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THE ITALIAN CLIMATE CHANGE THINK TANK

MONETARY POLICY AND CLIMATE TRANSITION

What can the ECB do for the European Green Deal?

TECHNICAL REPORT
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EXECUTIVE SUMMARY

- Climate change asks central banks to act on multiple fronts: (i) the potential changes induced by climate impacts on the transmission mechanism of monetary policy tools; (ii) the ways in which central banks can contribute to mitigating climate risks, and (iii) the support that monetary action can provide to investments for the green transition[1].

- Climate change is becoming a key factor for monetary policies, the effectiveness of which depends on the behaviour of the financial system, particularly the banking system. The banking system plays a central role in the transmission process, and its stability is a cornerstone of that of the entire economic system. In this context, it is operationally essential for central banks to include climate change in monetary policy assessments to preserve their ability to intervene.

- **Central banks could also play a proactive role** that goes beyond protecting the transmission mechanism and extends to facilitating the processes of transformation required to mitigate climate risks at systemic level. There is plenty of empirical evidence to demonstrate that, with their specific tools, monetary policies can have a varied effect on the accessibility and cost of capital, favouring green enterprises, facilitating the decarbonisation of carbon-intensive businesses and penalising harmful activities.

- In the context of the European Green Deal, the actual implementation of monetary policies offers great potential scope for the ECB and NCBs[2] to contribute to the pursuit of European decarbonisation goals, while adhering to their own mandates. In short, the **ECB and NCBs can adopt operational criteria aimed at encouraging the reallocation of resources by the banking system to favour green financial investments and credit**.

- Although mitigating the climate crisis is not its main responsibility, the ECB is required by the EU Treaties to support the European Union's policies, albeit secondarily to its goal of maintaining price stability[3].

- The ECB may enact various lines of conduct in order to achieve this objective: (a) It may adopt policies aimed at excluding securities issued by carbon-intensive sectors or businesses (*negative screening*); (b) It may orient its open market operations (both standard and non-standard) to favour "sustainable" securities (*positive screening*); (c) It may orient its collateral framework (securities' eligibility and haircuts) to also properly take into account systemic climate risks and encourage the reallocation of bank assets in line with

[1] In this report, the generic expression "green" is used in a restrictive manner with specific reference to activities aligned with the Green Deal strategy and the sustainability criteria defined by the European Taxonomy. The expression "brown" is used to identify activities that do not fall into this category.

[2] The European Central Bank (ECB) and National Central Banks (NCBs) form part of the Eurosystem (the system formed by the central banks of the countries that have adopted the Euro currency) which is currently also identified with the acronym ESCB (European System of Central Banks) adopted in European Union Treaties. For the purposes of this report, the ECB is considered as a synonym of the Eurosystem or of the ESCB.

[3] Art. 127 of the TFEU: *"The primary objective of the European System of Central Banks (hereinafter referred to as "the ESCB") shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Union..."*

the goals of the European Green Deal. In all three cases, the methods used by the Central Bank would correct the market bias in favour of carbon-intensive activities.

- The ECB started the underwriting of green bonds and sustainability-linked bonds on the open market in September 2020, and in July 2022 it announced further climate sustainability measures that, in the months that followed, were implemented on three levels: (1) The integration of criteria for the selection of eligible securities as collateral for open market and bank refinancing operations (*collateral framework*) with an internal rating system that takes into account carbon footprint, the quality of reporting and decarbonisation plans of the issuers; (2) The implementation of a progressive "tilting" of its security portfolio for monetary operations, consisting of securities issued by private non-financial enterprises, through the reinvestment of maturing securities on the basis of the aforementioned internal rating systems (*portfolio tilting*); (3) The integration of climate risk assessments into internal risk-management practices and policies for the reporting of its activities.

- However, the inclusion of carbon rating in the selection of eligible securities as collateral for open market and refinancing operations has only been applied to securities issued by non-financial firms (corporate securities) and not to those issued by national authorities or financial intermediaries, or to securitised assets. As a result, the carbon intensity criterion has, in general, only been applied to an extremely limited portion of the total number of eligible securities (11%). Furthermore, the criteria applied for the selection of the latter have not resulted in any differentiation in the "haircuts" applied (i.e., the cost of bank refinancing), with the justification that climate risks are already reflected in the market assessment of the issuers' credit risk.

- Portfolio decarbonisation policies have not included securities issued by public-sector entities, nor those issued by financial institutions, and within the framework of quantitative easing programmes implemented between mid-2022 and mid-2023 (APP and PEPP), were focused exclusively on securities issued by private non-financial companies as part of programmes that were suspended in July 2023 (CSPP) or that are due to expire by December 2024 (PEPP). With the exception of the PEPP (which has been granted increased flexibility), securities operations have been conducted on the basis of the *market neutrality* principle (i.e., in the same proportion as the market capitalisation of securities). As the majority of securities on the market have been issued by companies with large carbon footprints, this has automatically resulted in the Central Bank's portfolio also being negatively affected by the same carbon bias. Furthermore, decarbonisation goals have not been taken into consideration in the criteria for granting non-standard bank refinancing as part of the TLTRO programmes (other than the eligibility criteria for private securities), nor have they been adopted when determining the entity of haircuts for collateral for open market and refinancing operations.

- The carbon impact of these policies on the system has therefore been modest, firstly because they have only influenced a relatively small proportion of securities, and secondly due to the extremely short period of time over which portfolio tilting policies were implemented (October 2022-July 2023), as a result of the deactivation of QE policies dictated by new restrictive monetary policies.

- In the deflationary period 2015-2021, in which the ECB continued to make net acquisitions of public-sector securities, and in the period that followed, until mid-2023, when the Central Bank kept reinvesting maturing securities, there would have been no contraindications to monetary policies aimed at a progressive and aggressive portfolio reorganisation through QE to favour both private securities with lower carbon footprints and GB/SLB-type securities. This long period of time represented a significant missed opportunity to: (a) reorient not only businesses, but also the public sector and financial intermediaries through the issuing of GB/SLB; (b) encourage private and public-sector issuers to adopt behaviour in line with EU climate goals through incentives (eligibility and haircuts); and (c) facilitate the granting of bank credit on the basis of decarbonisation programmes, energy efficiency and/or green investments (TLTROs).

- The general situation has changed drastically since the end of 2021. The inflationary tensions that resulted from the Russia-Ukraine conflict and the energy crisis that followed have completely overturned the expansive stance of monetary policies, which have set in motion intense increases in interest rates. In this new phase, QE no longer represents a viable measure for the central bank to foster the decarbonisation of the economy.

- However, the transition requires significant investment, both for the development of innovative technology and for the transformation of infrastructure, production processes, mobility and residential real estate. A prolonged period of high interest rates tends to be more detrimental to investments in renewable energy and sustainable technology, while failing to penalise fossil fuels and energy intensive manufacturing processes. The pursuit of a monetary policy to support decarbonisation and technological transformation could serve to create conditions for differentiating the cost of capital to favour green activities while penalising brown activities, through:
    - the **extension of carbon-rating criteria for the selection of eligible securities** (currently only applied to corporate securities) to also cover categories of securities issued by financial institutions (covered bonds and ABS) that are explicitly linked to the funding of energy efficiency and/or decarbonisation programmes;
    - the application of **preferential haircuts** for categories of GB/SLB or compliant issuers with credible decarbonisation plans (which would foster the growth of secondary markets and would also indirectly render it advantageous for banks to grant securitisable credit of a similar nature).
    - the **implementation of long-term subsidized bank refinancing**, similar to TLTROs, aimed exclusively at refinancing bank credit issued in favour of green investments and decarbonisation programmes.

  These operations would be policy neutral, i.e., they would be compatible with any general monetary policy goal (as they can be calibrated according to antinflationary targets), but their effects would be anyway highly selective (as they tend to segment the market and promote the substitution of types of securities without necessarily having undesired monetary policy impacts).

- There are, however, at least three strategic aspects that need to be addressed by the Central Bank before defining a monetary action aligned with the objectives of the European Green Deal:
    - The adoption of an "**impact approach"** of assessing the effectiveness of monetary policy operations with reference to the processes for decarbonising the economy. This implies: (a) measuring the **reduction in absolute financed emissions** (and not

only carbon intensity); (b) **setting targets** (or adopting benchmarks) to periodically assess the extent to which monetary policy impact is aligned with the European Union's climate goals.

- A switch **from an exclusively *risk-based* logic to a *policy-oriented* logic**, acknowledging that the latter is necessary to address the systemic dimension of climate risks.
- The **abandoning of the *market-neutrality* criterion** in the composition of the Central Bank's open market operations, recognising that the market is unable to suitably value climate risk and is therefore incapable of avoiding the resulting biases in favour of carbon-intensive activities to the detriment of investments required for the transition.

1 INTRODUCTION: THE MONETARY POLICY LEVER FOR THE CLIMATE TRANSITION

1.1 THE COMPLEXITY OF THE MONETARY POLICY TRANSMISSION MECHANISM

In recent years, the implications of climate change for monetary policy and the role that central banks can play in accelerating processes for decarbonising the economy and, more generally, the ecological transition, have been reviewed by a broadening literature[4].

Climate change is pushing central banks to act on multiple fronts:

- The potential changes brought about by climate impacts on the transmission mechanism and the effectiveness of monetary policy tools.
- The ways in which central banks can contribute to mitigating climate risk.
- The support that monetary action can provide to investments for the green transition[5].

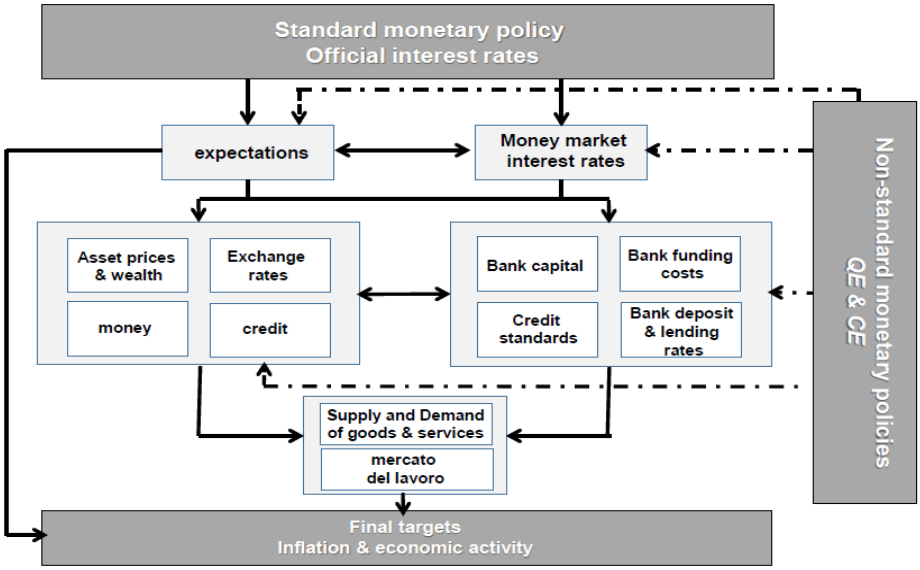
This report will focus on the second and third aspects, taking into account the fact that the main concern of monetary authorities is the stability of prices and the financial system, which rely on the proper functioning of the transmission mechanism. The contributions that central banks can make to mitigating risk and to the transition also largely depend on this mechanism. It would therefore be opportune to outline how these aspects are interconnected.

As far as macroeconomic terminology is concerned, "*transmission mechanism*" refers to the process that connects the tools governed directly by the Central Bank (policy and bank reserve rates) to developments in the variables that represent the end goals of monetary action (inflation, economic activity, etc.). Between the two lies the behaviour of all the various economic macro-agents (families, firms, financial intermediaries), which the Central Bank can only influence indirectly, through various "*channels*". The implementation of monetary policy is, to some extent, like a game of billiards, in which the central banks have just one ball that they can use to move the others, cannoning off the side cushions or setting in motion chain reactions that require them to estimate the angle and calibrate the intensity of their shot in order to achieve the final desired effect. The schematic representation that the Central Bank provides of the transmission mechanism is thus an overview of the results of economic research and macroeconometric models that allow "cannons" and "chains" to be identified and permit them to estimate the necessary angle and intensity of the initial impulse **[figure 1].**

[4] Campiglio et al. (2018); Giovanardi et al. (2022); Dafermos et al. (2021); Dafermos et al. (2022), Davies (2023).

[5] In this report, the generic expression "green" is used in specific reference to assets aligned with the Green Deal strategy and the sustainability criteria defined by the European Taxonomy. The expression "brown" is used to identify activities that do not fall into this category.

Figure 1 *– The monetary policy transmission mechanism*



Source: ECB (2021c) p. 107, https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op271~36775d43c8.en.pdf

Climate change can influence many of the steps in the network of causal nexuses that make up the transmission mechanism. These can be summed up in four main transmission channels: interest rates, expectations, credit, and the value of financial, real and monetary assets.

- *Interest rates*: risk premiums related to climate change can alter in accordance with how much operators are willing to risk, affecting the traditional elasticity of savings, investments and credit aggregates in the face of variations in policy interest rates.
- *The value of financial and monetary assets*: in the short term, climate risks lead to an increase in risk premiums and market volatility, as well as instability.
- *Credit*: banks can feel the effects of the physical and transitional impacts of climate, both through a deterioration in the riskiness of borrowers and their consequential insolvency, and through the depreciation of portfolio assets, which can in turn erode profitability and levels of capitalisation. A fall in the value of the financial assets held by banks also reduces the value of available collateral and limits access to interbank and central bank loans. It is therefore possible for the materialisation of climate risks to alter the response of banks to monetary action taken by the authorities, leading to a rationing of credit and to less responsive bank interest rates.
- *Expectations*: as the effects of transmission are less predictable, and it is more difficult for the Central Bank to identify the origin of shocks and calibrate the timing and intensity of its actions, it is also more difficult for the authorities to stabilise and orient market expectations regarding the future evolution of monetary policy.

Climate change is thus becoming a factor that heavily conditions monetary policy, the effectiveness of which depends on the behaviour of the financial system and, above all, on that of the banking

system, which is central to the transmission process and whose stability forms the cornerstone of the stability of the entire economic system[6].

In this context, including climate change in their monetary policy assessments is an essential operational necessity for central banks to maintain their ability to intervene (Schnabel 2020, 2021; De Guindos 2021).

However, they can also play a proactive role that goes beyond simply protecting the transmission mechanism and contributes to facilitating the transformation processes required to mitigate climate risk on a systemic level[7].

Indeed, there is plenty of empirical evidence to suggest that monetary policies, with their specific tools, can have a varied effect on the accessibility and cost of capital in ways that favour green enterprises, facilitate the decarbonisation of carbon-intensive ones and penalise harmful activities[8]. The central banks (and above all, from our viewpoint, the ECB) have been putting extensive effort into analysing the implications of climate change for monetary policy for some years now[9], yet the translation of this analysis into effective policy action has, until now, proven to fall well short of its potential[10].

A reconstruction of the evolution of monetary policy and orientation on the basis of climate risks not only helps to understand its logic, but also to better understand where and how support from the ECB for the European Green Deal can be most effective, without prejudice to the priorities assigned to the Central Bank in terms of its institutional role within Europe.

1.2 THE RANGE OF ACTION OF THE EUROPEAN CENTRAL BANK

In the leading developed countries, central banks are independent of governments and manage their monetary policies in accordance with the macroeconomic goals set out by their institutional mandates (inflation, economic growth, employment, financial stability, etc.). In Europe, the European Central Bank (ECB) controls monetary policy for the countries that have adopted the Euro (the Eurozone or Euroarea)[11] and, on the basis of European Union Treaties, has price stability as its primary

[6] In Europe, the banking system serves as the intermediary for approximately 80% of financial flows, compared to less than 50% in the United States. Its stability thus plays a determining role in the functioning of the entire system (Gerali et al. 2010; Langfield-Pagano 2015; Gertler et al. 2016).

[7] Dafermos et al.(2020; 2022b; 2023); Aiqui et. al (2023).

[8] Abiry et al. (2019); Ferrari-Nispi Landi (2023); Goudel et al. (2023); D'Arcangelo et al. (2023); Tomasi et al. (2023).

[9] ECB (2021c; 2022b); Abiry et al. (2022); Ferrari-Nispi Landi (2023); Bartocci et al. (2022).

[10] European Parliament (2023).

[11] The 1992 Maastricht treaty (which was drawn up before the effective introduction of the Euro in 2000-2002) assigns responsibility for monetary policy to the European System of Central Banks (ESCB). As not all European Union states have adopted the Euro as their currency, the term *Eurosystem* was used to define a collective comprised of the ECB and the national central banks (NCBs) of the countries that have adopted the Euro. The monetary policy of the Eurozone is decided and managed by the Eurosystem (administered by the Governing Council composed of the governors of all the participating central banks, which defines goals and guidelines for intervention, and by the

goal. The ECB provides support for European Union economic policies, including those aimed at climate and environmental sustainability[12], on the condition that they do not compromise its primary objective of price stability[13]. Consequently, tackling the climate crisis is not one of the prime responsibilities of the ECB, beyond providing support for European Union policies, although this is secondary to its objective of inflation stability.

In terms of the European Green Deal, how monetary policy is actually implemented offers great potential scope for the ECB and NCBs to contribute to the pursuit of European decarbonisation goals. In short, the ECB and NCBs can adopt operational criteria aimed at encouraging the reallocation of resources by the banking system to favour green financial investments and credit, while adhering to their own mandates.

The Central Bank may adopt various lines of conduct in order to achieve this result. In general, it may:

a. Adopt policies to exclude securities issued by carbon-intensive sectors or businesses (negative screening).
b. Orient its open market operations (sale and purchase of securities on the market) to favour the issuing of "sustainable" securities (positive screening) [14].
c. Orient its collateral-guarantee policy (eligibility and haircuts) to properly take into account climate risks as well.

In all three cases, the methods adopted by the Central Bank would serve as both significant indicators and as a way to correct risk/return incentives, focusing market behaviour on the priorities of the European Union's climate policy (Schoenmaker 2021).

In practical terms, what tools does the ECB have access to?

The Central Bank's regular monetary activities are implemented through a wide range of tools that can, however, be divided into two main groups: (a) open market operations and (b) the so-called "last resort" refinancing of banks. As a response to the severe crises seen over the last fifteen years, these standard tools have since been supplemented with another two types of tool that are non-standard in nature and entity, but that essentially correspond to a similar technical classification: (c) operations commonly classified as quantitative easing and (d) so-called credit easing operations (Corsi-Mudde 2022).

