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The Near-Term Forward Yield Spread as a Leading Indicator: A Less Distorted Mirror

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The spread between the yield on a 10-year Treasury bond and the yield on a shorter maturity bond, such as a 2-year Treasury, is commonly used as an indicator for predicting U.S. recessions. We show that such "long-term spreads" are statistically dominated in recession prediction models by an economically more intuitive alternative, a "near-term forward spread." This latter spread can be interpreted as a measure of the market's expectations for the near-term trajectory of conventional monetary policy rates. The predictive power of our near-term forward spread indicates that, when market participants expected—and priced in—a monetary policy easing over the next 12-18 months, this indicated that a recession was quite likely in the offing. Yields on bonds beyond 18 months in maturity are shown to have no added value for forecasting either recessions or the growth rate of GDP.

JEL codes: E52, G12

Keywords: Yield Spread, Recession Forecast, Monetary Policy, Policy Path

[1] Board of Governors of the Federal Reserve System. The views in this document do not necessarily reflect those of the Federal Reserve System, its Board of Governors, or staff. This paper is a slightly revised, updated and more fully exposited version of the analysis in June 28, 2018 Feds Note, "(Don't Fear) The Yield Curve."

Introduction

Commonly cited measures of the term spread, such as the difference between the 10-year and 2-year nominal Treasury yields, have dropped over the past several years (Figure 1, blue line), a trend that has raised concerns and provoked extensive commentary in the financial press. Those concerns owe to the statistical power that low levels of term spreads have shown for predicting low GDP growth or recessions over the subsequent year. In particular, many studies over the past couple decades have documented this predictive power of the term structure, such as Estrella, and. Mishkin (1998) and Rudebush and Williams (2009), to name just a couple. Recently, Bauer and Mertens (2018) and Johansson and Meldrum (2018) show that the predictive power of term spreads remains undiminished of late, and is robust to the inclusion of additional predictors.

In this note, we show that, for predicting recessions, such measures of a "long-term spread"—the spread in yields between a far-off maturity such as 10 years and a shorter maturity such as 1 or 2 years—are statistically dominated by a more economically intuitive alternative, a "near-term forward spread." This latter spread can be interpreted as a measure of the market's expectations for the trajectory of conventional near-term monetary policy. When negative, it indicates market participants expect monetary policy to ease on net over the next several quarters, presumably because they expect monetary policymakers to respond to the threat or onset of a recession. The predictive power of our near-term forward spread indicates that, when market participants expected—and priced in—a monetary policy easing over the next 18 months, their fears were validated more often than not.

In some sense, our findings merely serve to demystify the historical predictive content of the yield curve by showing that the informative component of yield spreads simply reflects expectations for monetary policy over the coming year that are embedded in asset prices. In other words, abstracting from the fact that bond traders and investors can have heterogeneous perceptions, for market participants to infer the likelihood of recession by looking at the yield curve—or better, the near-term forward spread—is akin to market participants looking at themselves in the mirror.

