BANCA D'ITALIA
EUROSISTEMA

Annual report on sustainable investments and climate-related risks

March 2023

Year 2022

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SYMBOLS AND CONVENTIONS

Unless otherwise specified, Bank of Italy calculations; for Bank of Italy data, the source is omitted.

In the tables:

– the phenomenon does not exist;

.. the value is nil or less than half of the final digit shown.

OVERVIEW

This Report describes the governance structure, strategy and process that the Bank of Italy uses to manage its investments and, in particular, to take account of sustainability and climate-related risks. The portfolios analysed are: the financial portfolio, namely financial assets not related to monetary policy, other than foreign currency reserves; the foreign currency reserves portfolio; and the Supplementary Pension Fund for Bank of Italy employees hired since 28 April 1993. At the end of 2022, these portfolios were worth a total of €169 billion.

The Report is inspired by the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) and the 'Guide on climate-related disclosure for central banks' of the Network for Greening the Financial System (NGFS).[1]

In continuity with the previous Report, this document fulfils two of the commitments taken on by the Bank in 2021, with the publication of the Responsible Investment Charter: to regularly publish information on the results achieved and on the methodologies applied to integrate environmental, social and governance (ESG) criteria into the allocation of its investments and into risk management and to contribute to the dissemination of the culture of sustainable finance in the financial system and among the public.

With this Report, the Bank also puts into practice the commitment it has taken on, together with the Eurosystem central banks, regarding the regular dissemination of information on the climate-related risks for non-monetary policy portfolios. It is an initiative that has called for very close collaboration among the central banks to find sources of common data and to draw up the methodology for shared reporting.

There is a chapter for each of the four areas identified by the TCFD: governance; strategy; risk management; and metrics and targets.

Governance mechanisms. – The governance arrangements adopted by the Bank for its investment choices remained unchanged in 2022. The following are described: the phases in the investment process into which sustainability profiles and climate-related risks are integrated; the functions tasked with the proposals and the bodies that oversee their approval; how the information on sustainability profiles and climate-related risks is communicated to the Bank's senior management; and the role played by the Climate Change and Sustainability Committee, which coordinates and steers the Bank's work on all ESG issues.

Strategy. – The Bank's investment strategy has combined financial and sustainability criteria since 2019. With its 2023-2025 Strategic Plan, the Bank will further strengthen

[1] NGFS, 'Guide on climate-related disclosure for central banks', December 2021.

its commitment to integrating the two aspects, thereby contributing to improving the management of sustainability risks and to combating climate change.

The Bank has decided not to adopt investment strategies based simply on excluding issuers from economic sectors with the biggest carbon footprint, and instead gives priority to the firms in each sector that are most committed to the climate transition. To this end, the models for selecting corporate equity and bonds have been revised in order to take account of firms' decarbonization commitments.

Two new activities were undertaken last year. Firstly, a thematic portfolio was set up, focusing on euro-area firms whose production allows them to contribute more to the transition towards a low-carbon economy. A constructive dialogue was also begun with the firms responsible for most of the greenhouse gas emissions associated with the Bank's equity portfolio, in order to look into their transition plans and to illustrate the Bank's sustainable investment strategy.

With reference to bonds issued by supranationals, sub-nationals and agencies (SSAs), the sustainability strategy deemed most suitable is that of thematic investment, by means of the gradual expansion, within the financial portfolio and the foreign currency reserves, of portfolios of green bonds.

The strategies presented draw on both the Bank's research and its participation in the national and international debate, particularly within the Eurosystem and the NGFS.

Risk management. – The risks linked to sustainability can affect the financial risk and portfolio yield profiles;[2] they also impact people's well-being, financial and price stability, the actual and potential growth rate of the economy, and therefore the institutional objectives of central banks. This is why the Bank is integrating climate-related and sustainability factors into its models for managing portfolio risks, starting with the strategic allocation phase. The selection of investments takes its cue from the results of a model that minimizes any capital losses that might occur, over a ten-year horizon, in the most adverse economic and financial scenarios, while, through specific constraints, improving (or at least maintaining) the ESG score of the portfolios year by year and gradually reducing the weighted average carbon intensity of investments in private-sector issuers.

In the subsequent investment selection phase, the integration of sustainability criteria takes place in different ways for each financial asset class. Specifically, for direct investment in corporate equity and bonds, the goal is to improve the ESG score and the climate metrics, compared with both the past and with the benchmark. The control of climate risk takes place bearing in mind not so much the level of historical emissions, but rather how it has changed and what firms' transition plans are. This is in the belief that this is the most appropriate way to monitor transition risk and that limiting the focus on

[2] E. Bernardini, I. Faiella, L. Lavecchia, A. Mistretta and F. Natoli, 'Central banks, climate risks and sustainable finance', Banca d'Italia, Questioni di Economia e Finanza (Occasional Papers), 608, 2021.

the level of past emissions would run the risk of penalizing companies in carbon-intensive sectors when they try to raise the necessary capital to support these plans.

Metrics and targets. – The metrics analysed are for both climate risks and other sustainability risks. As far as the financial portfolio is concerned, which is the biggest in terms of size (€134 billion at end-2022), the evolution in the metrics confirms the positive results of the last few years. The metric for the weighted average carbon intensity of the direct equity portfolio is 32 per cent lower than the market benchmark and is down by 36 per cent compared with end-2020, compared with a decrease of 16 per cent in the benchmark. Corporate bonds have declined by 16 per cent over the two-year period; the final figure is 18 per cent lower than the benchmark. As regards government bonds, in the financial portfolio the share of green bonds has grown in one year from 0.7 to 2.8 per cent. The metrics for the Supplementary Pension Fund also show an improvement for corporate shares and bonds.

With reference to the other aspects of sustainability, the equity and corporate bond portfolios have aggregate ESG scores above the benchmark. Some data, such as those on gender diversity in management bodies, are better than the benchmark for all the portfolios analysed. An examination of the other ESG data, such as those on consumption of resources and on well-being at work, highlights how the efforts to make direct equity portfolios more sustainable have borne fruit over time.

As regards targets, the Bank of Italy intends to manage its investments in line with the Paris Agreement and the European Union's target of carbon neutrality by 2050. To this end, the Bank is committed to regular reviews of its investment strategies in order to ensure, according to its mandate, that the path to decarbonization supports the fulfilment of these targets. However, effectively achieving them is dependent on compliance with the commitment to climate neutrality declared by the firms and by the governments in countries in which the Bank invests.

The Bank of Italy will continue to provide information on the initiatives undertaken and the results achieved. The approaches and methodologies described in this Report are based on the current state of the debate, the available data and the relevant legislation; they are therefore subject to continuous scrutiny and may evolve in line with any new developments.

1. THE GOVERNANCE OF INVESTMENTS

The Bank of Italy's governance of investments is the responsibility of the Governing Board, the Strategies and Financial Risks Committee and the Investments Committee. On sustainability issues, the Climate Change and Sustainability Committee, chaired by a member of the Governing Board, performs strategic guidance and coordination functions; it does not have tasks directly related to investments, but promotes analyses focused on the risks and opportunities relating to ESG profiles, which contribute to refining methodologies for the Bank's sustainable investments. The Committee is assisted by the Climate Change and Sustainability Hub, which coordinates the work on ESG issues across the various departments in the Bank, and benefits from the collaboration of its specialists on the subject, gathered in a permanent contact group.

Both long-term allocation proposals (strategic allocation) of the Bank's financial portfolio and foreign currency reserves and short-term allocation proposals (tactical allocation) are prepared by the risk management function in collaboration with the market operations and economic research functions. The annual strategic allocation proposal integrates financial considerations and climate and sustainability risk issues (see Chapter 3, Risk Management). The proposal is submitted for a prior opinion to the Strategies and Financial Risks Committee and is then approved by the Governing Board. The regular verification of the convergence of the financial portfolio towards the strategic allocation is the responsibility of the Investments Committee (Figure 1.1; see the box 'The Bank's sustainable investment governance bodies').

A similar governance mechanism is also used for the management of the supplementary pension fund for Bank of Italy staff.[1]

The governing bodies of the Bank and, as regards the staff pension fund, its members and their representatives, regularly receive information that includes both financial and sustainability profiles of the portfolios, prepared by the risk management function.

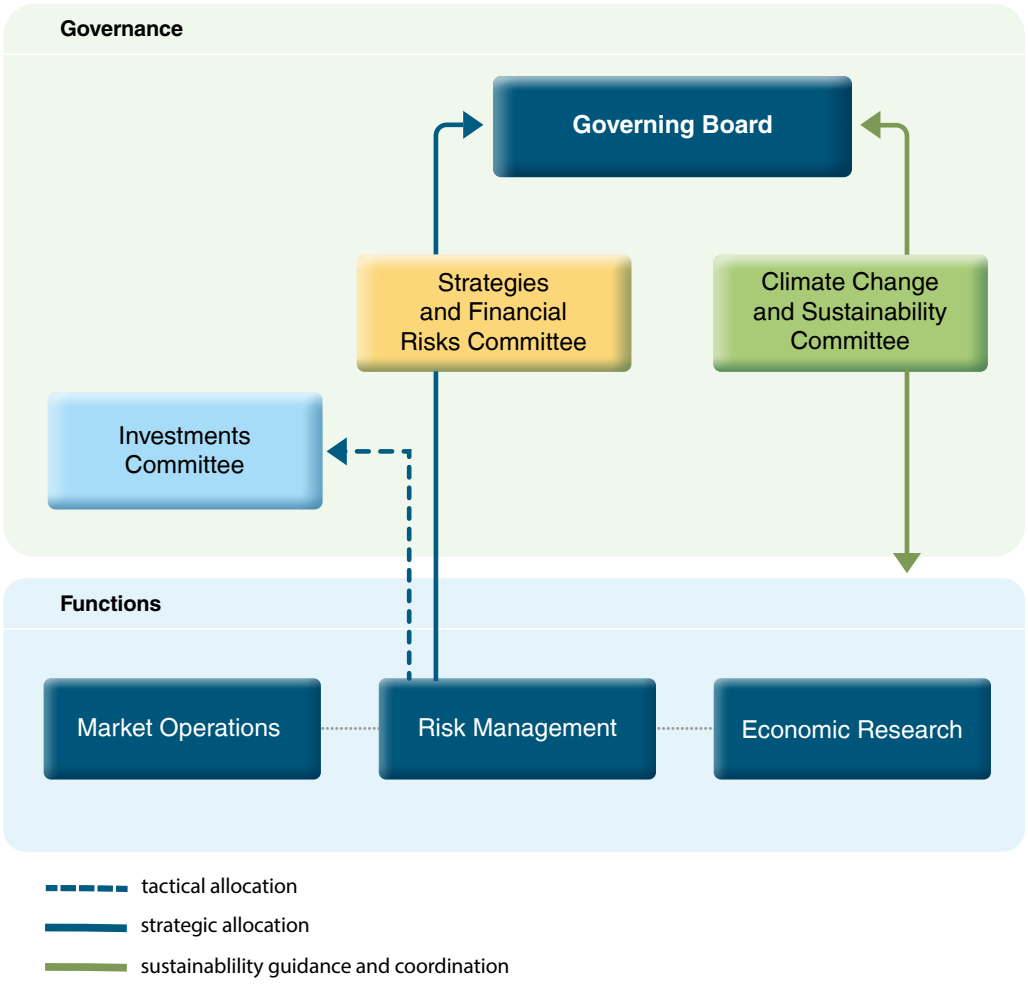
In line with its environmental policy objectives, the Bank of Italy is also committed to reducing the environmental footprint of its internal operations (see *Environment Report*, 2022). The Organization Directorate coordinates the initiatives in collaboration with the Environmental Task Force.[2]

1 The strategic allocation of this fund is reviewed every three years. Before submitting the final proposal to the Governing Board, the risk management function submits it to the non-binding opinion of a joint committee made up of representatives of the Bank and of pension fund members.

2 The Environmental Task Force is made up of representatives of the internal units in charge of property management, logistics, information technology, banknotes, procurement and tenders, human resources and communication and of the network of environmental experts working in each of the Bank's branches in Italy.

Figure 1.1

The Bank's sustainable investment governance bodies



THE GOVERNANCE FRAMEWORK FOR THE BANK OF ITALY'S SUSTAINABLE INVESTMENTS

The Governing Board is a collegial body, made up of the Governor, the Senior Deputy Governor and three Deputy Governors.

The Strategies and Financial Risks Committee is chaired by a member of the Governing Board; it also includes the Heads of the Directorates General for Economics, Statistics and Research, for Markets and Payment Systems, the Accountant General, and the Heads of the Directorates for Financial Risk Management and for Market Operations.

The Investment Committee is chaired by the Head of the Directorate General for the Markets and Payment Systems and its members also include the Heads of the Directorates for Financial Risk Management and for Market Operations and two senior managers in the Directorate General for Economics, Statistics and Research.

The Climate Change and Sustainability Committee is chaired by a member of the Governing Board. The other members are the Heads of the Directorates General for Economics, Statistics and Research, for Markets and Payment Systems, for Financial Supervision and Regulation, the Head of the Secretariat to the Governing Board and a representative of the Italian Insurance Supervisory Authority (IVASS). The meetings are also attended by representatives of the Directorates General for Property and Tenders and for Planning, Organization and Accounting, which carry out the relevant sustainability tasks in the Bank of Italy, as well as by representatives of the Directorates General for: Consumer Protection and Financial Education, for Currency Circulation and Retail Payments, by the General Counsel, and by a representative of the Internal Audit Directorate.

More information is available on the Bank's website, in the section *Functions and Governance*.

2. STRATEGY

This chapter describes the functions and composition of the financial investments made by the Bank of Italy and by the Supplementary Pension Fund for its employees hired since 28 April 1993. It also illustrates the investment strategy and how the sustainability criteria are applied.

