The Effectiveness of Term Spread as a Predictor of Recessions

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I. Introduction

The yield curve contains information about monetary policy and market views toward business cycle risks. Particularly, the yield curve is shaped based on expectations of short-term rates and inflation. A rise in the short rate tends to flatten the curve and slow real growth in the near term. As investors believe that inflation and real interest rate will fall, the slope of the curve might turn negative. This signals a potential downturn.

The inverted slope of the U.S. Treasury yield curve has been cited as a leading indicator of economic recessions in many studies. The inversions have preceded recessions in the past several decades. From early research of Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998), the spread between short- and long-term rates has been shown to exhibit a negative correlation with real GDP growth and a positive correlation with recession probabilities over subsequent quarters. Particularly, the 10-year-3-month Treasury spread outperforms other financial variables in predicting recessions.

Mishkin's study became the basis for later studies focusing on the yield curve's predictive power after controlling for monetary policy stance. Jonathan Wright (2006) from Washington DC Federal Reserve Board included the federal funds rate, which reflects a measurement of monetary policy stance that is less impacted by term premiums in the prediction. He found that including both the federal funds rate and 10-year-3-month term spread provides better in-sample and out-of-sample predictive performance than regressions using the term spread alone. Bauer and Mertens (2018), however, found that the ability of the yield curve to predict recessions has little to do with the stance of monetary policy. In the 2019 yield curve inversion case, Daniel Cooper, Jeff Fuhrer, and Giovanni Olivei (2020) from the Federal Reserve Bank of Boston found that after accounting for the unusually accommodative stance of monetary policy, the yield curve inversion likely overestimated the probability of a recession.

While the 10-year-3-month term spread, which Arturo Estrella and Mary R. Trubin claim to be the best maturity combination (2006), became the most cited measure of the yield curve slope in research, the Federal Reserve economist David Miller (2019) has shown through his analysis of

different spreads that there is no single most accurate predictor at any horizon. There is continuing debate about which segment of the yield curve has the greatest predictive power. Additionally, almost all studies have used nominal yield in the calculation of spread, which fails to take inflation expectations into account. This potentially causes issues, as changes to the real and inflation components of the Treasury yield could offset each other and result in a constant nominal yield for instance.

This paper examines the performance of predicting whether or not the economy will be in a recession from one to four quarters ahead using the Treasury term spread of the 10-year yield with the yield of different maturities: 10-year-3-month Treasury, 10-year-6-month Treasury, 10-year-1-year Treasury, 10-year-3-year Treasury, 10-year-5-year Treasury. Both the nominal yield and proxy for real yield will be examined. The predictive power of the yield curve spread will be compared with that of other predictors including consumption-based, investment-based, and employment-based economic indicators.

The present analysis based on the original work of Mishkin and existing literature offers five slight modifications. First, I employ monthly yield curve data from January 1972 to November 2022, whereas Mishkin employed quarterly data from the first quarter of 1959 to the first quarter of 1995. Even though some studies still use data starting in 1952, data before 1972 could be unreliable, particularly long-term yields because many long-maturity bonds at the time had prices distorted by callable or "flower bonds" (redeemable at par in payment of estate taxes). In addition, the Bretton Woods System restricted foreign access to purchase Treasuries, which might have influenced the pricing of the yield curve. Second, while many studies employ nominal yield in predicting recessions, I isolate the impact of inflation on spread by using a proxy for real yield. For instance, the nominal yield will be adjusted based on the percentage difference in the CPI index over the corresponding months or be replaced with TIPS yield when available. I examine if the real yield improves predictive power. Third, most literature focus on the 10-year-3-month Treasury yield spread as the common measure of the yield curve slope, while the Federal Reserve often employs the 10-year-1-year spread. I focus on testing rates of varying maturities to the 10-year Treasury to examine the significance of different term spread in predicting recessions. Because there is typically a term premium that investors demand to hold long-dated assets, varying

term spread improves precision in comparing the yield curve spread versus other predictors. Fourth, similar to the approach used by Daniel Cooper, Jeff Fuhrer, and Giovanni Olivei (2020) in testing result stability, where they split the 1966-to-2009 sample in 1987, I split the 1972-to-2022 sample in 1997, where I test the pre-1997 sample, the post-1997 sample, and the full sample to predict recessions. Based on the pre-1997 sample, out-of-sample predictions will be made for the period from January 1997 to November 2022. Lastly, literature on the yield curve in recent years has focused on term spread and the inclusion of financial variables. I consider, in addition to the term spread, a number of other recession predictors including consumption-based, investment-based, and employment-based economic indicators, which financial industry practitioners employ to forecast recessions (see Goldman Sachs Global Economics Paper No: 60).

My findings are relevant for evaluating the probability of an impending recession following multiple yield curve inversions in 2022. Evidence of an oncoming recession is of great interest, as policymakers may respond by adjusting monetary and fiscal policy while market participants may utilize it to assess investment risks. Forecasts of impending recession also interest households and businesses for financial planning in the near term.

My results show that the yield curve spread for the sample period from 1972 to 2022 exhibits strong predictive power for recessions that occurred during the 1970s and early 1980s. However, the yield curve spread of the post-1997 sample has much less predictive power. The real yield including the TIPs yield and inflation-adjusted yield does not seem to have stronger predictive power than nominal yields, which needs further analysis due to the limit of sample size and measurement error. Overall, the yield curve spread is still an effective predictor of recessions. Particularly, adding the term spread in addition to recession indicator variables yields a better in-sample fit.

II. Model and Method

To measure the predictive power of the yield curve spread with respect to future recessions, I employ a probit model, in which the observable recession indicator variable R_t takes a binary outcome based on the National Bureau of Economic Research (NBER) recession dates.

$$R_t = \begin{cases} 1, & recession \\ 0, & otherwise \end{cases}$$

In the case of term structure as the single predictor, the estimated probit model uses the normal distribution function to convert the value of the yield curve spread into a probability of recession in the near horizons including one quarter, two quarters, and four quarters ahead, which is defined in the equation of the form:

$$P(R_{t+i} = 1) = \Phi(\beta_0 + \beta_1 SPREAD_t)$$

Where the probability of a recession occurring is $P(R_{t+i} = 1)$, β_0 is the intercept, and β_1 is the coefficient. $SPREAD_t$ is the spread between short-term and long-term Treasury yield at time t. Similarly in the case of three predictors, the equation is in the form of:

$$P(R_{t+i} = 1) = \Phi(\beta_0 + \beta_1 PREDICTOR_{1_t} + \beta_2 PREDICTOR_{2_t} + \beta_3 PREDICTOR_{3_t})$$

The model is estimated by maximum likelihood, with likelihood function:

$$\mathrm{L} = \prod_{[R_{t+1=1}]} \mathrm{F}(\beta' x_t) \prod_{[R_{t+k=0}]} [1 - \mathrm{F}(\beta' x_t)]$$

The probit equations are estimated using the monthly samples of predictor variables that explain the probability of a recession 3 months (one quarter), 6 months (two quarters), and 12 months (one year) in the future. The primary measure of testing goodness of fit is a R-squared analogue, the McFadden R-Squared,

$$Pseudo\ R^2 = 1 - \frac{\ln L\ (M_{Full})}{\ln L\ (M_{Null})}$$

M_{Full} is the model with the predictors, whereas M_{Null} is the model without the predictors. L is the estimated likelihood. Values of 0 and 1 correspond to “no fit” and “perfect fit” respectively. A McFadden R-Squared between 0.2 and 0.4 represent an excellent fit.

