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The Predictive Power of the Yield Curve Across Countries and Time*

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Abstract

In recent years, there has been renewed interest in the yield curve (or alternatively, the term premium) as a predictor of future economic activity. In this article, we re-examine the evidence for this predictor for both the United States and other advanced economies. We examine the sensitivity of the results to the selection of countries, and to time periods. We find that the predictive power of the yield curve has deteriorated in the last half of the sample period, although there is evidence of a reversal in the lead-up to the Great Recession. There is reason to believe that European country models perform better than those with non-European countries when using more recent data. In addition, the yield curve proves to have predictive power even after accounting for other leading indicators of economic activity.

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I. Introduction

In 2006, several observers noted the inversion of the yield curve in the United States. That event sparked a resurgence in the debate over the usefulness of the yield curve as an indicator of future economic activity, with an inversion indicating a slowdown (and in some formulations, a recession). Use of the inverted yield curve as a recession indicator, while common in the United States, is not widespread in other countries. Moreover, prior to the 2007 recession, there was general agreement that – in light of the increased credibility ascribed to monetary policy – the yield curve no longer served as a useful early warning signal for growth slowdowns. Figure 1 displays the yield spread, the difference between long- and short-term government interest rates, through time for the United States and other select advanced economies. The yield spread dips and turns negative prior to each recession period, including the recession beginning in 2007. For European countries, the relationship is not as consistent but there does appear to be some level of coincidence.

The motivation for studying the yield spread is manifold. First, policymakers often need to adjust plans to anticipate future economic conditions. Although policymakers rely on a range of data and methods in forecasting future conditions, movements in the yield curve have in the past provided useful insights, and could still represent a useful tool. Second, variations in correlation between asset prices and economic activity might inform debates regarding the workings of the macroeconomy. Precisely which countries exhibit a robust relationship between the yield curve and growth might be suggestive of certain channels being important, to the exclusion of others. A similar sort of reasoning applies to examining the goodness of fit over different time periods.

While there is already a voluminous literature on the subject of yield curves and US economic activity, we nonetheless believe now is an opportune time to re-examine the evidence. This conviction is rooted in several developments.

The first is the advent of the euro in 1999. With the creation of a more integrated European bond market, and increased economic linkages on the real side, the historical links (or non-links, as the case may be) between interest rates and output might have changed. Yet, until the Great Recession, there had not been a sustained and significant downturn in the post-EMU European economy, and, hence, little opportunity to test the predictive power of the yield curve in this context.

The second is the 'conundrum', that is, the failure of long-term interest rates to rise along with the short-term policy rate in the mid-2000s. Some people ascribed the 'conundrum' to the disappearance of risk, variously associated with the cross-country decline in inflation and output volatility – what is sometimes called the 'Great Moderation' – or with greater risk-management on the part of financial institutions. Others have focused on pension funds' demand for long-term assets, or

