

Predicting Recessions and Growth with Financial Indicators: A Cross-Country Analysis

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UW Madison & NBER

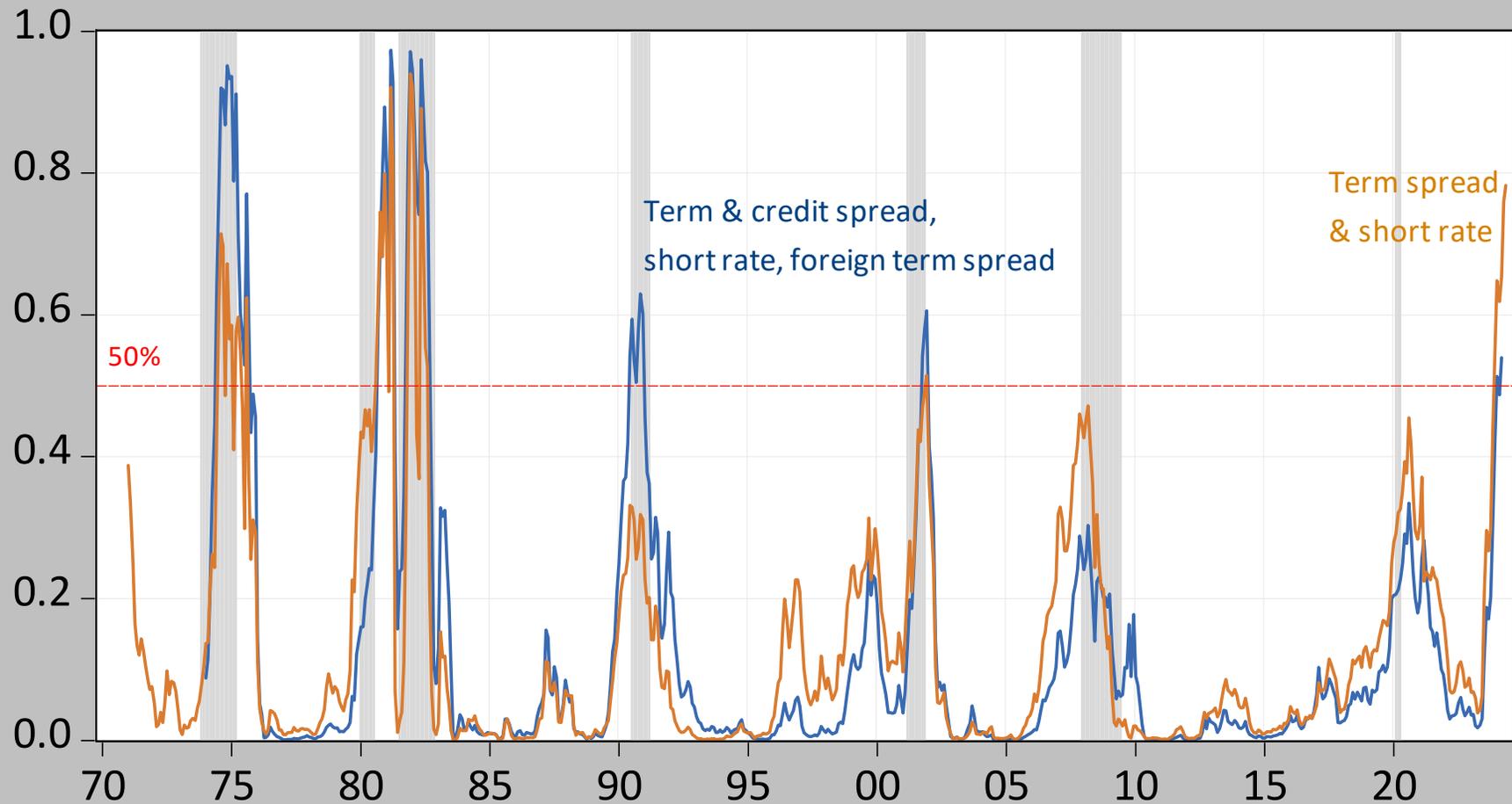
Laurent Ferrara

SKEMA Business School

ISF 2023 at Darden School

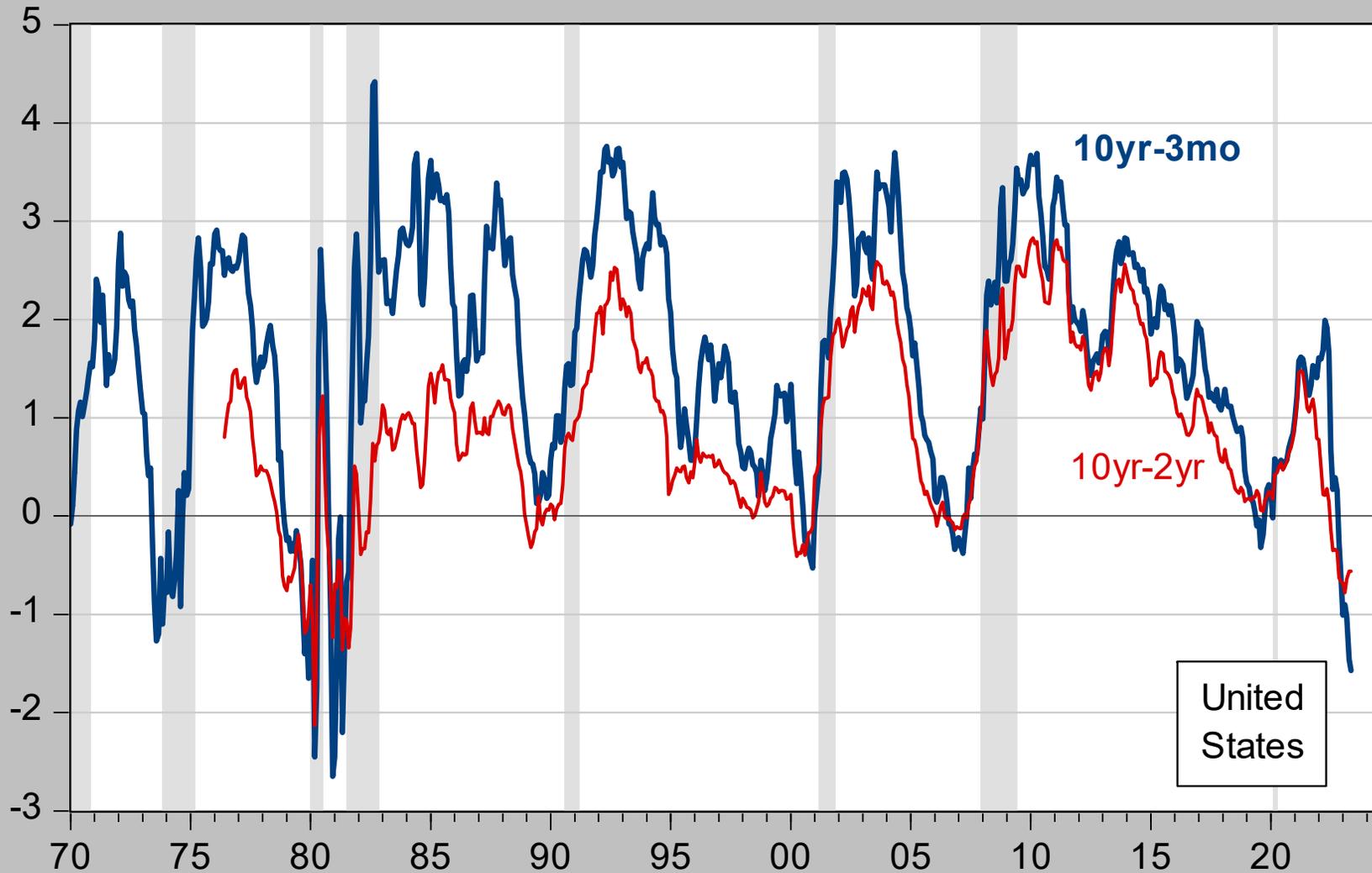
June 28, 2023

Predicting US Recessions

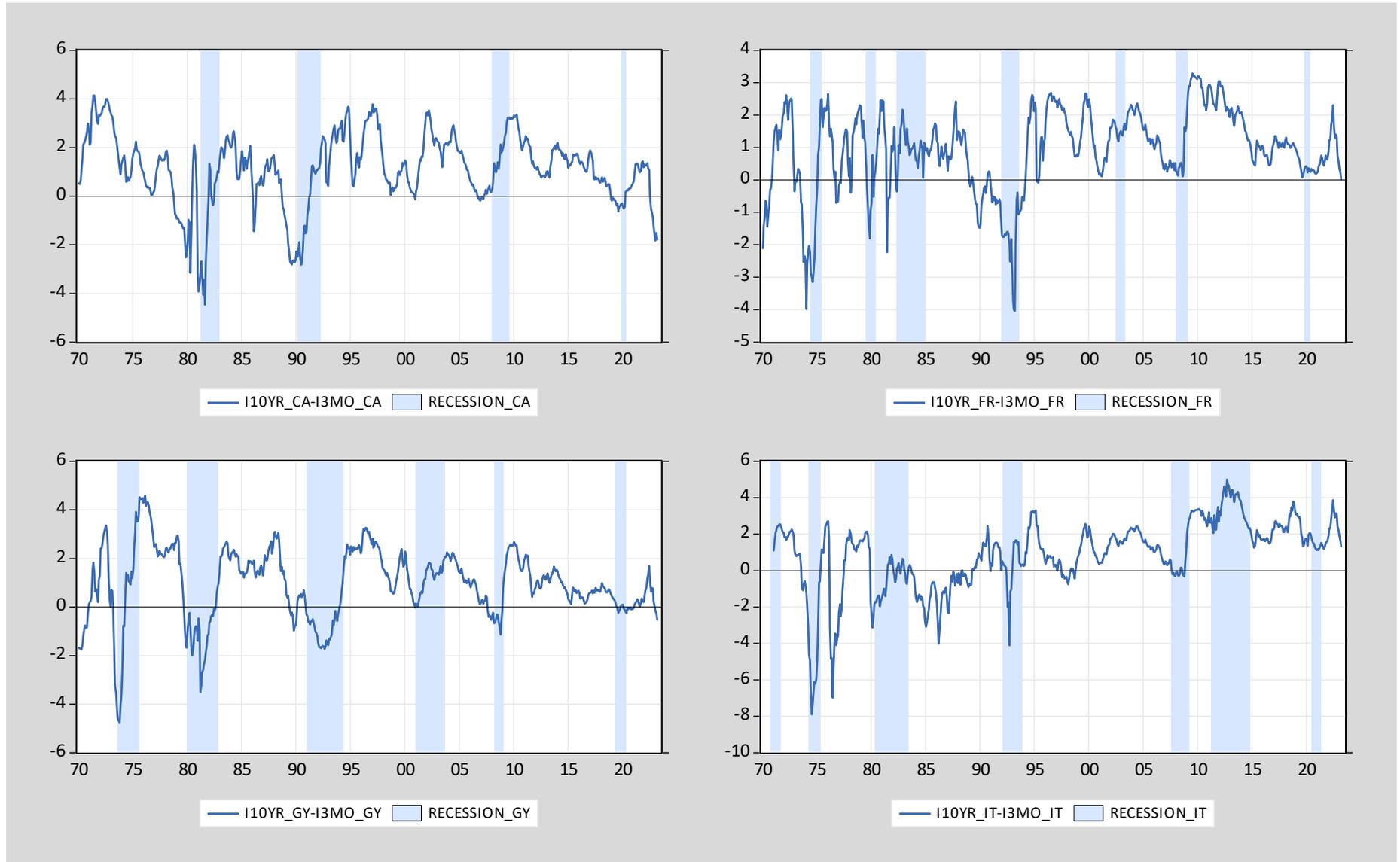


Data through 6/16/2023, NBER peak-to-trough, assumes no recessions through June 2023₂

Using the US Term Spread

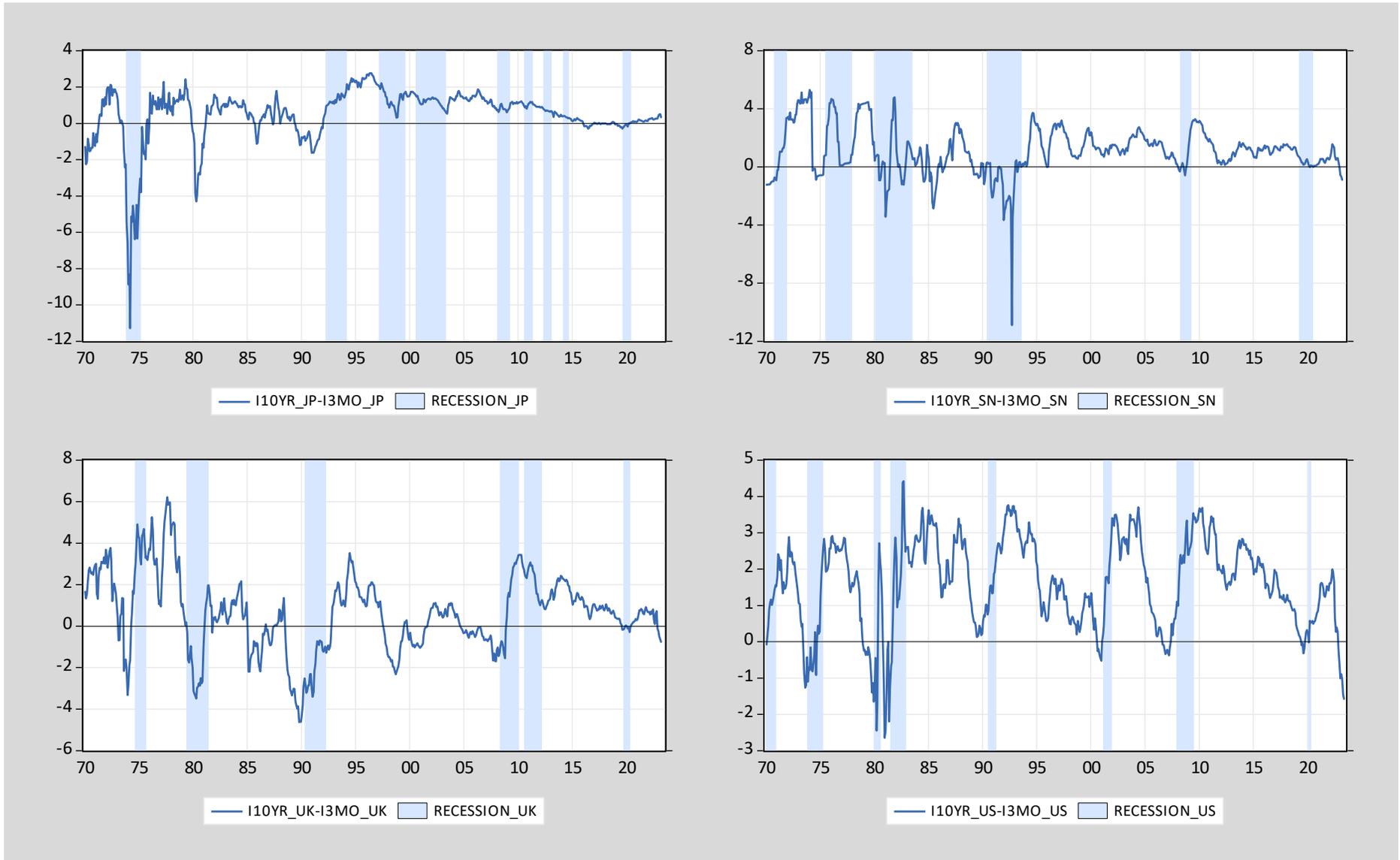


Term Spread, Recession in Other Countries



Assumes no recessions through Feb 2023. ECRl peak-to-trough recession dates

Term Spread, Recession in Other Countries



Assumes no recessions through Feb 2023. ECRl peak-to-trough recession dates

Theory for Term Spread

Linkages between long and short-term rates:

- Expectations Hypothesis of the Term Structure

Long term bond yield is the average of the one period interest rates expected over the lifetime of the long term bond

- Liquidity Premium Theory

Allows that there will be supply and demand conditions that pertain specifically to bonds of that maturity

Theory for the Term Spread

- Long term rates can be decomposed as:

$$i_t^n = \frac{i_t + i_{t+1}^e + \dots + i_{t+n-1}^e}{n} + \ell_t^n$$

- Given $\ell_t^n > 0$ when do we observe an inverted yield spread?
- Short-term rates lower during slow economic growth
 - Monetary Policy
 - Decreased credit demand
- Hamilton & Kim (2002) note term premium also predicts slower growth

Literature

- U.S. yield curve signaling recession