Executive Board of six members, which implements the guidelines decided on by the Governing Council). The NCBs intervene in the executive phase. In this report, the ECB is considered as synonymous with the Eurosystem.

[12] Art. 11 TFEU.

[13] Art. 127 of the TFEU: *"The primary objective of the European System of Central Banks (hereinafter referred to as "the ESCB") shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Union..."* Price stability is defined by the ECB as a *"year-on-year increase in the harmonised index for consumer prices for the Euro area of below but close to 2% over the medium term."*

[14] The main downside of exclusion policies is that they do nothing to encourage the decarbonisation of the most pollution-intensive sectors and businesses, i.e., those that could potentially make the most significant contribution to reducing emissions. The logic behind so-called "transition finance" is, instead, to finance the decarbonisation programmes of the most energy and carbon-intensive activities, on the condition that said programmes are aligned with general climate goals and are both certifiable and monitorable (European Commission 2023; OECD 2022; TCFD 2021; UN HLEG 2022).

The structure of this report is designed around the use the European Central Bank makes, or could make, of these tools. Paragraphs 2 and 3 will provide an overview of the technical characteristics of each of these four methods; paragraph 4 will illustrate the policies adopted by the ECB/Eurosystem in terms of climate sustainability; paragraph 5 will present the various lines of intervention that the Central Bank can adopt to support the transition, even in the period of inflation that has emerged since 2021-22; and paragraph 6 will highlight the strategic and methodological hurdles that the ECB needs to clear in order to be able to implement relatively proactive policies in support of the European Green Deal. Paragraph 7 will provide a series of brief concluding remarks.

2 THE STANDARD OPERATIONS OF THE ECB

2.1 THE CHANNEL OF OPEN MARKET OPERATIONS

Open market operations (OMOs) are operations involving the purchase and sale of securities on the secondary market from and to ordinary banks. As the purchase of securities by the Central Bank results in the crediting of liquid reserves to the accounts that banks hold at the Central Bank, and since these free reserves represent the main component of the monetary base, the net impact of purchasing securities is to increase the availability of cash. Vice versa, the sale of securities by the Central Bank has a restrictive monetary effect. In turn, the sum of free bank reserves has an influence on the level of interbank interest rates, i.e., the rates at which banks exchange liquidity via reciprocal accounts that each bank holds with the others. Interbank accounts see a daily flow of excess liquidity from the banks that have more cash inflows than outflows, and this excess liquidity serves to cover the temporary deficit of banks that have, on the contrary, suffered (or predict they will suffer) cash outflows greater than their cash inflows. Interbank accounts thus serve as a large reservoir for the redistribution of the overall available monetary base within the banking system. If, within the system, the majority of positions are characterised by a surplus of liquidity, redistribution takes place at lower interbank rates; if, on the contrary, a deficit of cashflow prevails, interbank rates tend to increase. The level and the evolution of interbank rates over the short and very short-term thus serve as an indicator of the state of liquidity of the banking system, which represents the cornerstone of the monetary policy transmission mechanism. Open market operations are used to keep the level of interbank rates within the range set by the Central Bank, increasing the monetary base if rates are considered to be too high and reducing it if they are considered to be too low. Given their operational significance, OMOs can, according to the goals and timing of monetary policy, assume a variety of technical forms and durations, and operations can be repeated or overlapped with others until the Central Bank has achieved its goal in terms of monetary rates. The open market purchase and sale of securities by the Central Bank can either be *definitive*, meaning that there is no advance intention to resell or repurchase, or *temporary*, through operations known as “repurchase agreements” (repo), which are, instead, purchases or sales of securities governed at the outset by contractual terms and conditions regarding date and price/yield for the counter-operation (repurchase or resale at the end of the fixed term). While definitive OMOs have a permanent impact on the monetary base, in the case of repo operations the issuing or subtraction of liquidity is limited to the duration of the operation. Repo operations thus serve as the main “valve” with which, in regular situations, the Central Bank regulates its short-term influence on the liquidity of the banking system (fine tuning). One thing that all types of OMOs have in common is that these operations are always initiated by the Central Bank, which offers to purchase/sell a determined amount of securities by auction. The yield rate for the operation is determined at auction based on the response of the banking system.

There are two main technical aspects of open market operations that play a significant role in terms of support for climate finance by central banks (Bindseil et al. 2017):

1) The list of securities that the Central Bank considers suitable for use (eligible) in these operations.
2) The so-called haircuts applied to the purchase/sale price of securities.

Both of these ancillary aspects of OMOs have an influence on the banking system in the management of its own portfolio of securities, which serves as a “warehouse” to allow access to the OMO financing auctions (the purchase of securities by the Central Bank) and which is stocked through liquidity draining operations (the sale of securities by the Central Bank).

The list of **eligible securities** drawn up by the Central Bank is currently composed mainly of State securities and securities issued by private companies with a high credit rating. If, for example, the list were to include not only green or sustainable securities (i.e., GB/SLB[15]), but also take into account the characteristics of the issuers in terms of present and forecast carbon footprint, this would represent a strong indirect incentive for ordinary banks to recompose their own security portfolios based on these characteristics, making a significant contribution to the expansion of the sustainable securities market.

A similar and equally significant impact can also be achieved through the **management of haircuts**. In repo financing operations (repurchase agreements for securities purchased by the Central Bank), the securities serve as collateral for the Central Bank against the risk of default by the counter party. The Central Bank protects itself from this risk by applying a "discount" to the initial purchase price that increases in proportion to the level of risk of the security in question. In repo purchasing operations (reverse repo), this discount takes the form of a higher cost applied to the liquidity for the bank taking part in the operation as the counter party. For example, if the securities are initially purchased at a price of EUR 98.75, with the resale set after one month at a cost of EUR 99, the annualised interest rate for the bank on the one-month loan would be 2.53%[16]; if, however, a haircut of 10 basis points is applied to the initial purchase price (thus resulting in a price of EUR 98.65), the annualised cost of the refinancing operation would increase to 4.25%, with an additional spread of 1.72 percent. In the assessment made by the Central Bank, the interest spread rate is set on the basis of the level of risk of the security, and so, when also factoring the exposure to climate risks, the cost of refinancing through securities with a higher risk exposure would be greater for the bank than if it were to use securities from virtuous issuers. For example, if climate risk assessments were to result in less-severe haircuts for green securities, and more drastic haircuts for securities issued by carbon-intensive businesses or those with decarbonisation programmes that are incompatible with the Paris goals, this would represent a further, significant incentive for ordinary banks to recompose their portfolios with green securities and/or securities from virtuous issuers.

2.2 THE LAST RESORT REFINANCING CHANNEL

The selection of eligible securities and criteria for the management of haircuts is not only important in the case of OMOs; these factors also have an influence on the other channel of monetary action available to the Central Bank: marginal (or last resort) refinancing. Refinancing is the concession of temporary credit granted by the Central Bank to individual banks with a shortfall in liquidity. Unlike OMOs, which are activated by the Central Bank (which proposes the volume of securities to be purchased/sold on the market, and for which the yield rate is determined by auction), refinancing operations are set in motion by the individual bank that requires them, and are granted by the Central Bank at a pre-determined rate. This rate (known as the marginal lending facility rate) is the main **official policy rate** of the Central Bank, and it plays an important role as an indicator. Announcements regarding variations in this rate, or its regularity, are the subject of press conferences held by the presidents of the ECB (or the Fed) following meetings of the Executive Board

[15] From this point onwards, we will be using the abbreviations GB for green bonds and SLB for sustainability linked bonds. For the technical and market characteristics of these instruments, please see Ainio et al. (2023).

[16] The yield of a repo operation is calculated with the formula $\left(\frac{P\ of\ repurchase\ at\ maturity}{initial\ P\ of\ sale} - 1\right) * \frac{360}{duration\ of\ operation\ (d)} * 100$, in our example: $\left(\frac{99{,}00}{98{,}75} - 1\right) * \frac{360}{30} * 100 = 2{,}53\%$

(or of the Open Market Committee), with the purpose of indicating the intentions of the monetary authorities and of guiding the expectations of the market on the future of interest rates. The significance of the marginal lending facility rate as an indicator is also due to the fact that it sets the maximum level of monetary rates required by the authorities (and thus also the maximum level of repos on the open market and of interbank rates). The fact that the marginal lending facility rate of the Central Bank is higher than those on the market means that banks turning to last-resort credit incur higher costs than with other sources of liquidity (the interbank market and OMO auctions), ensuring that banks make use of this channel only when they are unable to cover their temporary need for liquidity in any other way. In other words, refinancing from the Central Bank is only used to cover a shortfall in liquidity once the liquidity available to the system has been redistributed among the various banks (through interbank accounts) and the remaining ("marginal") banks whose needs have not been covered turn to the Central Bank as a "last resort".

However, access to refinancing operations for ordinary banks also requires the latter to provide securities as collateral for the credit received, and thus the Central Bank once again refers to the same list of eligible securities and applies haircuts in accordance with the level of risk associated with the individual securities.

Consequently, the selection of eligible securities and the system of haircuts are, in essence, levers that can be applied to all the available monetary policy tools and that have a determining influence on how banks manage their securities portfolios in accordance with the liquidity created by the Central Bank (Adler et al. 2023).

The logic for selecting eligible securities and calculating haircuts is also applicable to the non-standard quantitative easing and credit easing operations that were set in motion in 2015, following the European debt crisis, and that continued almost uninterrupted until 2023. The breadth of impact that these measures have is obviously proportional to the scale of the operations implemented by the Central Bank (Corsi-Mudde 2022).

3 UNCONVENTIONAL OPERATIONS BY THE ECB

In general, the term unconventional monetary policy operation refers to the non-standard measures known as *quantitative easing* (QE) and *credit easing* (CE). QE consists of operations for the purchase of large and potentially infinite amounts of securities from the secondary market by the Central Bank; credit easing (CE), on the contrary, consists of medium-long-term refinancing operations, again of significant scale. Both of these operations result in the creation of a similarly ample and unusual quantity of liquidity[17]. The basic mechanism of both actions is similar to that of OMOs and standard marginal refinancing; in the case of QE, the initiative is taken by the Central Bank, which announces and implements operations for the purchase of securities (specifying the entity and type of securities) and allows the price of the operations to be determined by auction; in the case of CE, the Central Bank announces the non-standard refinancing programme and determines the rates, but the decision to access the funding is left to the individual banks.

As is the case with many other central banks, the USA Federal Reserve (Fed) first used large-scale QE operations at the onset of the outbreak of the sub-prime financial crisis in 2007, which escalated in September 2008 following the collapse of the Lehman Brothers investment bank[18]. The adoption of unconventional policies by the ECB can be divided into three distinct periods. Until 2012, the ECB maintained an extremely prudent attitude[19]. In 2012, with Mario Draghi's famous "*whatever it takes*" statement, the ECB announced its intention to use unlimited QE operations to counter the speculative pressure that, at the time, was harming the Euro, although it only truly began to implement large-scale operations much later, in 2015[20]. In line with its mandate, the ECB modulated its actions in accordance with its primary objective of keeping inflation at around 2%. It only implemented extraordinary policies on a large operational scale when inflation fell towards zero, i.e., much below the monetary policy target, and when serious risks of a breakdown of the Eurozone transmission mechanism became apparent due to the debt crisis that had struck Europe[21].

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[17] In theory, unlike all other operators, central banks are not subject to any budget constraints that limit the extent of their liabilities. Indeed, the liabilities of central banks represent legal tender (i.e., they are legally recognised as payment in the exchange of goods and services) and therefore have no maturity period and are not obligatorily redeemable. Technically, the purchase of securities on the open market or last-resort credit is paid/issued by the Central Bank through accrediting to the reserve accounts of the counter-party banks. The increase in assets for the Central Bank is thus balanced by an equivalent increase in liabilities (bank reserves). Unless they are sterilised with counter operations, QE/CE operations lead to an increase of equal amount in the free reserves of the banks (monetary base), which in turn sets in motion an expansion of credit and monetary funds. As a result, QE/CE operations have an extremely expansionary effect on the economy. The true limitation of monetary expansion is therefore not, as it is with all other agents, budget constraints, as the Central Bank can accumulate unlimited debt; the real limitation to monetary expansion is inflation. Inflation reduces the purchasing power of currency, erodes consumer and business confidence, and undermines the proper functioning of the payment system. It is no coincidence that non-standard QE/CE measures are kept active only until inflation appears to be under control.

[18] Fawley-Neely (2013); Cuckierman (2016); Fisher (2021).

[19] Cour Thiermann-Winkler (2013); Rostagno et al. (2019).

[20] The operations announced in July 2012 by the then president of the ECB Mario Draghi's famous *"whatever it takes"* (Financial Times, July 26 2012) were the OMT (outright market transactions) that were approved that September but never actually implemented. (ECB 2012).

[21] Rostagno et al. (2019); European Parliament (2022).

3.1 QUANTITATIVE EASING: THE APP AND THE PEPP

Over time, the QE policies of the ECB have evolved into numerous programmes with precise goals and rules of engagement. The APP (*asset purchase programme*)[22] was launched at the beginning of 2015, taking the form of four sub-programmes which differed according to the type of securities purchased: the CSPP (*corporate securities purchase programme*), dedicated to securities issued by private non-financial businesses; the PSPP (*public sector purchase programme*), dedicated to the purchase of public-sector securities; the CBPP (*covered bonds purchase programme*)[23], dedicated to covered bonds issued mainly by banks, and the ABSPP (*asset backed purchase programme*), dedicated to securitised assets, also prevalently issued by special purpose vehicles connected to banks[24] **[figure 2a].**

The cumulative sum of all these operations reached a peak of more than EUR 4600 billion in 2022. Net purchases of securities under the APP began to fall gradually in 2018, practically reaching zero in 2019[25]; following a temporary reprise during the COVID-19 pandemic, the programme was finally suspended in July 2023. As reinvestments in mature securities ceased, the quantity of securities held by the ECB gradually began to fall **[Figure 2b** and **Table 2, par.5 below].**

The guiding criteria for the operations of the Central Bank under the APP were ***market neutrality***, for programmes related to securities issued by private entities (CSPP, CBPP, ABSPP), and the so-called ***capital key*** for issuances of public-sector securities (as part of the APP and PSPP). *Market neutrality* ensures that operations by the Central Bank are proportional to the market capitalisation of the individual securities, in order to prevent these operations from distorting the price-determination process. The *capital key*, on the other hand, stipulates that the entity of operations by the Central Bank regarding public-sector securities from the various Eurozone countries is proportional to the share that each of the latter holds of the ECB's capital, in order to avoid any redistribution of resources between countries[26].

With the purpose of mitigating the negative economic impact of the COVID-19 pandemic, between March 2020 and March 2022 an additional non-standard programme, the PEPP (*pandemic emergency purchase programme*)[27] was launched. This programme focused on the same categories of securities as the APP, but with different goals, and contrary to the latter, had flexible limits in terms of the distribution of operations regarding public-sector securities issued by various countries within the Eurozone. The PEPP was suspended at the end of March 2022, but the reinvestment of mature securities was scheduled to continue until the end of 2024.

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[22] ECB, *Asset Purchase Programmes (APP)*, https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html

[23] This was known as the CBPP 3, as two similar programmes had been implemented in 2009 and 2011.

[24] For further information on the nature and technical characteristics of covered bonds (CB) and asset backed securities (ABS), please refer to Ainio et al. (2023)

[25] Net purchases are practically zero as only the mature securities are gradually reinvested.

[26]The capital key only involves countries that have adopted the Euro which, as such, hold a share of the capital of the ECB; for example, focusing exclusively on the primary countries, Italy has a share of 16.9%, Germany of 24.6%, France of 20.4% and Spain of 11.9%. Cfr. ECB, *Capital Subscription*, https://www.ecb.europa.eu/ecb/orga/capital/html/index.en.html

[27] ECB, *Pandemic Emergency Purchase Programme (PEPP)* , https://www.ecb.europa.eu/mopo/implement/pepp/html/index.en.html

In the PEPP, flexibility in terms of deviation from the capital key was granted in recognition of the fact that European countries were forced to handle the pandemic primarily through financial support and public-sector spending measures for the most heavily affected sectors, and that these efforts would have had an uneven effect on the public-sector finances of different countries[28]. Unlike the APP, which was aimed at mitigating deflation forces emerging in a generalised manner within the Eurozone, the PEPP was aimed at bolstering the efforts involving public-sector finance in a differentiated manner across countries to prevent the increase in public-sector debt from compromising the financial stability of the more vulnerable ones. Unlike the APP, the PEPP was, in effect, a financial repression measure aimed at limiting the impact of expansive fiscal policies on interest rates and spread.[29]

3.2 THE TRANSMISSION PROTECTION INSTRUMENT

Once the effects of the APP and - above all - the PEPP had worn off, the ECB proposed a mechanism, called the TPI (*transmission protection instrument*), which allowed it to implement non-standard open market operations involving public-sector securities outside the criterion of the *capital key*. However, the TPI can only be implemented if the financial situation of a country deteriorates due to factors not related to its specific macroeconomic and/or public-sector finance situation, but rather as a result of disturbances of a speculative nature[30]. As is clearly reflected in its name, the rationale behind the TPI is to ensure the proper functioning of the monetary policy transmission mechanism, i.e., to avoid unjustified interest rate differentials of the various countries from compromising its effectiveness.

3.3 CREDIT EASING: THE TLTRO

In addition to QE measures, the ECB also implemented non-standard bank refinancing programmes.

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[28] The pandemic had an extremely negative impact on economies due to the long period of lockdown, which resulted in both a significant fall in demand for consumer items and investments due to the impossibility for families and businesses to spend, and in a simultaneous fall in offer due to the halting of most production activities. In order to ensure that this extreme situation did not set in motion a chain of bankruptcies and a disastrous financial crisis, this extreme situation required compensatory measures involving the suspension/reduction of taxes and an increase in public-sector spending to support the health system, and a focus on favouring the most affected sectors and areas of society.

[29] In hindsight, it is however interesting to note that while purchases in Italian and Spanish state securities were proportionally higher than their respective capital keys, the amount of German securities was no lower than the capital key of Germany, remaining generally in line with the latter (25%), cf. European Parliament (2020).

