

Do Treasury Nominal Securities and Treasury Inflation-Protected Securities Deliver Equivalent Returns?

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Received January 09, 2024; Revised February 10, 2024; Accepted February 20, 2024

Abstract We analyze the investment returns of Treasury Nominal Securities (TNS) and Treasury Inflation-Protected Securities (TIPS) of the U.S. from January 2003 to December 2021. We find that the month-by-month rolling investments in 5-year TNS and TIPS create similar returns, in line with the equivalence between the month-by-month rolling 5-year breakeven (BE) and Consumer Price Index for all urban consumers (CPIU) inflation rates. However, the rolling investments in 10-year TNS generate significantly higher returns than those in 10-year TIPS, consistent with the rolling 10-year BE inflation rates significantly exceeding their respective CPIU counterparts.

Keywords: Treasury Nominal Securities (TNS), Treasury Inflation-Protect Securities (TIPS), Yields, Returns, Inflation

Cite This Article: Yan He, Junbo Wang, and Uric Dufrene, “Do Treasury Nominal Securities and Treasury Inflation-Protected Securities Deliver Equivalent Returns?.” *Journal of Finance and Economics*, vol. 12, no. 1 (2024): 15-23. doi: 10.12691/jfe-12-1-2.

1. Introduction

Treasury Inflation-Protected Securities (TIPS) are the inflation-indexed government debts of the U.S. They differ from the traditional Treasury Nominal Securities (TNS) of the U.S. in that the TIPS principal varies directly with the Consumer Price Index for all urban consumers (CPIU), whereas the TNS principal is a fixed amount. At the end of 2020, TIPS had an outstanding amount of \$1,579 billion, equivalent to 7.5% of all marketable debts issued by the Treasury [1]. We categorize the existing studies about TIPS into three groups and review them in the following.

The first group of studies discusses that both the issuer and investors benefit from the issuance of TIPS. Reschreiter [2] and Chung, Kim, and Zhang [3] note that inflation-indexed bonds help the government reduce its borrowing cost.¹ Siegel and Waring [4] claim that the TIPS instrument is almost ideally designed for pension, foundation, endowment, and individual tax-deferred investments.² Barnes, Bodie, Triest, and Wang [5] state that buying a newly issued TIPS and then holding it to

maturity is an effective way to lock in a risk-free real rate of return for investors. Lipton and Kish [6] document that a real-return mutual fund is rarely better than a TIPS index in terms of absolute and risk-adjusted returns. Laatsch [7] declares that an investment in TIPS is a useful hedge against inflation.

The second group of studies shows that the comparisons of TNS and TIPS give rise to mixed results. There is no definitive conclusion on whether TNS and TIPS deliver equivalent or different investment returns. Carlson, Haskins, and Hansen [8] find that TIPS investments generate higher yields and larger cash values than TNS investments. Andonov, Bardong, and Lehnert [9] report positive excess returns of inflation-linked government bonds over comparable nominal bonds in 1997-2009. Xu [10] points out that TNS investment tends to outperform its TIPS counterpart during periods dominated by increasing concern for credit and liquidity risks, but TIPS investment tends to outperform its TNS counterpart during highly inflationary environments. Laatsch [7] documents that TIPS returns perform better than TNS returns during periods of inflation. Fleckenstein, Longstaff, and Lustig [11] and Andreasen, Christensen, and Riddell [1] measure the TIPS liquidity premium. They remark that TIPS are less liquid than TNS, raising the implied yields from TIPS because investors generally require compensation for carrying liquidity risk. Zweig [12] observes that during the recent period of rising inflation and rising fed fund rates (January to November of 2022), the total return on TIPS is not much better than that on TNS, and both returns are negative. Grossman [13] recommends that buying and holding a 5-year TNS will be exactly as good as buying and holding a 5-year TIPS if the

¹ However, Fleckenstein, Longstaff, and Lustig [11] find that the U.S. government could have saved millions by issuing nominal debt instead of TIPS; and Ermolov [16] reports that nominal debt is cheaper to issue at medium maturities (5-10 years) and inflation-linked debt is cheaper to issue at long-term maturities (20 years).

² In addition, Siegel and Waring [4] warn that anyone with purely nominal liabilities should avoid TIPS investments. For example, insurance companies that have issued only nominal annuities and life insurance policies should avoid holding TIPS.

actual CPIU inflation over the next 5 years averages the amount of breakeven (BE) inflation implied by the difference between the 5-year TNS and TIPS yields.

The third group of studies declares that the BE and CPIU inflation rates affect the TNS and TIPS investment returns. As Chu, Pittman, and Yu [15] show, TIPS prices respond quickly to the monthly update of the CPIU. According to Barnes, Bodie, Triest, and Wang [5] and Grossman [13], the BE inflation rate is defined as the TNS yield less the comparable TIPS yield, and it is regarded as a market-based forecast of how much the CPIU will rise in the future.³ As Grossman [13] states, if an investor believes that the actual CPIU inflation over the next 5 years will average more than the BE inflation, the investor will buy 5-year TIPS and sell 5-year TNS. If other investors agree, increasing demand for TIPS will elevate the price and depress the yield of TIPS, whereas decreasing demand for TNS will depress the price and elevate the yield of TNS. The arbitrage trading helps raise the BE inflation closer to the actual CPIU inflation. After 5 years, if the actual CPIU inflation turns out to be higher than the initially implied BE inflation, the TIPS return will be higher than the TNS return.

