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Questioni di Economia e Finanza

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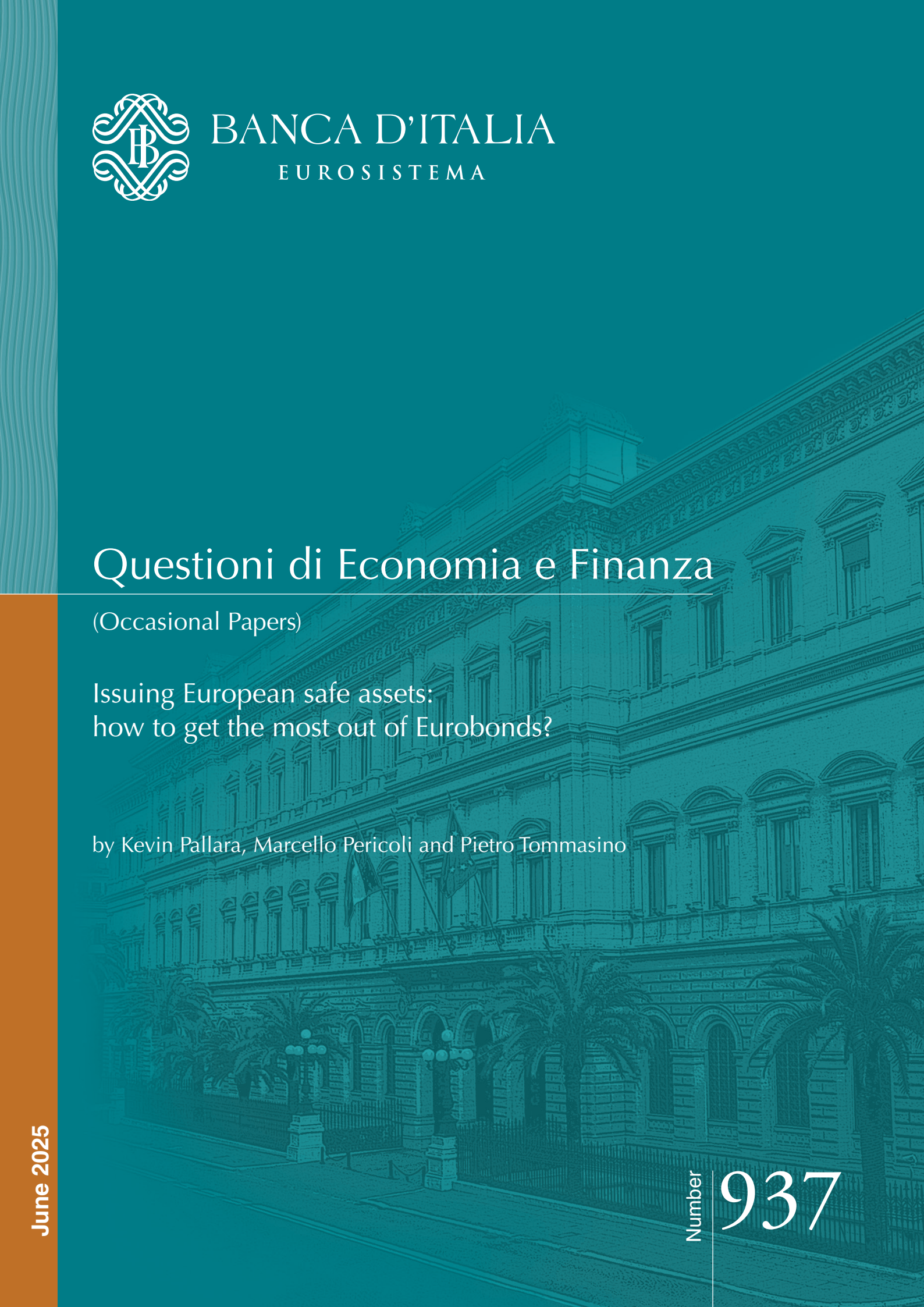

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ISSUING EUROPEAN SAFE ASSETS: HOW TO GET THE MOST OUT OF EUROBONDS?

by Kevin Pallara*, Marcello Pericoli* and Pietro Tommasino*

Abstract

This study examines the market for euro-denominated bonds issued by the European Commission on behalf of the European Union (commonly referred to as Eurobonds). We find that the yields on currently outstanding Eurobonds exceed their theoretically appropriate levels. The yield on the model-implied Eurobonds benefiting from joint guarantees is actually around 40 basis points lower than that on the Eurobonds currently in circulation. There is therefore an untapped margin for reaping aggregate savings in terms of reduced interest expenditures. Based on an examination of the main characteristics of Eurobond issuances and of their investor base, we suggest that the wedge is due to a combination of insufficient liquidity and an inconvenience premium, as well as to the uncertainty about future jointly guaranteed issuance. However, we also highlight that the model-based yield on the 10-year Eurobond is about 20 basis points above that of a Bund with the same maturity, so countries like Germany and the Netherlands might have no incentive to promote joint emissions in the future. A successful strategy for the development of the Eurobond market would require two key elements: firstly, a steady flow of Eurobond emissions, which could be granted by common investment programmes; and secondly, some form of redistribution for the aggregate gains.

JEL Classification: E43, F34, G12, H63, H81.

Keywords: European safe asset, Eurobonds, joint liability, sovereign credit risk, term structure of interest rates.

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1. Introduction

Economic historians have highlighted the tight link between state building, financial market development and sovereign debt (Eichengreen et. al, 2021). First, the ability to issue public debt is a precondition for providing public goods and making public investments which represent the bulk of modern statehood (defense, infrastructures, etc.); the need to secure a stable funding for the Sovereign also propelled crucial institutional improvements (the rule of law, limits to government powers[1], an adequate tax system and an effective tax administration). Second, the availability of sovereign debt securities goes hand in hand with helping to create specialized market operators (Flandreau and Flores, 2009), fulfilling the demand for liquid assets and ensuring collateral in the economy.

This nexus, which underpins the historical consolidation of today's European States, resonates in the debate about the future of the European Union (EU). Indeed, issuance of a common EU debt would be the backbone of a common EU fiscal capacity, which in turn could help national fiscal policies and the common monetary policy to stabilize the business cycle[2] and provide public goods at EU level (in fields such as defense and/or the digital and green transition) in an efficient and effective way (Romanelli et al., 2022). A euro-denominated security would also be instrumental for the completion of the capital market union and would foster financial stability, avoiding the volatility of cross-border capital flows which typically propagate tensions in sovereign debt markets in Europe (Brunnermeier et al., 2017).

While the analytical case for an EU debt instrument seems rather compelling, in practice progress up to now has been limited. The most sizable issuance took place in 2020 when, to deal with the

[1] The seminal paper on this is North and Weigast (1989). See also Stasavage (2016).

[2] Issuing debt in the aftermath of an adverse aggregate macroeconomic shock would be the natural way to implement a counter-cyclical EU fiscal policy (debt issuance would be the mechanical effect of a reduction in EU revenues and/or an increase in EU spending).

pandemic crisis, the European Commission (EC) issued bonds guaranteed by all EU member states to finance to temporary programmes: the Support to mitigate Unemployment Risks in an Emergency (SURE, October 2020) [3] and Next Generation EU (NGEU, June 2021). However, this was an isolated case: net issuances under the NGEU programme are bound to end in 2026 and the related debt will be fully repaid by 2056, while those under the SURE programme ended in December 2022 and related debt will be repaid by 2052.

