



French sovereign debt liquidity: main factors, recent developments and resilience during the Covid crisis

For a debt instrument to be considered a safe asset, its liquidity must be preserved – it can be bought and sold without a loss – especially when interest rates fluctuate significantly. This article measures the liquidity of French sovereign debt by analysing the “free float” – the debt that can be traded on financial markets. It finds that the liquidity of sovereign securities with a lower free float declined more during the Covid crisis. The Eurosystem’s securities lending facility has helped to mitigate the scarcity effect created by the decline in free float since 2015. Moreover, during the period of liquidity stress that started to subside at the end of March 2020, liquidity deteriorated first in the repo market, then in the cash market and finally in the futures market. Nevertheless, in a global context where liquidity stress episodes are more frequent, French public debt remains one of the most liquid in Europe.

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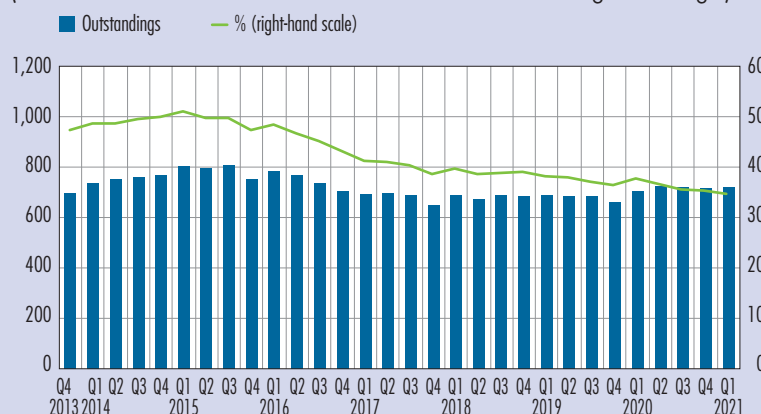
EUR **2,813** billion
outstanding French government debt,
Q4 2021 as per Maastricht

51.1% to **34.8%**
changes in the French central
government bonds and bills free float
between 2015 and 2021

EUR **18** billion
maximum daily volume of OATs lent
through the securities lending facility
held by Banque de France (securities
lending facility) against cash between 2019
and 2021

Free float of the French government bonds and bills (central government)

(volumes in billions of euro on the left and % of total outstandings on the right)



Sources: SHS data from the ECB, authors' calculations.

Note: The free float is calculated by subtracting from the total outstanding marketable debt 1) official foreign holdings, 2) Eurosystem holdings, and 3) holdings of insurance companies and pension funds.



1 Structure of the French government bond market: main stakeholders and investors

Significant outstandings, underpinned by its issuer's active management policy

French public debt issued on the markets is one of the most traded in the European Union (EU), due to its high outstanding amounts and issuance volumes – EUR 2,813 billion in the fourth quarter of 2021, i.e. 22% of the EU's public debt¹ – France's high credit rating, and Agence France Trésor's active debt management, based on the principles of consistency, predictability and transparency (Copin et al., 2022).

In order to meet the government's financing needs and those of each class of investor (operational or regulatory constraints, type of management, performance requirements), AFT uses a wide range of instruments with maturities ranging from 12 weeks to 50 years. There are six such instruments: Treasury bills (BTFs) with a maturity of less than one year, fixed-rate bonds (OATs and green OATs), inflation-indexed bonds, or linkers (OATi, OAT€i, and green OAT€i). A seventh instrument can be traded since France authorized the stripping of its sovereign bonds in 1991 (STRIPS) – <https://www.aft.gouv.fr/en/stripped-government-securities>.

AFT meets the demand stemming from investors that regularly seek to trade "off-the-run securities", i.e. bonds that are traditionally less liquid as they started maturing and no longer represent the current market benchmark, by re-issuing such bonds. These issuances improve the liquidity and depth of the 95 debt securities that have been issued by AFT.² In 2020 for instance, 55% of

issuances comprised benchmark securities, while 15% concerned new securities, and 30% replenished off-the-run securities. Moreover, AFT often buys back its short-dated bonds (with typically a remaining term of up to two years), in order to smooth the volume of maturing bonds which are financed by long-dated bonds when market demand for long-term securities exceeds financing needs in a given year (see also annex B "Survey on Liquidity in Government Bond Secondary Markets", OECD, 2022).

Liquid markets that attract significant volumes: cash, repo and futures markets

Market liquidity can be defined as the ability to buy and sell assets quickly (immediacy) with high trading volumes and numerous counterparties (depth and breadth) without substantially affecting the assets' price (tightness or resilience).³ In terms of **instruments**, liquidity generally refers to assets that can be converted into cash quickly without a significant loss in value.⁴

The liquidity of French tradeable debt is underpinned by large trading volumes on the cash, repo and futures markets, which are linked by an arbitrage relationship. Compared to the German Bund, for example, the average daily volumes of French debt instruments traded are comparable, despite the fact that there are half as many French primary dealers compared to the primary market counterparts of the German issuer⁵ (see Chart 1a below)⁶. Furthermore, the volumes of government bond repos are now higher for France than Germany (see Chart 1b). Lastly, volumes of 10-year futures contracts on French government bonds represent a growing share of European volumes (see Chart 1c).