In this paper, we hypothesize that TNS and TIPS would deliver equivalent returns based on monthly rolling investments over a long period of time. Given the same issuer, TNS and TIPS may be exposed to similar credit risk. For the same maturity type, TNS and TIPS may bear different types of interest rate risk, with the former bearing nominal interest rate risk and the latter bearing real interest rate risk. That is, a TNS investor earns a return of real interest and expected inflation, while a TIPS investor earns a return of real interest and actual inflation. Consequently, given the same issuer and the same maturity type, the deviation between the TNS and TIPS investment returns may be triggered by the disparity between the expected and actual inflation. In the long term, arbitrage trading would rebalance the expected and actual inflation rates and re-equalize the TNS and TIPS investment returns, bringing each pair back to equilibrium. Therefore, the equilibrium condition in this study refers to the TNS and TIPS investment returns equating to each other as well as the BE and CPI inflation rates equating to each other.

Empirically, we analyze the TNS and TIPS investment returns and the BE and CPIU inflation rates from January 2003 to December 2021. The data frequency is monthly. The maturity types of TNS and TIPS contain 5 years, 7 years, and 10 years, respectively.

Our findings are summarized as follows. First, TNS and TIPS are highly correlated in terms of their monthly yields. In addition, for each of the three maturity types, the means of the monthly TNS and TIPS returns are similar, as are the means of the monthly BE and CPIU inflation rates. Second, the month-by-month rolling investments in 5-year TNS and TIPS create similar returns. However, the rolling investments in 10-year TNS generate significantly bigger returns than those in 10-year TIPS. Third, the month-by-

month rolling 5-year BE and CPIU inflation rates are in equilibrium. Nevertheless, the rolling 10-year BE inflation rates significantly exceed their respective CPIU counterparts.

2. Data and Measures

2.1. Data Sample and Conditions

We collect monthly data on the CPIU, constant-maturity TNS, and constant-maturity TIPS from the website of the Federal Reserve Bank of St. Louis.⁴ The sample period stretches from January 2003 to December 2021, covering 19 years (228 months). The maturity lengths of TNS and TIPS consist of 5 years, 7 years, and 10 years, based on which we define the month-by-month rolling 5-year, 7-year, and 10-year periods.⁵ The TNS and TIPS with the same maturity length are compared with each other, as are the TNS and TIPS with the same rolling periods and the BE and CPIU inflation rates with the same rolling periods.

The entire sample period of 19 years may be long enough for the rolling 5-year TNS and TIPS to revert to an equilibrium condition, but it may not be long enough for the rolling 10-year TNS and TIPS to balance out. We want to extend the sample period earlier so that our historical observations are sufficient for empirical tests. However, based on our data source, the earliest available TIPS yield was in January 2003, which confines the whole sample period.

We describe the data conditions below.

- All investments in TNS and TIPS are held to maturity.
- For both TNS and TIPS, coupons are paid semiannually.
- The yields of both TNS and TIPS are reported monthly. The yield is reported as the annual yield to maturity. The monthly yield is estimated as the annual yield divided by 12 months.
- For both BE and CPIU inflation, their monthly rates are calculated based on monthly TNS and TIPS yields and monthly CPIU data, and the workouts are described in Section 2.2.
- Overall, the preliminary observations include 228 monthly yields of TNS for each maturity type, 228 monthly yields of TIPS for each maturity type, 228 monthly rates of BE inflation for each maturity type, and 228 monthly rates of CPIU inflation.

2.2. Outcome Measures

Our study utilizes two outcome measures: investment returns and inflation rates. An investment return contains two components: a real yield (TIPS yield) and an inflation rate. The inflation rate can be the BE or CPIU inflation rate. The BE inflation rate is expected or *ex ante* and

³ Although the implied BE inflation is expected or *ex ante* in nature, it varies from the inflation expectation obtained from surveys. Weber, D'Acunto, Gorodnichenko, and Coibion [14] discuss the households', firms', and professional forecasters' inflation expectations revealed in surveys.

⁴ The address (<http://fred.stlouisfed.org>) shows the website of the Federal Reserve Bank of St. Louis.

⁵ There are other maturity lengths of TIPS (such as 20 years and 30 years), but their available data start much later than January 2003, making their sample periods much shorter than those of the 5-year, 7-year, and 10-year TIPS. Thus, we do not employ the TIPS with other maturity lengths.

calculated as the TNS yield minus the TIPS yield. The CPIU inflation rate is actual or ex post and calculated as the percentage change in CPIU over a period.

Figure 1 demonstrates the components of investment returns for TNS and TIPS. The TNS return contains the TIPS yield and the BE inflation rate, whereas the TIPS return contains the TIPS yield and the CPIU inflation rate. In Panel A, the TNS and TIPS investment returns are identical, as are their return components. In Panel B, the TNS return exceeds the TIPS return because the BE inflation rate exceeds the CPIU inflation rate. In Panel C, the TIPS return exceeds the TNS return because the CPIU inflation rate exceeds the BE inflation rate. Thus, the difference between the TNS and TIPS returns, if any, is mainly due to the difference between the BE and CPIU inflation rates.

Let 0 denote the beginning time, and N, the number of years to maturity. Let Y_{tns} represent the annual yield of TNS, and Y_{tips} , the annual yield of TIPS.

