Convenience Lost*

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Abstract

We show that long-term Treasury convenience yields are more sensitive to changes in Treasury supply than short-term Treasury convenience yields. The fiscal expansion in the past two decades and the resultant increase in Treasury supply depressed convenience yields heterogeneously across maturities — driving them close to zero for short-term Treasurys and into negative territory for long-term Treasurys. As a result, the seigniorage revenue earned by the U.S. for issuing safe and liquid assets declined by a third. The recent shortening of U.S. Treasury maturity structure was unable to fully offset the impact of the aggregate increase in debt quantities on the convenience yield nor recover the seigniorage revenue that the U.S. historically earned.

Keywords: Convenience Yield, Seigniorage Revenue, Fiscal Capacity

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The United States government enjoys a unique position in global financial markets as the supplier of the world's primary reserve asset. Investors are willing to pay a *convenience yield* to hold onto Treasurys due to their safety, liquidity, and regulatory advantages, which has been deemed an *exorbitant privilege* for the U.S. government. As a result, the U.S. government borrows relatively cheaply and earns a seigniorage revenue – the implicit income from issuing debt at below-market interest rates. However, recent developments in the U.S. fiscal condition and global financial markets have raised concerns about the sustainability of its privilege. As the U.S. public debt increased from 30% of GDP in 2000 to around 100% of GDP today, is the U.S. privilege from supplying reserve assets as large as it used to be? And will the U.S. continue to enjoy this privilege in the future?

This paper contributes to this critical discussion by documenting new results about the relationship between U.S. government debt level, debt maturity structure, and bond convenience yields. We show that the U.S. fiscal expansion in the past two decades, which led to a significant increase in Treasury supply, has substantially eroded the convenience yields that have long benefited the U.S. economy.

We begin with two empirical observations. First, convenience yields on U.S. Treasurys have declined markedly in recent years, turning negative across several maturities. Figure 1(A) illustrates the evolution of convenience yields for U.S. Treasurys across different maturities over time. Our primary measure of convenience yields is the difference between maturity-matched swap rates and Treasury yields, as swap rates are typically considered a near risk-free rate devoid of liquidity premiums. By comparing Treasury yields with maturity-matched swap rates, we isolate the convenience yield — the spread that measures the extra return investors forgo for the benefits of holding Treasurys.

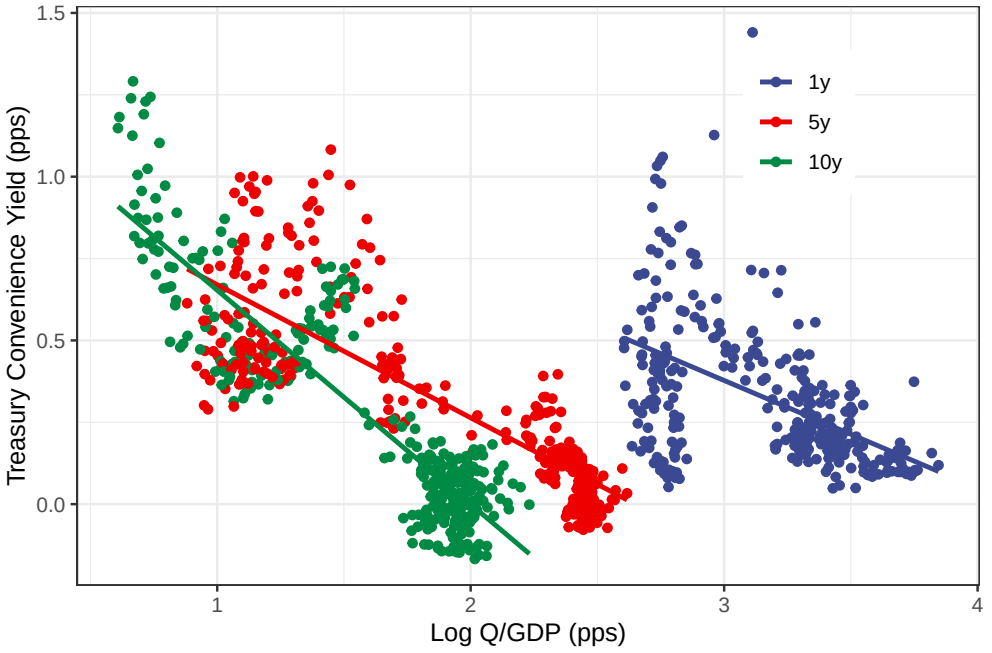
Notably, the convenience yield on long-term Treasury debt has declined more than the convenience yield on short-term Treasurys. Figure 1(A) shows significant variations across maturities. At the end of our sample, the 1-year Treasury convenience yield is close to 0 percent, while the 10-year Treasury convenience yield is around -0.25 percent.

Figure 1
Treasury Convenience Yields by Maturity

(a) Time Series



(b) Convenience Yields and Log Debt Quantity



Our second empirical observation reveals a clear negative relationship between convenience yields and outstanding Treasury quantities. Figure 1(B) illustrates this by plotting the log quantity of outstanding debt, categorized into three maturity buckets and normalized by GDP, against their corresponding convenience yields. The fitted lines show that the negative relationship between convenience yields and quantity is steeper for long-term debt than that for shorter-term debt. This heterogeneity underscores the potential impact of Treasury supply on the U.S. government's fiscal capacity and borrowing costs.

These two observations prompt a natural question: is there a causal relationship between the increase in the supply of Treasurys and the decline in Treasury convenience yields, and does this relationship vary by maturity? Understanding this relationship is crucial for broader discussions about the U.S. fiscal capacity, because these convenience yields contribute to a form of seigniorage revenue for the U.S. government from the provision of a safe and liquid store of value. However, as convenience yields decrease and become negative, the U.S. government loses this revenue source and even potentially starts paying a premium to its creditors.

Establishing a causal link between Treasury supply and convenience yields is challenging due to the endogeneity of Treasury yields and supply. For instance, the U.S. government might choose to issue more debt when demand for Treasurys is high (e.g., during periods of financial turmoil). A naive OLS approach might find a positive relationship between Treasury convenience yields and the supply of debt, leading to a biased estimate. To address this endogeneity problem, we employ an instrumental variables approach to identify the slopes of the demand curves. Following the methodology of Romer and Romer (2010), and extended by Jiang and Richmond (2024), we construct instruments for the supply of Treasurys by identifying changes in the tax code that are exogenous to current economic conditions. The timing and magnitude of our Treasury supply shocks are derived from estimates of the expected revenue impact of the legislation by the Congressional Budget Office. Tax code changes that reduce future tax revenue are considered positive shocks to

Treasury supply.

Our instrumental variable regression estimates show that increases in Treasury supply cause convenience yields to decline, with a larger impact on long-term debt. A 5 percent increase in the supply of long-term debt relative to GDP results in a 0.72 percentage point decline in convenience yields at the 10-year horizon.[1] In contrast, the convenience yield on short-term Treasurys is relatively insensitive to changes in supply, remaining stable as debt levels rise.

To understand the aggregate implications of these estimates, we sum up the product of Treasury supply and convenience yields across maturities. Our findings indicate that the seigniorage revenue from Treasury convenience has decreased by one-third over the past decade. This decline in seigniorage revenue results entirely from the decline in convenience yields in medium and long-term Treasurys. In contrast, the aggregate seigniorage from short-term Treasurys has remained stable, even as the supply of short-term Treasuries increased.

Moreover, our estimates allow us to answer how much of the decline in seigniorage revenue can be attributed to the increase in Treasury supply. To do so, we fix the demand curves for U.S. Treasury in 2010 based on the estimates from our instrumental variables regression, and compute the counterfactual seigniorage revenue by updating the supply of Treasurys in subsequent years. We find that the increase in Treasury supply alone can account for almost all of the decline in the level of the seigniorage revenue from 1997 to 2024.