Harvey (1988,1989), Stock and Watson (1989), Estrella and Hardouvelis (1991), Hamilton and Kim (2002)

- Concurrent research expands data outside the U.S.

Harvey (1991), Davis and Henry (1994), Plosser and Rouwenhorst (1994), Estrella and Mishkin (1997), Bonser-Neal and Morley (1997), Mehl (2009), Chinn and Kucko (2014), Sabes and Sahuc (2023)

Other Factors

- Credit risk (we don't have cross country)
Gilchrist and Zakrajsek (*AER*, 2012)
- Disaggregated by sector dividend/price yield (same)
Chatelais, Stalla-Bourdillion, Chinn (*JIMF*, 2023)
- Financial Conditions Indexes (FCI)
Hatzius, Hooper, Mishkin, Schoenholtz, Watson
(2010); Arrigoni, Bobasu, Venditti (*IMFER*, 2022)
- Foreign Term Spread (FTS)
Ahmed & Chinn (2022)
- “Financial Cycle” or Debt-Service Ratio (DSR)
Borio, Drehmann, Xia (*J. Macro*, 2020)

Data

- Recessions defined by ECRI (NBER for US)
- Canada, France, Germany, Italy, Japan, Sweden, UK and US; and for Brazil, India, China, South Africa and Korea
- Activity defined by industrial production growth (y/y)
- Interest rates: 10 year, 3 month from OECD
- Arrigoni et al. (2022) FCI from F. Venditti
- Foreign term spread uses GDP weights from WEO, interest rates from OECD
- Borio, Drehmann, Xia (2020) DSR from Xia, updated from BIS

Probit Model

- We begin with a simple specification and augment

$$\Pr(R_{t+1,t+k} = 1) = \phi(\alpha_0 + \alpha_1 Spread_t + \alpha_2 i_t^{3mo} + X_t B)$$

- $k = 12$ (monthly data)
- Full sample, 1970-2023M02 (interest rates, indicators up to 2022M02)
- Shorter for FCI (1995-2020M05), Debt-Service Ratio (1985-2022)