1 Consolidated debt as per Maastricht criteria (source: *Statistical Data Warehouse*) which includes, in particular, bonds issued by the *Caisse d'amortissement de la dette sociale*.

2 Number of securities issued by AFT as of 1 January 2023, (AFT, 2023).

3 See Appendix A1 and De Renzis et al. (2018) for an explanation of the different aspects of liquidity.

4 See OECD statistical glossary and Poli et al. (2021).

5 Agence France Trésor defines the French primary dealer or SVTs (*spécialistes en valeurs du Trésor*) as "its preferred counterparties for all of its market activities. They advise and assist Agence France Trésor on its debt issuance and management policy, and more generally on any question relating to the proper functioning of the markets". However, the counterparties that are selected by the German Finanzagentur as members of the Bund Issues Auction Group do not have comparable primary and secondary market share targets and market making requirements. See the AFME Primary Dealer Handbook, and AFT's SVT charter. See also AFME (2020), AFT (2022), Barone et al. (2022) and OECD (2022).

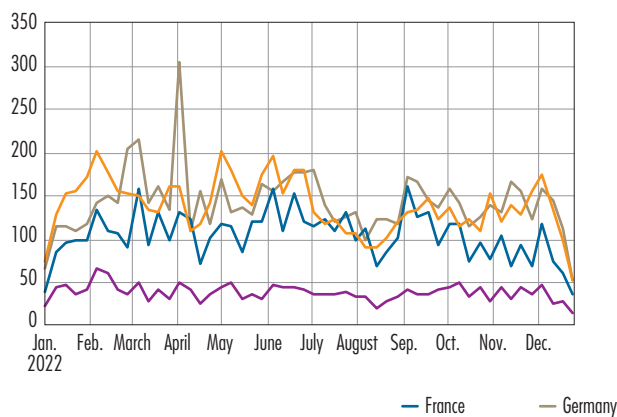
6 ICMA states that the data is aggregated from the 55 Trading Venue and Approved Public Arrangements, thereby covering more than 80% of secondary trading. Complementary such as the turnover ratio is published by AFME in its *Government Bond Data Report*.



CI Comparison of volumes on the cash, repo and futures markets

a) Cash market

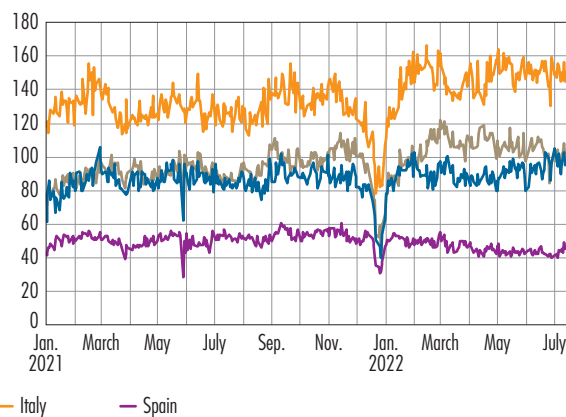
(weekly trading volumes of sovereign bonds, EUR billion)



Source: MiFID data, as compiled by ICMA, European Secondary Bond Market Data.

b) Repo

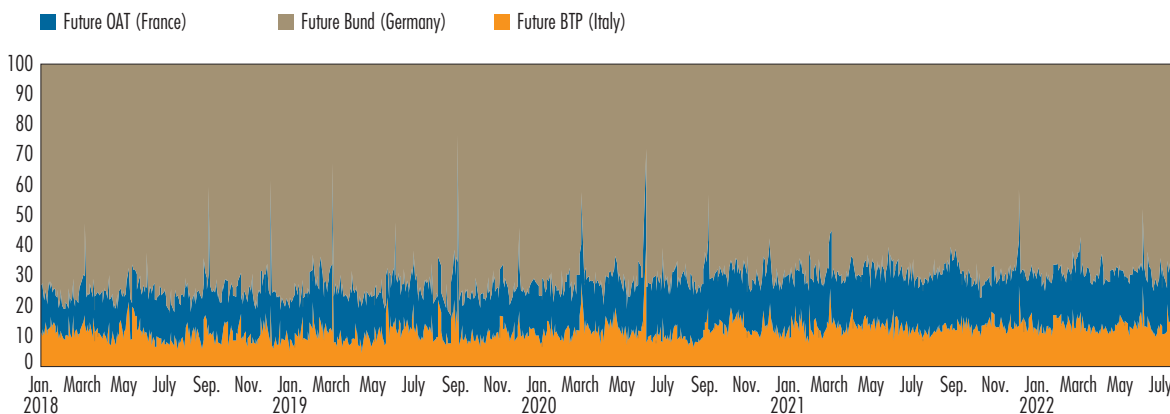
(daily sovereign repo trading volumes by country via LCH SA, EUR billion)



Source: LCH.

c) 10-year government bond futures contracts

(daily volumes of futures by country, %)



Source: Bloomberg.

