

Sustainable, Values-based Banking Model – Clustering Procedure for assessing its Convergence Pattern across European Banks

By Iustina Alina Boitan & Wafaa Shabban♦*

The paper subscribes to the strand of literature dedicated to sustainable banking, which represents a major shift from the conventional banking business model. At the core of the business mission and strategy lies the strong commitment of not only achieving profit, but also long-lasting, sustainable social and environmental impacts. The aim of the paper is to uncover whether financial institutions that have consolidated their mission, vision, environmental and societal involvement, as well as regular activity as a sustainable bank (and hence share the same active commitment on sustainable finance) follow a similar business model and strategy, and respectively display a resembling pattern of financial performance and exposure to risks. The classification of sustainable banks into homogenous groups is made by performing an unsupervised learning clustering algorithm called cluster analysis. Clustering is carried out for the most recent year with available data, applying an agglomerative hierarchical method and defining a distance (proximity) measure and a linkage rule. The sample of banks included in the study consists of those European banks that have voluntarily joined the Global Alliance for Banking on Values (GABV). To achieve this goal, we consider several key financial indicators collected from their 2022 annual reports. In particular, financial performance is proxy by the ROE and ROA, operational efficiency is computed as cost-to-income ratio, the exposure to the liquidity risk is represented by the loan/deposit ratio, capital adequacy is represented by tier 1 ratio, while the balance sheet composition is reflected by the share of bank loans to total assets, the share of financial assets to total assets, the share of deposits to total assets. The findings will shed light on whether the business model adopted by GABV sustainable banks, rooted in the strong commitment to a values-based banking model with a positive impact on local communities and the environment, displays highly homogeneous characteristics or, on the contrary, there is dissimilarity in terms of the key indicators considered.

Keywords: *sustainable banking; sustainable finance; business model; banking performance; banking risk; cluster analysis; descriptive statistics; proximity matrix*

*Professor, PhD. Habil., Bucharest University of Economic Studies, Faculty of Finance and Banking, Bucharest, Romania.

Email: iustina.boitan@fin.ase.ro

♦Doctoral Student, Bucharest University of Economic Studies, Doctoral School of Finance, Bucharest, Romania.

Email: shabbanwafaa22@stud.ase.ro

Introduction

The current global challenges faced due to climate change have given a new impetus to the emergence of sustainability in finance and business fields of activity. Broadly speaking, it contributes to redefining the traditional business models of financial intermediaries and channeling the financing not only to achieve profit but also to achieve sustainable social and environmental impacts by taking into account environmental and social aspects¹ which will lead to a more sustainable economy.

Starting from the importance of the transition to a more sustainable economy, sustainable finance plays the main role in enabling the financial sector to mobilise the required capital for this transition². Adopting sustainable finance practices has become an important issue³, as it provides a pathway and opportunity to achieve a sustainable innovation environment⁴. In addition, the sustainable economy desiderate can be supported by means of green financial decisions⁵.

Governments, banking supervisory and regulatory institutions, and financial intermediaries are seeking to meet the challenges related to expected financial, economic and climate crises through sustainability⁶. This situation paved the way for bringing sustainable, green finance to the forefront of the banking business, and the banking sector also started to provide environmentally, sustainable products and services (eco-friendly products) as a response⁷ as well as to voluntarily join the membership of various international initiatives such as the Equator principles, the Principles for Responsible Investment, the United Nations Environment Program – Financial Initiative, the United Nations Global Compact, the Net Zero Banking Alliance, the European Federation of Ethical and Alternative Banks and Financiers, to name just a few of them. Adherence to any of these international or regional frameworks translates into the alignment of the business vision, strategy, and current operations with a set of core best-practice principles in the field of sustainability.

Recent banking activities gravitate around several trends such as digital banking, green bonds, green credit cards, green accounts, and even green mortgages⁸. Furthermore, many concepts referring to sustainable finance are being used today referring to environmental finance, climate finance, green investment, and green finance⁹.

The scope of the paper is to particularly focus on those banks that joined the Global Alliance for Banking on Values (GABV). Membership of this association signals a firm, transparent commitment of using finance to deliver sustainable

¹Hasanah, Rachmawati & Murwaningsari (2022).

²Sommer (2020).

³Munir, Irfan & Malik (2022).

⁴Falcone & Sica (2019).

