

Recession Forecasting with Credit and Oil Price Channels

*A Multinomial Logit with Exclusion Restrictions,
Kauppi–Saikkonen Dynamics, and Gilchrist–Zakrajsek Credit Channel*

Frank Schmid

frank.schmid@frankschmid.com

March 13, 2026

Abstract

This paper develops a recession forecasting model that distinguishes between credit-channel and oil-channel recessions. The model is a Markov-switching multinomial logit that predicts the probability of each recession type one quarter ahead, with exclusion restrictions ensuring that credit-channel recession risk is driven by the excess bond premium (EBP) of Gilchrist and Zakrajsek (2012) and the term spread, while oil-channel recession risk is driven by crude oil price changes. The Kauppi–Saikkonen (2008) dynamic extension—adding the lagged recession indicator—improves the area under the receiver operating characteristic curve (AUC) from 0.916 to 0.958. Replacing the Baa–Aaa corporate bond spread with the EBP transforms the model’s detection of the 2001 dot-com recession: the one-quarter-ahead signal rises from 4.7% to 53.4%. The model achieves $AUC = 0.958$, $F1 = 0.817$, and Brier score = 0.046 on 243 quarterly observations (1965:Q2–2025:Q4), and correctly identifies the dominant recession channel in six of eight National Bureau of Economic Research (NBER)-dated episodes. The current forecast assigns a 98.0% probability to continued expansion in 2026:Q1.

JEL Classification: E32, E37, C25, C35 Keywords: Recession forecasting, multinomial logit, excess bond premium, oil shocks, exclusion restrictions, Kauppi–Saikkonen

Contents

1	Introduction	1
2	Literature Review	1
2.1	The Yield Curve as a Recession Predictor	1
2.2	Dynamic Probit Models	1
2.3	Credit Spreads and the Excess Bond Premium	2
2.4	Oil Prices and Recession Risk	2
3	Data	2
4	Methodology	3
4.1	Multinomial Logit with Exclusion Restrictions	3
4.2	Kauppi–Saikkonen Dynamic Extension	3
4.3	The Excess Bond Premium	3
5	Model Progression	3
5.1	From Static to Dynamic	3
5.2	From Baa–Aaa to the Excess Bond Premium	4
6	Results	4
6.1	Final Model Coefficients	4
6.2	Pre-Recession Signal Strength	5
6.3	Within-Recession Detection	5
7	Out-of-Sample Evaluation	5
8	Current Forecast	6
9	Conclusion	6
	References	7

1. Introduction

This paper develops a recession forecasting model that distinguishes between credit-channel and oil-channel recessions. The model is a multinomial logit that predicts the probability of each recession type one quarter ahead, with exclusion restrictions ensuring that credit-channel recession risk is driven by the Gilchrist–Zakrajsek (2012) excess bond premium (EBP) while oil-channel recession risk is driven by crude oil price shocks. We extend the static specification with the Kauppi and Saikkonen (2008) dynamic component, which adds a lagged recession indicator to capture recession persistence.

The paper makes four contributions. First, we classify the eight NBER-dated postwar recessions as either credit-channel or oil-channel and show that the predictors of each type differ. Credit-channel recessions (1969–70, 1981–82, 1990–91, 2001, 2007–09) are preceded by deterioration in credit market conditions, measured by the EBP. Oil-channel recessions (1973–75, 1980, 2020) are preceded by oil price shocks.

Second, we impose exclusion restrictions on the multinomial logit: credit market variables enter only the credit-channel equation, and oil price variables enter only the oil-channel equation. This structure ensures that each coefficient has a clear economic interpretation and prevents the model from conflating the two channels.

Third, we show that the Kauppi–Saikkonen dynamic extension—adding the lagged recession indicator—improves within-recession detection. The likelihood ratio test statistic is 48.1 on two degrees of freedom ($p < 10^{-6}$), and the AUC rises from 0.916 to 0.958.

Fourth, we demonstrate that replacing the Baa–Aaa corporate bond spread with the Gilchrist–Zakrajsek EBP transforms the model’s ability to detect the 2001 dot-com recession: the one-quarter-ahead signal rises from 4.7% to 53.4%. The EBP isolates the financial intermediation channel from expected default risk.

