Treasury bills and bonds: where (and when) is the demand?

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Abstract

Using the re-issuance policy of the French Treasury, we show that issuances of long-term debt (bonds) increase yields four times as much as issuances of short-term debt (bills). Surprisingly, the modest price impact of bills is not due to differences in secondary market liquidity, nor the dash-for-cash during crises. Duration alone cannot explain the higher price impact of bond issuances. The different properties of bills and bonds stem from preferred habitat investors who need time to absorb additional bond issuance compared to the elastic demand of foreign investors for bills. Governments thus rely on bills when they need cash quickly.

JEL classification: E43, E44, H63.
Keywords: Sovereign debt auctions, debt maturity, preferred habitat, safe assets

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I Introduction

"When borrowing needs change quickly, bills are our issuance 'shock absorber'. Because we want nominal coupon securities to adjust gradually, bills play an important role in managing changes in borrowing needs that are [...] unexpected."
— Scott Bessent, Secretary of the US Treasury, 12 November 2025

Governments across the world perceive it is easier to issue additional short-term debt (bills) unexpectedly than long-term debt (bonds or "coupon securities"). This can be read in the preceding quote and in similar statements made in various countries as well as by international institutions.[1] This feature of modern debt management appears clearly in the data during crises, when deficits rise sharply. For example, during the great recession (2008-09) or the pandemic (2020-21), many countries had to immediately issue significant amounts of public debt to finance large deficits. They decided to do so overwhelmingly through the use of Treasury bills, *i.e.* debt securities with initial maturity of one year or less. This can be seen on figure 1, which shows the issuance breakdown between bills and bonds of four countries with completely different fiscal frameworks and traditions: France, Germany, the US and Japan.

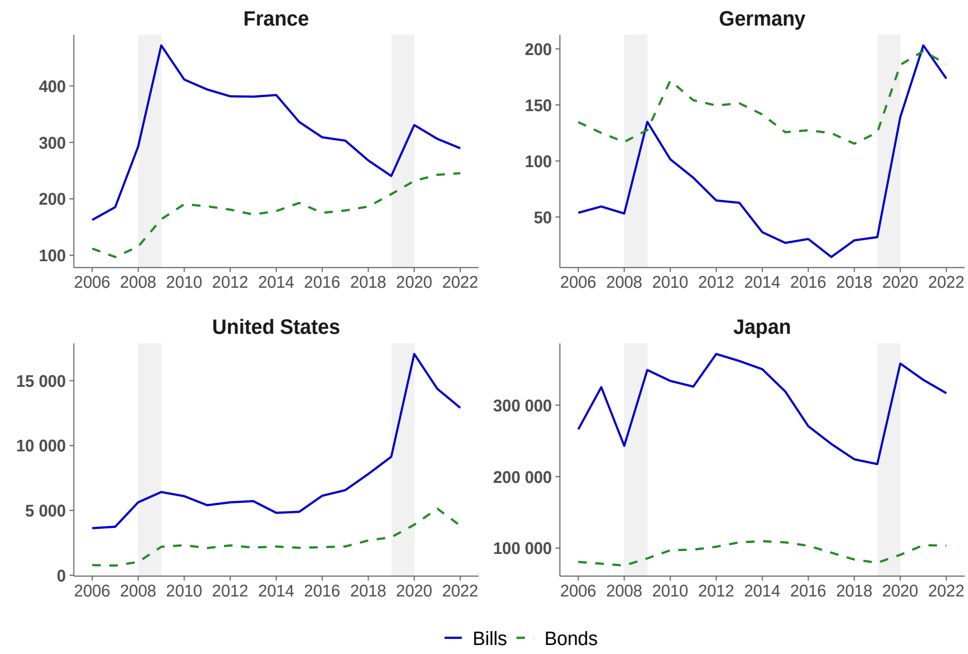
In most countries, when deficits increase this translates into a permanent jump in the debt stock. This is because usually no systematic fiscal measures are voted to offset these negative shocks. The decline of GDP over one year is a permanent loss which may be partially recovered subsequently but will leave public finance strained for several years. There is *a priori* no reason to finance a permanent increase in debt with short-term securities, which are usually seen as carrying higher refinancing and interest rate risk for

[1] "*In case of an unexpected rise in funding requirements during a crisis, [sovereign issuers] tend to borrow more from the T-bill markets.*" (OECD Sovereign Borrowing Outlook 2021). Appendix A contains similar statements from the French, German, US Treasury and the Financial Times. However, whether this perception that it is easier to issue additional short-term debt unexpectedly is warranted remains an unexplored research question.

sovereign issuers. The relative price of issuing at short *vs.* long maturities (the term premium) did not appear to change in favor of the former type of debt during the episodes discussed above (*e.g.* Berardi (2023)). Moreover, we could not find any legislation limiting the recourse to long-term debt in recent years.[2]

Figure 1: Issuance of bills and bonds of four large countries

This figure shows the nominal amount of bills (solid blue line) and bonds (dashed green line) issued per year and per country. Shaded areas indicate crisis years. Internet appendix A shows outstanding amounts. Bills are defined as debt securities with 1-year of initial maturity or less. We classify all other debt securities as bonds. We group notes and bonds together for the US as this distinction does not exist in most countries.



Source: National Ministries of Finance's websites

In this paper, we show empirically that indeed bond yields increase by more than bill yields in case of a surprise issuance, *i.e.* in the short run, governments face a steeper demand curve on the bond market than on the bill market. This feature applies in normal times and in crisis times. To be sure, we will show that when governments want to sell

[2]Hubert de Fraisse (2025) shows that some legal restrictions were in place in the US until 2007, but they applied only to the 30-year bond and not to shorter maturities. We did not find any restriction on the maturity of French debt in the literature or through discussions with the Treasury, the central bank or market participants.

debt, the prices (*resp.* yields) of bills fall (*resp.* rise) by less than the price (*resp.* yield) of bonds. By conservative estimates, bond yields increase by around four times more than bill yields after auction announcements and before actual issuance, costing the Treasury as much. Moreover, the increase in the yield is partially reversed for bills after auctions but is persistent for bonds. These additional costs lead debt management offices to use bills as their first line of defense to accommodate large and permanent shocks. They substitute slowly toward bonds issuance thereafter (see opening citation and figure 1). As we will show, bond market investors need to be prepared in advance to absorb additional issuance, and may be able to do so but over longer periods of time.

We use the case of France as its institutional setting offers many advantages. First, it is the largest issuer of euro-denominated Treasury bills. We present evidence that French T-bills were considered safe assets during our sample period. Second, most issuances are "re-openings" or "re-issuance". That is, to borrow funds, the French Treasury usually sells more or "increases the size" of an existing security that was already created and tendered years before. This allows us to look at the effect of issuing a given security on the secondary market yield of that same security several days before and after the issuance. Secondary market yields are a good proxy for financing cost. As we show, they are on average equal to primary market yields on auction day and are available before and after the auction. Third, the re-openings are not fully expected by the market, allowing us to assess the effects of unexpected issuance of bills and bonds.[3] Fourth, the French Treasury established a similar procedure for issuing bills and bonds, but auctions occur on different

[3] In contrast, the US Treasury commonly re-opens bills and longer-term bonds, but these re-openings are known to the market when the securities are first created. There are only rare and irregular surprise re-issuances, such as when T-bills are re-opened on an *ad-hoc* basis as cash-management bills.

days of the week, making it easy to compare the price impact of each type of securities issuance.

Auction routine has remained virtually unchanged for the last 40 years in France, contrary to other countries such as the US (Garbade (2015)). During this period, re-openings occur once to twice per week, providing us with plenty of observations. Auctions and announcements always take place on the same days of the week (public holidays excepted). The securities to be issued are not known to the market prior to announcements, triggering supply shocks on a given securities' market, which we exploit.

Methodologically, we use a lead-lag model to estimate the impact of the issuance of a given French Treasury security on its end-of-day secondary market yield, one week before and one week after the auction. Our specifications are close to Lou, Yan, and Zhang (2013), who look at the impact of new ("on-the-run") bonds issuance on the secondary market yield of previously issued ("off-the-run") bonds in the US. We augment these regressions with dates fixed-effects, securities fixed-effects and additional control variables. We also consider bills (not only bonds) and look at the impact of a given securities issuance on its own secondary market yield, which is possible thanks to the practice of re-issuance.

We show that announcements of re-issuance cause an immediate market reaction, ahead of the auction itself. Our regressions indicate that between announcement and issuance a bond typically sees its yield increase by up to 2.8 basis points per billion issued, while over the same period, a bill sees its yield increase by 0.9 basis points. Other regressions find more modest effects but put the difference between bills and bonds' reactions at one-to-four. We also run our regressions in percentage of GDP, as opposed to per billion issued and in proportion of each security's outstanding amount. The difference in price impact remains between one-to-three and one-to-four. The difference rises to one-to-five in our robustness exercises. Our empirical set-up is able to identify yield changes over a few days only, but they matter for public finance because we show that yields peak exactly on the day of issuance. In other words, even if these yield increases were to be short-lived, the Treasury bears their full cost. These estimates are in line with those found in other countries for the response of bond yields (the response of bills being largely unexplored).

Our identification strategy relies on (supply) surprises regarding the security that will be re-issued and how much of it will be re-issued. This strategy is valid if the market cannot anticipate better which bill will be re-issued than which bond will be re-issued, and how much of it will be re-issued. If anything, there is greater variability in issuance for bills and correspondingly higher *ex-ante* uncertainty. This greater variability can be seen for instance on figures 1, in internet appendix A and in our descriptive statistics, which will show that the standard deviation of bill issuances is larger than bond issuances. Moreover, we will show that there is an equivalent number of bills and bonds that can be re-issued at any point in time, and in fact slightly fewer bonds than bills, suggesting again that surprises if anything should be larger for bills. Thus, there no reason to believe that issuances can be better anticipated for bills than bonds, but rather the opposite.

We account for the possibility of reverse causality in case the Treasury strategically issues more debt when yields increase only modestly after the announcement of an issuance. Such strategic behavior from the debt management office would bias our price impact estimates toward zero. For that purpose, we use announced amounts as opposed to amounts actually issued. We control for demand, following the same method as Ray, Droste, and Gorodnichenko (2024) and Kacperczyk, Pérignon, and Vuillemey (2021). Moreover, we explicitly account for the large bond purchases of the ECB and euro-area national central banks under its various Quantitative Easing (QE) programs, a key event during our sample period. We also control for periods of crises, such as the great recession and the pandemic, to demonstrate that our results are not driven by the demand for short-term safe assets in times of stress.

We next turn our attention to the channels through which bond issuances increase yields by more than bill issuances. One natural candidate to explain this phenomenon is duration risk: as the Treasury injects duration risk in the market, the price of high-duration assets (bonds) should fall (*i.e.* yields should rise), in a symmetric fashion from QE (Krishnamurthy and Vissing-Jorgensen (2012), Greenwood and Vayanos (2014)). However, we show that duration risk is not a major driver in our results. We split our bond sample in three: “short”, “medium” and “long” term bonds. Bonds most affected by additional issuance are, in fact, those with the shortest maturity.