[30] In making its decisions in these matters, the Governing Council of the ECB avoids offering monetary support to unsustainable budgetary situations. When deciding whether to implement TPI operations, the ECB needs to take into account certain aspects regarding each of the issuing countries involved: (1) that the issuing country is in line with the European Union's fiscal regulations (in particular that it is not subject to the excessive deficit procedure); (2) that it is not subject to the excessive macroeconomic imbalance procedure and that it is compliant with recommended corrective measures; (3) that it is on a sustainable public-sector debt trajectory. Cfr. ECB (2022), *Transmission Protection Instrument*,ECB Press Release, July 21, https://www.ecb.europa.eu/press/pr/date/2022/html/ecb.pr220721~973e6e7273.en.html

Over the course of the 2011-2012 period, in the face of relatively modest QE operations, an initial sizeable LTRO (long-term refinancing operation) programme was implemented to underpin the liquidity of the banking system in the most acute phase of the Eurozone debt crisis[31]. The original LTROs were bank refinancing operations with much longer periods of validity than normal (3 years rather than 3 months) and governed by official rates that were, at the time, close to zero. In this phase, these credit-easing operations represented the ECB's main tool, identifying the banking systems of countries with high levels of public-sector debt as the weakest link in the Eurozone crisis[32].

The ECB's official goal was to ensure liquidity for banks and to support credit. However, as the cost of refinancing via LTRO was much lower than the yield of public-sector securities, banks found it much more economical to refinance their own portfolios of state securities rather than to grant credit to the economy. Indeed, as well as guaranteeing low-risk carry trade[33], an ample portfolio of public-sector securities also provided banks with something to offer as collateral in these refinancing operations with the Central Bank (Acharya-Steffen 2015; Crosignani et al. 2016).

The original LTRO operations provided banks with abundant liquidity but proved to be of little effect in terms of expansionary impact on the economy through credit. In order to overcome this problem, starting in 2014, unconventional European refinancing programmes were redesigned as TLTROs (*targeted long-term refinancing operations*). The TLTROs have the same technical characteristics as their predecessors, but they benefit from extremely advantageous finance costs if the refinancing operation is aimed at an increase in loans to families and businesses[34]. In other words, not only does the new instrument provide banks with liquid resources, but it also allows the Central Bank to guide their ultimate destination.

The technical design of TLTROs therefore appears to be particularly well-suited today to encourage banks to increase their green loans to the economy.

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[31] Cour Thimann-Winkler (2013)

[32] In their role as the main holders of public-sector debt securities, national banks were thus considered by international investors to be exposed to sovereign risk (for example the Italian national bank) and were therefore penalised on international interbank markets, with negative impact on their liquidity that tended to be passed on to stock exchanges considered to be safer (for example Germany), excessively widening the spread between the interbank refinancing rates of the banks of "weaker" countries and those of "stronger" countries. Thus, in order to prevent bank liquidity crises and the large-scale disinvestment of public-sector securities, which would have worsened the divergence between the Eurozone countries, the ECB favoured the channel of non-standard bank refinancing.

[33] In financial jargon, *carry trade* is a strategy that consists of borrowing over a long period to finance an investment that offers returns that are higher than the cost of the debt.

[34] In TLTRO programmes, the interest rate applied to each participating bank is calculated ex-post on the basis of whether the rate of growth of the bank's credit over the period in question (lending performance) is higher or lower than a predetermined threshold set for each individual case by the ECB (lending target). For example, for the TLTRO III, the reference periods for verifying the condition of credit growth and the calculation of reduced interest rates were: for the two operations implemented in 2019, between April 2019 and March 2021; for the four operations implemented in 2020, between March 2020 and March 2021; for the four operations implemented in 2021, between October 2020 and December 2021. The relationship between the interest rate and lending performance has also varied over time; in operations implemented in 2019, the rate was inversely correlated to the rate of credit growth, while in 2020 and 2021 a binary, dual-rate system was applied. In 2020, during the COVID-19 pandemic, refinancing rates were as much as 50 bps lower than the rate of return for free bank reserves, which was already at -50%, thus guaranteeing banks a risk-free negative refinancing rate of one percent. Cf. ECB, European Central Bank, *Targeted Long-Term Refinancing Operations (TLTROs)*, https://www.ecb.europa.eu/mopo/implement/omo/tltro/html/index.en.html

The three-year TLTRO programmes have been systematically renewed, **[figure 3a]**[35], and the conditions of the most recent - the TLTRO III from 2019 - were rendered even more favourable in response to the pandemic crisis[36].

In addition to the cost of the loan being connected to the achievement of credit goals, the expansion of the categories of securities eligible as collateral for operations is also worth a mention due to its importance[37]. Since the operations must be secured by collateral and the categories of suitable securities are predetermined by the Central Bank, the overall entity of the refinancing effectively accessible to individual banks is conditioned by the entity and composition of their securities portfolios (Barbiero et al. 2021).

The launch of large-scale refinancing operations, together with the specification of eligible securities, thus has two collateral effects of extreme significance: (a) it encourages banks to acquire securities from the market that are accepted as collateral by the Central Bank, and (b) maintains the value of these securities and lowers costs for the issuers. It goes without saying that if these criteria included a preference for green or sustainable securities, they would serve as powerful leverage for significantly expanding the market for these financial assets.

Support for the securities market is, of course, also a result of standard refinancing operations, but in that case, the effect is short or extremely short term; in the case of TLTROs, the effect is cumulative and lasting. Indeed, the securities offered as collateral for loans from the Central Bank cannot be liquidated on the market until the loan has been paid off and therefore remain frozen in the banks' portfolios for the entire duration of the financing operation. This restriction, technically known as *asset encumbrance*, means that in order to have access to further financing from the Central Bank, banks must gradually restock their portfolios with new securities that are eligible as collateral in addition to those that have already been used **[figure 3b]**. The composition of eligible securities thus becomes a form of policy leverage, the power of which is greatly amplified by the lengthy duration of TLTROs.

The TLTRO experience has proven to be a success. Unlike the original LTROs, the operational setup of the TLTROs has proven to be extremely effective in influencing the volume and composition of bank credit, without generating incentives for banks to take on excessive risk (Barbiero et al. 2021,

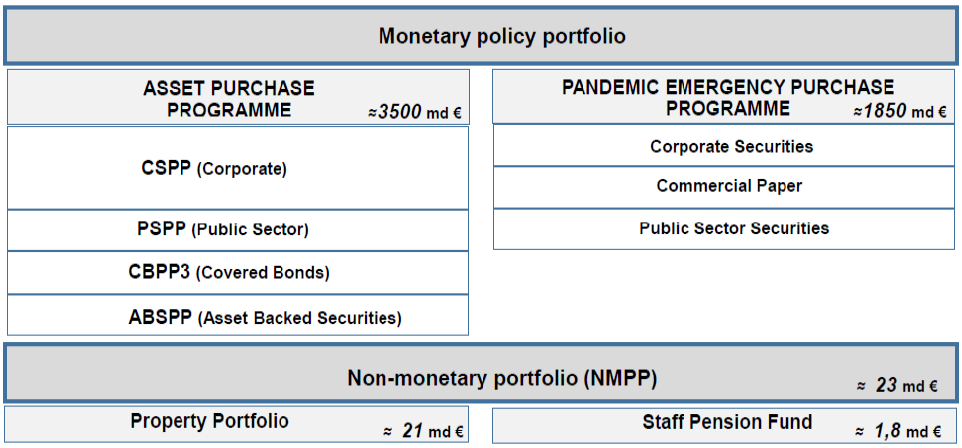
[35] TLTRO I of June 2014 was followed by TLTRO II of March 2016 and TLTRO III of March 2019. TLTRO III was divided into three tranches, for a total of 10 three-year operations. The maximum amount that each participating bank can request (borrowing allowance) has varied over time, from 30% in 2019 to 55% in 2021 of the total current loans to non-financial enterprises and families (with the exclusion of mortgages).

[36] As well as increasing the upper limit of refinancing from 30% to 55% of the credit portfolio of the beneficiary banks, between April and December 2020 the ECB also widened the categories of securities considered as eligible for collateral and reduced the refinancing rate to -1% for banks that meet credit expansion targets. Alongside the PEPP and the benefits applied to TLTRO III, the ECB has also implemented a non-standard refinancing programme, the PLTRO (pandemic long-term refinancing operation) (European Parliament 2020; Barbiero et al. 2021).

[37] In April 2020, the ECB decided to accept non-negotiable assets such as loans covered by public-sector guarantees and issued in response to the COVID-19 pandemic as collateral, in addition to high-quality liquid assets (HQLA). Cfr. ECB (2021d), *What Are Additional Credit Claim (ACC) Frasmeworks?*, May 15 2020 (updated January 14 2021), https://www.ecb.europa.eu/ecb-and-you/explainers/tell-me-more/html/acc_frameworks.en.html

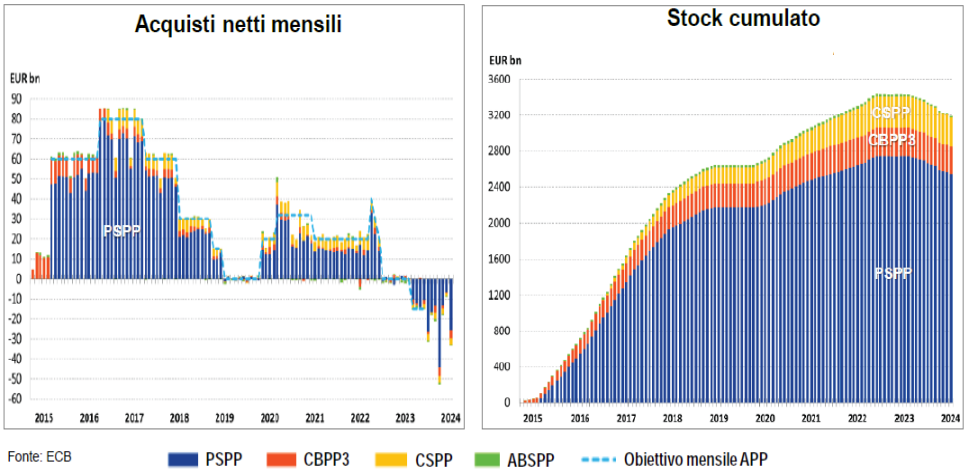
2022)[38], and at the same time, allowing banks to easily comply with regulatory liquidity requirements (Corsi-Mudde 2022)[39].

Figure 2a – *ECB QE programmes and non-monetary policy portfolios (amounts as of 2023)*



Source: ECB (2023b)

Figure 2b – *ECB APP net monthly and cumulative purchases (€ bn)*

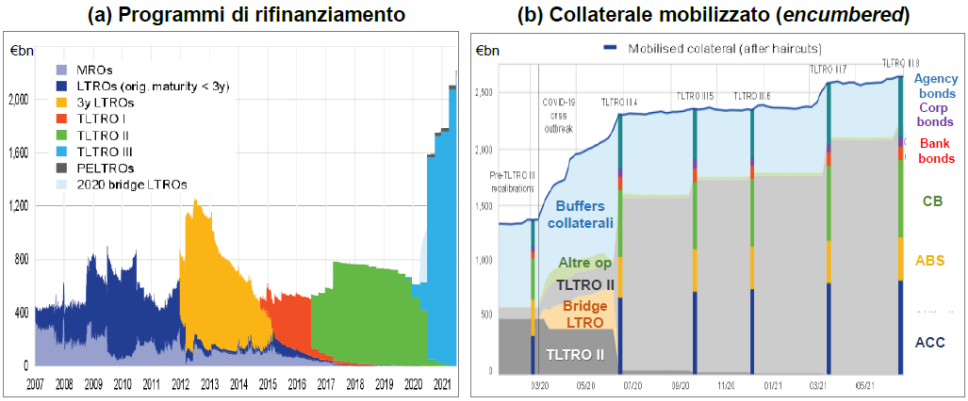


Fonte: ECB, https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html

[38] TLTRO III represented the largest injection of liquidity into the banking system, reaching a level of EUR 2200 bn at the end of 2021. Its success can be explained by the particularly favourable conditions, although at the time these conditions were also the source of preoccupation regarding the possible moral hazards they could have potentially raised. On the contrary, evidence has demonstrated that the ample availability of low-cost liquid resources has also led banks with extremely low intermediation margins to abstain from increasing the risk profile of their credit portfolios (Barbiero et al. 2022).

[39] According to Basel III regulation (adopted by EU legislation with CRD directives and CRR regulations), banks are required to maintain a minimum level of portfolio liquidity (LCR, liquidity coverage ratio), part of which can consist of high-quality liquid assets (HQLA). Compliance with this requirement represents a limit on the securities that banks can offer as collateral for refinancing (which are subject to encumbrance), (Grandia et al. 2019).

Figure 3 – *Evolution of the ECB LTRO and TLTRO programmes and mobilisation of securities as collateral (encumbered) (€ bn)*



Fonte. ECB, Barbiero et al. (2021), https://www.ecb.europa.eu/pub/economic-bulletin/articles/2021/html/ecb.ebart202106_02~35bf40777b.en.html

4 THE ECB'S CLIMATE SUSTAINABILITY POLICY

In terms of sustainability, the European Central Bank has launched initiatives on two fronts: the first regarding internal procedures and the management of its own portfolio (NMPP, *non-monetary policy portfolio*)[40], and the second concerning monetary policy tools (MPP, *monetary policy portfolio*). The initiatives regarding internal organisation take the form of obligations of disclosure for governance, risk-management processes and risk-management metrics[41]. The management of the bank's own portfolio concerns criteria for the selection of securities and the strategy for recomposing the portfolio in line with European decarbonisation goals.[42]

The second front, which is the most important from the perspective of this report, concerns monetary policy strategy, focusing on two aspects in particular: (1) management of the collateral framework and (2) open market operations.[43]

These initiatives run parallel to actions aimed at refining the criteria and tools of bank supervision, above all focusing on disclosure by banks on their exposure to climate risks and the actions they are taking in terms of sustainability.[44] Granular information on the situation of the banking system is also an essential ingredient for monetary policy in substantiating the monitoring of risk, as input for monetary policy models, and to refine stress tests.[45] Since 2020, the year in which the ECB issued guidelines for the prudential management of climate risks by banks and for the relative reporting (ECB 2020a), the data collected and processed by the ECB has become progressively wider ranging[46], as has the monitoring[47] and the precision of supervisory tools[48]. However, evidence shows that disclosure and oversight activities alone have not been enough to redirect the banking system to provide better support for sustainable activities.[49]

[40] The concept of NMPP is not strictly related to the Central Bank's own portfolio, but also the portfolio of the pension fund for bank personnel (ECB 2024d).

[41] NGFS (2021b; 2024).

[42] ECB (2024d).

[43] NGFS (2021a); ECB (2021a; 2021b, 2021c; 2024c).

[44] ECB (2020a).

[45] ECB (2021).

[46] ECB (2023a; 2024b).

[47] ECB (2022c; 2022d; 2023d).

[48] Reghezza et al. (2021); Alogoskoufis et al. (2021); Sydow et al. (2021); ECB (2022a; 2023c).

[49] EBA (2023); ECB (2024a); Recommon (2024); Sastry et al. (2024).

4.1 MANAGEMENT OF THE COLLATERAL FRAMEWORK

ECB policy concerning the management of the collateral framework is determined by the statutory priority of defending the integrity of the Bank's balance sheet.[50] Activities regarding the selection of eligible securities[51] and the application of haircuts[52] are therefore carried out on the basis of exclusively **risk-based selection criteria** (Bindseil et al. 2017).[53] However, this logic is based on the fundamental assumption that all risk factors have been appropriately taken into consideration in market assessments. On the basis of the idea that climate risks are not necessarily reflected in credit ratings, in the value of securities and thus in the yield spreads expressed by the market, the ECB has reviewed its policy to progressively limit the proportion of securities issued by non-financial enterprises with high carbon footprints, and to potentially review the haircuts applied to the latter (ECB 2022b).

Eligibility criteria

In July 2022, the ECB introduced, among the criteria for the selection of eligible securities, an internal composite rating related to the current and forecast carbon intensity of issuers **[cf. Annex A.1]**. However, this rating has only been applied to securities issued by non-financial firms (corporate bonds) and not to those issued by national authorities or to securitised assets.[54]

Table 1 – *Universe of eligible securities and securities used as collateral by banks for Eurosystem refinancing*

	Totale		Central and Regional Gov.Securities		Totale Non-Gov.Securities (incl. Corporate)		Corporate Bonds	
	Eligible	Utilized	Eligible	Utilized	Eligible	Utilized	Eligible	Utilized
Media (mld €) 2022 Q3 – 2024 Q4	17.902	1.548	10.309	264	7593	1770	1924	50
% su totale	*100%*	*100%*	*54,2%*	*11,6%*	*42,4%*	*87%*	*10,7%*	*2,5%*
% su non-Gov. Sec.					*100%*	*100%*	*25,3%*	*2,8%*

Source: processing by ECCO of ECB data, Eurosystem Collateral Data, https://www.ecb.europa.eu/mopo/coll/charts/html/index.en.html

[50] Cf. art.18.1 of the Statute of the ESCB/ECB.

[51] Eligible securities are chosen by the ECB on the basis of asset class, credit rating, maturity, place of issuance and currency. Cf. ECB, European Central Bank, *Eurosystem and Collateral*, https://www.ecb.europa.eu/mopo/coll/html/index.en.html

[52] Haircuts are calculated by the ECB on the basis of three main factors: (i) the time required to liquidate the security (residual life and market liquidity); (ii) the variability of market values (market risk); (iii) the credit risk associated with the security (default risk). Factors (ii) and (iii) depend on factor (i), meaning that typically, the higher the liquidity and lower the residual maturity of a security, the smaller the haircut (Adler et al. 2023).

[53] Above all in exceptional situations, the ECB tends to review criteria for calculating haircuts in order to adapt them to the circumstances. During the 2008-2009 crisis, in line with risk-based logic, the criteria were modified on multiple occasions in order to maintain the ECB's tolerance to risk (the entity of the most probably negative outcome to be covered with haircuts) constant, even in situations of elevated and variable volatility. On the contrary, in the case of the COVID-19 pandemic, the ECB moved away from exclusively risk-based criteria, reducing both haircuts and eligibility criteria in order to facilitate financial support for the economy from banks (Adler et al. 2023).

[54] The categories of government bonds include central and regional government bonds. The non-government categories include corporate bonds, uncovered bank bonds, covered bonds and asset-backed securities (ABS).