Against this background, we first describe the main features of the market of the existing Eurobonds,[4] and we document that their yields include a non-negligible liquidity premium as well as a "convenience yield" with respect to the highest-standing national sovereign bonds. Second, using the methodology of Pallara and Renne (2024), we compute model-implied yields for Eurobonds, which turn out to be much lower than the actual ones. This implies that there are large *potential* gains, to be shared among member states, in issuing jointly guaranteed bonds, but these gains have not yet been reaped. At the same time, we find that the model-implied yields are about 20 basis point higher than the German ones.

These results suggest that EU policy should have two priorities. The first is to reduce Eurobond yield spreads, bringing them more in line with what they could be – at least according to our estimates. This requires fixing the current operational set up of the Eurobond market and ultimately calls for ensuring an adequate stream of issuances in the medium-to-long run. The second policy priority is to design a cross-country redistribution scheme which makes participation in the common issuance convenient *for all* the countries involved.

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[3] SURE provided loans for almost €100 billion granted on favourable terms from the EU to Member States to address sudden increases in public expenditure for the preservation of employment. SURE loans were backed by guarantees from Member States in proportion of each Member's national income. The possibility to apply for SURE funds ended on 31 December 2022. The European Commission had issued €98.4 billion social bonds in nine rounds under the EU SURE instrument to help protect jobs. The issuances consisted of bonds ranging from 5 to 30 years.

[4] In the rest of the paper, we use the term Eurobonds to refer to bonds issued by a supranational body, such as the European Commission (EC), on behalf of EU countries that are perceived as jointly liable for repaying them at maturity.

The rest of the work is structured as follows. Section 2 presents some of the most influential proposals for the introduction of Eurobonds and surveys the literature. Section 3 describes the existing Eurobond market, in terms of yields, spreads, issues, holders and liquidity. Section 4 presents the model that we use for our simulations, and the model-implied Eurobond yields. Section 5 concludes and offers some policy implications.

2. Eurobonds: review of academic literature and policy proposals

Several arguments have been put forward in favour of issuing common bonds in Europe. Some emphasize that, if implemented on a large scale, joint debt instruments would foster market integration, enable the EU to compete with the US bond market in terms of size and liquidity (Giovannini, 2000; Hellwig et al., 2011) and reduce financing costs for financially strained countries, leading to overall gains (De Grauwe et al., 2009; Claessens et al., 2012). Others see joint debt instruments as a tool to strengthen financial stability, particularly by breaking the "bank-sovereign doom loop" that emerged after the Great Financial Crisis and the euro debt crisis (European Commission, 2011; Brunnermeier et al., 2017; Delivorias et al. 2020). Bianchi et al. (2023) show that, with the introduction of a euro-area fiscal authority which can issue Eurobonds for short-run macroeconomic stabilization (national governments retain responsibility for long-term fiscal sustainability) there would be better coordination between fiscal and monetary authorities and more effective cyclical stabilization without jeopardizing long-run fiscal sustainability.

However, joint debt issuances come with serious challenges, including coordination hurdles, political barriers to transferring sovereignty to EU level, and the risk of weakening incentives for sound fiscal policies.

Some analytical works examine the conditions under which common bond issuance could represent an improvement for all the parties involved. Tirole (2015) emphasizes the moral hazard[5]

[5] For earlier criticisms which also focus on moral hazard see Persson and Tabellini (1996) and Alesina and Perotti (1998).

implications, and finds that joint debt could produce a Pareto improvement only if the Countries involved are sufficiently similar ex ante. Tirole (2015) results rest on two assumptions: (i) the main link between countries (and therefore the main reason to issue joint liabilities) is given by negative spillovers in case of a country default; and (ii) fiscally stronger countries do not have any competitive advantage, with respect to private lenders, in disciplining borrowers.

However, as argued by Basu and Stiglitz (2015), if weaker and stronger countries are involved in joint projects which are mutually beneficial, the latter can leverage on this relationship to discipline borrowers and at the same time they can also gain by doing so[6]. Therefore, joint liability can improve the welfare of all the parties involved even if they have different creditworthiness to start with.[7]

In a dynamic set-up, Abraham et al. (2025) envisage a context in which Sovereigns borrow only from a supranational fund, and sign a contract with the fund according to which loan repayments are state-contingent contract that depends on an ex ante assessment of the borrowers' riskiness[8]. The authors demonstrate that the contract with the fund will be honored with certainty and that this safety extends to the securities ("Eurobond") that the fund issues in order to finance itself. Furthermore, all countries gain from the introduction of the fund even if they have different credit standings.

Several policy-oriented contributions focus on institutional details, and advance specific operational and implementation proposals. The European Commission (EC) (2011) suggests entirely replacing standard national issuances with jointly-guaranteed bonds[9]. Conversely, the "Eurobills" scheme proposed by Hellwig et al. (2011) reserves joint guarantees for short-term debt instruments, equal to

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[6] This is tantamount to reject the two above mentioned Tirole (2015) assumptions. Real-world examples of joint endeavors abound, e.g. in the fields of aerospace industry or in defense (weapons systems).

[7] More generally, research has shown that the potential for peer monitoring, that is inherent in many forms of joint liability lending, can improve efficiency and raise welfare (Ghatak and Guinnane, 1999).

[8] This assessment would be similar to what in the real world is called a Debt sustainability analysis.

[9] Starting from 2012, the idea of a European fiscal union has been endorsed, in one way or another, in several official documents by EU institutions (for a discussion see Balassone et al., 2018).

10% of GDP. Delpla et al. (2010) propose a mechanism (known as blue/red) in which European countries issue common public debt up to the Maastricht Treaty threshold with joint guarantees ("blue") that rank senior; the share of issuance exceeding this threshold ("red") has a junior-grade classification.[10] Other schemes discussed by the European Commission (2011), propose partial replacement of national issuance with bonds benefitting from several but not joint guarantees, where each member state maintains the responsibility of its respective share of issuance.

Alternatively, Brunnermeier et al. (2017) propose the creation of synthetic tranches from a portfolio of national sovereign bonds, with the aim of mitigating sovereign credit risk for financial institutions. Cioffi et al. (2019) explore the possibility of transferring a portion of national debts to a European Redemption Fund, with countries committing to contribute to its endowment on a yearly basis. This scheme aims at stabilizing member states' public finances by reducing annual refinancing needs, without upfront redistribution. Departing from debt mutualization, Amato et al. (2023) propose the constitution of a European Debt Agency to manage European debt efficiently, aiming to mitigate roll-over and sustainability risks. The Agency would issue perpetuities and loan to sovereigns. The loan prices would be determined transparently, tying them to economic fundamentals to foster fiscal discipline and prevent excessive costs due to market price deviations. Instead of mutualizing debt, this approach would encourage responsible fiscal behaviour among EU member states and reduce the macroeconomic impact of fluctuations in interest risk premia.

3. The current Eurobond market

This Section focuses on bonds issued by the EC since 2020 to fund the emergency pandemic-related programmes (NGEU and SURE), which represent the bulk of the outstanding bonds. These issuances provide an unprecedented laboratory to evaluate the characteristics of a common issuance: how

[10] The idea that such a scheme can increase fiscal responsibility even for "Periphery" countries is formalized and vindicated by Beetsma et al., 2014

creditworthiness is perceived by investors, how it contributes to the bonds' attractiveness in global financial markets and how it builds over time.

