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LINKING FINANCIAL PERFORMANCE AND EFFICIENCY TO SUSTAINABILITY IN BANKING SECTOR: A LITERATURE SYNTHESIS

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Abstract. Efficiency generally translates to better financial performance and profitability and, thus, is often taken into account when analyzing activity of the banking sector. The sustainability approach adds social and environmental effects to the economic ones. Even though there have been studies on the different facets of the sustainable banking and its dimensions, it is important to discuss the integration of the sustainability concept with banking efficiency and financial performance measures. The objective of this research is to identify the prevailing indicators of sustainable banking in the presence of considerations on bank financial performance and efficiency. Such indicators can be used in multiple frameworks directed towards specific goals. Therefore, this paper also discusses the notions of the sustainable banking alongside the used methods used to handle the sustainability indicators. Thus, this paper presents the comprehensive review of sustainable banking linked to financial performance and efficiency, where indicators, and methods are analyzed in an integrated manner.

Keywords: banking, sustainability, indicators, analytical framework, sustainable banking, efficiency, financial performance, ESG.

JEL Classification: G21, G39.

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Introduction

The analysis of banking sector performance has taken multiple directions. First of all the profitability of the banking sector (Gemar et al., 2019; Shen et al., 2021) is a major concern, as it is the case for any other sector. A more nuanced picture may be got by viewing through efficiency dimension, i.e. considering the frontier approach (Simar & Wilson, 2007; Yu et al.,

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2019). Another dimension is related to risk, to bank system stability, e.g. studying the resilience (Baselga-Pascual et al., 2018) and non-performing loans (Khan et al., 2020). The information technologies and tools have been developed to track the performance of the banking (Tunowski, 2020; Karkowska, 2020). These concepts are related to the explanatory variables to reveal the mechanism through which the bank system may be improved.

Recently, the sustainability approach has been widely integrated in assessment used in a variety of scientific fields, including the banking sector. The banking sector plays a unique role as an intermediary in sustainable development, as it can influence the growth of sustainable business through financing (i.e., lending and investing), see, e.g., Nițescu and Cristea (2020). Accordingly, there have been reviews on the criteria of banking sustainability (da Silva Inacio & Delai, 2021) and sustainable banking in general (Nájera-Sanzhez, 2020). Still, further research is needed to discuss the methodological issues pertinent to the sustainable banking and its measures.

As their principal objective, sustainable banks seek to perform in the sense of the requirements poised by the both the shareholders and the goals of sustainable development; as for conventional banks, they rely on the principles of the corporate social responsibility (CSR) (Costa-Climent & Martínez-Climent, 2018; Shen et al., 2016). Wu et al. (2017) confirmed that bank efficiency and performance indicators show that the more banks focus on sustainability, the better their financial performance. Scholtens and van't Klooster (2019) argue that banks are financial intermediaries and do not have a direct measure of their sustainability, and therefore suggest that banks' policies and activities be assessed in terms of their environmental, social and governance characteristics.

This paper seeks to identify and discuss the indicators of sustainable banking that are used in conjunction with measures of financial performance and efficiency. This allows to go beyond the purely economic or ESG approaches (or their application in an isolated manner) that often dominate the academic discourse and regulatory frameworks. The choice of the indicators depends on the theoretical premises. The paper is divided into the five sections. In Section 1, we introduce the rationale behind the sustainable development and how we approach the research. In Section 2, we discuss the different approaches to sustainable banking. In Section 3, The systematic literature review is used to extract the indicators of bank sustainability. Also, the indicators are grouped according to the areas they describe as sustainable banking may be perceived as an antecedent to or outcome of different external processes. In Section 4, the most used methods for determining the sustainability of banks are presented. In this case, the methods that are capable of simultaneously considering sustainability and financial performance or efficiency of banks are discussed. The last section covers the authors' conclusions, limitations, and future research possibilities.

1. Rationale of sustainable development and research approach

The concept of sustainable development is one of the most challenging concepts in scientific literature because of its amplitude (Zimm et al., 2018). As it was put in the Brundtland Commission report: "[sustainable] development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). According to

this concept, sustainable development refers to an overarching concept that should prevail in the long run and imply stability of the economic and environmental systems. The areas of possible impact to and by sustainability factors are very different. Additionally, the sustainability notion has become popular among researchers with an increasing variety of research techniques.

The banking sector has a unique position in terms of sustainability. As Jeucken and Bouma (2017) stated, the central role within an economic system is occupied by the banking sector, and, thus, the implementation of sustainable development goals highly relies on the bank activities. Nițescu and Cristea (2020) further explained that banks may affect the (sustainable) development of an economy through selection of the projects that are financed by the funds accumulated from the population. This concerns the countries' pursuit of the overarching goal of sustainable development, the improvement of population quality of life through the progressive reduction of poverty, and inclusion of the sustainability approach in strategic provisions for rational use of natural resources. In general, the concept of the sustainable financial sector, including banking, is more related to long range planning. Moreover, sustainable financing is defined as a solution acknowledging the environmental, social and governance (ESG) impact of financial services (Gerster, 2012).