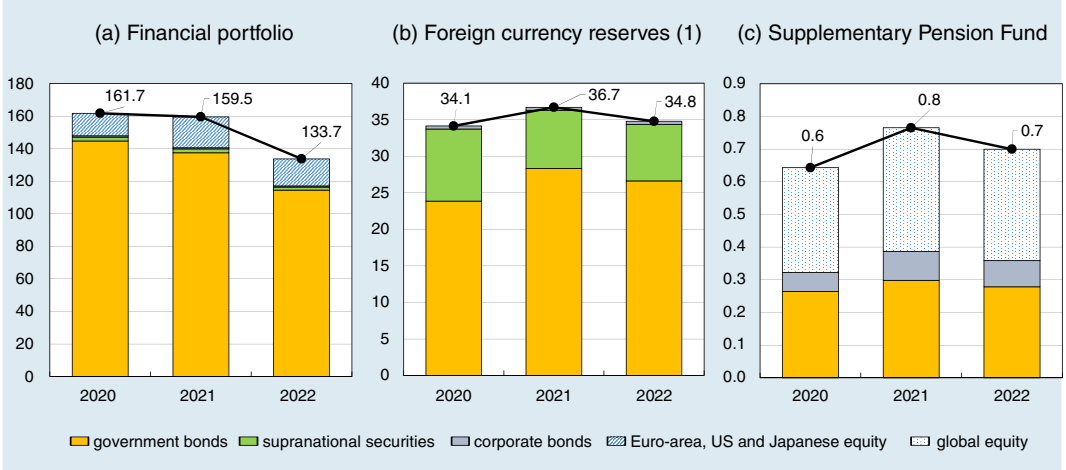
2.1 *The characteristics of the financial investments*

At the end of 2022, the Bank of Italy's financial investments (its financial portfolio with holdings in euros, foreign currency reserves and Supplementary Pension Fund) amounted to €169.2 billion and was mainly composed of euro-area and issuing countries' government bonds in the major currencies, in view of their security and liquidity characteristics.

The financial portfolio. – At the end of 2022, the financial portfolio had a market value of €133.7 billion, 86 per cent of which was in government bonds, mainly of the Italian Republic (Figure 2.1); there were also government bonds from other euro-area countries and from comparable supranational issuers.[1] In 2022, the fall in value was mainly due to the effect of the rise in interest rates on government bonds and, to a lesser extent, the decline in the stock market.

Figure 2.1

Market value of investments 2020-22
(billions of euros)



(1) Excludes net claims on the IMF, cash, and bank deposits.

[1] The values referred to here are based on market prices, regardless of the valuation criteria used to prepare the Bank's financial statements. Estimates were made where necessary. Increases or decreases in the values do not necessarily translate into accounting changes.

Approximately 12 per cent is invested in listed shares of companies in the euro area and in investment funds denominated in foreign currencies, which track equity indices for the United States and Japanese markets. A smaller part is invested in euro-denominated corporate bonds. Due to the institutional role played by the Bank of Italy, securities issued by the banking, insurance and financial service sectors are excluded from investment universe.

Foreign currency reserves. − The foreign currency reserves held by the Bank of Italy are an integral part of those of the Eurosystem; they help support the credibility of the European System of Central Banks (ESCB) and can be used for foreign currency market interventions to support currency stability.[2]

At the end of 2022, the foreign currency reserves were worth €44.2 billion (excluding net claims on the IMF) and included USD (74 per cent), JPY, GBP, CAD, AUD, CNY and KRW. This Report considers the component relating to government bonds, supranational and corporate bonds amounting to €34.8 billion, net of deposits and cash accounts. The reduction in value compared with the previous year was mainly due to the effect of the rise in interest rates.

The Supplementary Pension Fund. − Employees of the Bank of Italy hired since 28 April 1993 can join an internal pension fund which provides a supplementary pension in addition to the one provided by the Italian National Institute for Social Security (INPS). At the end of 2022, the total market value of the Fund's holdings was equal to €0.7 billion, invested in a diversified set of assets. In 2022, the value of the portfolio declined owing, above all, to the rise in interest rates on government bonds and the decline in the stock market.

2.2 *The strategic objectives of the investments*

The Bank's investment policy integrates financial and sustainability objectives. The financial goals are of a traditional nature, i.e. aiming to contain financial risks and prudently to seek returns that will preserve the invested capital even in tense market conditions and will contribute to covering the Bank's expenses.[3] This approach is integrated with sustainability information with a twofold objective: on the one hand, to take account of the impact of sustainability risks on the pursuit of traditional objectives and, on the other, to contribute to protecting the environment and to sustainability,

[2] The Bank also uses foreign currency reserves to settle payments on public debt payments in foreign currency on behalf of the Treasury and to fulfill its commitments to international organizations (such as the International Monetary Fund).

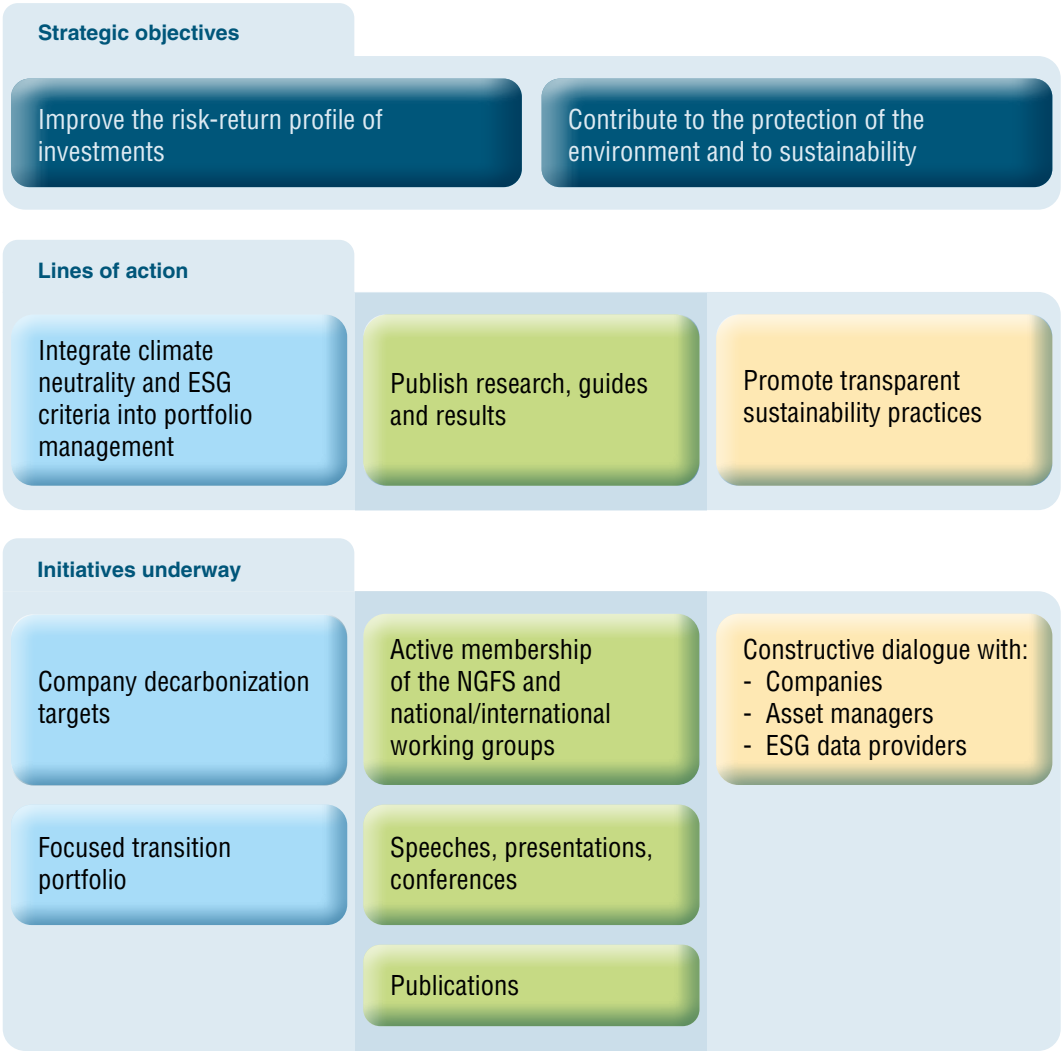
[3] For foreign currency reserves, it is also necessary to ensure a very high degree of liquidity.

in line with Italian and EU legislation.[4] The main inspiration for this approach can be found in the Bank's Responsible Investment Charter.

These objectives are pursued through specific lines of action, which are in turn divided into various initiatives (Figure 2.2; also see Section 2.3, 'Lines of action and ongoing initiatives).

Figure 2.2

Sustainable investment strategy



4 See the European Union's Green Deal measures to achieve climate neutrality and, for Italy, the amendments to Articles 9 and 41 of the Constitution, which introduced an explicit reference to the protection of the environment, biodiversity and ecosystems and the principle that private economic initiatives may not harm public health or the environment (as well as not running counter to social utility, safety, freedom and human dignity, as already provided for in Article 41).

Improve the risk-return profile of investments. – In managing its own investments in equity and corporate bonds, the Bank of Italy aims to optimize the risk-return profile of its portfolios, bearing in mind any sustainability risks (see Chapter 3, 'Risk management'). This strategy uses exclusion criteria based on compliance with legislation and international conventions on employment, arms and tobacco.[5] Furthermore, within each sector, the strategy tends to prioritize the companies that have adopted the best ESG practices and those most engaged in changing their production models, to reduce risks linked to climate transition ('best-in-class' methodology).

In the short term, this strategy could lead to a slower decarbonization of the portfolio than the result that could be achieved by simply disinvesting from sectors with a higher environmental impact. It seems in any case more likely to encourage an orderly transition, in that it supports and incentivizes companies across all sectors to make changes to their own activities. Internal studies show that excluding companies only on the basis of their historical level of emissions could risk penalizing those companies that are most committed to climate transition, which are often those with the highest emissions.

Contribute to the protection of the environment and to sustainability. – The Bank has indicated its commitment to the environment as one of the priorities of its Strategic Plan for 2023-2025, paying particular attention to the issue of fighting climate change as regards its investment activities. Specifically, the Bank intends to follow a decarbonization path for its non-monetary policy portfolios.

Regarding government and supranational bonds, achieving this goal will depend on the compliance of the countries and companies in which the Bank invests with the commitments taken on under the Paris Agreement. In order to support the implementation of the measures underlying these commitments, the Bank has also adopted the strategy of establishing portfolios of green bonds issued by sovereigns, supranationals and agencies (see Section 3.2, 'Portfolio risk management').

Regarding investments in equity and corporate bonds, the Bank uses indicators on the decarbonization commitments of companies and on the reductions made in the last few years (see Section 3.2, 'Portfolio risk management'). This approach is based on the awareness that successfully decarbonizing the Bank's corporate securities portfolio will greatly depend on the aims, soundness and observance of the transition plans of the companies in which it invests (see the box 'Transition plans').

TRANSITION PLANS

The Task Force on Climate-related Financial Disclosures (TCFD) defines the transition plan for a company as a structured set of objectives and actions to support the transition to an economy with low greenhouse gas emissions.[1]

1 TFCD, Guidance on Metrics, Target, and Transition Plans, October 2021.

5 The exclusion criteria are specified in the Bank's Responsible Investment Charter.

A credible and effective transition plan must: (a) define specific short, medium and long-term emission reduction targets based on climate science and regularly monitor them with reference to appropriate indicators; (b) form part of the overall strategy of the company; and (c) indicate the roles and responsibilities of senior management.

One of the main standards that companies follow when setting emission reduction targets is the one developed by the Science-Based Targets initiative (SBTi).[2] The SBTi certifies that the objectives indicated in the companies' transition plans are aligned with climate science and international climate agreements while providing investors with a way to evaluate the company's position vis-à-vis the transition. In this regard, the Bank of Italy, in selecting the securities in which to invest, gives priority to those of companies with commitments that are ambitious and certified by the SBTi.

[2] SBTi is a non-profit organization based on a partnership between the Carbon Disclosure Project (CDP), the United Nations Global Compact, the World Resources Institute (WRI) and the World Wide Fund for Nature (WWF).

The investment strategy of the Supplementary Pension Fund. – This Fund pursues a long-term investment strategy to finance additional income to that provided by INPS for staff in retirement. For this reason, decisions are based on prudent criteria. In compliance with this principle, the adoption of sustainability criteria in the Fund's investment activity was done gradually. As a result, almost all equity investments are made using vehicles that favour exposures towards companies with low carbon emissions or apply criteria that exclude companies with low ESG scores. Furthermore, the investment fund through which the Fund invests in corporate bonds gives priority to companies with the best capability to adapt to climate change.

2.3 *Lines of action and ongoing initiatives*

In its Responsible Investment Charter, the Bank of Italy has defined its three lines of action to achieve the objectives outlined in the previous section (Figure 2.2):

a) Encourage the dissemination of information on ESG profiles on the part of companies, intermediaries and other financial system operators;

b) Integrate ESG indicators into the management of its investments and into the financial risk measurement and management systems.

c) Publish research and guides on the subject of sustainable finance and regularly communicate the results in terms of ESG profiles to encourage the dissemination of a sustainability culture in the financial system and among the public.