- 0: beginning time
- N: number of years to maturity
- Y_{tns} : annual yield of TNS
- Y_{tips} : annual yield of TIPS

The investment return can be either the Total Return over time to maturity or the Average Monthly Return. The definitions are provided as follows for TNS and TIPS.

- Total Return of TNS = $(1 + Y_{\text{tns}}/2)^{2N} - 1$
- Total Return of TIPS = $(\text{CPIU}_N/\text{CPIU}_0) * (1 + Y_{\text{tips}}/2)^{2N} - 1$
- Average Monthly Return of TNS = $Y_{\text{tns}}/12$
- Average Monthly Return of TIPS = $(1 + Y_{\text{tips}}/12) * (\text{CPIU}_N/\text{CPIU}_0)^{1/(12N)} - 1$

Please note that even if investors hold TIPS until maturity, the Total Return and the Average Monthly Return of TIPS could still be negative for two reasons. First, during certain periods of time, the TIPS yields are negative, possibly causing a negative TIPS return. Second, when negative CPIU inflation (i.e., deflation) occurs, the TIPS principal decreases, which might lead to a negative TIPS return.

The inflation rate can be either the Total Rate of Inflation over time to maturity or the Average Monthly Rate of Inflation. The definitions are offered as follows for BE and CPIU inflation.

- Total Rate of BE Inflation = $(1 + Y_{\text{tns}}/2)^{2N} - (1 + Y_{\text{tips}}/2)^{2N}$
- Total Rate of CPIU Inflation = $(\text{CPIU}_N/\text{CPIU}_0) - 1$
- Average Monthly Rate of BE Inflation = $Y_{\text{tns}}/12 - Y_{\text{tips}}/12$
- Average Monthly Rate of CPIU Inflation = $(\text{CPIU}_N/\text{CPIU}_0)^{1/(12N)} - 1$

We place all the outcome measures under the rolling-period tests. For every outcome measure, the month-by-month rolling 5-year investments contain 168 monthly observations, the month-by-month rolling 7-year investments contain 144 monthly observations, and the month-by-month rolling 10-year investments contain 108 monthly observations.

Panel A. Equivalent Returns

TNS return (TNS yield)		=	TIPS return	
TIPS yield			TIPS yield	
BE inflation rate (ex ante or expected)			CPIU inflation rate (ex post or actual)	

Panel B. TNS Return Exceeding TIPS Return

TNS return (TNS yield)		>	TIPS return	
TIPS yield			TIPS yield	
BE inflation rate (ex ante or expected)			CPIU inflation rate (ex post or actual)	

Panel C. TIPS Return Exceeding TNS Return

TNS return (TNS yield)		<	TIPS return	
TIPS yield			TIPS yield	
BE inflation rate (ex ante or expected)			CPIU inflation rate (ex post or actual)	

Figure 1. Components of Investment Returns

3. Empirical Results

3.1. Preliminary Results for the Entire Period

Figures 2 and 3 display the yields of TNS and TIPS throughout the entire study period. Figure 2 shows the monthly yields of 5-year, 7-year, and 10-year TNS. The three types of TNS yields stay close and move together in the range of 0.0175% to 0.4292%.⁶ Their overall trend is downward, where the maximum yield of 0.4292% occurred for the 10-year TNS in June 2006, and the minimum yield of 0.0175% occurred for the 5-year TNS in July 2020. Figure 3 shows the monthly yields of 5-year, 7-year, and 10-year TIPS. Like those of TNS, the three types of TIPS yields also stay close and move together, ranging from -0.1558% to 0.3475%.⁷ In addition, the overall trend of TIPS yields is also downward, where the maximum yield of 0.3475% happened for the 5-year TIPS in November 2008, and the minimum yield of -0.1558% happened for the 5-year TIPS in July 2021.

⁶ The minimum and maximum are from Panel A1 of Table 1.

⁷ The minimum and maximum are from Panel A2 of Table 1.