Basic, Full Sample

Table 1: Probit Regression of Recession Twelve months ahead, 1970-2023M02

coefficient	CA	FR	GY	IT	JP	SN	UK	US
constant	-0.895	-1.632	-1.039	-1.136	-0.429	-1.342	-1.162	-0.846
	0.188	0.153	0.142	0.136	0.097	0.133	0.130	0.194
Spread (-)	-72.582	-9.093	-38.304	12.959	-4.862	-3.606	-15.622	-60.425
	8.661	5.421	5.755	4.189	5.095	3.818	3.811	7.710
3 mo (+)	-0.304	10.677	12.909	3.908	-8.937	10.179	3.554	7.370
	2.303	1.659	2.133	1.228	2.062	1.445	1.464	2.450
Pseudo R								
sq.	0.405	0.141	0.282	0.018	0.036	0.117	0.084	0.308
N	626	626	626	614	626	626	626	626

With FCI, FTS, Shorter Sample

Table 2: Probit Regression of Recession Twelve months ahead, 1995-2021M05

coefficient	CA	FR	GY	IT	JP	SN	UK	US
constant	-0.729	-0.471	-0.561	-1.456	-0.896	-0.151	-2.115	-2.642
	0.418	0.316	0.250	0.275	0.214	0.331	0.311	0.617
Spread (-)	7.566	-93.321	-68.094	33.052	58.013	7.969	43.980	19.067
	44.922	27.000	19.063	9.752	22.579	30.867	20.105	37.959
3 mo (+)	11.203	-0.757	13.240	23.538	62.540	-7.014	28.843	74.176
	8.929	7.727	7.499	7.145	34.162	6.482	8.506	16.258
FCI (+)	0.258	-0.273	-0.428	-0.795	0.046	0.314	0.828	0.195
	0.140	0.166	0.198	0.209	0.156	0.177	0.151	0.279
FTS (-)	-145.209	21.647	-2.977	-44.706	-15.362	-156.204	-20.838	-214.143
	66.804	19.375	15.330	12.345	9.970	34.488	26.382	65.668
Pseudo R								
sq.	0.305	0.156	0.198	0.140	0.096	0.323	0.163	0.523
	305	305	305	305	302	305	305	305

Foreign Term Spread

- Ahmed & Chinn (2022) find foreign term spread is better predictor of US recessions than US term spread
- This counter-intuitive result is fairly robust
- Would be unsurprising that foreign financial variable would be influential (e.g., Agrippina and Rey thesis global financial cycle, and US monetary policy).
- However, surprising that it's true for US recessions
- And for CA, IT, SN

Full Specification, Shorter Sample

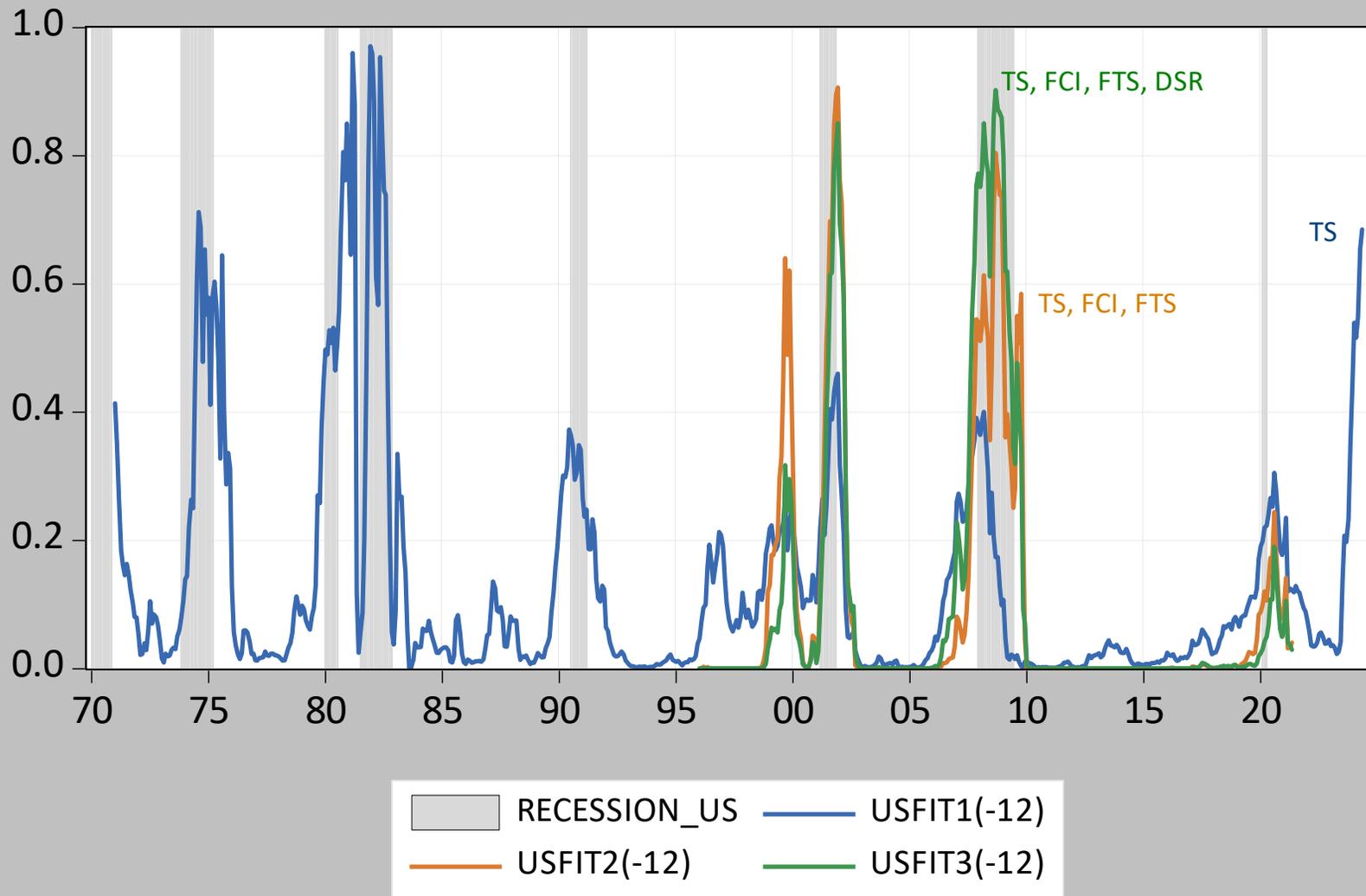
Table 3: Probit Regression of Recession Twelve months ahead, 1995-2021M05

coefficient	CA	FR	GY	IT	JP	SN	UK	US
constant	7.444	-13.796	-7.778	-17.535	-1.928	20.295	-12.010	-10.803
	3.080	4.351	1.951	2.299	0.576	6.747	1.624	2.716
Spread (-)	-32.471	-36.276	-80.215	63.078	32.262	-118.508	159.954	-37.789
	52.667	30.876	21.859	16.282	26.256	54.616	44.736	42.433
3 mo (+)	-17.858	29.934	-10.610	-32.563	36.386	-89.237	49.539	15.585
	15.201	12.398	10.222	15.356	36.905	28.451	16.417	24.316
FCI (+)	0.285	-0.648	-0.098	0.619	0.033	1.012	1.061	-0.044
	0.145	0.224	0.210	0.372	0.155	0.324	0.226	0.284
FTS (-)	-166.974	4.999	-25.415	-195.925	-12.783	-155.422	-176.056	-154.258
	74.674	20.923	17.181	29.114	10.092	46.141	56.268	67.750
DSR (+)	-32.549	70.528	64.766	160.211	7.819	-87.973	63.654	63.037
	12.080	22.982	17.472	22.210	4.038	28.979	10.328	20.197
Pseudo R								
sq.	0.354	0.219	0.252	0.525	0.105	0.386	0.469	0.576
	305	305	305	305	302	305	305	305