Changes in French government bond holdings' accelerated by Eurosystem purchases

The structure of French government bond holdings has changed significantly over the years, shaped by quantitative easing and the rise of certain players such as hedge funds, pension funds and passive investment funds.

After increasing from 52% to 56% between 2004 and 2014, the share of French central and local government debt held by **non-residents** began to decline as of 2014, with the start of the Eurosystem's various asset purchase programmes, to reach 47% in the third quarter of 2021 (see Chart 2 below). At the end

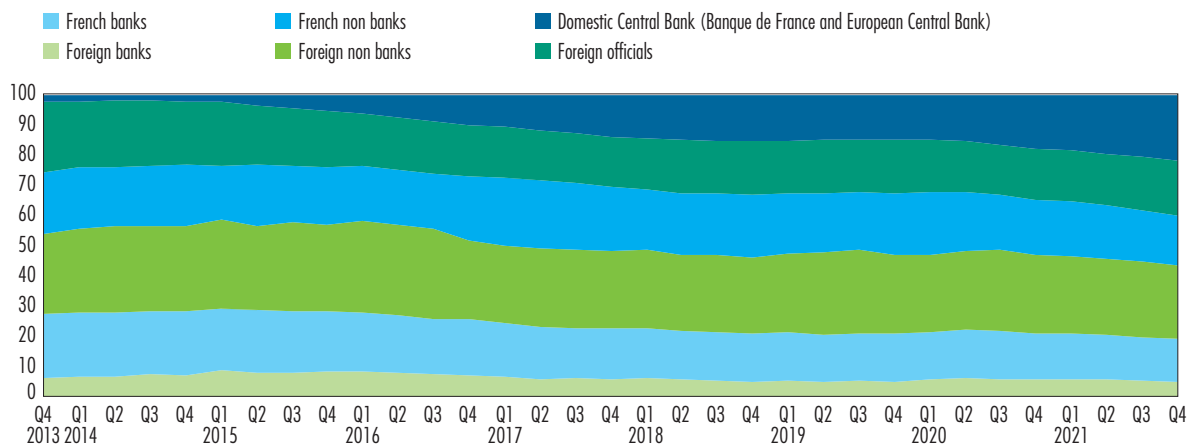
of 2021, the largest non-resident holders of French central and local government debt were non-banks (24.3%), official sector holders (18.5%, mainly central banks and sovereign wealth funds) and commercial banks (4.7%).

As regards **residents**, large-scale purchases of bonds for monetary policy purposes increased the share of securities held by the Banque de France and the European Central Bank – ECB (22%), while the holdings of domestic banks gradually declined, and accounted for only 14% at the end of 2021. Lastly, resident non-banks hold 16% of the total stock, representing a slight decline. Banque de France balance of payments data provide additional details on the composition of resident investors in central



C2 Holdings of French government debt

(%)



Source: IMF Sovereign Debt Investor Base for Advanced Economies sourcing from Eurosystem data (Securities Holding Statistics).

Note: General government debt (central and local).

government debt. The largest resident holders are the “other residents” (mainly the Banque de France), with 24% of the outstandings, followed by French insurers (17%), while French banks and mutual funds hold 7% and 2% of the central government’s debt stock, respectively.

A market with active counterparties on well-defined segments of the yield curve, reflecting growth in algorithmic trading and passive investing

Over the past decade, most investors have remained active, with the exception of those who could not hold securities with negative yields due to regulatory or tax reasons. As a result (and more generally because of falling yields), insurers and asset managers were pushed, before the rise in yields in 2022, into longer-dated securities and are now particularly active in 10-to-30-year bonds (see Chart 3 below). This is now less the case, due to the rise in yields and the flattening of the yield curve. Central banks and commercial banks invest mainly on the short and medium end of the curve (0-10 years).

In the case of central banks, this is due to their objective of holding highly liquid assets in their foreign reserves management and keeping the average maturity in line with that of the domestic government bond market regarding their portfolios held for monetary policy purposes. Commercial banks, for their part, seek to build up the reserves of high quality liquid assets (HQLAs) needed to comply with Basel liquidity ratios.

