

European banks' business models as a driver of strategic planning: one size fits all

European
banks'
business
models

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Abstract

Purpose – This paper aims to verify the presence of a management model that confirms or not the one size fits all hypothesis expressed in terms of risk-return. This study will test the existence of stickiness phenomena and discuss the relevance of business model analysis integration with the risk assessment process.

Design/methodology/approach – The sample consists of 60 credit institutions operating in Europe for 20 years of observations. This study proposes a classification of banks' business models (BMs) based on an agglomerative hierarchical clustering algorithm analyzing their performance according to risk and return dimensions. To confirm BM stickiness, the authors verify the tendency and frequency with which a bank migrates to other BMs after exogenous events.

Findings – The results show that it is impossible to define a single model that responds to the one size fits all logic, and there is a tendency to adapt the BM to exogenous factors. In this context, there is a propensity for smaller- and medium-sized institutions to change their BM more frequently than larger institutions.

Practical implications – Quantitative metrics seem to be only able to represent partially the intrinsic dynamics of BMs, and to include these metrics, it is necessary to resort to a holistic view of the BM.

Originality/value – This paper provides evidence that BMs' stickiness indicated in the literature seems to weaken in conjunction with extraordinary events that can undermine institutions' margins.

Keywords Business model, Performance, Bank management, Business model stickiness, One size fits all, Risk-return

Paper type Research paper

1. Introduction

Recent regulatory innovations aimed at safeguarding the financial system's stability have limited the decision-making freedom of institutions, profoundly changing the environment in which banks operate. This set of constraints has contributed jointly to the macroeconomic context to the adoption or abandonment of less profitable business models (BMs). This paper analyzes banks' BMs through quantitative cluster analysis techniques. The business

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model analysis (BMA) represents a valuable tool for regulators to investigate the institutions' reaction and adaptation to the new set of rules and verify ex post the impact in terms of profitability and risk of the new supervisory framework.

As is known, the BM provides evidence of the company's competitive advantage over competitors and how human, material, technological and intangible resources are organized to achieve the objectives set in strategic planning and risk management. The BMA briefly considers these qualitative dimensions, which allows a quantitative treatment of these dimensions and comparability between institutions.

The interest in BMA has progressively grown over time because of the importance assumed in the supervisory processes. It represents a valuable tool used by supervisors in assessing risk exposure and business line vulnerabilities, ensuring a holistic view of risk management processes (EBA, 2018). This orientation led to the inclusion of BMA in the Supervisory Review and Evaluation Process (SREP) to assess the sustainability, feasibility of the BM, exposure and appetite to risks, implementing a forward-looking perspective (Farnè and Vouldis, 2017; Gualandri and Venturelli, 2020).

Adopting and implementing a BM consistent with the risk profile identified during strategic planning (also in compliance with the available capital) has strategic importance for banks' governance. Moreover, external stakeholders could use BMA to identify banks' competitors according to BM configuration and compare the most profitable bank in terms of risk-return yield for a specific BM.

The interactions among balance sheet items and the existence of unobservable qualitative characteristics, able to alter BM characteristics, make BMA inefficient in clustering banks' BMs. Furthermore, this methodology is insensible to exogenous events that indirectly affect balance sheet items and BMs.

This work aims to verify the presence of a management model that expresses overperformance conditions in terms of risk-return, confirming or not the *one size fits all* hypothesis. In addition, we will try to identify the adaptations made to the BM by bank management in response to external events, therefore verifying the existence of stickiness phenomena. Finally, the importance of BMA integration with the risk assessment process will be discussed.

The paper is organized as follows. Section 2 presents an analysis of the literature relating to the BM in the context of business theory and subsequently concerning the banking sector. The third paragraph presents the data set and the clustering methodology used. Section 4 identifies and analyzes the four main BMs obtained through the clustering process. Finally, in Section 5, the conclusions and possible paths for further study are presented.

2. Literature review

There is no unique definition of a BM in the literature relating to business theory. However, one research stream considers BM as a success factor whose main determinants consist of policy, governance and assets. According to these variables, it is possible to discriminate the multiple configurations of the BM (Wirtz, 2011).

The resource-based view theory offers a different perspective, according to which business is understood as a combination of resources and skills. The former constitutes the elementary units of each company, contributing both to objectives achievement, defined in the strategic planning and performance improvement (Penrose, 1959). For some companies, typically operating in high-tech sectors, intangible assets play a predominant role in the BM rather than tangible ones, and this is because of their relevance in the core business (note that, for other sectors, the role of the two asset classes indicated could be reversed). According to the perspective under examination, a BM is a valuable tool for

determining how and to what extent each resource contributes to the value generation process (Friedman and Langlinais, 1999; Osterwalder, 2004a, 2004b; Chen *et al.*, 2014). A significant evolution of this approach considers the effect of transactions through which the company can generate value for both customers and the organization (Zott and Amitt, 2008; DaSilva and Trkman, 2014; Ernst and Young, 2018): the connection between resource-based view and transaction cost theory explains how the various resources used by the company contribute to the value creation process.

A final research stream has dealt with the interactions between business strategy and BMs. The first, considered a manifestation of the BM, aims to operational structure optimization, organization and coordination of business activities (Timmers, 1998; Seddon *et al.*, 2004; Shafer *et al.*, 2005; Ernst and Young, 2020). As the BM defines the business strategy, the time horizon is long term, while the business strategy focuses on shorter periods (Magretta, 2002; KPMG, 2006; Casadesus-Masanell and Ricart, 2010; Teece, 2010; Casadesus-Masanell and Ricart, 2011). A further difference is that the BM has improved business processes and levers: prices, cost control, quality and distribution channels. These aspects refer to the internal dimensions of the company, while the business strategy is more focused on the market and external competition. Following these two dimensions of analysis, it is possible to state that the goal of the BM is the definition of a set of activities aimed at maximizing the competitive advantage (Mottura, 2011).

The BM in the banking sector is discussed from a holistic perspective to grasp strategic choices and the value creation, in the multiple management areas, through the coordination and use of resources used in offering services to customers (Di Veglia and Franzese, 2020). An exhaustive analysis of the literature is provided in a study that recognizes no uniformity of agreement on the definition of BM in the banking sector. The boundary of the matter is expanding, driven by BM innovations (Zott *et al.*, 2011). A BM is a planning tool designed to generate value through the optimal exploitation of the resources available to credit institutions (Pierige, 2018): consequently, the BM is a valuable mechanism for identifying business mix, business strategy and institution competitive positioning. The strategic business areas are placed in the business strategy from which the construction of the business mix derives. The latter affects: capital allocation in the multiple areas of activity, the composition of liabilities and revenue streams. The business strategy indicates how these objectives are pursued by the composition of the range of services offered and identifying the customers the institution targets (Cosma *et al.*, 2016). In this regard, it is possible to observe how a data-driven approach provides a partial representation of the entire BM, ignoring, for example, qualitative elements such as competitive advantage, segmentation and cost-leadership (Di Antonio, 2018; Di Antonio *et al.*, 2019).