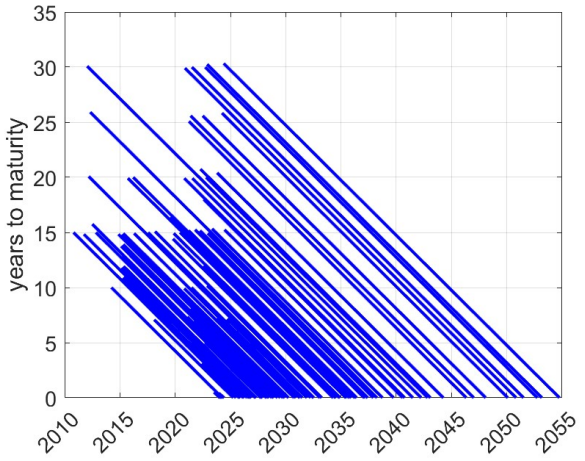
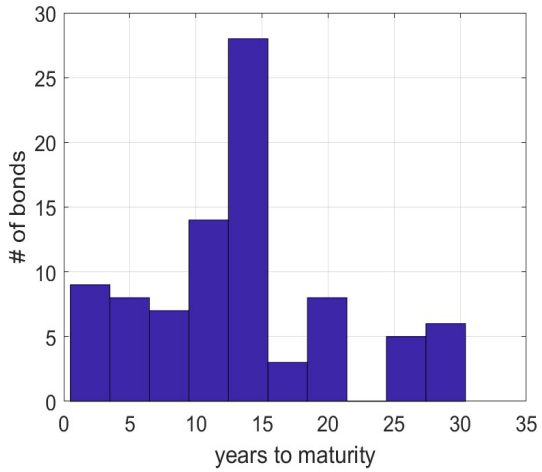
3.1 Issues and maturities

Over 90 percent of the €546 billion of outstanding EU debt (as issued by the European Commission up to 2024Q3) has been issued since 2020.[11] Large-scale net borrowing is expected to continue until 2026 to fund the remainder of NGEU, and the concessional loans issued to support Ukraine. By then, the total amount of Eurobonds should exceed €1 trillion by 2026. After that point, however, given the one-off nature of the NGEU program, the amounts outstanding will gradually decline.

From October 2010 to March 2025, 88 bonds in total have been issued by the European Commission. Issuances are characterized by long maturity, typically between ten and thirty years (Figure 1.a). As of March 2025, however, 30% of outstanding bonds have a maturity of less than 10 years, 40% have a maturity between 10 and 15 years, and the remainder have a maturity of up to 30 years (Figure 1.b)

[11] Besides the debt issued to finance the programmes started in response to the pandemic crisis, we include in our definition of Eurobonds the debt of the European Financial Stability Mechanism, the Balance of Payment assistance facility, and the Macro-Financial Assistance. Bonds issued by the European Stability Mechanism (ESM), the European Financial Stability Facility (EFSF) and the European Investment Bank (EIB) are not considered.

Figure 1 – Issues and maturities

a –Outstanding Eurobonds by maturity (*)	b – Number of outstanding bonds and years to maturity (March 2025)
	

Source: LSEG/Refinitv, Securities Holding Statistics, ECB.

(*) Each outstanding Eurobond is represented by a dot showing its remaining maturity on that date. For example, a dot at a ten-year maturity in January 2015 denotes a security that is to mature ten years later, in January 2025. That same security will be represented by a dot at the nine-year maturity in January 2016. The last Eurobond was issued in May 2024 and will expire in 2054.

3.2 Investors' base

To examine the Eurobonds' investor base, we rely on the confidential Securities Holdings Statistics by Sector (SHSS) quarterly dataset, collected by the Eurosystem since the end of 2013. SHSS data come from depository institutions and keep track of all securities issued by entities based in the euro area or denominated in euros. The holdings are reported at the single ISIN level.

Figure 2 shows the evolution of Eurobond holders' shares and outstanding amount by type of investor and by country from 2020 to 2024. Excluding those purchased under the ECB Asset Purchase Programmes, these shares remained fairly stable over the period examined. The focus is on these last four years because recent issuances programmes have led to the outstanding amount of Eurobonds to rise from less than €50 billion in the first quarter of 2020 to €546 billion in the third quarter of

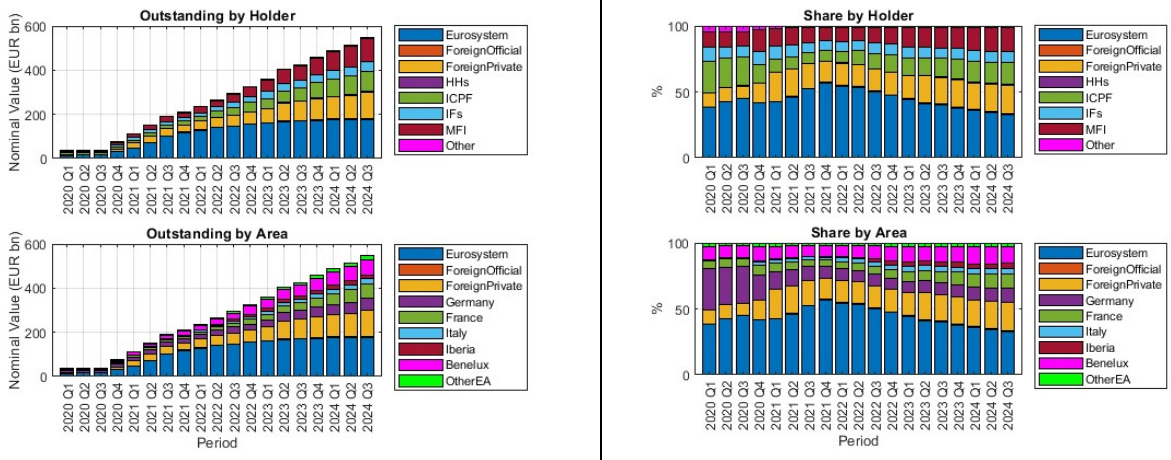
2024. According to the latest available data, the Eurosystem was the largest holder with around 32% of the €546 billion outstanding. The second largest holder was the foreign sector, with around a 22% share, followed by Banks plus Money Market Funds (MMFs) with an 18% share, Insurance Companies plus Pension Funds with 17% and Financial Institutions and Mutual Funds with around 8% (households and other investors hold a negligible fraction).

The breakdown by country of the holder shows that after foreign investors, in the third quarter of 2024, the Benelux (Belgium, the Netherlands and Luxembourg) was the largest holder with around 12%, owing to a large presence of pension funds in the region.[12] Germany and France follow with around 10%, while Italy and Spain hold around 4%.

Figure 2 – Eurobonds' holdings

a) Eurobonds holders by investors and by area (amount outstanding)

b) Eurobonds holders by investors and by area (share)



Source: Securities Holding Statistics, ECB.

