III. LARGE-SCALE EU ISSUANCE: 3 YEARS ON

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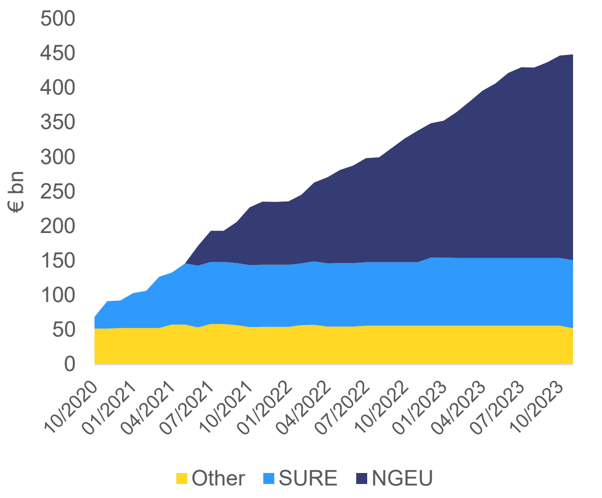
Abstract: *Large scale issuance by the EU began a little over three years ago, in October 2020. Since then, the outstanding amounts issued by the EU have risen continuously in connection with the SURE and NGEU programmes, from approximately € 50 bn to potentially more than € 900 bn by 2026. This chapter takes stock of the first three years of large-scale EU issuance in terms of its market performance and the savings that NGEU loans can provide to beneficiary Member States. In particular, we investigate the changing contributions of different drivers of market performance over time along the yield, spread and liquidity dimensions. Three phases are identified in this regard, from an encouraging performance up until early 2022, through a modest deterioration in 2022, to a degree of recovery in 2023. We also compute illustrative country-specific measures of the financial benefit from taking up an NGEU loan, as opposed to borrowing directly from the market, and conclude that, from the strict perspective of funding cost differentials, NGEU loans can offer sizeable returns to the Member States that have requested them.*

III.1. INTRODUCTION

The response to the covid-19 crisis saw an important institutional breakthrough for the EU in the form of large-scale joint debt issuance to fund European policies protecting jobs, fostering investment and promoting structural reforms. Large scale issuance began with the Support to mitigate Unemployment Risks in an Emergency (SURE) programme in October 2022 and expanded in connection with the NextGenerationEU (NGEU) programme from June 2021 onwards. The bonds issued under these two initiatives have added to existing EU bonds (90) issued under smaller, previous programmes, namely those related to: the balance-of-payments assistance facility for non-euro area Member States; macro-financial assistance to third countries; and the European Financial Stabilisation Mechanism for euro area Member States. The result has been a continuous rise in EU bonds outstanding since 2022 as SURE loans to Member States expanded to reach figures just under the maximum envisaged size (i.e., € 100 bn) and NGEU grants and loans continue to be disbursed to EU countries (Graph III.1). With the passing of the deadline for requesting NGEU loans in August 2023, the amounts to be issued under NGEU over the coming three years are now known to potentially reach a little over € 700 bn, assuming the full disbursement of grants and requested loans. This means that EU issuance is on track to reach a peak of close to € 900 bn by 2026, which would make it the fifth largest EU sovereign debt issuer if it were a country, placed just behind Spain, and ahead of Belgium and the Netherlands.

Graph III.1: **EU bond amounts outstanding, per programme**



Source: Bloomberg, own calculations.

(89) The author would like to thank Eric Ruscher, Leonor Coutinho and colleagues at the Directorate-General for Budget for their very helpful comments and suggestions. Any remaining errors or omissions are my own.

(90) When referring to “EU bonds” throughout this chapter we mean all the bonds issued by the EU as an entity. We do not, however, consider the bonds issued by the European Atomic Energy Community in our analysis given their rather idiosyncratic market performance.

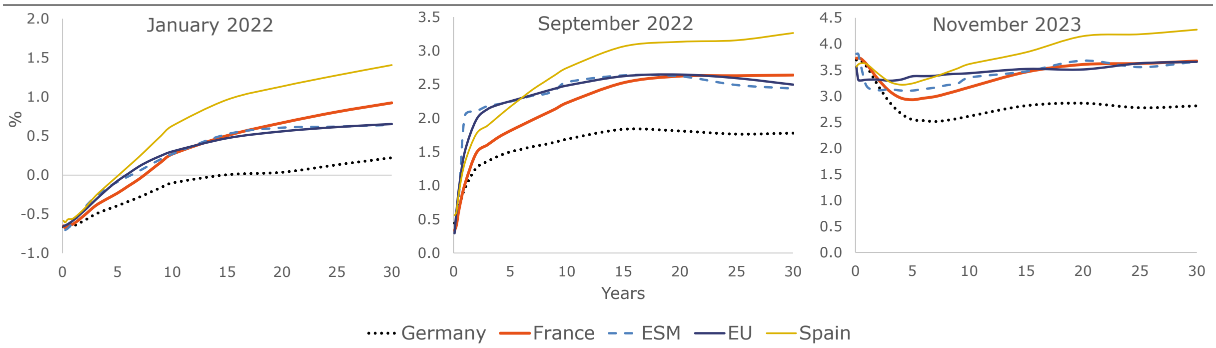
In this chapter we update the analysis of the market performance of EU bonds first conducted in Monteiro (2022) ([91]) by looking into the determinants of their yields and spreads over the past three years (Section III.2) as well as into their liquidity performance (Section III.3). We also take advantage of the fact that all NGEU loan requests have now been submitted to conduct a first assessment of the net financial gains accruing to the beneficiary Member States (Section III.4.). Finally, Section III.5 reflects on institutional factors influencing the performance of EU issuances while Section III.6. concludes by bringing together the results of the preceding sections.

III.2. EU BOND YIELDS AND SPREADS

Large-scale EU issuance has consistently enjoyed a favourable reception from market players as attested by the large primary market demand, interest from foreign investors, relatively low spreads and a AAA rating from four out of the five major credit rating agencies ([92]). Notably, such a positive reception has been sustained notwithstanding the possible excess supply challenges from a meteoric rise in EU issuance and the constraints imposed by its association to the sub-sovereign, supranational and agency (SSA) class, which is usually less favourably treated (regulatorily or otherwise) than the larger European government bond (EGB) class to which belong the securities issued by EU central governments. EU bond performance since October 2020 can, nevertheless, be broadly divided into three phases, each with its own nuances.

The **first phase** lasted until early 2022 and was characterised by increasing EU bond liquidity, spreads that compared well with those of France and evidence of favourable pricing effects on NGEU, SURE and

Graph III.2: **European yield curves**



Note: EU curve fitted based on the Nelson-Siegel-Svensson model.

Source: Bloomberg, own calculations.

green bonds ([93]).

The **second phase** lasted until the end of 2022 and saw a moderate increase in spreads with respect to reference EU sovereigns in a context characterised by continued monetary policy normalisation and Russia's unprovoked full-scale invasion of Ukraine. As will be seen, this was also the period when

([91]) Monteiro, D. (2022), "The market performance of EU bonds", *Quarterly Report on the Euro Area*, Vol. 21, No. 1.

([92]) The EU enjoys a AAA rating or equivalent from Fitch, Moody's, DBRS and Scope. It enjoys an AA rating from Standard & Poor's.

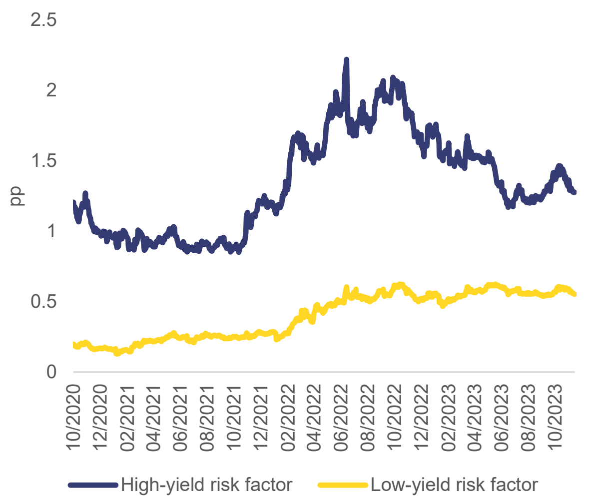
([93]) See also Monteiro (2022), op. cit., for an analysis of this phase.

sovereign risk increased and both market liquidity conditions and the relative convenience yield ([94]) of European SSA bonds worsened.

