May 2023

TIPS Issuance, Demand, and Level of Supply

Please discuss what Treasury should consider for TIPS issuance for the rest of CY2023 and beyond, in the context of the committee's views on the appropriate level of TIPS supply in the medium and long-term. How have investor portfolio allocations to TIPS changed recently and how do you expect demand to evolve going forward? In addition to the share of TIPS as a percentage of total debt outstanding, are there any other measures Treasury should use to help inform the appropriate level or range of TIPS outstanding?

Executive Summary

Treasury structurally benefits from the TIPS program.

- Treasury can reduce its costs by offering TIPS to investors who need inflation protection in their portfolios.
- TIPS offset likely higher deficits during low inflation periods; past studies suggest deficit volatility decreased by TIPS share up to 13%.
- Ex-post and ex-ante cost of TIPS vs nominals are random in short run, but Treasury can use them to monitor in the long run if it is realizing structural benefits.

Recent demand environment has been cyclically weaker, but structural demand for TIPS likely remains strong.

- Reasons for investors to own TIPS remain firmly in place; TIPS are owned by a diverse investor base.
- 2022 saw retail TIPS fund outflows around negative price returns; historical experience suggests that such outflows rebound quickly.
- Market pricing of inflation, auction results, and trading activity suggest demand is not weak.

We recommend larger TIPS auction sizes within framework of regular and predictable issuance.

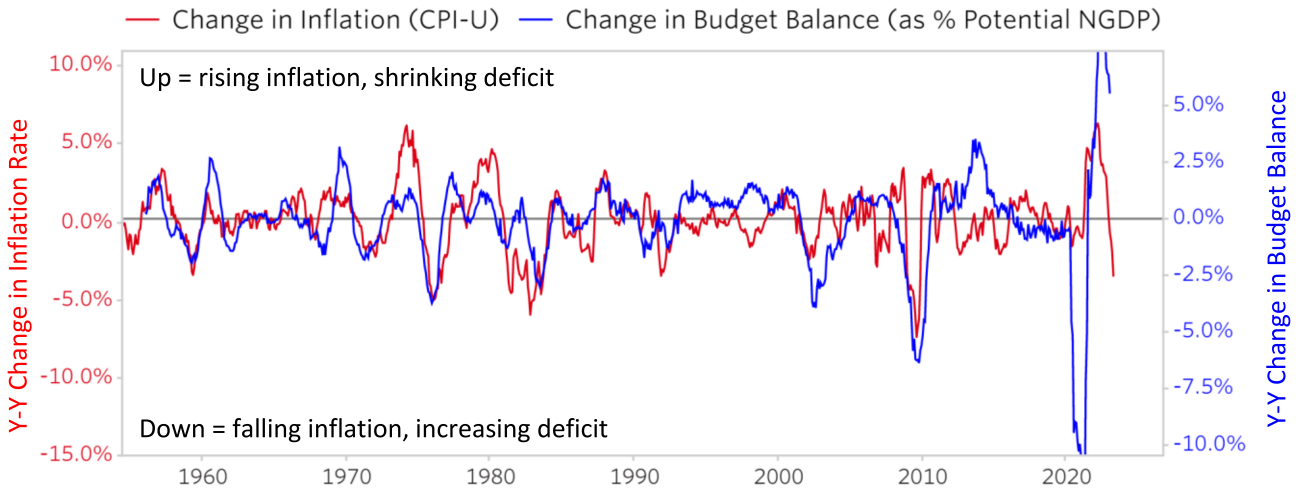
- Higher TIPS share is likely optimal for Treasury so long as market will bear additional issuance.
- Without increased auction sizes, TIPS share would fall in coming years due to higher overall deficits, coming maturities, and SOMA runoff.
- With current demand, we recommend incrementally larger auctions and monitoring of indicators to ensure market is absorbing supply.

Additional perspectives on appropriate TIPS program size (beyond share of debt) can be useful.

- Treasury could use benchmarks like TIPS outstanding relative to the domestic economy and domestic savings pool to calibrate program size.
- Relative to these benchmarks, TIPS program size has been stable at upper end of range and will likely remain so going forward.
- TIPS program size remains in middle of range of major international inflation-linked bond programs.

TIPS Are a Natural Hedge for Treasury as Government Deficit Typically Rises During Periods When Inflation Falls

- On an ex-post basis the **deficit typically rises when inflation falls** (and vice-versa). See following pages for details.
- TIPS interest costs will be lower than nominal coupon bonds during low inflation, offsetting generally higher deficits.
- Past TBAC work concluded that **total deficit volatility is reduced for TIPS allocations up to 13% of the debt stock**.*



Correlation of Inflation to Government Finances

Ex-Post Correlations to CPI-U Inflation, 1950-2023

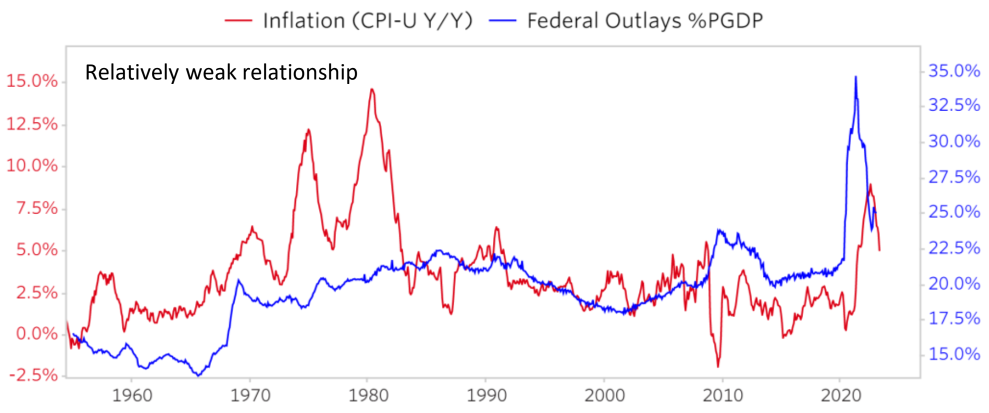
	Correlation to… Changes in Inflation	Level of Inflation	
Change in Total Deficit	-38%	-20%	*(higher inflation <-> falling deficit)*
Change in Receipts	47%	20%	*(higher inflation <-> rising receipts)*
Change in Outlays	-17%	-12%	*(higher inflation <-> falling outlays)*

Source: Treasury, Bureau of Labor Statistics

** 2018 TBAC Presentation to Treasury: https://home.treasury.gov/system/files/276/CombinedChargesforArchives4thqtr2018.pdf*

Government Outlays Are Not on Net That Related to Inflation

- A bit less than 25% of federal spending is explicitly linked to broad CPI.
- Another 25% is linked to medical price components of CPI.
- Remainder (>50%) largely unindexed, though obviously affected by inflation to some extent.
- Portion of federal spending is countercyclical and works in opposite/offsetting direction, e.g. outlays on unemployment benefits.



Source: Treasury, Bureau of Labor Statistics

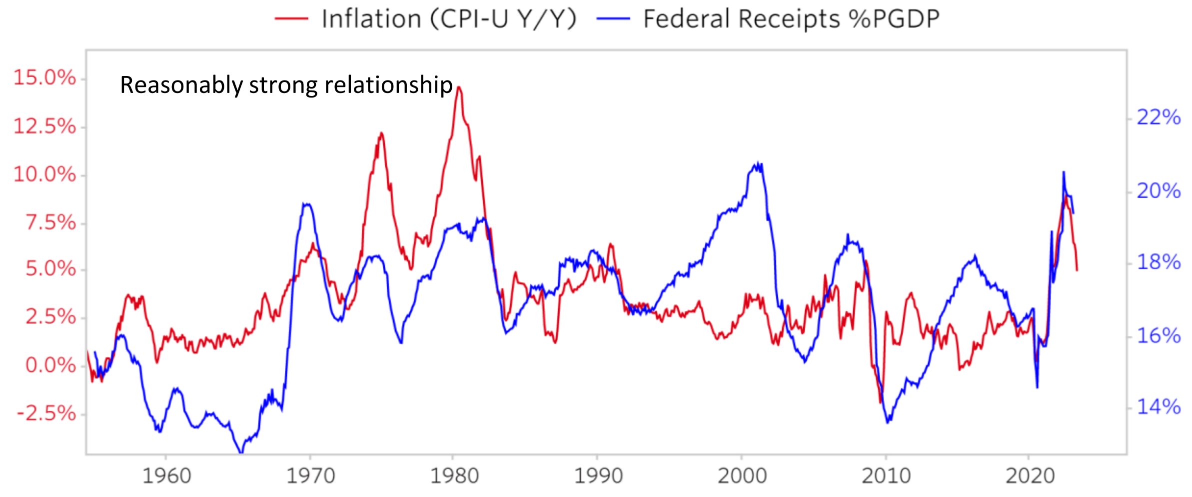
Federal Public Finances & Inflation

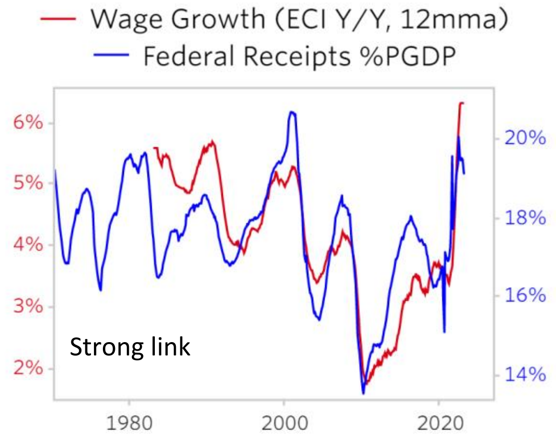
	Index	2022 Lvl (%GDP)	% of Total Outlays/ Receipts
Total Outlays	--	**25.0%**	**100%**
Primary Outlays	--	**22.9%**	**92%**
Indexed to CPI		**5.6%**	**22%**
Social Security	CPI-W	4.4%	18%
Military/ Civilian Retirement	CPI-W	0.9%	4%
Supplemental Security Income (SSI)	CPI-W	0.2%	1%
Driven By Medical Prices		**6.2%**	**25%**
Medicare	MEI*	3.9%	16%
Medicaid	CPI- Medical	2.3%	9%
Not Significantly Indexed	--	**11.1%**	**44%**
Defense Discretionary	--	3.0%	12%
Nondefense Discretionary	--	3.7%	15%
Other**	--	4.3%	17%
Net Interest	--	**2.1%**	**8%**
Receipts	--	**19.4%**	**100%**
Personal Income Taxes	Nominal Wages	10.3%	53%
Payroll Taxes	Nominal Wages	6.0%	31%
Other	--	3.0%	16%

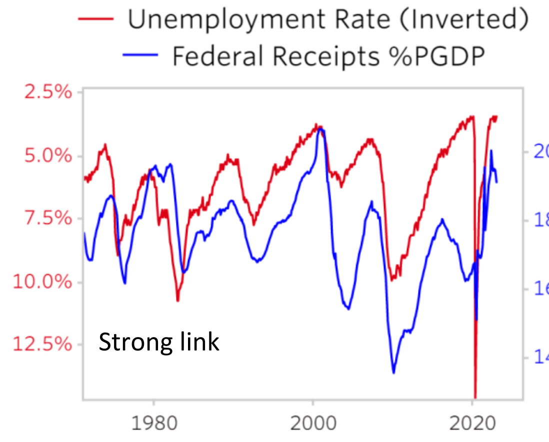
*MEI is the Medicare Economic Index, which is used to measure medical cost inflation of various inputs to producing physician services. ** Other includes some veterans benefits, SNAP, and other mandatory programs.

