BBM BANK BUSINESS MODELS

BANKING BUSINESS MODELS MONITOR

EUROPE

Performance, Risk, Response to Regulation and Resolution: 2005-2021

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1. INTRODUCTION

In a changing regulatory context and evolving market structures, bank business models (BBM) analysis emerged as a policy tool to better understand the nature of risk attached to banks and the relative contribution to each identified business model to systemic risk throughout the economic cycle.

This Monitor for Europe provides an updated identification of BBM for 3,503 banking groups and subsidiaries in the European Economic Area (EEA) and Switzerland, accounting for 35,567 bank-year observations, using Ayadi (2019) definition, methodology and financial stability framework.

The financial assessment includes the links with ownership, the migration of business models, the assessment of performance and risks, and how different business models respond to regulation and resolution.

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, whilst 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, whilst maintaining equivalent levels of financial performance and contributing, to a lesser extent, to the accumulation of risk at a system level and being more resilient to extreme stress conditions.

2. THE YEARS OF PANDEMIC

The monitor analyses data from 2005 to 2021. 2020 will be remembered as the year of the COVID pandemic. Countries all over the world have faced an important economic crisis that has affected their economic growth. According to a first estimation of annual growth for 2020, based on seasonally and calendar adjusted quarterly data, GDP fell by 6.8% in the euro area and 6.4% in the EU (Eurostat, 2021).

Table 2.1 The GDP growth in 2020 of main EU countries

Published growth rates of GDP in volume up to 2020Q4*
(based on seasonally adjusted** data)

	Percentage change compared with the previous quarter				Percentage change compared with the same quarter of the previous year			
	2020Q1	2020Q2	2020Q3	2020Q4	2020Q1	2020Q2	2020Q3	2020Q4
Euro area	-3.7	-11.7	12.4	**-0.7**	-3.2	-14.7	-4.3	**-5.1**
EU	-3.3	-11.4	11.5	**-0.5**	-2.6	-13.9	-4.2	**-4.8**
Belgium	-3.4	-11.8	11.6	**0.2**	-2.0	-13.9	-4.3	**-4.8**
Czechia	-3.3	-8.5	6.9	**0.3**	-1.9	-10.8	-5.0	**-5.0**
Germany	-2.0	-9.7	8.5	**0.1**	-2.2	-11.3	-4.0	**-3.9**
Spain	-5.3	-17.9	16.4	**0.4**	-4.2	-21.6	-9.0	**-9.1**
France	-5.9	-13.7	18.5	**-1.3**	-5.7	-18.8	-3.9	**-5.0**
Italy	-5.5	-13.0	16.0	**-2.0**	-5.6	-18.1	-5.1	**-6.6**
Latvia	-2.3	-7.1	7.1	**1.1**	-1.0	-8.6	-2.6	**-1.7**
Lithuania	0.0	-5.9	3.8	**1.2**	2.2	-4.6	-1.6	**-1.3**
Austria	-2.8	-11.6	12.0	**-4.3**	-3.3	-14.2	-4.2	**-7.8**
Portugal	-4.0	-13.9	13.3	**0.4**	-2.4	-16.4	-5.7	**-5.9**
Sweden	0.3	-8.0	4.9	**0.5**	0.7	-7.4	-2.7	**-2.6**

* See "Methods and definitions"
** Growth rates to the previous quarter and to the same quarter of the previous year presented in this table are generally both based on seasonally and calendar adjusted figures since unadjusted data are usually not transmitted for the compilation of GDP flash estimate.

Source dataset: namq_10_gdp

As observed in Table 2.1, the second quarter of 2020 has been the worst one, whilst during the last quarter of 2020 GDP growth returns positive, if compared with the previous quarter. Although compared to the same quarter of the previous year, the GDP growth rate of the last quarter of 2020 remains strongly negative. As we would expect, the situation is not the same for all European countries. The decrease of GDP is more pronounced for Spain (-9.1%), Italy (-6.6%) and Portugal (-5.9%). Some eastern countries show a more contained decrease (e.g., Lithuania and Latvia).
Figure 2 reports the forecasts on GDP growth up to 2026. After a decline in GDP in 2020 and the recovery of 2021, in the subsequent years the expectations are positive for all the main European countries.

Figure 2.1 The growth of GDP forecasting

Source: International Monetary Fund (2023)

However, although the economy is going to return to growth, the pandemic will not pass without a trace on the financial sector and the banking sector.

Capital requirements and liquidity measures

Since March 2020, the European Central Bank (ECB) introduced several measures to ensure that banks could support the real economy. First, a measure on the bank capital requirement has been approved. Banks can disregard the additional capital buffers imposed by Basel 3 Accord. In fact, the ECB allowed the banks to operate temporally below the level of capital defined in the Pillar 2 Guidance, as well as the liquidity coverage ratio. Moreover, given the persisting uncertainty over the economic impact of the coronavirus (COVID-19) pandemic, the ECB expects dividends and share buy-backs to remain below 15% of the cumulated profit for 2019-20 and not higher than 20 basis points of the Common Equity Tier 1 ratio, whichever is lower. Banks that intend to pay dividends or buy back shares need to be profitable and have robust capital trajectories. The aim of these measures is to safeguard the bank's capacity to absorb losses. Banks should continue to use their bank capital and liquidity buffers to both support the real economy through the lending activity and loss absorption.

Asset Quality measures

The measures related to bank asset quality can be distinguished in two main group of measures:

- The NPL recognition
- The NPL provisioning

The ECB increases the flexibility in default recognition and NPL provisioning. In particular, the flexibility regards the classification of debtors as "unlikely to pay" when banks call on public guarantees granted in the context of coronavirus. Moreover, the European Banking Authority (EBA) states that public and private moratoria granted by governments and EU bodies, in response to the COVID-19 pandemic, do not need to be classified as forbearance measures. In addition, the application of public or private moratoria does not automatically trigger the occurrence of a significant increase in credit risk under the IFRS9 framework.

However, although the ECB and EBA allow greater flexibility to banks, they should avoid pro-cyclical assumptions in their models to determine the loan loss provisions. With regard to the NPL provisioning, as COVID-19 is likely to increase the probability of default of a large number of firms and, consequently, of exposures, banks should consider an increase in their loan loss provisions. The ECB invites banks to consider the macroeconomic forecasts, using a top-down approach to mitigate the risk of generalised sift to Stage 2. This is usually because the macroeconomic forecasts and information are available only at a collective level. Consequently, the result may lead to an increase in the probability of default of the entire portfolio, when it is well known that not all clients are the same. Moreover, the ECB suggests to banks that they should use long-term macroeconomic forecasts – only using available historical information if this information is representative for the long-term horizon and when the information takes into consideration at least one or more full economic cycles. Finally, the ECB asks banks to use the macroeconomic forecasts for specific years. Following these indications, banks should be able to better measure loan loss provisions, avoiding excessively procyclical assumptions in their expected credit loss.

Monetary policy measures

During 2020, the European Central Bank reinforced the purchases of assets and introduced the pandemic emergency programme purchase for public and private sector asset (PEPP). Moreover, the ECB enhanced the long-term refinancing operations, increasing the liquidity injected into the banking system. With regard to interest rates, the ECB also decided for 2020 and 2021 to keep interest rates unchanged. At the end of 2020, all these measures were prolonged up to June 2022.

The aim of these measures is to sustain the real economy in absorbing the shock of the crisis and to support households and businesses with access to finance, by relaxing banks' funding constraints.

Governments And Institutions' Measures to Support Bank Borrowers

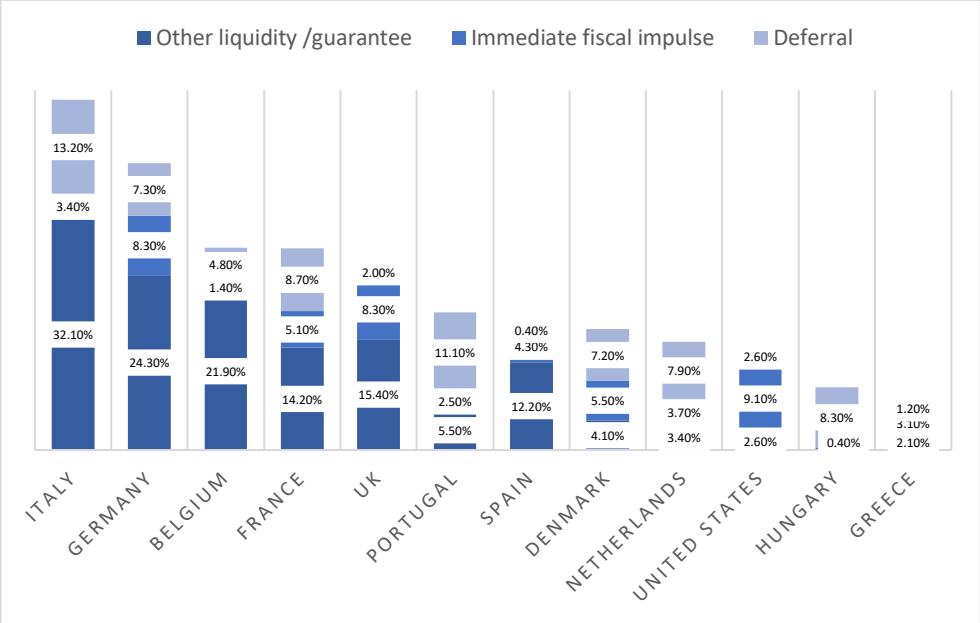
The measures issued by government to support obligors can be distinguished in three main categories:

- *Immediate fiscal measures*: public money has been transferred to companies and families through subsidies and tax exemptions, increasing public deficits and debts.
- *Contingent fiscal measures* such as public guarantees, public loans and tax deferrals: in order to support the real economy and to discourage a credit crunch, governments offer the banking sector the possibility of lending money and requesting a public guarantee on these loans. These kinds of measures do not immediately affect the public accounts, but they could have a substantial impact on the public sectors' accounts in the future, whether or not the loans are repaid and the guarantees collected.
- *Fiscally neutral measures*: governments introduced a moratorium, i.e., the possibility for borrowers to freeze their bank loans. The aim being to prevent the possible wave of defaults that would have been caused by the lockdown measures. In this case, the measure is fiscally neutral because it does not require an investment of public money.

What emerges from this review is that, depending on the type of measures adopted by governments, the costs in terms of an increase of public deficit and debt could be immediate, nil or transposed in the future.

The European Systemic Risk Board (2021) underlines that the most adopted measure is the public guarantees for a total of 1,580 billion euros and, second, is the moratorium (a fiscal-neutral measure) for 838 billion euros. The immediate fiscal measures are the least utilised amongst the three categories. This suggests that governments aim to support the economy, trying to avoid an immediate impact on the public deficits and debts.

Figure 2.2 Governments measures to support real economy (as % of GDP of 2019, Main European countries)



Source: Anderson et al. 2020
https://www.bruegel.org/publications/datasets/covid-national-dataset/Italy

Although data can suffer from an element of potential weakness, Anderson et al. (2020) use data from the Bruegel – a Brussels-based think-thank on data for a sample of EU countries. In Figure 2.2, data on other liquidity/guarantees, immediate fiscal impulse and deferral are reported. The data summarises the amount (as share of GDP of 2019) of these measures by country. It emerges that, depending on the country observed, the measures are used in different manners. In particular, Italy, Germany and Belgium use guarantees a lot along with the other form of liquidity measures. With regard to immediate fiscal impulse, the data shows that they are used more by Germany and the UK. Deferral is adopted more by Italy, Portugal and France. Some countries, such as Hungary and Greece, set aside a low percentage of GDP intended for these support measures.

The main beneficiaries of moratoria are the small-medium enterprises (SMEs). In fact, the EBA (2020) highlights that 60% of the loans subject to EBA-compliant moratoria were given to non-financial companies (NFCs), whilst 40% were given to households. In total, 16% of SME loans were granted moratoria, followed by 12% of commercial real estate loans and 7% of residential mortgage loans.[1]1 With regard to public guarantee schemes (PGSs), the guarantees are directed mainly to

[1]1 See EBA, "First evidence on the use of moratoria and public guarantees in the EU banking sector" November 2020.

NFCs and around 44% of these loans had guarantees in place with a residual maturity of between 2 and 5 years, whilst a further 34% of loans have a guarantee with a residual maturity of between 6 months and one year (EBA, 2020).

Since public measures are crucial in overcoming this period, they have a limited duration. In fact, most moratoria, for example, are due to expire in June 2021, whilst other measures, such as the public guarantees on bank loans, can be requested for a defined amount and for loans that have a specific period of amortisation. This is important to keep in mind because when the measures cease to be in force, whether banks have adopted a moral hazard behaviour in the granting of loans or in the classification of deteriorated positions, the banking sector may face a "cliff edge effect" in the NPLs.

In the rest of the monitor, the results observed for 2020 and 2021 will be discussed, in consideration of the extraordinary nature of the historical period.

3. Business Models Identification

The sample under study in this Monitor is comprised of 3,503 banking groups and subsidiaries in the European Economic Area (EEA) and Switzerland (CH)[2].

Banks are unequally spread across the 32 countries in the EEA and Switzerland. More specifically, we include 2,846 Eurozone banks, 372 EU (non-Eurozone) banks and 287 banks from the four EFTA countries (Switzerland, Iceland, Norway and Liechtenstein). See also Appendix II.

The banks included in the study together account for more than €52 trillion at the end of 2021, which represents more than 95% of the banking assets in the EEA. The sample includes 35,567 bank-year observations and has data for all instruments required to adhere to the business models' framework, as defined in Ayadi (2019).

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 team in a comprehensive datasheet for the business models' analysis.

The database covers the period from 2005 to 2021. The balance sheet and profit and loss statement data were retrieved from S&P IQ Capital for more than 3,000 banks, of which there has only been comprehensive coverage from 2010 onwards. The market data was obtained from Bloomberg, Markit and Refinitiv.

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 3.1.

The activities and funding indicators cover almost the entire balance sheet and are considered as instruments for the clustering analysis, as defined in Ayadi (2019).

Hence, loans to banks, loans to customers and trading assets on average cover 91% and 93% of the assets side of bank balance sheets, respectively. In turn, on average, 93% 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, the

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

coverage ranging between 89% and 93%. The situation is more contrasted for riskiness and regulatory indicators, with the coverage ranging between 2.24% and 100%. In particular, some riskiness and regulatory indicators are covered in less than 5% of the entries. Whilst 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 3.1 Description of indicators used in the 2023 Monitor

Variable	Coverage	Mean	Std. dev.	Min.	Max.
BALANCE SHEET INDICATORS					
Loans to banks (% of assets)	92.63%	0.109	0.133	0.000	1.000
Customer loans (% of assets)	93.32%	0.575	0.211	0.000	1.000
Trading assets (% of assets)	91.90%	0.268	0.177	-0.905	1.000
Bank liabilities (% of assets)	92.97%	0.121	0.131	0.000	1.221
Customer deposits (% of assets)	93.27%	0.652	0.229	0.000	7.753
Debt liabilities (% of assets)	88.49%	0.120	0.183	-0.306	3.333
Derivative exposure (% of assets)	88.96%	0.007	0.035	0.000	0.758
Tang. comm. eq. (% tang. assets)	92.82%	0.103	0.094	-1.056	1.000
OWNERSHIP					
Shareholder-value (dummy var.)	100,00%	0.255	0.436	0.000	1.000
Commercial (dummy var.)	100,00%	0.242	0.429	0.000	1.000
Nationalised (dummy var.)	100,00%	0.012	0.108	0.000	1.000
Stakeholder-value (dummy var.	100,00%	0.745	0.436	0.000	1.000
Cooperative (dummy var.)	100,00%	0.486	0.500	0.000	1.000
Savings (dummy var.)	100,00%	0.235	0.424	0.000	1.000
Public (dummy var.)	100,00%	0.026	0.158	0.000	1.000
Listed on stock exchange (dummy var.)	100,00%	0.093	0.290	0.000	1.000
PERFORMANCE					
Return on assets (RoA)	92.86%	0.005	0.054	-5.643	1.933
Return on equity (RoE)	92.31%	0.052	0.198	-8.151	12.441
Cost-to-income ratio (CIR)	91.77%	0.794	10.679	-584.111	1330.722
Net interest income (% of total income)	91.69%	0.665	1.347	-18.788	226.188
Trading income (% of total income)	89.88%	0.030	1.344	-227.313	24.478
Commission & fee income (% of total income)	91.51%	0.236	0.382	-38.332	17.708
Other income (% of total income)	89.74%	0.068	0.396	-22.680	46.040
Customer loan growth (% change)	68.50%	1.318	97.932	-1.000	11754
RISKINESS					
Z-score (no. of std. dev. from default)	92.69%	58.147	58.022	-15.756	1301.857
Loan loss provisions (% of gross customer loans)	75.98%	-0.003	1.285	-206.290	26.715
Non-performing loans (% of gross customer loans)	62.04%	0.034	0.070	0.000	2.718
Stock returns (avg. daily returns)	7.00%	0.008	0.116	-0.691	4.205
Stock returns (std. dev. daily returns)	7.00%	0.026	0.058	-0.165	1.669
CDS spread (senior annual avg.)	2.24%	1.758	2.518	0.000	20.043
CDS spread (senior annual std. dev.)	2.24%	0.433	0.794	0.000	7.322
Srisk	100.000%	0.006	0.067	0.000	1.000
REGULATION					
Risk-weighted assets (RWA) (% of assets)	81.31%	0.565	0.672	0.000	69.550
Tier 1 capital ratio (% of risk-weighted assets)	79.28%	0.135	0.107	-0.210	5.535
Tangible common equity (% tang. assets)	92.82%	0.103	0.094	-1.056	1.000
MREL	87.80%	4.310	191.002	-10432	22467.436

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 3.1 are used as a basis for the identification of distinct business models, based on the Activity/Funding (A/F) definition we have adopted[3].

In the second phase, the business models and ownership structures are evaluated over time, in terms of economic performance, risk and response to regulation and resolution.

To identify the bank business model, we use the clustering methodology and the SAS codes[4].

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.[5] 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.

First, Table 3.1 gives the descriptive statistics of the five models resulting from the cluster analysis on the sample of banks in Europe during the overall period of analysis (2005-2021), based on the five instruments used to define them.

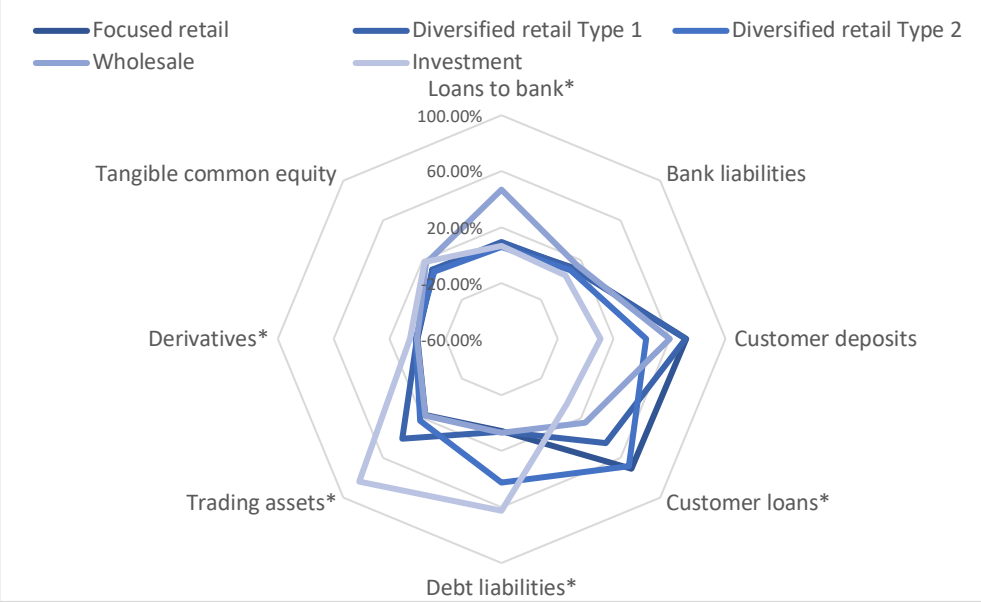
Second, an overview of the main structural and financial attributes of the business models is provided. Third, a complementary analysis is performed on the ownership structures of banks to better understand the interaction.

[3] Ayadi et al (2016) and Ayadi (2019).

[4] Used in Ayadi et al (2016) and Ayadi (2019). As a reminder: the 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, whilst 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.

[5] 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.

Figure 3.1 Comparison of business models in banks in Europe, 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 C*ustomer deposits* represent the balance sheet share of deposits from and loans to non-bank customers, respectively. *Bank liabilities* and *bank loans* identify the share of liabilities of and loans to other banks, including bank deposits, issued debt, interbank transactions and received funding from central banks. *Debt liabilities* are calculated by netting customer deposits, bank liabilities, total equity and negative fair values of all derivative transactions from total liabilities. *Derivative exposures* capture 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

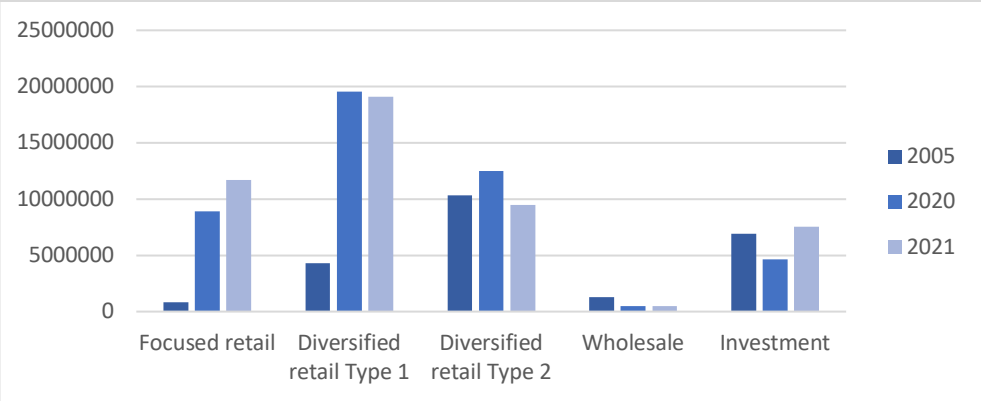
Focused retail, Diversified retail type 1 and Diversified retail type 2 represent the retail-oriented banks, which are relatively more active in lending to customers. Hence, customer loans account for 70.98%, 45.10% and 68.77% of the total assets, on average surpassing, or very close to, the sample averages.

Looking at the differences between the various retail-oriented banking models, Focused retail-banks are, on average, most active in the classical deposit-loan intermediation. Customer deposits account for 71.94% of the total funding (total liabilities including equity), whilst customer loans account for 70.98% of total assets. The remaining exposures, such as trading assets and bank loans, are relatively limited with, respectively, 16.93% and 8.41%. The Focused retail model represents about a quarter of the sample and includes the smallest banks amongst the retail-oriented models, both in terms of total and average assets (see Appendix III).

The other two retail models show a greater diversification in their activities and funding. Diversified retail type 1 has relatively more trading assets and bank loans, 40.44% and 9.43% respectively. The funding is comparable to Focused retail model, with a relatively high dependence

on customer deposits and limited reliance on both bank deposits and debt liabilities. Diversified retail type 1 represents about 30% of the observations in the sample and 35.56% of the total assets.

Figure 3.2 Total size of business models, 2005-2021



Source: Authors

Diversified retail type 2 has more diverse assets and liabilities than the Focused retail model. It has significantly more trading assets than Focused retail, with trading assets accounting for 22.25% of the total assets. The main difference with the other retail-oriented models, however, is the funding. Amongst the different business models, Diversified retail type 2 relies most on debt liabilities, 42.53%, although this model represents only about 12% of the observations.

The **Wholesale** model 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 46.82% of total assets, whilst trading assets account for 17.23% of their balance sheets. These banks are substantially less leveraged than their peers, with a high tangible common equity ratio of 16.46%. In fact, the average of the five clusters is equal to 12.51% and, with the exception for Investment banks that show 18.09% of tangible common equity over total assets, the other three business models show a tangible common equity ratio lower than 10%. However, compared to the previous Monitor, it is possible to observe a positive and increasing trend in the tangible common equity of all the BBMs, suggesting an increase in bank capitalisation.

The Wholesale banks 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, 15.31% of the total assets. In turn, customer loans account for only 24.55% 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.

The last model groups together large investment-oriented banks; these banks have substantial trading activities. The cluster averages for trading assets and derivative exposures represents

respectively 83.94% and 5.36% of total assets. In funding, the focus is on less stable and less traditional sources, such as debt liabilities.
In what follows, this model 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.
When looking at the shares of asset across countries (Appendix V), banks in eastern, central and southern European countries are predominately retail oriented, whereas in France, the UK and Switzerland they are investment oriented. The trends from 2005 to 2021 are consistent and relatively stable, except for Switzerland, where banks have migrated from investment and wholesale to retail-oriented business models.

Table 3.2 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	8.41%**	70.98%**	16.93%*	12.42%**	71.94%**	5.71%**	0.17%**	9.71%**
	Min..	0.00%	33.08%	-90.45%	0.00%	0.00%	-30.55%	0.00%	2.78%
	Max.	40.20%	100.00%	35.24%	122.09%	121.49%	100.00%	11.66%	99.36%
	St.Dev.	7.27%	9.40%	8.37%	0.12	13.22%	6.44%	0.63%	5.96%
	Obs	16,742	16803.00	16,656.00	16,767	16799.00	16080.00	16119.00	16731
Model 2 – Diversified retail (Type 1)	Mean	9.43%**	45.10%**	40.44%**	11.58%***	71.54%**	6.25%**	0.70%**	9.89%***
	Min..	0.00%	0.00%	0.48%	0.00%	0.00%	-0.20%	0.00%	5.58%
	Max.	37.26%	63.94%	92.13%	95.75%	166.70%	47.79%	73.16%	99.96%
	St.Dev.	7.09%	12.14%	10.84%	0.12	17.26%	8.01%	3.51%	7.82%
	Obs	10,635	10667.00	10,554.00	10,639	10660.00	10243.00	10279.00	10618
Model 3 – Diversified retail (Type 2)	Mean	5.91%***	68.77%***	22.25%**	9.63%**	43.30%**	42.53%***	1.43%**	8.40%***
	Min..	0.00%	17.43%	-36.86%	0.00%	0.00%	10.74%	0.00%	2.91%
	Max.	56.37%	99.31%	55.39%	62.44%	775.33%	224.30%	31.03%	99.34%
	St.Dev.	5.87%	11.77%	10.03%	0.09	24.26%	17.97%	2.98%	5.53%
	Obs	4,126	4193.00	4,064.00	4,151	4187.00	3631.00	3684.00	4133
Model 4 – Wholesale	Mean	46.82%***	24.55%*	17.23%**	15.31%**	60.20%**	6.94%**	0.51%**	16.46%**
	Min..	0.00%	0.00%	-61.03%	0.00%	0.00%	-0.24%	0.00%	1.41%
	Max.	100.00%	57.43%	64.59%	99.49%	99.96%	103.10%	53.33%	100.00%
	St.Dev.	19.90%	17.38%	12.98%	0.24	32.61%	14.13%	2.99%	18.66%
	Obs	2,666	2698.00	2,645.00	2,701	2707.00	2616.00	2624.00	2694
Model 5 – Investment	Mean	6.63%**	5.90%**	83.94%***	4.49%**	10.71%**	62.64%**	5.36%*	18.09%**
	Min..	0.00%	0.00%	11.12%	0.00%	0.00%	-7.78%	0.00%	1.02%
	Max.	98.80%	41.80%	100.00%	89.85%	101.36%	333.33%	75.84%	100.00%
	St.Dev.	11.45%	9.26%	17.89%	0.11	20.13%	32.03%	12.06%	25.26%
	Obs	1,098	1159.00	1,087.00	1,132	1147.00	1106.00	1139.00	1156
All banks	Mean	**11.27%**	**57.30%**	**26.74%**	**11.81%**	**65.57%**	**11.81%**	**0.67%**	**10.40%**
	Min..	**0.00%**	**0.00%**	**-90.45%**	**0.00%**	**0.00%**	**-30.55%**	**0.00%**	**1.02%**
	Max.	**100.00%**	**100.00%**	**100.00%**	**122.09%**	**775.33%**	**333.33%**	**75.84%**	**100.00%**
	St.Dev.	**13.52%**	**21.09%**	**17.78%**	**0.13**	**22.88%**	**18.41%**	**3.38%**	**9.58%**
	Obs	**35,267**	**35520.00**	**35,006.00**	**35,390**	**35500.00**	**33676.00**	**33845.00**	**35332**

***Notes**:* The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. *Source:* Authors

Table 3.3 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	12.63%**	50.42%***	28.36%**	11.62%**	57.74%***	16.68%**	1.66%**	12.12%***
	Min.	0.00%	0.00%	-40.05%	0.00%	0.00%	0.00%	0.00%	1.21%
	Max.	100.00%	99.58%	100.00%	99.49%	108.04%	245.79%	73.16%	100.00%
	St.Dev.	16.93%	25.77%	21%	16.03%	28.11%	21.89%	5.78%	14.01%
	Obs	8,617	8716.00	8,512.00	8,669	8711.00	8443.00	8508.00	8659
Cooperative	Mean	11.79%**	58.75%***	26.57%**	12.09%***	69.28%**	8.84%***	0.17%***	9.91%**
	Min.	0.00%	0.00%	-61.03%	0.00%	0.00%	-30.55%	0.00%	2.91%
	Max.	100.00%	99.00%	100.00%	98.12%	121.49%	100.00%	46.45%	99.89%
	St.Dev.	12.33%	18.05%	16%	11.49%	19.33%	16.23%	1.19%	6.88%
	Obs	17,555	17645.00	17,460.00	17,598	17633.00	16589.00	16655.00	17558
Nationalised	Mean	6.99%**	56.37%**	29.21%**	11.39%***	53.93%**	20.55%***	4.09%***	9.15%**
	Min.	0.00%	0.00%	0.75%	0.00%	0.00%	0.06%	0.00%	1.42%
	Max.	44.86%	88.71%	100.00%	61.17%	92.88%	94.27%	75.84%	99.94%
	St.Dev.	7.51%	19.14%	16.94%	12.12%	24.68%	18.70%	7.93%	14.96%
	Obs	411	421.00	410.00	419	420.00	411.00	414.00	420
Public	Mean	10.73%***	59.72%**	22.82%***	10.62%**	57.98%**	21.03%**	1.43%**	9.06%***
	Min.	0.00%	0.00%	0.06%	0.00%	0.00%	-2.71%	0.00%	0.00%
	Max.	97.63%	98.96%	100.00%	96.57%	94.35%	93.89%	39.87%	95.51%
	St.Dev.	15.19%	24.43%	17.44%	15.03%	26.86%	22.06%	3.70%	8.86%
	Obs	928	934.00	921.00	932	934.00	906.00	908.00	929
Savings	Mean	8.87%**	61.45%***	25.67%***	11.52%*	67.45%***	11.28%*	0.35%***	9.82%***
	Min.	0.00%	0.00%	-90.45%	0.00%	0.00%	-0.24%	0.00%	-1.58%
	Max.	100.00%	100.00%	100.00%	122.09%	775.33%	333.33%	53.33%	100.00%
	St.Dev.	11.35%	19.47%	16.16%	11.62%	20.46%	16.34%	1.70%	8.09%
	Obs	7,756	7804.00	7,703.00	7,772	7802.00	7327.00	7360.00	7766
All banks	Mean	11.27%	57.30%	26.74%	11.81%	65.57%	11.81%	0.67%	10.40%
	Min.	0.00%	0.00%	-90.45%	0.00%	0.00%	-30.55%	0.00%	-1.58%
	Max.	100.00%	100.00%	100.00%	122.09%	775.33%	333.33%	75.84%	100.00%
	St.Dev.	13.52%	21.09%	17.78%	0.13	22.88%	18.41%	3.38%	9.58%
	Obs	35,267	35520.00	35,006.00	35,390	35500.00	33676.00	33845.00	35332

***Notes**:* The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. *Source:* Authors

***Source**:* Author

4. BUSINESS MODELS AND OWNERSHIP

The descriptive statistics for the main variables describing the activities and funding strategies across ownership structures[6] are provided in Table 3.3, for the whole period.

The commercial banks account for most of the banking assets (59.42%), whilst only accounting for 24.57% of the total number of banks in the sample. The commercial banks are, on average, less active in retail activities than other ownership structures. Customer loans are 50.42% compared to the sample average of 57.30% and customer deposits are 57.74% compared to the average of 65.57%. 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 12.12%, which is significantly above the capital levels for the other ownership structures (on average 10.40%).