III. Indicators Examined and Data

The focus of this paper is to test how effective is the yield curve spread as a predictor of future recessions, but I also examine other predictors including consumption-based, investment-based,

employment-based, and other macroeconomic indicators as comparisons. Here are the time series used in the paper:

Predictor Variables

1. Yield Curve Spread
    a. Nominal Spread (1972-2022): 10-year-3-month Treasury, 10-year-6-month Treasury, 10-year-1-year Treasury, 10-year-3-year Treasury, 10-year-5-year Treasury
    b. CPI Inflation-adjusted Spread (1972-2012): 10-year-3-month Treasury, 10-year-6-month Treasury, 10-year-1-year Treasury, 10-year-3-year Treasury, 10-year-5-year Treasury
    c. TIPS Spread (2003-2022): TIPS10yr-3m, TIPS10yr-6m, TIPS10yr-1yr, TIPS10yr-3yr, TIPS10yr-TIPS5yr (*TIPS Yield for 5-year maturity, CPI Inflation-adjusted Yield for 3-month, 6-month, 1-year, and 3-year maturity)

2. Consumption-based Indicators
    a. Total Vehicle Sales (1972-2022)
    b. Michigan Consumer Sentiment (1978-2022)
    c. Real Disposable Income (1972-2022)
    d. Advance Retail Sales (1992-2022)

3. Investment-based Indicators
    a. Industrial Production: Manufacturing (1972-2022)
    b. Inventory (1992-2022)
    c. Private Housing Permit (1972-2022)
    d. Real Manufacturing Sales (1972-2022)

4. Employment-based Indicators
    a. Initial Claims (1972-2022)
    b. Job Openings (2001-2022)
    c. Manufacturing Employees/Total Employees (1972-2022)

5. Other Indicators
    a. NASDAQ Composite (1972-2022)
    b. Real M2 Money Stock (1972-2022)
    c. Effective Federal Funds Rate (1972-2022)
    d. Leading Index (1982-2022)
    e. Case-Shiller Home Price Index (1987-2022)

The spread variables are based on the market yield on U.S. Treasury securities of different maturities quoted on an investment basis from January 1972 to November 2022. For the real yield, the nominal yield will be adjusted based on the percentage difference in the CPI index over the corresponding months or replaced with the TIPS yield when available. The consumption-based, investment-based, employment-based, and other macroeconomic indicators, expressed in percent changes, are selected based on research of financial industry forecasters and the NBER Business Cycle Dating Committee.

Response Variables

1. NBER Recession Indicator Variable (1972-2022)

The National Bureau of Economic Research (NBER) Recession Indicator Variable indicates U.S. recessions based on the NBER Business Cycle Dating Committee. The Committee determines the months of peaks and troughs based on measures of aggregate real economic activity published by the federal statistical agencies. These measures include real personal income less transfers (PILT), nonfarm payroll employment, industrial production, and others. These measures correspond to economic activity in consumption, investment, and employment, which guide the selection of predictor variables in this paper.

All data can be found and downloaded from FRED, the data website maintained by the Federal Reserve Bank of St. Louis, and are in monthly frequency.

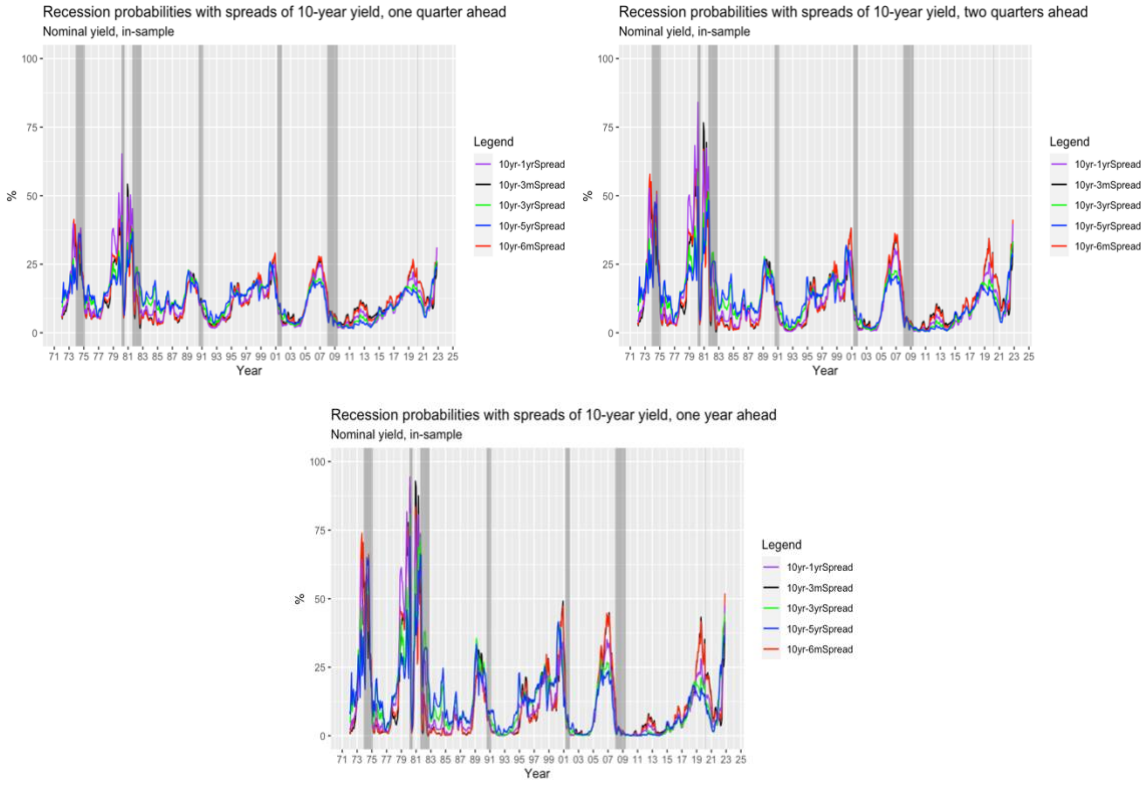
IV. Results

To examine the predictive power of the yield curve spread, I run in-sample and out-of-sample tests for the spread of both nominal yield and inflation-adjusted yield. The out-of-sample results are obtained by first estimating a given model with data from the beginning of the sample up to a particular month. Then the estimates are used to form projections for one, two, and four quarters ahead of the month so that the available data beyond the prediction date would not be used to predict recessions.

The full sample (1972 to 2022), pre-1997 sample, and post-1997 sample of nominal yield are tested for their recession predictive power. The out-of-sample test was tested based on the pre-1997 sample.