In a different literature stream, the BM is analyzed concerning performance, efficiency and risk measures: following the 2008 crisis, interest has grown in the links between the BM and the overall riskiness of the institutions. Attention was paid to the impact of systematic risk on BMs and the likelihood that public bailout of institutions should be used as a crisis management tool (Altunbas *et al.*, 2011). The relevance of the interaction between systemic risk, tail risk and BM obliges regulators to consider the trade-off between these dimensions, applying divergent supervisory objectives (Van Oordt and Zhou, 2014). The context of banks that use internal rating-based models to measure credit risk highlights the possible exploitation of regulatory arbitrage and a significant role of the BM in risk assessment processes for prudential purposes (Ayadi *et al.*, 2016a).

In sectorial literature, it is deemed that there is no single BM that offers the absolute best performance in terms of risk and returns (ECB, 2016; Vacca *et al.*, 2017): nevertheless, it can be observed that the retail model, although characterized by high levels of risk and a higher

cost of capital, has over-performed all BMs in terms of return on equity (ROE) and return on assets (ROA) (Roengpitya *et al.*, 2014) [1]. On the other side, Tanzi *et al.* (2018), implementing a cluster analysis, have provided empirical evidence supporting the idea that niche banks show higher performance than global banks. Even if the former face more consistent operative costs and key vulnerabilities, the latter are not rewarded with a high-risk premium for executing risky activities. A second valuable contribution is represented by their original BM classification; banks' BM is cataloged in: insurance and welfare management services, asset management and online platforms.

In the BMA research, it is usual to implement clustering procedures using the value of the assets and liabilities of the banks belonging to the sample as a grouping criterion. The groups, thus, identified are characterized by a similar balance sheet composition and defined according to the more excellent orientation of the institution towards a retail or investing activities BM. The analysis of BMs focused on performance indicators, exposure to risk, growth in loans and degree of internationalization has made it possible to identify higher levels of risk and volatility in investing activities BM, unlike universal banks characterized by a greater capacity to absorb cycle downturns (Passmore, 1985).

Subsequent studies, implementing a cluster analysis methodology, use the European banking system as a sample executing two business-based models (Amel and Rhoades, 1988; Ayadi and De Groen, 2014).

The retail model, characterized by a predominance of the loan portfolio and wide use of deposits as a primary source of financing, is defined by average levels of profitability and low-performance variability (Ayadi *et al.*, 2016b).

This model contrasts with the typical model of investing activities BM, equipped with an extensive investment portfolio and financed mainly through the interbank market, characterized by higher levels of economic and financial results volatility compared to other BMs. A study considered a large sample of banks belonging to 34 countries between 2005 and 2013, noting a significant decline in profitability over the period (Roengpitya *et al.*, 2014). Following the drop in confidence in banking institutions during the sub-prime crisis, the interbank market experienced a sharp contraction in business volumes. Consequently, many wholesale-founded BMs transformed into retail models. A paper focused on a data set of 77 European banking institutions has identified high levels of profitability in retail banking for the years before the 2007 financial crisis and worse performance during the period of the sovereign debt crisis (De Meo *et al.*, 2016) [2].

The change in market conditions may induce institutions to adapt their BM, but these adjustments present a significant degree of stickiness. In a study based on cluster analysis, the tendency of banks not to migrate from one cluster to another following market shocks or in the presence of significant environmental changes emerged (ECB, 2016). These shreds of evidence underline how the BM is correlated to the strategic plan, characterized by larger time horizons and slow adaptation times to changes.

In contrast to previous studies, further research identified better performance in terms of risk and returns in retail banks. This evidence was obtained, including in the analysis of some strategic variables: market capitalization, the composition of assets and liabilities and banks' risk profiles. While diversification allows for improved profitability, retail institutions are nevertheless exposed to financial distress and greater exposure to business cycle downturns (Mergaerts and Vennet, 2016).

Finally, a different research stream integrates qualitative measures in BMA. This orientation represents an alternative to the quantitative procedures generally implemented to highlight analysis dimensions not considered before but explanatory to differentiate between the models (EBA, 2014; Volgarino, 2017). Moreover, integrating this approach with

the already consolidated procedures has allowed a hybrid analysis method (Cernov and Urbano, 2014; Pwc, 2019; Leone, 2020).

3. Methodology and data set

As it is known, cluster analysis is a valuable tool for identifying and indirectly reclassifying institutions' BMs into homogeneous groups. These clusters require using a set of variables so that it is possible to use a distance function necessary for carrying out the analysis.

In literature, the most commonly used balance sheet dimensions for the banking sector are represented by: loans to customers to assess the extent of credit concessions concerning total assets; trading activities, whose percentage weight compared to the balance sheet total is more present in investment banking models; deposits as an expression of the sources of financing used by the institutions; liabilities other than deposits to give evidence of the different sources of funding activated as debt; and nonperforming loans to provide evidence on the ability of the institutions to correctly assess the riskiness of the concessions (Mergaerts and Vennet, 2016; Ayadi *et al.*, 2019; Ayadi *et al.*, 2021) [3].

Concerning the income, regulatory and risk profile, it is possible to observe the use of interest margin to study the performance of the characteristic activity of the institutions in which credit is the primary activity; brokerage margin as a profitability driver for institutions with a BM oriented towards investment banking; ROA to study the overall profitability of assets; and ROE to analyze the institution's attitude to remunerate the holders of own capital (Ayadi *et al.*, 2021).

The principal regulatory indicators used are: risk-weighted assets, used to assess the capital requirements required by the legislation and by the rules of capital endowment envisaged by Basel; and the Net Stable Funding Ratio, a supervisory indicator that makes it possible to verify the correspondence between available and necessary funding for 12 months (ECB, 2016).

In conclusion, the chosen variables to identify the BMs using an indirect classification method are: loans to banks; trading activities; exposure to derivatives; customer loans; deposits; liquidity; and similar instruments. Table 1 represents the main statistics regarding the variables considered, and Table 2 shows the correlation analysis.

The proposed classification of the BMs of banks is based on an agglomerative hierarchical clustering algorithm (Ward, 1963; Batagelj, 1988; Murtagh and Legendre, 2014), which allows the creation of clusters by minimizing the distance function (so-called *Ward's Minimum Variance Method*) [4].

The ideal number of clusters (k^*) to divide the set of banks was obtained by considering all the possible aggregations for levels of k between 1 and 8 (Hardy, 1996). Each group's optimum point was identified using the information obtained from a selection

	CRVB (%)	AUMG (%)	DPST (%)	ESDV (%)	PRSC (%)	CHQA (%)	NPL (%)	ROE (%)	ROA (%)
Minimum	0.17	2.87	16.86	0.05	14.16	14.43	0.21	0.47	0.02
First quartile	3.39	14.45	26.34	2.21	26.43	16.34	0.72	4.94	0.21
Median	5.22	29.52	31.19	4.74	38.01	17.99	0.99	7.58	0.37
Third quartile	9.75	51.69	37.53	9.48	48.32	23.81	1.26	11.52	0.69
Maximum	25.02	79.25	54.32	27.19	60.99	54.24	3.33	29.02	1.31
Average	7.57	33.46	33.29	6.67	36.71	22.99	1.19	8.95	0.47
Variance	3.31	49.94	10.06	3.95	15.52	11.80	0.05	3.41	0.01
Standard deviation	18.18	70.67	31.72	19.86	39.40	34.34	2.30	18.46	0.98

Table 1.
Variables summary

	CRVB (%)	AUMG (%)	DPST (%)	ESDV (%)	PRSC (%)	CHQA (%)	NPL (%)	ROE (%)	ROA (%)
CRVB	100.00	40.84	-17.78	57.37	-64.91	-2.90	-19.06	-22.57	-36.01
AUMG		100.00	-16.86	32.77	-55.98	32.50	-33.53	3.75	-2.77
DPST			100.00	-34.50	55.72	19.95	27.32	1.54	16.23
ESDV				100.00	-56.76	12.40	-8.36	-23.03	-21.34
PRSC					100.00	-7.74	42.87	45.34	63.23
CHQA						100.00	-7.92	9.53	-5.26
NPL							100.00	19.13	27.99
ROE								100.00	45.54
ROA									100.00

Table 2.
Correlations matrix

Note: CRVB = loans to banks; AUM = asset under management; DPST = deposits; ESDV = exposure in derivatives; PRSC = customer loans; CSHQA = Cash + HQLA; and ZSCR = Z-Score

method: Elbow; Silhouette; and Gap Statistic (Rousseeuw, 1986). Therefore, Table 3 summarizes the k^* [5] levels to identify the four subgroups to reclassify the banking institutions for each year of observation (k^*). Each of the four clusters corresponds to a specific BM assigned a numerical code between 1 and 4 [6].