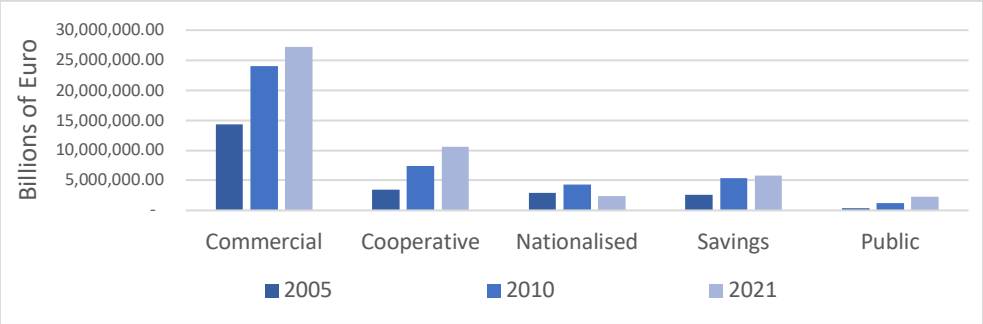
The cooperative banks are, at around 49.66% of the observations, the largest group of banks in the sample, while only accounting for 18.75% of the assets. The activities of cooperative banks are relatively more retail oriented. Customer loans and deposits are respectively 58.75% and 69.28%. Despite their retail orientation, the average inter-bank and trading activities are still sizeable. Bank loans and trading assets are respectively 11.79% and 26.57%.

The nationalised banks are, in number, the smallest group, representing only 1.18%. The restrictions put on recapitalisation make it less likely that small banks are being nationalised.[7] The nationalised banks are relatively more active in market activities, i.e., the 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 derivatives and the second highest share in debt liabilities, second only to the share underlined by public banks. The nationalised banks have, on average, the lowest capital level of all the ownership structures.

[6] See description on ownership structure in Ayadi (2019).

[7] 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).

Figure 4.1 Total size of ownership structures, 2005-2021



Source: **Authors**

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 (21.03% compared to 11.81% for the entire sample) and derivative liabilities (1.43% compared to 0.67%), whilst they depend less on customer deposits (57.98% compared to 65.57%).
The savings banks form a quarter of the banks in the sample, but only 11.57% as a share of the total assets (See also Figure 4.1). 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 61.45% and 67.45%. The average inter-bank and trading activities are still substantial, but slightly less than those of cooperative banks, at 8.87% and 25.67% respectively.
From a country perspective, there is a great dominance of commercial banking in Europe, particularly in Eastern Europe. Cooperatives and savings banks are active in countries like Austria, France, the Netherlands, and Norway[8].

[8] In this Monitor, we do not include credit unions in the analysis.

Table 4.1 Ownership attributes of business models (% of institutions) (for 2005-2021)

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Commercial	19.25%***	23.49%***	30.77%**	40.02%**	52.69%**	24.57%
Nationalised	0.86%***	1.19%**	2.57%***	0.66%**	2.05%**	1.18%
Shareholder-value	22.06%	31.01%	18.77%	57.40%	49.13%	24.79%
Cooperative	52.27%***	53.58%***	38.81%***	44.12%**	28.23%**	49.66%
Savings	2.75%**	1.67%**	4.30%***	2.88%***	3.08%***	2.63%
Public	24.88%**	20.07%***	23.55%**	12.32%***	13.94%***	21.96%
Stakeholder-value	77.94%	68.99%	81.23%	42.60%	50.87%	75.21%
Listed on stock exchange	7.44%	7.04%	21.86%	3.10%	11.21%	8.82%

(% of institutions) (for 2021)

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Commercial	19.33%***	24.51%**	22.01%***	38.62%**	60.00%***	23.06%
Nationalised	0.66%***	2.86%**	0.56%***	0.69%***	2.00%**	1.20%
Shareholder-value	18.67%	25.94%	18.66%	47.59%	64.00%	23.19%
Cooperative	54.03%***	48.30%***	44.85%***	50.34%**	12.00%**	50.11%
Savings	1.97%***	2.50%**	4.46%**	2.07%***	6.00%***	2.58%
Public	24.01%***	21.82%**	28.13%**	8.28%***	20.00%***	23.06%
Stakeholder-value	81.33%	74.06%	81.34%	52.41%	36.00%	76.81%
Listed on stock exchange	6.83%	10.02%	11.98%	4.14%	12.00%	8.33%

Notes: The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. *Source:* Authors

Source: Author

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Turning to the variation in ownership structures in terms of number of institutions, Table 4.1 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. The highest share of listed banks can be found amongst the diversified retail (type 2) banks (21.86%). On the other hand, wholesale and investment banks are shareholder banks, with a higher share of commercial banks. However, wholesale banks show the lowest percentage of listed banks (3.10%).

The second part of Table 4.1 shows the relationship between ownership structure and business models in terms of number of institutions, with regard to the last year observed (2021). The data shows that, in the last year, banks with a specific ownership structure adopt different business models compared to the past. In fact, in 2021, the number of shareholder value banks that adopt the diversified retail (type 1) model, with a percentage of 25.94, is higher than the percentage observed on average for the whole period. Contrary to this, the stakeholder value banks more adopt the diversified retail (type 2) model in 2021, whilst a decrease in the adoption of the other BMs is observed. However, stakeholder banks remain oriented to retail activities. These findings suggest that shareholder banks increase activity aimed at the market, whilst stakeholder banks become more retail oriented and inter-bank oriented, lowering the adoption of more market- oriented business models

.

Table 4.2 Distribution of ownership structures across business models (2005-2021, % of assets)

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Commercial	33.53%***	62.38%***	51.38%**	23.47%**	90.90%**	33.53%
Nationalised	5.75%***	12.34%***	7.94%***	2.40%***	1.62%***	5.75%
Shareholder	59.43%	25.27%	40.30%	68.24%	5.11%	32.66%
Cooperative	27.46%**	16.81%**	24.47%**	20.48%**	2.48%**	18.75%
Public	7.55%***	0.97%***	2.74%***	27.68%***	2.24%***	3.09%
Savings	25.72%**	7.50%**	13.48%**	25.97%***	2.76%***	11.57%
Stakeholder	40.57%	74.73%	59.70%	31.76%	94.89%	67.34%
Listed on stock exchange	41.68%	71.80%	58.63%	1.93%	67.50%	61.44%

(2021, % of assets)

	Model 1 - Focused retail	Model 2 – Diversified retail (Type 1)	Model 3 – Diversified retail (Type 2)	Model 4 – Wholesale	Model 5 – Investment	ALL
Commercial	59.82%***	43.81%***	44.44%***	82.76%**	39.85%**	56.47%
Nationalised	9.25%**	0.15%**	4.48%***	1.31%***	0.01%***	4.98%
Shareholder	47.69%	30.45%	57.10%	14.27%	48.77%	37.39%
Cooperative	19.62%***	33.07%***	27.71%***	2.26%***	32.09%***	21.56%
Public	1.72%**	6.64%**	4.15%**	10.25%***	24.80%***	4.83%
Savings	9.58%***	16.34%***	19.23%***	3.43%***	3.25%***	12.15%
Stakeholder	52.31%	69.55%	42.90%	85.73%	51.23%	62.61%
Listed on stock exchange	55.88%	68.49%	43.11%	57.70%	2.39%	58.16%

Notes: The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. *Source:* Authors

Source: Authors

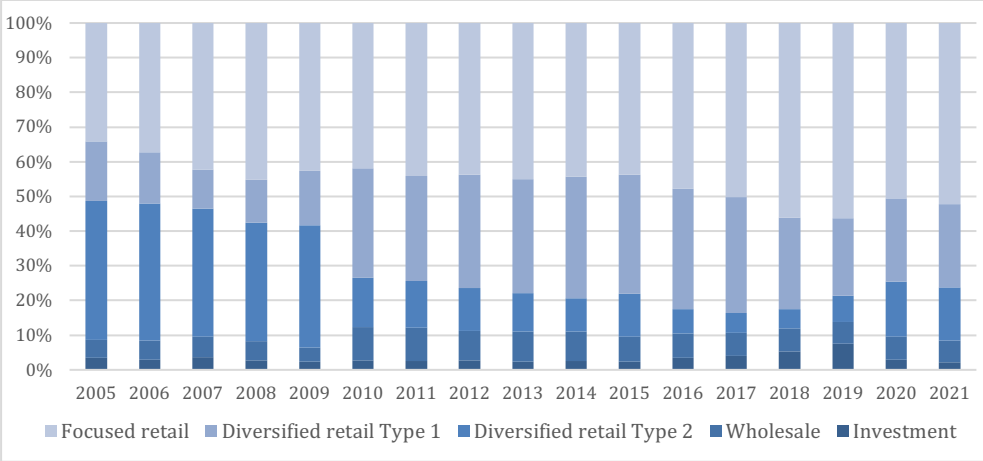
In terms of assets, the results are substantially different. As shown in *Table 4.2*, the dominance of the commercial banks amongst the investment-oriented banks is more apparent, whilst the share of wholesale bank assets is marginal. The commercial banks represent 40.02% of the wholesale banks in number, but only 23.47% of the assets. In turn, the public banks only represent 12.32% of the banks, but 27.68% 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 (25.97%), whilst the share in investment bank assets is marginal (2.76%). Second only to the commercial banks, cooperative banks have relatively the largest share of the retail-oriented bank assets (mainly retail focused), except for retail diversified (type 1). In fact, in Focused retail, the cooperative banks represent 27.46% of total assets and in Diversified retail (type 2) they represent 24.47% of total assets. Instead, in Diversified retail (type 1) they represent 16.81% of total assets. Additionally, in this last business model, the third ownership structure in terms of total assets, is represented by nationalised banks (12.34%).

Also, in terms of assets, the situation changes when we look at the data referring to 2021. Here, commercial banks represent 39.85% and 82.76% respectively of wholesale and investment business models - a very high percentage compared to the average value of the total period. In 2021, in terms of total assets, shareholder banks represent a higher share, thanks to stakeholder banks in all the bank business models.

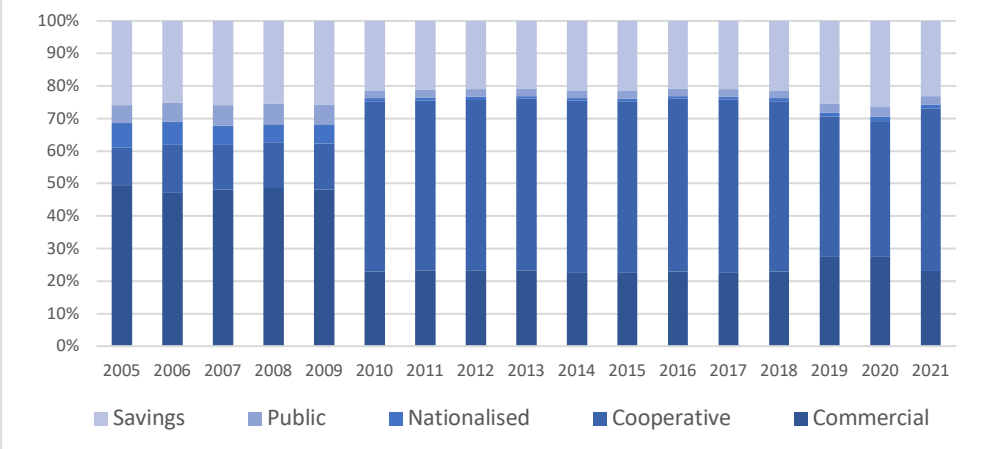
Finally, Figure 4.2 shows the distribution of year-observations across the period observed, both with regard to the business model adopted and the ownership structure assumed by banks. With regard to business model, Figure 4.2 underlines that the distribution of bank business models adopted in Europe during the period detected changed considerably. The number of investment BMs remains substantially the same, whilst the number of banks that adopt more retail-oriented BMs increases. In particular, the adoption of the focussed retail and diversified retail (Type 1) models strongly increases during the most recent years, whilst to the contrary, the number of banks which adopt the diversified retail (Type 2) model decreases. This data is interesting because it suggests that during the most recent years, the European banking system is tending to move to more retail-oriented business models.

Looking at the ownership structure composition, we observe that in 2010 the sample composition changes, with an increase in the number of cooperative banks. This is due to the large increase in the number of banks that are included in the sample. In fact, since 2010, our sample increases from about 300 to 3,000 institutions, because we also include smaller European banks that are represented primarily by cooperative banks.

Figure 4.2 The distribution of year-observation over the period observed (% of observation and business models adopted)



(% of observation and ownership structure)



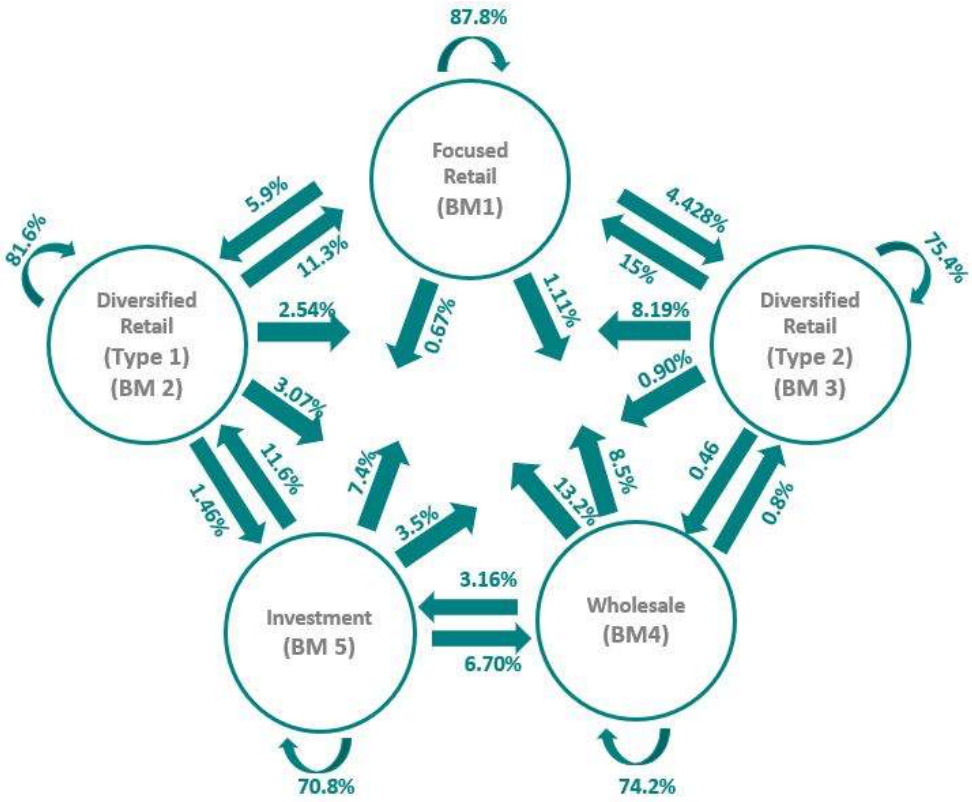
5. MIGRATION OF BUSINESS MODELS

Banks change their business models, hereafter called "migration"[9]. The process of switching from one business model to another can provide a wealth of information about the strategy of banks and their behaviour in the markets and about their risk profiles and their contribution to systemic risk over time.

Figure 5.1 Model transition matrix, share of bank (%, 2005-2021)

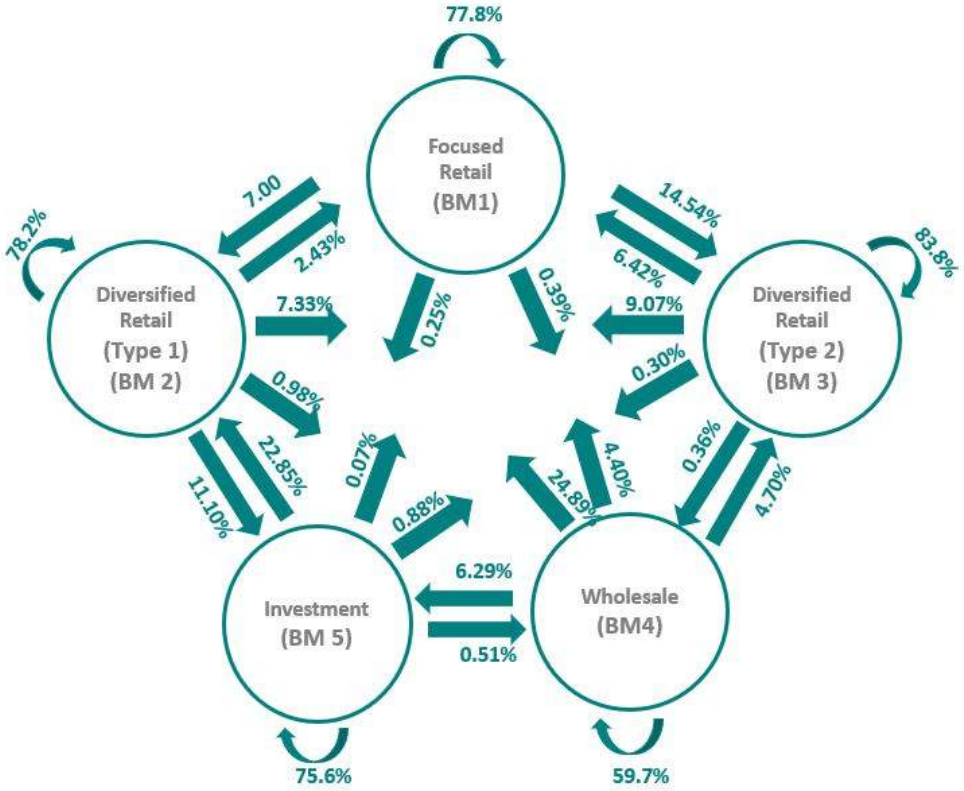
a) Number of Observations

b)



[9] Term used in Ayadi et al (2016), Ayadi et al (2017) and confirmed in Ayadi (2019) to describe the process of changing business models in banks.

c) Total assets



***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. The first figure shows the number of observations that migrates, whilst the second figure shows the migrations in terms of total assets.
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.[10] Figure 5.1 provides the transition matrix for the five models during the years 2005 to 2021. The assignment of banks to the focused retail model shows the highest persistence; 87.8% 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 sampled years (81.6%, 75.5%, 74.2%, and 70.8% respectively). The remainder of migration was primarily to diversified retail (type 1), with flows ranging between 5.99% from focused retail to 13.26% 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 (11.29%) and 15% of banks migrated from diversified retail (type

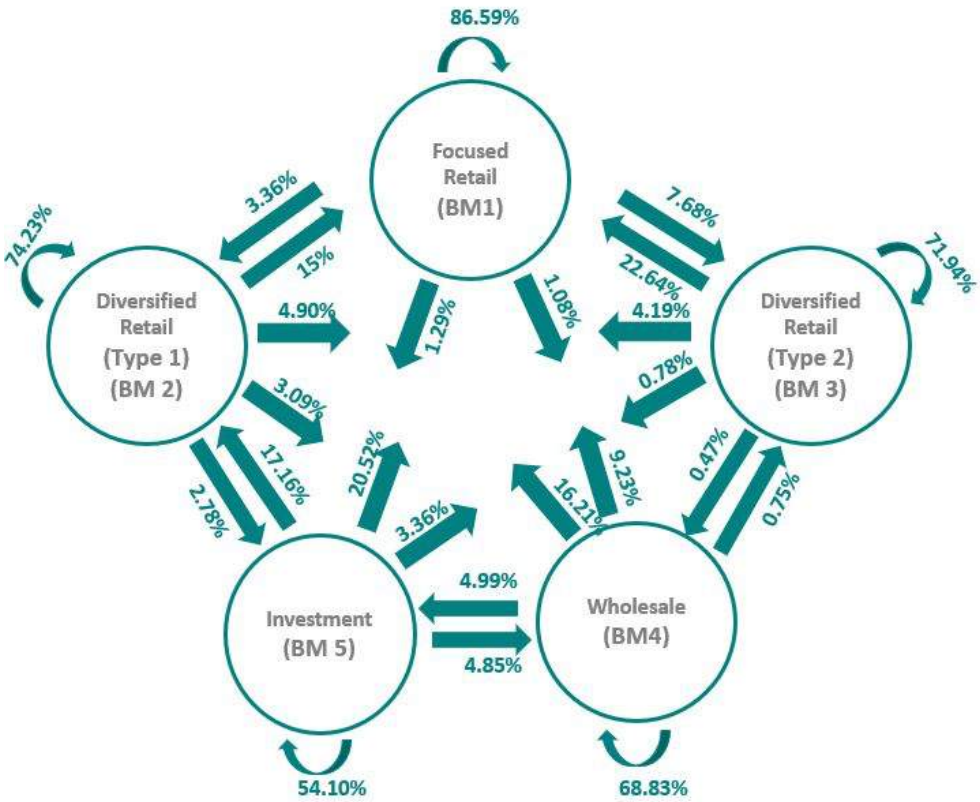
[10] See Appendix X for a list of systemic banks, including their business models.

2) to focused retail. Many wholesale-oriented banks further migrated to investment banks and vice-versa; 3.16% of wholesale banks migrated to investment banks and 6.70% in the other direction.

However, looking at the migrations in terms of total assets, the percentages are slightly different with investment banks showing the highest persistence, whilst with regard to the retail focused business models, we observe that larger retail banks move to diversified retail business models (both type 1 and type 2).

Looking at the total migration, for 35,567 bank-year observations and 3,503 banks, we observe 5,468 migrations and 1,973 banks that move at least once. Therefore, migrating banks move on average 2.77 times. This suggests that, although banks are stable and mainly remain in the same business models during the period observed, there is a group of banks that has migrated and evolved business model more than once during the last 16 years.

Figure 5.2 Model transition matrix latest two years, share of banks (%, 2019-2021)



Note: The figures give the share of banks (in number) 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 last three years examined, the changes are largely the same (See also Figure 5.2). The persistence is slightly lower for almost all business models. In particular, banks migrate from diversified retail (type 2) to the focused retail business model (22.64%) and to the diversified retail (type 1) (4.19%). This suggests that during the COVID pandemic, banks tended to migrate more.

With regards to the other bank business model, Figure 5.2 shows that banks adopting the investment business model migrate to focused retail (20.52%) and to the diversified retail (type 1) business model (17.16%), whilst wholesale banks mainly move to the diversified retail (type 1) business model (16.21%). Finally, banks that adopt the focused retail business model show the highest persistence and banks that change their business model move primarily to diversified retail (type 1) (3.36%) and to diversified retail (type 2) (7.68%).

Results of the last three years underline a lower persistence of banks in the market-oriented business models, suggesting a "return to the basic" during this recent period.

During 2020, all over the World, the health crisis due to the Covid-19 infection also impacted the economic system. The period of pandemic also persisted in 2021. Looking at migrations during these two last years, amongst the 5,468 migrations observed during the whole period, 870 are registered in the last year (i.e., more than 15% of the total). The least persistent business model is the investment model, with 44% of banks remaining in the same BM. More than 50% of banks move from investment to more retail-oriented BMs, such as focused retail and diversified retail (type 1 and type 2) BMs. The other BMs show a greater persistence, although it is lower than the sample average.

Table 5.1 Model transition matrix during Covid-19 crisis (2020-2021)

BMs (t↓; t+1→)	Focused retail	Diversified retail Type 1	Diversified retail Type 2	Wholesale	Investment
Focused Retail	85.01%	3.62%	10.28%	1.09%	0.00%
Diversified retail (type 1)	11.11%	77.97%	6.87%	2.82%	1.22%
Diversified retail (type 2)	22.06%	4.20%	72.90%	0.21%	0.63%
Wholesale	8.08%	17.69%	0.00%	71.54%	2.69%
Investment	28.33%	17.78%	4.44%	6.11%	43.33%
Total	**51.89%**	**24.03%**	**15.65%**	**6.02%**	**2.41%**

Note: The table gives the share of banks (in number) that belong to a specific model in one period switching to another model (or remaining assigned to the same model) in the next period, considering the two years of COVID-19 pandemic.
Source: Authors

6. PERFORMANCE OF BUSINESS MODELS

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

Diversified retail banks (type 2) appear to do relatively better out of the other retail-oriented banks models in return on assets (RoA) and return on equity (RoE), and also in terms of cost-to-income ratio (CIR). In turn, the more market oriented, diversified retail (type 1) banks appear to be on the other side of the spectrum, showing the significantly lowest RoA and CIR amongst retail-oriented banks. The results of the other business models are more diffuse. The investment banks show the lowest RoA but a RoE that is higher than the sample average. The wholesale banks show the highest RoA and the second highest RoE. Moreover, the CIR of wholesale and investment banks is the worst of the five business models, showing values higher than 70%.

Looking at the differences between ownership structures, the commercial banks clearly stand out in terms of RoA and RoE, whilst in terms of CIR they are in line with the sample average. In turn, the other shareholder value type institutions do worst. Hence, the nationalised banks quoted both the lowest RoA and RoE, with negative average values. 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 highest CIR, whilst the cooperative and savings banks seem significantly more efficient amongst stakeholder banks.

Surprisingly, the contribution to the real economy of the wholesale and investment banks has been significantly higher than other business models. The loan growth of the diversified retail type 1 banks was significantly lower than any of the other types. The loan growth of the other retail-oriented banks is clearly in the middle.

The loan growth of the nationalised and commercial banks is the lowest in the period from 2005 to 2021. Savings banks show the highest growth of loans, followed by cooperative banks.

The average performances of the business models and ownership structures, shown in Table 6.1, hide the evolution of profits over recent years. As depicted in Figures 6.1 (a and b), when the time span of the profit indicators is considered, a distinction should be made between the financial crisis from 2007 to 2009, the Eurozone economic crisis from 2010 to 2013, the post-crisis period (2014-2019) and the health crisis of 2020-2021.

Table 6.1 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)	0.38%**	0.33%**	0.47%**	0.49%***	0.29%**	0.38%
Return on equity (RoE)	5.21%***	5.74%***	8.30%***	8.22%**	7.28%***	6.73%
Cost-to-income (CIR)	62.89%***	67.53%**	59.15%**	72.00%**	74.71%***	64.86%
Net interest	67.27%***	51.63%***	59.71%**	39.18%***	29.80%***	54.00%
Commission & fees	23.27%**	28.83%**	23.68%**	41.83%***	34.65%***	27.12%
Trading	4.38%***	12.17%***	10.49%***	5.90%***	23.90%***	11.69%
Other	5.08%**	7.37%***	6.12%***	13.08%***	11.66%***	7.19%
Customer loan growth	8.37%***	4.23%**	10.97%***	20.61%***	10.32%***	8.36%

b) Ownership structures

	Commercial	Cooperative	Nationalised	Public	Savings	All
Return on assets (RoA)	0.44%***	0.41%**	-0.10%**	0.37%**	0.38%**	0.38%
Return on equity (RoE)	8.00%***	6.84%***	-2.06%***	5.79%***	6.08%***	6.73%
Cost-to-income (CIR)	64.59%**	65.44%***	68.17%***	69.03%***	62.79%***	64.86%
Net interest	50.35%***	57.65%**	68.25%***	57.85%**	58.95%***	54.00%
Commission & fees	28.68%**	26.59%**	20.05%**	23.47%**	24.32%***	27.12%
Trading	14.85%***	7.15%***	5.41%***	10.66%***	5.82%**	11.69%
Other	6.12%***	8.61%***	6.28%**	8.02%**	10.92%**	7.19%
Customer loan growth	7.89%**	9.82%***	4.99%***	9.77%**	10.01%***	8.36%

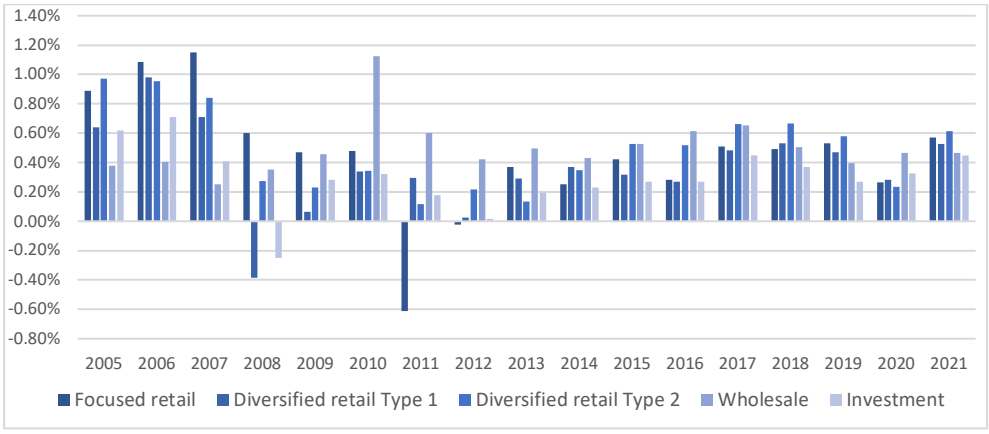
Notes: The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. *Source:* Authors

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 and 2011. More specifically, in the run-up and during the financial crisis, investment and diversified retail (type 1) banks clearly lagged behind their peers, with profits turning to losses or close to break-even. Thereafter, during the Eurozone crisis, the profits of investment banks recovered to levels well below pre-crises levels. On the other hand, the returns from retail banks only fell in 2008, turning the profits of focused and diversified retail (type 1) banks into negative territory during the economic crisis (2011-2012). Interestingly, only diversified retail (type 2) and investment banks obtain positive results for every year. The RoA returns to increase after the economic crisis (2014-2019) with a positive trend, although the profitability does not return to the pre-crisis level. In 2020, during the COVID-19 crisis, RoA returns to decrease for all BMs except for wholesale and investment banks, however, the trend returns to increase in 2021.

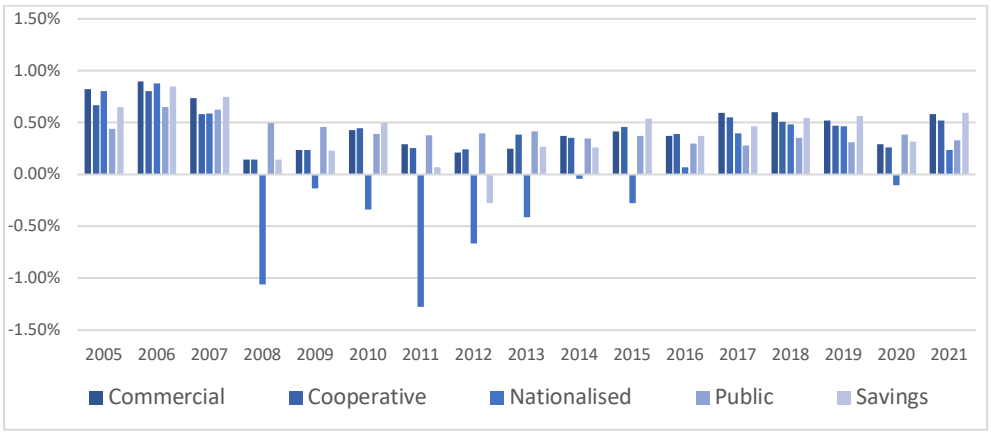
Looking across ownership structures, before the crises, the public and savings banks reported slightly lower profits than the other types of banks. During the first year of the crisis (i.e., 2007) banks across all ownership structures were able to continue making profits close to the pre-crisis levels. 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 2015, and investment banks in 2012. During the most recent years, banks start to increase their profitability, although this positive trend has been stopped by the heath crisis in 2020. In particular, nationalised banks show negative RoA. In 2021 all ownership structures highlight positive RoA.

Figure 6.1 Evolution of return on assets (RoA)

a) Business models



b) Ownership structures



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

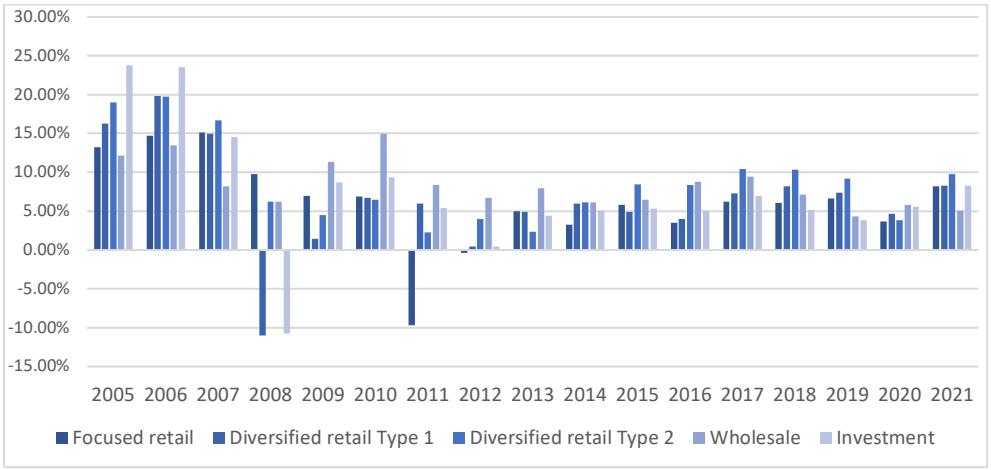
***Source**:* Authors

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). Before the financial crisis, all the bank business models show a positive RoE, higher than 10%. During the financial crisis 2007-2009, profitability decreased and, in particular, the investment and diversified retail (type 1) model emphasised a negative value. During the European financial crisis, more retail-oriented banks, such as focused retail and diversified retail (type 1), also underlined negative results, whilst wholesale and investment banks highlighted low RoE but higher than break even. In the year following the crisis, all business models show an increase in RoE. However, as in the case of RoA, the profitability decreases during 2020, returning to increase in 2021.