In addition to swap-based measures of convenience yields, we also examine Treasury-based Covered Interest Parity (CIP) deviations, also referred to as the Treasury basis. The Treasury basis measures the relative convenience of U.S. Treasurys compared to hedged foreign government bonds. Du et al. (2018) shows that the Treasury basis relative to the G10 countries has declined over time, particularly at longer maturities. We use our instrumental variables approach to estimate the extent to which this decline in the Treasury basis was

[1] We estimate that a 1 log-point increase in the supply of long-term debt to GDP decreases the long-term convenience yield by -1.12 percentage points. The mean supply of long-term debt in our sample is 5.54 percent of GDP. Hence, $-1.12 \times (\log(5.54 + 5) - \log(5.54)) = -0.72$

driven by increases in supply. Our results show that a 5 percent increase in the supply of long-term debt relative to GDP results in a 0.62 percentage point decline in the long-term Treasury basis.[2] This finding reinforces the notion that the U.S. is losing its unique position in providing safe and liquid assets as a result of increased levels of government debt.

We end the paper with a discussion of how our findings impact our understanding U.S. fiscal sustainability, optimal debt management, and unconventional monetary policy. Prior research shows that the convenience of U.S. Treasuries significantly increases the borrowing capacity of the U.S. (Krishnamurthy and Vissing-Jorgensen (2012); Choi et al. (2022); Jiang et al. (2024a)). Our results quantifying the loss of Treasury convenience provide evidence that the U.S. is losing its capacity to issue more debt.

Moreover, the heterogeneity in demand elasticities across maturities shows that the impact of public debt expansion on bond premiums depends on the maturity choice, which creates a challenging trade-off for the U.S. Treasury. While the flatter demand curve for short-term debt suggests room for additional issuance, increased reliance on short-term funding heightens roll-over risks in an environment of historically high debt levels and interest payments. The variation in demand elasticities for Treasurys across maturities also matters for the current discussion of unconventional monetary policies. Quantitative easing and tightening operate by shifting supply along the steeper, long-term demand curves and may generate larger distortions on convenience yields compared to conventional policy focused on short-term markets.

Related Literature. Our paper contributes to a large literature studying Treasury demand (Krishnamurthy and Vissing-Jorgensen 2012; Nagel 2016; Choi, Kirpalani, and Perez 2022; Fang, Hardy, and Lewis 2022; Krishnamurthy and Li 2023; Acharya and Laarits 2023; Jansen, Li, and Schmid 2024; Chaudhary, Fu, and Zhou 2024). While these earlier works focus on the aggregate Treasury portfolio, we show interesting heterogeneity in demand elas-

[2]We estimate that a 1 log-point increase in the supply of long-term debt to GDP decreases the long-term Treasury basis by -0.95 percentage points. The mean supply of long-term debt in our sample is 5.54 percent of GDP. Hence, $-0.95 \times (\log(5.54 + 5) - \log(5.54)) = -0.61$

ticity across maturities, and argue that this is a key factor for understanding the variations in U.S. seigniorage revenues.

Recent research highlights how fiscal conditions and inflation expectations shape Treasury convenience yields. Gomez Cram, Kung, and Lustig (2024) argue that bondholders increasingly bear fiscal risks, affecting Treasury pricing and eroding convenience yields. Li, Fu, and Xie (2022) show that shifts in inflation expectations impact the demand for safe assets, further influencing convenience yields.[3] Koijen and Yogo (2020) provide a complementary perspective, using a global asset demand system to quantify U.S. convenience yields based on the unique demand of global investors for U.S. assets.

Moreover, using Treasury CIP basis as a measure of U.S. Treasury's premium relative to foreign government debt, Du, Im, and Schreger (2018) document a decline in this premium after the Global Financial Crisis, particularly at longer maturities. Joslin, Li, and Song (2021) measure the term structure of liquidity premiums on U.S. Treasurys using the Treasury-Refcorp bond spread. We add to this literature by extending the methodology in Romer and Romer (2010) to identify the slopes of demand curves, and documenting heterogeneity in these slopes across maturities.[4]

Our paper is also related to work on the "inconvenience yield" of U.S. Treasurys in recent years (Duffie 2020; He, Nagel, and Song 2022; Ma, Xiao, and Zeng 2022). These works focus largely on the microstructure mechanisms. For example, Du, Hébert, and Li (2023) show that dealers switched from net short to net long in the Treasury market, which increased the premium they require to hold Treasurys. Like Jiang et al. (2022b), our paper complements these works by providing a macro perspective: the underlying increase in Treasury supply is a key driver of the decline in convenience yields and seigniorage revenues in recent years, which has led long-term Treasurys to lose more premia than short-term Treasurys.

[3]This paper studies the supply of safety and convenience properties of U.S. Treasury assets. A related literature argues that non-financial corporations can also act as suppliers of safe assets (see Greenwood et al. (2010), Mota (2023)).

[4]Wiegand (2024) constructs a measure of high-frequency fiscal policy shocks and studies their impact on asset prices, and finds a negative relation between increases in fiscal spending shocks and measures of convenience yields, even at high frequencies.

Our paper also contributes to our understanding of the U.S. exorbitant privilege (Gourinchas and Rey 2007; Curcuru, Dvorak, and Warnock 2008; Chernov, Schmid, and Schneider 2020; Jiang 2022; Gourinchas and Rey 2022; Atkeson, Heathcote, and Perri 2022; Jiang, Richmond, and Zhang 2024b; Jiang, Lustig, Van Nieuwerburgh, and Xiaolan 2024a; Jiang 2024). While the U.S. has been benefiting from issuing debt at lower interest rates, our evidence indicates that this advantage is increasingly limited to short-term debt, with negative yields on long-term debt signaling potential limits to the global market's capacity to absorb U.S. debt.

Finally, in terms of optimal debt management, Greenwood et al. (2015) study the trade-off between the liquidity benefits of short-term debt and the refinancing risk associated with frequent roll-overs. Relatedly, Farhi and Maggiori (2018) revisit the "Triffin dilemma," arguing that global demand for safe assets encourages the U.S. to supply them, potentially at the cost of fiscal sustainability. Our findings align with this trade-off: as the U.S. government issues more short-term debt to exploit favorable convenience yields, this may increase its exposure to roll-over risk as debt level rises. The maturity-specific demand curves from our estimate provides a quantitatively important consideration for the U.S. Treasury's optimal debt management strategy (Bhandari et al. 2017; Jiang et al. 2020).

1 Data and Empirical Strategy

Our empirical strategy aims to quantify the relationship between the quantity of debt outstanding and the convenience yields on U.S. Treasurys. We begin by describing the data used in our analysis. Afterwards, we discuss potential endogeneity concerns and how we address these concerns through an instrumental variables approach.

We construct a comprehensive dataset capturing U.S. government debt outstanding across multiple maturities along with their corresponding convenience yields. Our primary measure of the quantity of debt outstanding is the market value of Treasury bills, bonds, and

notes. We build these series based on security-level data from CRSP. We group aggregate the market value of Treasurys into three maturity buckets: less than 3 years, 3–6 years, and 6–15 years. We label these maturity buckets short-term, medium-term and long-term, respectively. We exclude the supply of callable bonds, inflation-adjusted bonds, and the Treasury holdings of the Federal Reserve banks.

We calculate the convenience yield as the spread between maturity-matched swap rates and Treasury yields:

$$cy_{h,t} = y_{h,t}^{Swap} - y_{h,t}^{Govt}.$$

We obtain swap rates from Bloomberg and Treasury yields from FRED. We associate the 1-year convenience yield with short-term Treasurys, the 5-year convenience yield with medium-term Treasurys, and the 10-year convenience yield with long-term Treasurys. Our analysis is conducted at the quarterly frequency.

U.S. financial markets transitioned away from LIBOR swap rates in 2022 and began using SOFR as the reference for risk-free rates.[5] We do the same in this paper. Up until the end of 2021, we use LIBOR swap rates as the reference risk-free rate. After 2021, we use SOFR rates.[6]

We also evaluate investor preferences for Treasurys relative to sovereign bonds issued by other advanced economies by computing the spread between U.S. Treasurys and the interest earned on foreign governments that have been swapped into dollars. This spread is called the Treasury basis (Du et al. 2018). We compute the Treasury basis against all G-10 currencies

[5]SOFR was announced as LIBOR's replacement in 2017. However, financial contracts could still reference LIBOR up until the end of 2021.