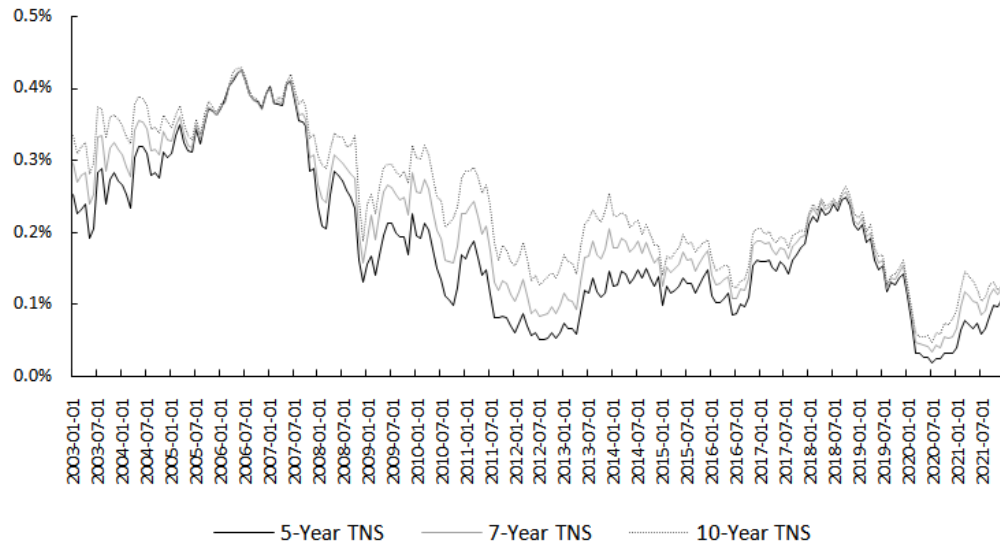


Figure 2. Monthly Yields of TNS

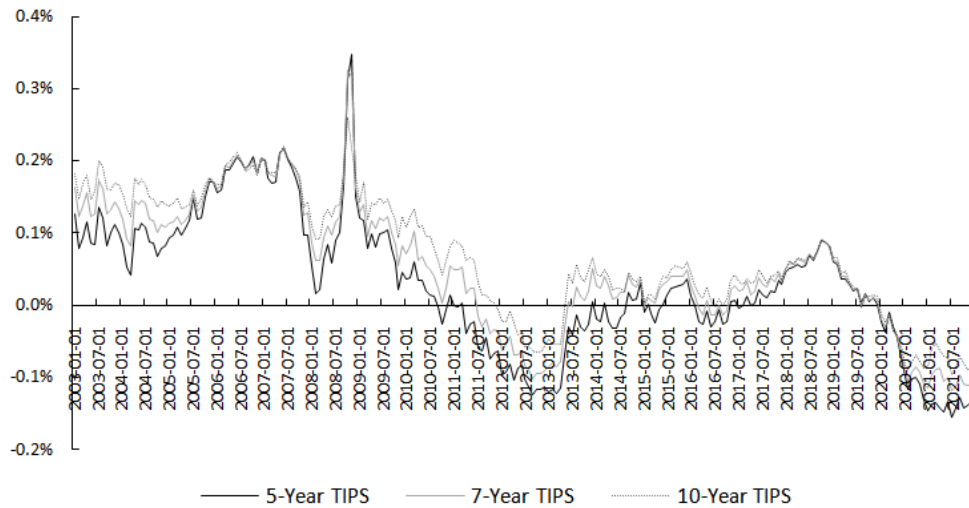


Figure 3. Monthly Yields of TIPS

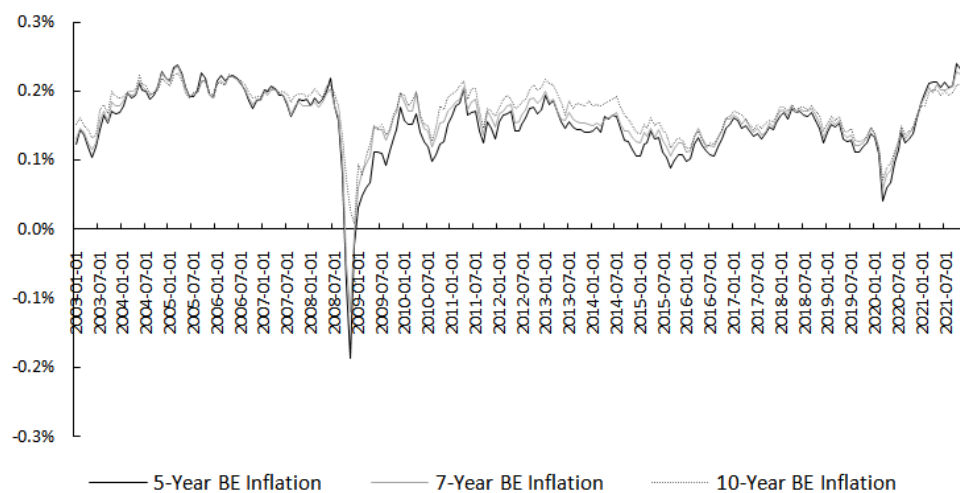


Figure 4. Monthly Rates of BE Inflation

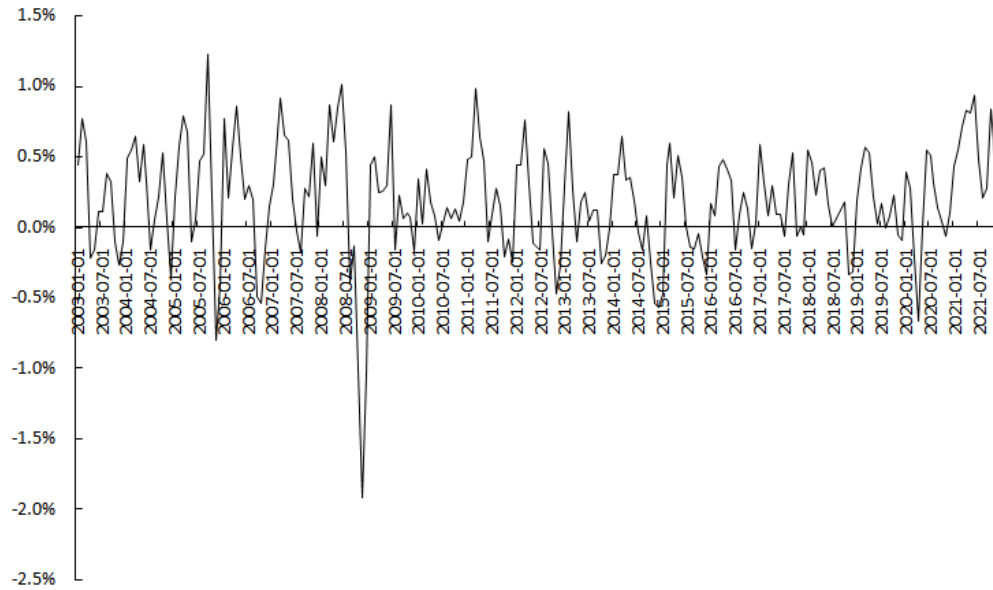


Figure 5. Monthly Rates of CPIU Inflation

Figures 4 and 5 display the rates of BE and CPIU inflation during the entire period. Figure 4 shows the monthly rates of 5-year, 7-year, and 10-year BE inflation. The three types of BE inflation rates stay close and move together in the range of -0.1867% to 0.2408% .⁸ Their overall trend is stable. The maximum rate of 0.2408% occurred for the 5-year BE inflation in October 2021, and the minimum rate of -0.1867% occurred for the 5-year BE inflation in November 2008. Figure 5 presents the monthly rates of CPIU inflation. Their overall trend is stable but volatile, fluctuating between -1.9153% and 1.2220% .⁹ The maximum rate of 1.2220% happened in September 2005, and the minimum rate of -1.9153% happened in November 2008.

Table 1 presents summary statistics of the monthly data for the entire period.¹⁰ Panel A of Table 1 shows the results for TNS and TIPS yields. Specifically, Panel A1 reports the statistics of the monthly yields of 5-year, 7-year, and 10-year TNS. We observe that the mean monthly yield is 0.1815% for the 5-year TNS, 0.2128% for the 7-year TNS, and 0.2410% for the 10-year TNS. Panel A2 reports the statistics of the monthly yields of 5-year, 7-year, and 10-year TIPS. The mean monthly yield is 0.0293% for the 5-year TIPS, 0.0512% for the 7-year TIPS, and 0.0704% for the 10-year TIPS. Therefore, each nominal yield (TNS yield) is much greater than its corresponding real yield (TIPS yield). Panel A3 reports the statistics of differences between monthly TNS and TIPS returns. The TNS return is equal to the TNS yield, while the TIPS return is derived from the TIPS yield and CPIU inflation rate.¹¹ The t values of the mean difference between TNS and TIPS returns are insignificant at the 5% level: -1.74 for the 5-year maturity type, -1.38 for the 7-year maturity type, and -1.03 for the 10-year maturity type. The results indicate that for the same maturity type,

