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Abstract: Severe simultaneous recessions are defined to occur when at least half of the countries under investigation (Australia, Canada, Germany, Japan, United Kingdom, and United States) are in recession simultaneously. I pose two new research questions that extend upon stylized facts for US recessions. One, are the occurrences of simultaneous recessions predictable? Two, does the yield spread predict future occurrences of simultaneous recessions? I use the indicator for severe simultaneous recessions as the explained variable in probit models. The lagged yield spread is an important explanatory variable, where decreasing yield spreads are a leading indicator for severe simultaneous recessions.

Keywords: Business cycle; Recessions; Yield spread; Probit model

JEL Classifications: C25; E32; E43; F44; G15

1 Introduction

Previous research has considered the predictability of recessions of a single country, most often the United States. The yield spread (the long interest rate minus the short interest rate) is known to predict future single-country recessions. In this paper I consider severe simultaneous recessions instead of single-country recessions as it is even more important to be able to foresee these than single-country recessions.

A severe simultaneous recession is defined to occur when at least half of the countries being studied are in recession simultaneously. The countries under investigation are six large developed countries, namely Australia, Canada, Germany, Japan, United Kingdom, and United States. To my knowledge, simultaneous recessions have not been investigated previously.

I use the probit model to describe the indicator variable for occurrence of simultaneous recessions. I provide both in-sample and out-of-sample analysis at $1 - 12$ month horizons. Future simultaneous recessions are predictable, and more so at short horizons than at long horizons. The yield spread has an important influence upon the likelihood of future simultaneous recessions. Small yield spreads imply future simultaneous recessions. The lagged indicator for simultaneous recessions is also a significant and important explanatory variable. In many ways, the empirical findings regarding severe simultaneous recessions are parallel to the findings regarding single-country recessions.

Why does the yield spread predict future recessions? The literature gives a number of different answers to this question, cf. the overview in Wheelock and Wohar (2009). The yield spread is a measure of the shape of the yield curve. Increasing yield spreads are a leading indicator for expansions and decreasing yield spreads are a leading indicator for recessions. The expectations hypothesis is often used to explain the stylized fact. According to the expectations hypothesis the yield spread is equal to the expected future short rate and a term premium. Falling yield spreads before recessions are caused by both factors, where the decreasing expectations to future short rates is more important, cf. Hamilton and Kim (2002). Another explanation why yield spreads predict future recessions is based upon monetary policy. Tight monetary policy is used to stabilize output growth and causes the yield spread to decrease. The power of the yield spread as a leading indicator depends on the monetary authority's behavior, cf. Estrella (2005). Consumption smoothing across business cycles is another explanation for the yield spread's role a leading indicator based on the model in Harvey (1988). When investors expect recessions they sell short term bonds and buy long term bonds, which implies decreasing yield spreads. Yet, Harvey (1988) concerns real interest rates whereas most empirical work is done on nominal interest rates.

Previous research shows that the yield spread is an important predictor for future output, most often measured by GDP growth rates. Stock and Watson (1989) show that the yield spread acts as a leading indicator for the GDP growth rate. Estrella and Hardouvelis (1991) document that a positive yield spread predicts future increases in real economic activity. Hamilton and Kim (2002) confirm the usefulness of the yield spread for predicting future GDP growth rates. In addition, Hamilton and Kim (2002) analyze why the yield spread predicts future GDP growth rates. According to the expectations hypothesis, the yield spread is the expectation of future short rates and a term premium. Hamilton and Kim (2002) show that the most important reason why the yield spread forecasts future GDP growth rates is that low yield spreads imply falling future short rates. Interest rate volatility does not explain the importance of the yield spread. Estrella (2005) provides a theoretical model in which the yield spread explains output and inflation. He shows that the predictive ability of the yield spread depends on the monetary policy reaction function.

The yield spread is also an important predictor for future US recessions. This is not surprising as recessions are naturally related to GDP growth rates. US recessions are dated by the NBER Business Cycle Dating Committee. Estrella and Mishkin (1998) investigate the predictability of future US recessions using probit models. They show that the yield spread is the most promising explanatory variable. Estrella and Hardouvelis (1991) use the yield spread to predict future US recessions within a probit model. Dueker (1997) extends upon this by considering a dynamic probit model where the lagged recession variable is included as an explanatory variable. Estrella and Trubin (2006) contain some practical guidelines about using the yield spread as a leading indicator. This is evidence of the popularity of the yield spread as a leading indicator for US recessions. Wright (2006) shows that using the federal funds rate in addition to the yield spread improves the predictability of future recessions. He considers the likelihood of a recession occurring during successive quarters instead of during a specific quarter as is usual. Rudebusch and Williams (2009) show that the yield spread is better able to forecast future recessions than professional forecasters are. Kauppi and Saikkonen (2008) suggest a dynamic autoregressive probit model to estimate US recessions from yield spreads, where the lagged recession indicator and lagged recession probability are used as an explanatory variable. They also provide improved multi-period forecasts.

Although most research in this area is conducted on US data, there are a few international studies. Still, all international studies consider recessions in each country separately. Stock and Watson (2003) forecast GDP growth rates for seven developed countries (Canada, France, Germany, Italy, Japan, UK, and US) using various economic explanatory variables including the yield spread. The yield spread is a good predictor, but there are variations across countries and across periods. Moneta (2005) considers the euro area collectively and uses the yield spread to forecast future euro area recessions. The findings for the euro area are similar to those for the US. Chinn and Kucko (2010) investigate the predictive ability of the yield spread for economic activity and recessions in different countries (Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, UK, and US). The predictive power of the yield spread varies across countries and is declining over time. Schrimpf and Wang (2010) consider four large economies (Canada, Germany, UK, and US) and investigate the ability of the yield spread to predict output growth. They find evidence of structural breaks. Again, the power of the yield spread is declining over time. Nyberg (2010) investigates recessions in the US and Germany. He uses the dynamic autoregressive probit model of Kauppi and Saikkonen (2008). The yield spread is an important explanatory variable for both countries, but other variables provide additional explanatory power, such as stock returns, interest rate differential between US and Germany, and the other country's yield spread.