⁵Shershneva & Kondyukova (2020).

⁶Ziola, Filipiak, Bak & Cheba (2019).

⁷Dikau & Volz (2021).

⁸Prabhu & Aithal (2021).

⁹Akomea-Frimpong, Adeabah, Ofosu & Tenakwah (2021).

economic, social and environmental development, for the general wellbeing of people and the planet. Consequently, these banks have tailored their mission, vision and financial activity in order to accommodate the environmental and societal involvement. The main research aim is to uncover whether there are specificities in terms of the business model adopted or, on the contrary, there is close alignment in terms of several financial indicators. We apply a cluster analysis approach as it is the most suited for revealing the presence of heterogeneity among selected banks, or of similarity patterns in terms of business model and strategy.

The paper delineates from existing research in that it proposes a new approach, namely to identify clusters of resembling values-based banks displaying similar financial features in terms of financial performance, operational efficiency, risk exposure, solvency and balance sheet structure. So far, there is limited research on GABV member banks and the research objectives vary broadly. For example, Kocornik-Mina, Bastida-Vialcanet & Eguiguren Huerta¹⁰ conduct a systematic multiple case study approach of the best practises implemented by GABV banks to achieve the desired social impact. The defining characteristics of GABV sustainable banks and their differentiating elements are evaluated by Valls Martínez, Martín-Cervantes & Peña Rodríguez¹¹ from a two-fold methodological perspective (factor analysis and cluster analysis) and reveal the delineation between two major groups: Ethical Banks per se and Poverty Alleviation Banks. A different research goal belongs to Valls Martínez, Cruz Rambaud & Parra Oller¹² who compare sustainable and conventional banking in Europe in terms of several financial indicators such as liquidity, coverage and solvency. The influence of social banking and financial sustainability on the economic development has been empirically assessed by Dourtmes and Andrikopoulos¹³.

Section 2 discusses the various ways sustainable finance is implemented in current banking activity by reviewing a series of conceptual and empirical approaches. Section 3 develops the methodological background and presents the specificities of the data. Section 4 showcases and explains the results obtained while the last one concludes.

Implementing the Sustainable Finance Policy and Measures in the Banking Activity – A Literature Review

From a sustainability perspective, the transition to a more sustainable eco-social system needs unprecedented sustainable, low-carbon investments, which need not only financial resources but also shifting these resources toward the pathway of sustainability that sustainable finance naturally deals with¹⁴.

¹⁰Kocornik-Mina, Bastida-Vialcanet & Eguiguren Huerta (2021).

¹¹Valls Martínez, Martín-Cervantes & Peña Rodríguez (2021).

¹²Valls Martínez, Cruz Rambaud & Parra Oller (2020).

¹³Dourtmes & Andrikopoulos (2021).

¹⁴Sommer (2020).

According to the Sustainable Banking Network and International Finance Corporation (2020), sustainable finance refers to all practices, policies, and regulations issued by governments or regulators and financial institutions to:

- i) manage and reduce the risks resulting from financial sector activities related to the environmental, social, and governance risks;
- ii) encourage assets, projects, investments, sectors, and businesses by facilitating the flow of capital to them.

The banking sector, through its privileged position as the major intermediary between financial resources and investment projects that need financing, can play a major role in fostering the completion of sustainable goals. To achieve this, banks must improve their range of sustainable products, which will directly benefit the bank's image, reputation and will improve trust and customer loyalty¹⁵. A study by Mejia-Escobar, González-Ruiz & Duque-Grisales¹⁶ indicates a growing trend of developing more sustainable banking projects in the financial markets, with banks that actively take into account the ESG considerations.

Liu & Huang¹⁷ explain the mechanism of how participation in sustainable finance of a bank affects its profitability and asset quality, as follows:

- ✓ banks can increase their market share and enjoy the benefits of expanding sustainable finance, which will lead to higher profitability. In addition, banks with more orientated resources toward sustainable finance can better manage the economic cycle. At the same time, it is likely that banks will face constraints in financing industrial investments with a higher level of pollution or higher consumption of energy;
- ✓ sustainable finance increases bank operating costs related to the implementation of new credit screening criteria and adjustment of internal credit rating systems to account for new ESG ones;
- ✓ sustainable finance investments are mostly related to the government priorities, therefore banks with sustainable finance investments may gain subsidies from the government to improve their risk management capacities and enhance it to be complying with sustainable finance practices.

