

April 30, 2024

TBAC Charge

New Products or Processes

Treasury is always considering ways to minimize borrowing costs, better manage its liability profile, enhance market liquidity, and expand the investor base in Treasury securities. In light of these objectives, we would like the Committee to comment on the likely costs and benefits of potential new Treasury products that might assist Treasury in achieving some or all of these objectives. In addition, are there any other debt management tools or processes that Treasury should consider utilizing? In answering the question, please review the practices and products employed by debt management authorities around the world.

Executive Summary

- The borrowing needs of the Treasury over the coming years are expected to drive an increase in issuance
- The share of outstanding Treasuries held by its two largest investor types (foreign investors and the Federal Reserve) has been decreasing in recent years
- In this context, we will explore potential new products and processes that achieve some or all of the objectives that guide Treasury's decisions:
 - Minimizing its borrowing costs
 - Expanding its investor base
 - Enhancing market liquidity
 - Managing its liability profile
- We will consider the following products:
 - Products previously used by Treasury: callable bonds
 - New products for Treasury: Green bonds, ability to strip Treasury notes / bonds into floaters and inverse floaters
 - Variants of existing Treasury products: 1-year FRN, 3-year TIPS, ultra long-end issuance and FRNs tied to note / bond yields
- We will also discuss some potential process changes or new processes:
 - Adapting the timing of Treasury settlements
 - Reopening operation, securities lending and issuance add-ons
 - Primary dealer league tables

Recommendations presented in these materials are preliminary but attractive from a blue sky perspective in the context of the debt management challenge and objectives outlined above. Further investigation is recommended before launching any new product or process.

Projected Borrowing Needs (as of January 2024)

Expected to Drive an Increase in Issuance

Projected Privately-Held Net Marketable Borrowing
 Assuming Private Coupon Issuance & Total Bills Outstanding Remain Constant as of 01/31/2024*

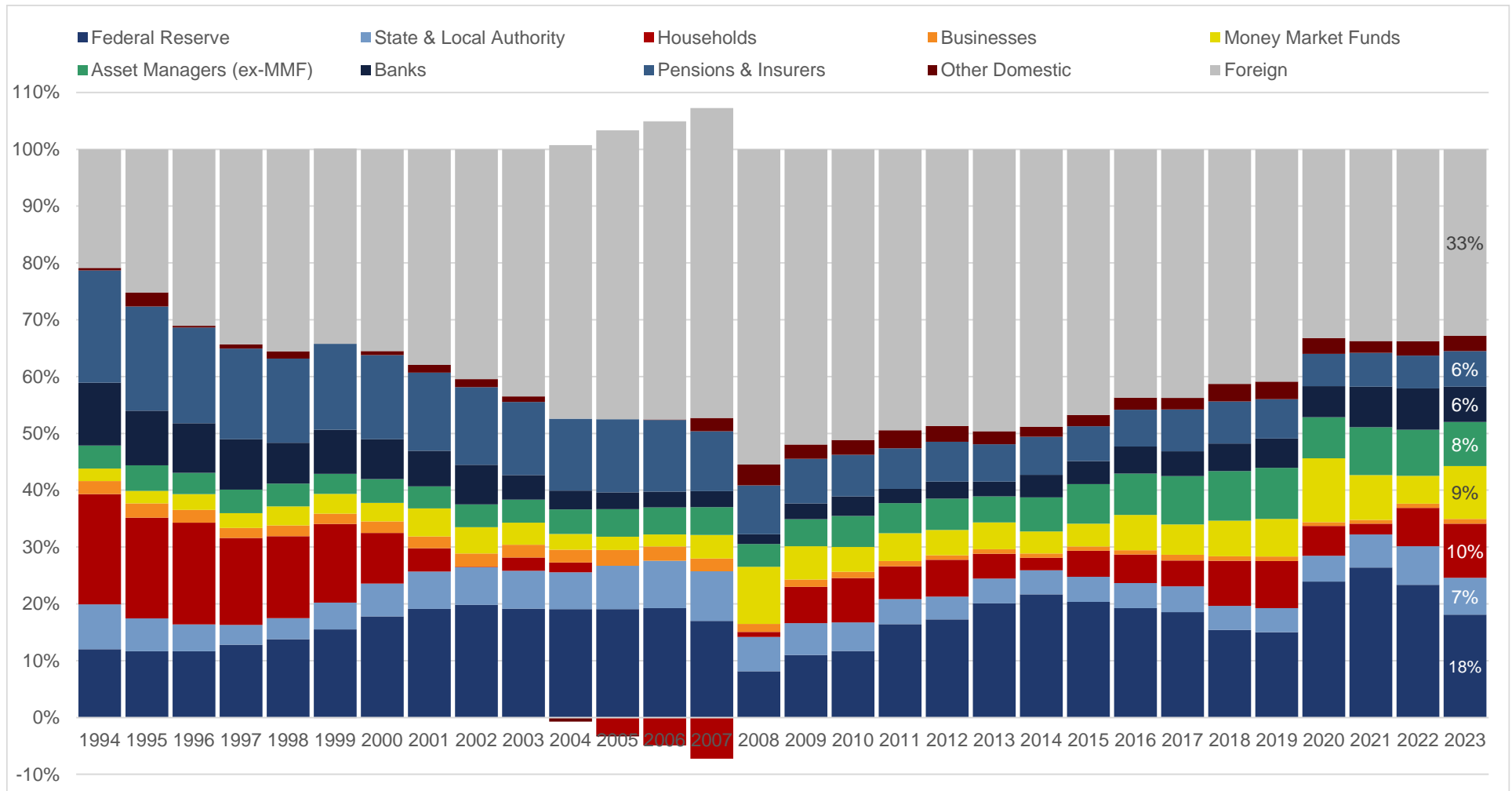


Source: Treasury presentation to TBAC, Q1 2024: <https://home.treasury.gov/system/files/221/TreasuryPresentationToTBACQ12024.pdf>

*Treasury's latest primary dealer survey median/interquartile range estimates can be found on page 18. OMB's borrowing projections are from Table S-1 of "Mid-Session Review, Budget of The U.S. Government," July 2023. Adjusted to reflect the latest assumptions about student loans. CBO's borrowing projections are using estimates from Table 2 of "How the Fiscal Responsibility Act of 2023 Affects CBO's Projections of Federal Debt," June 2023. OMB and CBO borrowing estimates from FY24 to FY26 are normalized to privately-held net borrowing after adding PD survey median SOMA redemption assumptions for FY24/25/26. In addition, all privately-held net borrowing estimates are normalized with PD's FY24 median ending cash balance of \$750 billion.

Holders of US Treasuries Over Time

% Held by Foreign Investors and the Federal Reserve Has Been Decreasing



Source: Federal Reserve Z1 Report

"Other Domestic" includes GSEs, issuers of asset-backed securities, security brokers and dealers, holding companies and other financial businesses

Treasury's Key Criteria for Assessing Potential New Products and Processes

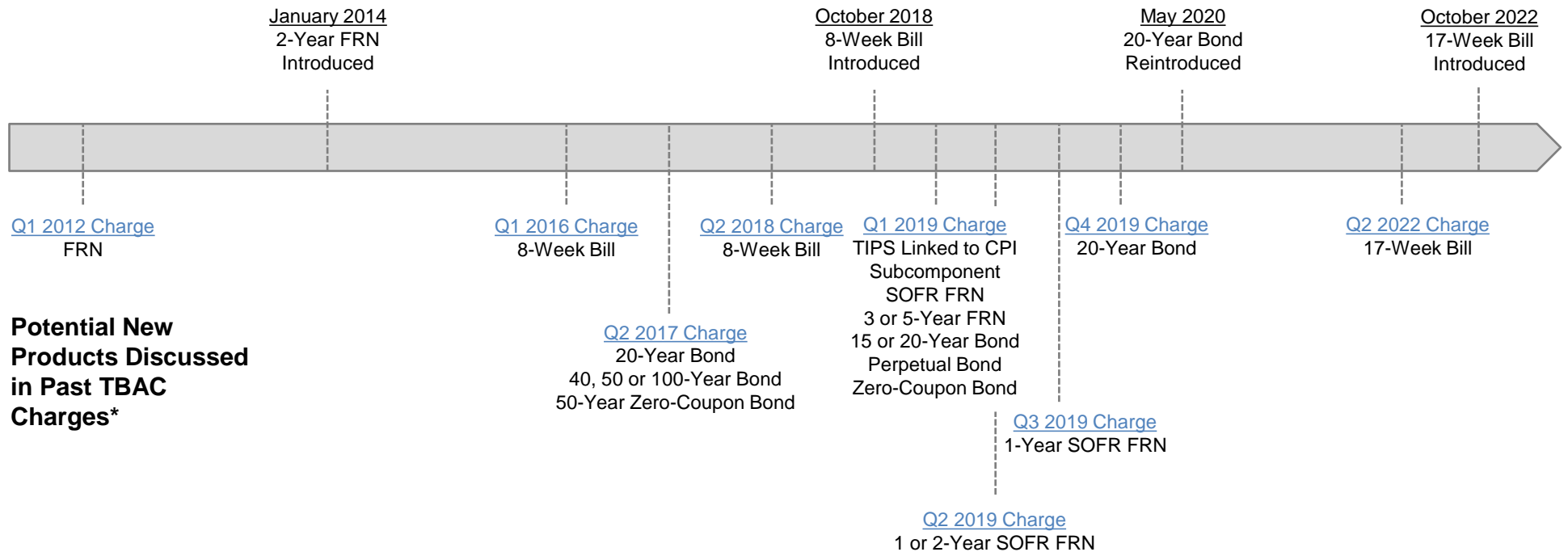
- When considering new products or processes, Treasury will evaluate them in light of the following objectives:
 - Minimizing its borrowing costs
 - Treasury seeks to minimize its borrowing costs over the long term
 - This is achieved in large part by issuing in a regular and predictable manner
 - From time to time, modifications to the types of products and tenors issued and to the processes surrounding issuance can also help with this objective
 - Expanding its investor base
 - Given the scale of Treasury's issuance, seeking out as broad an investor base as possible is a key element in Treasury's strategy to issue debt efficiently and to support a well-functioning market
 - Enhancing market liquidity
 - Taking steps to achieve the highest degree of market liquidity possible makes Treasuries a more attractive asset, thereby increasing demand and reducing borrowing costs over time
 - Market liquidity must be considered in the context of market volatility and other structural factors that support the resilience of the Treasury market as well
 - Managing its liability profile
 - In managing its debt issuance, Treasury takes into consideration its future financing needs, shorter term cash management, and other considerations that could vary when analyzed across a range of economic outcomes and market environments
- We will discuss potential new products and processes by considering whether they can assist Treasury in achieving some or all of these objectives and by taking into account other considerations such as operational complexity and overhead required to launch and maintain these products or processes