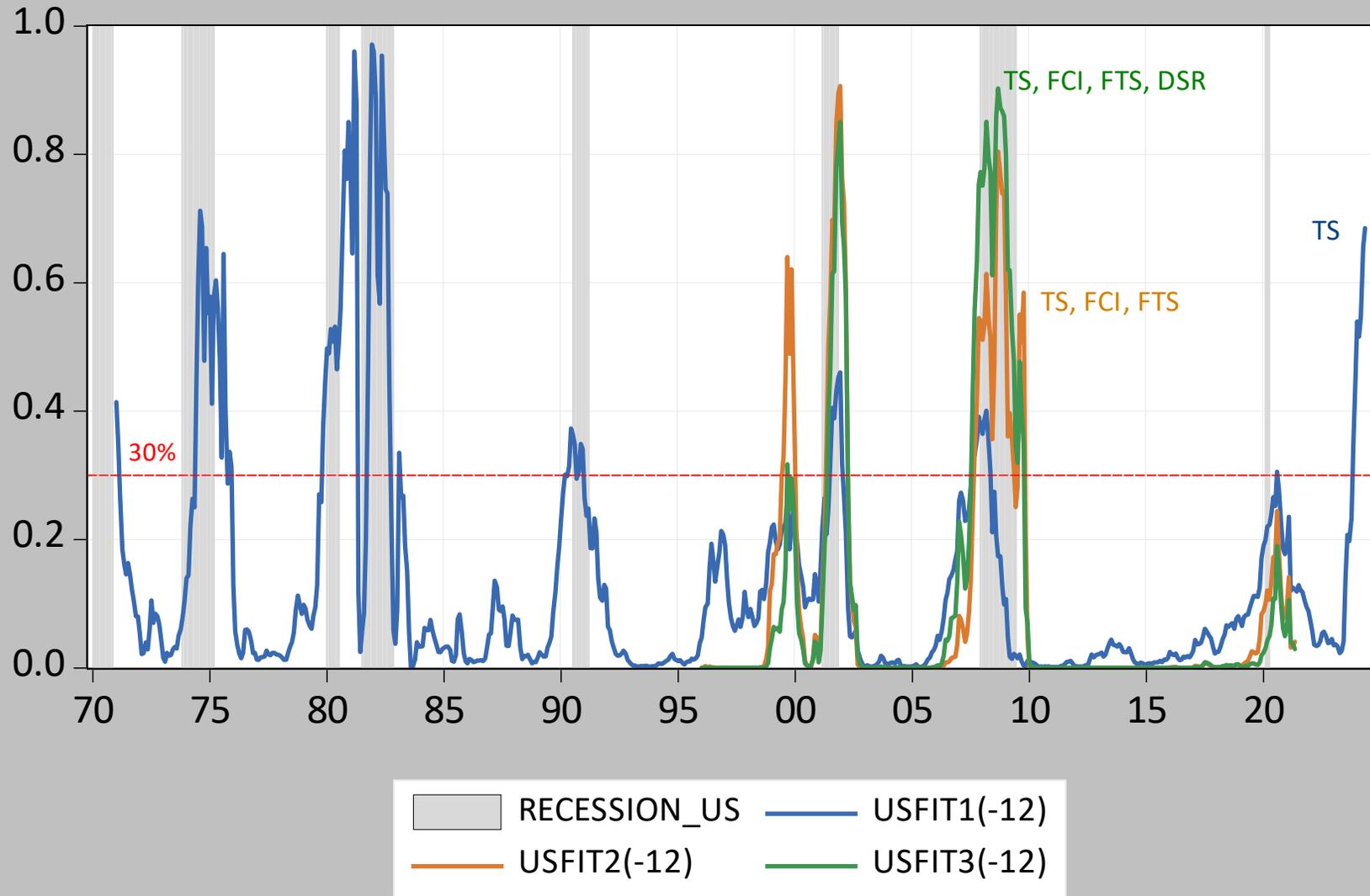
Debt-Service Ratio

- Debt-Service Ratio (DSR) has correct sign except for Canada, Sweden
- Adds substantially to pseudo R2 for Italy, UK (where it has correct sign)

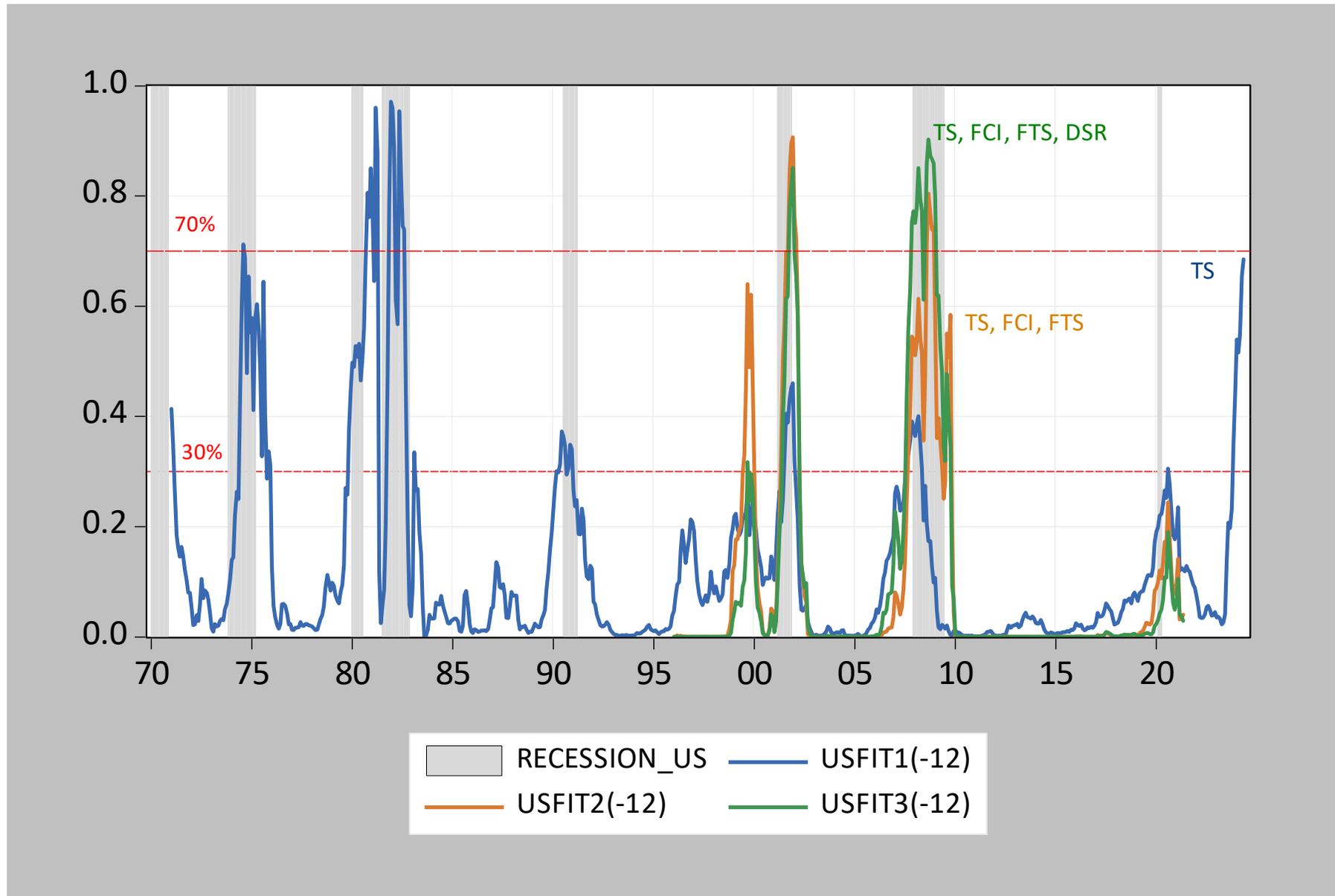
US Comparison of Prediction



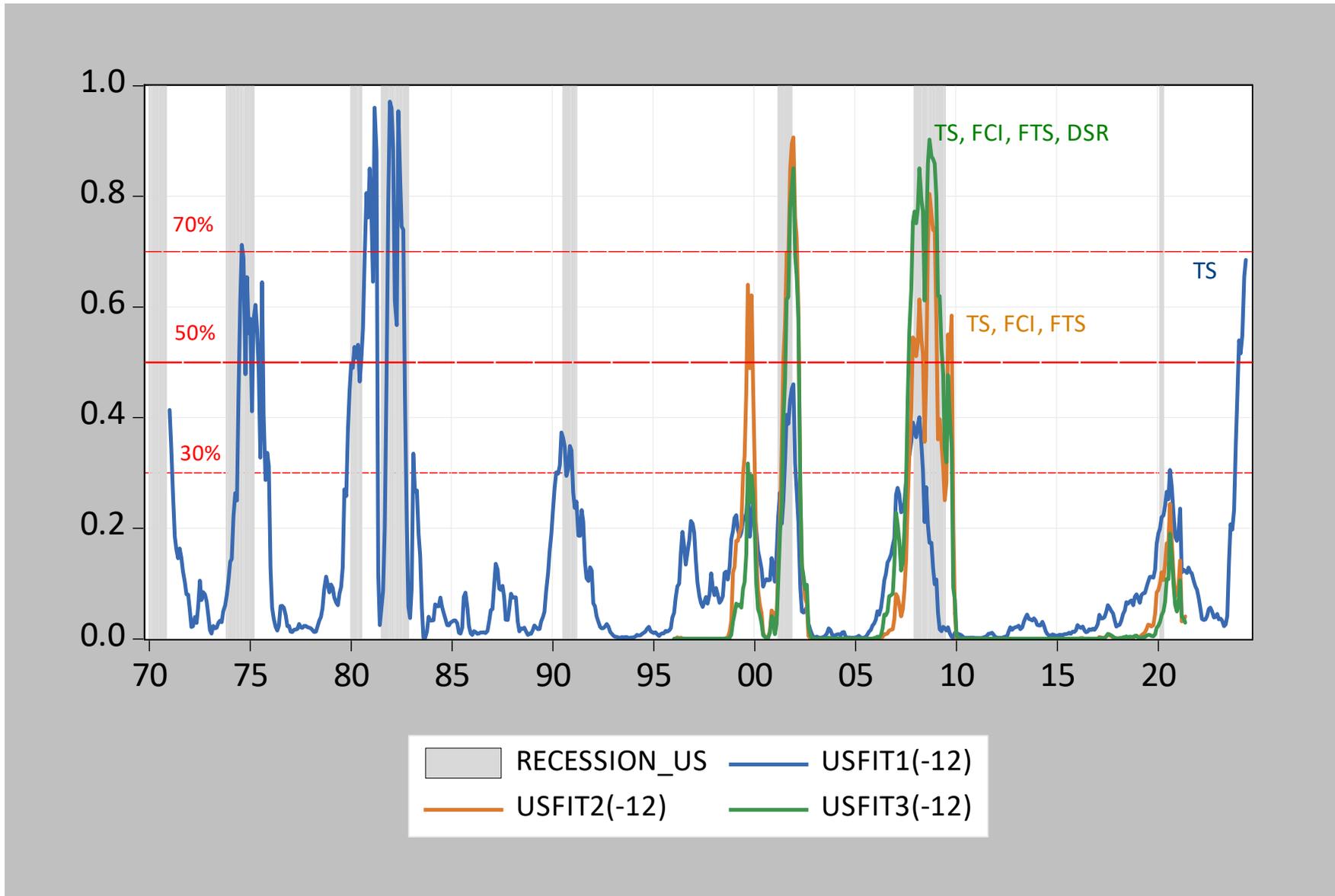
What's the Right Threshold? (I)