A complementary research strand investigates the relationship between banking involvement in sustainable finance and the new related risks. Prudential regulation and supervision can guide and help banks identify and address financial risks related to sustainability proactively, which encourages the banking sector to continue its involvement in sustainability and deal with the inherent risks related to sustainable finance¹⁸. Indeed, most experts point out that environmental risks related to sustainability may negatively affect the banking sector due to increased

¹⁵Ibo-enwo, Igbudu, Garanti & Popoola (2019).

¹⁶Mejia-Escobar, González-Ruiz & Duque-Grisales (2020).

¹⁷Liu & Huang (2022).

¹⁸Alexander & Fisher (2019).

volatility in asset prices and borrower default, in addition to the limitation and restriction of credit for some economic sectors that had been classified as unsustainable from an environmental standpoint. Liu & Huang¹⁹ bring a different point of view. If the scale of the bank's sustainable finance activities compared to all its other business lines is too low, it indicates a tendency to neglect risk management associated with sustainable finance objectives and the management's preference to maximise profits and minimise risks related to sustainable finance.

A point-by-point explanation of the various typologies of risks that can affect banks' desire to involve in sustainable practices belongs to Bank of England²⁰. Corporate credit risk is defined as the sudden exit from the market of companies that depend on high carbon emissions for reasons like changes in customer preference or even government policies to encourage certain kinds of investments. The retail credit risk occurs when a climate event occurs that significantly impairs the borrower's real assets. It applies especially to commercial banks that hold large portfolios of mortgage loans. Banks will be subject to face market risks because in case of changes in the economic policy or economic priorities, there may occur a change in the price of assets. Finally, the policy and legal risk arises when a country extends environmental protection in its national policies and law.

From the perspective of Cato²¹, the risk of sustainability should be reflected in the prudential consideration of the bank capital requirements. Assets included in the bank collateral can be evaluated higher when these assets do not have negative environmental effects, compared to assets they do have.

Prudential regulation which has duties in maintaining financial stability has to make sure that these risks are considered as systemic risks. In the same vein banks have to recognise it by taking sustainability risks into account in their internal risk management models. However, the response of most banks to these risks was related to adopting various green banking practices or improving existing practices and principles with a focus on the management of ESG risk²².

A survey of the existing literature shows that some banks started to delineate from the mainstream banking industry in terms of business mission, targeted customers, and expected environmental and/or societal impact. Some of them label themselves green banks, sustainable banks, social, or ethical banks. Weber & Remer²³ define social banks as banks that are orientated to have positive social effects for the local communities. For example, sustainable banks with a social dimension try to reach social and financial inclusion and embed sustainability in the financial sector through many practices such as transparency and accountability, tax payment, and prevention of corruption. These practices apply not only to bank employers, but also to all potential partners of the banking business. In addition to

¹⁹Liu & Huang (2022).

²⁰Bank of England (2018).

²¹Cato (2022).

²²Alexander & Fisher (2019).

²³Weber & Remer (2011).

that, several social banks provide financial education programs for specific target groups such as disadvantaged people²⁴.

The main role of sustainable finance is to channel financial resources towards social and environmental added value projects and investments. This progress can be achieved through ethical banks, which aim to encourage sustainable and responsible investments. The efficiency of ethical, sustainable banking activity is reflected in the ability of an ethical bank to support socially responsible projects²⁵. In the same vein, the banking sector, by reallocating financial resources to more sustainable sectors, plays an important role in supporting the transition of the economy to a more sustainable one through the following:

- ✓ supporting the adoption of climate change and environmental changes;
- ✓ mitigation of the environmental risk when it occurs;
- ✓ supporting recovery efforts²⁶.

Green banks or environmentally responsible banks represent an important form of banking activity that leads to the emergence of several synergistic effects: i) the economic efficiency of the bank will increase; ii) positive impact on the social image of the bank; iii) the harmful, negative effects of banking activity on the environment are expected to decrease; iv) environmentally responsible bank practice is susceptible to generate social benefits in the future²⁷. According to Mir & Bhat, green banking practices represent all sustainable banking services that have the main role in achieving environmental sustainability, which will lead to protecting our planet by preventing environmental damage. Green banking practices have impacts on both the environmental performance of banks and the source of green finance of banks, according to Chen, Siddik, Zheng, Masukujjaman & Bekhzod.²⁸

According to the empirical results of Zhang, Wang, Zhong, Yang & Siddik²⁹, green banking activities have a significant positive effect on the performance of environmental banks, in addition to their role in achieving sustainable economic development. Green banking development plays the main role in reducing costs and increasing the benefits of development, such as increasing competition between banks and increasing the rate of online banking facilities, in addition to reducing the costs related to long-term projects and investments.

