An Analysis of the Predictive Capacity of Contemporary Yield Spreads for US Recessions

Thomas Cunningham & Zhenhua Hou

Texas A&M University

The slope of the graph representing the differences in long-term versus short-term interest rates has, for several decades now, been used as an indicator and predictive tool to forecast real output growth, and, consequently, recessions. Currently, there are several forecast methods and perspectives used in such predictions, which can lead to disagreement in forecasts. In this paper, we plan to provide a thorough analysis of a clearer definition of the most accurate short-term versus long-term measurements, and measure overall predictive ability from a selection of popular current spreads used in econometric modeling.

The initial concept behind a yield curve spread analysis stems from Irving Fisher's consumption-based theory of interest rates in 1907. Fisher posited that the marginal value of present consumption relative to the marginal value of future consumption would be equal to the interest rate for the same time period, ceteris paribus. Extrapolating this to the yield spread, if a recession is predicted for one year in the future, one may have the impetus to purchase a one-year bond (in lieu of current consumption). Such demand for future bonds will lower the yield. From there, the yield on a longer-term bond could be lower than a shorter-term bond, which would be outside of what is normally anticipated. Harvey (1986) states that "the evidence suggests that there is a link between the yield spread and consumption fluctuations…The empirical results suggest that the yield spread contains information relevant for forecasting future consumption. The results show that the yield spread has some ability to predict future consumption growth both within sample and out of sample." Using Harvey's analysis of the yield spread, Estrella and Hardouvelis (1991) provide empirical analysis of the predictive capacity of the yield spread for GDP growth and, by extension, recessions.

Most commonly, the yield spread is used as an indicator with a one-year lead. To clarify, an inverted yield curve (where the yield spread is negative) is believed to envisage a recession one year in the future. As purely an indicative variable, the yield spread has fared well in recent years, particularly since the late 1970's. Using this indicative property, forecasters have developed models to forecast the likelihood of future recessions, potentially giving a greater degree of insight into economic performance. These forecasters, however, seem to disagree on several fronts, including which yield spread to use (*i.e.* what is the best determination of long term vs. short term) and how to model the data. Common yield spreads used in modern econometric forecasting include the ten-year – one-year spread (10Y/1Y), ten-year – three-month spread (10Y/3M), ten-year – two-year spread (10Y/2Y), five-year – three-month spread (5Y/3M), and the difference between the ten-year and Federal

Funds rate (10Y/FF). Prominent modern institutions which use the aforementioned spreads include the Federal Reserve Bank of Cleveland, the Federal Reserve Bank of St. Louis' Financial Stress Index, and Estrella & Hardouvelis use the 10Y/3M spread. On the shortest end of the short-term spectrum, the Conference Board's Leading Economic Index factors the 10Y/FF spread into their calculations, while on the shortest end of the long-term scale, Campbell Harvey's most recent yield curve models solely use the 5Y/3M spread. Other popular spreads include the 10Y/1Y and 10Y/2Y spreads, which are recommended by the Wells Fargo Investment Institute and Marketwatch, respectively.

Our model reflects a re-evaluation of the predictive capacity of common yield spreads based around a fixed window, rolling window, or recursive forecast. Our in-sample window is a ten-year segment from 1983 to 1993, compounded quarterly. These in-sample results are regressed against a binary variable of US recessions as defined by NBER. Due to the binary nature of whether a recession is happening (or will happen), a probit regression model was used. Our spread variable is set with a lag of four quarters, as the common yield spread literature measures the predictive abilities of the yield spread with a one-year-ahead window. As explained in the previous section, our selection of spreads is based from the popular spreads used in contemporary econometric forecasting. An item of note for our model is that, based off of the original Harvey model of consumption growth, the current Harvey literature shows solely the predictive capacity of the yield spread as a binary indicator (predicted correctly vs. not predicted correctly). We plan to incorporate this aspect along with the Estrella and Hardouvelis model of probabilistic forecasting in order to attempt a well-rounded measure of spread accuracy. Our goal is to shed light on the strengths and shortcomings of the various yield spreads in order to provide insight into whether the yield curve as a whole (and if so, which spreads more specifically) is a valid measure of the predictive nature of recessions.