We also run regressions using the spread between yields and overnight index swaps (OIS) rates as our dependent variable. This measure should be purged of the expected path of short-term interest rates and of the term premium of euro-denominated assets. The impact of additional issuance on this spread should be zero if yields move due to an increase in the term premium. In fact, we show that this variable reacts almost exactly like bond yields to an issuance, suggesting that auctions depress asset prices but are not large enough to affect the term premium in euro. This analysis is possible because we study one of many countries of the euro-area, and the OIS market in euro is larger than its sovereign bond market (Dalla Fontana, Holz auf der Heide, Pelizzon, and Scheicher (2019)). Moreover, interest rate swaps are cleared and thus collateralized purging them of any credit risks. OIS rates are routinely used for high-frequency identification of monetary policy shocks, demonstrating their capacity to react at least as quickly as bond yields.

These results are most consistent with the theory of "preferred habitat" as modeled by Vayanos and Vila (2021). In that setting, the different demand curves of preferred habitat investors for each specific maturity play a key role in explaining how yields react to demand shocks. In the presence of preferred habitat investors alongside arbitrageurs with limited risk-bearing capacity, the price impact is not monotonously increasing in the duration of the security.

In the presence of preferred habitat and risk-averse arbitrageurs, additional supply at one maturity point propagates to yields of bonds with close maturities, as noted by Ray et al. (2024) and Selgrad (2023). We extend this reasoning to supply shocks such as additional issuance of specific securities by the Treasury. We show that indeed the price impact of the supply of bonds propagates to securities of similar maturities, while the supply of bills does not. The effect decays as the distance between two bonds along the yield curve grows. This pattern is consistent with bond investors having stronger preferences for specific maturities compared to bill investors.

With these results at hand, we go on and explore why investors on the bill market have flatter demand curves than on the bond market, at least in the short-run. We show that standard metrics of secondary market liquidity do not explain this feature of T-bills. To be sure, contrary to the literature's consensus, bills are in general less liquid than bonds on the secondary market. Indeed, we find that in France the bid-ask spread for bills is around five times as large as for bonds. Thus, we conclude that the ease to sell bills on the primary market is not explained by liquidity on the secondary market.

We present evidence that investors in the T-bill market are large-pocketed foreign institutions looking for safety. They buy and hold T-bills to maturity, thus rendering bills relatively illiquid. Investors on the bond market are by and large pension funds and insurance companies comfortable with taking duration risk but with little flexibility on the amounts they invest in the short-run. Thus, they are unable to immediately accommodate higher supply from the Treasury on the category of assets they hold (bonds). As time goes and they receive more cash from their customers, they may be able to absorb additional supply of bonds.

The main contribution of this paper is to improve our understanding of preferred habitat. Using debt supply shocks, we are able to study the demand curve for bonds but also for bills. This could not be done in the QE literature because bills are typically not part of central bank asset purchase programs. We also show that some agents (insurance companies, pension funds and foreigners) have preference for specific points of the yield curve but that this is not only due to the amount of duration risk that a given security carries, especially for bonds. Moreover, we provide evidence of significant costs, by the literature's standards, of surprise issuance of one type of security over the other. As shown by Faraglia, Marcet, Oikonomou, and Scott (2019) the issuance costs associated with auction announcements have dramatic implications on debt maturity and theoretically rationalize the use of short-term debt by sovereign issuers.[4] Our findings thus contribute to the understanding of governments' reliance on Treasury bills when they need to raise money quickly. Incidentally, our findings are also useful to estimate the effect of a potential Quantitative Tightening (QT) program, under which central banks announce the sale of some of their securities holdings.

The rest of this paper is organized as follows. Section II reviews the literature, section III describes the institutional background. Section IV details our empirical strategy and

[4] In fact, Faraglia et al. (2019) use empirical estimates from Lou et al. (2023), which is the closest US equivalent from our paper to calibrate the costs to issue debt. This cost to issue debt is the key friction of their model, which allows to rationalize the use of Treasury bills.

results. Section V presents evidence on the ownership structure of bills and bonds. Section VI concludes.

II Literature review

Our paper first contributes to the fast-expanding literature on preferred habitats, as theoretically modeled by Vayanos and Vila (2021). Empirically, some papers (*e.g.* Greenwood and Vayanos (2014) or more recently Gomez Cram, Kung, and Lustig (2025)) insist on the price of duration risk along the whole curve to explain yield variations following debt supply shocks. Other papers such as Ray et al. (2024), Selgrad (2023) or Lucca and Wright (2024) stress the "local" effects of supply and demand shocks on the yield curve, a pattern most consistent with the presence of preferred habitat investors. Using the institutional set-up of France, with frequent re-issuance and a large OIS market, we are able to show that duration risks plays a minor role in explaining yield changes around debt issuance. Lastly, we document that governments lean primarily on the T-bill debt market in case of shocks to the budget and extends the maturity of their liabilities afterwards. This suggests that bond investors can be relatively price-inelastic with strict quantity targets in the short-run, but that their demand may grow in the medium run, suggesting a dynamic dimension to preferred habitat.

Our paper has implications for the literature on the optimal maturity of debt. Seminal contributions in this field include *inter alia* Lucas and Stokey (1983), Angeletos (2002) or Aiyagari, Marcet, Sargent, and Seppala (2002). These articles model a Ramsey planner issuing risk-free debt. The main conclusion is that governments should issue large amounts of long-term debt, and hold short-term assets (*i.e.* negative issuance of short-term debt).

Moreover, government should buy back the whole stock of long-term debt and issue new long-term debt every year. As shown by Buera and Nicolini (2004), this leveraged strategy would imply borrowing amounts equivalent multiples of GDP in the long-term debt market. Such debt management recommendations are far remote from the observed behavior of governments. In order to bring theory closer to the practice of debt management offices, Faraglia et al. (2019) introduced transaction costs of issuing debt in a theoretical model. Once these costs are accounted for, theory delivers more realistic maturity profile and gives a role to short-term debt issuance Faraglia et al. (2019). To our knowledge, our paper is the first one to show that issuance costs are lower for bills than for bonds and that it is therefore less costly to issue such short-term debt when resources are needed quickly.

We also contribute to the literature on the price impact of sovereign debt auctions. Although sovereign debt issuance in OECD countries are typically regular and predictable events, they have an impact on securities price when they occur. This has been shown in the case of the US (Lou et al., 2013, , Phillot, 2025 and Ray et al., 2024), Canada (Allen, Hortacsu, Richert, and Wittwer (2024)), the UK (Lengyel, 2022), Spain (Bigio, Nuno, and Passadore, 2023), Portugal (Albuquerque, Cardoso-Costa, and Faias, 2024), Germany (Beetsma, Giuliodori, de Jong, and Widijanto, 2016), Italy (Sigaux (2024)) and Switzerland (Cavaleri, Ranaldo, and Rossi (2025)). Arcidiacono, Bellon, and Gnewuch (2024) show that the issuance of German benchmark bonds reduces the convenience yield of their French counterpart, nearly one-for-one.[5] To our knowledge, no paper has ever shown the lower impact of bill auctions, and therefore their advantage over bonds to

[5]Van Spronsen and Beetsma (2022) is one of the other rare contributions dealing with French debt auctions. It studies several countries and thus focuses on the 10-year bonds only.

finance quickly extra funding needs.[6] Given that France is the largest euro-area issuer of T-bills, it provides an ideal laboratory to study this question.

Lastly, our paper sheds new light on the nature of safe assets. While many contributions have explored the properties of safe assets from the demand side in periods of crises (*e.g.* (Greenwood, Hanson, and Stein, 2015; Gorton and Ordonez, 2022)), we show that T-bills face a relatively flat demand curve at all times. This may trigger their volume to rise during crisis also due to higher supply and not just increased demand. While often assumed in the literature, we also show that safe assets such as bills are not clearly more liquid than bonds by conventional metrics.

III Institutional background

Debt management offices (DMO) in high-income countries nowadays issue securities in a "regular and predictable manner". This approach was developed in the US by Paul Volcker when he was a Treasury official in the 70's (Garbade (2015)). It is believed that minimizing surprises, as opposed to "opportunistic" issuances, leads to lower volatility in the government securities market, which improves the safety characteristics of Treasury securities and in turn leads to lower funding costs over the medium run (Garbade (2007)), as summarized by then-assistant Treasury secretary Powell before the US Congress:

"*Treasury believes that the best way to achieve the goal of minimizing borrowing costs to the U.S. taxpayer is to minimize surprises to the market.*" Jerome Powell, (1991)

[6] Some papers such as D'Avernas and Vandeweyer (2024) have examined the price impact of bills issuance independently of bonds issuance. They find effects several orders of magnitude lowers than ours, suggesting that our setting offers key advantages to study this question.

This feature of modern debt management implies that any effect we observe on the yield of a security around auction is by construction extremely small, as the DMO intends to minimize volatility by implementing such regular and predictable routine.

The French DMO, the *Agence France Trésor* (AFT) issues T-bills (*Bon du Trésor à taux Fixe* or BTF) on Monday every week. Typically three different bills may be issued (*e.g.* with 3-month, 6-month and 12-month residual maturity).

On the first Thursday of the month, the French DMO issues long-term bonds, *"Obligation assimilable du Trésor"* (OAT) with 7-year residual maturity or more. Three different bonds are typically issued on those days (*e.g.* 8-year, 10-year and 12-year). On the third Thursday of the month medium-term bonds between 2 and 8-year maturity are issued. These medium-term bonds are also issued in batch of three (*e.g.* 3-year, 5-year and 6-year).

This regular and predictable auction process was introduced in 1986 in the context of a large-scale financial markets reform in France (Pons (1988)), and has been little changed since. We begin our study in January 1999, the start of the single currency, and thus avoid dealing with franc-denominated securities.

Every Friday, the Treasury announces which securities (identified by codes and maturity dates) will be (re)-issued on Monday and Thursday of the following week. That is, announcements come on T-1 and T-4 for bills and bonds respectively (see figures 2 and 3). Indicative volumes are also communicated. Crucially, exactly which security (bills or bonds) will be issued during the following week is not known before the announcement, except for "benchmark" bonds, as explained below. Historically, announcements came at various times during the day and we were not immediately able to identify these moments. For that reason, we feel more comfortable using daily end-of-day secondary market yields than intraday data.

Figure 2: Issuance timeline for bills

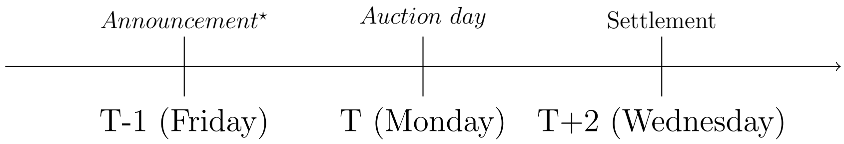
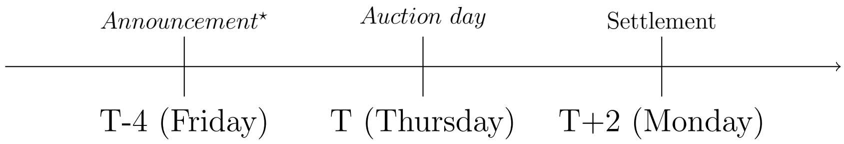


Figure 3: Issuance timeline for bonds



*The announcement contains the International Identifier Security Number (ISIN) codes of the securities to be issued and an indicative issuance size.