²⁴Lange & Schmitt (2019).

²⁵Barbu & Boitan (2019).

²⁶Barbu & Boitan (2019).

²⁷Shershneva & Kondyukova (2020).

²⁸Chen, Siddik, Zheng, Masukujjaman & Bekhzod (2022).

²⁹Zhang, Wang, Zhong, Yang & Siddik (2022).

Methodology and Data

Cluster analysis is included in the category of unsupervised learning algorithms and is widely used as a classification tool. It performs a structural differentiation of banks³⁰ by grouping them, according to some pre-established input variables, into meaningful and relatively homogeneous groups or clusters. Its main purpose is to group cases according to their degree of similarity or proximity so that observations included within a specific cluster are more homogeneous than observations between clusters³¹.

The approach used to form clusters is the hierarchical one, because we have no prior knowledge on how many clusters should be generated. Due to this important feature it is largely employed by existing studies, regardless the purpose of the analysis. The major advantage lies in that there is no need to specify the expected number of clusters in advance because it is automatically determined as a hierarchy of nested partitions and displayed in the form of a tree diagram called dendrogram³². It is applied an agglomerative algorithm that begins by including each case into a single cluster, then according to the distance measure computed the closest clusters are merged in each successive step, giving rise to high-quality partitions inside each hierarchical framework displayed in a simple and intuitive manner³³. As a similarity measure we rely on distance measures represented by the squared Euclidean distance. In the next step we use the matrix of distances between the various input variables or characteristics to perform a similarity-based clustering, by means of a linkage rule called average linkage method. According to this approach, the distance is defined by computing the arithmetic mean between all pairwise distances³⁴.

The study is carried out on a sample of 11 commercial banks operating in Europe that are active members of the GABV network. The list of banks included in the study, as well as the country of origin and some specific business model features are summarised in table 1.

³⁰Korzeb, Niedziółka & Zegadło (2022).

³¹Figueiredo Filho, D., Rocha, E., Júnior, J., Paranhos, R., Silva, M. & B. Duarte (2014).

³²Gagolewski, Cena, James & Beliakov (2023).

³³Cena & Gagulewski (2020).

³⁴Gagolewski, Cena, James & Beliakov (2023).

Table 1. List of GABV Banks included in the Study

Name of the bank	Country	Mission/vision/strategy
3Bank	Serbia	Provides financial services to customers who make a positive economic, social and environmental impact, with special focus on clients who have difficulty in accessing such services (equal rights to financial services for all).
Fiare Banca Etica	Spain	Intends to act as a tool of social transformation through the financing of third sector projects, the social and solidarity economy and the promotion of a culture of financial intermediation, under the principles of transparency, participation and democracy.
Banque Alternative	Switzerland	Positions itself as an ecological, social and transparent bank, committed through its business activities to the common good, to human beings and the environment. Social and ecological principles are put before profit.
Charity Bank	UK	Defines itself as an ethical bank that creates lasting social change for the communities. It supports charities with loans that they couldn't find elsewhere and ensures people that their savings could be invested ethically.
Cultura Bank	Norway	Follows a banking business where money is not viewed as an end in itself but as a tool to create social justice and a better environment.
Ecology Building Society	UK	Aims at building a greener society by providing mortgage loans for properties and projects that respect the environment and support sustainable communities, funded through transparent savings accounts.
Bank of Karditsa	Greece	Its mission is to be dynamically present in the development of the local economy by meeting the financial needs in the most personalised way, with speed, friendliness and transparency.
MagNet Bank	Hungary	Positions itself as a community-building financial institution, a values-based bank which aspires for active social participation and consciously develops its environment.
Merkur	Denmark	Denmark's largest value-based bank that serves both business and private customers who search for an ethical and responsible bank.
Triodos Bank	Netherlands	Its mission is to make money work for positive change, in ways that benefit people and the environment, and to create a society that protects and promotes quality of life and human dignity for all.
Unity Trust Bank	UK	Its mission is to help create a better society by supporting organizations to prosper and contribute to positive economic, social and environmental change. It only lends to creditworthy organizations that comply with bank's ethical values and are able to deliver quantifiable impact in their local communities.