Encourage the dissemination of ESG information. – The Bank promotes the dissemination of exhaustive sustainability information in its role as an investor, as a supervisory authority, and as an entity interested in the success of the efforts made by European and Italian lawmakers to protect the environment. In this context, in 2022 the Bank, as a shareholder, began constructive dialogue with the companies

mainly responsible for most of the greenhouse gas emissions in its portfolio in order to strengthen climate strategies and raise awareness of the importance of broad and transparent communication of decarbonization strategies and ESG issues and to illustrate the investment criteria it has adopted. The Bank considers this dialogue crucial for all its investment management objectives, both financial and environmental (see the box 'Questionnaire on decarbonization strategies and sustainability').[6]

QUESTIONNAIRE ON DECARBONIZATION STRATEGIES AND SUSTAINABILITY

In its capacity as an investor, the Bank of Italy prepared a questionnaire on decarbonization strategies aimed at investee companies with high greenhouse gas emissions, which comprises about 20 Italian and euro-area companies contributing approximately 80 per cent of the weighted average carbon intensity of the equity portfolio. The questionnaire covers the following themes:

a) Climate governance: the corporate governance body designated to decide, plan and incentivize the adoption of decarbonization plans and remuneration systems linked to climate objectives;

b) Climate strategy: the company's decarbonization strategy, alignment with the Paris Agreement, challenges in executing the strategy, investments in assets that can drive decarbonization;

c) Climate change risk management: monitoring and managing climate risks, the transition scenarios used and the decarbonization objectives;

d) Metrics and targets: quantitative data on the company's decarbonization objectives and the results achieved;

e) Dialogue with shareholders on climate issues: the relationship with shareholders as regards transition plans, both in the context of the shareholders' meetings and through informal discussions;

f) Environmental and social issues: the governance structure and the strategies for environmental questions (natural resources, biodiversity, the circular economy, etc.) and social aspects.

At the time of publication of this Report, the Bank has sent the questionnaire to a small pilot group of companies and it has initiated the interviews. Then, over the course of this year, it will involve other companies identified.

6 The importance of this initiative has been confirmed by recent studies, conducted internally, of a representative sample of Italian, German and French companies. In 2021-22, informal talks, outside the shareholders' meetings, on sustainability constituted an important channel for dialogue both for shareholders to express their expectations to companies and for companies themselves to explain to their shareholders the reasons for the choices made. These studies have shown that the shareholders' meeting maintains its function as a forum for discussion between shareholders and the company on issues of sustainability; moreover, only in a few cases are the shareholders called upon to express their opinion by exercising the right to vote. See G. Buscemi, T. De Stefano and M. Fanari, 'Sustainability in corporate meetings in Italy, Germany and France', Banca d'Italia, mimeo, 2023.

In 2022, the Bank also organized meetings with the managers of the equity funds in which it invests to explain its expectations in terms of sustainability. In addition, it has explored ways of integrating ESG profiles into portfolio management and looked at the role played by managers in promoting initiatives in this area.

The Bank also interacts with providers of ESG indicators to express its own needs for information and to report possible improvements, inconsistencies or errors.

Integrating climate neutrality and ESG criteria into investments and risk management. – As regards the equity and corporate bond portfolio, an indicator for corporate decarbonization commitments was developed internally in 2022 (see Section 3.2, 'The methodology for portfolio risk management'). A thematic equity investment line focused on the energy transition was also launched to seize the opportunities for returns associated with the transition to a net-zero emissions economy and to contribute to the development of products, services and technologies necessary for the transition. The new portfolio, worth around €220 million, is invested in companies operating in the sectors of alternative energy, energy efficiency systems, electric mobility and green construction.

Publishing studies, guidelines and results. – In 2022, the Bank took part in numerous opportunities for dialogue with Italian and international representatives of the financial system, giving its point of view on the subject of sustainable finance and climate risks.[7] Studies of ESG bonds have been published;[8] the effects of a permanent asset purchase programme on the part of the Bank of Italy for securities issued by companies with low emissions during the transition to an economy with zero net CO_2 emissions;[9] the resilience of ESG securities during the 2020 stock market crash;[10] the effectiveness of clean energy incentive policies;[11]the interactions between the greenhouse gases (GHG) tax and unconventional monetary policy in the euro area;[12] and gender diversity in the corporate bodies of Italian banks.[13] Regarding the financial effects of climate change,

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7 Speeches by the Bank's representatives at conferences and events include: the 3rd Research Workshop on 'Long-term investors' trends: theory and practice', organized by Long-Term Investors @ UniTo and the Bank of Italy's Directorate General for Economics, Statistics and Research; the conference Second Digital Day. At the roots of sustainability organized by the University of Florence; the XVII Convention AIFIRM organized by Associazione Italiana Financial Industry Risk Managers (AIFIRM); the conference Ambiente, Mercato, Comunità: spunti per l'educazione alla ragione organized by the Italian Ministry of Education; and the conference La trasformazione sostenibile: ambiente economia e società. Le sfide che ci attendono, le azioni possibili organized by Fondazione Centesimus Annus Pro Pontifice (FCAPP).

8 P. Antilici, G. Mosconi and L. Russo, 'Quando innovazione finanziaria e finanza sostenibile si incontrano: i Sustainability-Linked Bonds', Banca d'Italia, Markets, Infrastructures, Payment Systems, 22, 2022.

9 A. Ferrari and V. Nispi Landi, 'Toward a green economy: the role of a central bank's asset purchases' Banca d'Italia, Temi di Discussione (Working Papers), 1358, 2022.

10 R. Albuquerque, Y. Koskinen and R. Santioni, 'Mutual fund trading and ESG stock resilience during the Covid-19 stock market crash', Banca d'Italia, Temi di Discussione (Working Papers), 1371, 2022.

11 F. Daniele, A. Pasquini, S. Clò, and E. Maltese, 'Unburdening regulation: the impact of regulatory simplification on photovoltaic adoption in Italy', Banca d'Italia, Working Papers, 1387, 2022.

12 A. Bartocci, A. Notarpietro and M. Pisani, 'Green fiscal policy measures and non-standard monetary policy in the euro area', Banca d'Italia, Temi di Discussione (Working Papers), 1377, 2022.

13 S. Del Prete, G. Papini and M. Tonello, 'Gender quotas, board diversity and spillover effects. Evidence from Italian banks', Banca d'Italia, Temi di Discussione (Working Papers), 1377, 2022.

the Bank has also organized opportunities for discussion with other national and international institutions.[14]

The studies also dealt with the impact of climate change on the real economy and some policies for adaptation and mitigation.[15] Research activities benefit from peer reviews at national and international level, thanks to participation in various conferences, sometimes co-organized with other institutions, and in seminars.[16]

Research was also carried out in collaboration with the other supervisory authorities, particularly with the Italian insurance supervisory authority (IVASS), and events dedicated to the effects of climate change on the insurance market and financial stability.[17]

At international level, the Bank has contributed to the publication of reports and guides on sustainable finance by the NGFS and the OECD, as well as technical reports produced by various Eurosystem working groups. Among other things, these groups worked on applying the principles of sustainable and responsible investment and measuring portfolio climate indicators.

The centrality of climate change and sustainability issues in research activity has also been confirmed for the coming years: one of the lines of action featured in the 2023-2025 Strategic Plan focuses on these aspects.

The section of the Bank of Italy's website dedicated to sustainable finance gathers the main contributions on this subject of the Bank's various departments.

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14 In particular, the Workshop on Climate change risk and credit assessment was held in 2022, dedicated to including climate change risks in credit risk assessment methodologies.

15 On these issues, a research project was developed consisting of more than 20 studies, the results of which were presented at the conferences Gli effetti del cambiamento climatico sull'economia italiana and summarized in M. Alpino, L. Citino, G. de Blasio and F. Zeni (eds.), 'The effects of climate change on the Italian economy. A Bank of Italy research project', Banca d'Italia, Questioni di Economia e Finanza (Occasional Papers), 728, 2022.

16 The Bank of Italy contributed to the organization of the twenty-seventh annual conference of the European Association of Environmental and Resource Economists (EARE), by participating in a policy session. Recently, during the annual meeting of the Italian Association of Environmental and Resource Economists (IAERE), the Bank organized an event to present the results of the analyses to the scientific community. Finally, several studies were published at the 1st Annual Workshop of the ESCB Research Cluster on Climate Change organized as part of the thematic network with other European central banks in September 2022.

17 For example, the Bank, in collaboration with IVASS and the Venice Capital of Sustainability Foundation, organized a conference entitled 'Gli effetti dei cambiamenti climatici in Italia: strategie di adattamento e ruolo delle imprese assicurative'.

3. RISK MANAGEMENT

This chapter illustrates how the Bank of Italy manages the financial and sustainability risks of its investments.

3.1 *Portfolio risk management*

The Bank of Italy has developed a risk management framework for non-monetary policy portfolios that considers not only financial risks but also risks related to climate change and, more generally, all ESG factors that could have a negative impact on the value of investments.

This process begins with the strategic allocation of resources among different asset classes and continues with the selection of issuers and securities. Sustainability criteria are integrated into both phases (Figure 3.1). In the strategic allocation phase, a quantitative asset and liability management (ALM) model has been applied since 2010.[1] The results of the model incorporate institutional considerations, thereby introducing a degree of discretion to the process.

The optimization exercise adopts a ten-year time horizon and aims to minimize the loss of capital that could occur in the most adverse economic and financial scenarios for the central bank's balance sheet. Sustainability considerations are used as constraints: every year, the model must improve or at least retain the ESG score of the existing portfolio and progressively reduce the carbon intensity of investments in private-sector issuers.[2] The optimization exercise provides a hypothetical optimal allocation of the value of the portfolio across various asset classes – government and supranational bonds and equity and corporate bonds – broken down by currency. The Strategies and Financial Risks Committee evaluates these indications and requests any modifications or further insights, also in light of discretionary assessments regarding the impact of each choice on the institutional tasks of the Bank.

In the second phase, the integration of sustainability criteria takes place in different ways for each financial asset class. For equity and corporate bonds, the selection is based on indicators that are representative of the whole market (e.g. euro-area equity indices). Securities issued by the banking, insurance and financial services sectors are excluded from the indices in light of the supervisory functions exercised over them by the Bank of Italy. Moreover, only for Italy, equities in the media sector are also excluded to avoid

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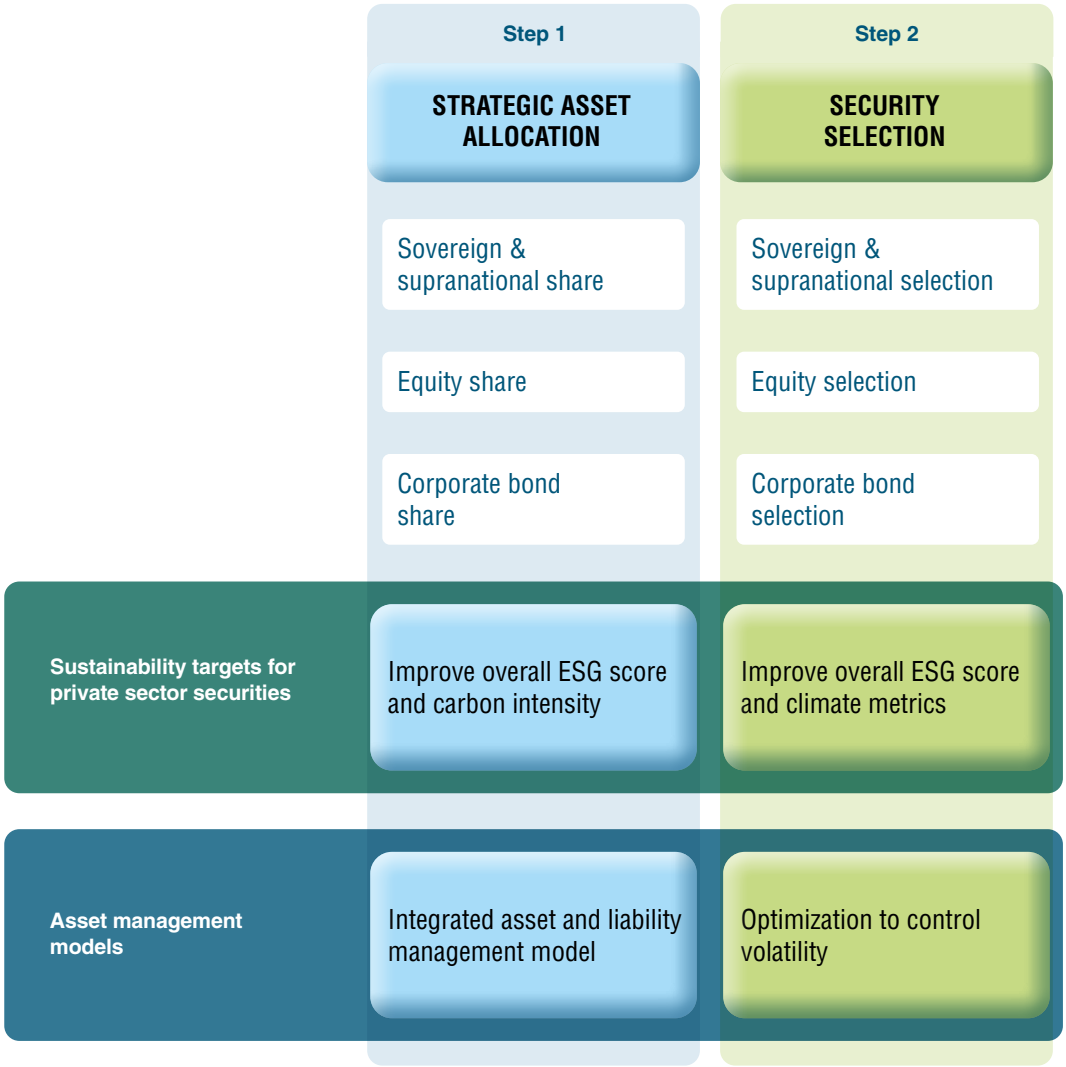
1 The model takes into account the entire balance sheet of the Bank of Italy and other implicit exposures that affect the Bank's solvency in the medium and long term, for example the current value of operating costs and monetary income (see the box 'Monetary income' in Annual Accounts – Year 2020, 2021).