Government Receipts Are Materially Tied to Inflationary Outcomes

- Government receipts have a reasonably strong relationship to inflation.
- The vast majority (>80%) of federal revenues are tied to nominal incomes (see table on prior page).
- While not literally indexed, nominal incomes are significantly related to inflation:
    - Wage inflation often accompanies broader price inflation.
    - Low unemployment rates both drive higher income (via total hours worked) and higher inflation (Phillips curve relationship).





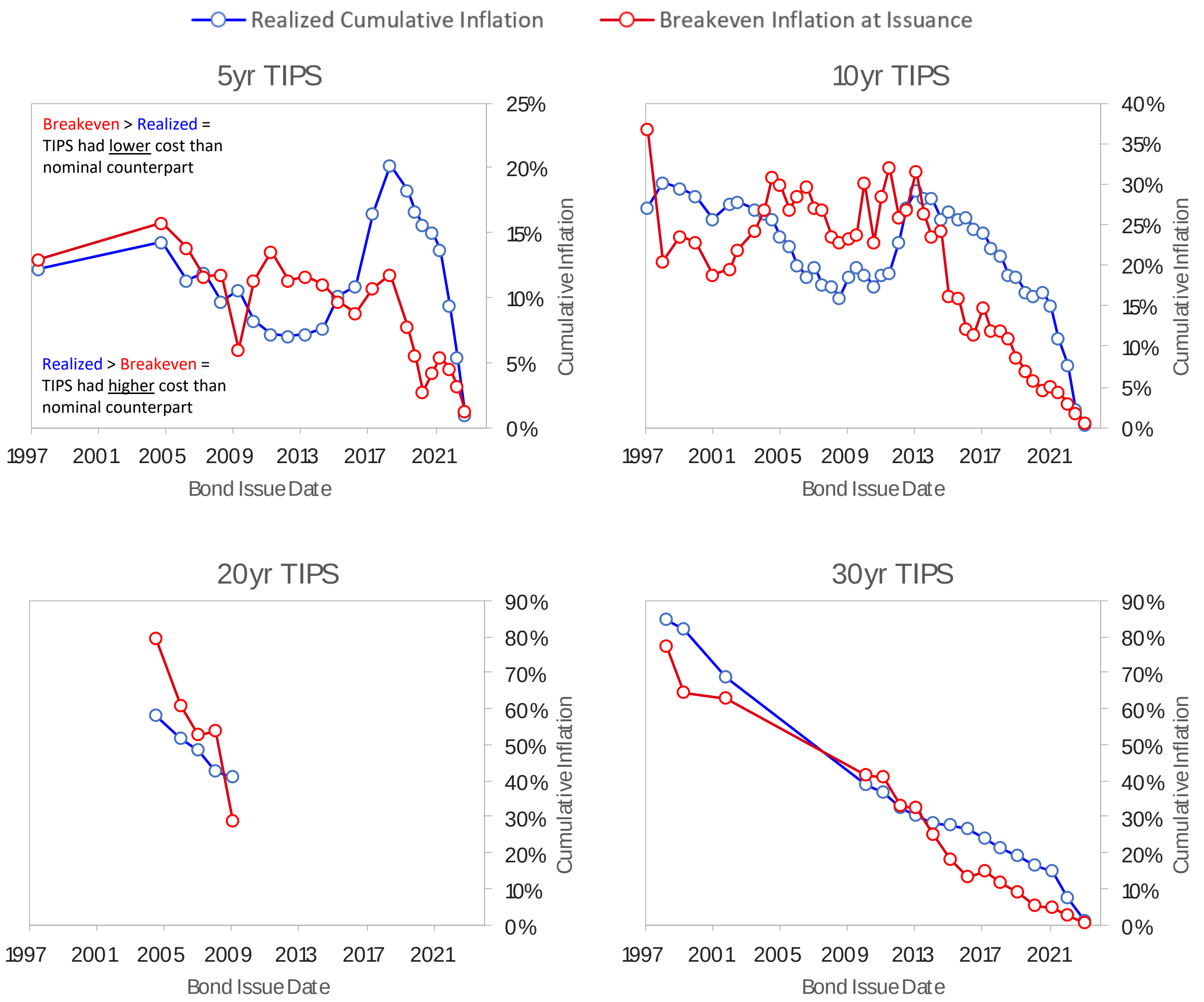


Source: Treasury, Bureau of Labor Statistics

Ex-Post Relative Cost of TIPS v Nominals Fluctuates Over Time, Broad Check on Inflation Risk Premium but Not a Guide for Short Term Issuance Choices

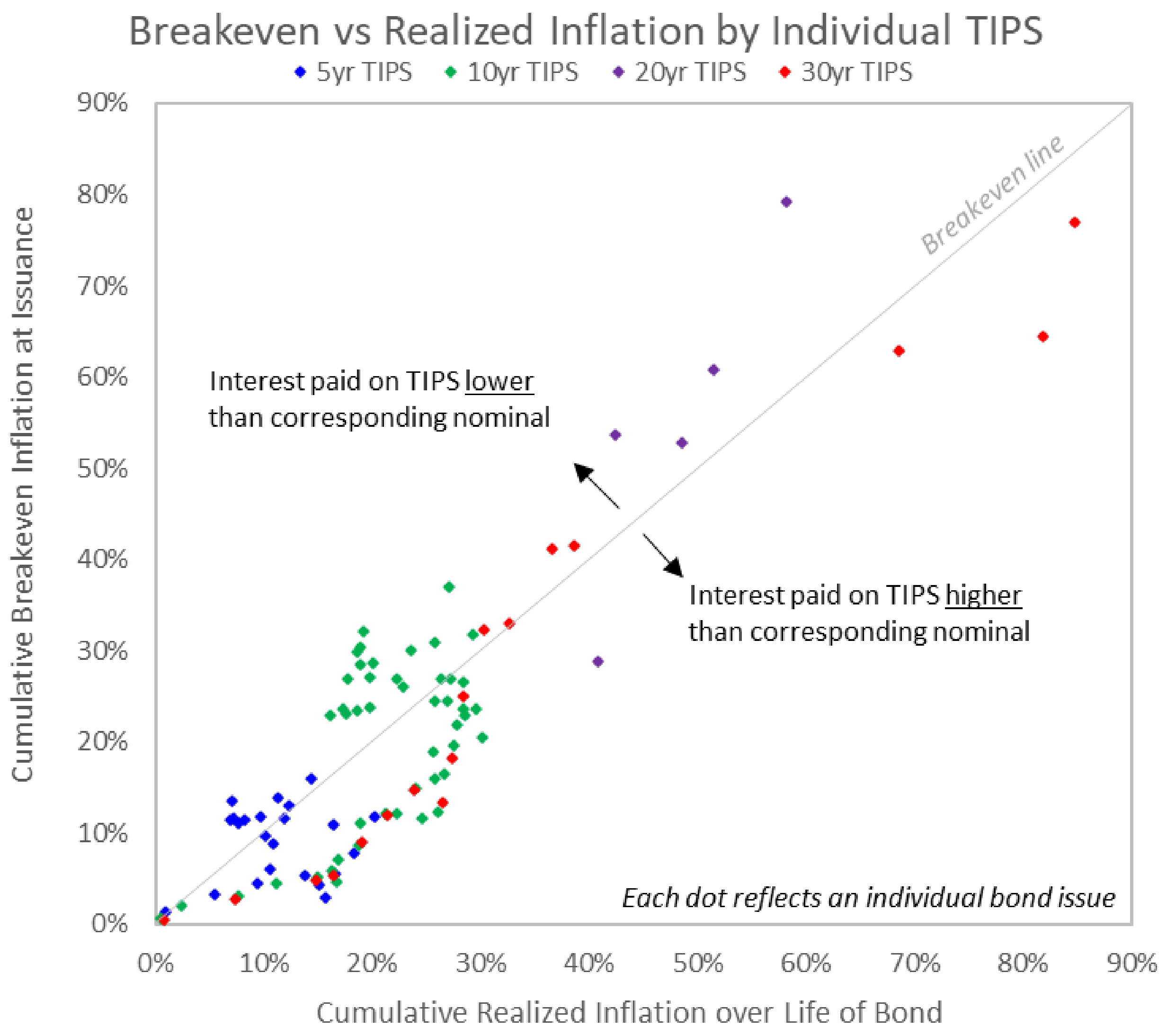
- TIPS issuance decisions should be based on structural benefit to Treasury, not timing market.
- Ex-post outcomes will fluctuate over time and are semi-random in short term, e.g.,
  - TIPS issued from ‘15 – ‘21 had higher cumulative interest costs than nominal counterparts due to inflationary spike in ‘21 – ’23.
  - Most TIPS issued from ‘05 – ‘12 had lower costs.
- Historically, around 40% of TIPS issues have realized lower interest costs than nominal counterparts. The overall cost has been $80bln higher vs comparable nominal coupons.
- Overall program cost ($80bln higher) reflects that the inflationary spike of ’21 – ’23 happened to occur when program size was larger.
- No sufficient evidence that investors have systematically over- or under-discounted inflation when pricing TIPS, but these ex-post outcomes should be monitored over the long term.

TIPS by Individual Bond: Breakeven Inflation at Issuance vs Cumulative Realized Inflation