On auction day (every Mondays and two Thursdays per month), bids are submitted and ranked in ascending order for each security (bids carrying the lowest yields receiving priority). The exact size of the issuance, within the pre-announced range, remains at the discretion of the Treasury. This is different from the US set-up where the exact dollar amount to be issued is known in advance (Ray et al. (2024)). If selected, participants pay the price they bid for (multiple price auction). Only primary dealers (around 15 banks) can bid, unlike in the US (Amin and Tédongap (2023)).

In December of each year, the French Treasury announces the total amount of bonds it intends to issues the following year. The Treasury also announces which “benchmark” bonds it will issue. These are typically one new 3-year bond, a new 5-year bond and one or two 10-year bonds. These bonds are however never issued in one go, but most often in six consecutive times. During these six auctions, the new benchmark bond are said to be “on-the-run”, meaning it is the newest bond of this maturity bucket to have been created. When a newer bond of the same maturity bucket comes into existence the previous bond becomes “off-the-run”.

Another important difference with the US is that off-the-run bonds are a significant part of the financing of the French Treasury. They represented around half of the financing in our sample. It is not rare to see a 10-year bond being re-issued 8-times while off-the-run. A couple of 10-year were re-issued up to 11 times in our sample while off-the-run. Issuance of off-the-run bonds is more frequent on average than on-the-run bonds.

The amount of T-bills to be issued is not announced in December of each year, nor which tenor will be issued. This difference with the well-prepared schedule for bonds already suggests that, in the short-run, bond investors are less equipped to absorb large quantities of additional securities.

IV Empirical strategy

A Data

We gather data on the issuance of sovereign bills and bonds from the website of the French DMO (*Agence France Trésor*) from January 1999 to December 2022, including auction dates, amounts issued of each security (identified via the International Securities Identification Number, ISIN), pre-announced range of the issuance for each ISIN (available only for bills), and maturity date of the security. We merge our ISIN-issuance dataset with end-of-day secondary market yield-to-maturity from Bloomberg. Our daily panel of securities goes from January 1999 to December 2022. We also collect overnight index swap rates (OIS) rates, available in Bloomberg from 2004.

We remove outliers in terms of one-day change of yield-to-maturity (our main variable of interest) by taking out the 0.5% of the distribution on both sides, *i.e.* we ignore 1% of observations. We remove inflation-linked and green bonds. Lastly, we remove the last

30 days of the life of each Treasury security as their yields display much larger volatility right before being redeemed, and no security is re-issued so close to maturity. Tables 1 and 2 display descriptive statistics for each type of securities in the sample after these cleanings are implemented, for all days (table 1) during the sample period and on auction days only (table 2).

Table 1: Descriptive statistics, all days (after cleaning)

Bills (BTF)	Mean	σ	Min	Max	N
Yield (%)	0.94	1.61	-1.55	5.45	110256
Δ yield (bps)	-0.11	2.17	-15.80	15.70	110256
Issuance	0.04	0.29	0.00	5.01	110256
Residual maturity	145.76	94.35	30.00	370.00	110256
Bonds (OAT)	**Mean**	**σ**	**Min**	**Max**	**N**
Yield (%)	1.81	1.81	-1.09	6.28	211357
Δ yield (bps)	-0.06	3.75	-15.90	15.70	211357
Issuance	0.01	0.12	0.00	5.73	211357
Residual maturity	3527.03	3916.19	30.00	18752.00	211357

Notes: Issuances are in billion of euros and residual maturities are in days.

Table 2: Descriptive statistics, auctions days (after cleaning)

Bills (BTF)	Mean	σ	Min	Max	N
Yield (%)	0.84	1.56	-0.97	5.13	2226
Δ yield (bps)	0.06	2.64	-15.70	15.50	2226
Issuance	1.89	0.90	0.25	5.01	2226
Residual maturity	195.48	109.29	31.00	367.00	2226
Bonds (OAT)	**Mean**	**σ**	**Min**	**Max**	**N**
Yield (%)	2.05	1.79	-0.71	6.16	729
Δ yield (bps)	0.33	4.67	-15.40	15.40	729
Issuance	1.89	0.79	0.26	5.73	729
Residual maturity	4881.61	4056.25	510.00	18619.00	729

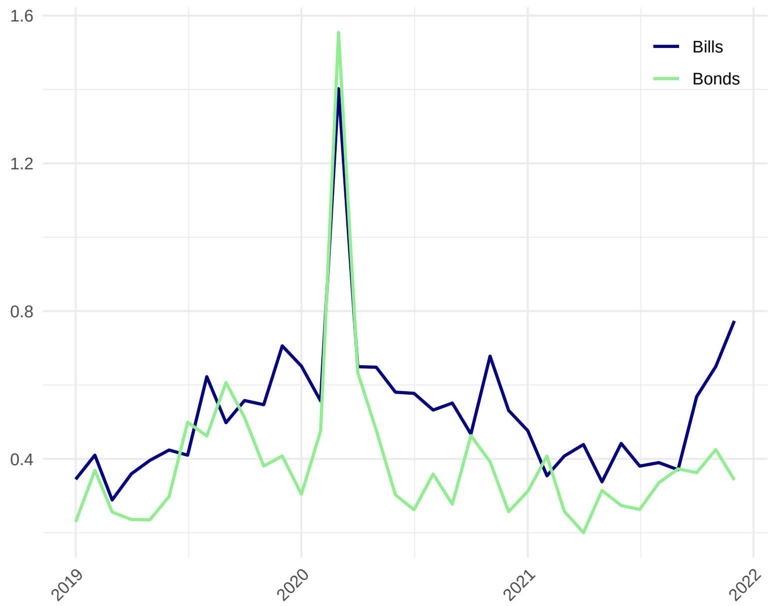
Notes: Issuances are in billion of euros and residual maturities are in days.

Naturally, the yield level (measured in percentage points) is on average larger for bonds than for bills, just like the standard deviation. This is consistent with a positive term premium on average and the larger duration risk associated with bonds compared to bills.

The yield change (measured in basis points), which will be our main variable of interest, is centered around 0 and is nearly perfectly symmetric, as shown by the minimum and the maximum values. Once again, the standard deviation is understandably larger for bonds than for bills. Interestingly, the average issuance size shown in table 2 is equal for bonds and bills during our sample period. The standard deviation of issuance is larger for bills, consistent with our stylized facts, suggesting a capacity for the Treasury to vary the issuance size for T-bills to a greater extent than for bonds.

Suggestive evidence of the ability of the Treasury to vary T-bill issuance can also be seen in auction prices. More specifically, one can look at the difference between the marginal rate of the auction (*i.e.* the least competitive accepted bid) and the average yield of accepted bids. This difference should represent the steepness of the demand curve for each bills and bond for the quantities supplied by the Treasury at each auction. This spread can be seen on figure 4. One can see that while the difference is always below one basis point, it increased markedly during COVID, and more so for bonds than for bills, even though the supply of the latter was raised significantly more than of the former. Unfortunately, marginal rates data are only available from 2019. Moreover, as explained in the next sub-section, marginal and average rates are by definition only available on auction days, which is why we rather use secondary market yields for our empirical analysis.

Figure 4: Average monthly spread between marginal and average rate of each auction (basis points)



Source: French debt management office's website

B Specifications

Our goal is to estimate the effect of government debt issuance on yield-to-maturity, which is ultimately what matters most to an issuer. Secondary market yields can serve as a proxy for primary market rates, which are by definition only available on auction days. Looking at the secondary market yield therefore allows to exploit more time-series (several days before and after issuance) and cross-sectional variations (all outstanding ISINs at one point in time and not only those re-issued). We check that in our sample the primary and secondary market yields are similar on auction days. As shown on figure 2 of the internet appendix, this is indeed the case. The difference between primary and secondary market yield is on average zero and uncorrelated with the amount issued.

Since we want to look at the secondary market yields few days before issuance, we cannot include newly issued bond in our sample. Moreover, the so-called "benchmarks" are around three new bonds of standard maturity issued each year. These maturities are 3, 5 and 10-year. These bonds are issued around six times in a row. During those months, the market knows that these bonds will be issued for sure. It makes these bonds hardly comparable with other securities, which re-issuance is uncertain. For that reason, we exclude these benchmarks when they are "on-the-run", that is as long as a newer benchmark has not been issued.

We run the following lead-lag model, separately for bills and bonds, to take into account announcement effects as well as post-issuance dynamics for each type of securities:

$$\Delta Y_{i,t} = \sum_{n=-5}^{N=5} \beta_n X_{i,t+n} + f_i + f_t + \varepsilon_{i,t} \tag{1}$$

where $\Delta Y_{i,t}$ is the daily change in the mid secondary market yield-to-maturity of ISIN i (expressed in basis points) between $t-1$ and t.

$X_{i,t+n}$ is the nominal amount of security i issued (variation of the total amount outstanding) on day $t+n$, where t is the date and n is an integer from -5 to 5 representing business days before and after issuance.[7] After looking at our results for one billion issued we replace $X_{i,t+n}$ by other indicators of issuance, such as dummy variables equal to 1 when there is an auction 0 otherwise. We also use announced amounts for that security's auctions instead of amounts actually issued.

We include both ISIN fixed effects (f_i) as well as date-fixed effects (f_t), to control notably for high-frequency shifts in demand (Kacperczyk et al. (2021)).

[7]Given that there are auctions and announcements of auctions every week in France, with sometimes securities issued two weeks in a row, we find it best to look at a window that is no wider than +/- 1 calendar week to avoid mixing up the effects of multiple auctions.

C Baseline results

The coefficients of our regressions are displayed on Figure 5 for bills and 6 for bonds. We observe a positive and significant reaction at the 1% level prior to the auction day (represented by day 0). Bills react one business day before the auction date while bonds react already four business days prior.

These are exactly the days when the ISIN and amounts to be issued are announced by the French DMO: announcements come on Friday for both bills and bonds, and auctions take place on Monday (one business days later) and Thursday (four business days later) respectively.

The increase in bond yields starts on announcement days (at T-4) and continues every single day until auction day, where the increase is significant at the 5% level but not at the 1% level. For bills, even if the increase seems to start before the announcement, there is no significant increase in the yield (even at the 10% level) before T-1, at which date it becomes significant at the 1% level. While we use a window of one week around auctions for both bills and bonds for symmetry, we show additional days prior to bond auction announcements in internet appendix D to demonstrate the absence of pre-trends.

Interestingly, T-bills' price impact is partly temporary. Indeed, the yield increases for bills are partially compensated after auction by some significant decreases, although smaller than the pre-auction rise. The patterns for bonds is different from what has been found in the literature for the US, for instance by Lou et al. (2013), who estimate the impact of an auction on yield to fade away completely after 5 days. This different pattern makes sense given that Lou et al. (2013) document the impact of issuances that are fully expected,

Figure 5: Yield change of bills (in basis points) around auctions for one billion euro issued

Figures 5 and 6 plot the yield change (in basis point) on days prior and after the issuance of a specific security. Auction day is day 0. The shaded areas mark announcement day (T-1 for bills and T-4 for bonds). Issuance is defined here as 1 billion euro issued. Yield changes are not cumulative from one day to the next.