Potential New Products

Potential New Products Discussed in Past TBAC Charges

Since 2012

Products Introduced (or Reintroduced) by the US Treasury



* Note that this includes products discussed but not necessarily recommended by the TBAC

1. Callable Bonds

Background and Rationale

Expansion of Investor Base	✓
Interest Savings	?
Improved Liability Profile Management	✓
Enhanced Market Liquidity	—
Development Work / Operational Uplift	✘

Recommendation: Treasury could consider exploring the issuance of callable bonds for the following reasons:

- Access to an expanded investor base: investors looking for yield enhancement by selling optionality
 - While coupon at issuance would be higher, potential for lower interest cost if rates move down after issuance (possibility to call the bond and refinance)
 - Complementary to existing Treasury instruments (bullet notes / bonds and FRNs) in terms of convexity profile of the Treasury's liabilities
- Callable bonds are bonds that the issuer can decide to redeem before their contractual maturity
 - We suggest bonds with a par call, where the issuer would repay the par value of the bond (plus accrued interest) upon call exercise
 - The issuer would be incentivized to call the bond if it can refinance the bond at a lower rate
 - Callable bonds typically have a “non-call period”, during which the issuer cannot call the bond. After that, they typically have Bermudan calls, which means that there will be multiple dates on which the issuer can choose to call the bond
 - For example, a “30nc5” callable bond with semi-annual calls is a 30-year bond that can be called by the issuer once every 6 months starting with the period five years after the bond was issued
 - To compensate for the option implied by the call feature of the bond, the issuer will need to pay a higher coupon on a callable bond than on the corresponding bullet bond
 - Investor demand is often driven by this higher coupon: investors who are seeking enhanced yield by selling optionality can buy callable bonds
 - While it might be counterintuitive given the higher coupon, Treasury's interest costs could be lowered by issuing a callable rather than a bullet:
 - Many issuers of callable bonds hedge them by trading cancellable swaps and see value in callables when they can be issued at tighter level than bullets on a hedged basis due to investor demand specific to callable bonds
 - Should Treasury prefer not to hedge, the potential lower interest payments would come from the ability to call the bond at par and refinance at lower rates if rates go down after issuance, for example in a recessionary environment
 - The potential scale of the expanded investor base is best illustrated by the \$12tn+ of outstanding bonds with call / prepayment options:
 - The USD callable bond market is greater than \$2 trillion, including \$750bn of agency callables and \$130bn of Formosa callables
 - The \$10tn+ agency mortgage-backed securities (MBS) market is also used by investors to enhance yield by selling optionality
 - Outstanding callable sovereign debt is limited: Spain (\$1.2bn issued in 2019), Belgium (\$0.4bn issued in 2013) as well as multiple bonds issued by developing countries, especially in Latin America
 - However, other developed countries have issued callable bonds in the past, including the US until 1984 (most recent issuance was \$102bn of 30nc25 issued between 1977 and 1984, called and refinanced at much lower rate levels between 2002 and 2009)

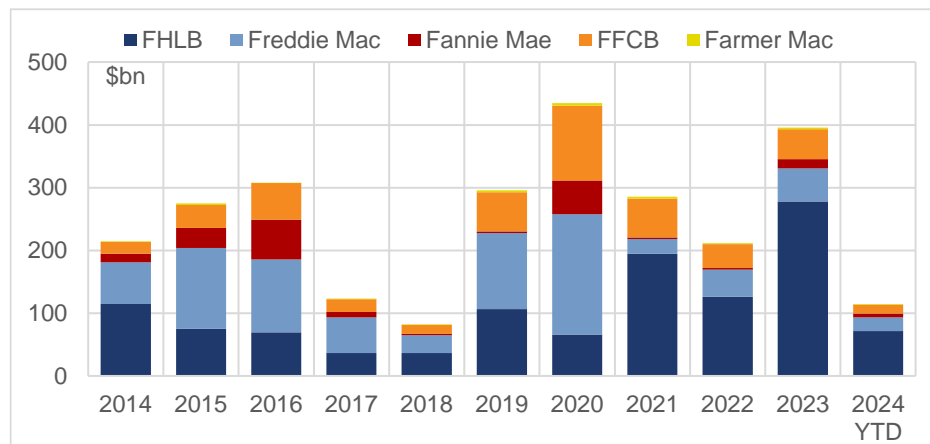
1. Callable Bonds

Overview of the Agency Callable Bond Market

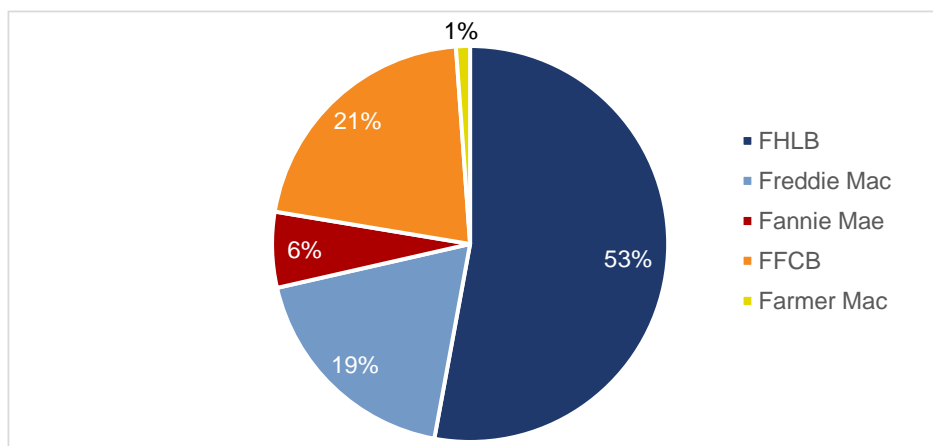
Expansion of Investor Base	✓
Interest Savings	?
Improved Liability Profile Management	✓
Enhanced Market Liquidity	-
Development Work / Operational Uplift	✘

- In the US, the three largest issuers of callable bonds are government agencies: the Federal Home Loan Banks (FHLB), the Federal Farm Credit Banks (FFCB) and Freddie Mac. Fannie Mae is also in the top ten
- The size of the outstanding agency callable bond market is ~\$750bn, with annual issuance of ~\$200bn to \$400bn over the past 5 years
 - Most agency callable bonds are short-dated: 75% were issued with a tenor of 5 years or less and 92% with a tenor of 10 years or less
 - The non-call periods are also short: 86% were issued with a non-call period of 1 year or less
- The investor base is comprised of a mix of asset managers (including money market funds), state & local governments, pension funds and insurance companies
 - The primary driver of investor demand is the increased yield relative to bullet bonds, especially from investors who cannot sell options via derivatives
- The size and relative steadiness of GSE callable issuance indicate that there could be enough investor demand for callables issued by government entities to justify introducing this new product
 - Further study would be warranted to estimate the potential size of that demand

Historical Gross Issuance of Agency Callable Bonds



Breakdown of Outstanding Debt by Issuer



Breakdown of Outstanding Debt by Tenor / Non-Call Period

	Tenor	Non-Call Period										Total	
		<= 1m	3m	6m	9m	1y	18m	2y	3y	4y	5y		
	<= 1y	0.0%	6.5%	5.0%	1.4%	1.6%							14.5%
	2y	0.5%	2.4%	2.0%	0.5%	3.7%	3.3%						12.3%
	3y	1.5%	5.5%	2.1%	0.5%	3.3%	0.1%	0.3%					13.4%
	4y	0.2%	2.7%	2.3%	0.2%	3.3%	0.3%	1.2%	0.0%	0.0%			10.3%
	5y	2.1%	6.2%	4.1%	0.5%	7.2%	0.7%	3.3%	0.6%	0.0%			24.7%
	7y	0.0%	2.5%	1.4%	0.0%	2.8%	0.1%	0.8%	0.6%	0.0%			8.1%
	10y	0.0%	1.8%	1.4%	0.1%	4.2%	0.1%	0.6%	0.4%	0.0%	0.3%		9.0%
	15y		0.8%	1.1%	0.1%	2.6%	0.0%	0.5%	0.2%	0.0%	0.4%		5.7%
	20y	0.0%	0.2%	0.3%	0.0%	1.1%	0.0%	0.0%	0.1%		0.2%		1.9%
	30y		0.0%	0.0%		0.1%		0.0%	0.0%		0.0%		0.2%
	Total	4.4%	28.6%	19.7%	3.3%	29.9%	4.6%	6.7%	1.8%	0.2%	0.9%		100%

Tenors and Non-Call Periods are rounded up

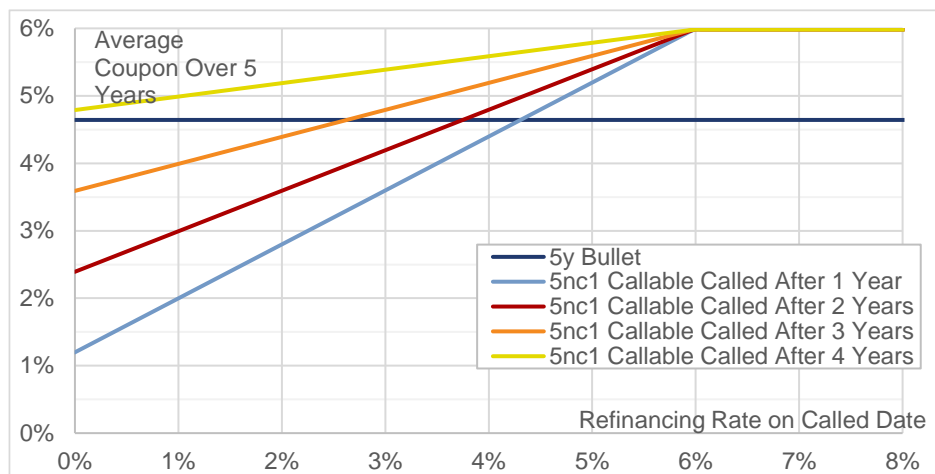
1. Callable Bonds

Impact on Interest Costs

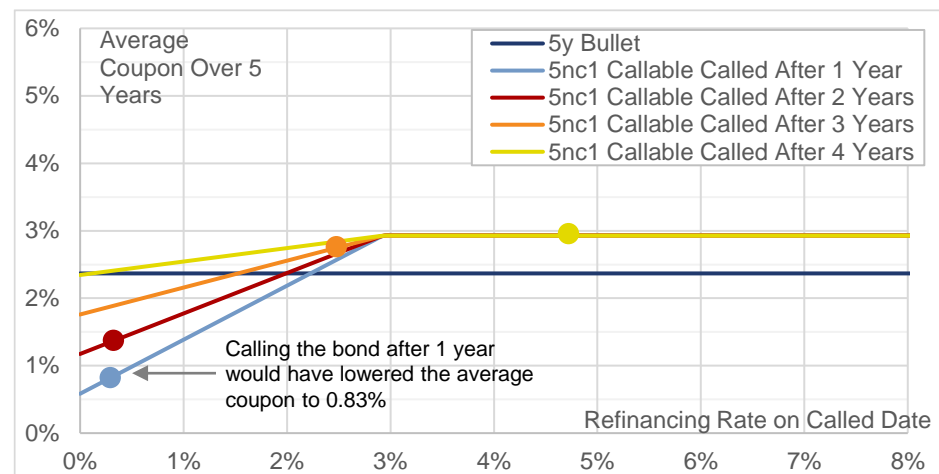
Expansion of Investor Base	✓
Interest Savings	?
Improved Liability Profile Management	✓
Enhanced Market Liquidity	-
Development Work / Operational Uplift	✘