Source: Treasury, Refinitiv, Bureau of Labor Statistics, author’s calculations

Additional Detail on Ex-Post Cost/Benefit of TIPS Over History



Source: Treasury, Refinitiv, Bureau of Labor Statistics, author's calculations

Share of TIPS with Lower Interest Costs Than Nominal Counterparts

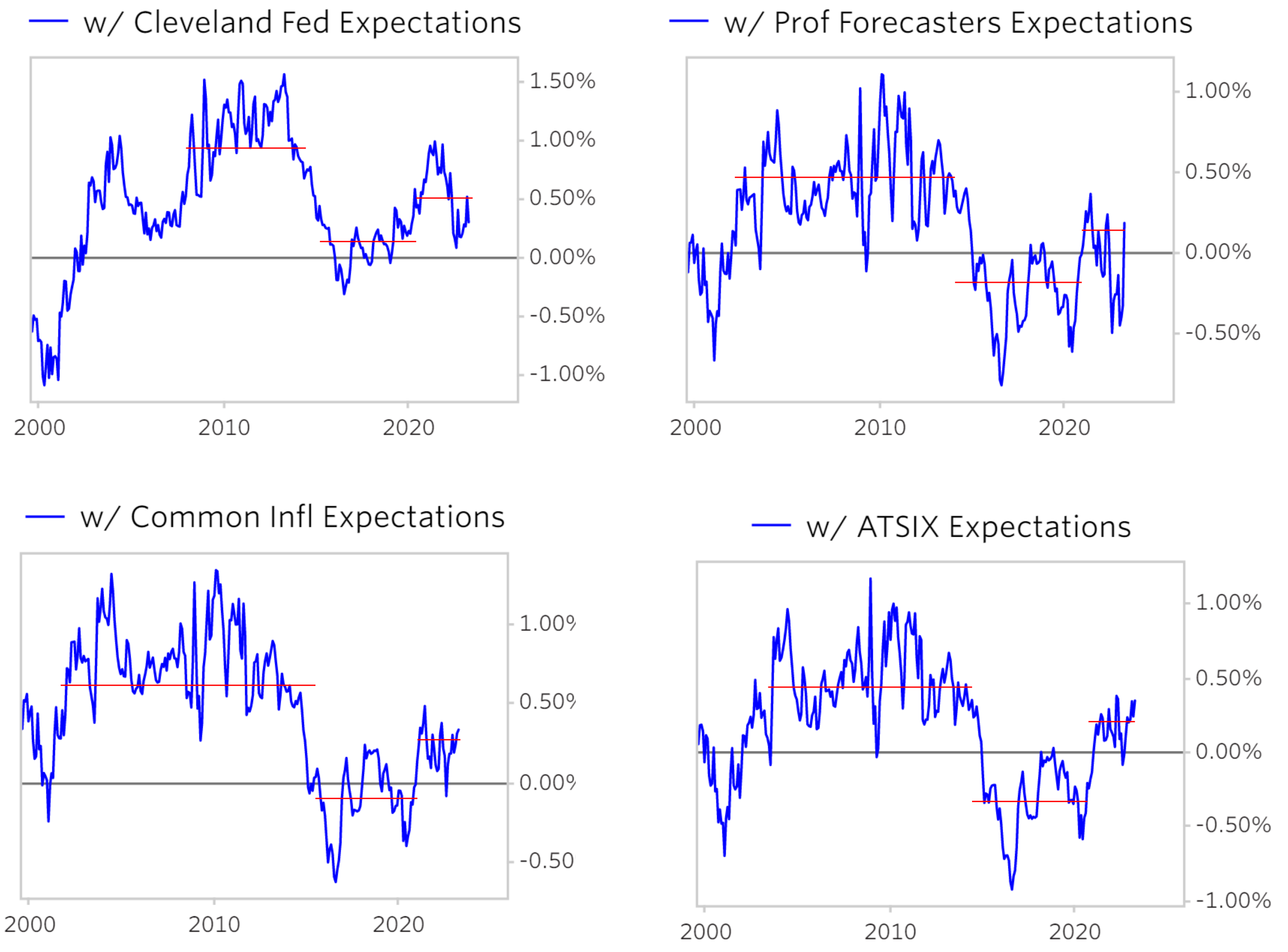
	% of Matured & Outstanding TIPS	% of Matured TIPS
All TIPS	41%	67%
5yrs	43%	60%
10yrs	43%	70%
20yrs	80%	(No Matured 20s)
30yrs	24%	(No Matured 30s)

Ex-Ante, TIPS Advantage Has Recently Increased as Breakeven Inflation Has Risen More Than Investor Surveyed Inflation Expectations

- Forward breakeven inflation rates (BEI) higher than / rising relative to investors' inflation expectations.
  - Inflation surveys have different biases and methodologies, readings should be taken as indicative rather than precise.
- Ex-ante benefit of TIPS to Treasury has improved as investor demand for inflation protection has risen.
  - Note: TIPS liquidity premiums have been stable, see slide 12.
- Investor demand for inflation protection seems to have increased relative to pre-pandemic, though stable in past 1-2 years (see next slide).
- Weaker BEI relative to surveys in '15 – '19 correspond roughly to negative ex-post results for bonds issued in those periods shown on prior pages.

Forward 5y5y Breakeven Inflation minus Surveyed Inflation Expectations

(higher readings = higher ex-ante benefit to Treasury from issuing TIPS)



Sources: Refinitiv, Federal Reserve. Surveys use 10yr expectations reading from indicated sources.

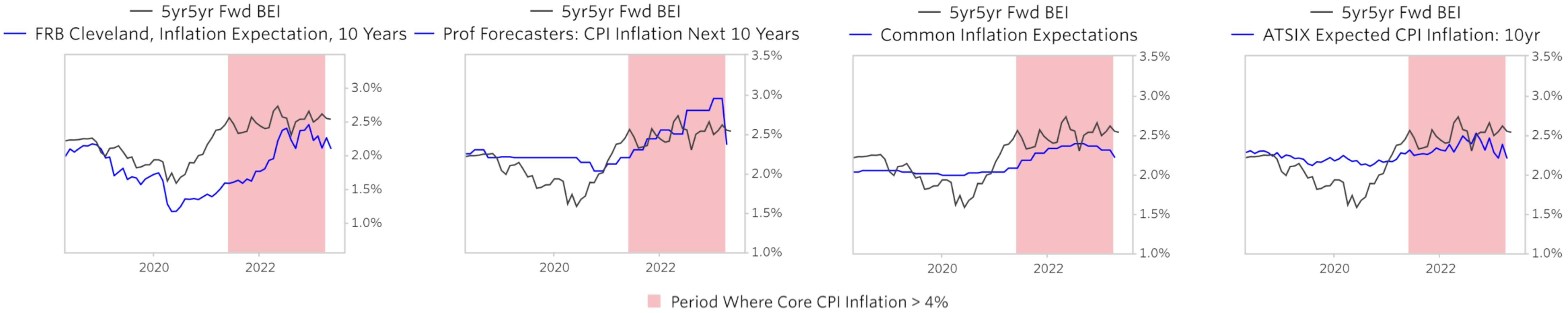
Inflation Expectations and Premiums Have Been Stable in Past Two Years

- In past two years, surveys and market pricing of inflation have largely remained anchored, reflecting credible Fed policy.
- By most measures, the gap between inflation expectations and break-even inflation has been positive and stable through the 2021 – ’23 inflation (Cleveland Fed surveyed expectations is exception).
- Recent short-term drivers of risk premiums are netting:
  - Recent volatile inflation likely increasing premiums.
  - Recent negative price performance for TIPS likely offsetting by reducing investor demand (see subsequent pages).
- Note that model from Cleveland Fed* has suggested recent expansion in inflation risk premium, but that model’s results have been very volatile in past ~5 years (signal/noise issue).

Inflation Expectations and Pricing In Recent Years

	Mar-21	Mar-22	Today	Last 24m Chg	Last 12m Chg
BEI 5y5f	2.5%	2.7%	2.5%	0.0%	-0.1%
Inflation Expectations					
Cleveland Fed	1.5%	1.9%	2.3%	0.8%	0.3%
Prof Forecasters	2.2%	2.5%	2.4%	0.2%	-0.1%
Common Inflation Exp	2.1%	2.4%	2.2%	0.1%	-0.1%
ATSIX Expected CPI	2.3%	2.3%	2.2%	-0.1%	-0.1%
BEI Less Expectations					
Cleveland Fed	1.0%	0.7%	0.3%	-0.7%	-0.4%
Prof Forecasters	0.3%	0.2%	0.2%	-0.1%	0.0%
Common Inflation Exp	0.4%	0.3%	0.3%	-0.1%	0.0%
ATSIX Expected CPI	0.3%	0.4%	0.3%	0.1%	0.0%

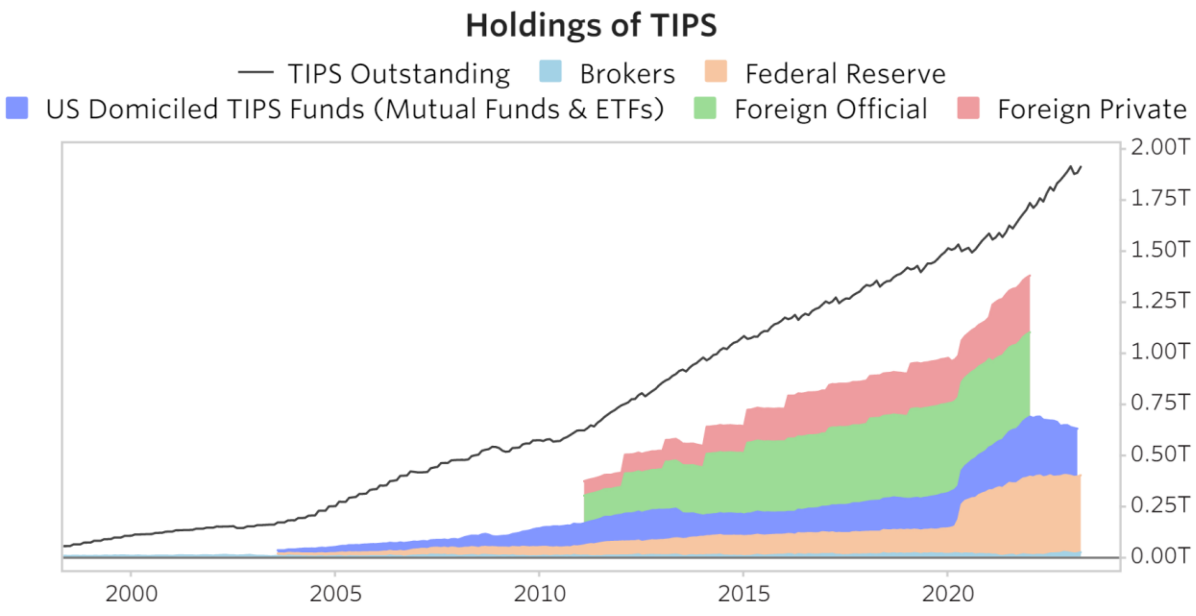
Sources: Refinitiv, Federal Reserve. Surveys use 10yr expectations reading from indicated sources.



*https://www.clevelandfed.org/indicators-and-data/inflation-expectations

Treasury Benefits From Offering TIPS Because They Are Good Product For Many Investors

- TIPS bring allocations to Treasury debt from investors in need of inflation protection (e.g., pensions with inflation-linked liabilities, anyone with future real consumption needs).
- Inflation-linked bonds are one of a small number of publicly traded securities that provide portfolio protection against rising inflation.
- Recent inflationary period highlights importance for investors of managing inflation exposure.
- TIPS are held by diverse group of investors including retail investment funds, pensions, asset managers, and foreign official and private portfolios, with no single group having an outsized share.



Note: foreign holdings not available for 2022 as of publication; will be released later in May '23.