2 The constraints include the risk budget (defined according to the risk aversion of the central bank) and an accounting constraint intended to avoid short-term losses, which could have reputational consequences. For further information on the model, see D. Di Zio, M. Fanari, S. Letta, T. Perez and G. Secondin, 'The strategic allocation and sustainability of central banks' investment', Banca d'Italia, Mercati, infrastrutture, sistemi di pagamento (Markets, Infrastructures, Payment Systems), 14, 2021, and M. Fanari and G. Palazzo, The strategic asset allocation of the investment portfolio in a central bank, in *Evolving practices in public investment management. Proceedings of the seventh public investors conference*. Bank of International Settlements, The World Bank, Bank of Canada and Banca d'Italia, pp. 1-22.

Figure 3.1

The management of sustainable investments



reputational risks. Securities that do not comply with the Responsible Investment Charter are not taken into consideration either. Selecting which equity securities to include in the portfolio tends to improve the ESG score and climate indicators compared with the benchmark index, while minimizing the expected deviation from the latter through a factor model.[3] Climate risk is controlled using a best-in-class methodology that takes into account: (a) current carbon intensity; (b) the commitment to reducing emissions of each company, quantified by an internally defined score that evaluates its objectives, solidity, and time horizon; and (c) an estimate, developed by an external supplier,

[3] The directly managed equity and corporate bond portfolios comprise fewer securities than the benchmarks; the replication of the indices is carried out with margins of tolerance for deviations from the index in terms of both economic sectors and individual securities.

of companies' expected greenhouse gas emissions in the coming years. By taking into account companies' estimated emissions and their commitment, the Bank reduces the risk of penalizing the companies most committed to the climate transition, which are often those with the highest current emissions.[4]

With regard to the Supplementary Pension Fund's investments in private-sector issuers, it was decided not to use direct investment but to invest in exchange-traded funds (ETFs) and in investment funds that replicate ESG-type indices. In selecting the funds, the assessments consider both the ESG indicators and the financial characteristics of the instruments, including the diversification, liquidity, and volume of the assets under management as well as fees, returns and volatility. In addition, a general principle of diversifying both the managers and the ESG strategies of the benchmark indices for the funds is applied.

Italian government bonds are the main financial asset in the Bank's portfolio for institutional reasons, as is generally the case for national central banks. For government securities, different considerations apply than for corporate securities. Firstly, the link between the public policies of sovereign issuers and the sustainability of their securities is more tenuous than for corporate issuers, as ESG indicators for government securities reflect the economic and production structure of a country. This structure, in turn, is affected by the actions of the economic agents, both public and private sector, of each country. Moreover, the environmental policies adopted by governments often have an indirect effect, which is typically transmitted to the indicators with a lag. Secondly, the government securities of the various countries, including those connected with foreign currency reserves, have very high liquidity and safety characteristics, which make them difficult to replace with alternative securities. In light of these considerations, sustainability indicators for government bonds are currently monitored within the risk control framework (see Chapter 4, 'Metrics and targets'), but do not influence investment choices. For this asset class, the most suitable sustainability strategy has been the creation of green bond portfolios issued by sovereigns, supranational organizations and agencies, which are included in the financial portfolio and in currency reserves.

3.2 *Portfolio risk control*

Financial risk control is carried out through a system of daily verified limits that aim to avoid excessive exposure to individual counterparties, geographical areas, and financial instruments. In addition, periodic reports are prepared in which, in addition to financial risk analysis, the climate and sustainability risks of the portfolios are also examined: ESG scores, weighted average carbon intensity, decarbonization commitments and prospective emissions, and indicators such as the climate value-at-risk and the implied temperature rise (see Chapter 4, 'Metrics and targets').

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4 These assessments are backed by the results of internal analyses, which examined a sample of euro-area corporate bond issuers. These analyses found that the sectors with higher greenhouse gas emissions (public utilities and energy) are also among those that have reduced their emissions the most compared with 2018-21 and are also the ones that expect to reduce them even further by 2025 on the basis of the commitments made.

With regard to climate indicators, given their centrality to the goal of climate neutrality of investments, the risk management function conducts in-depth analyses of the underlying methodologies to identify any limitations or inconsistencies and propose possible solutions, as in the case of the decarbonization commitment score developed internally. In this context, an analysis has been launched to identify the limitations of the use of weighted average carbon intensity (WACI) in portfolio allocation during periods of high inflation (see the box 'The limitations of carbon intensity').

THE LIMITATIONS OF CARBON INTENSITY

The WACI of a portfolio is a widely used indicator: it is easy to understand and makes it possible to compare portfolios that differ in terms of composition and size. However, it has two methodological limitations.

The first concerns the effects of inflation and exchange rates on revenue. In periods of high inflation, all other conditions being equal, the nominal value of a company's revenue (i.e. the denominator of the WACI) increases, while there is no comparable effect for the numerator. Therefore, WACI tends to signal an improvement in companies' carbon efficiency that is greater than the one actually recorded. The same effect would be observed in the case of a devaluation of the exchange rate of the euro against the currency used to measure a company's revenue (for example, in the case of a devaluation of the euro against companies that invoice in US dollars). To avoid these drawbacks and enable a comparison of a portfolio's WACI over time or to compare geographically diversified portfolios, companies' revenue should be deflated and calculated at fixed exchange rates before being used to calculate their carbon intensity. Alternatively, physical intensity measures can be used. These metrics do not calculate the ratio of greenhouse gas emissions to revenue, but rather their ratio to a physical quantity indicative of the company's product (for example, kWh in the case of public utility companies or tonnes of steel in the case of steel companies). However, these indicators can only be used to compare companies within sectors, but not across sectors.

The second limitation of WACI concerns the scope of the greenhouse gases considered in the calculation of a company's carbon intensity, which usually includes direct emissions (Scope 1 emissions under the Greenhouse Gas Protocol) and indirect emissions under the company's control resulting from the consumption of purchased electricity (Scope 2 emissions). However, the inclusion of Scope 2 emissions can lead to double-counting if both electricity-producing and electricity-consuming companies are present in the same portfolio. The problem of double-counting is even more evident in the case of WACI referring to indirect emissions outside the company's control, that is, upstream and downstream of its value chain (Scope 3 emissions), due to commercial relationships between companies in the portfolio. Therefore, caution is needed when using indirect emission data for portfolio analysis.

4. METRICS AND TARGETS

This chapter presents the main metrics used by the Bank of Italy to analyse and measure the risks and opportunities linked to the climate and to the sustainability (ESG) of its investments. The detailed data are reported in the Appendix, together with the Methodological Notes on how the metrics are calculated.

It also illustrates the climate-target inspiring the Bank's actions, regarding non-monetary policy portfolios.

4.1 *Climate risk metrics*

The approach agreed on with the European Central Bank and the other Eurosystem national central banks has three main indicators based on historical greenhouse gas emissions (see the Methodological Notes in the Appendix for the details on how to calculate them). Their use is recommended by the TCFD and by the Partnership for Carbon Accounting Financials (PCAF).[1] The indicators are as follows:

a) the weighted average carbon intensity (WACI);

b) the total carbon emissions or financed emissions, i.e. the amount of greenhouse gas emissions that can be attributed to any given portfolio;

c) the carbon footprint, which measures the total greenhouse gas emissions of the portfolio, normalized for the market value of the portfolio itself.

Three versions of these indicators are calculated for the government securities portfolios, in relation to three different methodologies for measuring a country's emissions, which respectively take into consideration:

– production emissions, i.e. the emissions generated in a country to produce goods and services;

– consumption emissions linked to consumption, i.e. the emissions generated in a country to satisfy domestic consumption, plus the emissions generated by imported goods;

– government emissions, i.e. the direct and indirect emissions of a country's central government.

The Bank uses two additional indicators based on historical data:

[1] The PCAF is a global partnership of financial institutions that collaborate to produce a harmonized method for assessing and disclosing the greenhouse gas emissions associated with their loans and investments.

– carbon intensity, which measures the average carbon efficiency of the firms in the portfolio;

– the percentage of green bonds in the portfolio.

The indicators relying on historical emissions have the advantage of using data, based on internationally recognized reporting rules; however, they may not be sufficient to assess climate risk as they do not necessarily reflect firms' strategies or climate scenarios, which are fundamental for a correct assessment of transition risk. The Bank uses various forward-looking climate indicators for the latter purpose. Two indicators (data on decarbonization commitments and short-term forecasts for future emissions) help to guide portfolio choices (see Chapter 3, 'Risk management'). A further four indicators are currently only used for risk assessment purposes, as they are very sensitive to the underlying scenarios (Implied Temperature Rise, Climate Value-at-Risk for transition risk, Climate VaR for physical risk; physical risk country score, see Appendix, Methodological notes).

4.2 *Analysis of climate and sustainability indicators*

Historical climate indicators

The historical climate indicators in this Report refer to the portfolios held by the Bank of Italy at the end of 2022. They were calculated using the most recent data available: greenhouse gas emissions of countries up to 2020 and of firms up to 2021. In addition, for the indicators for government securities at the end of 2022, the data on GDP, population and government spending refer to 2021.[2] Especially for government bonds, the indicators for the last two years have changed very little, because of the modest modifications to the allocation of portfolios and to the amounts invested.

The financial portfolio. – In 2022, the WACI for government bonds in the financial portfolio was 165 tonnes of CO_2 equivalent (hereinafter tCO_2e) per one million euros of GDP, according to the method of emissions linked to each country's production (Table 4.1). This figure is aligned with that of the benchmark index (Figure 4.1).[3] The WACI has improved compared with the previous two years because of the increase in GDP resulting from the easing of the restrictions imposed to contain the COVID-19 pandemic (Figure 4.2).

In the same period, the share of green government bonds, the purchase of which began in 2020, has risen to about 3 per cent. Among supranational and agency bonds, and corporate bonds, it amounts respectively to more than 20 per cent and almost 7 per cent.

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2 It is not possible to rely on more recent data owing to the time lag for the production of macroeconomic and climate-related data.

3 The index is based on an ICE company index that includes nominal euro-area government bonds with an average rating of at least BBB.

Table 4.1

Historical climate indicators: financial portfolio (1)
(absolute values, unless otherwise specified; 2022)

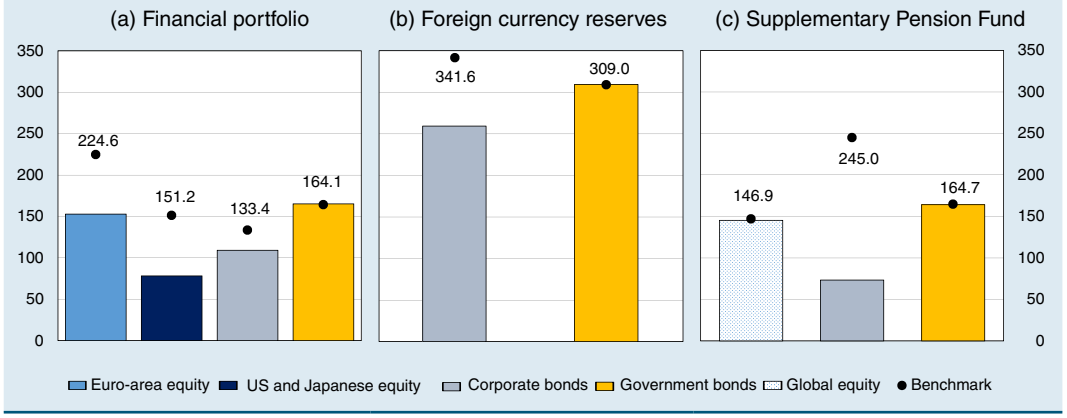
Metrics	Sovereign bonds			Other securities			
	Production emissions	Consumption emissions	Government emissions	Supra and agency bonds	Corporate bonds	Euro-area equity	US and Japanese equity
Portfolio size (€ billion)		117.8		2.2	0.8	14.2	2.4
Weighted Average Carbon Intensity *(tCO2e / €M revenue or GDP)*	165.1 (100%)	8.3 (100%)	82.3 (100%)	3.7 (87%)	109.4 (98%)	152.8 (100%)	78.1 (98%)
Total Carbon Emissions (Scope 1 & Scope 2) *(tCO_2e)*	19,447,799 (100%)	24,956,161 (100%)	1,949,851 (100%)	110 (78%)	56,843 (98%)	1,341,061 (100%)	60,961 (98%)
Carbon footprint *(tCO2e per €M invested)*	165.1 (100%)	211.9 (100%)	16.6 (100%)	0.1 (78%)	74.5 (98%)	94.5 (100%)	25.8 (98%)
Carbon Intensity *(tCO2e / €M revenue or GDP)*	165.1 (100%)	8.3 (100%)	82.0 (100%)	1.6 (78%)	145.5 (98%)	160.4 (100%)	85.9 (98%)
Green bonds share *(%)*		2.8 (100%)		20.5 (100%)	6.9 (100%)	–	–

(1) For a description of the indicators, see the Methodological Notes in the Appendix. For government bonds and corporate bonds, the size of the portfolio refers to the nominal value of the securities, whereas for equities it refers to market values. The degree of coverage for each indicator is given in brackets. Coverage means the percentage of the portfolios securities for which the indicator is available.

The WACI for the euro-area equity portfolio, equal to 153 tCO_2e per million euros of revenue, is 32 per cent lower than the benchmark (225 tCO_2e; Figure 4.1)[4] and reflects: (a) the weight and the sectoral structure of Italian investments, which have a greater share of public services, energy and industry sectors; (b) the management style, which gives priority to forward-looking data such as firms' decarbonization commitments, rather than applying exclusions based on historical greenhouse gas emissions.