- To illustrate the interest cost differential between a bullet and a callable bond, we will assume a 5nc1, the most common structure in the agency callable market:
 - As of 15-Apr-2024, we would estimate the coupon of the callable as 5.98%, 134bps higher than a bullet
 - Note that the cheapness of Bermudan* volatility driven by investor demand for callable bonds leads to this level being 4bps tighter than what would be implied by the European* options market. For longer-dated structures (e.g. 10nc1), this benefit could exceed 10bps
 - While this cheapness may vary over time, it has been fairly consistent over the past 10 years
 - The bottom left chart compares the average interest cost to Treasury over 5 years between the callable and the bullet bond, as a function of the date on which the bond is called and of the refinancing rate on the called date
 - The 134bps coupon spread between callable and bullet would be more than offset by the benefit of the call option if the refinancing rate is 4.31% or lower in 1 year, 3.75% or lower in 2 years or 2.63% or lower in 3 years
- For a specific example of how this could have played out in the recent past, the bottom right chart shows the same analysis for a hypothetical 5nc1 bond issued 5 years ago (spread of 56bps between callable and bullet, lower than today due to lower implied volatilities and a steeper interest rate curve at the time). Each dot represents the potential refinancing rate each year after issuance
 - Given the significantly lower rates in 2020, the bond could have been called and refinanced after 1 year, lowering the average coupon to 0.83% (154bps lower than the 5y bullet rate in April 2019)

5nc1 Scenario Analysis: Pricing as of 15-Apr-2024



5nc1 Scenario Analysis: Pricing as of 15-Apr-2019



Source: Presenting member calculation, as of 15-Apr-2024. Levels are indicative only and for discussion purposes. Levels were calculated assuming a SOFR-flat issuer and adjusted for spot swap spreads to be reflective of the Treasury curve.

* Bermudan options have multiple possible exercise date while European options only have a single exercise date. Supply/demand dynamics in the callable bond market are the primary driver of market-implied Bermudan volatility while market-implied European volatility is based on a broader set of market participants and a much larger volume of transactions, especially in the derivatives market

1. Callable Bonds

Considerations

Expansion of Investor Base	✓
Interest Savings	?
Improved Liability Profile Management	✓
Enhanced Market Liquidity	—
Development Work / Operational Uplift	✘

<p>“Regular and Predictable” Framework</p>	<ul style="list-style-type: none"> ■ In considering the issuance of callable bonds, Treasury would need to factor in the potential rate-sensitivity of supply/demand dynamics: <ul style="list-style-type: none"> — As an issuer, Treasury might be more incentivized to issue callables when rates are high, given the potential for calling the bond and refinancing at lower rates — On the other hand, investor demand might be stronger when rates are lower and investors have more interest in yield enhancement ■ However, these factors are typically mitigated by the price of the call option and, as a result, callables could still fit within the “regular and predictable” framework in most rate environments (with the possible exception of a regime of extremely low rates)
<p>Choice of Issuance Tenors and Non-Call Periods</p>	<ul style="list-style-type: none"> ■ It is common for issuers of callable bonds to be reactive to investor demand in deciding which tenors and non-call periods to use for issuance ■ Given Treasury’s “regular and predictable” framework, we would recommend focusing on tenors / non-call periods which have seen the most consistent demand so that Treasury can plan to issue in size with minimal variations in structure over time <ul style="list-style-type: none"> — In this respect, targeting the investor base of agency callables would make most sense, with structures such as 5nc1 ■ Treasury previously issued 30nc25 callables – we don’t expect that there would be enough investor demand or potential for interest savings to justify such a long non-call period
<p>Optimal Option Exercise</p>	<ul style="list-style-type: none"> ■ When issuing a callable bond with a European call (single exercise date), deciding whether to call the bond is relatively straightforward, although a long notification period (Treasury previously used 4 months) can be more challenging when the call option is close to at-the-money ■ For callable bonds with a Bermudan call (multiple possible exercise dates), the exercise decision is more complex as the issuer needs to decide not just <u>whether</u> to call the bond but also <u>when</u> to call the bond (now or at a later date) <ul style="list-style-type: none"> — By exercising the bond at an earlier date, the issuer can refinance and decrease its interest payments earlier but is foregoing the option to call the bond and refinance at a later date, when the interest savings could be greater ■ If it were to issue callable bonds, Treasury would need to develop a model to decide when it is optimal to call the bond
<p>Impact on WAM</p>	<ul style="list-style-type: none"> ■ When communicating the WAM of its outstanding debt, Treasury would need to consider how to treat the uncertainty regarding the maturity of callable bonds ■ As an alternative to using their contractual maturity, Treasury could consider using an option-adjusted maturity, which would vary over time as the call probability on the possible exercise dates changes <ul style="list-style-type: none"> — This would have the benefit of presenting a “best estimate” at a given point time of the expected maturity of outstanding callables — The option-adjusted maturity could be derived from the optimal option exercise model discussed above ■ The choice to use contractual vs. option-adjusted maturity should only have a minor impact on WAM unless callable issuance share becomes large and/or Treasury chooses to use longer-dated tenors than what we suggest above
<p>Stripping</p>	<ul style="list-style-type: none"> ■ Stripping callable bonds would introduce instruments with interesting duration / convexity profile: C-STRIPS and P-STRIPS would be the equivalent of interest-only (IO) and principal-only (PO) mortgage-backed securities ■ However, it would introduce additional challenges (non-fungibility of C-STRIPS, operational complexity) ■ We believe that, initially, Treasury should consider issuing callable bonds that are not eligible for stripping <ul style="list-style-type: none"> — If Treasury does not issue callables in the long-end of the curve (where stripping demand is more pronounced), we do not believe that the inability to strip will increase interest costs

2. Green Bonds

Overview

Expansion of Investor Base	✓
Interest Savings	?
Improved Liability Profile Management	–
Enhanced Market Liquidity	–
Development Work / Operational Uplift	✘

- **Recommendation:** Treasury could consider exploring the issuance of green bonds for the following reasons:
 - Access to a growing investor base which couldn't invest in traditional US Treasuries to the same extent: institutional investors with a target allocation for green investments (e.g. pension funds), investment funds with a climate-related mandate (1200+ funds globally as of year-end 2022*)
 - Benefit from the potential demand for green bonds denominated in USD specifically (only 22% of the outstanding universe is USD-denominated vs. 49% EUR-denominated)
 - Empirically, the issuance of green bonds has been at levels similar to or marginally tighter than traditional bonds from the same issuer and with the same maturity
- Green bonds are bonds issued to fund projects with environmental benefits
 - Most of the green bonds issued are “use of proceeds” bonds: their proceeds are allocated for green projects but they are backed by the entire balance sheet of the issuer
 - Example of eligible expenditures in green bonds issued by large sovereigns include clean transportation, energy efficiency, renewable energy, living and natural resources, pollution prevention / control and climate change adaptation
- While the first green bonds were issued in 2007 by the European Investment Bank (EIB) and the World Bank, it was in the late 2010s that the market started growing at a meaningful pace, driven in part by sovereign issuance
- As of April 2024, the total outstanding amount of green bonds is ~\$2.6 trillion, of which 17% were issued by sovereigns and another 19% were issued by supranationals and other government entities
- All major sovereign issuers in developed markets, except for the US, have issued green bonds:
 - European Union: France (\$81bn outstanding), Germany (\$70bn), Italy (\$40bn), Netherlands (\$25bn)...
 - Other G10 issuers: United Kingdom (\$65bn), Japan (\$11bn), Canada (\$7bn)...
- While a small green premium (“greenium”) benefiting issuers has been observed in most issuance to date, it may not persist as the market matures
 - Investor demand outpacing supply has been the primary factor driving pricing so far but the relative depth and liquidity of green bonds vs. traditional bonds might become more of a factor in the future
 - We recommend that the decision to issue green bonds on a regular and predictable basis be primarily based on Treasury's investor base expansion objective, with greenium only being a potential secondary benefit
- Considerations:
 - Upfront work would be required to develop a green bond framework and ongoing work required to implement it (e.g. process for evaluation and selection of projects, management of proceeds, reporting)
 - It could be relevant to study ICMA's Green Bond Principles (GBP) and practices followed by other major sovereigns
 - There could be more investor demand for green bonds linked to incremental green spending (not previously authorized spending) due to concerns over “greenwashing”. If so, the use of green bonds may need to be included in the legislation authorizing the spending
 - An alternative to green bonds could be sustainability-linked bonds (SLBs), with a coupon that varies depending on sustainability performance targets. However, we would not recommend SLBs given the potential difficulty in defining the targets and the penalty-based approach to sustainability objectives

Data Source: Bloomberg, as of 11-Apr-2024. Notional amounts were converted to USD using the foreign exchange rate at time of issuance.