The **third and present phase** unfolded throughout 2023 and saw a recovery in EU and broader SSA bond performance. During this period, EU yields moved again closer to those of France while the liquidity and the relative convenience yield of EU bonds improved. As will be presently seen when discussing the econometric results, the specific price effects ([95]) previously identifiable for NGEU, SURE and green bonds are no longer in evidence in the third phase, suggesting increased homogeneity across EU issuances.

Graph III.2 provides a summary picture of the three phases by plotting selected European yield curves at different moments in time. By January 2022, EU bond yields were still broadly in line with those of France, underperforming the latter at shorter maturities, while outperforming French government bonds at maturities beyond the 10-year tenor. In September 2022, however, a riskier macroeconomic environment saw French bonds consistently outperform EU and other European SSA bonds, except at very long maturities. Recent data shows a degree of reversion to previous relative performances, with EU bond yields once again more aligned with French yields. During the past three years, EU bond yields have remained significantly above those of Germany, except for very short maturities, while broadly in line with those of another European supranational, the European Stability Mechanism (ESM). Overall, EU bond performance has followed broader trends in the SSA class. At the same time, the very rapid expansion of EU issuance into the comparatively small SSA segment has been a challenge with which the EU issuer has successfully dealt ([96]).

Graph III.3: **Sovereign risk factors in the euro area**



Note: risk factors calculated as the (normalised) first principal component of the 10-year spread with respect to Germany of AT, BE, FI, FR, NL (“low yield”) and EL, IE, IT, PT, ES (“high yield”).

Source: Bloomberg, own calculations.

While the absolute level of EU bond yields has been mostly driven by higher policy rates since early 2022, the spreads with respect to Germany have been influenced by other euro area-wide trends such as:

1. A general increase in sovereign riskiness across EU countries, as captured by the summary indicators plotted in Graph III.3.

2. An increase in the convenience yield of reference sovereign bonds, such as those of Germany and France, which implied a decline in the relative convenience yield of EU and other SSA bonds vis-à-vis these countries. For example, in the second half of 2022, high demand for German and French bonds led to a significant increase in their prices and therefore a decrease in their yields relative to the €STER OIS rate (a derivatives-based measure of the risk-free rate).

([94]) By convenience yield we mean a security’s price component that reflects the services provided by that security such as the possibility of using it under favourable conditions in collateral and repo markets, to fulfil regulatory requirements or to meet investment mandates.

([95]) By specific price effects we mean variations in bond prices across EU issuance programmes that remain evident even after controlling for basic security characteristics such as duration and market liquidity. Econometrically, the existing of such “pricing specialness” corresponds to dummy variables controlling for the NGEU, SURE and green issuance programmes being statistically significant.

([96]) See, in this regard, the econometric discussion in Box III.1.

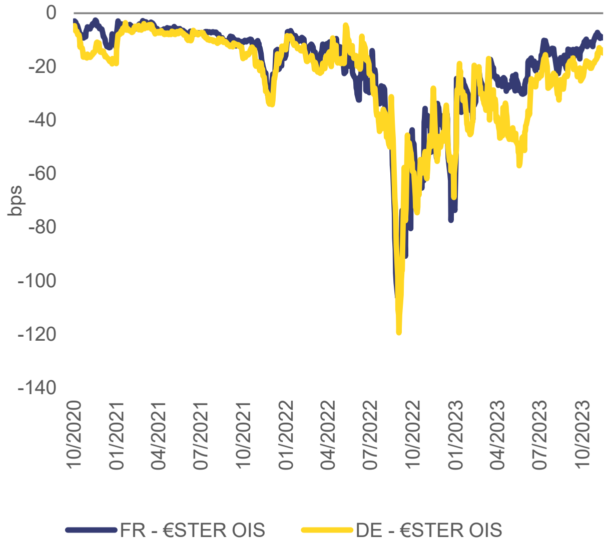
This can be observed in Graph III.4.

Increased demand for reference bonds was, in turn, partly driven by higher market volatility and increased margin calls in energy platforms during this period. Given that SSA bonds are less used for collateral purposes,they were relatively disadvantaged. At the same time, increased hedging activities in response to rapid monetary policy normalisation led to higher swap rates, which also contributed to widen the difference between SSA rates and those of reference sovereign bonds.

3. An increase in general market illiquidity in 2022 feeding through to EU bond liquidity conditions, as will be seen in Section III.3.

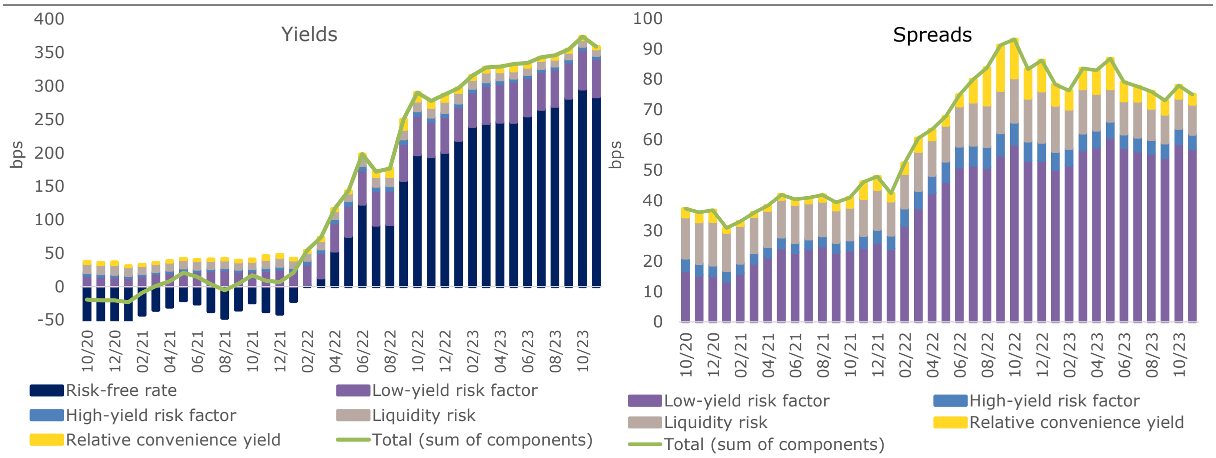
The remainder of this section assesses the relative importance of the different drivers of EU bond yields and spreads over time based on an econometric panel data analysis covering more than 100 EU bonds and bills. The technical details are provided in Box III.1.

Graph III.4: **Spreads of 6-month German and French bonds with respect to the 6-month €STER OIS**



Source: Bloomberg, own calculations.

Graph III.5: **Main dynamic drivers of the average yields and spreads of bonds issued by the EU**



Note: in simple average terms, covering all the securities in the sample at a given point in time; displayed spreads do not take into account the constant term, which takes a negative value in the present estimation.

Source: own estimations.