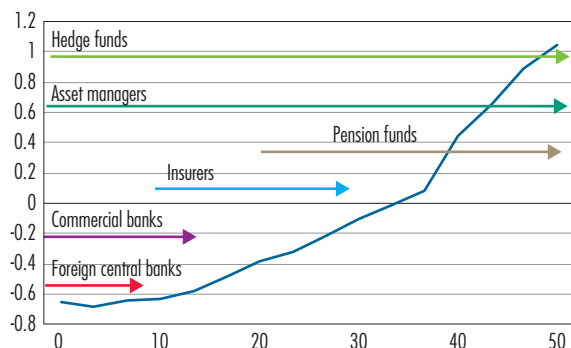
Moreover, large asset managers (such as Amundi, BlackRock, Vanguard, etc.) have played a greater role in recent years. Their index funds, which hold nearly 17% of the European bond market, now serve as vehicles for price discovery.⁷ Furthermore, algorithmic traders have become increasingly active in the French government bond markets, either working for hedge funds or for similar structures set up by real money investors (traditional asset managers). Market data shows that for the majority of OAT trades, which are small in size (up to EUR 5 million), 30-74% of prices are normally quoted by algorithms, thereby doubling over the past three years.

⁷ The price discovery process is notably defined as follows: “Prices of a financial product are discovered through trading activities among market participants. This process by which prices adjust to incorporate new information is referred to as the price discovery (hereafter PD) process”, (Inoue, 1999).



C3 Stylised nominal yield curve and investors' preferred habitat

(x-axis: residual maturity in years; y-axis: yield in %)



Source: Authors, as per AFT, 2022.

Note: Stylised yield curve at constant maturities.

hold. Thus, investors' preference for certain debt securities and their holding horizons (hold-to-maturity vs. available-for-sale), which stems, amongst others, from their regulatory framework and accounting standards, has an impact on the free float. Therefore, the holdings of "inelastic" investors, such as central banks, foreign official institutions, and insurance companies and pension funds (ICPF) are excluded from the free float.⁸ As Chart 4 shows, the free float of French government debt relative to its total outstanding has been declining since the end of 2015 (down 15 percentage points), but has been stable in absolute terms (with more than EUR 700 billion of marketable securities in 2020).

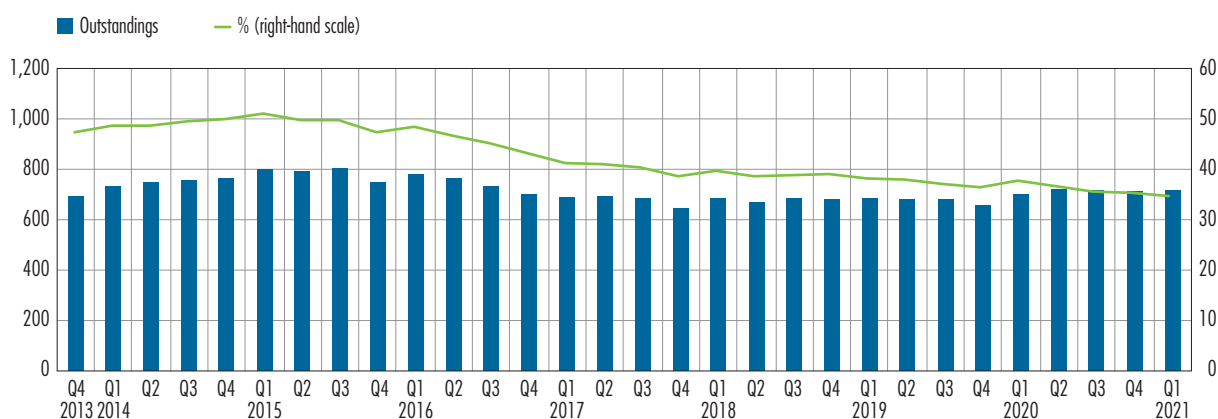
The share of tradeable debt (the free float) has fallen sharply since 2015 while the absolute amount remains stable

The free float is the proportion of the outstanding debt held by investors willing to exchange the securities they

The free float also plays an important role in fostering market liquidity, particularly in times of market stress (see Chart 6 below). The free float of sovereign debt instruments is a cornerstone of the smooth functioning of financial markets in that it determines a large share of safe assets available to market participants, which constitute stores of value and serve as collateral in financial transactions (Jank et al., 2020).

C4 Free float of the French government bonds and bills (central government)

(volumes in billions of euro on the left and % of total outstandings on the right)



Source: Authors' calculations based on ECB data (SHS and SDW).

Note: The free float is calculated by subtracting from the total outstanding marketable debt 1) official foreign holdings, 2) Eurosystem holdings, and 3) holdings of insurance companies and pension funds.

⁸ Depending on the jurisdiction however, pension funds can contribute to the free float when they need to sell sovereign bonds due to margin calls for instance (see Bank of England, 2022).



2 The resilience of the French market during the Covid crisis: liquidity dynamics during the stress episode of March 2020

The liquidity stress of March 2020: massive sales where the increase in bid-ask spreads was greater for securities with a lower free float

The spread of the coronavirus in March 2020 triggered a shock in global bond markets, resulting in high volatility and market dislocations, both in Europe and the United States. Massive and widespread sell-offs (“dash for cash”) resulted in a severe deterioration of market liquidity conditions in the United States (Duffie, 2020). In Europe, the worsening of liquidity conditions on French and German government bond markets was preceded by a significant demand for safe euro-denominated assets, i.e. a “flight to safety” or a dash for collateral” (Moench et al., 2021).