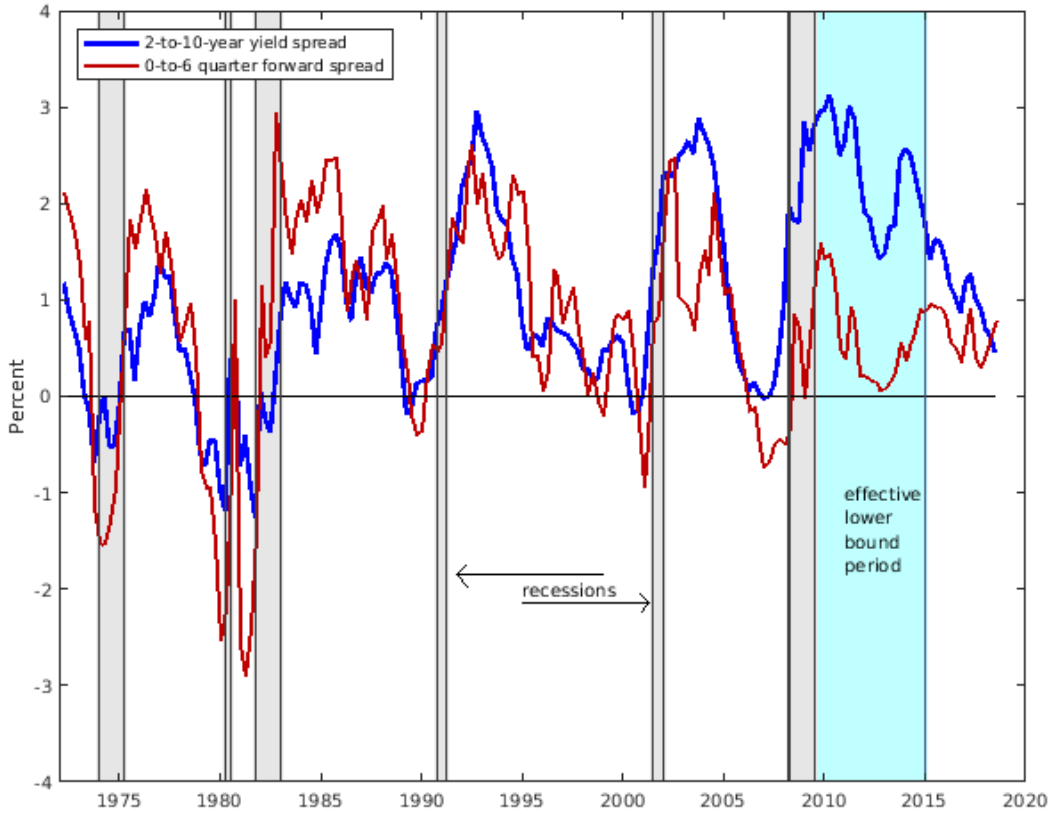
Defining Near-Term Forward Spreads

Like a standard term spread measure using yield to maturity, a forward spread gauges the slope of the Treasury term structure. However, using forward rates should help identify more precisely than yields where on the maturity spectrum the signal for recession lies.[2] The forward rate at a given maturity can be thought of as a gauge of the market's expected short rate at that horizon, plus a term premium. On the other hand, because a (constant maturity) yield is an average of the forward rates over the given maturity, yields tend to dull the signal embedded in forward rates. The near-term forward spread we focus on is the difference between the current implied forward

[2] In some sense, our approach echoes the philosophy driving the Johansson-Meldrum (2018) analysis, where the signal embedded in the term spread is decomposed by examining the three principal components of yield curve.

rate (on Treasury bills) six quarters from now and the current yield on a three-month Treasury bill, plotted in red alongside the long-term yield spread in Figure 1.[3] To match the frequency of our macroeconomic data, we use the quarterly average of the daily values of the near-term forward spread.

Figure 1: Long-term Yield Spread and Near-term Forward Spread



Source: Federal Reserve Bank of New York; Federal Reserve Board staff estimates.

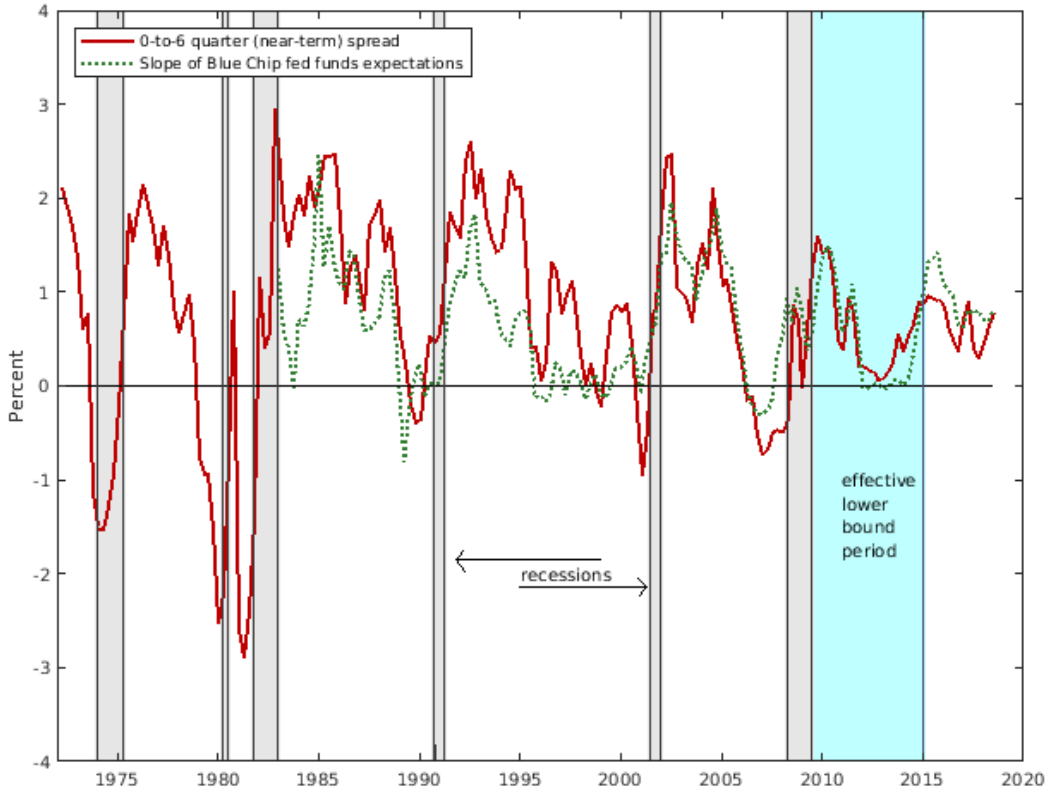
Arguably, changes in this forward spread should be driven largely by changes in the market's expectations for the path of interest rates set by monetary policymakers over the next six quarters, departing from this only to the extent of fluctuations in term premiums on shorter-term Treasuries. Indeed, as shown in Figure 2, the near-term spread covaries closely with a survey-based measure of the expected trajectory of the federal funds rate over a roughly comparable horizon, the dotted green line, and they have moved nearly in lock step since 2001.[4] Thus, the near-term forward spread does indeed appear to be a pretty good gauge of market expectations regarding monetary policy. In particular, when the near-term forward spread is negative, it