This paper is the third in a series. The first, “Observational Equivalence in Taylor Rule Estimation,” demonstrates that the Fed’s reaction function cannot be identified from aggregate time-series data. The second, “Supply-Side Inflation Forecasting When the Phillips Curve Is Flat,” shows that supply-side indicators forecast inflation when the output gap does not. The present paper extends the supply-side framework to recession forecasting, using oil prices as the supply-side indicator and the EBP as the credit-channel indicator.

2. Literature Review

2.1 The Yield Curve as a Recession Predictor

The work of Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998) established the term spread—the difference between the 10-year and 3-month Treasury yields—as a predictor of U.S. recessions. However, the term spread’s predictive power has weakened in recent decades. Johansson and Meldrum (2018) showed that falling term premiums mean the yield curve can flatten without implying higher recession risk. The 2007–09 GFC was not preceded by deep yield curve inversion—the spread was positive—yet it was the worst recession since the Great Depression. And the persistent inversion of 2022–23 did not produce a recession.

2.2 Dynamic Probit Models

Dueker (1997) introduced the dynamic extension by including the lagged recession indicator. Kauppi and Saikkonen (2008) developed a unified framework with four specifications: static, dynamic (adding the lagged recession indicator), autoregressive (adding the lagged model probability), and

dynamic autoregressive (adding both). They found that the dynamic model outperforms the static model for predicting recession duration. We adopt their dynamic specification (M2) as our preferred model.

2.3 Credit Spreads and the Excess Bond Premium

Gilchrist and Zakrajsek (2012) constructed a credit spread index from micro-level corporate bond data and decomposed it into an expected default component and a residual—the EBP. They showed that the predictive content of credit spreads for future economic activity is due to the EBP, which reflects the risk-bearing capacity of the financial sector. Favara, Gilchrist, Lewis, and Zakrajsek (2016) used the EBP in a probit model to predict NBER-dated recessions.

2.4 Oil Prices and Recession Risk

Oil price shocks have long been recognized as a leading indicator of recessions. Hamilton (1983, 2003) documented that oil price increases preceded most postwar U.S. recessions, and that the relationship is nonlinear: large positive shocks have disproportionate effects on economic activity. We use the year-over-year percentage change in crude oil prices as the supply-side predictor. This variable is available from FRED back to the 1940s, is never revised, and captures the energy-price channel that drove the 1973–75 and 1980 recessions.

3. Data

The sample runs from 1965:Q2 to 2025:Q4 (243 quarterly observations). Real Gross Domestic Product (GDP) growth rates are from the Philadelphia Fed’s Real-Time Data Set for Macroeconomists (RTDSM). The model is estimated on revised data to identify the true economic state, following the argument that the latent recession state is a feature of the actual economy, not of initial measurement.

The dependent variable is a three-category classification of the next quarter’s regime: expansion (0), credit-channel recession (1), or oil-channel recession (2).

Table 1: Classification of NBER Recessions

Episode	Duration	Channel	Primary Driver
1969:Q4–1970:Q4	5 quarters	Credit	Monetary tightening
1973:Q4–1975:Q1	6 quarters	Oil	OPEC oil embargo
1980:Q1–1980:Q3	3 quarters	Oil	Iranian revolution
1981:Q3–1982:Q4	6 quarters	Credit	Volcker disinflation
1990:Q3–1991:Q1	3 quarters	Credit	S&L crisis, Gulf War
2001:Q1–2001:Q4	4 quarters	Credit	Dot-com bust, Enron
2007:Q4–2009:Q2	6 quarters	Credit	Global Financial Crisis
2020:Q1–2020:Q2	2 quarters	Oil	COVID-19 pandemic

The predictors, all lagged one quarter, are as follows. **Credit-channel equation:** (i) term spread inverted portion ($\min(TS, 0)$); (ii) GDP growth negative portion ($\min(GDP, 0)$); (iii) term spread 4-quarter moving average; (iv) EBP positive portion ($\max(EBP, 0)$); (v) EBP 4-quarter moving average; (vi) lagged recession indicator (Kauppi–Saikkonen dynamic component). **Oil-channel equation:** (i) GDP growth negative portion; (ii) oil price Y/Y positive portion ($\max(Oil, 0)$); (iii) oil Y/Y 4-quarter moving average; (iv) lagged recession indicator.

The EBP is from the Gilchrist–Zakrajsek dataset maintained by the Federal Reserve Board, available from 1973:Q1. For the pre-1973 period, we construct a synthetic EBP by calibrating the Moody’s Baa–Aaa credit spread to the EBP distribution over the overlap period. Oil prices are from the Producer Price Index for crude petroleum (FRED), available back to the 1940s. All predictors are available in real time and are never revised.

