Probability of Recession Model

Jan 2018

Overview

- Leading Indicators
- Interest Rate Spread based Probability of recession model

Leading Indicators

Conference Board Leading Economic Indicators

The Board makes six considerations when choosing an appropriate cyclical component for any index. These six considerations are carried about with the following six statistical and economic tests:

- Conformity - The data series must conform consistently in relation to the business cycle.
- Consistent timing - The series must exhibit a consistent timing pattern as a leading, coincident or lagging indicator.
- Economic significance - Its cyclical timing must be economically logical.
- Statistical adequacy - The data must be collected and processed in a statistically reliable way.
- Smoothness - Its month-to-month movements must not be too erratic.
- Currency - The series must be published on a reasonably prompt schedule, preferably every month.

Conference Board Leading Economic Indicators

#	Leading Indicators	Description
1	The average weekly hours worked by manufacturing workers	Adjustments to the working hours of existing employees are usually made in advance of new hires or layoffs
2	The average number of initial applications for unemployment insurance	When more workers apply for unemployment compensation for the first time, this signals that there will be more layoffs in the future.
3	The amount of manufacturers' new orders for consumer goods and materials	This component is considered a leading indicator because increases in new orders for consumer goods and materials usually mean positive changes in actual production.
4	Vendor performance (slower deliveries diffusion index)	Vendor performance leads the business cycle because an increase in delivery time can indicate rising demand for manufacturing supplies
5	Manufacturers' new orders for non-defense capital goods	New orders lead the business cycle because increases in orders usually mean positive changes in actual production and perhaps rising demand. This measure is the producer's counterpart of new orders for consumer goods/materials component (#3)
6	New building permits for private residential buildings	Building permits mean future construction, and construction moves ahead of other types of production

Conference Board Leading Economic Indicators

#	Leading Indicators	Description
7	The S&P 500 stock index	The S&P 500 is considered a leading indicator because changes in stock prices reflect investor's expectations for the future of the economy and interest rates.
8	The inflation-adjusted monetary supply (M2)	The money supply measures demand deposits, traveler's checks, savings deposits, currency, money market accounts, and small-denomination time deposits. Bank lending, a factor contributing to account deposits, usually declines when inflation increases faster than the money supply, which can make economic expansion more difficult.
9	Interest rate spread(10-year Treasury vs. Federal Funds target)	The interest rate spread is often referred to as the yield curve and implies the expected direction of short-, medium- and long-term interest rates. Changes in the yield curve have been the most accurate predictors of downturns in the economic cycle.
10	Average consumer expectations for business conditions	This component leads the business cycle because consumer expectations can indicate future consumer spending or tightening. The data for this component comes from the University of Michigan's Survey Research Center, and is released once a month.

Probability of Recession Model

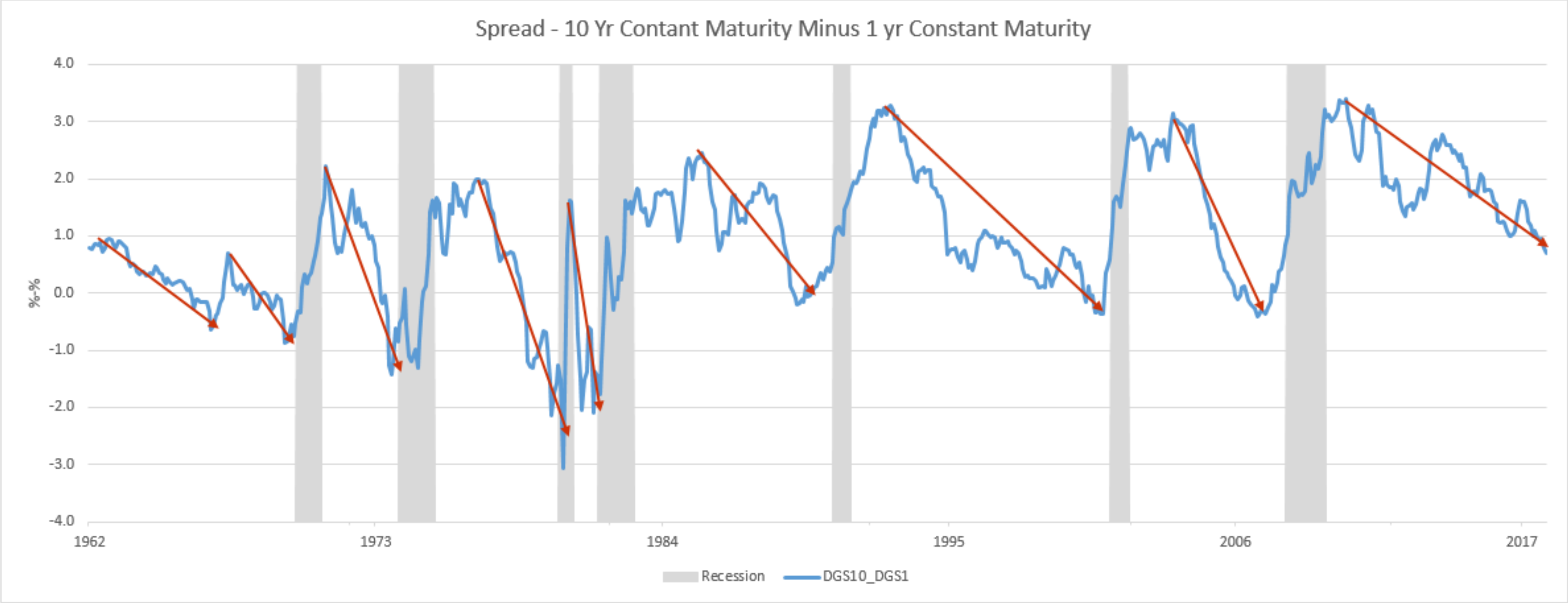
Overview

- The spread between long term and short term interest rates has long been considered as a leading indicator of the recession
- The model discussed here predicts the probability of recession 12-month ahead based on the spread between rates of 10 Year Treasury Note and 1 year Treasury Bill
- The spread and recession data were obtained from the St Louis Federal Reserve (FRED) website.
- Probit model* was employed to predict probability of recession.
- The model was developed in Anaconda Python environment
- The probability of recession for December 2018 is 12.58%.