As discussed earlier, our predictive measurement analysis is a three-pronged approach. First, what is the root mean squared forecast error of each spread against the out-of-sample forecast (1993 – 2019) to measure the probabilistic accuracy generally. Our secondary and tertiary factors center around whether the associated spreads have any false positive or false negative indicators, given a prediction threshold uniform across all measured spreads. As shown in Table 2, the RMSFE ranges from .2553772 (10Y/1Y Fixed Window) to .3003397 (10Y/2Y Rolling Window, as shown in Table 3). Given this, we feel that this shows a slight advantage to the 10Y/1Y fixed model, however, additional evidence is required for a firm statement as such. As shown in Table 2, at a 40% prediction threshold, the 10Y/1Y fixed and rolling window forecasts are most accurate with no false positives nor false negatives. On the opposite end of the spectrum, the 10Y/FF spread rolling window forecast recorded the least accurate results, with two false positives and two false negatives (as shown in Table 5).

In summation, there is evidence to believe that the yield spread is a reputable indicator of future recessions. More specifically, the 10Y/1Y spread has shown to be a formidable alternate option as a measurement tool, seeing as how major economic forecasters (Federal Reserve Banks of Cleveland, St. Louis, the Conference Board) use indicators that fare less well than the 10Y/1Y spread. As with most forecasting research, additional insight is needed into optimal lag periods, additional spreads to be measured, etc. The interpretation of our results is that the one year and ten-year yields represent more optimal estimators of short term vs. long term sentiments, respectively. Some arguments have been made that the three-month rate is too short term of a measurement option to accurately measure investor risk analysis versus a long-term rate, which is compounded even more with the Federal Funds rate; we concur with this sentiment.