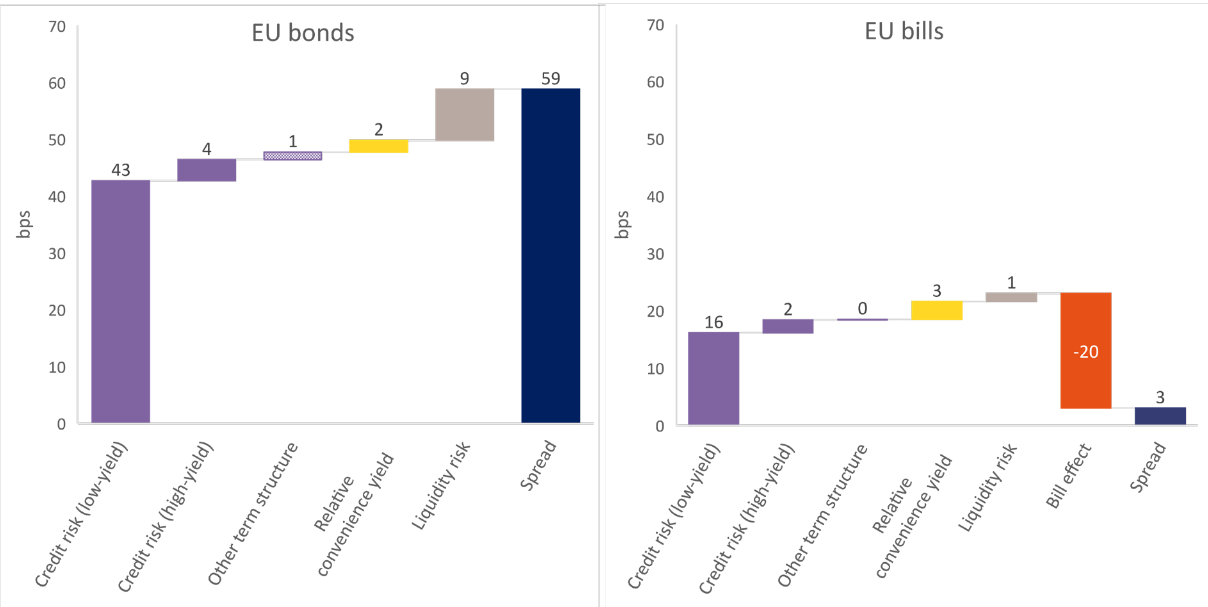
Graph III.5 summarises the dynamics of an "average" EU bond ([97]) over the three years since the first SURE issuance in October 2020. As can be observed, monetary policy normalisation is, by far, the largest

([97]) For visualisation purposes, we focus on an "average" EU bond, that is, a hypothetical EU bond with characteristics (such as maturity and liquidity) equal to in-sample averages. Given that the simple average EU bond maturity has remained between 9 and 10 years throughout the sample period, the graph can be understood as closely depicting this maturity segment.

factor behind the increase in EU bond yields, with changes in risk-free rates (assessed at the matching maturity) transmitting approximately one-to-one to yields, as expected. However, spreads with respect to AAA sovereign euro area bonds ([98]) have also increased since early 2022, with the main driver being a general increase in the sovereign risk of Member States. This result can be understood as more than a statistical correlation, rather pointing to a structural interpretation whereby the EU is fundamentally exposed to the sovereign risk of Member States, both via its budgetary claims as well as via its loans under different programmes. It is interesting to note in this respect that the sovereign risk factor that has dominated spread dynamics is that associated with low-yield euro area Member States, rather than that associated with high-yield countries.

This result suggests that i) EU bonds, being themselves low risk, track the asset class of low-risk sovereign bonds and ii) that low-yield Member States may be perceived as the ultimate guarantor of EU bonds in a hypothetical stress scenario, making the EU particularly exposed to this set of countries. It is also worth noting how the relative convenience yield disadvantage of EU and other SSA bonds peaked in the second half of 2022 as investors dashed for reference sovereign bonds. It was also during this period that liquidity risk ([99]) deteriorated somewhat, before recovering in 2023.

Graph III.6: **Spread decomposition of "average" EU securities as at November 2023**



Note: decomposition for hypothetical EU securities where the values of the explanatory variables take the average values of the respective subsamples; EU bonds in the present graph strictly defined as non-bill EU securities; "other term structure" refers to residual term structure effects not captured elsewhere.

Source: own estimations.

([98]) In practice, the bonds of Germany and the Netherlands. It should be noted that, while the present analysis takes AAA euro area government bonds as a reference, the market practice for pricing EU bonds often takes euro swap curves as the benchmark. However, given the potential substitutability between EU and national issuance (as illustrated e.g. in a government's decision to take up a loan under the EU's Recovery and Resilience Facility), the focus of this chapter is on a comparative reading of EU and national funding costs. At the same time, wedges between AAA bond yields and swap rates are controlled for in the econometric analysis via the OIS_t variable.

([99]) Liquidity is measured throughout this article via the bid-ask spread. While the bid-ask spread is a standard indicator of market liquidity that is readily available, there are other measures of bond market liquidity that can provide complementary insights.

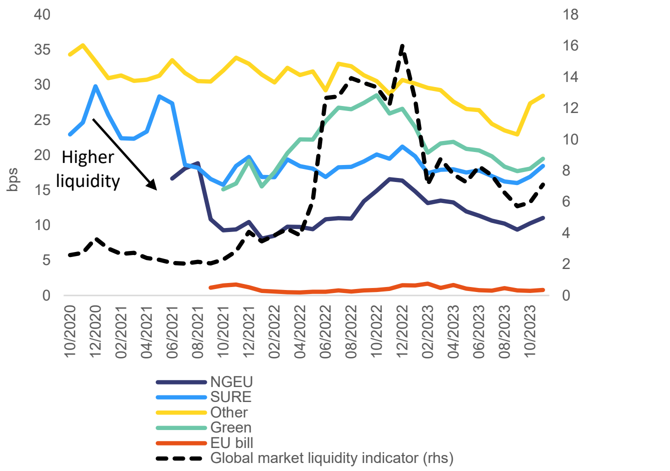
Another result that follows from the econometric analysis is that NGEU, SURE and green bonds do not appear to currently behave in a statistically different manner from that of other EU bonds once their basic characteristics, such as maturity and market liquidity, are controlled for. However, EU bills do appear to enjoy lower spreads, even after accounting for their short maturities and high liquidity, which can be understood as a consequence of the large demand and very favourable market reception that the EU bills programme has enjoyed ([100]). This point is more clearly seen in Graph III.6, which zooms in on the latest datapoint in our sample, November 2023. Some additional takeaways from the results displayed in this graph are that: i) the convenience yield becomes a more relevant factor at shorter maturities, although the relative disadvantage of both EU bonds and bills in this regard has now returned to low figures; ii) an "average" EU bill carries a minimal spread and residual liquidity risk; iii) the magnitude of the bill effect broadly offsets the magnitude of the combined credit risk factors, possibly meaning that EU bills carry no perceived credit risk.

III.3. THE LIQUIDITY PERFORMANCE OF EU BONDS

Financial market liquidity can be defined as the ability to trade a security without generating significant price movements nor otherwise incurring in significant transaction costs. While there are different liquidity measures, we focus in this article on the bid-ask spread, a standard indicator ([101]) computed as the difference between a bond's ask and bid prices ([102]).

The liquidity performance of EU securities has evolved over time, driven both by market-wide trends and idiosyncratic factors, while also varying according to the associated EU programme. As can be observed in Graph III.7, EU bills are by far the most liquid EU securities (as measured by the bid-ask spread) and are followed, of late, by NGEU bonds and by bonds issued under the EU-bond designation, which is being applied to all bonds issued by the EU since the start of 2023 as per the Commission's new unified funding approach

Graph III.7: **Developments in the average liquidity of EU securities**



Note: liquidity measured by the bid-ask spread; based on the simple average of all EU-issued securities in the relevant subsample; market liquidity computed based on the normalised first principal component of the 10-year bid-ask spreads of German, French, Italian and Spanish government bonds.

Source: Bloomberg, own calculations.

([100]) EU bills were introduced in the second half of 2021 and fund the EU's liquidity holdings needed to manage liquidity risk and to temporarily fund disbursements.