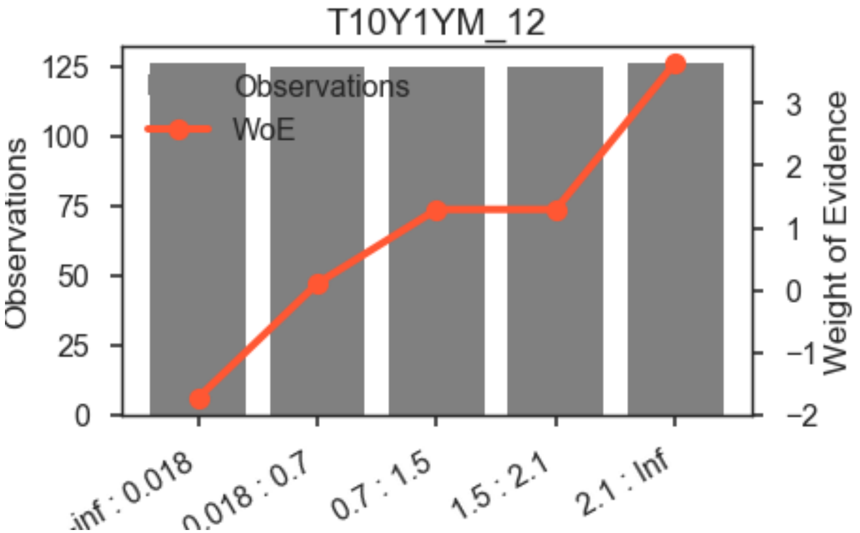
Note: The industry typically employs probit models to predict recession. The results of probit models is similar to that of logit models. The difference lies in the cumulative distribution functions. Probit model uses cumulative distribution function of the standard normal distribution whereas logit uses cumulative distribution function of logistic distribution.

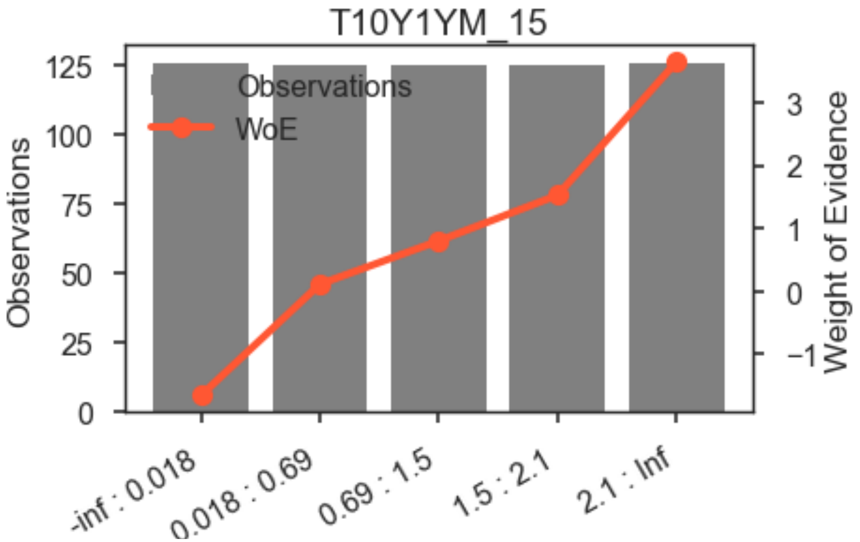
Spread Leading Recession

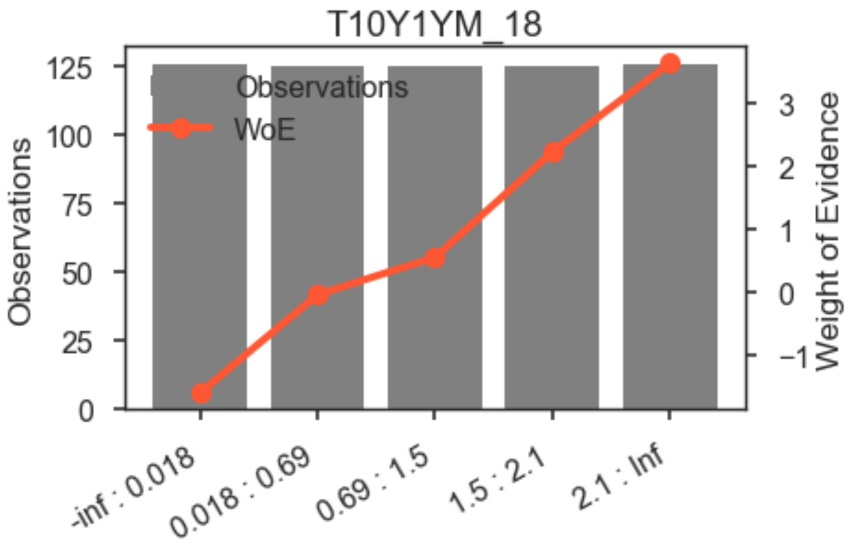
The interest rate spreads have been predictive of the previous 7 recessions in the US. However the underlying cause for each of the recession is different.