Yield Curve Spread

A. *Jan 1972 – Nov 2022 Sample Performance (Nominal)*

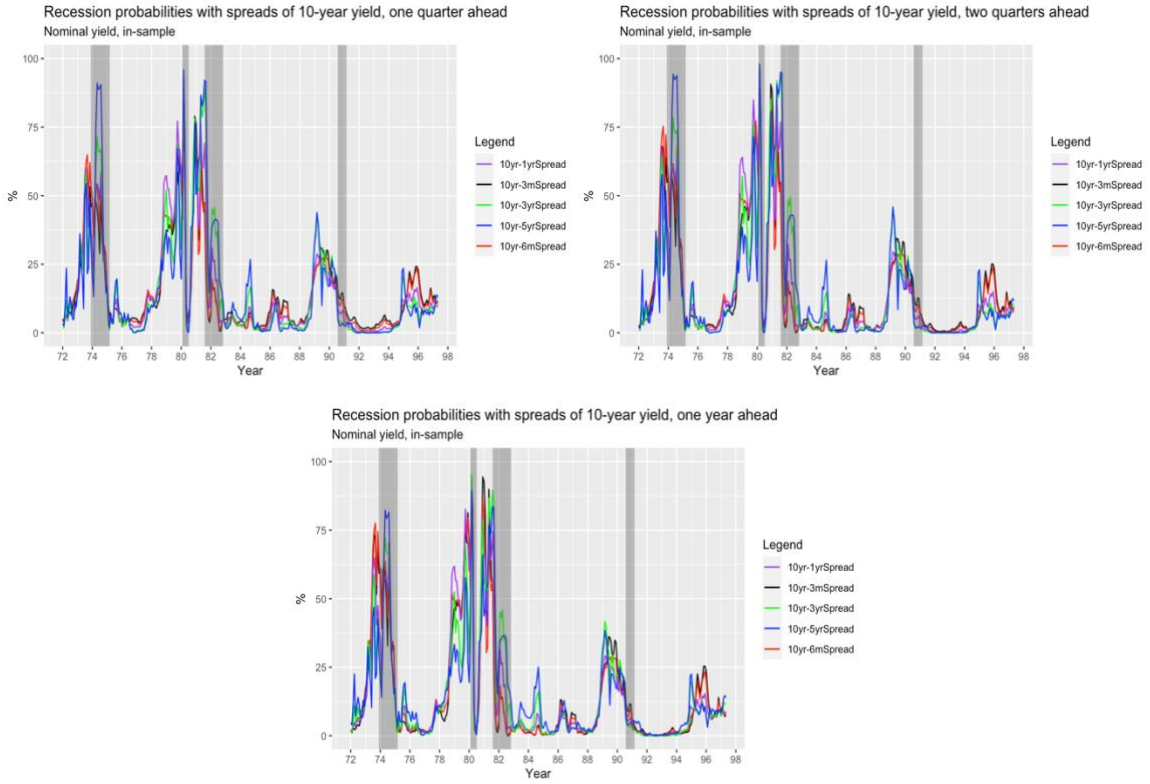


McFadden R-Squared	1Q	2Q	4Q
10yr-3mSpread	0.08	0.17	0.29

10yr-6mSpread	0.09	0.18	0.29
10yr-1yrSpread	0.10	0.19	0.28
10yr-3yrSpread	0.07	0.12	0.22
10yr-5yrSpread	0.06	0.11	0.18

From the full sample, the yield curve spread has the most predictive power for recessions occurring four quarters ahead, as shown by the higher McFadden R-Squared of the 4Q column. All predictors are significant based on the p-values of the regression output.

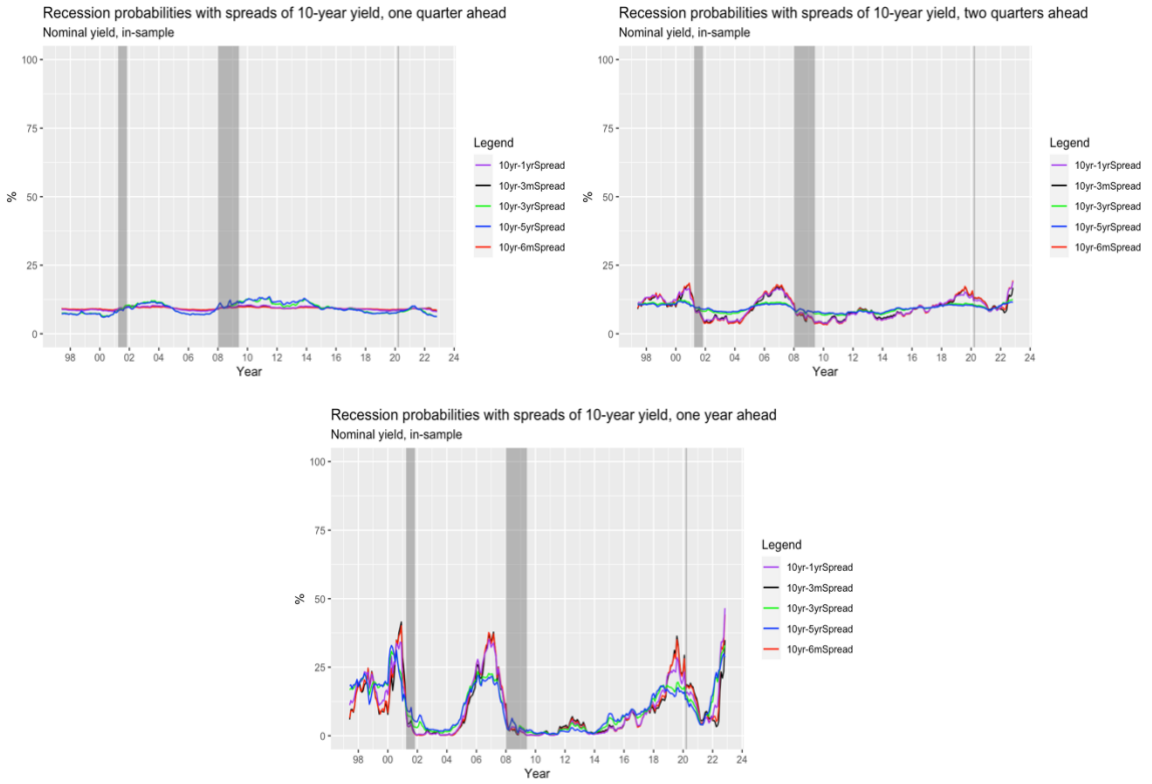
B. *Jan 1972 – May 1997 Sample Performance (Nominal)*



McFadden R-Squared	1Q	2Q	4Q
10yr-3mSpread	0.20	0.31	0.37
10yr-6mSpread	0.23	0.33	0.35
10yr-1yrSpread	0.27	0.36	0.33
10yr-3yrSpread	0.31	0.40	0.33
10yr-5yrSpread	0.33	0.39	0.26

The yield curve spread from the pre-1997 sample has more robust predictive power for recessions overall than the full sample, as shown by the better fit across time horizons. All predictors are significant based on the p-values of the regression outputs.

C. June 1997 – Nov 2022 Sample Performance (Nominal)

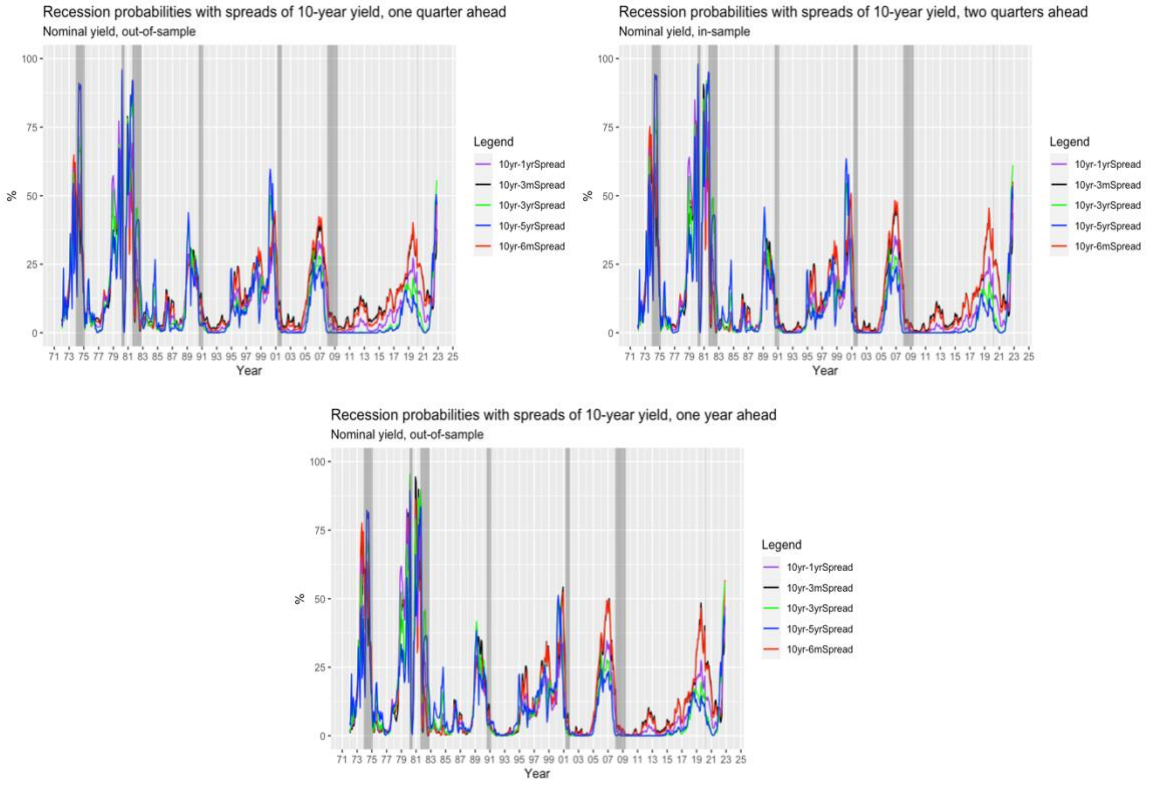


McFadden R-Squared	1Q	2Q	4Q
10yr-3mSpread	0.00	0.03	0.18
10yr-6mSpread	0.00	0.03	0.19
10yr-1yrSpread	0.00	0.02	0.18
10yr-3yrSpread	0.01	0.00	0.12
10yr-5yrSpread	0.01	0.00	0.11

From the post-1997 sample, the yield curve spread's predictive power significantly lessens, as shown by a much smaller McFadden R-Squared, with a weaker fit than the pre-1997 sample. Particularly, all the predictors are insignificant for recessions occurring one quarter ahead. For

two quarters ahead, all the predictors are significant except 10yr-3yrSpread and 10yr-5yrSpread, while for one year ahead, all the predictors are significant.