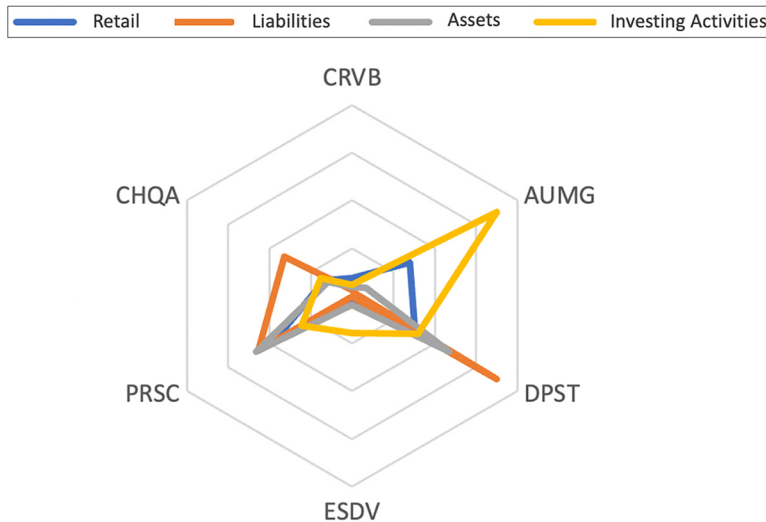
Figure 1 shows a graphical example of the BMs representation produced for each analysis year. A radar scheme was preferred to evaluate the evolution of the four BM categories, according to the six variables placed at the top of the hexagon and the time factor [7]. It is possible to note that the observed changes represent a change in the business strategy followed by a recomposition of the items belonging to the assets and liabilities. So, after 2008, following the lack of confidence that spread in the interbank market and the erosion of profit margins in the credit granting, institutions' balance sheets were more exposed to assets under management and readily liquidable instruments. There is, therefore, a convergence towards BMs focused more on commission profiles and CSHQA provisions to face the growing micro-prudential requirements. From the graphical display of the clusters (Figure 2), it can be observed that setting $k = 5$ would not increase the quality of the grouping.

The initial data set (source Bloomberg, data) consists of quarterly observations from 60 credit institutions operating in Europe for 20 years selected according to appropriate dimensional criteria and applying a filter in terms of data continuity: the

Year	Elbow	Silhouette	Gap	k	Year	Elbow	Silhouette	Gap	k
2020	4	4	4	4	2009	4	5	5	5
2019	4	4	4	4	2008	4	5	4	4
2018	4	4	5	4	2007	4	5	4	4
2017	4	5	4	4	2006	4	4	5	4
2016	4	5	4	4	2005	4	4	4	4
2015	4	5	4	4	2004	4	4	4	4
2014	4	5	4	4	2003	4	4	4	4
2013	4	4	4	4	2002	4	4	4	4
2012	4	4	4	4	2001	4	5	4	4
2011	4	4	4	4	2000	4	5	4	4
2010	4	4	4	4					

Table 3.
k-value selection,
 $k^* = 4$

Business Model 2020



European
banks'
business
models

Figure 1.
Example of business
model graphical
representation
(year 2020)

final sample of 36 banks is represented by institutions without missing data in charge of clustering variables and Z-Score for the two decades analyzed [8]. Considering 36 credit institutions, it is possible to assess 756 BMs, providing a sizeable valuable sample for econometric analysis. Table 4 shows the institutions subject to selection and the distribution by nationality with the specification of the number of G-SIBs.

Once the respective BM was assigned to each institution, it was possible to analyze the historical trend of the ROE and ROA and the risk assessed through the Z-Score (Köhler, 2012) [9]. The entire 20-year period taken into consideration was divided into five subperiods to highlight the changes in the variables because of the reversals of the economic cycle. The first refers to the period between 2000 and 2004 following the bursting of the dot-com bubble, the second starts in 2005 and ends in 2008, including the beginning of the sub-prime crisis, the third begins in 2009 and ends in 2012, including the events immediately following the problem and then attempt to recover economies, the fourth starts in 2013 and ends in 2015, a representative period of the sovereign debt crisis and the Greek one; finally, the last period begins in 2016 and ends in 2020 understanding both the consequences of quantitative easing and the first effects produced by the pandemic.

The one size fits all hypothesis on banks' BMs has been involved in understanding if a single BM overperforms all the others in terms of risk-return and consistently during economic cycle fluctuations. There is a comprehensive and common opinion regarding this topic in literature, and any BM can guarantee the best risk-return profile over time. However, extensive and diversified banks present low levels of efficiency, while well-capitalized banks suffer short-term efficiency losses that are compensated in the long run (Curi *et al.*, 2015). According to Fiechter *et al.* (2011), the reason why the best BM does not exist depends on stakeholder's concerns:

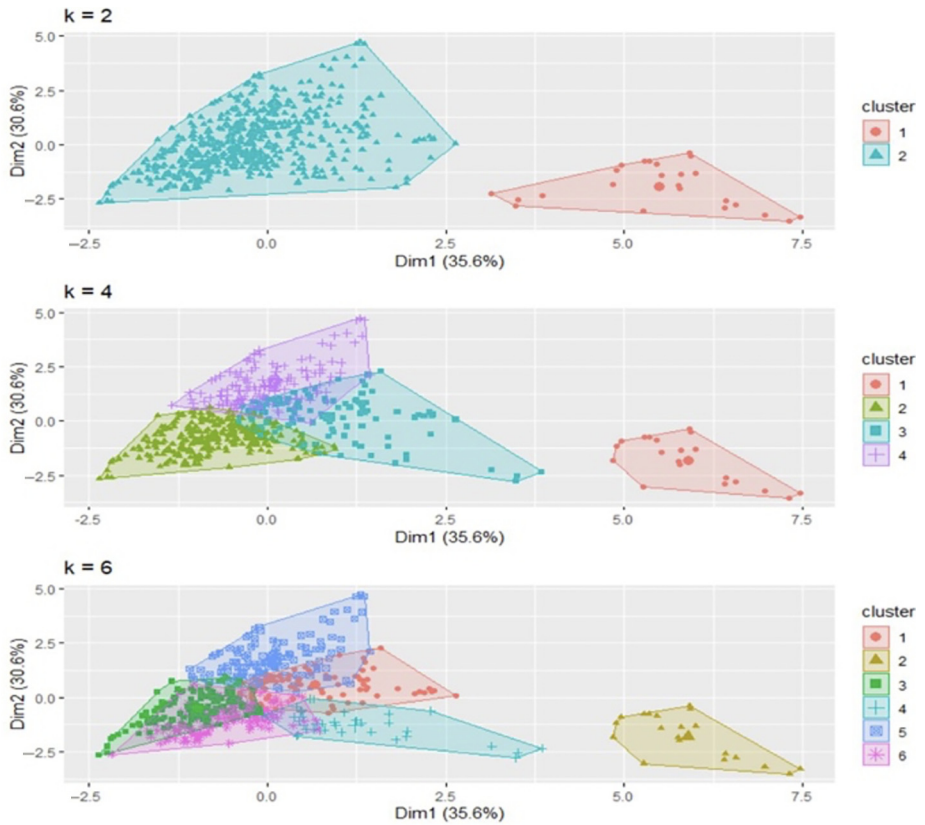


Figure 2.
Groupings by values
of k , 2020

Source: own elaboration

- In a banking group perspective, BMs differ according to tax and regulatory regimes.
- Cross-border bank structure is preferred in countries with low levels of regulation; on the other side, subsidiary-based models are favored if host country legislation is better than home country one.

In this paper, we have artificially assigned each bank a BM for each observation every year. The resulting assignment should be interpreted as the clustering algorithms' natural consequence. Frequent BM changes must be associated with changes in charge of clustering variables. On the other side, even if clustering shows high sensitivity levels to variable fluctuations, the tendency of a single BM to be assigned to the same bank may manifest in the adoption of the same BM over an extended time horizon. To test the one fits all hypothesis, it is necessary to empirically observe if the same business structure is kept constant for an adequate period.

4. Results

4.1 Performance and risk analysis

The clustering algorithm allowed the corresponding BM to the banks belonging to the sample in the 20 years observed. Each institute has been assigned a numerical code between

#	Name	G-SIB	Country	#	Name	G-SIB	Country
1	ABN AMRO		Netherlands	31	Julius Baer Group		Switzerland
2	Allied Irish Banks		Ireland	32	Jyske Bank		Denmark
3	Alpha Bank		Greece	33	KBC		Belgium
4	Banca Transilvania		Romania	34	KFW		Germany
5	Banco B. V. Arg.		Spain	35	Caixa Bank		Spain
6	Banco Popular		Spain	36	Landesbank B. W.		Germany
7	Banco Sabadell		Spain	37	Lloyds Banking G.		UK
8	Bank of Cyprus		Cyprus	38	Mediobanca		Italy
9	Bank of Ireland		Ireland	39	Millennium BCP		Portugal
10	Bankinter		Spain	40	Montepaschi		Italy
11	Barclays	✓	UK	41	Nat. B. of Greece		Greece
12	Bayerische L.		Germany	42	Natwest Markets		UK
13	BNP Paribas	✓	France	43	Nordea		Finland
14	BPCE	✓	France	44	OP-Pohjola Group		Finland
15	Commerzbank C.		Germany	45	OTP Bank		Hungary
16	Rabobank U.A.		Netherlands	46	Piraeus Bank		Greece
17	Crédit Agricole	✓	France	47	Rabobank		Netherlands
18	Credit Suisse	✓	Switzerland	48	Raiffeisen Bank. G.		Austria
19	Danske Bank		Denmark	49	Santander	✓	Spain
20	Deutsche Bank	✓	Germany	50	Skandinaviska E.B.		Sweden
21	Dexia		Belgium	51	Société Générale	✓	France
22	DNB		Norway	52	Sparkassen Fin.		Germany
23	DZ Bank		Germany	53	Standard Chart.	✓	UK
24	Erste Group		Austria	54	Svenska Hand.		Sweden
25	Espírito Santo		Portugal	55	Swedbank		Sweden
26	Eurobank		Greece	56	Sydbank		Denmark
27	Hellenic Bank		Cyprus	57	Royal B. Scotland		UK
28	HSBC	✓	UK	58	UBS	✓	Switzerland
29	ING Group	✓	Netherlands	59	UniCredit	✓	Italy
30	Intesa Sanpaolo		Italy	60	Volksbank		Austria

European
banks'
business
models

Table 4.

Institutes analyzed
and characteristics

Source: Own elaboration

1 and 4 to identify the BM adopted [10]. The BMs, thus, identified can be classified into four categories:

- (1) *Retail banks* are characterized by the prevalence of loans to customers within the composition of their activities and are mainly financed by the collection of deposits.
- (2) *Banks with diversified liabilities* are differentiated from the retail model because of the greater use of the interbank market as the primary source of financing.
- (3) *Banks with diversified assets*, unlike the retail model, hold a significant part of their assets in the form of liquidity and greater consistency of the securities portfolio as a percentage of total assets.
- (4) In the category of investing activities, we include both investment and wealth management banks. These are united by the investment activity carried out:
 - on their own account (investment banks); and
 - on behalf of third parties (wealth management banks).

They present a significant share of assets under management and derivatives concerning total assets or banks that carry out asset management and fund placement activities. In this paper, we refer to the locution “investing business model” to summarize the more verbose expression: “investment and wealth management business models”.

Investing activities BM’s ROE has a greater reactivity to market fluctuations rather than the ones noticed for all the other grouping categories (Figure 3). The former is more exposed to cycle reversals. The ROE contraction given to the sub-prime crisis occurred almost two years earlier than in retail and assets diversified BMs. Furthermore, the sovereign debt crisis highlighted that banks with large investment portfolios were more exposed to the effects of this kind of event (Llewellyn, 2013).

A similar trend can also be observed in BMs characterized by a consistent diversification of liabilities, for which recourse to the interbank market constitutes a significant financing instrument. This characteristic, combined with the greater impact of the loan portfolio, raises the riskiness of liability-oriented institutions compared to investing activities BM, whose level of risk is lower. To confirm the above, it is possible to observe that the Z-Score of the former discounts higher levels of volatility in the 20 years observed.



Figure 3. Business models' performance

After 2015, characterized by the introduction of quantitative easing measures, the period penalizes all management models mainly oriented toward granting credit to customers.

Therefore, it is evident that the diversified banks on the passive side have better profitability both in terms of ROE and ROA against a more considerable average risk. A negative correlation can, of course, be observed between ROE and Z-score. Low levels of the latter indicator denote lower riskiness in line with the risk-return paradigm: high levels of profitability are correlated to high-risk profiles and low Z-score values.

With this in mind, the diversified liability and retail institutions present highly cyclical profitability levels. On the other hand, banks whose BMs are characterized by a significant recourse of assets under management, even if they suffer a drop in profitability in the event of an adverse business cycle, have higher Z-scores. This phenomenon is indisputable if we consider that diversified asset institutions hold a considerable percentage of assets in liquidity and similar instruments.

The Coronavirus pandemic has reduced the movement of people, and the consumption of services and, in general, slowed down economies on a global scale. In a European context of low rates that penalize the margins of institutions, we can observe a worsening of performance for all BMs analyzed. It is also possible to identify a significant and generalized contraction of all the indicators examined except for the investing activities BM and assets models. Nevertheless, the performance of the assets records a growing trend (Figure 4).

To identify the BM that complies with the risk-return relationship, the return on equity, on assets and the Z-Score were analyzed in four different time frames corresponding to the four most recent inversions of the economic cycle.