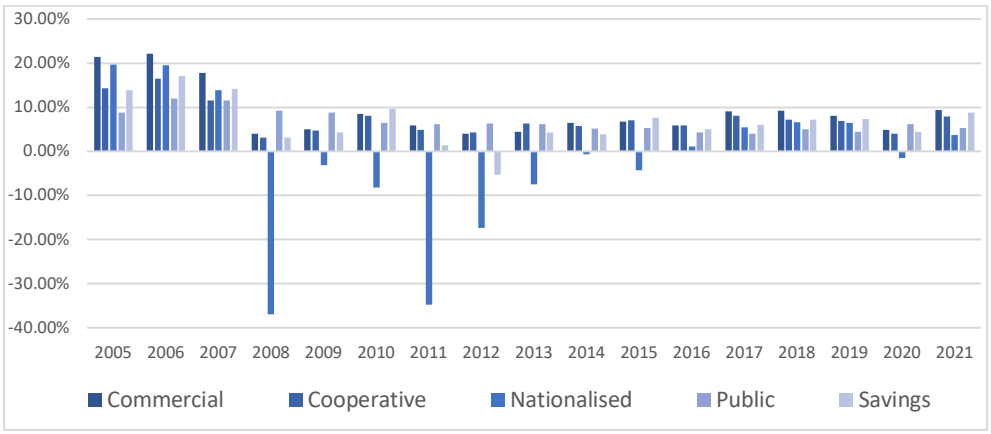
Also, for ownership structures, the results are broadly similar. Since 2005, the leverage ratios of across ownership structures have converted and, with it, the RoE ratios. In fact, the low leverage of the public and savings banks increased the gap to the commercial and cooperative banks with higher RoE. 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. Only in the most recent year, nationalised banks underline an increase in the profitability ratio, higher than zero. However, during the Covid-19 crisis, these banks again show a negative profitability. The decrease in RoE observed during the Covid-19 pandemic, is circumscribed to only 2020, the RoE returning to increase in 2021.

Figure 6.2 Evolution of return on equity (RoE)

a) Business models



b) Ownership structures



Note: 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

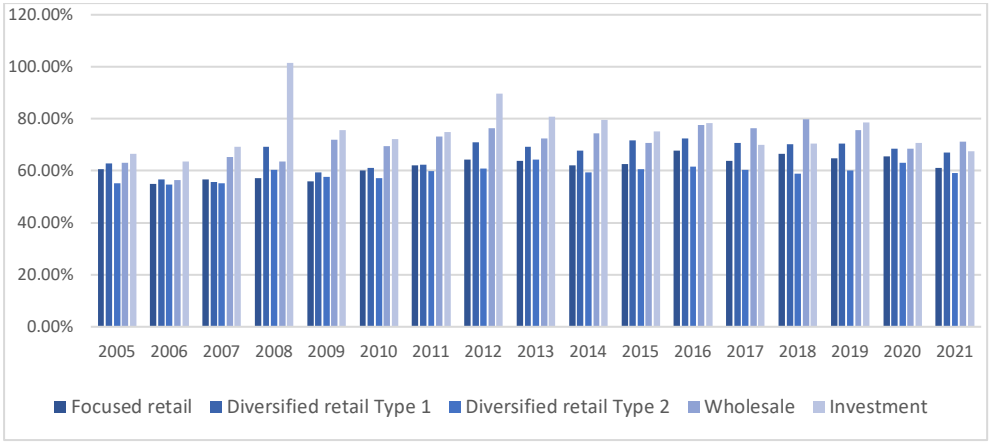
The operational efficiency is measured using the cost-income ratio (CIR). The efficiency across all the business models has deteriorated in the past decade, from 68.92% to 59.87% - at the height of the crisis - for the entire sample, decreasing again in the last year of the analysis but remaining higher than the pre-crisis period (64.16%). In particular, Figure 5.3 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 during the European financial crisis. The efficiency ratio of diversified retail (type 2) banks improved over the last two years, showing the lowest cost

income ratio. Also, the diversified retail (type 1) and focused retail models improve their efficiency, although they do not reach the level of diversified retail (type 2). In 2020, all banks, except wholesale and diversified type 1, show an increase of CIR, but this increase is observed only during the year of the pandemic, with the efficiency of banks starting to improve in 2021 (except wholesale banks which show an increase in the cost income ratio).

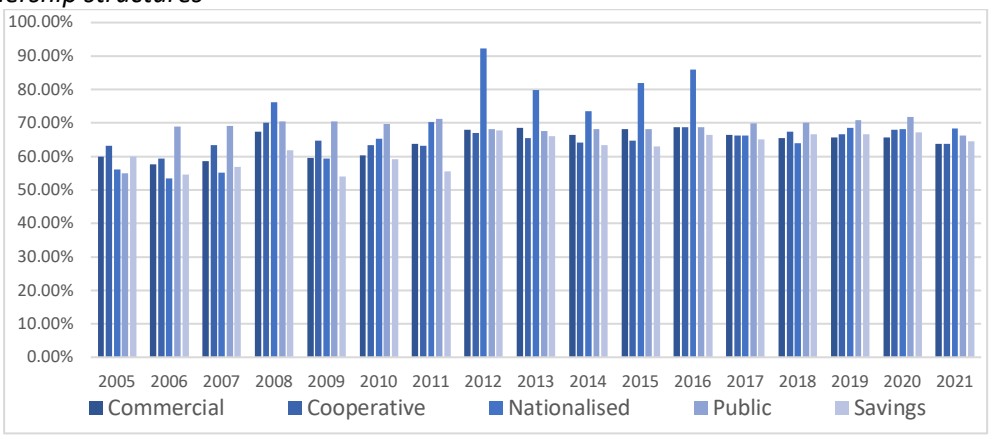
Also, across all the ownership structures, the CIR deteriorated, after a first improvement in the years before the financial crisis. The nationalised banks were initially amongst the most efficient banks but turned out to be the least efficient between 2012 and 2016. The worst years were at the height of the economic crises, with a CIR of 92.3% in 2012. The efficiency ratios of the other ownership structures were more stable over time. However, public banks show a deterioration in their cost efficiency in the most recent years, surpassing 70% from 2018 onwards. However, in 2021 the cost income ratio returns to be lower than 70%, whilst all the other ownership structures also underline a lower cost income ratio after the Covid-19 pandemic, suggesting an increase in their cost efficiency.

Figure 6.3 Evolution of cost-income ratio (CIR)

a) Business models



b) Ownership structures



Note: 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 6.4 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 primarily by the debt liabilities-reliant diversified retail (type 2) and deposit funded diversified retail (type 1) banks.

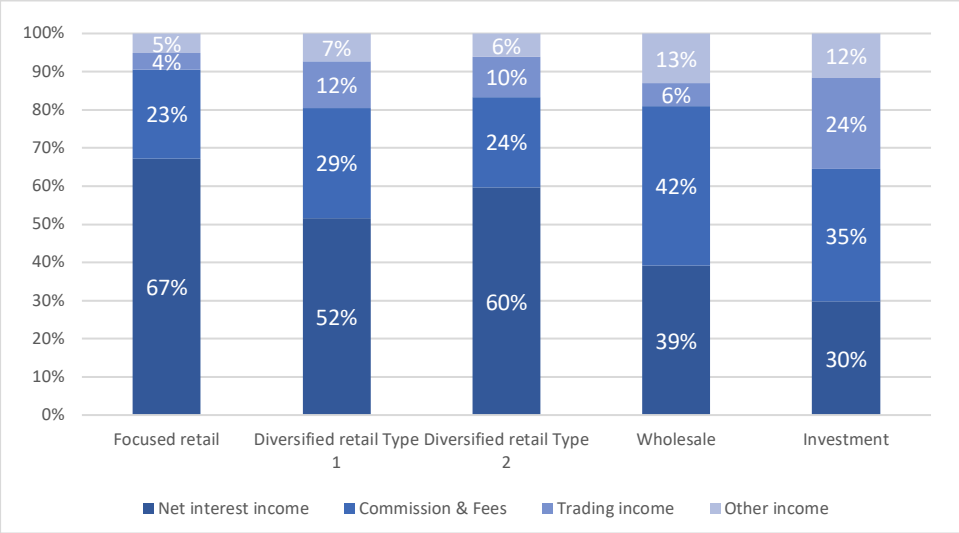
The figures also highlight several less straightforward results. In particular, all business models on average earn between 23% and 42% of their net incomes in commissions and fees.

With regard to the commission & fees, wholesale banks show the highest value, followed by investment banks. This is in line with the main activities carried out by these banks.

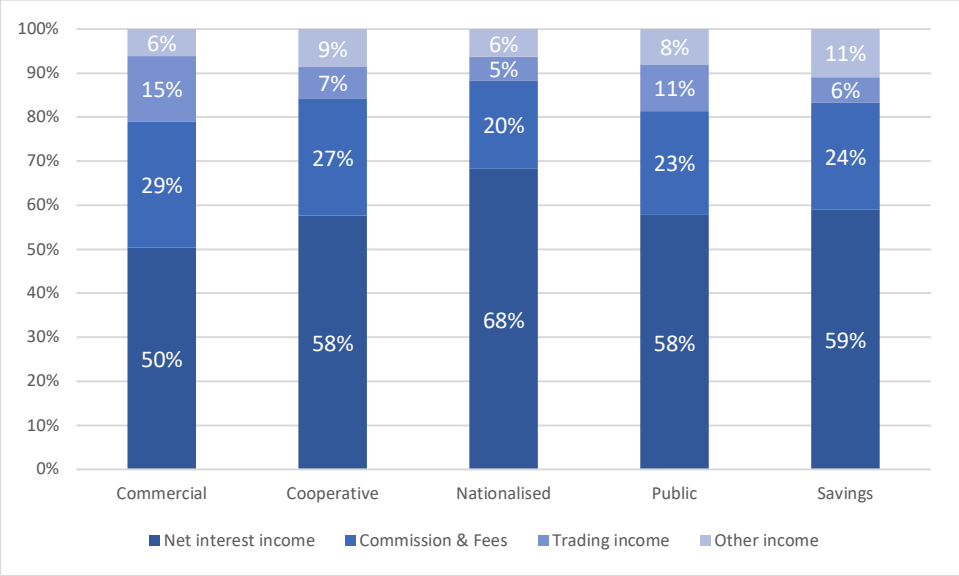
Income varies across ownership structures. The stakeholder value banks rely relatively more on net interest income than commercial banks. For the commercial banks, commission and fee income is more important than for other ownership structures. The trading incomes are significantly more important for commercial banks than for cooperative, savings and nationalised banks that prioritised their interest incomes. In particular, nationalised banks show the highest percentage of net interest income (68%).

Figure 6.4 Main income sources, 2005-2021

a) Business models



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 ownership structure, for the period from 2005 to 2021.

***Source**:* Authors

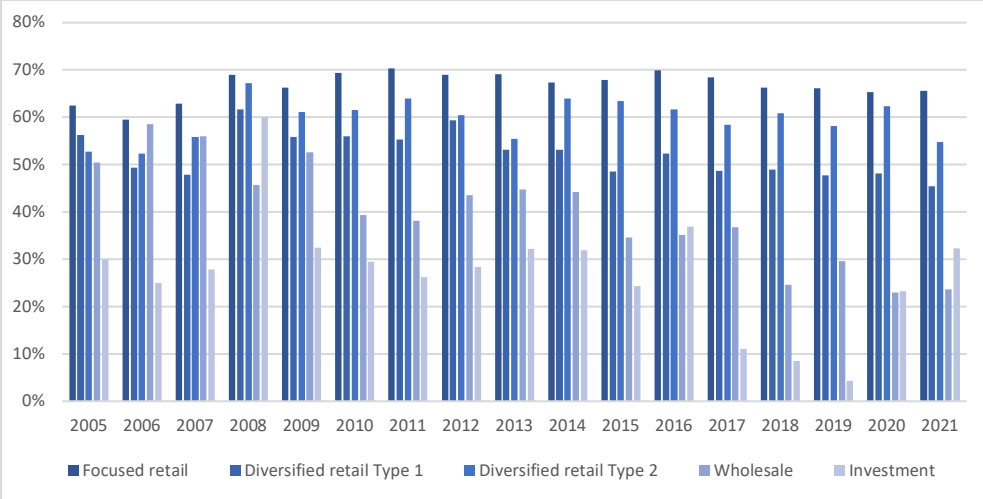
The net interest income has become relatively more important since the outbreak of the financial crisis. The net interest income of retail-oriented banks has increased during the 2008 financial crisis. The net interest income levels remain, however, above the pre-financial crisis levels, as shown in Figure 6.5. During the most recent years, the net interest income of retail-oriented banks remains high and stable and during the health crisis of 2020 these banks do not show a drop in their net interest income, except for wholesale banks. The wholesale banks were, especially during the period from 2006 to 2009, heavily reliant on interest income, whilst afterwards the net interest income, as a share of the total, dropped to lower than the pre-crisis level, with an average value equal to 23% in 2020, the lowest average net interest income amongst BMs. Net interest income accounted for up to 30% of the investment banks' income, before it jumped to 60% in 2008. Afterwards, between 2009 and 2014, the share fell sharply, ranging between 24% and 37%. Between 2017 and 2019, the percentage drastically decreases, arriving at around 4% in 2019. In the most recent years, the net interest income increases again, up to 23% during the COVID-19 crisis and 32% in 2021.

The net interest income of the commercial banks has continuously been the lowest amongst the ownership structures. In turn, the public banks relied most on net interest income. In the period after 2011, their share of net interest income was similar to that of nationalised banks, which became more dependent on interest income after governments took control, arriving at a share higher than 77% in 2012 and remaining higher than 70% after the European financial crisis. 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. For all ownership structures, the weight of net interest income over the total operational income increases during the period investigated, in all cases exceeding the

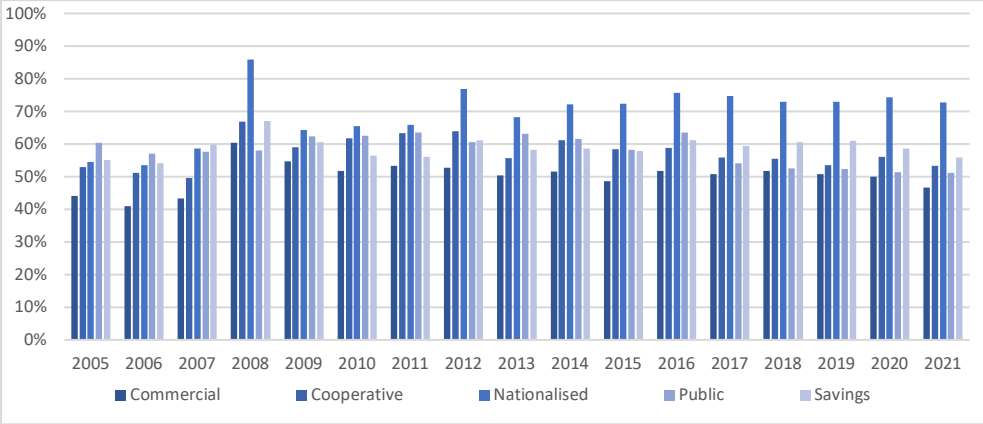
50% mark, arriving at more than 70% in the case of nationalised banks. Only commercial banks show a percentage lower than 50% in some years (such as in 2005-2006 and 2015).

Figure 6.5 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 ownership structure and accounting year.

Source: Authors

An analysis of the evolution of trading income, depicted in Figure 6.6, 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 (-29%). The trading earnings represented less than a tenth of the wholesale banks'

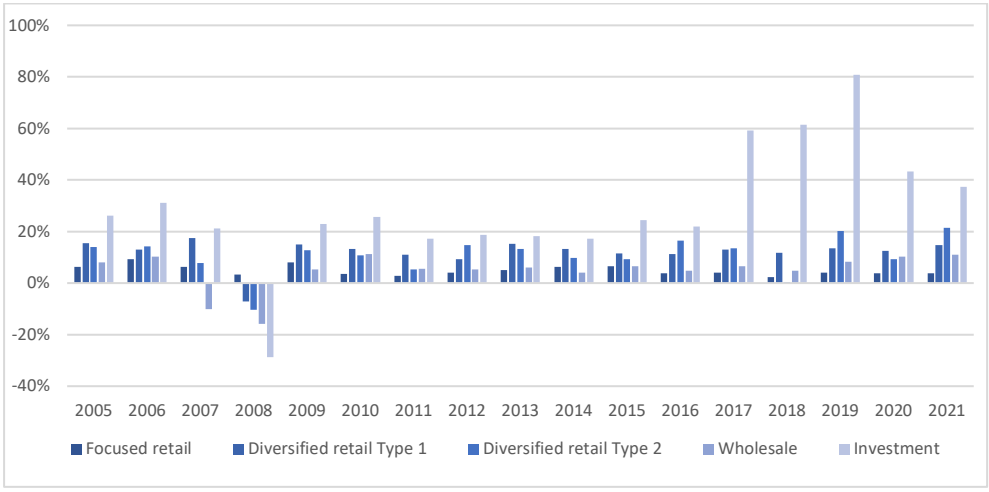
earnings before and after the 2007-2009 financial crisis. In 2007 and 2008, however, the wholesale banks showed trading losses of 10% and 16%, respectively. To a large extent, the concentrated losses in the wholesale banking sector were due to the write-downs on US subprime exposures in the early phases 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.[11] In the period following the crisis, wholesale banks continue to have a low share of trading income, lower than 10%, only in 2020 the share increasing up to 10%.

Turning to ownership structures, the commercial banks reported the highest share of trading income, except for 2008. In fact, banks across all ownership structures reported losses at the height of the financial crisis, except for public banks. The commercial banks lost relatively least, whilst the nationalised banks lost most - albeit the latter were able to recover part of these losses 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 (2012). 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.

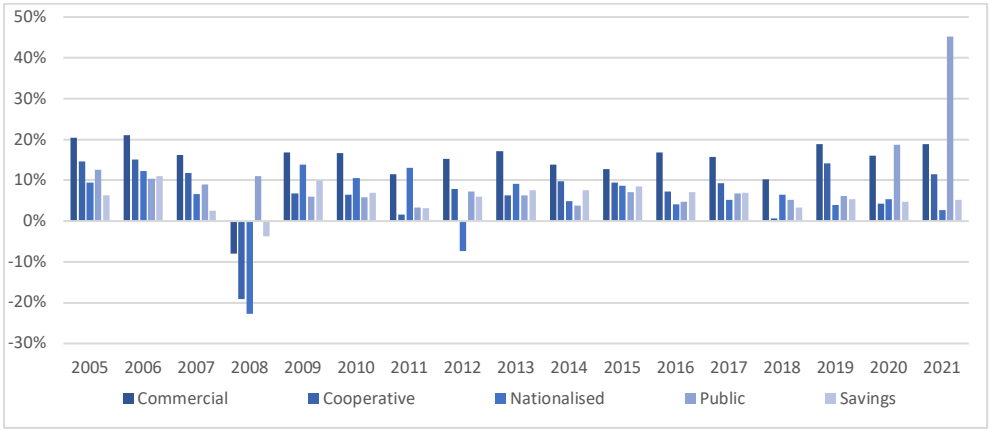
Figure 6.6 Evolution of trading income

a) Business models



[11] 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 operating income. The values are presented by 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.).[12] 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 more stable securities than loans (Lang &

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

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.[13]

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.

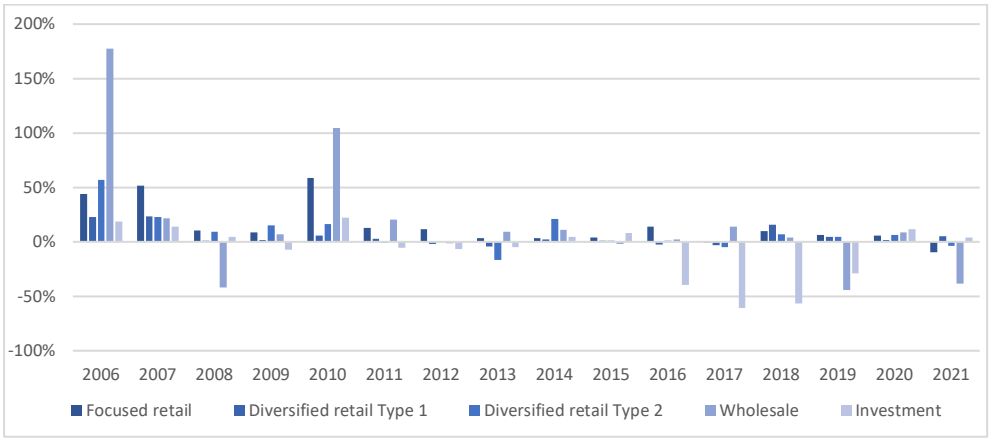
Figure 6.7 shows that the growth of loans subsided substantially after 2007 across all business models, except for wholesale banks that already experienced a decline in 2007. In particular, the results confirm that outstanding customer loans shrank for investment banks during the financial crisis, turning negative in 2009. All groups managed to expand their outstanding loans in 2010. Thereafter, the focused retail business model continued to expand its loan books at gradually lower rates between 2010 and 2012, despite the crisis. Meanwhile, the debt liabilities dependent diversified retail (type 2) banks reported a growth of loans close to zero during 2011 and 2012, up to a point of negative growth of customer loans in 2013 and 2017. In 2020, the loan growth of all business models remains substantially stable, except for investment and diversified retail (type 1) that still decreases its loans growth, but in 2021 the growth rate decreases again, especially for focused retail, diversified retail type 2 and wholesale banks, which display a negative growth of gross loans.

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 45% between 2006 and 2007, whilst the loan portfolio shrank by -9% to -11% annually in the period from 2010 to 2018. 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. The loan growth remains consistently positive, except for 2018, when these banks registered a negative growth of -1% and -3% in 2021. 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 were 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. Moreover, commercial banks also show a decrease in growth of loans after the crises (in 2013, 2016-2018) with negative growth rates. Cooperative banks display a negative growth of loans in 2013 and 2017. Savings banks show negative growth of loans in 2013 and 2015. Finally, all ownership structures show positive growth of gross loans during the Covid-19 pandemic, however, in the year after (2021) the rates are negative for all ownership structures, except nationalised, banks which show a growth of gross loans equal to zero.

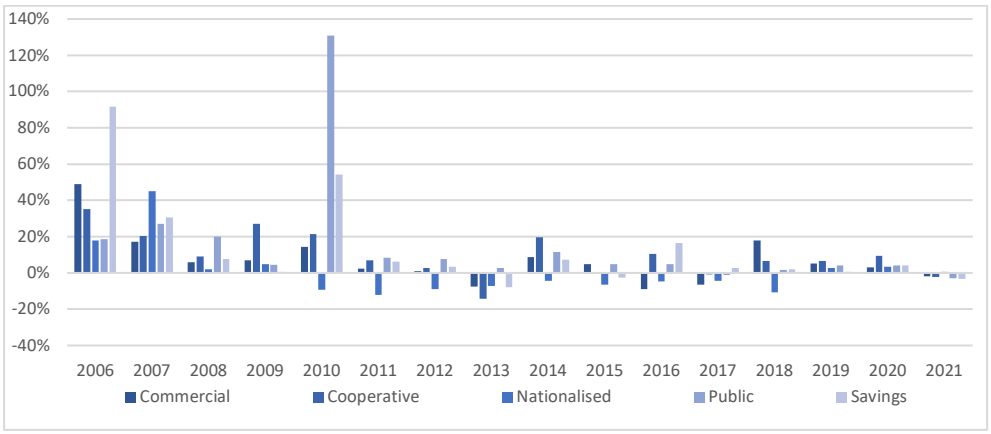
[13] It should not be forgotten that a decline in credit growth may not necessarily be a negative outcome, but largely the result of a realignment of asset prices with fundamentals. Borio & Lowe (2002) and Reinhart & Rogoff (2009) show that rapid credit growth, in conjunction with rising real estate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

Figure 6.7 Growth of outstanding customer loans (% change from last year)

a) Business models



b) Ownership structures



Note: All figures are the median values of growth of gross loans for each accounting year, by business model/ownership structure.

***Source**: Authors*

To summarise, 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, whilst the wholesale and investment banks fared better through the 2010-2012 economic crises. Afterwards, in 2013 and 2014, the profitability of the banks increased to levels below what they were used to before the crisis. Most ownership structures have been able to remain profitable during the crises, except for the nationalised banks (2008 to 2013 and 2015). One of the main drivers behind the lower returns during the financial crisis was the losses on trading assets and investments, whilst 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 recent 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 banks have continued to extend credit, despite the financial and economic crises, even if at lower growth rates. 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 business models, largely due to the variability and responsiveness of earnings to market conditions.

With regards to the last health crisis of 2020, all business models seem to suffer in term of profitability. However, all banks continue to support the real economy, showing positive loan growth during this year. The support for the real economy diminishes in 2021.

7. RISKS OF BUSINESS MODELS

This section provides a risk assessment of bank business models and ownership structures.

The eight key risk indicators are summarised in Table 7.1.

For the most part, the results reconfirm earlier arguments on the risk attributes of various models suggested in Ayadi et al. (2011, 2012), Ayadi & De Groen (2014a) and Ayadi et al. (2015). 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 (in terms of CDS spread). However, in terms of loan loss provisions, diversified retail (type 1) banks are those that underline the highest value, whilst in terms of non-performing loans, the more retail-oriented banks show the highest ratio. On the contrary, more market-oriented banks (wholesale and investment) underline the lowest NPL ratio. These results are in line with the lending activity undertaken by more retail-oriented BMs.

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 remain risky, with the highest loan loss provisions and the highest credit default swap-rates (CDS), both of senior and subordinated bonds (only public banks show a higher CDS). The commercial banks are doing considerably better on the different risk indicators and are within the range of the cooperative and savings banks, although they are, on average, closer to default more than the other ownerships (except for the nationalised one). With regards to the non-performing loans, nationalised banks show the worse credit portfolio quality, confirming the importance of government intervention.

The systemic risk assessed by SRISK shows the highest average in the diversified retail (type 2) model, whilst with regard to the ownership structure, the SRISK is higher for nationalised banks. The SRIK emphasises the systemic exposure of banks, with banks contributing more to systemic risk.

Table 7.1 Risk indicators

a) *Business models*

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	All
Z-score (std.dev. from default)	19.84**	14.53***	11.54***	7.63**	6.26**	13.29
Loan loss provisions (% of gross customer loans)	0.51%**	0.67%**	0.55%***	0.39%***	0.47%***	0.57%
Non-performing loans (% of gross customer loans)	4.44%***	4.15%***	3.21%**	2.46%**	2.14%***	3.66%
Stock returns (avg. daily returns)	1.52%**	1.52%***	1.07%**	3.12%***	1.20%**	1.40%
Stock returns volatility (std. dev. of daily returns)	5.85%**	3.67%**	2.93%***	1.91%**	2.34%***	4.22%
CDS spread (senior, annual avg.)	2.99**	1.70***	1.40**	0.77**	0.77**	1.76
CDS spread (subordinated, annual avg.)	4.53**	3.10***	2.51***	0.50***	1.09**	2.97
SRISK	0.000***	0.000**	0.020**	0.010**	0.010***	0.010

b) *Ownership structures*

	Commercial	Cooperative	Nationalised	Public	Savings	All
Z-score (std. dev. from default)	7.52***	23.25***	2.11***	21.55***	19.22***	13.29
Loan loss provisions (% of gross customer loans)	0.65%***	0.39%**	0.81%**	0.16%**	0.52%**	0.57%
Non-performing loans (% of gross customer loans)	3.45%**	3.29%***	6.29%**	1.91%***	3.70%***	3.66%
Stock returns (avg. daily returns)	1.32%***	2.38%***	0.53%***	0.91%*	1.73%**	1.40%
Stock returns volatility (std. dev. of daily returns)	4.51%***	5.70%**	3.92%***	4.97%***	2.48%***	4.22%
CDS spread (senior, annual avg.)	1.36***	1.17***	3.41**	3.47**	1.59***	1.76
CDS spread (subordinated, annual avg.)	2.46***	2.13***	5.34***	4.36***	2.73***	2.97
SRISK	0.010**	0.000*	0.060*	0.000*	0.000*	0.010

Notes: The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. *Source:* Authors

The first indicator, Z-score, is a balance-sheet based indicator that provides an estimate of a bank's distance to default.[14] 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.

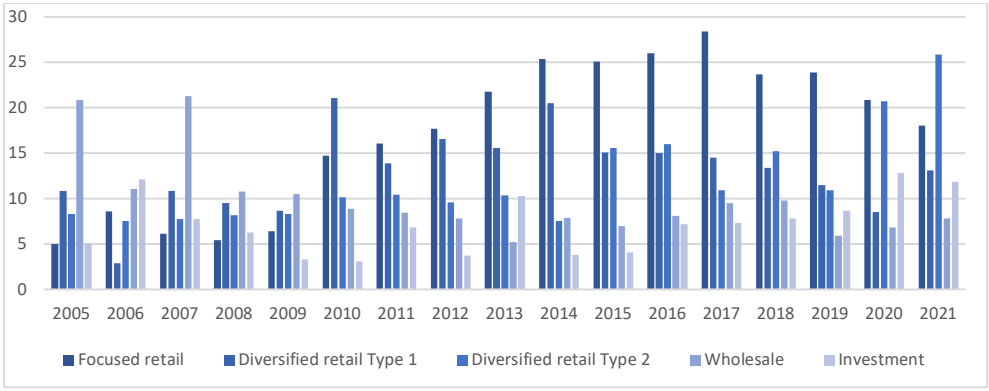
The weighted averages are largely in line with the median values shown in Table 7.1. The investment banks display the main exception, with substantially lower weighted figures. This suggests that the Z-scores of the larger investment banks are substantially lower than of the retail-oriented banks. Since 2019, investment banks increase their distance to default, whilst wholesale banks seem closer to default. Since 2011, the focused retail banks appear safer, with a higher distance to default. The other retail-oriented 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 diversified retail (type 1) banks. Figure 7.1 shows that the differences in Z-scores across business models have primarily been created in the most recent years.

Considering the ownership structure, the cooperative, public and savings banks show the highest weighted average values during the period observed - nationalised banks the lowest. In general, Z-scores of all ownership structures increase over time. Contrary to most other banks, the Z-scores of the public banks were very high at the beginning of the period observed; they reduce during the sovereign debt crisis and return to increase after the crisis period. The lowest z-score is observed in nationalised banks.

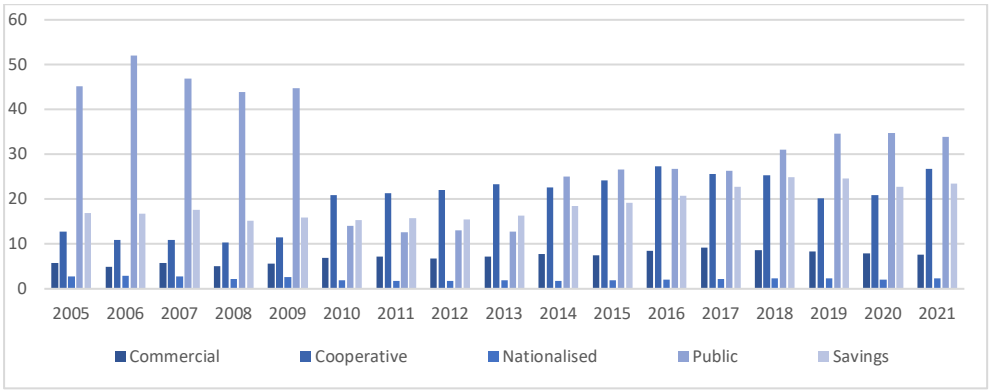
[14] See Appendix V for the calculation of the Z-score.

Figure 7.1 Evolution of Z-scores

a) Business models



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 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.