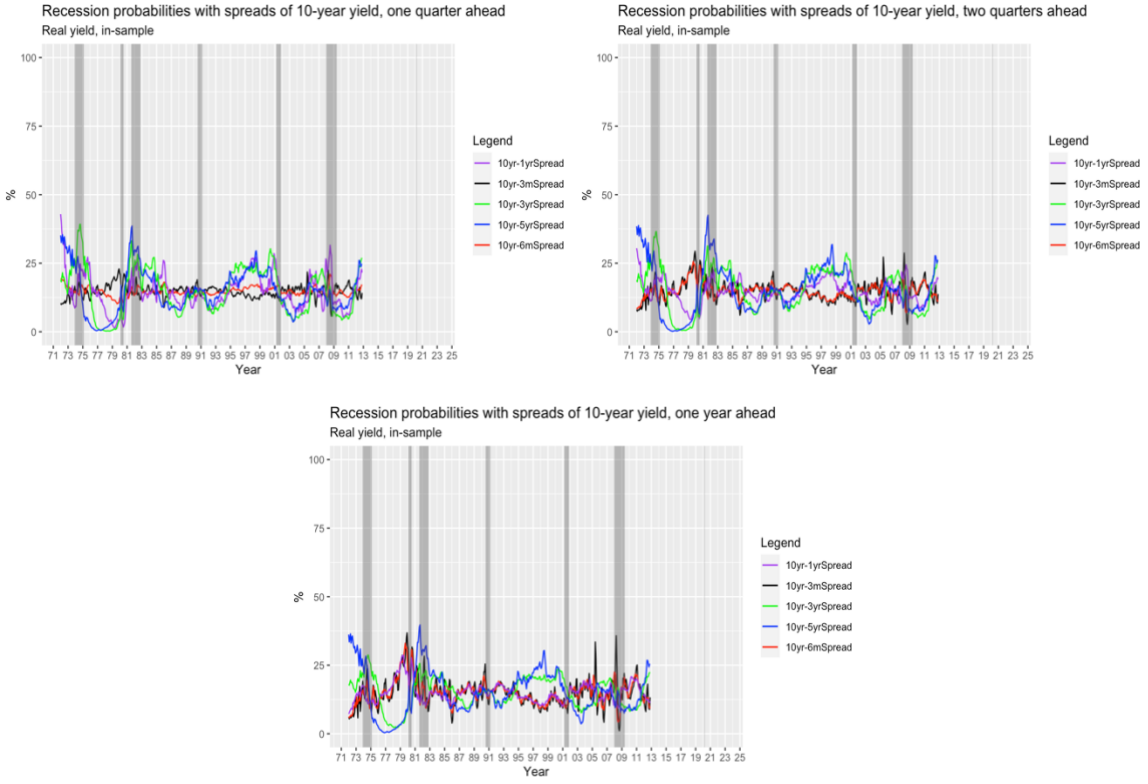
D. June 1997 – Nov 2022 Out-of-Sample predictions based on pre-1997 Sample (Nominal)



McFadden R-Squared	1Q	2Q	4Q
10yr-3mSpread	0.20	0.31	0.37
10yr-6mSpread	0.23	0.33	0.35
10yr-1yrSpread	0.27	0.36	0.33
10yr-3yrSpread	0.31	0.40	0.33
10yr-5yrSpread	0.33	0.39	0.26

Out-of-sample predictions are made for the period from January 1997 to November 2022. The out-of-sample fit based on the pre-1997 sample is strong, as shown by a much greater McFadden R-Squared. Particularly, prior to 2001, 2008, and 2020, the recession probabilities all reached close to 50%. All predictors are significant based on the p-values of the regression outputs. Interestingly, the recession probability for this year has surpassed 50%.

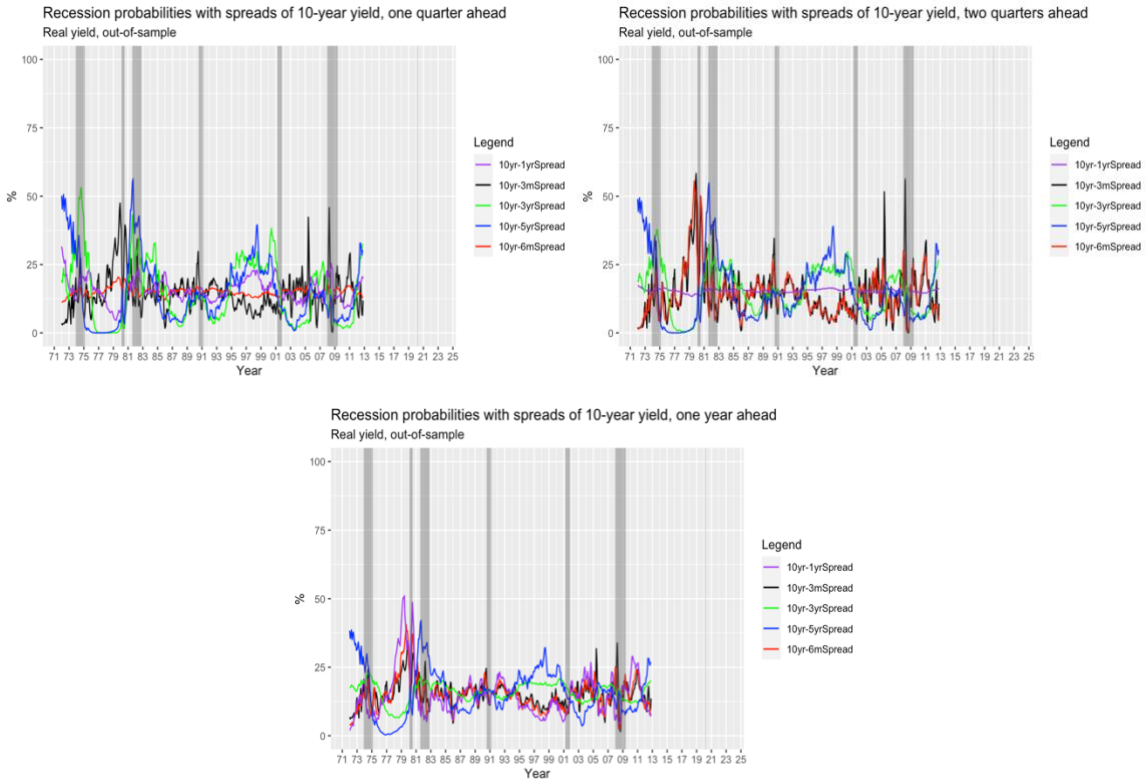
E. Jan 1972 – Nov 2012 Sample Performance (Inflation-adjusted)



McFadden R-Squared	1Q	2Q	4Q
10yr-3mSpread	0.01	0.02	0.03
10yr-6mSpread	0.00	0.01	0.02
10yr-1yrSpread	0.04	0.02	0.01
10yr-3yrSpread	0.08	0.07	0.03
10yr-5yrSpread	0.06	0.07	0.06

The predictive power of inflation-adjusted yield is much less than that of nominal yield, given that the McFadden R-Squared values are all close to zero. For recessions occurring one quarter ahead, all the predictors are significant except 10yr-3mSpread and 10yr-6mSpread. For two quarters ahead, all the predictors are significant except 10yr-6mSpread, while all the predictors are significant for one year ahead.