Up to the sovereign debt crisis, institutions with asset diversified BMs overperformed the other groupings on average. These results are justified by a lower level of Z-Score: the diversified institutions in the support are characterized by greater instability and, consequently, more significant risks.

The reduction in transactions in the interbank market and the gradual contraction in interest rates penalized both the liability-oriented BM and the retail sector. For the first, a consistent reduction in the Z-Score is observed, highlighting the presence of higher intrinsic risk and a higher expected return. Both ROE and ROA show higher values than the competitors' indicators.

Although characterized by lower average profitability than other institutions, investing activities BMs are identified by lower volatility of the Z-Score and substantial stability of the return on assets.

The historical period analyzed is, however, influenced by unprecedented exogenous changes, such as the management of large credit portfolios characterized by significant percentages of nonperforming loans, a prolonged phase of negative rates with severe consequences on the interest margin of the institutions and the blocking of economies following the restrictions introduced following the advent of the Covid-19 pandemic.

4.2 Business models migration analysis

It is possible to identify the tendency of institutions to migrate from one BM to another, dividing observations into five different subgroups in correspondence to business cycle downturns (Figure 5) [11].

The retail BM is adopted in correspondence with the growth phases of the economic cycle and afterward quickly replaced [12]. These periods are characterized by an expanding credit market, benefiting from rising rates and sustained demand for credit. As soon as a cycle inversion occurs, the loan portfolio undergoing qualitative deterioration obliges institutions to reduce their exposure to credit risk to recover the lost margins. However, less

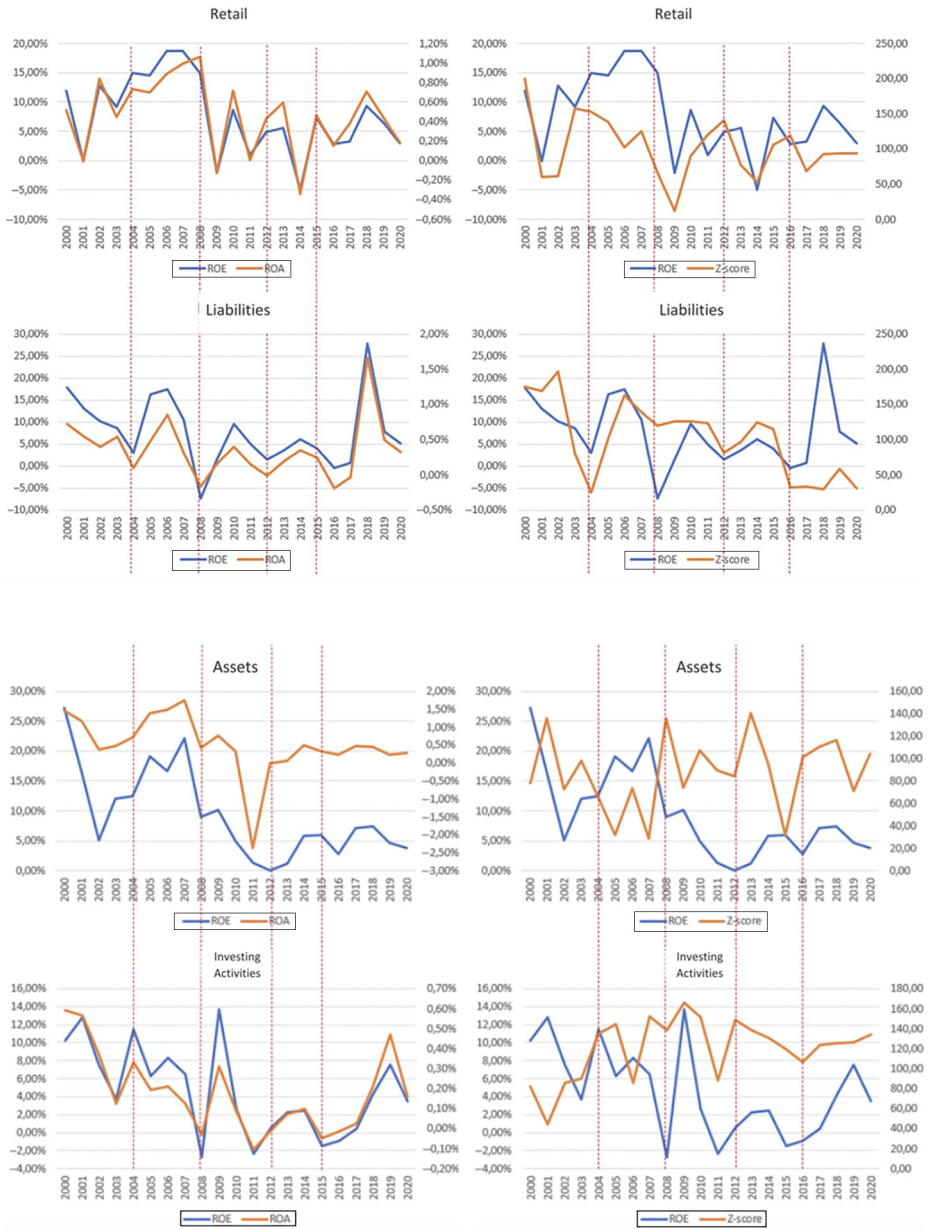
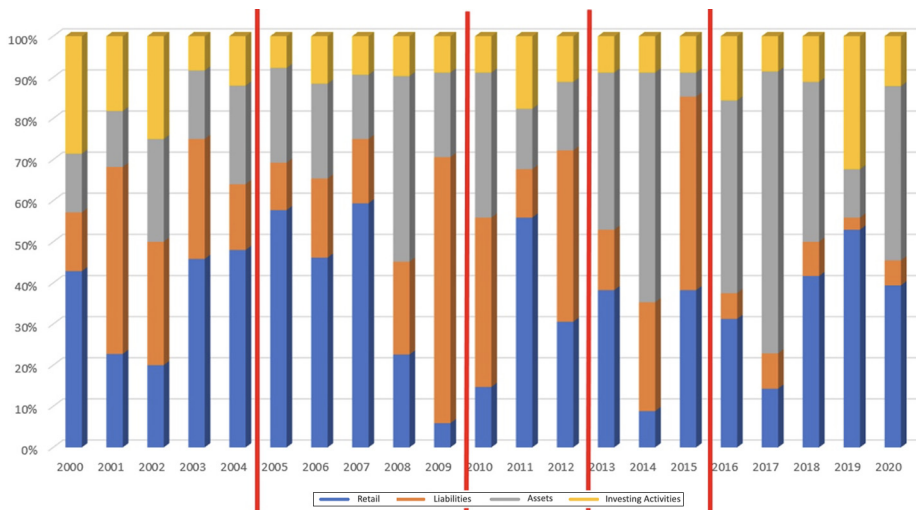


Figure 4. Return on equity, return on assets and Z-Score comparison for each business model

Note: Blue variable on the y-axis and orange variable on the x-axis

Source: own elaboration



European
banks'
business
models

Figure 5.
Business models
distribution

than 40% of intermediaries adopt this BM, and although investing activities BM ensures lower risk, the latter is implemented by less than 15% of the banks analyzed.

The diversified liabilities model is mainly adopted in the preceding phases of market growth or phases of greater volatility. Note the reduction in the use of this BM starting from 2016, the date from which the first effects of the expansionary monetary policies appeared, because of the quantitative easing introduced the previous year.