Wheelock and Wohar (2009) review the literature on the ability of the yield spread to predict output growth and recessions. In general, they consider the literature in favor of the yield spread as an important leading indicator.

The remaining part of the paper is structured as follows. First, the data are introduced in Section 2. Second, the econometric framework is laid out in Section 3. Third, the in-sample results are discussed in Section 4, which is followed by the out-of-sample evidence in Section 5. Finally, Section 6 concludes.

2 Data

I use monthly data covering the period $1953M04$ to $2010M12$. The starting point is determined by the availability of the recession data.

2.1 Recession Data

I use the NBER business cycles to date the US recessions. These cycle dates are publicly available and have been used in all previous studies of US recessions that I am aware of.[1] The "peak" month defines the first month in recession, and the

[1] The NBER business cycle dates are available from `www.nber.org/cycles/`

month before the "through" month defines the last month in recession. Thus, the most recent recession is December 2007 through May 2009. I introduce a dummy variable that equals 1 when the US is in recession and 0 otherwise; US_t.

For Australia, Canada, Germany, Japan, and the United Kingdom I use the Economic Cycle Research Institute (ECRI) business cycle dates.[2] The ECRI uses the same methodology to date business cycles as the NBER. The ECRI business cycle data appear to be the standard data source for non-US recessions, cf. Nyberg (2010), Chinn and Kucko (2010), and Schrimpf and Wang (2010). The recession indicators for Australia, Canada, Germany, Japan, and the United Kingdom are denoted AU_t, CA_t, GE_t, JP_t, and UK_t and are defined similarly to US_t.

Figure 1 shows the time series evolution of the individual recession indicators. Table 1 tabulates the frequency of the recession indicators. Germany is most often in recession (22% of the sample period) and Australia is the least often in recession (8% of the sample period). On average, each country is in recession 15% of the sample period. The recession periods of the six countries are obviously not identical.

The variable CR_t counts the number of simultaneous recessions.

$$CR_t = AU_t + CA_t + GE_t + JP_t + UK_t + US_t \tag{1}$$

The larger CR_t is, the more severe is the overall crisis of the world economy. Table 1 tabulates CR_t. Most of the time, no countries are in recession (396 out of 693 months). 19% of the time only one country is in recession and 10% of the time two countries are in recession. In 94 months (14%) there are simultaneous recessions in at least three countries. Of these instances, exactly three countries in recession is most common (54 months), then four (26), and then five (14). All six countries are newer in recession simultaneously.

I construct a dummy variable for severe simultaneous recessions in the six countries. The variable DR_t is an indicator for the occurrence of simultaneous recessions at time t which equals 1 when at least three countries are in recession at time t and 0 otherwise. Thus, I define a severe simultaneous recession period when at least half of the countries under investigation are in recession at the same time.

$$DR_t = \begin{cases} 0 \text{ if } CR_t \leq 2 \\ 1 \text{ if } CR_t \geq 3 \end{cases} \tag{2}$$

Table 1 also tabulates DR_t. Most often DR_t is zero (in 599 out of 693 months)

[2] The ECRI business cycle dates are available at `www.businesscycle.com/resources/cycles`.

indicating that the world economy is not in severe simultaneous recession. In 94 months (14%) there are simultaneous recessions in at least three countries (i.e. where $DR_t = 1$). Thus, the amount of time that the world economy is in severe simultaneous recession is comparable to the amount of time that each country is in recession.

Figure 2 shows the number of countries in recession (CR_t) as well as the recession indicator (DR_t). The periods of simultaneous recessions are detailed in Table 2. There are six severe simultaneous recessions in the sample period. On average, the severe simultaneous recession period lasts for 16 months. The two most recent severe simultaneous recessions are the dot-com bubble in 2001 and the financial crisis in $2008 - 2009$.

2.2 Yield Spread

The symbol for the yield spread is YS_t. The term structure data are available from the FRED database at the Federal Reserve Bank of St. Louis. The yield spread is the difference between the 10-year rate and the 3-month rate. The 10-year rate is the 10-year constant maturity rate (FRED symbol is G10). The 3-month rate is the 3-month Treasury bill secondary market rate (TB3MS). The choices of for constructing the yield spread are similar to previous studies including Estrella and Mishkin (1998) and Wright (2006).

Figure 3 shows the time series evolution of the yield spread and the indicator for simultaneous recessions. The yield spread is strongly variable during the sample period. The yield spread is typically positive but it is negative in some shorter periods. In general, the yield spread is falling and it is often negative in the period up to a simultaneous recession. This gives an early signal that the yield spread could be an important explanatory variable for simultaneous recessions.

3 Probit Model for Simultaneous Recessions

The indicator variable for simultaneous recessions (DR_t) is a binary choice variable. Thus, DR_t is comparable to the single country recession indicator, say US_t that is previously described by the probit model, cf. Estrella and Mishkin (1998), Dueker (1997), Wright (2006), Estrella and Trubin (2006), Rudebusch and Williams (2009), Kauppi and Saikkonen (2008), and Schrimpf and Wang (2010). In consequence, the probit model is used to describe DR_t as well.