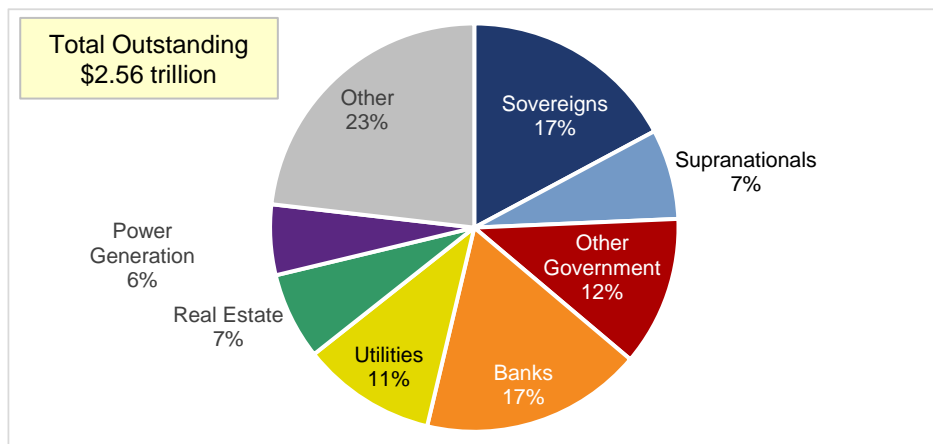
* Source: Morningstar “Investing in Times of Climate Change 2023”

2. Green Bonds

Overview of the Outstanding Universe (all amounts are in USD equivalent)

Expansion of Investor Base	✓
Interest Savings	?
Improved Liability Profile Management	-
Enhanced Market Liquidity	-
Development Work / Operational Uplift	✘

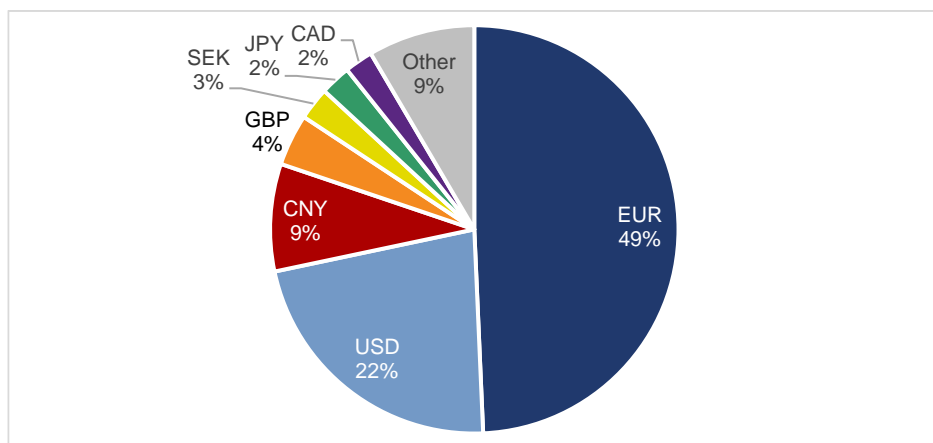
Breakdown by Issuer Type



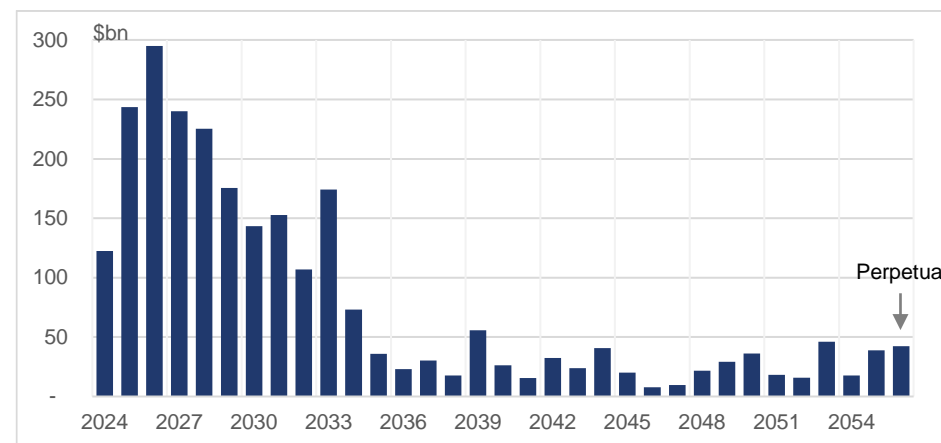
Government Issuers with Largest Outstanding Amounts (\$bn)

Sovereigns		Supranationals		Other Government	
France	80.5	European Investment Bank (EIB)	70.5	KfW	66.4
Germany	69.5	European Union	61.1	Societe des Grands Projets	30.9
United Kingdom	64.5	Asian Development Bank	8.8	China Development Bank	15.2
Italy	40.4	World Bank (IBRD)	8.6	Province of Ontario Canada	12.3
Netherlands	25.1	Nordic Investment Bank	6.8	Japan Housing Finance Agency	9.2
Hong Kong	24.9	International Finance Corp (IFC)	6.7	Queensland Treasury Corp	8.6
Belgium	20.7	Eurofima	6.0	NRW Bank	7.7
Austria	13.9	EBRD	5.6	Kommuninvest I Sverige AB	7.4
Spain	13.7			Landwirtschaftliche Rentenbank	7.0
Ireland	12.2			Nederlandse Waterschapsbank NV	6.8
Japan	10.6			Societe Nationale SNCF SACA	6.4
Chile	7.4			Export-Import Bank of Korea	6.1
Canada	6.9			CPPIB Capital Inc	5.2
Hungary	6.9				

Breakdown by Currency



Breakdown by Maturity



Data Source: Bloomberg, as of 11-Apr-2024. Notional amounts were converted to USD using the foreign exchange rate at time of issuance.

3. Potential Variants of Existing Products

	1y FRN	3y TIPS	Ultra Long End	Note / Bond-Linked FRN
Expansion of Investor Base	✓	–	✓	?
Interest Savings	–	–	✘	?
Improved Liability Profile Management	✓	✓	?	–
Enhanced Market Liquidity	✓	✓	–	–
Development Work / Operational Uplift	–	–	–	✘

We recommend that Treasury explore the issuance of 1-Year FRNs and 3-Year TIPS, as suggested in prior TBAC charges

1-Year FRN

- In its [Q3 2019 charge](#), TBAC recommended the issuance of a 1-year SOFR FRN
- The benefits of a 1-year FRN relative to a 2-year FRN include:
 - Incremental demand from government money market funds given their WAL limits (not to exceed 120 days)
 - Potential new demand from securities lending participants and investors looking for a repo / cash alternative (for SOFR FRNs in particular)
 - Increased market liquidity resulting from a more diversified investor base
- A 1-year FRN compares favorably to increased bill issuance given the ability for Treasury to term out its funding while keeping a WAM profile attractive to government money market funds
- We expect that there would be sufficient demand for either a 1-year SOFR FRN or a 1-year T-bill FRN

3-Year TIPS

- In its [Q2 2023 charge](#), TBAC recommended increased TIPS issuance to maintain the TIPS share of outstanding debt given higher deficits and increased TIPS maturities
- In its [Q4 2023 charge](#), TBAC suggested that Treasury evaluate the suitability of issuing front-end TIPS
- The issuance of 3-year TIPS could have the following benefits:
 - Ability for Treasury to increase TIPS issuance to keep TIPS share of outstanding debt stable, e.g. issuing \$25bn per quarter would increase TIPS outstanding by \$300bn, increasing TIPS share by ~1% and keeping it in the TBAC-recommended range of 7-9%
 - Avoids increasing auction size for existing tenors to an extent where the market might have difficulty absorbing supply
 - Increases liquidity of the front-end of the TIPS curve and potentially taps into investor demand for securities most sensitive to short-term inflation expectations
- The fact that there is currently most demand for the shortest TIPS tenor (5y) leads us to believe that a nearby tenor (3-year) would be well received but more work needs to be done to determine if there would be sufficient demand to absorb the additional supply

While potential investor demand would need to be explored further, Treasury could also revisit ultra long-end issuance and consider the issuance of FRNs linked to Treasury note / bond yields

Ultra Long-End Issuance

- In its [Q2 2017 charge](#), TBAC considered the issuance of ultra long-end bonds (40, 50 or 100-year bonds) and concluded that a reintroduction of the 20-year bond would be more attractive but that further study of ultra-long securities might be warranted, including 50-year zero-coupon bonds
- In its [Q1 2019 charge](#), TBAC recommended that Treasury consider the issuance of perpetual debt and of zero-coupon bonds
- While we do not believe that ultra-long-end issuance should be a priority in the short to medium-term, the following products could be worth exploring at a later stage:
 - Ultra long-end zero-coupon bonds could be attractive for investors seeking a higher amount of duration per dollar invested than is available with any existing Treasury instrument
 - Perpetual bonds could be attractive given the greater ability to reopen the same bond over time and have acceptable liquidity

FRNs Linked to Treasury Note / Bond Yields

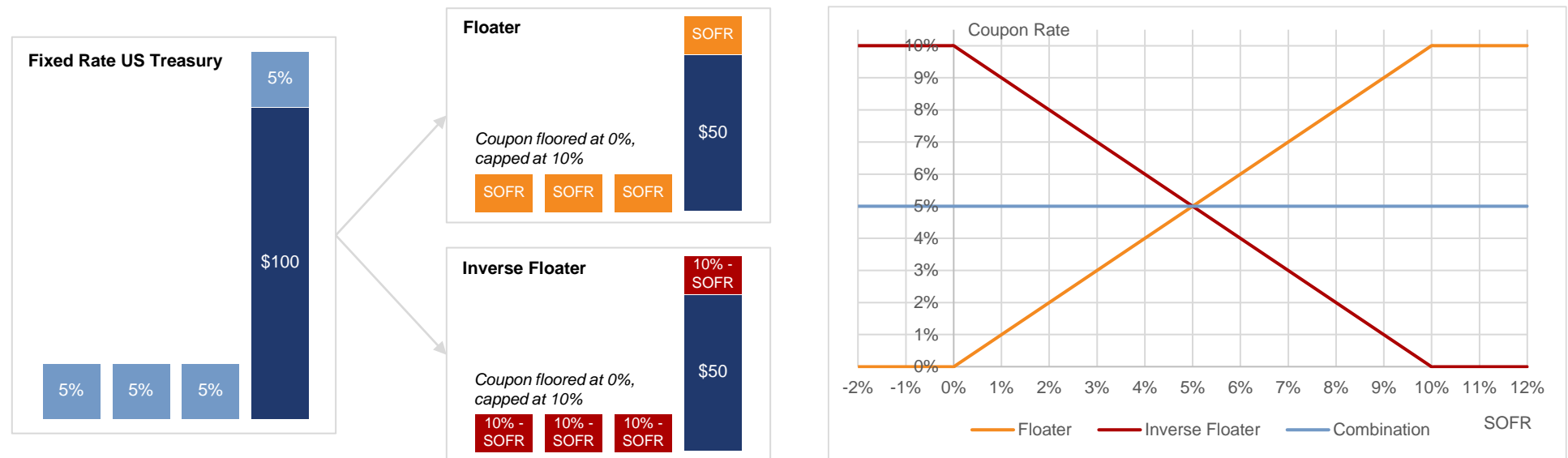
- In Japan, there are ~\$230bn of outstanding 10y JGB floaters indexed to 10y JGB yields (issuance of ~\$1bn to \$2bn per month in recent years)
 - They are targeted at retail investors looking for yield enhancement in an upward sloping curve environment
 - An earlier program targeted at institutional investors was discontinued
- The demand for such a product might be specific to Japan given the extended period of near-zero short-term interest rates and could be very sensitive to the shape of the yield curve
- However, Treasury could explore if there is enough demand for this product in the US – likely as nonmarketable securities issued to retail – to justify the overhead to launch / maintain such a product (it is unknown at this stage)
- The ability to strip Treasuries into a pair of floaters and inverse floaters (discussed next) could be an alternative path for investors looking for such exposure

4. Stripping Treasuries Into Floaters and Inverse Floaters

Expansion of Investor Base	✓
Interest Savings	-
Improved Liability Profile Management	-
Enhanced Market Liquidity	-
Development Work / Operational Uplift	✗