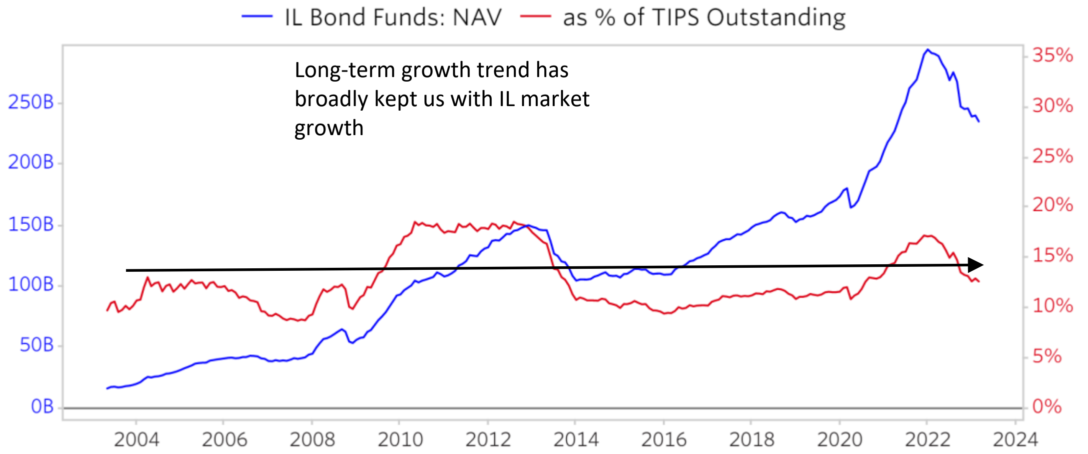
Holdings of TIPS, by Share

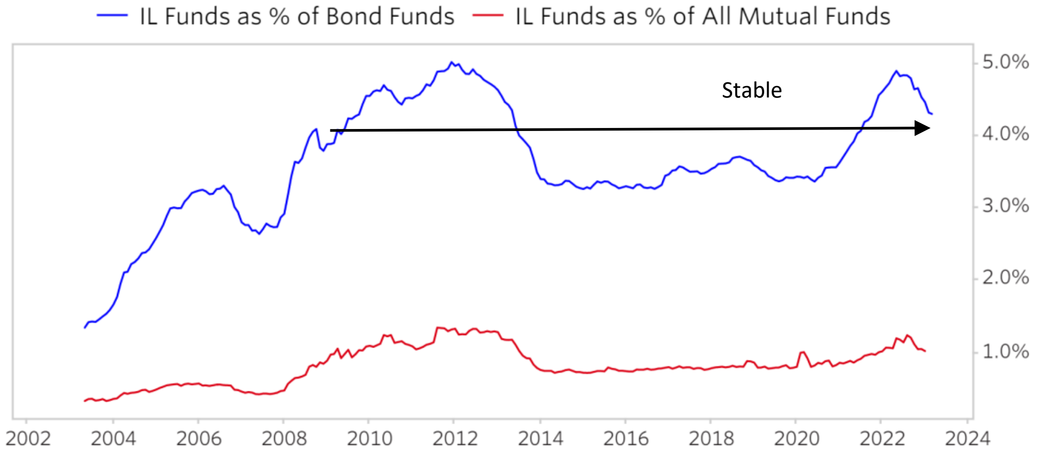
US Domiciled TIPS Funds (Mutual Funds & ETFs)	17%
Foreign Official Sector	24%
Foreign Private Sector	16%
Broker-Dealer Inventories	0%
Federal Reserve	22%
All Others (e.g., Pensions, Asset Managers, Households)	21%

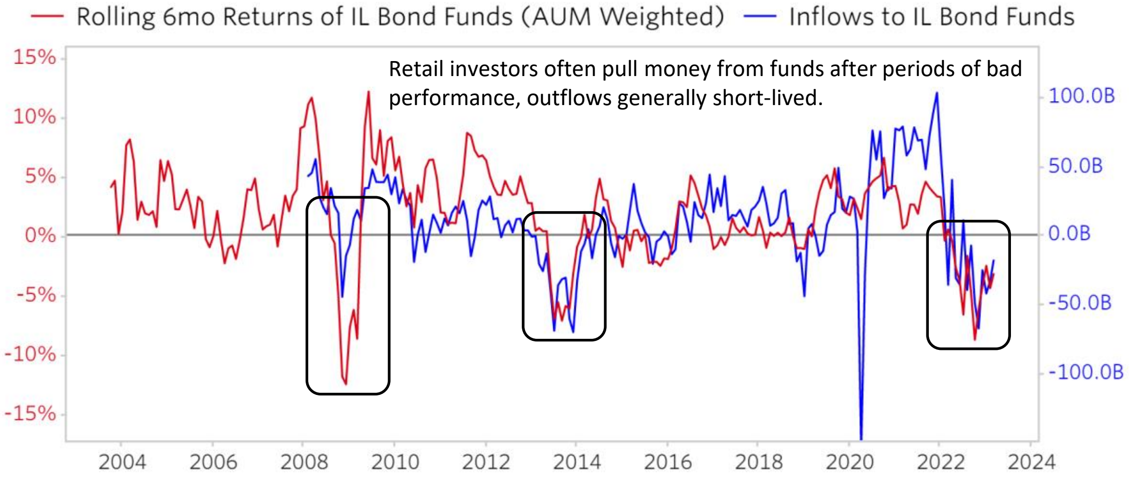
Sources: Lipper, Department of the Treasury, Federal Reserve

Retail Demand via Dedicated TIPS Funds: Secularly Strong, Recently Weak

- Dedicated TIPS funds have grown substantially in recent decades.
- These funds have been stable at 4-5% of the bond fund universe and ~1% of the total mutual fund universe. They have kept pace with TIPS market growth, consistently reflecting 12-15% of TIPS outstanding.
- TIPS funds saw considerable withdrawals in 2022 as returns were weak, outflows began in April, peaked in October and have been decreasing since (through Feb.).
- Past episodes of withdrawals have tended to be short lived (3 months of outflows in ‘08, 14 months in ‘13, 1 month in ‘20), with inflows returning afterward.
- We would expect similar behavior today, especially in the light of recent inflationary experience and recent better returns for TIPS.



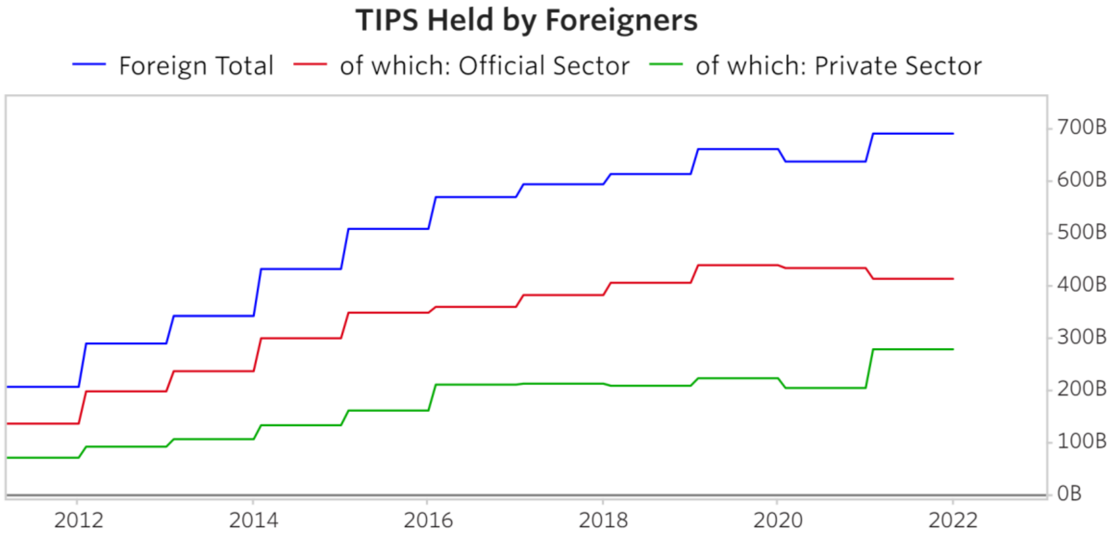


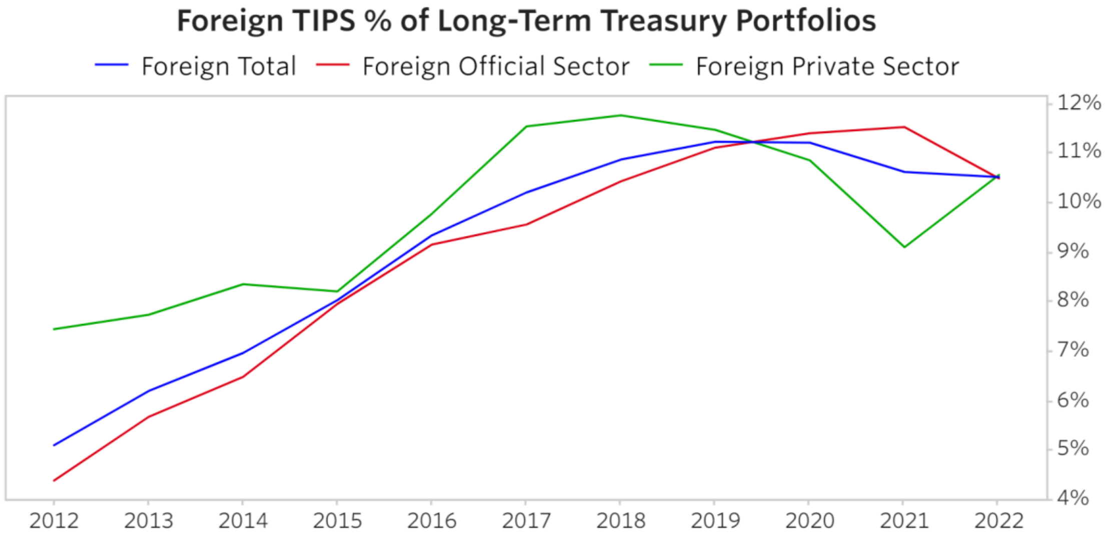


Source: Lipper, author’s calculations

Foreign Investment Demand Remained Strong Through 2021

- Foreign private sector purchases of TIPS were strong through 2021*. Still-low policy rates, steeper yield curve in USD than foreign currencies, and rising inflation likely supported demand.
    - This picture is dated, 2022 figures to be released later this month.
- Foreign official sector TIPS holdings have been flat in recent years, consistent with weaker FX reserve accumulation slowing post-2015.
- TIPS allocations within foreign treasury portfolios have been flat at 10.5-11%, somewhat above the TIPS share of Treasury debt.
- Overall foreign holdings of TIPS reflect 40% of TIPS outstanding.

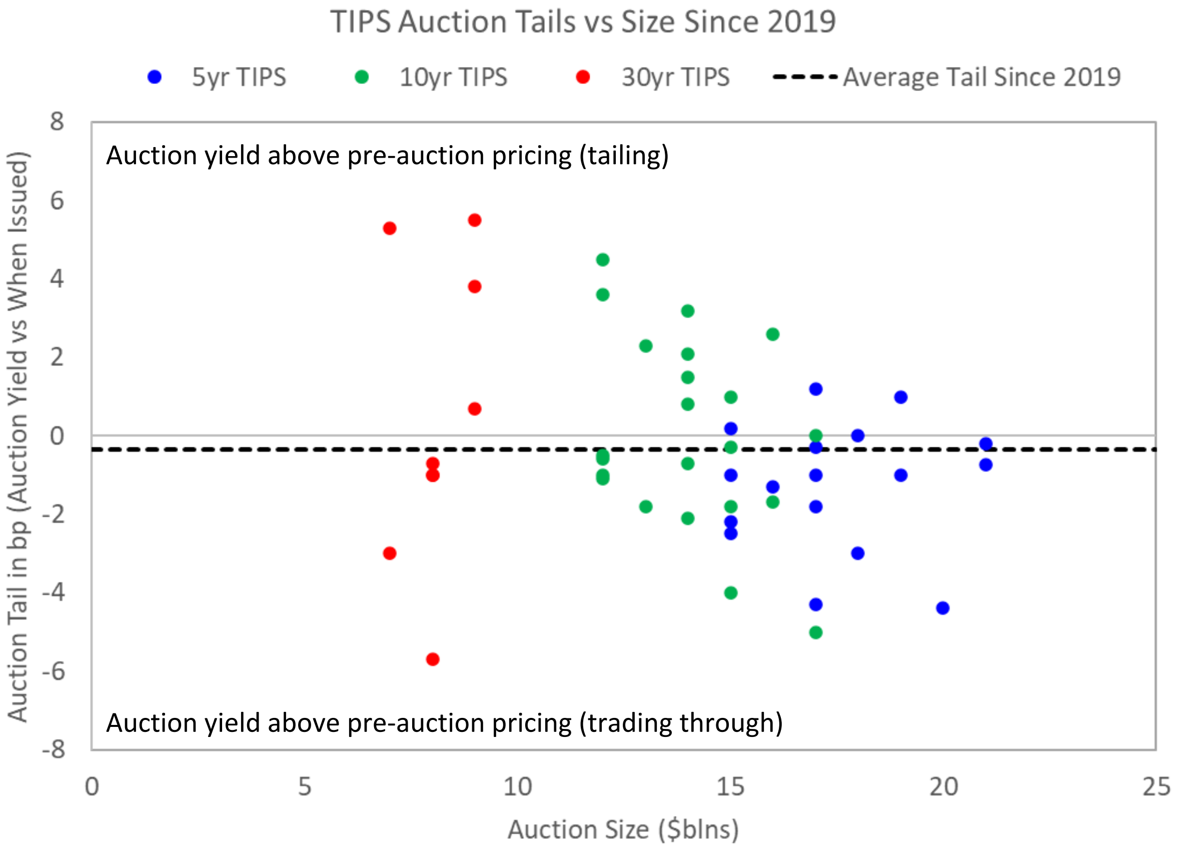




Source: Treasury, author's calculations

Even With Weaker Price Action in 2022, TIPS Auctions Well Absorbed, Especially at Shorter Maturities

- TIPS auctions have generally been well absorbed even as auction sizes have moderately increased in last few years.
- Auction yields coming in close to pre-auction pricing (on average trading through by 0.3 basis points since 2019).
- 5yr TIPS trading through more frequently, 10yr TIPS more balanced, and wide range on 30yr TIPS.