Let x_t denote the explanatory variables at time t and β be the parameter vector, then the probability of a simultaneous recession depends on x_t as follows:

$$\begin{aligned}\Pr\left(DR_t = 1|x_t, \beta\right) &= \Phi\left(x'_{t-k}\beta\right) \\ DR_t &= \Phi\left(x'_{t-k}\beta\right) + \varepsilon_t\end{aligned} \tag{3}$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution and ε_t is the error term. The probit model is applied to both in-sample and out-of-sample analysis. Horizons between 1 and 12 months are considered; $k = \{1, 2, \ldots, 12\}$.

The explanatory variables in the **full model** are a constant, the lagged indicator for simultaneous recessions, and the lagged yield spread.

$$x'_{t-k} = \left\{ \begin{array}{ccc} c & DR_{t-k} & YS_{t-k} \end{array} \right\} \tag{4}$$

Using the lagged explained variable itself as an explanatory variables is similar to Dueker (1997) and is what he terms a dynamic probit model. In addition, we consider the effect of each of the explanatory variables individually using **model (a)**

$$x'_{t-k} = \left\{ \begin{array}{cc} c & DR_{t-k} \end{array} \right\} \tag{5}$$

and **model (b)**

$$x'_{t-k} = \left\{ \begin{array}{cc} c & YS_{t-k} \end{array} \right\} \tag{6}$$

4 In-Sample Results

Table 3 shows the results from estimating the probit model for the entire sample period for horizons $k = 3, 6, 9, 12$.[3] The explanatory power as measured by McFadden (1974) R-squared is decreasing, the longer the forecast horizon. This is probably as expected as it is likely to be more difficult to predict further into the future. At a 3-month horizon, the R-squared is 0.58, whereas it is much smaller at the 12-month horizon where it is 0.21.

The coefficient to DR_{t-k} is positive no matter the horizon. This entails that current simultaneous recessions imply a stronger likelihood of future simultaneous recessions k periods ahead. This simply says that recessions and expansions tend to persist for several months.

The coefficient to YS_{t-k} is negative across all horizons. This means that smaller yield spreads today imply a stronger likelihood of simultaneous recessions in the future. The coefficient to YS_{t-k} is significant which implies that

[3] The estimation is done partly in EViews and partly in GAUSS.

the yield spread is an important leading indicator.

The estimated probit models for the simultaneous recession indicator DR_t are to some extend similar to the probit models for the US recession indicator, US_t. For US_t it is also the case that there is positive dependence upon the lagged recession indicator and negative dependence upon the lagged yield spread. In contrast, for single-country recessions the predictability of future recessions is increasing with the forecast horizon, cf. Dueker (1997) whereas it is decreasing for severe simultaneous recessions.

Table 4 concerns the in-sample predictability represented by the root mean square error ($RMSE$) and the mean absolute error (MAE). For horizon k these are calculated as follows

$$\begin{aligned} RMSE_k &= \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\widehat{p}_{t,t+k} - DR_{t+k}\right)} \qquad (7) \\ MAE_k &= \frac{1}{T}\sum_{t=1}^{T}\left|\widehat{p}_{t,t+k} - DR_{t+k}\right| \end{aligned}$$

where T is the number of observations. $\widehat{p}_{t,t+k}$ is the fitted probability of a recession at time $t+k$; $\widehat{p}_{k,t+k} = \Phi\left(x'_{t+k}\widehat{\beta}\right)$ where $\widehat{\beta}$ is the vector of estimated coefficients for the probit model given in equation (3) When $\widehat{p}_{t,t+k} \geq 0.5$ the model predicts that the economy is in recession at time $t+k$. In addition, the R-squared is listed. The table shows the results for the full model and for models (a) and (b). For all three predictability measures and for all horizons, the in-sample predictability is superior for the full model to both models (a) and (b).

At short horizons, the in-sample predictability is mainly caused by the lagged simultaneous recession indicator DR_{t-k}, which is seen by the fact that the $RMSE_k$ and MAE_k are not much smaller for the full model than for model (a). Still, the yield spread is also important, which is seen by comparing the R-squared of the full model and model (a). At the 3-month horizon the R-squared for the full model is 0.58, whereas it is 0.49 for model (a) and 0.04 for model (b).

Figure 4 shows the in-sample predictability at a 3-month horizon graphically. The figure shows the fitted probability of a recession, $\widehat{p}_{t,t+3}$ for each model. The full model and model (a) both correctly identify the severe simultaneous recession periods during the sample. For model (b), the forecasted probability of a severe simultaneous recession increases in the periods leading up to the severe simultaneous recession, but it does not increase above the 0.50 threshold that formally indicates a severe simultaneous recession. At the 3-month horizon, the yield spread in itself is not adequate information to identify future recessions correctly.

At long horizons the roles of DR_{t-k} and YS_{t-k} are reversed, namely the predictability is mainly caused by the lagged yield spread and not so much by the autoregressive component. Figure 5 shows the in-sample predictability at the 12-month horizon. The fitted probability of simultaneous recessions ($\widehat{p}_{t,t+12}$) is almost identical for the full model and model (b). The predicted probability of a recession is increasing before all recessions, but the predicted probability does not increase above the 0.50 threshold. At the 12-month horizon, model (a) is not helpful for in-sample prediction. At longer horizons, the predictability is not so good for the last three simultaneous recessions for all three models. The fact that the predictive ability of the yield spread is decreasing over the sample period is similar to the findings in Schrimpf and Wang (2010) regarding individual-country recessions.

5 Out-of-Sample Results

The out-of-sample predictability is investigated. I use a rolling window of 360 observations to estimate the probit model. The out-of-sample period is $1984M12$ to $2010M12$, giving 318 observations. The out-of-sample period covers the last three recessions. Again, I use horizons of $k = 1, 2, \ldots, 12$ months.

Using the first 360 observations I estimate the probit model and make one out-of-sample forecast of the simultaneous recession probability k months ahead, $\widehat{p}_{1,1+k}$. Then the probit model is re-estimated for the updated sample where the oldest observation is discarded and one more recent observation is included. A new out-of-sample estimate is then calculated. The out-of-sample estimation continues this way.

