Sustainable and Responsible Management

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Academic Research Papers

The role of banks as a mean of orientation in the sustainable energy sector

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Abstract

The focus of research and analysis was on the role of banks in the sustainable energy sector, and it studied how banks are concretely engaging in sustainable investment through project financing and especially in terms of ESG factors. The aim of the analysis is to assess which investments the banks compared are most focused on, and above all to understand how project financing can help banking groups invest in ESG factors, especially in the energy sector. The goal set by the EIB is net zero by 2050, i.e., to aim for renewable resources to permanently replace non-renewable resources. Banks are moving to promote project financing investments dedicated precisely to renewable and zero-impact sources. The study was conducted on a sample of 8 of the Italy's and Europe's biggest banks financing the largest fossil fuel entities.
The purpose of this paper's contribution is to highlight how, based on analyses conducted at the European level among the largest banking groups, one is still far away achieving good performance in terms of sustainable investment in the energy sector continuing to prefer investment in nonrenewable sources.

Keywords – ESG; Project finance; Banks; Energy sector; Investments; Fossil fuels

Paper type – Academic Research Paper

Sommario

La ricerca e l'analisi si sono concentrate sul ruolo delle banche nel settore dell'energia sostenibile, studiando come le banche si stanno impegnando concretamente negli investimenti sostenibili attraverso il project financing e soprattutto in termini di fattori ESG. L'obiettivo dell'analisi è valutare quali sono gli investimenti su cui le banche a confronto si concentrano maggiormente e soprattutto capire come il project financing possa aiutare i gruppi bancari a investire nei fattori ESG, soprattutto nel settore energetico. L'obiettivo fissato dalla BEI è il net zero entro il 2050, ovvero puntare a sostituire definitivamente le risorse non rinnovabili con quelle rinnovabili. Le banche si stanno muovendo per promuovere investimenti in project financing dedicati proprio alle fonti rinnovabili e a impatto zero. Lo studio è stato condotto su un campione di 8 tra le maggiori banche italiane ed europee che finanziano le più grandi entità di combustibili fossili.
Il contributo di questo lavoro è di evidenziare come, sulla base di analisi condotte a livello europeo tra i

maggiori gruppi bancari, si sia ancora lontani dal raggiungere buone performance in termini di investimenti sostenibili nel settore energetico, continuando a preferire gli investimenti in fonti non rinnovabili.

1   Introduction

Every year (for almost three decades) the UN brings together all the countries of the world in a global conference to discuss climate and climate change. This conference, the so-called Conference of the Parties, has the task of focusing attention on climate problems that affect all states and for which we are all responsible. The last UN climate conference, the twenty-sixth (COP26), was held in the United Kingdom (in Glasgow from 31 October to 12 November 2021).

The objectives of COP26 were several:

- reduce global CO_2 emissions by 2030 and reduce them to zero by 2050;
- limit global temperature increases to no more than 1.5°C;
- work to safeguard communities, natural habitats and ecosystems threatened by climate change;
- provide the necessary funding to ensure that the previous targets are met;
- activate a process of collaboration, dialogue and confrontation between countries.

Despite the awareness of how necessary it is for the entire planet to reduce CO_2 emissions, the Glasgow conference by no means concluded that at least one target on the agenda could be achieved. Reducing and zeroing emissions would first require a move towards stopping the use of coal, but this stop never came. The assembled countries only agreed on a slowdown in this use, and only of some types of coal. This is "unabated coal", whose emissions are not abated by special capture systems.

Regarding global temperature rise, the conference confirmed that the ceiling not to be exceeded is 1.5°C. But considering the decisions taken regarding CO_2 emissions, one wonders whether this limit will be respected.

Africa, Latin America, but also South Asia have suffered most in recent years from hurricanes, torrential rains, and rising temperatures (all phenomena related to climate change). From this conference they expected at least some help or a concrete plan to deal with the crisis and its consequences. In fact, the UN has already planned a support programme: it is the Santiago Network, which aims to create a network capable of uniting developing countries first of all with each other, but also with experts and professionals to help them deal with climate change. A good programme in short, it is just a pity that it has never been activated in practice. As was the support funding.

The planned funding was 100 billion US dollar to be allocated to the least developed countries and to support the energy transition. But in 2020 the figure was not reached, and the deadline was obviously postponed to 2023. Collaboration, dialogue and confrontation appeared at times on the conference table. China and the United States, quite unexpectedly, proved to be willing and supportive of collaborative proposals on climate change. In its plans to safeguard forests and combat deforestation, Brazil, one of the most hostile countries on the subject, agreed to sign a document that sees the investment of 16.5

billion euro to try to stop increasingly aggressive deforestation. The European Union, which is responsible for representing as many as 27 countries, has managed to be consistent with its goals, even if with some discontent. According to the hardest estimates, such as that of the Climate Action Tracker, with the current plans there would be a 2.4°C rise in temperature by 2100. The decisions to be taken do not end with the Glasgow conference. Countries that have not submitted their action plans will have to do so in the coming months, and only then will a programme to reduce CO_2 emissions begin. The results of this work will be presented and evaluated at COP27 in Egypt.

To measure the climate and sustainability profiles of investments, both public data and information provided by specialized companies are used. In selecting its investments, the Bank of Italy considers the ESG (Environmental, Social and Governance) score and carbon intensity of companies to improve the sustainability profile compared to benchmark indices. To assess the impact of ESG criteria on management, other measures are added to these indicators. One of those most widely used by the financial industry is the weighted average carbon intensity of the portfolio: for each company, emissions are divided by turnover and this indicator is aggregated using the weight of each company in the portfolio at market values. A second indicator is the carbon footprint, calculated as the ratio between the emissions attributable to the securities in the portfolio and the market value of the portfolio itself; the indicator represents the grams of CO_2 attributable to each euro invested. Compared to absolute emissions, these indicators have the advantage that they can be used to compare different portfolios in terms of composition and size, and to select the most effective management strategies in the de-carbonization process.

The current geopolitical situation regarding the Russian-Ukrainian conflict is moving the EU towards alternative routes to gas supply and breaking the dependence on Russia. The Trans Adriatic Pipeline (TAP) is a pipeline to which the EU is turning its attention as a source of supply. Their use has reached such high thresholds that the environment is suffering and so is society itself. The TAP invested 3.9 billion euro (provided by the largest international commercial banks and the EIB) partly for the continuation of the construction of the gas pipeline from Azebaijan to Italy through Albania and Greece and partly for the local communities affected by the gas crossing.

Based on the introductory context in which this research is set, the following paragraphs will provide the reader with a clearer and broader view of the work done, through a topic review regarding the role of banks and sustainable investments in ESG terms in the energy sector and their achievements following the guidelines included in the ECB agenda.

To conclude, the last paragraph focuses, in particular, on an in-depth study regarding the case of gas fuel and how the 8 banks under analysis have contributed, together with 17 other commercial banks and the EIB, through project financing, to target ESG investments in the Trans Adriatic Pipeline.

2   Topic review

Stopping the financing of fossil fuels, with a major and primary contribution from all the world's banks and favouring the use of renewables, could lead to an increase in GDP and a redistribution of capital. It is expected that in 2030, following this line of green finance, coal consumption will be significantly reduced (2.5% below Business as Usual) and the use of renewables will increase to 46%.

Divesting from the fossil fuel sector does not have any downside in terms of investment-related measures. Moreover, fossil fuel companies have to respond rather quickly to loan maturities in a very short time, they have fewer facilities and access to bank financing, as well as high interest rates. Reduced access to finance and worsening economic conditions are the result of increased credit risk linked to the fossil fuel loan portfolio. And it is for this reason that, in order to mitigate the risks, central banks and supervisory authorities are initiating green banking and the focus is on both risk management and the search for a link between new business opportunities and climate change. Despite, however, all these long-discussed social and economic aspects, empirical studies do not state with certainty that energy efficiency has a positive effect on requiring external financing from the company. Therefore, there is potential to continue to improve the internal management policy in terms of energy efficiency. In global terms, investment in renewable energy is not showing a steady upward trend: it was already noticed in 2017 when investments in renewable energies decreased by 3% compared to the previous year. Lenders are still showing interest in fossil fuel- related projects over green ones and a plausible motivation may be the relationship between risk and return expected by those same projects. It is interesting to note how low-income countries, especially private debt supports the transition from biomass to fossil fuels, especially coal. On the banking side, the sector is slow enough to introduce climate protection policies; moreover, the banking strategy that takes account of climate risks depends on its importance, certainly, attributed to the theme of lending and investment policies and therefore factors of internal and external communication. The reasons for these actions lie in the fact that tangible incentives are still lacking, A lack of willingness on the part of profit- making companies to internalize environmental externalities and the perception of high risk linked to low- carbon technologies in their strategy. With the withdrawal of the US in 2017 from the Paris Accords, European banks have limited lending to industries and sectors involved in the production of fossil fuels. One aspect that should not be overlooked is the influence of foreign funding on the development and production of energy and long-term carbon dioxide emissions. Foreign funding provided by Chinese institutions, Japan and the United States have been targeting fossil fuel energy technologies from the early 2000s to 2018, and their contribution to renewable energy production has been less than 15%. It is also important to note that Asian financial institutions influence the western banking sector by directing them to support new coal technologies.

The acronym ESG designates a method of investment analysis in which, in addition to the traditional variables (risk, return and liquidity), environmental, social, and corporate governance aspects and risks are considered in the decision-making process. The adoption of these criteria represents a paradigm shift for investment decisions and financial strategy, incorporating practices traditionally associated with sustainability and social issues. It is clear that in order to implement a project financing investment, the bankability of the project must be assessed. The economy, especially the banking world, is also feeling the effects of the changed climate conditions, and the banks themselves at an international level are making efforts to make investments with a low environmental but also social impact, which in a certain sense also concerns the governance factor. And it is precisely these three factors (environmental, social, governance) around which the chapter in question develops: a comparison is made between the largest Italian and foreign banking giants.

A high ESG score means that the bank has stable and good financial conditions; The US banks that have adopted policies to mitigate environmental risks have suffered less from the supply crisis than those that have not adopted ESG-friendly policies. What is recognized is certainly the relationship between ESG risks and other risk factors, and therefore it is essential to adopt strategies to include these three factors. Given the importance of the banking sector to the real economy and to the sources of energy production, it seems perhaps trivial to question whether they may be affected by the low assessment of ESG. To date, the abandonment of fossil fuel financing does not seem to have negative effects for financial investors but this because it basically depends on the fact, in fact, that banks have not changed the structure of the investment portfolio and therefore the risk-return ratio.

3   The ECB Climate Agenda

The European Central Bank argues that governments and legislators are at the forefront of the fight against climate change and have the most appropriate tools to tackle it, remembering, however, that it is the duty of each of us to do our part. And this also applies to the European Central Bank itself. Climate change and the transition to a greener economy affect the ECB's primary objective of maintaining price stability, as they have an impact on the economy as well as on the risk profile and value of the Eurosystem's balance sheet assets. As a supervisory authority, it is responsible for contributing to the safety and soundness of the banking sector by ensuring that it is adequately prepared to manage climate risk. Moreover, as a European institution, acting within its mandate and without prejudice to its primary objective, it has a role to play in supporting general economic policies to achieve the EU Treaty's

objectives. Environmental protection is one of these objectives. The ECB's action on climate change is therefore based on three main objectives:

- managing and mitigating the financial risks associated with climate change and assessing its economic impact;
- promoting sustainable finance to foster a transition to a low-carbon economy;
- sharing expertise to promote wider change.

In order to achieve the objectives, an accurate and thorough analysis of the impact of climate change needs to be carried out, and urgent action needs to be taken as time is of the essence. The ECB Climate Agenda details the priorities and activities and includes the full range of work to address climate change, divided into six strategic priority areas aimed at achieving the underlying objectives. The agenda is updated periodically as activities are completed, preparing the economy for the future and helping to make it more sustainable overall.