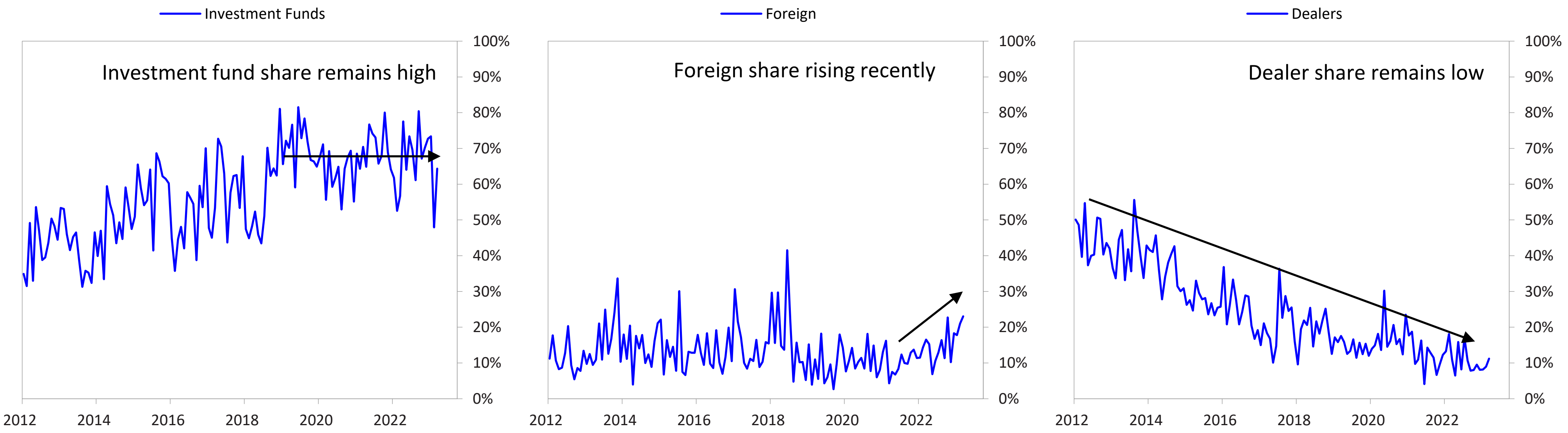


Source: Treasury, Barclays

Investor Share of Auction Allotment Has Remained Stable

- Gains in investment fund allotment at auction remaining durable.
- Dealer share remains low.

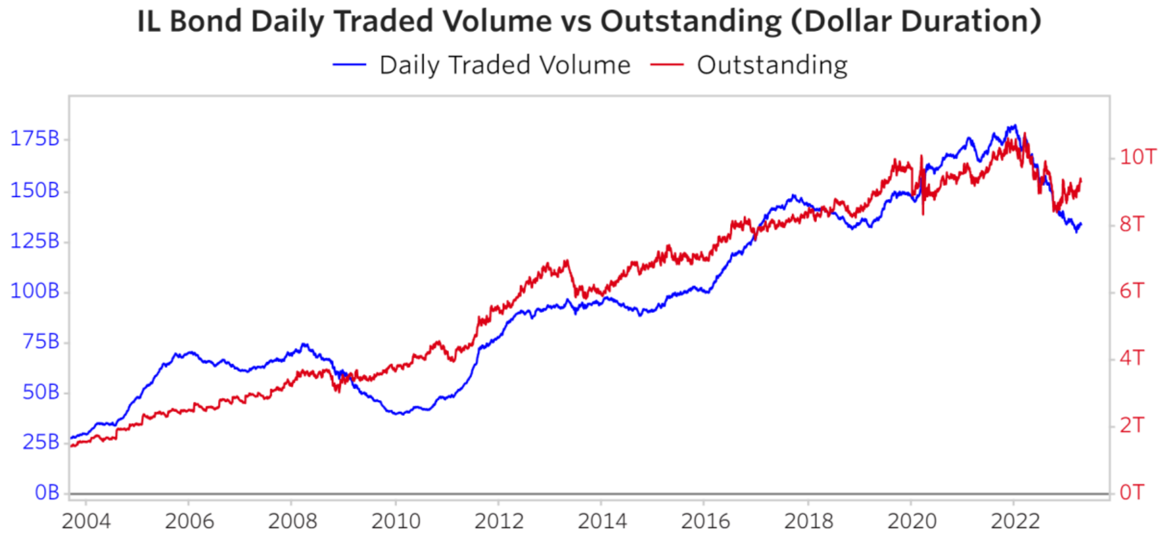
TIPS Auctions Allotment by Investor Type (All Maturities)

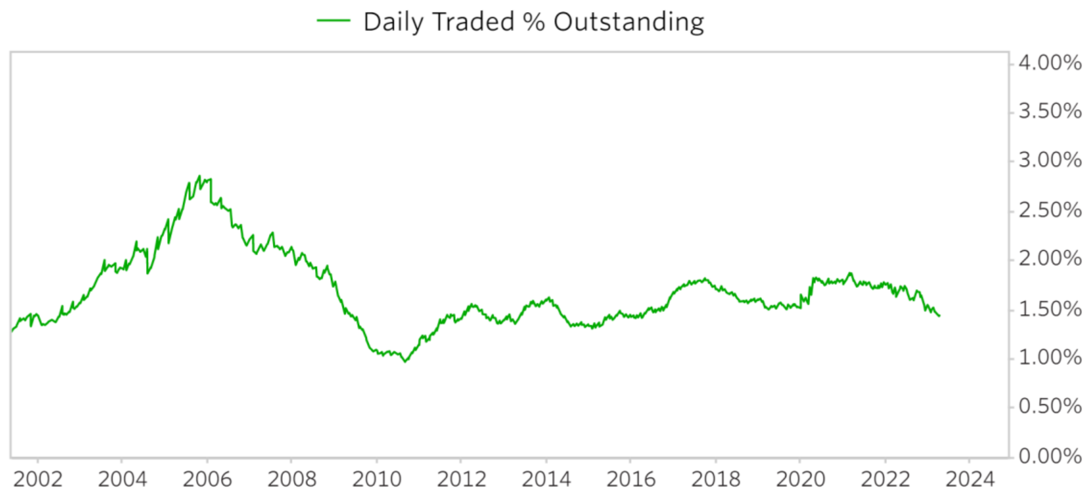


Source: Treasury

Trading Volumes Suggest Market Size Growth Has Not Outpaced Investor Demand

- Traded volumes in TIPS have increased more-or-less in line with outstanding market size over past decade.
- Ratio of traded volumes to outstanding have been stable since 2012.

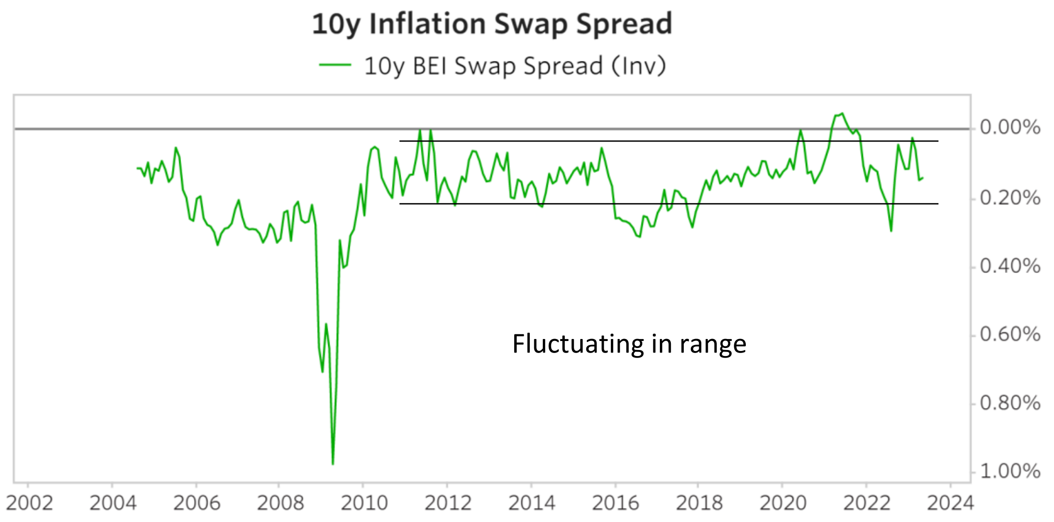




Source: Treasury, SIFMA, author's calculations

Inflation Swap Spreads Roughly Stable, Reflecting No Aggregate Shift in TIPS Liquidity Premium

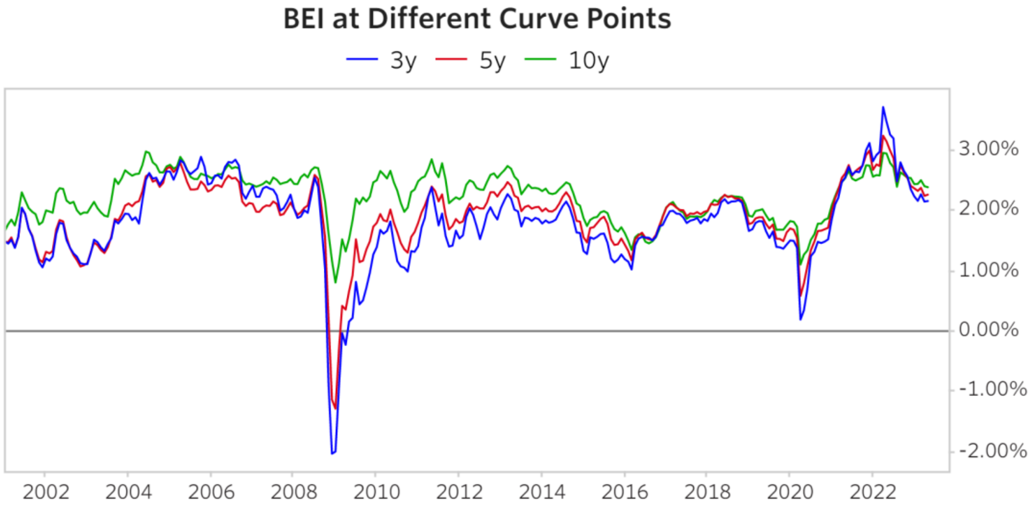
- Difference between BEI on TIPS and inflation swaps has fluctuated between 10-20 basis points since 2010, with modest exceptions in 2015 and mid-2022.
- Investors have been pricing the liquidity of TIPS at a more-or-less consistent rate.
- This suggests that the differences between surveyed and priced inflation shown on prior page mostly reflect demand trends, not shifts in liquidity.