As a result, carbon intensity criteria have, in general, only been applied to an extremely limited portion of the total number of eligible securities (11%). Furthermore, as banks tend to use the less-liquid securities (i.e., their own securities or ABS) as collateral for refinancing operations, the proportion of corporate securities effectively used as collateral for refinancing operations is extremely modest (2.5%) **[Table 1][55].**

The application of the same carbon-intensity criteria adopted by the Eurosystem for corporate securities to non-government securities issued by financial intermediaries (bank bonds, covered bonds and ABS) would lead to a fourfold increase in the universe of eligible securities, extending it to include types of instruments that are structurally less liquid.

Their conditional eligibility to current and forward-looking carbon-intensity criteria of the underlying assets being financed would, on the one hand, serve as a factor for the development of the sustainable financial instrument market and, on the other, encourage banks to extend credit to the aforementioned assets with a view to their future securitisation (Ainio et al. 2023).

The difficulties that hindered the assessment of the *greenness* of recipients of bank credit, and consequently of the instruments used for their securitisation, have effectively been resolved by the authorities[56]. As a result, it is now possible to apply the certification criteria required by legislation to these instruments, just as they are applied to the financed businesses and banks.[57]

Haircuts

The ECB continues to view the extending of haircuts to high-carbon-intensity issuers with extreme caution, arguing that climate risks are, at least in part, already taken into consideration by the current calculation methodology under the form of liquidity and credit risk. Indeed, evidence shows that issuing businesses that are formally committed to decarbonisation programmes and providing suitable disclosure tend to benefit from more favourable market ratings and spread (Carbone et al 2021; Adler et al 2023).

[55] The data and the percentages shown in **Table 1** refer to averages for the 2022 Q3 – 2024 Q4 period. Even when excluding government bonds, corporate bonds represent just a quarter of the eligible non-government securities issued and a tenth of those actually used as collateral. Cf. ECB, European Central Bank, *Eurosystem Collateral Data*, https://www.ecb.europa.eu/mopo/coll/charts/html/index.en.html

[56] ESRB-ECB (2022); Colesanti Senni et al. (2023); Ainio et al. (2023).

[57] In order to classify the securities resulting from securitisation as green, it is not sufficient to apply the requirements of the European Green Bond Standard (EUGBS). According to the recommendations of the EBA (2022), in terms of securitised assets, the EUGBS should not be applied to the SPV, but rather to the originator bank. The shifting of requirements regarding the use of the resulting assets to the originator would pose no legal problems. The shifting of the focus from the green nature of the underlying financed assets to the use that the originator makes of the assets resulting from the operation represents a widening of the perimeter of application of the EUGBS that would favour market development, both by allowing originator banks to free up existing resources previously directed towards non-green assets and use them to finance new green assets, and by setting in motion a process in which the new green assets financed can later be used as collateral for successive sustainable finance operations. Ainio et al. (2023) chap. 4

Nonetheless, it is plausible that the characteristics of climate risks (both physical and regarding transition) may not be suitably captured by the traditional estimation methods used by the ECB[58], and that a different assessment logic should be adopted (Bolton et al. 2020; Chenet et al. 2022; Noera 2024b)**.**
Even within a risk-based context, climate risks have a radical nature that may escape traditional statistical representations, and that consequentially require an approach that is more precautionary than financial, i.e., independent of the specific quantification of risk exposure (Weitzman 2009, 2011; Lenton 2019; Bolton et al. 2020). In addition, there is also reason to believe that even the application of a risk-based logic itself could be interpreted in a more extensive manner by monetary and supervisory authorities[59]. This particular form of reasoning is in line with calls from many scholars, who maintain that monetary and supervisory authorities should adopt an explicitly policy-oriented approach, i.e., one that is aimed at favouring the shift.[60]

It would therefore be reasonable and conceptually justifiable to reorient the ECB's haircut policy on the basis of an additional and systematic bonus for issuers more aligned with EU climate goals. This would not be in conflict with the ECB's priority to defend the integrity of its own assets, but would, in addition, be fully consistent with the Central Bank's secondary goal of supporting European policies.

4.2 OPEN MARKET OPERATIONS FOR SECURITIES ISSUED BY NON-FINANCIAL CORPORATIONS

In July 2022, the ECB announced that it would be extending criteria to include climate risks, not only for securities eligible for collateral in its refinancing operations to the banking system, but also for non-standard programmes, albeit limited to securities issued by private non-financial corporates (in particular CSPP and PEPP) (ECB 2022b). The same logic has not been extended to public-sector (PSPP) and bank securities (CBPP, ABSPP).

With reference to private issuers, the policy of the ECB has been to both favour sustainable securities (green bonds and sustainability-linked bonds) and to progressively reorient the purchase of securities on the open market towards issuers with lower carbon footprints, in order to realign the portfolio with the Paris goals (*tilting*). The selection criterion for securities has, as a matter of fact, been updated with an internal rating system based on the assessment of issuers' carbon footprints, their future decarbonisation programmes, and the quality of the data provided **[see Annex A.1].**

[58] The current methodology is based on a maximum expected shortfall assessed with an extremely wide probability interval (99%) and estimated over an extremely long period of time (i.e., one that includes multiple crises); for example, climate risk should have little or no impact on securities with little residual maturity. For securities with longer residual maturity, the market price only takes into account climate risk to the extent to which said risk is suitably considered by credit ratings.

[59] Täger (2021); Bossinot et al. (2022); Chenet et al. (2022); Noera (2024b).

[60] Campiglio et al. (2018); Bolton et al. (2020); Battiston et al. (2021); Dafermos et al (2021, 2022).

4.2.1 THE REORGANISATION OF THE PORTFOLIO IN FAVOUR OF LOW-CARBON BOND ISSUERS

The tilting of the Central Bank's portfolio began in October 2022 and intensified in February 2023, through the reinvestment of mature private securities from the CSPP programme. However, shortly after, in July of the same year, the Bank decided to progressively reduce the size of its financial portfolio, and the suspension of reinvestments was accompanied by an interruption to the restructuring of the CSPP portfolio. Consequentially, the portfolio reorganisation policy was operational for just 15 months, and affected only an extremely small portion of the mature securities reinvested (24 bn out of a total of approximately 300 bn).

The CSPP did not show any significant improvement in terms of carbon footprint indicators over the 2022-2023 period as a result of the new criteria. Indeed, as of the end of 2023, the CSPP programme represented just 8.4% (367 bn) of the entire monetary stock of the Eurosystem/ECB (4387 bn). A further 19% (291 and 600 bn respectively) was represented by covered bonds and asset-backed securities issued by financial intermediaries and underwritten by the Central Bank as part of the CBPP3 and ABSPP programmes, but this was not subject to any portfolio decarbonisation policy.

The impact of these actions on the overall decarbonisation of the economy has therefore been extremely modest, as it is proportional to the fractional size of these operations relative to the total. Furthermore, the timeframe for applying the portfolio decarbonisation programme was too short to have any significant effect on the willingness of private issuers to decarbonise.

Between the end of 2021 and the end of 2023, the stock of corporate bonds held by the Eurosystem had slightly diminished and, although the indicators representing the carbon intensity of the portfolio seemingly improved, this effect appeared to be particularly pronounced before the adoption of the titling policy by the Central Bank. Furthermore, considering the relative nature of the carbon-intensity metrics employed, it could mainly be attributed to the recovery in turnover and business valuation during the strong cyclical post-COVID rebound of 2021-22 **[cf. Annex A.2]**[61].

Of greater interest, however, is the positive impact that the CSPP had on the conditions for access to the market of bonds issued by private companies.

A large body of empirical evidence demonstrated that the original CSPP programme had a significant impact on yields[62], reducing both those of eligible and non-eligible securities, but to a different extent, thereby increasing the negative spread in favour of the former[63]. The first impact

[61] Between 2021 and 2023, the WACI indicator fell by 94 MtCO2e (from 266 to 172 MtCO2e); however, 87% of this decrease (82 MtCO2e) took place in 2021-2022, before the tilting policy was implemented. A similar trend was seen with other indicators, such as carbon intensity (CI) and carbon footprint (CF) (ECB 2024c).

[62] Todorov (2020) estimated an average reduction in yield of 30 bps following the announcement of the CSPP; Rischen-Theissen (2020) found that the structural underestimation of the European bond market was reduced by the actions of the ECB, leading to a decrease in yield for eligible securities of approximately 24 bps.

[63] Unlike with public-sector securities, the Eurosystem can also underwrite private issuances on the primary market (i.e., on issuance). In examining data from the primary market in the first year of the CSPP, Zaghini (2019) revealed a reduction of 36 bps for both eligible and non-eligible securities following the announcement by the ECB of the

may presumably be attributed to the announcement effect of the Central Bank's initiative, and the second to the substitution in operators' portfolios of non-eligible securities with eligible securities. Over a longer period of time however, the effects of a reduction in yield partially transmitted to non-eligible securities as well, marking an increase in demand for private securities that was not restricted to the eligible segment. **In other words, the CSPP had a positive effect on the financing conditions of the entire private sector, and not only on those that were targeted by the Central Bank's operations (eligible)[64]**.

4.2.2 THE UNDERWRITING OF GREEN BONDS AND SUSTAINABILITY-LINKED BONDS

As part of its strategy to support European climate policy, since 2021 the Eurosystem/ECB has accepted sustainability-linked bonds (SLB) in addition to green bonds (GB), both as collateral in its own refinancing operations and as the subject of open market operations (ECB 2020b).[65]

Purchases of GB/SLBs by the ECB/Eurosystem have mainly been made as part of the PSPP and PEPP and have therefore concerned not only private-sector issuances, but also the purchase of public-sector GBs/SLBs on the secondary market (De Sanctis et al. 2018b). In fact, issuances by private businesses and institutions can also be underwritten by the ECB/Eurosystem on the primary market, unlike those of public-sector entities.[66]

programme, but before it effectively went into action; an impact of a further 70 bps concentrated exclusively on eligible securities once the programme had actually been implemented (H2 2016), lastly also provoking a later and slower downturn (50 bps) for non-eligible securities.

[64] In the first six months of application of the CSPP (H2 2016), improvements in rates exclusively for eligible securities saw a parallel increase in the supply of both eligible and non-eligible securities, although this shift in overall supply initially corresponded to an increase in demand for eligible securities only (driven by the ECB). The later increase in demand for non-eligible securities only came six months later, and was more gradual. The phenomenon can be explained with the fact that the ECB's operations absorbed a significant part of the supply of eligible securities (approximately 30%) and that the "scarcity effect" had led some operators to also underwrite non-eligible securities (Zaghini 2019). The evidence of Pegoraro-Montagna (2021), which also demonstrated an increase in the propensity for risk of the underwriters, can also be read in this light. Mäkinen et al. (2022) also obtained similar results over a longer period of application of the CSPP (2016-2018). The transmission mechanism described above (capital structure or portfolio channel) was also tested within a wider context by Grosse-Rueschkamp et al. (2019), who demonstrated how, by including bank credit in the framework, the reduction in yield for private bonds as a result of the actions of the Central Bank led businesses to use bond issues to substitute bank credit as well, freeing capital for the banks, who could therefore also extend credit to riskier enterprises. The indirect benefits of the CSPP are thus also extended to the credit market.

[65] An SLB is a security whose coupon is indexed to pre-defined sustainability goals that can be measured and verified over pre-established periods of time. The goals must be specifically related to the issuer (they cannot, for example, make general reference to EU decarbonisation goals) and must be clearly stated in the listing prospectus available to the public. Cf. Ainio et al. (2023).

[66] The purchase of public-sector securities by the ESBC/ECB on the primary market is forbidden by art. 123 (1) of the TFEU.

Access to green public-sector issuances for QE operations and the simultaneous offer of European Union NGEU (Next GenerationEU) securities[67] have created the conditions for the rapid development of the green segment of the European bond market, and also, in parallel, resulted in a more than a three-fold increase in the portion of GBs in the Eurosystem portfolio between 2020 and 2023 (from 0.7% to 1.9%). Despite this rapid growth, the percentage of green securities still remains at an altogether marginal level in the Central Bank's portfolio (65 bn out of a total of 3260 bn in public-sector securities) as it is tied to the limited liquidity of the market and to the fact that, strictly speaking, green bonds are tied to specific projects. Further development of this segment thus appears to depend on the possibility that the European Union will follow up on the experience of the NGEU for the funding of the Green Deal.[68]

Technically speaking, SLBs are a more functional type of security than GBs with regard to operations by the Central Bank on the open market, but even here the limited liquidity of the market is an obstacle to their wider use. The ECB is therefore forced to limit its operations in this segment as well, in proportion to the dimension of the market.

SLBs are securities whose returns are not tightly bound to specific projects, but for which the coupon rate is indexed to the achievement of predefined goals. **The fact that Member States are committed to pursuing European climate goals within defined periods of time means that they could issue public-sector SLBs linked to said goals and receive support from the intervention policies of the Central Bank, which could grant them preferential status. As well as increasing the breadth and liquidity of the market, support from the Central Bank would also represent a framework of incentives for Member States that are in line with European climate goals, indexing the cost of loans to the achievement of these goals.**

However, the ban on intervention in the primary market for public-sector securities limits the opportunity of the Eurosystem to directly facilitate the development of an ample public-sector SLB market. The ban on operating directly in primary markets means that the Central Bank can only provide indirect support: it could, for example, allocate a portion of its QE operations on the secondary market for these forms of securities or encourage banks to underwrite them through eligibility policies and haircuts that favour public-sector SLBs.

In this second case, the expansion of the SLB market (and the consequentially higher opportunity for the Central Bank to operate on said market) depends on the level of demand for these securities from the banks. Therefore, even though the scale of Central Bank open market operations in SLB is limited, giving to these kinds of securities preferential status in terms of eligibility and haircuts would give the banks an incentive to increase their demand and to the market to grow in size.

In fact, as it is demonstrated by the experience of the PEPP pandemic programme (which we will review in the next paragraph), the ECB's intervention on the securities market plays a decisive role in orienting bank's preferences and fostering market development (Bremus et al. 2021; Zaghini 2021, 2024).

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[67] The NGEU originally provided for issuances worth EUR 250 bn i.e., 31% of the overall nominal amount allocated by the fund. Of these, 44.2 bn in green bonds were issued between 2021 and August 2023. Cf. European Commission (2024).

[68] Noera (2024a).

4.2.3 THE EXPERIENCE OF THE PEPP AND THE GREEN BOND MARKET

In March 2020, faced with the need to counter the outbreak of the COVID-19 pandemic, all the main central banks reacted by expanding their own QE programmes[69]. In this context, the ECB launched the PEPP (*pandemic emergency purchase programme*)[70], a non-standard QE programme aimed at compensating for the disruption caused by lockdowns and keeping the monetary policy transmission mechanism operational in the face of an extremely violent and widespread economic shock[71]. The programme of net purchases remained operational for two years and was suspended in March 2022, although reinvestments of maturing securities was set to continue until the end of 2024. As was the case with the APP, the PEPP addressed all categories of issuer, both public and private; however, the characteristics of the PEPP differed from those of the APP in terms of their wide-ranging operational flexibility in terms of time, composition by asset class, and jurisdiction of the issuers. **The PEPP allowed the Central Bank to deviate from both the criterion of market neutrality and that of the capital key.** In order to adapt to shifting market conditions, this flexibility was put to extensive use by the Central Bank and allowed the financial situation in the Eurozone to be swiftly brought under control **[Figure 4]**[72].

The PEPP experience is particularly interesting because it allows for an analysis of the effects of ECB QE operations on yields for issuances from non-financial corporates, distinguishing the effects between the various categories of security and above all on green bonds.[73]

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[69] In March 2020, the Bank of England launched the COVID Corporate Financing Facility (CCFF) and expanded the asset purchase programme APP, which was already operational in Great Britain, by £ 450 bn. In the USA, for the first time ever, the Fed extended its QE operations to include corporate securities both on the primary market (PMCCF, primary market corporate credit facility) and on the secondary market (SMCCF, secondary market corporate credit facility), with an initial allocation of USD 300 bn that was later increased to USD 850 bn.

[70] The PEPP initially provided for an overall limit on operations of EUR 1850 bn, although this was not fully used. Cf. ECB, *Pandemic Emergency Purchase Programme (PEPP)*, https://www.ecb.europa.eu/mopo/implement/pepp/html/index.en.html

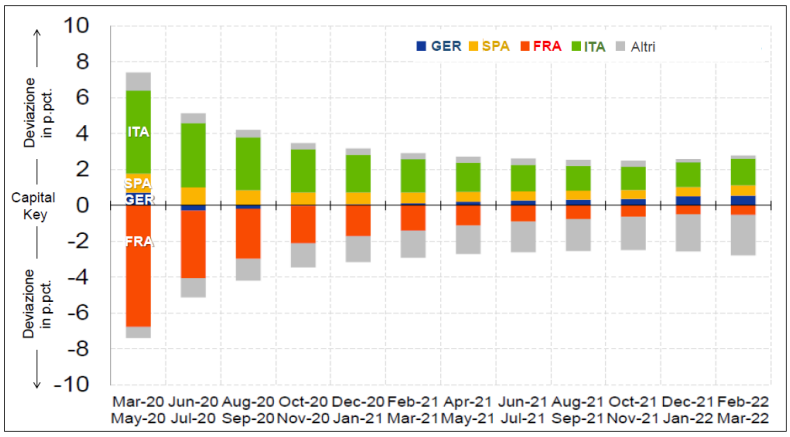
[71] Although the SARS-COVID-19 virus began to circulate in Europe as early as the end of 2019, the decision to take initial measures to close certain areas was made in the second half of February 2020, with disruptive effect on the financial markets (an increase in volatility and a widening of the spread beyond the maximum levels seen during the 2011-12 debt crisis). The urgency and the vital importance of non-standard and large-scale measures taken by the monetary authorities was also unanimously stressed by economists and respected policy makers (Draghi 2020; Benassy-Quéré et al. 2020; Baldwin 2020).

[72] The implementation of the PEPP maintained the quotations of state securities and halted the shock to the spread between long-term securities and monetary rates that was seen over the first few months of 2020. The differential between ten-year bonds in the Eurozone (GDP weighted) and the overnight index swap (OIS) is seen by the ECB as an indicator of the status of the monetary policy transmission system. The latter can have a direct impact on the level of the OIS (by modulating bank liquidity), but only an indirect impact on long-term yields (which are dependent on market conditions); the decoupling of the two rates is thus an indication that monetary policy has poor capacity to influence the entire interest rate structure. However, in order to obtain this result, the Eurosystem had to intervene in an asymmetrical manner on the securities of the various issuing countries in order to control the yield of those seen to deviate, i.e., to a large extent Italy, and to a lesser extent Spain (European Parliament 2020a; Böninghausen et al. 2022; Schnabel 2024).