4   Methods of analysis

The contribution of this paper is to highlight the performance of financial investments that take ESG factors into account and how they bring about global environmental, social and governance improvements. Another aspect under analysis is the investment picture in favour of renewables rather than fossil fuels.

In order to carry out this survey, bank reports were used as reference points, specifically the Bank of Italy, the European Central Bank and the eight European banks taken as a point of comparison between them.

4.1 Bank of Italy report on ESG investments

The Bank of Italy, in its investment policy, pursues strategic objectives of containing financial risks in order to preserve invested capital even in conditions of market tension, and of prudently seeking returns to help cover the Institute's costs. As of 2019, these objectives have been supplemented with assessments of ESG factors. The effort to protect the environment is actively pursued by the legislator to ensure sustainable and lasting growth: although BI is not subject to sustainability regulations, in its role as an investor it faces issues and makes choices that have points in common with those of private investors (e.g. asset management companies, insurance companies, banks). The risk profile of investments is influenced by climate change, as well as by the environmental, social and governance

conditions in which companies operate. By favouring ESG-conscious companies, investors can improve their risk and return profile. Awareness of the difficulties of integrating sustainability profiles into financial choices fuels and qualifies dialogue with market participants, helps promote transparency of information and spreads the application of good conduct. Ultimately, dialogue increases the effectiveness of the Institute's action, which aims to make the financial system more resilient to the risks associated with sustainability profiles.

Through the publication of the *Responsible Investment Charter* (2021), BI has defined the three strategic lines of action it intends to pursue:

- to promote sustainability with initiatives to encourage the dissemination of information on ESG profiles by issuers, intermediaries, and other players in the financial system;
- to integrate ESG criteria into its own investment and financial risk management, promoting the dissemination of good practices of sustainable investment and risk management in the financial system;
- to publish commitments and results on sustainable finance, periodically communicating what has been achieved in terms of sustainability and contributing to the dissemination of the culture of sustainable finance in the financial system and among citizens.

The Bank of Italy is also outlining a path for the de-carbonization of equity and bond portfolios by setting intermediate, pre-defined and measurable targets. In addition to looking at the past trend of companies' greenhouse gas emissions, particular attention is paid to short- and medium-term (up to 10 years) and long-term (10-30 years) de-carbonization commitments; both commitments, although included in the plans of a still limited number of companies, are highly relevant for assessing companies' transition prospects and related risks. The actual trend in emissions will therefore be compared with the declared commitments in order to assess the consistency of the transition plans. In order to help reduce emissions, a thematic equity portfolio has been set up, dedicated to companies operating in the fields of alternative energies, energy efficiency systems, electric mobility and green building. These investments can indeed contribute to the ecological transition by fostering the necessary technological innovations. For government and supranational securities in euro and foreign currencies, portfolios of green securities will be expanded according to their availability on the market. In February 2021, the Institute's commitment (together with other Eurosystem central banks) to develop shared principles on climate sustainability of investments in euro-denominated portfolios for non-monetary policy purposes was announced. Looking ahead, the Eurosystem aims to publish information on climate-related risks by the first quarter of 2023, in line with the recommendations of the TCFD (Task Force on Climate-related Financial Disclosures, established in 2015 by the Financial Stability Board, that promotes and monitors the stability of the global financial system).

The integration of ESG criteria into the selection of investments in equities of eurozone issuers, which began in 2019, was subsequently extended to the currency component, including US and Japanese equities. With regard to the latter component the integration of ESG was chosen to invest in ESG exchange-traded funds (ETFs) and undertakings for the collective investment in transferable securities (UCITS). Sustainability assessments are complemented by those on the financial characteristics of the instruments, including diversification, liquidity, volume of assets under management, fees, yield and volatility. With regard to corporate bonds, the Bank holds two portfolios consisting of euro and US dollar investments, respectively. The integration of environmental, social and corporate governance criteria into the management of these portfolios took place with the switch to sustainability indices developed by market providers.

Different considerations apply to public securities than to private securities. First, the link between the policies of sovereign issuers and the sustainability of their securities is more tenuous than for private issuers. Undoubtedly, ESG profiles can play a significant role in a country's long-term growth and financial strength. However, ESG indicators for government bonds reflect the economic and production structure of a country, which is affected by the actions of the various economic agents, public and private, operating in it. Secondly, government bonds of various countries, including those attributable to foreign exchange reserves, have very high liquidity and security characteristics, which make them difficult to replace with alternative instruments. For institutional and historical reasons, Italian government bonds represent the main financial asset in the Bank's portfolio, in line with what is generally observed for national central banks.

With regard to government bonds, sustainability indicators are monitored but do not influence investment choices; an exception are green bonds of euro area sovereign issuers and supranational institutions, whose weight in the Bank's investments will grow over time, depending on issuance policies. With regard to supranational bonds, the Bank purchased a US dollar green bond fund managed by the Bank for International Settlements. Finally, the integration of climate and sustainability risk information into the internal analysis and reporting process is underway: retrospective indicators such as carbon footprint and carbon intensity, forward-looking indicators such as climate value-at-risk and implicit temperature rise are being developed.

To integrate sustainability into their portfolio choices, investors need information on the ESG profiles of financial instrument issuers. It is therefore important to understand their characteristics, limitations and potential for measuring and managing the sustainability profiles of investments and for monitoring performance. The methodologies applied by ESG score providers present a degree of heterogeneity in terms of the number of key parameters considered and the relevance assigned to different ESG profiles, which also varies according to sector, prevailing activity and country. This

explains why the scores for the same issuer, calculated by different providers, can sometimes differ. Comparison with accounting and financial information shows that there is considerable room for improvement for ESG indicators; regarding accounting information, international standards for publication and uniform rules for validation by external auditors have long existed.

Other aspects must also be considered when using indicators. Firstly, ESG scores are by no means a precise measure of companies' sustainability strategy, but rather express a summary assessment of their ability to manage risks and seize opportunities related to sustainability factors as a whole. Secondly, the importance of the three factors included in the ESG profiles varies significantly from sector to sector. Climate and environmental aspects play a decisive role for companies in power generation services, oil and gas, and raw materials, while in the financial and technology sectors social and governance aspects tend to be more relevant. Government bonds require specific considerations. Thirdly, the essentially retrospective nature of the scores makes them partially useful for assessing the future strategies of companies. De-carbonization plans for investment portfolios, on the other hand, require consideration of the possible evolution of technology, public policies, consumer and investor preferences; but above all, it is necessary to have detailed and reliable information on companies' transition plans, with a focus on investment programmes aiming at de-carbonization.

Forward-looking climate risk indicators compensate for these deficiencies by using scenarios that assume different future combinations of adopted climate policies and socio-economic developments: their use is vital for understanding the physical and transition risks of a financial portfolio. The values of these indicators are very sensitive to the underlying assumptions and methodologies and are thus generally subject to even greater levels of uncertainty than retrospective indicators. For this reason, they have so far only been used by the Bank of Italy to assess ex post climate risk exposure and not to guide portfolio choices; the integration of some of these indicators into portfolio choices is currently underway. Greenhouse gas emissions upstream and downstream of the corporate value chain (so-called Scope 3 emissions) are currently not considered in the measurement for the Institute's portfolios due to strong informational limitations of a conceptual and applicative nature.

As mentioned, the Bank considers the ESG score and the carbon intensity of companies to improve the sustainability profile compared to benchmark indices and adds indicators like the weighted average carbon intensity of the portfolio and the carbon footprint (see above).

For the forward-looking indicators, four measures are used, of which the first three are from MSCI ESG Research. The first indicator measures the risks that could arise for different classes of companies during the transition to a low-carbon economy. For example, in the highest risk class are companies with activities that are incompatible with a low-emission economy, while in the best class are those that offer products that are functional to the transition, such as electric cars or energy production from

renewable sources. The indicator is the share of investments in companies in the lowest transition risk category.

The second indicator, Climate Value-at-Risk (Climate VaR), measures the percentage change in a company's value resulting from the potential effects of climate risk, both physical and transitional. The model considers three factors:

- the risks to the company associated with changing climate policies. Data from Integrated Assessment Models (IAMs) are used to estimate the effects for companies of meeting reduction targets defined by public policies;

- the technological opportunities related to the transition to a low-emission economy;

- the physical risk, represented by the costs due to disruptions of production activities due to acute (cyclones and floods) and chronic (increased temperatures and precipitation) climate events, or the opportunities resulting from not being exposed to these events.

The third indicator is the implicit temperature increase: for each firm, it expresses the increase in global temperature in degrees Celsius (°C) that would occur at the beginning of the next century if the entire economy performed as well as that firm in terms of over- or under-utilisation of the carbon budget (carbon budget overshoot/undershoot) needed to keep the global temperature below 2°C. Finally, the fourth indicator considers companies with commitments or targets defined according to the methodology developed by the Science Based Target initiative (SBTi): it measures the percentage weight of companies in the portfolio and index that have made a commitment to SBTi to define a de-carbonization plan, or that have de-carbonization targets already approved by SBTi.

The analysis of the ESG profile was conducted separately for government bonds in euro and for those in foreign currencies. The former is included in the financial portfolio and consist mainly of Italian securities; the remainder is composed of securities from other euro area countries. Government bonds in foreign currencies account for most of the foreign exchange reserves and include government bonds from the United States, Japan, the United Kingdom, Australia, Canada and China.

4.2 The choices of major Italian banking groups for ESG investments in comparison with major European banking groups

4.2.1 Illimity Bank

Illimity Bank, the first cloud-based bank that has integrated sustainability into its strategy since its inception, has published its second Non-Financial Statement in which it takes stock of the various achievements it has already made in integrating environmental, social and governance factors into its strategy.

On the environmental side, Illimity has already achieved carbon neutrality on Scope 1 and Scope 2 emissions, and as an operator in the world of distressed credits it has set up an Energy Desk with the aim of intervening directly in the management of photovoltaic plants to restore their full contribution to green energy production.

With regard to social issues, the Bank is engaged in real estate projects aimed at initiatives with a social impact. It has also embarked on a path to neutralize the gender pay-gap, which is below 5%. The Bank was also confirmed for the third consecutive year as a Great Place to Work and for the first time entered the Best Workplaces in Europe ranking. In the area of governance, the Shareholders' Meeting approved the transition to a one-tier governance system to align with international best practices and included the concept of sustainable success in the Articles of Association.

Illimity has immediately integrated sustainability into its strategies: in its Strategic Plan 2021-2025 it increasingly involves ESG factors in its objectives, especially in the long term, including the measurement and management of Scope 3 financed emissions and the improvement of ESG ratings and scores. Illimity also aims to increasingly involve customers by supporting them in their sustainable transition.

On the credit side, it is adopting a new policy of indicating sectors excluded from financing and a procedure to integrate ESG assessment in the granting of credit.

As part of its impaired loans business, the Bank has set up an Energy Desk dedicated to investing in non- performing loans with underlying assets in photovoltaic plants, which has reached its first investment target of 100 million euro in photovoltaic plants through its joint venture with VEI Green, enabling it to produce 9.1 GWh of renewable energy by 2021.

An innovative initiative in the start-up phase in the field of sustainable finance is the Sustainable Energy Basket Bond, created to support investment plans for the energy transition with ESG objectives of SMEs. Companies admitted to the programme will be able to access financial resources at subsidised conditions according to their current and prospective sustainability profile to be allocated to projects and investments aimed at achieving the United Nations Sustainable Development Goals (SDGs). One of the cornerstones of the Bank's ESG plan is to measure and subsequently manage Scope 3 financed issues related to SME financing. Illimity has also joined the digital platform dedicated to sustainability Open-es, launched by ENI in collaboration with Boston Consulting Group (BCG) and Google Cloud, and open to all companies to support the sustainable development of production chains. Registered companies have to answer a very detailed ESG questionnaire, thanks to which they can measure their sustainability performance, analyse and share data and experiences.

