BCBS	Basel Committee on Banking Supervision
CCC	Cubic clustering criterion
CDS	Credit default swap
CET1	Common equity Tier-1
CIR	Cost-to-income ratio
EBA	European Banking Authority
ECB	European Central Bank
EEA	European Economic Area
EFTA	European Free Trade Association
EU	European Union
EUR	Euro
FSB	Financial Stability Board
GDP	Gross domestic product
GFC	Great Financial Crisis
GSIBs	Global systemically important banks
IOFSC	International Observatory of Financial Services Cooperatives
IRB	Internal rating-based
NSFR	Net stable funding ratio
PSI	Private sector involvement
RoA	Return on assets
RoE	Return on equity
RWA	Risk-weighted assets

RoRWA	Return on risk-weighted assets
SHV	Shareholder-value
SRF	Single Resolution Fund
SSB	Sum of square between
ST	Stress test
STV	Stakeholder-value
SPRSQ	Semi partial R-squared
TCE	Tangible common equity
TCR	Total capital requirement
USD	United States Dollar
XBRL	eXtensible Business reporting language

Appendix I.
List of Variables

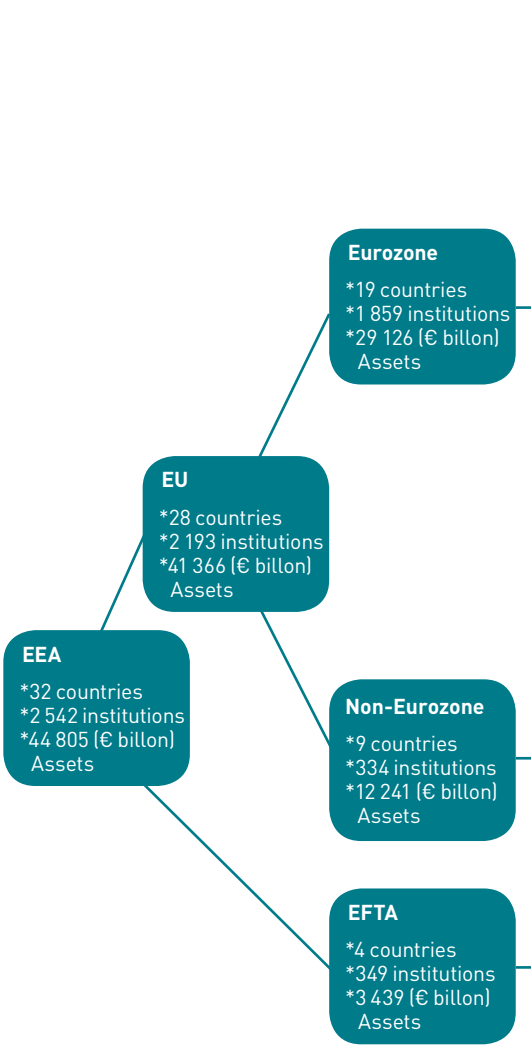
No.	Variable	Coverage
1	Country (headquarter location)	100%
2	Reporting currency	100%
3	Ownership (SHV/STV)	99%
4	Ownership (cooperative, savings, etc.)	100%
5	Listed (YES/NO)	100%
6	Internationalisation (total – no. of countries)	98%
7	Internationalisation (subsidiaries – no. of countries)	98%
8	Internationalisation (branches – no. of countries)	98%
9	Assets (total)	100%
10	Assets (% of GDP)	100%
11	Cash (and balances with central banks)	99%
12	Loans to banks (total)	99%
13	Loans to customers (gross)	55%
14	Loans to customers (net)	99%
15	Intangible assets	98%
16	Liabilities (total)	99%
17	Deposits (banks)	99%
18	Deposits (central banks)	11%
19	Deposits (customers)	99%
20	Repurchase agreements (liabilities)	5%
21	Derivatives (total - fair value - negative)	45%
22	Capital (equity - total)	99%
23	Capital (tangible common equity)	98%
24	Capital (common equity)	99%
25	Income (total)	99%
26	Income (interest - net)	99%
27	Income (commissions - net)	99%
28	Income (trading - net)	96%
29	Income (other)	96%
30	Expenses (operating - total)	99%
31	Expenses (operating - personal)	98%
32	Expenses (operating – risk costs)	98%
33	Expenses (operating – loan loss provisions)	97%
34	Profit (before tax)	99%
35	Income tax	99%
36	Profit (after tax)	99%
37	Risk-weighted assets (total)	77%
38	Capital (regulatory capital)	77%
39	Capital (tier I - total)	70%
40	Capital (core tier I - total)	18%
41	Applicable Basel Standards (I/II)	84%
42	Basel approach (SA/IRB)	19%
43	State aid (Received - YES/NO)	87%
44	CDS spread (senior, average, local currency)	6%
45	CDS spread (senior, volatility, local currency)	6%
46	CDS spread (senior, average, USD)	5%
47	CDS spread (senior, volatility, USD)	5%

No.	Variable	Coverage
48	CDS spread (subordinated, average, local currency)	3%
49	CDS spread (subordinated, volatility, local currency)	3%
50	CDS spread (subordinated, average, USD)	3%
51	CDS spread (subordinated, volatility, USD)	3%
52	Share price (year-end)	11%
53	Share price (average)	11%
54	Share price (volatility)	11%
55	Share price (observations)	12%
56	Share price (volume)	10%

No.	Variable	Coverage
57	Supervisor (European Banking Authority - YES/NO)	100%
58	Supervisor (Single Supervisory Mechanism - YES/NO)	100%
59	Supervisor (Financial Stability Board - YES/NO)	100%
60	Asset quality review (impact in % of RWA)	1%
61	Stress test 2014/15 (impact in % of RWA)	1%
62	Capital shortfall 2014/15 (in % of RWA)	1%
63	Cumulative peak losses aided banks (% of total liabilities)	3%