The concept of sustainability in the financial sector is the subject of controversy. Buallay (2018), Korzeb and Samaniego-Medina (2019), Birindelli et al. (2020), Nițescu and Cristea (2020), Paltrinieri et al. (2020), Saidane and Abdallah (2020) state that the facets of the ESG comprise the three main factors that financial institutions need to consider. The overall concept is to "integrate sustainability issues into the financial sector to make it part of the solution: a stable financial system that serves the sustainable footprint of humanity" (Gerster, 2012). The question of how to achieve this imperative is still open. However, as one can note the literature on the related issues has been offered indicating that the implementation phase has commenced. In this light, it is important, for researchers and practitioners, to summarize methodological aspects in developing and evaluating a sustainable banking. It is expected that the involvement of the ESG criteria in the banking decision-making process makes them more advanced in society. However, the inclusion of the financial and economic objectives of the banking activities needs to be facilitated in order to fully represent the goals of sustainability. Despite the increase of number of papers on sustainability in banking sector, Galleta et al. (2022) indicates an emerged gap in papers on the relationship between the effectiveness of environmental policies and corporate performance. This paper embarks on the systematic literature review in order to identify the major trends in this regard.

The relevant papers were identified by considering the entries in the Google Scholar for the recent years (2016–2021). The keywords considered included "bank" AND "sustainability" AND ("efficiency" OR "financial performance"). The term "sustainability" can cover ethical banking, corporate socially responsible banking, green banking and the related notions. Also, studies use term "sustainability" to define stable performance results in banking sector, i.e. to the ability of a bank to continue operating in a sustainable way over time. The papers that focus on sustainability in performance of banking sector from the latter perspective have been omitted. Also, the papers dealing with macro-economic analysis where banking sector is only cursory mentioned were also ignored. The retained papers for further analysis are presented in Table 1. Qualitative analysis was carried out by exploiting the MAXQDA package.

Table 1. The coverage, research goals, used methods and indicators of analyzed articles (source: compiled by authors, 2022)

Reference	Obs.	Banks	Period	Countries	Indicators	Method	Goal
Buallay (2018)	2350	235	2007–2016	Europe	8	A linear regression model	Linking ESG to bank performance
Valls Martínez et al. (2020)	92	24	2015–2018	Europe	22	Statistical tests, analysis of variance	Comparing performance of ethical and conventional banking
Gutiérrez-López and Abad-González (2020)	256	45	2014, 2016, 2018	Europe	21	Panel regression	Finding determinants of banks' solvency
Tan and Tsionas (2022)	792	72	2007–2017	China	19	Stochastic frontier analysis, panel models for time series (VAR)	Analyzing sustainability efficiency in terms of internal and external sustainability
Buallay et al. (2020a)	7050	882	2008–2018	World (80 countries)	10	Panel regression with instrumental variables	Relating sustainability reporting and bank performance
Nițescu and Cristea (2020)	108	12	2007–2016	Romania	8	Panel regression	Quantifying the impact of ESG on bank risk management
Buallay et al. (2020b)	372	59	2008–2017	Middle East and North Africa (MENA)	9	Panel regression with instrumental variables	Relating ESG and bank performance
Korzeb and Samaniego-Medina (2019)	420	14	2015–2017	Poland	10	Multi-criteria decision making	Analyzing the implementation of the sustainable development principles in the banking sector
Manta et al. (2020)	61	61	2015–2017	Europe	13	Panel regression	Relating social disclosure and financial performance
Ioan et al. (2020)	130	–	2005–2017	India, Brazil, Romania	7	Panel and cross-section (pooled) regression	Analyzing the influence of non-performing loans, CO_2 emissions, bank credit, and inflation on the sustainable economic growth
Forcadell et al. (2019)	938	168	2003–2016	USA, Europe	10	Panel regression with instrumental variables	Relating service innovation and bank sustainability

End of Table 1

Reference	Obs.	Banks	Period	Countries	Indicators	Method	Goal
San-Jose et al. (2018)	38528	2752	2008–2014	Europe	11	Data Envelopment Analysis	Assessing sustainability of banking
Aras et al. (2018)	–	7	2013–2015	Turkey	11	Content analysis; Multi-criteria decision making	Evaluating bank sustainability
Platonova et al. (2018)	222	24	2000–2014	Gulf Cooperation Council (GCC) region	8	Panel regression	Relating CSR and financial performance of Islamic banks
Scholtens and van't Klooster (2019)	532	43	2002–2016	Europe	13	Panel regression	Relating sustainability to default risk and systemic risk
Shen et al. (2016)	49000	6125	2000–2007	World (18 countries)	25	Propensity score matching	Relating CSR can profitability and non-performing loans
Bhaskaran et al. (2021)	2130	427	2015–2019	World	29	Panel regression	Relating social and governance measures to ESG performance
Bătae et al. (2021)	346	39	2010–2019	Europe	26	Panel regression	Relating ESG and bank financial performance
Weber (2016)	230	46	2009–2013	China	8	Panel regression, Granger test	Relating policy to sustainability and financial performance of banks
Shah et al. (2019)	–	45	2010–2018	World (14 countries)	6	Data Envelopment Analysis	Measuring efficiencies of sustainable and non-sustainable banks

As da Silva Inacio and Delai (2021) noted, the rise of awareness of sustainable banking can be seen from 2007. Note that the financial crisis in 2008 has brought several challenging years for the global banking sector. And as result, the banks faced a decade of low interest yield environment. The studies reported in the selected articles cover different countries and, in certain cases, embark on international comparisons.