Figure 4.1

Weighted average carbon intensity (WACI) of investments
(tCO_2e per million euros of turnover or of GDP) (1)



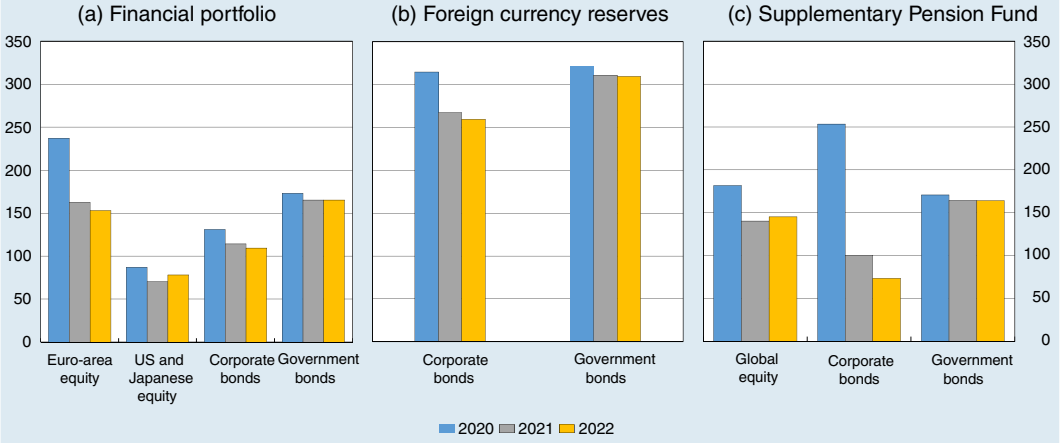
Source: Based on ISS data.
(1) For government securities, the WACI referring to emissions linked to production is reported.

4 The index for comparing the euro-denominated equity portfolio is the one used for its management, while the index for equity investments in United States and Japanese securities is formed by the standard MSCI market indices for the United States and Japan.

The WACI for 2022 is 36 per cent lower than in 2020 (Figure 4.2) because of the portfolio shift towards securities with lower greenhouse gas emissions and the decrease in the average carbon intensity of the benchmark (-16 per cent in the same period). The improvements in the index are linked among other things to the progress of firms in undertaking decarbonization programmes, as witnessed by the growth of firms with commitments and targets validated by the SBTi, which in terms of weight has gone from 43 per cent in the 2020 index to 70 per cent in 2022.

Figure 4.2

Performance of weighted average carbon intensity (WACI)
(tCO_2e per million euros of turnover, 2020-22)



Source: Based on ISS data.
(1) For government securities, the WACI referring to emissions linked to production is reported. The bars are arranged in chronological order for each class of financial asset.

Investments in United States and Japanese equity funds at the end of 2022 had a WACI of 78 tCO2e per million euros of revenue, 48 per cent lower than the benchmark and 10 per cent lower than in 2020 (Figures 4.1 and 4.2).

The WACI for investments in corporate bonds in 2022 also fell by 16 per cent compared with 2020, falling to 109 tCO_2e, 18 per cent lower than the benchmark.

Foreign currency reserves. – Government bonds in foreign currencies have higher climate risk indicators than those denominated in euros in the financial portfolio as there is a smaller average share of renewable energies and natural gas among the energy sources used by the countries that issue the bonds. The WACI estimated with emissions linked to production in 2022 is equal to 309 tCO_2e and is in line with the index (Figure 4.1);[5] it has decreased slightly compared with 2020 (-4 per cent) because of the increases in GDP.

Investments in corporate bonds have a WACI of 259 tCO_2e (Table 4.2), 18 per cent lower than in 2020 and 24 per cent lower than the benchmark (Figures 4.1

[5] The index is the result of aggregating several ICE indices for the foreign government bonds held in the portfolio.

and 4.2). The percentage of green bonds is negligible among government securities, while the bonds of supranational institutions and agencies, and of corporate bonds reached shares of 7.3 and 2.8 per cent respectively (Table 4.2).

Table 4.2

Historical climate indicators: foreign currency reserves (1)
(absolute values, unless otherwise specified; 2022)

Metrics	Sovereign bonds			Other securities		
	Production emissions	Consumption emissions	Government emissions	Supra and agency bonds	Corporate bonds	Equity
Portfolio size (€ billion)		27.5		8.4	0.4	–
Weighted Average Carbon Intensity *(tCO2e / €M revenue or GDP)*	309.4 (100%)	17.4 (100%)	265.5 (100%)	..	259.3 (100%)	–
Total Carbon Emissions (Scope 1 & Scope 2) *(tCO_2e)*	8,504,001 (100%)	9,191,770 (100%)	1,161,414 (100%)	..	41,352 (100%)	–
Carbon footprint *(tCO2e per €M invested)*	309.4 (100%)	334.4 (100%)	42.3 (100%)	..	93.8 (100%)	–
Carbon Intensity *(tCO2e / €M revenue or GDP)*	309.4 (100%)	16.4 (100%)	251.1 (100%)	..	170.8 (99%)	–
Green bonds share *(%)*		0.1 (100%)		7.3 (100%)	2.8 (100%)	–

(1) For a description of the indicators, see the Methodological Notes in the Appendix. For government bonds and corporate bonds, the size of the portfolio refers to the nominal value of the securities, whereas for equities it refers to market values. The degree of coverage for each indicator is given in brackets. Coverage means the percentage of the portfolios securities for which the indicator is available.

Table 4.3

Historical climate indicators: Supplementary Pension Fund (1)
(absolute values, unless otherwise specified; 2022)

Metrics	Sovereign bonds			Other securities		
	Production emissions	Consumption emissions	Government emissions	Supra and agency bonds	Corporate bonds	Equity
Portfolio size (€ billion)		0.3		–	0.1	0.3
Weighted Average Carbon Intensity *(tCO2e / €M revenue or GDP)*	164.1 (100%)	8.9 (100%)	74.7 (100%)	–	73.4 (95%)	145.2 (97%)
Total Carbon Emissions (Scope 1 & Scope 2) *(tCO_2e)*	46,518 (100%)	59,726 (100%)	4,534 (100%)	–	2,959 (95%)	24,127 (97%)
Carbon footprint *(tCO2e per €M invested)*	164.1 (100%)	210.7 (100%)	16.0 (100%)	–	32.5 (95%)	70.7 (97%)
Carbon Intensity *(tCO2e / €M revenue or GDP)*	164.1 (100%)	8.7 (100%)	74.2 (100%)	–	88.8 (95%)	169.8 (97%)
Green bonds share *(%)*		1.7 (100%)		–	22.1 (100%)	–

(1) For a description of the indicators, see the Methodological Notes in the Appendix. For government bonds and corporate bonds, the size of the portfolio refers to the nominal value of the securities, whereas for equities it refers to market values. The degree of coverage for each indicator is given in brackets. Coverage means the percentage of the portfolios securities for which the indicator is available.

The Supplementary Pension Fund. – The Supplementary Pension Fund has adopted a passive management style. The WACI scores and those of the other climate indicators are therefore almost identical to those of the benchmark indices, with the exception of corporate bonds[6] (Figure 4.1). If we look at individual asset classes, the historical climate indicators for government bonds have values entirely similar to those of the financial portfolio (Tables 4.1 and 4.3, Figure 4.1). Absolute emissions are an exception, which are very limited for the Fund because of their relatively small size.

Equities and bonds have a WACI score of 145 and 73 tCO_2e per million euros respectively, slightly lower compared with the levels of the financial portfolio.[7] These have improved in the three years under analysis thanks to both a different portfolio allocation, implemented in 2021; and the subscription of funds with a low carbon footprint for investments in euro-denominated corporate bonds and in equities not denominated in euros.

Forward-looking climate indicators

The three portfolios analysed are exposed to firms with decarbonization commitments certified by SBTi with percentages that range from 58 to 73 per cent (Table 4.4). The actual portfolio implied temperature rise in 2100 compared with the pre-industrial levels varies between a minimum of 1.9°C (corporate bonds in the Supplementary Pension Fund) and a maximum of 2.8°C (corporate bonds for foreign currency reserves investment).[8]

According to the Climate VaR indicator, the financial losses due to transition risk along a horizon that extends to the end of the century, in an orderly transition scenario, would range between 0.5 per cent of the current value of the corporate bonds of the foreign currency portfolio and 5 per cent of equity investments in the financial portfolio. These losses, in a disorderly transition scenario, would increase up to 20 per cent in the case of the equity of the Supplementary Pension Fund.[9] In most cases, they would be lower than those of the benchmark, which bears witness to the positive effects of the investment choices made over these years (Figure 4.3).

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6 The benchmark is formed by the aggregation of a series of broad market indices that cover the bond market (government and non-government) of the euro area and the global equity market. The only asset class with climate indices that differ from the benchmark is that of corporate bonds, whose benchmark does not currently include sustainabiliy elements.

7 Bearing in mind the passive management style of the Fund's equity investments, the WACI scores are nearly identical to those of the benchmark indices, while they are lower for corporate bonds, whose benchmark does not currently include sustainability elements, unlike a part of the equity investments.

8 For the methodology, see MSCI ESG Research (2022), 'Implied Temperature Rise Methodology Summary', September 2022.

9 A disorderly transition climate scenario refers to a possible future in which the transition towards a low-carbon economy takes place in a chaotic rather than a planned way. In this scenario, the measures needed to reduce greenhouse gas emissions are not adequately implemented, and are inconsistent or delayed, with significant negative effects at the social and economic levels as well as on health and on the environment. See NGFS (2022), 'NGFS Scenarios for central banks and supervisors'.

Table 4.4

Forward-looking climate indicators for the financial portfolio (1)

(per cent, unless otherwise specified; December 2022)

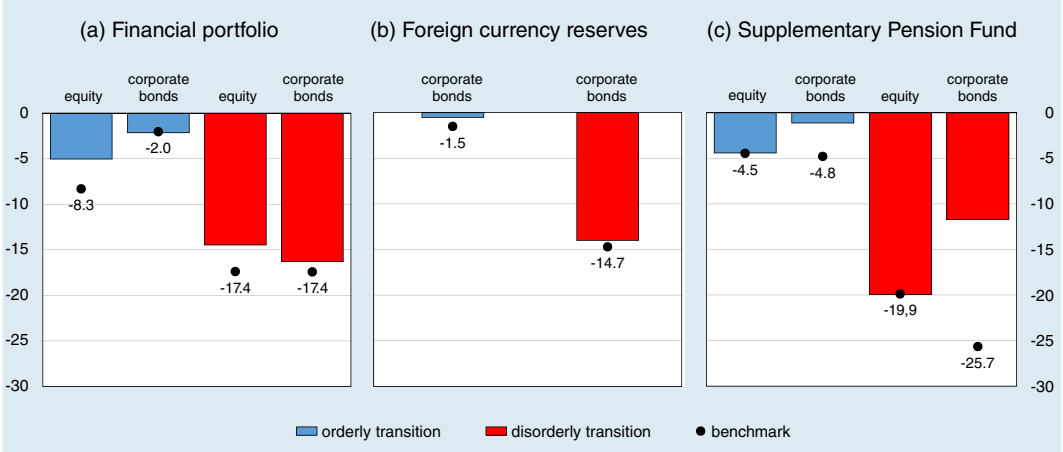
Metrics	Financial portfolio			Foreign currency reserves		Supplementary Pension Fund		
	Sovereign bonds	Corporate bonds	Equity	Sovereign bonds	Corporate bonds	Sovereign bonds	Corporate bonds	Equity
Companies with commitment or target SBTi	–	64.0 (98%)	73.3 (100%)	–	67.0 (100%)	–	66.7 (99%)	57.6 (99%)
Implied temperature rise (°C)	–	2.5 (97%)	2.3 (100%)	–	2.8 (99%)	–	1.9 (95%)	2.3 (96%)
Climate VaR - NGFS Orderly Scenario (2)	–	2.1 (98%)	5.0 (100%)	–	0.5 (100%)	–	1.1 (98%)	4.4 (98%)
Climate VaR - NGFS Disorderly Scenario (2)	–	16.3 (98%)	14.5 (100%)	–	14.0 (100%)	–	11.7 (98%)	20.0 (98%)
Physical Climate VaR (2)	–	13.4 (100%)	20.0 (91%)	–	9.8 (100%)	–	26.3 (98%)	21.3 (94%)
Physical risk indicator Moody's Four Twenty Seven (3)	88.9 (100%)			91.1 (100%)	–	71.3 (100%)		

(1) For a description of the indicators, see the Methodological Notes in the Appendix. The degree of coverage for each indicator is given in brackets. Coverage means the percentage of the market value (i.e. the nominal value for corporate bonds) of the securities in the portfolio for which the indicator is available. – (2) Potential loss in the value of the portfolios. – (3) Absolute values.