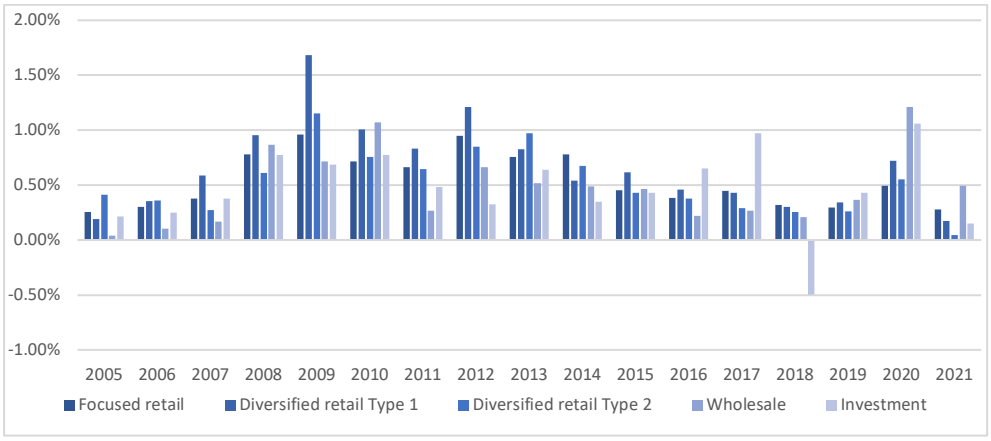
The results displayed in Figure 7.2 show that the pre-crisis risk-costs of wholesale banks and, to a lesser extent investment banks, were lower than those of retail banks. During the financial

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 wholesale banks. However, the cost of risk returns to increase in 2012. The trend returns to decrease only after the crises (from 2014 onwards). During 2020 (pandemic crisis) all business models show an increase of loan loss provisions, suggesting an increasing focus on credit quality. The cost of risk returns to be low for all BMs in 2021.

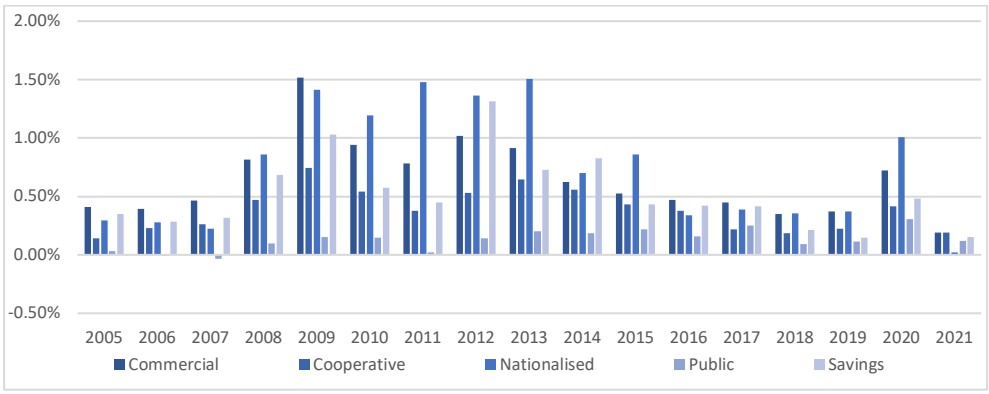
Turning to the results across ownership structures, in the pre-crisis period, the commercial banks took the highest loan loss provision, whilst the public banks even released provisions. During the financial and economic crises, the shareholder value banks (i.e., commercial and nationalised banks) took the highest provisions, whilst the savings and, to a lesser extent, cooperative banks also booked higher loan loss provision compared to the previous period. However, these banks show lower provisions than shareholder value banks. Also, with regard to the ownership structures, 2020 highlights an increase in the cost of risk for all the structures.

Figure 7.2 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

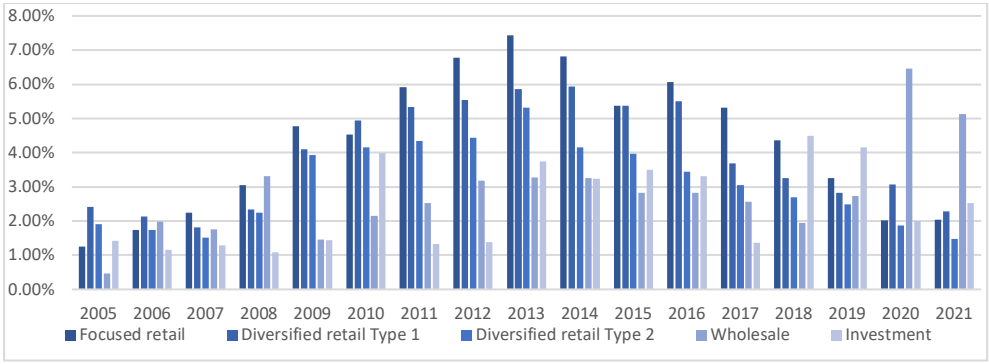
The third indicator, the non-performing loans over gross customer loans, proxies the quality of credit portfolio. The results reported in Figure 7.3 show that, during the financial and economic crises, the deterioration of bank loans increases. In particular, retail-oriented banks display a stronger increase of NPLs. This is in line with the asset composition of these banks, for which the loans component is dominant compared to investment and wholesale banks. Since 2014, the ratio starts to decrease for two main reasons: i) the economic crisis ends and customers re-start to pay their loans, but most of all, ii) banks sell part of their deteriorated loans, cleaning their balance-sheets. Although there was the pandemic crisis of 2020, except for wholesale banks, NPLs ratios of all business models remain stable or decrease in the last year observed.

With regard to the ownership structure, during the financial crisis (2008-2010), commercial and nationalised banks show the highest amount of NPLs in their balance-sheets. Starting from the economic crisis, nationalised banks display the highest ratio of NPLs over gross customer loans. This suggests that nationalised banks are the riskiest banks in terms of credit risk with the worse credit portfolio quality. Public banks seem to be the banks with the best credit portfolio quality.

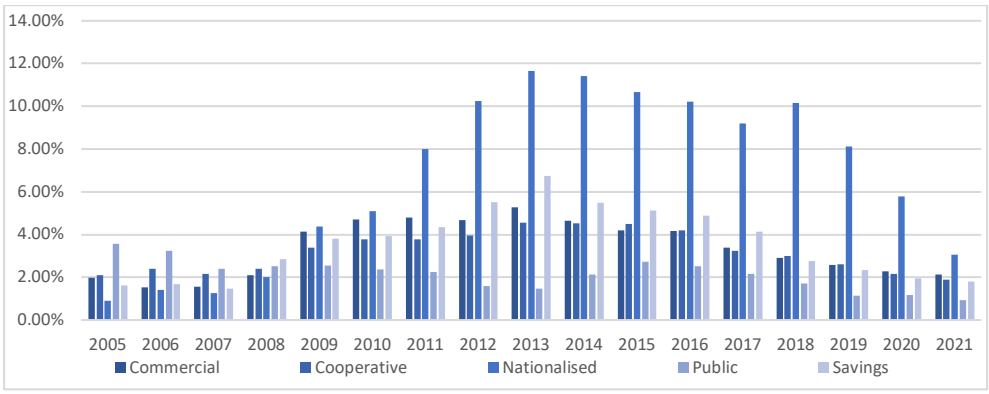
The weight of non-performing loans over gross loans ratio differs during the Sovereign debt crisis (2010) and in a general way after the crisis (2017). In fact, after the financial crisis, the percentage of NPL held by focused retail banks increases in most of the countries observed, whilst investment banks decrease their NPL from 2010 to 2017 (See Appendix V). Regarding the ownership structure, commercial and cooperative banks remain the most exposed banks to the NPL problem. In Iceland, Ireland, Portugal, Denmark and Slovenia the share of nationalised banks that hold a high percentage of NPL increases after the crisis (See Appendix V).

Figure 7.3 Non-performing loans (% of gross customer loans)

a) Business models



b) Ownership structures



***Note**:* The amounts expressed in the figure are the non-performing loans as share of the total gross customer loans.

***Source**:* Authors

The fourth 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, whilst 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 an important limitation, however, 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 7.4 show that, pre-crisis, the share prices 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, except for wholesale banks. During the economic crisis, the average returns were close to zero or negative and, in 2011, all business models

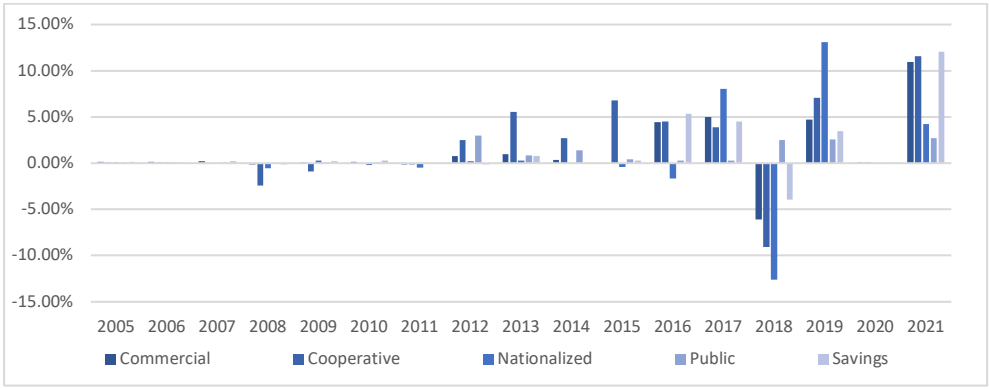
underlined negative returns; only afterwards, were the shareholders able to recover part of the losses. In the post-crises period, banks come back to show positive returns, except for 2018, the year in which all business models show negative stock returns. During the pandemic crisis of 2020 more retail oriented banks show negative returns, whilste in 2019 and 2021 all business models show positive stock returns.

The results across ownership structures show a large consistency in the direction of the returns, except for 2007 and 2010, in which the cooperative and nationalised banks lost and the commercial, public and savings banks gained in value. Nationalised banks also show negative returns from 2014 to 2016, when the other BMs always display positive stock returns. In 2018, all ownership structures, except for public banks, show negative returns, whilst in 2020 only nationalised and public banks lose value.

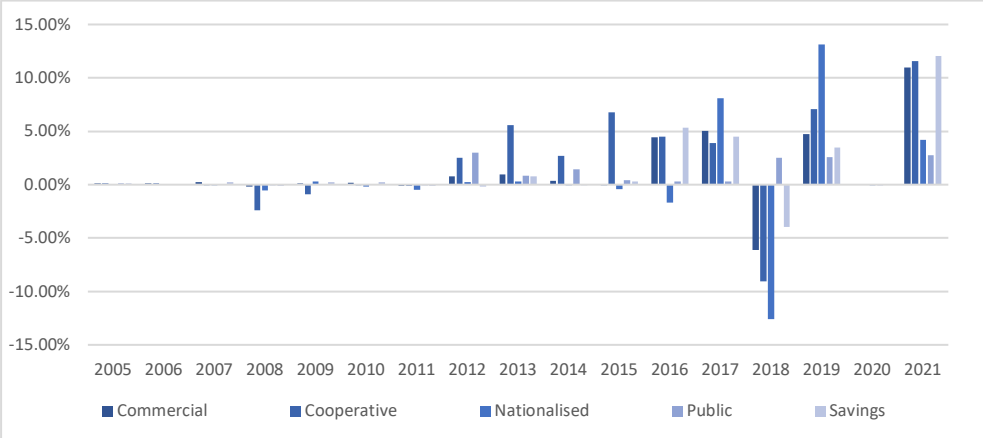
Both in terms of business models and ownership structure, 2008, 2011 and 2018 emphasise the worst stock returns. 2008 and 2011 represent the first year of the financial and economic crisis, respectively, whilst 2018 is remembered as the worst year for the financial markets in over a decade.

Figure 7.4 Evolution of stock returns (avg. daily returns)

a) Business models



b) Ownership structures



Note: The figure shows the average values of annual average daily returns on publicly listed shares.

Source: Authors

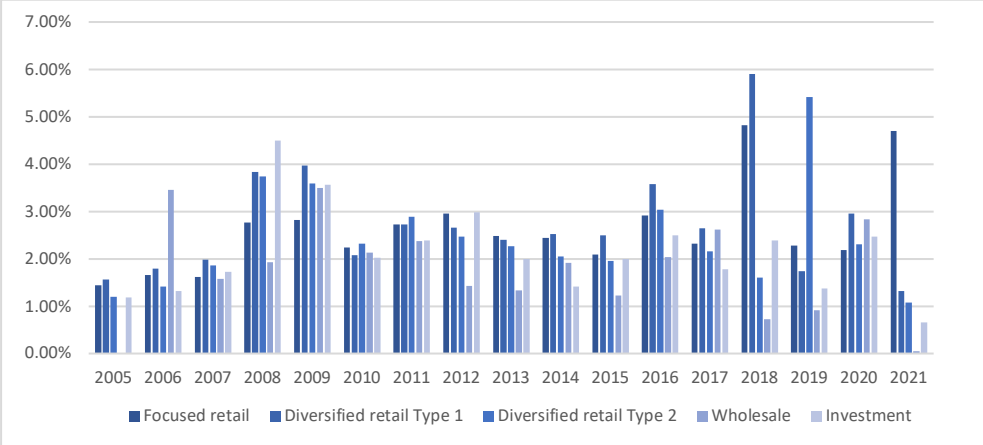
The fifth indicator, **annual standard deviations in daily stock returns** measures the risk sensitivity of listed banks.

The volatility of the stock returns has been similar across most business models, except for wholesale banks in 2006 and investment banks in 2008, focused retail in 2018 and 2021, diversified retail (type 1) in 2018 and diversified retail (type 2) in 2019. The volatility increased substantially during the financial crisis, whilst since 2010, the volatility settles at slightly higher levels than the pre-crisis levels. Only in 2016 does the volatility return high for all business models and, in 2018, more retail-oriented BMs show a strong increase in volatility.

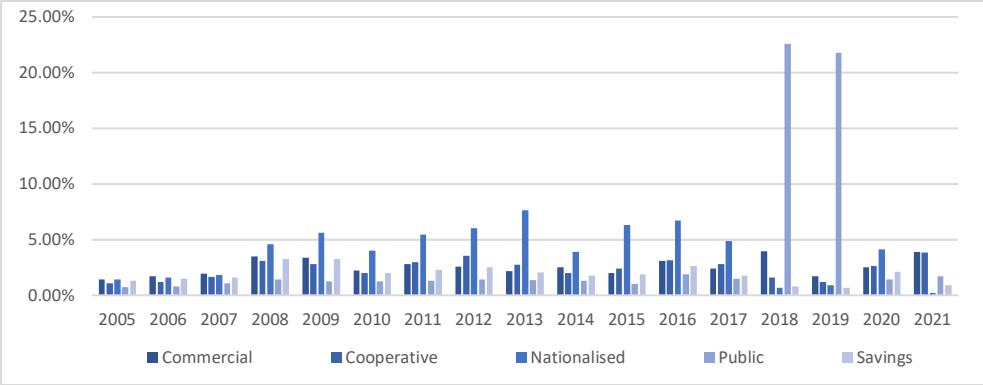
Figure 7.5 also shows that the differences between ownership structures are more substantial. Before the financial crisis, the volatility was fairly similar, except for the public banks for which it was lower and, in some years, nationalised banks show a higher volatility than other ownership structures. 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, whilst the share returns of nationalised and cooperative banks remained more volatile, with nationalised banks showing the highest volatility throughout the financial crisis and post crisis period. In 2018-2019, public banks show a relevant increase of volatility (higher than 20%). An increase in volatility is also observed during the Covid pandemic in all ownership structures.

Figure 7.5 Evolution of stock return volatility

a) Business models



b) Ownership structures



Note: The amounts expressed in the figure are average annual standard deviations of daily stock returns.

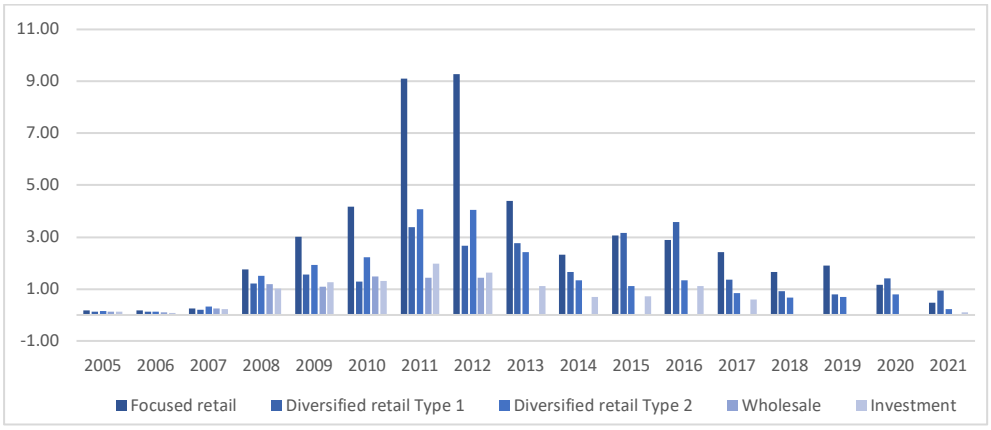
Source: Authors

The sixth indicator, **median CDS spreads for senior securities**, displays a very low level for all business models during the pre-crisis period (2005-2007). The CDS spreads strongly increase during financial and economic crises. There is a significant higher CDS spread for the deposit funded focused retail and diversified retail (type 1) banks than for all other banking business models (see also Figure 7.6). 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, 2014 and 2015), there is nothing to distinguish the market participants amongst these three models in terms of their inherent risks.

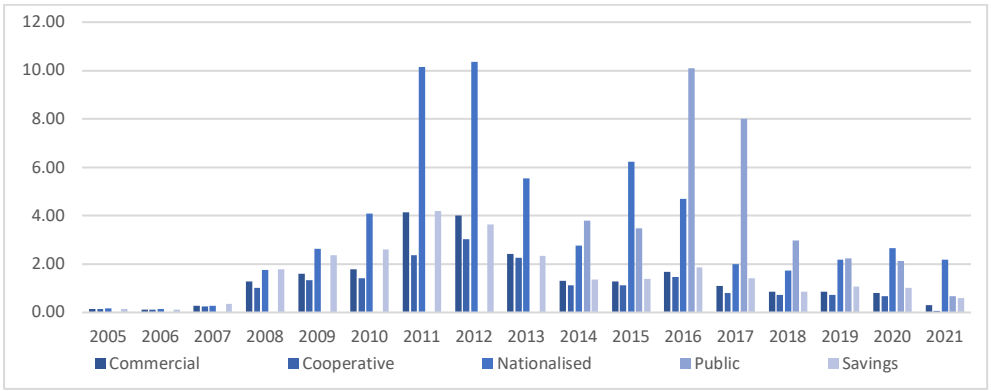
The comparison across ownership structures shows that, except for the government owned banks, the CDS-rates are not significantly different. In particular, the nationalised and cooperative banks respectively quoted the highest and the lowest CDS-rates. Provided that other indicators do find substantial 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 bailouts or state guarantees (Calomiris & Kahn, 1991).

Figure 7.6 Evolution of CDS spreads (senior) (%)

a) Business models



b) Ownership structures



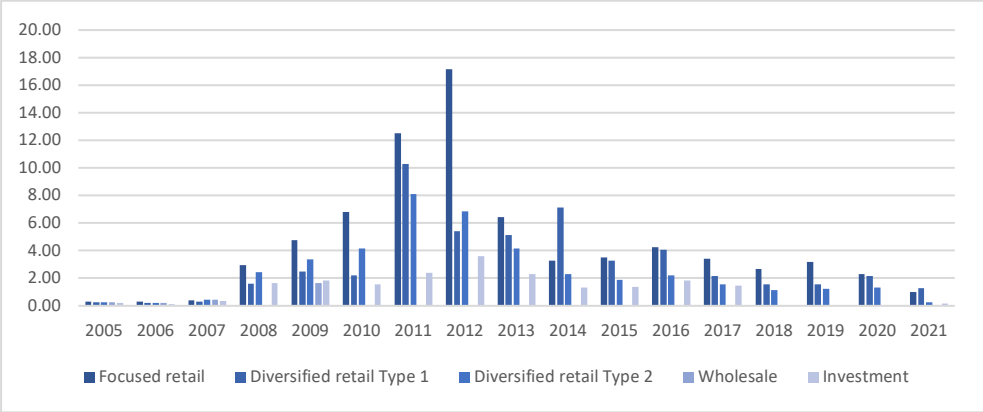
Note: The figure presents the average annual average CDS spreads on senior bonds. Since 2013, no CDS spreads of senior bonds for public banks are observed.

Source: Authors

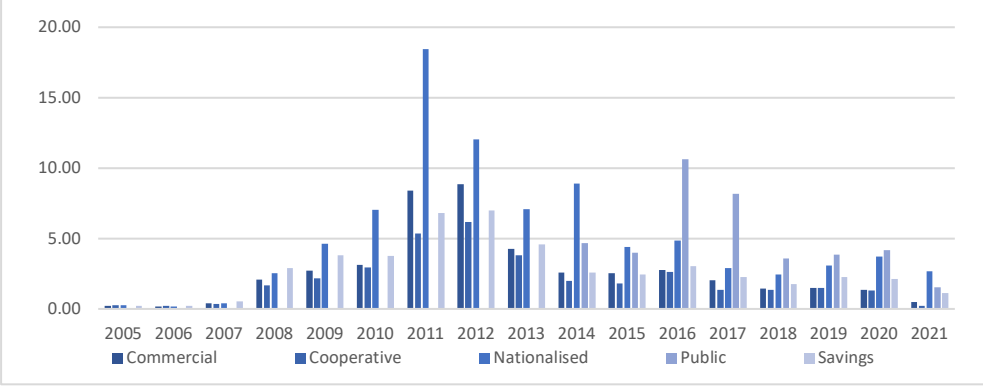
The seventh indicator, **median CDS spreads for subordinated securities** are clearly higher than the rates for senior securities. Hence, contrary to the senior securities, the subordinated ones were, in some extraordinary cases, subject to bail-ins during the financial and economic crises. The number of observations for subordinated securities is, however, much lower than for CDS-rates on senior securities. Figure 7.7 displays a substantially higher CDS spread for the small and least financially integrated focused retail banks than all other banking business models. After the crises, the CDS spread of subordinated securities comes back to lower levels, although they remain higher than those observed in the pre-crisis period. Notwithstanding much higher CDS-rates for nationalised banks during the financial and economic crises, the other ownership structures do not significantly show differences. Public banks (which are observed since 2015) display higher CDS-rates compared to other ownership structures.

Figure 7.7 Evolution of CDS spreads (subordinated) (%)

a) Business models



b) Ownership structures



Note: The figure presents the average 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 eighth indicator is the SRISK that measures the capital shortfall of a firm conditional on a severe market decline, and is a function of its size, leverage and risk. SRISK is an estimate of the amount of capital that a financial institution would need to raise, in order to function normally if we have another financial crisis (Brownlees & Engle, 2017). When the capital shortfall is negative, i.e., the firm has a capital surplus, the firm functions properly. On the other hand, when this quantity is positive the firm experiences distress. The definition of SRISK and the methodology adopted to measure this indicator are reported in Appendix IX. The sum of SRISK across all banks can be used as a measure of overall systemic risk in the entire financial system. It can be approximated as the total amount of capital that the government would have to provide to bail out the financial system in case of a crisis.

Looking at the SRISK indicator of the whole banking system, Figure 7.8 underlines that, on average, during the period under investigation, banks show a positive capital shortfall. Before and during the crisis of 2007-2009 the level of SRISK is higher, suggesting a high systemic risk. After this crisis the SRISK decreases and becomes close to zero, therefore, the systemic risk, in general, is low. Diversified retail (type 2) banks show, on average, the highest capital shortfall, whilst focused retail banks the lowest.

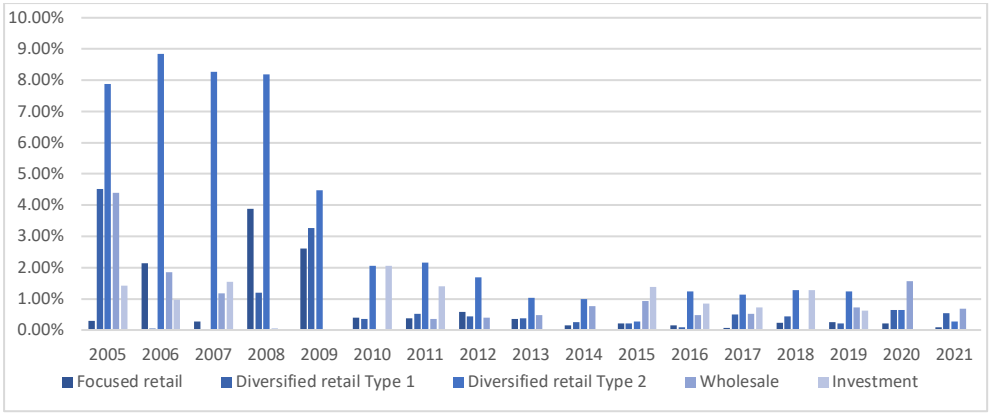
Remembering that banks with the highest SRISK are the largest contributors to the undercapitalisation of the financial system in times of distress, in the pre-crisis period (2005-2007) diversified retail (type 2) banks emphasise the highest exposure to systemic risk, whilst retail-oriented banks – both focused and diversified type 1 – show the lowest exposure.

However, the average relative exposure has gradually dropped down from 2005 to 2010, essentially in the market funded business models (diversified retail type 2, wholesale and investment). From 2011 to 2013, the average relative exposure has stabilised to very low values. After 2016, SRISK of diversified retail type 2 and investment banks returns to increase.

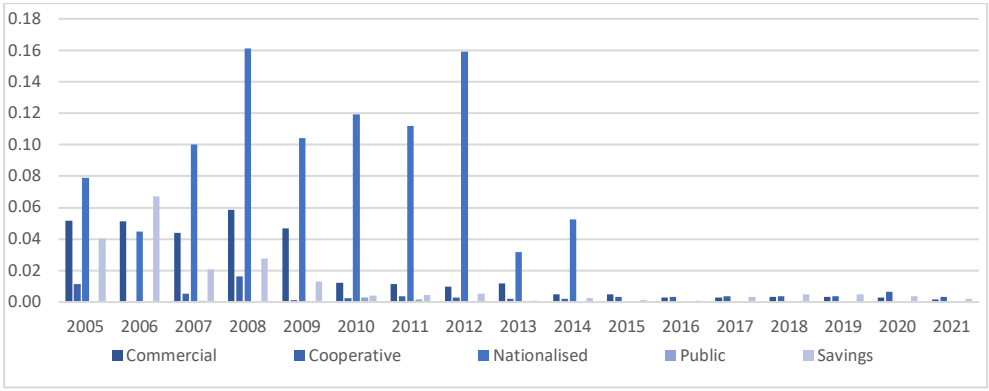
With regard to the ownership structure, the commercial and nationalised banks have shown a high capital shortfall before and after the financial crisis, whilst from 2009 to 2013, during the financial and economic crises, the nationalised banks are those with the highest SRISK. However, after 2015, nationalised and public banks show the lowest SRISK.

Figure 7.8 Evolution of the (unweighted) mean of systemic risk exposers (SRISK)

a) Business model



b) Ownership structures



***Notes**:* The figure above shows the systemic exposure of each bank with a positive shortfall in each year has been computed with reference to the whole banking sector. The capital shortfall is defined as the difference between the 8% of risk-weighted assets and total equity (SRISK), all divided by the sum of the positive SRISK of each year. The figures show only banks with a positive shortfall.

***Source**:* Authors' elaborations

To summarise, 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, whilst 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, in particular based on the balance sheet indicators. In turn, the other type of government owned banks, the nationalised banks, appear to be the riskiest 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.

8. BANK BUSINESS MODELS RESPONSE TO REGULATION AND RESOLUTION

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 8.1.

The regulatory capital ratios suggest that the retail-oriented banks have significantly higher average risk weights than the wholesale and investment banks. In turn, wholesale banks have a significantly higher Tier 1 ratio. Taken both indicators together, the focused retail banks have the highest accounting capital (i.e., tangible common equity over tangible assets) and the investment banks the lowest.[15] Amongst the ownership structures, the average risk weights are, in general, close to the sample average, except for the savings banks, which show the highest risk-weighted asset density. Public banks have the highest capital ratios. Overall, the public banks have the strongest capital position and, consequently, they are least leveraged (therefore, they have the highest capitalisation ratio).

The average of liquidity ratios of the market-oriented business models is significantly higher than for the retail-oriented models, in particular for investment banks. Diversified retail (type 2) banks show an average NSFR lower than 100%. The differences across ownership structures are less apparent. The average values are all above the requirement of 100%.

The preliminary calculation of the potential bail-in contribution shows that the market-oriented, as well as both commercial and state-owned banks, are likely to be able to absorb higher losses before they would receive a contribution from the resolution fund. 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.

Lastly, the Minimum Requirement for Own Funds and Eligible Liabilities (MREL) is higher for investment banks. Looking at the ownership structure, commercial and cooperative banks show the highest average requirement.

[15] In the table we report the capitalisation ratio, i.e., tangible common equity over tangible assets that is the reciprocal of leverage ratio.

Table 8.1 Regulatory & supervisory indicators

a) *Business models*

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	All
Risk-weighted assets (RWA) (% assets)	43.94%***	33.72%***	37.74%**	29.23%***	22.00%**	43.94%
Tier-1 capital ratio (% of RWA)	14.15%***	13.92%**	12.56%***	15.15%***	13.99%**	14.15%
Tang. common eq. (% of tang. assets)	6.58%***	4.34%***	4.37%***	5.48%***	3.06%***	6.58%
NSFR (Avail./req. funding)	113.12%***	131.39%**	96.87%***	249.00%***	124.25%**	121.50%
Bail-in contribution (% of total liabilities)	4.20%**	5.13%***	4.79%***	5.51%***	6.16%**	4.20%
MREL	10.32%**	9.97%***	10.31%**	9.26%***	16.34%***	10.32%

b) *Ownership structures*

	Commercial	Cooperative	Nationalised	Public	Savings	All
Risk-weighted assets (RWA) (% assets)	33.66%***	34.66%***	34.43%**	32.00%***	40.21%**	34.61%
Tier-1 capital ratio (% of RWA)	13.30%***	14.06%***	12.77%***	17.89%**	12.92%***	13.48%
Tang. common eq. (% of tang. assets)	4.23%**	4.81%**	3.41%**	5.95%***	5.51%***	4.47%
NSFR (Avail./req. funding)	127.84%***	121.21%**	109.63%**	116.08%***	117.14%***	121.50%
Bail-in contribution (% of total liabilities)	5.14%**	5.02%**	5.10%**	5.26%***	4.56%***	5.05%
MREL/TLAC	10.65%***	10.46%***	9.40%***	9.18%***	9.87%**	10.33%

Notes: The difference in means of the five business models is tested by using the ANOVA test. According to the results of these tests, the number of asterisks (*, **, ***) stands for the statistical difference of means of the clusters at 10%, 5% and 1% respectively. See Appendix VII for the assumptions pertaining to the construction of the net stable funding ratio (NSFR) measure and Appendix VIII for the assumptions pertaining to the construction of the TLAC.

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, thus, are required to hold more regulatory capital to account for their risk-weighted balance sheet, without counting the risk pertaining to the off-balance sheet.[16]

[16] The off-balance sheet exposures could not be included in this Monitor because of too few observations and insufficient

According to the statistical analysis of this indicator, both investment and wholesale banks appear to be less risky, with distinct average risk weights of 21.8% and 29.2% respectively, which is substantially lower than the risk weights of the retail-oriented banks (between 33.7% and 44.6%). Only in the last two years, 2020-2021, diversified retail (type 1 and 2) banks show a lower risk than wholesale, but not than investment banks. 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.[17] Figure 8.1 shows that the average risk weights of diversified retail banks have gradually been declining during the period observed, whilst focused retail banks show an initial increase in their risk sensitivity, followed by a gradual decrease after the financial crisis. Investment and wholesale banks show a stable risk weighted asset during the period investigated.

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 33.7% and 34.4%. 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 and return to decrease only in 2020.

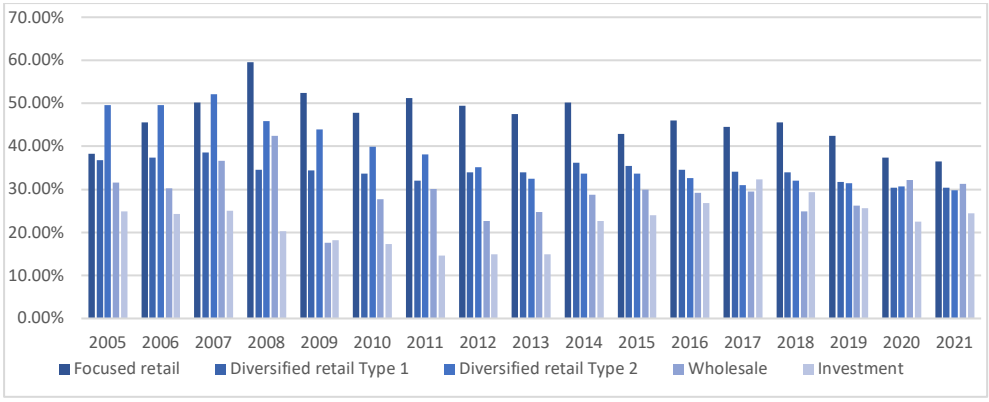
It is interesting to note that the risk weighted assets of all business models and all ownership structures shows a decrease in 2020, which continues in 2021. This suggests that during the health crisis, despite banks continuing to support the real economy with lending activity, the risk weighted asset density does not rise, due to the government guarantee associated with these loans.

comparability.