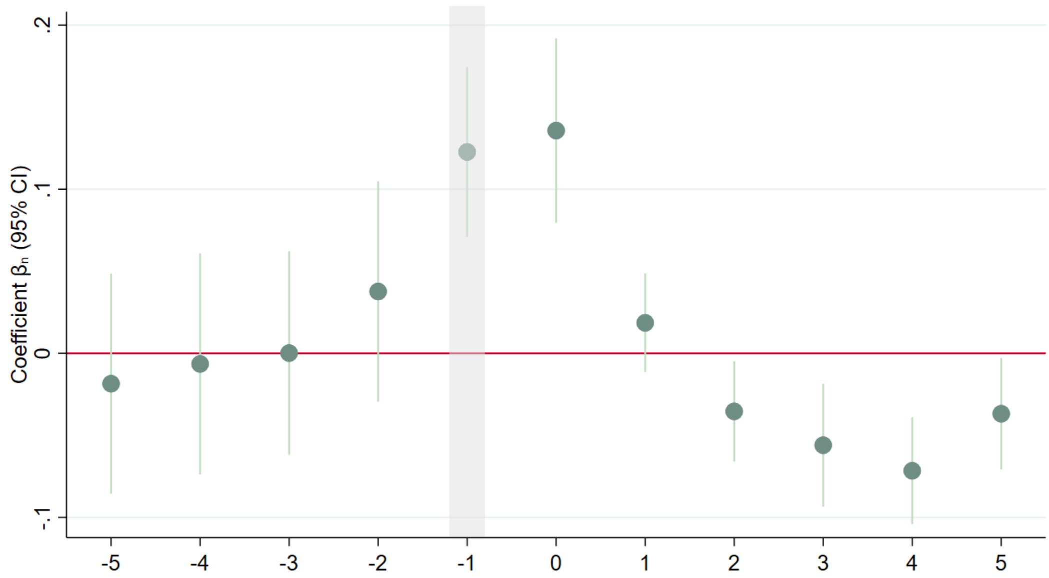


Figure 6: Yield change of bonds (in basis points) around auctions for one billion euro issued

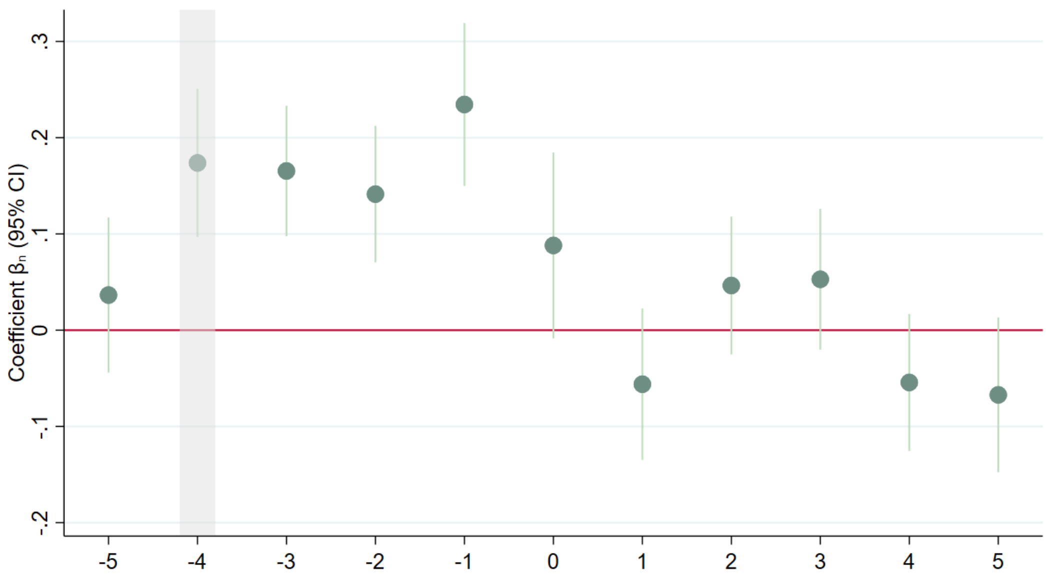


Table 3: Impact of 1 billion euro of additional issuance on yields

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. Robust standard errors are clustered by date.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.290***	0.803***	0.292***	1.078***
p-value	[0.000]	[0.000]	[0.002]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	99442	208131	62892	121075
R^2	0.548	0.789	0.565	0.804
Adjusted R^2	0.515	0.783	0.533	0.798

contrary to our empirical exercise where there are surprises regarding which security and how much of it will be re-issued.[8]

In any case, the absence of any significant increase in yields prior to the announcement and the sharp rise upon announcement make us confident that we are identifying unexpected supply increases of specific securities.[9]

In order to estimate the cumulative yield increase that the Treasury incurs between the announcement of the auction and the actual sale of the security, we cumulate the coefficients from four days before the auction, to auction days, *i.e.* $\sum_{n=0}^{4} \beta_n$. We test the significance of the sum of these coefficients. This method is equivalent to the plots of Lou et al. (2013) or Beetsma et al. (2016), who look at confidence intervals around the sum of these coefficients. Results are shown in the first two columns of table 3.

[8]We thank an anonymous referee for making this point.

[9]Duarte and Umar (2025) make a similar argument in the context of the surprise suspension of some auctions.

We can see that the total yield increase after announcing the issuance of a T-bill is 0.290 basis points per billion euro issues (column 1), much less than for bonds, which coefficient stands at 0.803 basis point per billion euro issued. If we stop our sample before January 2015, date at which the ECB and euro-area central banks started to buy government bonds (and virtually no bills) in large amounts, the coefficient for bills remains nearly unchanged but the coefficient for bonds increases significantly to 1.078 basis point per billion issued, more than three times the coefficient for bills (columns (3) and (4)). This larger price impact prior to 2015 is intuitive considering the absence of a large bond buyer such as the central bank.[10] Given that central banks slowed down or stopped purchasing bonds in 2022, estimates on the pre-QE sample may be more informative for present and future debt management practices than estimates on the full sample.

Even if part of the effect we measure is transitory (especially for bills), the Treasury transacts in the (primary) bond market on day 0 and thus incurs the cost of the full increase we detect between announcement and issuance. The presence of time fixed effects probably leads to ignore the impact that securities issuance have on similar securities on the same day. We address this issue in section F. We also run our regression using issuance in percentage of GDP and in proportion to the outstanding amount of the security, as opposed to billion of euros. Results are shown in internet appendix E. The difference in bills and bonds is then more than one to three in the full sample and nearly one to four in the pre-QE period. However, we are primarily interested in the financing of the Treasury

[10]Early in 2015, the ECB announced the start of its Public Sector Purchase Program (PSPP), under which it bought up to 15 billion euros per month of French debt. Only bonds were eligible under that program. In March 2020, the ECB announced a Pandemic Emergency Purchase Program (PEPP). Even if bills were theoretically eligible in this second program, the weighted average maturity of the PEPP portfolio for France was never below 6.9 years at the time of writing, *i.e.* it was composed mostly of bonds.

and in comparing our estimates to the literature. In the rest of this paper, we therefore focus on issuance impact per billion euros issued.

Crucially, we show in our robustness section that if we run the baseline excluding the periods of stress such as the GFC and COVID-19, the difference between the price impact of bills and the price of bonds grows to one to five. Thus, we are confident that our results are not driven by years of crises when one could suspect that the demand for safe assets would lower the price impact of bills.

Lastly, it is important to stress that announcements for bills contain a range for each individual security, while announcement for bonds contain a range for the aggregate amount of all three bonds to be issued the following week, leaving more room to the Treasury to adjust issuance amount between announcement and auction day. We will show in the next subsection that neutralizing this strategic behavior only accentuates the difference in the price impact of bonds *vs.* bills. Still, we acknowledge that relatively more (*resp.* less) information is revealed for bonds than for bills on auction (*resp.* announcement) day. However, figure 6 shows that most if not all the effect on bond yields appear before auction day, and that the yield impact on auction day is in fact nearly insignificant. This suggests that the minor difference in the information revelation process cannot explain why bond yields react more than bills yields.

D Reverse causality

One may suspect some reverse causality. For instance, the French DMO may issue systematically more bonds if there is a limited increase in the yields after its announcements. This would bias our coefficients toward 0. This phenomenon recalls the challenge faced in the QE literature, when central banks may buy securities which react the least to their purchases (Arrata, Nguyen, Rahmouni-Rousseau, and Vari (2020), Koijen, Koulischer, Nguyen, and Yogo (2021)). However, in the French debt issuance context, we have the advantage of knowing exactly when and what the market learns about the sale. We use this feature in two ways.

One way to neutralize the behavior of the DMO between the announcement and the actual auction is to use the range of the amount to be issued, which is communicated to the market when it announces which security it will issue. This range is unfortunately only available for bills on an ISIN-by-ISIN basis. We thus replace our independent variable with the middle of the range announced for each T-bill. The results are displayed in columns (1) and (2) of table 4. These are close if not identical coefficients to our baseline.

Table 4: Impact of announced amounts and of auction events on yields

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity in basis points. The independent variable is the amount announced (columns 1-2) or a dummy variable equal to 1 when the security issued (columns 3-6). Robust standard errors are clustered by date.

	1 Bills ann.	2 Bills ann. pre-QE	3 Bill dummy	4 Bond dummy	5 Bill dummy pre-QE	6 Bond dummy pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.290***	0.296***	0.336***	0.974***	0.292***	1.206***
p-value	[0.000]	[0.002]	[0.000]	[0.000]	[0.001]	[0.000]
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99442	62892	99442	208131	62892	121075
R^2	0.548	0.565	0.548	0.789	0.565	0.804
Adjusted R^2	0.515	0.533	0.515	0.783	0.533	0.798

In order to look at bonds, we run regressions where instead of using the amounts issued as the right-hand side variables, we employ a dummy equal to 1 when the ISIN is re-issued and 0 otherwise. In this way, we measure the impact of an average issuance, which is dictated by long-term budgetary considerations rather than the effect of a specific issuance, which may be strategic. This second strategy is similar to Lou et al. (2013), even if there are important differences, due to the institutional set-up, and notably re-issuances. We employ the same method with bills for comparison.

The coefficient plots for regressions using dummy variables are shown on figure 7 and 8, and display similar patterns as per-billion auction. Coefficients are divided by 1.89, the average size of an auction in billion of euro for comparison with the baseline. The pattern for bonds seems somehow cleaner, with a nearly-exact same increase at T-4, T-3 and T-2.

Table 4 shows on column (3) and (4) the daily increases in the yields of bills and bonds respectively, cumulated over the four days preceding the auction, for the whole sample. Coefficients are slightly higher than in the case of the baseline suggesting a small bias towards zero in the baseline. Yields on bonds are still found to react by around three times as much as for bills, at 0.974 basis points *vs.* 0.336. The difference between bills and bonds increases during the pre-QE period, where the coefficient on the latter is more than four times larger than the coefficient on the former (0.292 *vs.* 1.206) as shown in columns (3) and (4).

Overall, results of table 4 suggest that there is little if no systematic change in the plans of the DMO between the announcement and the actual auction, but that in any case bonds react more strongly to additional supply than bills. In theory, the market could be anticipating the issuance of a given security, even before it is announced, which would again lead us to underestimate the impact of issuances on yields, as part of the increase would already be priced-in when the announcement comes. However, there is at one point in time a comparable number of bills, medium-term bonds and long-term bonds, around 20 of each type (see figure 3 of the internet appendix), and thus there is no reason that

Figure 7: Yield change around bill auctions (in basis points), for a given ISIN being re-issued (discrete event)

Figures 7 and 8 plot the yield change (in basis point) on each day prior and after the issuance of a specific security (defined at the ISIN level). Auction day is day 0. The shaded areas mark announcement day (T-1 for bills and T-4 for bonds). Issuance is defined as a dummy variable equal to 1 when there is an issuance and 0 otherwise. Coefficients are then divided by the average size of an auction (1.89 billion euro) to make these coefficients directly comparable to the baseline.