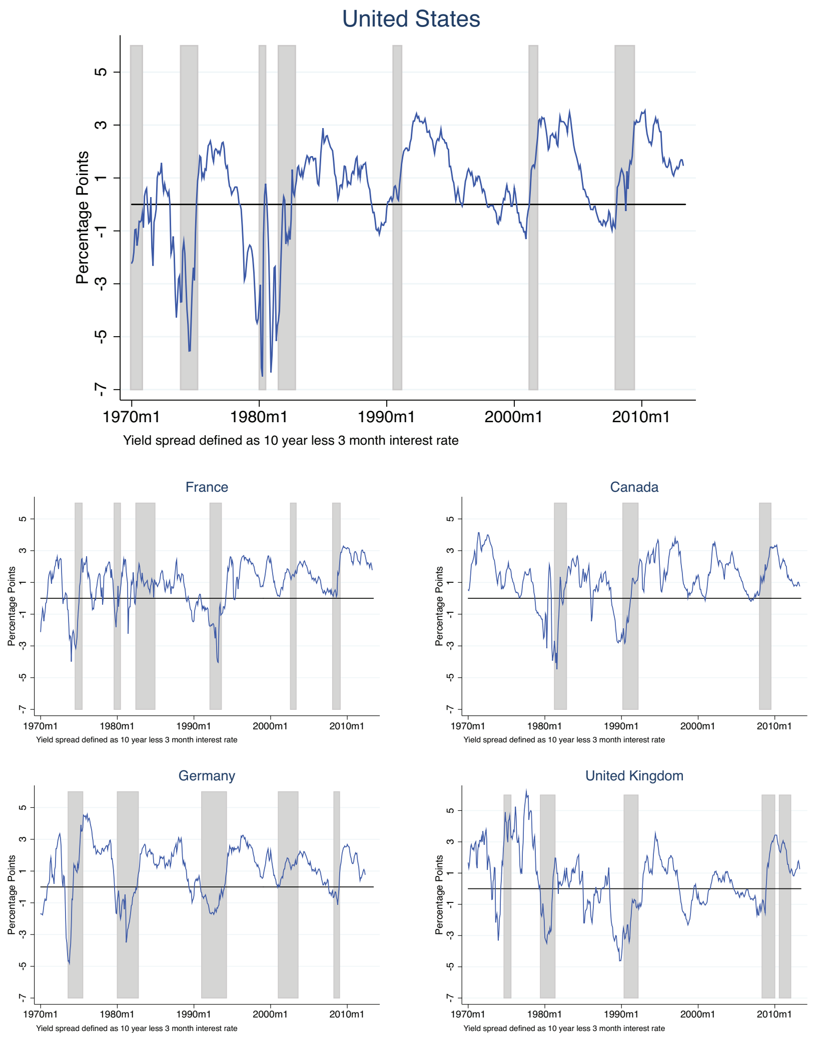

Figure 1: Yield curves and recessions: selected countries.

foreign central bank purchases of Treasury assets.[1] Regardless of the merit of such arguments, we think it of interest to determine whether the previously extant correlations hold in the more recent period.

Third are the Japanese and US encounters with the zero lower bound (ZLB). When a country reaches the ZLB, the monetary authority can no longer lower the short-term interest rate and may try to lower long-term rates (which will flatten the

[1]See for instance, Warnock and Warnock (2006). A contrasting view is in Rudebusch et al. (2006), and Wu (2008).

yield curve) to stimulate economic growth. Hence, one might expect the relationship between the yield curve and subsequent economic growth to deteriorate once central banks have reached the ZLB.

The article is organized in the following fashion. In Section II, we lay out a framework for examining what determines the long-term interest rate relative to the short, and relate that to the literature on the yield curve as a predictor of future economic activity. In Section III, we describe the data and implement our empirical tests. In Section IV, we repeat the exercise using a binary indicator for a recession as the dependent variable. Section V explores these relationships using real-time data. Section VI concludes.

II. Background

A. Theoretical Framework

Following previous literature, this article focuses on the yield spread defined as the ten-year Treasury yield less the three-month Treasury yield (or the closest equivalent for countries other than the United States).[2]

The linkage between the long-term and short-term interest rates can be decomposed thus

$$i_t^n \frac{i_t + E(i_{t+1} + \cdots + i_{t+n-1}|\Omega_t)}{n} + l_t^n \tag{1}$$

In this equation, i_t^n is the interest rate on a bond of maturity n periods at time t, $E(i_{t+j}|\Omega_t)$ is the expected interest rate on a one period bond in period $t+j$, based on Ω_t, the information available at time t. l_t^n is the liquidity (or term) premium for the n-period bond priced at time t. This specification includes both the expectations hypothesis of the term structure (EHTS) (corresponding to the first term on the right-hand side of equation (1), and the liquidity premium theory (corresponding to the second term).