2. Framework of the discussion on sustainable banking

After defining environmental, social, and governance (ESG) areas that are important for the banking sector, another step is identifying indicators that can be used in methodological framework. The approach combines both qualitative and quantitative criteria (Rebai et al., 2016).

To understand how sustainability is assessed in the banking sector we distinguish the subjects of study and classify the analyzed articles by the relationship between these subjects. By taking (1) sustainability (ESG), (2) bank or banking sector, and (3) external environment (i.e., country's economy, financial sector) as the three distinguished subjects, then the analyzed articles are classified:

- *Sustainability at the bank-level and what factors that influence it.* Studies focused on this topic were done by Buallay (2018), Tan and Tsionas (2022), Buallay et al. (2020a), Nițescu and Cristea (2020), Bhaskaran et al. (2021), Weber (2016), and Forcadell et al. (2019).
- *Relationship between sustainability and bank performance.* The most popular research topic is to analyze sustainability issues within the bank itself. Studies focused on this topic are: Buallay (2018), Valls Martínez et al. (2020), Gutiérrez-López and Abad-González (2020), Tan and Tsionas (2022), Buallay et al. (2020a), Nițescu and Cristea (2020), Buallay et al. (2020b), Manta et al. (2020), San-Jose et al. (2018), Aras et al. (2018), Platonova et al. (2018), Bătae et al. (2021), Shah et al. (2019), and Scholtens and van't Klooster (2019).
- *Influence of banking on the sustainability of the economy.* Banking sector, because of its intermediary role between depositors and borrowers, can influence the development of sustainable economy (Korzeb & Samaniego-Medina, 2019; Ioan et al., 2020; Scholtens & van't Klooster, 2019).
- *How banks engaging in sustainability can affect the external environment (economy or financial system).* Studies focused on this topic were done by Korzeb and Samaniego-Medina (2019), Scholtens and van't Klooster (2019), and Shen et al. (2016).

Depending on area of study authors have used indicators that can be classified in these groups: macroeconomic, bank-specific, industry related, and environment, social, governance (ESG) indicators. In the studies analyzed, there were about 280 indicators used. These indicators are reviewed in the next section.

3. Indicators used in the sustainable banking analysis

This section presents the layout of indicators used for assessment of the sustainable banking and performance. About 280 different indicators were used in the articles analyzed. Indica-

tors related to the financial performance and the risk of banks are well-established and often used in the literature. Macroeconomic and industry-related indicators are used as control variables because countries stand at different economic and financial market development levels. Meanwhile, indicators related to sustainability, which are the focus of this article, do not yet have an established practice. Some composite measures of sustainability are used by multiple authors. Most of the sustainability indicators are unique and used in a sole paper. The sustainability-related indicators appear as both dependent and independent variables in the analysis. The indicators used in the earlier literature are grouped based on the objects of analysis (bank-level, industry-level, economy-level, sustainability dimension).

3.1. Data sources used

Empirical research is highly dependent on the data used. Thus, it is important to discuss the data sources and their relationships with the concepts and measures of sustainability. As regards the studies mentioned in the Table 1, they use 14 different indicators on average and rely on 61 to 49000 bank-year observations.

The aforementioned studies highlight several problems with data. The first one is the lack of data on all selected variables. This problem persists even with international data providers. The lack of data on all selected variables reduces the sample size in terms of banks or countries (Buallay et al., 2020a; Gutiérrez-López & Abad-González, 2020; Manta et al., 2020). Therefore, authors either reduce the sample size or exclude the potential indicators from the research. The missing data leads to data sets where observations are not proportional to the total number of banks in each country (Manta et al., 2020). Bătae et al. (2021) notes that the data related to sustainability is still relatively new, and methodology is not always clear and transparent. The indicators do not have long series.

Financial banks' data are collected from BankScope (Bureau van Dijk; data till the end of 2016; Manta et al., 2020; San-Jose et al., 2018; Platonova et al., 2018; Shen et al., 2016), Bloomberg (Buallay et al., 2020a; Manta et al., 2020), Orbis Bank Focus database (Gutiérrez-López & Abad-González, 2020), FitchConnect database (Tan & Tsionas, 2022). The missing data can also be collected from banks' annual financial statements (Tan & Tsionas, 2022; Platonova et al., 2018; Bătae et al., 2021).

Macroeconomic data for different countries across the globe are taken from World Economic Outlook Database that is updated twice a year by the International Monetary Fund (Laeven & Valencia, 2008), World Bank database (Tan & Tsionas, 2022; Manta et al., 2020; Bătae et al., 2021), annual data on corruption situation can be get from the Transparency International (Tan & Tsionas, 2022). The banking regulatory authorities publish the business environment indicators (Tan & Tsionas, 2022).

The banks' environmental, social, and governance indicators belong to non-financial disclosure. Though some data have been published for more than ten years, some of these data can be missing for the specific bank or year (Manta et al., 2020). Also, definitions of the indicators can vary from bank to bank. In this case, the researchers should be cautious in the latter case as this may undermine the validity of the research. As noted by Buallay et al. (2020b) the indicators used for social performance are subjective and covers mandatory and voluntary activities.