Figure 4.3

Climate VaR for transition risk for investments in private-sector securities (1)

(per cent; December 2022)



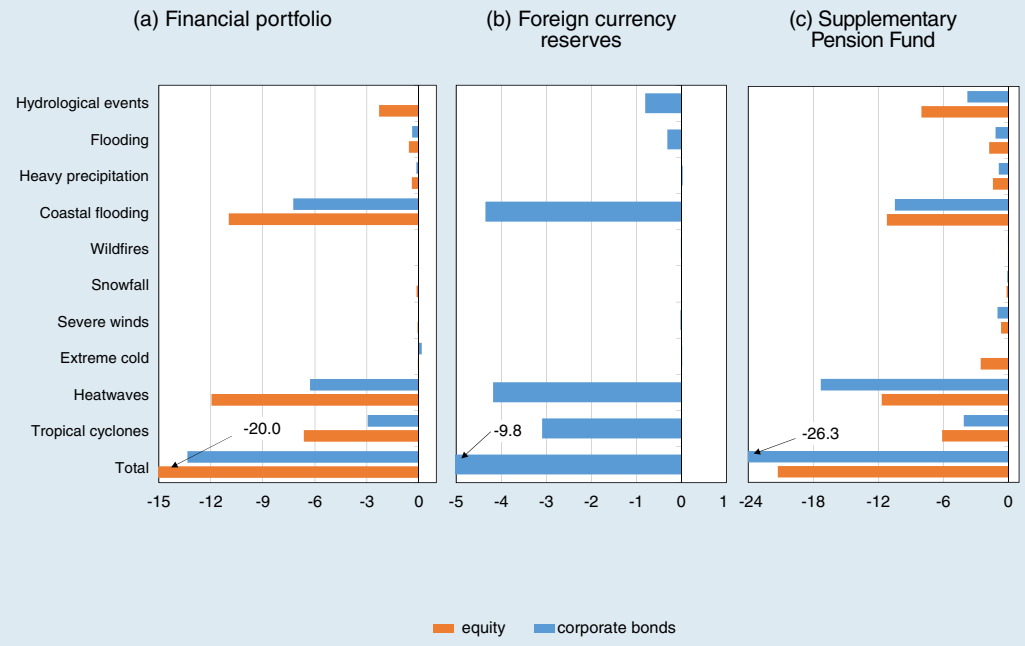
Source: Based on MSCI ESG Research data.
(1) Potential loss in the value of the portfolios and of the relative indices (represented by dots in the graph). For a description of the scenarios, see 'NGFS Scenarios for central banks and supervisors', 2022.

These losses would be accompanied by those stemming from climate-related events (Climate VaR for physical risk). The estimates reported here, which only concern losses stemming from a scenario of events with a strong impact and with a one-century horizon, would vary from about one tenth to over one fourth of

the value of the portfolios analysed (Table 4.4). The main causes would be heat waves, coastal floods and tropical cyclones, especially for foreign currency reserves, owing to the geographical exposure implied in the structure of each portfolio (Figure 4.4).

Figure 4.4

Physical risk events and potential portfolio losses (1)
(loss of market capitalization in percentage points; December 2022)



Source: Based on MSCI ESG Research data.
(1)The aggregate figure represents the overall portfolio risk, which summarizes the loss stemming from the ten types of climate event considered in the model. The aggregate figure does not add up to the sum of the individual risk factors owing to correlations between different climate events.

As far as government bonds are concerned, only one forward-looking indicator is reported, regarding exposure to physical risk. On an increasing scale of risk exposure that goes from zero to 100, for the portfolios analysed, it varies between the figure of 73 found for the government bonds in the Supplementary Pension Fund, which has a diversified portfolio of euro-area sovereign issuers, and that of 91 for the securities in the foreign currency reserve portfolio, which invests in the leading world economies outside of the euro area. As this indicator is a risk score, it cannot measure the possible loss of value connected with the occurrence of these risks.

Environmental, social, and governance indicators

With reference to the risks and opportunities connected to environmental, social and governance factors, the themes covered in the *Responsible Investment Charter* have been analysed: the responsible use of natural resources, the effects on ecosystems, health and safety in the workplace, equality and inclusion, corporate governance practices and compliance with ethical principles.

The indicators shown in the tables are regularly compared with those of non-ESG market indices. Two separate lists of indicators are used for the analysis of the portfolios of government securities and of corporate bonds and equity.[10]

The financial portfolio. – The government bond portfolio, mainly comprising Italian securities, in comparison with a very diversified index composed of 16 countries that have adopted the euro, shows better results for energy intensity indicators and share of renewable sources (Appendix, Table A.4). Conversely, the aspects that show negative results compared with the index are female participation in the workforce, the average percentage of investment in research and development and perceived corruption in the public sector. For the remaining indicators, the results were slightly worse.

As regards equity investments, the indicators that show significantly better results compared with the index are the environmental ones, especially for use of water, energy and waste production. Those with slightly worse results are related to accidents at work, the percentage of firms with anti-corruption policies and firms with remuneration linked to sustainability objectives (Appendix, Table A.5).

Investments in corporate bonds have clearly better results than the indicators for use of water, energy, waste production, accidents at work, and flexible working hours (Table A.6).

Foreign currency reserves. – Investments in government bonds produce results that are basically in line with the index; the only aspects that show negative results are forest cover and energy intensity (Appendix, Table A.4).

Investments in corporate bonds on the part of the reserves produce clearly better results than the market index for use of energy and water, waste production and flexible working hours. The only indicator that has a significantly worse result is the one relating to training hours by employee (Appendix, Table A.6).

The Supplementary Pension Fund. – In the Supplementary Pension Fund (Appendix, Table A.4), the social indicators for government bonds present minimal differences compared with the index, as a result of the passive management style adopted.

Equity investments denominated in euros present better indicators than the index as regards the use of energy and waste production; for the remaining aspects, the differences are minimal.

As regards corporate bonds, the indicators are better compared with the index for all sustainability themes (especially the environmental ones). An exception is waste recycling and the percentage of signatories to the UN Global Compact principles (Appendix, Table A.6).

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10 Bonds issued by supranationals, sub-nationals and agencies are not considered in this analysis.

4.3 *The targets*

According to climate science, to limit the rise in temperature below levels beyond which there could be very negative impacts at the environmental, economic and social levels, it is necessary to achieve net zero gas emissions by mid-century.[11]

In 2021, the Eurosystem agreed on a common position for the application of sustainable and responsible investment principles to non-monetary policy portfolios, creating the conditions to contribute, through investment activity, to the transition to an economy with low greenhouse gas emissions.

The Bank is committed to regular reviews of its investment strategies in order to ensure, according to its mandate, that its portfolio management supports the achievement of the Paris Agreement's goals and the European Union's target of carbon neutrality by 2050. However, effectively achieving them is dependent on compliance with the commitment to climate neutrality declared by the firms and by the governments in countries in which the Bank invests.

Over the next few years, this long-term commitment could be achieved by setting quantitative intermediate targets, also thanks to the experience that the Bank will gain in this field.

[11] For a detailed analysis of the conditions needed to limit the rise in temperatures to 2°C, making it possible to remain below an increase of 1.5°C, see the Intergovernmental Panel on Climate Change – IPCC, 'Climate Change 2022. Mitigation of Climate Change. Summary for Policymakers' and the IPCC's 'AR6 Synthesis Report. Climate Change 2023'.

APPENDIX

CONTENTS

METHODOLOGICAL NOTES

TABLES

METHODOLOGICAL NOTES

Climate-related and ESG risk indicators

The three main climate indicators agreed upon by the European Central Bank and the other national central banks of the Eurosystem, whose use is recommended by the Task Force on Climate-related Financial Disclosures (TCFD) and the Partnership for Carbon Accounting Financials (PCAF), are the following:

- **weighted average carbon intensity (WACI)**, which measures the portfolio's exposure to issuers with high levels of greenhouse gas emissions compared with their volume of activity, the latter measured by revenue for corporate issuers and by gross domestic product (GDP) for sovereigns (Table MN.4). The WACI of the portfolio is then calculated by weighting the carbon intensity of each issuer with its weight in the portfolio. The use of WACI is recommended by the TCFD because it is easy to understand and can be used to compare portfolios of different sizes and compositions;

- **total carbon emissions** or financed emissions, measure the amount of greenhouse gas emissions that can be attributed to a given portfolio (Table MN.2). As recommended by the Partnership for Carbon Accounting Financials (PCAF), the attribution is made by weighting the greenhouse gas emissions of each company by the share of the company's value held by the investor, known as enterprise value including cash (EVIC), equal to the sum of capital, debt issued and liquidity. In the case of government securities, GDP is used (Table MN.5). Since total carbon emissions are not normalized by portfolio size, the indicator is not suitable for comparing portfolios of different sizes or for analysing the same portfolio over time;

- the **carbon footprint** measures the total greenhouse gas emissions of the portfolio, normalized by the market value of the portfolio itself. It can be used to compare different portfolios, even though it is affected by the volatility of the market prices of the securities that compose it. To partially overcome this limitation, the carbon footprint data of the securities portfolios included in this report are calculated using their nominal value and not their market value. However, the market value was used for equity investments.

The Bank relies on two further indicators based on historical emissions:

- **carbon intensity**, which measures the average efficiency of the companies in the portfolio in terms of greenhouse gas emissions and which differs from the WACI owing to the method used for attributing the carbon intensity of the issuers, which in this case is based on the share of value held by the investor (Table MN.1).

- **percentage share of green bonds** in the portfolio (Table MN.1).

As regards the indicators for government bond portfolios, three different versions are calculated, in relation to three different methods for measuring a country's emissions (Table MN.2):

- **production-based emissions**, which refer to the emissions generated within the country to produce goods and services for both domestic consumption and exports; these emissions are therefore normalized by GDP (table MN.4);

- **consumption-based emissions**, i.e. emissions generated within the country to meet national demand and those generated by imported products, excluding domestic emissions related to exports; as they are based on consumption, these emissions are normalized by population. This method addresses the problem of 'carbon leakage'

stemming from the transfer of production with high greenhouse gas emissions from countries with more severe climate policies to countries with less stringent ones.

- **government emissions**, i.e. the direct and indirect emissions of a country's central government, normalized by the monetary value of central government consumption.

In addition to indicators based on historical emissions, five forward-looking climate indicators are analysed:

- **Implied temperature rise (ITR)**, which 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 the company being analysed in terms of overshooting or undershooting the carbon budget necessary to keep the global temperature increase below 2°C. To allocate the emissions budget to a given company, the global budget is divided among countries and economic sectors and, within the sectors, to individual companies on the basis of the amount of revenues;

- **Climate value-at-risk (climate VaR) from transition risk**, which measures the percentage change of a company's value in terms of the present value of the costs, by the end of the century, could arise from: (a) the risks connected with the change in climate policies, estimated using integrated assessment models (IAM),which make it possible to represent the relationships between environmental and socio-economic factors; and (b) the technological opportunities connected to the transition to a low-carbon economy; The indicator is estimated with reference to both orderly transition and disorderly transition scenarios. The first scenario refers to a possible future in which the transition to a low-carbon economy occurs in a coordinated manner, while the second scenario assumed a non-coordinated and delayed transitions, with significant negative effects at social and economic level, as well as on public health and the environment (see NGFS, *Scenarios for central banks and supervisors*, September 2022);

- **Climate value-at-risk (climate VaR) from physical risk**, which measures the percentage change of a company's value in terms of the present value of the costs that, on a horizon of 100 years, could arise from the damages from adverse climatic events, both acute and chronic;

- **Companies' decarbonization commitments,** summarized by the weight in the portfolio of companies that have made a commitment with SBTi to draw up a decarbonization plan, or which have decarbonization objectives already approved by SBTi itself;

- **Country physical risk score**, which evaluates government securities with an increasing risk score ranging between zero and 100, obtained by taking into account several sources of physical risk (e.g. floods, droughts, rising sea levels) and socioeconomic measures.

Tables MN.7 and MN.8 report environmental, social and governance (ESG) factors.

Table NM.1

Backward-looking climate metrics – formulas

Metric	Formula
Weighted average carbon intensity (WACI) (1)	$= \sum_{n}^{i} \left(\frac{\text{current value of investment}_i}{\text{current portfolio value}} \right) x \left(\frac{\text{issuer's carbon emissions}_i}{\text{issuer's revenue, PPP adj.GDP, population, or final consumption expenditure}_i} \right)$
Total carbon emissions (1)	$= \sum_{n}^{i} \left(\frac{\text{current value of investment}_i}{\text{EVIC or PPP adj.GDP}_i} x \ \text{issuer's carbon emissions}_i \right)$
Carbon footprint (1)	$= \frac{\sum_{n}^{i} \left(\frac{\text{current value of investment}_i}{\text{EVIC or PPP adj.GDP}_i} x \ \text{issuer's carbon emissions}_i \right)}{\text{current portfolio value}}$
Carbon intensity	$= \frac{\sum_{n}^{i} \left(\frac{\text{current value of investment}_i}{\text{EVIC or PPP adj.GDP}_i} \right) x \ \text{issuer's carbon emissions}_i}{\sum_{n}^{i} \left(\frac{\text{current value of investment}_i}{\text{EVIC or PPP adj.GDP}_i} x \ \text{issuer's revenue, PPP adj.GDP, population, or final consumption expenditure}_i \right)}$
Green bond share	$= \frac{\text{current portfolio value of green bond}}{\text{current portfolio value}}$

(1) Climate metrics agreed with the Eurosystem.

Table MN.2

Types of carbon emissions allocation methods by issuer type

Issuer type	Factor	Remarks	Source
Corporate	Scope 1 and 2 emissions *(tons CO_2 equivalents - tCO_2e)*	Scope 1 comprises direct GHG emissions that occur from sources that are controlled or owned by an organisation (e.g., emissions associated with fuel combustion in boilers, furnaces, vehicles). Scope 2 comprises indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling.	ISS
Supra & Agency			
Sovereign	Production emissions *(tCO_2e)*	Emissions produced domestically within a country's physical borders, including domestic consumption and exports. This definition follows the territorial emissions approach adopted by United Nations Framework Convention on Climate Change (UNFCCC) for annual national inventories.	ISS
	Consumption emissions (tCO_2e)	Emissions related to domestic demand, accounting for trade effects. This metric provides a broader view of a sovereign's emissions and tackles the issue of carbon leakage that arises due to production shifts from countries where goods are consumed later.	Carbon4 Finance
	Government emissions *(tCO_2e)*	Direct emissions (e.g. from buildings, vehicles) and indirect emissions (e.g. emissions related to energy consumption, but also expenditures, subsidies, and investments) of the central government.	ISS

Table MN.3

Backward-looking climate metrics – reference date

Issuer type	Remarks
Corporate	For the years 2022 and 2021, climate metrics are based on 2021 Scope 1 and Scope 2 emissions. For 2020 indicators, on 2020 emissions.
Supra & Agency	
Sovereign	All metrics are referred to 2020 emisisons, with the exception of China and South Korea, for which emissions refer to 2019.