[6]LIBOR rates were approximately 20 basis points higher than maturity-matched SOFR rates in 2021 due to counterparty risk embedded in LIBOR. In order to account for this spread, we add the average maturity-matched LIBOR-SOFR spread between November 1, 2020 and December 31, 2021 to the SOFR rate when computing convenience yields. Appendix A.2 shows our results are quantitatively similar if we end the sample in 2021. Another alternative to using Libor swap rates as our measure of a risk-free rate is to use OIS rates written on the Federal Funds Rate (OIS-FFR). We present regression results using the difference OIS-FFR rates and Treasury rates as our measure of convenience yields in Appendix A.6. The results in Appendix A.6 are quantitatively similar to the ones presented in the main body of the paper.

using sovereign bond yields, forward exchange rates, spot exchange rates, and cross-currency bases data from Bloomberg.[7] We describe our procedure for computing the Treasury basis in Section 2.2.

The key empirical challenge is that the supply of debt may be endogenous to market conditions and convenience yields. The U.S. government may borrow more precisely when convenience yields are high and the demand for Treasurys is high, such as during the Global Financial Crisis. To address this endogeneity concern, we employ an instrumental variables approach to identify exogenous changes in the supply of Treasurys originating from fiscal policy shocks. We obtain a time-series of fiscal policy shocks from Jiang and Richmond (2024), which extends the narrative approach of Romer and Romer (2010) to identify shocks from 1980 to 2023.

Following Romer and Romer (2010), our approach uses narrative records such as presidential speeches, executive-branch documents, and Congressional reports to categorize fiscal shocks into four groups: (1) endogenous countercyclical policies to return growth to normal, (2) endogenous policies motivated by spending changes, (3) exogenous policies to deal with an inherited budget deficit, and (4) exogenous policies motivated by a desire to raise long-run growth. We are interested in shocks to U.S. fiscal policy that are unrelated to U.S. and global macroeconomic conditions. Thus, we use shocks from category (4), which are the most likely to satisfy our exclusion restriction. As Romer and Romer (2010) note, a very common reason for tax cut under this category is one in which policymakers say that the economy is doing fine (output is growing normally), but they want output to grow faster than normal. This category also includes tax cuts for philosophical reasons, such as for economic fairness.[8]

[7] The G-10 currencies are the Australian dollar, Canadian dollar, Swiss franc, Danish kroner, Euro, British pound, Japanese yen, Norwegian kroner, New Zealand dollar, and Swedish kroner.

[8] See Jiang and Richmond (2024) for a broader discussion of the shocks used in this paper.

2 Empirical Results

2.1 Impact of Treasury Supply on Convenience Yields

Our analysis of Treasury convenience yields proceeds in two steps. First, we examine the relationship between year-over-year changes in convenience yields and year-over-year changes in the supply of Treasurys within each maturity bucket described above. Following Krishnamurthy and Vissing-Jorgensen (2012), our baseline specification regresses the changes in convenience yields on the changes in the log market value of debt normalized by GDP.[9] Afterwards, we implement our instrumental variables strategy to establish causality.

Our regression equation is

$$\Delta cy_{h,t} = \alpha_h + \beta_h \Delta \log \frac{D_{h,t}}{GDP_t} + \gamma_h 1_{t \geq 2008} + \varepsilon_{h,t}, \tag{1}$$

where the change operator Δ computes year-on-year growth rates within our quarterly sample: $\Delta x_t = x_t - x_{t-4}$. The coefficient β_h captures the sensitivity of the convenience yield to changes in the supply of Treasurys available within a given maturity bucket. We also include an indicator variable $1_{t \geq 2008}$ to account for the structural break in the debt dynamics following the Global Financial Crisis, after which the pace of debt issuance accelerated.

In our benchmark analysis, we remove the periods classified as NBER recessions from our sample because these periods are characterized by significant policy interventions and market volatility, which can distort the long-run supply-demand dynamics in the Treasury market that we are interested in. In particular, these periods are characterized by large shifts in demand curves for Treasurys, which can lead to convenience yield movements that are not driven by changes in Treasury supply. This exclusion allows us to focus on the shape of Treasury demand curve in normal times.[10]

[9] In Appendix A.5, we present results using the total face value of all Treasurys within maturity buckets as the measure of Treasury supply. The results are quantitatively similar to the ones presented in this section.

[10] Appendix A.3 presents our regression results when we do not exclude NBER recessions. The results are quantitatively similar the ones presented in this section.

TABLE 1
TREASURY SUPPLY AND CONVENIENCE YIELDS BY MATURITY

	Short-term ($\leq$ 3Y)	Medium-term (3Y–6Y)	Long-term (6Y–15Y)
Panel A: Ordinary Least-Squares			
Δ Log(Debt/GDP)	-0.53***	-0.33**	-0.58***
	(0.20)	(0.13)	(0.15)
Observations	86	86	86
R^2	0.15	0.27	0.40
Panel B: Instrumental Variables			
Δ Log(Debt/GDP)	-0.18	-0.78***	-1.12***
	(0.57)	(0.24)	(0.21)
Observations	86	86	86
R^2	0.12	0.12	0.19
F-test (1st stage)	9.26	19.84	10.06

Notes: This table presents regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions include a post-2008 indicator variable. Our sample benchmark sample runs from 1997Q2 to 2024Q2, excluding NBER recession periods. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

Table 1 presents the impact of changes in Treasury supply on convenience yields within maturity buckets. Panel A shows the ordinary least squares (OLS) results. Consistent with Figure 1, we find that the convenience yield on medium and long-term Treasurys tend to decline as Treasury supply increases. The point estimate of -0.58 on long-term Treasurys indicates that a 5 percentage point increase in the log long-term debt-to-GDP ratio from its mean is associated with a 0.37 percentage point decline in the convenience yield on long-term Treasurys.[11]

Panel B of Table 1 presents the results of our instrumental variables specification and establishes a causal link between Treasury supply and the convenience yield on Treasurys. We instrument changes in the log debt-to-GDP ratio with the fiscal shocks based on tax legislation. Similar to the OLS specification, we find that increases in the supply of medium

[11] We report in Appendix Table A.1 that the mean supply of long-term debt in our sample is 5.54 percent of GDP. Hence, $-0.58 \times (\log(5.54 + 5) - \log(5.54)) = -0.37$

and long-term Treasurys reduce the convenience yields on medium and long-term Treasurys. On the other hand, changes in the supply of short-term Treasurys do not significantly impact the short-term convenience yield.

The estimates show that increases in Treasury supply significantly decrease the size of convenience yields. A point estimate of -1.12 on long-term Treasurys indicates that a 5 percentage point increase in log long-term debt-to-GDP results in a 0.72 percentage point decline in the convenience yield on long-term Treasurys. A point estimate of -0.78 on medium-term Treasurys indicates that a 5 percentage point increase in log medium-term debt-to-GDP from its mean results in a 0.37 percentage point decline in the convenience yield on medium-term Treasurys.[12] The standard deviation of the convenience yield on 5-year and 10-year Treasurys are 0.28 and 0.35 percentage points, respectively. Hence, our results suggest that moderate changes in Treasury supply can meaningfully affect convenience yields.[13]

2.2 Impact of Treasury Supply on the Treasury Basis

An alternative measure of the liquidity and safety benefits from holding Treasurys is the Treasury basis. The Treasury basis measures the difference between the convenience yield of U.S. government bonds and those of government bonds of other countries after swapping all cash flows into dollars. In this section, we estimate the effect of changes in the supply of Treasurys on Treasury basis within each maturity bucket.