The banks' ESG disclosure scores, various sustainability indicators are provided by Thomson Reuters DataStream Asset4 database (Scholtens & van't Klooster, 2019; Shen et al., 2016), the ESG database of Refinitiv Eikon (hosted by Thomson Reuters; Bhaskaran et al., 2021; Bătae et al., 2021), Bloomberg LP (Manta et al., 2020). The problem of incomplete sustainability data may be circumvented by merging the data from different databases.

Therefore, multiple datasets are available for the measurement of the sustainable banking. These databases are often subscription-based ones. However, these databases mostly cover the listed banks. The research of the sustainable banking in countries, which does not have the listed in the stock exchange banks, often requires collection of the primary data.

3.2. Macroeconomic indicators

Authors used macroeconomic indicators analyzing what external factors influenced the sustainability in the banking sector, how banks influence sustainability of the economy, how banks engaging in sustainability can affect the external environment. As authors cover different countries in their research, macroeconomic indicators are used to control the relationship between indicators.

We classify macroeconomic indicators according to the area that these indicators describe. Thus, five groups of indicators are defined: (1) Gross domestic product (GDP), (2) Inflation, (3) Unemployment, (4) Business environment, and (5) Dummy (see Table 2).

GDP related indicators are the most used to define the level of specific country development. A control variable is needed as the growth of economy influences the overall banking sector. Every author used the growth of gross domestic product (GDP growth rate) or GDP itself in their research. The other indicators used are the growth of GDP per capita and GDP per capita.

Inflation rate, expressed as annual average rate change in Consumer price index (CPI), was the other popular indicator in scientific papers. Buallay et al. (2020a) reasons the use of inflation as it shows macroeconomic uncertainty. The banks can choose to reduce the more risky activities when face the uncertainty in economy.

Business environment. Corruption, country governance indicators are used to describe environment in which banks operate. The quality of country governance has positive impact on the bank performance. World bank defines that "Governance consists of the traditions and institutions by which authority in a country is exercised" and publish six indicators that describes the quality of country governance from different aspects: (1) voice and accountability, (2) political stability and absence of violence, (3) government effectiveness, (4) regulatory quality, (5) rule of law and (6) control of corruption. The average of those indicators is used as a composite indicator of the country governance. Transparency International provides data for countries corruption level. Interestingly, the higher tolerance for corruption in China brings positive effect for social efficiency, i.e., increase the credit for small and medium companies. Tan and Tsionas (2022) argue that small and medium companies tend to give more bribes to bank managers in order to have credit for the riskier projects. Without generalization of such statement, one may find it as an argument for expecting for a higher risk in economies with higher share of the small and medium enterprises compared to those

where such share is lower. This also applies for the financial institutions. Also, specific indicators such as Internet and Mobile penetration was used to explore how service innovation performance enhanced the banking corporate sustainability (Forcadell et al., 2019).

Several *dummy variables* related to macroeconomic environment were included in models. Country's economy dummy separated developing countries (Buallay et al., 2020a; Bhaskaran et al., 2021). Single supervisory mechanism dummies were used by Ioan et al. (2020) to investigate their influence on sustainable economic growth.

The case of the level of tolerance on corruption and social efficiency shows that both quantitative methods (proof of existence of relationship) and qualitative analysis (knowledge of experts on practices in banking sector) give understanding what cause effect on the relationships between indicators.

It is worth mentioned that in the articles that were rejected from the scope of this analysis authors researching the efficiency of banking sector frequently choose unemployment rate and government finance related indicators (i.e. Budget balance, Public spending, Public debt to GDP).

Table 2. The usage of macroeconomic indicators in analyzed articles (source: compiled by authors, 2022)

Group of Indicators	Indicators	Literature
GDP related indicators	GDP	Buallay (2018), Ioan et al. (2020), Forcadell et al. (2019), Shen et al. (2016)
	GDP growth rate	Tan and Tsionas (2022), Buallay et al. (2020a), Niţescu and Cristea (2020), Buallay et al. (2020b), Forcadell et al. (2019), Scholtens and van't Klooster (2019), Bătae et al. (2021)
	GDP per capita growth rate	Shen et al. (2016)
	GDP per capita	Bătae et al. (2021)
	Public debt to GDP	Scholtens and van't Klooster (2019)
Inflation	Change in Consumer price index (CPI)	Tan and Tsionas (2022), Buallay et al. (2020a), Niţescu and Cristea (2020), Ioan et al. (2020), Scholtens and van't Klooster (2019)
Business environment	Corruption	Tan and Tsionas (2022)
	Country governance	Buallay (2018), Buallay et al. (2020b)
	Internet penetration	Forcadell et al. (2019)
	Mobile penetration	Forcadell et al. (2019)
Unemployment		Niţescu and Cristea (2020)
Dummy	Developed country dummy	Buallay et al. (2020a), Bhaskaran et al. (2021)
	Trigger event dummy	Ioan et al. (2020)
	Single supervisory mechanism dummy	Ioan et al. (2020)

3.3. Industry related indicators

The characteristics of an industry is another environmental dimension. We classify these indicators into three groups: (1) banking sector development, (2) competition, (3) capital market development (see Table 3). The size of the banking industry, competition level are the areas that give insight about the development of the banking sector. From the size perspective, the credit and capital markets are both important for the banking sector as banks operate in both markets. Banks distribute the funding to sustainable projects by giving loans or investing into financial instruments. Absolute value (i.e. Capital market capitalization) or the relative value (i.e. Capital market capitalization to GDP, Banking sector assets to GDP) indicators are used to describe the size, development level of industry. Herfindahl–Hirschman index and the Share of Top-5 banks' assets were used to describe competition and concentration in banking sector.