In the United States, the main net sellers of Treasuries in March 2020 were hedge funds and official foreign investors, who sold securities to dealers whose intermediation capacities had reached their limits, thereby contributing to further drying up liquidity condition (Duffie, 2020). On the French market, amongst the majors sellers of sovereign debt were the money market funds that reduced their government bond holdings between February and March 2020 to pay

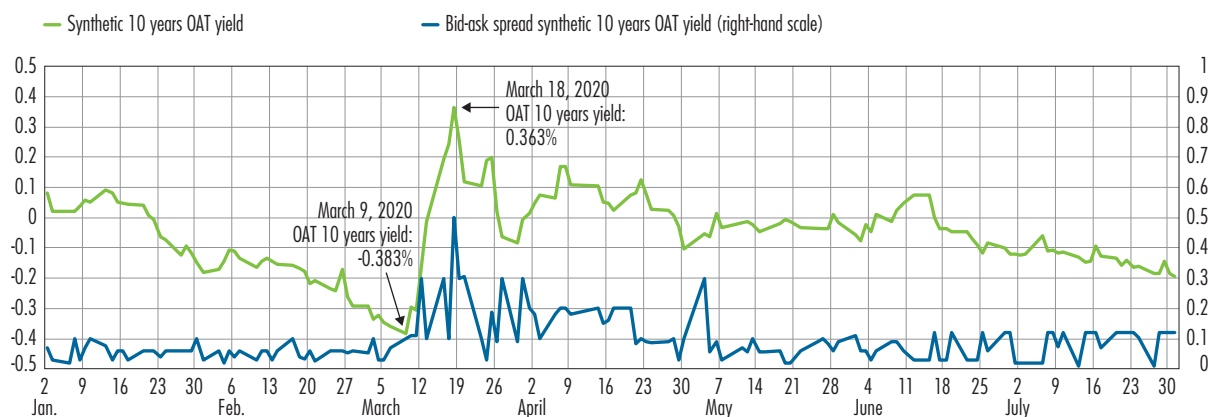
for redemptions. Moreover, extreme bond market volatility (see Chart 5 below) caused many shocks to Value at Risk (VaR), a common risk management measure, thereby forcing several hedge funds to reduce their trading volumes.

The stress, which was caused by significant selling on the French sovereign debt market, began with the announcement of the Italian lockdown on March 9. It intensified on 11 March after the World Health Organisation (WHO) declared that Covid-19 was a pandemic, before escalating further in the wake of the ECB press conference on March 12, to finally begin abating with the PEPP⁹ announcement on March 18. This stress resulted in extreme volatility in the 10-year OAT yield, with a jump of over 73 basis points in just over a week (see Chart 5 below).

This volatility was followed by a liquidity dry-up, notably reflected by the widening of the bid-ask spreads. Liquidity supply factors that have contributed to a widening of spreads include trading algorithms that automatically adjust their bid-ask spread in the event of high volatility. This widening lasted longer than expected, in particular due to a large number of hedge funds that benefit from volatile market conditions and higher bid-ask-spreads. While these funds could have contributed to a tightening of bid-ask-spreads, they could not do so in March because many had breached their risk limits.

C5 Bid-ask spreads and synthetic 10-year OAT yield from January to July 2020

(left-hand scale: yield in %; right-hand scale: base price = 100)



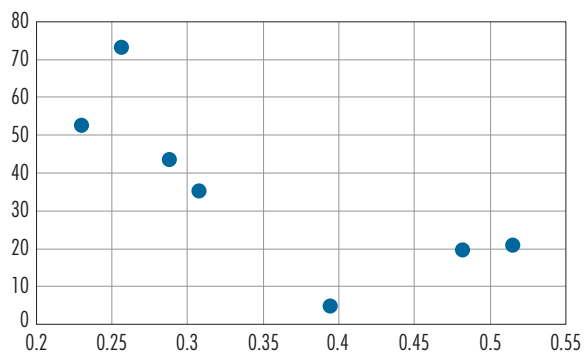
Source: Refinitiv.

⁹ Pandemic Emergency Purchase Programme.



C6 Free float of each the OATs deliverable to the futures contract and maximum bid-ask reached in March 2020

(x-axis: in bps; y-axis: in %)



Sources: Authors' calculations using ECB (SHS) and Bloomberg data.

The reduction in the free float of French government bonds observed since 2015 may also have exacerbated the liquidity stress on certain bond issues: for example, on the 10 year OATs futures delivery basket (with a residual maturity of between 8.5 and 10.5 years), **the increase in bid-ask spreads was greater** for securities with a **lower free float** in March 2020 (see Chart 6).