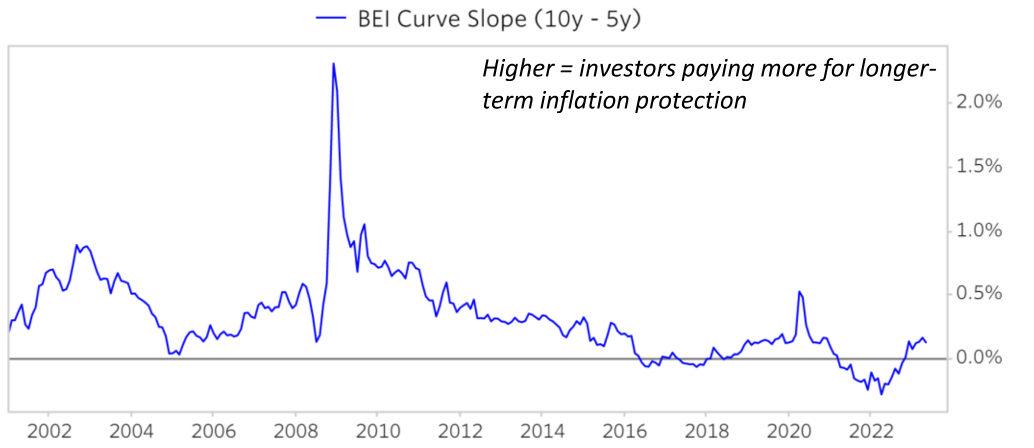


Source: Refinitiv

Breakeven Inflation Curve Has Flattened, a Shift From Pre-2016

- Upward sloping breakeven inflation (BEI) curve, i.e., BEI higher at longer maturities compared to shorter maturities, was present pre-2016. This suggested investors willing to pay more for longer-term inflation protection.
- Today, that slope has flattened, likely due to increased investor demand for shorter-dated TIPS (see next page). That may suggest focusing auction size increases in shorter tenors.
- Alternative factors:
    - Could reflect better liquidity in shorter tenors.
    - Could reflect decreased inflation risk premium.
    - Could reflect expectations that inflation will be higher in near term.

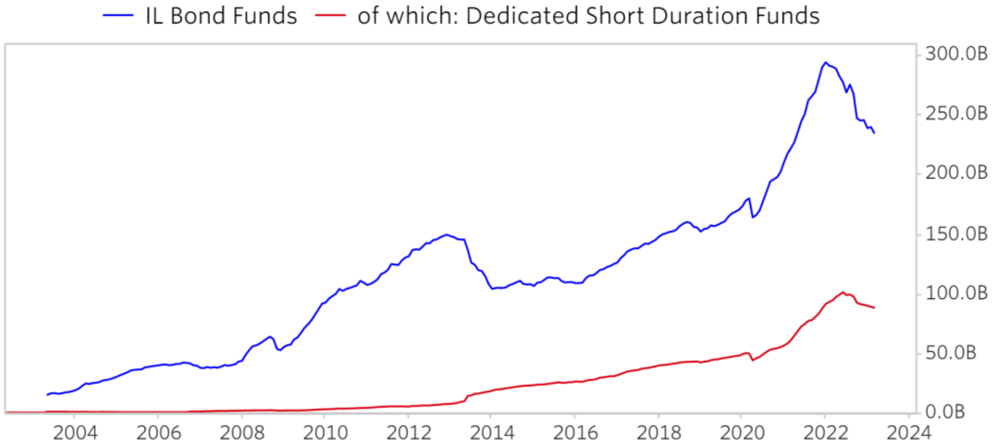


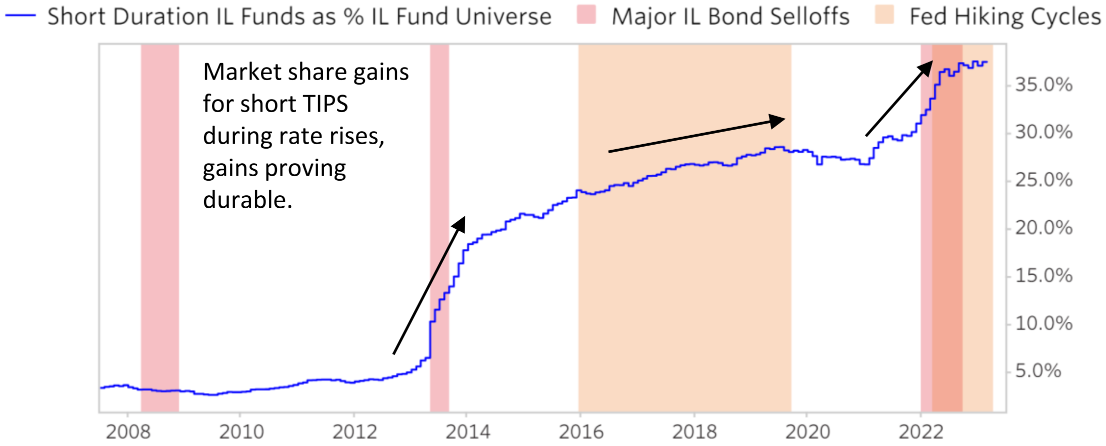


Source: Refinitiv

Investor Demand for Shorter Duration TIPS Has Increased Considerably Over Past Decade

- Dedicated short-duration TIPS funds have gained considerable market share in the TIPS fund universe.
- Shift in investor demand toward shorter-duration TIPS is consistent with flattening of the breakeven inflation curve.
- Not clear if this shift will be durable across interest rate cycles. If sustained, factor for Treasury to weigh in considering maturity profile of TIPS outstanding.





Source: Lipper, author's calculations

Considerations for TIPS Issuance in CY ‘23 and Medium Term

- Treasury should maintain regular and predictable issuance patterns.
- Current TIPS share is 7.6%, low end of past 15 years’ range. Increasing would likely benefit Treasury as long as market can bear increases.
- TIPS share tends to fall in recessions (and did in 2020), should be rebuilt during expansions.
- TIPS share will likely fall below 7% in coming years without increase in auction sizes due to a number of factors:
    - Larger deficits,
    - Rolldown of Fed’s SOMA, and
    - Increased maturities in coming years: average $160bln/year in next 5 years vs $110bln/year past 5 years.
- Investor demand looks healthy; inflation likely more of a concern today than in past decades when TIPS share was higher.
- Increase in retail interest for shorter maturity TIPS suggests additional supply could be focused there.

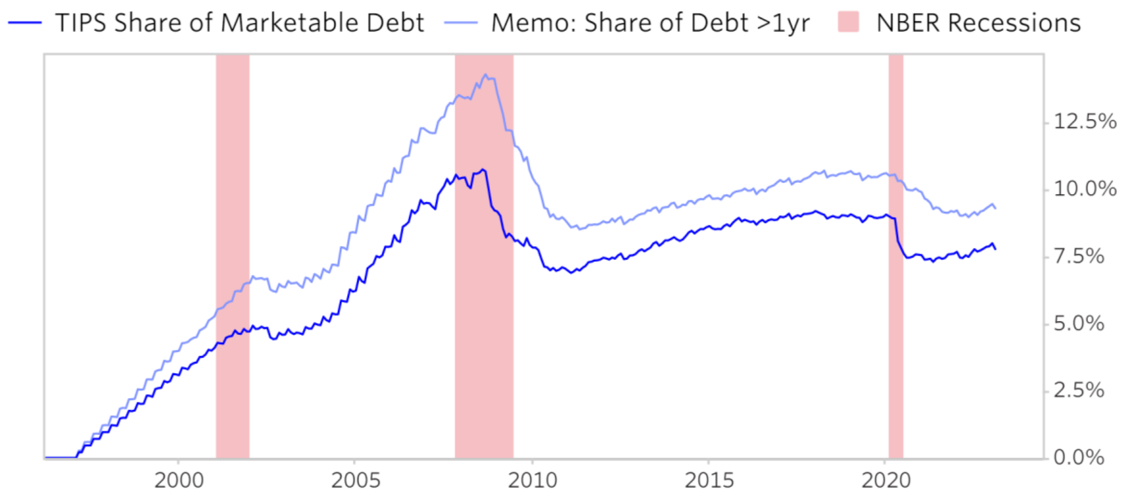
Any increases in TIPS auctions should be made with monitoring of market conditions using measures shown today, including:

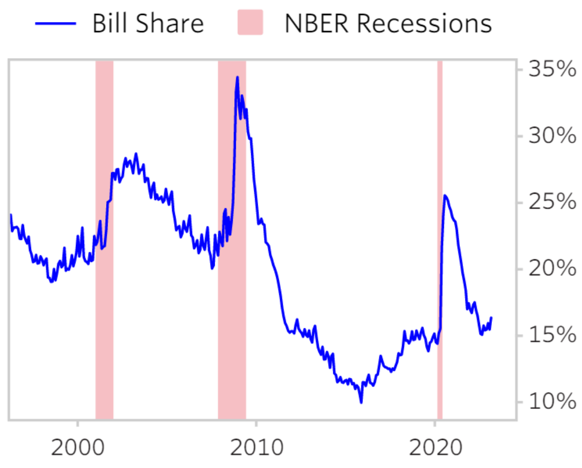
- Forward break-even inflation rates relative to surveyed inflation expectations
- Spreads between TIPS and corresponding maturity inflation swaps
- Auction results (price performance around auctions, investor shares, etc.)
- Retail investor inflows
- Foreign holdings of TIPS
- Market traded volumes / turnover

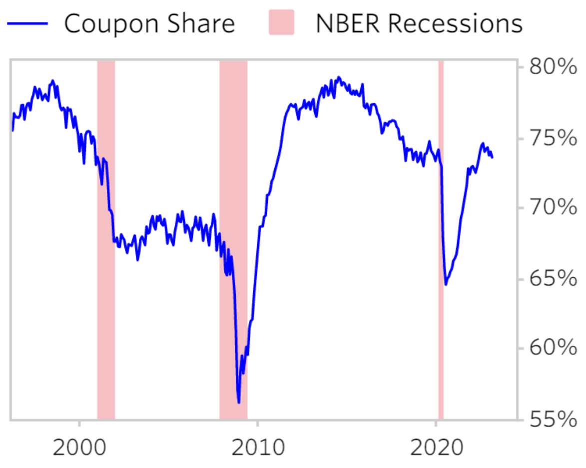
- TIPS market size relative to benchmarks like size of domestic savings pool and economy should be monitored in addition to TIPS share of marketable debt.

TIPS Share is Currently 7.6%, Lower End of Range in Recent Decades, and Will Likely Fall in Next Recession

- Pandemic recession and large issuance of brought TIPS down to below 7.5% of marketable debt, the lowest level since 2007. It has gradually increased to 7.6% since then.
- We should expect drops in TIPS share during recessions, with slow recovery post-recession.
  - Relative size & depth of markets keeps TIPS issuance steadier; higher issuance in recession first pushed into bills, then nominal coupons.