the mean monthly TNS return is similar to the mean monthly TIPS return.

Table 1. Summary Statistics

Panel A. Summary statistics of TNS and TIPS yields

Panel A1. TNS

	5-year TNS	7-year TNS	10-year TNS
Mean of monthly yields	0.1815%	0.2128%	0.2410%
S.D. of monthly yields	0.1043%	0.0981%	0.0957%
Median of monthly yields	0.1592%	0.1917%	0.2263%
Maximum of monthly yields	0.4250%	0.4258%	0.4292%
Minimum of monthly yields	0.0175%	0.0325%	0.0458%

Panel A2. TIPS

	5-year TIPS	7-year TIPS	10-year TIPS
Mean of monthly yields	0.0293%	0.0512%	0.0704%
S.D. of monthly yields	0.0952%	0.0897%	0.0846%
Median of monthly yields	0.0217%	0.0408%	0.0613%
Maximum of monthly yields	0.3475%	0.3250%	0.2617%
Minimum of monthly yields	-0.1558%	-0.1192%	-0.0967%

Panel A3. Differences

	5-year	7-year	10-year
Mean of monthly TNS returns	0.1815%	0.2128%	0.2410%
S.D. of monthly TNS returns	0.1043%	0.0981%	0.0957%
Mean of monthly TIPS returns	0.2274%	0.2494%	0.2685%
S.D. of monthly TIPS returns	0.3836%	0.3872%	0.3921%
Mean diff. (TNS – TIPS)	-0.0459%	-0.0366%	-0.0274%
t value on the mean difference	-1.74	-1.38	-1.03

⁸ The minimum and maximum are from Panel B1 of Table 1.

⁹ The minimum and maximum are from Panel B2 of Table 1.

¹⁰ We estimate the mean by excluding 10% of the data points from the top and bottom tails.

¹¹ Monthly TIPS return = $(1 + \text{monthly TIPS yield}) * (1 + \text{monthly CPIU inflation rate}) - 1$

Panel B. Summary statistics of BE and CPIU inflation rates

Panel B1. BE inflation

	5-year BE Inflation	7-year BE Inflation	10-year BE Inflation
Mean of monthly rates	0.1576%	0.1651%	0.1732%
S.D. of monthly rates	0.0499%	0.0421%	0.0344%
Median of monthly rates	0.1558%	0.1650%	0.1775%
Maximum of monthly rates	0.2408%	0.2367%	0.2258%
Minimum of monthly rates	-0.1867%	-0.1192%	0.0092%

Panel B2. CPIU inflation

	CPIU inflation
Mean of monthly rates	0.2032%
S.D. of monthly rates	0.3884%
Median of monthly rates	0.1994%
Maximum of monthly rates	1.2220%
Minimum of monthly rates	-1.9153%