Table 5 shows the out-of-sample predictability as measured by the $RMSE$ and MAE calculated similar to the in-sample counterparts in equation (7) above. T is now the number of out-of-sample forecasts. In addition, the pseudo R-squared is shown. It is calculated as in Estrella (1998) and it compares the log-likelihood of the estimated probit model (l_U) to the log-likelihood of a probit model including only a constant (l_C):

$$\text{pseudo } R^2 = 1 - \left(\frac{l_U}{l_C}\right)^{-(2/T)l_C} \tag{8}$$

The properties of the out-of-sample predictability are similar to the in-sample predictability. The out-of-sample predictability is stronger the shorter the forecast horizon. At short horizons, the autoregressive component (DR_{t-k}) is most important and at long horizons the yield spread (YS_{t-k}) is most important. Still, at all horizons the full model has the best predictive ability above models (a) and (b). The R-squared is very large, implying that the explanatory variables have strong predictive power compared to just a constant. At the 3-month out-of-sample horizon, the pseudo R-squared is 0.90 for the full model, and 0.89 and 0.61 for models (a) and (b).

Figure 6 shows the out-of-sample predictability at the 3-month horizon. The full model and model (a) both predict all recessions in the out-of-sample period. Model (b) does not predict the recessions precisely, but the forecasted probability of future recession does increase in the periods leading up to the recessions but not above the 0.50 threshold. At the 3-month horizon the yield spread has some but not adequate informative value about future severe simultaneous recessions.

Figure 7 shows the out-of-sample predictability at the 12-month horizon. At the 12-month horizon, model (a) cannot predict any of the simultaneous recessions. The full model and model (b) have almost identical forecasts. They correctly identify the second last simultaneous recession. For the 1990 (third last) and the 2008−2009 (last) simultaneous recessions, the predicted probability of future simultaneous recessions does increase up to the recessions, but not above the 0.50 threshold. At the 12-month horizon the suggested probit model is not doing so well. So, the models do not identify the two recessions precisely.

6 Conclusion

Here I provide the first analysis of severe worldwide recessions as measured by the occurrence of simultaneous recessions in a number of individual countries. I consider recessions in Australia, Canada, Germany, Japan, United Kingdom, and US. A severe simultaneous recession is when at least three countries are in recession at the same time. The indicator for severe simultaneous recessions follows a probit model where the explanatory variables are the lagged indicator for simultaneous recessions and the lagged yield spread.

The future simultaneous recessions are predictable in-sample and to some extend also out-of-sample. The future simultaneous recessions are more predictably at shorter horizons than at longer horizons. The yield spread is mainly important for predictability at longer horizons.

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Table 1: Frequency Tabulation of Recession Variables

Value	AU		CA		GE		JP		UK		US		DR		CR	
0	640	92%	603	87%	544	79%	563	81%	617	89%	582	84%	599	86%	396	57%
1	53	8%	90	13%	149	22%	130	19%	76	11%	111	16%	94	14%	133	19%
2															70	10%
3															54	8%
4															26	4%
5															14	2%
6															0	0%

The table shows the distribution of the recession variables; AU, CA, GE, JP, UK, and US are the recession indicator variables for Australia, Canada, Germany, Japan, UK, and US. DR is an indicator for at least three countries in simultaneous recession. CR counts the number of simultaneous recessions

Table 2: Simultaneous Recession Periods

No	From	Through	Duration
1	1953M07	1954M04	10
2	1973M11	1975M02	16
3	1980M01	1980M06	23
	1981M04	1981M04	-
	1981M07	1982M10	-
4	1990M06	1992M02	21
5	2001M03	2001M10	8
6	2008M02	2009M05	16

The table shows the beginning and ending of each of the periods of simulteneous recessions and their duration (in months).

Table 3: Probit Models for Multiple Recessions

Horizon	k=3			k=6			k=9			k=12		
Constant	-1.39	(0.12)	***	-1.07	(0.11)	***	-0.86	(0.10)	***	-0.71	(0.09)	***
DR(-k)	3.10	(0.29)	***	1.96	(0.20)	***	1.26	(0.19)	***	0.71	(0.19)	***
YTS(-k)	-0.54	(0.12)	***	-0.52	(0.09)	***	-0.54	(0.07)	***	-0.60	(0.07)	***
McFadden R-squared	0.58			0.35			0.24			0.21		

Probit models for DR (indicator for at least three countries in simultaneous recession) where the explanatory variables are a constant, DR lagged, and the yield spread (YS) lagged for horizons of k=(3,6,9,12) months. Robust standard errors in parenthesis. */**/*** indicate that the parameter is significant at the 10%/5%/1% level of significance.

Table 4: In-Sample Predictiveability

Horison (k)	1	2	3	4	5	6	7	8	9	10	11	12
						Full model						
RMSE	0.149	0.197	0.226	0.253	0.276	0.291	0.298	0.304	0.308	0.310	0.311	0.308
MAE	0.047	0.075	0.094	0.113	0.129	0.140	0.147	0.152	0.158	0.160	0.159	0.156
McFadded R-squared	0.775	0.664	0.580	0.489	0.415	0.352	0.310	0.272	0.240	0.222	0.211	0.210
						Model (a)						
RMSE	0.148	0.199	0.230	0.257	0.278	0.295	0.306	0.315	0.321	0.324	0.326	0.328
MAE	0.047	0.083	0.109	0.134	0.155	0.173	0.184	0.193	0.199	0.201	0.203	0.203
McFadded R-squared	0.746	0.595	0.487	0.387	0.300	0.224	0.168	0.119	0.085	0.061	0.040	0.024
						Model (b)						
RMSE	0.342	0.340	0.337	0.333	0.329	0.324	0.319	0.315	0.313	0.311	0.309	0.304
MAE	0.234	0.231	0.228	0.223	0.218	0.213	0.207	0.202	0.199	0.196	0.191	0.186
McFadded R-squared	0.004	0.018	0.035	0.049	0.066	0.083	0.102	0.120	0.130	0.139	0.157	0.178

Root mean squared error (RMSE), mean absolute error (MAE), and McFadden R-squared for in-sample predictability for probit models for DR at horizons k=1,2,..,12 months. Explanatory variables at full model: constant, DR(-k), and YS(-k). Explanatory variables at model (a): constant and DR(-k). Explanatory variables at model (b): constant and YS(-k).