Source: authors, based on information collected from banks' websites

The list of input variables that are included in the study as proxies for the business model specificity in terms of risk, return, financial soundness and balance sheet composition is described in table 2 below. Data is collected from banks' annual reports for the 2022-year end.

Table 2. *Description of Variables*

Variable name	Definition
return on assets - ROA	Computed as the ratio of bank's after-tax profit in total assets
cost to income ratio	Designates the operational efficiency. Usually banks are targeting a level of around 60% or less, as a strategy of controlling the operational expenses that will further improve their profitability.
common Equity tier 1	Is a measure of capital adequacy, of how much capital is available to withstand unexpected losses or shocks, computed as a percentage of a bank's risk-weighted credit exposures. The higher the capital ratio the wider bank's resilience to unexpected shocks.
loan/deposit ratio	Quantifies the exposure to the liquidity risk. A value close but below one suggests that loans are funded mainly by customer deposits (core, stable accounts), which indicates a safe balance sheet structure.
financial assets to total assets	Evaluates the proportion of income-generating assets (other than loans) represented by shares and bonds. Banks' intention of holding them (for frequent trading, for sale, or until maturity) provides clues on its financial behavior: speculative or precautionary.
bank loans to total assets	Is a proxy of the size of bank lending to customers.
deposits to total assets	Indicates bank's level of indebtedness to the customers, in the form of deposit accounts attracted from them.

Source: authors

Before proceeding with the cluster analysis, the main descriptive statistics are discussed in order to uncover some initial characteristics of our dataset, and then a correlation matrix is generated to verify whether our variables are highly correlated to each other.

Table 3. *Descriptive Statistics*

	No. obs	Min.	Max.	Mean	Std. Dev.
ROA (%)	11	.0000	2.38	.75	.79
cost to income (%)	11	36.80	80.00	66.57	13.73
common Equity tier 1 (%)	11	9.05	22.91	16.29	4.17
loan/deposit (%)	11	43.90	145.00	86.21	30.91
financial assets to total assets (%)	11	.38	31.31	8.69	8.55
bank loans to total assets (%)	11	35.75	84.44	65.80	13.78
deposits to total assets (%)	11	55.97	93.91	84.52	10.89

Source: authors

The mean value of ROA is 0.75 and the standard deviation is 0.79 which indicates that the values of the variable tend to be close to the sample's mean. The minimum value of ROA is 0 and is recorded by Merkur Bank while the maximum value is 2.38 and belongs to 3Bank.

The minimum value of cost to income ratio is 36.80 and is registered by Unity Trust Bank, while the maximum one is 80, being recorded by Merkur Bank and Triodos Bank. The standard deviation is 13.73 indicating that the values of the ratio are spread out over a wider range; hence, there is high data variability among banks.

The maximum value of the Common Equity tier 1 indicator is 22.91 and belongs to 3Bank while the minimum value is 9.05 and is recorded by MagNet Bank.

The mean value of the loan/ deposit ratio is 86.21 and the standard deviation is 30.91 indicating high deviation of the values from the sample's mean and thus the presence of broad heterogeneity in terms of this indicator. The minimum value is 43.90 being registered by Merkur Bank while the maximum one is recorded by Cultura Bank.

The maximum value of financial assets to total assets is 31.31 and belongs to Cultura Bank while the minimum one is 0.38 and is registered by 3Bank.

The minimum value of bank loans to total assets is 35.75 registered by Merkur Bank while the maximum one is 84.44 registered by Banca Etica. The standard deviation of 13.78 suggests high deviation of the values of variables, which tend to be far away from the mean value which is 56.80.

The maximum value of deposits to total assets is 93.91 and is recorded by Ecology Building Society while the minimum one is 55.97 and is recorded by 3Bank.