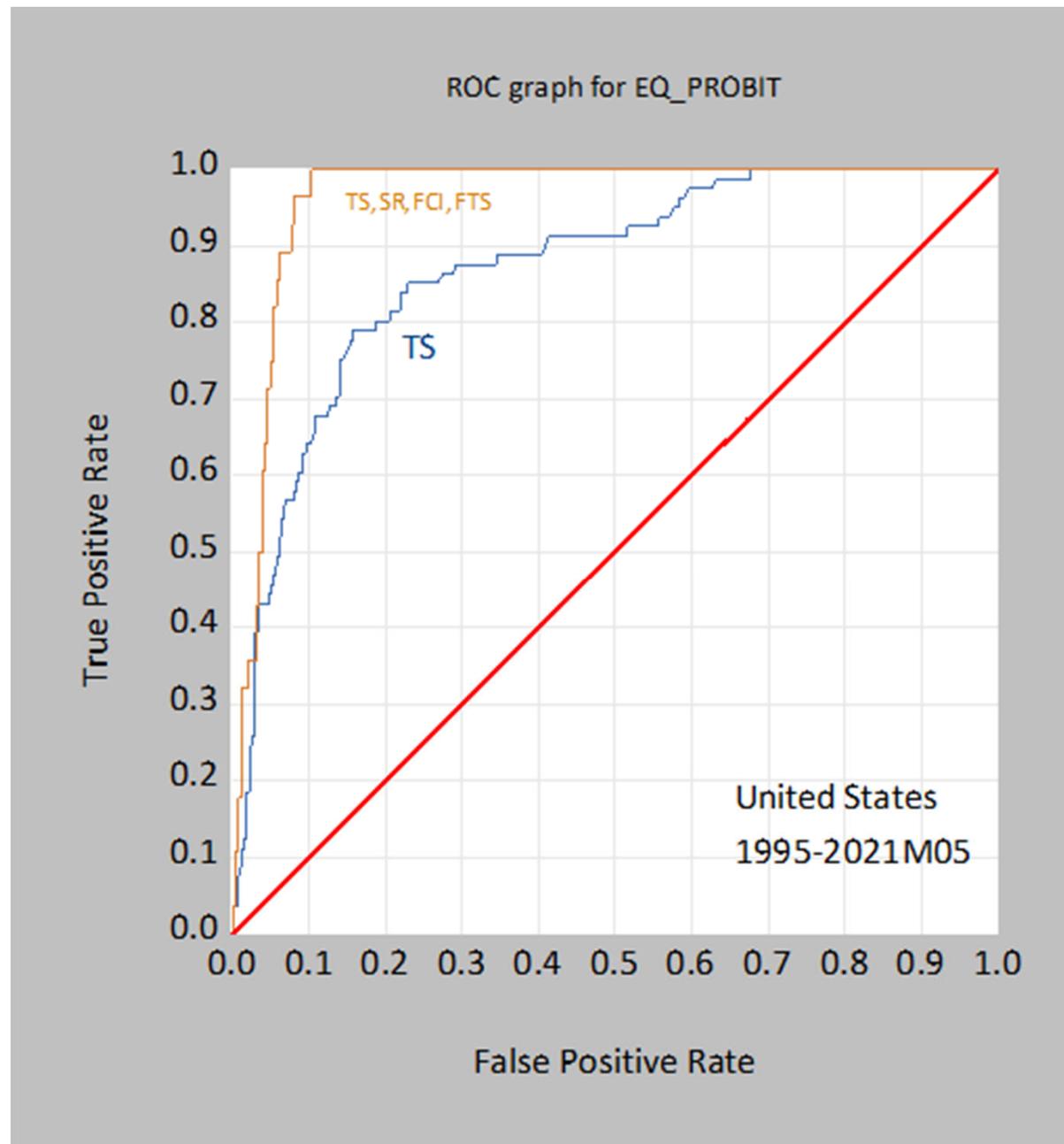
What's the Right Threshold? (II)



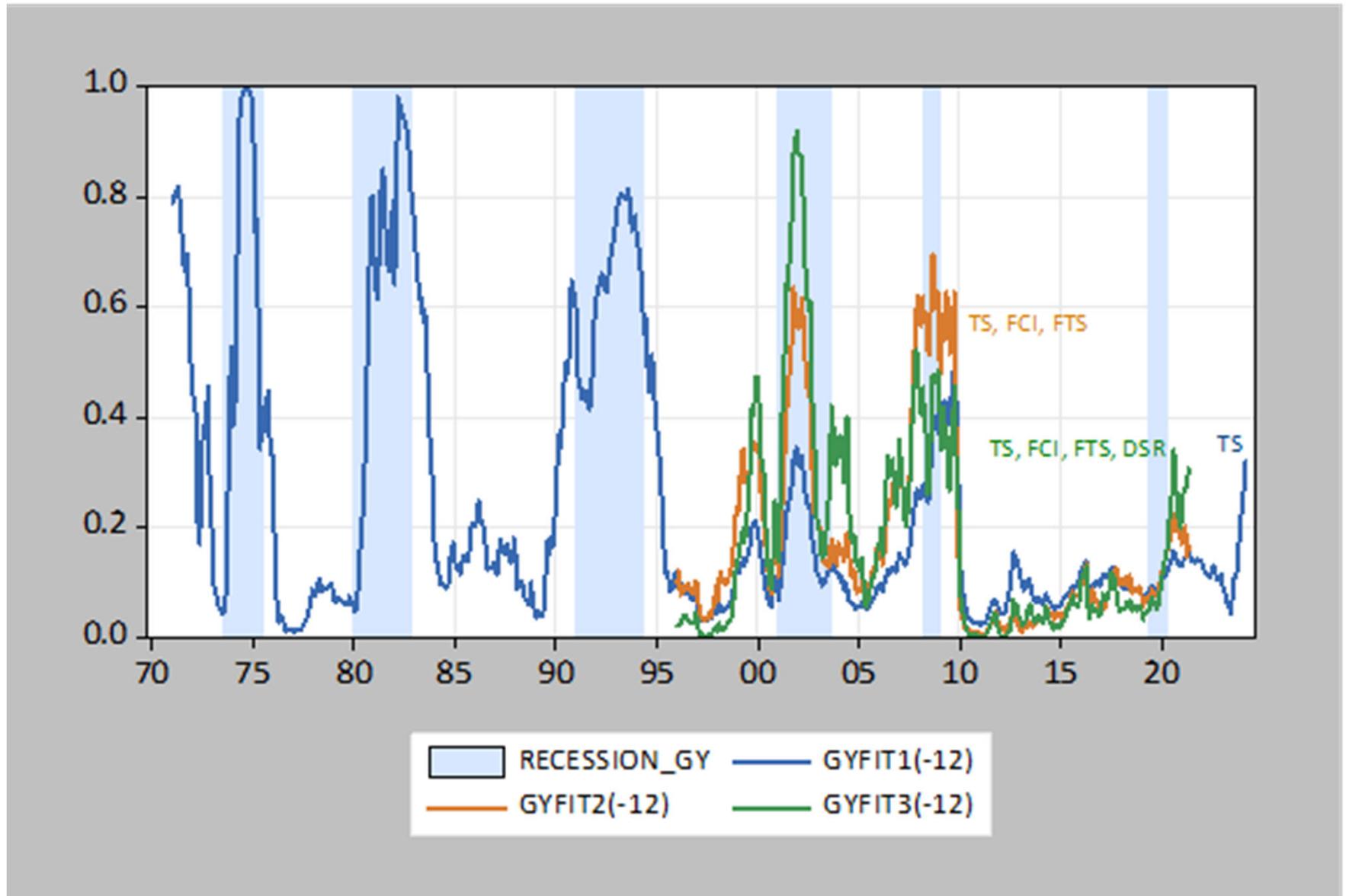
What's the Right Threshold? (III)



Receiver Operating Characteristics Curve



Germany: Comparison of Prediction



IP Growth (y/y) Regressions

- Regression of subsequent 12 mo growth rate on spread, indicators

$$\Delta IP_{t,t+k} = \alpha_0 + \alpha_1 Spread_t + \alpha_2 i_t^{3mo} + X_t B + \epsilon_{t+k}$$

- Sample is 1970-2019 (to omit pandemic recession)

Basic Specification, Full Sample

Table 4: OLS Regression of Industrial Production Growth Next Twelve Months, 1970-2019

coefficient	CA	FR	GY	IT	JP	SN	UK	US
constant	-0.023	-0.013	0.002	-0.018	-0.025	-0.005	0.010	-0.010
	0.011	0.010	0.011	0.016	0.013	0.012	0.007	0.012
Spread (+)	2.301	1.505	1.590	1.113	2.501	1.138	0.474	1.541
	0.307	0.380	0.364	0.429	0.452	0.367	0.219	0.325
3 mo (-)	0.284	0.157	-0.078	0.233	0.749	0.116	-0.018	0.086
	0.136	0.082	0.138	0.134	0.200	0.111	0.094	0.135
Adj R sq.	0.297	0.151	0.224	0.064	0.154	0.086	0.052	0.148
N	588	588	588	576	588	588	588	588