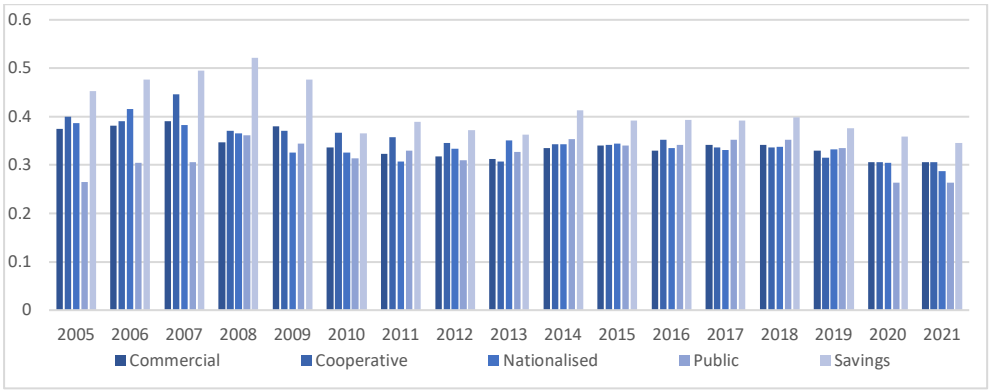
[17] See below for a deeper inquiry into why the regulatory and estimated risk measures may differ so radically.

Figure 8.1 Evolution RWAs (% of total assets)

a) Business models



b) Ownership structures



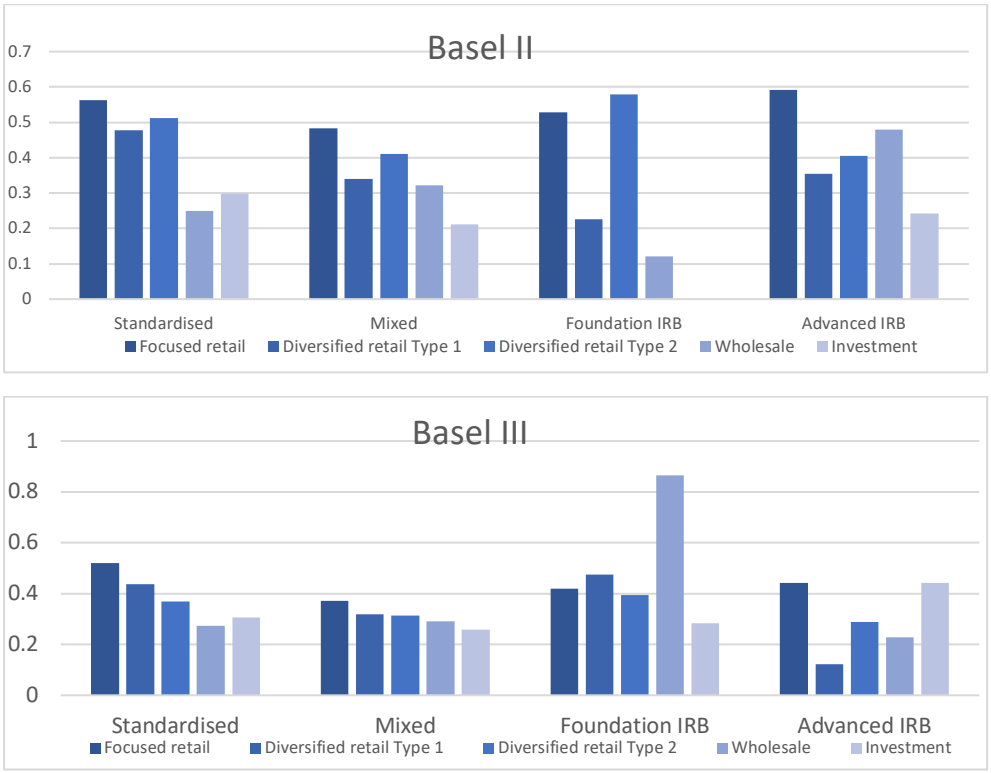
***Note**:* The amounts expressed in the figure are the total weighted assets as share of total assets.

***Source**:* Authors

Observing the average of RWA density of banks under Basel II and Basel III regulation, Figure 8.2 underlines that, in general, by passing from Basel II to Basel III, banks reduce their RWA density. The only exception to this reduction is investment banks that show an average increase of RWA over total asset ratio.

In general, banks more oriented to lending activity (focused retail and diversified retail both type 1 and type 2 banks) show higher RWA density ratio than banks that adopt a more market-oriented banks (i.e., investment and wholesale business models).

Figure 8.2 Average RWA density (%) by Business Model



***Notes**:* The figure above shows the average level of RWA density ratio that is a proxy of a bank's risk appetite. The figure underlines the difference amongst business models, the credit risk measurement approach and the Basel version adopted by institutions.

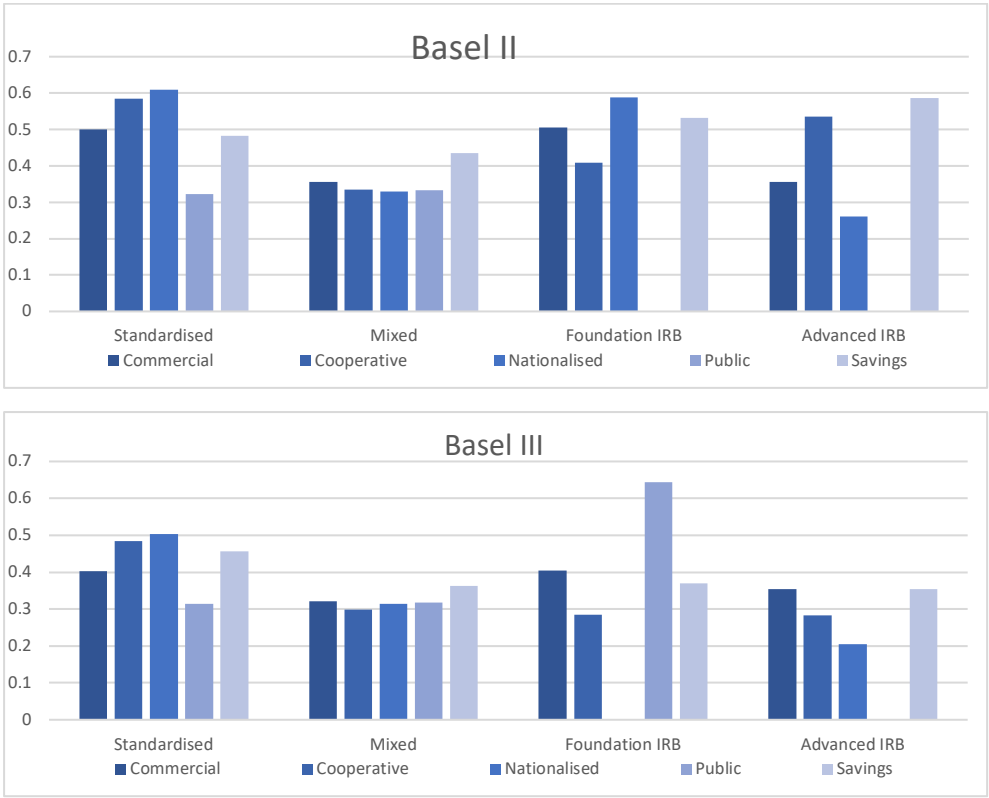
***Source**:* Authors

Referring to ownership structure, Figure 8.3 shows a generic reduction of RWA density from Basel II to Basel III. Moreover, on average, mixed models under Basel III exhibit lower RWA, with the exception of public banks which remain on average stable.

In general, the standardised approach under Basel III underlines higher RWA density than other credit risk measurement approaches, except for public banks that show the highest RWA density level when using the FIRB approach.

These findings suggest that the passage from Basel II to Basel III, generally, decreases the risk weighted assets over total assets ratio and, as should be expected, the highest savings are registered by those banks that adopt the AIRB approaches.

Figure 8.3 Average RWA density (%) by Ownership Structure



Notes: The figure above shows the average level of RWA density ratio that is a proxy of a bank's risk appetite. The figure underlines the difference amongst business models, the credit risk measurement approach and the Basel version adopted by institutions.

Source: Authors

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

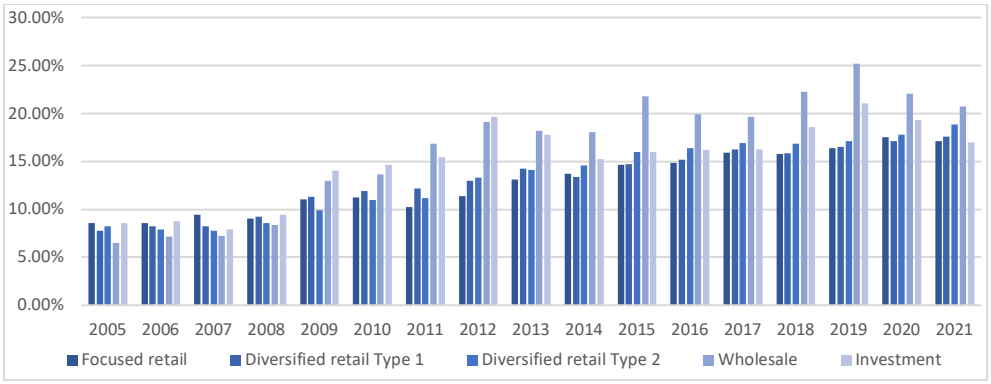
The results in Figure 8.4 show that Tier-1 ratios have been gradually increasing since the financial crisis. However, the ratios are statistically almost indistinguishable amongst the five business models in most years, implying a more or less identical absorption capacity. Only the Tier-1 ratio of the wholesale banks is, on average, significantly higher than that of the retail-oriented and investment banks. Since 2009, both wholesale and investment banks underline a better capital requirement than the other business models. It is only in the last year that investment banks realign themselves with the others. This result may be due to the activities carried out by wholesale and investment banks that are less risk-weighted asset absorbers than those carried out by more retail-oriented banks.

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 11% since 2005 and more than 18% since 2012). In the most recent years, cooperative, nationalised and public banks show a stronger increase in Tier-1 ratio.

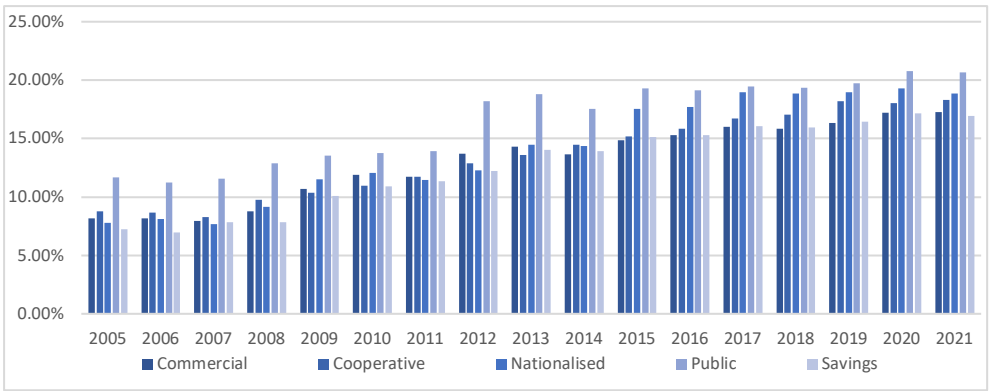
The fact that the differences in risk and absorption capacity are barely reflected in the risk weights and Tier-1 ratios is intriguing, suggesting the possibility that, either the main regulatory instruments currently in use may not be adequate for capturing (or signalling) the loss-absorption capacity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

Figure 8.4 Evolution of Tier-1 capital ratios (as % of risk-weighted assets)

a) Business models



b) Ownership structures



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

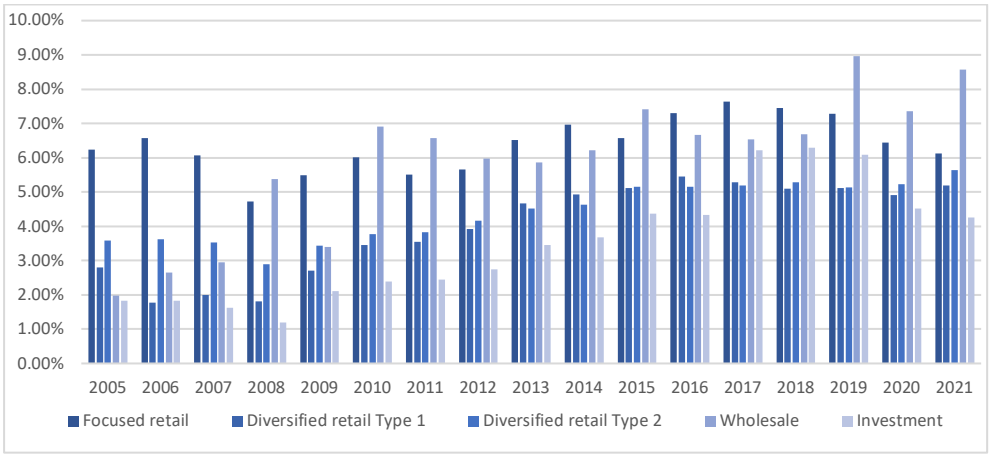
Source: Authors

The third indicator measures the loss-absorption capacity using a simple **leverage ratio**[18] (i.e., tangible common equity over tangible assets). The tangible common equity ratios are statistically distinct for all business models. Figure 8.5 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., on average more than 6%), 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. Moreover, the results suggest that wholesale banks can absorb relatively more losses than investment and diversified retail banks, with an average tangible common equity ratio of 5.48%. Although there is an increase in the most recent years, investment banks show the lowest tangible common equity ratio, which remains lower than the sample average.

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 and savings banks still hold more tangible common equity than any other ownership structures. Moreover, since the outbreak of the financial crisis, the tangible common equity across all ownership structures has increased, except for Nationalised banks that show a decrease between 2006-2008 and during the pandemic period. On average, the tangible common equity ratio of the period investigated is between 5% and 6.2%.

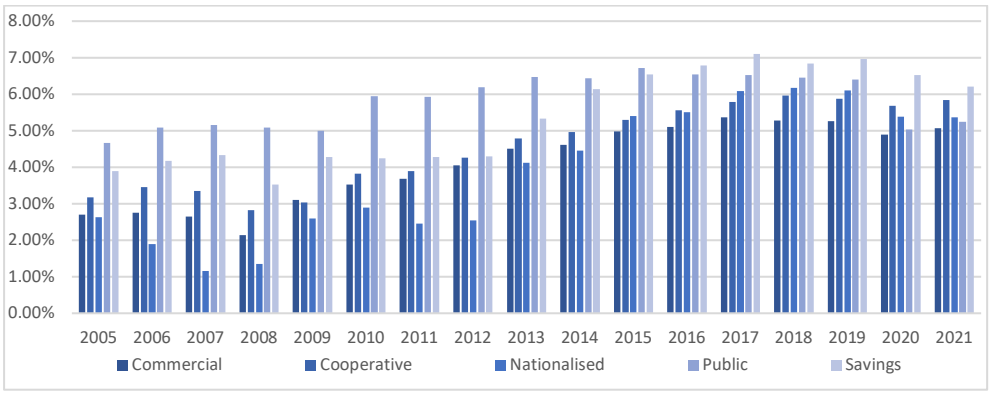
Figure 8.5 Leverage ratios (tangible common equity)

a) Business models



[18] 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

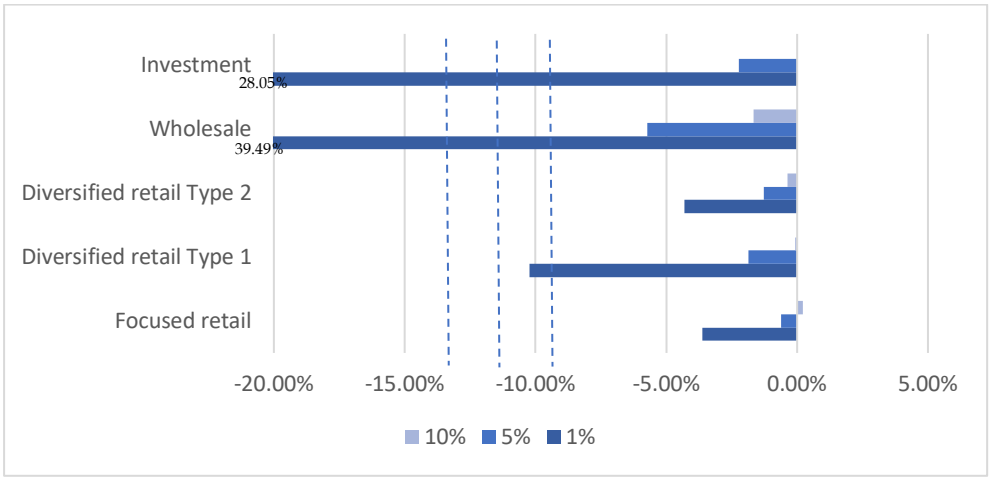
An alternative assessment of default risks follows the 'top-down' approach to calibrating regulatory minimum capital requirements under stress conditions, as described in BCBS (2010b). This method allows for the assessing of the resilience of banks per business model to external shocks. More specifically,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

Naturally, the distribution of returns of actual banks is substantially more varied than the example above. Assuming that a bad year is defined as a once-in-a-10-year event, i.e., lower 10th percentile losses, then generally banks face no RoRWA losses. Only focused retail banks show a positive loss. If a bad year is defined as rarer and, thus, a more destructive event, i.e., lower 5th percentile, then the potential losses increase on average to 2.33%.[19]

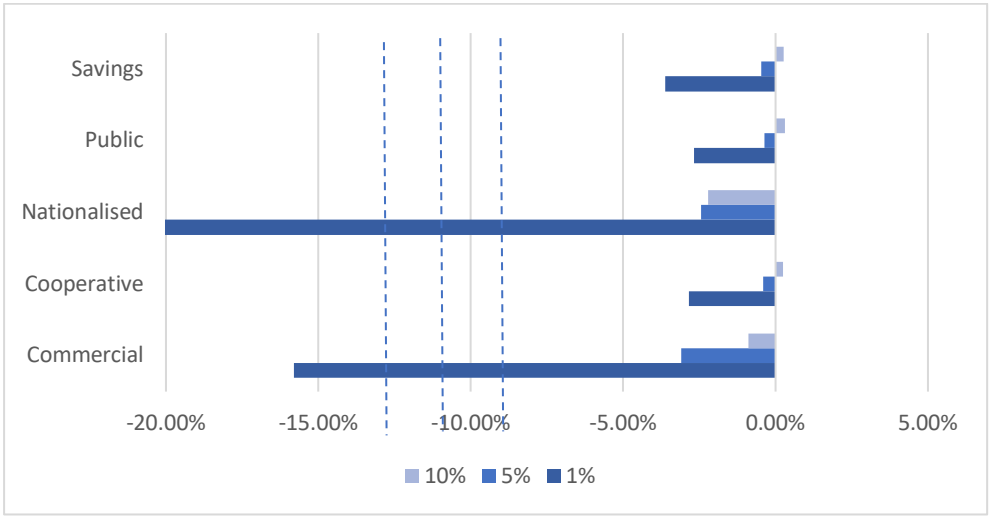
[19] Assuming that earnings are randomly and independently distributed, the estimates would imply that a bank with risk-adjusted capital of less than 2.28% would face a default likelihood of 5%, at any given point in time. However, the earnings distributions of different banks are typically highly correlated, 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.

Figure 8.6 Return on risk-weighted assets (top percentiles)

a) Business models



b) Ownership structures



28.39%

***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 2017. 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

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 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.[20] The estimation results should, nevertheless, be interpreted with caution due to potential estimation errors.

The lower percentile estimates, depicted in Table 8.2, 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 6.3% 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 7.1% and 7.9% respectively.[21]

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, all BMs underline negative RoRWA at the 1st percentile. Both wholesale and investment banks show the highest losses, as compared to the retail-oriented banks, regardless of the statistical procedure used[22]. This leads to questions surrounding the resilience of these two business models when they are facing extreme stress conditions. Also in the post crisis period, i.e., 2013-2019, it seems that the investment and wholesale banks continue to show the highest losses. However, such a finding must be closely monitored annually, to form a view on the long-term resilience of business models in banks. During the COVID crisis, all business models show negative values of RoRWA, although the percentages are lower than in the previous crisis. This is also due to the origin of crisis which, in this case, is exogenous to the banking system. Wholesale banks underline the highest losses (-13.6% at the 1st percentile) and these banks are the only ones to also show negative values of RoRWA at the 10th percentile.

As for the ownership structures, commercial banks and, understandably, nationalised banks are subject to more losses than others in extreme stress conditions. This result may suggest that

[20] 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.

[21] 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.

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

these types of banks are intrinsically riskier and less resilient than other types of banks, such as saving banks and cooperatives banks, which exhibit much lower losses in extreme stress conditions. These two ownership structures show the highest losses in all the subperiods analysed.

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. Hence, they should be dealt with by their respective governments or resolution authorities, in order to avoid a future detrimental impact on financial stability.

Table 8.2 Lower percentile estimates for return on risk-weighted assets (RoRWA)

a) Business models

		Sample statistics		
	Obs	1st	5th	10th
ALL YEARS (2005-21)				
Model 1 – Focus. retail	16807	-3.8%	0.0%	0.2%
Model 2 – Div. retail (T1)	10672	-6.7%	-0.8%	0.2%
Model 3 – Div. retail (T2)	4208	-5.6%	-1.7%	-0.3%
Model 4 – Wholesale	1169	-25.4%	-3.8%	-0.8%
Model 5 – Investment	2711	-29.6%	-3.5%	-0.8%
All banks	35,567	-6.2%	-0.8%	0.1%
PRE-CRISIS (2005-06)				
Model 1 – Focus. retail	180	0.1%	0.8%	0.9%
Model 2 – Div. retail (T1)	80	0.2%	0.3%	0.7%
Model 3 – Div. retail (T2)	200	0.1%	0.5%	0.8%
Model 4 – Wholesale	16	-24.8%	-24.8%	-24.4%
Model 5 – Investment	27	1.0%	1.0%	1.0%
All banks	503	-0.5%	0.5%	0.8%
FIN. CRISIS (2007-09)				
Model 1 – Focus. retail	441	-4.7%	-1.5%	0.0%
Model 2 – Div. retail (T1)	133	-11.3%	-2.0%	-1.2%
Model 3 – Div. retail (T2)	358	-4.7%	-1.4%	-0.1%
Model 4 – Wholesale	29	-15.5%	-10.2%	-7.1%
Model 5 – Investment	52	-9.1%	-5.7%	-1.8%
All banks	1,016	-7.1%	-1.8%	-0.4%
ECON CRISIS (2010-12)				
Model 1 – Focus. retail	4009	-5.4%	-0.3%	0.2%
Model 2 – Div. retail (T1)	2921	-7.7%	-0.8%	0.2%
Model 3 – Div. retail (T2)	1234	-5.6%	-1.8%	-0.5%
Model 4 – Wholesale	248	-17.2%	-5.5%	-1.2%

Model 5 – Investment	852	-32.1%	-11.1%	-4.0%
All banks	9264	-7.9%	-1.3%	0.01%
POST-CRISIS (2013-2019)				
Model 1 – Focus. retail	9976	-3.3%	0.0%	0.3%
Model 2 – Div. retail (T1)	6510	-6.4%	-0.7%	0.2%
Model 3 – Div. retail (T2)	1744	-6.8%	-2.3%	-1.0%
Model 4 – Wholesale	768	-38.6%	-0.4%	-0.8%
Model 5 – Investment	1506	-38.6%	-3.5%	-0.7%
All banks	20504	-6.1%	-0.7%	0.1%
COVID CRISIS (2020-2021)				
Model 1 – Focus. retail	2201	-2.7%	-0.1%	0.2%
Model 2 – Div. retail (T1)	1028	-8.2%	-0.8%	0.8%
Model 3 – Div. retail (T2)	670	-1.9%	0.1%	0.3%
Model 4 – Wholesale	108	-13.6%	-3.1%	-0.6%
Model 5 – Investment	273	-4.3%	0.2%	0.0%
All banks	4280	-4.2%	-0.2%	0.2%

b) Ownership structures

		Sample statistics		
	Obs	1st	5th	10th
ALL YEARS (2005-21)				
Commercial	8738	-14.5%	-3.0%	-0.3%
Cooperative	17662	-3.3%	0.0%	0.2%
Nationalised	421	-41.7%	-10.3%	-4.0%
Public	935	-3.9%	-0.4%	0.2%
Savings	7811	-4.7%	-0.2%	0.2%
All banks	35567	-6.2%	-0.8%	0.1%
PRE-CRISIS (2005-06)				
Commercial	243	-24.4%	0.4%	0.8%
Cooperative	67	0.2%	0.3%	0.8%
Nationalised	36	0.7%	0.8%	0.9%
Public	29	0.3%	0.3%	0.6%
Savings	128	0.2%	0.5%	0.8%
All banks	503	-0.5%	0.5%	0.8%
FIN. CRISIS (2007-09)				
Commercial	491	-10.2%	-2.5%	-0.7%
Cooperative	143	-1.4%	0.7%	0.1%
Nationalised	58	-5.8%	-3.2%	-2.2%
Public	63	-0.6%	0.2%	0.4%
Savings	261	-3.9%	-0.7%	-0.0%
All banks	1016	-7.1%	-1.8%	-0.4%
ECON. CRISIS (2010-12)				

Commercial	2147	-17.8%	-4.6%	-1.6%
Cooperative	4846	-3.0%	0.0%	0.2%
Nationalised	93	-49.0%	-13.8%	-10.3%
Public	222	-7.0%	-0.5%	0.3%
Savings	1956	-6.1%	-0.9%	0.1%
All banks	9264	-7.9%	-1.3%	0.01%
POST-CRISIS (2013-2019)				
Commercial	4784	-15.0%	-2.6%	-0.5%
Cooperative	10624	-3.7%	0.0%	0.2%
Nationalised	180	-41.7%	-17.1%	-4.5%
Public	502	-3.6%	-0.6%	0.2%
Savings	4414	-4.7%	0.0%	0.3%
All banks	20504	-6.1%	-0.7%	0.1%
COVID-CRISIS (2020-2021)				
Commercial	1073	-7.4%	-0.8%	0.0%
Cooperative	1982	-3.1%	0.0%	0.2%
Nationalised	54	-225%	-8.3%	-0.4%
Public	119	-2.0%	0.0%	0.2%
Savings	1052	-2.7%	-0.0%	0.2%
All banks	4280	-4.2%	-0.2%	0.2%

Note: The figures correspond to the 1st, 5th, and 10th percentile estimates of the distribution of the RoRWA, conditional on the business models/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 of 2005 and 2006, losses only occurred for wholesale banks (at all the percentiles investigated), whilst during the crises, losses were observed in the 10th percentile and below, for all BMs. The losses climbed gradually during the crises. During the 2007-09 financial crisis, 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, whilst the investment banks reported the highest losses during the economic crisis. The focused retail and diversified retail (type 1) banks, furthermore, clearly lost more during the financial crisis than during the economic crisis, whilst the losses of the diversified retail (type 2) banks show similar losses during the financial crisis and the economic crisis. As expected, the losses of all business models deteriorated in the aftermath of the crises.

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. Commercial banks are the only banks which show negative values of RoRWA before the beginning of the 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, whilst 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 differs, depending on the nature of the crisis. Hence, the overall banking system remains afloat. In this analysis and at least during this period of investigation, retail-oriented banks, savings and cooperatives banks have provided systemic resilience to the European banking sector. Conversely, investment, wholesale, nationalised and commercial banks have dragged the overall banking system to loss levels in extreme stress conditions.

Another dimension is the comparison of the mean values for RoRWAs (Table 8.3). For the period between 2005 and 2009, far fewer observations were available. The results for all the years show that the wholesale and diversified retail (type 2) banks, on average, reported distinctly higher RoRWAs than banks belonging to the more retail-oriented and investment models. Looking at all the crises' years (2007-09), the focused retail banks are those with the best performance, however, in the subsequent crisis (2010-2012) they are the ones that perform worse than the others, whilst the wholesale banks are significantly better performing.

In the aftermath of the crisis, both focused retail banks continued to perform significantly worse than the other four business models.

During the COVID crisis, investment and wholesale banks show the highest RoRWA.

The averages for the different ownership structures show that the nationalised banks were the only ones reporting a negative average value when considering the entire sample period. These losses are mainly due to the negative values observed during the financial and economic crises. In turn, the commercial banks reported the significantly highest returns. During the COVID pandemic, no ownership structure registers any losses.

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.

Table 8.3 Mean RoRWA

a) Business models

	Focused retail	Diversified retail (Type 1)	Diversified retail (Type 2)	Wholesale	Investment	ALL
All years (2005-21)	**0.88%**	**0.98%**	**1.23%**	**1.69%**	**1.34%**	**1.10%**
Pre-crisis (2005-06)	2.36%	2.14%	1.93%	1.26%	2.72%	2.10%
Financial Crisis (2007-09)	1.27%	0.22%	0.93%	1.01%	0.54%	0.71%
Economic Crisis (2010-12)	-0.17%	0.62%	0.60%	2.60%	1.16%	0.56%
Post-crisis (2013-19)	0.96%	1.14%	1.52%	1.89%	1.11%	1.23%
Covid crisis (2020-21)	1.20%	1.33%	1.31%	1.47%	1.70%	1.33%

b) Ownership structures

	Commercial	Cooperative	Nationalised	Public	Savings	ALL
All years (2005-21)	**1.30%**	**1.19%**	**-0.30%**	**1.17%**	**0.95%**	**1.10%**
Pre-crisis (2005-06)	2.26%	1.88%	2.10%	1.92%	1.63%	2.10%
Financial Crisis (2007-09)	0.98%	0.79%	-0.59%	1.54%	0.74%	0.71%
Economic Crisis (2010-12)	0.95%	0.87%	-2.35%	1.22%	0.25%	0.56%
Post-crisis (2013-19)	1.35%	1.32%	0.16%	0.98%	1.11%	1.23%
Covid crisis (2020-21)	1.43%	1.29%	0.25%	1.35%	1.31%	1.33%

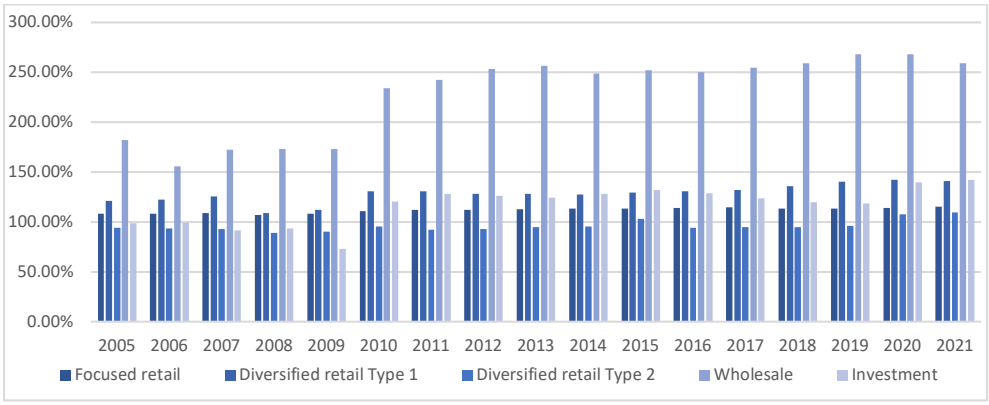
***Notes**:* All figures are the mean values for all banks in the sample.

***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.[23] Figure 8.7 shows that the wholesale and investment banking models face relatively lower liquidity risks, whilst the retail-oriented models may face higher risks. It is important to note that not all models satisfy the 100% funding requirement, as is required by 2021. In fact, diversified retail (type 2) banks show a NSFR lower than 100% for most of the entire period, although during the last two years the average NSFR shows values higher than 100%. In general, the liquidity conditions have gradually improved for most models, particularly for the wholesale banks, which show the highest NSFR. The differences between the ownership structures are much smaller. The NSFR increased in all ownership structures since 2005 and even the nationalised banks, which reported the lowest ratios throughout the sample period, quoted a ratio above the funding requirement after the financial crisis (since 2010).