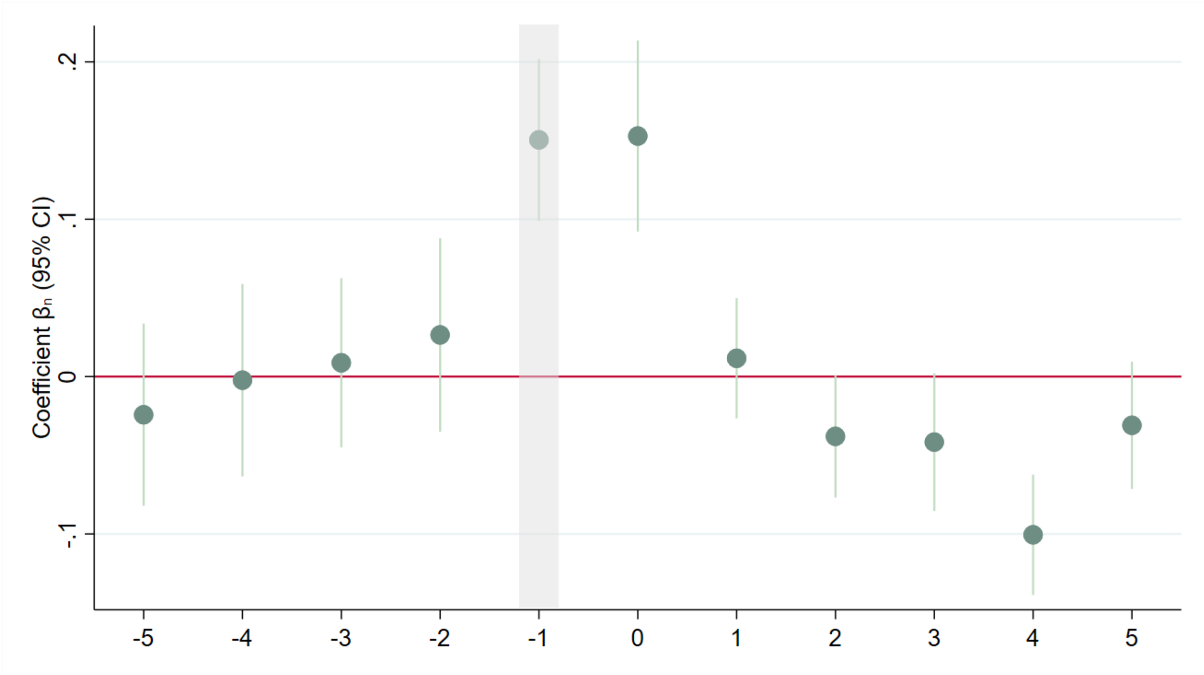
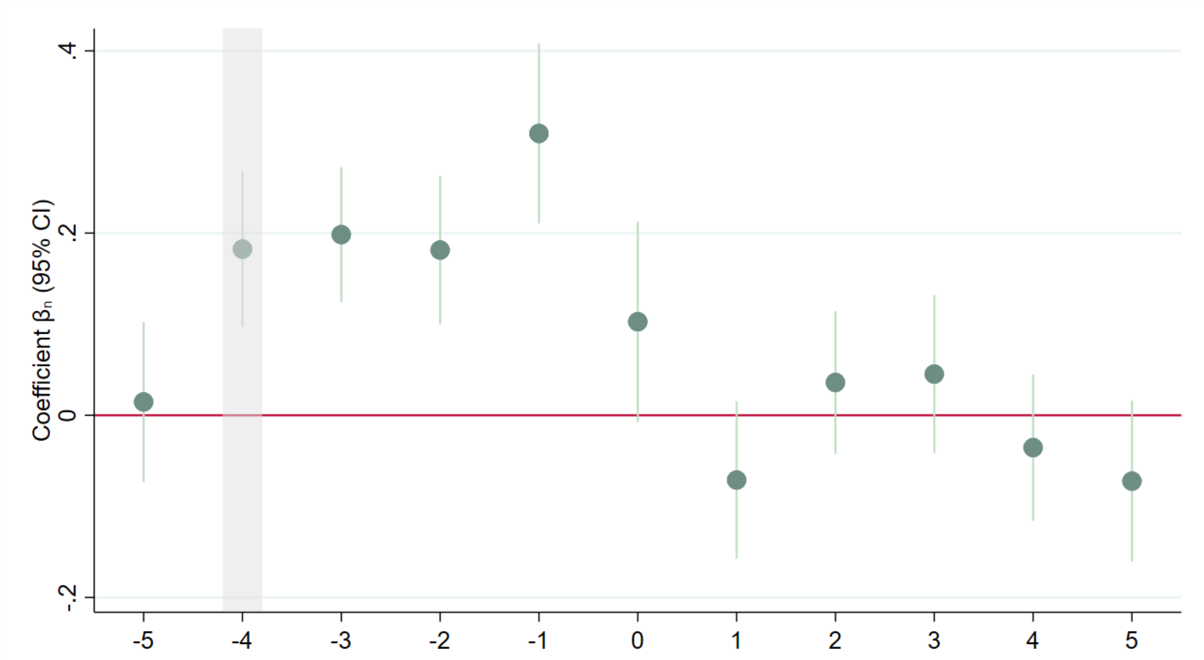


Figure 8: Yield change around bond auctions (in basis points), for a given ISIN being re-issued (discrete event)



one category of securities could be better anticipated than another ahead of the auctions dedicated to that type of security. While slightly more information is revealed for bonds on auction days (the range to be issued is available only for bills), most if not all the yield increase occurs prior to the auction, especially for bonds, suggesting that most of the effect comes from whether a bond will be re-issued or not. Information revealed on auction day such as how much is actually issued seems to play little if no role.

E The role of duration risk

Standard intuition would suggest that bond supply raises yields because it increases the amount of duration risk that the market has to bear, the exact opposite of QE (Greenwood and Vayanos (2014)). One way to look at this question is by examining the spread between the yield of a security of a specific maturity and the overnight index swap rates (OIS) of the same maturity, a measure of the asset swap spread. OIS should carry both expectations of future interest rates and the price of duration risk, *i.e.* the term premium in euro. If increases in the supply of bonds raise their yields through a change in the term premium, the yield-OIS spread should not react to news of future issuance. OIS are among the most liquid euro-denominated fixed income instruments and are used in the context of high-frequency identification (Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019)).

We construct daily swap curves from standard OIS maturity retrieved from Bloomberg. Using a Nelson-Siegel-Svensson model, we compute the term structure for each day at one-month interval and match these monthly nodes of the swap curve with each security based on its residual maturity. We then run our baseline regressions using the asset swap spread on the left-hand side and billion issued on the right-hand side with day and ISIN fixed-effects.

Table 5: Impact 1 billion of additional issuance on yield-OIS spread

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the asset swap spread in basis points. Robust standard errors are clustered by date.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.305***	0.591***	0.307**	0.995***
p-value	[0.006]	[0.000]	[0.026]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	83529	178396	48044	94277
R^2	0.559	0.757	0.583	0.765
Adjusted R^2	0.529	0.750	0.554	0.758

Results are shown on table 5. For comparisons, we run regressions on the same sample (table 3 of the internet appendix) given that OIS were not available in the early days of the euro-area. As expected, coefficients drop for bonds but remain positive, significant and larger than for bills. In the pre-QE period, one billion issued increases asset swap spread by 0.995 basis points, that is slightly less than the 1.16 basis points for bonds yields (column (4) of table 3) but remains really close. This suggests that most of the effect of issuance on yields does not come from a rise in the term premium, which is is the price of duration risk (Vayanos and Vila (2021)).

To confirm that all the bond yields' increases do not come only from the term premium, we run our regressions on a subsample of bonds of different maturities. We cut our bond sample in three, according to residual maturity. We call "short" bonds all those with less than 3-year of residual maturity, the standard maturity for the shortest bonds issued by the French Treasury. We then call "medium" bonds those between 3 and 8 years of residual maturity, thus capturing the standard 5-year bond but not any 10-year bond issued in previous years. Lastly, the "long" bonds category includes all bonds with residual maturity of 8 years or more. These thresholds at standard maturities allow to have a comparable number of observations in each bucket. Results of these regressions for the whole sample and the pre-QE period are displayed in table 6.

Table 6: Results for each bond maturity buckets

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the yield to maturity in basis points. Robust standard errors are clustered by date.

	1 Short	2 Medium	3 Long	4 Short pre-QE	5 Medium pre-QE	6 Long pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.806***	0.389***	0.405***	0.863***	0.720***	0.500***
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59536	68592	79773	35990	41994	42893
R^2	0.757	0.971	0.959	0.778	0.973	0.954
Adjusted R^2	0.730	0.968	0.956	0.751	0.971	0.949

One can see that actually the effect of issuance on bond yields does not increase with maturity, but quite the opposite, especially in the pre-QE period. In the full-sample regressions, the effect of issuance for the shortest maturity bonds is nearly twice as large as for the longest maturity bonds (columns (1) and (3) of table 6). Moreover, the bonds most affected by QE seem to be those of medium maturity (columns (2) and (5)). This makes sense given that ECB QE portfolio for France had a weighted average maturity between 6 and 7 years, suggesting heavy purchase on that segment.[11] This result is all

[11] See this webpage for public historical data on the weighted average maturity of the Public Sector Purchase Program (PSPP) portfolio: https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html

the more surprising that the so-called "short" bonds are not some very old and illiquid securities recently re-issued. On average, the initial maturity of old bonds is 7 years, compared to 9.7 years for "medium" bonds and 25.2 years for "long" bonds.

Such a pattern is consistent with the notion of preferred habitat, *i.e.* markets are segmented as some agents want a specific asset with specific maturity to match their needs. Demand elasticity may not decrease monotonously with duration risk as would be the case in the absence of preferred habitat, with agents willing to bear only limited duration risk (Vayanos and Vila (2021)).[12] In section 5, we will present evidence that bonds are indeed held by investors who may have specific needs along the yield curve while bills investors may care less about maturity.

Incidentally, the secondary role played by duration risk suggests that primary dealers are not the only force behind the price dynamics we observe around auctions. Dealers have no reason to be attached to specific points of the yield curve and should only try to avoid taking excessive duration risk with their inventories, as explained by Fleming, Nguyen, and Rosenberg (2024). In line with Jansen, Li, and Schmid (2024), we classify primary dealers as risk-averse arbitrageur in the sense of Vayanos and Vila (2021), at least when it comes to their own inventory holdings. We thus conclude that at least part of the impacts we observe, is due to the presence of preferred habitat investors.

F Spillover from other securities issuance

Up to now, we have focused on the effect of issuance on a security's own yield. However, in the presence of preferred habitat and limited risk-bearing capacity, supply and demand

[12]We would like to thank Antoine Hubert de Fraisse for this insight.

shocks should have effects on other securities of similar maturity (Ray et al. (2024), Selgrad (2023)). Such interactions are particularly important in the context of French Treasury auctions where three of four securities of the same type (bonds or bills) are issued on the same day.