- Treasury could consider expanding the STRIPS program to provide market participants the ability to strip a fixed-rate Treasury into a floater and inverse floater
 - This potential new product could expand the investor base to investors currently using structured products to obtain such duration profiles: the outstanding par value of agency Inverse Interest-Only (Inverse IO) CMOs is ~\$420bn*
- For example, \$100 of a 5% coupon Treasury could be stripped into \$50 of a Treasury floater with a coupon of SOFR flat and \$50 of a Treasury inverse floater with a coupon of (10% - SOFR), with both the floater and inverse floater having a coupon floored at 0% and capped at 10%
 - This would allow the holder of the inverse floater to have more duration per unit of investment than a fixed rate Treasury
- Another example would be to strip \$100 of a 5% coupon Treasury into \$50 of a levered Treasury floater with a coupon of 1.5*SOFR and \$50 of a levered inverse floater with a coupon of (10% - 1.5*SOFR), with a 0% floor and 10% cap on the coupon in both cases
 - The levered floater would allow its holder to be short duration, something not currently possible when buying existing Treasury products
- Such a stripping program would be more operationally challenging than the existing STRIPS program (e.g. calculation of the floating interest payments), especially if the offering is designed to be flexible in terms of reference index, floating rate multiplier and/or floor/cap strikes

Illustration of Stripping a 5% Fixed Rate US Treasury into a Floater and an Inverse Floater



* Note: an inverse IO does not have any principal repayment – the entire principal repayment would be paid to holders of the other tranche(s) of the CMO, e.g. the floater tranche

5. GDP Bonds / Longevity Bonds

	GDP Bond	Longevity Bond
Expansion of Investor Base	—	?
Interest Savings	✘	✘
Improved Liability Profile Management	✓	—
Enhanced Market Liquidity	—	—
Development Work / Operational Uplift	✘	✘

While these products could at some point be worth considering, we do not recommend them in the short to medium-term: their novelty may result in low investor demand and/or high interest costs

GDP Bonds

- The issuance of GDP-linked bonds has been explored by other sovereigns in the past, with the primary benefit to the issuer being counter-cyclicality (i.e. less interest payment on the debt when the economy is doing poorly)
- The design could be similar to TIPS, with interest and return of principal being indexed to nominal GDP instead of CPI
 - A scaling factor lower than 1 for the principal repayment might be necessary to issue the bond at par since nominal GDP growth can exceed the nominal level of rates for extended periods
 - The lag used in these instruments would need to consider the potential for revisions to the GDP data
- Aside from GDP-linked warrants issued by countries restructuring their debt (e.g. Argentina, Greece), there has not been issuance of GDP-linked debt by major countries
- The reluctance to issue has come in part from the expected premium that may be demanded by investors for the novelty and pro-cyclicality of the instrument from the investor's perspective

Longevity Bonds

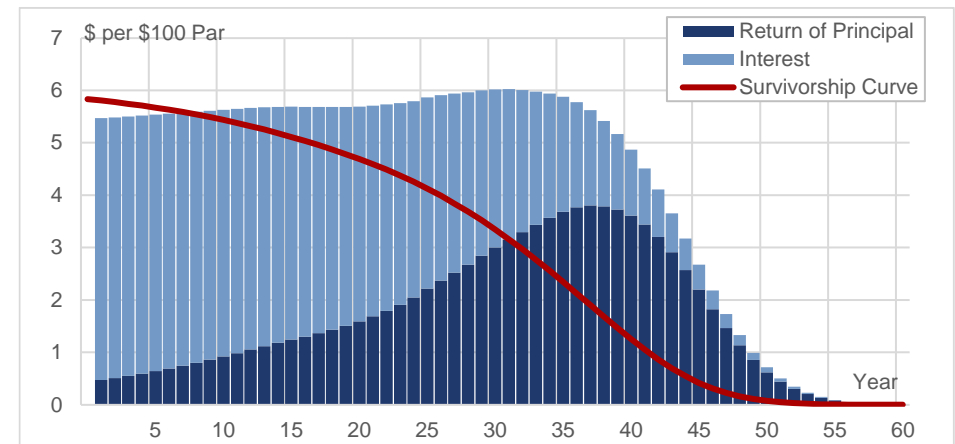
- Longevity bonds are bonds whose cashflows are indexed to the longevity of a reference population
- A possible design would be to:
 - Pay interest on the par value of the bond multiplied by the percentage of the reference population alive at the beginning of the current period, and
 - Make a partial repayment of principal for the change in the size of the reference population since the prior period
- The target investors for such an instrument would be defined benefit pension funds and insurance companies that underwrite lifetime annuities and are exposed to longevity extension
 - However, it may be difficult to identify reference populations that will provide an effective hedge against the specific longevity exposure of these institutions
- Treasury would also need to consider the extent to which it is already exposed to a longevity extension (e.g. Social Security benefits)

Illustrative GDP Bond Cashflows¹

	Nominal GDP YoY (%)	Nominal GDP Index	Interest Payments	Principal Repayment	Total Cashflows
31-Dec-18		100.0			
31-Dec-19	4.7%	104.7	1.05		1.05
31-Dec-20	0.6%	105.3	1.05		1.05
31-Dec-21	11.9%	117.9	1.18		1.18
31-Dec-22	7.1%	126.2	1.26		1.26
31-Dec-23	5.9%	133.7	1.34	120.31	121.65

Coupon Rate *	Scaling Factor *
Nominal GDP Index	Nominal GDP Index

Illustrative Longevity Bond Cashflows²



1. Assumes annual cashflows for simplicity. The coupon / factor are illustrative and not intended to represent the level at which such a bond would or should have been issued
 2. Assumes 5% interest and a hypothetical survivorship curve of a population of 50-year-old Americans at issuance

Potential New Products Discussed in This Charge

Summary Table

Potential New Product	Issuance by Other Countries (Developed Markets)	Expansion of Investor Base	Interest Savings (other than resulting from an expansion of the investor base)	Improved Liability Profile Management	Enhanced Market Liquidity	Development Work / Operational Uplift
Callable Bonds	Small outstanding callables in Belgium and Spain	✓	? (savings if rates go down)	✓	—	✗
Green Bonds	All major issuers except the US	✓	? (potential greenium)	—	—	✗
1-Year FRN		✓	—	✓	✓	—
3-Year TIPS		—	—	✓	✓	—
Ultra Long-End Issuance	Many countries, including UK, Japan, France, Spain and Austria	✓	✗	?	—	—
FRNs Indexed to Treasury Note / Bond Yields	Japan (indexed to 10y JGBs)	?	?	—	—	✗
Floaters / Inverse Floaters (Stripping)		✓	—	—	—	✗
GDP Bonds		—	✗	✓	—	✗
Longevity Bonds		?	✗	—	—	✗

 We recommend that Treasury conduct further study to determine if these products should be launched

 Treasury could also consider these products

 We do not recommend that Treasury consider these products in the short to medium-term (but they may be worth exploring in the future)

Potential New Processes

1. Adapting the Timing of Treasury Settlement

Current Issuance Schedule

- Settlement of Treasury issuance varies by product / tenor:
 - Bills settle on Tuesdays or Thursdays, depending on tenor
 - Notes, bonds and FRNs settle on the 15th of the month or the last calendar day of the month, depending on tenor
 - TIPS settle on the last business day of the month
- When the 15th and/or last calendar day of the month falls on a Tuesday or Thursday, the amount settling on that date can be very large as both bills and a subset of notes, bonds, FRNs and TIPS will settle on the same day
 - See below for the example of February 2024

Issuance Pattern for US Treasuries

	Tenor	Auction Frequency	Issue Date
Bills	4-Week	Weekly	Tuesday
	8-Week	Weekly	Tuesday
	13-Week	Weekly	Thursday
	26-Week	Weekly	Thursday
	17-Week	Weekly	Tuesday
	52-Week	Monthly	Thursday
	CMB	Ad hoc	Ad hoc
Notes	2-Year	Monthly	Last calendar day of the month*
	3-Year	Monthly	15th of the month*
	5-Year	Monthly	Last calendar day of the month*
	7-Year	Monthly	Last calendar day of the month*
	10-Year	Monthly	15th of the month*
Bonds	20-Year	Monthly	Last calendar day of the month*
	30-Year	Monthly	15th of the month*
TIPS	5-Year	Quarterly	Last business day of the month
	10-Year	Bi-Monthly	Last business day of the month
	30-Year	Semi-Annually	Last business day of the month
FRNs	2-Year	Monthly	Last calendar day of the month* (Last Friday of the month for reopenings)

* If that date is not a valid business day, the issue date will be the next valid business day

US Treasuries Issued in February 2024 (\$bn, by Issue Date)

Monday	Tuesday	Wednesday	Thursday	Friday
			01-Feb-24	02-Feb-24
			42d Bill 79.5	
			13w Bill 86.0	
			26w Bill 75.3	
			Total 240.8	
05-Feb-24	06-Feb-24	07-Feb-24	08-Feb-24	09-Feb-24
	4w Bill 95.1		42d Bill 79.5	
	8w Bill 89.7		13w Bill 84.2	
	17w Bill 59.3		26w Bill 73.7	
	Total 244.0		Total 237.4	
12-Feb-24	13-Feb-24	14-Feb-24	15-Feb-24	16-Feb-24
	4w Bill 95.1		42d Bill 79.5	
	8w Bill 89.7		13w Bill 85.1	
	17w Bill 59.3		26w Bill 74.4	
			3y Note 57.9	
			10y Note 44.8	
			30y Bond 26.4	
	Total 244.0		Total 368.1	
19-Feb-24	20-Feb-24	21-Feb-24	22-Feb-24	23-Feb-24
	4w Bill 95.1		42d Bill 79.5	FRN 28.0
	8w Bill 89.7		13w Bill 83.7	
	17w Bill 59.3		26w Bill 73.2	
			52w Bill 47.1	
	Total 244.0		Total 283.5	
26-Feb-24	27-Feb-24	28-Feb-24	29-Feb-24	
	4w Bill 95.1		42d Bill 79.5	
	8w Bill 89.7		13w Bill 83.4	
	17w Bill 59.3		26w Bill 72.9	
			2y Note 65.6	
			5y Note 66.6	
			7y Note 43.6	
			20y Bond 16.5	
			30y TIPS 9.2	
	Total 244.0		Total 437.4	

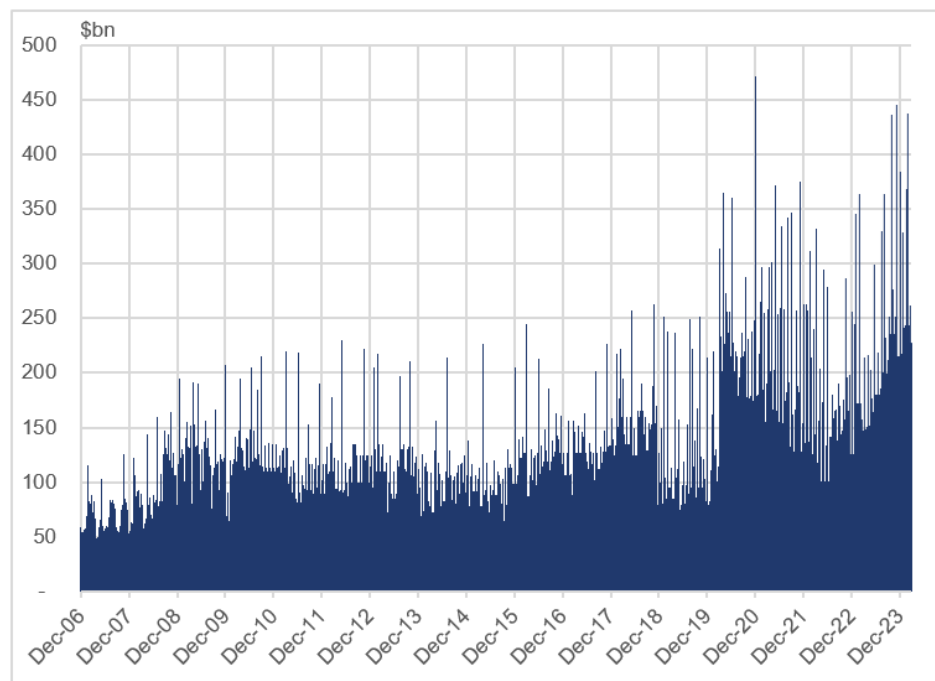
Data Source: Treasury Direct. The amount issued is calculated by multiplying the total face value accepted by the price resulting from the auction.