Appendix II.
Distribution of Banks across Countries

Distribution of banks across countries



Country	Number of institutions	Assets (€ billon)
Austria	79	770.6
Belgium	23	909.8
Cyprus	8	127.2
Estonia	2	0.4
Finland	10	135.7
France	79	7,831.7
Germany	1,108	7,309.5
Greece	16	442.0
Ireland	15	409.6
Italy	314	2,970.4
Latvia	13	17.6
Lithuania	5	5.6
Luxembourg	33	276.7
Malta	7	16.3
Netherlands	30	2,782.8
Portugal	22	445.1
Slovakia	4	9.2
Slovenia	11	25.9
Spain	80	4,639.5
Bulgaria	9	11.6
Croatia	15	9.5
Czech Republic	12	25.4
Denmark	76	851.4
Hungary	8	49.9
Poland	13	136.1
Romania	8	18.9
Sweden	58	1,669.6
United Kingdom	135	9,468.3
Iceland	7	25.1
Liechtenstein	7	40.9
Norway	90	548.7
Switzerland	245	2,824.6

Notes: The figure above shows the distribution of banks across the EEA-countries and the aggregates for the different sub-agglomerations within the EEA. Total assets data used for the aggregate figures are for the latest year (2014 or before) available.

Source: Authors

Evolution of the sizes across business models

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total assets (€ billion)										
Focused retail	682	999	1,655	2,053	1,854	3,103	3,161	3,003	3,274	2,522
Diversified retail (Type 1)	2,728	2,615	5,365	1,905	2,714	5,156	6,413	8,422	6,806	8,450
Diversified retail (Type 2)	8,972	13,200	12,800	14,400	15,900	16,300	15,100	12,700	12,800	11,300
Wholesale	1,023	1,238	653	635	938	1,095	1,267	1,261	1,164	1,122
Investment	8,755	11,100	13,900	19,900	15,900	17,100	18,700	16,500	16,400	17,100
All banks	22,200	29,200	34,400	38,800	37,400	42,800	44,600	41,900	40,400	40,500
Number of institutions										
Focused retail	63	88	119	135	121	642	700	709	728	572
Diversified retail (Type 1)	61	65	71	67	89	960	963	1,023	999	750
Diversified retail (Type 2)	76	104	115	111	111	347	351	310	280	218
Wholesale	10	14	19	19	19	182	186	163	162	113
Investment	23	28	35	33	31	204	193	224	235	199
All banks	233	299	359	365	371	2,335	2,393	2,429	2,404	1,852
Median total assets (€ billion)										
Focused retail	6.8	8.0	8.6	8.7	9.3	0.7	0.8	0.8	0.9	0.9
Diversified retail (Type 1)	8.9	8.5	7.7	8.8	8.8	0.8	0.9	0.9	0.9	1.0
Diversified retail (Type 2)	43.7	45.7	37.9	41.2	41.1	1.3	1.2	1.2	1.5	2.0
Wholesale	39.9	8.6	6.8	6.7	9.9	0.6	0.8	0.6	0.7	0.7
Investment	173.3	127.1	142.2	159.9	143.8	1.7	1.4	1.2	1.3	1.5
All banks	12.0	12.9	11.6	12.3	12.6	0.9	0.9	0.9	0.9	1.0

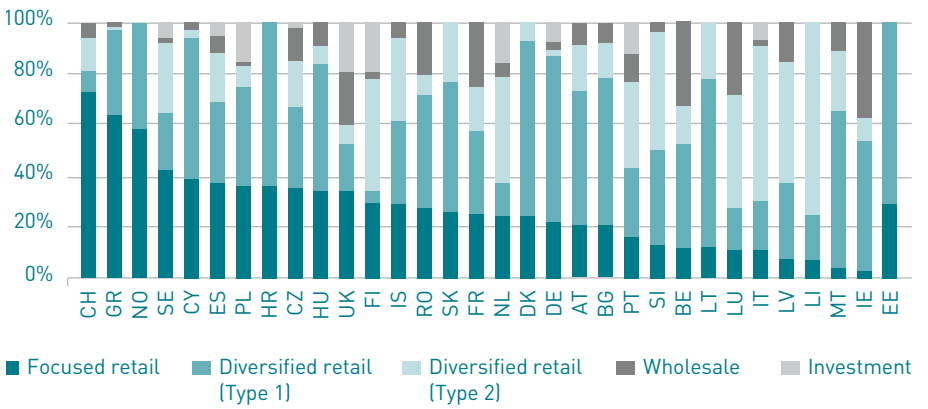
Evolution of the sizes across Ownership structures

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Sum of total assets (€ billion)										
Commercial	15,300	17,400	19,900	22,000	20,500	23,900	25,300	24,700	22,700	24,000
Cooperative	3,449	4,106	4,814	5,060	5,977	7,109	7,637	7,778	7,529	7,707
Nationalised	3,081	4,549	6,244	6,029	4,999	5,132	4,847	4,333	3,553	3,263
Public	387	1,112	1,236	1,356	1,470	1,795	1,959	2,033	1,947	2,061
Savings	3,138	3,744	4,290	4,568	4,522	5,333	5,265	5,219	4,950	3,978
All banks	25,354	30,911	36,484	39,013	37,468	43,268	45,008	44,063	40,678	41,008