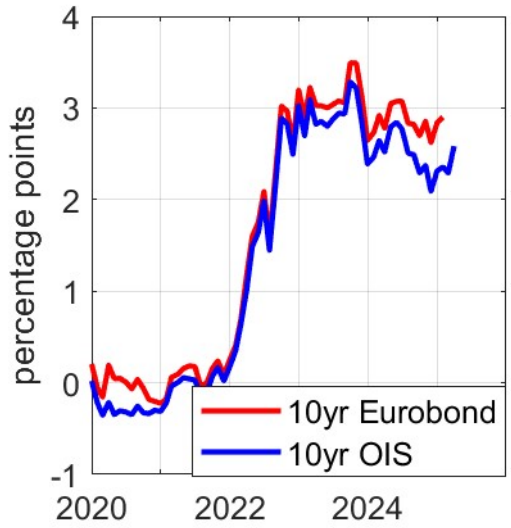
[12] Notably, Benelux is the "entrepot" region for Money Market Funds (MMF) in Europe. Indeed, the residence and the nationality of ultimate investors may be very different. Thus, for instance, the true foreign share could be higher if the United States or Japan investors buy via MMF residing in Luxembourg. See Beck et al. (2024) for a further discussion.

3.3 Yields and spreads

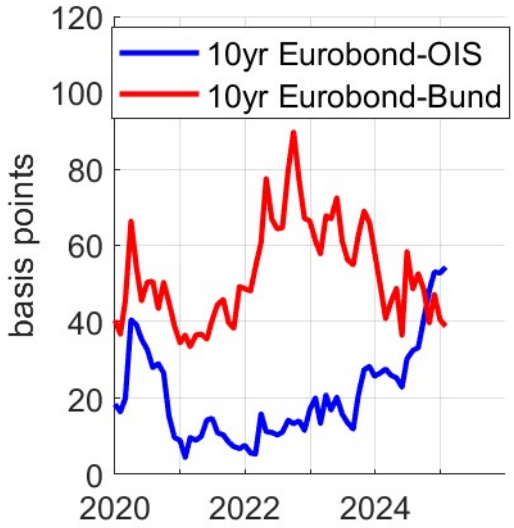
We estimate the term structure of Eurobond yields using a cubic spline methodology, a common approach for constructing smooth yield curves by interpolating between observed data points.[13] As expected, the 10-year Eurobond interest rate closely follows the corresponding Overnight Index Swap (OIS) rate (Figure 3 panel a).[14] Between 2020 and 2024, yields on Eurobonds were, on average, 20 basis points higher than the corresponding OIS rates, peaking to around 50 basis points at the end of 2024. In contrast, the yield spread relative to corresponding German government bonds (Bund), commonly regarded as the major euro-denominated safe asset, hovered around 50 basis points, widening up to 90 basis points in 2022.

Figure 3 – Yields and spreads

a) Eurobonds yield and OIS



b) Eurobond spread with OIS and Bund



[13]Using the cubic spline methodology, one could potentially calculate yields and forward rates over any horizon; however, it is advisable to only focus on the output of these methodologies at horizons for which outstanding securities are available for estimation (see, for instance, Gürkaynak, Sack and Wright, 2007).

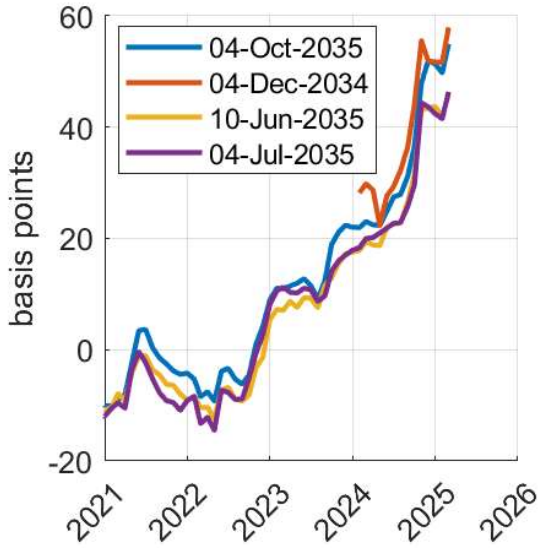
[14] An Overnight Index Swap (OIS) is a derivative contract in which two parties agree to exchange, or "swap", interest rates over a specified period. One party will pay a fixed interest rate and receive a floating interest rate, which is pegged to an overnight rate, such as the Fed funds rate in the US. The "overnight" refers to the continual resetting of the rate based on the index's daily fluctuations. OIS plays a pivotal role in financial markets as it provides a gauge of market expectations of central bank rates. It can reflect future monetary policy changes and the corresponding market sentiments. As OIS is a risk-free rate, it is used in various contexts including to value and hedge interest rate risk in derivative portfolios, calculate counterparty risk, and make policy decisions.

Source: Banca d'Italia calculations, LSEG/Refinitiv Eikon Datastream. Panel a) of the figure shows the zero coupon yield of Eurobonds estimated starting from the prices of the securities issued by the EC in circulation with a cubic spline methodology illustrated in Pericoli M., 2014, "Real Term Structure and Inflation Compensation in the Euro Area, *International Journal of Central Banking*, March. Panel b) shows the differential between the zero coupon yield of Eurobonds compared to the OIS rate and the zero coupon yield of the German government bond.

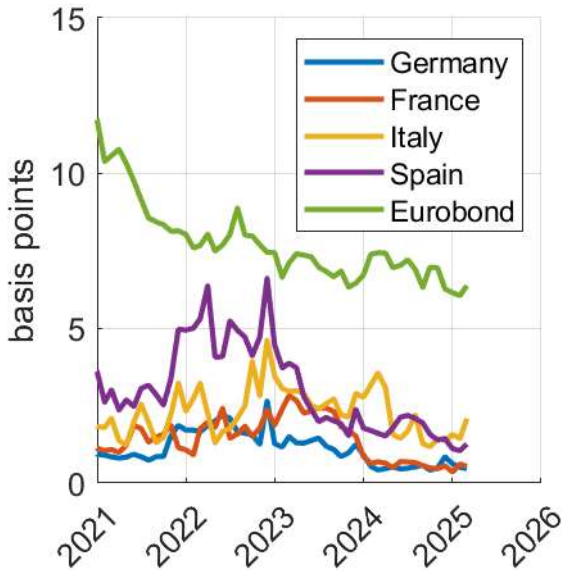
Eurobond yields could differ from OIS rates and Bund yields for reasons of liquidity and convenience. Among the various measures of liquidity, we use the asset swap spread and the bid-ask spread of Eurobonds. The asset swap spread, the difference between the yield of a bond and the corresponding swap rate that reflects mainly liquidity risk associated with the bond, shows a striking deterioration of liquidity since January 2024 (Figure 4 panel a). Similarly, the bid-ask spread continues to average over three times those of domestic government bonds of the main euro-area countries, signalling the relative illiquidity of Eurobonds (Figure 4 panel b).

Figure 4 – Asset swap spread and bid-ask spread

a) Eurobond Asset Swap Spreads



b) Bid-ask spread



Source: Banca d'Italia calculations, LSEG/Refinitiv Eikon Datastream, Panel a) shows the monthly average asset swap spread of four Eurobonds whose expiration date is shown the legend, respectively, EU000A1Z6TV6 – 1.5% – 22-Sep-2015/04-Oct-2035, EU000A3K4ES4 – 3.0% – 28-4-2025/04-Dec-2034, EU000A28X702 – 0.125% – 06-Jul-2023/10-Jun-2035, EU000A285VM2 – 0% – 03-Dec-2020/04-Jul-2035. The asset swap spread is the difference between the yield of a bond and the corresponding swap rate for the same maturity and reflects the credit risk and the liquidity risk associated with the bonds; an increase in the asset swap spread signal a decrease in credit quality or liquidity. Panel b) shows the monthly average bid-ask spread; it is computed as the percentage difference between the bid price and the ask price over the mid price of the 10-year government bond benchmark; for the Eurobond we consider bonds with maturity between 9 and 11 ½ years,

As Eurobonds can also be considered safe in terms of credit risk[15], we can interpret the spread between Eurobonds and OIS as a combination of convenience and liquidity premium. The OIS rate, being the average of the overnight rates over the reference horizon, may be considered not only risk-free but also highly liquid due to a potential unlimited supply. Given that Bunds are highly liquid as well, we can interpret the difference between the Eurobond-Bund and the Eurobond-OIS spread, namely the OIS-Bund spread, as a premium for convenience.[16]

This evidence suggests that EU is not yet fully accepted as a provider of safe assets. To reduce financing costs and align Eurobond yields to German yields, markets must be convinced that

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[15] Moody's assigned its highest rating (AAA) to the EU, noting its Member States' commitment to ensuring the continued soundness of the Union's finances, given the high credit profile of the EU members with a higher rating. However, Standard and Poor's gave the EU a long-term issuer rating of AA, its second highest rating.