1. Adapting the Timing of Treasury Settlement

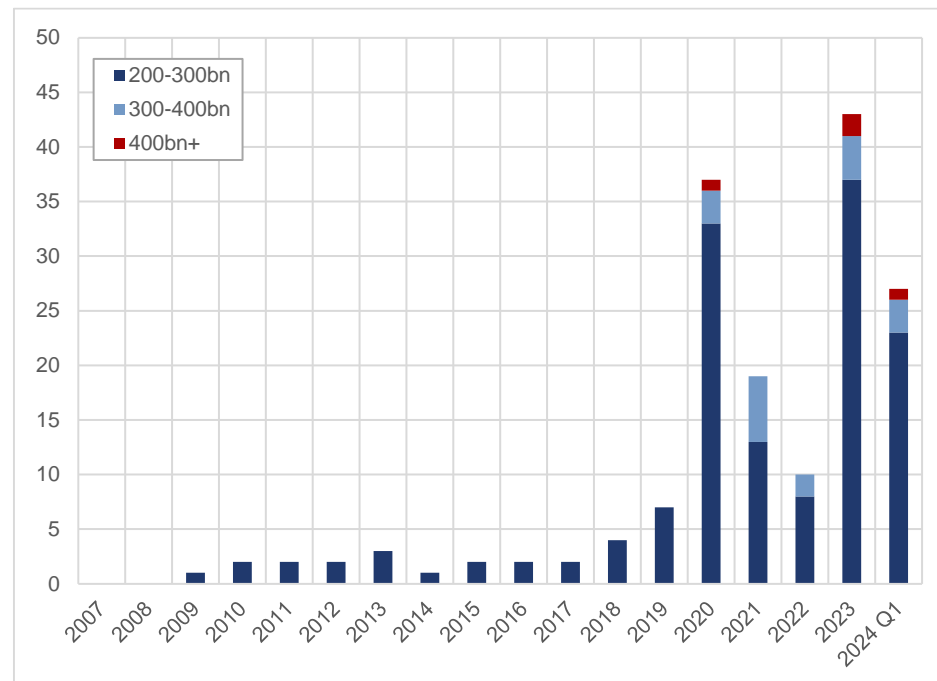
Daily Settlements Have Increased Materially in Recent Years

- In recent years, the increased amount of issuance, especially bills, has resulted in a material increase in the number of days with a large notional of Treasuries settling
 - In Q1 2024 alone, there were 23 days with settlements between \$200 and 300bn, 3 days with settlements between \$300 and 400bn and 1 day with settlements above \$400bn
- This can present challenges for primary dealers who must consider the mismatch in timing between their cash outflows (payment to the US Treasury) and their cash inflows (payment from clients on whose behalf they placed orders)
- Pre-funding these intraday liquidity needs is an added cost to primary dealers and could result in increased funding pressures on peak settlement days as bill issuance grows
- Some potential solutions to consider and analyze would include:
 - Introducing a third settlement day for some bill tenors (e.g. Wednesday)
 - Adapting the settlement date of coupon bonds to avoid bill settlement days
 - Introducing a mechanism to settle different bonds at different times during the day
- Operational feasibility and impact on ability for investors such as money market funds to roll bills as they mature would need to be considered

US Treasuries Issuance Amount (in \$bn, by Issue Date)



Number of Days with Issuance Amount > \$200bn

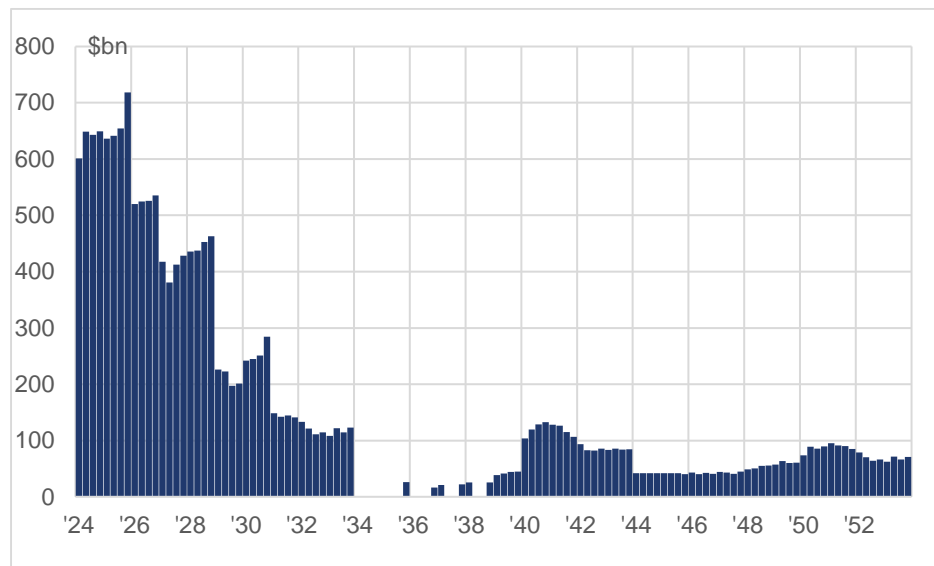


Data Source: Treasury Direct. The amount issued is calculated by multiplying the total face value accepted by the price resulting from the auction.

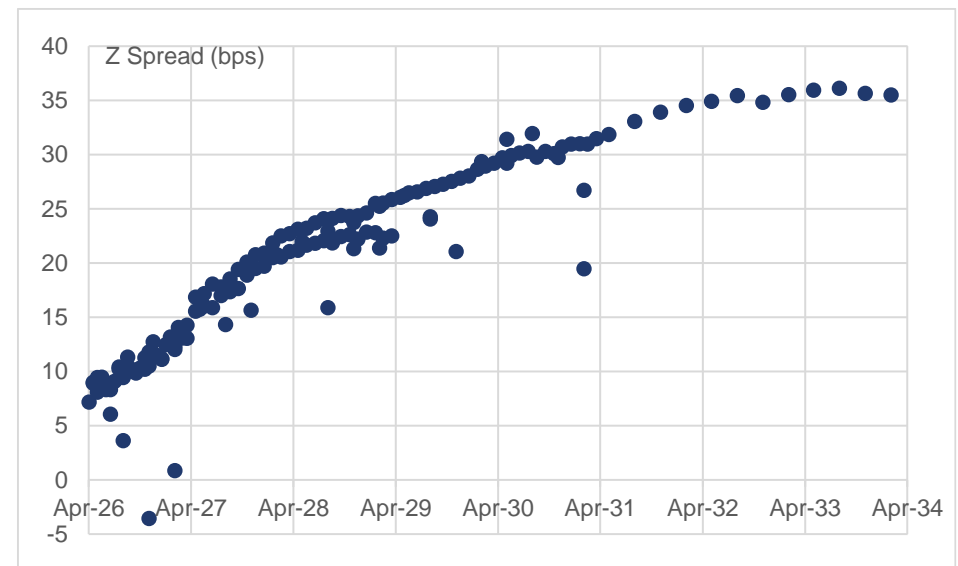
2. Reopening Operations

- Treasury could explore conducting reopening operations as a complementary program to the buyback program it will soon be launching
- Reopening operations could allow Treasury to:
 - Smooth out the maturity profile of Treasuries across the curve
 - Limit dislocations caused by the scarcity of certain securities
 - Decrease its interest cost by reopening securities trading “rich” in the secondary market
- However, the constraints considered for buybacks¹ should also apply to reopenings:
 - Reopenings should not have a harmful impact to the “regular and predictable” framework
 - Reopenings should not be used to fundamentally change the maturity profile of the Treasury curve or to mitigate episodes of acute market stress
 - We recommend excluding current CTD bonds to avoid adding uncertainty in futures delivery, which could negatively impact market liquidity for both futures and cash Treasuries. We don't expect the same issue with potential CTD bonds or future CTD bonds
- Given that there is no corresponding objective in the upcoming buyback program, more work would be needed to understand what approach Treasury could use to identify “rich” securities to target for reopenings and to capture the richness without being disruptive to the market

Current Maturity Profiler per Quarter



Z Spread Curve² (2026 to 2034 Maturities)



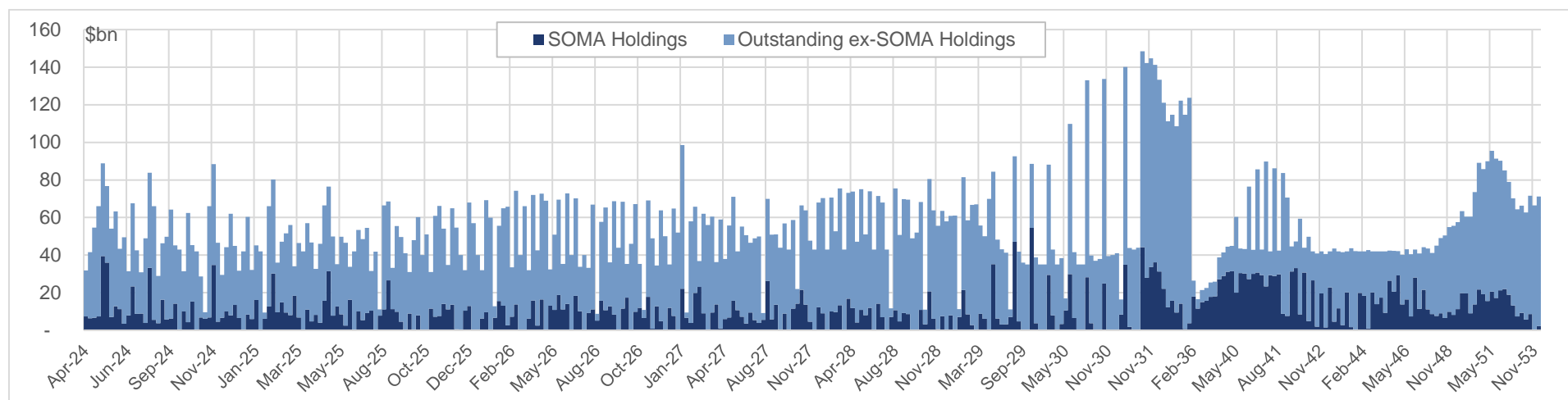
1. See May 2023 Presentation to TBAC: <https://home.treasury.gov/system/files/221/TreasurySupplementalQRQ22023.pdf>