[73] Bremus et al. (2021); Zaghini (2019, 2021, 2024).

Despite being, in many ways, similar to the CSPP[74], the PEPP's average monthly effect was ten times greater[75] and, since it was not bound by market neutrality, it was also granted more freedom to address GBs, influencing their yield in a differential manner.

Figure 4 – *Cumulated deviations from ECB capital key for public-sector assets under the PEPP (percentage point)*



Source: ECB- Schnabel (2024), Annex, https://www.ecb.europa.eu/pub/pdf/annex/ecb.sp240528_annex.en.pdf

The neutrality criterion for market operations, which required the CSPP to reflect the existing composition of the market (favouring more energy-intensive and carbon-intensive issuers), significantly constrained the ECB's flexibility in terms of its policy to reorganise the portfolio in favour of green securities[76]. Instead, the impact of the PEPP on market yields of corporate securities appears quantitatively much broader than that of the CSPP[77]. As could be reasonably expected, the reduction is more accentuated for eligible securities (which are all investment grade) than for non-eligible securities (which also include sub-investment-grade issuances) **[Figure 5a]** and is also more intense for GBs than for non-GBs **[Figure 5b]**[78].

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[74] The PEPP eligibility criteria for securities were the same as those for the CSPP (investment grade rating, issued in Euro, residency in a Eurozone country, inclusion of non-banking intermediaries and exclusion of banks).

[75] Initially, PEPP operations were for an average value of EUR 120 bn per month; in the first month of application (June-July 2016), CSPP purchases totalled 10.4 bn. (ECB Economic Bulletin, 4/2017).

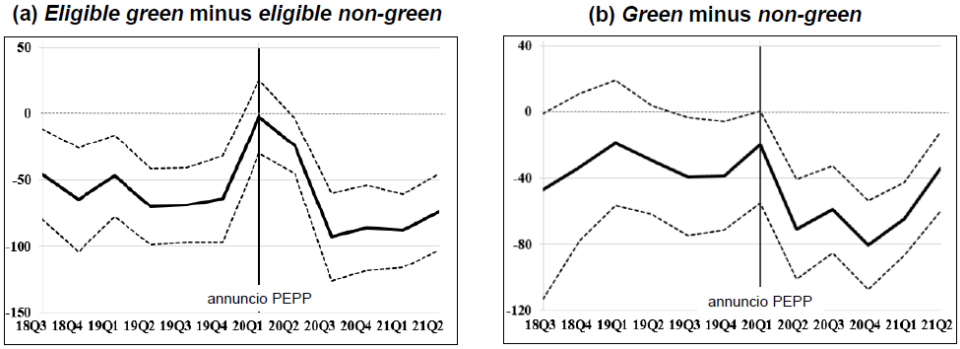
[76] Dafermos et al. (2020); Papoutsi et al. (2021); Schoenmaker (2021).

[77] According to the estimates of Bremus et al. (2021), with the CSPP the yield of green bonds falls by between 18 and 33 bps in comparison to similar securities that are not affected by the Central Bank's operations; with the PEPP, the average reduction was 135 bps.

[78] On the secondary market, the impact of the PEPP was, in some senses, similar to that of the CSPP, above all in the segment of higher-rating (investment grade) securities: the announcement of the two programmes was followed by a fall in the secondary market yields of both eligible and non-eligible private securities, although to a wider extent for the PEPP. More notable differences between the two programmes emerged in the segment of the riskier (sub-investment-grade) securities. While, with the CSPP, there were no significant differences between eligible and non-eligible securities, with the PEPP the fall in market yield of eligible securities (which are all investment grade) was much greater than that of the non-eligible securities. It is likely that investors' increased aversion to risk fuelled by the pandemic crisis greatly limited the extent to which the effects spilled over to drive demand for sub-investment-grade non-eligible securities. One possible conclusion to be drawn from this is that it is not so much the distinction between eligible and non-eligible securities that counts, but rather the more classic difference between rating classes (Bremus et al. 2021). However, these findings, which are, in general, similar to those that emerged in the case of the CSPP, focus exclusively on the discriminating factors of eligible/non-eligible and investment-sub-investment grade, and do not allow an identification of the specific behaviour of the green bond segment. The same marked segmentation of

Instead, a detailed examination of the exclusive GB primary market uncovers an even more interesting peculiarity; one can, in fact, note that over the course of the PEPP programme (unlike for the CSPP), the green-bond (GB) segment benefited from a yield premium (*greenium*) over non-GBs in both the eligible and non-eligible sectors **[figure 6a-6b]** (Zaghini 2024)[79]. In other words, the difficulty of substituting GBs with other categories of securities concentrated the spill-over of demand (portfolio rebalancing) almost exclusively within the GB segment.[80]

Figure 5 – *Difference in yield at issuance between eligible and non-eligible securities and between green and non-green securities (basis points)*



Fonte: Banca d'Italia- Zaghini (2024)

The larger scale and the greater flexibility of PEPP operations compared to CSPP operations thus led to a more accentuated reduction in yield of GBs, reflecting the shift of market demand in their favour.

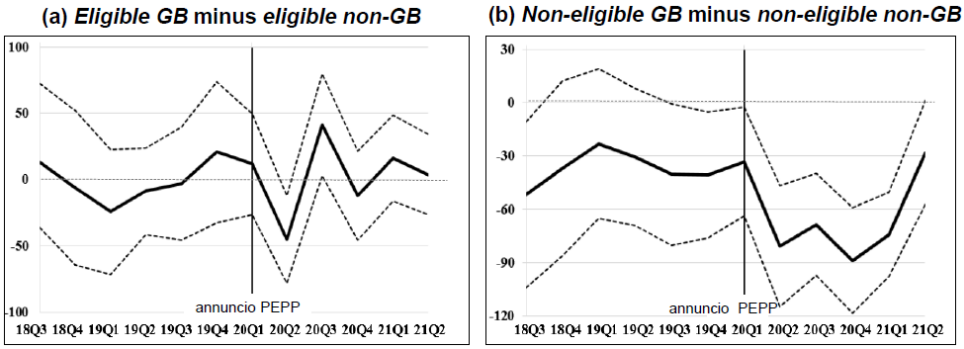
This greater reduction also tends to encourage businesses to issue GBs. In studying the effects of the CSPP programme on the corporate securities market, Todorov (2020) and Pegoraro-Montagna (2021) highlight positive effects not only on price, but also on liquidity and supply of eligible securities, and Galema-Lugo (2021), in analysing the liability structure of the issuing businesses, show that, in relation to the CSPP programme, the supply of target securities increased more than that of non-target securities.

market reaction by rating categories has also been confirmed on the primary market for private securities, where, in this case, the preference demonstrated by investors for investment-grade securities saw an exclusive focus within the segment of the effects of demand, with no distinction between eligible and non-eligible securities: the scarcity of the former due to the Central Bank's intervention led to some of the unsatisfied demand shifting to the latter (Zaghini 2021).

[79] However, the announcement effect of the PEPP initially more than proportionally benefited eligible GBs over non-eligible GBs (-51 bps compared to -22.5 bps) (Zaghini 2024).

[80] The dominance of the portfolio rebalancing channel (the substitution effect) over that of liquidity (which tends to affect all assets in an indiscriminate manner) has also been seen in general, beyond the GB segment, in terms of QE operations carried out both by the Fed (Krishnamurty-Vissing Jorgensen 2011; D'Amico-King 2010) and by the ECB (Krishnamurty et al. 2017; Albertazzi et al. 2018).

Figure 6 – *Difference in yield at issuance within the green-bond segment (basis points)*



Source: Banca d'Italia- Zaghini (2024)

These findings have potentially extremely significant policy implications:

- The first is that the less substitutable a category of securities is compared to others, the stronger the effects of the Central Bank's QE operations.[81]
- Due to their very purpose and structure, the substitutability of GB/SLBs is very low compared to other categories of assets[82]. The poor substitutability of these securities means that, in the event of QE operations by the Central Bank exclusively concentrated on them, the yield-reduction effects prevalently tend to be limited to the segment and have little impact on other categories of securities.
- These segmentation effects in favour of GB/SLBs are stronger and longer lasting on the primary market than on the secondary market[83], and while the ECB/Eurosystem is prohibited from underwriting public-sector securities on the primary market, it faces no such restrictions for private securities.
- Lastly, given the selective and discriminate nature of these effects, they do not interfere with more general monetary policy goals, whose impact on the general level of yields and the monetary base depend on the overall entity of the Central Bank's operations on the market, rather than on their composition.

These considerations suggest that a Central Bank policy explicitly oriented toward the purchase of GB/SLBs in its market operations could have selective and targeted effects on the cost of obtaining capital for non-financial corporates, thereby favouring the development of this market segment.

The leverage of targeted purchases on the primary and secondary markets of GB/SLB by the Central Bank is thus a decisive addition to the Green Deal's effort to facilitate private funding of the transition, not only by supporting the demand for these types of securities, but also by indirectly stimulating supply.

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[81] The effect on yield depends on the level of gross substitutability of the various assets in the portfolios of the end investors (Tobin 1958, 1969; Vajanos-Vila 2021). In the case of two perfectly substitutable securities, the variations in their yields should be identical, while for two extremely different securities (or securities that are exchanged in segmented markets), the lower their substitutability, the greater the difference in the reaction of their respective yields (because the spill-over effects between one market and the other will be limited). Bernanke (2012); Albertazzi et al. 2018; Eser et al, 2019).

[82] Ainio et al. (2023).

[83] The estimates by Zaghini (2019, 2024) concern the primary market, while those by Bremus et al. (2021) concern the secondary market.

A similar approach could be applied by the Central Bank also to public securities, both by giving an incentive to bank demand via collateral policy and by direct intervention on the secondary market of GB/SLB.

4.3 THE PROBLEM OF DECARBONISING THE OPEN MARKET OPERATIONS IN SOVEREIGN SECURITIES

4.3.1 THE REORGANISATION OF THE PORTFOLIO IN FAVOUR OF LESS-CARBON-INTENSIVE ISSUERS

Public-sector securities represent 85% of the Eurosystem monetary policy portfolio. However, the QE operations targeting public-sector securities (PSPP and PEPP) have not been involved in any policy aimed at reorganising the portfolio in accordance with the carbon intensity of issuers. With the exception of the PEPP, operations for the purchase of public-sector securities are proportional to the share that each Member State has in the ECB's capital (*capital key*), as well as to the market share of each security (*market neutrality*)[84]. As a result, neither the (modest) percentage of green bonds and sustainability-linked bonds nor the evolution over time of the carbon intensity of the Eurosystem's monetary policy portfolio has been the result of policy actions; instead, they have been just the outcome of spontaneous market trends[85].

The abstention of the Central Bank from operating directly on public securities in terms of carbon intensity is understandable. The application of the same logic of portfolio tilting to sovereign bonds for goals similar to those adopted for private securities as part of the CSPP and PEPP programme would have been neither technically manageable nor institutionally acceptable. In addition to presenting undeniable challenges in terms of assessment and monitoring, it would have implicitly granted the ECB supervisory powers over the policies of Member States, something that is not among its responsibilities. The need to preserve the efficiency of the transmission mechanism and market stability (as with the PEPP) would not have justified a deviation from the capital key criteria: rather, this would have been managed based on the degree to which each Member State respected the European Union's decarbonisation goals. This would have resulted in the Central Bank assuming the power to sanction Member States, something that bears no relation to the statutory duties of the ECB.

However, the ECB should have been able to act indirectly, by favouring the issuance of green bonds (GB) and, above all, of sustainability-linked bonds (SLB) by Eurozone countries. The modest entity and the limited depth of the GB/SLB market places inevitable restrictions on the purchases that could be made of these categories of securities **[Figure 7a][86]**. The secondary market of sovereign GB/SLBs issuances does not, in other words, provide sufficient capacity for the average size of the QE

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[84] ECB, European Central Bank, *FAQ on the Public Sector Purchase Programme (PSPP)*, https://www.ecb.europa.eu/mopo/implement/app/html/ecb.faq_pspp.en.html

[85] Cf. ECB (2024c).

[86] In addition to scarcity (conditioned by the fact that the Central Bank is prohibited from operating on the public-sector securities market), the poor liquidity of the secondary GB/SLB market is also due to the fact that the demand for these securities comes from institutional investors, who tend to hold on to them until maturity.

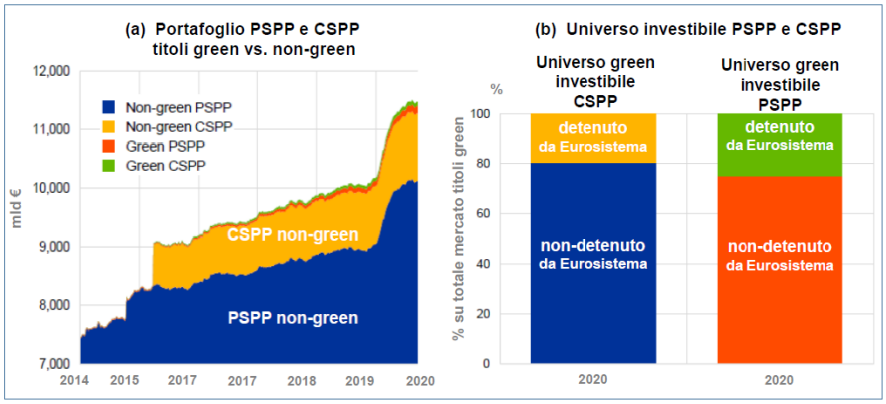
operations carried out by the ECB. As a result, the impact on the public-sector securities market was practically non-existent, also because the ECB avoided to exert any influence on the GB/SLB market: a s a matter of fact, the percentage of GB/SLBs in the ECB portfolio was always lower than the share of green securities in the total European sovereign bond market and failed to apply systematic pressure to their value.[87]

The ECB is, in any case, the leading investor in this market, over time absorbing as much as one fifth of the (limited) overall issuances **[Figure 7b].** Despite the meagre quantities that characterise the market of public-sector securities such as GB/SLBs, the Central Bank's actions could have been directed towards accelerating development, rather than being limited to following its spontaneous evolution.

With the long period of QE, which came to an end in July 2023, a significant opportunity was missed to reorient incentives, including for public issuers, towards issuing financial instruments required to fund the energy/climate transition. The ECB could have destined a portion of its operations (calibrated to the size of the market) for the explicit purpose of favouring the emission of GBs and, above all, SLBs by Member States, encouraging their supply. All other circumstances being equal, the Central Bank's purchase of these securities on the secondary market would have reduced market yields, which, in turn, would have also led to lower issuance costs on the primary market, to the benefit of virtuous countries.

Looking at the future, a decarbonisation policy involving also sovereign securities should be addressed by the ECB. As far as this issue is concerned, the considerations developed above suggest that SLBs would be the most suitable instrument for progressively reorganising the Eurosystem portfolio towards methods of financing for Member States that are in line with the energy and climate macro-targets set by the European Union under the Green Deal.

Figure 7 – *ECB/Eurosystem holdings for monetary policy operations (bn € and % incidence on the eligible universe)*



Source: ECB (2021c) p. 158, https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op271~36775d43c8.en.pdf

In the case of SLBs, any benefits for the debtor State in terms of interest due are index-linked to the achievement of decarbonisation targets, which are periodically monitored by the European Commission and extend over time to the entire outstanding stock of securities, not just newly issued

[87] ECB (2024c) pp.26-28, https://www.ecb.europa.eu/ecb/climate/climate-related-financial-disclosures/shared/pdf/ecb.crfd2024_MPPs.en.pdf

assets. The advantage for the issuer is thus proportional to the cumulative amount of the securities issued, and as such is both a strong incentive for States to issue new SLBs and to respect decarbonisation goals. Unlike GBs, SLBs are not tied to the funding of specific projects, but are instead connected to the overall performance of the country in question, with significant advantages in terms of management and monitoring for the issuing country (Ainio et al. 2023).

Once the security has been issued, the spread between the negative interest on SLBs and standard issuances depends on the contractual reward/penalty mechanism incorporated into the instrument, not on the support of the Central Bank. In other words, it operates independently from the evolution of monetary policy.

The prerequisite for the Central Bank to implement selective policies of this nature, extending them to also include public-sector securities, is obviously the abandonment of the *market neutrality* criterion that has, until now, been adopted by the Eurosystem.

What is worth stressing here is that, on the contrary, **it does not require the abandonment of the *capital key* criterion**, as the issuing countries would continue to be uniquely responsible for deciding whether to issue GB/SLBs rather than other forms of debt securities. The Central Bank could act on the outstanding debt of different countries based on the composition decided by each Member State and the ECB would not be required to alter the overall desired total amount (which remains dictated by monetary policy considerations). Eventually, however, the Member States who issue more SLB linked to Green Deal goals and KPIs (monitored by the European Commission) would gain a lower cost of debt.

The interventions of the Central Bank would not affect the overall amount of operations and the desired absolute level of interest rates, but would act only on the composition of these interventions, just creating conditions that are more favourable for certain segments of the financial market (*green*) than for others (*brown*).