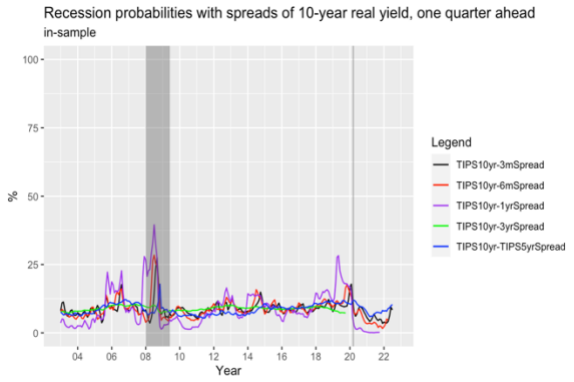
F. June 1997 – Nov 2012 Out-of-Sample predictions per pre-1997 Sample (Inflation-adjusted)

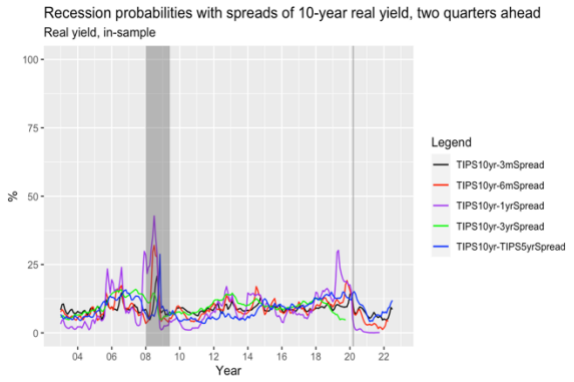


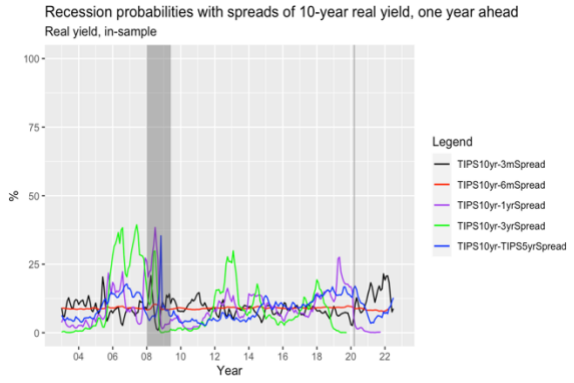
McFadden R-Squared	1Q	2Q	4Q
10yr-3mSpread	0.05	0.08	0.02
10yr-6mSpread	0.00	0.07	0.03
10yr-1yrSpread	0.02	0.00	0.06
10yr-3yrSpread	0.16	0.09	0.02
10yr-5yrSpread	0.17	0.17	0.10

The out-of-sample predictive power of inflation-adjusted yield is also much less than that of nominal yield, as shown by a much smaller McFadden R-Squared. Particularly, a false signal appears in 1998 and 2006 when recession probabilities rise to elevated levels. For recessions occurring one quarter ahead, all the predictors are significant except 10yr-6mSpread. For two quarters ahead, all the predictors are significant except 10yr-1yrSpread, while all the predictors are significant except 10yr-3yrSpread for one year ahead. Measurement error of the real rate could explain the low predictive power of inflation-adjusted yield, as the adjustment is based on realized inflation instead of inflation expectations.

G. Jan 2003 – Nov 2022 Sample (TIPS)







McFadden R-Squared	1Q	2Q	4Q
TIPS10yr-3mSpread	0.02	0.01	0.02
TIPS10yr-6mSpread	0.04	0.05	0.00
TIPS10yr -1yrSpread	0.12	0.13	0.10
TIPS10yr -3yrSpread	0.00	0.02	0.19
TIPS10yr -TIPS5yrSpread	0.01	0.03	0.04

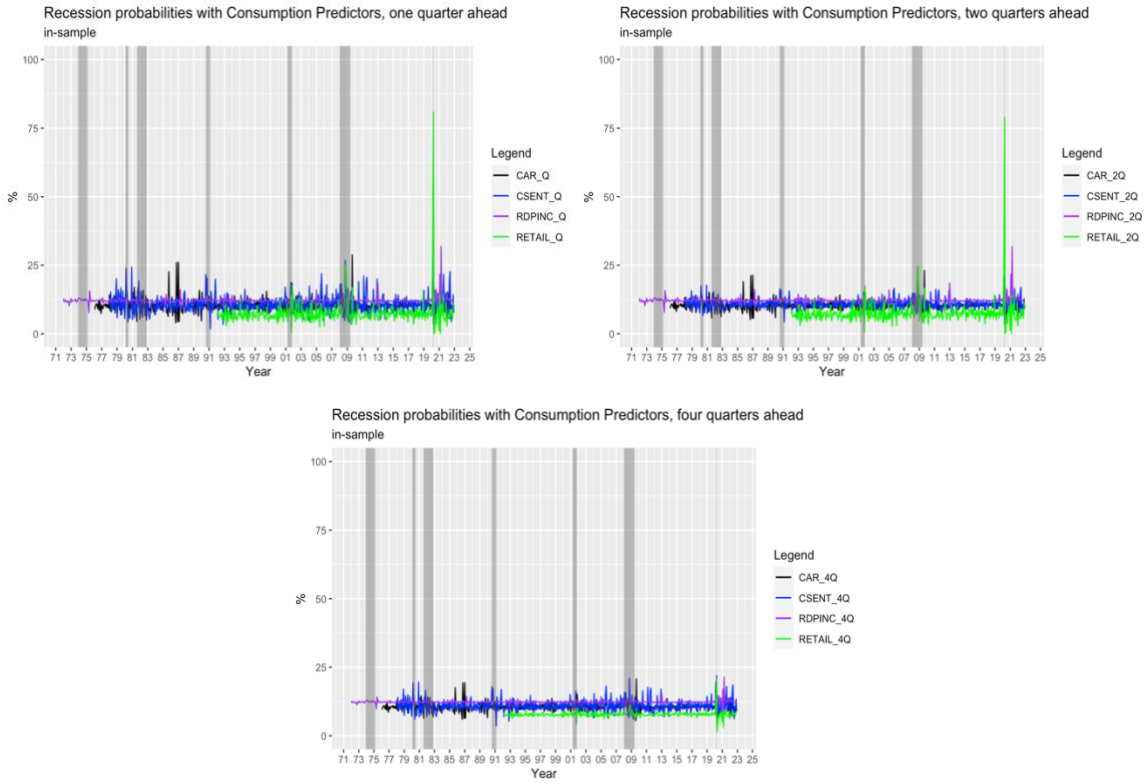
For recessions occurring one quarter and two quarters ahead, only TIPS10yr-6mSpread and TIPS10yr-1yrSpread are significant. All the predictors are significant except TIPS10yr-3mSpread and TIPS10yr-6mSpread for one year ahead. Measurement error of the real rate still exists due to inflation adjustment of three-month, six-month, one-year, and three-year yield. However, it improves upon the inflation-adjusted yield as the TIPS yield captures inflation expectations. This could explain why the TIPS yield has better predictive power than the inflation-adjusted yield. Overall, the nominal yield still has greater predictive power than the TIPS yield based on the available samples. Since only two recessions have occurred since 2003, the year beginning TIPS yield availability, further evidence is needed to support this claim.