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of institutions										
Commercial	122	142	170	172	172	617	641	646	640	539
Cooperative	29	49	56	56	56	1,022	1,049	1,076	1,069	896
Nationalised	22	25	25	26	26	33	31	30	28	25
Public	13	23	29	31	32	66	67	68	66	62
Savings	66	78	97	98	99	642	646	641	636	456
All banks	252	317	377	383	385	2,380	2,434	2,461	2,439	1,978
Median total assets (€ billion)										
Commercial	6.3	7.2	7.5	8.5	9.0	1.4	1.4	1.4	1.5	1.9
Cooperative	17.8	16.5	17.3	17.4	19.1	0.6	0.6	0.7	0.7	0.8
Nationalised	54.4	61.8	68.4	69.8	74.8	66.8	72.0	65.5	68.4	65.4
Public	12.2	15.7	11.7	12.5	15.8	7.8	8.1	9.0	8.9	9.5
Savings	9.0	10.8	11.3	11.1	11.8	1.3	1.4	1.4	1.4	1.5
All banks	10.9	11.6	10.9	11.1	12.2	0.9	0.9	0.9	1.0	1.1

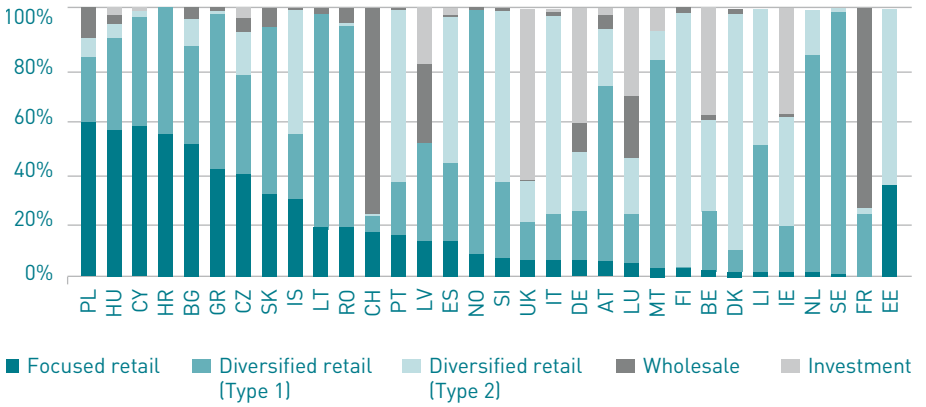
Notes: All figures correspond to the year-end observations for the relevant sub-sample.
Source: Authors

Distribution of banks across business models and countries (% of institutions)



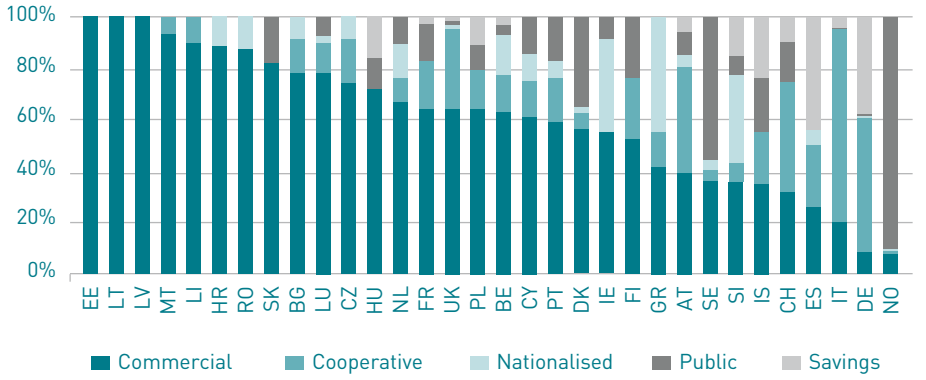
Notes: The figure above shows the distribution of banks across business models based on share in observations for the entire sample period in the EEA-countries and Switzerland. The countries are ordered based on the share of focused retail banks.
Source: Authors

Distribution of banks across business models and countries (% of assets)



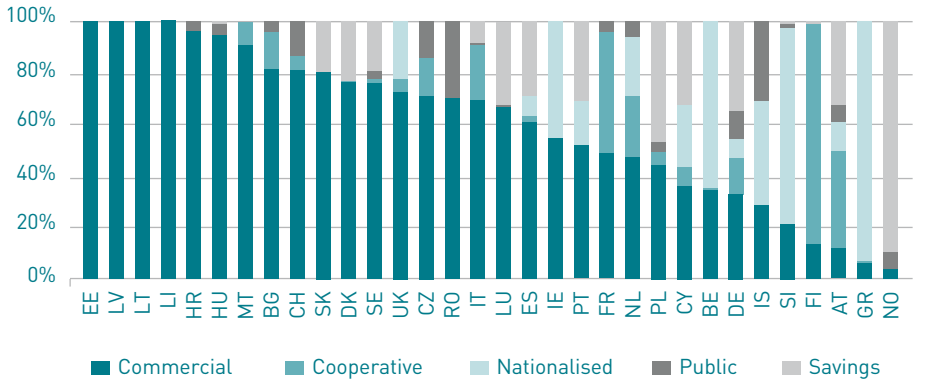
Notes: The figure above shows the distribution of banks across business models based on share in assets for the entire sample period in the EEA-countries and Switzerland. The countries are ordered based on the share of focused retail banks.
Source: Authors

Distribution of banks across ownership structures and countries (% of institutions)



Notes: The figure above shows the distribution of banks across ownership structures based on share of observations assets for the entire sample period in the EEA-countries and Switzerland. The countries are ordered based on the share of commercial banks.
Source: Authors

Distribution of banks across ownership structures and countries (% of assets)