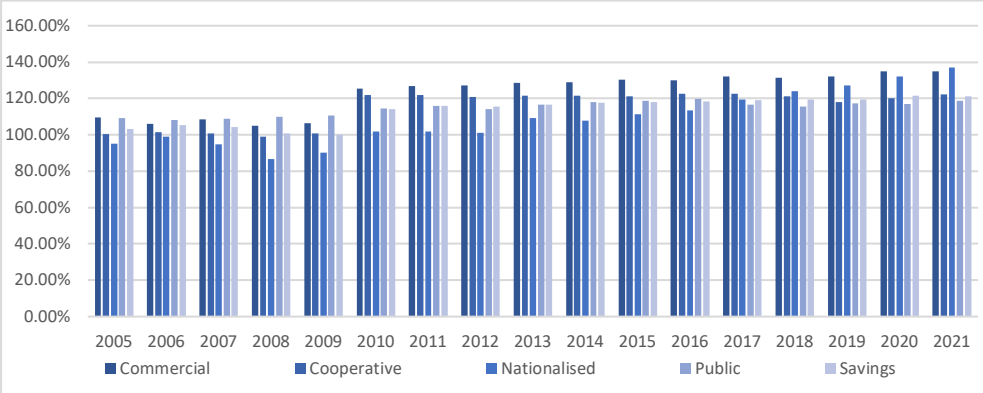
Figure 8.7 Evolution of net stable funding ratio (NSFR)

a) Business models



[23] 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.

b) Ownership structures



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

Source: Authors

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

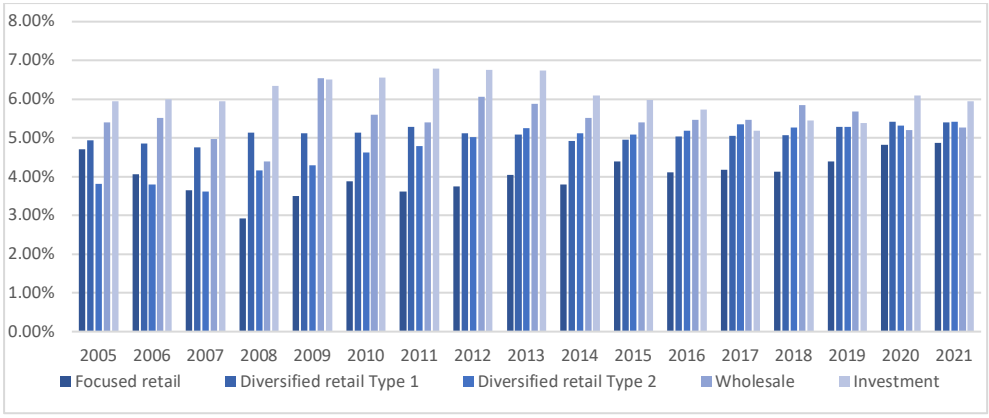
When the bank is unable or unlikely to meet the capital requirements, the recovery and resolution mechanism will need to ensure that the bank will either be orderly resolved or viably restored. The following indicators assess various aspects of the Bank Recovery and Resolution Directive and the Single 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 a share of total liabilities, including own funds, before resolution funds can be tapped. The legislation prescribes that banks need to have at least 8% of bail-inable liabilities, which is equal to the minimum amount that needs to be bailed-in before an amount of 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.

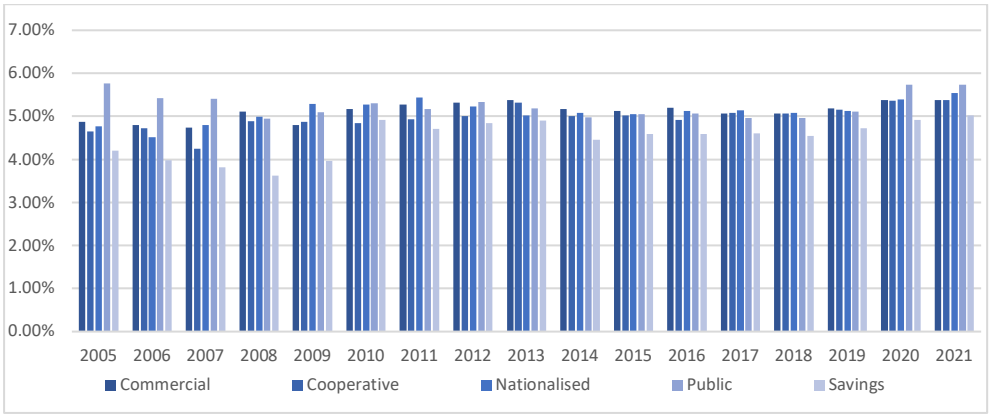
Figure 8.8 shows the banks' minimum contribution to a potential resolution. The bail-in contribution of the retail-oriented banks is significantly less than the wholesale and investment banks, though the diversified retail (type 2) banks, that previously had the lowest bail-in contribution, converged 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. Since the average risk weight is gradually increasing, the bail-in contribution capacity remained stable in recent years, which might mean that the resolution fund would need more funds.

Figure 8.8 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., the 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

Banks are called to ensure the proper functioning of the bail-in mechanism, increasing the absorption capacity of bank losses is the **MREL (Minimum Requirement for Own Funds and Eligible Liabilities)**[24]. Over the last few years, new requirements have emerged for intermediaries in the Banking sector, with particular reference to the structure of their liabilities and the need to achieve the minimum requirements relating to it, represented in more detail by:

[24] MREL is measured using the methodology proposed by Ayadi et al. (2016) "Total Assets" versus" Risk Weighted Assets": does it matter for MREL requirements?"

a) MREL (minimum requirement for own funds and eligible liabilities) conceived in 2014 with a strictly European connotation: the reference body for continuous monitoring is the SRB (Single Resolution Board);

b) TLAC (total loss absorbing capacity) conceived in 2015, referring to institutions of systemic importance (G-SII). Defined by the Financial Stability Board (FSB), it has a geographically wider jurisdiction.

In 2019, approaching the advent of the so-called "banking package" (i.e., CRR2, CRD5, BRRD2) it was recognised that, despite some important differences in purpose and calculation process, there is a significant overlap of information assets and the perimeter involved for the purpose of satisfying the corresponding reporting requirements. A legislative push towards the convergence of MREL and TLAC has therefore emerged.

The legislative framework delegates to the EBA the implementation criteria and the translation of the regulatory provisions into specific reporting requirements, to be integrated into the ITS (Implementing Technical Standard); this will, therefore, be reflected in further reporting and disclosure requirements for European banks.

With this method, we assume that the MREL is computed, based on the TLAC standard applied to the entire banking sector in Europe. The computation uses the formula max (18% RWA, 6.75% LRE) as a percentage of total liability and own funds.

The results are reported for the first component (18% RWA) and for the second component (6.75% LRE) and for the max between the two. All results are reported un-weighted. This method compares the calculations of the MREL requirements using the RWA, the LRE and the max of the two (See Appendix VIII for more details).

Table 8.4 reports results refer to the whole sample, distinguishing between business models (Panel A) and ownership structure (Panel B). As displayed in Table 8.4, using the combined requirement formula (last column), focused retail banks have the highest requirements, followed by diversified retail (type 2) banks. On the contrary, investment banks display the lowest requirements. Using the RWA formula, the highest requirements are shown by retail-oriented banks, whilst banks with business models that are more market-oriented display the lowest RWA requirement. With regard to LRE, mean requirements converge to values slightly lower than 6.75% for all business models. Thus, the LRE-based requirements do not backstop those based on RWA, since the latter are much higher.

As regards to ownership structures (Panel B), average requirements based on RWA are particularly low for public banks. However, all ownership structure, except for savings banks, show

RWA requirements lower than LRE. The LRE-based requirements slightly correct for that low average level, pushing it from 6.28% to 7.71% in the combined maximum requirements. Also, mean requirements for nationalised, commercial and cooperative banks noticeably increase between their RWA estimate and the combined RWA and LRE maximum requirements.

Table 8.4 MREL estimations for all banks, unweighted

Panel A (by business models)

Business Models	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)
Focused retail	8.07%	6.73%	9.07%
Diversified retail Type 1	6.35%	6.70%	7.38%
Diversified retail Type 2	6.82%	6.70%	7.88%
Wholesale	5.22%	6.73%	7.66%
Investment	4.11%	6.71%	6.77%
Tot	**6.28%**	**6.71%**	**7.65%**

Panel B (by ownership structure)

Ownership	18% RWAs	6.75% LRE	Max (18% RWA. 6.75% LRE)
Commercial	6.06%	6.70%	7.47%
Cooperative	6.24%	6.71%	7.63%
Nationalised	6.20%	6.70%	7.54%
Public	5.76%	6.74%	7.63%
Savings	7.24%	6.73%	8.36%
Tot	**6.28%**	**6.71%**	**7.65%**

In line with the European Banking Authority (EBA) and the Financial Stability Board (FSB), we distinguish banks between global systematically important banks (G-SIB), other systematically important banks or domestic systematically important banks (D-SIB) and finally, no systematically important banks. Non systemic banks are less significant institutions under the direct supervision of a nationally competent authority, as per the list published by the ECB.

Looking at D-SIB, the RWA-based requirements are very low for wholesale and investments banks, but the LRE-based requirements slightly correct for that low RWA average level, pushing the combining average ratio to 5.60% and 4.17% respectively. With regard to the G-SIB, the RWA average level lower than the LRE is observed for all BMs, except for diversified retail (type 2) banks. Moreover, referring to No-SIB, retail-oriented banks show the highest average RWA requirements and, also, when we observe the combining average ratio.

Considering the ownership structure, D-SIB and No-SIB savings banks show the highest average combining ratio. Amongst G-SIB, commercial banks display the highest average combining ratio, whilst cooperative the lowest.

On average, No-SIB are those banks that show the highest requirement. This is in line with the assumption that smaller banks should have a higher coefficient because they are better capitalised and have a higher allowable collection, whilst the need to refinance instruments suitable for compliance with the requirement, is almost entirely attributable to systemically or nationally relevant banks (so-called G-SIB and O-SII) (Prometeia, 2016).

Table 8.5 MREL estimations for G-SIB, D-SIB, No-SIB, unweighted
Panel A (by business models % of total asset)

Business Models	G-SIB			D-SIB			No-SIB		
	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)
Focused retail	6.55%	6.73%	6.94%	7.57%	6.71%	7.96%	8.02%	6.73%	9.20%
Diversified retail Type 1	5.76%	6.69%	6.95%	5.97%	6.70%	7.05%	6.36%	6.71%	7.78%
Diversified retail Type 2	6.90%	6.67%	7.54%	6.72%	6.69%	7.61%	7.10%	6.73%	8.88%
Wholesale	-	-	-	5.60%	6.74%	7.14%	5.03%	6.73%	8.17%
Investment	4.04%	6.71%	6.71%	4.17%	6.71%	6.71%	3.75%	6.73%	6.84%
Tot	**5.68%**	**6.69%**	**7.04%**	**6.15%**	**6.70%**	**7.29%**	**6.38%**	**6.72%**	**8.21%**

Panel B (by ownership structure % of total asset)

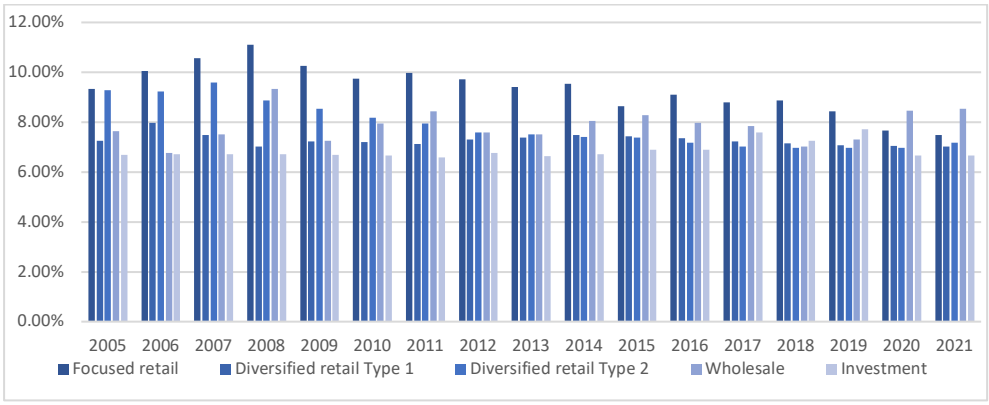
Ownership	G-SIB			D-SIB			No-SIB		
	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)	18% RWAs	6.75% LRE	Max (18% RWA, 6.75% LRE)
Commercial	5.72%	6.69%	7.11%	6.14%	6.69%	7.31%	5.86%	6.72%	7.86%
Cooperative	5.38%	6.69%	6.75%	5.97%	6.69%	7.05%	6.65%	6.73%	8.51%
Nationalised	5.88%	6.66%	6.85%	6.06%	6.69%	7.19%	6.49%	6.72%	8.24%
Public	-	-	-	3.89%	6.73%	6.73%	6.53%	6.74%	8.00%
Savings	-	-	-	6.98%	6.72%	7.81%	7.54%	6.74%	9.01%
Tot	**5.68%**	**6.69%**	**7.04%**	**6.15%**	**6.70%**	**7.29%**	**6.38%**	**6.72%**	**8.21%**

Figure 8.9 shows the evolution of MREL during the period under investigation[25] and emphasises that focused retail banks, on average, are those banks with the highest capital requirement, up to 2019, whilst investment banks show the lowest. This is not surprising, because smaller banks should have a higher coefficient because they are better capitalised and have a higher allowable collection quota.

Considering the ownership structure, savings banks display the highest MREL. However, the gap between these banks and the others drops during the most recent years (2019-2021). In fact, whilst the other ownership structures have shown a stable indicator during the whole period, savings banks have passed from 9.0% in 2005 to 7.6% in 2021, more in line with the MREL of other ownership structures.

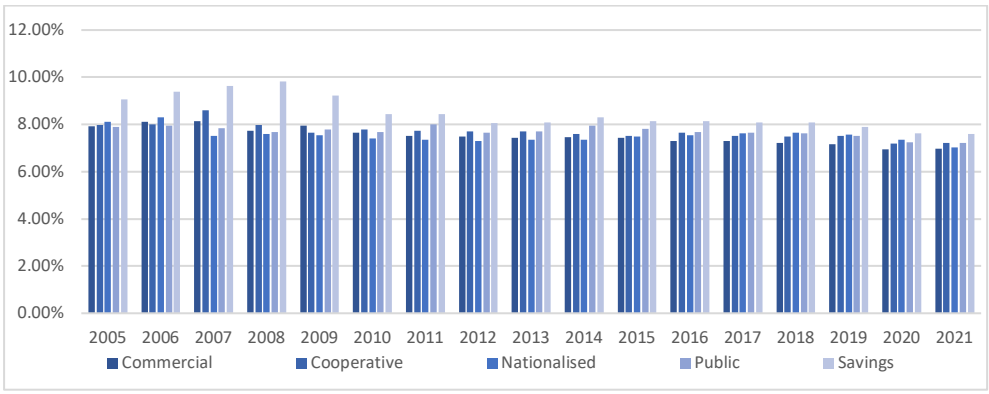
Figure 8.9 Evolution of MREL indicator

a) Business model



[25] We know that the MREL is introduced in 2016 but, in this section, we observe the amount of the capital requirement on own funds for the whole period investigated, in order to observe the evolution of this indicator.

b) Ownership structure



***Notes**:* The figure above shows the evolution of MREL indicator, both with regard to the different bank business models and the ownership structure.

***Source**:* Authors' elaborations

To conclude, this section assessed the response of banks to prudential requirements 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.

Some of the indicators are distinct, whilst 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 now become compulsory. However, their construction remains difficult to realise and the existing public reporting falls largely short on information about maturity of both assets and liabilities, needed to enable exact estimates to be made for the liquidity ratios. The rough estimates for this Monitor showed that the average values have increased in the most recent years and are, in general, 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 riskiest banks should have a higher average risk-weight and thus capital requirement, whilst 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.

9. CONCLUSIONS

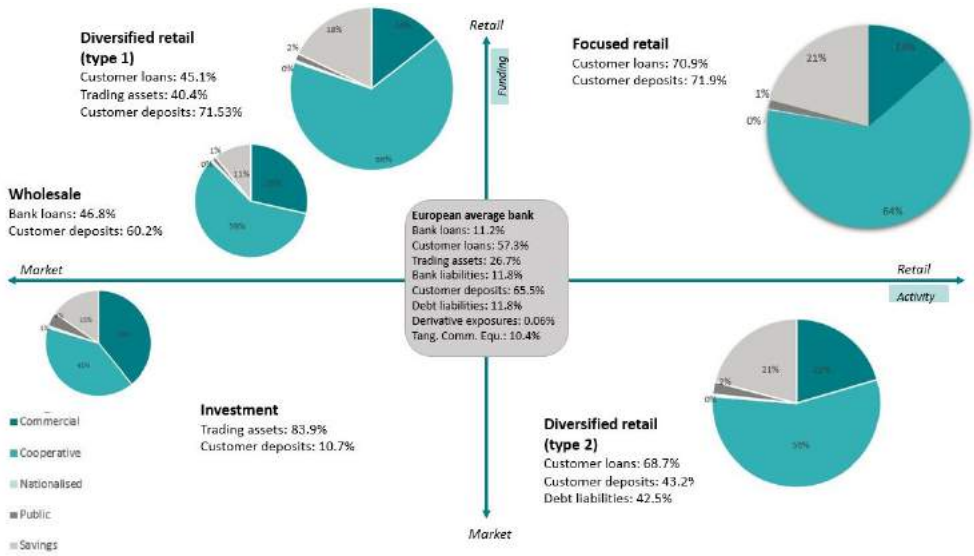
The Bank Business Model (BBM) Monitor of the European banking sector, using data from 2005 to 2021, assesses the banking sector structure in light of the changing economic, legislative and supervisory environment. It also attempts to gain better insights into the impact of different types of corporate 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 BBM Monitor includes 3,503 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 35,567 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 9.1 and the key findings per bank business model in Table 9.1.

Figure 9.1 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 19% of the small institutions are shareholder-value (SHV) banks, whilst about 48% are cooperative and 29.5% 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, whilst trading income and other income are only minor components. The share of the banks that were identified as focused retail remained similar during the period investigated.

The focused retail banks have performed rather well, compared to their peers between 2005 and 2021. Looking at the whole period, focused retail banks show the third highest return on assets. With the exception of the economic crisis of 2011 and 2012, in which they show negative profitability, they reported amongst the highest return on assets. Albeit, in terms of return on equity, focused retail banks show the lowest RoE. The focused retail banks reported the second-best operational efficiency, measured in terms of cost-to-income ratio, second only to the diversified retail type 2 banks. Interestingly, the focused retail banks suffered significantly lower loan losses than the diversified retail banks and reported the second most stable loan growth, confirming their undeniable role in the real economy, however, focused retail banks display, on average, the highest non-performing loans ratio. The focused retail banks are least leveraged and distant from default, i.e., the highest Z-score, and they seem more resilient to extreme stress conditions, compared to other business models; this is confirmed by the low level of SRISK. With regards to capital requirement, focused retail banks show, on average, the highest value amongst retail-oriented banks. 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. This model has the highest percentage of shareholder-value banks (66%). In particular, diversified retail banks (type 1) combine lending to customers with a moderate percentage of trading activities (i.e., 40.4% 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 (81.6% of banks remain in the same BM).

The other activities are barely reflected in the income, with the largest share of income being obtained from net interest. The commission and fees income, as well as the trading income are the highest amongst retail-oriented banks. Moreover, the trading income of the retail-oriented banks is more stable than for 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 second largest average 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 (type 1) banks score relatively high on regulatory risk indicators, compared to the other retail models, i.e., relatively lower average risk-weights and higher regulatory Tier-1 ratios (the latter compared to the other diversified retail banks). However, they show the lowest MREL indicator amongst retail-oriented banks.

The diversified retail (type 1) banks' returns deteriorated during the crises. The returns on assets and equity have been among the highest pre-crisis,but marginalised during the financial crisis and turned negative during 2008.

The diversified retail (type 1) banks suffered higher loan losses and non-performing loans than focused retail banks. The banks, nevertheless, reported the highest customer loan growth during the pre-crises period and always a positive growth, except for 2012-2013 and 2016-2017 and show higher SRISK after the financial and economic crises than focused retail banks.

Diversified retail (type 2) banks are relatively large in size as compared to the other retail-oriented banks. Amongst these banks are the commercial, 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) banks are the smallest amongst 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. In addition, the diversified retail (type 2) banks show the highest operational efficiency compared to the other BMs.

The diversified retail (type 2) banks are relatively risky based on various reporting indicators. The banks have the lowest average distance to default amongst the retail-oriented banks. In turn, the diversified retail (type 2) banks scored, on average, higher on the regulatory risk indicators than the diversified type 1 business model, i.e., banks that adopt this business model show a level of risk-weighted assets and MREL in the middle, between the focused retail and diversified retail type 1 models and the lowest Tier 1 ratio, compared to the other retail-oriented banks.

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, but moderate non-performing loans, in the middle, between investment and wholesale banks, as well as the other retail-oriented banks. Moreover, in the post-crises period, this business model shows higher return on assets than the other retail-oriented business models. 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, which returns to growth in the post-crisis period. However, in 2013, 2017 and 2021 the growth of customer loans is negative.

Wholesale banks are amongst the smallest 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, which provide liquidity and other services to the local banks, as well as public banks. 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 fee income. The wholesale banks are traditionally characterised by low loan losses. Despite the extraordinary losses during the financial crisis, the wholesale banks still had both the lowest loan loss provisions and the lowest non-performing loans.

The wholesale banks' returns have been reasonably stable, except during the financial crisis. 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. In terms of support to the real economy, wholesale banks show the highest negative values in 2008, 2015, 2019 and 2021. It is also observed that during the most recent years the percentage of banks that leave this BM increases more than the percentage of banks that move from other BMs to this one. Moreover, considering performance and risk during the period of the Covid-19 pandemic, results underline that, on average, banks in this BM perform worse. This does not suggest that this BM is the worst business model absolutely, but this sheds light on the average performance, suggesting that banks that decide to move to the wholesale BM are, on average, banks that perform worse and are more risky.

Table 9.1 Results across business models, 2005-21

	Ownership	Migration	Financial performance & operational efficiency	Contribution to the real economy	Risk	Response to regulation and resolution
Model 1 - Focused retail (16,807 obs.)	Skewed towards stakeholder value types (e.g., cooperative, savings banks)	Most stable business model (86.59%); migration	Relative high returns, except for econ. crisis and high operational efficiency	High stable customer loan growth; the biggest supporter during fin. Crisis. Negative growth only in 2021	The highest distance to default; the lowest loan loss provisions amongst retail banks, but the highest NPL ratio; the highest CDS spread of subordinated bonds. Low SRISK.	The highest risk weights; moderate Tier-1 cap. and the highest tangible equity; the lowest bail-in contribution. The highest MREL among retail banks.
Model 2 – Diversified retail (Type 1) (10,672 obs.)	Skewed towards stakeholder value banks (i.e., small cooperatives, savings and commercial)	Highly stable business model (81.64%); largest migration to focused retail and main receiver from other models	Returns as well as operational efficiency deteriorated during the fin. and econ crises	High customer loan growth (but lower than focused retail during and after the crises); negative growth during econ. crisis and 2016-2017	The second highest distance to default; the highest loan loss provisions and the second highest NPL ratio. Low SRISK	Amongst retail-oriented banks, the lowest risk weights; moderate Tier-1 cap. and tan. eq.; moderate bail-in contribution and the highest NSFR.
Model 3 – Diversified retail (Type 2) (4,208 obs.)	Cooperative, Commercial and savings banks	Highly stable business model (75.45%); migration to other retail-oriented models	Returns most stable and the only retail-oriented model not posting a loss in a single year; the highest average return among retail-oriented banks; the highest operating efficiency	Negative growth of customer loans during/after econ. crisis, especially 2013 and 2017. Negative growth also during 2021.	The lowest distance to default among retail-oriented banks; Moderate loan loss provisions and NPL ratio. The highest SRISK that increases after the financial crisis.	High risk weights; the lowest Tier-1 cap. and low tan. eq.; low bail-in contr.; least liquid. Moderate level of MREL and bail-in contribution. The lowest NSFR

Model 4 – Wholesale (2,711 obs.)	Predominantly commercial banks and cooperative	Highly stable business model (74.25%); migration to diversified retail (type 1) and investment	Returns stable, although the reduction during fin. crisis; the highest average return during the period; and the second worse cost-efficiency	Relatively high customer loan growth during crises but with some years with negative sign, especially in 2008, 2019 and 2021.	Low distance to default; the lowest loan loss provisions and the second lowest NPL ratio (but with an increase in the last years); The lowest CDS spread of senior and subordinated bonds. Moderate SRISK. The lowest RoRWA	Low risk weights; the highest Tier- 1 cap. and moderate tan. eq.; high bail-in contribution. Moderate MREL. The highest NSFR.
Model 5 – Investment (1,169 obs.)	Predominantly commercial banks, but substantial share of cooperative banks	Stable business models (70.80%); migration to diversified retail type 1	Returns rather stable, except for fin. crisis, and lowest cost efficiency	The loan growth deteriorated relatively more during and after the fin. and econ. crises. The BM with more years with negative growth	The lowest distance to default; moderate loan loss provisions and the lowest NPL ratio. Moderate SRISK.	The lowest risk weights; high Tier-1 cap. and the lowest tan. eq.; the highest bail-in contribution. The highest MREL. High NSFR.

Source: Authors

Amongst the five models, the banks identified as **investment-oriented** are relatively small in number. The investment banks primarily engage in trading activities, whilst relying on debt securities and derivatives for funding. The investment banks 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, with wholesale banks, which relies for less than half of its income on net interest income. Also, the commissions and fees form one third of income. The income of investment banks has the highest level of trading income amongst business models (24%).

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. The operational efficiency has been similar to that of the wholesale banks, and they show the highest level of cost-to-income ratio, revealing a cost efficiency that is lower than retail-oriented 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. In fact, from the beginning of the financial crisis (2009), on average, the growth of customer loans shows a negative sign, except for 2010 and 2015. Only in the last two years, i.e., during the COVID pandemic, does the growth rate return to be positive. Despite the deleveraging, the leverage of the investment banks is still relatively high, which is likely to reflect in the highest bail-in contribution under the new resolution regime. Moreover, the investment banks show the lowest risk-weighted assets and a high Tier 1 ratio, although it is the second lowest amongst BMs.

Turning to the results across ownership structures, the **commercial banks** account for more than half of all the banking assets, whilst representing only about 24.6% of the number of institutions. The commercial banks conduct relatively more lending and trading activities. This is also reflected in their income structure, which consists substantially of net interests and commission and fees income (79% of the total). 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 and in the most recent years, after the economic turmoil, commercial banks have returned to producing high profits.

The commercial banks suffered both moderate loan losses and non-performing loans. In terms of support to the real economy, although in general commercial banks show a positive growth of loans ratio, they show negative growth of gross loans in 2013, 2016-2017 and 2021. The commercial banks had, especially during the first years of the sample period (i.e., from 2005 to 2009), relatively high SRISK, second only to nationalised banks. The MREL indicator is moderate over time. 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 49.6% of the observations, but only 18.7% of the assets. The activities of the cooperative banks are, on average, retail-oriented. Hence, the operational income consists primarily of net interest revenues. The cooperative banks reported stable returns, which were amongst 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 non-performing loans and reported stable loan growth. The cooperative banks were relatively moderately leveraged which, combined with the low volatility in earnings, reflected in the highest distance to default. Observing the regulatory and market risk measures, the cooperative banks are less risky than commercial banks, looking at the lower CDS-spreads, the lower risk-weights and total SRISK compared to commercial banks.

The **nationalised banks** are the smallest group of banks representing about 1% of total observations, but with a moderate average size (8% of the total assets). The nationalised banks, in particular, include in terms of number diversified retail (type 2) banks (i.e., 2.57%), whilst in terms of total assets, the diversified retail (type 1) and (type 2) banks (i.e., 12.34% and 7.94% respectively%) are nationalised banks. These banks, on average, depend most on market activities, with relatively large 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 2015. Moreover, nationalised banks are the only ownership structure that shows a negative return on assets in 2020. These were partially due to the high cost related to problem loans and to the trading losses registered in 2008 and 2013. They show the highest level of NPL during the period observed. The negative returns were funnelled through in the form of a decline in the customer loan portfolio that, from 2010 to 2018, turns out to be negative. The volatility and bad performance of the banks were also reflected in the lowest distance to default amongst bank ownership structures. 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 Tier-1 capital ratios and leverage ratio. The NSFR, on average, is the lowest during the period observed. In term of SRISK, nationalised banks show the highest level, suggesting that these banks are those that contribute most to the systemic risk.

The **public banks** form only a small part of the sample, both in terms of number and total assets. The public banks are mainly involved in retail activities and primarily depend on net interest income. The operational efficiency of the public banks, measured through cost-to-income ratio, is higher than all the other structures.

The public banks suffered both the least loan losses and, on average, the lowest NPL ratio and reported the highest loan growth (with savings banks), particularly at the height of both the financial and economic crises. The highest capital levels also led to the relative furthest distance to default, based on the reporting measure, i.e., a moderate Z-score. This was supported by the regulatory and market risk measures, because the CDS-spreads and average risk-weights were the lowest amongst 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 11.7% of the assets in the sample, but about a fifth of the institutions (21.96%). 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 cooperative and public banks.

The savings banks' lower returns and higher loan losses and non-performing loans during the crises, were reflected in the relatively low loan growth figures. Despite all this, these banks display moderate regulatory capital and market volatility.

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, whilst 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, whilst 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. Finally, these findings underline that, depending on the macroeconomic conditions, i.e., economic crisis, financial crisis, the COVID-19 pandemic or tranquil period, BMs do perform differently.

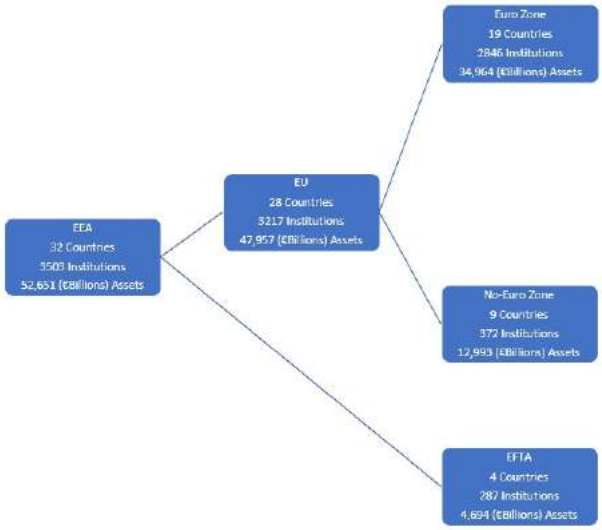
9. Appendix I. List of Variables

No.	Variable	Coverage	No.	Variable	Coverage
1	Country (headquarter location)	100%	26	Income (interest - net)	99%
2	Reporting currency	100%	27	Income (commissions - net)	99%
3	Ownership (SHV/STV)	100%	28	Income (trading - net)	97%
4	Ownership (cooperative, savings, etc.)	100%	29	Income (other)	97%
5	Listed (YES/NO)	100%	30	Expenses (operating - total)	99%
6	Internationalisation (total – no. of countries)	98%	31	Expenses (operating - personal)	98%
7	Internationalisation (subsidiaries – no. of countries)	98%	32	Expenses (operating – risk costs)	86%
8	Internationalisation (branches – no. of countries)	98%	33	Expenses (operating – loan loss provisions)	100%
9	Assets (total)	100%	34	Profit (before tax)	99%
10	Assets (% of GDP)	100%	35	Income tax	99%
11	Cash (and balances with central banks)	99%	36	Profit (after tax)	99%
12	Loans to banks (total)	99%	37	Risk-weighted assets (total)	87%
13	Loans to customers (gross)	84%	38	Capital (regulatory capital)	88%
14	Loans to customers (net)	100%	39	Capital (tier I - total)	83%
15	Intangible assets	99%	40	Capital (core tier I - total)	43%
16	Liabilities (total)	100%	41	Applicable Basel Standards (I/II)	91%
17	Deposits (banks)	99%	42	Basel approach (SA/IRB)	75%
18	Deposits (central banks)	38%	43	State aid (Received - YES/NO)	87%
19	Deposits (customers)	100%	44	CDS spread (senior, average, local currency)	3%
20	Repurchase agreements (liabilities)	33%	45	CDS spread (senior, volatility, local currency)	3%
21	Derivatives (total - fair value - negative)	99%	46	CDS spread (senior, average, USD)	3%
22	Capital (equity - total)	100%	47	CDS spread (senior, volatility, USD)	3%
23	Capital (tangible common equity)	99%	48	CDS spread (subordinated, average, local currency)	3%
24	Capital (common equity)	99%	49	CDS spread (subordinated, volatility, local currency)	3%
25	Income (total)	99%	50	CDS spread (subordinated, average, USD)	3%

No.	Variable	Coverage	No.	Variable	Coverage
51	CDS spread (subordinated, volatility, USD)	3%	58	Supervisor (Single Supervisory Mechanism - YES/NO)	100%
52	Share price (year-end)	11%	59	Supervisor (Financial Stability Board - YES/NO)	100%
53	Share price (average)	11%	60	Cumulative peak losses aided banks (% of total liabilities)	5%
54	Share price (volatility)	11%	61	MREL	100%
55	Share price (observations)	12%	62	Non-performing loans (% of customer gross loans)	69%
56	Share price (volume)	10%	62	SRISK	100%
57	Supervisor (European Banking Authority - YES/NO)	100%			

10. APPENDIX II. DISTRIBUTION OF BANKS ACROSS COUNTRIES

Distribution of banks across countries



Country	Institutions	Assets
AT	330	1127697.122
BE	23	843762.141
CY	18	158507.3579
DE	1582	8152359.972
EE	6	7529.553
ES	167	5523150.989
FI	43	821764.577
FR	79	9848811.031
GR	21	355285.335
IE	14	415758.0689
IT	454	4293842.702
LT	5	7937.16895
LU	39	332902.9077
LV	16	12659.5002
MT	10	26227.17814
NL	34	2602370.077
PT	54	377083.318
SI	11	36655.24
SK	5	10279.377

Country	Institutions	Assets
BG	10	16655.26
CZ	9	37597.12
DK	76	1022199.58
GB	176	10454143.87
HR	14	7136.32
HU	9	91428.39
PL	14	155114.15
RO	7	36828.32
SE	57	1171258.19

Country	Institutions	Assets
CH	163	3355577.82
LI	6	27131.76
IS	8	86482.08
NO	110	600260.81

***Note**:* 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 is for the latest year (2021 or before) available.
Source: Authors

11. APPENDIX III. DEFINITION OF BANK BUSINESS MODELS AND DISTRIBUTION ACROSS YEARS AND COUNTRIES

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) (in Ayadi (2019)). 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.[26] 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.
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).*[27] 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.