[3] The current level of the forward rate 6 quarters ahead is inferred from the yields to maturity on Treasury notes maturing 6 quarters from now and 7 quarters from now. In particular, it is the rate that would have to be earned on a 3-month Treasury bill purchased six quarters from now that would equate the results from two investment strategies: simply investing in a Treasury note that matures 7 quarters from now versus investing in a Treasury note that matures 6 quarters from now and reinvesting proceeds in that 3-month Treasury bill.

[4] Starting in 1997, the survey-based measure is the Blue Chip expected federal funds rate 5-quarters ahead minus the Treasury bill yield. Prior to 1997, the 5-quarter ahead forecast is not available, so a 4-quarter ahead forecast scaled by a factor of 5/4 is used instead.

signals that investors expect the Federal Reserve to ease monetary policy in the near term. When do investors expect monetary policy easing? Presumably, when they anticipate a substantial slowing or decline in economic activity. Consequently, assuming market participants have some foresight, it is not all that surprising that negative readings for the near-term spread tend to precede (and thus can be used statistically to forecast) recessions. This interpretation implies that inversions of the near-term spread do not cause recessions. Rather, they merely reflect something that market analysts already track closely—investors' expectations for monetary

Figure 2: Near-term Forward Spread and Market-Expected Paths of Short Rates



Source: Federal Reserve Bank of New York; Blue Chip Financial Forecasts; Federal Reserve Board staff estimates.

policy over the next several quarters and, by extension, the economic conditions driving those expectations. While, measures of the long-term spread also impound this information, they are likely to be affected by other factors unimportant for forecasting recessions, which would degrade their forecasting power.[5]

Methodology and Results

The data used in our analysis is quarterly and spans the period from 1972:Q1 to 2018:Q2. Our macroeconomic data are standard. We use data published by the NBER to define quarters as periods of either recession or expansion. For GDP growth, we use the four-quarter log difference of real GDP as published by the Bureau of Labor Statistics. Our financial data are

[5] One such factor could be a secular decline in the inflation risk premium on long-term bonds.

also fairly standard. All of our measures of term spreads all begin with daily estimates of the continuously-compounded zero-coupon nominal U.S. Treasury curve estimated as in Kim and Wright (2005). The yield curve for each day is composed of yields at maturities from one to 40 quarters. We take quarterly averages of the daily yield data. We calculate forward rates from the zero coupon curve using the standard formula

$$f_t^{n,1} = (n+1)\, y_t^{n+1} - n\, y_t^n$$

where $f_t^{n,1}$ is the forward in quarter (t) rate from quarter (n) to ($n+1$), and y_t^n is the zero-coupon yield for maturity n (expressed at annual rate). Yield (alternatively, forward) spreads are calculated as the difference between the zero-coupon yields (alternatively, forwards) at two horizons (e.g. 10-year minus 2-year). We also obtain quarterly-average values for the "excess bond premium" (EBP) measure of investor sentiment or risk appetite due to Gilchrist and Zakrajsek (2012), which we use as a control in some of the following analysis.