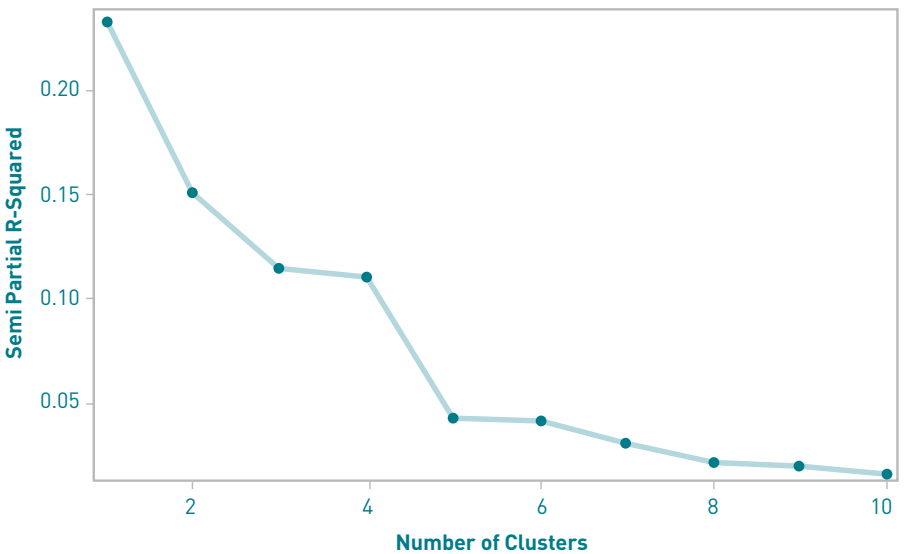


Notes: The figure above shows the distribution of banks across ownership structures based on share in assets for the entire sample period in the EEA-countries and Switzerland. The countries are ordered based on the share of commercial banks.
Source: Authors

Appendix III.
Determining the Optimal Number of Clusters

The pseudo-F statistics of Calinski & Harabasz confirms 5 clusters as the optimal solution. We present here three other popular selection criteria; Semi Partial R-Squared, Cubic Clustering Criterion and Sum of Squares Between. They all support the five-cluster configuration.

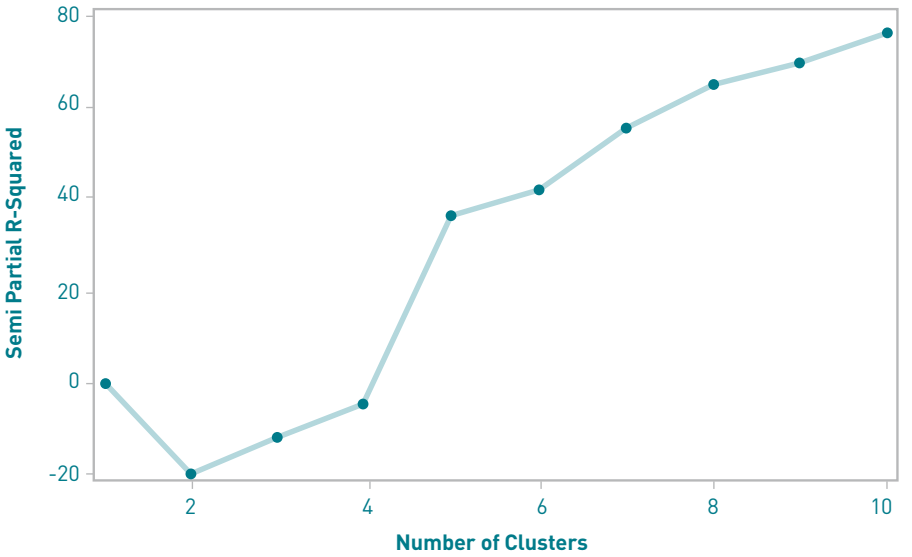
Semi Partial R-Squared (SPRSQ) across clusters



Notes: The Semi Partial R-Squared measures the loss of homogeneity when a new group is created. Since we are seeking homogeneous groups, it must be small enough. Also, the number of clusters must be parsimonious. It is clear from the figure that 5 is an important break point for the number of clusters, where the curve has started to level off and most of the drop in the semi-partial R-squared has been achieved.

Source: Authors

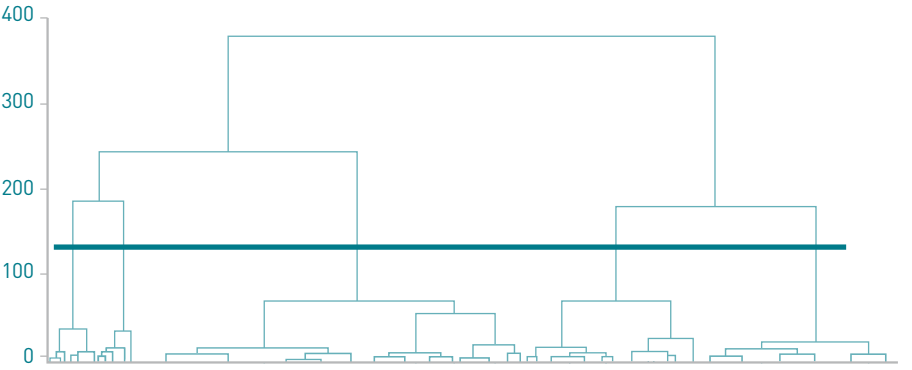
Cubic Clustering Criterion (CCC)



Notes: The higher the Cubic Clustering Criterion (CCC) is, the more homogeneous the clusters are. The figure shows the jump in CCC obtained from increasing the number of clusters from 4 to 5, which is also a clear break point. The requirement of a parsimonious number of clusters supports a number of 5 clusters as one of the best choices

Source: Authors

Sum of Squares Between



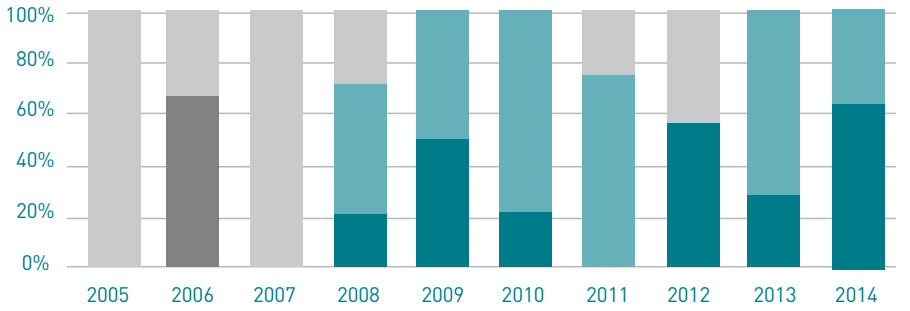
Notes: On the Dendrogram, new clusters are formed in a hierarchical way by partitioning existing clusters. The Y-axis represents the distance between datasets according to the measure Sum of Square Between (SSB). More precisely, one reads for each horizontal line, the distance between two clusters. The cut off line for 5 clusters can even drop below 100, while keeping the number of clusters at 5. It is clear again that by selecting 5 clusters, most of the reduction in SSB is achieved.