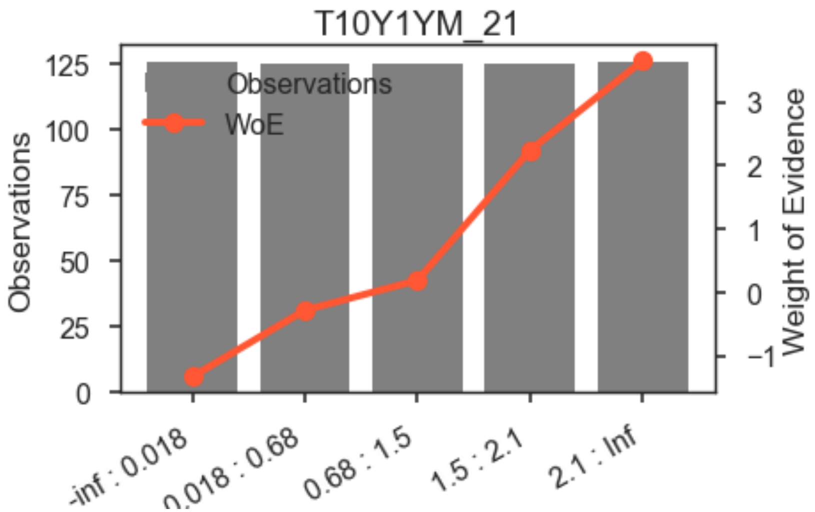


Relationship between lags and recession

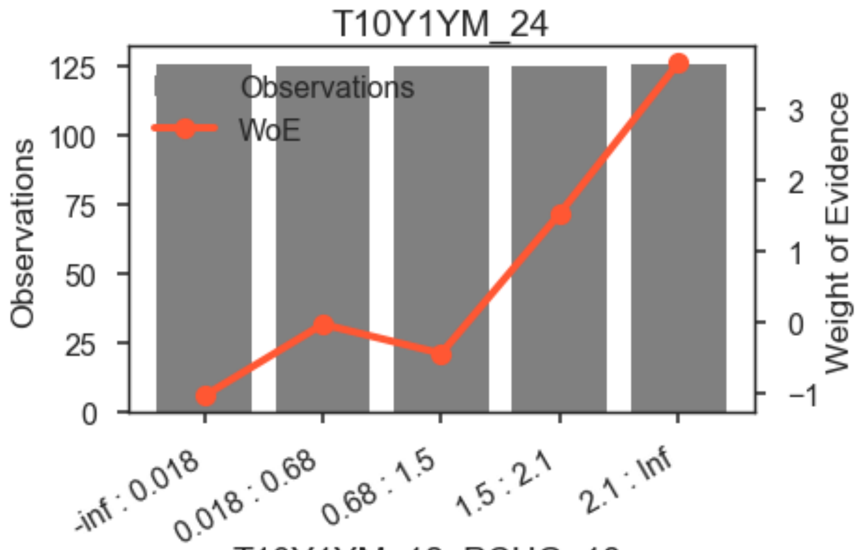


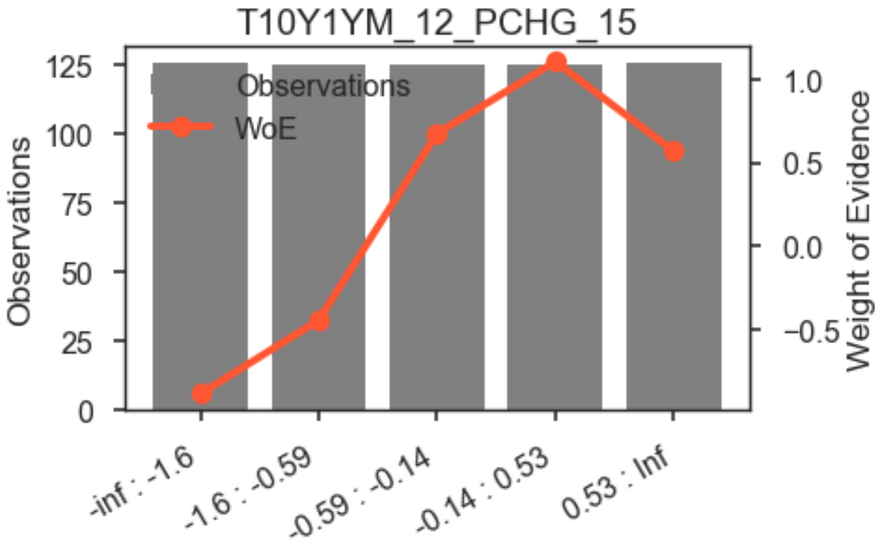


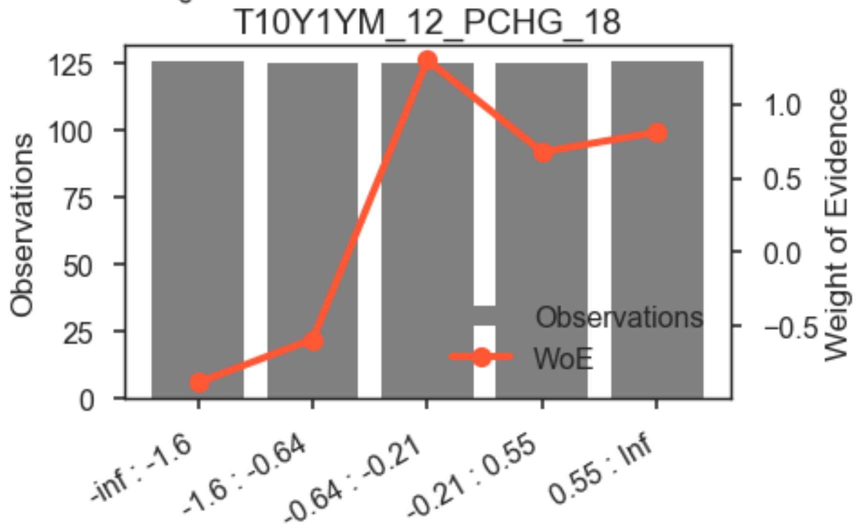


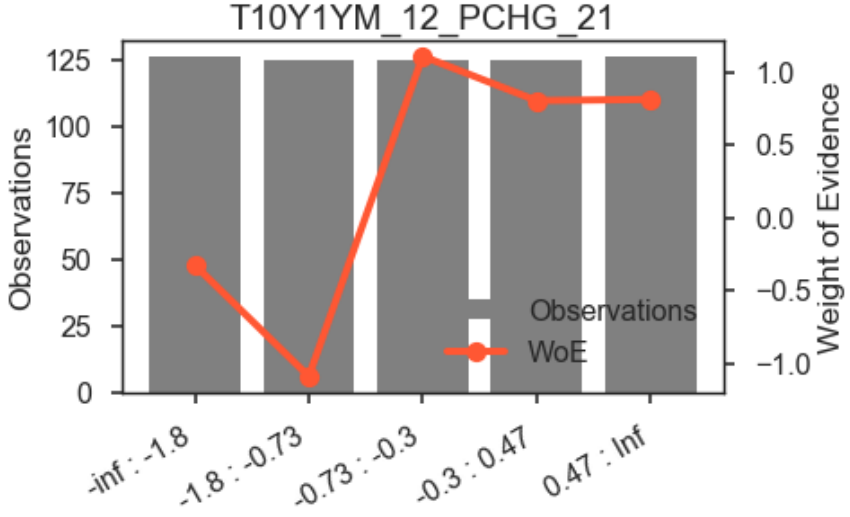


Relationship between lags and recession

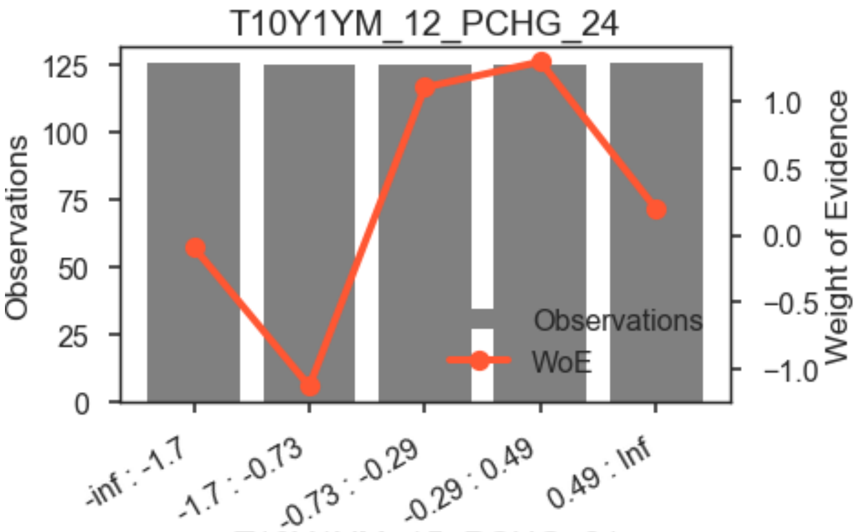


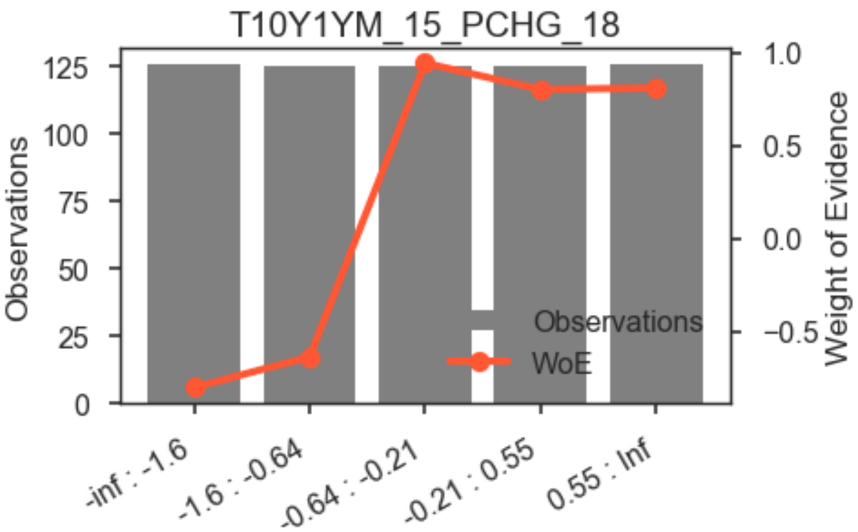


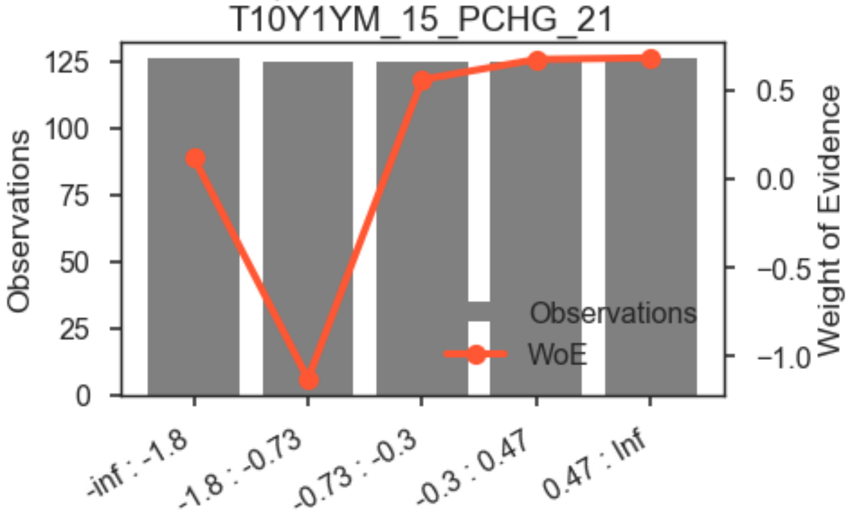