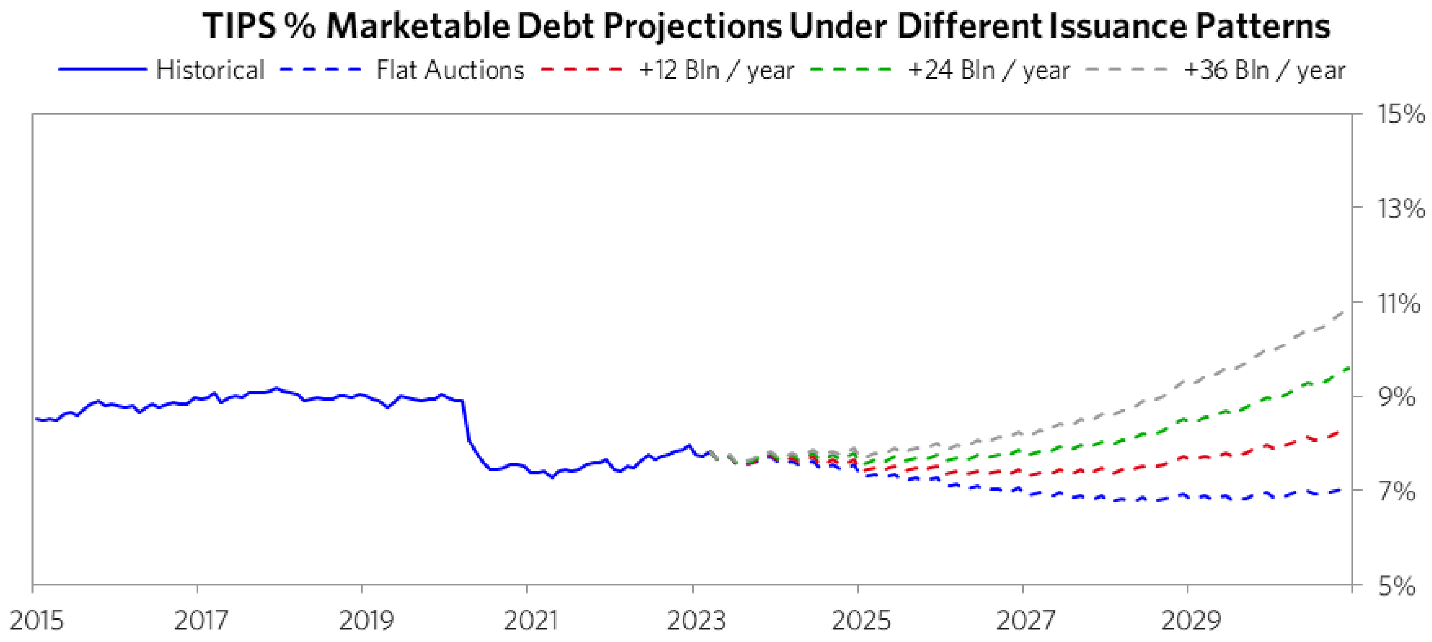




Source: Treasury, NBER

With Current Auction Sizes, TIPS Share Will Likely Fall Even Without a Recession

- Each colored line shows the TIPS share under different issuance patterns.
    - For clarity, “increase of $12bln per year” means total auctions in ‘24 are $12bln larger than in ’23, total auctions in ‘25 are $12bln larger than in ‘24, and so on.
- This chart is shown for illustrative purposes only, and the projections are highly subject to volatility in various assumptions, shown below.

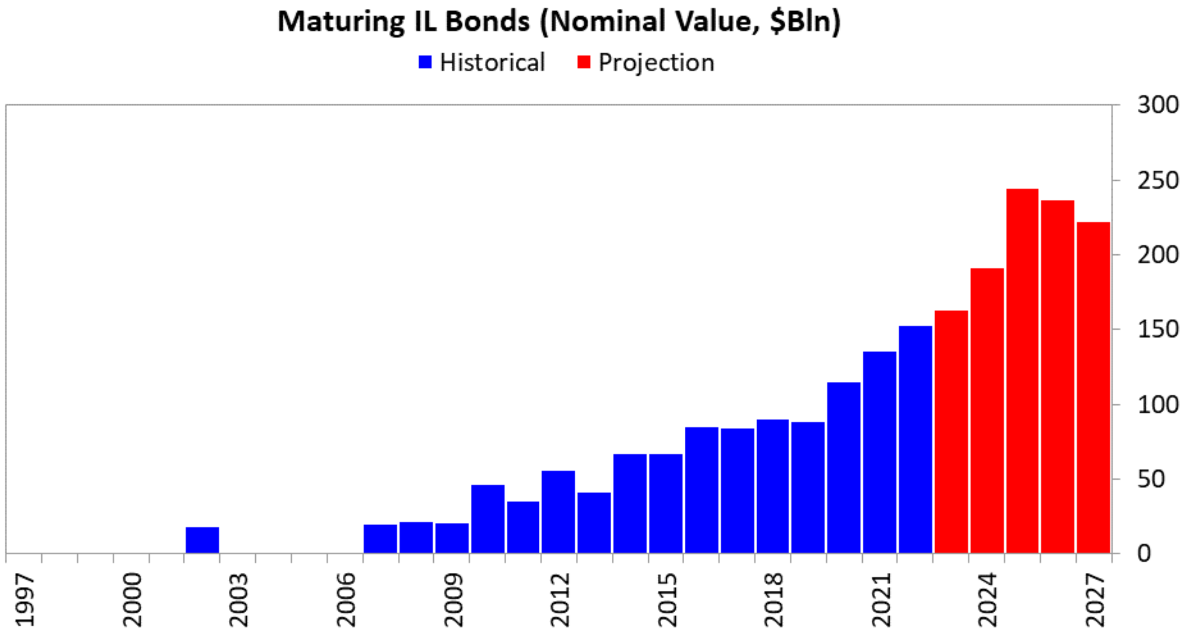


Source: Treasury, CBO, Federal Reserve, author’s calculations

Assumptions:
- *Issuance increases taken pro-rata from other products.*
- *Deficit evolves consistent with CBO projections.*
- *SOMA portfolio rolldown ends in ’24, consistent with primary dealer surveys projections; Fed portfolio share of TIPS held constant from there.*
- *Inflation evolves consistent with Federal Reserve’s Summary of Economic Projections.*

TIPS Maturities Set To Accelerate, Will Decrease TIPS Share

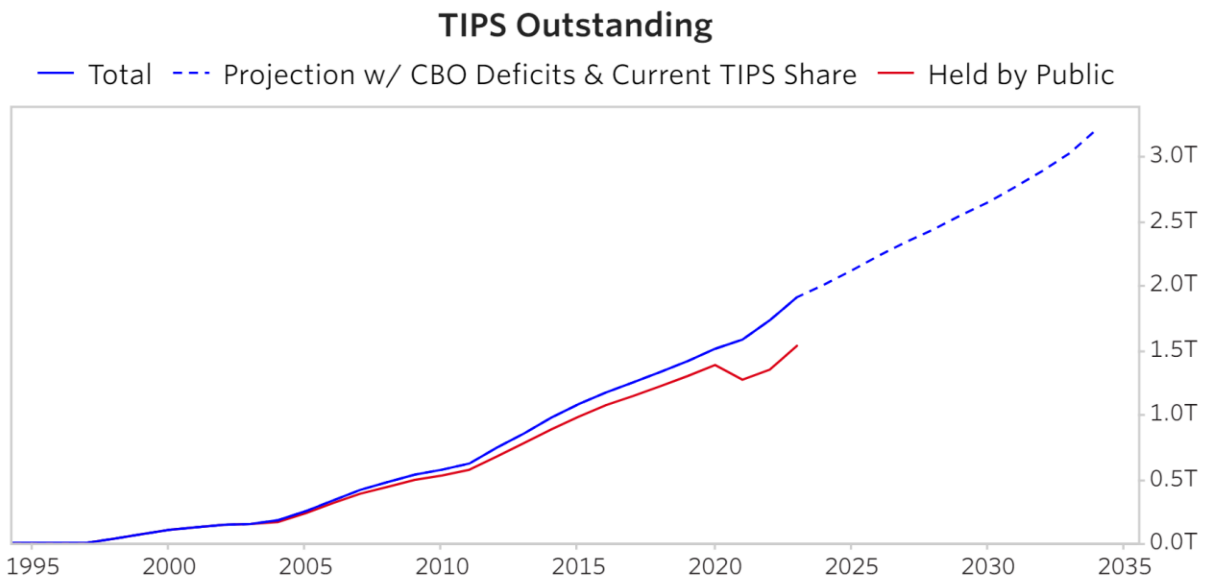
- The increasing pace of maturing IL bonds, including 20 year TIPS issued from 2005 – ‘09 with lots of accrued inflation, will decrease the TIPS share over time.



Source: Treasury

Treasury Should Consider Additional Perspectives Beyond Share of Marketable Debt Outstanding to Calibrate TIPS Program Size

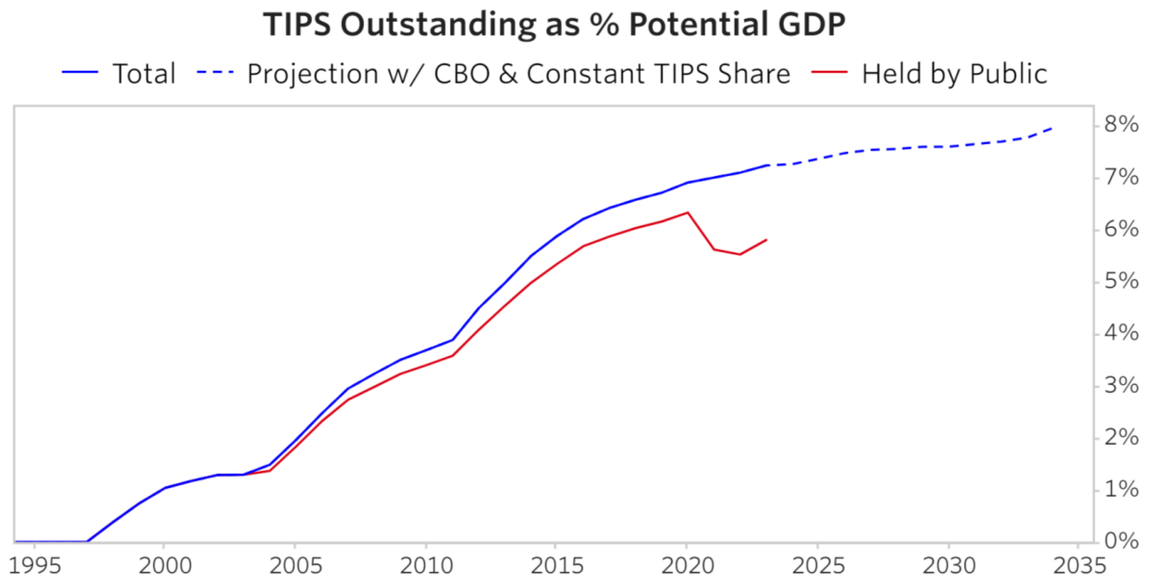
- Maintaining consistent TIPS share of marketable debt will result in total outstanding of TIPS increasing from $2 to $3 trillion in the next ten years using CBO financing projections.
- Public will end up owning greater share of TIPS as Fed SOMA portfolio shrinks.
- This growing size of TIPS market held by public suggests additional perspectives would be useful to benchmark program size and assess market's ability to digest issuance.