This effect has just one condition for its occurrence: a reduced substitutability between securities from green and brown issuers, a condition that is already empirically assessed by the literature **(par. 4.2.3)**, guaranteed by the very technical characteristics of GB/SLBs themselves and that could be bolstered by the differentiated actions of the Central Bank and/or by a differentiated approach also of prudential bank regulation **[Box 1].**

Box 1 - *Greenium and open-market operations by the Central Bank*

Open-market operations carried out by the central banks govern the market yields of securities through four main channels of transmission: (a) portfolio rebalancing; (b) signalling; (c) the implicit guarantee channel and (d) the induced effect on the credit channel (European Parliament 2020b).

a) **Portfolio rebalancing** is based on the fact that the intervention of the Central Bank generates an excess demand in the target segment of the bond market, lowering its market yields while at the same time reducing the availability of securities in that segment, forcing operators to reorganise their portfolios with securities from other sectors, thereby reducing yields on non-target securities. This shifting effect becomes slower and of more modest quantity in direct proportion to the substitutability of the target securities compared to others and is obviously weaker if the intervention of the Central Bank compensates for a lack of demand from other operators rather than substituting said demand (crowding out). An intervention by the Central Bank that is explicitly aimed at favouring the issuing of GB/SLB-type securities, i.e., assets linked to sustainability projects or index linked to energy-efficiency/decarbonisation goals, would benefit from both advantages and could be applied to public-sector securities as well as private securities. GB/SLB issuances continue to represent a niche proportion of sovereign debt; they have technical characteristics that render them complementary to other types of public-sector securities, rather than substitutes of the latter, and they suffer from a lack of demand from private and institutional investors.

b) Instead, **signalling** works by informing the market of the authorities' intentions and tends to bolster credibility of the policies pursued over time[88]. The signalling effect is not necessarily generalised, but may be discriminating, concentrating its effects on the target securities, irrespective of their level of substitutability. In this case, this channel could be an extremely effective vehicle for the extension of exceptions to the rule of market neutrality.

c) The **implicit guarantee** channel works in an indirect manner, reducing the riskiness of the securities subject to the intervention of the Central Bank, both by supporting demand on the secondary market and indicating the quality of said securities.

d) The **credit channel** also operates in an indirect manner, encouraging banks to reorient the composition of their own portfolios toward the target securities in order to use them as collateral in Central Bank refinancing operations and/or benefit from the lower absorption of capital resulting from their reduced risk.

All these effects lead to differential reductions in the yields of the target securities, favouring virtuous issuers and, above all, fostering the creation of an ample market for securities linked to the transition goals.
Some empirical macroeconomic simulations carried out by the ECB confirm the effectiveness of the open-market operations by the Central Bank on the yield differential in cases in which the "green" securities (GB/SLB) are less-than-perfect substitutes for other categories of securities (Abiry et al. 2022; Ferrari-Nispi Landi 2023).

For that matter, the level of substitutability of GB/SLBs compared to other types of securities, which is already low due to their technical characteristics, could be further reduced by other parallel measures taken by the Central Bank that increase segmentation (for example differentiated collateral frameworks and capital requirements for banks[89]).

[88] During the crisis, the APP bolstered the credibility of the expansive policies of the time, as the scope of the QE policies was also dictated by the average maturity of the securities purchased by the Central Bank, which implicitly confirmed the logic of long-term actions aimed at expansion (Jeanne-Svensson 2004; Bhattari et al. 2015).

[89] Cf. Noera (2024b).

4.4 THE CARBON CONTENT OF TLTRO REFINANCING OPERATIONS

TLTRO refinancing operations have been implemented by the ECB with the explicit goal of providing refinancing at favourable conditions for the issuing of credit to the economy, instead of it being used by banks to profit from the favourable yield spread in relation to government bonds. The particularly favourable interest rates were, indeed, conditional on the growth of the amount of credit issued by individual banks to businesses and families. Instead, the TLTRO programmes have not provided for any favourable conditions for the issuing of green loans by banks **(cfr par.3.3).**

From a carbon footprint perspective, the only possible effect attributable to the TLTRO is indirect, related to the selection criteria applied to eligible securities to be used as collateral. However, the empirical evidence show that this indirect effect did not materialize at all. Colesanti Senni et al. (2023) estimated that the loans issued by banks benefiting from the TLTRO III programme in the March 2020 - March 2021 period had a considerably significant impact on carbon (151 MtCO2, equivalent to 8% of the total emissions of the Euroarea in 2019), and that 80% of the credit went to high-carbon-intensive sectors.

As seen previously, the TLTRO III programme has been accompanied by heavily discounted rates that are conditional to the achievement of predetermined targets for an increase in credit issued by the beneficiary bank. **The TLTRO programme has been successful, but it achieved its goals to the detriment of the ECB's obligation to support European decarbonisation policies**, moreover during a period in which there were no contraindications in terms of inflation.

The operations related to the TLTRO III programme, which was implemented in 2019, are now also progressively coming to an end, due to the significant increase in refinancing rates due to monetary restrictions and the voluntary early repayment programmes planned by the ECB.[90]

Thus, **the conditions (in terms of bank asset encumbrance and standard refinancing rates) are once again being recreated for the activation of TLTRO programmes specifically designed to reorient the flow of credit in line with European climate goals.**

[90] https://www.ecb.europa.eu/mopo/implement/omo/tltro/html/index.en.html

5 DECARBONISATION OF THE SECURITIES PORTFOLIO OF THE CENTRAL BANK AND THE MANAGEMENT OF MONETARY POLICY

5.1 THE NEW PHASE OF MONETARY POLICY

During the long and deflationary period from 2015 to 2021, in which the ECB continued to make net purchases of public-sector securities[91], there would have been no contraindications in terms of monetary policy to pursuing a systematic and aggressive QE reorganisation of the Central Bank's portfolio in favour of lower-carbon-footprint private securities and of private and public-sector GB/SLB-type securities. In a situation where interest rates were close to zero (*zero lower bound*), such as the one central banks faced because of the dual financial and pandemic crises, the reduction of yields across the entire public-sector securities segment would not have had contraindications, but rather it would have been a factor bolstering the anti-deflation monetary policies of QE[92]. During that phase, the Central Bank's challenge was not only to reduce short-term rates (which are directly influenced by the official rates) but also to lower longer-term rates, which instead depend on market expectations.[93]

Table 2 – *Evolution over time of ECB/Eurosystem QE programmes*

Monetary policy portfolio					
ASSET PURCHASE PROGRAMME			**PANDEMIC EMERGENCY PURCHASE PROGRAMME**		
Acquisti netti	Mar 2015 – Mar 2016	€60 mld/mese			
	Apr 2015 – Mar 2017	€80 mld/mese			
	Apr 2017 – Dec 2017	€60 mld/mese			
	Jan 2018 – Sep 2018	€30 mld/mese			
	Jan 2018 – Sep 2018	€30 mld/mese			
	Oct 2018 - Dec 2018	€15 mld/mese			
Solo reinvestimenti	Jan 2019 - Oct 2019	Totali			
Acquisti netti	Nov 2019 - Mar 2022	€ 20 mld/mese	**Acquisti netti potenziali massimi**	Mar 2020 - Jun 2020	€ 750 mld max
	Apr 2022	€ 40 mld/mese		Jun 2020 - Dec 2021	€ 1.350 mld max
	May 2022	€ 30 mld/mese		Dec 2020 - Mar 2022	€ 1.850 mld max
	Jun 2022	€ 20 mld/mese			
Solo reinvestimenti	Jul 2022 - Feb 2023	Totali	**Solo reinvestimenti**	Dec 2021-Dec 2024	Totali
	Mar 2023 – Giu 2023	Parziali			
No acquisti netti No reinvestimenti	da Jul 2023		**No acquisti netti No reinvestimenti**	da Jan 2025	

[91] The rate of net purchases fell gradually over time, from an average of EUR 60 bn per month in 2016 to 30 bn between January and September 2018, and 15 bn over the final months of 2018. Following a long pause, during which no net purchases were made and which only saw the reinvestment of mature securities (January-October 2019), the response to the pandemic crisis required a recovery in net purchases over the course of 2022, both through the APP (with a progressive decrease from 40 bn to 20 bn per month) and with the new PEPP (initially 120 bn per month). In July 2022, net purchases under the APP were once again halted, and reinvestments continued, albeit at an ever-lower pace, until June 2023, at which point these were also suspended. Net purchases under the PEPP programme were interrupted at the end of 2021, and reinvestments of mature securities are due to cease at the end of 2024 **[Table 2**]

[92] Altavilla et al. (2017); Albertazzi et al. (2018); Hammermann et al. (2019); Rostagno et al. (2019).

[93] Furthermore, the specific problem of the Eurozone was also the significant national segmentation of public-sector securities markets, above all due to the *home-bias* of bank portfolios and the consequent spill-over of the country risk to national banks. In other words, the asymmetry of risk premiums rendered the monetary policy transmission mechanism uncertain.

The general situation has changed drastically since the end of 2021; the inflation-provoking tension that resulted from the Russia-Ukraine conflict and the energy crisis that followed has completely overturned the expansive stance of the central banks, which have set in motion intense increases in interest rates in order to contrast inflation.

Between July 2022 and June 2023, net purchases of securities were halted, with only the reinvestment of mature securities remaining[94]. In July 2023, the reinvestment of mature securities was also definitively suspended[95] **[Table 2].**

This final an definitive suspension also eliminated any possibility for the progressive decarbonisation of the portfolio accumulated by the Central Bank. As was the case of the CSPP programme in 2021-22, even the simple reinvestment of maturing securities was in fact a functional mechanism for reorganising the portfolio in favour of green securities (or those from issuers with coherent decarbonisation programmes) and turned out also compatible with the new restrictive direction of monetary policy (De Grauwe 2019; Schoenmaker 2020).

The definitive abandoning of QE, instead, appears to impede any reorganisation of the Central Bank's portfolio. Indeed, the reduction of the portfolio's carbon footprint can no longer depend on the substitution of old securities with green ones, but can only be the outcome of the reduction in the carbon footprint of the issuers, for a given portfolio composition (European Parliament 2023).
In this new phase, QE no longer represents, for the Central Bank, a channel to foster the decarbonisation of the economy, **but this advocates for a more intense use of other selective instruments (i.e. collateral framework and TLTRO).**

Obviously, if in the future, deflationary trends should emerge once again, it could prove beneficial to reactivate also non-conventional monetary tools for decarbonizing the ECB monetary portfolio. Such a scenario is not ruled out in the longer term: according to the simulations produced by the central banks themselves, the climate crisis tends, over the medium-long term, to have a depressive effect on demand[96]. However, it is likely that inflationary pressures could persist in the short term (Ferrari-Nispi Landi 2022; Schnabel 2023)[97]. In this case, in line with the ECB's primary objective, the main mission of price stabilisation would prevail, as it does now.

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[94] Reinvestment of mature securities was total between July 2022 and February 2023, and only partial between March 2023 and July 2023.

[95] The suspension regarded reinvestments under the APP, while those under the PEPP have been maintained until December 2024 (Hammermann et al. 2019; Schnabel 2023a, 2023b; Lane et al. 2024).

[96] Alogoskoufis et al (2021); ECB (2021c); NGFS (2023); Coenen et al. (2023); Ferrari-Nispi Landi (2023).

[97] In an extremely evocative and often-cited speech, Isabel Schnabel, a member of the Executive Board of the ECB, coined three new terms to identify three categories of short-term inflationary shock associated with the climate crisis: (1) Climateflation, i.e., the effect on prices of physical climate calamities, either direct (flood, fire, drought) or indirect (destruction of production capacity, reduction in productivity, etc.); (2) Greenflation, i.e., the combined pressure applied by the cost of critical raw materials (lithium, cobalt, rare-earth elements, etc.), for which demand tends in the short term to increase more rapidly than supply, and decarbonisation policies, which result in higher costs for businesses (carbon prices and carbon tax); (3) Fossilflation, i.e., the pressure on prices for fossil energy sources caused by geopolitical tensions and the oligopolistic structure of the market (Schnabel 2022). On the contrary, in the medium-long-term period, the climate crisis tends to have a clear recessive effect and lead to a

This observation temporarily removes QE from the Central Bank's available arsenal to support the Green Deal, but not the other weapons at its disposal: above all the collateral framework and the channel of long-term refinancing to the banking system (TLTRO).

5.2 WHAT CAN THE ECB DO TO SUPPORT THE GREEN DEAL, EVEN IN PERIODS OF MONETARY TIGHTENING?

The transition requires significant investment both for the development of innovative technology and for the transformation of infrastructure, production processes, mobility and residential real estate[98]. However, a prolonged period of high interest rates tends to be detrimental to investments in renewable energy and sustainable technology more than it penalises fossil fuels and energy intensive manufacturing processes[99]. Yet, the *market-neutral approach* that currently characterises Central Bank operations does not mitigate this asymmetry, and tends to be driven by market inertia in favour of fossil fuels[100]. The Central Bank ends up, against its will, acting in contrast to the European Union's decarbonisation goals, which it should instead support.

The pursuit of a monetary policy that supports decarbonisation and technological transformation should work by creating conditions that differentiate the cost of capital in favour of green assets, while penalising brown assets. This effect can occur both directly, encouraging issuers of securities to assume behaviour in line with the decarbonisation goals of the Green Deal, or indirectly, through the banking channel. Indeed, as has been seen in previous paragraphs:

- The favourable rate differential and the supply of securities by private issuers reacts positively to inclusion in the list of eligible securities for Central Bank operations (Todorov 2020; Pegoraro-Montagna 2021; Galema-Lugo 2021), particularly in the case of GB/SLBs (Zaghini 2024).
- As seen in previous paragraphs, banks refinance their activities via the Central Bank, providing securities as collateral. The list of securities eligible as collateral is drawn up by the Central Bank and it encourages banks to hold eligible securities in their portfolios, maintaining their market demand (Brand et al. 2019). By extending the selection criteria for eligible securities, which currently only applies to corporate securities, to include categories of securities issued by financial institutions (bank bonds, covered bonds and ABS), the Central Bank increases market liquidity and further encourages the issuing of securities related to decarbonisation programmes and green investments. As a result, this increase in liquidity lifts prices and lower debt costs for green issuers (Nyborg 2015; Nagel 2016).
- Preferential haircuts for categories of GB/SLBs or securities from compliant issuers with credible decarbonisation programmes would foster growth on secondary markets, and would

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reduction in revenue. If, however, agents are short-sighted and cannot foresee a future decrease in their revenue, their short-term behaviour will continue to be characterised by significant demand, allowing shocks in supply to result in an acceleration of price dynamics (Ferrari-Nispi Landi 2022).

[98] IEA (2021, 2023); CPI (2023); Noera et al. (2023); Bouabdallah et al. (2024).

[99] Egli et al (2018); Van Tilburg (2023).

[100] Matikainen et al. (2017); Schoenmaker (2019); Dafermos et al. (2021); Papoutsi et al. (2022); Cosemans-Schoenmaker (2022); Colesanti Senni et al. 2023).

also indirectly render it advantageous for banks to grant securitisable credit of a similar nature (Schoenmaker 2019; Dafermos et al. 2022).

- An even more direct effect would come from a long-term refinancing scheme, similar to the TLTRO, this time aimed exclusively at providing favourable refinancing of bank credit for green investments (van't Klooster-Van Tilburg 2020; van't Klooster 2022; Batsaikhan-Jourdan 2021; Böser-Colesanti Senni 2021; Colesanti et al. 2023).

These instruments would work together not only to support the bank's market demand for GB/SLBs, but also to orient the issuing of bank credit towards less-carbon-intensive assets or those aimed at the green transition, through Central Bank refinancing at differentiated rates.

From a qualitative point of view, a concentration of these actions could have significant impacts similar to those of QE operations [Table 3] but, in quantitative terms, the effects would be highly selective, as they tend to segment the market ab origine and promote forms of substitution that do not necessarily have expansive monetary impacts. These operations are, in effect, policy neutral, i.e., they are compatible with any general monetary policy goal (van't Klooster 2022). These considerations are further backed up by the fact that the relative size of the "green" securities market is still modest, and that the technical structure of these securities binds them closely to the implementation of investments and the achievement of verifiable decarbonisation goals.

Furthermore, there are currently a number of mutually complementary methods available to the ECB to assess the refinanceability of bank credit vis-à-vis the European decarbonisation goals and strengthen its supportive action to the Green Deal. The ECB could: (1) make reference to the disclosure requirements provided for by the CSRD for listed banks (Dir 2022/2464/EU) in force since 2024, and to the requirement for larger banks to publish the Green Asset Ratio (GAR), in force since January 2024; (2) make reference to the European Taxonomy (Reg 2020/852/EU) and to the publication of the BTAR (Banking Book Taxonomy Alignment Ratio), which is optional for banks; (3) directly link refinancing to European projects (for example Repower EU, Green Deal Industrial Act, etc.); (4) assess to what extent banks respect the expectations of the ECB in terms of climate risk within the context of SREP (Supervisory Review and Evaluation Process) assessments; (5) make reference to the internal credit risk assessment systems of individual banks (IRB), adapted for climate risks and validated by the ECB.

Table 3 *– Size of the ECB/Eurosystem financial portfolio and of the portfolio of collateral for refinancing operations for the banking system (€ bn - Dec. 2023)*

	APP+PEPP		Eligible collateral		Utilized collateral	
	bn €	%	bn €	%	bn €	%
Sovereign & Sub-sovereign	3.260	74,3%	10.486	57,8%	153	13,5%
Total non-sovereign	1.127	25,7%	7.822	42,7%	986	86,5%
of which: Corporate bonds	367	8,4%	1.926	10,5%	47	4,1%
TOTAL	4.387	100,0%	18.308	100,0%	1.139	100,0%

Source: ECB (2024), https://www.ecb.europa.eu/ecb/climate/climate-related-financial-disclosures/shared/pdf/ecb.crfd2024_MPPs.en.pdf and https://www.ecb.europa.eu/mopo/coll/charts/html/index.en.html

5.2 IS THERE A RISK OF DESTABILISING THE FINANCIAL SYSTEM?

The convergence of monetary support and facilitation tools aimed at the transition from fossil fuels to green technologies brings with it, in the short term, an evident risk of fuelling speculation and destabilising the financial system through accelerated disintermediation from fossil fuels. Indeed, these tools encourage an increase in the level of business debt[101] and accelerate the emergence of stranded assets[102]. One possible side effect of this eventuality is the increased financial vulnerability of banks (which are exposed to the risk of debtors' insolvency).

This risk, however, appears to be moderate and, in any case, manageable.

To the extent that substitution effects prevail over those of scale, the threat to business solvency may be mitigated both by the careful quantitative calibration of the Central Bank's actions and by close coordination with macroprudential supervision policies.[103]

The option of accompanying the transition with prudential measures, concerning in particular the banks' capital requirements is, for one, justified by the need to safeguard financial stability and by the acknowledgement that climate risks are systemic in nature, i.e. a form of risk that calls for additional macroprudential buffers. There is also the possibility of calibrating differentiated capital coefficients in accordance with the types of assets financed by the bank in order to avoid the penalisation of green assets (Dafermos et al. 2021). For a detailed examination of these aspects, see Noera (2024b).

[101] Grosse Rueschamp et al. (2019); Todorov (2020); Giovanardi et al. (2022).

[102] Caldecott (2018); Van der Poeg-Rezai (2020).