Table MN.4

Backward-looking climate metrics: normalization factors

Issuer type	Factor	Remarks	Source
Corporate	Revenue in milion euro (for Scope 1 & 2 emissions)	The total amount of income generated by the sale of goods and services related to the primary operations of the business. Commercial revenue may also be referred to as sales or as turnover.	ISS
Supra & Agency			
Sovereign	Production: PPP adj. GDP in million euro	GDP is the sum of gross value added by all resident producers plus any product taxes and minus any subsidies not included in the value of the products. The Purchasing Power Parity (PPP) conversion factor is a spatial price deflator and currency converter that eliminates effects of differences in countries' price levels.	World Bank
	Consumption: population	Total population of a country.	World Bank
	Government: final consumption expenditure in milion euro	General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defence and security but excludes government military expenditures that are part of government capital formation.	World Bank

Table MN.5

Backward-looking climate metrics: attribution factors

Asset class	Factor	Remarks	Source
Sovereign	PPP adj. GDP in milion euro	GDP is the sum of gross value added by all resident producers plus any product taxes and minus any subsidies not included in the value of the products. The Purchasing Power Parity (PPP) conversion factor is a spatial price deflator and currency converter that eliminates effects of differences in countries' price levels.	World Bank
Equities	Enterprise Value Including Cash (EVIC)	The sum of the market capitalisation of ordinary shares at fiscal year end, the market capitalisation of preferred shares at fiscal year-end, and the book values of total debt and minority interests. No deductions of cash or cash equivalents are made to avoid the possibility of negative enterprise values.	ISS, Bloomberg
Supra & Agency bonds			
Corporate bonds			
Covered bonds			

Table MN.6

Forward-looking climate metrics

Metric	Remarks	Source
Implied temperature rise	Expresses the increase in global temperature in degrees Celsius (°C) that would occur at the beginning of the next century if the whole economy performed in a similar way to that firm in terms of overshooting or undershooting the carbon budget necessary to keep the global temperature below 2°C.	MSCI ESG Research
Climate transition Value-at-Risk	Measures the percentage change in a company's market value considering the present value of the costs that could derive by the end of the century from: (a) the risks for the company stemming from changes in climate policies; (b) the technological opportunities relating to the transition to a low-carbon economy. The indicator is reported with reference to both orderly and disorderly transition scenario.	MSCI ESG Research
Physical climate Value-at-Risk	Measures the percentage change in a company's market value considering the present value of the costs that could derive from the damages from adverse climatic events, both acute and chronic, on a century time orizon.	MSCI ESG Research
Companies with commitment to or a target with SBTi	Percentage weight of companies in the portfolio that have made a commitment with SBTi to define a decarbonization plan or that have decarbonization targets already approved by SBTi.	MSCI ESG Research
Physical risk score for sovereign	Measures a country's exposure to the risks of climate change. It is based on 19 metrics that consider 6 sources of risk (floods, droughts, hurricanes and typhoons, sea level rise, water stress and forest fires) and 3 socio-economic measures (expected population in 2040, expected GDP in 2040 in dollars at 2005 purchasing power parity (PPP) and current agricultural area). It can range between 0 (mini-mum risk) and 100 (maximum risk).	Moody's Four Twenty Seven
Estimated short-term greenhouse gas emissions	Estimates of companies' emissions based on historical emissions and commitments declared for the coming years in the transition plans.	MSCI ESG Research

Table MN.7

ESG indicators for private sector issuers

Metrics	Description	Source (a)
ESG Score	Evaluates companies' management of risks and opportunities related to environmental, social and corporate governance factors. It can vary between 0 and 10; the higher the score, the better the ESG profile.	MSCI ESG Research, 2021
Environmental indicators		
Weighted Average Energy Intensity *(GJ / € revenue)*	weighted average of the portfolio companies' energy intensity. Companies' energy intensity is the energy consumption normalized by sales in EUR. The intensity is weighted with the weight of each issuer in the portfolio.	Refinitiv, 2021
Weighted Average Water Intensity (*million m3 / €M rev*enue)	weighted average of the portfolio companies' water intensity. Companies' water intensity is the water withdrawn from any source, either directly by the company or acquired from public utilities, normalized by sales in EUR. The intensity is weighted with the weight of each issuer in the portfolio.	Refinitiv, 2021
Weighted Average Waste Intensity (*tonnes* / €M revenue)	weighted average of the portfolio companies' waste intensity. Companies' waste intensity is expressed in terms of the tonnes of solid waste produced by the company, normalized by sales in EUR. Liquid waste is included only if expressed in tonnes. For utilities and for the energy and mining sectors, waste materials, such as waste rocks and ashes, are also considered waste. The intensity is weighted with the weight of each issuer in the portfolio.	Refinitiv, 2021
Waste Recycling Ratio *(%)*	Percentage ratio between the amount of recycled waste and the amount of total waste. The counting of recycled waste also includes waste destined for waste-to-energy and waste used for composting.	Refinitiv, 2021
Estimated revenue aligned with the EU Taxonomy *(%)*	Weighted average of the estimated revenue that the companies in the portfolio/index generate from activities aligned with the EU Taxonomy of sustainable activities.	MSCI ESG Research, 2021
Social indicators		
Women in management positions (%)	Percentage of female managers out of the total number of company managers. If the company provides the data broken down by managerial category, only the category of middle managers is considered.	Refinitiv, 2021
Average training hours (hours per year)	Average annual training hours per employee.	Refinitiv, 2021
Companies with flexible working hours *(%)*	Percentage of companies that offer flexible working hours, including formulas such as telecommuting, job-sharing and a compressed work week.	Refinitiv, 2021
Trade union representation *(%)*	Percentage of workers represented by independent trade unions or covered by collective bargaining agreements. When both union representation and collective bargaining data are available, the latter is used to calculate the indicator.	Refinitiv, 2021
Injury rate	Number of injuries and deaths, including injuries that do not lead to absences from work, compared with the total number of hours worked per year. The ratio is multiplied by the scale factor of one million. If the company does not communicate the hours worked, the figure is approximated as the number of workers multiplied by 2000.	Refinitiv, 2021
Governance indicators		
UN Global Compact signatories *(%)*	Share of companies that have signed the United Nations Global Compact.	MSCI ESG Research, 2021
Board members independence *(%)*	Percentage of independent directors on the Board. For companies with a two-tier system, the figure refers to Supervisory Board members only.	MSCI ESG Research 2021
Combined CEO/ Chair *(%)*	Percentage of companies in which the roles of Chief Executive Officer and Chairman of the Board of Directors are assigned to the same person.	MSCI ESG Research, 2021
Women on Boards of Directors	Percentage of women on the Board of Directors. In the two-tier system, the calculation is based solely on the members of the Supervisory Board.	MSCI ESG Research, 2021
Pay linked to sustainability performance *(%)*	Share of companies that have introduced reference to sustainability performance in determining the variable components of the Board's remuneration.	MSCI ESG Research, 2021
Companies with anti-corruption policies *(%)*	Share of companies that have anti-corruption policies.	MSCI ESG Research, 2021

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Table MN.8

ESG indicators for government issuers

Metrics	Description	Source (a)
ESG score	Evaluates the country's exposure to environmental, social and governance factors and their management. It can vary between 0 and 10; the higher the score, the better the ESG profile.	MSCI ESG Research, 2022
Environmental indicators		
Energy intensity (EJ)	Ratio of total energy supply expressed in megajoules (MJ) and 2011 PPP GDP in dollars.	BP and World Bank 2021
Forest cover (%)	Percentage of area covered by forests.	FAO, 2020
Share of renewable sources in total energy supply (%)	Share of renewable energy sources in the total energy supply needed by the country in a given year.	IEA, 2021
Social indicators		
Gini index	Level of concentration of income distribution in a population. It can vary between 0 (maximum equi-distribution) and 100 (maximum concentration).	OCSE, World Bank, 2019
Investments in R&D (%)	Percentage of GDP invested in Research & Development.	OCSE, 2020
Female participation in the labour market (%)	Female participation rate in the labour market compared with the male one.	ILOSTAT 2022
Governance indicators		
Democracy index	Examines a country's state of democracy. It focuses on 5 categories: electoral process and pluralism, civil liberties, government function, political participation and political culture. It can vary between 0 (authoritarian regime) and 10 (full democracy).	The Economist, 2021
Corruption perceptions index	Measures the level of perception of public sector corruption. It can vary between 0 (maximum corruption) and 100 (minimum corruption).	Transparency International, 2021

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TABLES

Table A.1

Historical climate indicators: financial portfolio (1)

(absolute values, unless otherwise specified; 2020-22)

Metrics	Sovereign bonds	Other securities			
		Supra and agency bonds	Corporate bonds	Equity	
				Euro-area	US and Japan
Portfolio size *(€ billion)*					
2022	117.8	2.2	0.8	14.2	2.4
2021	117.3	2.1	0.7	16.1	2.8
2020	117.5	2.1	0.7	12.1	1.6
Green bonds share (%)					
2022	2.8 (100%)	20.5 (100%)	6.9 (100%)	–	–
2021	0.7 (100%)	10.1 (100%)	3.7 (100%)	–	–
2020	0.03 (100%)	5.3 (100%)	2.4 (100%)	–	–

Metrics	Sovereign bonds			Other securities			
	Production emissions	Consumption emissions	Government emissions	Supra and agency bonds	Corporate bonds	Equity	
						Euro-area	US and Japan
Weighted Average Carbon Intensity (WACI) *(tCO_2e / €M revenue or GDP)*							
2022	165.1 (100%)	8.3 (100%)	82.3 (100%)	3.7 (87%)	109.4 (98%)	152.8 (100%)	78.1 (98%)
2021	165.2 (100%)	8.3 (100%)	82.3 (100%)	3.3 (89%)	114.4 (97%)	162.6 (100%)	70.1 (97%)
2020	172.9 (100%)	8.3 (100%)	82.6 (100%)	1.0 (77%)	131.0 (98%)	237.0 (100%)	87.0 (97%)
Total Carbon Emissions (Scope 1 & Scope 2) *(tCO_2e)*							
2022	19,447,799 (100%)	24,956,161 (100%)	1,949,851 (100%)	110 (78%)	56,843 (98%)	1,341,061 (100%)	60,961 (98%)
2021	19,377,801 (100%)	24,871,596 (100%)	1,942,479 (100%)	58 (71%)	56,123 (97%)	1,596,610 (100%)	56,589 (97%)
2020	20,311,298 (100%)	26,077,026 (100%)	2,035,408 (100%)	26 (77%)	44,512 (98%)	1,213,905 (95%)	31,033 (91%)
Carbon footprint *(tCO_2e per €M invested)*							
2022	165.1 (100%)	211.9 (100%)	16.6 (100%)	0.1 (78%)	74.5 (98%)	94.5 (100%)	25.8 (98%)
2021	165.2 (100%)	212.0 (100%)	16.6 (100%)	0.03 (71%)	75.3 (97%)	99.0 (100%)	20.0 (97%)
2020	172.9 (100%)	222.0 (100%)	17.3 (100%)	0.01 (77%)	59.7 (98%)	100.2 (95%)	18.8 (91%)
Carbon intensity (2) *(tCO_2e / €M revenue or GDP)*							
2022	165.1 (100%)	8.3 (100%)	82.0 (100%)	1.6 (78%)	145.5 (98%)	160.4 (100%)	85.9 (98%)
2021	165.2 (100%)	8.3 (100%)	82.0 (100%)	0.9 (71%)	148.5 (97%)	179.4 (100%)	71.4 (97%)
2020	172.9 (100%)	8.3 (100%)	82.3 (100%)	0.6 (77%)	154.5 (94%)	259.4 (95%)	80.7 (91%)

(1) For a description of the indicators, see the Methodological notes. For government bonds and corporate bonds, the size of the portfolio refers to the nominal value of the securities, while for equity, it refers to the market value. The degree of coverage of each indicator is also given in brackets. Coverage refers to the percentage of the value of the securities in the portfolio for which the indicator is available.

Table A.2

Historical climate indicators: foreign currency reserves (1)

(absolute values, unless otherwise specified; 2020-22)

Metrics	Sovereign bonds	Other securities		
		Supra and agency bonds	Corporate bonds	Equity funds
Portfolio size *(€ billion)*				
2022	27.5	8.4	0.4	–
2021	27.8	8.7	0.4	–
2020	22.9	12.0	0.4	–
Green bonds share (%)				
2022	0.1 (100%)	7.3 (100%)	2.8 (100%)	–
2021	0.2 (100%)	6.5 (100%)	3.2 (100%)	–
2020	0.03 (100%)	3.1 (100%)	3.6 (100%)	–

Metrics	Sovereign bonds			Other securities		
	Production emissions	Consumption emissions	Government emissions	Supra and agency bonds	Corporate bonds	Equity funds
Weighted Average Carbon Intensity (WACI) *(tCO_2e / €M revenue or GDP)*						
2022	309.4 (100%)	17.4 (100%)	265.5 (100%)	..	259.3 (100%)	–
2021	310.8 (100%)	17.7 (100%)	269.1 (100%)	..	267.1 (100%)	–
2020	321.0 (100%)	17.2 (100%)	265.9 (100%)	..	314.6 (100%)	–
Total Carbon Emissions (Scope 1 & Scope 2) (tCO_2e)						
2022	8,504,001 (100%)	9,191,770 (100%)	1,161,414 (100%)	..	41,352 (100%)	–
2021	8,651,150 (100%)	9,332,330 (100%)	1,186,517 (100%)	..	38,030 (100%)	–
2020	7,367,575 100%	7,952,274 100%	1,003,501 100%	..	22,676 (98%)	–
Carbon footprint *(tCO_2e per €M invested)*						
2022	309.4 (100%)	334.4 (100%)	42.3 (100%)	..	93.8 (100%)	–
2021	310.8 (100%)	335.3 (100%)	42.6 (100%)	..	95.6 (100%)	–
2020	321.0 (100%)	346.5 (100%)	43.7 (100%)	..	61.5 (98%)	–
Carbon intensity (2) *(tCO_2e / €M revenue or GDP)*						
2022	309.4 (100%)	16.4 (100%)	251.1 (100%)	..	170.8 (99%)	–
2021	310.8 (100%)	16.8 (100%)	254.9 (100%)	..	185.3 (98%)	–
2020	321.0 (100%)	16.4 (100%)	251.3 (100%)	..	236.0 (94%)	–

(1) For a description of the indicators, see the Methodological notes. For government bonds and corporate bonds, the size of the portfolio refers to the nominal value of the securities, while for equity, it refers to the market value. The degree of coverage of each indicator is also given in brackets. Coverage refers to the percentage of the value of the securities in the portfolio for which the indicator is available.