Table 4. Correlation Matrix

		ROA (%)	cost to income (%)	equity tier 1 (%)	loan/ deposit (%)	bank loans to total assets (%)	financial assets to total assets (%)	deposits to total assets (%)
ROA (%)	Pearson Correlation	1	-0.57	0.26	0.23	0.04	-0.21	-0.46
	Sig. (2-tailed)		0.06	0.43	0.48	0.89	0.53	0.15
cost to income (%)	Pearson Correlation	-0.57	1	0.28	0.27	0.16	-0.04	-0.32
	Sig. (2-tailed)	0.063		0.40	0.41	0.62	0.89	0.33
Common Equity tier 1 (%)	Pearson Correlation	0.26	0.28	1	0.45	-0.15	0.35	-0.53
	Sig. (2-tailed)	0.43	0.40		0.15	0.64	0.28	0.09
loan/deposit (%)	Pearson Correlation	0.23	0.27	0.45	1	0.55	0.37	-0.46
	Sig. (2-tailed)	0.48	0.41	0.15		0.07	0.25	0.15

bank loans to total assets (%)	Pearson Correlation	0.04	0.16	-0.15	0.55	1	-0.21	-0.27
	Sig. (2-tailed)	0.89	0.62	0.64	0.07		0.53	0.42
financial assets to total assets (%)	Pearson Correlation	-0.21	-0.04	0.35	0.37	-0.21	1	0.35
	Sig. (2-tailed)	0.53	0.89	0.28	0.25	0.53		0.28
deposits to total assets (%)	Pearson Correlation	-0.46	-0.32	-0.53	-0.46	-0.27	0.35	1
	Sig. (2-tailed)	0.15	0.33	0.09	0.15	0.42	0.28	

Source: authors

The probabilities associated with the correlation coefficients between variables are not significant, therefore we can conclude that variables are not statistically correlated and hence redundant information is not present in the dataset considered. All of them will be further included in the cluster analysis.

Findings and Interpretation

The distance matrix (Table 5) showcases in numerical form the computed distances between banks, according to their intrinsic features represented by the seven variables abovementioned.

Table 5. Squared Euclidean Distance

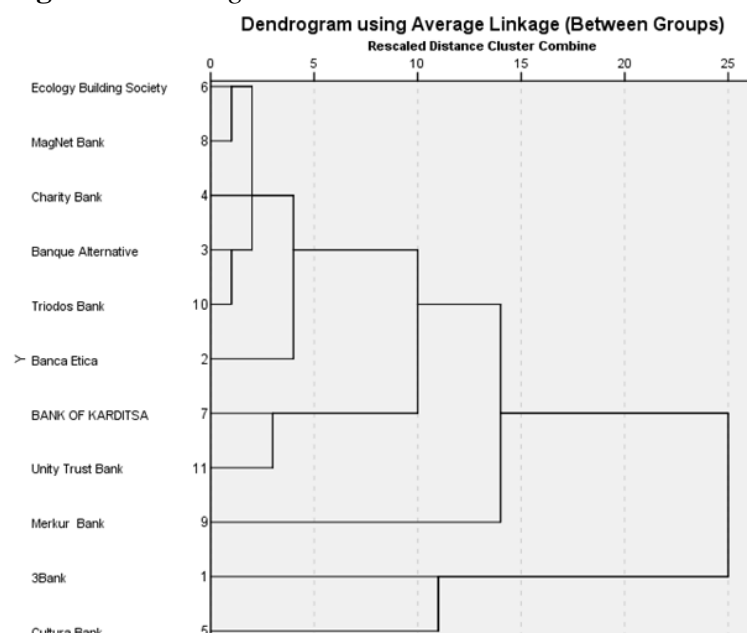
Cases	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
B1	0,00	2030,0	3416	3538,4	2489,7	4683,0	6897,3	5195,9	10988	4718,6	10092
B2	2030,0	0,00	752,2	372,28	3004,9	868,40	2569,2	1053,8	5994,3	1132,1	4686
B3	3416,1	752,23	0,00	633,43	4913,7	567,97	1838,6	547,69	2888	235,74	3669,0
B4	3538,4	372,28	633,4	0,00	4395,9	255,07	1059,5	365,7	4176,6	714,29	2577,8
B5	2489,7	3004,9	4913	4395,9	0,00	5353,6	7892,1	5689,4	11678	5176,4	10038
B6	4683,0	868,40	567,9	255,07	5353,6	0,00	924,75	62,98	2900,9	311,45	2353,8
B7	6897,3	2569,2	1838	1059,5	7892,1	924,75	0,00	877,80	2435,0	1548,6	573,05
B8	5195,9	1053,8	547,6	365,76	5689,4	62,98	877,80	0,00	2607,0	267,70	2273,4
B9	10988	5994,3	2888	4176,6	11678	2900,9	2435,0	2607	0,00	2137,7	2741,1
B10	4718,6	1132,1	235,7	714,29	5176,4	311,45	1548,6	267,70	2137,7	0,00	2953,7
B11	10092	4686,0	3669	2577,8	10038,	2353,8	573,05	2273,4	2741,1	2953,7	0,00