[103] Cassola et al. (2019); Bolton et al. (2020); Diluiso et al. (2021); Dafermos-Nikolaidi (2021); Alessi et al. (2022); Ohemke (2022); Ohemke-Opp (2023).

6 OPEN ISSUES REGARDING A MONETARY STRATEGY ALIGNED WITH THE GREEN DEAL AND THE PARIS GOALS

We have seen how, provided they are compatible with the ECB's primary objective of price stability, the Central Bank's action can be highly supportive of the EU policies designed to mitigate the climate crisis. Notwithstanding, the present monetary initiatives in this field appear to suffer from unwarranted methodological biases that limit their effectiveness.

There are at least three crucial issues that need to be clearly addressed before defining a monetary strategy that, in line with the statutory priorities of the ECB, could implement initiatives aligned with the objectives of the European Green Deal:

i. The adoption of an **"impact approach"** of assessing monetary policy operations with reference to the processes for decarbonising the economy, aimed at measuring the effective contribution of monetary policies to these processes.
ii. A switch **from a purely *risk-based* (single materiality)** logic in the selection of assets that can be used for monetary policy operations to a ***policy-oriented* (double materiality)** logic, acknowledging that the latter is required precisely to address the systemic dimension of climate risks.
iii. The **abandoning of the *market-neutrality* criterion** in the composition of the Central Bank's operations, recognising that the market is still unable to suitably value climate risks and is therefore incapable of avoiding the resulting allocation biases in favour of carbon-intensive activities to the detriment of the investments required for the transition.

6.1 ABSOLUTE IMPACT VS OPTICAL ILLUSIONS

The key consideration is to assess whether the ECB's current approach towards climate change is not only conceptually coherent, but also effective in supporting the European Union's climate policies. In this regard, what matters is the actual impact that monetary policies have on the ultimate goal, which is the trajectory of total greenhouse gas emissions. Indeed, the European Union has set a goal of reducing total emissions by 55% by 2030 (compared to 1990 levels) and achieving net zero emissions by 2050. The policies adopted by the ECB in 2021 do not appear to be methodologically in line with these goals with respect to two aspects:

a) the flawed criteria for measuring the impact of monetary policy on processes aimed at decarbonising the economy and
b) the absence of reference thresholds and/or a market benchmark that would allow for their alignment with European targets to be assessed.

Impact assessment criteria. Since 2023, the ECB has published annual data on the carbon footprint of its financial portfolio[104] on the basis of indicators recommended by the TCFD and the NGFS[105]. **Table 4**[106] shows the variations of indicators analysed in **Annex A.2** between December 2020 and

[104] ECB (2023b, 2024b).

[105] Cfr. TCFD (2021); NGFS (2024).

[106] The most recent data, organised by type of issuer, are shown in table **A.2.1** in **Annex A.2**.

December 2023, a period that partially overlaps with the period in which the ECB implemented its own policy to reorganise the portfolio of securities issued by non-financial businesses (October 2022-July 2023).

The indicators show that the evolution of the overall monetary policy portfolio (MPP) of the ECB/Eurosystem between the end of 2020 and the end of 2023 saw a reduction in its contribution to GHG emissions of the financed counterparts (direct emissions *Scope 1* and *Scope 2* emissions from electricity consumption) However, when taking into consideration the indirect effect on emissions along the value chains (*Scope 3*)[107], emissions have continued to increase significantly. Even though the estimate of *Scope 3* emissions is incomplete and presumptive[108], their significant quantitative importance is confirmation that effective support from the Central Bank to the EU's decarbonisation policy cannot overlook them.

Furthermore, the indicators adopted by the ECB and summarized in **Annex A.2** do not provide a measurement of the actual impact on the total emissions of the financed counterparts, but only assessments of their carbon intensity (emissions per product unit[109]). The WACI (*weighted average carbon intensity*) is, for example, the average carbon intensity of the financed entity, weighted on ECB total portfolio holdings, and therefore depends both on the composition of the portfolio and on the carbon intensity of each individual financed entity; the TCE (*total carbon emissions*) similarly, is the carbon intensity of each financed entity for the total value of the securities held in the portfolio (rather than for their percentage weight , as is the case for WACI). Both indicators reflected the positive trend in the carbon intensity of the bond issuers, both public-sector and private entities. However, for the latter, the result was mainly due to the cyclical post-COVID recovery of economic activity (GDP and revenue) rather than to a structural improvement. Furthermore, the divergence between the trends for the two indicators (downward for WACI and upward for TCE) depends on the fact that, carbon intensity being equal, TCE was driven upwards by the significant growth in the absolute value of QE operations in sovereign securities, while WACI was driven downwards by the related reduction in the portfolio weighting of corporate bonds (i.e., the only category that had showed a significant improvement in carbon intensity). Both the worsening in the TCE and the improvement in the WACI were only apparent, due to their construction, not to the underlying evolution of absolute emissions.

As a matter of fact, the trend of the indicators also depends, often heavily, on the variables used for their standardisation. In the post-Covid period, these variables played a determining role due to the

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[107] *Scope 1* includes emissions produced by sources controlled or owned by the organisation (resulting, for example, from combustion for furnaces, motors, vehicles, etc.); *Scope 2* includes indirect emissions associated above all to the purchase of electricity; *Scope 3* refers to all indirect emissions not covered by *Scope 2,* i.e., emissions produced by suppliers (upstream) and by clients as a result of using the products sold (downstream). Cf. PCAF (2022).

[108] the data regarding Scope 3 indirect emissions are still of poor quality. The calculation of ECB indicators is based partially on self-certified data provided by issuers and partially on estimates by data providers. Significant improvements are expected in the near future as a result of the application of the CSRD and the CSDDD, which require the application of the ESRS developed by EFRAG.

[109] The indicators regarding public-sector issuers (sovereign bonds) cannot be directly compared with those for non-public-sector issuers, as the variables they are based on differ in nature. The carbon intensity of public-sector issuers is, for example, calculated as the ratio between GHG/GDP, while that of private issuers is the ratio of GHG/revenue or GHG/EVIC. See **Annex A.2** for these technical aspects.

combined effects of a significant cyclical recovery in economic activity and inflation[110], which led to a temporary improvement in carbon intensity (the ratio of emissions over production or revenues) as well as to an increase in the volume of QE operations (which, in the Eurosystem portfolio, led to a more than proportional increase in public-sector securities compared to private securities). All these movements have little to do with actual decarbonisation, i.e. reduction of GHG in absolute terms.

The indicators used by the ECB can therefore create optical illusions, hindering the monitoring of the total absolute GHG emissions, which are the true target of European policies.

In order to measure how much of these emissions have been effectively financed through Central Bank portfolio investments, it would be more appropriate to observe the **absolute total emissions of each issuer weighted in accordance with the value of their securities held in the portfolio by the Central Bank** (WATC, *weighted average total carbon*) **[see Annex A.2]**.

Benchmarks. To enable an assessment of the overall impact of its monetary activities in relation to the European Union's goals, the ECB should also indicate reference thresholds for the indicators adopted and/or identify a market benchmark in line with the latter, periodically publishing either the relative alignment or the gap.

Table 4 – *Variations in carbon intensity of the ECB/Eurosystem's MPP (WACI and TCE indicators) (overall and % variations in the December 2020 - December 2023 period)*

		Sovereign over GDP (excl. LULUCF)		Others non - sovereign su Fatturato o EVIC			
				Total		of-which: Corporates	
		Δ2020-23	Δ%p.a.	Δ2020-23	Δ%p.a.	Δ2020-23	Δ%p.a.
Total portfolio (bn €)		+905	+12,8%	+169	+5,5%	+79	+9,1%
WACI (tCO2e / mln €)	Scope 1+2	-29	- 5,7%	-42	-14,4%	-117	-13,5%
	Scope 3			+445	+20,2%	-348	-8,2%
	Total	-29	- 5,7%	+403	+16,2%	-465	-9,1%
TCE (Mln tCO2e)	Scope 1+2	+56,7	+ 4,7%	-0,5	-0,3%	-0,6	-0,4%
	Scope 3			+122,3	+14,2%	+39	+154,5%
	Total	+56,7	+ 4,7%	+121,8	+12,1%	+38,9	+4,1%

Source: ECB (2024c), Annex 2 and 3

6.2 POLICY-ORIENTED LOGIC VS. RISK-BASED LOGIC

Assuming an *impact-based* logic implies not only monitoring indicators that are in line with the final goals, but also adopting a *policy-oriented* operational philosophy, i.e., functional to the achievement of said goals.

[110] Inflation is a permanent factor of distortion, but in the 2022-23 period its influence was extremely strong due to the energy crisis.

As has been seen, the climate strategy adopted by the ECB is set out over three complementary levels: (1) managing climate risks; (2) supporting the green transition; (3) fostering the broadest understanding of sustainability and transparency policies by agents and the Bank itself (ECB 2022b; 2023b). The first of these levels makes explicit reference to a so-called *risk-based* logic, while the second and the third are clearly *policy-oriented*.

The management of climate risks stems from the obvious consideration that the climate risks faced by the issuers of the securities held translate into risks for the stability of the Central Bank[111]. Instead, support for transition and for the transmission of sustainability policies within the rest of the economy is based on the fact that, despite having price stability as its primary objective, the ECB also has an institutional duty to contribute to achieving the European Union's goals, which are explicitly aimed at "sustainable development" and "environmental protection".[112]

Risk-based logic implies that the measures adopted by the Central Bank are focused on the impacts that climate change can have on its own stability. Risk-based logic is therefore linked to a *"single materiality"* criterion, which does not take into account the direct and indirect impact of the institution's policies on the external environment (as is the case, instead, for the *"double materiality"* criterion")[113]. External impact can also be defined as *policy-oriented* to the extent that the Central Bank's actions are deliberately aimed at modifying the economic and financial behaviour of economic agents.

In the case of climate change, *risk-based* logic and *policy-oriented* logic are not contradictory, but complementary. In fact, they are extremely correlated, since the systemic nature of climate risks means that they must also be mitigated through the adoption of suitable prevention policies at a general macroeconomic level (Campiglio et al. 2018; Bolton et al. 2020; Gourdel et al. 2023; Noera 2024b).

Mitigating emissions and supporting the Green Deal are therefore of strictly operational importance for the Central Bank, as they are a key ingredient to prevent climate systemic risks. Since, as shown before, instruments are compatible with the primary objective of controlling inflation, they can and must be fully applied to achieving the ECB secondary goals of assuring financial stability and supporting the green transition.

This broader view of the duties of the Central Bank **in no way undermines the independence of the ECB and the Eurosystem** from the governance bodies of the European Union or of the Member States as set out by art. 130 TFEU. The decisions made by the ECB in pursuing its goals and in using

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[111] Once again, as was previously the case for the management of collateral, reference is made to art. 18.1 of the Statute of the ESCB/ECB.

[112] Art. 127 of the TFEU states: *"... Without prejudice to the objective of price stability, the ECB shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union..."*, where the reference to art. 3 of the Treaty on European Union indicates, among the goals: *"...a high level of protection and improvement of environmental quality..."*, a goal also repeated in art. 11 of the TFEU: *"Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development"*.

[113] Täger M. (2021); Oman-Svartzman (2021);Bossinot et al. (2022).

instruments are completely autonomous and are founded exclusively on an assessment of the overall macroeconomic situation and of the risks to which it is exposed as a result of the climate crisis. This interpretation grants the Central Bank a proactive role in terms of the European Union's climate policies (Schneibel 2020b; Elderson 2021; Thiemann et al. 2023) and goes beyond the minimalist view that prevailed before the pandemic crisis (Coeurè 2015; Wuermeling 2017; Bindseil 2017), which focused its activity exclusively on the primary objective of controlling inflation and protecting the Central Bank's own capital.

However, **this vision has not yet found adequate application in the actions of the ECB and the Eurosystem and, as a result, has not been translated into an *impact-based* logic**. Policy-oriented criteria have been partially introduced in the policies for the selection of eligible securities for collateral, as well as for quantitative easing, but in both cases this has only concerned a small proportion of the outstanding securities (exclusively those issued by non-financial corporates, thus excluding all other issuers). In contrast, the policy regarding the management of haircuts applied to securities accepted as collateral for bank refinancing has remained anchored to a restrictive interpretation of *risk-based* logic, and long-term refinancing tools (TLTRO) continue to be completely unrelated to decarbonisation goals.

The overall result is that, in spite of the proclaimed policy, ECB's actual policies give little contribution to decarbonising the Eurozone economy (ECB 2024c) **and, paradoxically, due to the application of the *market neutrality* principle, have implicitly supported the most carbon-intensive activities, in clear contrast to the climate policies of the EU** (Schoenmaker 2019; Colesanti Senni 2023).

6.3 MARKET EFFICIENCY VS MARKET NEUTRALITY

One of the main obstacles to the full adoption of a *policy-oriented* logic aimed at mitigating climate risks is the principle of *market neutrality* on which the ECB, like many other central banks, bases its actions.[114]

The aim of the market-neutrality principle is to ensure that central bank interventions do not interfere with the formation of market prices for securities and consequently with the allocation of resources (Coeuré 2015; Wuermeling 2018). The market-neutrality principle thus requires the purchase of securities by the Central Bank to be proportional to their capitalisation. However, this rule is not binding for the ECB, which has sometimes adopted other criteria[115] and which, in

[114] The principle of market neutrality is, for example, adopted by the ECB in its quantitative easy APP (Asset Purchasing Programme), by the Bank of England for its CBPS (Corporate Bond Purchase Scheme), by the Bank of Japan and by the Bank of Canada.

[115] For example, the eligibility criteria for securities adopted by the ECB do not respond to the principle of proportionality in terms of the capitalisation of securities. Furthermore, in quantitative easing operations that target public-sector securities, the purchase of securities on the market is proportional to the share that the various countries hold in the capital of the ECB (capital key) rather than to their capitalisation (for example with the PSPP, Public Sector Purchase Programme, and with the PEPP, Pandemic Emergency Purchase Programme).

accordance with its mandate, is permitted to intervene in a manner that deviates from the neutrality principle in cases where market practices appear to lead to distortions.[116]

The principle of market neutrality is based on the idea that financial markets are *efficient*, i.e., that the formation of prices fully reflects all available information and thus also includes suitable risk assessments. There is also the idea that mitigating climate change is the responsibility of governments and parliaments, through the implementation of suitable fiscal and legislative policies, and not of central banks, whose primary objective is to guarantee price stability. It is no coincidence, in reflection of this theoretical approach, that the majority of macroeconomic models used by central banks to analyse the effects of climate change and policy simulate climate policies with one sole instrumental variable, not belonging to the toolbox of Central Banks: the level of a carbon tax or the market price of carbon (Abiry et al. 2022; Ferrai-Nispi Landi 2023; Coenen et al. 2023).

However, market mechanisms like the price of carbon or fiscal mechanisms such as the carbon tax - considered by many to be the main instruments for mitigating the crisis - appear to be insufficient to drive the transition towards a decarbonised economy in an orderly and timely manner, and it is increasingly clear that the entire financial system needs to be involved in order to achieve this goal (Elderson 2021; Lagarde 2021; Altunbas et al 2021; De Haas-Popov 2022).

The incomplete mechanism of carbon pricing and the consequential underestimation of the impact of greenhouse gas emissions also leads to the chronic underestimation of climate risks by financial markets[117] **and to a distorted allocation of resources in favour of more carbon-intensive activities.**[118]

It therefore falls well within the responsibility of central banks both to guarantee the conditions of market transparency that allow for appropriate risk management by financial actors, and to correct the distortions that hinder market efficiency (Schnabel 2020b; NGFS 2021; Hartmann et al. 2022).[119]

Recognition of this aspect leads to a shift from the principle of *market neutrality* to that of *market efficiency* in the operative implementation of monetary policy (Schnabel 2021). Indeed, **acknowledging that the presence of negative externalities and the incomplete nature of markets results in inefficient allocation of resources also implies recognising that the principle of *"neutrality"* is contradictory to that of *"efficiency"***. In other words, in an inefficient market, *neutrality* contribute to preserve the inefficiency, not to overcome it.

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[116] The principle of neutrality is based on the spirit of art. 127 (1) of the TFEU, according to which the Central Bank *"shall act in accordance with the principle of an open market economy with free competition, favouring an efficient allocation of resources (...)"*. However, the same principle can also be invoked to remove any distortion or obstacle that hinder the market from achieving said efficient allocation of resources (Schnabel 2021).

[117] Andersson et al. (2016); Hong et al. (2019).

[118] Battison et al. (2017); Cosemans-Schoenmaker 2022.

[119] There is, however, also a respected school of thought that maintains, on the contrary, that central banks should remain strictly true to their primary mandate (Cochrane 2020). Nonetheless, the European Central Bank has decided to incorporate climate risk into its monetary strategy (ECB-ESRB 2021; ECB 2021a, 2021b; DeGuindos 2021; Elderson 2021).

The application of the *market neutrality* principle means that the composition of actions implemented by the Central Bank is a passive reflection of the composition of the market, which is still greatly dominated by carbon-intensive issuers (Matikainen et al 2017; Papoutsi et al 2022; Cosemans-Schoenmaker 2022). By definition, adherence to the principle of *market neutrality* excludes the possibility that the Central Bank could act to correct this distortion, consequently hindering its ability to play a proactive role in the success of the EU's climate policies, which it is supposed to support. On the contrary, in this case, the *neutrality* of the Central Bank has the very opposite effect, favouring more carbon-intensive activities. Therefore, **the criterion of market *neutrality must*, inevitably, be abandoned in order to ensure that the actions of the ECB do not systematically work against the climate goals of the European Union.**

Table 5 *– Comparison between climate policy criteria adopted by the ECB/Eurosystem and alignment with the EU Green Deal*

OMA & QE/CE programmes		
	ECB/Eurosystem on Corporate bonds only (*)	**EU Green Deal aligned**
Guiding principle	Market neutrality	Carbon neutrality
Scope	Reivestiment of maturing bonds	Porfolio tilt
Selection criteria	Internal climate scoring	Carbon footprint of the bond issuer
Metric	GHG intensity	Total GHG of the bond issuer
Exclusion	Issuers not CSRD aligned	Bond issuers with disaligned decarbonization plans

Collateral Framework		
	ECB/Eurosystem on Corporate bonds only (*)	**EU Green Deal aligned**
Guiding principle	Risk exposure (single materiality)	Climate neutrality (double materiality)
Scope	Only Corporate bonds	Corporate and sovereign
Selection criteria	Bond credit risk	Carbon footprint of the bond issuer
Metric	Credit risk evaluation of the bond	Total GHG of the bond issuer
Exclusion	Bond isuers not CSRD aligned	Bond issuers with disaligned decarbonization plans

(*) programmi CSPP e PEPP

7. CONCLUSIONS

This report has analysed the actions of the European Central Bank with the aim of identifying ways in which the existing institutional structure and current macroeconomic context could allow it to provide more effective support to the European Green Deal.