[26] 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 indistinct clustering. In turn, using a larger set did not change the results substantially, as long as the defined indicators were included.

[27] 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.

Evolution of the sizes across Business models

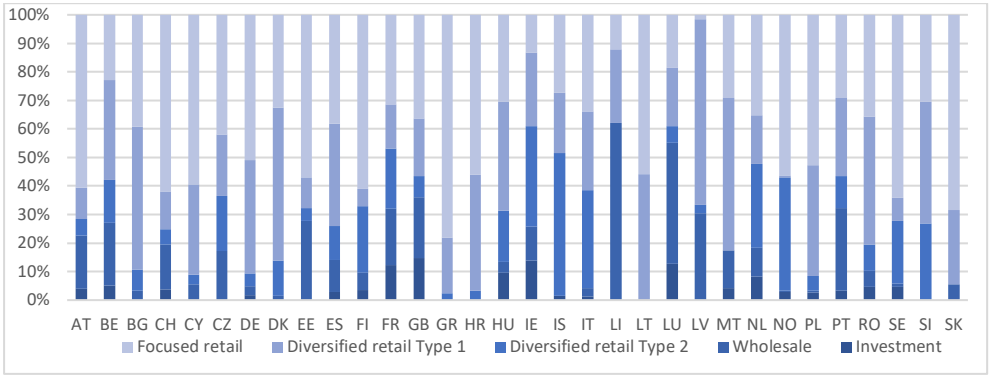
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
								Total assets (€ billion)									
Focused retail	816	1,237	1,760	2,658	2,502	3,982	4,777	4,701	5,001	4,921	6,382	6,302	7,181	7,581	8,893	8,923	11,672
Diversified retail (Type 1)	4,320	3,679	8,017	10,525	13,170	13,081	15,682	16,810	14,560	16,823	18,311	15,205	16,794	16,203	16,772	19,528	19,093
Diversified retail (Type 2)	10,347	13,369	13,002	13,107	15,194	16,846	16,222	14,848	14,056	13,448	11,829	13,500	13,729	14,421	14,434	12,506	9,488
Wholesale	1,288	1,044	752	367	411	578	619	691	768	639	677	628	732	694	474	493	468
Investment	6,908	7,986	9,201	8,663	3,345	7,708	6,707	6,257	5,841	6,816	5,066	7,097	2,398	2,549	2,665	4,639	7,539
All banks	23,679	27,313	32,733	35,321	34,621	42,195	44,007	43,307	40,226	42,647	42,265	42,731	40,834	41,447	43,237	46,088	48,261
								Number of institutions									
Focused retail	79	101	141	154	146	1218	1311	1316	1349	1312	1245	1367	1375	1467	1117	908	1109
Diversified retail (Type 1)	40	40	37	42	54	901	881	972	973	1031	974	1002	926	709	456	446	530
Diversified retail (Type 2)	93	106	122	116	120	418	400	371	338	286	351	209	167	153	153	301	344
Wholesale	12	15	20	18	14	262	273	244	249	235	195	171	161	152	112	109	119
Investment	8	8	12	9	8	82	80	81	72	80	72	100	105	134	142	57	50
All banks	232	270	332	339	342	2881	2945	2984	2981	2944	2837	2849	2734	2615	1980	1821	2152
								Mean total assets (€ billion)									
Focused retail	10	12	12	17	17	3	4	4	4	4	5	4	5	5	7	9	10
Diversified retail (Type 1)	108	92	217	251	244	15	18	17	15	16	19	15	18	23	37	44	36
Diversified retail (Type 2)	111	126	106	113	126	40	40	40	42	47	34	64	82	94	94	41	27
Wholesale	107	70	38	20	29	2	2	3	3	3	3	4	4	4	4	4	4
Investment	863	998	767	963	418	94	84	77	81	85	70	71	23	19	19	81	151
All banks	102	101	98	104	101	15	15	14	13	14	15	15	15	16	21	25	22

Evolution of the sizes across Ownership structures

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sum of total assets (€ billion)																	
Commercial	14,354	16,435	19,079	20,952	19,599	23,996	25,394	25,080	23,252	25,366	25,514	25,226	24,018	24,383	25,471	26,594	27,200
Cooperative	3,435	4,156	4,733	5,019	6,042	7,403	7,849	8,056	7,824	8,434	8,250	8,647	8,245	8,463	8,944	9,771	10,558
Nationalised	2,898	3,304	4,923	5,071	4,671	4,260	4,070	3,606	2,928	3,024	2,648	2,389	2,149	2,069	2,136	2,256	2,378
Public	387	427	483	523	581	1,187	1,280	1,273	1,261	1,449	1,512	1,523	1,401	1,459	1,549	2,144	2,317
Savings	2,605	2,992	3,514	3,756	3,728	5,350	5,413	5,291	4,963	4,373	4,341	4,946	5,022	5,072	5,137	5,323	5,808
All banks	23,679	27,313	32,733	35,321	34,621	42,195	44,007	43,307	40,226	42,647	42,265	42,731	40,834	41,447	43,237	46,088	48,261
Number of institutions																	
Commercial	115	128	160	166	165	695	719	733	739	707	691	715	685	656	591	536	537
Cooperative	27	40	47	47	49	1580	1616	1650	1677	1664	1590	1666	1595	1506	926	815	1167
Nationalised	17	19	19	19	20	32	31	30	28	25	25	26	24	26	26	26	28
Public	13	16	21	21	21	71	75	76	76	77	75	75	72	67	60	59	60
Savings	60	68	86	87	88	644	654	658	659	669	650	650	627	613	546	515	537
All banks	232	271	333	340	343	3022	3095	3147	3179	3142	3031	3132	3003	2868	2149	1951	2329
Mean total assets (€ billion)																	
Commercial	125	128	119	126	119	35	35	34	31	36	37	35	35	37	43	50	125
Cooperative	127	104	101	107	123	5	5	5	5	5	5	5	5	6	10	12	12
Nationalised	170	174	259	267	234	133	131	120	105	121	106	92	90	80	82	87	17
Public	30	27	23	25	28	17	17	17	17	19	20	20	19	22	26	36	3
Savings	43	44	41	43	42	8	8	8	8	7	7	8	8	8	9	10	4
All banks	102	101	98	104	101	14	14	14	13	14	14	14	14	14	20	24	10

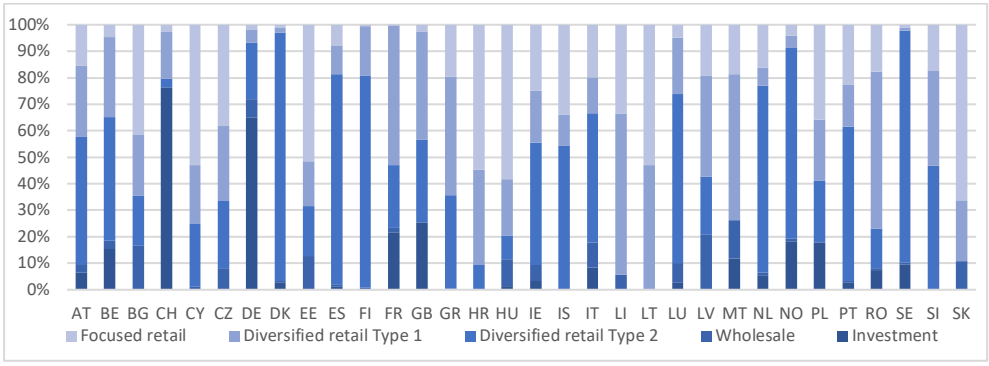
***Note**:* All figures correspond to the year-end observations for the relevant sub-sample.
***Source**:* Authors

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



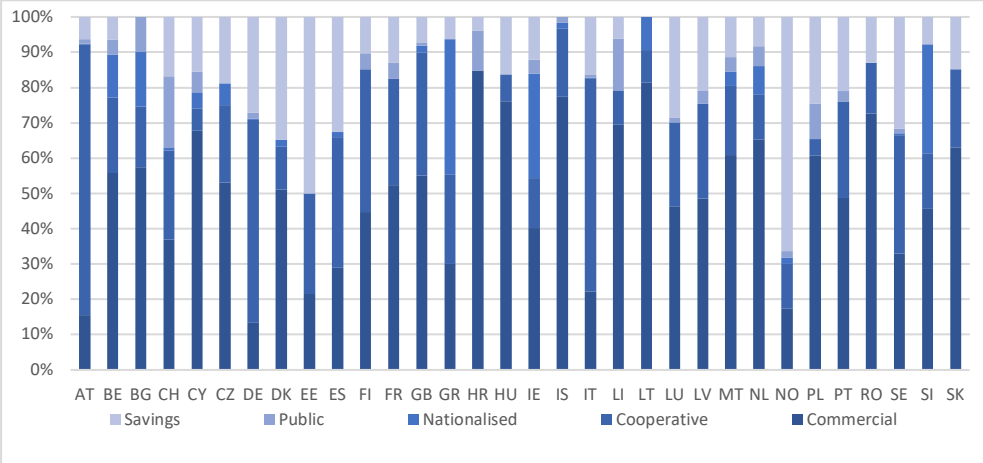
***Note**:* The figure above shows the distribution of banks across business models, based on share in observations for the entire sample period in the EEA-countries and Switzerland.
***Source**:* Authors

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



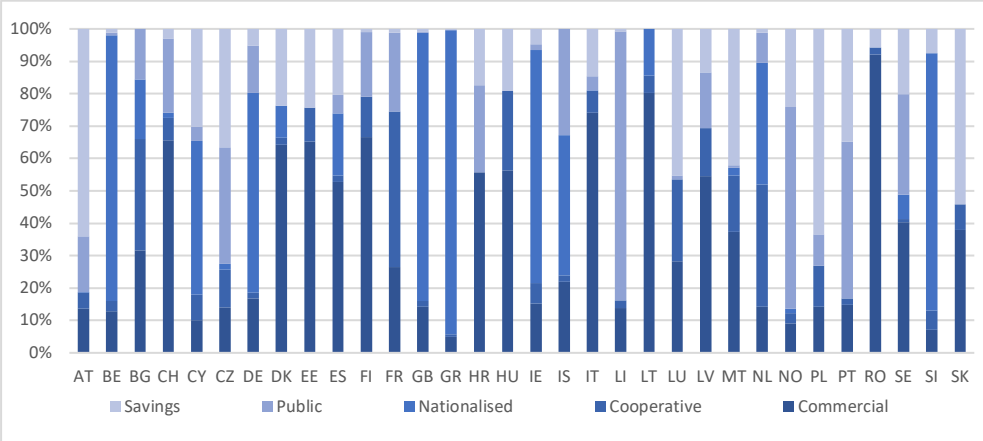
***Note**:* The figure above shows the distribution of banks across business models, based on share in assets for the entire sample period in the EEA-countries and Switzerland.
***Source**:* Authors

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



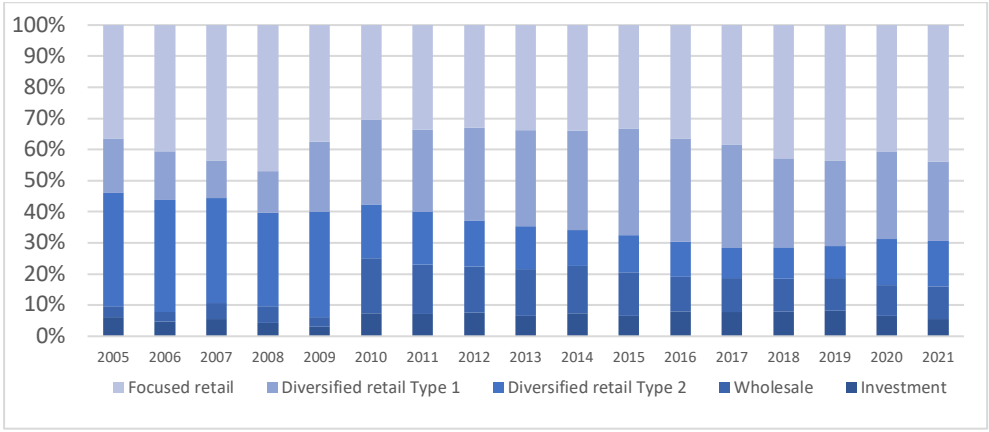
***Note**:* The figure above shows the distribution of banks across ownership structures, based on share of observations assets for the entire sample period in the EEA-countries and Switzerland.
***Source**:* Authors

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



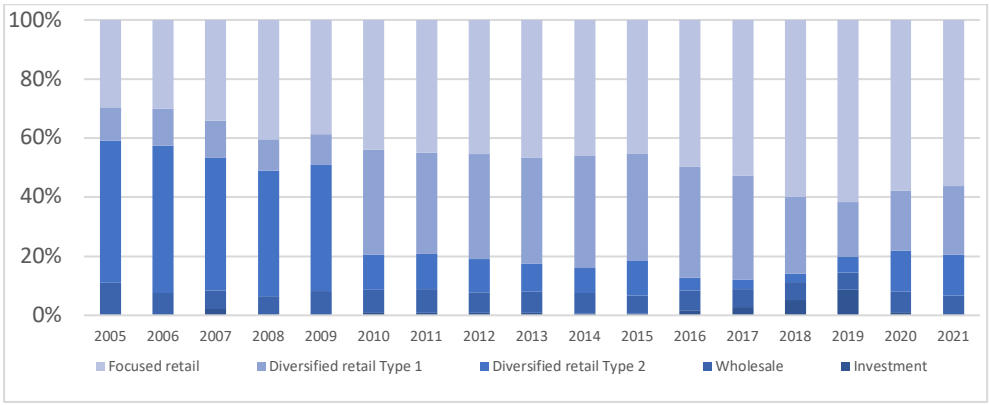
***Note**:* The figure above shows the distribution of banks across ownership structures, based on share in assets for the entire sample period in the EEA-countries and Switzerland.
***Source**:* Authors

Distribution of commercial banks across business models and years (% of institutions)



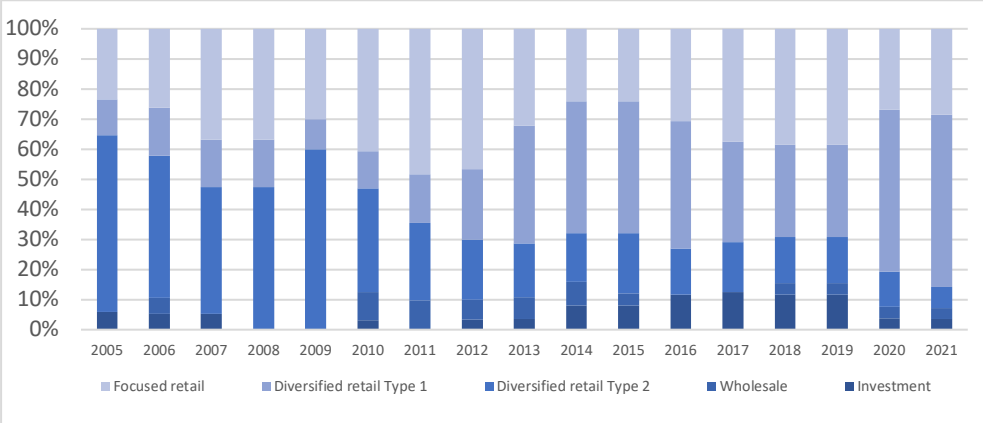
Note: The figure above shows the distribution of commercial banks across years and business models, based on share in number of institutions for the entire sample period in the EEA-countries and Switzerland.
Source: Authors

Distribution of cooperative banks across business models and years (% of institutions)



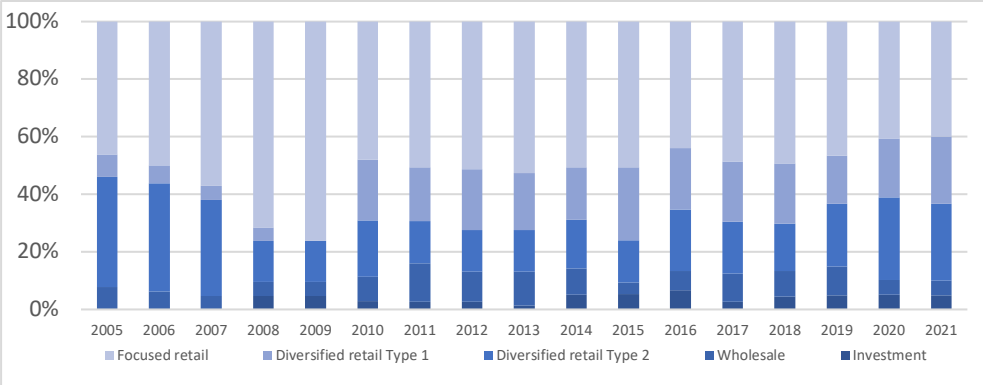
Note: The figure above shows the distribution of cooperative banks across years and business models, based on share in number of institutions for the entire sample period in the EEA-countries and Switzerland.
Source: Authors

Distribution of nationalised banks across business models and years (% of institutions)



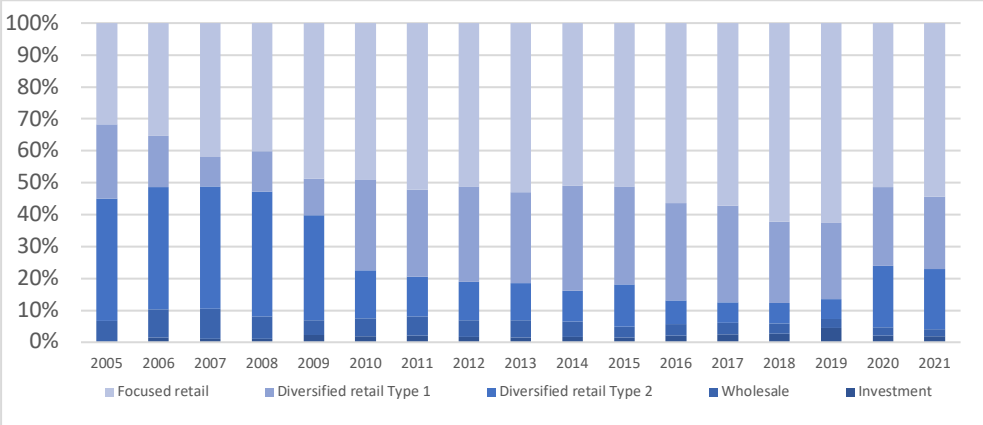
***Note**:* The figure above shows the distribution of nationalised banks across years and business models, based on share in number of institutions for the entire sample period in the EEA-countries and Switzerland.
Source: Authors

Distribution of public banks across business models and years (% of institutions)



***Note**:* The figure above shows the distribution of public banks across years and business models, based on share in number of institutions for the entire sample period in the EEA-countries and Switzerland.
Source: Authors

Distribution of savings banks across business models and years (% of institutions)



***Note**:* The figure above shows the distribution of savings banks across years and business models, based on share in number of institutions for the entire sample period in the EEA-countries and Switzerland.
Source: Authors

12. APPENDIX IV. DETERMINING THE OPTIMAL NUMBER OF CLUSTERS

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.[28]

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 ratio of between-cluster variance to within-cluster variance.[29] 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. 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.

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

[29] 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.

Pseudo-F indices for clustering configurations for banks in Europe

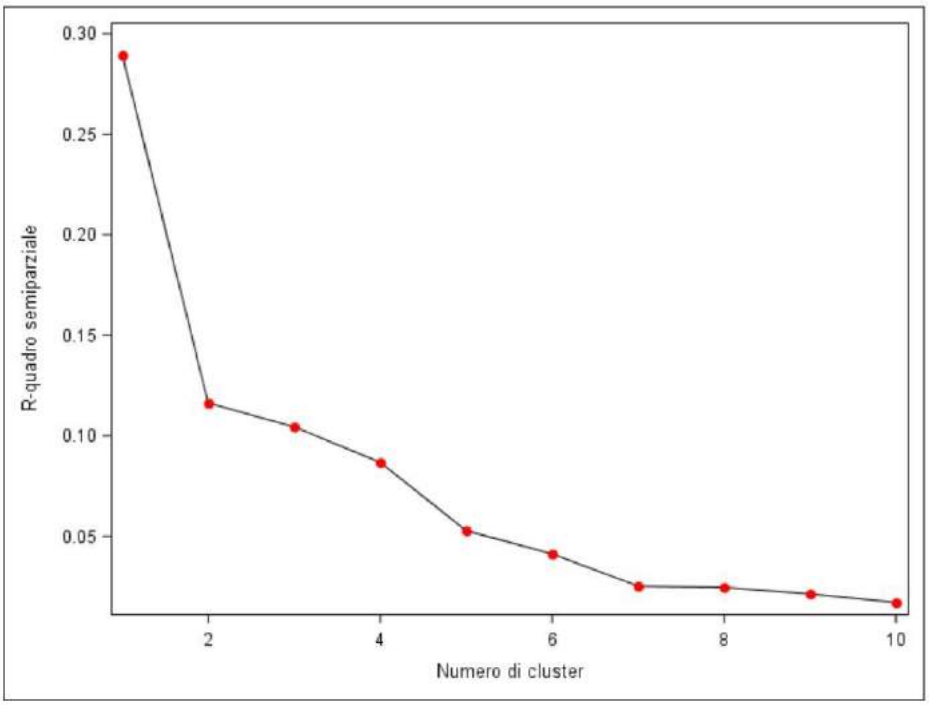
Number of clusters	Pseudo-F index (Calinski & Harabasz)	Number of clusters	Pseudo-F index (Calinski & Harabasz)
1	…	6	7,875
2	7,925	7	7,653
3	7,578	8	7,649
4	7,677	9	7,757
5	**8,196**	10	7,610

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

Source: Authors

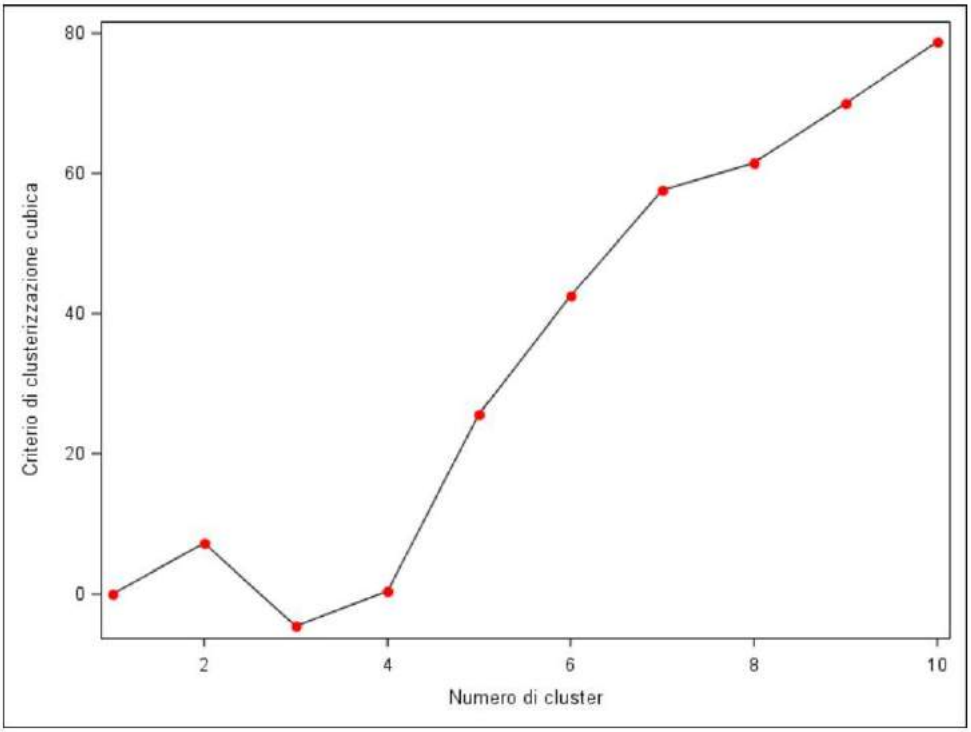
The pseudo-F statistics of Calinski & Harabasz confirms 5 clusters as the optimal solution. We present here three other popular selection criteria; Semi Partial R-Squared, Cubic Clustering Criterion and Sum of Squares Between. They all support the five-cluster configuration.

Semi Partial R-Squared (SPRSQ) across clusters



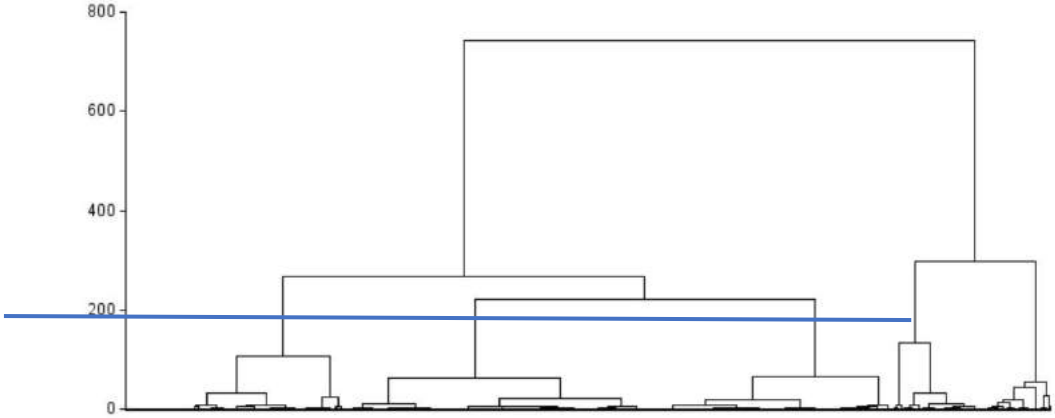
***Note**:* The Semi Partial R-Squared measures the loss of homogeneity when a new group is created. Since we are seeking homogeneous groups, it must be small enough. Also, the number of clusters must be parsimonious. It is clear from the figure that 5 is an important break point for the number of clusters, 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)



***Note**:* 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

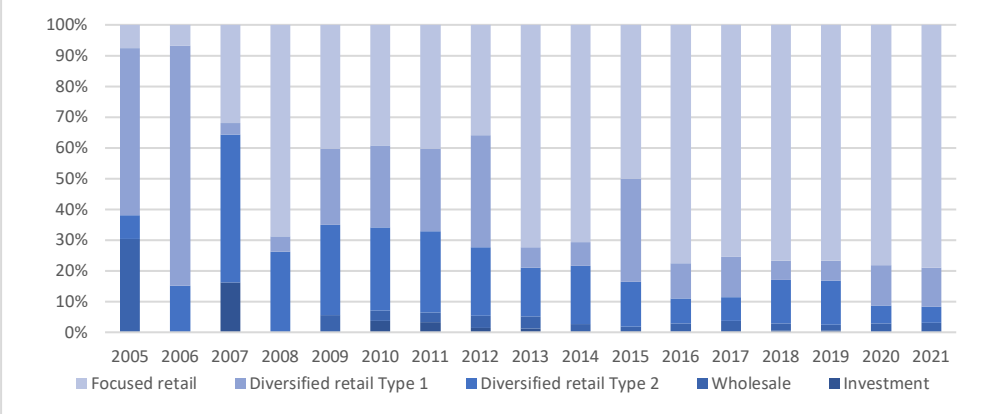
Sum of Squares Between



***Note**:* 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, whilst keeping the number of clusters at 5. It is clear again that by selecting 5 clusters, most of the reduction in SSB is achieved.
Sources: Authors

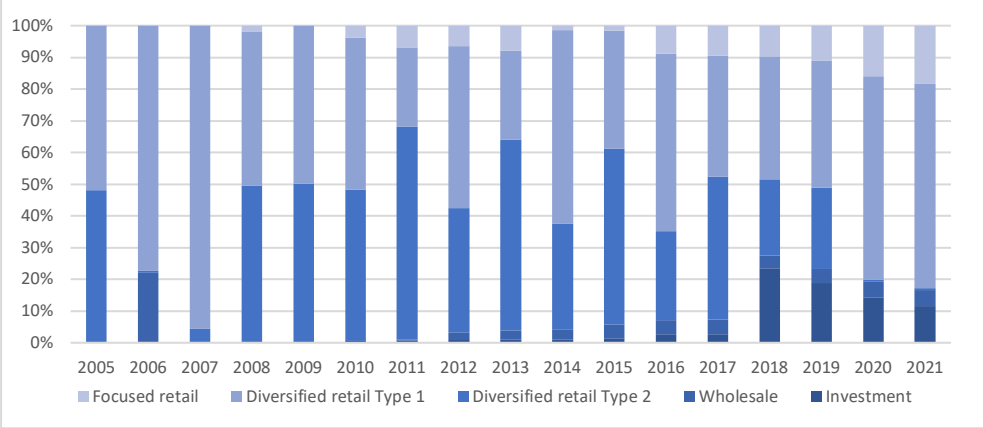
13. APPENDIX V. BUSINESS MODELS ACROSS YEARS FOR SELECTED COUNTRIES

Banking business models in Austria (% of assets)



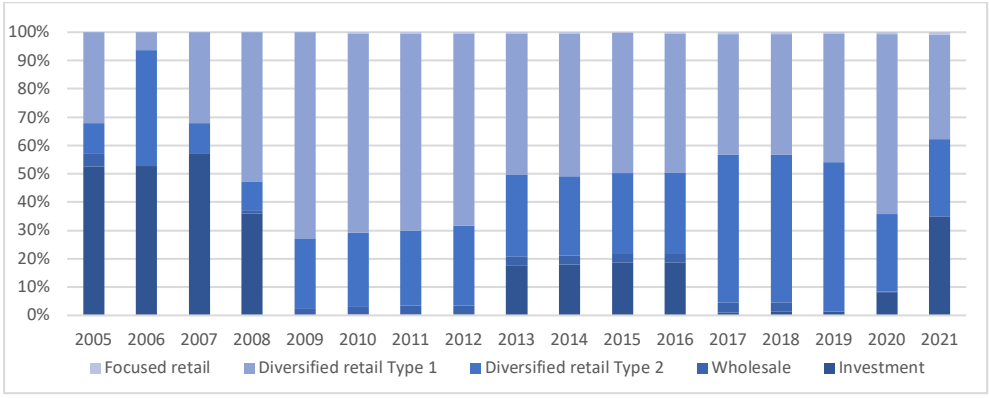
***Source**:* Authors

Banking business models in Belgium (% of assets)