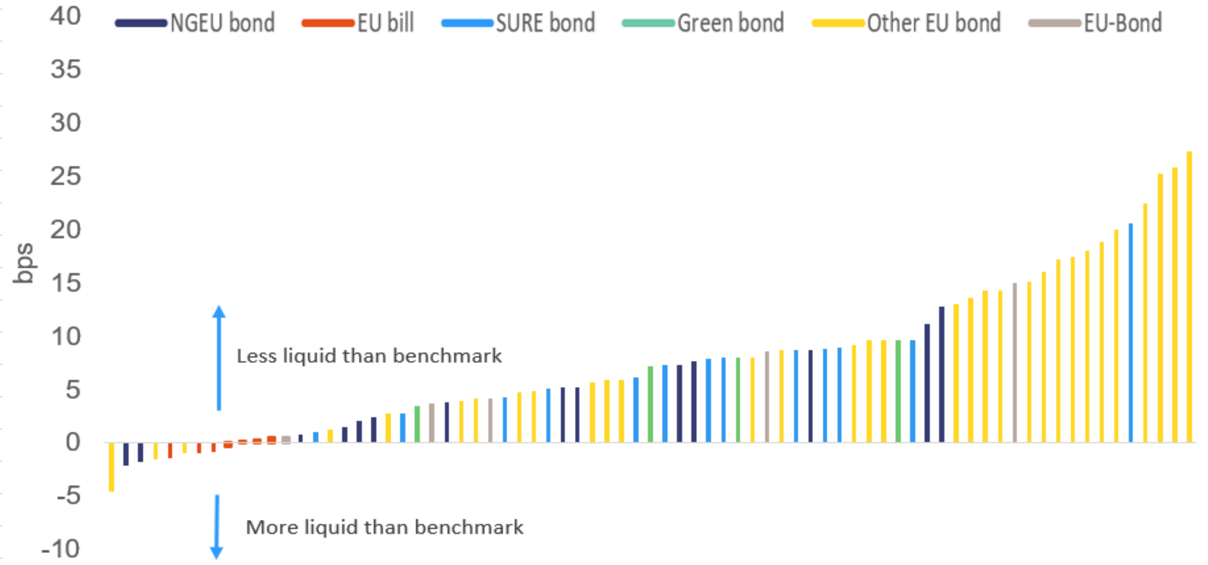
([101]) For instance, the bid-ask spread was considered the single most important indicator of liquidity issues in a 2016 survey of OECD government debt management offices. See OECD (2016), "OECD Sovereign Borrowing Outlook 2016", OECD Publishing.

([102]) Specifically, the bid-ask spread was computed as a bond's ask price minus its bid price, where prices are sourced from Bloomberg. Given that bond prices are conventionally quoted as percentages of face value, we express the price difference in basis points, although our bid-ask spread indicator could equivalently be read as cents on a face value of one hundred euros. It should be noted that the magnitude of the bid-ask spread does not bear a one-to-one relation to bond yields, which are also expressed in bps. The econometric analysis in Box III.1 translates the bid-ask spread into a yield impact, with decompositions presented in this article suggesting that the liquidity premium represents a comparatively limited component of EU bond yields once all factors are accounted for. It is also worth noting that normalising the bid-ask spread by, e.g., dividing it by a mid price does not significantly alter results in the present context.

(see Section III.5.) ([103]). SURE bond liquidity closely tracks that of NGEU and appears to have enjoyed a structural improvement with the introduction of NGEU bonds in June 2021. A slow structural improvement in the liquidity performance of other EU bonds also appears to have been taking place as the pool of outstanding EU bonds expanded over time. It can also be observed that most EU bonds reacted negatively to a temporary increase in market illiquidity in 2022, which has meanwhile dissipated in 2023. The most recent figures also show a slight deterioration in EU bond liquidity which correlated with market-wide trends.

Graph III.8 zooms in further on the latest datapoint by presenting the liquidity differentials of the EU bonds and bills active in the market in November 2023, as calculated with respect to benchmark sovereign securities. It can be observed that a few EU securities beat the benchmark ([104]) while the vast majority of them are within a radius of 10 bps (or 10 cents on 100 euros of face value). It is also worth observing that the most significant differentials are concentrated in the class of other EU bonds (which are often legacy bonds belonging to older issuance programmes), while securities issued under newer EU programmes tend to enjoy a better performance.

Graph III.8: **Relative liquidity of EU bonds and bills active in November 2023**



Note: covering a sample of 80 EU securities, nine of which have been omitted for visualisation purposes due to their outlier behaviour; based on a 30-day average of the bid-ask spread of a given EU bond minus the bid-ask spread of the respective benchmark bond, as identified by Bloomberg.

Source: Bloomberg, own calculations.

An exploratory econometric analysis of EU bond liquidity suggests a number of empirical facts: i) liquidity decreases with increasing residual maturity, although this effect becomes weaker the longer the maturity; ii) liquidity increases with the size of a bond's outstanding amounts, although with decreasing returns to scale; iii) the liquidity of medium- to long-term bonds increased as the total pool of EU bonds got larger; iv) EU bonds are responsive to global liquidity conditions and this response becomes stronger with a bond's residual maturity; v) NGEU and SURE bonds enjoy a favourable liquidity effect even when

([103]) Given the changing sample of underlying EU securities, the dynamics shown in Graph III.7 also reflect compositional aspects. However, a security-by-security inspection shows that, notwithstanding some idiosyncrasies, the graph is fairly representative of the overall dynamics of each subsample.

([104]) A benchmark security is identified by Bloomberg for each EU bond and bill. They are low risk securities of a comparable maturity which, in the case of our sample, correspond to selected German and French securities.

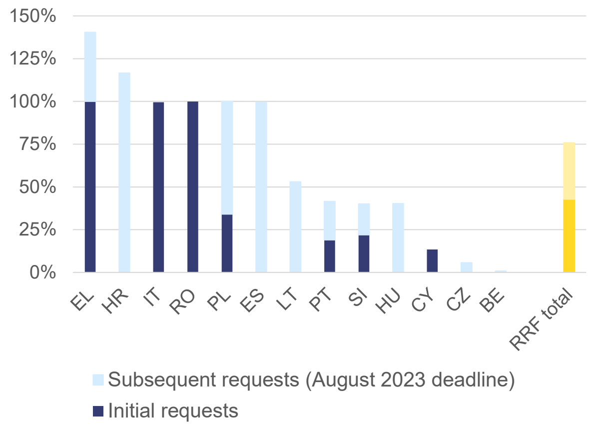
controlling for their sizes and maturities ([105]); and vi) the liquidity dynamics of other EU bonds are more idiosyncratic when compared with NGEU and SURE bonds.

The details of the econometric analysis are reported in Box III.1.

III.4. NET FINANCIAL GAINS FROM NGEU BORROWING

NGEU offered Member States the possibility to borrow up to 6.8% of their 2019 GNI to conduct investment and reforms via the Recovery and Resilience Facility (RRF) and in accordance with national Recovery and Resilience Plans. The total amounts made available were € 385.8 bn, to be financed through joint EU issuance ([106]). With the passing of the deadline for requesting RRF loans, the maximum uptake (assuming full approval of pending requests) is now known and plotted in Graph III.9. As can be observed, 13 Member States decided to request RRF loans, with six of them requesting the full amounts to which they were entitled based on the 2019 GNI criterion, or more ([107]). Overall, the total uptake of RRF loan amounts on offer has been approximately three quarters.

Graph III.9: **Uptake of RRF loans**



Note: assuming full approval of loan requests.

Source: Eurostat, other Commission services, own calculations.