Figure1. 10yr3m Fixed Forecasting Scheme

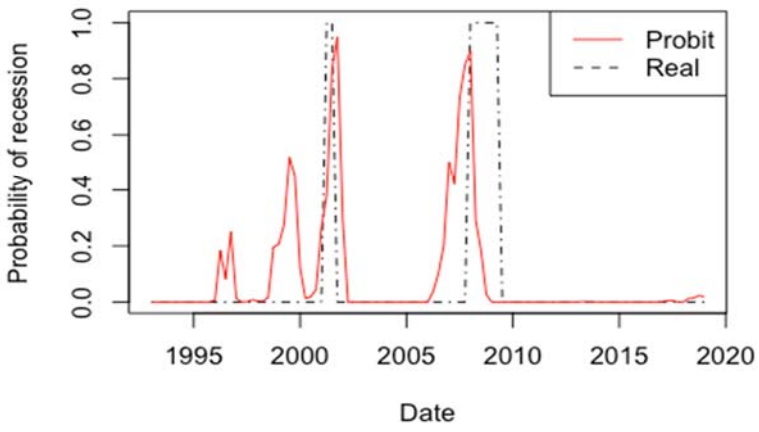

Figure2. 10yr3m Rolling Forecasting Scheme

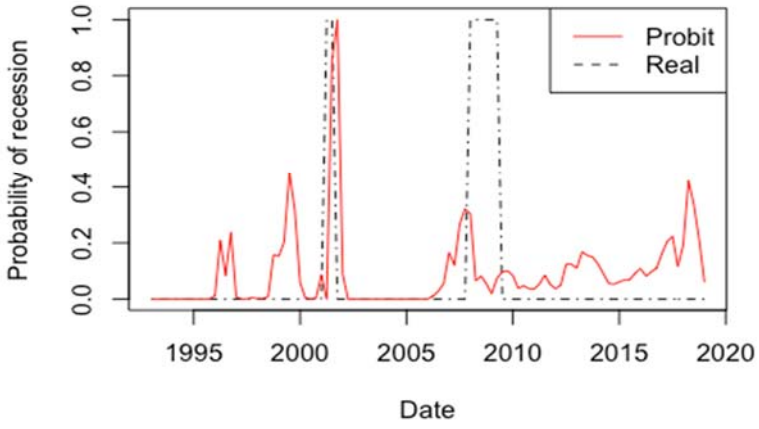

Figure3. 10yr3m Recursive Forecasting Scheme

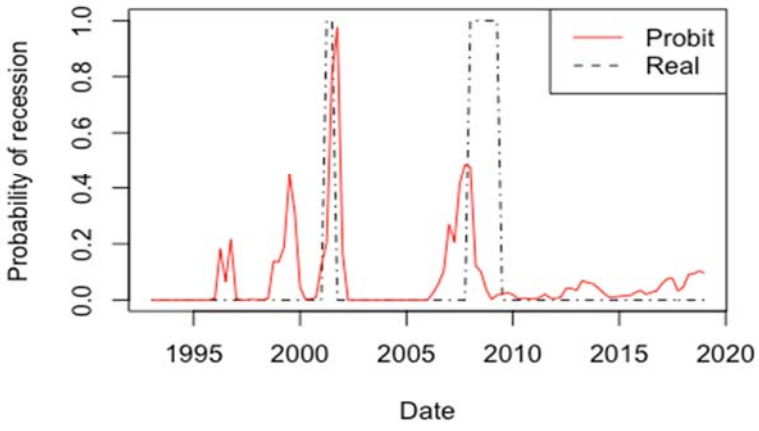

Figure4. 10yr1yr Fixed Forecasting Scheme

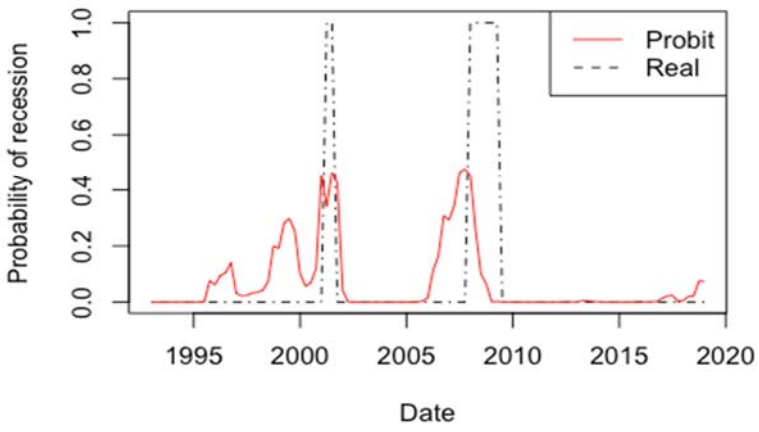

Figure5. 10yr1yr Rolling Forecasting Scheme

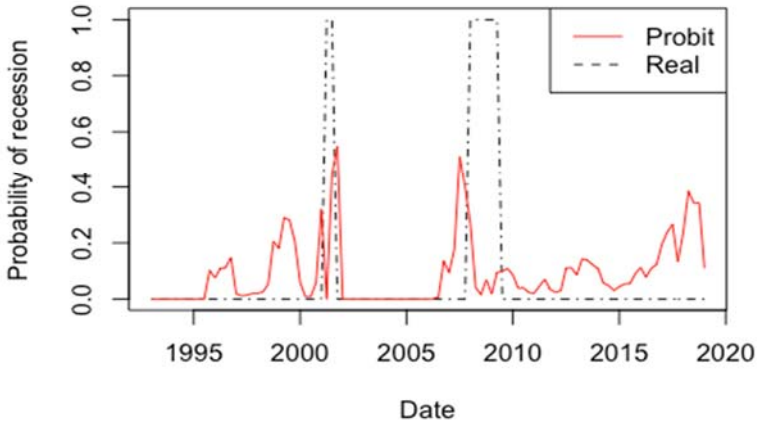

Figure6. 10yr1yr Recursive Forecasting Scheme

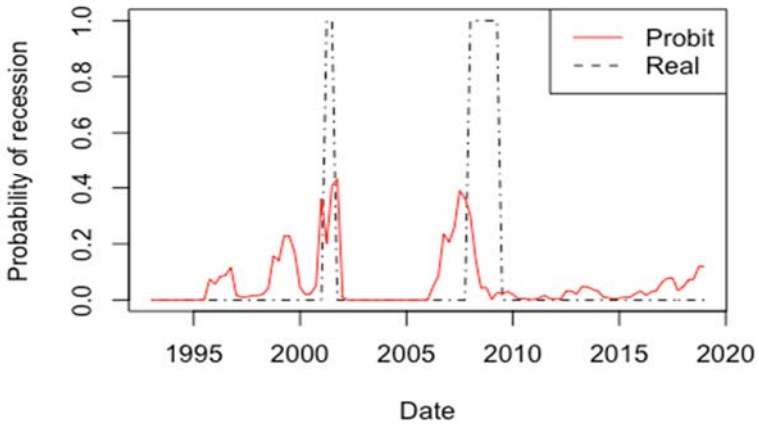

Figure7. 10yr2yr Fixed Forecasting Scheme

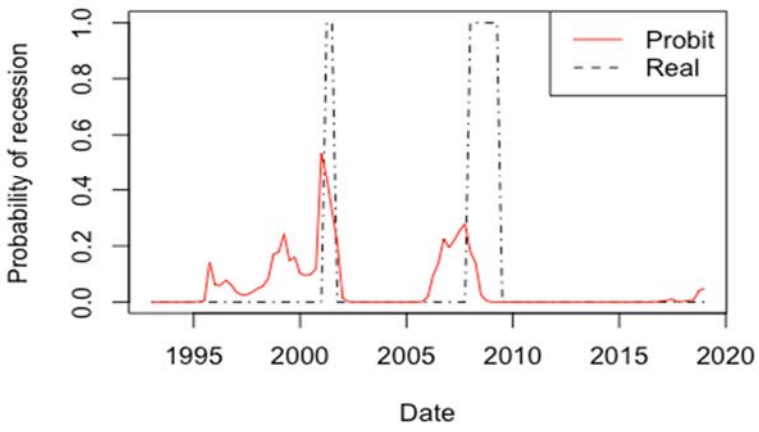

Figure8. 10yr2yr Rolling Forecasting Scheme