Table 5: Out-of-Sample Predictability

	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000
						Full model						
RMSE	0.134	0.186	0.222	0.251	0.275	0.293	0.302	0.311	0.314	0.315	0.318	0.321
MAE	0.041	0.071	0.096	0.122	0.142	0.158	0.168	0.176	0.180	0.182	0.185	0.186
Pseudo R-squared	0.971	0.933	0.899	0.869	0.840	0.816	0.803	0.789	0.783	0.779	0.775	0.770
						Model (a)						
RMSE	0.136	0.188	0.225	0.254	0.277	0.296	0.311	0.323	0.329	0.335	0.339	0.343
MAE	0.043	0.077	0.104	0.133	0.159	0.182	0.199	0.213	0.223	0.230	0.237	0.243
Pseudo R-squared	0.967	0.927	0.888	0.849	0.812	0.777	0.748	0.721	0.705	0.691	0.678	0.668
						Model (b)						
RMSE	0.354	0.358	0.359	0.357	0.354	0.350	0.345	0.341	0.337	0.334	0.331	0.329
MAE	0.240	0.233	0.228	0.223	0.218	0.213	0.207	0.204	0.201	0.198	0.194	0.190
Pseudo R-squared	0.631	0.618	0.613	0.621	0.630	0.644	0.665	0.683	0.700	0.715	0.729	0.741

Root mean squared error (RMSE), mean absolute error (MAE), and pseudo R-squared for out-of-sample predictability of probit model for DR at horizons k=1,2,..,12. Rolling window estimation, window length of 360 months. Explanatory variables at full model: constant, DR(-k), and YS(-k). Explanatory variables at model (a): constant and DR(-k). Explanatory variables at model (b): constant and YS(-k).