[16] Decomposing the Eurobond yield of maturity h (y_t^{EU}) as follows,

$$y_{t,t+h}^{EU} - OIS_{t,t+h} = (y_{t,t+h}^{EU} - y_{t,t+h}^{DE}) + (y_{t,t+h}^{DE} - OIS_{t,t+h}), \quad (i)$$

where $OIS_{t,t+h}$ is the OIS rate of maturity h, y_t^{DE} is the Bund yield of maturity h, we can interpret the spread between the Eurobond and OIS as a combination of liquidity premium and convenience yield. The implicit assumption here is that the credit risk associated with the Eurobond is close to the one associated with the German Bund under the idea that the actual Eurobonds are perceived – yet not fully and unanimously – as jointly-guaranteed by UE countries (see footnotes 14 and 28). Thus, if the distance between the credit risk premium associated to the Eurobonds is not large w.r.t. the German Bund's one, we can neglect from detracting the EU default swap from the left-hand side of equation (i) and, subsequently, subtracting and adding the German default swap from the right-hand side (see Jiang et al., 2024). Note also that there exists no such thing as the credit default swap (CDS) for Eurobond, our educated guess is that it would oscillate between the Bund one and a weighted average of the EU single countries CDS depending on how the market perceives the guarantees attached to the common bond (in Section 4 there is an extensive discussion and a modelling effort that aims at pinpointing such interplay). The first term of the right-hand side of equation (i) – namely the Eurobond-Bund spread ($y_{t,t+h}^{EU} - y_{t,t+h}^{DE}$) – represents a combination of a relative convenience yield with respect to the Bund and a liquidity premium. The second term of the right-hand side of equation (i) – namely the Bund-OIS spread ($y_{t,t+h}^{DE} - OIS_{t,t+h}$) – taken with a negative sign represents a "pure" convenience yield or premium (e.g., Krishnamurthy and Vissing-Jorgensen, 2012). That is, the premium that is due to a component of the demand of a safe asset that reflects a "non-pecuniary" element (Krishnamurthy and Vissing-Jorgensen, 2012). As shown by since the global financial crisis (GFC), even long-maturity U.S. Treasury bonds have traded at a yield consistently above the interest rate swap rate of the same maturity. The emergence of a negative swap spread appears to suggest that Treasury bonds are "inconvenient," at least relative to interest rate swaps. Moreover, an asset swap spread between the Bund's yield and the corresponding swap rate is very close to the observed Bund-OIS spread. Asset swap spreads are a good indicator of the convenience yield (see Schnabel, I., "No longer convenient? Safe asset abundance and r*", keynote speech at the Bank of England's 2025 BEAR Conference, 25 February 2025). Both interest rate swaps and government bonds are essentially risk-free assets, so they should in principle yield the same return. Finally, note that from equation (i) the spread between the Eurobond-Bund spread and the Eurobond-OIS spread represents the OIS-Bund spread, namely the convenience premium.

Eurobonds are traded in the same way as sovereign bonds and not as Supranational, Sub-sovereign and Agencies bonds (Claeys, McCaffrey and Welslau, 2023). Bonfanti and Marcucci (2024) show that investment mandates limit the pool of potential investors for supranational bonds compared to government bonds with similar credit rating. As a result, this decreases the expected liquidity during crises, requiring supranational bonds to pay a premium even under normal conditions. This dynamic is driven by investors, such as mutual funds, who may have liquidity needs during crises. Indeed, mutual funds hold only a small fraction of the Eurobonds currently in circulation (as shown in Section 3.2).

There are some fixes in terms of market characteristics of the Eurobonds that can soften the cost of funding for the EU (more on this in Section 5.1, below).

However, while technical fixes can help, the fundamental issue remains political and hinges on member states' willingness to reap the full benefits of common EU borrowing and to make some progress on the fiscal union front (further discussed in Section 5.2). Until now, Eurobonds have been penalized by the lack of a stable and regular supply, which can be guaranteed only by the creation of a permanent common budget capacity (see Panetta, 2022, 2023, 2024; Draghi, 2024).

In the remaining part of this work, we try to estimate quantitatively the size of the gains that would derive from a joint issuance of Eurobonds in place of (or partially replacing) national bonds, guaranteed jointly by all EU member countries.

4. Potential advantages of Eurobonds: a model-based evaluation

4.1 The model

We compute theoretical Eurobond yields with the methodology of Pallara and Renne (2024). Then, we compare the yields of model-based Eurobonds with actual Eurobonds and with those of national government bonds.

The model assumes that a country's probability of default depends on its fiscal space, defined as the distance between current government debt and its fiscal limit, i.e. the maximum outstanding government debt that can credibly be financed by future primary surpluses (Bi, 2012; Bi and Leeper, 2013). Accordingly, the probability of default is positive (zero) if the fiscal space is negative (positive). The default probability of each country in isolation takes the following parametric form,

$$(1 - \exp(-\alpha\, max(0, d_t - \ell_t)),$$

where d_t (ℓ_t) is the debt-to-GDP (fiscal limit-to-GDP) ratio. The parameter α measures the elasticity of the probability of default to the fiscal space and characterizes the nature of the fiscal limit such that when the parameter is high (low) the probability of default approaches one faster (slower) and the fiscal limit is stricter (looser).

The model also envisages bonds benefitting from several and joint guarantees by all countries participating in the issuance (SJG bonds).

In a stylized setting, assuming risk-neutral investors, a zero risk-free interest rate, normally distributed debt-to-GDP ratios, and constant fiscal limits, the price at time *t* of a one-period zero-coupon bond with joint guarantees (SJG) and no recovery rate is given by

$$P_{t,1}^{SJG} = E_t \exp(-\alpha \max(0, \omega \boldsymbol{d}_{t+1} - \omega \boldsymbol{\ell})), \qquad (1)$$

where $\omega \boldsymbol{d}_{t+1}$ and $\omega \boldsymbol{\ell}$ are the GDP-weighted sum of countries' debt-to-GDP ratios at *t+1* and their fiscal limits, respectively, and ω is the vector of GDP weights.[17] As long as the probability of having a weighted debt-to-GDP ratio ($\omega \boldsymbol{d}_t$) greater than the joint fiscal limit ($\omega \boldsymbol{\ell}$) is lower than the probability that $d_{jt} > l_j$ for all j, the price (yield) of the GDP-weighted average of national bonds is lower (higher) than that of the SJG bond. This holds as long as the correlation across shocks on each

[17] According to the model, the price at time t of a one-period zero-coupon zero-recovery-rate bond issued by country *j* is equal to $P_{t,1}^{j} = E_t \exp\left(-\alpha \max\left(0, d_{j,t+1} - \ell_{j,t+1}\right)\right)$, where $d_{j,t+1}$ and $\ell_{j,t+1}$ are respectively the country *j*'s debt-to-GDP ratio and fiscal limit at time *t+1*. The price admits a closed-form solution deduced from standard results on truncated normal distributions.

country's debt is less than one, such that there is scope for diversification of the countries' fiscal risks. Since the price of a SJG bond is higher than the national bond prices, this implies that the countries would be able to reduce the cost of their debt servicing using such bonds.