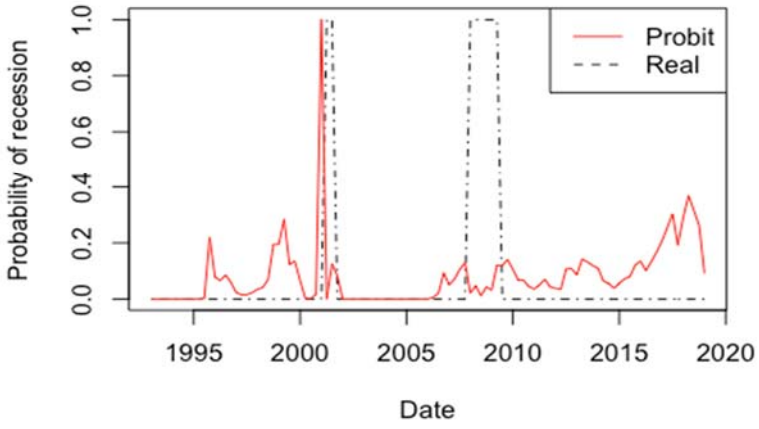

Figure9. 10yr2yr Recursive Forecasting Scheme

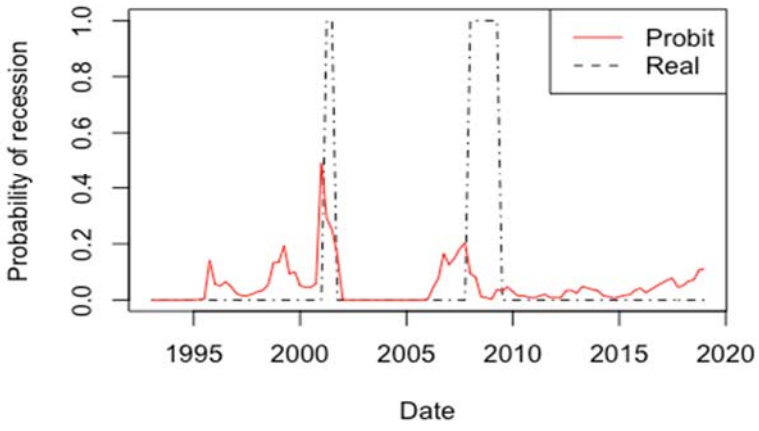

Figure10. 5yr3m Fixed Forecasting Scheme

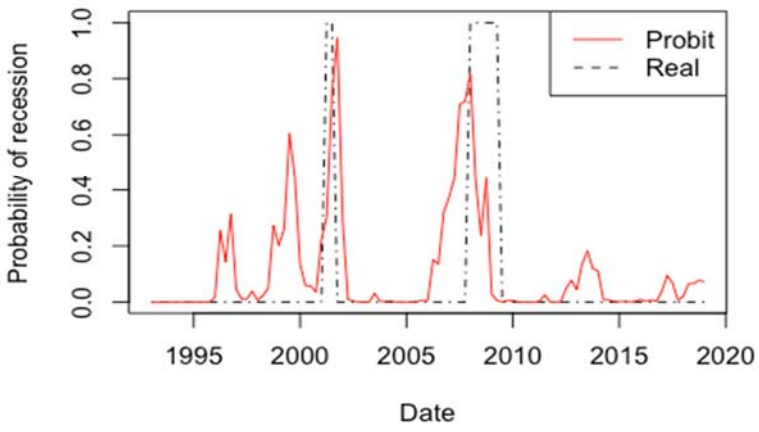

Figure11. 5yr3m Rolling Forecasting Scheme

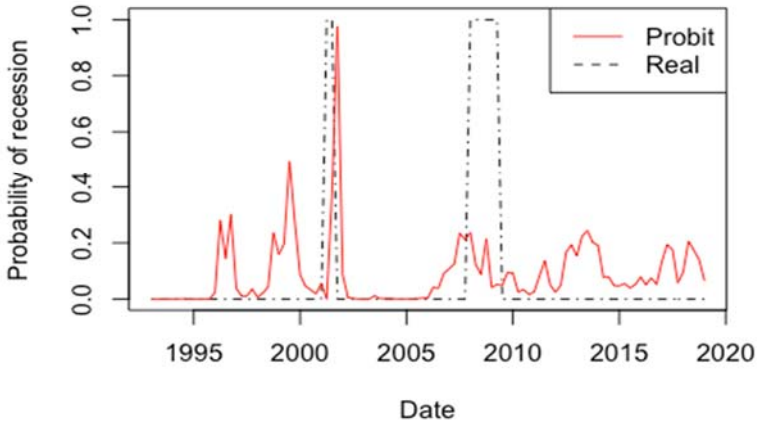

Figure12. 5yr3m Recursive Forecasting Scheme

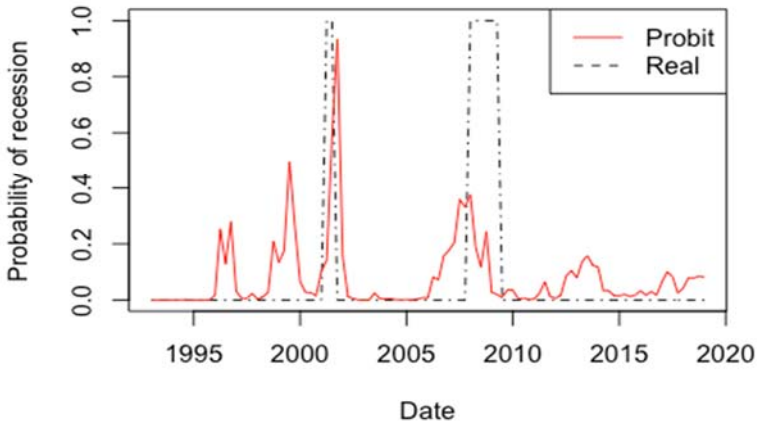

Figure13. 10yrFF Fixed Forecasting Scheme

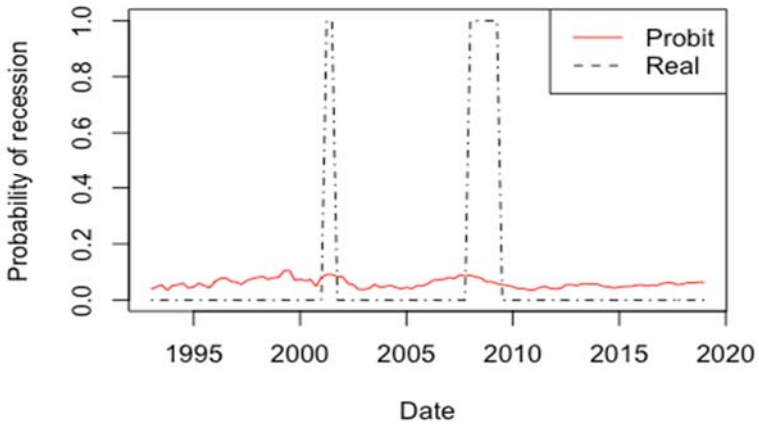

Figure14. 10yrFF Rolling Forecasting Scheme

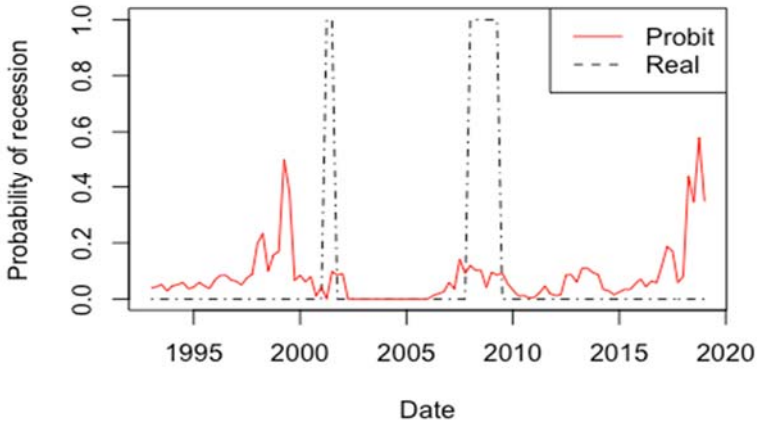

Figure15. 10yrFF Recursive Forecasting Scheme

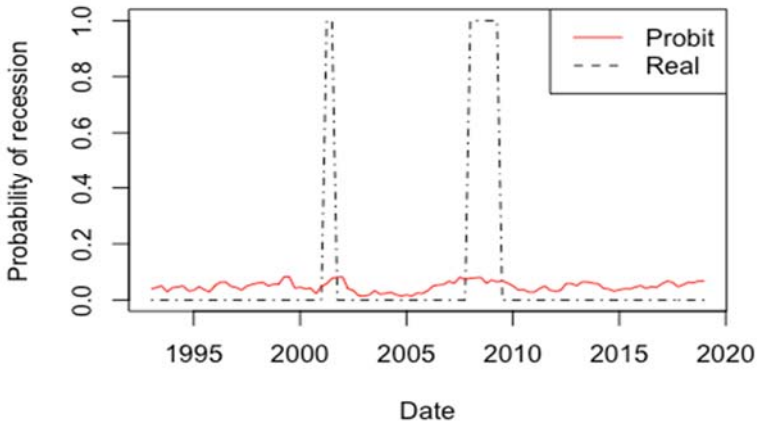