Figur 1: Single-Country Recessions

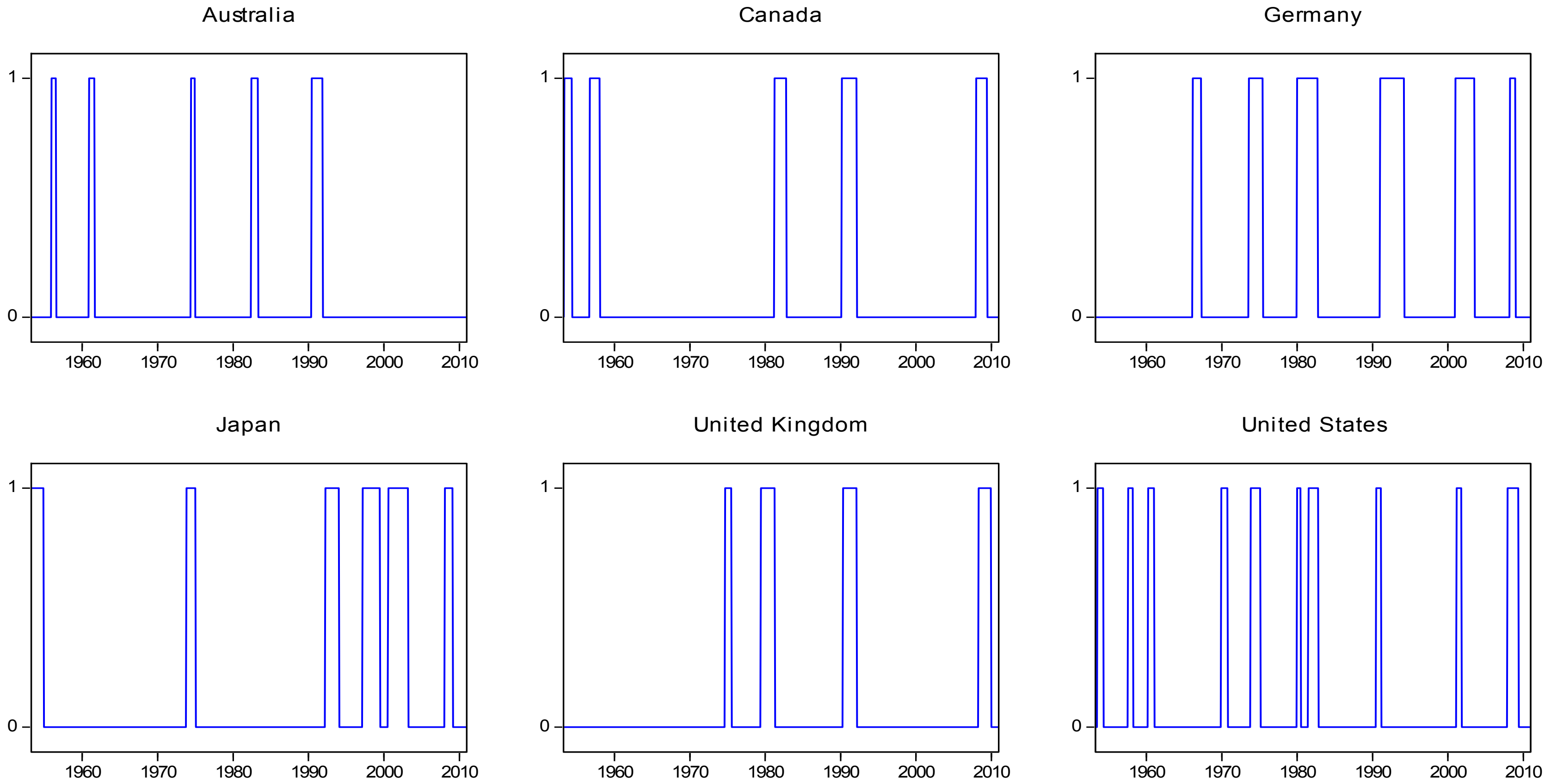


Figure 2: Simultaneous Recessions

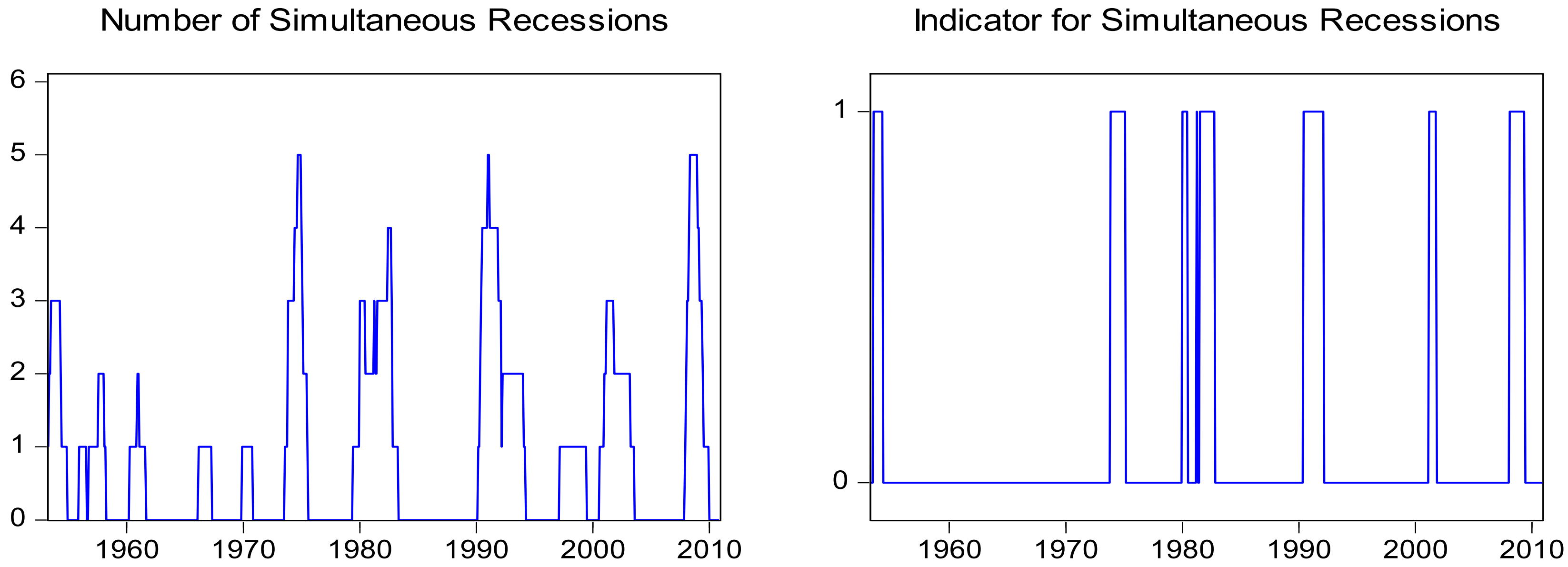


Figure 3: Term Spread and Indicator for Simultaneous Recessions