Source: authors based on SPSS analysis

The final outcome of the cluster analysis is presented synthetically in the form of a dendrogram or hierarchical tree that illustrates the hierarchical composition of a group of banks, in successive stages of clustering, due to the decreasing degree of similarity between them. The clustering solution that is kept for interpretation purposes is the one generated for the distance range 0-5, as it is the most meaningful and detailed in terms of identifying homogenous clusters.

The highest the distance clusters merge the broadest the dissimilarity between them.

Figure 1. Dendrogram



Source: authors based on SPSS analysis

The hierarchical clustering for the year 2022 shows the presence of five clusters with specific distinctive features:

➤ Charity Bank, Banque Alternative, Ecology Building Society, MagNet Bank, Triodos Bank and Banca Etica feature some of the lowest levels of ROA, below the sample's average of 0.75%. The cost to income indicator ranges around the sample's average of 66.57%, as well as the tier 1 indicator and the loan/deposit ratio. These banks are scoring the highest values in the sample for loans to total assets and deposits to total assets, and some of the lowest, below-average values of financial assets to total assets. Thus, banks included in this cluster have as main source of financing the deposits attracted from customers while on the asset side, the most prominent part is hold by the loan portfolio. Lending is the main financial activity conducted by these banks signalling their commitment for the financing of sustainable, green investment projects. In addition, they exhibit a medium operational efficiency, capitalization and exposure to the liquidity risk arising from the mismatch between the maturity of the deposit accounts and the one of loans.

➤ Bank of Karditsa and Unity Trust Bank record one of the highest ROA levels in the entire sample (1.64%), the lowest values for cost to income ratio and for the share of financial assets in total assets, below average values for tier 1 indicator, loan/deposit ratio and loans/assets ratio, and high values of deposits to total assets. Consequently, these banks are best performers in terms of minimizing their operational costs and maximizing financial return. Most of their financial

liabilities are represented by deposit accounts. However, lending has a share of only 50-57% of total assets.

➤ Merkur Bank is an outlier bank that features the minimum value of ROA, of loans/assets and of loan/deposit ratios among all the banks in the sample, and the highest cost to income ratio. Tier 1 and deposits/assets position above the average, while financial assets to total assets record a below average value. It appears that the bank succeeds to attract large amounts of financing from customers in the form of core deposit accounts, has a low exposure to the liquidity risk and is well capitalised, but it faces profitability problems and deficiencies in the operational cost management (the lowest operational efficiency). The explanations for obtaining these low levels are included in the 2022 annual report. From the total operational costs, IT costs (in areas such as cybersecurity, compliance, GDPR and anti-money laundering) have been steadily increasing in the past years and account for a large proportion of Merkur's total costs. Staff costs also increased due to the fierce competition for hiring high-skilled, specialised employees. The main source of income is the interest income associated with the loan portfolio and it is declining because customers have refinanced their mortgage loans, thereby reducing their outstanding debt with the bank. The ratio of loans to total assets is of only 36%. This fact is explained by the decreasing interest of bank customers to apply for new loans, the refinancing of existing loans as well as bank's involvement in the impact investment field related to green and ethical investment products. In addition, by having a look at the composition of the balance sheet, it appears that cash in hand and demand deposits with central banks represent almost 53% of total assets. Therefore, this bank exhibits a cautious, precautionary financial behavior.

➤ 3Bank features the maximum value of ROA in the entire sample of banks (2.38%), a large value of cost to income ratio, and the maximum value of the tier 1 (22.9%). It holds the second highest value of the loan/deposit ratio (135%), a large value of bank loans to total assets, but at the same time the lowest value of financial assets to total assets (0.38%) and of deposits to total assets (55.97%). Consequently, it is the best performer in terms of generating financial returns, being also the best capitalised bank. Its business model is different in that only half of its liabilities are represented by deposit accounts attracted from customers. A remaining amount of 26% is represented by deposits and other liabilities attracted from banks and other financial institutions. This fact puts further pressure on the exposure to liquidity risk, as the loans granted are only partially covered by the stable customer deposit accounts. Deficiencies appear also in terms of cost management.