Du et al. (2018) show that the Treasury basis relative to a foreign country i can be expressed as the deviation from covered interest rate parity between government bond yields in the United States and country i:

$$\Phi_{i,n,t} = \underbrace{y^{Govt}_{i,n,t} - f_{i,n,t} + s_{i,t}}_{\text{synthetic dollar bond}} - y^{Govt}_{USD,n,t}, \tag{2}$$

[12] We report in Appendix Table A.1 that the mean supply of long-term debt in our sample is 8.09 percent of GDP. Hence, $-0.78 \times (\log(8.09 + 5) - \log(8.09)) = -0.37$

[13] See Appendix Table A.1 for additional summary statistics.

where $f_{i,n,t}$ is the forward rate for hedging currency i against the dollar over a period of n-years, and $s_{i,t}$ is the spot exchange rate. The first three terms on the left-hand side of equation (2) sum up to the yield on a synthetic dollar bond. Investors who hold the synthetic dollar bond receive cash flows in dollar, but physically hold onto a foreign government bond for the duration of the investment. The final term in equation (2) is the yield on the U.S. Treasury bond.

The difference in yields between the synthetic dollar bond and the U.S. Treasury bond captures the liquidity and safety benefits of physically holding onto a U.S. Treasury security as opposed to the government bond of another country. An increase in the Treasury basis, $\Phi_{i,n,t}$, indicates an increase in the convenience benefits of the U.S. Treasury, because the foreign government must compensate investors more for holding onto its bond.

Du et al. (2018) show that the U.S. Treasury basis has declined over time, particularly at longer maturities. We replicate these results using our sample in Appendix Figure A.1 and confirm that the Treasury basis has declined over our sample period. Not only are U.S. Treasurys losing their convenience over time, but Treasurys are also losing their convenience relative to foreign government bonds. Du et al. (2018) also show that the Treasury basis exhibits an inverse relationship with the aggregate supply of Treasurys. Panel B of Appendix Figure A.1 shows that the Treasury basis exhibits an inverse relationship with the supply of Treasurys within each maturity bucket as well. Similar to the demand curves presented with convenience yields on the y-axis, the inverse relationship between Treasury basis and supply appears steeper for longer-maturity bonds.

Building on Du et al. (2018), we estimate the causal impact of increases in Treasury supply on the Treasury basis using a novel instrument. These estimates allow us to quantify the aggregate impact of the growth in Treasury supply on the international seigniorage earned by the Treasury for providing safe assets to the world, as we discuss in the next section.

Table 2 estimates the impact of changes in Treasury supply on the Treasury basis. We regress changes in the Treasury basis on changes in the log U.S. debt-to-GDP ratio by

TABLE 2
TREASURY SUPPLY AND THE TREASURY BASIS BY MATURITY

	Short-term ($\leq$ 3Y)	Medium-term (3Y–6Y)	Long-term (6Y–15Y)
Panel A: Ordinary Least-Squares			
Δ Log(Debt/GDP)	-0.31**	-0.29***	-0.34**
	(0.15)	(0.10)	(0.15)
Observations	83	82	82
R^2	0.11	0.22	0.20
Panel B: Instrumental Variables			
Δ Log(Debt/GDP)	-0.30	-0.68***	-0.95***
	(0.53)	(0.24)	(0.19)
Observations	83	82	82
R^2	0.11	0.05	-0.28
F-test (1st stage)	8.66	19.38	9.50

Notes: This table presents regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions include a post-2008 indicator variable. Our sample benchmark sample extends from 1997Q1 to 2024Q1, excluding NBER recessions. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

maturity bucket. We instrument changes in the log U.S. debt-to-GDP ratio with our fiscal policy shocks that we used in the prior section in Panel B. We find that increases in the supply of medium and long-term Treasurys decrease the average Treasury basis on medium and long-term Treasurys. Similar to our results with the Treasury convenience yield in the previous section, we find that changes in the supply of short-term Treasurys do not significantly impact the short-term Treasury basis.

The point estimate of -0.95 on long-term Treasurys indicates that a 5 percentage point increase in long-term debt-to-GDP from its mean results in a 0.61 percentage point decline in the long-term Treasury basis. A point estimate of -0.68 on medium-term Treasurys indicates that a 5 percentage point increase in medium-term debt-to-GDP from its mean results in a 0.33 percentage point decline in the medium-term Treasury basis.

3 Fiscal Implications

3.1 Aggregate Effects on Seigniorage Revenue

In the previous section, we showed that increases in Treasury supply decreased the convenience yield of Treasury securities relative to domestic and foreign benchmarks across maturity buckets. Between 2000 and 2024, the debt-to-GDP ratio increased from 56 percent to 123 percent of GDP. How much of an impact did this doubling of the U.S. debt-to-GDP ratio have on the seigniorage revenue earned by the U.S. government?

In this section, we quantify the aggregate effects of Treasury issuance on the seigniorage revenue earned by the U.S. for issuing safe and liquid financial securities. We estimate the U.S. government's seigniorage revenue at each date t by taking the market value weighted sum of convenience yields on each maturity bucket:

$$\mathcal{S}_t = \sum_h cy_{h,t} D_{h,t}, \tag{3}$$

where $\mathcal{S}_t$ represents the seigniorage revenue in period t, h indexes maturity buckets, $cy_{h,t}$ is the convenience yield for maturity bucket h, and $D_{h,t}$ is the market value of debt within that maturity bucket.

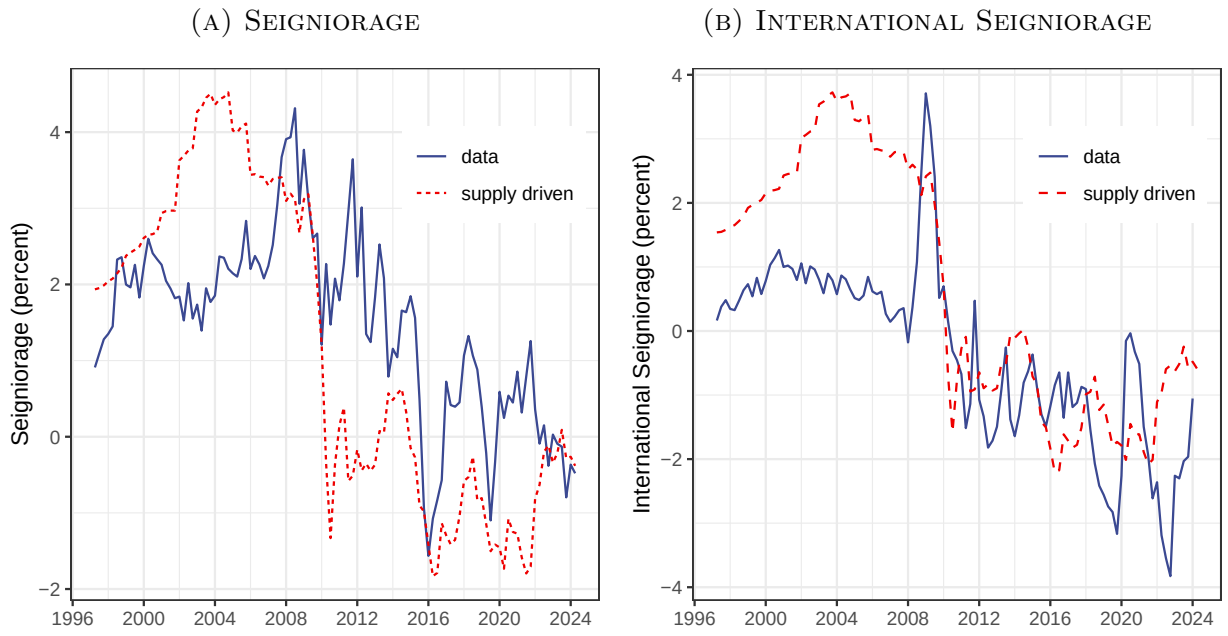
Our calculation of seigniorage revenue relies on a key simplifying assumption. Specifically, we assume that the convenience yield on the marginal Treasury security is equal to the average convenience yield earned on all Treasury securities within each maturity bucket. This is equivalent to assuming that the government buys back and reissues all Treasury securities each period at prevailing market prices and convenience yields, which allows us to apply the current period's convenience yield to the entire stock of outstanding debt. While this abstracts from some real-world complexities in Treasury issuance and trading, it provides a tractable framework for estimating the aggregate seigniorage benefits. The resulting estimates represent annualized figures that capture the funding advantage enjoyed

by the U.S. government if it reissues its entire debt stock each year at current market conditions.