Source: Authors

Appendix IV.
Business Models across Years for Selected Countries

Banking business models in Austria (% of assets)

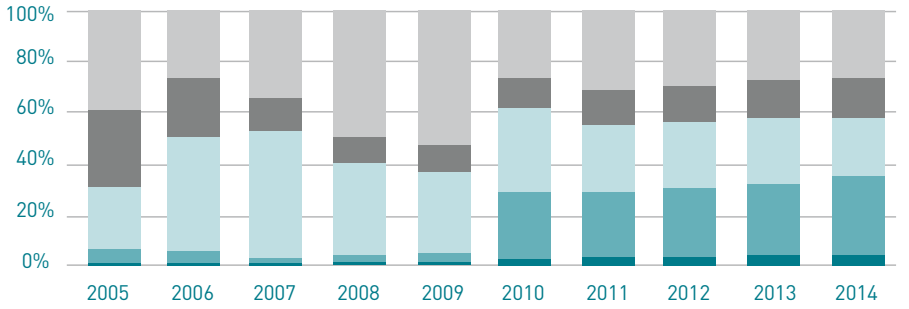
Banking business models in Belgium (% of assets)



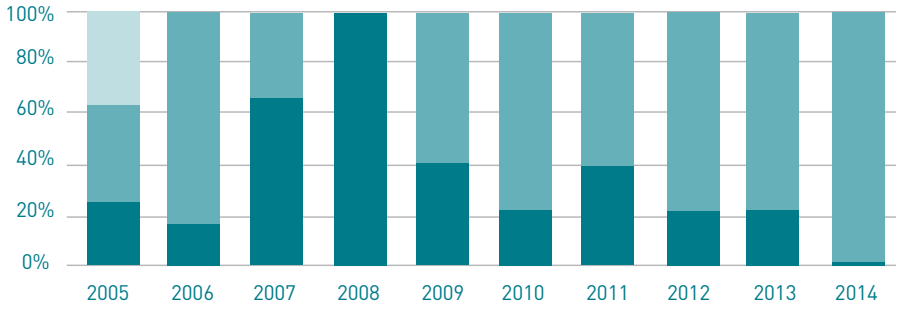
Source: Authors

Banking business models in France (% of assets)

Banking business models in Germany (% of assets)

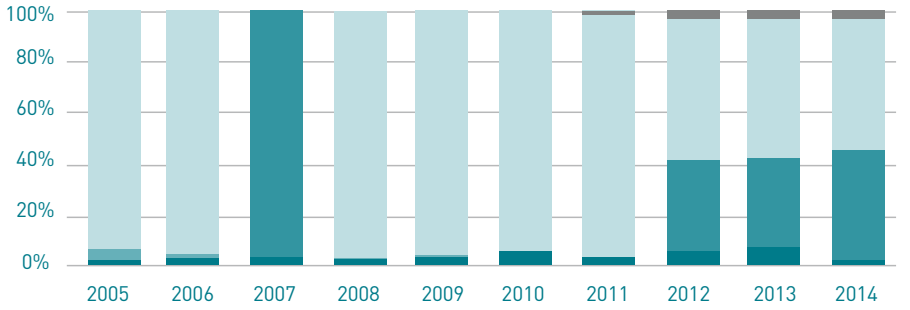


Banking business models in Greece (% of assets)

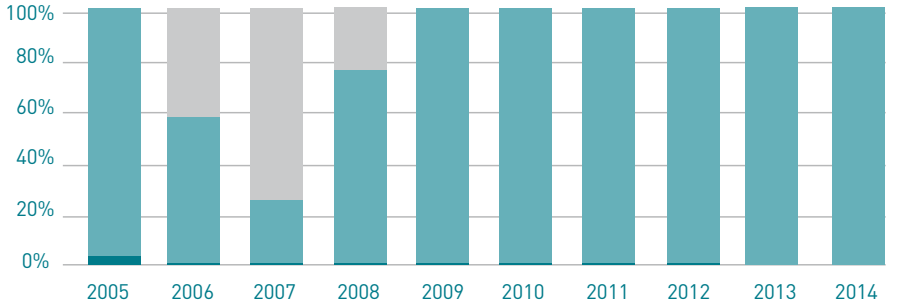


Banking business models in Ireland (% of assets)

Banking business models in Italy (% of assets)

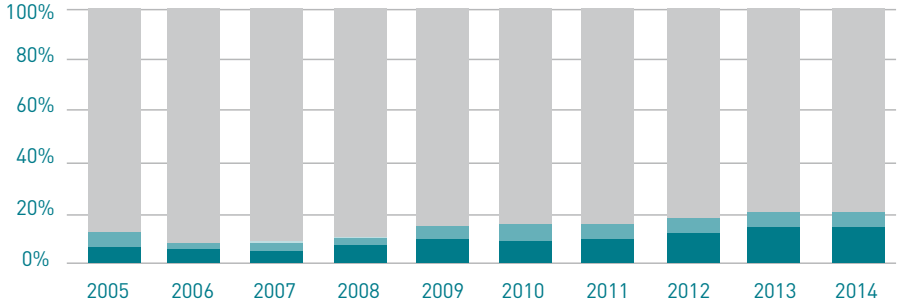


Banking business models in the Netherlands (% of assets)