A key aspect to emphasize is the importance of shock correlation in shaping the benefits of joint debt issuance. When debt shocks across countries are imperfectly correlated, joint issuance enables risk diversification, reducing the probability of breaching the joint fiscal limit.[18] This, in turn, improves market confidence and lowers borrowing costs. In the case of idiosyncratic shocks – those affecting individual countries rather than the entire EU – joint issuance serves as a risk-sharing mechanism. Countries facing fiscal distress benefit from the financial stability provided by their peers, mitigating the adverse consequences of temporary economic downturns. Consequently, SJG bonds are not merely a tool for reducing borrowing costs but they also enhance the resilience of the European fiscal system by creating a collective buffer against asymmetric shocks.

As a second step, we depart from the simple model of equations (1)-(2) and assume autoregressive processes for the debt-to-GDP ratio and the fiscal limit,[19] a stochastic risk-free interest rate, risk-

[18] In the fully-fledged model (discussed briefly below), the correlation across debt innovations is taken equal to 50%, which is the cross-country average of sample correlations between changes in debt-to-GDP ratios; the correlation across fiscal limit innovations is set to the same value.

[19] The debt-to-GDP ratio follows an AR(2) process replicating the standard debt accumulation equation, in which debt-to-GDP depends on its first lag, interest payments and primary surplus (excluding stock-flow adjustments). The fiscal limit follows a simple AR(1).

averse investors and partial recovery from default,[20,21] such that – after some algebra – the price of a h-period bond issued by country i at time t is equal to:

$$P_{t,h}^{j} = (1 - RR)E_t\left(\mathrm{M}_{t,t+h}\left(1 - D_{j,t+h}\right)\right) + RR\ E_t\left(\mathrm{M}_{t,t+h}\right), \qquad (3)$$

where $\mathrm{M}_{t,t+h}$ is the stochastic discount factor between dates t and $t+h$, $D_{j,t+h}$ is a dummy that takes on a unit value in case of default at time $t+h$, RR is the recovery rate in case of default, $E_t\left(\mathrm{M}_{t,t+h}\right)$ is the price of a zero-coupon risk-free bond with a payoff of 1 at $t+h$ with certainty, $E_t\left(\mathrm{M}_{t,t+h}\left(1 - D_{j,t+h}\right)\right)$ is the price of a zero-coupon bond with a payoff of 1 at $t+h$ without default, and a payoff of zero otherwise.[22] By definition, the bond yield in equation (3) is given by $i_{t,h}^{j} = -\log\left(P_{t,h}^{j}\right)/h$ and the sovereign spread by $s_{t,h}^{j} = i_{t,h}^{j} - i_{t,h}^{0}$, where $i_{t,h}^{0}$ is the risk-free bond yield. Equation (3) can be written in state-space form,

$$[S_t\ \ RF_t]' = F(X_t; \Theta) + \Omega\eta_t$$

$$X_t = G(X_{t-1}, \eta_t; \Theta) = \mu_x + \Phi_x X_{t-1} + \Sigma_x \epsilon_t, \qquad (4)$$

where S is the vector of spreads, RF is the vector of risk-free yields, X is the state vector of factors (debt/GDP ratios, fiscal limit/GDP ratios, short-term rate), Θ is the set of parameters to be estimated,[23] $\eta_t, \epsilon_t \sim IID(0, I)$, and Ω, Σ_x are variance-covariance matrices. Note that, $G(\cdot)$ is linear while $F(\cdot)$ is non-linear in the state vector. Fiscal limits are computed using the inversion-technique

[20] In the model of Pallara and Renne (2024) investors are risk averse, their risk preferences are captured by a stochastic discount factor, and the state vector follows a VAR(1). As a result, the probability of default depends on the fiscal space while the stochastic discount factor is exponentially affine as in Ang and Piazzesi (2003). In this context, risk-free bond prices admit closed-form recursive solutions. Following Duffie and Singleton (1999), prices are computed assuming that the payoff is equal to the recovery rate of a risk-free zero-coupon of equivalent residual maturity if the country defaults, zero otherwise.

[21] A credit risk model featuring more structural macroeconomic features, based on the concept of *fiscal fatigue*, is presented in Renne and Pallara (2024).

[22] The pricing involves a framework in the spirit of Black's shadow rate (1995) given the *max* operator specification of the default intensity. As closed form solutions are not employable, we resort to Wu and Xia (2016) methodology.

[23] Note that some parameters are calibrated. See Pallara and Renne (2024) for further details.

methodology of Chen and Scott (1993)[24] and the parameters (Θ, Ω) by maximum likelihood. The system shown in (4) is estimated from the second quarter of 2008 to the last quarter of 2023 for Germany, France, Italy, Spain, the Netherlands, and Belgium. Quarterly data are from Eurostat and LSEG-Refinitiv. The short-term risk-free rate is proxied by the three-month OIS rate. The 2-,3-,5-, and 10-year risk-free bond yields are measured by the difference between the Bund and the corresponding German Credit Default Swap (CDS) premium (Monfort and Renne, 2014).

In this framework, sovereignty is not eliminated but shared within a collective issuing authority. From this perspective, there is no fundamental distinction between a "joint and several" collective guarantee and sovereign bonds issued by individual nations, as both ultimately depend on member states' ability to generate revenues and fulfil their obligations.

4.2 Results

The estimates show that, from 2008 to 2024, the issuance of SJG bonds would have been characterized by a lower cost of debt compared to the weighted-average of actual national sovereign spreads.[25,26] However, except for the period following the Great Financial Crisis (GFC), the German yield is always lower than the SJG yield. This implies that Germany would not have any benefit from participating in a SJG bond issuance and that incentives must be designed so as to make it financially worthwhile for fiscally virtuous countries to take part in SJG bond issuance (see Section 5.3 for

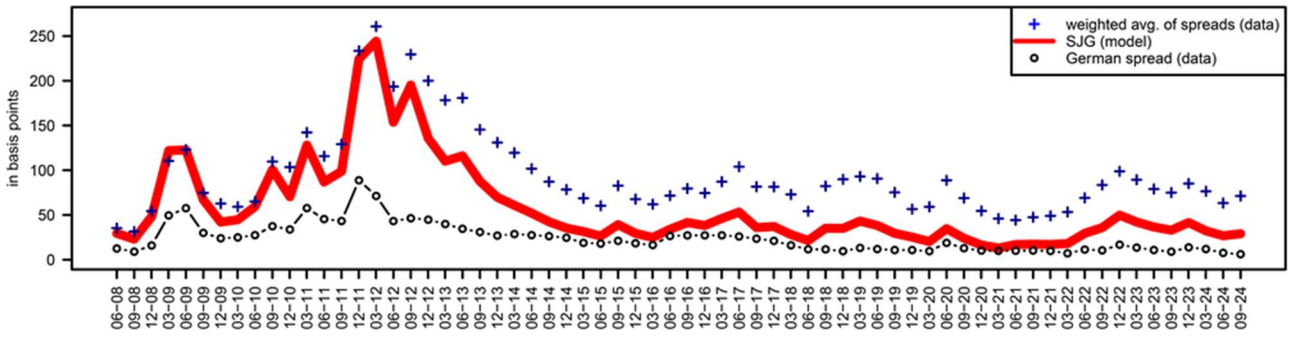
[24] Factors are obtained by inverting a non-singular system relating prices to factors. This system results from the assumption that some of the observed prices are modeled without errors. In the present case, we assume that, for each country, the averages of the three sovereign spreads (with maturities 3, 5, and 10 years) are perfectly priced. Under this assumption, we can recover the fiscal limits and, simultaneously, compute the likelihood function associated with the considered model parameterization. This opens the door to maximum-likelihood estimation.