The solid blue line in Panel A of Figure 2 presents the time series of the seigniorage revenue on medium and long-term Treasurys from 1997 to 2024 as a percent of the annual federal interest expense. This ratio captures how the funding advantage from issuing medium and long-term Treasurys compares to the aggregate interest expense, which is a useful benchmark for evaluating the fiscal implications of Treasury convenience.

We observe that the seigniorage revenue earned from medium and long-term Treasurys has declined over time. It reached a peak in the third quarter of 2008 at 4.3 percent of the federal interest expense, and then declined to -0.5 percent of interest expense at the end of

FIGURE 2
IMPACT OF SUPPLY ON SEIGNIORAGE REVENUE ON MEDIUM AND LONG-TERM TREASURYS



Notes: These figures present the seigniorage earn on medium and long-term U.S. Treasurys over time. The left figure computes seigniorage using the convenience yield while the right figure computes seigniorage using the Treasury basis. Both figures present seigniorage as a percent of the annual federal interest expense. The blue solid lines present the data, and the red dashed lines present the counterfactual seigniorage yield that only accounts for changes in the supply of Treasurys.

our sample.

The dashed red line in Panel A of Figure 2 computes the counterfactual seigniorage revenue from Treasury convenience if variation in seigniorage revenue was solely driven by changes in Treasury supply. To compute the red dashed line, we take the convenience yields and Treasury supply in 2010 as our starting point and compute counterfactual convenience yields for each period using the estimates in Table 1:

$$\widehat{cy}_{h,t} = cy_{h,2010} + \widehat{\beta}_h \left(\log \frac{D_{h,t}}{GDP_t} - \log \frac{D_{h,2010}}{GDP_{2010}} \right), \tag{4}$$

where $\widehat{\beta}_h$ is the coefficient on $\Delta \log \frac{D_{h,t}}{GDP_t}$ from the IV estimation. After estimating these counterfactual convenience yields for each time period, we apply equation (3) to compute the "supply-driven" seigniorage revenue.

Figure 2 shows that changes in Treasury supply explain the majority of the decline in the seigniorage earned from Treasury convenience. The time series of the red dashed line aligns closely with the observed time series of seigniorage from the data. Over our sample period, changes in the supply of Treasurys account for a decline in seigniorage of approximately 2 to 3 percentage points of the federal interest expense.

Panel B of Figure 2 carries out a similar analysis for the decline in seigniorage using the Treasury basis. In this exercise, we use the cross-country Treasury basis $\Phi_{i,n,t}$ to compute the premium on U.S. Treasurys. The solid blue line represents the production between the market value of debt and the Treasury basis, summed across the medium-term and long-term maturity buckets. This value, which we call the "international seigniorage", represents the extra value investors assign to the aggregate supply of U.S. Treasurys in comparison to government debt issued by other advanced economies.

There are two salient features of the time series of the international seigniorage. First, analogous to the seigniorage figure, the total Treasury basis is steadily declining over time. The decline seems especially pronounced after the Covid pandemic. Second, the total Trea-

sury basis does exhibit spikes during periods of global financial distress, such as the Global Financial Crisis and the Covid pandemic. These spikes indicate that U.S. government debt still maintains its position as a safe haven asset during economic downturns.

The red dashed line in Panel B of Figure 2 presents the counterfactual international seigniorage if variation in the Treasury basis was solely driven by changes in supply. To compute the red dashed line, we take the Treasury basis and Treasury supply in 2010 as our benchmark observation, and we compute the counterfactual Treasury basis for each period using the estimates in Table 2:

$$\widehat{\Phi}_{h,t} = \Phi_{h,2010} + \widehat{\beta}_h \left(\log \frac{D_{h,t}}{GDP_t} - \log \frac{D_{h,2010}}{GDP_{2010}} \right), \tag{5}$$

where $\widehat{\beta}_h$ is the coefficient on $\Delta \log \frac{D_{h,t}}{GDP_t}$. The counterfactual international seigniorage shows that changes in supply explain around 3 to 4 percentage points of decline in the Treasury basis, which is almost the entirety of the decline in international seigniorage over our sample period.

While we have focused on the role that Treasury supply has in determining convenience yields and Treasury basis, Figure 2 also shows that the value of the liquidity and safety property is much more volatile than what is implied by changes in supply alone. It is likely that there are additional demand shocks, which are particularly salient during crisis episodes, that drive higher frequency variations in the convenience yield and Treasury basis. The key message our exercise highlights is that changes in supply alone can explain the decades-long trend decline in the value of Treasury convenience.

Our analysis of the seigniorage revenue from U.S. Treasurys focuses on the medium and long-term maturity buckets, because our regression results show that convenience yields for these maturity buckets were the most sensitive. The Treasury earns a substantial amount of seigniorage revenue from short-term debt. However, the value of the seigniorage earned on short-term debt has remained roughly stable at around 4 percent of federal interest expenses

over the sample period. The decline in convenience yields on short-term debt has roughly matched the magnitude of the increase in the supply of short-term debt such that the product of the two values has remained constant. Similarly, the value of international seigniorage hovers around 3 percent of federal interest expenses over the sample period. Appendix A.7 presents the details for the seigniorage earned on short-term Treasurys and all Treasurys over our sample period.

3.2 Implications for Optimal Debt Management

Our results show that the increase in debt quantity over the past two decades has contributed significantly to the decline in Treasury convenience, and that this decline was largely driven by increases in the supply of medium and long-term Treasurys. These results help distinguish between two competing narratives about Treasury demand. First, if the demand curves for Treasurys of different maturities have similar slopes, then, the dispersion in convenience yields across maturities reflects heterogeneous demand shocks across the maturity spectrum. These demand shocks, which could be driven by different regulatory requirements, risk and hedging characteristics, or clientele preferences, move the intercept of the demand curve for each maturity.

Second, if the demand curves have different slopes, then, the dispersion in convenience yields between short-term and long-term Treasurys is a direct reflection of these slopes. Even with similar demand curve intercepts and debt quantities, the convenience yield on short-term Treasurys can still differ from that on long-term Treasurys.

These two scenarios have different implications for the government's debt management strategy. In the first case, as short-term Treasurys also have a downward-sloping demand curve with respect to the debt level, their relative funding advantage as observed in the data can quickly disappear as the government issues more short-term debt. In the second case, the flatter demand curve for short-term Treasurys implies that the government can issue more short-term debt without significantly affecting the convenience yield on short-term

Treasurys.

Our empirical analysis favors the second scenario, suggesting some additional fiscal space for the U.S. government to issue more short-term debt. At the same time, the steeper relationship between debt level and long-term Treasury's convenience yield indicates that the market's capacity to absorb additional long-term Treasury may be more constrained than previously thought. This limitation could restrict fiscal space more than analyses based solely on the average interest rate would suggest.

This steeper slope of the long-term demand curve creates a challenging trade-off for debt management. While short-term issuance appears more attractive due to its flatter demand curve and currently higher convenience yields, it exposes the government to substantial roll-over risk. This risk is particularly acute given: (1) the historically high debt-to-GDP ratio, which means larger volumes need to be refinanced, (2) the fact that roll-over needs are concentrated in time, potentially forcing the government to refinance large amounts during potentially adverse market conditions. A sudden shift in market sentiment or liquidity conditions could make it difficult or extremely costly to refinance maturing debt, potentially triggering a fiscal crisis. This scenario becomes more likely as the share of short-term debt in the total debt stock increases.