4. Methodology

4.1 Multinomial Logit with Exclusion Restrictions

Let y_{t+1} denote the regime in quarter $t+1$, taking values 0 (expansion), 1 (credit-channel recession), or 2 (oil-channel recession). The model specifies:

$$P(y_{t+1} = j \mid X_t) = \frac{\exp(z_j(t))}{1 + \exp(z_1(t)) + \exp(z_2(t))}$$

where $z_0(t) = 0$ (expansion is the base category), $z_1(t) = X_D(t)\beta_D$ is the credit-channel index function, and $z_2(t) = X_S(t)\beta_S$ is the oil-channel index function. The exclusion restrictions are enforced by construction: X_D contains only credit market and term spread variables, while X_S contains only oil price variables. No credit variable appears in the oil equation, and no oil variable appears in the credit equation.

4.2 Kauppi–Saikkonen Dynamic Extension

Adding the lagged recession indicator y_t captures recession persistence:

$$z_j(t) = X_j(t)\beta_j + \delta_j \cdot y_t \quad \text{for } j = 1, 2$$

where $y_t = 1$ if the economy was in any recession in quarter t , and 0 otherwise.

4.3 The Excess Bond Premium

The Gilchrist–Zakrajsek (2012) credit spread index is constructed from micro-level corporate bond data. The credit spread is decomposed into an expected default component—estimated from a Merton (1974) distance-to-default model—and a residual, the EBP. The EBP captures the component of credit spreads that reflects the risk-bearing capacity of the financial sector. The EBP spiked to +3.3 during the GFC (2008:Q4) and +1.6 before the 2001 recession, but was near zero or negative before the oil-channel recessions of 1973–75, 1980, and 2020—a pattern that validates our exclusion restrictions.

5. Model Progression

5.1 From Static to Dynamic

The static multinomial logit (M1) with exclusion restrictions and the Baa–Aaa credit spread achieves an in-sample AUC of 0.916, an F1 score of 0.690, and a Brier score of 0.093. Adding the Kauppi–Saikkonen lagged recession indicator (M2) improves all metrics: AUC rises to 0.958, F1 to 0.817, and Brier drops to 0.046. The likelihood ratio test statistic is 48.1 on two degrees of freedom, rejecting the static specification at any conventional significance level.

Table 2: Model Comparison—Static vs. Dynamic

Model	LL	AIC	k	AUC	F1	Brier
M1: Static	−82.6	185.2	10	0.916	0.690	0.093
M2: Dynamic (preferred)	−53.4	130.8	12	0.958	0.817	0.046
M4: Dynamic AR	−51.9	131.8	14	0.960	0.800	0.048

Note: LL = log-likelihood; AIC = Akaike Information Criterion; k = number of parameters; AUC = area under the receiver operating characteristic (ROC) curve; Brier = Brier score (lower is better). The preferred model uses the EBP and oil Y/Y.

5.2 From Baa–Aaa to the Excess Bond Premium

Replacing the Baa–Aaa credit spread with the EBP yields a further improvement. While the overall improvement is modest, the recession-by-recession picture reveals a gain for the 2001 recession: the one-quarter-ahead signal rises from 4.7% to 53.4%. The EBP was +1.59 before the 2001 recession, reflecting the deterioration in financial intermediation after the dot-com bust. The raw Baa–Aaa spread was only 1.10%—the rising default risk component was masking the pure intermediation signal.

6. Results

6.1 Final Model Coefficients

Table 3: Final Model Coefficients (M2 with EBP)

Predictor	Credit Channel	Oil Channel
Constant	−3.88	−5.66
TS inverted	−0.19	—
GDP negative	0.12	−0.10
TS 4Q average	−0.43	—
EBP positive	2.10	—
EBP 4Q average	0.71	—
Oil Y/Y positive (/100)	—	0.96
Oil Y/Y 4Q average (/100)	—	6.36
y_{lag} (KS dynamic)	3.81	2.98

Note: “—” indicates exclusion restriction (coefficient constrained to zero). 12 parameters total. EBP = excess bond premium (Gilchrist–Zakrajsek, 2012); Oil Y/Y = crude oil price year-over-year change; KS = Kauppi–Saikkonen.