Table 3. The usage of industry related indicators in analyzed articles (source: compiled by authors, 2022)

Group of Indicators	Indicators	Literature
Banking sector development	Ratio of banking sector assets to GDP	Tan and Tsionas (2022)
Competition	Herfindahl–Hirschman index	Shen et al. (2016)
	Share of Top5 banks' assets	Tan and Tsionas (2022)
Capital market development	Ratio of market capitalization to GDP	Tan and Tsionas (2022)
	Capital market capitalization	Scholtens and van't Klooster (2019)

3.4. Bank-specific indicators

Bank-specific indicators were used to evaluate the changes in financial, operative performance, and risk profile of bank. We classify bank-specific indicators either by the type of financial statements or by the area they describe. Eleven groups of indicators are defined: (1) Bank risk, (2) Capital adequacy, (3) Liquidity, (4) Efficiency, (5) Leverage, (6) Market value, (7) Profitability, (8) Balance sheet, (9) Profit (loss) statement, (10) Other, and (11) Dummies (see Supplementary Material). We do not separately discuss the indicators of the operation scale (e.g., total assets, number of employees).

The measures that belong to bank risk indicators, capital adequacy indicators, liquidity indicators are constructed to describe the risk of a specific bank. They describe the quality of bank assets, bank's ability to cover liquidity needs, and meeting regulatory requirements on liquid assets. Efficiency indicators mainly describe how banks manage their costs (Bătae et al., 2021). Leverage indicators useful when analyzing the source of bank's funds for core business. The listed banks have the set of market value indicators. They indicate how investors and capital market perceives the results and future perspective of the listed bank. Profitability indicators show the performance results of the banks, i.e., their capability to use banks' funds efficiently. The absolute indicators from financial statements (balance sheet, profit (loss) statement) are useful for evaluating the banks' size impact or are required by the research methods. The bank-specific indicators also can be dummy indicators, i.e., dividing banks by their internal characteristics to meet the needs and specifics of research.

Bank-specific indicators, especially from the financial statement, are natural logarithm transformed before using them as variables in research models. Scholtens and van't Klooster (2019), Baselga-Pascual et al. (2018), Tan and Tsionas (2022), Buallay et al. (2020a, 2020b), Bătae et al. (2021), Weber (2016) use the natural logarithm of the financial data to normalize the distribution; natural logarithm transformation control for heteroscedasticity, outliers, omitted variables, and smoothens the data.

Return on Assets (ROA) and Return on Equity (ROE) are omnipresent in the papers dealing with bank performance. Both ROA and ROE are profitability indicators; the main one for the banking sector is ROA as loans to clients (core business for traditional bank) are in the asset category in financial statements. ROA indicates how efficient bank use its resources, bank ability to generate income from gathered funds. ROE is important indicator from shareholders perspective, aimed to measure bank's performance based on the investment into the capital (equity). Both ROA and ROE represent current financial performance (Buallay, 2018). Total assets, usually in natural logarithm transformed, identifies the size of the bank. Baselga-Pascual et al. (2018), Athanasoglou et al. (2008) state the relationship between profitability and the size of bank is not linear: increases in initial stage, but due to increased complexity of procedures, bureaucracy, decreases. It is worth to mention that banks must manage the risk (credit, liquidity, operational, market, ESG) to be profitable and the ability to manage the risk comes with managerial capacity, bank's efficiency that also can be represented by the size of bank (Mercieca et al., 2007).

Credit risk related indicators: the value of Non-performing loans (NPL), Non-performing loans to Gross loans (NPL ratio) represent the quality of bank assets and it ability to manage the credit risk. It is worth to mention that Baselga-Pascual et al. (2018) considers the Z-score as a better banks' risk measure than NPL ratio. Non-performing loans represent the risk that is already happen, i.e. backward looking. The Z-score is defined as the number of standard deviations that a bank's ROA must fall below the mean for the bank to become insolvent. A lower Z-score indicates that the bank is taking more risk and is less stable. Z-score is forward looking indicators and captures more than credit risk alone (Baselga-Pascual et al., 2018; Scholtens & van't Klooster, 2019). The other risk indicators are defined by regulatory requirements: Capital adequacy ratio (CAR), Tier 1 capital (represents the most liquid capital). CAR is popular indicator to show the ability of banks to withstand unforeseen losses, banks' capability to absorb the financial losses. Tier 1 capital is the proxy for the level of solvency (Valls Martínez et al., 2020; Gutiérrez-López & Abad-González, 2020; Forcadell et al., 2019; Scholtens & van't Klooster, 2019). These two indicators are useful to measure the overall risk perception of bank without going deeper into its components. Liquid assets to Assets indicator can be treated as alternative for Capital adequacy ratio or Tier 1 capital and is calculated from bank's balance sheet.