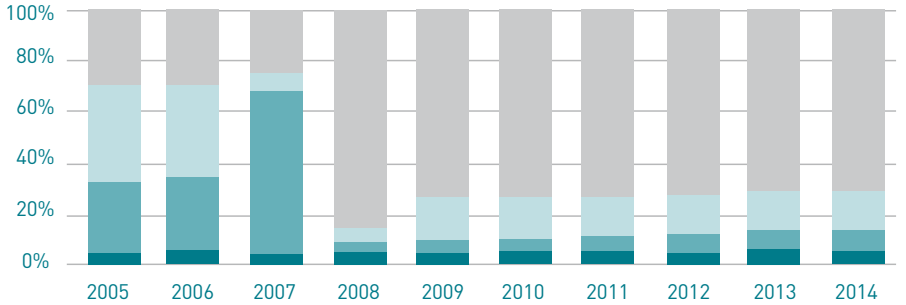


Banking business models in Spain (% of assets)

Banking business models in Switzerland (% of assets)



Banking business models in United Kingdom (% of assets)



Source: Authors

Appendix V.
Calculation of Z-score

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

$$\pi_{jt} + E_{jt} < 0. \tag{A1}$$

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

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

where ϕ 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:

$$D_{jt} = \frac{-\left(E_{jt}/TA_{jt}\right) - \mu_j}{\sigma_j}\,, \tag{A3}$$

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 2005-2014.

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

$$Z_{jt} = -D_{jt}. \tag{A4}$$

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

Appendix VI. Assumptions on NSFR

The assumptions for the net stable funding ratio (NSFR) are similar to those put forward in IMF (2011). Introduced by the Basel Committee on Banking Supervision (BCBS, 2010a), 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, in order 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 is 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 present in the study. Although comparable to the measure developed by 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
AVAILABLE STABLE FUNDING	
Customer deposits	85%
Deposits from banks	0%
Derivative liabilities (negative, fair-value)	0%
Debt liabilities	50%
Equity & reserves	100%

Balance sheet items	Factors
REQUIRED STABLE FUNDING	
Cash	0%
Customer loans	80%
Loans to banks	0%
Derivative assets (positive, fair-value)	90%
Trading assets	50%

Source: Ayadi et al. (2012)

Appendix VII.
List of Systemic 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 Holdings Plc	UK	Commercial	2,176,062	71%	2005-14	D1, D2, I
2	BNP Paribas SA	FR	Commercial	2,077,758	65%	2005-14	I
3	Crédit Agricole Group	FR	Cooperative	1,762,763	51%	2005-14	I
4	Barclays Plc	UK	Commercial	1,748,934	30%	2005-14	I
5	Deutsche Bank AG	DE	Commercial	1,708,703	-22%	2008-14	I
6	Royal Bank of Scotland Group Plc	UK	Nationalised	1,353,345	20%	2005-14	D1, I
7	Société Générale SA	FR	Commercial	1,308,170	57%	2005-14	I
8	Banco Santander SA	ES	Commercial	1,266,296	57%	2005-14	D1, D2
9	Groupe BPCE	FR	Cooperative	1,223,298	19%	2009-14	D2
10	Lloyds Banking Group Plc	UK	Commercial	1,101,075	144%	2005-14	D2
11	ING Groep N.V.	NL	Commercial	992,856	-19%	2006-14	D2, I
12	UBS Group AG	CH	Commercial	883,722	-33%	2005-14	I
13	UniCredit SpA	IT	Commercial	844,217	7%	2005-14	D1, D2
14	Credit Suisse Group AG	CH	Commercial	766,432	-2%	2006-14	I
15	Crédit Mutuel Group	FR	Cooperative	706,720	62%	2005-14	D2
16	Rabobank Group	NL	Cooperative	681,086	34%	2005-14	D2
17	Nordea Bank AB	SE	Commercial	669,342	106%	2005-14	D2
18	Intesa Sanpaolo SpA	IT	Commercial	646,427	136%	2005-14	D2
19	Banco Bilbao Vizcaya Argentaria, SA	ES	Commercial	631,942	61%	2005-14	D1, D2

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)
20	Commerzbank AG	DE	Commercial	557,609	25%	2005-14	D1, D2, I
21	Danske Bank A/S	DK	Commercial	463,510	42%	2005-14	D2
22	Deutsche Zentral-Genossenschaftsbank AG	DE	Cooperative	402,543	0%	2005-14	I
23	ABN AMRO Group NV	NL	Nationalised	386,867	-61%	2006-14	D2, I
24	Fundación Bancaria Caixa d'Estalvis i Pensions de Barcelona, "la Caixa"	ES	Savings	351,269	95%	2005-13	D1, D2
25	Svenska Handelsbanken AB	SE	Savings	297,233	76%	2005-14	D2
26	DNB ASA	NO	Savings	291,863	116%	2005-14	D2
27	Skandinaviska Enskilda Banken AB	SE	Commercial	278,720	38%	2005-14	D2
28	BFA, Sociedad Tenedora de Acciones, SAU	ES	Nationalised	269,159	-17%	2010-13	D1, D2, I
29	Landesbank Baden-Württemberg	DE	Savings	266,230	-34%	2005-14	W, I
30	Dexia SA	BE	Nationalised	247,120	-51%	2005-14	D2, I
31	KBC Group NV	BE	Commercial	245,174	-25%	2005-14	D1, D2, I
32	Bayerische Landesbank	DE	Savings	232,124	-32%	2005-14	D1, D2, W
33	Swedbank AB	SE	Commercial	223,852	76%	2005-14	D2
34	La Banque Postale	FR	Public	212,839	99%	2005-14	W, I
35	NORD/LB Norddeutsche Landesbank Girozentrale	DE	Savings	197,607	0%	2005-14	D1, D2
36	Erste Group Bank AG	AT	Savings	196,287	29%	2005-14	D1