Banks opt for a model more oriented towards the diversification of assets immediately after a deterioration in the credit market or phases of declines in official rates by central banks. In 2008 and the two years 2013–2014, this phenomenon is more evident, justified in the attempt of the institutes to recover the profitability lost in terms of interest margin.

Finally, the investing activities BM seems to be marginally implemented, with greater use in the years preceding the crisis.

Tables 5 and 6 propose an analysis of the tendency of institutions to change their BM at the end of the economic cycles as described above [13]. The reasons that can induce the instinct to change the BM are:

- performance improvement;
- risk diversification;
- pursuit of a growth strategy;
- changes in demand for banking and financial products; and
- following changes in sector regulations (Ayadi *et al.*, 2021).

In the analysis carried out, the institutions' migrations to pursue the first three purposes outlined above are considered. The migration process was then further subdivided according to the overall dynamics of the evolution of the BMs for the single institution:

- “multiple migrations” for banks that in the observed periods have adopted multiple BMs without reusing previously implemented models; and
- “reverse migrations”, for banks that at the end of the observation period reused the BM chosen in previous periods.

Region/Size/Country	Migrating banks		Non-migrating banks (%)
	Reverse change (%)	Multiple change (%)	
<i>By region</i>			
North	47.06	23.53	0.00
South	29.41	47.06	0.00
West	23.53	29.41	100.00
<i>By size</i>			
Large	29.41	17.65	100.00
Medium	29.41	29.41	0.00
Small	41.18	52.94	0.00
<i>By Country</i>			
Austria	5.88	0.00	0.00
Belgium	0.00	5.88	0.00
Denmark	5.88	5.88	0.00
Finland	5.88	5.88	0.00
France	0.00	5.88	50.00
Germany	5.88	5.88	50.00
Greece	11.76	11.76	0.00
Italy	11.76	11.76	0.00
Norway	5.88	0.00	0.00
Netherlands	0.00	11.76	0.00
Spain	5.88	23.53	0.00
Sweden	11.76	0.00	0.00
Switzerland	11.76	0.00	0.00
UK	17.65	11.76	0.00
	100.00	100.00	100.00

Table 5.
Business model
migration table

The institutes that have not changed their BM were also noted.

Western European banks have a low migration rate for their BMs, and in the subset of institutions that have not made any migration, they represent 100% of the sample. The latter are distinguished both by size and by country of origin. Their totality is characterized by large banks operating in Germany or France. No small- and medium-sized institute has kept its BM constant in northern or southern Europe.

The highest multiple rates of BM change were found for banks operating in southern Europe (Greece, Italy and Spain) and for small ones. Regarding the change aimed at restoring old BMs, the most significant frequency was found for small-sized institutions operating in northern European countries, except for Italy and Greece.

For the sample banks based in Austria, Norway, Sweden and Switzerland, it was observed that the use of different BMs in the five observed periods was followed by a restoration of the first-period BM.

We can conclude that institutions characterized by a more significant size change the BM less frequently or even remain constant [14]. On the other hand, small banks tend to change the BM multiple times in search of better performance or to reduce risk exposure.

Banks are required to consider BM coherence with strategic planning as needed by the SREP assessment procedure (ECB, 2018). The level of consistency should be guaranteed at the business, product-line level or according to risk areas. Furthermore, BM and strategic planning coherence should hold in terms of financial flows: banks have to manifest the

Area	Country	Name	Size	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
West	Netherlands	ABN-AMRO	Medium	1	1	1	1	1	2	3	3	2	1	1	1	1	1	2	1	1	1	2	1	1
South	Greece	Alpha Bank	Small	3	1	1	1	3	2	3	3	1	3	1	3	1	1	3	1	3	2	3	2	2
South	Spain	Banco Bilbao Vizcaya Argentaria	Medium	3	4	1	3	3	2	1	2	2	2	2	2	3	1	1	1	1	1	4	2	3
South	Spain	Banco Popular	Small	3	1	1	1	1	3	3	3	2	1	3	2	3	1	1	1	1	1	4	4	4
South	Spain	Banco Sabadell	Small	1	1	1	3	1	2	3	1	2	3	1	3	1	1	1	1	1	1	2	1	1
North	The UK	Bankinter	Small	4	4	4	3	1	2	3	3	1	1	3	2	2	1	1	1	1	2	2	1	1
North	The UK	Barclays	Large	4	4	4	4	4	4	4	4	2	4	2	4	3	4	4	4	4	4	3	3	3
West	France	BNP Paribas	Large	4	4	4	3	4	1	2	3	4	2	2	2	3	2	2	2	2	2	2	2	2
South	Spain	Caixa Bank	Medium	3	1	1	3	1	2	3	1	2	3	1	1	1	1	1	1	1	1	1	1	1
West	Germany	Commerzbank	Medium	3	1	3	3	3	1	2	3	4	2	2	2	2	2	2	2	2	3	1	2	2
West	France	Credit Agricole	Large	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
West	Switzerland	Credit Suisse	Large	1	1	3	3	3	1	2	2	3	4	2	2	2	2	2	2	2	2	1	4	3
West	Germany	Deutsche Bank	Large	4	4	4	4	4	4	4	4	2	2	4	4	4	4	4	4	4	4	4	3	1
North	Norway	DNB	Small	2	1	2	2	2	3	1	3	3	4	1	1	1	1	3	3	3	2	2	2	2
South	Greece	Eurobank	Small	3	1	1	1	1	2	3	1	2	1	3	3	1	1	3	3	2	2	2	2	2
North	The UK	HSBC	Large	3	4	3	3	3	1	2	3	1	2	2	2	3	1	1	1	1	1	2	2	3
West	Netherlands	ING Group	Large	2	3	2	2	2	3	1	2	3	4	2	2	2	3	1	2	4	3	3	2	3
South	Italy	Intesa Sanpaolo	Medium	1	1	3	3	3	1	3	3	1	1	3	2	3	1	1	3	1	3	1	1	1
North	Denmark	Jyske Bank	Small	1	1	3	3	1	2	3	1	2	1	3	2	3	1	1	1	1	1	1	1	1
West	Belgium	KBC	Small	1	4	1	3	3	1	3	1	2	1	2	2	3	1	1	1	1	3	2	2	2
North	The UK	Lloyds Banking Group	Medium	3	3	3	3	2	2	3	1	2	1	3	2	4	4	4	4	4	4	4	4	4
South	Italy	Mediobanca	Small	1	1	1	3	3	1	2	3	1	1	3	2	3	1	2	1	1	1	1	1	1
South	Italy	Montepaschi	Small	1	3	3	3	3	1	3	3	1	1	3	2	3	1	1	1	1	3	1	4	4
South	Greece	National Bank of Greece	Small	3	1	3	1	2	3	3	3	2	3	3	3	3	1	3	3	3	3	2	3	1
North	The UK	Natwest Markets	Small	3	2	3	3	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2
North	Finland	Nordea	Medium	1	1	3	3	3	1	2	3	1	1	2	2	2	2	1	1	1	1	1	4	2
North	Finland	OP-Pohjola Group	Small	1	4	1	3	3	2	3	1	2	1	2	3	3	3	3	3	3	3	3	3	3
South	Greece	Piraeus Bank	Small	3	1	1	1	1	2	3	1	2	3	1	3	1	1	1	3	3	2	3	1	3
West	Austria	Ratifeisen Banking Group	Medium	1	1	2	2	1	2	2	3	4	2	1	1	1	1	3	3	3	3	3	3	3
North	Sweden	Skandinaviska	Medium	1	4	3	3	1	1	3	3	1	1	2	2	3	1	1	1	1	1	1	2	2
West	Germany	Sparkassen Finanzgruppe	Small	3	1	1	1	1	2	3	1	1	1	1	3	1	3	3	3	3	3	2	3	1
North	The UK	Standard Chartered	Large	3	1	3	3	3	1	2	3	1	3	2	3	1	2	3	1	1	1	2	2	1
North	Sweden	Swedbank	Medium	1	3	1	3	3	1	3	3	1	1	2	2	3	1	1	1	1	1	2	2	1
North	Denmark	Sydbank	Small	3	1	3	3	2	3	1	2	1	3	2	3	1	1	1	1	1	1	1	1	1
West	Switzerland	UBS	Large	1	4	3	3	3	1	2	3	1	1	2	2	2	2	2	2	2	1	1	2	2
South	Italy	UniCredit	Large	1	1	3	3	3	1	2	3	2	1	3	2	3	1	1	1	1	1	2	3	1
				4	Wealth Management			3	Asset diversified			2	Liability diversified		1	Retail								