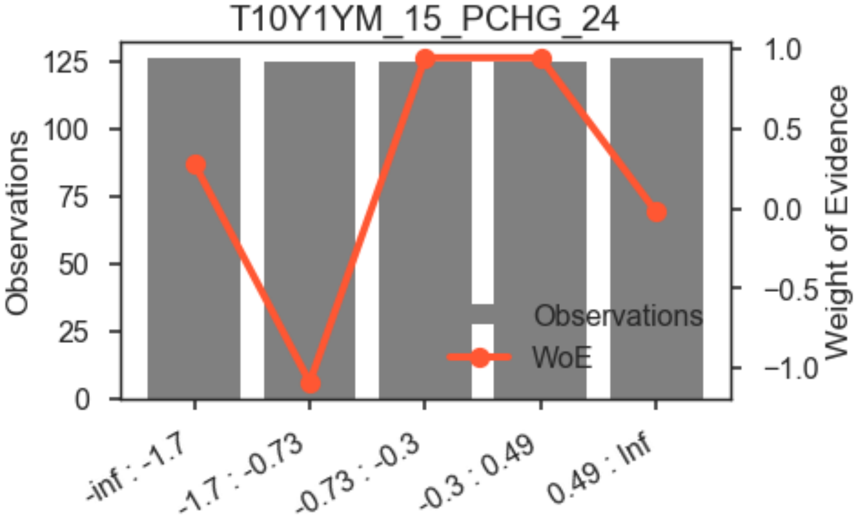


Relationship between lags and recession

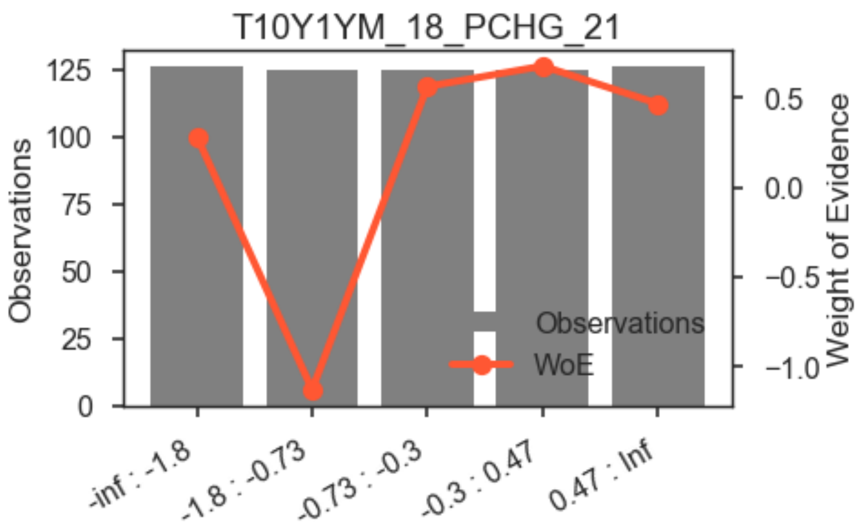


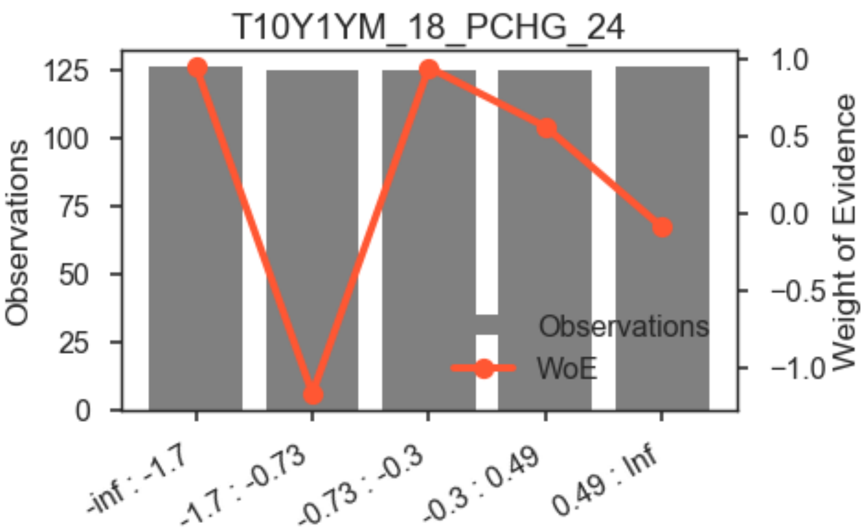


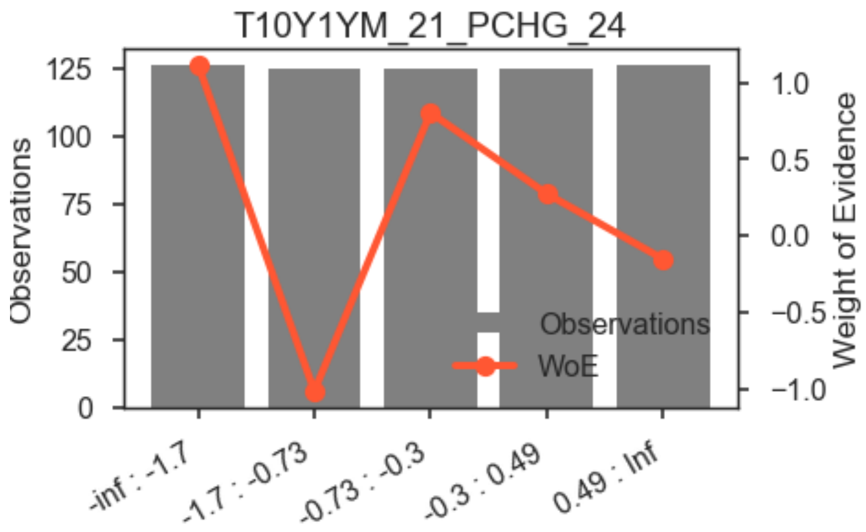




Relationship between lags and recession





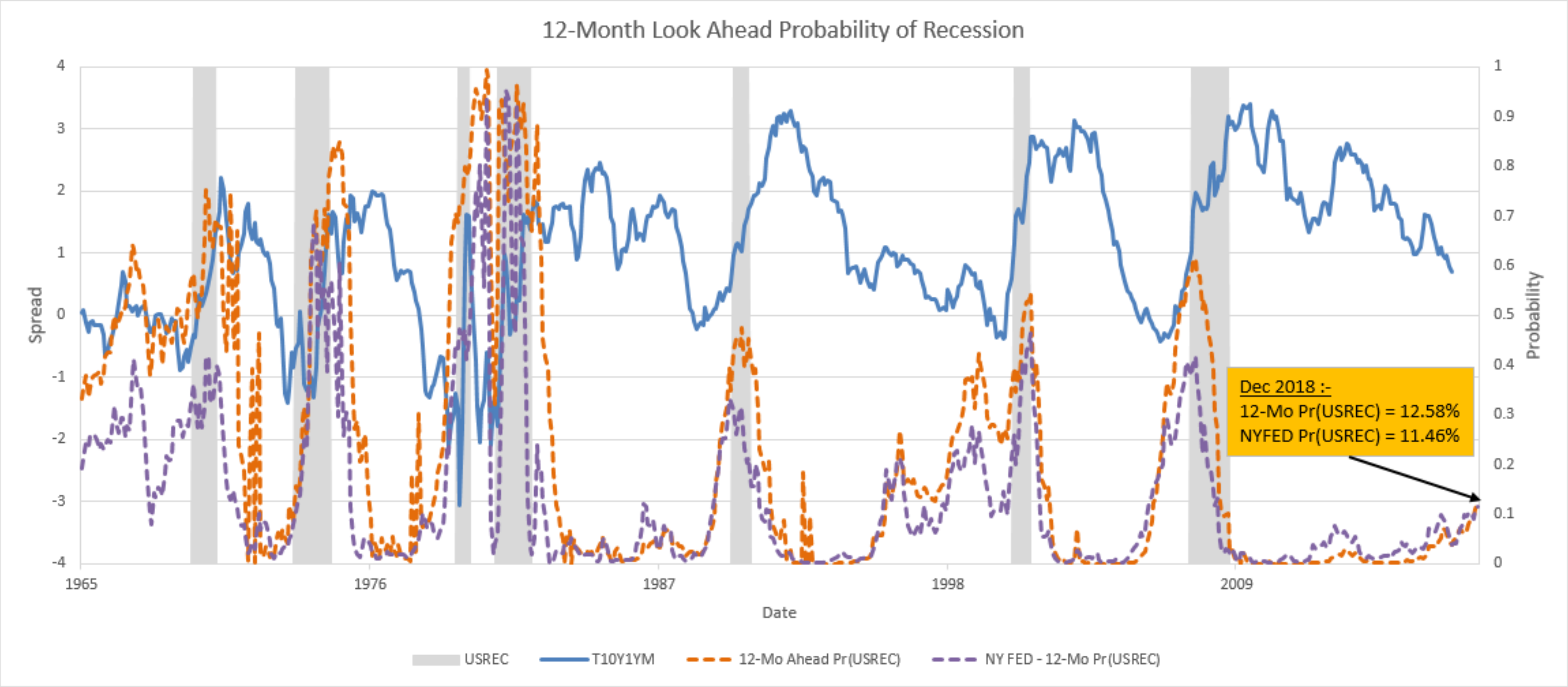


Recession Model Summary

Type	Probit
Dependent Variable	USREC (0,1)
Number of Observation	627
Pseudo R Sq.	0.163

Attributes	Coefficient	std err	z	P>|z|	Relationship with USREC
T10Y1YM_12	(0.61)	0.09	(6.78)	-	Lower value, higher likelihood of recession
T10Y1YM_18	(0.38)	0.12	(3.16)	0.00	Lower value, higher likelihood of recession
T10Y1YM_24	(0.21)	0.10	(2.19)	0.03	Lower value, higher likelihood of recession
T10Y1YM_18_PCHG_24	0.02	0.01	2.08	0.04	Higher value, higher likelihood of recession
T10Y1YM_21_PCHG_24	0.02	0.01	1.96	0.05	Higher value, higher likelihood of recession