Following the long-standing academic literature, our recession prediction analysis is based on a probit model. We estimate the probability of transition to recession within the four quarters ahead as a function of the near-term forward spread, a standard long-term yield spread and, in some specifications, added controls. One minor departure from the most previous studies is that we drop from the estimation any observations in which the economy was already in recession in the previous quarter. This choice enables us to simply estimate the probability of transitioning into recession. Arguably, one should allow for a somewhat different model for estimating the probability of remaining in recession. Nonetheless, our main results are not sensitive to this choice. Following other recent studies, we also drop observations during which the effective lower bound was binding, as this also effectively constrained our near-term forward spread to be nonnegative. Also during that period, forward guidance may have been unusually persuasive.

The statistical results of our probit analysis are shown in Table 1. In the first specification, we show a standard result from the literature that the long-term yield spread, (10 year minus 2 year) indeed exhibits power for forecasting future recessions. A one standard deviation decrease in the long-term spread increases the probability of recession by 36 percentage points, an economically large effect that is also statistically significant. As shown by the bottom two rows, the average level for the model-implied probability of a recession was 44 percent for observations preceding recessions that actually occurred within the specified four-quarter window, compared to 12 percent in preceeding periods in which no recession occurred. This suggests than on an in-sample basis, the model delivers a fairly discriminating signal. However, the results of Specification (2) show that the near-term forward spread performs even better, with a higher coefficient and a sharper in-sample fit.

In order to gauge whether both spreads contribute some information for regression prediction, specification (3), includes both variables in a single model Here, the near-term forward spread remains highly significant; all else being equal, a decline from its mean level by one standard

deviation increases the probability of recession increases by 35 percentage points. In contrast, the estimated marginal effect of the competing long-term spread on the probability of recession is economically small and not statistically different from zero. This suggests that essentially all of the information in the long-term spread is subsumed by the near-term forward spread.

Table 1: Near-term Spread versus Far-term spreads for Forecasting Recessions

explanatory variables (spreads)		spec (1)	spec (2)	spec (3)	spec (4)	spec (5)	spec (6)	spec (7)
6 qtr forward - 1 qtr T-bill	*sensitivity*		0.44	0.35	0.32	0.26	0.38	0.43
	pval		(<0.01)	(<0.01)	(<0.01)	(<0.09)	(<0.01)	(<0.01)
10 yr yield - 2 yr yield	*sensitivity*	0.36		0.06				
	pval	(<0.01)		(0.39)				
10 yr yield -1 yr yield	*sensitivity*				0.07			
	pval				(0.39)			
10 yr yield - 1 qtr T-bill	*sensitivity*					0.11		
	pval					(0.39)		
40 qtr forward - 6 qtr forward	*sensitivity*						0.08	0.12
	pval						(0.25)	(0.25)
other controls?		no	no	no	no	no	no	yes
mean fitted prob | recession		0.44	0.51	0.50	0.50	0.50	0.51	0.68
mean fitted prob | no recession		0.12	0.12	0.10	0.10	0.10	0.10	0.06