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)
37	Nykredit Holding A/S	DK	Savings	195,734	52%	2006-14	D2
38	Belfius Banque SA	BE	Nationalised	194,407	-15%	2005-14	D1, W, I
39	Banca Monte dei Paschi di Siena SpA	IT	Savings	183,444	19%	2005-14	D2
40	Landesbank Hessen-Thüringen Girozentrale	DE	Savings	179,489	9%	2005-14	D2
41	Banco de Sabadell, SA	ES	Savings	163,346	212%	2005-14	F, D1, D2
42	Banco Popular Español SA	ES	Commercial	161,457	108%	2005-14	F, D1, D2
43	Raiffeisen Gruppe Switzerland	CH	Cooperative	156,695	111%	2007-14	F
44	NV Bank Nederlandse Gemeenten	NL	Public	153,505	70%	2006-14	D2
45	Raiffeisen Zentralbank Österreich AG	AT	Cooperative	144,929	54%	2005-14	D1
46	NRW.BANK	DE	Public	143,843	6%	2006-14	D2, I
47	Zürcher Kantonalbank	CH	Public	131,477	139%	2005-14	D1
48	Bank of Ireland	IE	Nationalised	129,800	2%	2005-14	D2
49	SNS REAAL NV	NL	Nationalised	124,806	83%	2005-14	D2, I
50	Banco Popolare Società Cooperativa	IT	Cooperative	123,082	79%	2006-14	D2
51	Unione di Banche Italiane SCpA	IT	Cooperative	121,787	77%	2005-14	D2
52	National Bank of Greece SA	GR	Nationalised	115,464	51%	2006-14	F, D1
53	DekaBank Deutsche Girozentrale	DE	Savings	113,175	-2%	2005-14	W, I
54	OP Financial Group	FI	Cooperative	110,427	109%	2005-14	D2
55	HSH Nordbank AG	DE	Savings	110,082	-41%	2005-14	D2

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)
56	Allied Irish Banks, Plc	IE	Nationalised	107,455	-19%	2005-14	D1, D2
57	Volkswagen Financial Services AG	DE	Commercial	107,231	170%	2005-14	D2
58	Landesbank Berlin Holding AG	DE	Savings	102,437	-29%	2005-13	I
59	Caixa Geral de Depósitos SA	PT	Savings	100,152	16%	2005-14	D1, D2
60	PostFinance Ltd.	CH	Commercial	99,952	5%	2013-14	I
61	Westdeutsche Genossenschafts-Zentralbank AG	DE	Cooperative	94,873	29%	2005-14	D1, W, I
62	Piraeus Bank SA	GR	Nationalised	89,290	279%	2005-14	F, D1
63	Landwirtschaftliche Rentenbank	DE	Public	88,846	15%	2005-14	W
64	Nederlandse Waterschapsbank NV	NL	Public	88,249	151%	2006-14	D2
65	Société de Financement Local SA	FR	Public	88,002	43%	2006-14	D2
66	Banco Comercial Português SA	PT	Commercial	76,361	-1%	2005-14	F, D2
67	Hypo Real Estate Holding AG	DE	Nationalised	75,566	-50%	2005-14	D2
68	Eurobank Ergasias SA	GR	Nationalised	75,518	70%	2005-14	F, D1
69	Alpha Bank AE	GR	Nationalised	72,935	66%	2005-14	F, D1, D2
70	Jyske Bank A/S	DK	Commercial	72,711	283%	2005-14	D1, D2, I
71	Mediobanca - Banca di Credito Finanziario SpA	IT	Commercial	70,464	84%	2005-14	D2
72	Landeskreditbank Baden-Württemberg–Förderbank	DE	Public	70,190	41%	2005-14	D2, I

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)
73	Julius Bär Gruppe AG	CH	Commercial	68,398	141%	2007-14	D1, I
74	Novo Banco, SA	PT	Nationalised	65,417	6%	2006-14	D1, D2
75	Fundación Bancaria Ibercaja	ES	Savings	63,118	106%	2005-13	F, D1, D2
76	Banca popolare dell'Emilia Romagna SC	IT	Cooperative	60,653	40%	2005-14	F, D2
77	Kutxabank, SA	ES	Savings	59,413	213%	2006-14	F
78	Powszechna Kasa Oszczednosci Bank Polski SA	PL	Savings	57,870	143%	2005-14	F, D1
79	Bankinter SA	ES	Savings	57,333	41%	2005-14	F, D2
80	ABANCA Corporación Bancaria, SA	ES	Nationalised	54,142	-19%	2010-14	F, D1
81	Caisse de Refinancement de l'Habitat	FR	Commercial	53,134	7%	2011-13	I
82	Iccrea Holding SpA	IT	Cooperative	49,667	250%	2005-14	F, D1, D2, W
83	Aareal Bank AG	DE	Commercial	49,557	26%	2005-14	D1, D2
84	Banca Popolare di Milano Scarl	IT	Cooperative	48,272	27%	2005-14	D1, D2
85	Banca Popolare di Vicenza SCpA	IT	Cooperative	46,475	96%	2006-14	F, D1, D2
86	Banco Mare Nostrum, SA	ES	Nationalised	43,835	-37%	2010-14	F, D1, I
87	Liberbank, SA	ES	Savings	43,137	-19%	2010-14	F, D1, D2
88	AXA Bank Europe SA	BE	Commercial	42,642	100%	2007-14	D1, D2
89	Banco BPI SA	PT	Commercial	42,629	41%	2005-14	D1, D2
90	Fundación Bancaria Unicaja	ES	Savings	41,243	46%	2006-13	F, D1
91	Banque et Caisse d'Epargne de l'Etat, Luxembourg	LU	Savings	41,211	4%	2007-14	D1, I