➤ Cultura Bank records below average values for ROA and bank loans to total assets, above average values for cost to income ratio and large deposits to assets ratio (89.9%), the 2nd highest value in the entire sample of the tier 1 equity ratio (20.79%), the highest value of loans to deposit ratio (145%) and of financial assets in total assets (31.31%). The strength of this bank, that is included in a distinct cluster, is represented by a strong capitalization. However, it seems that it faces some problems with the cost management as it exhibits a large level of operational cost inefficiency, which puts further pressure on the profitability indicators. Bank

loans to total assets represent around 62%, indicating that lending to the real economy and households is not an aim in itself, being complemented with holding a high share of financial assets. A closer look into the annual report shows that the portfolio of financial assets is mainly composed by sovereign and corporate bonds that generate stable, fixed-income. Thus, the bank appears to follow a precautionary financial behaviour with a steady increase of income revenues, as it invests in low risk financial assets that generate a predictable, recurrent income. However, the bank is highly exposed to the liquidity risk as its loans are not fully covered by core deposit accounts and it has to rely on additional sources of financing such as loans from other banks. In its latest 2023 annual report this drawback is clearly acknowledged, together with the board commitment of redesigning the bank's business strategy in order to decrease the risk tolerance to liquidity risk.

Conclusions

The findings generated through our unsupervised exploratory analysis revealed that the business model adopted by a sample of European sustainable banks affiliated to the GABV network displays heterogeneous features in terms of the key indicators considered. Although they all acknowledge a strong commitment for the implementation of a values-based banking model with positive impact on local communities and environment, the current global/regional factors (macroeconomic, geopolitical) as well as the banking competition in the domestic banking system are leaving their mark on the major banking business indicators.

As the clusters' features indicate, some banks (Bank of Karditsa and Unity Trust Bank) have succeeded to balance the financial goals with the social and environmental ones, maintaining at the same time good resilience to unexpected shocks and appropriate management of operational costs and liquidity risks. It should be mentioned that there is no bank or group of banks that are rated worst in all the considered financial indicators. Instead, some of them (Merkur Bank, Charity Bank, Banque Alternative, Ecology Building Society, MagNet Bank, Triodos Bank and Banca Etica) exhibit the worst profitability, other record some of the highest cost to income ratios (Merkur Bank, 3Bank, Cultura Bank) or the highest exposure to the liquidity risk (3Bank, Cultura Bank).

Another finding is related to the accomplishment of their basic, traditional function namely the financial intermediation between depositors, as holders of capital, and borrowers. The banks that prioritise lending to customers, by holding the largest share of the loan portfolio in total assets, are those included in the first cluster (Charity Bank, Banque Alternative, Ecology Building Society, MagNet Bank, Triodos Bank and Banca Etica) and the one included in the fourth cluster (3Bank).

At the opposite are some banks that involve in both lending (although at a smaller scale, of up to 60% of total assets) and investing in the purchase of financial assets such as shares and bonds: Cultura Bank (31.31%), Unity Trust Bank (15.4%) and Triodos Bank (10.9%). Consequently, these banks display a more diversified but prudent business model. They exhibit a precautionary

financial behaviour by investing in fixed-income bonds issued by the sovereign or financial institutions in order to achieve stable interest income and use them as a collateral in case of liquidity shortage (the loans received from the central bank have to be mandatorily guaranteed with a portfolio of eligible assets, such as bonds). In addition, some of them prefer to hold large cash amounts in accounts with the central bank (Unity Trust Bank, Triodos Bank). Therefore, these amounts of money are used neither for lending nor for investment purposes, but are kept in the form of liquid assets to serve as a buffer of liquidity in case of emergency or sudden shocks. It is a conservative strategy implemented as a result of the economic and financial uncertainty that has dominated the past few years, during the pandemic crisis.

To conclude with, economic literature summarises the most desired approach in the conduct of the banking business by social (ethical) banks: those exhibiting noticeable resilience in periods of financial stress and operating under moderated risk exposure are positively connected to economic development³⁵.

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