European banks' business models

Table 6. Business models migration per year

ability to generate acceptable earnings for three years by implementing a forward-looking approach.

The outcome of BMA can be exploited to enrich and verify the sustainability of other SREP components, including strategic plans (ECB, 2018). Competent authorities could implement BMA to verify the coherence previously stated and identify banks' key vulnerabilities exposed at the BM and strategic level. Supervisory authorities assess strategic plan viability and BM sustainability by issuing a score as follows:

- low level of risk for the BM and strategic plan viability;
- medium–low level of risk for the BM and strategic plan viability;
- medium–high level of risk for the BM and strategic plan viability; and
- high level of risk for the BM and strategic plan viability.

These conclusions are mainly driven by: material assets concentration; competitive position; robustness check of hypothesis on the evolution of business environment; performance coherence to risk appetite and funding structure; competitive pressure on product and services; and strategic plan viability according to management execution capabilities (ECB, 2018). However, these dynamics cannot be perceived by traditional BMA tools, so the manager should implement a holistic view of the BM, integrating qualitative information on the competitive environment, the institution's positioning within the market, the key factors and key vulnerabilities.

4.3 Empirical analysis

Econometric models based on panel regression were built to validate the significance of the clustering variables concerning risk and profitability measures of banking institutions.

H1. ROE is affected by allocating resources in customer loans, interbank assets, assets under management, derivatives, cash, HQLA* and the use of deposits as a possible source of financing [15].*

$$ROE_{it} = \beta x_{it} + \delta \bar{x}_i + \gamma_t + \theta_i + \varepsilon_{it}$$

H2. ROA is affected by allocating resources in customer loans, interbank assets, assets under management, derivatives, cash, HQLA* and the use of deposits as a possible source of financing [16].*

$$ROA_{it} = \beta x_{it} + \delta \bar{x}_i + \gamma_t + \theta_i + \varepsilon_{it}$$

H3. The Z-Score is affected by allocating resources in customer loans, interbank assets, assets under management, derivatives, cash, HQLA and the use of deposits as a possible source of financing.

$$Zscr_{it} = \beta x_{it} + \delta \bar{x}_i + \gamma_t + \varepsilon_{it}$$

with x_{ict} vector of the regressors of the i -th bank at time t , \bar{x}_i their average, γ_t represents the fixed effects at year t and ε_{it} the error component.

It should be noted that ROE can be affected by BM classification, and it does not provide a reliable profitability and riskiness index (De Wet and Du Toi, 2007; ECB, 2010).

The regressors used are: Assets Under Management (AUM) as a significant driver for identifying the BMs of investing activities BM; the number of loans granted to customers, primarily present in the BMs of retail institutions and diversified regarding assets and deposits, which are decisive for identifying the BMs of retail banks and diversified in liabilities.

Assets under management, loans and deposits are expected to have an estimated positive β value, following the expected positive correlation between these regressors and the three dependent variables represented by ROA, ROE and Z-Score (Trocino, 2016; Ayadi *et al.*, 2019).

Considering that the pooled OLS requires the absence of correlation between the unnoticed effects and the regressors to obtain consistent estimators, we, therefore, opted for panel regression models with fixed effects, characterized by a higher R^2 . Subsequently, the Hausman tests were conducted for each model. The p -values from the comparison between the fixed effects and the random effects models were lower than the 5% threshold. Therefore, the use of random effects models is excluded considering the small sample size.

The results of the regressions carried out on the profitability indicators highlight the statistical significance of deposits, the loan portfolio and exposure to derivatives with a confidence level higher than 99.9% (Table 7); note that the confidence level for deposits in the case of the ROE analysis and the exposure in derivatives, concerning the ROA, drops to 90%. This evidence confirms *H1* and *H2* introduced in § 3.3 even though it was impossible to validate the relevance of receivables from other credit institutions and assets under management. Furthermore, the estimated β is consistent with the hypothesized correlation between regressors and dependent variables.

Concerning the analysis of the Z-Score, it can be observed that the increase in assets under management, deposits and loans has a negative impact on the risk index being analyzed. A negative value of β estimated for deposits constitutes an unexpected result but is consistent with the correlation indicated in § 3.3. Furthermore, it can be observed that deposits, exposure to derivatives and high-quality assets (including cash values) are

Coefficients	Model ROE	Model ROA	Model Z-Score
<i>CRVB</i>	0.2111 (0.1397)	0.0106 (0.0097)	1.4852 (18.4399)
<i>AUM</i>	0.0674 (0.0488)	0.0035 (0.0034)	-8.3696 (6.4402)
<i>DPST</i>	0.1152 (0.0655)	0.0154 *** (0.0046)	-124.6968 *** (8.6505)
<i>EXDE</i>	0.4010 *** (0.1153)	0.0148 (0.0080)	81.5053 *** (15.2208)
<i>LOAN</i>	0.1253 *** (0.0286)	0.0080 *** (0.0020)	-4.5596 (3.7717)
<i>CSHQA</i>	-0.1574 (0.1087)	-0.0118 (0.0076)	47.9875 *** (14.3577)
R^2 :	0.0888	0.0786	0.3449
Adjusted R^2 :	0.0242	0.0133	0.2984
<i>F-Statistic</i> :	8.4801 on 6 and 552 DF	7.4197 on 6 and 552 DF	45.7934 on 6 and 552 DF
<i>p-value</i> :	8.4229e-09	1.23e-07	< 2.2e-16

Table 7.
Panel regression with
fixed effects on (a)
ROE; (b) ROA and (c)
Z-Score

Notes: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

characterized by a confidence level higher than 99.9%. Therefore, it is possible to validate *H3* even though the receivables from banking institutions and assets under management do not have significant statistical significance.

4.4 Robustness check

The analysis aims to verify whether the balance sheet items have statistical significance in predicting the target variables, validating the clustering procedure used previously. Then, using the Hausman test and comparing the fixed effects panel regression results with those of the pooled ordinary least squares, it was possible to choose the most appropriate model (Table 8).