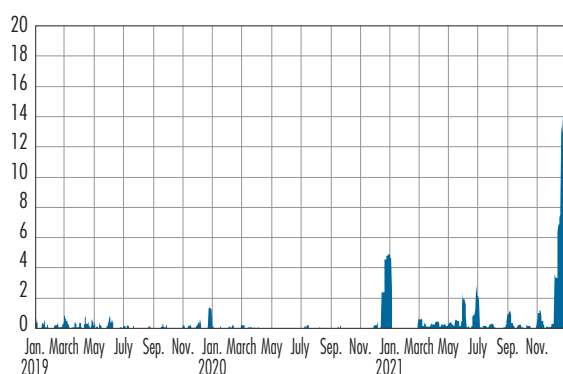
Two official repo facilities that act as shock absorbers in times of collateral scarcity

Both Agence France Trésor (through the *Caisse de la dette publique*) and the Banque de France (with the securities lending facility or SLF) offer securities lending to eligible banks (see box below).

An analysis of the volumes of OATs lent by the Banque de France against cash via the SLF confirms the interest of counterparties in this facility, with daily peaks of more than EUR 18 billion during the year-end runs, notably due to the balance sheet constraints of several players (banks, insurers, money market funds, see Chart 7a). A granular analysis shows that the maximum outstanding amounts of individual OATs lent was as high as 300% of the free float of a given issue on a given date, a significant level (see Chart 7b). These sizeable proportions are due to the sometimes very small free float of some issues, which may be much smaller than the volumes held by the Eurosystem, that can be borrowed via the SLF. In March 2020 however, the SLF was only used moderately by banks.¹⁰

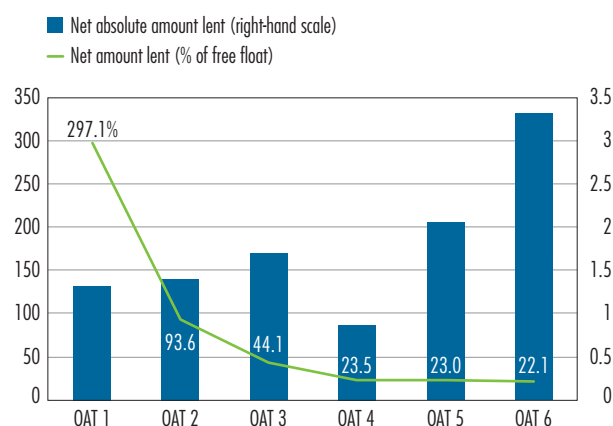
C7 Outstandings of OATs held in Banque de France portfolios that are lent against cash via the SLF

a) Outstanding OAT loans against cash
(EUR billions)



Sources: Banque de France data and SHS.

b) Outstandings of the most lent OATs relative to their free float in Q4 2019
(left-hand scale: in %; right-hand scale: in EUR billions)



¹⁰ We observe a peak in outstanding of OATs and BTFs that were lent through the SLF against cash of 200 million on March 10, 2020 against 817 million and 673 million on March 5, 2019 and March 10, 2021 respectively.



The amounts lent and borrowed through the SLF show that it mitigates the scarcity effect of safe assets stemming from their declining free float. The SLF does so by occasionally increasing the amount of tradeable securities at highly demanded maturities of the curve (see the first operation in the chart below). Similarly, although the AFT facility was anecdotally used during the 2017-21 period (EUR 580 million in securities were lent over the period), it constitutes a backstop facility to ensure the delivery of securities in the event of a liquidity squeeze and thus to modulate the sovereign free float. The very marginal use, at this stage, of the AFT facility demonstrates that the securities portfolio held by the Banque de France is sufficiently

large and diversified to meet all needs of banks and market participants.

It should be noted however that the impact of the SLF on the sovereign free float is not systematically net positive, as several transactions may reduce it (see the last three types of operations listed in the chart below). Indeed, the free float of a security lent by the Banque de France **increases** when that of a security provided as collateral **decreases**. Furthermore, central bank refinancing operations in the Eurosystem are collateralised on average with 30% government bonds, which tends to reduce the amount of government securities available on the market (Brueckner et al., 2022).

Stylised representation of the impact of the securities lending facility and refinancing operations on the government bond free float

	Eurosystem		Counterparty		Impact on free float
Repo	OAT/BTF		Cash	→	Increase in sovereign free float, decrease of the monetary base (MO)
Repo - Reverse repo	OAT/BTF		OAT/BTF	→	No impact on free float and the monetary base (MO)
Repo	Corporate bond		Cash	→	No impact on sovereign free float, increase in corporate free float, decrease of the monetary base (MO)
Repo - Reverse repo	Corporate bond		OAT/BTF	→	Decrease in sovereign free float, increase in corporate free float, no impact on the monetary base (MO)
Reverse repo	Cash		OAT/BTF	→	Decrease in sovereign free float, increase of the monetary base (MO)
Refinancing Operation	Cash		OAT/BTF	→	Decrease in sovereign free float, increase of the monetary base (MO)

Source: Authors' creation.

Note: OATs are French government bonds while BTF are the French government bills. Market participants that are typically deemed inelastic other than the national central bank can however have a major impact on the free float, e.g. insurers, pension funds.