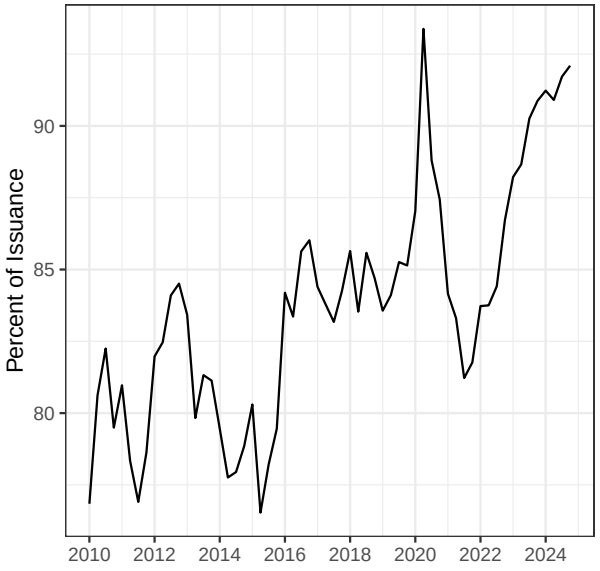
3.3 Responses from Treasury Issuance

One possible action that the Treasury can take to mitigate the decline in Treasury convenience is to tilt the issuance of Treasurys towards shorter maturities. Using data from Securities Industry and Financial Markets Association, Panel A of Figure 3 shows that this has indeed been happening over the past decade. The market value of Treasury bills as a share of the issuance has increased from around 80 percent to over 90 percent. Did this shift in the maturity structure of Treasurys impact the value of Treasury convenience in the aggregate?

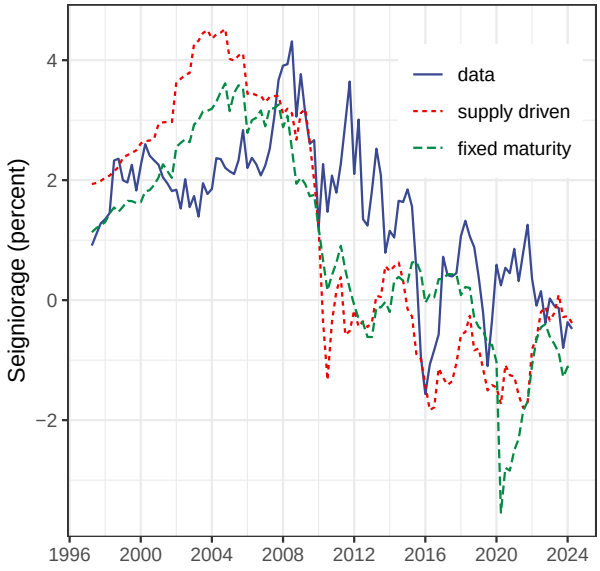
We consider the following exercise to evaluate the impact of the maturity change on

Figure 3
Maturity Shift and Seigniorage Revenue

(a) Market Value of Bills



(b) Impact of Maturity Shift



Notes: The left figure presents the market value of Treasury bills as a share of total issuance over time. The right figure presents the seigniorage earned from the Treasury convenience as a percent of federal interest expenses. The blue solid line presents the data, and the red dashed line presents the counterfactual seigniorage yield explained by changes in the supply of Treasurys, and the green long-dashed line presents the counterfactual seigniorage yield if the maturity structure of Treasurys was also held constant.

seigniorage revenue. In each period, we redistribute the market value of all Treasury securities across maturities such that the share of Treasurys in each maturity bucket matches that of the first quarter of 2010. This exercise assumes that the total amount of borrowing remains constant in each period. We then compute the convenience yield within each maturity bucket that is implied by this fixed maturity distribution according to equation (4). These implied yields capture how the convenience yields on Treasurys would have evolved had the maturity structure of U.S. government debt remained fixed over time.

The green dashed line in the Panel B of Figure 3 presents the results of our exercise. The resulting change in seigniorage under a fixed maturity scenario looks very much like the change in seigniorage from the previous section where we allowed both the maturity structure and the aggregate supply to change over time. Towards the latter part of our

sample, the green line lies below the red line and indicates that the shift towards shorter maturities marginally increased convenience yields and seigniorage revenues. However, the impact of the maturity structure on convenience yields is overshadowed by the increase in the total quantity of public debt outstanding.

4 Discussion and Broader Implications

International Role of U.S. Treasurys and Reserve Currency Status. Our findings highlight significant shifts in the global demand for U.S. Treasurys, with important implications for the dollar's reserve currency status. The declining convenience yields on long-term Treasurys suggests that the unique advantages of holding U.S. government debt are diminishing, particularly for investors of long-term debt. If the U.S. government's capacity to issue long-term debt without significantly eroding its convenience yield is limited, global investors may increasingly seek alternative safe assets to fulfill their long-term investment needs. This shift could reduce global demand for U.S. Treasurys, potentially impacting the U.S. dollar's dominance in international finance and diminishing the strategic benefits accruing to the United States from its reserve currency status.

Implications for the Interaction between Monetary Policy and Fiscal Condition. The different slopes of Treasury demand curves across maturities also have important implications for how monetary policy interacts with convenience yields and the resultant seigniorage revenue. For example, when the Federal Reserve conducts quantitative easing (QE), its purchases of long-term Treasurys operate along a steeper demand curve, potentially creating larger effects on seigniorage revenue. In contrast, conventional monetary policy operations tend to focus on short-term debt markets with a flatter demand curve, leading to more modest effects on convenience yields for a given amount of intervention.

This asymmetry suggests that different monetary policy tools can have varying effects on the government's seigniorage revenue due to their distinct impacts on convenience yields

across different maturities. For instance, during a monetary tightening cycle, the Federal Reserve's sale of Treasurys—especially longer-term bonds—could significantly reduce bond convenience yields, thereby increasing the government's financing burden. Our findings highlight the nuanced role of monetary policy on government seigniorage revenue, as demonstrated by Krishnamurthy and Vissing-Jorgensen (2012), who illustrate how central bank balance sheet policies influence bond market liquidity and pricing. We emphasize the importance of considering maturity-specific impacts for optimal policy formulation.

Moreover, given the fact that the Fed has already accumulated a Treasury portfolio with varying maturities, how Fed manages its Treasury portfolio matters for government seigniorage revenue. For example, additional purchases of long-term Treasurys offset by sales of short-term Treasurys can significantly modify the level and the distribution of bond convenience yields, even when this operation does not change the total amount of Treasurys held by the Fed.

Implications for Models of Treasury Demand. Our results also shed light on the key dimensions of heterogeneity that models of Treasury demand need to capture. The preferred habitat model of Vayanos and Vila (2021), an important workhorse model in this field, studies the dynamic interaction between arbitrageurs who maximize risk-adjusted returns from trading in the Treasury market, and preferred-habitat investors who have downward-sloping demand curves for Treasurys of different maturities. The model focuses on how the intercepts of preferred-habitat investors' demand curves vary across bond maturities and over time, which capture demand shocks in this market.

Our results highlight the heterogeneity in the slopes of aggregate demand curves across maturities. Conceptually, this heterogeneity can arise from two sources. First, the preferred-habitat investors with different maturity profiles may have different slopes in their demand curves, in addition to different intercepts. Second, the arbitrageurs may also perceive different risk and liquidity differences across maturities, leading to different slopes in their

demand curves. Both mechanisms are potentially interesting, as they shed light on possible ways to enrich the preferred habitat model and better understand the dynamics of Treasury convenience yields.

More recently, the literature has been focusing on the heterogeneity in Treasury demand elasticity across investor types (Jiang, Krishnamurthy, and Lustig 2022a; Fang, Hardy, and Lewis 2022; Jansen, Li, and Schmid 2024). Our results suggest that the heterogeneity in demand elasticity may also vary across maturities, and the two types of heterogeneity may interact in an interesting way. For example, it is worth exploring whether the difference in demand elasticity across maturities is driven by different types of investors who trade in different maturity habitats, or by the same type of investors who have different preferences for different maturities.