To support companies in their growth from an ESG perspective, there are various strategies: there is the classic special purpose finance product, aimed at financing a specific project that has certain green

or social characteristics. In this case, the important aspect is the procedures and certification systems that ensure that the funds disbursed are actually directed towards that investment.

4.2.2 UniCredit

UniCredit has defined sustainability targets to further reduce both its direct environmental impact, through specific energy choices, and the exposure of its loan portfolio to companies operating in controversial sectors. In concrete terms: since 2008, greenhouse gas emissions have been reduced by more than 50%; the target of a 60% reduction by 2020 has been reached, with the aim of achieving an 80% reduction by 2030. By 2023, the bank's offices in Italy, Germany and Austria will use only renewable energy sources.

In favour of the environment, UniCredit is distributing reusable metal bottles throughout the Group. Plastic bottles and tableware have been completely eliminated from break areas and canteens, and all single-use plastic products will be removed from the Bank's premises by 2023.

UniCredit is also working with its customers on a transition to a low-carbon economy: through projects such as the Paris Agreement on Capital Transition Assessment (PACTA), it is assessing the exposure of its portfolio to climate risk, in partnership with the 2 Degrees Investing initiative.

With the new Group policy on coal, UniCredit has committed to a total exit from coal industry financing in all markets by 2028.

The new oil and gas (O&G) policy covers the Arctic, prohibiting the financing of new projects for the extraction of Arctic oil and Arctic offshore gas as well as shale O&G and related fracking, oil from tar sands and the financing of deepwater O&G. Corporate financing for customers active in these areas will only be allowed if their share of revenues from these types of activities is below 25%.

UniCredit has committed to increase lending to over 9 billion euro to the renewable energy sector by 2023, increase customer loans for energy efficiency by 34% for SMEs in Western Europe. Loans for individuals in Western Europe are +67% (vs. target of +25%), while new issues in CEE have already reached 10% of total loans in 2020 (vs. target >6%).

UniCredit's goal is to reach the Top 5 in the Europe, Middle East and Africa (EMEA) market rankings for green bonds and ESG-linked financing by 2023; to achieve this goal, they rely on the help of the customer-facing Sustainable Finance Advisory Team, which enables the Bank to combine its expertise in sustainability with internationally recognized excellence in the capital markets in order to deepen the dialogue with customers on ESG issues and facilitate their access to the European green finance market.

On the environmental side, it has worked to reduce greenhouse gas emissions by 60% since 2008, aiming for zero by 2030.

4.2.3 Intesa Sanpaolo

Intesa Sanpaolo, with its ESG Thematic Area, collects funds with investment policies that invest the equity and corporate bond component through underlying funds that, in addition to fundamental information, also perform ESG assessments (ESG funds) or in underlying funds issued and/or managed by management companies that adopt ESG criteria in their investment process.

There are 6 funds:

- 3 flexible active capital internal funds dedicated to clients who wish to delegate the management of their investments to a professional manager who adopts an active style and is not tied to a benchmark, with the objective of optimizing returns while respecting the pre-established risk budget;

- 3 internal profile funds that offer clients the possibility of delegating the management of their investment in line with their financial profile and the objective of these funds is to maximize performance against the reference benchmark and according to the risk profile of each fund.

The Thematic Area is designated for those clients who wish to devote their investment choices to specific themes closely related to ESG criteria.

With the new Corporate Plan 2022-2025, approved on 4 February 2022, the Group intends to further strengthen its leadership in the ESG area with a world-leading position for social impact and a strong focus on climate.

In the last quarter of 2021, an important contribution of the Group was to combat climate change by joining all Net-Zero alliances promoted by the Unep Finance Initiative. More than a year ahead of the deadline set by the Net-Zero Banking Alliance (NZBA), Intesa Sanpaolo has defined, within the 2022-2025 Business Plan, emission reduction targets to 2030 aligned to net zero for the O&G, power generation, automotive and coal mining sectors, which account for more than 60% of the financed emissions of the portfolio of non-financial companies in the sectors indicated by the NZBA.

Intesa Sanpaolo's Corporate Plan 2022-2025 aims at a solid and sustainable creation and distribution of value, high capitalization and a marked connotation towards environmental, social and governance factors: a commitment of about 115 billion euro for the community and green transition and 500 million to support people in need. The goal is zero net emissions by 2030 for its own and by 2050 for its loan and investment portfolios, asset management and insurance business. Within this framework, the group has declared its intention to apply for Science Based Target Initiative (SBTI) certification.

The Group looks at strengthening its leadership in all the main ESG rankings, adopting a specific biodiversity policy and envisaging a new credit decision-making model that is based on an evolution of the credit framework and that also includes climate/ESG components (e.g., sectoral ESG heatmap, ESG score at counterparty level) applied to the entire credit chain and that includes a strengthening of

strategic impact credit initiatives (e.g., Renaissance Programme). At the same time, the plan aims to ensure that "the assessment, monitoring and management of ESG risks are integrated into the Risk Management governance framework through the further development of methodologies and the adoption of risk management tools, systems and processes for ESG risks, with a particular focus on climate risk". Through a "new digital trading factory", special attention will be paid to sustainable procurement, with the evolution of the group's supplier base in line with the overall ESG strategy (e.g., suppliers assessed based on ESG criteria).

For insurance companies, the ESG commitment will mean a carbon intensity reduction path for direct investments and the development of an insurance offer dedicated to the same ESG in the non-lifeline of business (e.g., products for companies that adopt eco-sustainable behaviour, green vehicles) and enrichment of the ESG/climate offer in the Group's life insurance range (e.g., ESG unit-linked).

4.2.4 Banco Popolare di Milano

In 2020, under the impetus of the new ESG Committee and in the light of an analysis of the requirements of the regulators, but also of the expectations of the financial market and the best practices of national and international competitors, Banco Popolare di Milano launched an internal assessment aimed at involving all of the Group's units in an important sustainability path. In February 2021, 7 strands of activities were therefore launched, which, in continuity with the 2020-2023 Plan's macro-areas of action, will aim to strengthen and concretize the integration of sustainability within the company's activities and business.

In particular, with the aim of fostering the transition of companies towards a sustainable business model, the allocation of the 5 billion euro Sustainable Investments 2020-2023 plafond was announced in 2020, planning the valorization of corporate best practices and the promotion of a culture of sustainable finance through communication channels, particularly online, with a focus on female entrepreneurship and financial support for green transition paths.

With a view to integrating ESG criteria within credit policies, with reference to the green sphere:

● an assessment was conducted on the Group's entire credit portfolio to highlight presence in sectors particularly impacted in terms of environmental sustainability on the basis of the European Commission's new taxonomy, in order to define strategies aimed at supporting investments linked to the green transition;

● specific policies have been implemented for the real estate sector, with the aim of supporting the development of the sector by directing attention to companies that, in addition to presenting

a low risk profile and interesting prospects, carry out construction and redevelopment of buildings according to environmental sustainability criteria;

- the granting of green loans for the purchase and renovation of buildings that take energy efficiency into account has been favoured. These policies will materialize, from the point of view of actual use, in the course of 2021.

Banco BPM's commitment to sustainable savings is reflected in the launch of a project to introduce qualitative and quantitative assessment models for financial instruments from an ESG perspective, and in the further expansion of the range of products managed with Enviromental, Social and Governance (ESG) and Sustainable Responsible Investment (SRI) criteria. Crucial is the close collaboration with Anima Sgr and Etica Sgr, the two asset management companies with which we have an established corporate partnership, and the involvement of new asset managers. In fact, in addition to Etica Sgr's SRI funds, which are already available to customers, the Group has added further OICRs (Undertakings for Collective Investment in Savings) managed by asset managers with consolidated experience in sustainable investments, including Raiffeisen, Pictet and Allianz. The products are diversified by asset class (equities, bonds, etc.) and are managed on the basis of exclusion criteria, best in class, impact investing, ESG criteria integration, thematic funds and engagement.

Already in 2021, the Group's first green bond was issued. As part of the bond issues by customers, including those based on sustainability aspects (ESG), in July 2020 Banca Akros acted as Joint Bookrunner in the green bond of Terna S.p.A. in the amount of 500 million euro. The issue was in great demand on the market: against an issued amount of 500 million euro, orders amounting to almost 2 billion were collected, confirming the financial market's interest in this type of bond. The proceeds of the issue were allocated to financing/refinancing Terna's green projects.

4.2.5 Montepaschi

In view of the growing importance of ESG risk factors in regulation, government policies, stakeholder awareness and also following specific initiatives promoted by the ECB, particularly on Climate-related and Environmental Risks, the Montepaschi Group launched in 2021 a multi-year plan of activities aimed at progressively integrating traditional risks and the risk management framework into the business model in order to finance sustainable transition in the context of defining ESG strategies and policies consistent with the Group's distinctive values.

The approach implemented has led to firstly identifying credit risks as a priority and secondly, depending on materiality within the Group, market and liquidity risks and business/strategic risks.

With regard to transition risk, the Montepaschi Group focused on:

- exposures to private individuals, secured by real estate: the Bank has made it compulsory, in the process of stipulating loans with reference to new disbursements, to acquire data on energy labels and CO_2 emissions relating to the real estate subject to financing and pledged as collateral, while on the existing portfolio a data remediation activity is underway aimed at computerizing the information contained in the paper/digital appraisal and purchase and sale documents;

- exposures to companies: an initial top-down analysis of the Group's credit exposures was carried out, based on the sector of economic activity, in line with the EBA and ECB indications on the subject, which suggest – in their respective studies and in the climate stress test exercise that the Bank is currently conducting – to adopt this approach in an initial phase of identifying exposures to climate and environmental risks for loans to manufacturing activities. With respect to the credit exposure to each sector eligible under the EU18 taxonomy, a management analysis was conducted in order to identify an aligned share of assets, i.e. potentially qualifying as sustainable under the taxonomy. The estimate of the aligned share is based on a methodology developed internally, and a logic of consolidation and integration of the already existing sector analyses. The coverage of the alignment coefficient thus determined, defined as the "MPS management TAC", is being extended also to sectors not yet eligible by the taxonomy, providing a broader estimate with respect to the business sectors that the taxonomy itself has already fully examined. In fact, sectors that are currently not eligible have been managed on the basis of their probability of being covered by the taxonomy in the future, into "Future eligible" (those sectors for which inclusion in the taxonomy is highly probable if not necessary), "Neutral" (when the activities currently appear to be disconnected from the taxonomy's drivers of interest, such as generic professional activities, etc.) and "Brown" (sectors that, due to the high risk of transition, the taxonomy could not admit as sustainable even with particularly restrictive screening criteria).

On the side of investment services for customers, the offer of products with underlying strategies linked to the theme of sustainability was expanded in 2021. In the first quarter of 2021, the Bank launched a specific project activity called "ESG Project - Impacts on the distribution model" with the aim of adapting the BMPS Group's compliance with ESG-themed regulations. In particular, the main actions implemented in 2021, with reference to the mapping of products according to ESG variables (environmental, social and governance factors), concerned:

- the definition of the level of granularity of ESG information to be used in classifying products;

- the identification of an external info-provider to provide this information with the appropriate data quality controls and for the perimeter of interest;

- the methodology to be adopted for the purposes of defining ESG ratings;
- the implementation of a corporate database for feeding and distributing information flows to the downstream procedures that perform adequacy checks and to the other procedures that need information on the sustainability factors of investment products.