In this section, we calculate an illustrative discounted return on investment (ROI) from the decision to request an RRF loan, accruing to the 13 beneficiary Member States. For presentational purposes, the ROI is defined as the net present value (NPV) of the financial benefits of requesting an RRF loan divided by the loan amount. The NPV of these benefits is, in turn, calculated as the loan amounts received (i.e., the gross benefit) minus the future principal and interest payments to be made (i.e., the cost), with all cash flows discounted at appropriate country-specific rates to account for the time value of money. Therefore, our ROI measure captures exclusively the financial gains from being able to access cheaper EU funding and take no consideration of the broad macroeconomic return resulting from the investments and reforms that RRF loans promote ([108]). The details behind the calculation of the ROI measure are presented in Box III.2, which also discusses how the computed ROIs represent illustrative indicators of *feasible* ex ante profitability, rather than *actual* ex post profits. In fact, the interest to be paid on RRF loans is subject to revision over time and therefore the actual financial returns can only be accurately determined once the

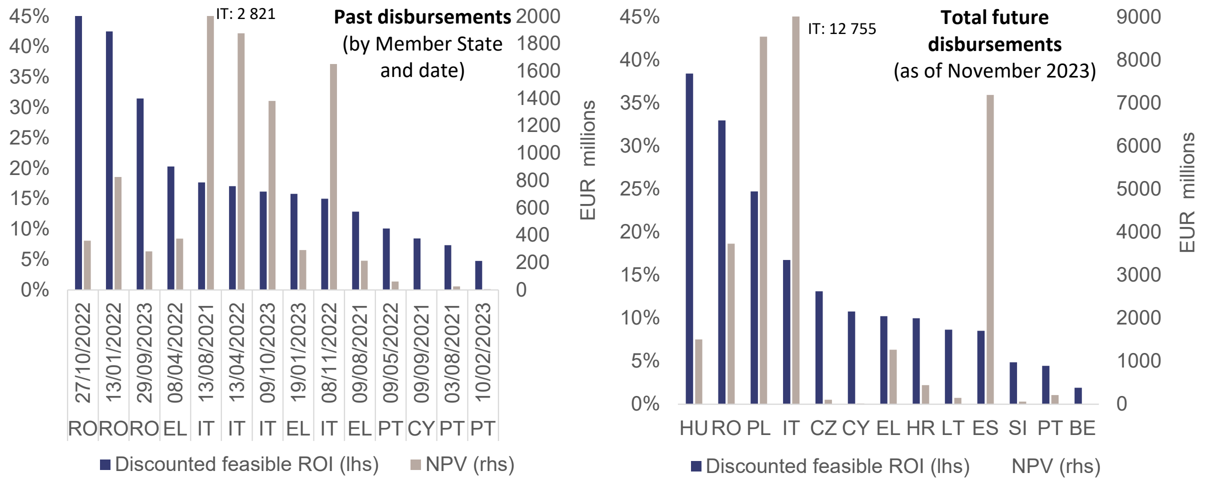
([105]) No similar effect is found for EU bills and green bonds.

([106]) The issuance to finance RRF loans has been labelled NGEU in previous sections, while previous references to NGEU loans can also be understood as referring to RRF loans. NGEU issuance has also served to finance non-repayable grants to Member States.

([107]) Loan requests beyond the limit of 6.8% of 2019 GNI need to invoke exceptional circumstances under Article 14 (6) of the Recovery and Resilience Facility Regulation.

([108]) For an assessment of the economic impact of the additional government investment promoted by NGEU see Pfeiffer, P., J. Varga and J. In 't Veld (2023), "Quantifying spillovers of coordinated investment stimulus in the EU", *Macroeconomic Dynamics*, 27(7). For recent estimates of the effects of structural reforms on Member State economies of the kind supported by RRF lending see Pfeiffer, P., J. Varga and J. In 't Veld (2023), "Unleashing Potential: Model-Based Reform Benchmarking for EU Member States", *European Economy* Discussion Paper 192, European Commission.

Graph III.10: **Discounted feasible ROIs and NPVs of RRF loans, per Member State and disbursement date**



Note: see Box III.2 for a discussion of the metrics and of the underlying methodology.

Source: own calculations.

entirety of an RRF loan has been repaid (at which point the prevailing effective interest rate over a loan's lifetime is fully known).

The left-hand chart of Graph III.10 shows the feasible ROIs associated with the different loan disbursements that had taken place by November 2023, as identified by the payment date and concerned Member State. Recipients are seen to have benefitted ex ante from the transactions given that ROIs are positive in every case. In addition, ROIs are also sizeable, ranging from 5% to 46%. The right-hand axis of the same chart shows the absolute NPV value associated with each transaction, which is a function not only of the ROI but, crucially, of the amount received in each disbursement, which tends to be larger for bigger Member States or for those that have otherwise requested larger amounts.

While the left-hand chart of Graph III.10 depicts ROIs and NPVs associated with loan disbursements that have already taken place, the right-hand chart shows the equivalent metrics for RRF loan amounts still to be disbursed as of November 2023, assuming that RRF loan requests will be approved in full. All transactions are once more seen to be profitable ex ante for all Member States given the positive ROIs, which range from 2% for Belgium to 38% for Hungary. Table 1 in Box III.2 provides aggregate ROI and NPV figures per Member State covering all loan disbursements, past and future.

III.5. INSTITUTIONAL FACTORS AND EU BOND PERFORMANCE

The market performance of EU bonds is shaped by a set of institutional factors that govern how EU issuance operates and is perceived in practice. In theory, joint EU issuance can provide an international euro-denominated safe asset of a very large size. Monteiro (2023) ([109]) reviews the main existing theoretical proposals for common sovereign debt instruments in the euro area and presents analytical results that confirm that the whole of euro area debt could in principle be turned into a common instrument with negligible risk premia and matching the quality of the best existing international safe assets This result can be understood as a consequence of the fact that the euro area is a large, rich and

([109]) Monteiro, D. P. (2023), "Common Sovereign Debt Instruments in the Euro Area", *European Economy* Discussion Paper 194, European Commission.

diversified economy, with an aggregate debt ratio that compares favourably with that of other advanced economies ([110]).

The main difference between existing theoretical constructs and the large-scale experience of the EU is threefold:

1. Theoretical common debt instruments are often endowed with a very large degree of credit enhancement, such as explicit seniority over national bonds, or unlimited joint and several guarantees from all participating Member States ([111]);

2. Theoretical instruments are usually permanent while large-scale EU issuance was designed to fund temporary programmes;

3. Theoretical instruments can reach very large sizes, such as 60% of GDP or 100% of sovereign debt outstanding, while current EU issuance, while large by historical standards, remains small by comparison with theoretical proposals.

The decomposition of the drivers of EU bond yields shown in Section III.2 underlines the relevance of Point 1. The perceived credit risk of the EU is fundamentally exposed to the perceived credit risk of Member States through the loan and budgetary claims of the EU vis-à-vis national governments. Reassuringly, the risk correlation over the past three years has been much stronger with respect to lower-risk, lower-yield sovereigns when compared with higher-yield sovereigns, highlighting how EU bonds are perceived as belonging to a lower-risk class. Nevertheless, the addition of new own resources to the EU budget would contribute to weaken its sovereign risk exposure and would render supranational EU bonds more similar to the better-regarded EGB class by increasing the revenue-raising ability of the EU. It is worth noting in this regard that the creditworthiness of EU bonds is generally underpinned by the EU budget and has been reinforced by the expansion of the EU's own resources headroom introduced in connection with the launch of NGEU. These underpinnings are set to remain stable irrespective of any discussions regarding the possible future introduction of new own resources. However, the addition of new own resources would help further de-link EU credit risk premia from that of Member States, particularly if the additional revenue could be partly managed as a financial buffer or be raised with some degree of discretion. In the first case, a buffer would lower perceived financial risks by acting in a manner akin to paid-in capital. In the second case, a degree of discretion would allow revenue to vary as a function of risks or of the state of the financial buffer which, again, would bring the EU budget closer in substance to the sovereign class.