Cost to Income (C/I) ratios measures the bank efficiency in controlling the costs (Bhaskaran et al., 2021). To calculate C/I the different types of costs and the different types of income are used. Typically, C/I is the operating costs divided by operating income (i.e., net income from interest, commissions, trading activities, etc.; Manta et al., 2020).

From group of Leverage indicators Equity to Assets, Loans to Deposits are frequently used. Both indicate the bank ability to attract the deposits from customers to fund bank's core activities.

From the group of market indicators, it is worth to mention Tobin's Q (Buallay, 2018; Buallay et al., 2020a, 2020b; Manta et al., 2020) that is used to represent the capital market perception for bank. Tobin's Q is the ratio of market value of share capital divided by banks' total assets. This indicator can be calculated only for listed banks.

Authors also used dummy indicators that were specific and suitable for their research: whether the bank is ethical (Valls Martínez et al., 2020); whether headquarters are in a euro-area country (Gutiérrez-López & Abad-González, 2020).

The data collected through the literature review suggest that some of the earlier studies focused on banks that were both listed and non-listed ones. Thus, the dummies for being listed could be used in further studies. This would help to assess the impact of informal public opinion and formal scrutiny that come with the listing.

3.5. Environment, social, governance (ESG) indicators

Sustainability factors are divided into environmental, social and governance indicators by the European Union regulation (Sustainable Finance Disclosure Regulation[1]; SFDR). *Environmental indicators* cover the bank's environmental impact, such as pollution, use of natural resources, and contribution to global warming. *Social indicators* cover bank's relationship with its stakeholders and community, working conditions for the employees and overall social responsibility of the bank. *Governance indicators* assess how bank is managed, whether stockholders' interests are considered and how conflicts of interest are managed.

We classified sustainability related indicators that are used in the analyzed articles into five groups: (1) composite indicators, (2) Economic impact, (3) Environmental, (4) Social, (5) Governance, (6) Dummy (see Table 4).

The disclosure of sustainability related indicators was not standardized and varied across countries for the period researched in the articles in Table 1, therefore only usage of sustainability indexes is common among the authors. The indexes were created either by authors themselves or by index providers (e.g. Dow Jones Sustainability Index, Bloomberg index). The sustainability reporting evaluation methods are various, e.g., Buallay (2018) lists the eight sustainability reporting methods in their article. Indexes covered all or one area of the sustainability factors. Basically, indexes showed whether and, if yes, at what extent banks disclosed ESG factors.

The authors used dummy indicators for defining legal systems (Shen et al., 2016), for disclosure of specific report (Gutiérrez-López & Abad-González, 2020); whether bank is engaging is sustainable activities (Shen et al., 2016; Nițescu & Cristea, 2020), and whether bank have specific policy (Manta et al., 2020).

Why the group of Economic impact is among the groups of sustainability indicators? Aras et al. (2018) consider that the banking industry, because of its intermediary role between depositors and borrowers, can make contribution to the sustainable development goals of economy. For example, investing in the development of infrastructure impacts the economy. Additional indicators that evaluate the effect of banking sector to sustainable economy comprise the Balance of green credits (Tan & Tsionas, 2022) and Environmental financing (Korzeb & Samaniego-Medina, 2019).

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R2088

Table 4. The usage of ESG indicators in studied articles (source: compiled by authors, 2022)

Group of Indicators	Indicators	Literature
Indexes	Sustainability index	Buallay (2018), Buallay et al. (2020a, 2020b), Forcadell et al. (2019), Aras et al. (2018), Platonova et al. (2018), Scholtens and van't Klooster (2019), Shen et al. (2016), Bhaskaran et al. (2021), Bătae et al. (2021), Weber (2016)
	Environmental index	Buallay (2018), Buallay et al. (2020a), Bătae et al. (2021), Weber (2016)
	Social index	Buallay (2018), Buallay et al. (2020a), Bhaskaran et al. (2021), Bătae et al. (2021), Weber (2016)
	Governance index	Buallay (2018), Buallay et al. (2020a), Bhaskaran et al. (2021), Bătae et al. (2021)
Economical impact	Economic sustainability disclosures	Aras et al. (2018)
	Financial sustainability disclosures	Aras et al. (2018)
Environmental	Balance of green credits	Tan and Tsionas (2022)
	CO2 emissions	Ioan et al. (2020)
	Energy saving policies	Korzeb and Samaniego-Medina (2019)
	Environmental financing	Korzeb and Samaniego-Medina (2019)
	Resource use efficiency	Bătae et al. (2021)
	Emission and waste reductions	Bătae et al. (2021)
	Environmental innovation	Bătae et al. (2021)
	Energy consumption and Savings disclosures	Aras et al. (2018)
	Natural environment disclosures	Aras et al. (2018)
Social	Development incentives	Korzeb and Samaniego-Medina (2019)
	Donation to Assets	Korzeb and Samaniego-Medina (2019)
	Donation to Net profit	Korzeb and Samaniego-Medina (2019)
	Donations	Tan and Tsionas (2022)
	Financial assistance	Korzeb and Samaniego-Medina (2019)
	Loans to small and medium sized enterprises	Tan and Tsionas (2022)
	Sponsorships	Korzeb and Samaniego-Medina (2019)
	Workforce	Bătae et al. (2021)
	Human rights	Bătae et al. (2021)
	Community	Bătae et al. (2021)
	Shareholder rights	Bătae et al. (2021)
	CSR strategy	Bătae et al. (2021)