Source: Treasury, CBO, author's calculations

Proposed Benchmark: TIPS Relative to Size of Economy

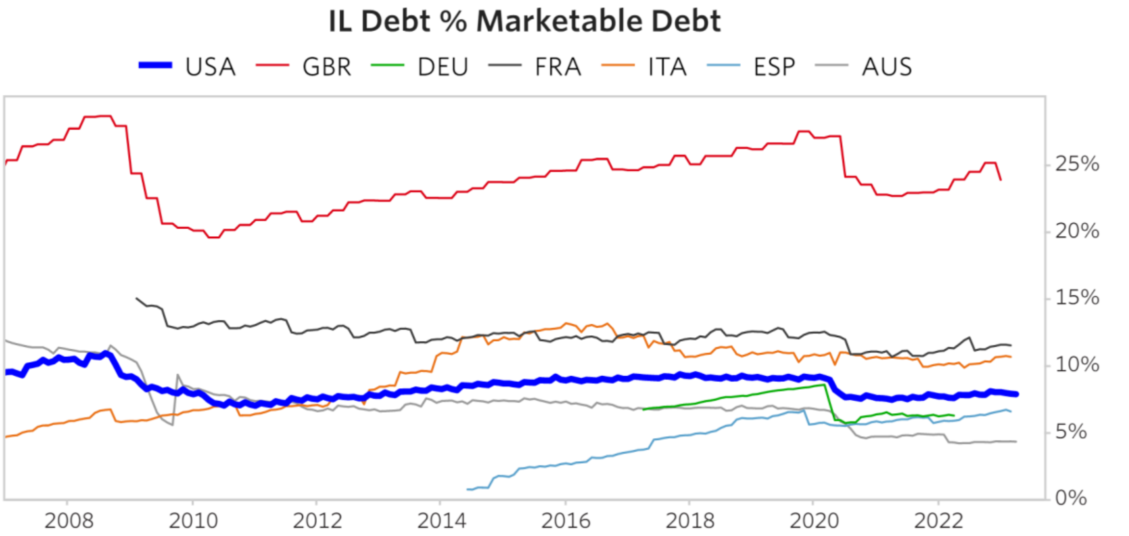
- Nominal GDP is a helpful concept for benchmarking the changes in debt stock and TIPS:
  - NGDP is tied to national incomes, which are used to service the debt.
  - Sources of demand relevant to TIPS likely grow with the economy, like household savings and the size of inflation-linked pension liabilities.
  - NGDP facilitates comparisons across time (e.g., comparing an amount of debt today to one in the distant past/future) and to other countries' programs (see subsequent page).
- We used potential NGDP to remove distortion from business cycle.
- In this perspective, TIPS have risen to highs (around 7% of NGDP). With constant debt share, TIPS would rise slowly to 8% of NGDP over next decade.
- Nominal GDP is outside of Treasury's control, so this is a check on program size and not something that can be actively managed to.

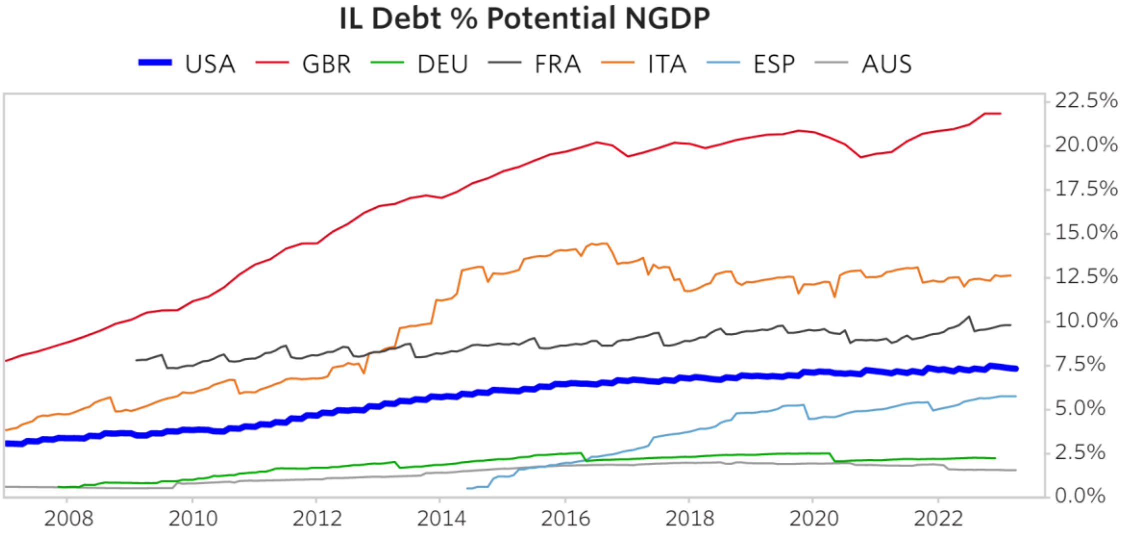


Source: Treasury, BEA, CBO, Federal Reserve, author's calculations

TIPS Program Size Is in Middle of Range of Other Developed Countries' Inflation-Linked Bond Programs as Share of Debt and Economy

- Most major economies with inflation-linked (IL) bond programs have IL shares of market debt between 5% and 12%, Treasury's 8% is in middle of range.
    - UK is outlier with 25% IL share due to requirement of their pensions to match inflation-indexed liabilities.
- Most have IL shares of 3% to 13% of nominal GDP; Treasury's 7% is in middle of range.
- Most countries' IL shares have fallen somewhat since the pandemic as large deficits were pushed into bills/nominals.
- Caution that market structures and participants vary considerably across geographies.

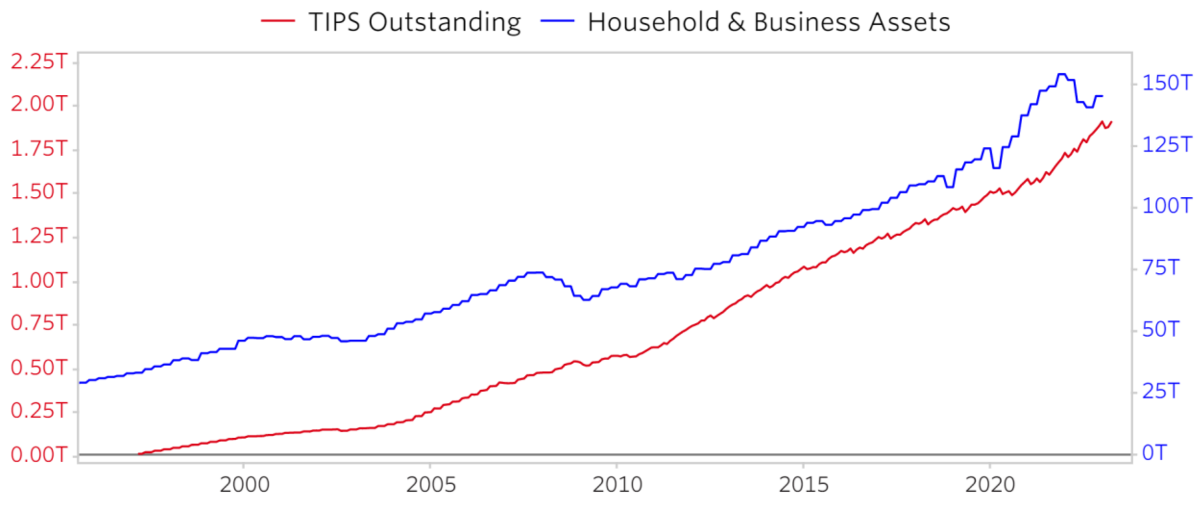


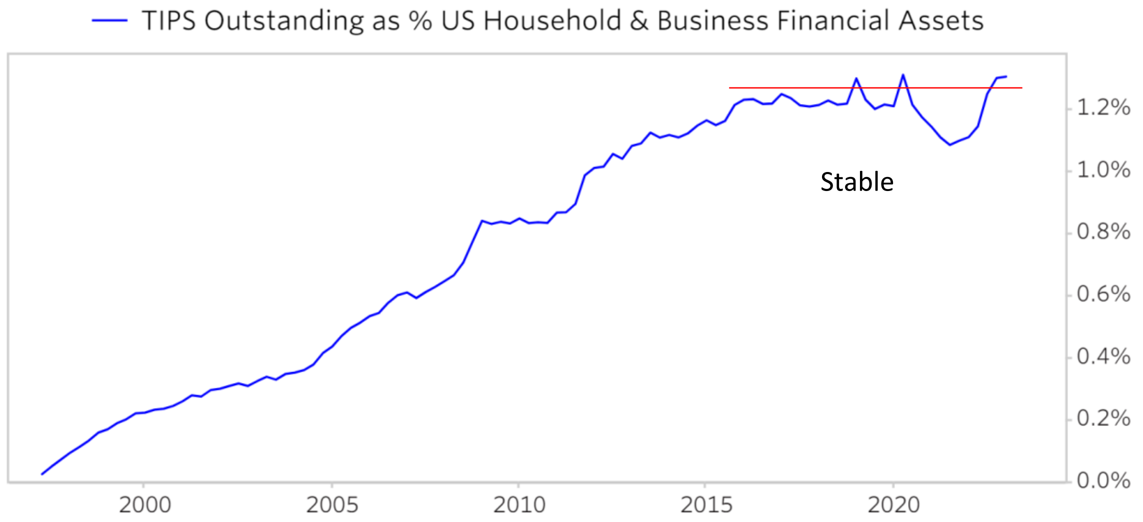


Source: Indicated countries' debt management offices and national statistics agencies

Proposed Benchmark: TIPS as a Share of US Domestic Assets

- US households and businesses' holdings of financial assets* ("domestic assets") are a helpful reference point for TIPS market size.
- This is an "asset allocation" framework, i.e., domestic investors in aggregate have a desired allocation to TIPS, and growing the TIPS program beyond that limit could push prices lower or require more foreign demand.
- TIPS market has been stable at around 1.2% of domestic assets since 2015.
- Domestic asset growth has averaged 7.5% per year since 1950; 7.5% increase in TIPS market is $150bln.
- As with nominal GDP, this is a check on program size and not something Treasury can actively manage.





Source: Federal Reserve Flow of Funds, author's calculations

** "Financial assets" referenced here include cash, securities, fund shares, pension & insurance assets, and other assets captured in the Federal Reserve's Flow of Funds tables L.101 & L.102. Intermediaries' balance sheets are not included in calculation to avoid double-counting private sector buying power.*

Conclusions

- Treasury likely accrues benefits from gradually increasing TIPS share from current levels as long as investor demand is adequate.
- Without increases in auction size, TIPS share will fall under current projections, especially if there is a recession.
- Variety of metrics suggest investor demand is strong enough to accommodate increases in auction sizes in regular and predictable manner.
- Any increases in auction sizes and TIPS share should be accompanied by monitoring of market conditions using metrics like:
    - Forward break-even inflation rates relative to surveyed inflation expectations
    - Spreads between TIPS and corresponding maturity inflation swaps
    - Auction results (price performance around auctions, investor shares, etc.)
    - Retail investor inflows
    - Foreign holdings of TIPS
    - Market traded volumes / turnover
- Increase in demand for shorter-term maturities by retail investors suggests more room to expand issuance in 5 and 10 year TIPS.
- A variety of perspectives / benchmarks should be monitored to calibrate overall TIPS program size in addition to share of marketable & marketable LT debt, such as TIPS relative to domestic assets (around 1.2% today) and TIPS relative to size of economy (7-8% today).

For future study:

- Monitor performance in different TIPS sectors, especially with respect to retail investors’ shift into shorter-duration TIPS funds.
- Continued calibration of the appropriate level of TIPS share.