As regards Points 2 and 3, they carry implications for the liquidity risk premium and relative convenience yield of EU bonds. The temporary nature of EU issuance means that EU bond liquidity can face pressures over the medium to long run, as the pool of NGEU and SURE bonds outstanding dwindles. A market presence that is temporary and expected to decline also decreases incentives to develop derivative markets around EU bonds and to promote their use as reference bonds on par with that of large, low-risk euro area sovereigns. At the same time, the existence of investment mandates, different investment classes and other constraints on actual market functioning further highlights how EU bond price formation does not result exclusively from pure risk-return considerations. For instance, there is a degree of segmentation in fixed income markets, with EU bonds currently regarded as under the SSA class, while the absence of EU bonds from benchmark bond indices is also seen as affecting performance ([112]).

([110]) For example, the 2022 general government debt-to-GDP ratio of Japan, the US and the UK was 261%, 121% and 101%, respectively. The same figure was 92% for the euro area.

([111]) By comparison, NGEU debt benefits from a specific credit enhancement in the form of an expansion in the EU's own resources headroom while SURE loans benefit from a specific enhancement in the form of collective guarantees from Member States covering up to 25% of potential losses.

([112]) As regards the importance of the inclusion of EU bonds in sovereign indices see the results of the EU inaugural investor survey, published in September 2023.

Still, several recent EU-level initiatives can help promote the liquidity and convenience yield of EU bonds. These include: the decision by the ECB to classify EU bonds more favourably for use as collateral in Eurosystem refinancing operations since June 2023; the introduction of quoting arrangements in November 2023 whereby members of the EU primary dealer network offer to trade EU securities at pre-determined bid-ask spreads and quantities; the Commission's decision to set up a repo facility that should be operational in 2024; an EU issuance service launched in January 2024 moving the settlement of EU bonds to a Eurosystem-based infrastructure; and a new unified funding approach that extends the funding approach adopted under NGEU to the latest financial support programme to Ukraine (MFA+) and to future programmes. Regarding the latter measure, it has meant that all EU bonds have been issued under a EU-Bond brand since January 2023, irrespective of the programmes that are funded by the proceeds of the issuance. This measure aims to reduce market fragmentation across EU bond issuances and the latest econometric evidence presented in Box III.1 suggests that homogeneity across EU bonds has indeed increased compared with previous analyses.

III.6. CONCLUSION

This chapter took stock of the first three years of large-scale EU issuance brought about by the SURE and NGEU programmes. During this period, EU issuance has consistently enjoyed a positive market reception, rising to the challenges posed by a swift expansion in debt market placement. The secondary market performance of EU bonds (and of the broader euro denominated SSA market) can, nevertheless, be split into three phases. Large-scale issuance had a good start in 2020-2021, meeting with a favourable assessment from market players, seeing its liquidity improve as the pool of EU bonds outstanding expanded and enjoying yields that compared well with those of France. Monetary policy normalisation and Russia's unjustified full-scale invasion of Ukraine made for a riskier macroeconomic environment in 2022, which was associated with a modest increase in SSA bond spreads as well as some deterioration in liquidity and relative convenience yield performance. However, these unfavourable trends partially reversed in 2023.

An econometric inquiry into the drivers of EU bond yields shows the dominant role that monetary policy normalisation has had in their increase. As regards spreads, EU bonds correlate more strongly with the sovereign risk of lower-yield Member States, which may be perceived as the ultimate guarantors of EU debt. Other relevant dynamic drivers of spread performance include time-varying liquidity risk and relative convenience yield. Econometric evidence also suggest that the EU bills programme has been particularly successful, enjoying favourable bill-specific price effects. While EU securities appear to have faced headwinds from a rapid market expansion, these have remained under control.

The liquidity performance of EU bonds varies both cross-sectionally and over time. EU bills are seen to be the most liquid instruments, followed of late by the newly branded EU-Bonds as well as by NGEU bonds, which are in turn closely tracked by SURE bonds. EU securities tend to be less liquid than reference sovereign securities of matching maturity, but the differential is usually not large. EU liquidity performance has also tracked to some extent broader market liquidity conditions, as expected. An exploratory econometric analysis suggests furthermore that EU bond liquidity is higher for shorter-dated bonds and that it increases to some extent with issue size and the pool of EU bonds outstanding.

An NPV analysis of the decision to take up an RRF loan suggests that it was ex ante a profitable choice for all the 13 Member States that had requested such loans by August 2023. From the strict viewpoint of the funding cost advantage of the EU, the computed rates of return on RRF loans tend to be quite large for the beneficiary countries. However, the actual rates of return will depend on how interest rate risk materialises and can only be known ex post, once RRF loans have been repaid.

Joint EU issuance enjoys vast theoretical potential, but actual EU bond performance is shaped by a variety of institutional factors and constrained by its temporary nature and association with the SSA class. Still, beyond its significant impact on the real economy, NGEU has also provided an important signal of commitment to the European project, which immediately lowered perceived sovereign risk when the programme was announced in 2020. The degree to which NGEU is successfully implemented will help shape views concerning the merits of common issuance to finance pan-European projects and initiatives.

Box III.1: **A panel data analysis of the market performance of EU bonds**

The analysis of the determinants of EU bond yields and spreads presented in Section IV.2 is based on a panel data regression model covering 107 EU securities from October 2020 to November 2023, totalling 2 393 observations. In November 2023, the sample was composed of 28 NGEU securities (of which 7 EU bills), ([1]) 13 SURE bonds and 4 green bonds, for a total of 80 securities. Due to securities being issued and maturing during the period under analysis, the panel is unbalanced. The raw data is sourced from Bloomberg at daily frequency (except where otherwise noted) and is averaged to monthly frequency in order to reduce its noise and to focus on the more stable and fundamental relations between variables. The chosen specification is as follows:

$$y_{i,t} = \alpha + \beta_1 y_{i,t}^{AAA} + \beta_2(\bar{T}_i \times BAS_t^{Mkt}) + \beta_3\overline{BAS}_i + \beta_4\bar{T}_i + \beta_5\bar{T}_i^2 + \beta_6 Risk_t^{LY} + \beta_7 Risk_t^{HY} + \beta_8(\bar{T}_i \times Risk_t^{LY}) + \beta_9 OIS_t + \beta_{10}(\bar{T}_i \times OIS_t) + \beta_{11} Bill_i + \varepsilon_{i,t} \qquad (1)$$

The variables take the following meaning:

- $y_{i,t}$ is the secondary market yield of EU security *i* in month *t*.
- $y_{i,t}^{AAA}$ is a measure of the risk-free rate in month *t* taken from the AAA sovereign yield curve constructed by the ECB and assessed at the same maturity as that of security *i*.
- BAS_t^{Mkt} is a measure of sovereign bond market liquidity constructed based on a normalised first principal component of the 5- and 10-year bid-ask spreads of German and French government bonds.
- $\overline{BAS}_i$ is the in-sample average bid-ask spread of EU security *i*, capturing its structural liquidity.
- $\bar{T}_i$ is the in-sample average residual maturity of EU security *i*.
- $\bar{T}_i^2$ is the square of the previous variable.
- $Risk_t^{LY}$ is a normalised first principal component of the 10-year spread with respect to Germany of AT, BE, FI, FR, NL (denoted as low-yield countries). This variable is depicted in Graph IV.3.
- $Risk_t^{HY}$ is the equivalent of the previous variable as calculated for EL, IE, IT, PT, ES (denoted as high-yield countries). This variable is also depicted in Graph IV.3.
- OIS_t is the spread of 6-month German securities with respect to the 6-month €STER OIS and proxies the time-varying convenience yield of reference euro area sovereign bonds.
- $Bill_i$ is a dummy variable that takes the value 1 if security *i* is an EU bill.
- $\varepsilon_{i,t}$ is an error term.