Consumption Predictors

H. Jan 1972 – Nov 2022 Sample (Total Vehicle Sales, Real Disposable Income)

Jan 1978 – Nov 2022 Sample (Michigan Consumer Sentiment)

Feb 1992 – Nov 2022 Sample (Advance Retail Sales)

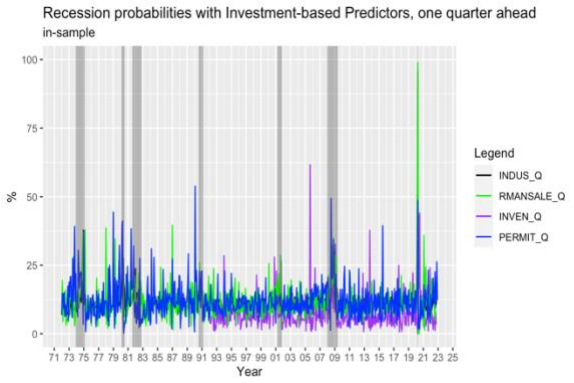


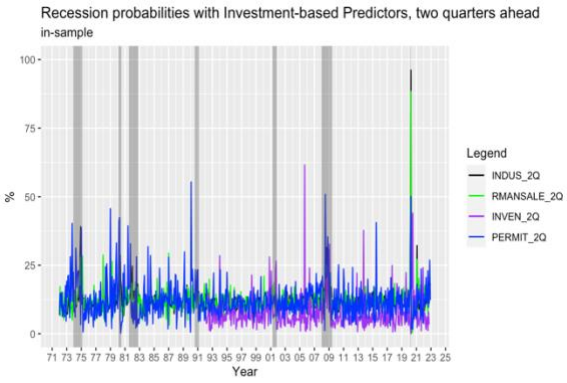
McFadden R-Squared	1Q	2Q	4Q
Total Vehicle Sales	0.01	0.01	0.00
Consumer Sentiment Index	0.02	0.01	0.01
Real Disposable Income	0.00	0.00	0.00
Advance Retail Sales	0.04	0.04	0.00

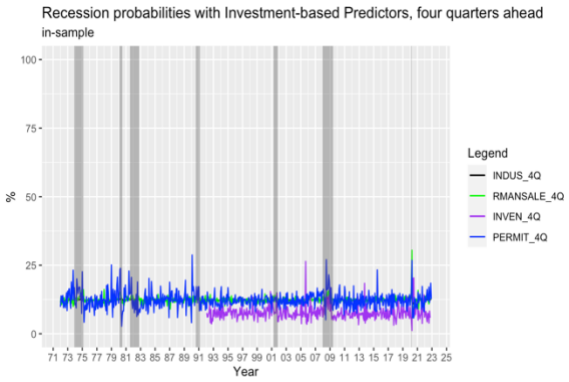
Consumption-based predictors yield little predictive power with low McFadden R-Squared. From the regression output, Consumer Sentiment Index and Advance Retail Sales are significant based on the p-values for recessions occurring one quarter ahead, while none of the predictors are significant for recessions occurring four quarters ahead.

Investment Predictors

I. *Jan 1972 – Nov 2022 Sample (Industrial Production: Manufacturing, Private Housing Permit, Real Manufacturing Sales)*
Feb 1992 – Nov 2022 Sample (Inventory)







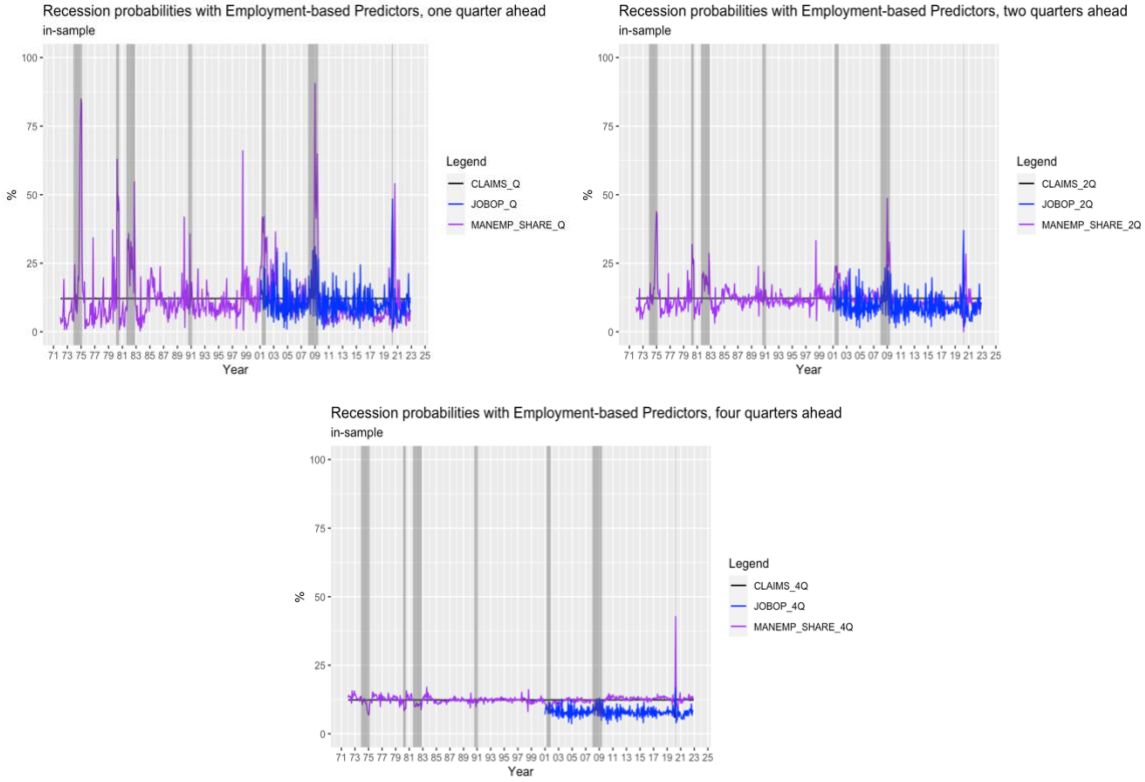
McFadden R-Squared	1Q	2Q	4Q
Industrial Production	0.06	0.03	0.00
Real Manufacturing Sales	0.06	0.03	0.00
Inventory	0.08	0.08	0.02
Housing Permit	0.06	0.06	0.01

Investment-based predictors yield greater predictive power than consumption-based predictors. Typically, investment contracts as a recession occurs, which is reflected by their ability to predict recessions one to two quarters ahead. From the regression output, all predictors are significant

for recessions occurring one or two quarters ahead while only Housing Permit is significant for occurring four quarters ahead.

Employment Predictors

J. Jan 1972 – Nov 2022 Sample (Initial Claims, Manufacturing Employees/Total Employees) and Feb 2001 – Nov 2022 Sample (Job Openings) Performance