With reference in particular to asset management, from the first half of 2021 a strategic decision was made to integrate ESG factors in all the main asset types that underpin MPS Advice/Athena in order to make them available to all those clients who will express a preference for sustainable investments from 2022 onwards. In order to monitor the risks and progress of asset management's commitment to ESG, an internal model was created to analyse (based on a series of qualitative/quantitative metrics) the portfolios of all asset management lines in their entirety. The focus is on material risks and the ESG risk overall assesses, precisely the so-called unmanaged risk.

The MPS Group continues to pursue improvement in its energy efficiency, in all activities that have a significant impact on the environment:

- the supply chain of the energy market, where with evolved portfolio management models the procurement of electricity has been taking place, for a decade now, entirely from renewable hydroelectric sources. Thanks to this sustainable approach, CO_2 emissions also for the year 2021 for electricity consumption are 0 t equivalent according to the market-based method;
- an advanced design of electrical and thermal engineering systems, based on equipment and components with performance, efficiency and efficiency requirements at the highest market values;
- real-time monitoring of energy consumption and environmental parameters, for which the first installation phase has been completed in over 1200 branches and is being extended to all Group branches. The ongoing upgrade of the initial monitoring project includes the correlation of environmental parameters with the operating set-points of air-conditioning systems through artificial intelligence and machine learning systems that will also allow the predictive ntenance of heating, ventilation and air conditioning systems;
- the analysis of energy consumption, which takes place through an advanced processing model that makes it possible to measure the effectiveness of initiatives to contain energy consumption by normalizing consumption net of seasonal climatic trends and other exogenous factors.

Consistently with the general guidelines established on the subject by the Code of Ethics, in compliance with legal obligations and in adherence to the principles promoted by the United Nations Global Compact Programme and the Principles for Responsible Banking of the UNEP (United Nation Environment Program) Financial Initiative, the Group has been committed for many years to the progressive improvement of the environmental performance of its operations.

4.2.6 France: *Crédit Agricole*

On 9 June 2020 Crédit Agricole CIB successfully reached financial close for the financing of the Fécamp offshore wind farm: the project is owned by a consortium consisting of EDF Renewables, Enbridge and WPD. The project comprises 71 Siemens Gamesa wind turbines with an installed capacity of 497 MW. It is the second offshore wind project financed in France after the Saint-Nazaire project (2019). For Fécamp was raised 2.4 billion euro, through commercial debt and EIB participation. The Bank played a leading role as underwriter, original cover bank, global bookrunner, agent and account bank, with a total Crédit Agricole CIB allocation of more than 650 million euro. The Crédit Agricole Group, through Caisses Régionales, LCL and Unifergie, confirmed a strong interest in participating in the transaction through an intra-group syndication.

Then, in the context of the AXA Climate Impact Day, Crédit Agricole CIB announced the issuance of a 100 million euro Transition Bond in the form of a private placement underwritten by AXA IM on behalf of the AXA Group. An amount equivalent to the proceeds of the Transition Bond will be allocated by Crédit Agricole CIB to a selection of loans for projects in carbon-intensive sectors that contribute to the transition to a low-carbon economy, such as LNG-fuelled ships, investments in energy-efficient industries and gas-fired plants in countries where power generation is currently based on coal. The underlying projects are estimated to reduce carbon emissions by a total of 26,500 t CO_2 per year.

The proceeds will then be used to finance green projects in accordance with EDF Green Bond Framework, published in January 2020 and externally reviewed by the Vigeo Eiris agency. The issue is part of EDF Cap 2030 strategy, with which the group set a goal in 2015 to double its renewable generation capacity to over 50 GW by 2030.

On 8 September 2020, among other Crédit Agricole projects, EDF issued, for the first time, 2.4 billion euro of 4-year OCEANE Green Bonds, convertible into new shares and/or exchangeable for existing shares. This is the largest issue of this type in the world and only the second largest in Europe. It is a jumbo transaction in the European equity-linked universe and the first convertible bond in more than five years to exceed 1.5 billion euro. The French State, which owns 83.6% of the group, subscribed to the offer for an amount of 960 million euro (about 40% of the total). Crédit Agricole CIB acted as joint bookrunner for this historic transaction. This leading role in the equity-linked bond market confirms Crédit Agricole CIB's position as a leader in green finance.

Foncière INEA, an SIIC that invests in new or newly constructed office buildings located in France's major regional cities, signed the first green loan aligned with the ambitions of the European taxonomy. This innovative structuring includes:

- a green loan (aligned with the Green Loan Principles) dedicated to financing the acquisition of new office buildings with a positive impact in terms of energy and carbon emissions;
- a margin reduction mechanism if Inea achieves energy and carbon performance in line with the ambitions of the European taxonomy.

ZECI is a company co-founded by EDF and Zola Electric that sells on credit and guarantees the maintenance of solar kits to meet the needs of off-grid rural populations. The offer is presented in the form of three-year credit sales contracts through Credit Agricole via mobile money payments and pay-as-you go flexibility: customers can adjust the payment over time according to their disposable income.

In particular, the financing of ZECI's (Zola EDF Cote d'Ivoire) solar home systems business aims to solve this problem by providing solar home systems to off-grid populations in Côte d'Ivoire. To finance ZECI's development, a securitisation vehicle (NEoT CI) was created to purchase home solar systems and credit sales contracts concluded with off-grid customers. This vehicle is owned by NEoT Off-Grid Africa, a platform dedicated to investing in off-grid projects in sub-Saharan Africa, managed by NEoT Capital and controlled by the infrastructure fund Meridiam, with Mitsubishi Corporation and EDF as co-shareholders. The financing of the vehicle (NEoT CI) was structured in the form of a securitisation by Crédit Agricole CIB, Société Générale CIB and Société Générale Côte d'Ivoire (SGCI), with an equity portion provided by NEoT Off-Grid Africa and a 11.80 billion franc CFA (approximately 18 million euro) senior loan in local currency provided by SGCI with guarantees provided by the African Development Bank (ADB) and Crédit Agricole CIB. In addition to participating in the implementation and financing of the project, the Grameen Crédit Agricole will also be responsible for monitoring the social and environmental performance of the project. The disbursement of the senior loan will be adjusted according to the growth and performance of the portfolio.

4.2.7 Germany: Siemens Bank

One of these cases was the financing of an onshore wind farm in southern Sweden, a region that consumes some of the highest levels of energy in the country and plays a key role in the development of Sweden's renewable energy infrastructure. This 72.6 MW facility will utilize 11 Siemens Gamesa wind turbines and will benefit from a long-term power purchase agreement. This was the first financing of a project in the Nordic countries. In this project, Siemens Bank assumed the role of mandated lead arranger. Overall, the financing sets a solid precedent for ongoing infrastructure developments in the renewable energy sector and could be replicated in future Nordic transactions.

In another project, Siemens Bank provided long-term financing in zloty and euro for the first renewable energy transactions financed in Poland. Acting as mandated lead arranger, Siemens Bank

financed the construction and operation of two portfolios of 86 small-scale solar PV plants. Digital infrastructure in general and data center investments in particular have seen significant growth in demand for financing. Siemens Bank works closely with Siemens Smart Infrastructure to support its customers' data center projects. To support the rapid growth of the digital services of a long-standing Siemens customer with nine data centers across Australia, Siemens Bank supported the expansion by participating in a senior secured syndicated loan. Together with Siemens Bank, Siemens offered a full suite of products to support this expansion.

In the financing of projects and equipment investments, for which longer-term and thus less cyclical planning cycles are regularly relevant, and also in the financing of projects in the infrastructure sector, which has proven to be quite resilient to credit defaults even in the context of the COVID-19 pandemic, Siemens Bank continues to observe intense competition in the search for attractive risk-return profiles, as interest rate levels remain historically low, especially in the eurozone. In addition, new competitors besides traditional banks, such as insurance companies, pension funds or alternative investment funds, continue to increase market liquidity with their demand for project and corporate loans, intensifying pressure on margins and documentation standards. In particular, due to the increased importance of the sustainability theme, the demand for financing with a positive ESG rating is growing, which will put further pressure on interest margins.

Siemens Bank sees a similar market and competitive situation in many Asian markets. However, Siemens Bank's wide-ranging geographical positioning has allowed the bank to offset weak trends in individual markets or sectors by exploiting opportunities in other markets. The COVID-19 pandemic also continues to pose significant challenges to banks' internal processes and controls, as many employees continue to predominantly use mobile or remote working. Nevertheless, during the financial year 2021, Siemens Bank was able to implement all critical processes and controls without limitations. The Bank was not affected by any significant COVID-19-related staff absences or IT infrastructure failures.

The effects of COVID-19 had a greater impact on project financing in the last fiscal year, due to the isolated effects of restrictions on construction activity. Corporate financing, on the other hand, has tended to pick up, and most have seen an improvement in their risk profile compared to the previous year. The focus is mainly on the energy, manufacturing and healthcare sectors. The effects of the COVID-19 pandemic were especially felt in project financing in the infrastructure sector, although most of this financing can still be classified as resilient. Provisions were released in the transport and service business sector.

Siemens Bank shares the expectation that economic development in the fiscal year 2022 will continue to be strongly influenced by the recovery from the effects of the COVID-19 pandemic. Based

on the aforementioned forecasts, Siemens Bank expects a scenario in which the global economy will recover steadily in the coming fiscal year, with sectoral and regional differences and possibly repeated setbacks due to restrictions in individual countries. In principle, Siemens Bank expects that, thanks to its portfolio structure with a high proportion of project financing business and a broad diversification of corporate lending, it will continue to perform well even in this difficult environment. Siemens Bank believes that demand for project finance and investment loans will remain at similar levels to previous years, as infrastructure project planning and project financing cycles are usually longer. In the Asia and Australia region, the Bank expects its business to grow further. This also applies to the Middle East, if political risks are strictly managed.

Political and economic developments in Turkey and the Middle East can have a negative impact on the debt servicing capacity of borrowers. While Siemens Bank limits political risks primarily through credit insurance, potential economic risks are managed through strict credit risk management. Siemens Bank believes that another risk factor is the persistent and intense competition in many regional markets for project and investment financing, due to the historically low level of interest rates and the associated high liquidity.

4.2.8 Netherlands: ING (Internationale Nederlanden Groep)

In the renewable energy and power sector, ING has been a leading bank in project financing since the mid- 1990s when the Amsterdam, New York and Singapore teams were established. ING has established itself as one of the top 10 European banks active globally in the energy sector and as a key financier in the renewables sub-sector. The team focuses on core technologies (solar, on/offshore wind and, selectively, geothermal) and, increasingly, on battery production and storage solutions.

In financing positive change, ING is aiming for year-on-year growth in sustainability-related products and income utilization products (such as bonds and loans), advisory services and sustainable equities. In 2020, ING supported the issuance of 62 green/social/sustainable sustainability-related bonds and promissory note, 54 green/sustainable sustainability-related loans, 19 sustainable structured finance transactions and 4 sustainable investment transactions.

In Bloomberg's rankings, ING ranks fourth for green/social/sustainability-related bond issuance, with over 3.8 billion euro in bonds issued, and sixth for green/sustainability-related loans, with over 7.5 billion euro in syndicated loans.