[25] The diversification mechanisms may have adverse effects on SJG bond yields when the expected fiscal space is negative enough. Intuitively, in this case, the distribution of the joint fiscal space and the default intensity turn out to be more concentrated on the "wrong side" of zero, yielding to lower prices for SJG bonds.

[26] Spreads are measured with respect to risk-free bond yields (namely, the difference between the German bond yield and CDS). Risk-free interest rates are linear in the state vector, while sovereign spreads are not due to the non-linearity in the default probability.

further discussion). With a focus on the period from 2020 until the end of the estimation sample (2024Q3), as most of EU debt was issued since 2020, the SJG spread is lower than the weighted average of national spreads by 40 basis points (Figure 5).[27] It is relevant to note that, during this period, shocks to national public debts were partially uncorrelated, allowing for potential diversification of fiscal risks.

Figure 5 – Model-implied spreads



Source: own calculations, Refinitiv Eikon Datastream, Eurostat. Note: The figure compares counterfactual yield spreads with respect to risk-free interest rates (computed as the difference between the Bund and the corresponding CDS).

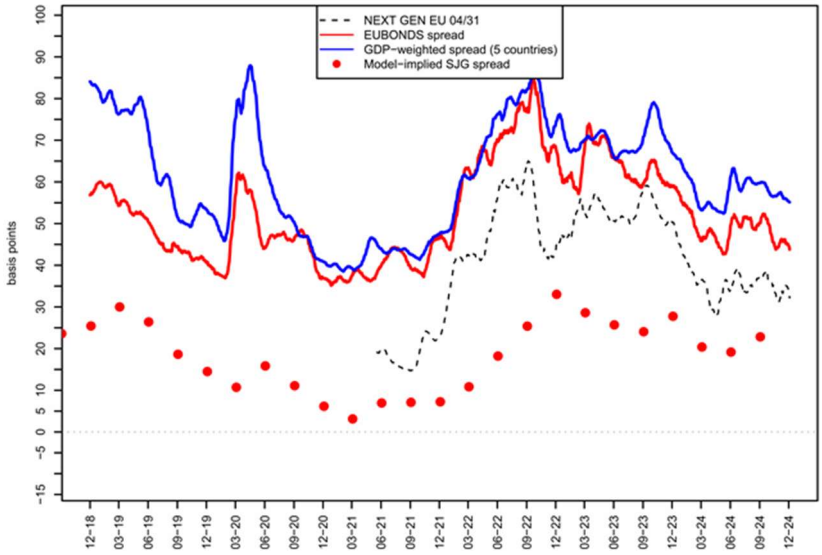
Finally, we compare the model-implied 10-year SJG spread with that for existing Eurobonds and for the GDP-weighted average of national government bonds[28] (all computed with respect to the Bund; Figure 6). As expected, SJG spreads (red dots) are the lowest, ranging between 0 bps and 30 bps. What is striking is that, starting from 2020, the spread for actual Eurobonds (red line) is very similar to the spread for the GDP-weighted bonds (blue line), even if the latter by definition enjoy a system of guarantees similar to what we define as SJG bonds (the outlook is only slightly better if we only

[27] The same is true if one considers the weighted-average of the *model-based* national sovereign spreads.

[28] Also in this case the weighted-average of the model-based national sovereign spreads tracks quite well the weighted-average of the real-world national sovereign spreads, suggesting that the model is accurate.

look at the NGEU component of the Eurobond bucket). [29] This comparison highlights that the potential gains of the SJG provision did not materialize (yet) in reality.

Figure 6 – Comparison between actual Eurobonds and model-implied spreads



Source: own calculations, LSEG/Refinitiv Eikon Datastream, Bloomberg, Eurostat. Note: The figure shows bond yield spreads w.r.t. the German 10-year government bond yield. Red dots correspond to proxies for SJG bond yield spreads. The blue line shows the GDP-weighted average of national-bond yield spreads with respect to Germany. The black dashed line shows the spread between the first NGEU bond yield spread (June 2021, maturing in April 2031) with respect to the German 10-year government bond yield.

5. Policy recommendations

Several factors can explain why the yields and spreads for existing Eurobonds are disappointingly high.[30] The relatively small size of the Eurobond market, and related aspects, such as the illiquidity of the market, the exclusion from government bond indices, the non-use of Eurobonds as collateral

[29] Moody's issuer rating is equal to Aaa for the EU and commented on the first NGEU issuance with the following words: "The multiple layers of debt service protection, including explicit recourse to extraordinary support […] creates the equivalent of a joint and several undertaking and obligation on the part of EU member states to provide financial support to the EU". Conversely, Standard and Poor's offers a long-term issuer rating within its second-highest rating tier (AA), which sits two levels below its highest rating. Standard and Poor's recognized the existence of political risks within the EU, stating that their assessment of the EU's long-term rating hinges on the commitment and financial capability of only the most affluent EU members that are net contributors to the EU budget.

[30] See also Bletzinger, Greif, and Schwaab (2022) for a thorough analysis of the reasons behind the factors exerting an upward pressure on the Eurobond yields.

in repurchase agreements, the haircut practiced by the largest CCPs and the absence of a futures market –all contribute in driving the spread vis-à-vis OIS rates and Bunds. Moreover, as highlighted in Section 3.1, the amount of Eurobonds traded on the secondary market is limited since the majority of investors who have these bonds in their portfolio tend to hold them until maturity. Last, the perceived lack of political willingness to ensure an adequate supply of EU bonds after 2026 discourages potential investors by magnifying the uncertainty about the future of EU common debt. In this Section we will discuss how these issues could be addressed.

5.1 Market fixes (and their limits)

The liquidity of Eurobonds can be increased by addressing some market malfunctioning. First, the issuer needs to convince investors that these are more like sovereign bonds than supranational bonds. We have already seen some attempts by index providers to include Eurobonds in sovereign bond indices. This is an important aspect, which could certainly accommodate investment mandates along the lines suggested by Bonfanti and Marcucci (2024). Second, minimizing the use of syndicated transactions can limit the power of primary dealers while the use of competitive auctions could increase the liquidity and the bonds available to investors. Emphasis should be placed on the short-term liquidity of the yield curve, which is currently zero. Improving market infrastructure could also increase their attractiveness to investors by strengthening a unified funding strategy and could lead CCPs to apply the same haircuts as they do for sovereign bonds[31]. Third, developing a futures market could help to increase trading volume.