Table 1. 10yr3m Yield Curve Spread Recession Indicator Probability

	Forecasting Models		
	Fixed Scheme (1)	Rolling Scheme (2)	Recursive Scheme (3)
RMSE	.2776903	.2836188	.2670552
Number of False Positive	1	2	1
Number of False Negative	0	1	0

Table 2. 10yr1yr Yield Curve Spread Recession Indicator Probability

	Forecasting Models		
	Fixed Scheme (1)	Rolling Scheme (2)	Recursive Scheme (3)
RMSE	.2553772	.2839421	.2591375
Number of False Positive	0	0	0
Number of False Negative	0	0	1

Table 3. 10yr2yr Yield Curve Spread Recession Indicator Probability

	Forecasting Models		
	Fixed Scheme (1)	Rolling Scheme (2)	Recursive Scheme (3)
RMSE	.2586696	.3003397	.2626499
Number of False Positive	0	0	0
Number of False Negative	1	1	1

Table 4. 5yr3m Yield Curve Spread Recession Indicator Probability

	Forecasting Models		
	Fixed Scheme (1)	Rolling Scheme (2)	Recursive Scheme (3)
RMSE	.2644944	.2815175	.2620607
Number of False Positive	1	1	1
Number of False Negative	0	1	1

Table 5. 10yrFF Yield Curve Spread Recession Indicator Probability

	Forecasting Models		
	Fixed Scheme (1)	Rolling Scheme (2)	Recursive Scheme (3)
RMSE	.2611373	.2833007	.2607636
Number of False Positive	0	2	0
Number of False Negative	2	2	2

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