ING's oil and gas financing business is characterized by the diversity of its clients: their geographic footprint varies from global to local; their position in the value chain ranges from fully integrated upstream, midstream, and downstream segments to pure-play companies in each segment; and their ownership varies from state-owned to public to private. A common factor for all of these clients is the

prospect of declining global demand for O&G, coupled with increasing societal demands for greater environmental responsibility. ING's climate and environment strategy for the O&G sub-sector team is to engage with those clients that demonstrate a commitment to adapt their business models to the requirements of a successful energy transition and to improve the ESG performance of their current operations. A particular development over the past two years has been loan structures that incorporate an incentive margin or penalty for performance against ambitious ESG targets (tailored to align with the client's strategy). KPIs (Key Performance Indicators) include the reduction of greenhouse gas emissions (especially CH_4 and CO_2), electrification of operations, heat reuse, investment in renewable energy and reduction of water consumption. As an example of financing in this area, ING acted as mandated lead arranger and bookrunner for Lundin Energy AB in the refinancing of its 5 billion US dollar secured reserve based lending facility into a mix of 5 billion US dollar unsecured term loans and a multi-currency revolving credit facility. Lundin is a Norwegian upstream oil & gas company listed on the Stockholm Stock Exchange with a market capitalization of approximately 9 billion US dollar and is a global leader in terms of sustainability targets, including the goal of becoming net zero from 2025 in all its operations (scope 1 and 2 emissions and scope 3 supply chain emissions).

ING remains committed to working with clients in the construction industry to realize their sustainability ambitions, including clients in the cement sub-sector. The Group aims to work alongside them to intensify the strong commitment to a clear de-carbonization agenda that corresponds to medium- and long-term goals.

Following their commitment, ING continues to extend various sustainability products to cement customers, such as their Sustainability Enhancement Loans and Bonds. Through the bond, Holcim commits to reduce the CO_2 intensity of cement to 475 kg CO_2/t by 2030, when the target will be validated by the Science Based Target (SBTi) initiative. The SBTi, a partnership between CDP, the UN Global Compact (UNGC), the World Resources Institute (WRI) and the World Wide Fund for Nature (WWF), helps companies set greenhouse gas emission reduction targets in line with climate science. With regard to global clients active in the lightweight building materials sector, ING was involved in several transactions in early 2021. In particular, they acted as mandated lead arranger in the 600 million euro RCF completed by Rockwool Group, a multinational manufacturer of mineral wool products and insulation solutions. In this case, the credit line is directly linked to sustainability targets on emissions, recycling and waste.

5 A case of project financing in terms of investiments in ESG: Trans Adriatic Pipeline

The above-mentioned banks participated, together with 17 other commercial banks and the EIB, in the project financing of the Trans Adriatic Pipeline. This natural fossil fuel pipeline is an integral part of the network complex known as the Southern Gas Corridor, i.e., the set of gas pipelines connecting the Caspian Sea area to Europe: it refers to a chain stretching 3500 km and capable of transporting approximately 10 billion cubic metres of natural gas each year. The investment in TAP stems from the idea of increasing the supply of gas itself to Europe so that it can diversify its sources of supply and focus on sources considered to be more secure. It is clear that such an important project has required international collaboration: the European Union has been in favour of this initiative from the outset, recognizing in it a significant role in terms of energy policy, both in terms of diversification of sources and in terms of carbon dioxide reduction efforts. The vision of the project aims at contributing to a sustainable energy future by focusing on innovation and competitiveness of services and respecting the Paris Agreement.

One of the aims of the project financing initiative was to invest in taking a major step towards completing the project and meeting the 2020 delivery schedule. TAP is increasingly seen as one of Europe's pivotal infrastructures and the operators have stated that the key guiding principle is a commitment to sustainability, risk management and minimization of impacts. The policy is one of zero harm and concern for the environment and society in particular, ESG criteria and the Paris Agreements. The contribution of project financing has undoubtedly been crucial in order to be able to invest in sustainability from all points of view; the operators themselves have been clear in recognizing the social and environmental repercussions caused by the construction and realization of pipelines and, in particular, the economic and social importance of agricultural land affected by the loss of revenue from its exploitation. It is precisely for this reason that the project financing was supported by the Social and Environmental Investment Programme (contribution of 55 million euro).

The commitment of the TAP project therefore aims not only to contribute to the opening of the Southern Gas Corridor in Europe, but also to ensure the protection of energy services and make an important contribution to the development of the countries crossed by the pipelines. Throughout the entire duration of the project, the countries involved enjoy foreign direct investment, more competitive energy markets stimulate the economy, and another important point is the creation of jobs and thus increased employment.

The TAP, in the eyes of Europe, is not only a means to somehow make up for the loss of gas supply imported from Russia, but also a project it wants to work on in order to decrease CO_2 emissions and is a

bet for greening development. The fight against climate change is high on the agenda and Ursula Von der Leyen reiterates her desire to make the European Union "carbon neutral" by 2050. And natural gas is considered the best source for the transition from carbon-based to carbon-free goal 2050 In this regard, the EIB has expressly stated that it will abolish fossil fuel financing as early as the end of 2021; the agreement was also signed thanks to Germany as the largest shareholder of   the European Investment Bank. The intention is to transform the EIB into a climate bank: research conducted by Bankwatch showed that the EIB provided loans worth 13.5 billion euro to the non-renewable resources sector between 2013 and 2018. The reform consists of increasing the maximum threshold for project financing for ten low-income countries from 50% to 75% to support the energy challenges but also the remaining member countries. In addition to this, the measures provide for transition support; funding is only granted for biogas, hydrogen, and power plants with emissions below 250g CO_2 per kWh.

6   Conclusions

It is clear that the Russian-Ukrainian war has destabilised the energy and commodities market. Just look at the rise in interest rates and the increase in prices.

Recent studies have shown that, due to the geopolitical conflict, the market for sustainable investments has slowed down dramatically. The market for CO_2 certifications has also slowed down: in the last 24 months it had grown by 200%, with the war it has fallen by 25%.

First the COVID-19 pandemic and now the current geopolitical situation must not be seen as "abandonment to sustainability" but, on the contrary, must induce countries and, above all, national and international banking groups even more to speed up their investment processes in renewable energies and cut off gas supplies from Russia for good.

The conflict is exposing the weaknesses of ESG investments: they represent the broadest category of socially responsible investments and when reference is made to ESG funds this often refers to investments in companies with high ESG ratings, which would entail channelling funds to companies with less market support and training staff to serve ESG.

It is hoped that by 2050, as stated by the European Investment Bank, the use of fossil fuels will be zero; to date, based on their results, the banks are far from achieving this goal.

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Using cluster analysis study to examine social impact bonds

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Abstract

Over the last few years, Social Impact Bonds (SIBs) have become a very popular financial instrument in the field of impact investing. The performance evaluation metric seems to be a critical factor for the future development of the SIB market. For this reason, the work's aim is to identify a holistic risk-return profile adapted for SIBs. I employ a cluster analysis, as an exploratory technique, by gathering together those SIBs sharing similar features in terms of financial return, social risk, and financial risk. The exploratory analysis examined the 34 SIBs completed and shows three distinct and homogeneous groups. The results of the work open up new avenues for future research in the field of SIB performance. Finally, our results represent a basis for the implementation of a forecast model for the risk-return profile of these financial instruments..

Sommario

Negli ultimi anni, i Social Impact Bond (SIB) sono diventati uno strumento finanziario molto popolare nel campo degli investimenti a impatto. Le metriche di valutazione delle performance sembrano essere un fattore critico per il futuro sviluppo del mercato SIB. Per questo motivo, l'obiettivo del lavoro è quello di identificare una relazione rischio-rendimento adatta per i SIB. Mi avvalgo di un'analisi cluster, che consente di raggruppare i SIB che condividono caratteristiche simili in termini di rendimento finanziario, rischio sociale e rischio finanziario. L'analisi ha analizzato 34 SIB completati e mostra tre gruppi distinti e omogenei. I risultati del lavoro aprono nuove strade per la ricerca futura nel campo della performance SIB. Infine, i nostri risultati rappresentano una base per l'attuazione di un modello di previsione per il profilo di rendimento del rischio di questi strumenti finanziari.

Tipo di articolo – Articolo accademico

1   Introduction

Impact investing represents an alternative asset class that considers an alternative way to allocate financial resources (La Torre & Calderini, 2018; Del Giudice & Migliavacca, 2019). In 2007, the term "impact investing" was coined during a conference organized by the Rockefeller Foundation (Bugg-Levine & Emerson 2011). However, it became popular a few years later, after the financial crisis caused by the collapse of the subprime real estate market (Carè & Wendt, 2018; Agrawal & Hockerts, 2019). Some scholars, including Benedikter (2011) and Geobey, Westley, and Weber (2012), argue that investors are considering these new forms of investment to restore their reputation after the 2008 crisis. As a matter of fact, the channeling of capital in impact investing firms has been increasing each year (Weber, 2016). Mudaliar and Dithrich (2019) estimate that, in 2019, the organizations manage USD 715 billion with an annual growth of 43%. Subsequently, impact investing will become an important asset class within the financial markets.

Not only the attention of practitioners but also of scholars is continuously growing towards this new asset class. Impact investing has some peculiar characteristics that make it also an interesting research topic.

The Word Economic Forum of 2013 identifies specific characteristics of impact investing "as an investment approach that intentionally seeks to create both financial return and positive social or environmental impact that is actively measured". This definition shows the unique features of impact investing that distinguish it from Socially Responsible Investing (SRI) (Rizzello & Carè, 2016; Carè & Wendt, 2018). Despite the interest generated in academia, scientific research has not produced a large number of studies, nor has it achieved significant results (Agrawal & Hockerts, 2021). The most recent systematic literature reviews (Agrawal & Hockerts, 2021) highlight that scholars have not provided a precise definition of impact investing. By means of a longitudinal thematic analysis of literature, Agrawal and Hockerts (2021) show that many terms present similar features with impact investing, which has caused confusion among scholars and practitioners. In particular, just like Höchstädter and Scheck (2015) and Carè and Wendt (2018), they point out that the terms "social finance" and "impact investing" are very similar concepts and underline that "social finance" and "social impact investing" are synonyms. They sustain that the "social impact investing" is an "impact investing" initiative with social scope. Agrawal and Hockerts (2021) compare the meaning that authors attribute to "social responsible investing" and "impact investing". The "social responsible investing" refers to profitable investments that involve many stakeholders in projects with high ESG (Environmental, Social and Governance) factor, that do not necessarily produce a positive social value (Geobey & Weber, 2013; Weber, 2016). Conversely, the "impact investing" has the aim to obtain a measurable and positive social

value and positive financial returns (Brandstetter & Lehner, 2015; Carè & Wendt, 2018). They conclude that "social responsible investment" and "impact investing" are different concepts, because they give different relevance to the social results of investment (Agrawal & Hockerts, 2021; Carè & Wendt, 2018). Agrawal and Hockerts (2021) support the statements of Porter and Kramer (2006) that consider the concepts of "venture philanthropy" and "impact investing" to be very similar. Based on this, we have decided to exclude papers that expressly refer to "social responsible investment". The purpose of this chapter is to identify the main research steams in the field of "social impact investing" and propose future research agendas.

Social Impact Bonds (SIBs) are the most innovative financial instruments in the field of impact investing (Carè & Wendt, 2018). The literature review of Broccardo et al. (2020) showed that social impact bonds will be a key subject in the years to come. SIBs have recently piqued the interest of governments, investors and researchers. They have also been known as Payment for Success bonds or Pay for Benefit bonds, even though such innovative financing instruments are not real bonds in financial terms, but rather contracts on future social results (Clifford & Jung, 2016). Therefore, SIBs involve contracts in which socially motivated investors, like high-net-worth individuals, and institutional investors provide working capital to social sector service providers, allowing them to scale up high- impact social programs. Investors receive financial returns in relation to the social impact achieved and they do not obtain payback if the social goals have not been achieved. This mechanism transfers the risk of not achieving social goals from public administration and taxpayers to investors. SIBs constitute forms of collaboration where commissioners, providers and investors share the risk and pool knowledge and experience in the delivery of services (Maier & Meyer, 2017). SIBs demand commissioners, investors and providers to work collaboratively and flexibly, rather than in the classic public procurement manner (Warner, 2013). Figure1 illustrates the operating scheme of SIBs and the relationships among the various stakeholders. The public commissioner seeks a solution to a specific social problem. The solution is associated to a measurable criterion on the basis of which the commissioner establishes the payment. The provider delivers the social service, which is usually a social enterprise (Carè & Wendt, 2018). The entire operation is organized by an advisor, who enables the impact investor to finance the operation in total transparency. Finally, an independent evaluator certifies the achievement of the predetermined outcomes (Chiappini, 2017; Scognamiglio et al., 2019).