In the credit equation, the EBP enters with coefficients of 2.10 for the current positive portion and 0.71 for the 4-quarter average, indicating that elevated excess bond premiums predict credit-channel recessions. The term spread 4-quarter average enters with a negative coefficient (−0.43), consistent with the finding that a persistently flat or inverted yield curve predicts tightening-driven downturns.

In the oil equation, oil price changes enter with coefficients of 0.96 for the current positive portion and 6.36 for the 4-quarter average, indicating that sustained oil price surges predict oil-channel recessions. The much larger coefficient on the moving average relative to the current level suggests that persistent energy cost increases matter more than transient spikes—consistent with Hamilton’s (2003) finding that the nonlinear, cumulative effect of oil prices drives the real economy.

6.2 Pre-Recession Signal Strength

Table 4: Pre-Recession Signal (1 Quarter Before Onset)

Episode	P(any)	P(Credit)	P(Oil)	EBP	Oil Y/Y	Channel ID
1969–70	4.6%	4.3%	0.3%	+0.24	0%	
1973–75	13.5%	2.2%	11.3%	−0.30	+50%	
1980	34.4%	3.6%	30.8%	−0.13	+80%	
1981–82	18.1%	17.9%	0.2%	+0.49	−10%	
1990–91	4.2%	2.3%	1.9%	+0.15	+30%	
2001	53.4%	53.3%	0.2%	+1.59	−20%	
2007–09	6.4%	2.2%	4.2%	+0.29	+50%	×
2020	1.9%	1.7%	0.2%	−0.22	−10%	×

Note: $P(\text{Credit})$ = probability of credit-channel recession; $P(\text{Oil})$ = probability of oil-channel recession. “Channel ID” indicates whether the model correctly identifies the dominant recession channel.

The model correctly identifies the dominant recession channel in six of eight episodes. The two exceptions are the GFC (oil was up +50% before 2007:Q4, generating some oil-channel probability that muddled the channel identification) and COVID-19 (an exogenous pandemic shock that no financial or oil price indicator could have anticipated; the EBP was −0.22 and oil was down 10%).

6.3 Within-Recession Detection

The Kauppi–Saikkonen dynamic component enables near-perfect within-recession detection. Once the first recession quarter is observed ($y_{lag} = 1$), the persistence coefficients (3.81 credit, 2.98 oil) elevate the recession probability for the following quarter. At the 50% threshold, the model detects 31 of 35 NBER recession quarters (89%; 31 of 33 excluding COVID). The GFC sequence illustrates the mechanism: the signal starts at 6.4% one quarter before onset, jumps to 98% once the first recession quarter is observed, and sustains 94–99% throughout the six recession quarters. When the recession ends, the probability drops to 2.8%—the model exits recessions as sharply as it enters them.

7. Out-of-Sample Evaluation

We evaluate the model using a pseudo-out-of-sample expanding-window exercise. The initial training window covers 1965:Q2–1989:Q4 (99 observations). Starting in 1990:Q1, we re-estimate the model each quarter and generate a one-quarter-ahead forecast. This exercise covers four NBER recessions: 1990–91, 2001, 2007–09, and 2020.

Table 5: Out-of-Sample Performance (1990:Q1–2025:Q4)

Model	AUC	F1	Brier
Multinomial logit (M2 + EBP)	0.881	0.550	0.097
Probit: term spread only	0.326	0.197	0.106
GDP < 0 rule	—	0.516	0.104

Note: OOS period contains 144 predictions with 15 recession quarters (10.4% rate).

The multinomial logit retains discriminative power out of sample: AUC drops from 0.958 (in-sample) to 0.881—a 6-point decline that is modest by the standards of the recession forecasting

literature, where 10–15 point drops are typical. The model outperforms both the Estrella–Mishkin probit ($AUC = 0.326$) and the naive $GDP < 0$ rule ($F1 = 0.516$).

The GFC provides the critical OOS test. The multinomial logit signals 65% recession probability at the GFC onset (2008:Q1), then escalates to 97–100% during the crisis—all correctly channeled as credit-side. The Estrella–Mishkin probit sits at 8% throughout the entire GFC because the yield curve was positively sloped.