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)
92	HASPA Finanzholding	DE	Savings	40,521	17%	2007-13	F, D1
93	Bpifrance Financement SA	FR	Public	40,188	105%	2009-14	D2, I
94	Raiffeisenlandesbank Oberösterreich AG	AT	Cooperative	38,574	74%	2006-14	D1, D2
95	Banca Carige SpA - Cassa di Risparmio di Genova e Imperia	IT	Commercial	38,310	66%	2005-14	D2
96	Argenta Bank- en Verzekeringsgroep SA	BE	Commercial	37,651	28%	2007-14	D1, D2, I
97	Volksbanken-Verbund	AT	Cooperative	36,678	-39%	2011-14	F, D1, D2
98	Münchener Hypothekenbank eG	DE	Cooperative	36,340	7%	2005-14	D2
99	Permanent TSB Group Holdings Plc	IE	Nationalised	36,293	-41%	2005-14	F, D2
100	Veneto Banca SCpA	IT	Cooperative	36,167	233%	2006-14	F, D2
101	Grupo Cooperativo Cajamar	ES	Cooperative	36,032	86%	2006-14	F
102	Banca Popolare di Sondrio SCpA	IT	Commercial	35,619	150%	2005-14	F, D1
103	Basler Kantonalbank	CH	Public	35,437	128%	2005-14	F, D1
104	Deutsche Apotheker- und Ärztebank eG	DE	Cooperative	35,129	19%	2005-14	F, D2
105	Banque Cantonale Vaudoise	CH	Public	34,924	62%	2005-14	F, D1
106	OTP Bank Nyrt.	HU	Commercial	34,661	68%	2005-14	F, D1
107	Bank für Arbeit und Wirtschaft und Österreichische Postsparkasse AG	AT	Nationalised	34,651	-32%	2006-14	D1, D2
108	Migros Bank AG	CH	Cooperative	33,625	89%	2005-14	F
109	Bank of New York Mellon SA/NV	BE	Commercial	33,381	0%	2009-09	W

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)
110	Precision Capital SA	LU	Commercial	32,483	>10000%	2006-13	I
111	Pictet & Cie Group SCA	CH	Commercial	32,280	0%	2014-14	I
112	State Street Bank Luxembourg SA	LU	Commercial	29,973	54%	2010-13	W
113	Raiffeisenlandesbank Niederösterreich-Wien AG	AT	Cooperative	29,514	105%	2005-14	D1, W, I
114	Bank of Cyprus Public Company Limited	CY	Savings	26,789	8%	2006-14	F, D1
115	Sydbank A/S	DK	Commercial	20,446	54%	2005-14	D1, D2
116	Cooperative Central Bank Ltd.	CY	Cooperative	13,937	333%	2006-14	F, D1, I
117	RBC Investor Services Bank SA	LU	Commercial	13,455	7%	2010-14	W, I
118	Sberbank Europe AG	AT	Commercial	13,214	199%	2005-14	F
119	Getin Noble Bank SA	PL	Commercial	11,996	9177%	2006-11	F, W
120	Nova Ljubljanska Banka d.d.	SI	Nationalised	11,909	-17%	2006-14	D1, D2
121	Bank Handlowy w Warszawie SA	PL	Commercial	11,598	23%	2006-14	D1, I
122	VTB Bank (Austria) AG	AT	Public	9,595	134%	2007-14	D1, W
123	Bank of Valletta Plc	MT	Commercial	8,297	53%	2006-14	D1
124	RCB Bank Ltd.	CY	Commercial	8,054	-24%	2011-14	F
125	Hellenic Bank Public Company Limited	CY	Commercial	7,552	42%	2005-14	D1
126	Bank BPH SA	PL	Commercial	7,355	-56%	2006-14	D1, D2
127	Alior Bank SA	PL	Commercial	7,020	360%	2009-14	F, D1
128	Banque Degroof SA	BE	Commercial	5,621	6%	2008-14	D1, I
129	Bank Ochrony Srodowiska SA	PL	Public	4,579	115%	2006-14	F, D1

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)
130	Nova Kreditna banka Maribor d.d.	SI	Nationalised	4,369	3%	2006-14	D1, D2
131	ABLV Bank, AS	LV	Commercial	4,270	267%	2006-14	F, D1, W, I

Note: The systemic banks included in this list are the banks directly supervised by the ECB, non-Euro area EBA stress tested and Swiss banks with more than € 30 billion (i.e. similar to the main criteria for direct supervision of banks inside the euro area). The business models to which the banks belong for different years are indicated in the column on the right-hand side. The business models are expressed with the first letter of the business models: Focused retail (F), Diversified retail – Type 1 (D1), Diversified retail – Type 2 (D2), Wholesale (W), and Investment (I). 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

The Banking Business Models (BBM) Monitor 2015 Europe is the first comprehensive edition of the International Research Centre on Cooperative Finance (IRCCF) of HEC Montreal's initiative to develop a Global Monitor of bank and credit union business models. The Global Monitor covers Europe, United States of America and Canada. More countries will be added subject to data availability.

The BBM Monitor 2015 for Europe identifies the business models of 2,518 banks covering more than 95% of assets of the European Union plus EFTA countries from 2005 to 2014, which accounts for 13,040 bank-year observations. Using a unique definition and a careful selection of multi-dimensional attributes and the development of state-of-the-art clustering methodologies, the BBM Monitor provides a coherent approach to analyse banks and to monitor their behaviour over time. The publication covers issues such as interaction with ownership structures, internationalisation, migration, financial performance and operational efficiency, contribution to the real economy, risk, resilience and robustness.

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