The first SIB in history was implemented to finance a rehabilitation program to reduce the recidivism rate of prisoners in the Peterborough area (UK, 2010). Since then, SIBs have spread all over the world; in fact, today, 137 SIBs are present globally for USD 440 million of capital raised, but only 34 are completed (Impact Bond Database, 2019).

Applications of SIBs span several social areas ranging from employment to education and social

welfare (Arena et al., 2016). The achievement of a pre-determined social outcome is key for the success of a SIB, because it triggers payout to the impact investors involved in such schemes. The risk of not achieving the desired outcome is labeled social risk (Weber, 2016).

The risk issue represents one of the main controversial points related to the use of SIBs on a larger scale and, at the same time, it is still underexplored (Scognamiglio at al., 2019; Carè & Welch, 2018). It is clear that the complexity of the SIBs model increases the probability of SIBs failing.

Thus, the study sought to explore the relationship between social risk and financial return within the context of SIBs, by clustering analysis. In more detail, I implement k-mean cluster analysis (Pham et al., 2004) in order to obtain three homogeneous clusters of completed 34 SIBs. Within these clusters, the SIBs present a similar profile of risk-return.

Figure 1 - SIB model
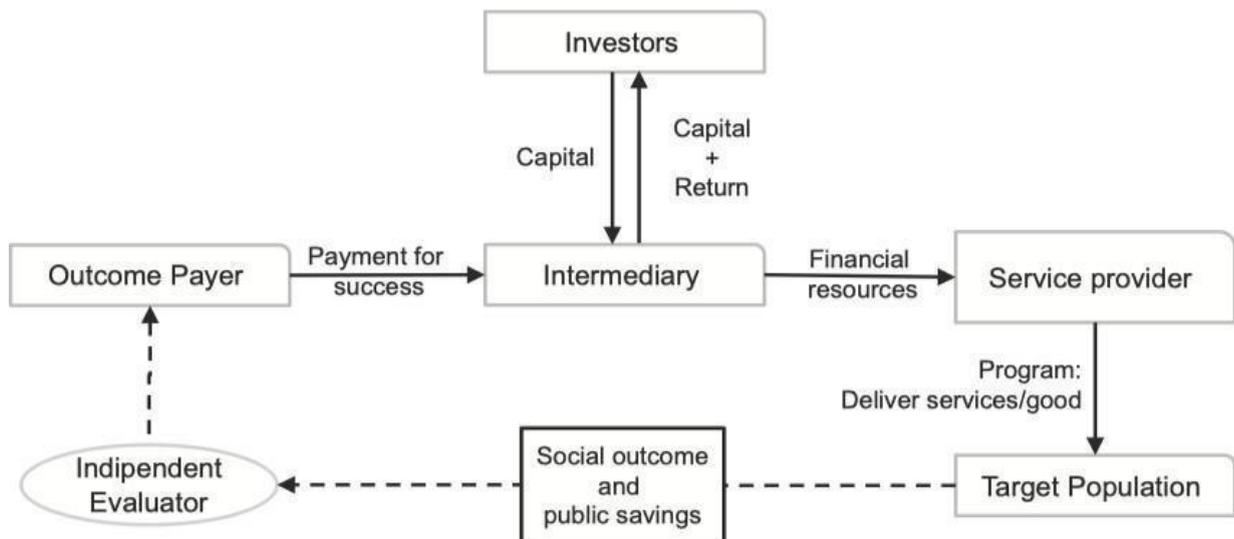
Source: Carè et al. (2020)

2   Literature review

2.1 Social Impact Bond and performance

SIBs represent one of the most debated form of financial innovation within the impact investing field (Fraser et al., 2016). Similar to impact investors, SIB investors expect both social and financial returns (O'Donohoe et al., 2010; Glänzel & Scheuerle, 2016).   Financial returns are generally, but not exclusively, expressed in terms of Internal Rate of Return (IRR) that may be fixed or variable in relation to the social performance achieved with the SIB intervention. Social returns are expressed in terms of pre-determined levels of expected social impact. An independent evaluator measures the achievement of these thresholds, which determine outcome payments to investors. Financial returns are obtained by the SIB investors, only if social impact has been achieved (Nicholls & Tomkinson, 2015a). Thus, the central element to the concept of social risk is whether social outcomes are achieved.

This type of risk has been recently explored by academics and practitioners in the impact investing field. More in detail, there is not a common understanding of the concept of social risk1 in the impact investing literature (Lehner, 2016). Recent contributions suggested that social risk is expressed in terms of not reaching the intended impact (Brandstetter & Lehner, 2015) or as the likelihood that a given allocation of capital will generate the expected social outcomes irrespective of any financial returns or losses (Nicholls & Tomkinson, 2015b).

In the specific context of SIBs, the term social risk is used to identify the possibility that the expected social outcome is not achieved (Disley & Rubin, 2014; Gustafsson-Wright et al., 2015; Arena et al., 2016; Maier & Meyer, 2017) due to unpredictable events (Chiappini, 2017) that may occur during the implementation of SIBs. However, the financial architecture of SIBs is peculiar and thus requires a more in-depth investigation of financial and social risk. In this vein, the systematic study of Scognamiglio et al. (2018) explored and segmented the concept of social risk in the specific field of SIBs. This study provided identification of social risk factors that could affect the success of a SIB. Scognamiglio et al. (2018) identified those social risk factors by performing literature review and organizing them in a preliminary model, based on a methodology introduced by Serrano-Cinca and Gutiérrez-Nieto (2013).

2.2 Cluster analysis

Cluster analysis is, by excellence, an unsupervised learning technique, that identifies the complex relationships between variables, without imposing any restriction. Consequently, the initial dataset

doesn't need the distinct specification of a target variable (the dependent variable) and, respectively, of predictor ones (independent variables). All variables have the same importance, because the analysis's goal is not to predict a certain value, but instead to identify the presence of specific patterns or correlations among variables, to include the different variables or cases into more homogenous groups.

Unlike other data mining techniques, we don't have to establish a predetermined set of classes, or to introduce a training stage based on a collection of past data. The entities' clustering is based exclusively on the similarities identified in the variables' structure. According to Romesburg (2004), this technique represents "a mathematical microscope for looking at the relations of similarity among a given set of objects. It cannot be used for making statistical inferences about these relations to a larger population. Any inferences a researcher makes by studying the tree are made by using reasoned analogy rather than by using formal statistical methods".

The cluster analysis is different with the factor analysis, because in the clustering analysis group's objects, meanwhile in the factor analysis is primarily concerned with grouping the variables. In additional information, factor analysis makes the grouping based on the patterns of variation (correlation) in the data whereas cluster analysis makes grouping on the basis of distance (proximity) (Müller & Hamm, 2014). Then, cluster analysis focuses on the examination of the interdependencies between variables, its finality consisting in gathering similar entities into more homogenous groups, named clusters.

Unlike other empirical methods of analysis, this method produces acceptable results even with small samples. In fact, Müller and Hamm (2014) identifies a rule of thumb equal to $2 \wedge k$, where k are the attributes. Within the field of the methods of cluster analysis, the most used is the non-hierarchical k-means, because it does not require any hypotheses on the data distribution (Pham et al., 2004).

The K-means algorithm gives the simple or flat condition, because it just gives a single set of clusters, with no particular organization or structure within them. But it can be used to the cases for more distantly data related to the others. So hierarchical clustering is the opposite of it.

The K-means algorithm is a popular data clustering algorithm. To use it requires the number of clusters in the data to be pre-specified. Findings the appropriate number of clusters for a given data set is generally a trial-and-error process made more difficult by the subjective nature of deciding what constitutes correct one. A new method to select the number of clusters for the K-means algorithm has been proposed in the paper. The new method is closely related to the approach of K-means clustering because it takes into account information will be the mirror of the performance of the algorithm. The proposed method can suggest multiple values of K to users for cases when different clustering results could be obtained with various required levels of detail (Pham et al., 2004).

Since, cluster analysis is an exploratory technique, allows the comparisons between all SIBs in the

sample, classifying them into a certain group, according to the similarities identified. The core principle of this technique is that of minimization of the variance between the components of a group, simultaneously with the maximization of the variance across groups.

3   Research Methodology

My research hypothesis is that is possible to group the SIBs on basis of social risk variables that are identified by Scognamiglio et al (2018). These groups should show different mean IRR.

Cluster analysis was used as a based method to reach the goal of this study. To get the number of clusters, this study does several repeated attempts to see the difference in the means distance between the initial of each cluster. K-means clustering was used in this research to get   the detail of characteristics for each cluster. Discriminant analysis was also used in this study to assess the capacity of the variables to predict the classification of enterprises within clusters. To make sure that the result was appropriate, it used canonical discriminant analysis for the verification of the data. The attributes employed are the social risk factor (Table 1) and financial return.

I consider the social risk factors of Scognamiglio et al. (2018) as social risk attributes. There are three risk factors: program process, players and social outcome evaluation. Each factor is divided into several sub-factors. Below is a brief description of how factors and evaluation criteria are composed. As for the program feature, the duration of the program is directly proportional to the social risk (Dorfleitner et al., 2021). Instead, the presence of a pilot phase reduces the social risk, because it is possible to redefine the social outcomes on the basis of experimental data (Dear et al., 2016).
Regarding the players, the presence of specialized operators reduces the social risk.

As for the social outcome evaluation, the sub-factors that reduce social risk are a small number of outcome evaluations. Table 2 shows the social risk factors values of the score model of Scognamiglio et al. (2018).

Table 1 - Social risk factors

Social risk factor	Social risk sub-factor	Options
Program process	Program features	Duration of program
		Pilot phase
		Empirical evidence
		Policy variation
Players	Service provider	Number of service providers
		Worker/target number relation
		Number of similar projects developed
		Years of experience of the service provider
	Intermediary	Intermediary present
		Years of experience
	Independent evaluator	Independent evaluator present
Social outcome evaluation	Evaluation	Methodology
		Number of outcomes

Source: The table reports the social risk variable identified by Scognamiglio et al. (2018)

Table 2 - Social risk factor values

Risk category	Risk factor	Sub-factor	Options	Score
Program process	Program features	Duration of program	More than 5 years	1
			From 3 to 5 years	2
			Less than 3 years	3
		Pilot phase	Yes	1
			No	2
		Empirical evidence	Evidence on large scale	1
			Evidence on small scale	2
			No evidence	3
		Policy variation	Yes	1
			No	2
Players	Service provider	Number of service providers	From 1 to 3	1
			From 3 to 5	2
			More than 5	3
		Worker/target number relation	One-to-one	1
			Not more than one to ten	2
			More than one to ten	3
		Number of similar projects developed	More than 10	1
			From 5 to 10	2
			Not more than 5	3
		Years of experience of service provider	More than 10	1
			From 5 to 10	2
			Not more than 5	3
	Intermediary	Intermediary present	Yes	1
			No	2
		Years of experience	More than 10	1
			From 5 to 10	2
			Not more than 5	3
	Independent evaluator	Independent evaluator present	Yes	1
			Not	2
Social outcome evaluation	Evaluation	Methodology	Experimental design that controls for both observed and unobserved variables	1
			Live but non- experimental counterfactual	2
			Constructed counterfactual with no live control	3
			Multiple	4
			No counterfactual	5
		Number of outcomes	From 1 to 3	1
			From 3 to 5	2
			More than 5	3

Source. The table reports the social risk factor value of Scognamiglio et al. (2018)

4 Data analysis

4.1 Samples

I used the entire population of 34 SIBs that were concluded by 2020. The sample was not randomly selected. In more detail, SIBs must be closed, and they have to comply with the requirements of the transparency and verifiability of information.