5 Conclusion

Our findings underscore the evolving nature of the U.S. dollar's role in the global financial system. As convenience yields turn negative and exhibit greater maturity dependence, the traditional view of U.S. debt as a uniquely safe and liquid asset may need to be reassessed.

Future research should explore the implications of these findings for international capital flows, exchange rates, and the potential emergence of alternative reserve assets. Additionally, further work is needed to understand the implications of negative, maturity-dependent convenience yields for optimal monetary and fiscal policy coordination in the world's largest economy and issuer of the primary reserve currency.

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Appendix

A Additional Tables and Figures

A.1 Summary Statistics

Table A.1
Summary Statistics

Variable	N	Median	Mean	Std. Dev.	Min	Max
Convenience yield (1Y)	86	0.258	0.315	0.202	0.0572	1.06
Convenience yield (5Y)	86	0.2	0.282	0.277	-0.0781	1
Convenience yield (10Y)	86	0.113	0.269	0.347	-0.158	1.23
Treasury basis (1Y)	86	0.172	0.195	0.168	-0.0539	0.843
Treasury basis (5Y)	85	0.00855	0.012	0.179	-0.385	0.508
Treasury basis (10Y)	85	-0.102	-0.0233	0.22	-0.4	0.557
Debt / GDP (Short-term)	86	27.7	25.4	7.48	14.6	41.1
Debt / GDP (Medium-term)	86	10.2	8.09	3.77	2.85	12.7
Debt / GDP (Long-term)	86	6.58	5.54	2.11	1.99	9.31
Debt / GDP (Aggregate)	86	46.4	39	12.9	20.1	59.6

Notes: This table presents summary statistics for the variables used in the regression analysis. The sample contains data from 1997Q2 to 2024Q2 and drop observations during NBER recessions. All values are presented in percentage points.

A.2 Regression Results with LIBOR Sample Only

In this section, we present regression results with a sample that ends in 2021. Hence, the convenience yield is the difference between the LIBOR rate and the maturity matched Treasury rate.

Table A.2
Treasury Supply and the Convenience Yield (Pre-2021, OLS)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.35*	-0.35**	-0.70***
	(0.19)	(0.14)	(0.12)
Observations	76	76	76
R^2	0.12	0.26	0.45

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

Table A.3
Treasury Supply and the Convenience Yield (Pre-2021, IV)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.28	-0.78***	-1.18***
	(0.47)	(0.25)	(0.21)
Observations	76	76	76
R^2	0.12	0.13	0.30
F-test (1st stage), Δ Log(Debt/GDP)	16.01	18.02	10.97

Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.4
TREASURY SUPPLY AND INTERNATIONAL CONVENIENCE (PRE-2021, OLS)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.33	-0.33***	-0.49***
	(0.20)	(0.09)	(0.10)
Observations	73	73	73
R^2	0.14	0.29	0.37

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.5
TREASURY SUPPLY AND INTERNATIONAL CONVENIENCE (PRE-2021, IV)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.24	-0.61***	-0.88***
	(0.46)	(0.22)	(0.16)
Observations	73	73	73
R^2	0.14	0.17	0.16
F-test (1st stage), Δ Log(Debt/GDP)	15.00	17.82	10.09

Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

A.3 Regression Results using Full Sample Period

In this section, we present regression results using the full sample that includes all observations, including those influenced by NBER recessions.

TABLE A.6
TREASURY SUPPLY AND THE CONVENIENCE YIELD (FULL SAMPLE, OLS)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.48**	-0.40**	-0.78***
	(0.19)	(0.20)	(0.15)
Observations	109	109	109
R^2	0.08	0.12	0.37

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.7
TREASURY SUPPLY AND THE CONVENIENCE YIELD (FULL SAMPLE, IV)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	0.05	-1.01*	-1.12***
	(0.48)	(0.52)	(0.38)
Observations	109	109	109
R^2	0.00	-0.08	0.31
F-test (1st stage), Δ Log(Debt/GDP)	7.66	8.87	7.66

Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.8
TREASURY SUPPLY AND INTERNATIONAL CONVENIENCE (FULL SAMPLE, OLS)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	0.23	-0.11	-0.24
	(0.30)	(0.24)	(0.16)
Observations	106	105	105
R^2	0.02	0.01	0.06

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.9
TREASURY SUPPLY AND INTERNATIONAL CONVENIENCE (FULL SAMPLE, IV)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.17	-0.73**	-0.66***
	(0.46)	(0.37)	(0.25)
Observations	106	105	105
R^2	-0.03	-0.26	-0.13
F-test (1st stage), Δ Log(Debt/GDP)	7.21	8.71	7.02

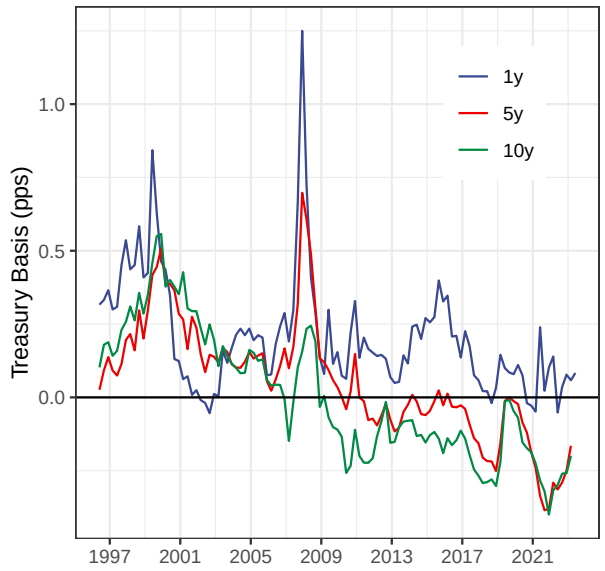
Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

A.4 Treasury Basis

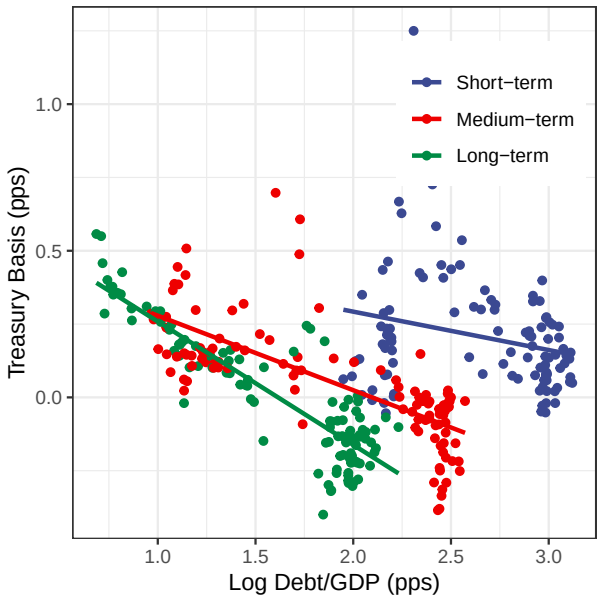
The following figures present the time series of the Treasury basis as computed by equation (2). The left panel presents the time series of the Treasury basis for 1 year, 5 year, and 10 year maturities. The right panel plots the Treasury basis against the supply of Treasurys within maturity buckets.

FIGURE A.1
TREASURY BASIS BY MATURITY

(A) TIME SERIES



(B) TREASURY BASIS AND DEBT SUPPLY



A.5 Results using the Book Value of Treasurys as Supply

In this section, we present regression results using the total face value of outstanding debt as the measure of quantity supplied.