8. Current Forecast

As of 2025:Q4, the model forecasts the following probabilities for 2026:Q1:

Table 6: Current Forecast (2025:Q4 Predictors)

Variable	Value
P(Expansion, 2026:Q1)	98.0%
P(Credit-channel recession)	1.7%
P(Oil-channel recession)	0.3%
Excess bond premium	−0.24 (below average)
Term spread	0.0% (flat)
Oil Y/Y	−5% (benign)
Lagged recession indicator	0 (expansion in 2025:Q3)

The model assigns a 98.0% probability to continued expansion in 2026:Q1. The EBP is negative (−0.24), indicating that corporate credit markets are not under stress. Oil prices are down 5% year-over-year, indicating no supply-side pressure. The term spread is flat at 0.0%, which would have been a mild warning signal in the Estrella–Mishkin framework but is not unusual in the post-quantitative-easing era when term premiums remain compressed.

9. Conclusion

This paper develops a recession model that decomposes recession risk into credit-channel and oil-channel components. The credit-channel equation, driven by the Gilchrist–Zakrajsek EBP and the term spread, captures recessions triggered by financial intermediation stress and monetary policy tightening. The oil-channel equation, driven by crude oil prices, captures recessions triggered by energy price shocks. Exclusion restrictions prevent cross-contamination between the two channels, ensuring that every coefficient has a clear economic interpretation.

Three findings stand out. First, the Kauppi–Saikkonen dynamic extension is transformative: adding the lagged recession indicator as a predictor improves the log-likelihood by 24 points ($LR = 48.1$, $p < 10^{-6}$), raises the AUC from 0.916 to 0.958, and enables near-perfect within-recession detection. Second, replacing the Baa–Aaa credit spread with the EBP improves the detection of the 2001 recession, from 4.7% to 53.4%, by isolating the financial intermediation channel from expected default risk. Third, the model correctly identifies the recession channel in six of eight historical episodes, with the exceptions being COVID-19—an exogenous pandemic shock outside the scope of any financial or oil price indicator—and the GFC onset, where concurrent oil price elevation muddled the channel attribution despite correct recession detection.

The model’s limitation is its reliance on the persistence mechanism for within-recession detection: the pre-recession signal one quarter before onset is modest for most episodes (3–14%), with the 2001 recession being the exception (53.4%). The model is a concurrent-plus-persistence predictor rather than a pure leading indicator.

9. References

- Benigno, G., di Giovanni, J., Groen, J.J.J., and Noble, A.I. (2022). "A New Barometer of Global Supply Chain Pressures." *Federal Reserve Bank of New York Staff Reports*, No. 1017.
- Dueker, M.J. (1997). "Strengthening the Case for the Yield Curve as a Predictor of U.S. Recessions." *Federal Reserve Bank of St. Louis Review*, 79(2), 41–51.
- Estrella, A. and Hardouvelis, G.A. (1991). "The Term Structure as a Predictor of Real Economic Activity." *Journal of Finance*, 46(2), 555–576.
- Estrella, A. and Mishkin, F.S. (1998). "Predicting U.S. Recessions: Financial Variables as Leading Indicators." *Review of Economics and Statistics*, 80(1), 45–61.
- Favara, G., Gilchrist, S., Lewis, K.F., and Zakrajsek, E. (2016). "Recession Risk and the Excess Bond Premium." *FEDS Notes*, Board of Governors of the Federal Reserve System.
- Gilchrist, S. and Zakrajsek, E. (2012). "Credit Spreads and Business Cycle Fluctuations." *American Economic Review*, 102(4), 1692–1720.
- Hamilton, J.D. (1983). "Oil and the Macroeconomy Since World War II." *Journal of Political Economy*, 91(2), 228–248.
- Hamilton, J.D. (1989). "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle." *Econometrica*, 57(2), 357–384.
- Hamilton, J.D. (2003). "What Is an Oil Shock?" *Journal of Econometrics*, 113(2), 363–398.
- Johansson, P. and Meldrum, A. (2018). "Predicting Recession Probabilities Using the Slope of the Yield Curve." *FEDS Notes*, Board of Governors of the Federal Reserve System.
- Kauppi, H. and Saikkonen, P. (2008). "Predicting U.S. Recessions with Dynamic Binary Response Models." *Review of Economics and Statistics*, 90(4), 777–791.
- Merton, R.C. (1974). "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates." *Journal of Finance*, 29(2), 449–470.
- Vrontos, S.D., Galakis, J., and Vrontos, I.D. (2021). "Modeling and Predicting U.S. Recessions Using Machine Learning Techniques." *International Journal of Forecasting*, 37(4), 1596–1616.