Results



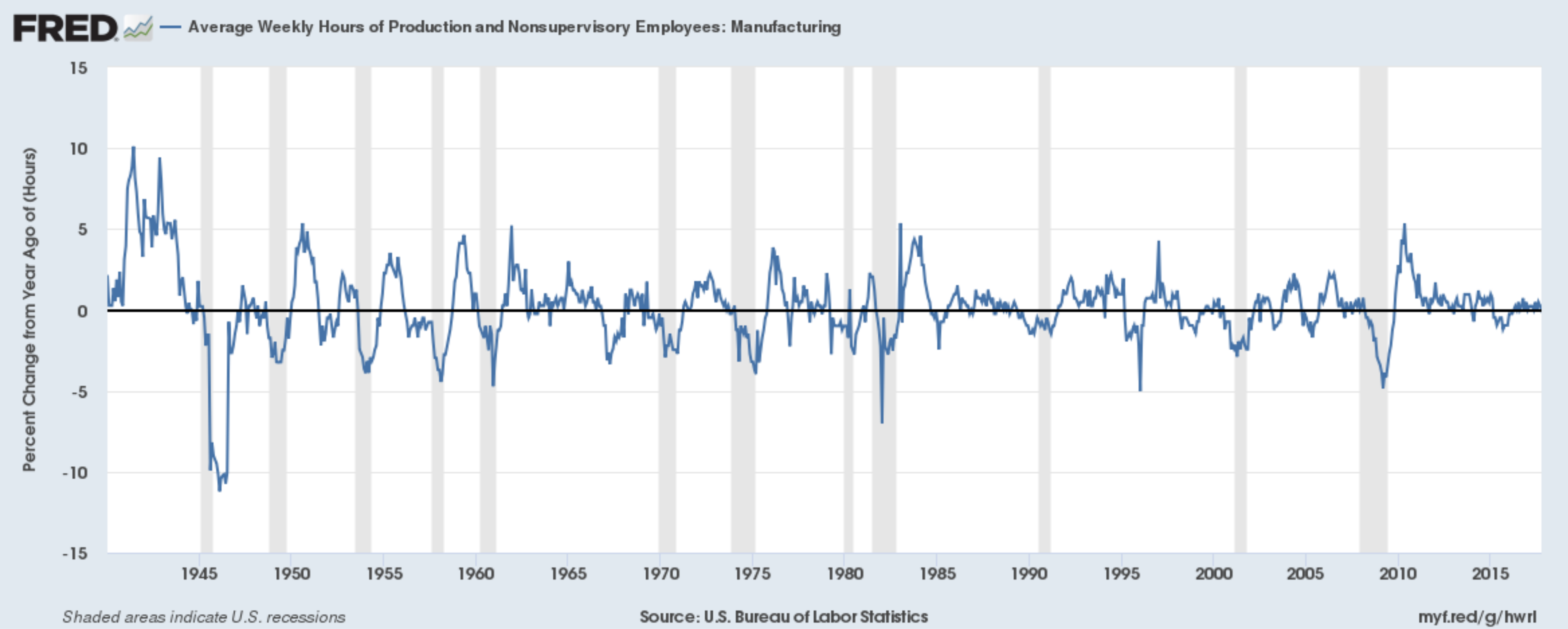
Note: The NY FED model uses the difference between 10-year and 3-month Treasury rates to calculate the probability of a recession in the United States twelve months ahead
(Source: https://www.newyorkfed.org/medialibrary/media/research/capital_markets/Prob_Rec.pdf)

Conclusion/Next Steps

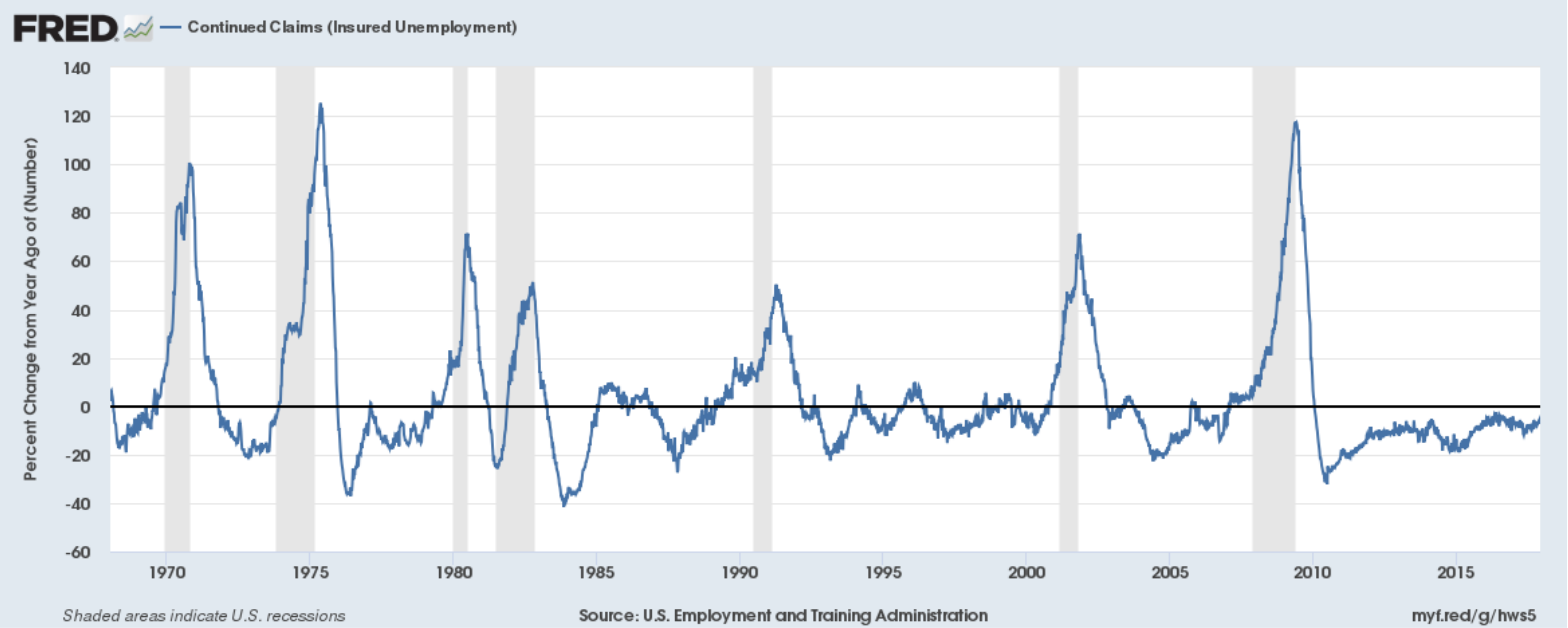
- Proposed Risk Rating - Low Risk Model
- Model parameters will be updated once, every month, based on the availability of the latest data
- Future versions could include a combination of other leading indicators listed in the appendix (many are from Conference Board)