In order to control for cross-security spillovers, we add as explanatory variables the issued amount of all securities of the same type (all bonds and all bills) on those days. This requires removing date fixed-effects. We use year fixed effects instead to control for changes in GDP, the general price level and the fiscal deficit.[13]

Because we do not have a high-frequency controls for the demand of bonds and bills in the form of date fixed effects, we include the total amount of bids at auctions for each ISIN. This is very close to Ray et al. (2024) or Kacperczyk et al. (2021) who use the bid-to-cover ratio. We just include the numerator and denominator separately. Like them, we assume that demand impacts the market when it is revealed, on auction day. We also control for other important high-frequency variables, such as changes to the term structure of interest rates using overnight index swaps for each maturity, general risk aversion using the VIX and credit risk using the 5-year CDS on France. All these controls variables are taken in first difference, just like yields.

Results are shown in table 7. In general, coefficients for "own issuance" are significantly larger than for regressions with date-fixed effects. In the pre-QE period, bonds issuance impact yields by 2.793 basis points. Like in the baseline, this number is between three and four times larger than the impact on bills (0.914 basis points). Once again, we find that QE had little effects on bills but a large impact on bonds, with the yield impact nearly

[13]It would not make sense to use week of month-fixed effects because bills are issued in batch of three or four every week, long-term bonds are issued once a month and medium-term bonds too.

two times as large during the period where the central bank is absent compared to the full sample (columns (2) and (4)).

Table 7: Impact of 1 billion of issuance of a security and of all securities of the type (bonds and bills) on yields

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable of interest is the amount issued of a security and of its closest substitutes, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. Robust standard errors are clustered by date.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued Own	0.948***	1.366***	0.914***	2.793***
	[0.000]	[0.005]	[0.000]	[0.000]
$\sum_{t=0}^{4}$ Issued Others	-0.053	0.091	-0.037	0.267**
	[0.632]	[0.297]	[0.828]	[0.017]
Demand	-0.185***	-0.300	-0.180***	-0.758***
	[0.000]	[0.141]	[0.000]	[0.009]
OIS	0.018	0.066***	0.016	0.056***
	[0.247]	[0.000]	[0.342]	[0.004]
VIX	-0.073***	-0.206***	-0.133***	-0.422***
	[0.000]	[0.000]	[0.000]	[0.000]
CDS	-0.012	0.018	-0.008	0.025
	[0.489]	[0.571]	[0.648]	[0.456]
Year FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	71598	151100	44487	87354
R^2	0.053	0.033	0.061	0.057
Adjusted R^2	0.041	0.032	0.049	0.055

As expected, demand (measured by the total amount of bids) is negatively signed and OIS is positive and significant for bonds. CDS is not significant, while VIX is. These two coefficients suggest that France benefited from safe-haven flows in times of stress as yields reacted negatively to market-wide stress (VIX) and was not sensitive to France perceived sovereign risk (CDS). We discuss further the role of crises periods in our robustness section.

The overall increase in the coefficient associated with a security own issuance suggests that date fixed effects absorb large portions of the change in yields in a given day. This is most likely because date fixed effects suppressed the average increase of all bond (*resp.* bill) yields on a given auction day. Removing date fixed effects and replacing them by our high-frequency controls, and in particular overnight index swap rates of the same maturity, allows to have a more precise estimate of the increase in yields following a surprise issuance.

However, the coefficient associated with the issuance of other securities is in general not significant. How can this be? We show in table 8 that one needs to take a more granular approach to capture spillovers.

More specifically, we do not test for the total amount of bonds (*resp.* bills) being issued but rather for the issuance of the closest ones in terms of maturity. For each bond (*resp.* bills) we select the two bonds which are the closest in terms of maturity: one with higher maturity and one with lower maturity, thus one bond is in "between" its two closest bonds. Then, we select the second closest ones and so on. For each security, we select ten pairs of bonds and take the sum of the issued amount of these two bonds.

As shown in columns (2) and (4) of table 8, the impact of issuance of securities of similar maturity on a bond yield is positive, significant and generally decreases with their distance to the bond on the yield curve. In fact, with the exception of the 2nd and the 7th closest securities for the whole sample and of the 3rd and 5th closest securities for the pre-QE sample, the impact of issuance decreases monotonously with the distance on the yield curve. Significance decreases monotonously for the ten pairs in all cases.

For bills, the issuance of neighboring securities have no impact. This makes sense as T-bills have by construction low duration risk and are close substitutes for cash. For

Table 8: Impact of the issuance of other securities

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The main independent variables are the amount issued of the security and of its closest substitute, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. For this table only, we remove filters on outliers.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
Own	0.950***	1.424***	0.876***	2.968***
Closest	-0.001	0.391***	-0.027	0.636***
2nd Closest	0.028	0.466***	-0.014	0.682***
3rd Closest	-0.015	0.321***	-0.038	0.486***
4th Closest	0.008	0.305***	-0.046	0.411***
5th Closest	-0.024	0.295***	-0.032	0.372***
6th Closest	0.022	0.246***	-0.008	0.379***
7th Closest	0.004	0.313***	0.023	0.405***
8th Closest	0.046	0.186*	-0.010	0.389***
9th Closest	0.045	0.161*	0.026	0.309**
10th Closest	0.051	0.176*	0.020	0.241**
Demand	-0.192***	-0.331	-0.184***	-0.808***
	[0.000]	[0.104]	[0.000]	[0.006]
OIS	0.018	0.066***	0.016	0.056***
	[0.239]	[0.000]	[0.341]	[0.004]
VIX	-0.073***	-0.205***	-0.132***	-0.419***
	[0.000]	[0.000]	[0.000]	[0.000]
CDS	-0.012	0.019	-0.007	0.024
	[0.503]	[0.557]	[0.682]	[0.467]
Year FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	71598	151100	44487	87354
R^2	0.053	0.033	0.061	0.057
Adjusted R^2	0.039	0.031	0.046	0.054

that reason, one should expect the influence of preferred habitat investors on T-bills to be less pronounced. This is in line with the theory of Vayanos and Vila (2021) which states that when there is no constraint to arbitrage, preferred habitat investors have no impact. This is also in line with the mechanism and elasticities found in Jansen, Li, and Schmid (2024).[14] This is evidence that bond market investors are more attached to specific maturity points on the yield curve, while T-bill investors do not care much about maturity, given that they are anyway fairly short.[15] Moreover, these results also show that the issuance of one bond impacts the yield of other bonds, suggesting that bond yields are not determined in isolation, which would happen if there were only preferred habitat investors on the market without any risk-averse arbitrageurs. We thus conclude that the two types of agents are present on the French debt market.

Incidentally, removing date fixed-effects enables us to identify larger impacts (3.06 basis points), but are very much credible when compared to rest of the literature. For instance, Lou et al. (2013) find that the five-day increase before auctions in bond yields to be between 2.3 and 4.3 basis points per billion euro issued for US bond auctions. For the UK, Lengyel (2022) finds that issuance shocks cause 0.8 to 1.2 basis points increase in yields per billion euro issued.[16]

[14]"First, the Treasury market exhibits a steeply downward sloping term structure of market elasticity, with strong arbitrage forces at the short end because of lower risks but substantially weaker ones at the long end" (Jansen, Li, and Schmid (2024)).

[15]Bill investors may be willing to migrate from one bill to the other whenever there is a reopening to exploit the yield increase. However, we believe that such arbitrage would bring relatively little gains (the increase in yields is less than a basis point following a reopening) and it would be costly, as evidenced by the significant bid-ask spread on the yields of T-bills discussed later.

[16]To make these calculations, we convert US Dollars and British Pounds in euros using the daily average exchange rates during the sample period of these two studies.

G Robustness

The first and most important test to demonstrate the solidity of our results is to run our regressions taking out periods of acute crises, which one may suspect to be the driver of the low impact of bills issuance on yields, as governments could exploit safe asset demand in time of stress. Thus, we re-run our baseline without the Global Financial Crisis (GFC) and COVID-19. To avoid using arbitrary dates, we take out all observations for one full year starting on 15 September 2008, when Lehman Brothers failed, for the GFC and one full year starting on 11 Mach 2020, when WHO characterize COVID-19 outbreak as a pandemic. Results are shown in table 9.

Table 9: the baseline without GFC and COVID-19

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. For this table only, we removed one year of data corresponding to the GFC and one year of data corresponding to COVID-19.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.221***	0.832***	0.193**	1.010***
p-value	[0.005]	[0.000]	[0.045]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	90382	187882	58262	111821
R^2	0.530	0.794	0.549	0.817
Adjusted R^2	0.496	0.788	0.515	0.810

Table 9 shows results extremely close to the baseline, and in fact the difference between bills and bonds is slightly larger when crises observations are removed. In the pre-QE period, the coefficient for bonds is now more than five times larger than the coefficient for bills. In table 4 of the internet appendix, we show that if we are even more conservative and take out the full years 2008, 2009, 2020 and 2021, the conclusion is the same. That is, the gap we have shown between bills and bonds in terms of price impact at issuance is in fact slightly larger than in the baseline and we can thus be confident that it is not at all a by-product of crises years.

In our second robustness test, we run our regressions but this time including outliers, *i.e.* including the 0.5% of observations on each side of the distribution that were previously removed. Results are shown in table 10. Once again, the difference between bills and bonds in terms of coefficient size and significance tends to grow, and is more than one to five in the pre-QE period. If anything, this result stresses the conservativeness of our baseline when estimating the difference in the price impact of bills *vs.* bonds.

Table 10: Including outliers

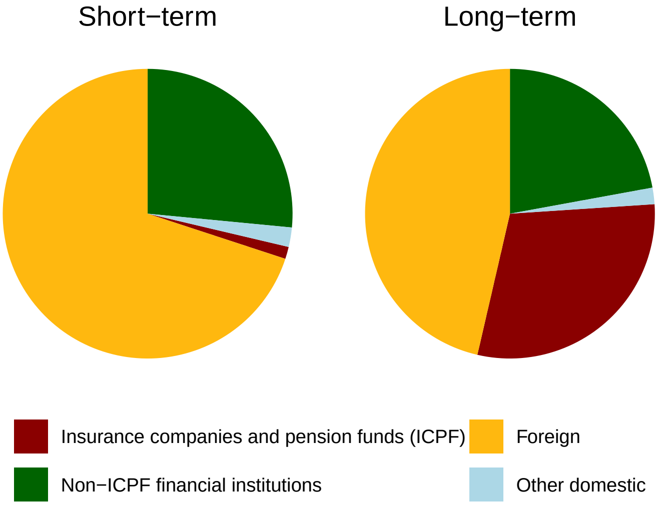
This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. For this table only, we remove filters on outliers.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.256**	0.831***	0.214	1.114***
p-value	[0.012]	[0.000]	[0.110]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	99900	209449	63290	121867
R^2	0.395	0.796	0.378	0.807
Adjusted R^2	0.351	0.789	0.332	0.801

V Who are the preferred habitat investors?

In previous sections, we showed that bills and bonds react differently to supply shocks, a pattern consistent with the presence of preferred habitat investors. In this section, we

Figure 9: Holding of bills (short-term) and bonds (long-term) per institutional sector



Source: ECB's securities holdings statistics (SHS) and quarterly sector accounts statistics (QSA). Average over 2013 (first observations) to 2020. Eurosystem purchases under the public sector purchase program (PSPP) have been excluded using ECB monthly reporting.