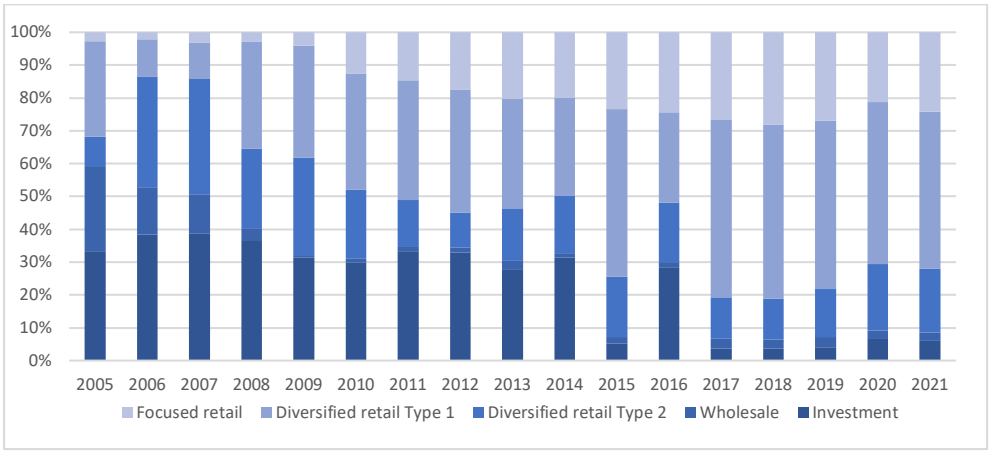
***Source**:* Authors

Banking business models in France (% of assets)



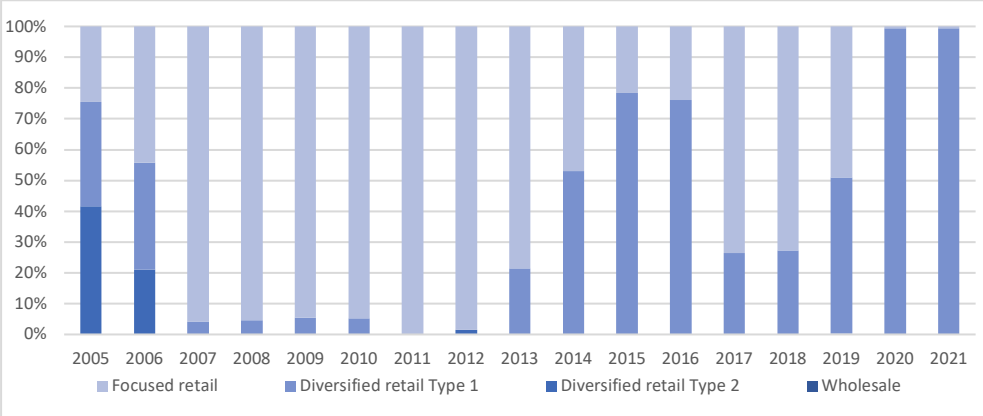
Source: Authors

Banking business models in Germany (% of assets)



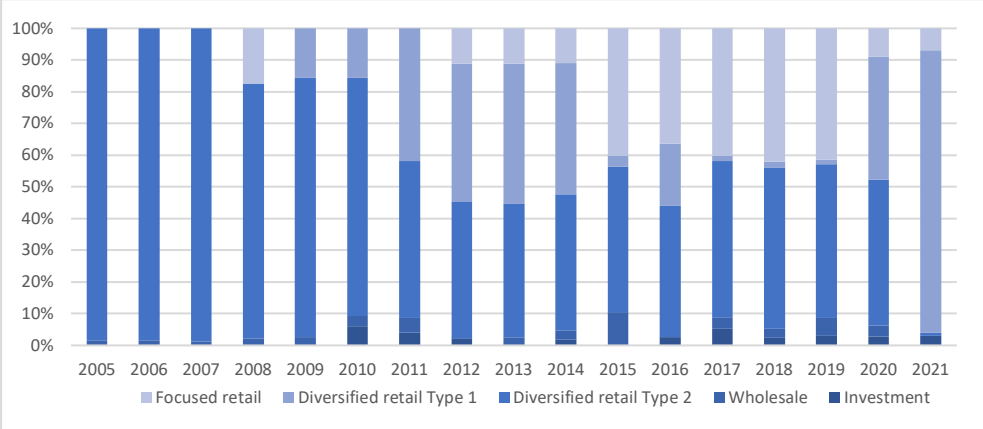
Source: Authors

Banking business models in Greece (% of assets)



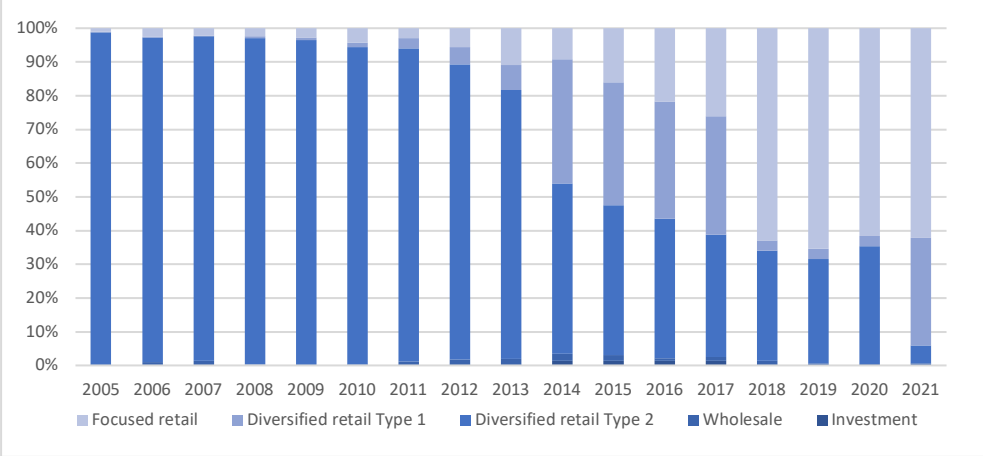
Source: Authors

Banking business models in Ireland (% of assets)



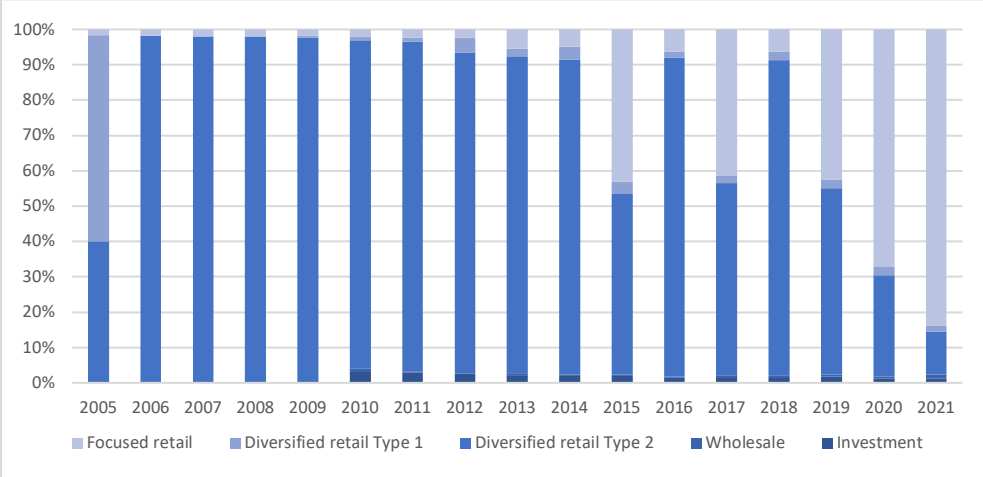
Source: Authors

Banking business models in Italy (% of assets)



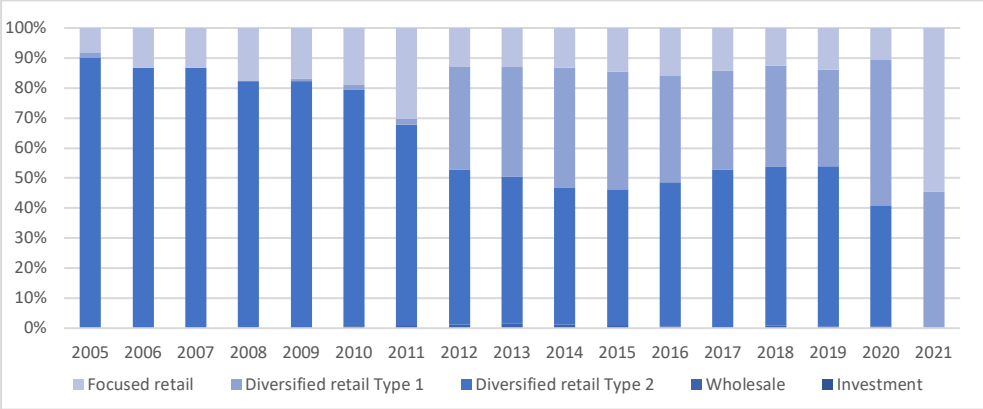
Source: Authors

Banking business models in the Netherlands (% of assets)



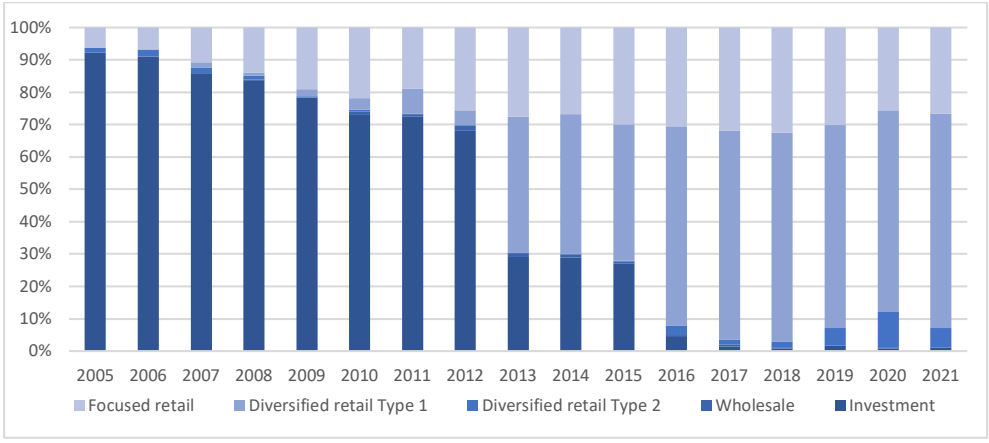
Source: Authors

Banking business models in Spain (% of assets)



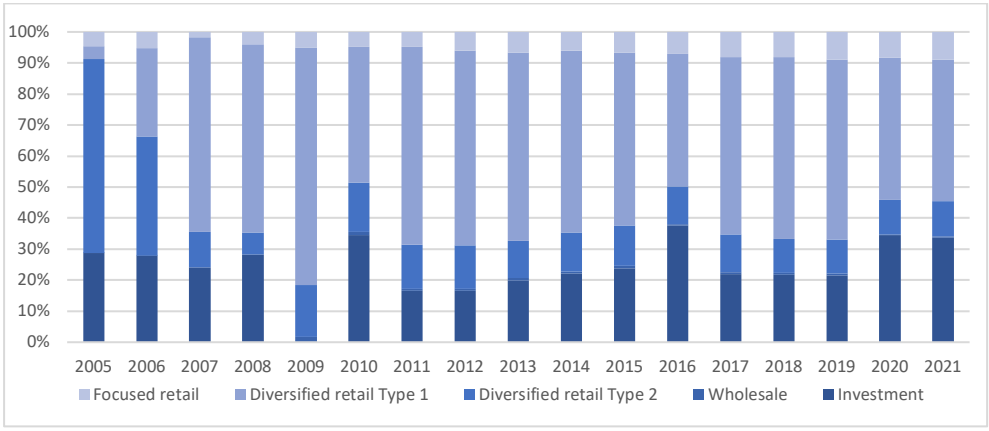
Source: Authors

Banking business models in Switzerland (% of assets)



Source: Authors

Banking business models in United Kingdom (% of assets)



Source: Authors

14. APPENDIX VI. 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:

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

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

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

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:

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

Note that a greater D implies a greater probability of default and therefore, a greater risk for the bank. The average and standard deviation calculations were obtained using available data for the years 2005-2014.

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

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

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

15. Appendix VII. 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 materialise 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%
Repurchase agreements	0%
Debt liabilities	50%
Equity & reserves	100%
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)*

16. APPENDIX VIII. ASSUMPTION ON MREL AND TLAC

The first step is to estimate MREL and its resilience to extreme shocks; the second step is a dynamic analysis and the exploration of possible country effects.

To estimate the MREL, we follow a three-step procedure. First, we use the TLAC formula; second, we compare with the EBA RTS two criteria; and third we complement the analysis by shock simulations, to assess the resilience of European banks in extreme stress conditions.

From the FSB term sheet, a formula for the TLAC according to the requirements of 2022, can be cast as: TLAC=Max (18% RWA, 6.75% LRE), where LRE is the Leverage Ratio Exposure. It is the denominator of the leverage ratio, as per Basel III. The leverage ratio exposure of the Basel III agreement is the sum of Total assets on the balance sheet and a number of (potentially substantial) off-balance sheet adjustments. It is important to note that the leverage ratio framework is not yet implemented in most European countries and the LRE is estimated in our study by subtracting intangible assets from total assets. The estimations are done separately for component 1 and component 2 of the formulae.

For the non-systemic banks (NSB), a total requirement of 8% RWA of minimum capital requirements and 2.5% RWA of capital conservation buffer applies for the loss absorption amount. In total, this amounts to a 10.5% RWA buffer requirement. Since they are deemed to be liquidated in case of insolvency, no recapitalisation amount will be imputed.

For the DSIB, a total requirement of 8% RWA of minimum capital requirements, 2.5% RWA of capital conservation buffer and an additional buffer requirement of 2% RWA will apply (systemic and/or countercyclical) for the loss absorption amount. In total, this amounts to a 12.5% RWA buffer requirement. Since they are deemed to be wound down for half of their business, the total recapitalisation amount is 6.25% RWA.

For the GSIBs, a total requirement of 8% RWA of minimum capital requirements, 2.5% RWA of capital conservation buffer and additional buffer requirements of 2% RWA (systemic and/or countercyclical) and a global systemic risk buffer of 2.5% will apply for the loss absorption amount. In total, this amounts to a 15% RWA buffer requirement. Since they are deemed not to be wound down, at least in the short run, the recapitalisation amount also totals 15% RWA.

To summarise, the NSB will face a total loss absorption and recapitalisation requirements of 10.5% RWA, the DSIB 18.75% RWA and the GSIB 30% RWA.

In addition, the contentious 8% of liabilities and own funds as the MREL minimum requirement applies for the GSIB and the DSIB.3F[30] In the sequel, SIB stands for the groups of Systemically Important Banks, i.e., the GSIB and the DSIB.

[30] In its sixth criterion for the calculation of the MREL, the RTS purports to uphold the provision in Art. 44 of the Bank Recovery and Resolution Directive (BRRD,) that set a floor of 8% of total liabilities, including own funds on the MREL of systemic banks, as a condition of accessing the Resolution Fund. This aspect of the standard is considered to be the main requirement currently hindering the endorsement of the RTS by the European Commission (See EBA (2016)).

17. APPENDIX IX. ASSUMPTION ON SRISK

Brownlees and Engle (2017) introduce SRISK to measure the systemic risk contribution of a financial firm to the whole financial system. SRISK is a measure of capital shortfall of a firm conditional on a severe market decline and is a function of its size, leverage and risk.

Equation (1) in the paper of Gehrig and Iannino (2017) has been adapted. The capital shortfall for every bank-year observation is calculated as:

SRISK= Capital shortfall=k*(risk-weighted assets)-equity, (1)

with k being the prudential ratio of capital. Usually, the k indicator is computed as k=8%, that is the minimum capital requirement asked by the Authorities.

The relative exposure of each bank to the aggregate SRISK of the financial sector is the ratio of the SRISK of the bank-year to the sum of the SRISKs that are positive. In conclusion, the aggregate SRISK provides early warning signals of distress in indicators of real activity.

$$SRISK\%_{it} = \frac{SRISK_{it}}{SRISK_t}, where\ i = firms\ with\ SRISK > 0 \qquad (2)$$

18. APPENDIX X. LIST OF SYSTEMIC BANKS EXAMINED (GLOBAL AND DOMESTIC)

Rank	Name	Country	Total assets (€ million, latest available year)	Type of ownership (as of year-end, latest available year)	Coverage (period, first-last year)	Change in assets (%, first-last year)	Business Model(s)
1	Aareal Bank AG	DE	48728	Commercial	2006-2021	21.444%	D1 D2
2	ABANCA Corporación Bancaria, SA	ES	80496.91	Commercial	2011-2021	10.263%	D1 F
3	ABLV Bank, AS	LV	2493.84	Commercial	2010-2018	22.739%	D1 W
4	ABN AMRO Group NV	NL	399113	Nationalised	2009-2021	3.154%	D2 F
5	Alior Bank SA	PL	18107.18	Commercial	2009-2021	91.569%	D1 F
6	Allied Irish Banks, Plc	IE	127875	Nationalised	2006-2021	-23.970%	D1 D2 F
7	Alpha Bank AE	GR	73355.96	Nationalised	2006-2021	32.112%	D1 D2 F
8	Argenta Bank- en Verzekeringsgroep SA	BE	55451.48	Commercial	2007-2021	47.109%	D1 D2 F
9	AXA Bank Europe SA	BE	29281.26	Commercial	2007-2021	27.160%	D2 F
10	Banca Carige SpA - Cassa di Risparmio di Genova e Imperia	IT	22309.82	Commercial	2006-2021	-13.345%	D2 F
11	Banca Monte dei Paschi di Siena SpA	IT	137868.6	Savings	2006-2021	-15.005%	D2 F
12	Banca popolare dell'Emilia Romagna SC	IT	136347.9	Cooperative	2006-2021	66.807%	D2 F
13	Banca Popolare di Milano Scarl	IT	51131.04	Cooperative	2006-2016	21.416%	D2 F
14	Banca Popolare di Sondrio SCpA	IT	55016.15	Commercial	2006-2021	70.841%	F
15	Banca Popolare di Vicenza SpA	IT	34424.24	Cooperative	2006-2016	31.008%	D1 D2 F
16	Banco Bilbao Vizcaya Argentaria, SA	ES	662884.7	Commercial	2006-2021	37.860%	D1 D2
17	Banco BPI SA	PT	41378.31	Commercial	2006-2021	14.048%	D2 F
18	Banco Comercial Português, SA	PT	92904.81	Commercial	2006-2021	14.918%	D1 D2 F
19	Banco de Sabadell, SA	ES	251946.6	Savings	2006-2021	71.113%	D2 F
20	Banco Mare Nostrum, SA	ES	38649.98	Nationalised	2011-2016	-73.870%	D1 F
21	Banco Popolare Società Cooperativa	IT	117411	Cooperative	2006-2016	41.492%	D2
22	Banco Popular Español SA	ES	147685.8	Commercial	2006-2016	37.942%	D2 F
23	Banco Santander, SA	ES	1595838	Commercial	2006-2021	47.747%	D2 F

24	Bank BPH SA	PL	7355.227	Commercial	2008-2015	-20.188%	D2
25	Bank Handlowy w Warszawie SA	PL	13488.04	Commercial	2006-2021	30.321%	D1
26	Bank Ochrony Srodowiska SA	PL	4488.344	Public	2007-2021	43.432%	D1 F
27	Bank of Cyprus Public Company Limited	CY	24962.79	Savings	2006-2021	0.264%	D1 F
28	Bank of New York Mellon SA/NV	BE	39956.66	Commercial	2010-2021	1.496%	D1 F W
29	Bank of Valletta Plc	MT	14358.44	Commercial	2007-2021	60.391%	D1
30	Bankinter SA	ES	107584.1	Savings	2006-2021	57.172%	D2 F
31	Banque Cantonale Vaudoise	CH	53968.91	Public	2006-2021	63.115%	F
32	Banque Degroof Petercam SA	BE	9995.902	Commercial	2010-2021	51.437%	D1
33	Banque et Caisse d'Epargne de l'Etat, Luxembourg	LU	53424.87	Savings	2006-2021	22.775%	D1 W
34	Barclays Plc	GB	1648164	Commercial	2006-2021	10.233%	D1 I
35	Basler Kantonalbank	CH	51574.69	Public	2006-2021	69.633%	D2 F
36	Bayerische Landesbank	DE	266554	Savings	2006-2021	-29.193%	D1 D2 F W
37	Belfius Banque SA	BE	192150.5	Nationalised	2006-2021	-32.409%	D1 D2 W
38	BNP Paribas SA	FR	2634444	Commercial	2006-2021	45.326%	D1 I
39	Caisse de Refinancement de l'Habitat SA	FR	21469.25	Commercial	2010-2021	-97.892%	D2 I
40	Caixa Geral de Depósitos SA	PT	104010.1	Savings	2006-2021	7.465%	D1 D2 F
41	Commerzbank AG	DE	473044	Commercial	2006-2021	-28.588%	D1 D2
42	Coöperatieve Rabobank U.A.	NL	639575	Cooperative	2006-2021	12.996%	D2 F
43	Cooperative Central Bank Ltd.	CY	14100.79	Commercial	2010-2016	68.037%	D1 F
44	Crédit Agricole Group	FR	2323557	Cooperative	2006-2021	40.612%	D1 D2
45	Crédit Mutuel Group	FR	1080491	Cooperative	2006-2021	55.328%	D2
46	Credit Suisse Group AG	CH	729044.2	Commercial	2006-2021	-7.078%	D1 I
47	Danske Bank A/S	DK	529348.3	Commercial	2006-2021	30.603%	D2
48	DekaBank Deutsche Girozentrale	DE	88864.9	Savings	2006-2021	-18.076%	D1 D2 I W
49	Deutsche Apotheker- und Ärztebank eG	DE	67372.49	Cooperative	2006-2021	51.093%	D2 F
50	Deutsche Bank AG	DE	1323993	Commercial	2006-2021	-19.675%	D1 I
51	Deutsche Zentral-Genossenschaftsbank AG	DE	627273	Cooperative	2006-2021	32.775%	D1
52	Dexia SA	BE	98650	Nationalised	2006-2021	-474.499%	D1 D2 I
53	DNB ASA	NO	291361.8	Savings	2006-2021	44.936%	D2
54	Erste Group Bank AG	AT	307428.2	Savings	2006-2021	40.896%	D1 D2 F

55	Etablissement Public à caractère Industriel et Commercial Bpifrance	FR	36802.6	Cooperative	2010-2021	34.608%	D2 I
56	Eurobank Ergasias SA	GR	77852	Nationalised	2006-2021	30.869%	D1 D2 F
57	Fundación Bancaria Caixa d'Estalvis i Pensions de Barcelona, "la Caixa"	ES	351268.6	Savings	2006-2013	40.466%	D2
58	Fundación Bancaria Unicaja	ES	34343.75	Savings	2006-2010	17.692%	F
59	Getin Noble Bank SA	PL	11988.28	Commercial	2006-2011	98.922%	F W
60	Governor and Company of the Bank of Ireland	IE	155296	Nationalised	2006-2021	-4.453%	D1 D2
61	Groupe BPCE	FR	1516021	Cooperative	2009-2021	32.138%	D2
62	Grupo Cooperativo Cajamar	ES	58513.03	Cooperative	2006-2021	66.904%	D1 F
63	HASPA Finanzholding	DE	63959.8	Cooperative	2011-2021	36.598%	F
64	Hellenic Bank Public Company Ltd.	CY	18836.11	Commercial	2006-2021	65.552%	D1 F
65	HSBC Holdings Plc	GB	2600916	Commercial	2006-2021	45.789%	D1 D2
66	Hypo Real Estate Holding AG	DE	75566	Nationalised	2006-2014	-113.844%	D2
67	Iccrea Holding SpA	IT	48704.37	Cooperative	2006-2015	65.583%	D2 F W
68	ING Bank NV	NL	951290	Commercial	2006-2021	5.919%	D1 D2 F
69	Intesa Sanpaolo SpA	IT	1069003	Commercial	2006-2021	72.705%	D1 D2
70	Julius Bär Gruppe AG	CH	112183.6	Commercial	2007-2021	74.710%	D1
71	Jyske Bank A/S	DK	87034.4	Commercial	2006-2021	75.246%	D1 D2
72	KBC Group NV	BE	340346	Commercial	2006-2021	4.391%	D1 D2
73	La Banque Postale, SA	FR	772310.4	Public	2006-2021	85.453%	D1 I W
74	Landesbank Baden-Württemberg	DE	282344	Savings	2006-2021	-47.793%	D1 D2 W
75	Landeskreditbank Baden-Württemberg–Förderbank	DE	89597.02	Public	2006-2021	41.950%	D2 W
76	Landwirtschaftliche Rentenbank	DE	95045.8	Public	2006-2016	12.969%	I W
77	Liberbank, SA	ES	47510.1	Savings	2011-2020	-7.023%	D1 F
78	Lloyds Banking Group Plc	GB	1055518	Commercial	2006-2021	51.683%	D2
79	Mediobanca - Banca di Credito Finanziario SpA	IT	82598.7	Commercial	2006-2021	44.168%	D2
80	Migros Bank AG	CH	52709.88	Cooperative	2006-2021	66.409%	F
81	Münchener Hypothekenbank eG	DE	52538.23	Cooperative	2006-2021	39.220%	D2 F
82	National Bank of Greece SA	GR	83958	Nationalised	2006-2021	8.992%	D1 F

83	Nederlandse Waterschapsbank NV	NL	96019	Public	2010-2021	40.264%	D2
84	NORD/LB Norddeutsche Landesbank Girozentrale	DE	114663	Savings	2006-2021	-69.951%	D1 D2
85	Nordea Bank AB (publ)	FI	570353	Commercial	2006-2021	39.180%	D1 D2
86	Nova Kreditna banka Maribor d.d.	SI	9958.393	Nationalised	2006-2021	57.232%	D1 D2 F
87	Nova Ljubljanska Banka d.d.	SI	21577.5	Nationalised	2006-2021	33.223%	D1 D2 F
88	Novo Banco, SA	PT	44618.52	Public	2014-2021	-46.615%	D1 D2
89	NRW.BANK	DE	153132.2	Public	2010-2021	-2.420%	D2
90	NV Bank Nederlandse Gemeenten	NL	149057	Commercial	2010-2021	20.478%	D2
91	Nykredit Holding A/S	DK	225073.2	Savings	2010-2021	21.848%	D2
92	OP Financial Group	FI	174110	Cooperative	2006-2021	65.806%	D2
93	OTP Bank Nyrt.	HU	74673.11	Commercial	2006-2021	62.192%	D1 F
94	Permanent TSB Group Holdings Plc	IE	22235	Commercial	2006-2021	-242.415%	D2 F
95	Pictet & Cie Group SCA	CH	47189.75	Savings	2014-2021	31.633%	D1
96	Piraeus Bank SA	GR	79789.5	Nationalised	2006-2021	61.234%	D1 F
97	PostFinance AG	CH	117354.8	Cooperative	2013-2021	18.891%	D1 I
98	Powszechna Kasa Oszcz?dno?ci Bank Polski SA	PL	91156	Savings	2006-2021	70.773%	D1 F
99	Precision Capital SA	LU	35296	Savings	2006-2017	100.000%	D1 I
100	Raiffeisen Gruppe Switzerland	CH	274406.1	Commercial	2007-2021	72.974%	F
101	Raiffeisen Zentralbank Österreich AG	AT	134846.6	Cooperative	2006-2016	14.252%	D1 F W
102	Raiffeisenlandesbank Oberösterreich AG	AT	51446.61	Cooperative	2006-2021	56.943%	D1 D2
103	RBC Investor Services Bank SA	LU	21096.67	Savings	2010-2021	40.408%	D1 W
104	RCB Bank Ltd.	CY	4900.065	Commercial	2011-2020	-118.049%	D2 F
105	Royal Bank of Scotland Group Plc	GB	931058.8	Nationalised	2006-2021	-38.922%	D1 D2
106	Sberbank Europe AG	AT	12942.12	Commercial	2006-2020	48.301%	F
107	Skandinaviska Enskilda Banken AB (publ.)	SE	321319.1	Commercial	2006-2021	33.390%	D2
108	SNS Bank NV	NL	72081	Nationalised	2006-2021	10.681%	D2 F
109	Société Générale SA	FR	1464449	Commercial	2006-2021	34.662%	D1 I
110	State Street Bank Luxembourg S.C.A.	LU	747.814	Cooperative	2010-2018	-2501.830%	I W

111	Svenska Handelsbanken AB (publ)	SE	325455.4	Savings	2006-2021	39.146%	D2
112	Swedbank AB (publ)	SE	267483.2	Commercial	2006-2021	44.034%	D2
113	Sydbank A/S	DK	22619.97	Commercial	2006-2021	31.966%	D1 D2 F
114	UBS Group AG	CH	982338.1	Commercial	2006-2021	-48.461%	D1 I
115	UniCredit SpA	IT	917227	Commercial	2006-2021	10.242%	D1 D2 F
116	Unione di Banche Italiane SpA	IT	131320.2	Cooperative	2006-2020	43.433%	D2 F
117	Veneto Banca SpA	IT	28078.25	Cooperative	2006-2016	61.337%	D2
118	Volksbanken-Verbund	AT	32095.45	Commercial	2007-2021	-194.930%	D2 F I
119	Volkswagen Financial Services AG	DE	121251	Commercial	2006-2015	63.775%	D2
120	VTB Bank (Austria) AG	AT	8193.19	Commercial	2010-2016	8.327%	D1 F W
121	Westdeutsche Genossenschafts-Zentralbank AG	DE	89794.5	Cooperative	2006-2015	9.574%	D1 W
122	Zürcher Kantonalbank	CH	185296.3	Public	2006-2021	68.249%	D1 D2 F

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

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20. List of Abbreviations

ABCP	Asset-backed commercial paper
AQR	Asset quality review
BBM	Bank 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
GFC	Great Financial Crisis
GDP	Gross domestic product
GSIBs	Global systemically important banks
IOFSC	International Observatory of Financial Services Cooperatives
IRB	Internal rating-based
LRE	Leverage Ratio Exposure
MREL	Minimum Requirement for own funds and Eligible Liabilities
NSFR	Net stable funding ratio
NPL	Non-Performing Loans
PSI	Private sector involvement
RoA	Return on assets
RoE	Return on equity
RoRWA	Return on risk-weighted assets
RWA	Risk-weighted assets
SHV	Shareholder-value
SRF	Single Resolution Fund
SSB	Sum of square between
SRISK	Measure of Systemic risk contribution
ST	Stress Test
STV	Stakeholder-value

SPRSQ	Semi partial R-squared
TCE	Tangible common equity
TCR	Total capital requirement
TLAC	Total-Loss Absorbing Capacity
USD	United States Dollar
XBRL	eXtensible Business reporting language

BBM BANK BUSINESS MODELS

The **Banking Business Models (BBM) Monitor 2024 Europe** is the European edition of the bank business model analysis, which is part of the Global Monitor of banks and credit unions business models. The Global Monitor covers Europe, United States of America, Canada Middle East and AFrica. More countries will be added subject to data availability.

The BBM Monitor 2024 for Europe identifies the business models of 3,503 banks covering more than 95% of assets of the European Union plus EFTA countries from 2005 to 2021, which accounts for 35,567 bank-year observations. Using a unique definition and a careful selection of multidimensional 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 monitor covers issues such as interaction with ownership structures, size, internationalization, migration, financial performance and operational efficiency, contribution to the real economy, risk, resilience, robustness and resolution.

The BBM Monitor is geared towards bank practitioners, policy makers, regulators, supervisors, and academics who are interested in independent research, analysis and expert views on the banking sector in Europe.

The BBM Monitor and Results will be updated annually and potentially extended subject to data availability. The business model identification results of the BBM Monitor 2024 for Europe are available for all the bank-year observations upon request.

The BBM research is promoted and funded by the Euro-Mediterranean Economists Association (EMEA). Collaboration is acknowledged with the Centre of Banking Research of the Bayes Business School of the City University of London. The BBM is disseminated on:

www.euromed-economists.org www.bbmresearch.org and www.emanes.org

The Euro-Mediterranean Economists Association (EMEA) is a Barcelona-based regional organization established in 2012, that serves as a leading independent and innovative policy research institution; a forum for debate on the political and socio-economic reforms in Mediterranean and Africa; and promoter of actions and initiatives that fulfil objectives of sustainability, inclusiveness, regional integration and prosperity. As a “think and act tank”, it strives to contribute decisively to the transition process in the Mediterranean and Africa amidst climatic challenges, unprecedented global financial and economic crises and geopolitical uncertainties and conflicts.

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