Panel B3. Differences

	5-year	7-year	10-year
Mean difference (BE – CPIU)	-0.0457%	-0.0382%	-0.0300%
t value on the mean difference	-1.76	-1.47	-1.16

The table presents summary statistics of the monthly data from January 2003 to December 2021. Panel A shows the results of TNS and TIPS yields. Specifically, Panel A1 reports the statistics of monthly yields of 5-year, 7-year, and 10-year TNS; Panel A2 reports the statistics of monthly yields of 5-year, 7-year, and 10-year TIPS; and Panel A3 reports the statistics of differences between monthly TNS and TIPS returns. Panel B shows the results of the BE and CPIU inflation rates. Specifically, Panel B1 reports the statistics of monthly rates of 5-year, 7-year, and 10-year BE inflation; Panel B2 reports the statistics of monthly CPIU inflation rates; and Panel B3 reports the statistics of differences between monthly BE and CPIU inflation rates. We estimate the mean by excluding 10% of the data points from the top and bottom tails.

Panel B of Table 1 shows the results for the BE and CPIU inflation rates. Specifically, Panel B1 reports the statistics of monthly rates of 5-year, 7-year, and 10-year

BE inflation. The mean monthly rate is 0.1576% for the 5-year BE inflation, 0.1651% for the 7-year BE inflation, and 0.1732% for the 10-year BE inflation. Panel B2 reports the statistics of the monthly CPIU inflation rates. We note that the mean is 0.2032%. Thus, the BE and CPIU inflation rates are similar. Panel B3 reports the statistics of differences between monthly BE and CPIU inflation rates. The t values of the mean difference are insignificant at the 5% level: -1.76 for the 5-year type, -1.47 for the 7-year type, and -1.16 for the 10-year type. The results imply that the mean monthly BE inflation rate is similar to the mean monthly CPIU inflation rate.

Table 2 reports the correlations among the monthly data for the entire period. The data include the monthly yields of 5-year, 7-year, and 10-year TNS; the monthly yields of 5-year, 7-year, and 10-year TIPS; the monthly rates of 5-year, 7-year, and 10-year BE inflation; and the monthly rates of CPIU inflation. First, we find that the three types of TNS yields are highly correlated (0.99, 0.94, and 0.98), as are the three types of TIPS yields (0.99, 0.95, and 0.98). Second, the TNS and TIPS yields are strongly correlated with each other, ranging from 0.84 to 0.93. Third, the three types of BE inflation rates are highly correlated (0.99, 0.92, and 0.94), but they have weak correlations with the CPIU inflation rate (0.54, 0.52, and 0.43). Finally, the BE and CPIU inflation rates have weak correlations with the TNS and TIPS yields, ranging from -0.18 to 0.48.

Overall, the preliminary results in Tables 1 and 2 show that TNS and TIPS are strongly correlated in terms of yield. Furthermore, for the same maturity type, the means of the monthly TNS and TIPS returns are indifferent at the 5% level, as are the means of the monthly BE and CPIU inflation rates. Therefore, in the long term (such as a few decades), TNS and TIPS may provide similar return performances for investors, and BE and CPIU inflation may stay in equilibrium. Below, we conduct rolling-period tests on the return and inflation measures.

Table 2. Correlations

	5-year TNS yield	7-year TNS yield	10-year TNS yield	5-year TIPS yield	7-year TIPS yield	10-year TIPS yield	5-year BE Infl. rate	7-year BE Infl. rate	10-year BE Infl. rate	CPIU Infl. rate
5-year TNS yield	1.00	0.99	0.94	0.88	0.89	0.89	0.41	0.41	0.44	0.10
7-year TNS yield		1.00	0.98	0.87	0.90	0.93	0.40	0.41	0.46	0.10
10-year TNS yield			1.00	0.84	0.89	0.93	0.37	0.40	0.48	0.09
5-year TIPS yield				1.00	0.99	0.95	-0.07	-0.07	0.00	-0.18
7-year TIPS yield					1.00	0.98	-0.03	-0.02	0.06	-0.13
10-year TIPS yield						1.00	0.04	0.06	0.14	-0.07
5-year BE Infl. rate							1.00	0.99	0.92	0.54
7-year BE Infl. rate								1.00	0.94	0.52
10-year BE Infl. rate									1.00	0.43
CPIU Infl. rate										1.00

The table reports the correlations among the monthly data from January 2003 to December 2021. The data include the monthly yields of 5-year, 7-year, and 10-year TNS; the monthly yields of 5-year, 7-year, and 10-year TIPS; the monthly rates of 5-year, 7-year, and 10-year BE inflation; and the monthly rates of CPIU inflation.

3.2. Rolling Investments in 5-year TNS and TIPS

Table 3 presents the test results of rolling investments in 5-year TNS and TIPS. Panel A of Table 3 reports the statistics of month-by-month rolling 5-year TNS vs. TIPS investment returns. For the rolling 5-year Total Return, the mean is 12.90% for TNS and 13.76% for TIPS, and the t value of the mean difference (−1.00) is insignificant at the 5% level. For the rolling 5-year Average Monthly Return, the mean is 0.20% for TNS and 0.21% for TIPS, and the t value of the mean difference (−0.86) is insignificant at the 5% level. Accordingly, the month-by-month rolling 5-year TNS and TIPS investments deliver equivalent returns.