2. Source: Presenting member calculation, as of 17-Apr-2024

3. Securities Lending

- Treasury could consider facilitating securities lending for Treasuries that are not in the Fed's SOMA portfolio or that the Fed holds in very small quantity
 - The presence of a securities lending backstop for all Treasury securities could ensure access and delivery, alleviating scarcity and risk of fails, thereby enhancing the ability for dealers to make two-way prices
 - Operationally, this could entail a back-to-back, cash-for-cash reverse repo of desired Treasury collateral. Treasuries created under this program would be for repo purposes only
 - If such collateral were created, it would mean that there is more of the bond available in repo than the outstanding issue size. For this reason, it would make sense to exclude such amounts for inclusion in bond indices, even on a temporary basis
 - The Fed's lending facility currently awards loans on competitive bidding in a multiple price auction, with the bid rate representing the lending fee rate that participants would be willing to pay to borrow the security. It is typically equivalent to the spread between the general collateral rate and the specials rate. Treasury could consider a similar approach for the "special issue" bonds
- In the UK, the standing repo facility is managed by the Debt Management Office (DMO) rather than by the Bank of England
 - The lending rate is set as a spread to the BoE's bank rate (the spread is currently 75bp), though this has varied over time
 - Having a fixed rate across securities is likely to be more effective in enhancing secondary market liquidity and simpler to implement, although at the cost of potentially distorting price discovery
- In evaluating the merits of a securities lending program, Treasury should evaluate the impact that it could have on the "regular and predictable" framework
 - While increasing the ability to borrow any Treasury security could be seen as a positive in that respect, the potential for the size of an issue available in the repo market to vary over time could be seen as a negative

Fed's SOMA Holdings Vary Significantly By Security¹



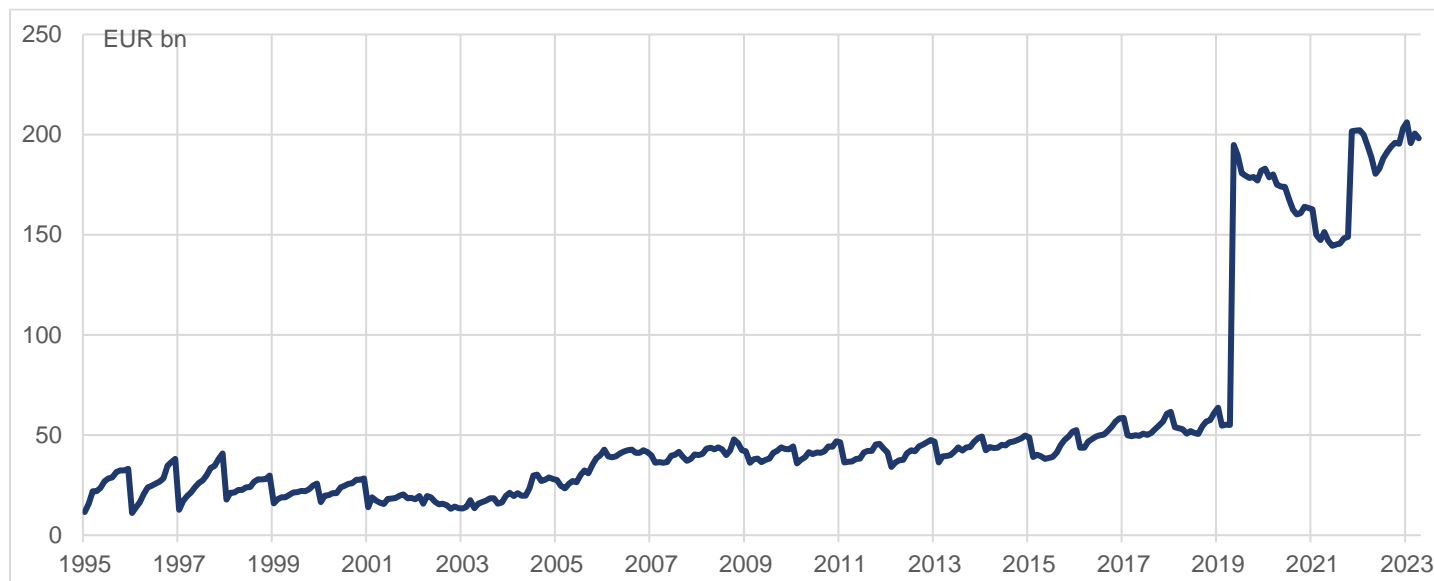
1. Source: Federal Reserve Bank of New York. Note: X-axis is not to scale

4. Issuance Add-Ons

Maintaining a “Reserve” Option to Lower Costs / Enhance Liquidity

- Currently, Treasury’s practice is to place the entire amount of issuance at the primary auction. This results in a regular and predictable outcome but means that Treasury could be missing out on the ability to satisfy additional future demand for that particular security.
- An alternative approach used by the German DMO is the concept of ‘retained holdings’
 - The bulk of Germany’s market financing is raised through a multiple price auction. An issuance volume target is announced ahead of the auction, and on auction day, about 80% of the target is raised in the primary market. The remaining 20% is credited to the DMO’s ‘holdings’ representing the retention quote
 - In the weeks following the auction, the retention quote is released into the markets, both to contribute to secondary market liquidity and to smooth issuance over time. These securities are sold directly into the secondary market by the Bundesbank
 - In theory, such an approach offers the ability to be somewhat opportunistic with issuance without relying on a syndication process. The retained amount, if unused, could also be used to alleviate security shortages
- It is not clear how this enhanced flexibility could fit within the “regular and predictable” framework used by Treasury
- Another approach, already discussed in the Q1 2019 charge, is syndication, and the ability to issue additional amounts based on demand indications, via a “greenshoe” option
 - This approach may be more appropriate for new products where demand is uncertain

Bond Notional Retained by the German DMO Over Time¹



1. Source: German Ministry of Finance

5. Primary Dealer League Tables

- As part of their issuance framework, some sovereign issuers publish league tables of primary dealers to incentivize behavior that helps achieve the objectives of the issuance strategy, such as supporting market liquidity and contributing to the minimization of borrowing costs
- For example, the French DMO (Agence France Tresor) publishes annual league tables ranking primary dealers on three criteria:
 - Primary market participation in auctions and buybacks (40% weight)
 - Market share in the secondary market (40% weight)
 - Qualitative assessment of the quality of services provided (e.g. advice provided to the DMO) (20% weight)
- While the use of dealer league tables is more prevalent in countries that rely on syndication, Treasury could explore whether their use could help achieve some of the objectives of its issuance strategy

French DMO League Table of Primary Dealers (2023)¹

Primary Market (40%)		Secondary Market (40%)		Quality of Services (20%)		Overall Ranking	
1	BNP Paribas	1	BNP Paribas	1	BNP Paribas	1	BNP Paribas
2	Societe Generale	2	Citi		Societe Generale	2	Societe Generale
3	HSBC	3	Deutsche Bank	3	Credit Agricole	3	Citi
4	JPMorgan	4	JPMorgan	4	HSBC	4	JPMorgan
5	Citi	5	Credit Agricole	5	JPMorgan	5	HSBC
6	Credit Agricole	6	Morgan Stanley	6	Citi	6	Credit Agricole
7	Morgan Stanley	7	Societe Generale	7	Natixis	7	Deutsche Bank
8	Deutsche Bank	8	Barclays	8	Bank of America	8	Morgan Stanley
9	Bank of America	9	HSBC	9	Morgan Stanley	9	Bank of America
10	Goldman Sachs	10	Bank of America	10	Deutsche Bank	10	Barclays

1. Source: French DMO (Agence France Tresor): <https://www.aft.gouv.fr/en/publications/communiqués-presse/21-february-2024-2023-league-table-most-active-primary-dealers-svts>

Conclusion

- To achieve some or all of its objectives (expansion of investor base, minimized borrowing costs, improved liability profile management and enhanced liquidity) in the context of an expected increase in issuance, we recommend that Treasury explore the issuance of the following products:
 - Callable bonds would allow an expansion of the investor base to investors who seek enhanced yield by selling optionality when investing in callable bonds or residential MBS. If issued unhedged, callable bonds would potentially allow Treasury to lower its interest costs during recessionary environments, when Treasury could benefit from calling the bonds and refinancing at potentially lower rates
 - Green bonds would allow an expansion of the investor base given the rapidly growing assets-under-management of funds or mandates restricted to green investments. All major sovereign issuers in developed markets, other than the US, have already issued green bonds
 - The issuance of 1-year FRNs, in addition to the existing 2-year FRNs, would see more demand from money market funds given their WAM / WAL constraints and could improve the liquidity of the FRN curve. This could also reduce the need to increase bill issuance
 - The issuance of 3-year TIPS could allow Treasury to keep the outstanding TIPS share stable without relying on increased auction size for existing tenors that may be difficult for the market to absorb
- While we would assign a higher priority to the potential new products above, Treasury could also consider:
 - Revisiting ultra long-end issuance, with a possible focus on zero-coupon bonds or perpetual bonds rather than par bonds
 - FRNs linked to Treasury note / bond yields for retail investors
 - The ability to strip fixed-rate Treasuries into floaters and inverse floaters (levered or not) to introduce duration profiles not achievable with existing Treasury products
- Note that the products mentioned above, with the exception of 1-year FRNs and short-dated TIPS, would require development work and/or an operational uplift that would need to be evaluated further
- Finally, Treasury could consider further studying process changes that could improve the functioning of the Treasury market:
 - Adapting the timing of Treasury settlements to reduce the intraday funding needs of primary dealers on large settlement days
 - Reopening program complementary to the buyback program that Treasury is soon launching
 - Processes used by other sovereigns that Treasury could consider include a securities lending program and primary dealer league tables