Appendix

The average weekly hours worked by manufacturing workers

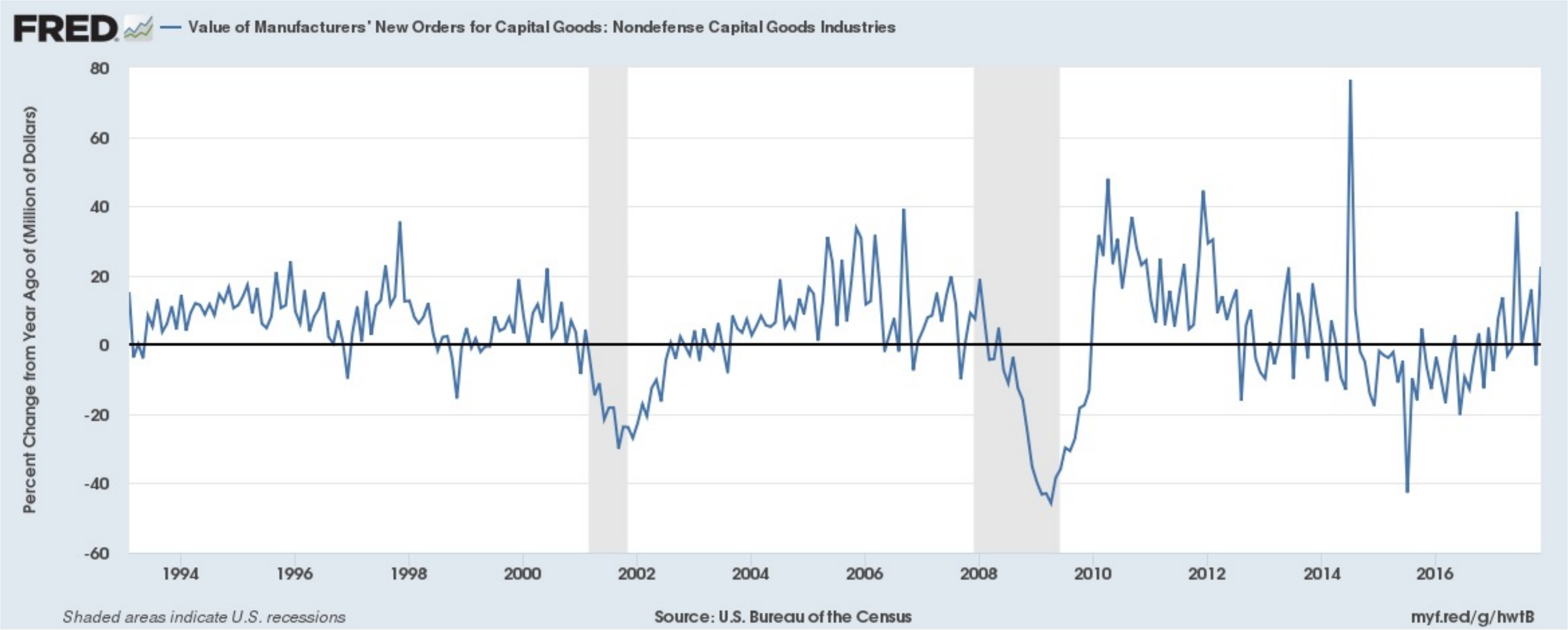


Continued Claims (Insured Unemployment)

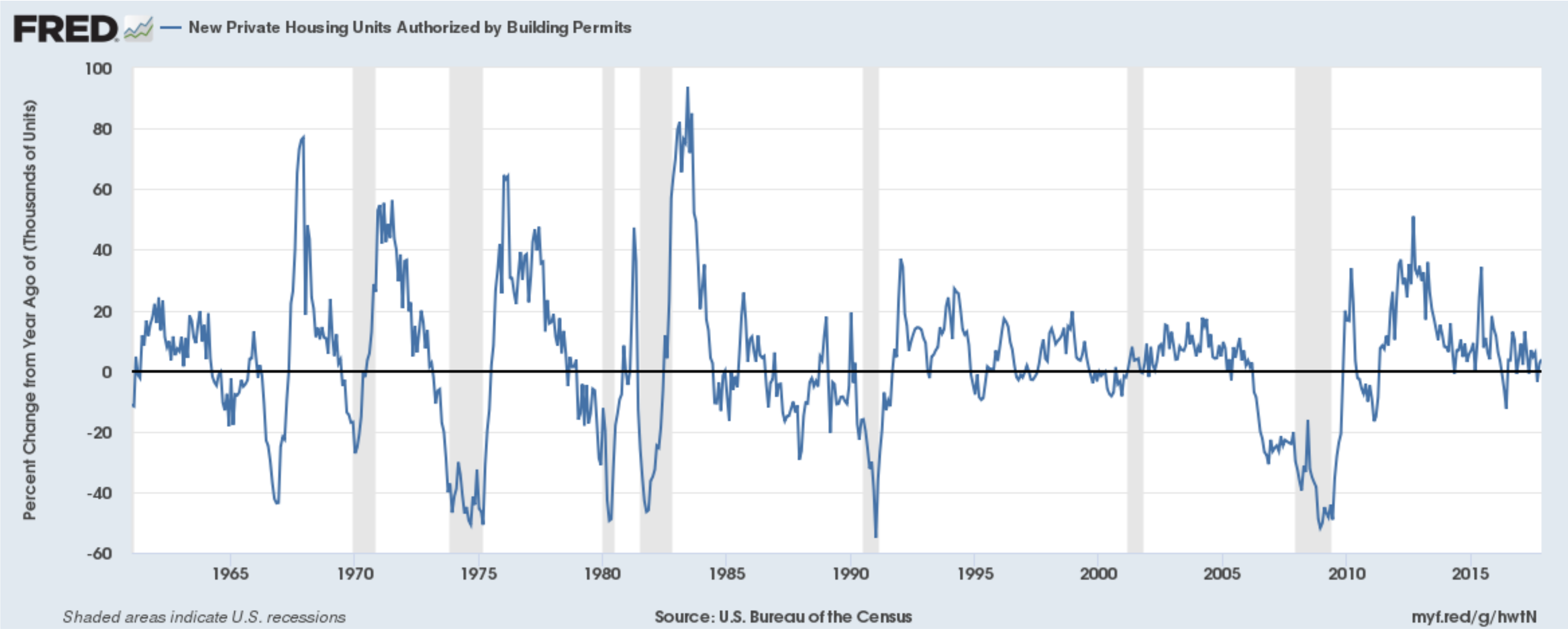


Value of Manufacturers' New Orders for Consumer Goods: Consumer Durable Goods Industries

Value of Manufacturers' New Orders for Capital Goods: Nondefense Capital Goods Industries