With FCI, FTS, Shorter Sample

Table 5: OLS Regression of Industrial Production Growth Next Twelve Months, 1995-2019

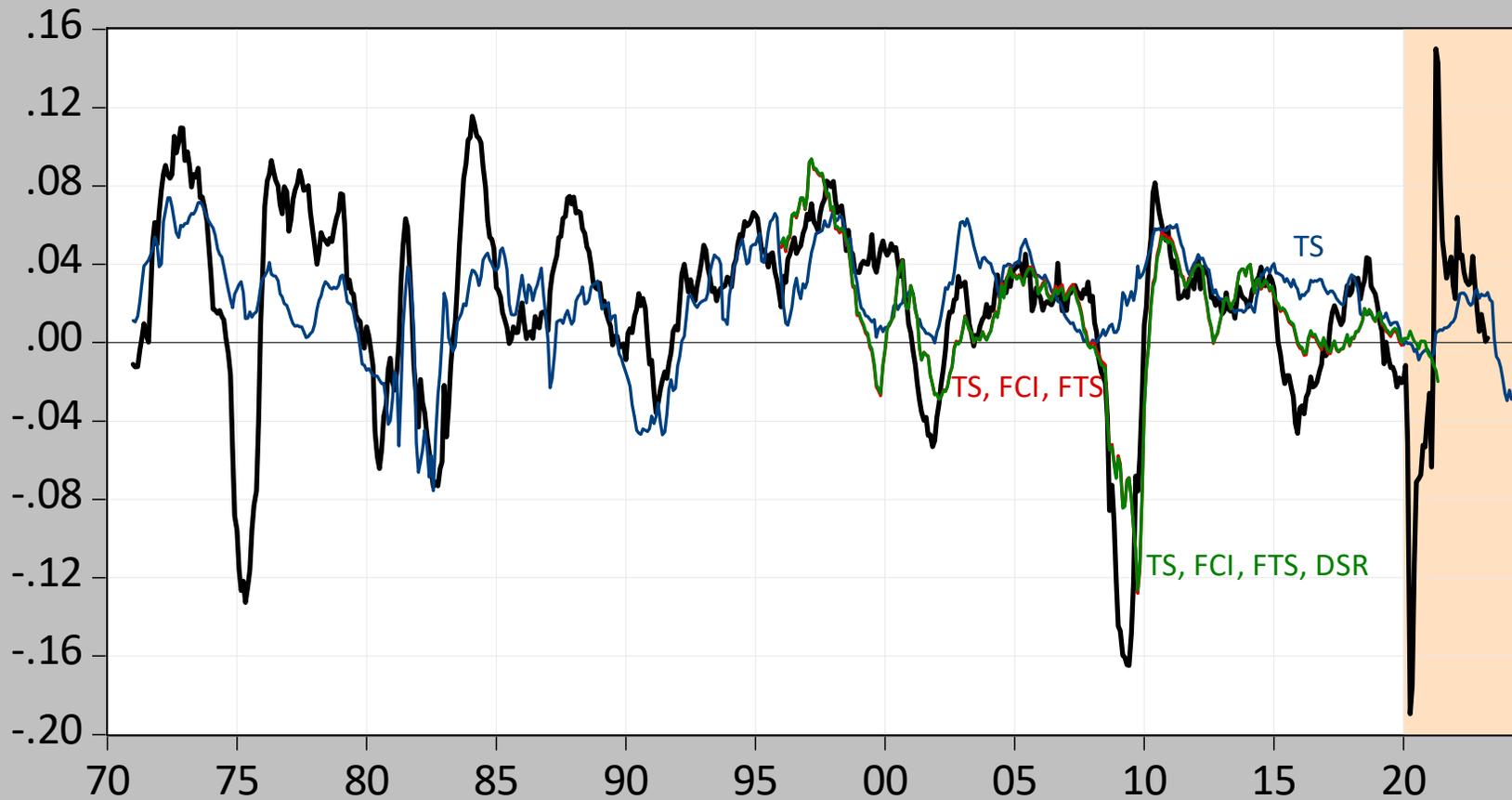
coefficient	CA	FR	GY	IT	JP	SN	UK	US
constant	0.018	0.001	0.033	-0.008	-0.053	-0.015	0.027	0.024
	0.016	0.010	0.020	0.021	0.022	0.012	0.014	0.011
Spread (+)	-0.259	2.274	3.585	1.116	6.964	3.825	-0.112	-2.502
	0.715	0.899	1.182	1.193	2.266	1.000	0.683	0.681
3 mo (-)	-0.580	-0.605	-1.817	-0.451	-13.523	-0.696	-0.287	-1.144
	0.302	0.300	0.508	0.405	5.880	0.278	0.261	0.345
FCI (-)	-0.023	-0.017	-0.017	0.012	0.045	-0.022	-0.012	-0.010
	0.008	0.006	0.007	0.013	0.017	0.008	0.007	0.005
FTS (+)	1.009	-1.481	-1.610	-0.325	1.167	-0.839	-0.599	5.278
	1.046	0.680	1.036	1.065	0.992	0.754	1.045	0.919
Adj R sq.	0.310	0.300	0.458	0.061	0.242	0.472	0.065	0.632
N	288	288	288	288	285	288	288	288

Full Specification, Shorter Sample

Table 6: OLS Regression of Industrial Production Growth Next Twelve Months, 1995-2019

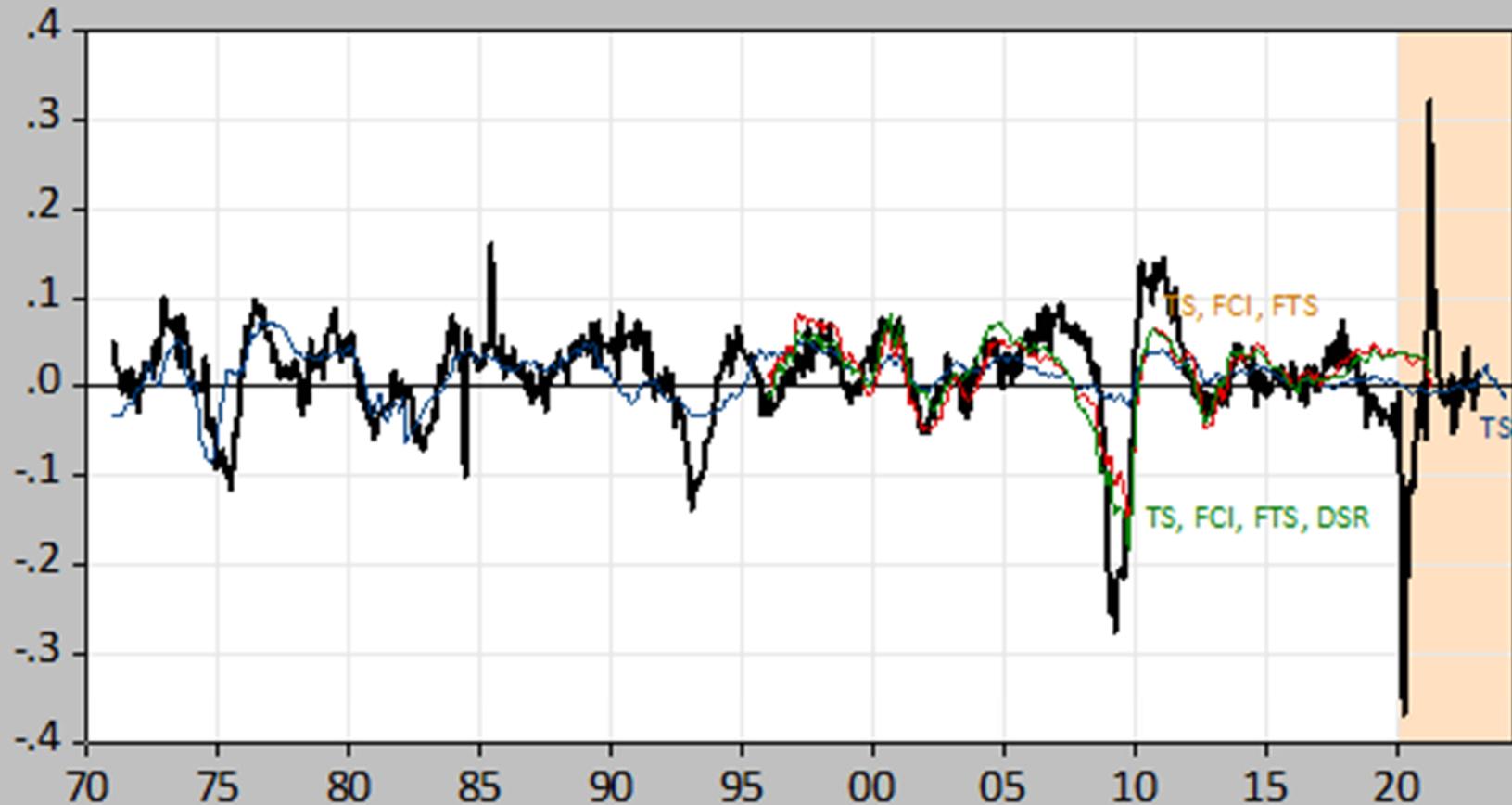
Coefficient	CA	FR	GY	IT	JP	SN	UK	US
Constant	-0.223	0.073	-0.268	0.236	-0.143	0.003	0.197	0.042
	0.063	0.098	0.115	0.073	0.084	0.063	0.031	0.063
Spread (+)	-0.287	1.981	3.682	1.553	4.802	3.703	-0.957	-2.385
	0.743	1.043	0.960	0.975	2.197	1.125	0.520	0.712
3 mo (-)	-0.305	-0.788	-2.847	0.448	-16.169	-0.722	-0.536	-1.044
	0.303	0.389	0.651	0.394	7.007	0.290	0.205	0.438
FCI (-)	-0.024	-0.015	-0.004	-0.018	0.045	-0.022	-0.009	-0.010
	0.006	0.007	0.009	0.009	0.016	0.008	0.004	0.005
FTS (+)	1.749	-1.376	-2.653	0.838	1.268	-0.688	-0.036	5.189
	1.168	0.710	1.037	0.955	1.071	0.832	0.697	0.950
DSR (-)	1.068	-0.384	2.688	-2.569	0.693	-0.085	-0.036	-0.130
	0.264	0.508	0.977	0.841	0.570	0.277	0.697	0.444
Pseudo R								
sq.	0.434	0.313	0.533	0.307	0.279	0.480	0.394	0.637
N	288	288	288	288	285	288	288	288