Table A.3

Historical climate indicators: Supplementary Pension Fund (1)

(absolute values, unless otherwise specified; 2020-22)

Metrics	Sovereign bonds	Other securities		
		Supra and agency bonds	Corporate bonds	Equity
Portfolio size *(€ billion)*				
2022	0.3	–	0.1	0.3
2021	0.3	–	0.1	0.4
2020	0.2	–	0.1	0.3
Green bonds share (%)				
2022	1.7 (100%)	–	22.1 (100%)	–
2021	1.7 (100%)	–	17.4 (100%)	–
2020	0.8 (100%)	–	4.9 (100%)	–

Metrics	Sovereign bonds			Other securities		
	Production emissions	Consumption emissions	Government emissions	Supra and agency bonds	Corporate bonds	Equity
Weighted Average Carbon Intensity (WACI) *(tCO_2e / €M revenue or GDP)*						
2022	164.1 (100%)	8.9 (100%)	74.7 (100%)	–	73.4 (95%)	145.2 (97%)
2021	164.3 (100%)	8.9 (100%)	75.1 (100%)	–	100.6 (95%)	140.3 (97%)
2020	170.8 (100%)	9.0 (100%)	75.3 (100%)	–	253.5 (93%)	181.7 (95%)
Total Carbon Emissions (Scope 1 & Scope 2) *(tCO_2e)*						
2022	46,518 (100%)	59,726 (100%)	4,534 (100%)	–	2,959 (95%)	24,127 (97%)
2021	41,520 (100%)	53,305 (100%)	4,052 (100%)	–	4,035 (95%)	28,373 (97%)
2020	38,059 (100%)	49,108 (100%)	3,703 (100%)	–	5,764 (91%)	21,331 (89%)
Carbon footprint *(tCO_2e / €M revenue or GDP)*						
2022	164.1 (100%)	210.7 (100%)	16.0 (100%)	–	32.5 (95%)	70.7 (97%)
2021	164.3 (100%)	211.0 (100%)	16.0 (100%)	–	48.8 (95%)	74.9 (97%)
2020	170.8 (100%)	220.4 (100%)	16.6 (100%)	–	111.0 (91%)	66.4 (89%)
Carbon intensity (2) *(tCO_2e / €M revenue or GDP)*						
2022	164.1 (100%)	8.7 (100%)	74.2 (100%)	–	88.8 (95%)	169.8 (97%)
2021	164.3 (100%)	8.7 (100%)	74.6 (100%)	–	117.6 (95%)	173.4 (97%)
2020	170.8 (100%)	8.8 (100%)	74.9 (100%)	–	256.1 (91%)	202.5 (89%)

(1) For a description of the indicators, see the Methodological notes. For government bonds and corporate bonds, the size of the portfolio refers to the nominal value of the securities, while for equity, it refers to the market value. The degree of coverage of each indicator is also given in brackets. Coverage refers to the percentage of the value of the securities in the portfolio for which the indicator is available.

Table A.4

Government securities: ESG indicators (1)
(absolute values, unless otherwise specified; December 2022)

Metrics	Financial portfolio				Foreign exchange reserves				Supplementary Pension Fund			
	Coverage (2)	Portfolio (3)	Index (4)	Difference (%)	Coverage (2)	Portfolio (3)	Index (5)	Difference (%)	Coverage (2)	Portfolio (3)	Index (6)	Difference (%)
ESG score	100%	5.9	6.4	-8.0	100%	6.2	6.1	1.9	100%	6.3	6.3	0
Environmental metrics												
Energy intensity (*MJ per one € of 2017 PPP GDP*) (7)	100%	2.6	3.0	-13.4	100%	4.4	4.3	2.7	100%	2.9	2.9	0
Forest cover *(%)*	100%	32.3	32.5	-0.2	100%	36.6	40.0	-3.4	100%	32.4	32.5	-0.1
Share of renewable sources in total energy supply *(%)*	100%	19.3	17.1	2.2	100%	9.1	9.0	0.1	100%	17.8	17.8	0
Social metrics												
GINI index	100%	32.7	30.3	7.7	100%	36.7	37.4	-1.9	100%	31.1	31.0	0.3
Investments in R&D *(%)*	100%	1.6	2.2	-0.6	100%	3.1	3.2	-0.03	100%	2.0	2.0	0
Female participation in the labour market *(%)*	100%	71.1	82.3	-11.2	100%	82.7	81.5	1.1	100%	78.9	78.9	0
Governance metrics												
Democracy index	100%	7.7	8.1	-4.5	100%	7.9	7.5	5.5	100%	8.0	8.0	0
Corruption perceptions index	100%	57.6	68.7	-16.2	100%	69.9	68.4	2.2	100%	65.4	65.3	0.2

(1) Higher values of indicate a better ESG profile, except for the Gini index. For a description of the indicators, see the Methodological notes. – (2) Coverage means the percentage share of the nominal value of the securities in the portfolio for which the indicator is available. – (3) The indicators marked in green are those for which the portfolio has a sustainability profile that is equal to or better than that of the index; those marked in red indicate it is worse. – (4) The index used is based on a similar index developed by ICE that includes nominal euro-area government securities with an average rating of at least BBB. – (5) The index is obtained by aggregating several ICE indices relating to government securities denominated in the currencies held in the portfolio. – (6) The index is obtained by aggregating several indices relating, respectively, to euro-area government securities (provided by ICE) and to Italian inflation-linked Italian government bonds (provided by Bloomberg). – (7) PPP stands for purchasing power parity.

Table A.5

Equity: ESG indicators (1)

(absolute values, unless otherwise specified; December 2022)

Metrics	Financial portfolio								Supplementary Pension Fund			
	Euro-area equity				US and Japanese equity funds				Equity funds			
	Coverage (2)	Portfolio (3)	Index (4)	Difference (%)	Coverage (2)	Portfolio (3)	Index (5)	Difference (%)	Coverage (2)	Portfolio (3)	Index (6)	Difference (%)
ESG score	100%	7.9	7.3	7.6	100%	7.4	6.7	10.5	98%	7.0	6.9	0.1
Environmental metrics												
Weighted Average Energy Intensity *(GJ / €M revenue)*	93%	1.3	1.8	-26.1	77%	0.8	0.9	-16.2	71%	1.8	1.9	-2.7
Weighted Average Water Intensity *(m^3 / €M revenue)*	93%	6.3	14.2	-55.8	73%	5.6	12.2	-54.4	67%	12.0	10.5	14.0
Weighted Average Waste Intensity (*tonnes / €M revenue*)	86%	22.0	30.9	-28.8	68%	167.7	166.8	0.5	61%	407.3	447.1	-8.9
Waste Recycling Ratio *(%)*	85%	73.0	71.2	1.8	58%	64.4	63.3	1.1	58%	67.5	67.4	0.1
Estimated revenue aligned with the EU Taxonomy *(%)*	100%	7.9	6.1	1.8	100%	6.3	5.0	1.3	98%	5.3	5.5	-0.1
Social metrics												
Women in management positions *(%)*	96%	30.0	29.4	0.6	83%	33.5	33.2	0.3	80%	32.2	32.0	0.1
Average training hours *(hours per year)*	88%	28.9	27.2	6.0	38%	25.8	25.0	3.3	63%	29.0	29.2	-0.8
Companies with flexible working hours *(%)*	100%	88.5	85.7	2.7	100%	76.0	73.3	2.7	99%	73.4	74.0	-0.6
Trade union representation *(%)*	80%	68.8	68.4	0.3	40%	20.9	21.2	-0.3	51%	49.8	49.2	0.6
Injury rate *(number of injuries per million employee-hours worked)*	68%	0.029	0.029	0.3	36%	0.045	0.041	9.8	46%	0.035	0.035	0.8
Governance metrics												
UN Global Compact signatories *(%)*	91%	83.7	82.9	0.8	100%	41.8	32.8	9.1	87%	55.0	54.3	0.6
Companies with anti-corruption policy *(%)*	91%	98.2	98.3	-0.1	100%	92.7	92.3	0.4	87%	92.2	91.9	0.3
Combined CEO/Chair *(%)*	100%	17.6	19.0	-1.4	100%	50.3	47.4	2.9	98%	28.8	28.5	0.3
Board members independence *(%)*	100%	82.6	80.6	2.0	100%	81.7	80.8	0.9	98%	79.2	79.4	-0.2
Women on Boards of Directors	100%	42.1	41.2	0.9	100%	33.4	32.6	0.8	98%	34.6	34.1	0.4
Pay linked to sustainability performance *(%)*	100%	22.8	25.3	-2.6	100%	36.1	39.8	-3.6	98%	36.7	37.6	-0.9

(1) For a description of the indicators, see the 'Methodological note'. – (2) Coverage means the percentage share of the market value of the securities in the portfolio for which the indicator is available. – (3) The indicators marked in green are those for which the portfolio has a sustainability profile that is equal to or better than that of the index; those marked in red indicate it is worse. – (6) The index is obtained by aggregating two indices relating to the Italian stock market with others relating to the euro area. Both exclude securities issued by financial companies – (5) The index is obtained by aggregating the MSCI USA and the MSCI Japan indices. – (6) The index for the equity index of the supplementary pension fund is obtained by aggregating several MSCI indices relating to the different geographical area in which the fund invests..

Table A.6

Corporate bonds: ESG indicators (1)
(absolute values, unless otherwise specified; December 2022)

Metrics	Financial portfolio				Foreign exchange reserves				Supplementary Pension Fund			
	Coverage (2)	Portfolio (3)	Index (4)	Difference (%)	Coverage (2)	Portfolio (3)	Index (5)	Difference (%)	Coverage (2)	Portfolio (3)	Index (6)	Difference (%)
ESG score	98%	7.4	7.3	1.7	100%	7.1	6.8	3.7	98%	7.5	7.1	4.7
Environmental metrics												
Weighted Average Energy Intensity (GJ / €M revenue)	95%	1.1	0.8	32.2	82%	0.6	1.2	-45.9	56%	0.9	1.4	-38.1
Weighted Average Water Intensity (m^3 / €M revenue)	90%	2.2	1.1	102.4	80%	28.2	34.4	-18.1	53%	5.6	9.8	-42.7
Weighted Average Waste Intensity (*tonnes / €M revenue*)	80%	22.2	48.8	-54.6	76%	9.4	37.9	-75.2	48%	34.8	115.3	-69.8
Waste Recycling Ratio *(%)*	67%	70.4	67.4	3.1	64%	62.2	64.6	-2.4	68%	67.4	71.0	-3.6
Estimated revenue aligned with the EU Taxonomy *(%)*	98%	5.0	5.6	-0.6	100%	5.9	5.3	0.6	99%	6.5	5.3	1.2
Social metrics												
Women in management positions *(%)*	92%	31.2	32.1	-0.9	91%	31.4	32.4	-1.0	88%	32.9	30.5	2.4
Average training hours *(hours per year)*	62%	22.7	24.5	-7.2	44%	21.8	28.2	-22.8	73%	27.2	25.1	8.3
Companies with flexible working hours *(%)*	100%	82.1	72.0	10.1	100%	79.6	69.3	10.3	100%	84.9	78.8	6.0
Trade union representation *(%)*	47%	60.5	53.9	6.6	42%	39.9	42.6	-2.7	55%	60.0	58.4	1.6
Injury rate *(number of injuries per million employee-hours worked)*	50%	0.015	0.019	-22.8	51%	0.033	0.036	-6.7	50%	0.030	0.033	-9.2
Governance metrics												
UN Global Compact signatories *(%)*	98%	76.8	78.4	-1.6	100%	35.4	37.8	-2.4	92%	83.1	84.0	-0.9
Companies with anti-corruption policy *(%)*	98%	98.4	97.5	0.9	100%	91.7	91.2	0.5	92%	99.1	98.6	0.5
Combined CEO/Chair *(%)*	98%	37.0	35.8	1.2	100%	49.0	44.8	4.1	98%	18.6	24.9	-6.3
Board members independence *(%)*	98%	81.5	83.4	-1.8	100%	82.0	80.4	1.5	98%	83.8	83.7	0.02
Women on Boards of Directors	98%	37.4	37.2	0.2	100%	34.3	32.6	1.7	99%	38.6	38.0	0.6
Pay linked to sustainability performance *(%)*	98%	30.9	22.8	8.1	100%	29.9	32.9	-3.0	98%	23.3	22.5	0.7

(1) For a description of the indicators, see the Methodological notes. – (2) Coverage means the percentage share of the market value of the securities in the portfolio for which the indicator is available. – (3) The indicators marked in green are those for which the portfolio has a sustainability profile that is equal to or better than that of the index; those marked in red indicate it is worse. – (4) ICE BofA AAA-A euro non-financial index. – (5) ICE BofA 1-10 year AAA-A US corporate non-financial index. – (6) The index, provided by Bloomberg, considers investment-grade corporate bonds denominated in euros.