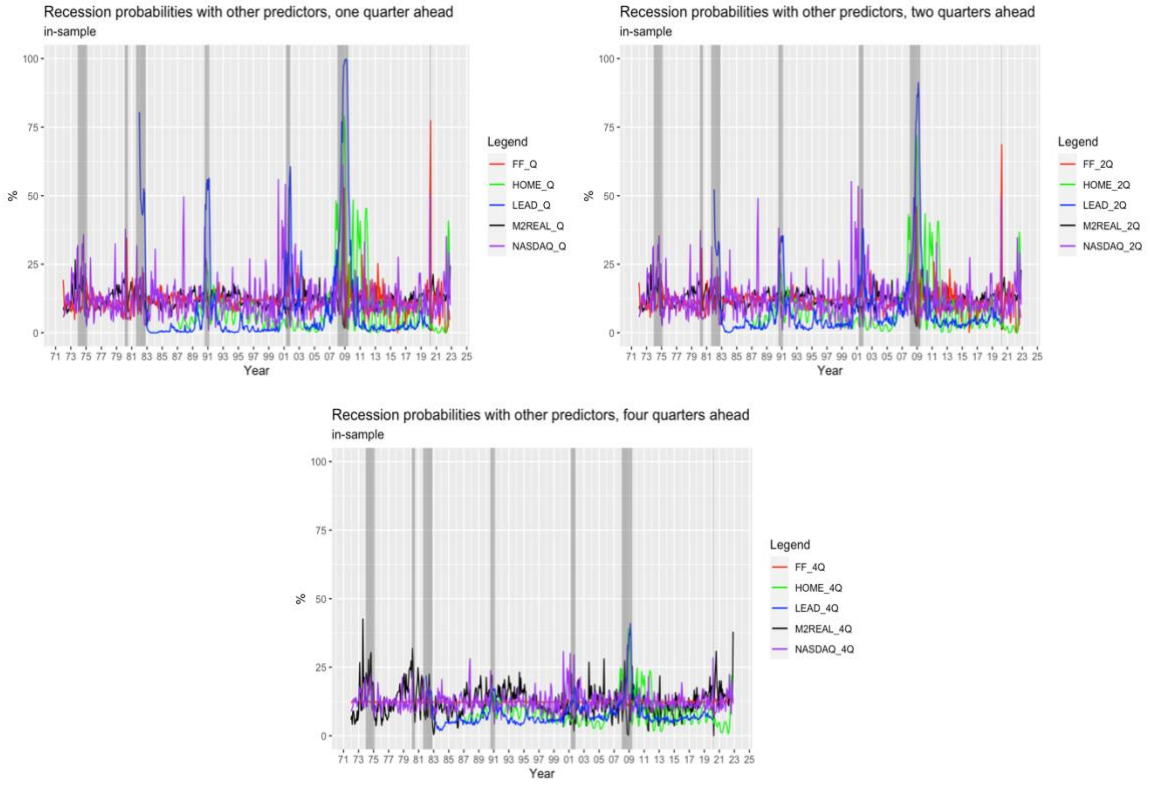


McFadden R-Squared	1Q	2Q	4Q
Initial Claims	0.00	0.00	0.00
Job Openings	0.06	0.04	0.01
Share of Manufacturing Employees	0.12	0.02	0.00

From the regression output, Job Openings and Share of Manufacturing Employees are significant based on the p-values for recessions occurring one quarter ahead, while none of the predictors are significant for recessions occurring four quarters ahead. Share of Manufacturing Employees has decent predictive power for recessions occurring one quarter ahead.

Other Predictors

K. 1972 – Nov 2022 Sample (NASDAQ Composite, Real M2 Money Stock, Effective Fed Funds) and Jan 1982 – Nov 2022 Sample (Leading Index) Performance



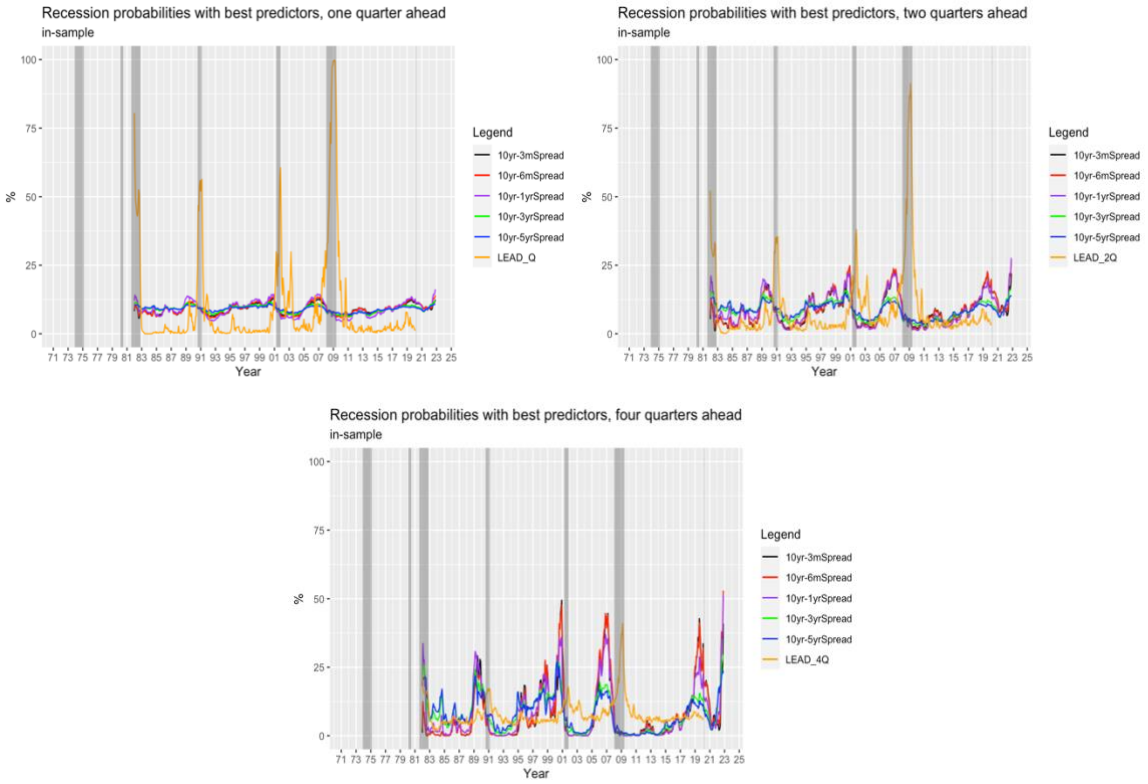
McFadden R-Squared	1Q	2Q	4Q
Real M2 Money Stock	0.02	0.01	0.04
Case-Shiller Home Price Index	0.19	0.16	0.05
NASDAQ Composite	0.06	0.06	0.01
Leading Index	0.43	0.23	0.04
Effective Federal Funds Rate	0.03	0.02	0.00

From the regression output, all of the predictors are significant in predicting recessions occurring one quarter or two quarters ahead, while only Effective Federal Funds Rate is insignificant in predicting recessions in four quarters ahead. In goodness of fit, Leading Index outperforms in

predicting recessions one quarter to two quarters ahead, followed by the Case-Shiller Home Price Index

In-Sample Best Predictors

L. Jan 1982 – Nov 2022 Sample Performance (Yield Curve vs. Leading Index)

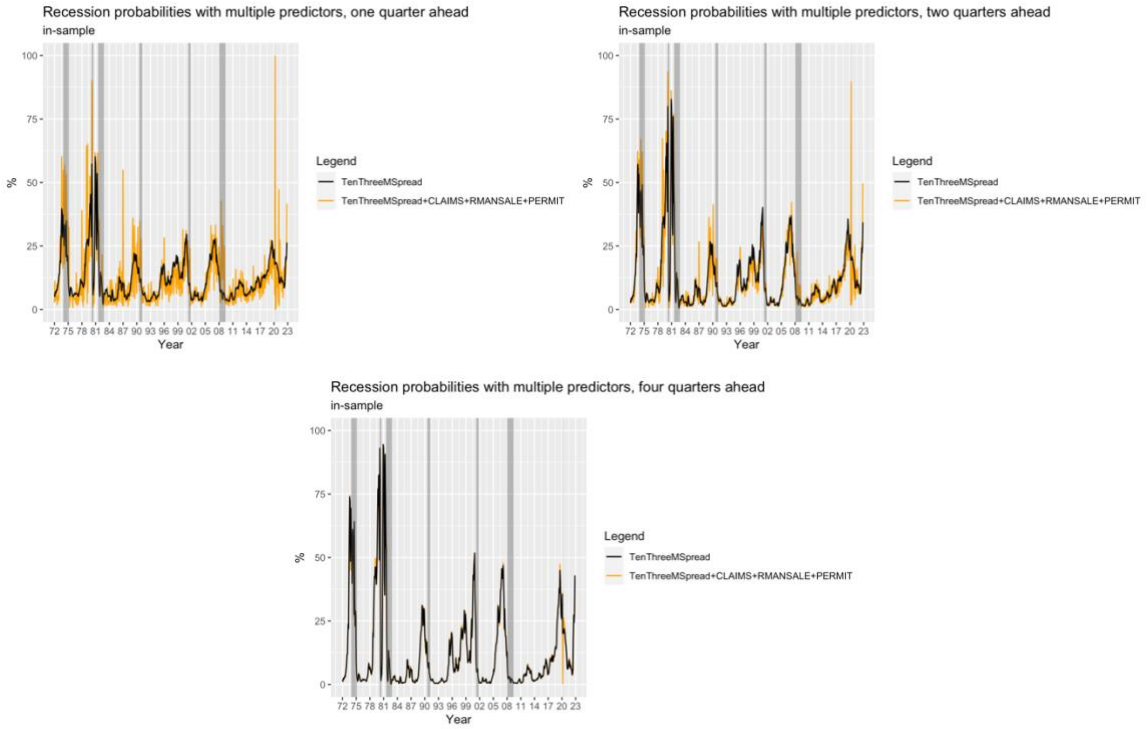


McFadden R-Squared	1Q	2Q	4Q
Leading Index	0.43	0.23	0.04
10yr-3mSpread	0.01	0.06	0.25
10yr-6mSpread	0.01	0.06	0.26
10yr-1yrSpread	0.01	0.07	0.22
10yr-3yrSpread	0.00	0.03	0.12
10yr-5yrSpread	0.00	0.02	0.10