End of Table 4

Group of Indicators	Indicators	Literature
	Contribution to community disclosures	Aras et al. (2018)
	Human resource development disclosures	Aras et al. (2018)
	Human rights disclosures	Aras et al. (2018)
	Product responsibility disclosures	Aras et al. (2018)
	Responsibility for banking products and services	Korzeb and Samaniego-Medina (2019), Bătae et al. (2021)
Governance	Corruption	San-Jose et al. (2018)
	Creditor rights. Range from 0 to 4. Higher score means more protection.	Shen et al. (2016)
	Percentage of female executives	Manta et al. (2020)
	Rule of Law × Efficiency of Judicial System. Range from 0 to 100. Higher score means more protection.	Shen et al. (2016)
	Shareholder rights. Range from 0 to 4. Higher score means more protection	Shen et al. (2016)
	Well-being index	San-Jose et al. (2018)
	Independent directors in board	Bhaskaran et al. (2021)
	Strategic Institutional Ownership	Bhaskaran et al. (2021)
	Management and oversight	Bătae et al. (2021)
	Governance sustainability disclosures	Aras et al. (2018)
Dummy indicators	A bank engage in corporate social activity dummy	Shen et al. (2016), Nițescu and Cristea (2020)
	The country's law origin is English Law dummy	Shen et al. (2016)
	The country's law origin is French Law dummy	Shen et al. (2016)
	The country's law origin is Germany Law dummy	Shen et al. (2016)
	Equal opportunity policy dummy	Manta et al. (2020)
	The disclosure of a specific CSR report dummy	Gutiérrez-López and Abad-González (2020)

As seen in Table 4, the chosen for research sustainability indicators are very different. We see that the content analysis method that Aras et al. (2018) used helps to created unique for research disclosure indicators. They analyzed the content of sustainability reports and created their own sustainability indicators based on usage of key words.

4. Methods for assessing the sustainability of the banking sector

The methods of varying complexity are used to determine the sustainability of banks, from the simplest methods of statistical tests (Valls Martínez et al., 2020) to complex mathematical programming and stochastic models (Manta et al., 2020). These methods require imputation of different indicators reflecting multiple dimensions of bank sustainability (Buallay et al., 2020a, 2020b). The nature of the methods used also determines the candidate indicators for the analysis. For instance, the production theory requires the use of the absolute indicators, whereas the other approaches allow for a mixture of the absolute and relative ones. Note that the sustainability-related indicators can be either the object of interest or explanatory ones.

The quantitative methods can be used in a stand-alone approach or integrated among themselves. Also, some methods may include more than one stage (Forcadell et al., 2019; Shen et al., 2016). These stages can be used for improving the accuracy of estimation (e.g., instrumental variables) or analyzing the effects of additional variables (e.g., two-stage efficiency analysis). Table 5 summarizes the major groups of the quantitative approaches used for analysis of the sustainable banking.

Table 5. Methods for assessing the sustainability of the banking sector used in the analyzed articles (source: compiled by authors, 2022)

No	Method	Description	References
1.	Regression analysis	Regression models assess the impact of various (sustainability) indicators on financial performance (ratios), probabilities of default or presence of an ESG program. The panel models are often used with the instrumental variable approach to account for endogeneity.	Buallay (2018), Gutiérrez-López and Abad-González (2020), Buallay et al. (2020a, 2020b), Nițescu and Cristea (2020), Manta et al. (2020), Ioan et al. (2020), Forcadell et al. (2019), Platonova et al. (2018), Scholtens and van't Klooster (2019), Bhaskaran et al. (2021), Bătae et al. (2021), Weber (2016)
2.	Propensity Scores Matching	The banks engaged in the CSR activities are compared to those not engaged by matching them according to major performance indicators.	Shen et al. (2016)
3.	Statistical analysis	Statistical tests are used to compare the two groups of banks, namely those that are considered as ethical ones and those that are treated as conventional ones.	Valls Martínez et al. (2020)

End of Table 5

No	Method	Description	References
4.	Stochastic Frontier Analysis	Production technology is estimated via regression analysis. The efficiency scores are measured based on the production technology that is adjusted by inclusion of the sustainability-related variables.	Tan and Tsionas (2022), Forcadell et al. (2019)
5.	Data Envelopment Analysis	The production frontier is established as a piece-wise linear envelope in a non-parametric framework. The sustainability-related variables can be included in the production technology.	San-Jose et al. (2018), Shah et al. (2019)
6.	Multi-criteria decision making	The MCDM methods are used to rank the banks based on utility scores that are determined by aggregating multiple bank performance indicators. The sustainability-related indicators can be included in the indicator set.	Korzeb and Samaniego-Medina (2019), Aras et al. (2018)
7.	Content analysis	Analysis of the occurrence of words related to bank sustainability.	Aras et al. (2018)

Besides, the qualitative approach is also relevant for sustainability analysis. For instance, Aras et al. (2018) used the occurrence of the keywords related to bank sustainability as a measure of bank sustainability. Thus, the qualitative analysis can provide insights on banks' commitment towards sustainability. However, this mostly reflects the intentions rather than actual actions.