The data was provided by the Government Outcomes Lab database. For each SIB, the risk factors indicated by Scognamiglio et al. (2018) were calculated. Specifically, I calculated: Program Process, Players, and Social outcome evaluation.

4.2 Findings

In this section, I will explain the characteristics of the three clusters which are based on 14 attributes, that explain the profile risk-return of SIBs. Table 3 reports the minimum distance between initial clusters as a criterion to select the best number of clusters (Zapata et al., 2018). The values of Table 3 sustain that the groups could be three, because after three groups the minimum distance decreases slowly (Zapata et al., 2018). Table 4 reports the means and standard deviation of attributes for the three groups. The cluster analysis shows a direct relationship between the financial return (IRR) and the social risk factors. The 3 clusters present differences in terms of financial return and social risk. Cluster 1 has the lowest level of social risk and the lowest financial return (IRR = 0.03%). Social risk is broken down by the series many factors (Scognamiglio et al., 2019). Cluster 1 values are the lowest in the sample. is result seems to be in line with the efficiency of the markets. The values of clusters 2-3 (the riskiest clusters and with the highest yields) have very close financial returns and social risk factors values, which makes economic interpretation of the results difficult.

In conclusion, the social impact bond market appears to be efficient, but these findings cannot be considered definitive as the size of the market is too limited. The validation procedure is necessary for the reliability of the results obtained from the cluster analysis (Sharma & Wadhawan, 2009). The author calculated the Wilk's Lambda discriminant analysis to test if the means of groups are different (Pham et al., 2004; Büyüköztürk & Çokluk-Bökeoğlu, 2008; Garson, 2012). The values of lambda are between 0 and 1 and small lambda values identify that group averages are different (Büyüköztürk & Çokluk-Bökeoğlu, 2008; Garson, 2012). In our case, Wilk's lambda is 0.032 (p-value 0.000), than the means of groups are different.

Table 3 - Minimum distance criterion

Cluster	Minimum distance between initial cluster
2	9.790
3	8.050
4	8.050
5	7.950
6	7.044
7	6.950
8	6.944
9	6.850
10	6.843

Source: our elaboration

Table 4 - Characteristics of cluster based on mean and standard deviation

Attributes	Group 1		Group 2		Group 3	
	mean	s.d.	mean	s.d.	mean	s.d.
IRR	0.03%	0.02%	0.045%	0.04%	0.05%	0.04%
Duration of program	5	2	6	2	7	2
Pilot phase	1	0.5	1	1	0	1.25
Empirical evidence	3	0.5	2	1	1	1.25
Policy variation	2	0.75	1	1.25	1	1.5
Number of service providers	6	0.75	3	1.25	2	1.5
Worker/target number relation	5	0.5	2	1	1	1.25
Number of similar projects developed	3	0.5	2	1	2	1.25
Years of experience of service provider	6	0.75	2.5	1.25	2	1.5
Intermediary present	3	0	2	0.5	1	0.75
Years of experience	6	0.75	3	1.25	2	1,5
Independent evaluator present	1	1	1	0.5	0	0.75
Methodology	2	0.5	4	1	5	1.25
Number of outcomes	5	1.25	3	1.2	2	1

Source: our elaboration

5   Conclusions

The objective of this paper is to apply quantitative methodologies to the context of Social Impact Bonds. Starting from the social risk factor of Scognamiglio et al. (2018), I measured the relationship between social risk and financial return by adopting the cluster analysis. In particular, social risk factors identified by Scognamiglio et al. (2018) were used as attributes to create the clusters. The results showed an inverse relationship between risk and return. Indeed, the clusters with higher average values in social risk factors have a higher IRR. The results so far obtained are encouraging but present methodological limitations that are insurmountable at the moment. A very small data sample was used, which nevertheless represents the entire population of the concluded SIBs. For further research, more reliable evaluations could be obtained by resorting to larger samples.

Moreover, while several scholars had pointed out the main characteristics of SIBs, their enabling factors and the main opportunities that come from their implementations, it had remained unclear how to evaluate their level of social risk. I have attempted to address this knowledge gap through this work. At the same time, this work contributes to the field of alternative methodological approaches for sustainable finance.

From a more practical point of view, this work could potentially contribute to the development of the entire SIB market by allowing both practitioners and policymakers to understand the areas from which uncertainty arises and thus help the development of more focused risk management practices and more standardized SIBs schemes.

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The influence of communicating a vaccine-related adverse event (Vre) on the propensity to get vaccinated. The case of Camilla Canepa's death in Italy

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Abstract

The aim of this paper is to investigate the influence of communication of vaccine-related event on individuals' propensity to get vaccinated. Applying the methodology of the event study, the case of the news of the death of Camilla Canepa, a young Italian girl, was considered as an adverse event related to the COVID-19 vaccine in the analysis conducted. The results show that, despite the availability of vaccine doses, an increasing trend of vaccine administration was observed in the pre-death news period and a decreasing trend in the post-death news period.

Keywords – Health communication; Vaccine-related event; Event study

Paper type – Academic Research Paper

Sommario

Lo scopo del presente studio è quello di analizzare gli effetti della comunicazione di un evento correlato alla somministrazione di vaccino sulla propensione degli individui a farsi vaccinare. La metodologia dell'event study viene applicata al caso della notizia del decesso di Camilla Canepa, una giovane ragazza italiana, considerato come evento avverso correlato al vaccino contro il COVID-19. I risultati mostrano che, nonostante la disponibilità di dosi di vaccino, vi sia stata una tendenza crescente della curva della somministrazione del vaccino, nel periodo antecedente alla notizia del decesso, e una tendenza decrescente, nel periodo successive alla notizia del decesso.

Parole chiave – Comunicazione sanitaria; Evento correlato al vaccino; Event study

Tipo di articolo – Articolo accademico

1   Introduction

The current paper aims to investigate the influence of scientific communication on individuals' choices in the field of health. In particular, it analyzed the effects that a particular news could have on the decision to undergo the anti-COVID-19 vaccination. In the specific case, the news of the death of the eighteen-year-old Italian Camilla Canepa, which took place on June 10, 2021, following a cerebral thrombosis that occurred some after receiving the AstraZeneca vaccine, was chosen as an "event" in the analysis.

Considering the study's aim, the event study methodology was applied. Traditionally, this scientific method is used to evaluate the effects of a particular event on the share price trend of listed companies, i.e. to consider the measure of the average change in the share price that occurs following the announcement of an important "event" (Binder, 1998). Event studies have been used extensively in the fields of accounting, economics, and finance to evaluate the effect on the stock price of a major company announcement (MacKinlay, 1997; Thompson, 1995). More recently, organizational researchers applied this methodology also in research focused on the study of managerial decisions, such as changes in corporate governance and on decisions involving corporate social responsibility (CSR) (Murashima, 2020; Qiu et al., 2021).

From literature review, emerged that several contributions applied the event study methodology to analyze the effects of certain events concerning the COVID-19 pandemic. Sayed and Eledum (2021) studied the short-term response of the Saudi stock market to the COVID-19 outbreak, in this case, the event study methodology was applied to calculate abnormal returns for trading days following the announcement of COVID-19 in both China and Saudi Arabia. In another contribution, the event study method is employed with the aim of verifying the impact of the COVID-19 pandemic on the equity returns of a sample of listed companies in the energy sector operating in Greece, the event study approach made it possible to demonstrate that the pandemic has affected the returns of most listed energy companies (Polemis & Soursou, 2020). In their study, Maneenop and Kotcharin (2020) examine the short-term impact of the outbreak on the global airline industry using event study methodology to determine the effects on airline stock returns following three major announcements from the World Health Organization regarding the spread of COVID-19. In another research, some scholars have applied event analysis to determine the possible effects of events related to the protests for the "George Floyd case" and the increase in COVID-19 infections (Valentine, R. et al., 2020).

Researches applying event study method to determine correlations between events concerning adverse reactions to the anti-COVID vaccine and the propensity of individuals to receive this vaccine belong to a further line of research. In one of the studies from this strand, David Comerford (2021) examined, in an event analysis, the effects of the decision of the UK regulatory authority not to

administer the Oxford AstraZeneca vaccine to people under 30, proposing a vaccine alternative. The decision became front page news, and online searches questioning vaccine safety increased exponentially; in this case, the study of the event dealt with examining the effects of the news on the attitudes of the British with respect to the anti-COVID-19 vaccine. Analysis of data collected the day after the story hit the front page showed no change in intentions or attitudes in the sample as a whole, nor in the subgroups considered most affected by guidance from UK regulators (people under 30 and people between the ages of 30 and 40).

The present paper fits into this last line of research, the research objective being the analysis of the influence of scientific communication on the choices of individuals in matters of health, considering the influence of a particular piece of news concerning adverse events attributable to the anti-COVID-19 vaccine on the decision to undergo this vaccination. The interest is therefore to study the distribution of the number of vaccinations performed on a given day before and after the particular event considered, i.e. the death of the eighteen-year-old Italian Camilla Canepa, which occurred on 10 June 2021, following a cerebral thrombosis which occurred some after receiving the AstraZeneca vaccine.

2   Background

2.1 Vaccines: the role of health communication

Especially when it comes to health, communication must be used wisely, with the right tones, the appropriate means, and particular attention to the target it is addressed to and the purpose it wants to achieve. A very interesting definition of health communication is the one proposed by the communication expert Renata Schiavo (2013, p. 8): "Health communication is a multifaceted and multidisciplinary approach to reach different audiences and share health-related information with the goal of influencing, engaging, and supporting individuals, communities, health professionals, special groups, policymakers and the public to champion, introduce, adopt, or sustain a behavior, practice, or policy that will ultimately improve health outcomes".

In the COVID-19 pandemic, certain aspects of communication have also contributed significantly to polarizing the debate on the origin and nature of the virus and then on vaccines. Starting with one of the most important: the language used by experts and journalists. Using war metaphors and terms from the military lexicon, for example, did nothing but exacerbate the feeling of rejection that many have had and force even further the delicate balance between public health protection and respect for individual freedoms. In an article published in *Nature Italy*, Massimiano Bucchi (2021) focused on the importance

of mutual trust between citizens and institutions, during the COVID-19 pandemic, highlighting that, in many countries, including Italy, politicians and experts described public opinion as hostile, skeptical and ignorant. The author argued for the need for clear and open communication by the institutions, which nurtures and strengthens responsible behaviours by citizens, instead of accentuating distrust and paternalism.

Communication regarding vaccines, in Italy as in the rest of the world, has always been a minefield, in which every misstep can cause a real "social explosion". It is important to correctly manage communication on such an important topic in general, and so urgent in particular (Stockwell & Fiks, 2013; Lewandowsky et al., 2021; Schiavo, 2020; Rzymski et al., 2021). To this end, it is also necessary to understand the doubts and fears of those who are not against vaccines a priori, and to listen to the motivations of those who, on the other hand, reject them a priori (Chou & Budenz, 2020; Tsai et al., 2021; Wei et al., 2022; Kim et al., 2022). Walking on this thin line without losing balance and without losing sight of the objective of safeguarding public health is not an easy undertaking, but it is certainly a skill that those involved in communication currently cannot fail to acquire (Gabarda & Butterworth, 2021; Breckenridge et al., 2022; Murphy, 2020).