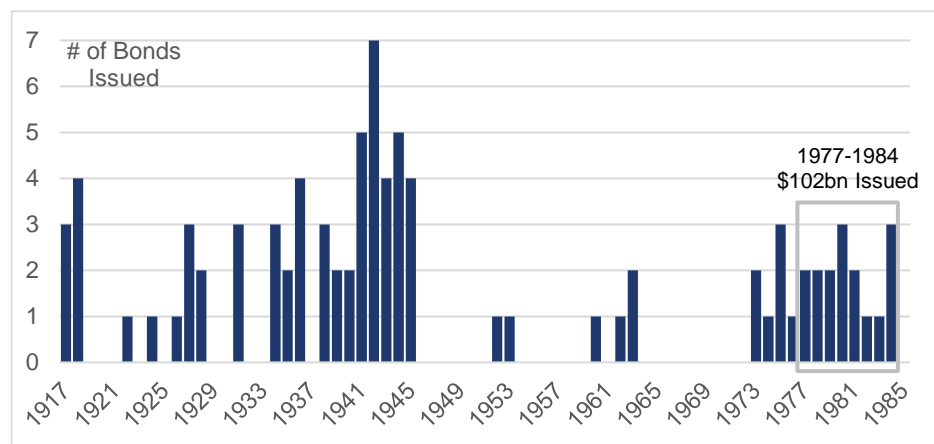
Appendix

Callable Bonds

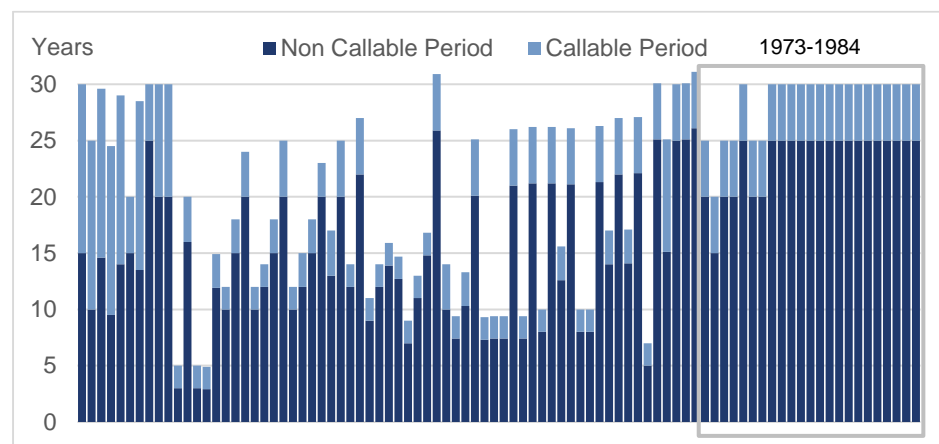
Historical Issuance of Callable US Treasuries

- 88 callable US Treasuries were issued from 1917 to 1984
- During the most recent period (1977 to 1984), \$102bn were issued, all of them 30-year bonds which were only callable after 25 years (5 years prior to maturity)
- Given the level of rates at the time, they had very high coupons, ranging from 7.625% to 14%, with a weighted average of 10.7%
- With the secular decline in rates in the four decades after issuance, there was a significant incentive for Treasury to call these bonds when they first became callable (2002 to 2009)
- The prevailing level of 5-year Treasury yield on the call date was ~340 to ~1125bps lower than the coupon of these callable bonds, resulting in significant interest savings from calling them and refinancing
- From the perspective of an issuer, this is an example (albeit extreme) of the potential benefits of issuing callable bonds when rates are elevated at issuance

Number of Callable US Treasuries Issued Since 1917¹



Historical Maturity and Non-Call Period¹



Note: X axis is not to scale

Call Exercises for Bonds Issued from 1977 to 1984²

Issuance Date	Maturity Date	Called on	Coupon	5y UST Yield on Call Date	Change in Interest After Call (%)	Amount Issued (\$mm)	Change in Interest After Call (\$mm/yr)
15-Feb-77	15-Feb-07	15-Feb-02	7.63%	4.19%	(3.4%)	4,250	(146)
15-Nov-77	15-Nov-07	15-Nov-02	7.88%	3.05%	(4.8%)	1,500	(72)
15-Aug-78	15-Aug-08	15-Aug-03	8.38%	3.40%	(5.0%)	21,360	(1,064)
15-Nov-78	15-Nov-08	15-Nov-03	8.75%	3.14%	(5.6%)	5,230	(293)
15-May-79	15-May-09	15-May-04	9.13%	3.82%	(5.3%)	4,610	(245)
15-Nov-79	15-Nov-09	15-Nov-04	10.38%	3.53%	(6.8%)	4,200	(288)
15-Feb-80	15-Feb-10	15-Feb-05	11.75%	3.71%	(8.0%)	2,650	(213)
15-May-80	15-May-10	15-May-05	10.00%	3.82%	(6.2%)	2,990	(185)
17-Nov-80	15-Nov-10	15-Nov-05	12.75%	4.50%	(8.3%)	4,080	(337)
15-May-81	15-May-11	15-May-06	13.88%	5.04%	(8.8%)	4,610	(407)
16-Nov-81	15-Nov-11	15-Nov-06	14.00%	4.62%	(9.4%)	4,900	(459)
15-Nov-82	15-Nov-12	15-Nov-07	10.38%	3.70%	(6.7%)	11,030	(736)
15-Aug-83	15-Aug-13	15-Aug-08	12.00%	3.11%	(8.9%)	14,760	(1,313)
15-May-84	15-May-14	15-May-09	13.25%	1.98%	(11.3%)	5,010	(564)
15-Aug-84	15-Aug-14	15-Aug-09	12.50%	2.42%	(10.1%)	5,130	(517)
15-Nov-84	15-Nov-14	15-Nov-09	11.75%	2.18%	(9.6%)	6,010	(575)
						102,320	(7,415)

Theoretical savings of \$7.4bn per year (on \$102bn of outstanding face value) from Treasury exercising on the first call date. Does not account for the partial buybacks prior to the call date and assumes refinancing by issuing 5-year notes at the prevailing secondary yield.

1: Source: https://fraser.stlouisfed.org/files/docs/publications/frbatreview/pages/67310_1995-1999.pdf

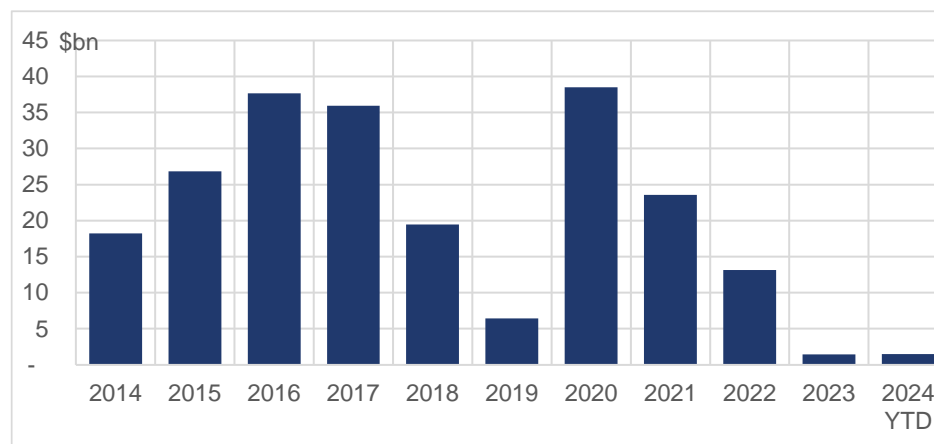
2: Source: Bloomberg, Presenting member calculation

Callable Bonds

Overview of the Formosa Callable Bond Market

- Formosa bonds are bonds issued in the Taiwanese market in a foreign currency
- Issuance in this market increased noticeably in the mid-2010s with growing interest and ability by Taiwanese investors (in particular life insurance companies) to invest in long-dated callable bonds denominated in foreign currency (especially USD)
 - The drivers of this demand have been the access to a broader range of issuers and the ability to earn a higher yield than in the domestic market
- The size of the outstanding USD-denominated Formosa callable bond market is ~\$129bn, with most of the issuers being financials (87%)
- Most outstanding bonds have a tenor of 30 to 40 years and a non-call period of 5 years or more
- Issuance has been slower since 2023 due to higher rates resulting in less legacy Formosa bonds being called / needing to be replaced and in more attractive yields for bullet bonds on an absolute basis
- While Formosa callable issuance was meaningful to the callable bond market for most of the past decade (especially from a risk perspective, given long tenors), we would not recommend that Treasury initially target their investors given the rate sensitivity of their demand

Historical Gross Issuance of Formosa Callable Bonds



Breakdown of Outstanding Debt by Issuer

Financial		
Issuer	\$bn	%
Citigroup	8.3	6.4%
JPMorgan Chase	6.6	5.1%
Barclays	6.3	4.9%
Bank of Nova Scotia	5.5	4.2%
Morgan Stanley	5.4	4.1%
Goldman Sachs	4.6	3.6%
BNP Paribas	4.6	3.5%
UBS / Credit Suisse	4.5	3.5%
Deutsche Bank	4.4	3.4%
Bank of America	3.9	3.0%
Natixis	3.7	2.9%
Abu Dhabi Commercial Bank	3.5	2.7%
MUFG Bank	3.4	2.7%
Credit Agricole	3.3	2.6%
Bank of Montreal	3.2	2.5%
Other	41.2	31.9%
Total	112.4	86.9%

Non-Financial Corporate		
Issuer	\$bn	%
Verizon	6.4	4.9%
AT&T	5.3	4.1%
Taiwan Semiconductor Manufacturing	2.0	1.5%
Comcast	0.8	0.6%
Intel	0.6	0.5%
CODELCO	0.6	0.5%
NextEra Energy	0.3	0.2%
Total	16.0	12.4%

Supranational / Government Agency		
Issuer	\$bn	%
Kommunalbanken (KBN)	0.4	0.3%
European Investment Bank (EIB)	0.3	0.3%
Export-Import Bank of Korea	0.2	0.2%
Total	1.0	0.7%

Breakdown of Outstanding Debt by Tenor / Non-Call Period

		Non-Call Period									Total
		<=1y	2y	3y	4y	5y	6y	7y	8y	10y	
Tenor	<=5y	0.2%	0.0%	0.0%							0.2%
	10y	1.3%	1.1%	0.7%	1.0%	0.2%			0.0%		4.3%
	15y	0.0%	0.0%	0.1%	0.1%	0.4%					0.7%
	20y	0.1%				0.4%					0.5%
	25y			0.2%		0.2%					0.4%
	30y	0.6%	0.8%	0.2%	0.0%	40.4%	7.2%	3.1%	0.6%	4.1%	57.1%
	35y	0.2%		0.2%		7.8%	0.7%	0.0%			8.9%
	40y	0.1%				24.6%	2.8%	0.2%	0.1%		27.9%
	Total	2.5%	1.9%	1.5%	1.1%	73.9%	10.8%	3.4%	0.8%	4.1%	100%

Tenors and Non-Call Periods are rounded up