As can be noticed, $Risk_t^{LY}$, OIS_t and BAS_t^{Mkt} are interacted with $\bar{T}_i$ to account for a term structure in credit risk, relative convenience yield and sensitiveness to market liquidity, respectively. ([2]) $Risk_t^{HY}$ is not interacted in the final specification as the associated coefficient was not found to be statistically significant. $\bar{T}_i$ and $\bar{T}_i^2$ also appear as independent terms to control for residual term structure factors not already captured elsewhere, while allowing for a curvature in these factors. Dummy variables controlling for NGEU, SURE and green bonds were not included in the final specification as the associated coefficients were not found to be

([1]) EU bills are considered to be part of the NGEU programme in the present analysis. In addition, the NGEU sub-sample also includes five bonds issued since January 2023 under the "EU-bond" label which are not, strictly speaking, directly associated with the NGEU programme as per the rationale of the new unified funding approach of the EU issuer.

([2]) A maturity interaction is also theoretically justified based on the fact that $Risk_t^{LY}$, OIS_t and BAS_t^{Mkt} are constructed from instruments with predetermined maturities that do not in general match the varying maturities of EU securities. The fact that BAS_t^{Mkt} only enters Equation (1) interacted with $\bar{T}_i$ but not in isolation has to do with the fact that the main effect is found to be statistically insignificant once a maturity interaction is included. This finding can, in turn, be understood as meaning that the impact of BAS_t^{Mkt} on yields tends to zero as a bond approaches the maturity date.

(Continued on the next page)

Box (continued)

statistically significant. (3) This points to there being no special pricing affect associated with these bonds once their basic characteristics are controlled for. Given that in an earlier analysis relying on a shorter sample such dummies were found to be significant, this result suggests stronger integration in the market for EU bonds, whereby the associated EU programmes are no longer distinguishing factors.

The estimation of an equation such as (1) usually involves choosing between a random effects (RE) and a fixed effects (FE) model. A Breusch-Pagan LM test rejects a pooled estimation approach while the popular Hausman test provides statistical evidence in favour of a FE model. However, given that some variables are time-invariant, the usual FE approach is not ideal as it does not allow estimating the coefficients associated with this type of variables. For this reason, we also estimate the model by relying on the Hausman-Taylor (HT) and on the Mundlak (MK) approaches, both of which can handle fixed effects while allowing for the estimation of the coefficients of time-invariant variables. The estimation results are reported in Table 1. As can be observed, coefficients are economically similar across models, irrespective of the comparative statistical validity of the different estimation approaches. Ultimately, the different models produce only minor changes in the decompositions shown in Section IV.2 and we opt to rely on the HT model as it is both suitable for handling fixed effects and for estimating the coefficients of time-invariant variables. (4)

Table 1:

EU bond yield regressions: estimated parameters

Model	α	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}	R^2
RE	-0.13	0.98	0.08	0.33	0.0098	-0.0006	0.58	0.04	0.04	-0.46	0.03	-0.20	99.5%
p-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.031*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	
FE	-0.06	0.97	0.08				0.61	0.03	0.04	-0.46	0.03		99.0%
p-value	*0.000*	*0.000*	*0.000*				*0.000*	*0.000*	*0.000*	*0.000*	*0.000*		
HT	-0.16	0.97	0.08	0.35	0.0102	-0.0006	0.59	0.04	0.04	-0.46	0.03	-0.20	99.5%
p-value	*0.001*	*0.000*	*0.000*	*0.001*	*0.180*	*0.020*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	
MK	0.07	0.97	0.08	0.42	-0.0132	-0.0006	0.60	0.04	0.04	-0.46	0.03	-0.18	99.6%
p-value	*0.432*	*0.000*	*0.000*	*0.000*	*0.322*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	

As can be observed in Table 1, all coefficients are highly significant, with the exception of the coefficient associated with $\bar{T}_i$, which is not significant in the HT and MK models, while being significant at a 5% level in the RE model. (5) In addition, all coefficient signs are theoretically valid. The goodness-of-fit is near perfect, which should not be taken as evidence either in favour or against the model specification, but rather seen as the result of taking yields as the dependent variable, where the risk-free rate $y_{i,t}^{AAA}$ has a large explanatory power. (6) The goodness-of-fit of an equivalent regression explaining EU bond spreads would be high, at approximately 80%, but not perfect.

Before concluding the consideration of Equation (1), it is worth noting that an expanded specification that includes as a regressor the total amount of EU debt outstanding as a share of total euro area government debt suggests that the rapid expansion in EU debt supply increased EU bond yields by approximately 4 bps on average between October 2020 and November 2023. A maturity interaction term further suggests this effect was more pronounced for longer-dated bonds and less pronounced for shorter-dated bonds and bills. It is worth noting in this connection that the relatively muted effect of the possible excess supply of EU debt is ultimately endogenous in the sense that it partly depends on the issuance strategy of the EU issuer and can thus reflect a successful approach to market placement.

(3) In the case of NGEU, the dummy variable is significant at conventional significance levels under the RE model, but is not found to be significant at a 5% level in the HT model, nor at a 10% in the MK model (see the remainder of this box for a discussion of the different models). As regards SURE and green dummy variables, there is strong evidence against their significance across all model versions.

(4) The MK approach also provides these advantages. As seen, however, the question of choosing between HT, MK and RE is a moot one in the present context.

(5) As regards $\bar{T}_i^2$, it is highly significant in the RE and MK model, and significant at a 3% level in the HT model.

(6) In fact, statistical testing provides evidence in favour of co-integration between $y_{i,t}$, $y_{i,t}^{AAA}$ and the other time-varying euro area-wide variables included in the regression, a result to be expected from financial fundamentals according to which bond yields can be decomposed into a risk-free rate and factors remunerating different types of financial risk.

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Box (continued)

Turning now to the empirical results on EU bond liquidity presented in qualitative terms in Section IV.3, they follow from an exploratory econometric panel data analysis applied to the same sample as previously described. The estimation equation is as follows:

$$BAS_{i,t} = \alpha + \beta_{BAS\_MKT}\left(T_{i,t} \times BAS_t^{Mkt}\right) + \beta_{AMNT\_i} AMNT_{i,t} + +\beta_{AMNT2\_i} AMNT_{i,t}^2 + \beta_{AMNT} AMNT_t + \beta_{TAMNT}\left(T_{i,t} \times AMNT_t\right) + \beta_T T_{i,t} + \beta_{T2} T_{i,t}^2 + \beta_{NGEU} NGEU_i + \beta_{SURE} SURE_i + \varepsilon_{i,t}$$

where

- $AMNT_{i,t}$ is the outstanding amount of EU security *i* in month *t*;
- $AMNT_t$ is the total outstanding amount of EU bonds and bills in month *t*;
- $NGEU_i$ is a dummy variable that takes the value one if an EU security is associated with the NGEU programme;
- $SURE_i$ is a dummy variable that takes the value one if an EU bond is associated with the SURE programme;

and all the remaining variables have the same meaning as before.

The chosen specification does not include BAS_t^{Mkt} as a standalone term as the associated coefficient was not found to be significant. At the same time, both BAS_t^{Mkt} and $AMNT_t$ appear interacted with residual maturity as their effect on liquidity was found to have a term structure. (7) It is also worth noting that controlling for the share of $AMNT_{i,t}$ that was placed in the market via an auction (as opposed to a syndication) does not produce a statistically significant effect.

The $BAS_{i,t}$ equation is estimated as a RE model following a Hausman test providing borderline statistical evidence in favour of that approach. (8) Table 2 reports the estimated coefficients and the associated p-values:

Table 2:
EU bond liquidity regression: estimated parameters

	α	β_{BAS_MKT}	β_{AMNT_i}	β_{AMNT2_i}	β_{AMNT}	β_{TAMNT}	β_T	β_{T2}	β_{NGEU}	β_{SURE}	R^2
Value	0.10	0.03	-0.02	0.0009	0.0002	-0.00003	0.04	-0.0004	-0.10	-0.11	56%
p-value	*0.000*	*0.002*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	

The goodness-of-fit of the regression is 56% and all coefficients are highly significant while having theoretically valid signs. Applying the regression to a subsample composed of NGEU and SURE securities does not change coefficient signs but improves the goodness-of-it substantially, highlighting how EU bonds issued under other programmes have more idiosyncratic liquidity dynamics.