Panel B of Table 3 reports the statistics of month-by-month rolling 5-year BE vs. CPIU inflation rates. For the rolling 5-year Total Rate, the mean is 10.23% for BE inflation and 10.03% for CPIU inflation, and the t value of the mean difference (0.54) is insignificant at the 5% level. For the rolling 5-year Average Monthly Rate, the mean is 0.16% for BE inflation and 0.16% for CPIU inflation, and the t value of the mean difference (−0.03) is insignificant at the 5% level. Therefore, the month-by-month rolling 5-year BE and CPIU inflation rates are in equilibrium.

Overall, Panels A and B of Table 3 demonstrate strong verifications for each other. The equivalence between the 5-year TNS and TIPS investment returns is associated with and illustrated by the equivalence between the 5-year BE and CPIU inflation rates.

Table 3. Rolling Investments in 5-Year TNS and TIPS

Panel A. Investment Returns

	Total Return		Average Monthly Return	
	5-year TNS	5-year TIPS	5-year TNS	5-year TIPS
Mean of returns	12.90%	13.76%	0.20%	0.21%
S.D. of returns	7.31%	8.32%	0.11%	0.12%
Median of returns	10.79%	12.30%	0.17%	0.19%
Maximum of returns	28.63%	34.86%	0.43%	0.50%
Minimum of returns	2.99%	−1.02%	0.05%	−0.02%
Mean diff. (TNS - TIPS)	−0.85%		−0.01%	
t value on the mean diff.	−1.00		−0.86	

Panel B. Inflation Rates

	Total Rate		Average Monthly Rate	
	5-year BE Inflation	5-year CPIU Inflation	5-year BE Inflation	5-year CPIU Inflation
Mean of rates	10.23%	10.03%	0.16%	0.16%
S.D. of rates	3.73%	2.98%	0.05%	0.04%
Median of rates	9.90%	9.76%	0.16%	0.16%
Maximum of rates	16.23%	19.61%	0.24%	0.30%
Minimum of rates	−12.84%	6.20%	−0.19%	0.10%
Mean diff. (BE - CPIU)	0.20%		0.00%	
t value on the mean diff.	0.54		−0.03	

The table presents the test results of rolling investments in 5-year TNS and TIPS. Panel A reports the statistics of month-by-month rolling 5-year TNS vs. TIPS investment returns. Panel B reports the statistics of month-by-month rolling 5-year BE vs. CPIU inflation rates. We estimate the mean by excluding 10% of the data points from the top and bottom tails.

3.3. Rolling Investments in 7-year TNS and TIPS

Table 4 presents the test results of rolling investments in 7-year TNS and TIPS. Panel A of Table 4 reports the statistics of month-by-month rolling 7-year TNS vs. TIPS investment returns. For the rolling 7-year Total Return, the mean is 23.83% for TNS and 22.87% for TIPS, and the t value of the mean difference (0.78) is positive and insignificant at the 5% level. For the rolling 7-year Average Monthly Return, the mean is 0.25% for TNS and 0.24% for TIPS, and the t value of the mean difference (0.96) is positive and insignificant at the 5% level. Thus, the rolling 7-year TNS investments create higher returns than the rolling 7-year TIPS investments, though their differences are insignificant.

Table 4. Rolling Investments in 7-Year TNS and TIPS

Panel A. Investment Returns

	Total Return		Average Monthly Return	
	7-year TNS	7-year TIPS	7-year TNS	7-year TIPS
Mean of returns	23.83%	22.87%	0.25%	0.24%
S.D. of returns	9.79%	10.90%	0.10%	0.11%
Median of returns	23.77%	22.25%	0.26%	0.24%
Maximum of returns	42.36%	45.21%	0.43%	0.45%
Minimum of returns	7.08%	1.85%	0.08%	0.02%
Mean diff. (TNS - TIPS)	0.95%		0.01%	
t value on the mean diff.	0.78		0.96	

Panel B. Inflation Rates

	Total Rate		Average Monthly Rate	
	7-year BE Inflation	7-year CPIU Inflation	7-year BE Inflation	7-year CPIU Inflation
Mean of rates	16.71%	13.95%	0.17%	0.16%
S.D. of rates	4.89%	3.11%	0.05%	0.03%
Median of rates	16.14%	12.51%	0.18%	0.14%
Maximum of rates	24.02%	19.63%	0.24%	0.21%
Minimum of rates	−12.20%	8.50%	−0.12%	0.10%
Mean diff. (BE - CPIU)	2.76%		0.02%	
t value on the mean diff.	5.72*		4.10*	

The table presents the test results of rolling investments in 7-year TNS and TIPS. Panel A reports the statistics of month-by-month rolling 7-year TNS vs. TIPS investment returns. Panel B reports the statistics of month-by-month rolling 7-year BE vs. CPIU inflation rates. The star (*) represents statistical significance at the 5% level. We estimate the mean by excluding 10% of the data points from the top and bottom tails.

Panel B of Table 4 reports the statistics of month-by-month rolling 7-year BE vs. CPIU inflation rates. For the rolling 7-year Total Rate, the mean is 16.71% for BE inflation and 13.95% for CPIU inflation, and the t value of the mean difference (5.72) is significant at the 5% level. For the rolling 7-year Average Monthly Rate, the mean is 0.17% for BE inflation and 0.16% for CPIU inflation, and the t value of the mean difference (4.10) is significant at the 5% level. Hence, the rolling 7-year BE inflation rates are significantly higher than the rolling 7-year CPIU inflation rates.