5.2 Institutional fixes: redistributing the gains from SJG issuance and moral hazard

The above-mentioned market interventions make sense if the EC dispels uncertainty by preparing a stable issuance plan that goes beyond the deadline foreseen for the SURE and NGEU programs. This could be achieved by a common fiscal capacity, which could use the debt resources to fund common-

[31] Another possible lever to incentivize Eurobonds' demand might be taxation. This topic is however highly technical and it deserves more thoughtful consideration (at the moment, we are not aware of any serious discussion on this point).

interest projects and should also be endowed with a stream of revenues in order to service the debt itself. A fiscal capacity is, however, much more than a technical fix. It would represent an important institutional innovation.

Even if these problems were addressed, Eurobond yields would still be higher than German yields. Therefore, other relevant institutional changes are required in order to make Eurobonds politically viable on a permanent basis.

We measure the gains deriving from the issuances of jointly-guaranteed bonds by calculating the difference between domestic bond yields and SJG yields during specific time periods as in Pallara and Renne (2024). In particular, we consider the hypothetical counterfactual case in which all countries issue the equivalent of approximately 7% of 2023 EU GDP (€1200 billion) in the third quarter of 2024 (Table 1). This amount is of the same order of magnitude of the public expenditure that, according to many observers, is required for the EU to successfully implement the green and digital transitions and to raise military spending to the levels required by current NATO agreements.[32] Countries with weaker public finances, such as Italy, would achieve large gains (around 100 bps) in the third quarter of 2024. In contrast, Germany would suffer a small loss (by about 6 bps).

[32] The needed resources are estimated at about €bn 800 yearly from 2025 to 2030, of which a proportion between 1/5 and ½ would have to be constituted by public money (Draghi, 2024, Panetta 2024b).

Table 1 - Redistribution of gains

Aggregate gains: €18.52 bn			
Panel A: SJG, Same funding costs (i.e. no ex-post redistribution)			
	redistribution weigth	post redistribution yield	yield gain
DE	-6%	345	-6
FR	31%	345	47
IT	52%	345	102
ES	18%	345	55
NL	3%	345	12
BE	3%	345	26
Panel B: SJG, Redistribution based on GDP weights			
	redistribution weigth	post redistribution yield	yield gain
DE	33%	302	36
FR	24%	355	37
IT	19%	408	38
ES	12%	362	37
NL	8%	320	37
BE	4%	334	37
Panel C: SJG, Same yield gains across countries			
	redistribution weigth	post redistribution yield	yield gain
DE	33%	301	37
FR	24%	355	37
IT	19%	409	37
ES	12%	362	37
NL	8%	320	37
BE	4%	334	37

Note: This table compares post-redistribution funding costs across countries under the SJG issuance scheme and under different redistribution schemes as carried out in Pallara and Renne (2024): one based on the relative GDP size (Panel B) and one based on defining a fixed yield gain for all countries (Panel C). The focus is on the 5-year maturity and on the end of the estimation sample (2024Q3). Yields are expressed in basis points. Aggregate gains (reported at the top of the table) are computed for the countries included in the sample and under the assumption that total issuance is equal to €1200 billion. In each panel, for all countries and dates, we show the redistribution weights, the post-redistribution yields, and the spread between national yields and the post-redistribution yields (that are the yield gains).

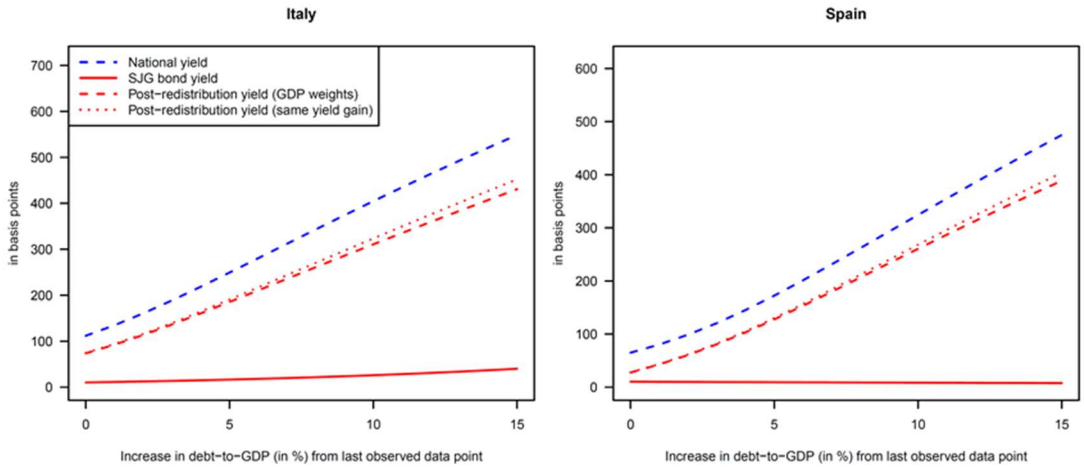
However, under a redistribution of gains, either based on the size of GDP (Panel B) or fixed (Panel C), all countries could benefit from the joint issuance of SJG bonds, with an average reduction in

yields of around 37 bps. These schemes are fairly simple conceptually and relatively easy to motivate and communicate. They could be codified in a rule and implemented automatically through annual transfers from the EU budget or another body (such as the ESM, the EUI or a brand new European debt agency).

It is fundamental to underscore that these redistribution schemes would preserve some degree of correlation between the national debts' developments and the costs borne by individual countries, preserving an incentive to pursue prudent fiscal policies.

For example, looking at the sensitivity of common and domestic post-redistribution yields to changes in the public debt of Italy and Spain from debt levels in the third quarter of 2024, it turns out that, as the debt-to-GDP ratio of either Spain or Italy rises from its current level, the financing costs for both countries remain lower than the cost associated with domestic issuance following redistribution. However, these costs exhibit a similar sensitivity to changes in public debt as those of national yields (Figure 7).

Figure 7 – Sensitivity of common and national yields to public debt deviations.



This figure shows the increase in different bond yields resulting from counterfactual increases in Italian indebtedness (left panel) or Spanish indebtedness (right panel), all else being equal, happening at the end of the estimation sample (2024Q3).

6. Conclusions

In the current challenging international landscape, launching an ambitious EU investment program to drive innovation, productivity and growth appears not only to be economically advantageous but also geopolitically essential. Focusing on strategic sectors such as the green economy, digital technologies, and defense (Panetta, 2024a, 2024b), the initiative should be implemented at the EU level to fully leverage economies of scale, internalize spillovers, and therefore prevent sub-optimal outcomes (as many of the investments involved have characteristics of "public goods"[33]).

EU debt is the best tool to finance this program because the costs are so high that funding them solely with existing national resources would not be feasible (Panetta 2024b, Draghi 2024). Furthermore, as argued earlier, a steady and foreseeable increase in EU debt is crucial to reap the benefits of joint issuance, while simultaneously fostering the growth of EU capital markets.

While this scheme would fall short of a fully-fledged fiscal union, and it would not establish a permanent fiscal capacity, adjustments to the EU fiscal framework would be appropriate. For example, limits could be imposed on the overall debt ratio (i.e. central and country-level combined). We acknowledge that pooling risks and liabilities also creates redistributive and democratic issues. Nevertheless, the main takeaway from our analysis is that overcoming these issues is both technically feasible and necessary, as the consequences of failing to act are becoming more and more evident.

[33] See, for instance, Fuerst and Pisani-Ferry (2019), Clays and Steinbach (2024), Wyplosz (2024), Beetsma et al. (2024).

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