The scope of responsibility attributed to the ECB/Eurosystem by the Treaties is strictly limited, but it includes the support to the European Union's Green Deal, which undeniably represents, on a global scale, one of the most wide-ranging and articulated projects to combat the climate crisis and transform both the economy and society. The legislative framework of the Green Deal is laying out the legal foundations upon which the transition process is being built and where goals can be achieved, but within this context, it is the behaviour of the market and of economic actors that plays a determining role in the final outcome.

The adverse effects of the climate challenge extend over very long-time frames, but actions to prevent them are measured in much shorter terms. Both the market and operators often fail to truly comprehend the scale of the challenge, undermining the possibility that market dynamics may spontaneously provide effective and timely solutions. It is thus necessary for the authorities to take action in order to guide the behaviour of agents, but above all to create market conditions that facilitate the development of the project.

The success of the Green Deal hinges on the large-scale mobilisation of public and private financial resources. The banking system and financial markets are the channels through which available resources can be directed to adequately finance the project. However, financial markets and intermediaries act because of incentives that often (due to a lack of foresight and objective calculation complexities) fail to apply risk/return assessments consistent with the magnitude of the transition and of climate risks.

The behaviours of financial markets and intermediaries are governed and influenced by the Central Bank, in its dual role of managing money and supervising financial stability. The Central Bank can and must correct those behaviours whenever they deviate in directions incompatible with the present and future stability of the system, by timely activating all the tools at its disposal. Otherwise, the orderly reallocation of an adequate quantity of private financial resources to face the challenges of climate could not be feasible without the proactive contribution of the Central Bank.

This report considers this to be possible within the current scope of the ECB/Eurosystem's institutional responsibility and argues that the obstacles that continue to prevent the Central Bank from acting accordingly with the utmost effectiveness are neither regulatory nor legislative; they are, instead, issues of technical and methodological nature. Therefore, are these issues that must be urgently addressed and solved.

Annex A.1

Selection criteria of securities for ECB monetary policy operations in terms of climate sustainability (*)

The selection of securities by the ECB for the purposes of both decarbonising its own portfolio and for monetary policy operations is carried out on the basis of an internal scoring system (*climate scoring*), which is calculated as the weighted average of three indicators:

a) A score based on the past volume of emissions (GHG) and on the carbon intensity of the bond issuer (GHG/revenue) (backward-looking climate metrics).
b) A score assigned to the bond issuer's proposed decarbonisation programmes (their existence, their aim and their alignment with the goals of Paris and the EU).
c) A score assigned to the quality of the information provided by the bond issuer (climate disclosures - their completeness and their verification by third parties).

Indicator (a) takes into account Scope 1 and Scope 2 GHG emissions declared by the issuer, as well as Scope 3 emissions for the issuer's sector, classifying them both in terms of comparison with the sector (best-in-class) and with the entire corporate universe (best-in-universe). If the issuer has made no disclosures regarding emissions, it is assigned the lowest score. The aim of this criterion is to maximise the incentives for issuing corporates to reduce their direct and indirect emissions and to make complete and certified estimates.

Indicator (b), instead, takes into account the future ambitions and decarbonisation programmes of the bond issuers. The highest score is assigned to programmes with *science-based* climate goals[120] and with processes that are both aligned with the Paris targets and verified by third parties. Issuers with no programmes are assigned the lowest score.

Lastly, indicator (c) reflects the quality of the emissions data provided by the issuer, in terms of both availability and accuracy. Significant importance is placed on whether the data are verified by independent third parties, with issuers providing self-reported data assigned the lowest score.
The portfolio is reorganised to favour bond issuers with the highest average of the three sub-scores. Depending on the average score assigned, each eligible bond is overweighted or underweighted within the ECB portfolio via-à-vis the market benchmark (based on market capitalisation).

(*) ECB (2024c; 2024d); ECB, *FAQ on Incorporating Climate Change Considerations into Corporate Bond Purchases*,
https://www.ecb.europa.eu/mopo/implement/app/html/ecb.faq_cspp_climate_change.en.html

[120] Cf. SBT (2019; 2022).

Annex A.2

A.2.1 The metrics used by the ECB/Eurosystem to assess the carbon footprint of the monetary policy portfolio[121]

The metrics used by the ECB/Eurosystem to represent the emissions financed indirectly by the portfolio held for monetary policy purposes are those presented by the TCFD (2021)[122]: WACI (*weighted average carbon intensity*), TCE (*total carbon emissions*) and CF (*carbon footprint*). In addition to these, the ECB also publishes a metric to indicate the *carbon intensity* (CI) of the portfolio.

Weighted Average Carbon Intensity (WACI): This is the average carbon intensity (*GHGi/Yi*) of the bond issuer, weighted by the share of each security in the Central Bank's portfolio. (*Bi/P*)

$$WACI = \sum_i^n \left({}^{B_i}/_{P}\right) \times \left({}^{GHG_i}/_{Y_i}\right)$$

where:

- B_i = value of the security issued by the issuer *i-th*
- P = the total value of the monetary policy portfolio of the Central Bank
- GHG_i = the total emissions (Scopes 1, 2 and, at times, 3) of the issuer *i-th*
- for a sovereign issuer *i-th* (public-sector debt securities)
- emissions produced in the country (production)
- emissions due to internal consumption (consumption)
- emissions due to public spending (government)
- Y_i = for a private issuer *i-th* (non-financial corporates and financial intermediaries):
- Revenue or Added Value
- for a sovereign issuer *i-th* (public-sector debt securities):
- GDP (adjusted for PPP - purchasing power parity) for emissions produced in the country.
- Final consumption (adjusted for PPP - purchasing power parity) for emissions related to internal consumption.
- Population.
- *WACI* may therefore vary both due to variations in the carbon intensity (*GHG/Y*) of the bond issuers and to modifications in the composition of the portfolio (*Bi/P*). The latter may have a determining influence on how the indicator is interpreted: a fall in the WACI of the portfolio as a result of its reallocation does not necessarily indicate a fall in the carbon intensity of the underlying sectors/businesses; it may simply be a sign of the ECB's reduced propensity for higher-carbon-intensity issuers.
- **Total Carbon Emissions (TCE).** This is the total amount held by the ECB of each security weighted by the carbon intensity (*GHGi/Yi*) of the bond issues, normalised respectively:

[121] ECB, European Central bank (2024c), *Climate-related Financial Disclosures of the Eurosystem's Corporate Sector Holdings for Monetary Policy Purposes,* Annexes, European Central Bank Report, June, https://www.ecb.europa.eu/ecb/climate/climate-related-financial-disclosures/shared/pdf/ecb.crfd2024_MPPs.en.pdf.

[122] TFDC, Task Force on Climate-related Financial Disclosures (2021), *Guidance on Metrics, Targets and Transition Plans*, October, https://assets.bbhub.io/company/sites/60/2021/07/2021-Metrics_Targets_Guidance-1.pdf.

- for private issuers, on the basis of the total balance-sheet of the company *i* at market value (EVIC, *enterprise value including cash*[123]): $Y_i = EVIC_i$
- for public-sector sovereign issuers, on the basis of Gross Domestic Product (adjusted for purchasing power parity - PPP): $Y_i = GDP_i$

$$TCE = \sum_i^n B_i \; x \; \left({}^{GHG_i}/_{Y_i}\right)$$

where:
B_i = value held of the security of the *i-th* issuer
GHG_i = total emissions (Scopes 1, 2 and, at times, 3) of the *i-th* issuer
The TCE indicator is sometimes expressed in an algebraically equivalent manner as the total emissions (*GHG*) of the portfolio, weighted by the value of the shares held in proportion to the economic value of the issuer (*Bi/Yi*)[124] i.e.:

$$TCE = \sum_i^n \left({}^{B_i}/_{Y_i}\right) \; x \; GHG_i$$

However, this representation and the very name of the indicator may be misleading. Despite its name, the TCE indicator is not actually a measure of absolute GHG emissions, but rather of the *total carbon intensity* (relative GHG emissions) *financed* by the ECB portfolio. Thus, TCE does not show the total absolute emissions financed (as its name would seem to suggest), but rather **the total *carbon intensity* financed by the portfolio**.

The **true total emissions** financed by the portfolio (WATC, *weighted average total carbon*) should actually be measured as the weighted average of total emissions of the entities financed, but this measure is not calculated by the ECB, i.e.:

$$WATC = \sum_i^n \left({}^{B_i}/_{P}\right) \times GHG_i$$

Carbon footprint (CF). The carbon footprint indicator is the ratio between TCE and the total value of the portfolio (P) and actually measures the *carbon intensity financed* for every euro of ECB's portfolio:

$$CF = \frac{\sum_i^n B_i \; x \; \left({}^{GHG_i}/_{Y_i}\right)}{P} = \frac{TCE}{P}$$

Carbon intensity del portafoglio (CI). L'indicatore misura l'intensità carbonica finanziata (TCE) in proporzione del valore dell'attività economica finanziata:

$$CI = \frac{\sum_i^n \left({}^{B_i}/_{Y_i^{(a)}}\right) \; x \; GHG_i}{\sum_i^n \left({}^{B_i}/_{Y_i^{(a)}}\right) \; x \; Y_i^{(b)}} = \frac{TCE}{\sum_i^n \left({}^{B_i}/_{Y_i^{(a)}}\right) \; x \; Y_i^{(b)}}$$

[123] EVIC is equal to the total market capitalisation of company shares (ordinary and preferred) + the book values of debt + liquidity. It differs from EV (enterprise value) inasmuch as liquidity is deducted in the latter.

[124] This is, for example, the representation provided in Annex 1 of ECB (2024c).

Where:

- for private issuers $Y_i^{(a)}$ = EVIC and $Y_i^{(b)}$= Revenue, thus $Y_i^{(a)} \neq Y_i^{(b)}$
- for public-sector sovereign issuers $Y_i^{(a)}$ = GDP (PPP adj.) and $Y_i^{(b)}$= GDP (PPP adj.), thus $Y_i^{(a)} = Y_i^{(b)}$

Therefore, for public-sector sovereign issuers (unlike private issuers):

$$CI = \frac{TCE}{\sum_i^n B_i} = \frac{TCE}{P} = CF$$

A.2.2 The evolution of carbon footprint metrics for the ECB/Eurosystem monetary policy portfolio

At the end of 2019 and the end of 2023, the carbon footprint metrics for the ECB/Eurosystem portfolio for monetary policy operations were as follows **[Table A.2.1]**. Of the two main components, that of sovereign securities and that of private-sector securities, only a part of the latter (non-financial corporates) was subject to a portfolio reallocation policy in favour of lower-carbon-intensity issuers (between October 2022 and July 2023). The values shown reflect the relative weightings of the various types of issuers in the portfolio.

Figure A.2.1 – *Metrics for the ECB/Eurosystem monetary policy portfolio (Dec 2019 – Dec 2023)*

	Sovereign sub-sovereign bond issuers		Other non-sovereign issuers									
	over GDP (excl. LULUCF)		Total		Corporate		Agencies		International institutions		Covered bonds	
	2019	2023	2019	2023	2019	2023	2019	2023	2019	2023	2019	2023
Total portfolio (mln €)	1,587	3,260	762	1,187	180	367	148	298	196	231	258	291
WACI (tCO2e / mln €)	175	140	87	55	316	172	5.5	3.8	0.5	0.2	3.6	1.4
TCE (Mln tCO2e)	277.7	455.2	32.5	47.1	32.1	46.7	0.171	0.259	0.0016	0.0009	0.126	0.094
Carbon Footprint (tCO2e / mln €)	175	140	54	48	195	132	1.3	0.9	0.0	0.0	0.5	0.3
Carbon Intensity (tCO2e / mln €)	175	140	97	72	332	187	20	17	0.4	0.0	3.2	1.6

(*) scope 1+2

Source :ECB (2024c) pp. 23-24

The evolution over time of carbon-intensity metrics for the ECB/Eurosystem's portfolio of private securities is useful in understanding their effective importance as indicators.

It is interesting to observe the trend within the indicators in detail, referring exclusively to the portion of the portfolio allocated to corporate bonds (the securities subject to selection on the basis of their carbon rating) **[Figure A.1a]**. Certain indicators used (WACI, CI and CF) show a clear downward trend between 2018 and 2023, which was particularly accentuated between 2021 and 2022. However, one of the indicators (TCE) appears to move counter to this trend in the 2019-21 period, stabilising in the successive two years. The trend of all the indicators is influenced by the carbon intensity of the businesses financed (*GHGi/Yi*), which falls over the course of the period in question. Especially between 2021 and 2022, the sharp decrease in the latter does not indicate a structural improvement in energy or carbon efficiency, but rather the extremely positive trend in revenue in many sectors, driven by the post-COVID economic recovery. Cyclical components can therefore play a significant role and, especially in the short term, lead to a distorted reading of the results. This is particularly evident in the parallel trends of WACI (blue line) and CI (yellow line), which are both fundamentally driven by evolutions in the business cycle (*Yi*) **[Figure A.1a].**

The trend of the first three indicators is influenced not only by the carbon intensity of the companies financed, but also by the weighting factors used. In the case of the WACI indicator, the effect of a reduction in carbon intensity is also associated with a reallocation of the portfolio in favour of lower-carbon-intensity securities. The tilting policy for the portfolio of private securities adopted by the ECB between October 2022 and July 2023, which reduced the proportion of more carbon-intensive sectors in the portfolio, made, on average, a 20% contribution to reducing the WACI indicator, and explains why, in **figure A.1a**, the blue line runs below the yellow line (indeed, CI is, as its name suggests, exclusively carbon intensity). This

reading is also confirmed by **figure A.1b**, which shows the individual contribution made to the variation in WACI by Δ*GHGi/Yi*, in blue, and by Δ*Bi/P*, in yellow, and where the contribution of the portfolio reallocation (in yellow) appears to be more pronounced in some of the more carbon-intensive sectors.

The TCE indicator (red line) moves counter to the other trends as it is driven upwards by the strong increase in the overall value of private securities purchased by the Central Bank (Δ*Bi*) between 2020 and 2021[125], which prevails over the effect of a reduction in carbon intensity Δ(*GHGi/Yi*).

Lastly, the downward trend for the carbon footprint (CF) indicator (green line) is, instead, more even and moderated, due to the fact that the effect of scale of the volume of securities acts both on the numerator and the denominator (Δ*ΣBi*)

Figure A.1a *– Evolution of carbon-intensity metrics for the Eurosystem's portfolio of private securities for monetary policies*

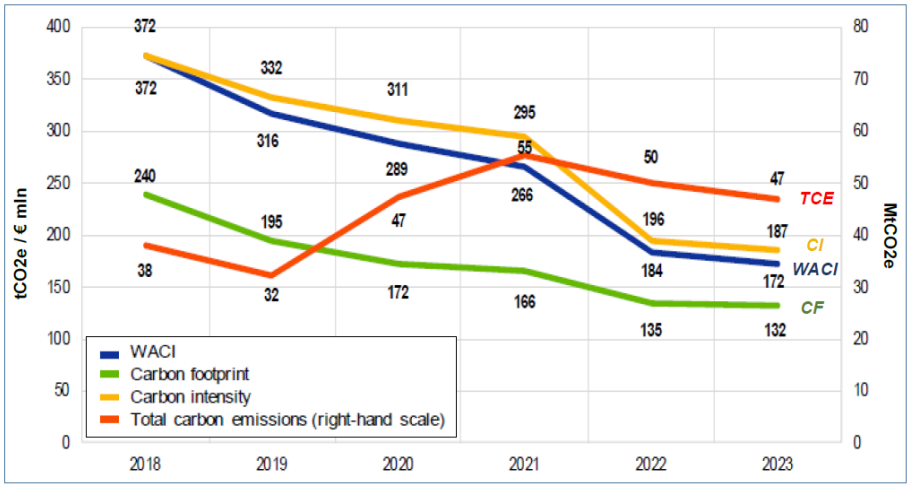
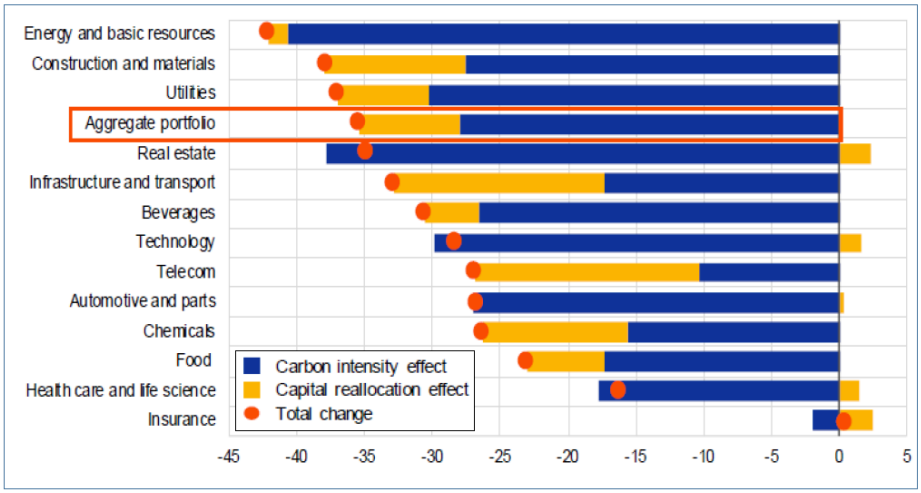


Figure A.1b *– Attribution of the changes in WACI for the Eurosystem's portfolio of private securities to the carbon intensity effect (blue) and the tilting policy (yellow)*



Source. ECB (2024c), https://www.ecb.europa.eu/ecb/climate/climate-related-financial-disclosures/shared/pdf/ecb.crfd2024_MPPs.en.pdf

[125] With the cumulative effects of the CSPP programme already under way and the PEPP, the portfolio of private securities held by the ECB more than doubled between 2019 and 2022 (from 180 bn a 385), with slower growth in 2022 and a fall in 2023 (ECB 2024c).

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