Note: Non-ICPF financials institutions include banks and all non-foreign financial institutions such as mutual funds. Foreign include all non-residents (public and private). Other domestic include non-financial corporations and households.

shed some light on who these different investors are and why they may prefer bonds over bills or vice-versa.

We start our investigation by looking at the ECB Securities Holdings Statistics (SHS) database. This dataset gives information for each government securities market of the euro-area and splits holders for bills and for bonds separately since 2013. Holders are grouped by categories such as Insurance Companies and Pension Funds (ICPF), Monetary and Financial Institutions (Banks), non-residents, *etc.* We graph the investor base (excluding the Eurosystem) on figure 9. The graph reveals stark differences. While ICPF are the single largest holders of French bonds, they represent only a modest fraction of T-bills outstanding. The latter category of securities is largely held by foreign institutions.

The presence of ICPF on the bond market is noteworthy as their preferred habitat behavior has been widely recognized in the literature. On the theoretical front Vayanos and Vila

(2021) use pension funds to exemplify preferred habitat investors. On the empirical side Koijen et al. (2021) or Arrata et al. (2020) show that asset purchase programs have a greater impact on yield or repo rates when ICPF are present, stressing their price-inelasticity.Jansen, Li, and Schmid (2024) show a similar result for the US bond market. Symmetrically, it is plausible to think that securities held mostly by this type of investors should see a greater price impact when they are issued.

Insurance companies and pension funds may have different demand curves at different maturity points, and it may not be possible to know *a priori* how demand changes with duration. In the short-run, they cannot expand their balance sheet beyond the insurance premia they receive from customers, a sticky flow. Kubitza (2023) shows empirically that premia payments significantly moves the bond demand of insurance companies. Moreover, insurance companies and pension funds have strict duration targets they need to adhere to. Investing into assets of duration higher or lower than their liabilities exposes them to a maturity mismatch (Guibaud, Nosbusch, and Vayanos (2013)). The duration of their portfolio is also heavily influenced by regulation (Jansen (2024), Greenwood and Vissing-Jorgensen (2019)).

The situation for T-bill investors is radically different. The share of ICPF in the holding structure of short-term debt is significantly lower than for long-term debt. Conversely, the share of foreign investors is significantly higher. Foreign investors may be private or public, such as foreign central banks. The crucial role of foreign investors in the US Treasury market and other government bond markets has been stressed by Somogyi, Wallen, and Xu (2025).

Why do foreign investors hold French Treasury bills? A natural argument is that bills are supposed to be more liquid on the secondary market than bonds (*e.g.* Nagel, 2016).

However, we show on figure 10 that French T-bills are in general less liquid than bonds, when using the standard measure, the bid-ask spread. Indeed, one can see that bid-ask spreads for bills are in general higher than for bonds (figure 10) and the 1-year tenor is consistently the most liquid of the bills.

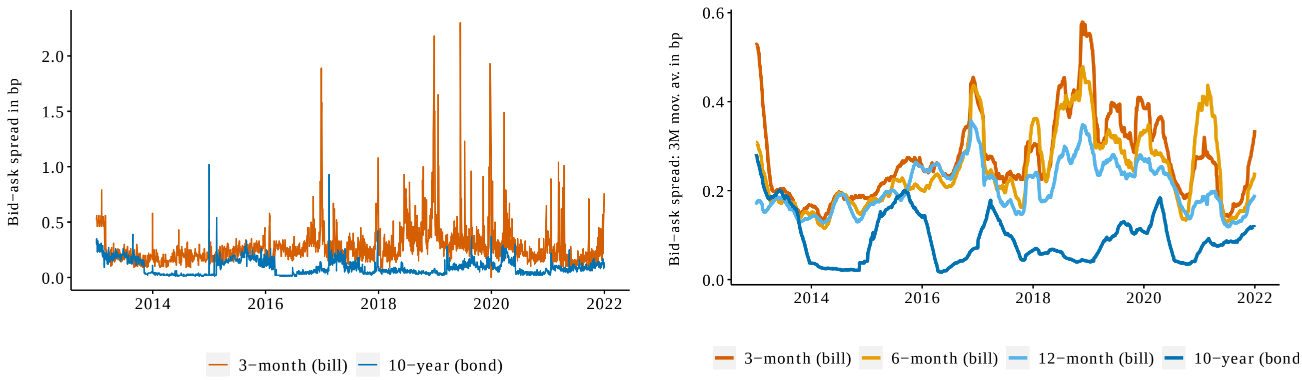
This suggests that it may actually be more expensive to buy and sell a bill on the secondary market than a bond, contrary to the standard intuition from the safe assets literature. This feature may not be specific to France and has been hinted in the case of the US some time ago by Fleming (2001), who showed T-bill bid-ask spreads to be higher than for bonds, and trading frequency to be higher for the latter category of securities.[17] This incidentally shows that our results cannot simply be explained by differences of secondary market liquidity. It is possible that this phenomenon is related to bid-ask spreads generally widening (in yield terms) as securities approach maturity, as documented by Fleming (2002).

[17] One should note however that we compute the bid-ask spreads based on yields and not on prices. While we believe that yields are the correct metric in this case because it compares well with our empirical exercise and is most relevant to the issuer, bid-ask spreads on prices might still be tighter for bills. If one was to use the price bid-ask spread, *e.g.* as in Chordia, Sarkar, and Subrahmanyam (2004), results would differ. For instance, the French 10-year on-the-run bond has a price bid-ask spread on average five times larger than the on-the-run 3-month bill over the period shown on figure 10.

Figure 10: Bid-ask spreads

This figure plots the bid-ask spread for the on-the-run 3-month and 10-year security issued by the French government. 3.b plots uses 3-month moving average for all French on-the-run T-bills (3-month, 6-month and 12-month initial maturity). Using moving average smooths out volatility and allows to plot more securities while keeping the graph readable.

(a) Daily data (b) Moving averages



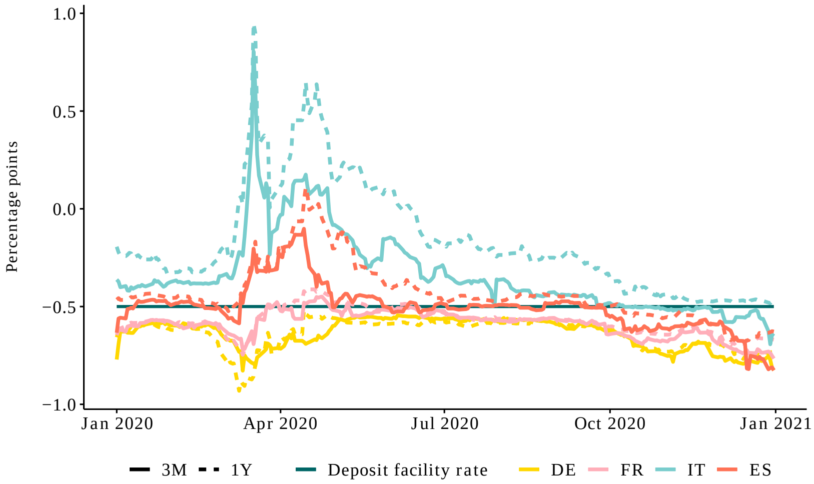
Source: Bloomberg

It must therefore be noted that the main feature of bills and the reason they are sought after is not their secondary market liquidity but, more probably, their their low interest and credit risk. Foreign investors may need to redeploy any cash inflow, coming from the sale or the payment from an asset in safe cash-like assets like repo or Treasury bills. Foreign central banks need to receive steady inflows of cash to be able to intervene on the FX market and may thus be looking for assets with redemption liquidity. They may accumulate a T-bill portfolio with staggered repayments to get cash regularly.

To be sure, France during our period of study redeemed one bill every week and was considered safe. As can be seen on figure 11, French and German T-bills showed similar flight-to-safety properties during the pandemic, at the opposite of Spain and Italy. Logically, the IMF Sovereign Debt Investor Base for Advanced Economies, reveals that an average of 17% of French debt is held by foreign central banks, compared to just 9% for Spain and 5% for Italy.

Figure 11: Yields on 3-month and 12-month T-bills for the four largest Euro-Area countries

This figure plots the yield-to-maturity of 3-month (thick lines) and 12-month (dashed lines) T-bills for the four largest Euro-Area country. Each color correspond to a country.



Source: Bloomberg

VI Conclusion

In this paper, we documented that when a government needs to raise a large amount of money quickly, it will favor the short-term debt market. This feature of debt management is visible in the data and in statements made by debt management offices and Treasury officials. Based on the rich set-up offered by French Treasury debt auctions, we have shown empirically, in the largest euro-denominated T-bills market, that indeed short-term debt issuances have a lower price impact than long-term debt issuances. The latter raise yields by four times as much as the former. This difference is not a by-product of crisis times and remains even when several years of crises are removed from the sample. Central bank purchases in the bond market consistently lower the price impact of auctions on yields.

The larger price impact of bond auctions compared to bill auctions cannot be explained only by duration risk. This is evidenced, for instance, by the fact that bonds with relatively short maturity have larger price impacts than longer-term bonds. Asset swap spreads react similarly to bond yields, suggesting that the price of duration risk is not the main driver of our results. Moreover, bond auctions have local effects on bonds of similar maturities, which is consistent with the presence of preferred habitat investors on the market for French debt.

The large share of insurance companies and pension funds in the French bond market corroborates this intuition. Indeed, these categories of investors are largely recognized in the literature as having strong preferences for some segment of the yield curve, and little leeway on how much they can invest at a given point in time. By contrast, T-bills investors are mostly foreign institutions, which are likely to be more flexible and more diverse.

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A Appendix

A Statements from national debt management offices

"*Like during previous crises, short-term borrowing is a tool to respond to unexpected shocks on financing needs. In 2020, the stock of [bills] will however remain way below the levels reached during the 2008-2009 crisis.*" *Agence France Trésor*, December 2020[18]

"*A large part of the additional borrowing requirement was financed via securities with maturities of less than one year - so-called non-interest-bearing federal Treasury bonds or Bubills. Compared to the original planning from December 2019, the issue volume of these instruments was roughly tripled. During the financial crisis in 2009/2010, the federal government had already used this very flexible instrument to cover its high borrowing requirements.*" *Bundesfinanzministerium*, February 2021[19]

"*The [Treasury Borrowing Advisory] Committee generally agreed that while T-bills would need to act as a shock absorber in the near term, Treasury should increase the supply of [bonds] over time to mitigate the increase in roll over risk.*" Treasury Borrowing Advisory Committee, May 2020

"As the deficit has risen, the US Treasury has found it increasingly hard to finance via long-term debt without causing an uncomfortable rise in borrowing costs. It has boosted the share of short-term debt it issues - but analysts warned it risks hitting the limits of demand." Financial Times, June 2024

[18]Translation from the authors, from "Comme lors des précédentes crises, l'endettement de court terme est un instrument de réponse à un choc imprévu sur le besoin de financement. L'encours de BTF demeurera cependant en 2020 nettement inférieur au niveau atteint lors de la crise de 2008-2009".