US: Comparison of Prediction



— IPGROWTH_US(-12) — USFIT1I(-12)
— USFIT2I(-12) — USFIT3I(-12)

German Comparison of Prediction



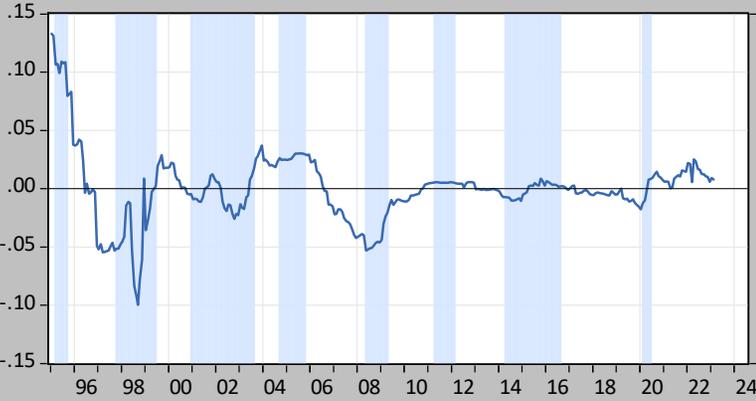
— IPGROWTH_GY(-12) — GYFIT1I(-12)
— GYFIT2I(-12) — GYFIT3I(-12)

Emerging Market Economies

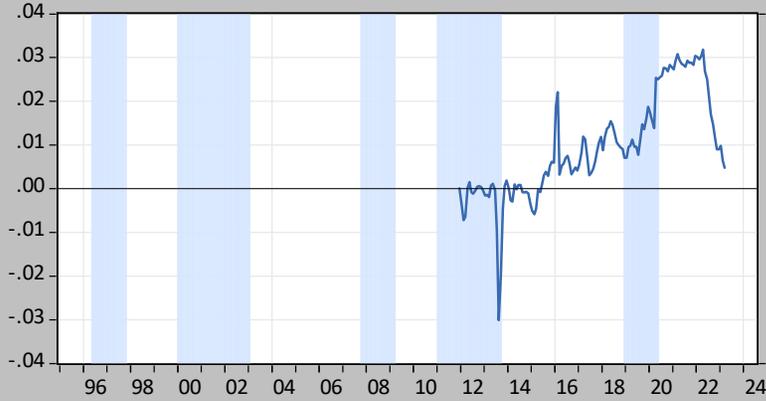
The term spread as predictor makes sense if

- Bond markets are liquid
- Long term bond prices reflect expected future short term bond prices
- The monetary authority undertakes countercyclical policy using the short term rate
- In EMDEs, govt bond markets are not as liquid

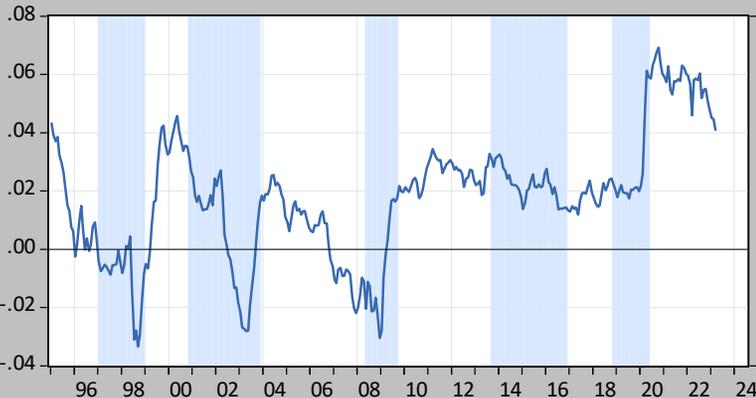
Term Spreads and Recessions in EME's



— SPREAD_BR RECESSION_BR



— SPREAD_IN RECESSION_IN



— SPREAD_ZA RECESSION_ZA



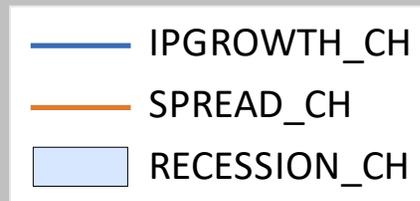
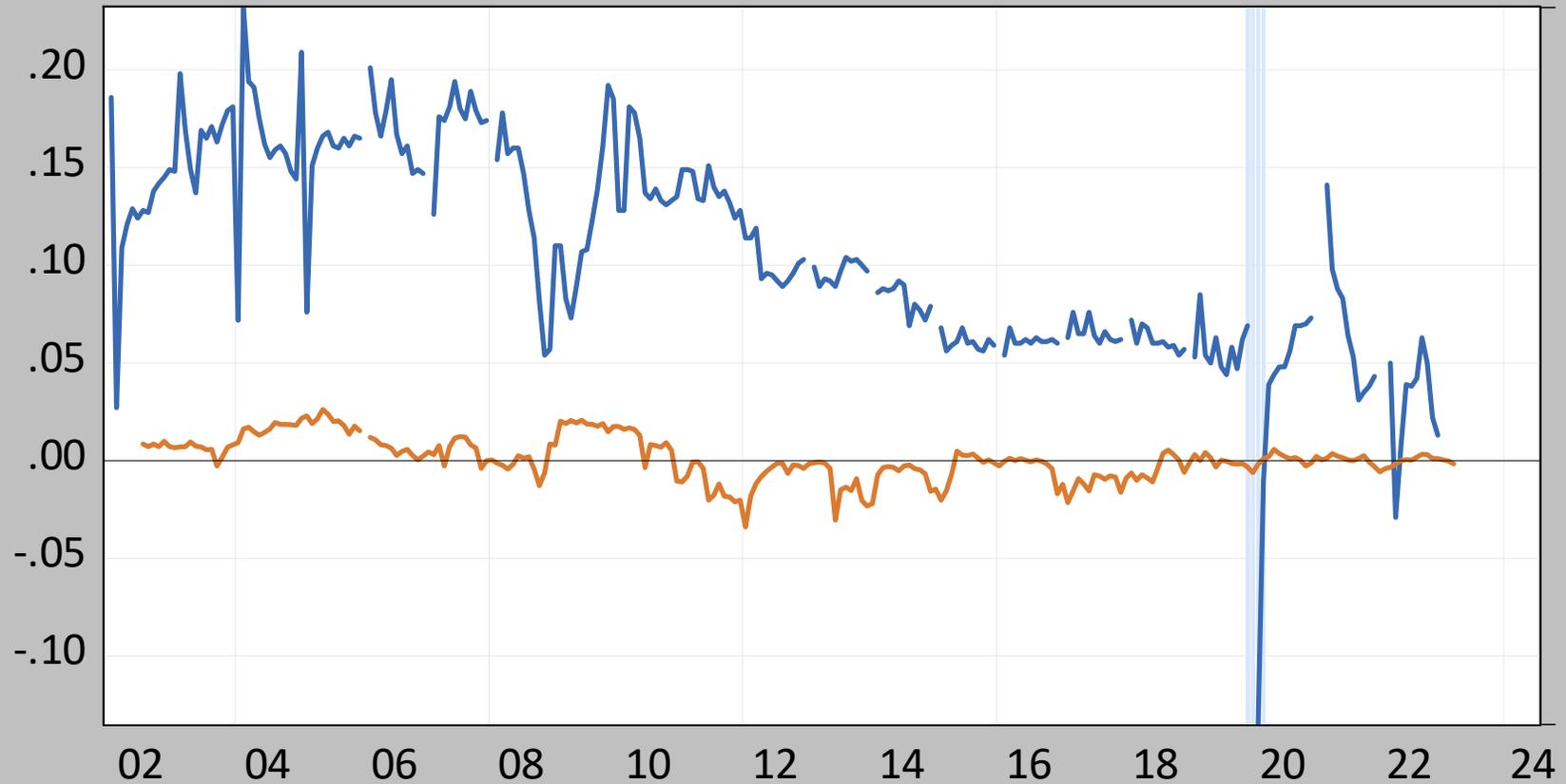
— SPREAD_KO RECESSION_KO