Overall, Panels A and B of Table 4 provide weak verifications for each other. The 7-year TNS investment returns are insignificantly higher than the 7-year TIPS investment returns, while the 7-year BE inflation rates are significantly higher than the 7-year CPIU inflation rates.

Table 5. Rolling Investments in 10-Year TNS and TIPS

Panel A. Investment Returns

	Total Return		Average Monthly Return	
	10-year TNS	10-year TIPS	10-year TNS	10-year TIPS
Mean of returns	47.22%	43.20%	0.32%	0.30%
S.D. of returns	10.77%	9.63%	0.06%	0.06%
Median of returns	48.45%	45.73%	0.33%	0.32%
Maximum of returns	66.28%	61.41%	0.43%	0.40%
Minimum of returns	20.70%	22.68%	0.16%	0.17%
Mean diff. (TNS - TIPS)	4.02%		0.03%	
t value on the mean diff.	2.89*		3.04*	

Panel B. Inflation Rates

	Total Rate		Average Monthly Rate	
	10-year BE Inflation	10-year CPIU Inflation	10-year BE Inflation	10-year CPIU Inflation
Mean of rates	28.92%	20.57%	0.18%	0.16%
S.D. of rates	6.65%	3.30%	0.04%	0.02%
Median of rates	30.50%	19.34%	0.19%	0.15%
Maximum of rates	38.17%	27.11%	0.23%	0.20%
Minimum of rates	1.35%	14.57%	0.01%	0.11%
Mean diff. (BE - CPIU)	8.34%		0.03%	
t value on the mean diff.	11.68*		6.83*	

The table presents the test results of rolling investments in 10-year TNS and TIPS. Panel A reports the statistics of month-by-month rolling 10-year TNS vs. TIPS investment returns. Panel B reports the statistics of month-by-month rolling 10-year BE vs. CPIU inflation rates. The star (*) represents statistical significance at the 5% level. We estimate the mean by excluding 10% of the data points from the top and bottom tails.

3.4. Rolling Investments in 10-year TNS and TIPS

Table 5 presents the test results of rolling investments in 10-year TNS and TIPS. Panel A of Table 5 reports the statistics of month-by-month rolling 10-year TNS vs. TIPS investment returns. For the rolling 10-year Total Return, the mean is 47.22% for TNS and 43.20% for TIPS, and the t value of the mean difference (2.89) is significant at the 5% level. For the rolling 10-year Average Monthly Return, the mean is 0.32% for TNS and 0.30% for TIPS, and the t value of the mean difference (3.04) is significant at the 5% level. So, the rolling 10-year TNS investments generate significantly higher returns than the rolling 10-year TIPS investments.

Panel B of Table 5 reports the statistics of month-by-month rolling 10-year BE vs. CPIU inflation rates. For the rolling 10-year Total Rate, the mean is 28.92% for BE inflation and 20.57% for CPIU inflation, and the t value of the mean difference (11.68) is significant at the 5% level. For the rolling 10-year Average Monthly Rate, the mean is

0.18% for BE inflation and 0.16% for CPIU inflation, and the t value of the mean difference (6.83) is significant at the 5% level. Therefore, the rolling 10-year BE inflation rates are significantly higher than the rolling 10-year CPIU inflation rates.

In sum, Panels A and B of Table 5 offer solid verifications for each other. The higher returns of rolling 10-year TNS (vs. TIPS) investments are congenial with and explained by the higher rates of rolling 10-year BE (vs. CPIU) inflation. That is, since the expected inflation rates exceed the actual inflation rates, the nominal Treasury debts generate higher returns than the inflation-indexed Treasury debts.

The discrepancies between the 10-year TNS and TIPS returns and between the 10-year BE and CPIU inflation rates might be related to the length constraint of our sample period. That is, if deviating from each other temporarily, the rolling 10-year TNS and TIPS investment returns could not return to equilibrium within the 19-year sample period, nor could the rolling 10-year BE and CPIU inflation rates.

4. Conclusions

We investigate 5-year, 7-year, and 10-year TNS and TIPS during the period from January 2003 to December 2021. Two outcome measures are at work: investment returns and inflation rates. Assume that all TNS and TIPS investments are held to maturity. The TNS return includes the TIPS yield and BE inflation rate, whereas the TIPS return involves the TIPS yield and CPIU inflation rate.

We recap the key empirical results into three aspects. First, the monthly yields of TNS and TIPS are strongly correlated. For each of the 5-year, 7-year, and 10-year maturity types, the mean monthly TNS return is indifferent from the mean monthly TIPS return. In addition, the mean monthly BE inflation rate is indifferent from the mean monthly CPIU inflation rate.

Second, the month-by-month rolling investments in 5-year TNS and TIPS deliver similar returns. In addition, the month-by-month rolling 5-year BE and CPIU inflation rates are in equilibrium, supporting the balance between the 5-year TNS and TIPS investment returns.

Third, the rolling investments in 10-year TNS produce significantly greater returns than those in 10-year TIPS, and the rolling 10-year BE inflation rates are significantly higher than their respective CPIU counterparts. If the whole sample period is long enough, the 10-year TNS and TIPS may deliver similar returns, and the 10-year BE and CPIU inflation rates may also return to equilibrium.

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