BOX

Two official repo facilities available to banks and Primary Dealers

The French government bond market has two official repo facilities: one managed by the Banque de France and the other by Agence France Trésor (AFT):

- The securities lending facility (SLF) operated by the Banque de France was set up by the Eurosystem in April 2015¹ to lend to markets the financial instruments acquired under asset purchase programmes. The Banque de France organises, daily competitive auctions, allowing eligible banks to borrow public and private securities² held under the Asset Purchase Programme (APP) and the Pandemic Emergency Purchase Programme (PEPP) for a period of one to four weeks (transactions with a daily maturity can also be traded bilaterally). These loans may be made against collateral in the form of cash or securities (only French sovereign securities are eligible);
- The repo facility set up by AFT is a last recourse instrument, is dissuasive in terms of pricing but can be used to source any sovereign security. As a result, between 2017 and 2021 it was used four times for limited amounts.³ This facility mandates a public institution called the Caisse de Dette Publique (CDP) to temporarily lend government bonds that are difficult to find on the market (but in high demand, typically bonds eligible for the FOAT contract). The CDP is allocated sovereign bonds by the French government, which can issue them directly to the CDP. Only primary dealers can access this repo facility and against other French securities of a similar market value.

¹ <https://www.ecb.europa.eu/>

² While all Eurosystem central banks are required to lend government securities acquired under the PSPP (Public Sector Purchase Program) and PEPP (Pandemic Emergency Purchase Programme), as well as securities acquired under the CSPP (Corporate Sector Purchase Programme) for the six national central banks (NCBs) carrying out these purchases (including Banque de France), it is up to the NCBs to decide whether or not to lend the securities acquired under the three covered bond purchase programs (CBPP, CBPP2 and CBPP3).

³ AFT Annual reports 2018, 2019, 2020 and 2021.

Transmission of liquidity shocks between markets: relative illiquidity on the repo market transmitted to the cash market and then to the futures market

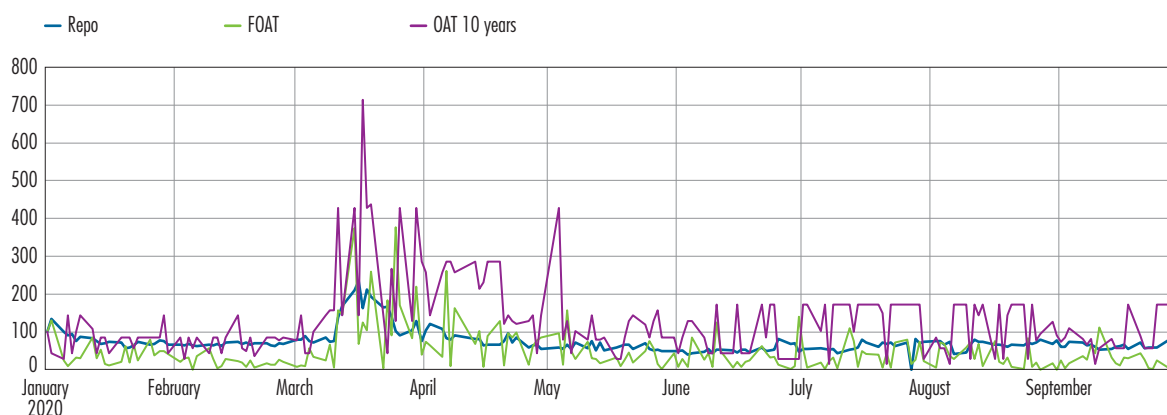
The fact that there are three active markets for French government debt – cash, futures and repo – allows us to revisit the **liquidity discovery** process – the sequencing of these markets reactions to liquidity stress and how this stress is transmitted between them. Pelizzon et al. (2014 and 2016) examine the arbitrage relationship between futures contracts and their underlying bonds in the Italian and German markets. Their results suggest that while the futures market leads the cash market in **price discovery** – the transmission of price shocks between markets – the cash market leads the futures market in liquidity discovery. Other authors have

concluded that at higher frequencies, liquidity discovery through prices is transmitted from the futures to the cash market, with volatility affecting in turn market liquidity conditions (Panzarino et al., 2016). Lastly, some authors concluded that the orders of certain types of customers who are very active in the futures market could subsequently be transmitted to the cash market (Di Gangi et al., 2022).

There are a number of liquidity metrics typically used in the three French markets (see Appendix A1). The difficulty in obtaining **pre-trade** liquidity measures, such as bid-ask spreads, means that the proxies usually developed in the literature are favoured (Schaffner et al., 2019). These proxies include the Amihud measure and, less frequently, the Corwin Schulz.



C8 Liquidity metrics in the cash, repo and futures markets



Sources: Bloomberg, author's calculations.

Note: For the cash market, bid-ask on the OAT 10y, for the futures market, Amihud metric calculated using the prices of active futures contracts weighted by volumes, for the repo market, Corwin-Schultz measure using transaction data on the repo market for French government collateral.