According to the Breusch-Pagan test, it is possible to affirm that there is not enough evidence to support the presence of heteroskedasticity; we fail to reject the null hypothesis with a 95% confidence interval (Table 9).

Furthermore, we checked the absence of multicollinearity among regressors assessing the variance inflation factor; we considered a threshold of 2 as a limit to reveal the presence of multicollinearity. The table below shows that each regressor presents a variance inflation factor more diminutive than the threshold (Table 10).

5. Conclusions

The BM adopted as a driver of strategic planning and the risk assessment, taking and monitoring process allows internal and external stakeholders to evaluate how income, equity and financial objectives are achieved.

It is feasible to assume that it is impossible to define a single model that responds to the *one size fits all* logic, given the evidence gathered in this work. Any BM guarantees a better long-lasting and stable risk-return profile over time: on the contrary, there was a tendency to adapt the model to exogenous factors. BMs' stickiness indicated in the literature seems to

Table 8.

Hausman test – fixed effect regression and pooled ordinary least squares

Hausman test	Model ROE	Model ROA	Model Z-Score
χ^2 :	5.7097	4.7380	5.1358
<i>p-value</i> :	0.4565	0.5778	0.5265

Table 9.
Breusch-Pagan Test

Test	Model ROE	Model ROA	Model Z-Score
<i>BP</i> :	4.8291	4.9601	2.8835
<i>p-value</i> :	0.5659	0.5489	0.08949

Table 10.

Variance inflation factor

CRVB	AUM	DPST	ESDV	LOAN	CSHQA
1.4221	1.2680	1.2052	1.5033	1.3197	1.0409

weaken in conjunction with extraordinary events that can undermine the economic margins of the institutions and negatively impact the consistency of assets or even increase debt positions.

There is a tendency for smaller- and medium-sized institutions to change their BM more frequently than larger institutions. The return to the previously implemented models is scarcely widespread for the latter. For large financial institutions, the stability of the BM is not linked to the achievement of an optimal level of risk return. Still, it is related to a more remarkable slowness in adapting to external events and a more complex re-planning of processes. It was observed that no model outperforms the others, although investing activities BM, characterized by a lower exposure to risks, is preferred by systemically important banks.

Quantitative metrics seem to be only able to represent the intrinsic dynamics of BMs partially and do not allow us to analyze nonaccounting dimensions such as: the range of services offered; the institution's exposure to particular products; relations with external stakeholders; the quality of governance; the quality of human resource management; and the corporate risk culture.

To include these metrics in the BMA, it is necessary to resort to a holistic view of the BM, integrating qualitative information on the competitive environment, the institution's positioning within the market, the key factors and key vulnerabilities. In this regard, the inability of quantitative models based on the analysis of balance sheet variables to provide a complete representation of business strategies is highlighted. Consider, for example, the use of ESG performance in assessing the probability of default of customers. This effect cannot be represented by accounting dimensions even if the credit origination processes are profoundly influenced. Or the ability of Fintech to revolutionize the BMs of credit institutions. The existence of a new *BM* creates the need for integration among quantitative and qualitative methods: mobile-only lending; low fee structures or banks' that do not charge any fee for specific services offered in their online platform; robo-advisors; big data for the instant and automated assessment of customer creditworthiness.

This information set needs to be verified within the context of risk planning, given the link between risk appetite and strategic objectives or between risk capacity and capital adequacy. In addition, the EBA's growing interest in qualitative aspects related to the BM and the need to conduct assessments from a forward-looking perspective underlines the attention to be paid to risk management and the sensitivity analysis of the related strategic choices regarding strategic planning, specific risk drivers, macroeconomic and sector variables and more generally of an exogenous nature.

It should be noted that the persistent regulatory innovation, which has characterized the scenario in the banking sector in the past 20 years, constitutes a strong constraint on the decision-making and strategic freedom of the decision-making bodies of credit institutions. This interference materialized in creating restrictions on capital allocation, and the tightening of internal procedures and processes contributed to the weakening of institutions' performance, already penalized by an unfavorable macroeconomic scenario. Moreover, the constrictions imposed on the banking activity have contributed to the stickiness of the BMs of larger institutions, characterized by suboptimal levels of risk-return. However, we convey that the imposition of stringent regulatory constraints limits migration phenomena from a microeconomic and management perspective. From a macroeconomic point of view, a rigorous set of conditions is a cost to be paid for stabilizing the financial system and limiting contagion effects ([González, 2005](#); [Padoa-Schioppa, 2005](#)).

Future research could evaluate the exposure and correlation of elements of the BM, of a qualitative and quantitative nature, with a set of significant exogenous variables for the conduct of the banking business. This analysis would allow approaching risk assessment and monitoring processes with the organizational and implementation ones of the business strategy.

Notes

1. The results refer to the years of observation, from 2005 to 2013.
2. This evidence contrasts with the results of previous analyzes that had captured a greater resistance capacity of this business model in crises.
3. It is assumed that an institution with a retail-oriented business model has a better historical set of information, useful for correctly analyzing the probability of default (PD) and loss given default (LGD) and exposure to default (EAD).
4. More precisely, the matrix based on the Euclidean formula was used, and the Ward2 methodology was implemented in R, as it considers the squared distances, increasing the quality of the grouping (Murtagh and Legendre 2014).
5. This value was obtained by rounding off the simple average of the k observed in the three optimization statistics of the cluster analysis.
6. Only the year 2009 has a k * level different from 4: this discrepancy can be explained in the modification of the business models of the institutions following the effects of the sub-prime crisis.
7. The variables represented are the same as in the clustering algorithm: CRVB = loans to banking institutions; AUM = asset under management; DPST = deposits; ESDV = exposure in derivatives; LOAN = customer loans; and CSHQA = Cash + HQLA.
8. The criteria for selecting the institutions are as follows: a) Total capital > 1 billion; b) Loans to customers > 5 billion; c) Total liabilities > 10 billion; and d) Total assets > 10 billion. Some institutions meeting these criteria were excluded if they present more than three years of missing data for the time horizon considered. The remaining banks are, therefore, 36.
9. The Z-Score measures the inverse probability of default as a reflection of past strategic decisions, the measurement of which is as follows: $Z_{Score} = \frac{ROA+CAR}{SD_{ROA}}$. A high Z-Score level is associated with a lower probability of default.
10. 1 = retail model; 2 = diversified model with respect to liabilities; 3 = diversified model respect to activities; and 4 = investing activities business model.
11. For the definition of the duration of the economic cycle, see the information provided on Page 8.
12. See, for example, the percentage drop recorded both in 2007 and in 2012.
13. The following five periods are taken into consideration: 1) 2020–2016; 2) 2015–2013; 3) 2012–2009; 4) 2008–2005; and 5) 2004–2000. In correspondence with each one, the following was assessed: the number of times the same institution has changed its business model; which was the predominant model in the period under consideration; the total number of business models adopted; if the institution is changing the business model has returned to previous models; and if the business model has remained constant over the time frame.
14. Institutions that did not change their business model used the investing activities business model characterized by high levels of Z-Score.

15. * It is assumed that there is a negative correlation between cash/high-quality assets and ROE. The reduction of risk and the high ability to transform these items into money contribute to the reduction of the potential profit generated by the investments made by the banking institution.
16. * It is assumed that there is a negative correlation between cash/high-quality assets and ROA. The reduction of risk and the high ability to transform these items into money contribute to the reduction of the potential profit generated by the investments made by the banking institution.

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