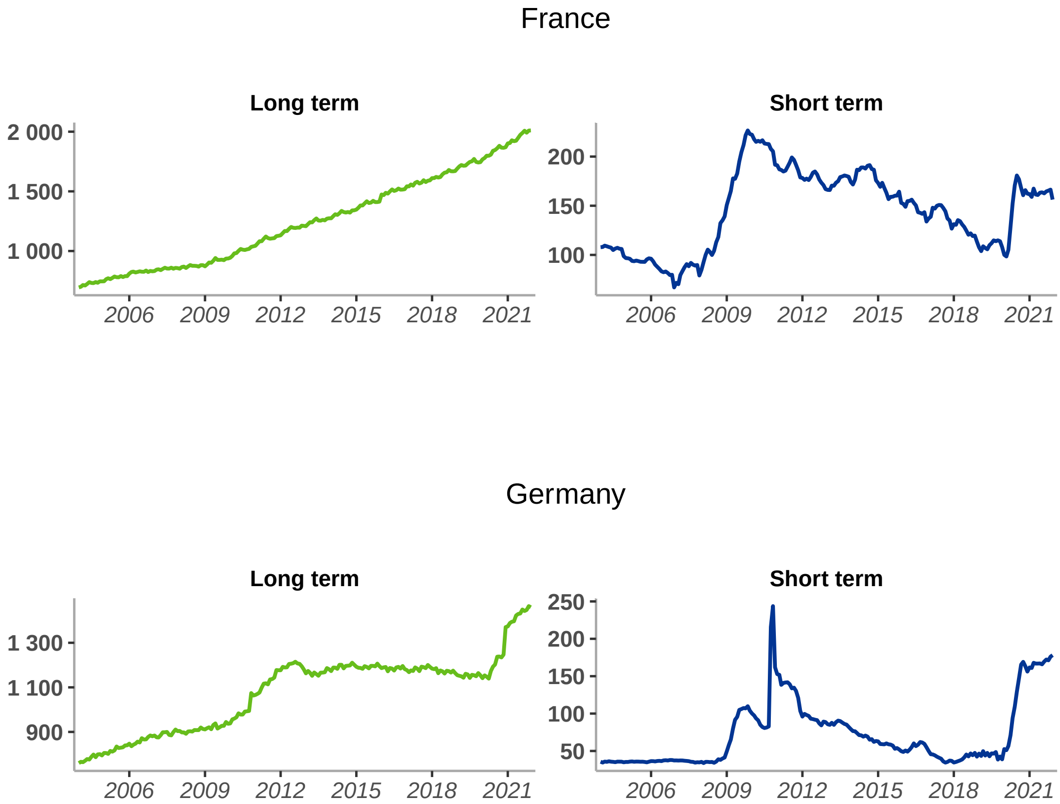
[19]Translation from authors: "Ein Grossteil des zusätzlichen Kreditbedarfs wurde über Wertpapiere mit Laufzeiten von unter einem Jahr – sogenannten Unverzinslichen Schatzanweisungen des Bundes oder Bubills – finanziert. Gegenüber der ursprünglichen Planung vom Dezember 2019 wurde das Emissionsvolumen dieser Instrumente etwa verdreifacht. Schon im Zuge der Finanzkrise hatte der Bund in den Jahren 2009/2010 dieses sehr flexibel einsetzbare Instrument genutzt [...]."

Internet Appendix

A Outstanding amounts

Figure 1: Outstanding amounts of bills and bonds in Germany and France

This graph represents the total gross amount outstanding for securities issued by the central governments of France and Germany. The two left panels represents bonds, and right panels bills.

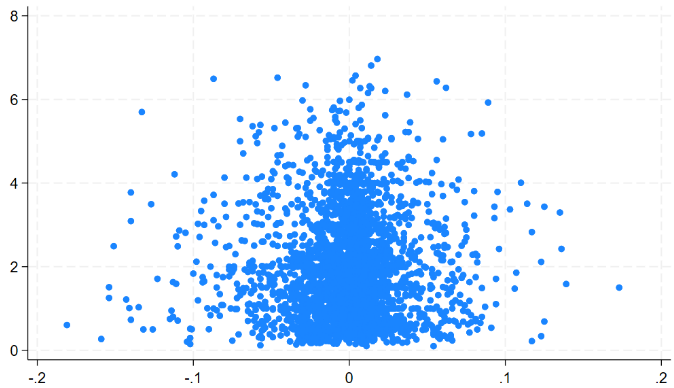


Source: National Ministries of Finance's websites

B Primary *vs.* secondary market yields

Figure 2: Difference between primary and secondary market yields, x-axis (percentage points) *vs.* amount issued y-axis (billion euro)

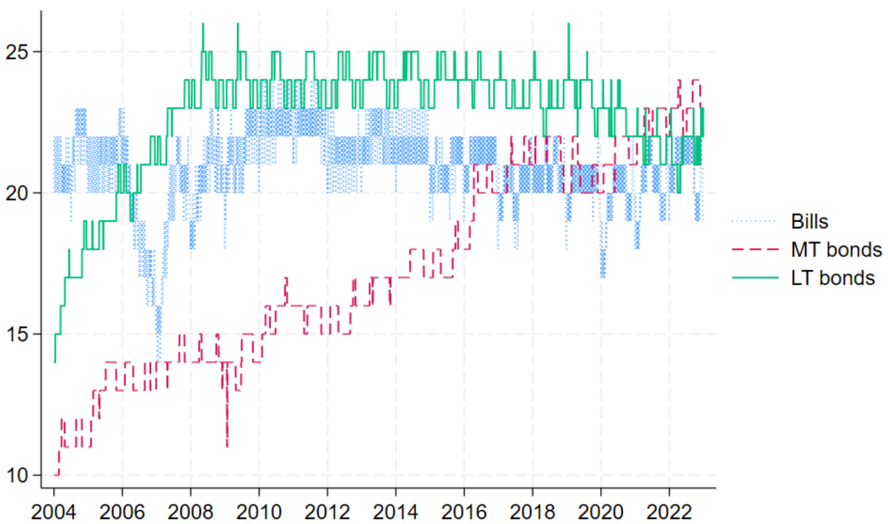
oThis figure represents the the difference between average yield at the auction for a given security and secondary market yields on the day of the auction for the same ISIN on the x-axis. The y-axis, show the total amount issued on of that security issued on that day.



C Number of securities outstanding

Figure 3: Number of securities of securities that can be re-issued by surprise at any point in time

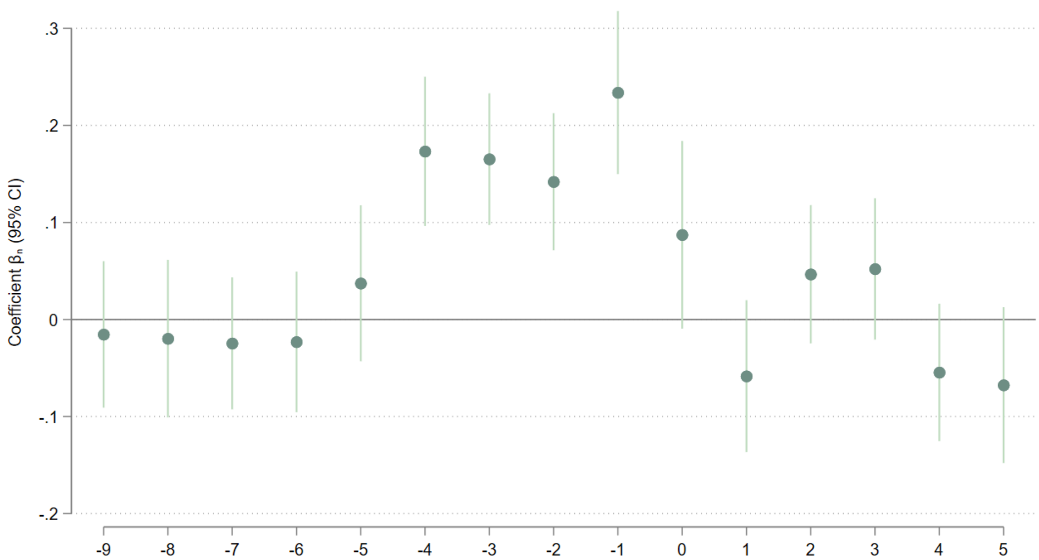
This figure plots the number of securities outstanding across the years. "MT bonds" are medium term bonds, *i.e.* bonds with a residual maturity of 7 years or less that can be re-issued the third (or second early in the sample) Thursday of the month. Long-term bonds are bonds with a residual maturity of 7 years or more and which can be re-issued on the first Thursday of the month. The 7-year cut-off for bonds is taken from to Agence France Trésor end-of-year statements in its guidance for the coming year issuance pattern.



D Evidence of the absence of pre-trend prior to bond auction

Figure 4: Yield change of bonds (in basis points) before auctions for one billion euro issued

This figure plots the yield change (in basis point) on days prior and after the issuance of a specific security. Auction day is day 0. Issuance is defined here as 1 billion euro issued. Yield changes are not cumulative from one day to the next.



E Scaling issuance

Table 1: Impact of additional issuance, in percentage of GDP, on yields

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in percentage of French quarterly GDP. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. Thus, an issuance which would represent one percent of French quarterly GDP would increase bond yields in the pre-QE period by 5.031 basis points. Robust standard errors are clustered by date.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	1.419***	4.332***	1.374***	5.031***
p-value	[0.000]	[0.000]	[0.002]	[0.000]
Observations	99442	208131	62892	121075
R^2	0.548	0.789	0.565	0.804
Adjusted R^2	0.515	0.783	0.533	0.798

Table 2: Impact of additional issuance, scaled by outstanding amount, on yields

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros divided by the outstanding amount before issuance. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. Thus, an issuance which would represent the full amount outstanding would increase bond yields by 4.8 basis points in the pre-QE period. Robust standard errors are clustered by date.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	1.065***	3.664***	1.234***	4.814***
p-value	[0.000]	[0.000]	[0.001]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	96769	203042	61321	116654
R^2	0.550	0.787	0.568	0.802
Adjusted R^2	0.517	0.781	0.535	0.795

F Baseline regression on a subsample where OIS data are available

Table 3: Impact of 1 billion euro of additional issuance on yields

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. All regressions use security fixed effects and date fixed effects. Robust standard errors are clustered by date.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.303***	0.798***	0.330***	1.160***
p-value	[0.000]	[0.000]	[0.001]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	83529	178396	48044	94277
R^2	0.530	0.775	0.548	0.784
Adjusted R^2	0.498	0.770	0.517	0.778

G Baseline regressions without the years 2008, 2009, 2020 and 2021

Table 4: Baseline without crises years

This table shows the result of the lead-lag model described in equation (1), estimated via OLS. The independent variable is the amount issued, in billion euros. The dependent variable is the total variations between T-4 and auction day of the security's yield-to-maturity basis points. For this table only, we removed the years 2008, 2009, 2020 and 2021.

	1 Bills	2 Bonds	3 Bills pre-QE	4 Bond pre-QE
$\sum_{t=0}^{4}$ Issued $_{t+k}$	0.185**	0.885***	0.155	0.976***
p-value	[0.039]	[0.000]	[0.144]	[0.000]
Date FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Observations	81156	167483	53546	102391
R^2	0.527	0.797	0.544	0.821
Adjusted R^2	0.492	0.791	0.509	0.815