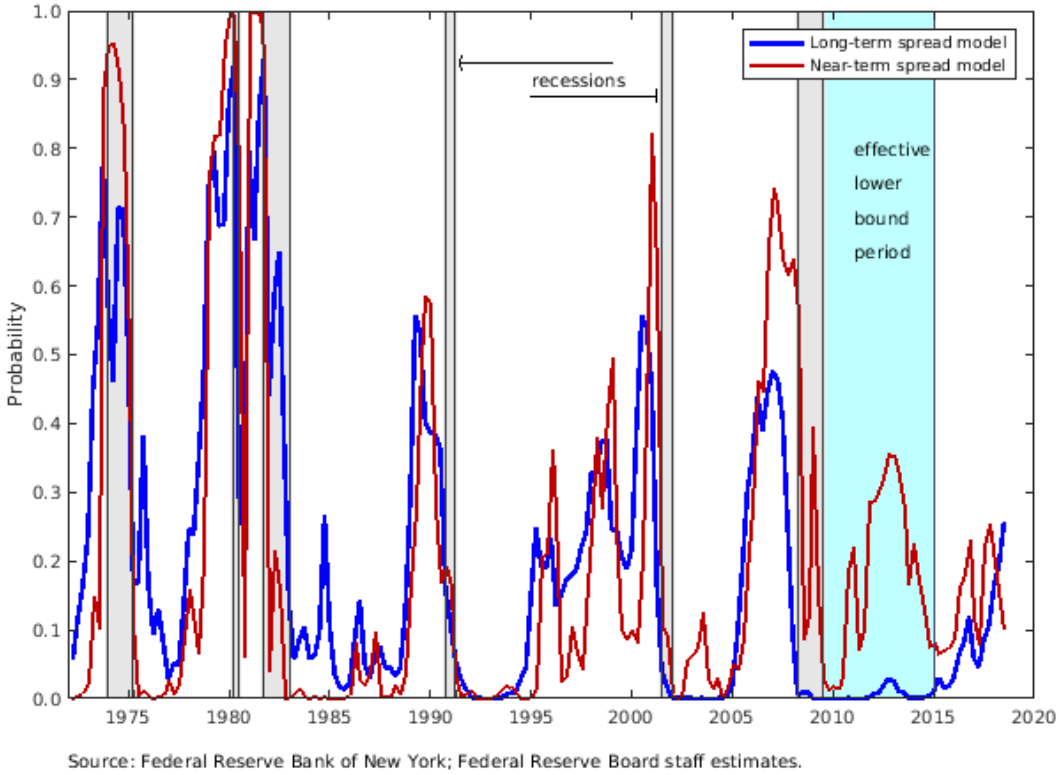
Notes. Data are quarterly 1972:Q1-2018:Q2. Results are for probit regressions in which the dependent variable is an indicator equal to 1 if the economy transitions to a recession 1, 2, 3, or 4 quarters ahead. Sensitivity is defined as the change in the estimated probability of recession when the explanatory variable falls by one standard deviation from its unconditional mean value, while the other explanatory variables remain at their unconditional means. The rows labeled *pval* report the bootstrapped significance level for a Wald test that the coefficient for the variable is significantly different from zero (bootstrapped under null hypothesis that the coefficient for that variable is zero). Controls, when included, are the excess bond premium and the nominal 90-day Treasury bill rate. The bottom two rows report the mean value for the fitted probability of recession on the eve of (a) a recession occurs in one of the next four quarters, or (b) no

Figure 3 shows the fitted conditional probabilities of recession from model 2, based on only the short-term spread (red line), compared to those from a more conventional model estimated using only the long-term spread (blue line). Generally, our model exhibits somewhat steeper spikes before recessions, indicating a sharper prediction. Perhaps most notably, it provides a clearer signal leading up to the most recent "Great Recession". Even so, there is admittedly not a lot of daylight between the two alternative models' most recent readings on recession probability in the year ahead. Still, the recent trend in probability from the more traditional model looks a bit ominous, whereas the near-term spread model shows no such trend.[6] Returning to Table 1, we examine the robustness of our initial result by running a number of additional specifications.

[6] The near-term spread model forecasts a higher probability of recession during the effective lower bound period because the near-term spread was pegged near zero, and presumably bounded from above by forward guidance by the FOMC. The near-term spread thus arguably was not reflective of expectations of macroeconomic performance in this period.

The fourth and fifth specifications show results when we use alternative candidates for the long-term spread, the 10-year minus 1-year and the 10-year minus 3-month

Figure 3: Estimated Recession Probabilities



Source: Federal Reserve Bank of New York; Federal Reserve Board staff estimates.

spreads. The latter choice overlaps more with our near-term spread, and is thus more highly correlated with the near-term spread. In this case, the hypothesis that the near-term spread has no marginal effect can only be rejected at the 9 percent significance level, though we can still easily accept the hypothesis that the long-term spread has zero marginal effect.

These results suggest that perhaps a better approach to testing whether there is additional information in the term structure beyond six quarters would be to instead include the 6-40 quarter forward spread, which is the complement to (i.e. does not overlap with) our near-term spread. Together, they span the slope of forward rates out to 10 years. In this specification (spec (6)), we again definitively reject the hypothesis that there is additional information in the term structure beyond what is contained in the near-term spread. In the final column (spec (7)), we take spec (6) and add two control variables, the "excess bond premium" from Gilchrist and Zakrajsek (2012) and the nominal 90-day Treasury bill rate. Though not shown, the excess bond premium coefficient is highly significant, but its inclusion does not result in any diminution of the coefficient on the near-term forward spread.