Chart 8 compares these different measures and confirms their correlation:

- For the cash market (OAT 10y), **bid-ask spreads** are used;
- For the futures market (FOAT), the **Amihud metric** is used and calculated assessing the difference in prices of volume-weighted active contracts, normalised by the daily volumes traded;
- For the repo market, MMSR (Money market statistical reporting) transaction data was analysed on French government collateral to produce the **Corwin and Schultz measure** (see Appendix A1).

Data analysis between January 2019 and December 2021 suggests that illiquidity in the repo market is then transmitted to the cash market and illiquidity in the cash market is finally found in the futures market (as per a Granger causality analysis of daily data).

It should be noted that the interventions in the different markets were quite heterogeneous, since support for

the cash market (e.g. PEPP) was announced on 18 March 2020, while the existence of the SLF to support the repo market was already active. There were no public interventions in the futures market.

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This article contributes to a growing literature aimed at better understanding the multiple facets of sovereign debt liquidity, as well as the transmission of liquidity. The publication of this article, marking the third anniversary of the brief liquidity stress peak triggered by the Covid pandemic, was only one such episode amongst others. For example, recent episodes of liquidity stress in the US Treasury market for instance include the 2014 "flash rally", the 2019 "repocalypse", the 2020 "dash for cash" and the 2022 liquidity tensions. Generally speaking, the gradual deterioration in recent years in sovereign debt liquidity¹¹ is becoming a topic of particular attention for central banks, Ministries of Finance, capital market authorities, international institutions, in particular the OECD¹², the FSB¹³ and the IMF, as well as market participants.

11 See Appendix A3.

12 See also OECD (2022), which shows in particular that sovereign market volatility is the third most common challenge faced by OECD issuers, after changes in government financing needs and cash flow forecasting.

13 Cf. FSB (2022).



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Appendix Methodology

A1 Liquidity: how to measure it?

A) Metrics based on transaction cost	B) Metrics based on volumes (depth and breadth)	C) Metrics based on price (resiliency and price discovery)	Post-trade, pre-trade
1) Quoted <i>bid-ask spreads</i>	Absolute difference between the lowest ask price and the highest bid price over a given period or on the most recent quote.		Pre-trade
2) Spread " <i>on-the-run/off-the-run</i> "	Differential in yield or B/A spread between a newly issued bond and a prior bond that is similar in all respects.		Pre-trade, if based on B/A spread
3) Amihud price impact	The ratio of absolute return over transaction volumes: $Price\ impact = \frac{1}{N} \sum_{t=1}^T \frac{ r_t }{V_t}$		Post-trade
4) Corwin-Schulz	Proxy of the bid-ask spread, looking at the spread between the highest and lowest price of a security during the trading day		Post-trade

Source: Authors.

A2 Methodology and analysis of precedence in the sense of Granger

In this article, a "Granger causality statistical hypothesis" is used for the liquidity measures between the three markets. We seek to determine if the past values of a variable have an explanatory power on the contemporary values of the other variables. Each row below estimates whether this precedence test holds in the data between a pair of variables: when it does, the result is highlighted with three asterisks, which means the degree of certainty is the highest.

The results suggest that illiquidity in the repo market affects liquidity in the cash market, and cash market liquidity in the futures market. Conversely, we do not find causality in the sense of Granger between the repo market and the futures market with regard to the liquidity discovery mechanism. At a lower degree of confidence, the futures market could lead the spot market.

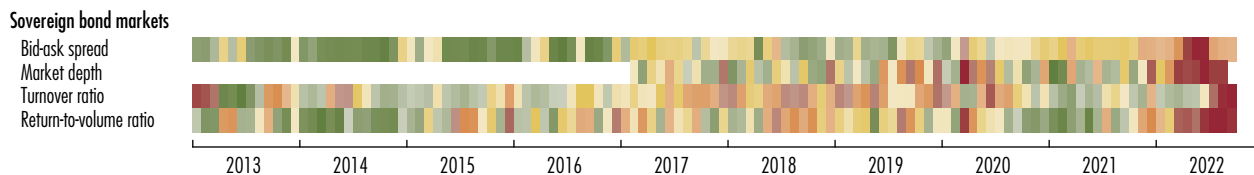
The variable	is caused as per the Granger causality by	F-stat	Prob > F
Future (Amihud)	Repo (Corwin-Schultz)	1.6683	0.1630
Future (Amihud)	OAT (Bid-ask CTD)	8.7785	0.0000***
Repo (Corwin-Schultz)	Future (Amihud)	.68047	0.6070
Repo (Corwin-Schultz)	OAT (Bid-ask CTD)	1.8383	0.1271
OAT (Bid-ask CTD)	Future (Amihud)	2.2441	0.0694*
OAT (Bid-ask CTD)	Repo (Corwin-Schultz)	7.6988	0.0000***

Source: Authors.



A3 Changes in the liquidity for sovereign issuers

The standard market liquidity metrics show some signs of deterioration.



Source: IMF, GFSR, 2022.

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