2.2 Communicating vaccine-related events (Vre)

In the present study, the definition of vaccine-related event (Vre) reported is that by World Health Organization (WHO), according to which Vre is an "event related to vaccines that can negatively affect a vaccination programme" (WHO, 2013, p. 11). WHO, in the guide *Vaccine Safety Events: managing the communication response,* reported six types of Vre: "i) adverse event following immunization (AEFI); ii) a new study or experimental data related to vaccines or immunization; iii) a report in the press, or a local rumor about vaccines; iv) the temporary suspension of a vaccine; v) vaccine recall; vi) the replacement of a vaccine" (WHO, 2013, p. 12). The guide not only describes the most frequent types of Vre but also provides strategies and tools for solving communication problems related to vaccine safety. The collection of this information is necessary to classify Vre, which according to the WHO guide can have three levels of impact: low, medium, high, each of which provides for a different communication scenario (WHO, 2013).

Considering the large amount of information necessary to manage similar events in the best possible way, it is advisable to "organize communication as much as possible 'in peacetime', planning response activities, identifying contacts who can act as institutional spokespersons, defining the practical aspects of communicative response, response methods and timing, communication channels, etc." (Fiacchini et al., 2018, p. 98). On this topic, several contributions have been provided in the literature. Renn and

Levine (1991) focused on credibility and trust as key factors for effective risk communication. Wang et al. (2020) described the risk perception and behavioral responses associated with risk communication, Hagen et al. (2020) instead considered the role of social media in promoting an effective communication efforts under crisis conditions. Furthermore, Dubé et al. (2020) focused on optimizing the communication material, while Zheng et al. (2022) also focused on the doctor-patient communication relationship.

3   Methodology

3.1 Data gathering

The current study was aimed at investigate the influence of scientific communication on individuals' choices in the field of health. By applying the Event Study methodology (Austin, 1993), the effects that a particular piece of news could have on the decision to undergo anti-COVID-19 vaccination were analysed. The news chosen as an "event" in the present analysis is that of the death of the eighteen-year-old Italian Camilla Canepa, which took place on June 10, 2021, following a cerebral thrombosis that occurred some after receiving the AstraZeneca vaccine.

Data used to conduct this analysis was gathered from two main sources:

- with reference to the daily number of vaccine administrations available in Italy, the data was found online, on the official website of the newspaper *Il Sole24ore* (Il Sole24Ore website);
- with reference to the number of vaccines made available to the various regional ASLs, the data was found online, on the GitHub.com website (GitHub website).

4.   Data analysis and statistical analysis results

4.1 Descriptive analysis

From the descriptive analysis (see Table 1), emerges that in the post-news case we find one more observation that corresponds to the day of the event. The descriptive analysis reveals that the administrations are on average and median more numerous following the news. The first approach is to run a test to check whether the distribution of the variable in the two times is different or not. The nonparametric Mann-Whitney test is used because the condition of normality of the data is not satisfied. The use of a non-parametric test, in fact, allows not to make assumptions on the parameters of the population as long as three conditions are met:

- at least ordinal dependent variable;
- only two groups;
- independence between observations.

It is immediate to verify that in the case under analysis they are all satisfied.

Table 1 - Descriptive analysis

Administrations

0	N.	Valid	61
		Missing	0
	Average		450855.92
	Median		465062.00
	Mod.		202488[a]
	Std. Dev.		102114.945
	Min		202488
	Max		632924
		25	377544.00
	Percentiles	50	465062.00
		75	529126.50
1	N.	Valid	62
		Missing	0
	Average		523183.26
	Median		557160.00
	Mod.		259727[a]
	Sdt. Dev.		83309.107
	Min.		259727
	Max		633995
		25	467072.00
	Percentiles	50	557160.00
		75	573523.50

a. There are more modes. The smallest value is displayed.

Source: our elaboration

4.2 Hypothesis test

In the behavioral science field, the Mann-Whitney U test is one of the most commonly used non-parametric statistical tests (Nachar, 2008), being frequently applied to compare localization measures for two samples where the assumption of normality is complicated (Rosner & Grove, 1999). The Mann-Whitney test has the null hypothesis that the distribution of the number of administrations is the same before and after the occurrence of the event; the empirical evidence represented by an extremely small p-value contradicts this hypothesis. It should be specified that the test, based on the

data, states that the number of vaccinations is different between the pre and post news but not that this is exclusively due to knowledge of it. The analysis is based on the data available but many variables are missing in order to have a complete picture of the factors that influence the administrations on a given day. Having ascertained that the two distributions are significantly different, we proceed with a multiple linear regression. The dependent variable Y is the number of administrations and the independent variables are X1: the day, X2 : whether we are in the pre-news (X2 = 0) or in the post (X2 = 1) and the interaction between the two variables X3 = X1 * X2 . The latter is inserted to observe a joint effect between the event and the day of administration, it is different from 0 if and only if X2 is also different (Table 2).

Table 2 - Hypothesis test

	Hypothesis null	**Test**	**Sign.[a,b]**	**Decision**
	Hypothesis test recap			
1	Distribution of administrations is the same on pre-post categories	Mann-Whitney U test with independent samples	<.001	Reject the null hypothesis

a. The significance level is .050.
b. The asymptotic significance is displayed.

Source: our elaboration

4.3 The model

The R2 coefficient, the percentage of variability of the dependent variable explained by the model, is on the borderline between low and modest. We note that all independent variables are statistically significant (Sign. <.001).

The model is: Y = β0 + β1X1 + β2X2 + β3 X1* X2.

In the period preceding the event (i.e. when X2 is equal to 0) the regression line will be Y = β0 + β1X1. The intercept is the number of vaccine administrations we expect on day 0, approximately 310243 administrations. The coefficient of the day variable tells us that for each additional day we expect an average increase of about 4546 administrations in the period before the event.

In the scenario of the occurred event, the straight line becomes: Y = β0 + β1X1 + β2 + β3 X1 = β0 + β2 +(β 1 + β3)X1 = 743003.575 -2376.436 *X1.

As emerged from the descriptive analysis, we expect a higher average in administrations on day 0 of the post-news scenario. It is interesting to note that in the post-event period, as the days go by, there is a

decrease in the number of administrations, specifically, for each day that passes, there is a decrease of approximately 2377 vaccinations (Table 3, Table 4).

Table 3 - The model^a

Model	R	R-squared	R-squared adapted	Standard error of estimation
1	.740[b]	.547	.536	67849.137

a. Dependent variable: vaccine administration.
b. Predictors: (constant), interaction, time, pre-post (0=pre news of the death, 1=post news of the death).

*Source: our elaboration*

Table 4 - Coefficients^a

Model	Non-standardized coefficients		Standardized coefficients	t	Sign.
	β	Standard error	β		
1 (Constant)	310242.866	17590.223		17.637	<.001
Pre-post (0= pre news, 1=post news)	432760.709	48656.304	2.182	8.894	<.001
Time	4535.905	493.399	1.624	9.193	<.001
Interaction	-6912.341	689.415	-3.343	-10.026	<.001

a. Dependent variable: vaccine administration.

Source: our elaboration

Finally, the graph of the trend of the number of vaccinations administered in the days under analysis is shown, in Figure 1, with the related interpolation lines. We note what emerged from the multiple linear regression, an increasing trend of administrations in the pre-news period and a decreasing trend in the post-news period.

Figure 1 - Trend of vaccinations (pre-post event)
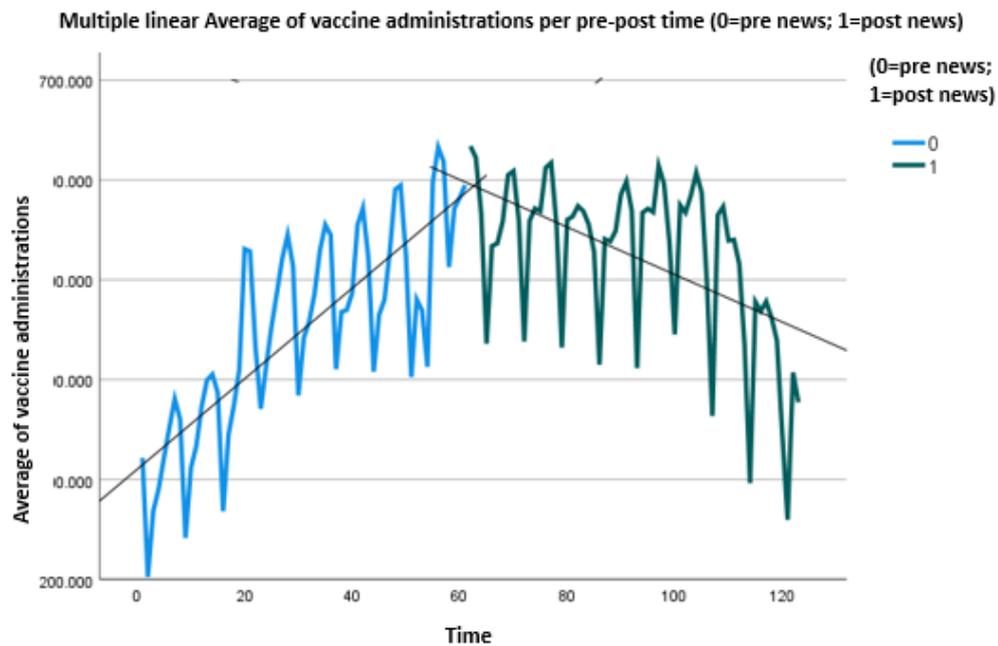
Source: our elaboration

5   Conclusions

The decision to undergo vaccination, like any other decision concerning health, is likely to be influenced by the risks and benefits perceived by each individual at the time of the choice. Factors that can influence the choice to get vaccinated are various, in quality and quantity. They can derive from the perception of the benefits that the vaccine would bring to public health, or, as more often happens, from that of the risks that the vaccine would bring to individual health. In the case of the COVID-19 vaccines, many circumstances that occurred before their discovery contributed to creating hostility, starting with doubts about the artificial nature of the virus and above all with suspicions about the possible "leakage" from the Chinese laboratory. The relief with which the anti COVID-19 vaccines were received in Italy, seen as the end of the nightmare of quarantines and restrictions, was soon replaced by more or less reasonable doubts about the nature and consequences of immunization. The phenomenon of vaccine hesitancy has been discussed, noting that most people are more timidly hesitant than stubbornly wary of vaccines. Both undecided and against would have a chance to make a conscious choice so delicate and so full of consequences for everyone's health: true information adequately

communicated. During the current pandemic, many factors of weakness have emerged in scientific communication regarding the new coronavirus and its vaccines, such as the arrogance not to admit uncertainty, lack of empathy and the choice of a language that makes us feel at war. Or rather, under siege.

In terms of vaccines, it is particularly important to adequately manage the communication of a related vaccine event, especially when it is an adverse event. Just as adverse reactions and deaths can negatively affect people's propensity to get vaccinated, so a music icon who gets vaccinated on live television can be instrumental in transforming the indecision of millions of people into confidence. If an adverse case occurs in the midst of a vaccination campaign, it is very probable that those who were previously against the vaccine are even more convinced that they have made the right choice by not getting vaccinated, but it is certain that those who were previously undecided will have one more element. and very heavy, to add to its list of cons. A particularly delicate Italian Vre was the death of Camilla Canepa, an 18-year-old girl who had participated in an Astrazeneca open day two days before her death, caused by a cerebral thrombosis attributable to the vaccine. In consideration of the power of news to directly or indirectly influence individual behaviors and choices, the news of Camilla Canepa's death was taken as a reference for an event study, to determine the existence or otherwise of a decrease in the number of vaccinated after this news broke. With the awareness of the impossibility of taking into account all the variables that could have caused a change in the number of vaccinations carried out (first of all the slowdown phase of the vaccination campaign due to the approach of summer), a comparison was made between the number of vaccinated 60 days before and 60 days after the eighteen-year-old's death. Taking into account the daily availability of vaccine doses, an increasing trend of vaccine administration was observed in the pre-news period and a decreasing trend in the post-news period.

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