The statistical dominance of the near-term spread for forecasting economic activity might be somewhat overstated by our use of the probit framework, which only allows for only two possible outcomes—recession or no recession. If there is some additional signal in the

remainder of the yield curve, perhaps it can be teased out by forecasting a measure of economic activity having a broader range of gradation, such as the growth rate of GDP over, say, the next four quarters.

The first three columns (specifications (1) to (3)), of Table 2 demonstrate that, when simply forecasting four-quarter ahead real GDP growth in a plain vanilla regression setting, the near-term forward spread is again a more powerful predictor than all the long-term spreads we tested. These specifications all include lagged GDP growth as a control as well. In specification (4), we include the 40-to 6-quarter forward spread, the complement to the 6- to 0-quarter forward spread in the forward curve, and find that it has no additional explanatory power for forecasting GDP growth. In specification (4a), we split the 40-to 6-quarter ahead forward spread into a far-term component (the 40-to 12-quarter forward spread) and a medium-term component (the 12-to 6-quarter ahead forward spread). Neither sub-component demonstrates any marginal forecasting power in the presence of the near-term forward spread. Finally, specification (4b) adds additional controls, the nominal short rate and EBP, and the result remains that the near-term forward spread is the more powerful predictor.

Table 2: Near-term Spread vs Far-term Spreads for Forecasting GDP Growth

explanatory variables (spreads)		spec (1)	spec (2)	spec (3)	spec (4)	spec (4a)	spec (4b)
6 qtr forward - 1 qtr T-bill	*coef*	1.35	1.43	1.69	1.22	1.32	1.22
	pval	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
10 yr yield - 2 yr yield	*coef*	-0.40					
	pval	(0.18)					
10 yr yield -1 yr yield	*coef*		-0.36				
	pval		(0.19)				
10 yr yield - 1 qtr T-bill	*coef*			-0.46			
	pval			(0.16)			
40 qtr forward - 6 qtr forward	*coef*				-0.22		-0.09
	pval				(0.16)		(0.68)
40 qtr forward - 12 qtr forward	*coef*					-0.02	
	pval					(0.50)	
12 qtr forward - 6 qtr forward	*coef*					-0.67	
	pval					(0.24)	
other controls		growth	growth	growth	growth	growth	growth, EBP, short rate
r-squared		0.37	0.37	0.37	0.37	0.37	0.39

Notes. Data are quarterly 1972:Q1-2018:Q2. Results are for OLS regression coefficients in which the dependent variable four-quarter ahead real GDP growth. The rows labeled *pval* report the bootstrapped significance level for the coefficient (significance levels are bootstrapped under null hypothesis that the coefficient for the spread variables are zero, but predictability due to the controls is preserved). In the rows labeled "Controls," "growth" refers to GDP growth, "EBP" refers to the excess bond premium, and "short rate" refers to the three-month nominal Treasury bill rate.

Conclusion

The narrow lesson to take away from this exercise is that the current near-term forward spread, which arguably serves as a proxy for market expectations of Federal Reserve policy, indicates the market is putting fairly low odds on a rate cut over the next four quarters. Unlike far-term yield spreads, the near-term forward spread has not been trending down in recent years, and survey-based measures of longer-term expectations for short term interest rates show no sign of an expected inversion.[7] More generally, our findings do not support the practice of appealing to the long-term spread for a different signal about the prospects for year-ahead economic performance. A more fundamental suggestion from our analysis is that the predictability of recessions based on the near-term spread would appear to be a case of "reverse causality." In particular, the near-term spread may only predict recessions because it impounds the expectations that market participants have already formed—expectations that a contracting economy will induce the Federal Reserve to lower short-term interest rates. If so, then market participants need only look in the mirror to gauge their concerns, rather than look to the yield curve. On the other hand, this signal could have value to policymakers to the extent that policymakers do not observe relevant information known to market participants.

[7] In the 2018:Q2 Survey of Professional Forecasters, the mean forecasts for the current year, and the one-, two-, and three-year ahead annual average rate for the three-month Treasury bill are 1.9, 2.6, 2.9, and 2.9 percent, respectively.

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