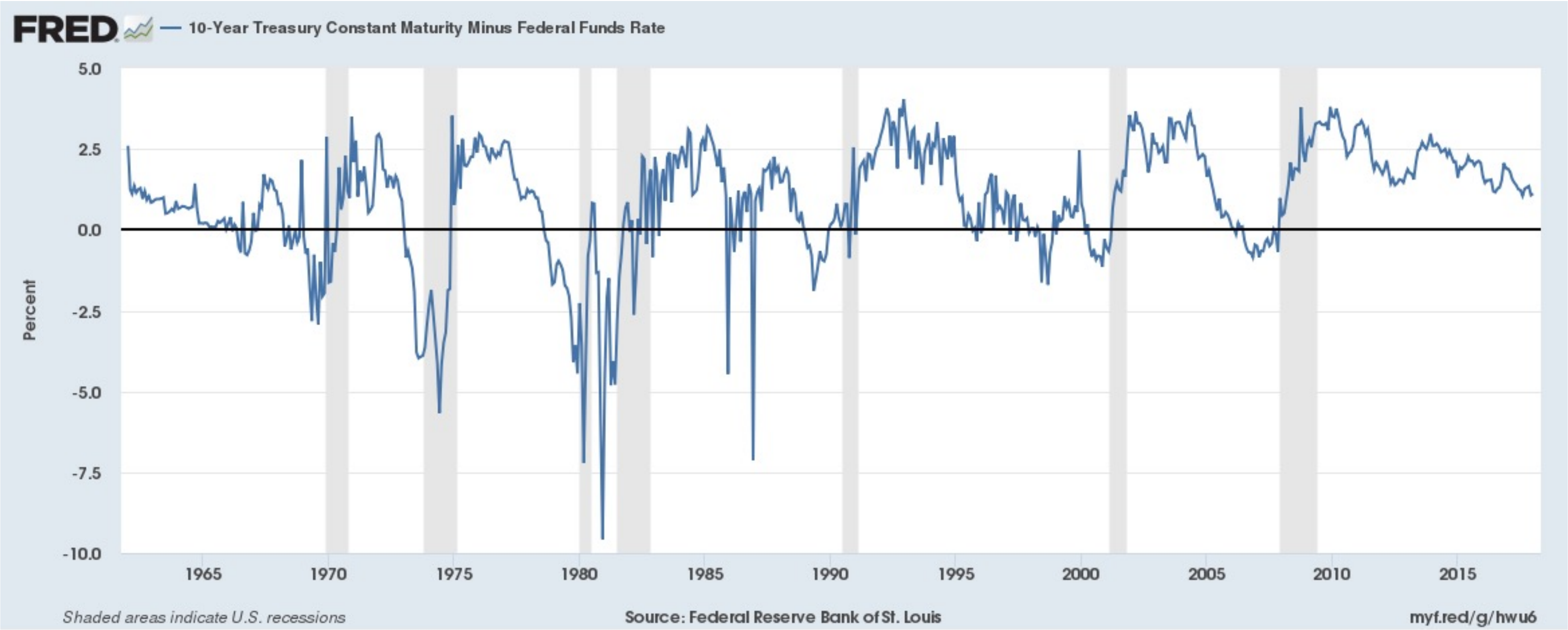


New Private Housing Units Authorized by Building Permits

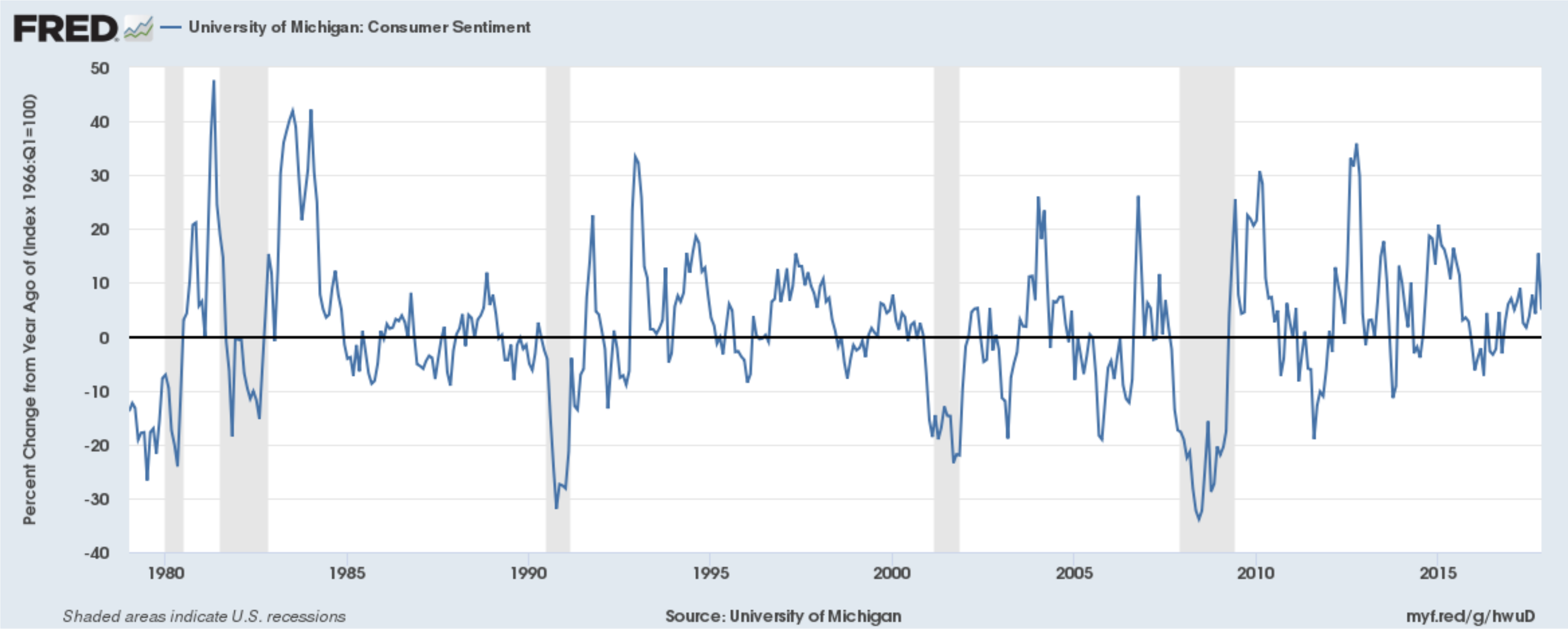


Money Supply M2

10-Year Treasury Constant Maturity Minus Federal Funds Rate



University of Michigan: Consumer Sentiment



Other Leading Indicators

The following are not necessarily the cause of the business cycle, but they still lead the cycles.

1. Corporate Profits
2. Industrial Production
3. Gross Private Domestic Investments