Comparing the Leading Index with the yield curve spread since 1982, the year beginning the availability of Leading Index, the yield curve spread has strong predictive power for recessions

occurring one year ahead whereas the Leading Index predicts recessions occurring one to two quarters ahead most effectively. The Leading Index is based on the following variables: state-level housing permits (1 to 4 units), state initial unemployment insurance claims, delivery times from the Institute for Supply Management (ISM) manufacturing survey, and the 10-year-3-month Treasury yield spread. I test the contribution of the index's major components by running a multiple-predictor regression based on Private Housing Permit, Initial Claims, Real Manufacturing Sales, and 10yr-3mSpread.

M. Jan 1972 – Nov 2022 Sample Performance (TenThreeMSpread vs. TenThreeMSpread+CLAIMS+RMANSALE+PERMIT)

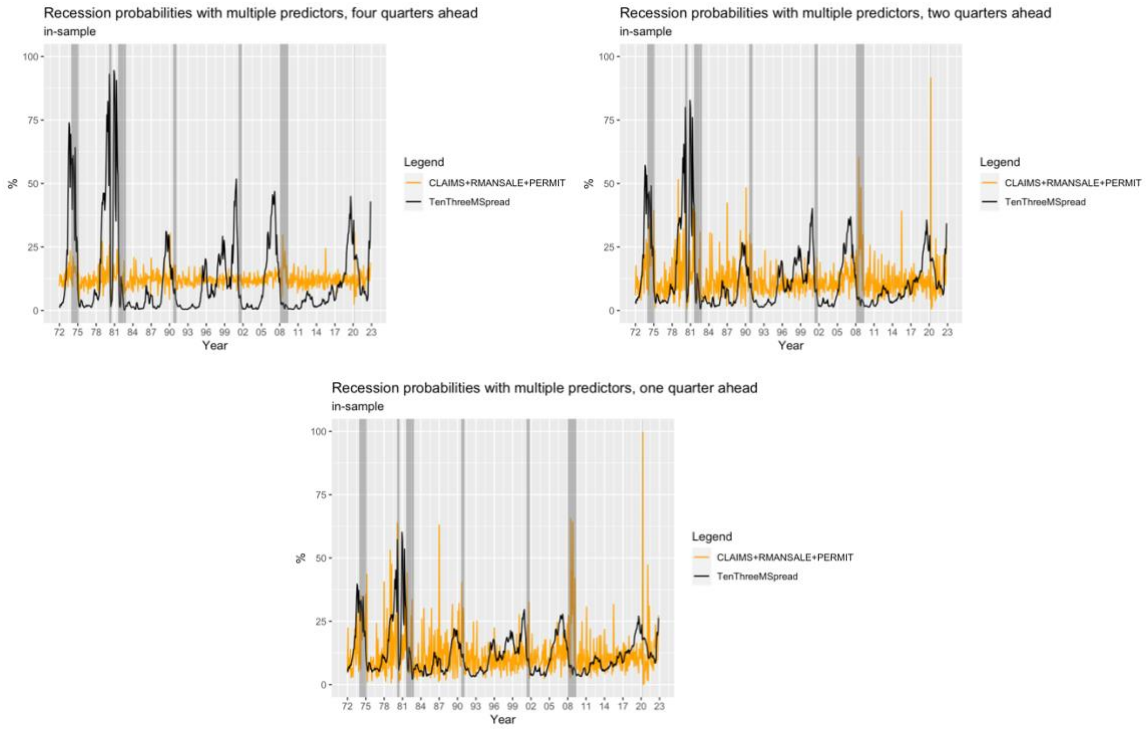


McFadden R-Squared	1Q	2Q	4Q
TenThreeMSpread	0.08	0.18	0.29
TenThreeMSpread+CLAIMS+RMANSALE+PERMIT	0.15	0.21	0.29

Clearly from the higher McFadden R-Squared in the multiple-predictor model, 10yr-3mSpread along with Private Housing Permit, Initial Claims, and Real Manufacturing Sales perform better in predicting recessions than the 10yr-3mSpread alone, particularly for recessions occurring one

and two quarters ahead. Therefore, this model serves as a helpful complement to my primary model by controlling for other recession indicator variables.

N. Jan 1972 – Nov 2022 Sample Performance (TenThreeMSpread vs. CLAIMS+RMANSALE+PERMIT)



McFadden R-Squared	1Q	2Q	4Q
TenThreeMSpread	0.08	0.18	0.29
CLAIMS+RMANSALE+PERMIT	0.10	0.07	0.01

Without the yield curve spread, we see that Private Housing Permit, Initial Claims, and Real Manufacturing together have less effective power.

V. Discussion

The yield curve spread of the sample period from 1972 to 1997 exhibits strong in-sample and out-of-sample predictive power, particularly toward recessions that occurred during the 1970s and early 1980s (with more than 50% probabilities). However, the predictive power of the yield

curve spread of the sample period from 1997 to 2022 decreases, as shown by weaker prediction of recessions occurring in the short term based on the post-1997 sample.

This could be affected by the stance of monetary policy, as the accommodative monetary policy in the 2000s pushed down short-term rates. After 2008, the Federal Reserve's large purchase of long-term Treasury securities and the selling of short-term Treasury securities during the Maturity Expansion Program have distorted the supply and demand in the Treasury market, as shown by the effect of decade-long QE purchases on reducing Treasury yields (Ihrig, Klee, Li, Wei, and Kachovec 2018). Long-term rates depended on both the supply of Treasuries and markets' expectations of future QE purchases. As the Fed decreased Treasury supply, the spread between short-term and long-term yield after 2000 became higher on average than in the 1970s. The Fed as a buyer of last resort might have made term premia smaller and less reflective of macroeconomic outlook, therefore reducing the predictive power of the yield curve in the past.

The predictive power of the inflation-adjusted yield could be affected by measurement error given the inflation expectations are not captured with realized inflation adjustment. Additionally, the TIPS yield has a smaller sample size than the nominal yield, during which only two recessions have occurred. Further research is needed to examine the predictive power of the TIPs spread.

From the results of consumption-based, investment-based, and employment-based economic indicators, an indicator that may drive one downturn may perform poorly in predicting other recessions generally. However, the Leading Index has a better in-sample fit than the yield curve spread. When components of the Leading Index are used to predict recessions, 10yr-3mSpread along with Private Housing Permit, Initial Claims, and Real Manufacturing Sales provide a better in-sample fit. Therefore, adding the term spread in addition to recession indicator variables increases the recession probabilities somewhat relative to the predictions with the term spread or recession indicator variables alone.

VI. Summary

Compared with consumption-based, investment-based, and employment-based economic indicators tested in this paper, the yield curve spread is still an effective predictor of recessions. However, its predictive power over time decreases due to the potential impact of monetary policy. The maturity difference in yield spread does not have a clear impact on predictive power. The real yield including the TIPs yield and inflation-adjusted yield does not seem to have stronger predictive power than nominal yield, which would need further analysis with the enlargement of sample size and reduction of measurement error.

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