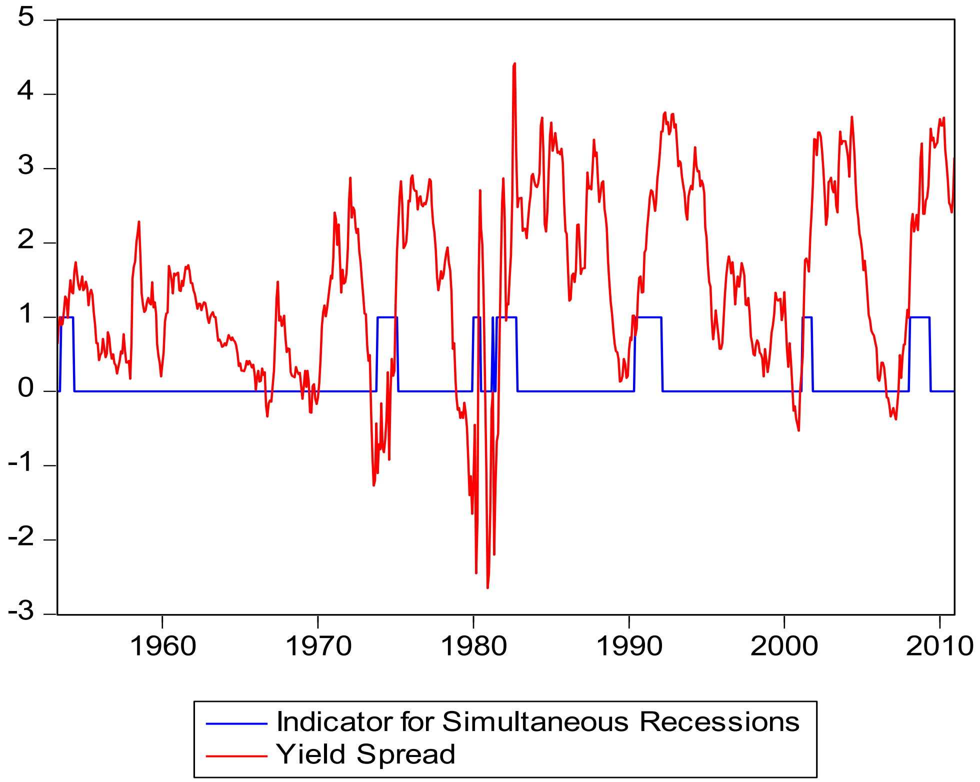


Figure 4: In-Sample Predictability at 3-Month Horizon

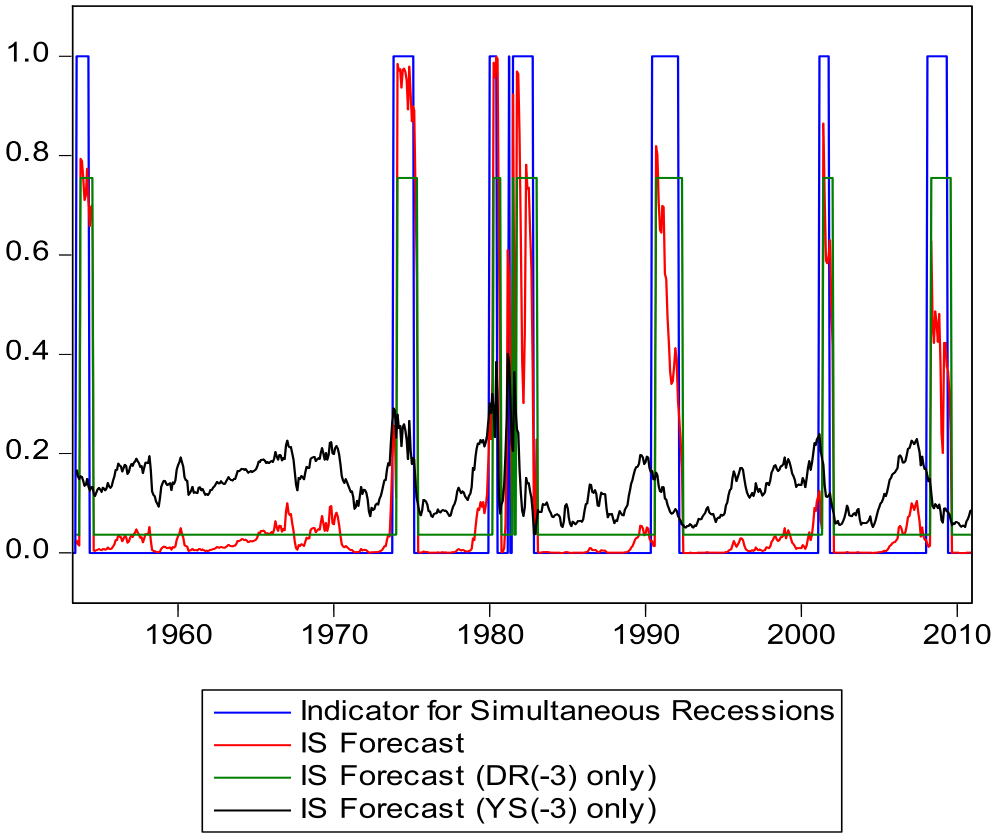


Figure 5: In-Sample Predictability at 12-Month Horizon

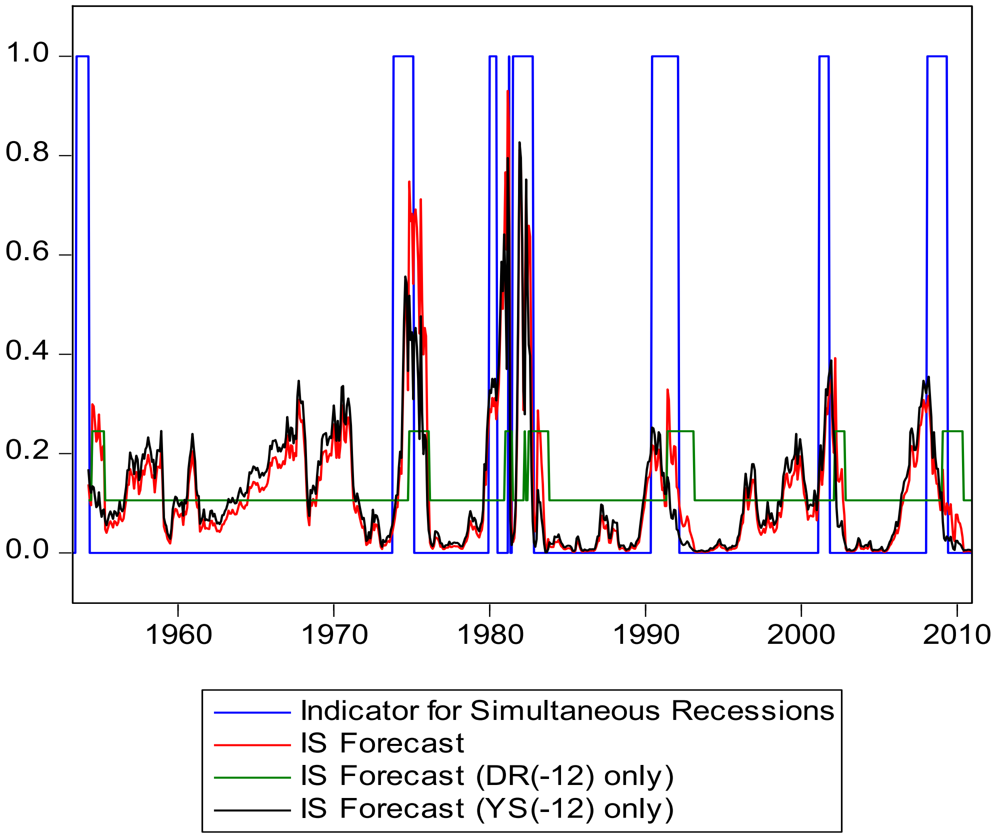