(7) The fact that BAS_t^{Mkt} has a term structure can be understood as a consequence of the fact that the indicator is constructed based on 5- and 10-year bonds whereas EU bonds have different maturities that may be less (shorter-dated bonds) or more affected (longer-dated bonds) by market-wide liquidity developments. For this reason, the main effect of BAS_t^{Mkt} is found to have a very low statistical significance (p-value of 0.7) once a time interaction is included.

(8) In particular, the null hypothesis of random effects has an associated p-value of 1.6%. FE and Mundlak models were also estimated and found to deliver the same signs on the set of regressors that are common among the three models.

Box III.2: **Calculating the discounted return on investment of an RRF loan**

The Commission adopted a diversified funding approach with respect to NGEU loans under which there is no back-to-back lending whereby the EU would associate to each RRF loan disbursement a given EU bond issuance. Rather, the Commission engages in maturity transformation, funding itself at average maturities that are shorter than RRF loan maturities while passing on its changing interest costs to Member States. This approach offers both potential benefits and risks to beneficiary countries. On the one hand, it allows funding 30-year Member State borrowing with potentially cheaper, shorter-dated EU borrowing whose maturity ranges approximately from 10 to 15 years, depending on the relevant "time compartment". ([1]) On the other hand, as EU bonds are rolled over, the cost of funding of the Commission may change, implying the risk of a revision in the interest rates charged on RRF loans.

In this article, we compute a feasible discounted return on investment (ROI) assuming that the Commission would fund itself without engaging in maturity transformation, thereby eliminating interest rate risk. The formula employed for calculating the discounted ROI is as follows: ([2])

$$Discounted\ ROI = \frac{Present\ value\ of\ benefit\ -\ Present\ value\ of\ cost}{RRF\ loan\ amount}$$

As mentioned in Section IV.4, our ROI measure captures exclusively the net gains from the financial transactions associated with an RRF loan that follow from the financing cost advantage of the EU with respect to the different borrowing Member States. As such, the present value of the benefit is simply the loan amount received, either in past disbursements or in future disbursements. ([3]) The present value of the costs considers, for each of the years ahead, how much a Member State will have to repay on its RRF loan in terms of interest and principal amortisation, with these amounts discounted at Member State-specific interest rates, as derived from national yield curves. RRF loan principal amortisation, in turn, reflects an initial 10-year grace period, followed by a 20-year period of constant repayments, in line with existing RRF loan agreements.

In order to finance RRF loans, the Commission is assumed to issue a series of bonds with maturities between t+11 to t+30, ([4]) matching the principal repayments that it will receive from Member States. These repayments are assumed to be used by the Commission upon receipt to pay back maturing EU bonds. As such, the assumed RRF lending operation entails neither interest rate risk for the parties involved nor roll-over risk for the Commission, with the interest amounts that the Commission charges to Member States being determined by the yields required on EU bonds at the time of disbursement. For past disbursements, the relevant EU rates correspond to those observed from the EU yield curve at the disbursement date. For future disbursements, which will take place until 2026, EU interest rates are inferred from the November 2023 EU yield curve, and are based on the relevant EU forward rates. ([5])

Graph 1 presents the EU and sovereign yield curves employed in the calculation of the ROIs associated with future disbursements. Where tenor gaps exist in our Bloomberg data source, they were filled in through inter-

([1]) In the context of the pricing of RRF loans, the Commission computes its cost of funding for each half year (i.e., the "time compartment") based on the average funding costs of the debt instruments that it issues during that period. This funding costs are then passed on to the RRF loans granted during that time compartment. As the EU debt instruments of that time compartment are rolled over, the funding costs that are passed on to Member States via the respective RRF loans are updated.

([2]) An alternative formula would be $Discounted\ ROI = \frac{Present\ value\ of\ benefit\ -Present\ value\ of\ cost}{Present\ value\ of\ cost}$. It can be shown that this formula produces ROI estimates that are close to those of the formula adopted above, except when dealing with very large ROIs, when it can produce significantly higher rates of return.

([3]) Future disbursements are discounted based on EU yields. The choice of the EU discount rate is due to the fact that, subject to full milestone compliance by Member States, the fulfilment of a promise of RRF loan disbursement is subject to the credit risk of the EU.

([4]) Or up to t+33, in the case of future loan disbursements, which are assumed to be phased over three years. In this case, the required EU issuance is also assumed to take place over three years, with the respective yields based on forward EU rates derived from the EU yield curve as at November 2023.

([5]) Loan amounts still to be disbursed are assumed to be paid as follows: 10% in 2023 and 30% in each of the three years from 2024 to 2026.

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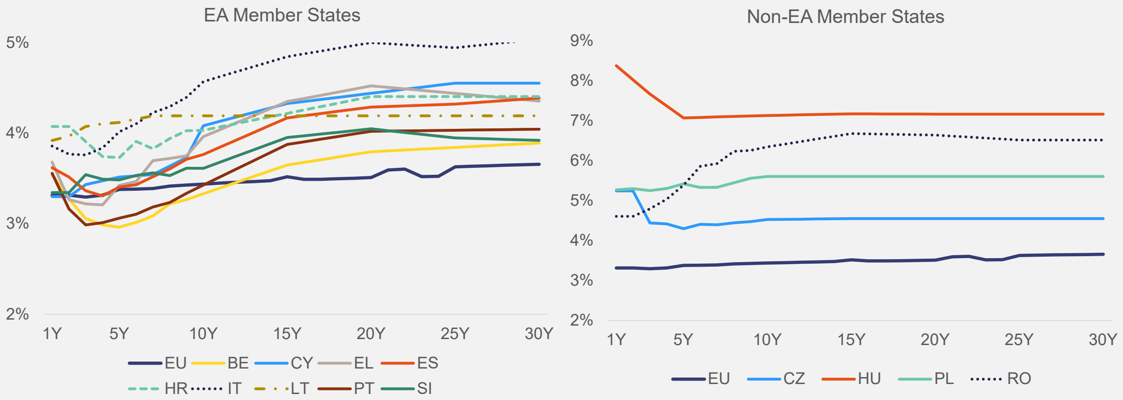
Box (continued)

Graph 1: **Yield curves of EU sovereigns in November 2023**



Note: EU curve fitted based on the Nelson-Siegel-Svensson model.
Source: Bloomberg, own calculations.

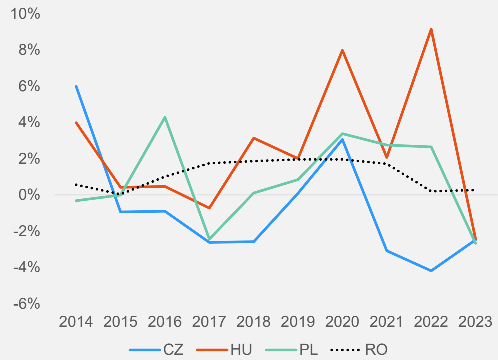
and extrapolation. Table 1 presents estimates for the discounted ROI and for the NPV of gains associated with the entirety of loan disbursements (both future and past, if applicable).

Table 1: **Discounted feasible ROIs and NPVs of RRF loans, per Member State (all disbursements)**

	BE	CZ	EL	ES	HR	IT	CY	LT	HU	PL	PT	RO	SI
ROI	2%	13%	12%	9%	10%	17%	10%	9%	38%	25%	5%	35%	5%
NPV (€ millions)	5	107	2 147	7 188	444	20 487	21	149	1 506	8 543	308	5 200	63

Note: covering past and future RRF loan disbursements; the NPV assumes full approval of requested amounts.
Source: own estimates.

Graph 2: **Year-on-year change in average bilateral exchange rates vis-à-vis the euro**



Note: positive figures denote appreciation.
Source: Eurostat, own calculations.