TABLE A.10
TREASURY SUPPLY AND THE CONVENIENCE YIELD (OLS)

	Short-term (≤3Y) (1)	Medium-term (3Y-6Y) (2)	Long-term (6Y-15Y) (3)
Δ Log(Face Value/GDP)	-0.48**	-0.49**	-0.70***
	(0.24)	(0.22)	(0.16)
Observations	109	109	109
R^2	0.07	0.16	0.30

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.11
TREASURY SUPPLY AND THE CONVENIENCE YIELD (IV)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Face Value/GDP)	-0.18	-0.71***	-1.10***
	(0.56)	(0.23)	(0.32)
Observations	86	86	86
R^2	0.12	0.22	0.21
F-test (1st stage), Δ Log(Face Value/GDP)	10.04	26.07	13.51

Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.12
TREASURY SUPPLY AND INTERNATIONAL CONVENIENCE (OLS)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Face Value/GDP)	-0.30*	-0.40***	-0.46***
	(0.15)	(0.10)	(0.12)
Observations	83	82	82
R^2	0.11	0.30	0.27

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.13
TREASURY SUPPLY AND INTERNATIONAL CONVENIENCE (IV)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Face Value/GDP)	-0.29	-0.63**	-0.94***
	(0.53)	(0.25)	(0.32)
Observations	83	82	82
R^2	0.11	0.25	0.03
F-test (1st stage), Δ Log(Face Value/GDP)	9.34	25.19	12.56

Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the Treasury basis on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

A.6 Results using OIS Rates as Alternative Risk-Free Rates

In this section, we present results that use overnight indexed swap (OIS) rates written on the Federal Funds rate as the risk-free rate for the United States, rather than LIBOR swap rates.

TABLE A.14
TREASURY SUPPLY AND THE CONVENIENCE YIELD (OLS)

	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	-0.70***	-0.44***	-0.66***
	(0.17)	(0.10)	(0.16)
Observations	84	84	84
R^2	0.28	0.36	0.43

Notes: This table presents OLS regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

TABLE A.15
TREASURY SUPPLY AND THE CONVENIENCE YIELD (IV)

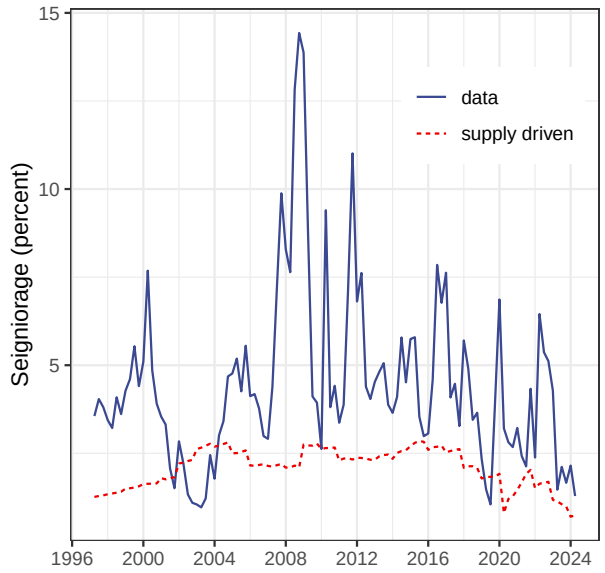
	Short-term (1)	Medium-term (2)	Long-term (3)
Δ Log(Debt/GDP)	0.09	-0.69***	-1.02***
	(0.64)	(0.25)	(0.33)
Observations	84	84	84
R^2	0.06	0.32	0.35
F-test (1st stage), Δ Log(Debt/GDP)	8.95	19.60	9.65

Notes: This table presents IV regression results from estimating equation (1) with 4-quarter changes in the convenience yield on the left-hand side. All regressions contain a post-2008 indicator. Newey-West standard errors with 8 lags are presented in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

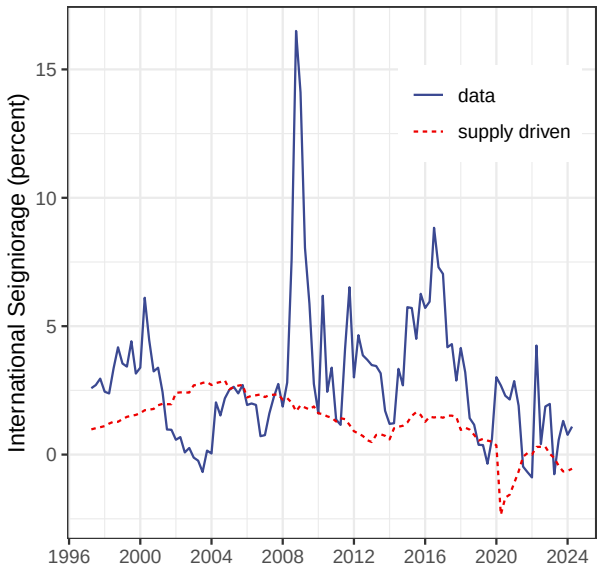
A.7 Seigniorage on Short-term Debt

FIGURE A.2
IMPACT OF SUPPLY ON SEIGNIORAGE FROM SHORT-TERM TREASURYS

(A) SEIGNIORAGE



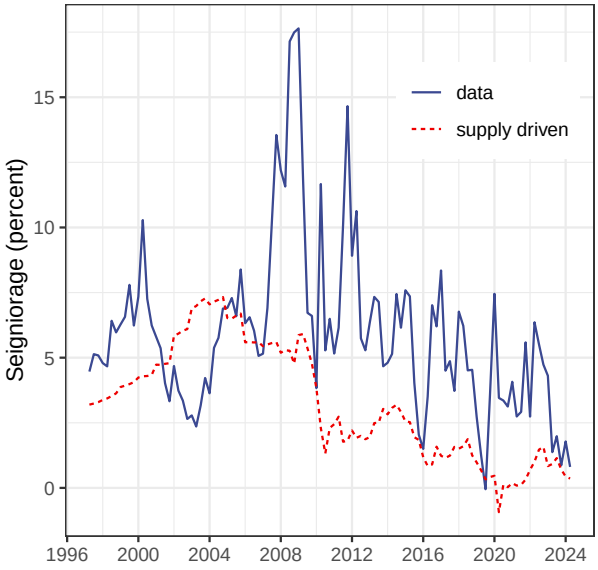
(B) INTERNATIONAL SEIGNIORAGE



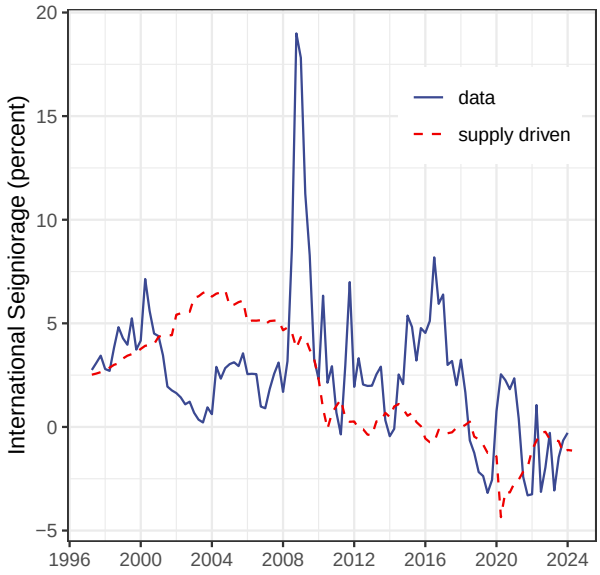
Notes: These figures present the seigniorage earn on short-term U.S. Treasurys over time. The left figure computes seigniorage using the convenience yield while the right figure computes seigniorage using the Treasury basis. Both figures present seigniorage as a percent of the annual federal interest expense. The blue solid lines present the data, and the red dashed lines present the counterfactual seigniorage yield that only accounts for changes in the supply of Treasurys.

Figure A.3
Impact of Supply on Seigniorage from All Treasurys

(a) Seigniorage



(b) International Seigniorage



Notes: These figures present the seigniorage earn on all Treasurys in our sample over time. The left figure computes seigniorage using the convenience yield while the right figure computes seigniorage using the Treasury basis. Both figures present seigniorage as a percent of the annual federal interest expense. The blue solid lines present the data, and the red dashed lines present the counterfactual seigniorage yield that only accounts for changes in the supply of Treasurys.