Probits for EME's

Table 7: Probit Recession Twelve months ahead, 1970-2023M02

coefficient	BR	IN	CH	ZA	KO
constant	-0.388	-8.880	0.817	-0.571	-2.517
	0.201	2.289	2.054	0.285	0.358
Spread (-)	-9.466	145.965	-102.830	-2.433	14.368
	2.920	46.333	74.696	4.581	14.774
3 mo (+)	0.793	103.132	-88.295	4.557	28.031
	2.201	28.246	63.838	2.552	8.090
Pseudo R sq.	0.034	0.129	0.071	0.018	0.099
N	326	123	235	326	257

China Is Problematic



Probits for EME's

Table 8: Probit Recession Twelve months ahead, 1995-2021M05

coefficient	BR	IN	CH	ZA	KO
constant	-0.448	-23.336	-0.089		-0.484
	0.275	4.962	2.327		0.641
Spread (-)	-12.221	333.936	-43.228		-0.590
	3.143	79.829	94.782		26.534
3 mo (+)	-2.961	328.339	-35.976		-26.183
	2.706	69.670	70.940		18.153
FCI (+)_	0.038	0.576	0.262		2.081
	0.094	0.499	0.339		0.682
FTS (-)	34.128	-341.844	-139.803		-57.329
	9.965	79.638	68.668		25.047
Pseudo R sq.	0.058	0.374	0.291		0.175
N	305	102	214		236

Probits for EME's

Table 9: Probit Recession Twelve months ahead, 1995-2021M05

coefficient	BR	IN	CH	ZA	KO
constant		-20.551	-9.197		-0.469
		5.144	11.240		2.473
Spread (-)		310.102	19.400		-0.596
		79.433	122.184		26.555
3 mo (+)		366.144	0.276		-26.218
		78.852	89.791		19.076
FCI (+)		1.263	-0.653		2.082
		0.617	1.237		0.721
FTS (-)		-268.859	-115.084		-57.353
		88.963	79.538		25.369
DSR (+)		-50.493	45.184		-0.070
		19.689	57.849		11.686
Pseudo R sq.		0.436	0.325		0.175
N		102	214		236

OLS for EME's

Table 10: OLS Industrial Prod Growth Next Twelve Months, 1970-2019

coefficient	BR	IN	CH	ZA	KO
constant	-0.020	0.196	0.040	0.003	-0.006
	0.019	0.041	0.037	0.042	0.012
Spread (+)	0.406	-2.962	3.952	-0.388	3.287
	0.329	0.890	0.960	0.835	1.019
3 mo (-)	0.325	-2.061	2.122	0.570	0.528
	0.188	0.536	0.982	0.409	0.586
Adj R sq.	0.061	0.150	0.285	0.089	0.150
N	288	85	189	288	219

OLS for EME's

Table 11: OLS Industrial Prod Growth Next Twelve Months, 1995-2019

coefficient	BR	IN	CH	ZA	KO
constant	-0.054	0.262	0.060		0.116
	0.023	0.032	0.033		0.043
Spread (+)	0.483	-3.099	1.356		-0.365
	0.231	0.655	1.095		1.276
3 mo (-)	0.642	-3.636	1.401		-3.175
	0.199	0.522	0.943		1.428
FCI (-)	-0.021	-0.010	-0.026		0.148
	0.007	0.011	0.005		0.051
FTS (+)	0.448	5.024	0.755		-0.096
	0.873	1.250	0.609		0.984
Adj R sq.	0.160	0.366	0.460		0.307
N	288	85	189		219

OLS for EME's

Table 12: OLS Industrial Prod Growth Next Twelve Months, 1995-2019

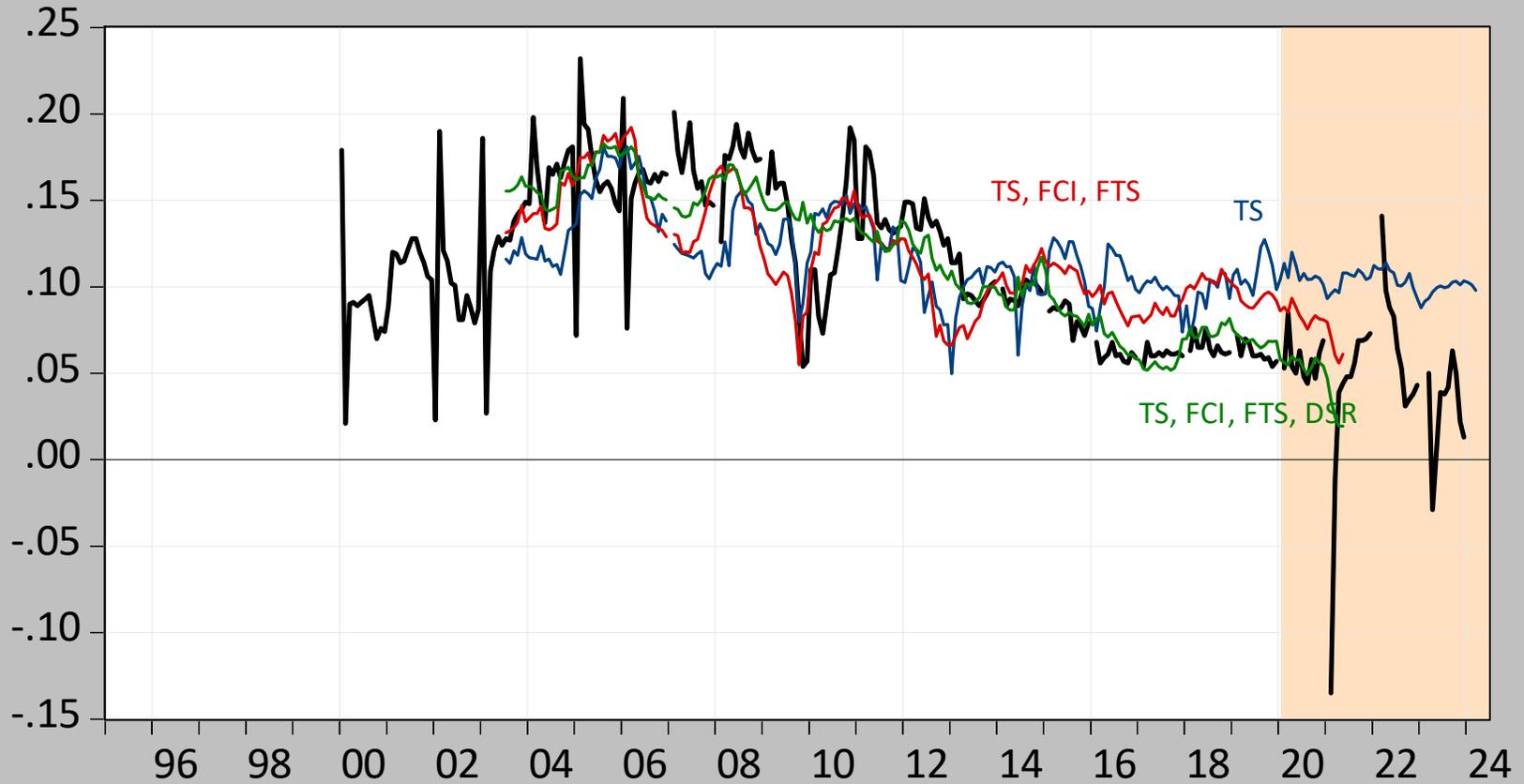
coefficient	BR	IN	CH	ZA	KO
constant		0.237	0.234		0.434
		0.027	0.051		0.113
Spread (+)		-2.986	0.870		-0.608
		0.614	0.676		1.337
3 mo (-)		-4.027	1.535		-4.065
		0.570	0.641		1.528
FCI (-)		-0.017	-0.011		0.183
		0.011	0.005		0.053
FTS (+)		3.666	0.526		-0.286
		1.100	0.410		0.855
DSR (-)		0.556	-1.132		-1.567
		0.251	0.217		0.467
Pseudo R sq.		0.397	0.707		0.388
N		85	189		219

OLS for EME's

Table 12: OLS Industrial Prod Growth Next Twelve Months, 1995-2019

coefficient	BR	IN	CH	ZA	KO
constant		0.237	0.234		0.434
		0.027	0.051		0.113
Spread (+)		-2.986	0.870		-0.608
		0.614	0.676		1.337
3 mo (-)		-4.027	1.535		-4.065
		0.570	0.641		1.528
FCI (-)		-0.017	-0.011		0.183
		0.011	0.005		0.053
FTS (+)		3.666	0.526		-0.286
		1.100	0.410		0.855
DSR (-)		0.556	-1.132		-1.567
		0.251	0.217		0.467
Pseudo R sq.		0.397	0.707		0.388
N		85	189		219

OLS for China



— IPGROWTH_CH(-12) — CHFIT1I(-12)
— CHFIT2I(-12) — CHFIT3I(-12)

Conclusions

- Recessions are predictable in most high income country cases
- The determinants are not consistent across countries (sometimes FCI, or DSR)
- Term spread is significant in bivariate context, but is not robust
- Spreads and other financial variables less successful in EM's

Next Steps

- Update FCIs
- Calculate out-of-sample metrics for industrial production growth
- Cross check results with GDP
- Nowcast DSRs?
- Consider alternative foreign variable (e.g., US monetary shocks)