Note that the groups presented in Table 5 may overlap in terms of their nature. For instance, regression analysis is also the basis for Stochastic Frontier Analysis or Propensity Score Matching, yet we delineate the methods that are particularly prevalent. Also, MCDM and DEA can be considered similar in that they both aggregate the variables yet use different principles of weighting (DEA uses endogenous weighting whereas the MCDM requires imputation of the predefined weights).

The multi-level approach can be used to isolate the effects related to different operation environments. Gutierrez-Lopez and Abad-Gonzalez (2020) used the ANOVA model to measure the impact of the time period, scenario, and bank on the capital ratio. The disclosure of the CSR reports was included as an explanatory variable.

As already mentioned above, the DEA and MCDM are interconnected in terms of their objectives and methodology. Basically, they both measure the relative performance of the banks and sustainability indicators may be involved in such measurements. However, MCDM is more suitable for instances where the number of indicators is relatively high compared to the number of banks analyzed. The DEA, however, may involve economic axioms besides purely mathematical aggregation that is pertinent to the MCDM. Korzeb and Samaniego-Medina (2019) applied the TOPSIS approach for a sample of the 14 Polish banks and used 10 criteria for comparison. Aras et al. (2018) considered 7 banks and 86 criteria. As for the

DEA-based studies, 248 banks are compared based on 6 indicators by Shah et al. (2019). In the latter study, the Malmquist index is applied to measure the productivity growth of sustainable and conventional banks. The sustainable banks are taken from the Dow Jones Sustainability Indices.

The parametric representation of the production technology is facilitated in the SFA. Also, this allows incorporating the sustainability-related variables either as inputs/outputs or explanatory variables that shift the production frontier or the distribution of the inefficiency. Forcadell et al. (2019) used the SFA to construct to measure the technological gap, i.e., to compare the performance of banks in a certain country with respect to the meta-technology. Tan and Tsionas (2022) developed a stochastic frontier approach for estimating the output distance function. Multiple specifications of the production technology are defined by treating different variables as the inputs and outputs (social, economic, environmental, and stability efficiencies are defined). These efficiencies are aggregated into internal and external sustainability.

Therefore, the use of the quantitative and qualitative methods relies on the objectives of the research and data available. The different methods feature inherent properties that may provide information on the sustainable banking in various ways. The parametric and non-parametric approaches allow incorporating the sustainability-related indicators as inputs to or outputs of the model. The methods related to production theory (e.g., DEA and SFA) consider inputs and output in the production technology sense and the sustainability-related indicators can appear in these sets or as grouping variables for the observations.

Conclusions

Banks contribute to the well-being of society through their decisions on (un)sustainable lending, investment decisions and its own operational practices. Thus, it is important to define the sustainability measures and their relations to the bank activities and external environment. Proper choice of such measures may serve as a tool for evidence-based analysis of the development of sustainable banking. Inevitably, the sustainable banking relates to the economy either by impacting it or being simulated by developments in the economy.

The earlier literature mostly looked into (i) which factors impacted the development of sustainable banking and (ii) whether the integration of the sustainability in the banks' policies and processes had an impact on banks' efficiency and performance. Considering the bank sustainability-performance nexus, there is still a shortage of research on how the sustainable banking contributes to the development of the sustainable economy.

Although the several decades passed since introduction of the sustainability concept, the sustainability indicators do not have an established practice and long-term data sets. The data related to sustainability is still relatively new, and methodology is not always clear and transparent. Therefore, the research of the sustainable banking in countries where only a handful of banks are listed ones often requires collection of the primary data.

The carried-out survey suggests that the conventional indicator-based frameworks may be supplemented with qualitative analysis. Choosing indicators for sustainable banking and performance analysis depends on the goal of the research as suggested by a relatively high

number of indicators used in the relevant studies. The basic indicators (ROA, ROE, Total Assets, Cost to Income) are omnipresent in the studies covered and can be included in the different models. The content analysis method can help to create the unique for research sustainability related disclosure indicators when quantitative data are missing otherwise.

The use of the quantitative and qualitative methods also depends on the objectives of the research and data available. The different methods feature inherent properties that may provide information on the sustainable banking in various ways. However, the carried-out analysis suggests that certain points (e.g., listing of a bank) are not sufficiently exploited in the analysis. The use of the modern computing techniques and increasing availability of the big data sources may further increase the scale and scope of the analysis of sustainable banking and performance.

As regards the methods used in the earlier literature on the bank sustainability-performance nexus, the use of the non-linear approaches appears to be rather limited. The use of such techniques as quantile-on-quantile regression, random coefficient models, general additive models, non-parametric regression, and the like approaches would help to identify the non-linear relationships between bank sustainability and performance.

Limitations and future research possibilities. As we discarded a lot of studies that do not meet our selection criteria, our paper presents limitations because of the small sample size. Nevertheless, we consider that extracted indicators represent the pool of relevant indicators for researchers, who study sustainability in banking sector.

Another factor that is essential for future research possibilities is mentioned lack of the long-term data sets. When the data related to sustainability is available, and it will be available due to regulatory requirements, the different topics of research will arise. One of the examples can be the evaluation what impact the sustainability related risk has on the banking lending and investment portfolios.

Disclosure statement

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