Figure 6: Out-of-Sample Predictability at 3-Month Horizon

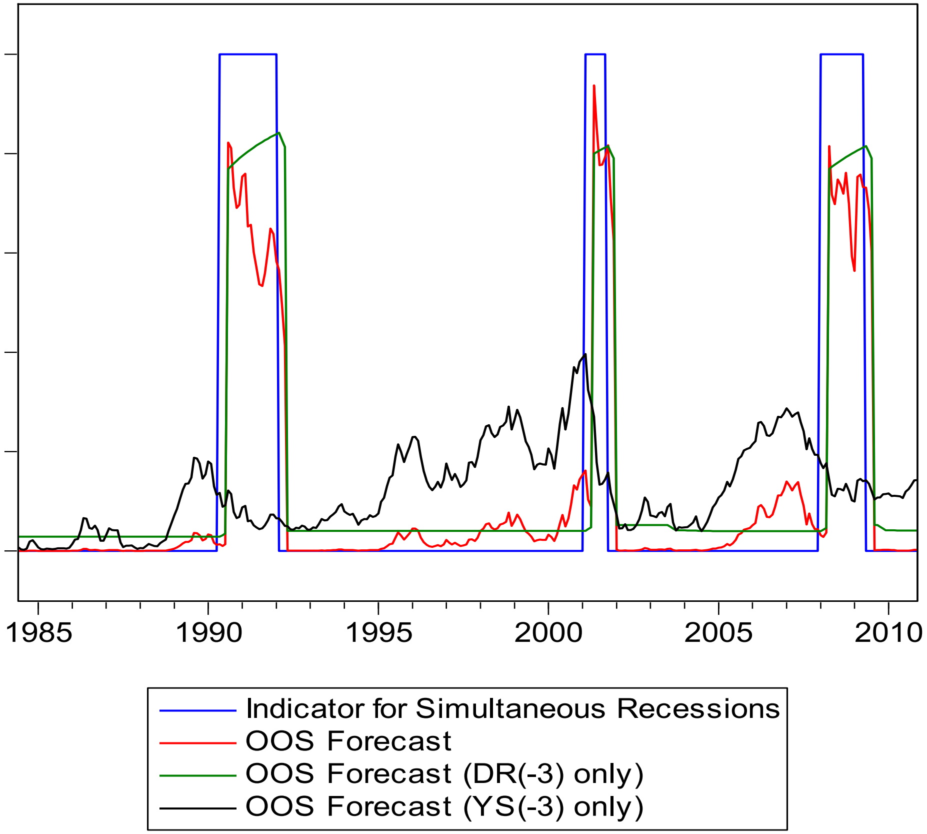
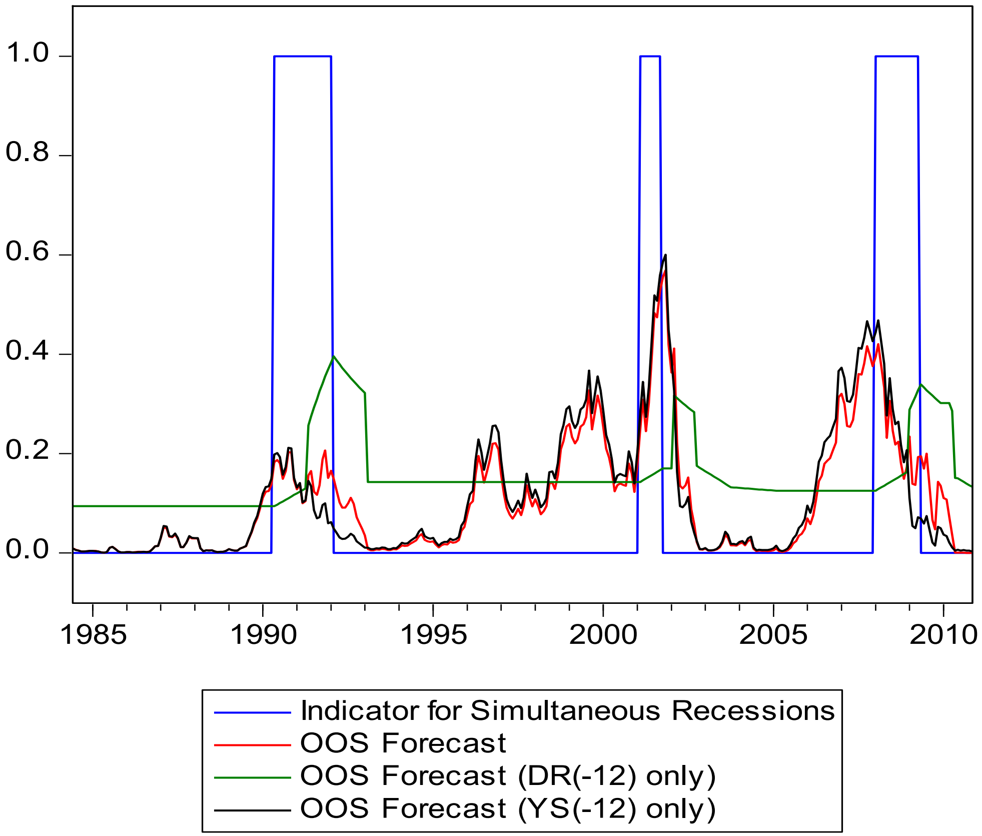


Figure 7: Out-of-Sample Predictability at 12-Month Horizon



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