The EHTS merely posits that the yield on a long-term bond is the average of the one period interest rates expected over the lifetime of the multi-period bond. The liquidity premium theory allows supply and demand conditions pertaining specifically to bonds of that maturity to affect pricing. The presence of idiosyncratic effects associated with a certain maturity of bond is sometimes linked to the 'preferred

[2]Using aggregate Euro area data, Moneta (2003) found that the ten-year/three-month spread specification performed better than any other pair of yield maturities that included two of the following: three-month, one-year, two-year, five-year, ten-year.

habitat theory', the idea that certain investors have a preference for purchasing assets of specific maturities.

Now, for the sake of simplicity, consider the case where l_t^n is small. Suppose expected future short-term interest rates are lower than the short-term rate today. In this case, the long-term interest rate will be less than the short-term interest rate (that is, the yield curve inverts). Since low interest rates are typically associated with decreased economic activity, an inverted yield curve could imply an expected downturn. Furthermore, given that, an inversion should imply a downturn a fortiori.

Why should short interest rates be lower during an economic downturn? There are two – not necessarily mutually exclusive – reasons. The first is that decreased economic activity decreases private sector demand for credit, and the monetary authority is likely to decrease the policy rate in response to the slowdown. The second is that increases in policy rates can precipitate a subsequent slowdown.

B. Selective Literature Review

The literature on the usefulness of the yield spread in forecasting future growth is extensive, and we review only a subset of the analyses here. Early studies regarding the relationship between growth and the yield spread date to the late 1980s: Harvey (1988, 1989), Stock and Watson (1989), Nai-Fu Chen (1991) and Estrella and Hardouvelis (1991) among others, suggested that an inverted yield curve (in this case a negative yield spread) could signal an impending recession. These early studies were primarily conducted using US financial data to predict future gross domestic product (GDP) growth.

While the simplest model requires only a single-variable specification with the yield spread as the lone independent variable, adding the short rate can improve forecasts and may provide at least as much information as the spread itself (Ang et al. 2006; Wright 2006). The specific maturities used to construct the yield spread varies in the literature, but empirical evidence suggests using the longest maturity yield to measure the slope of the yield curve (Ang et al. 2006). Models that forecast levels of output growth exhibit a general decline in predictive power since the 1980s, while models that predict binary recession indicators tend to be more stable. Despite this decline, simple real-time models for forecasting recessions that are based on the yield spread outperform professional forecasters (Rudebusch and Williams 2009). The forecasting ability of the yield curve may depend on whether or not the economy is responding to monetary shocks. In addition, controlling for structural breaks leads to very different forecasts than models that do not control for such breaks (Chauvet and Potter 2002, 2005).

Other research focuses on whether the relationship between the yield spread and future economic growth holds in countries other than the United States. Harvey

(1991), Davis and Henry (1994), Plosser and Rouwenhorst (1994), Bonser-Neal and Morley (1997), Estrella and Mishkin (1997), Kozicki (1997) and Estrella et al. (2003) study non-US OECD countries using post-1970 data, and generally conclude that the yield spread can predict future economic growth outside the United States to some extent. However out-of-sample studies conducted by Davis and Fagan (1997) (with US and German data), and Smets and Tsatsaronis (1997) (with European data) found that parameter estimates are unstable over time and are thus poor for forecasting.

III. Empirical Model and Results

A. Data

Compiling the dataset confronts the researcher with many choices, including the selection of countries to study and the choices of regressors and regressand. In addition to countries adequately representing the euro area, we selected countries outside the euro area to provide a basis of comparison for perspective and a sense of robustness regarding the results. Also, to ensure the interest rates are market-determined rates, we selected only countries that have robust and liquid financial markets. The need for a sufficiently large time sample (1970–2013) further restricted the set of countries we could examine.[3] Given these constraints, we restrict our analysis to Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States.

We select industrial production (IP) as our measure of economic activity for the majority of our analysis. While GDP is the broadest indicator of economic activity, the use of industrial production presents some substantial advantages in terms of timeliness and reliability.[4] In any case, growth rates of industrial production tend to follow GDP closely.[5] All of the countries in the data set report industrial production at a monthly frequency while GDP is reported at a quarterly frequency; using IP therefore affords us increased precision. In terms of our recession indicators, we use the NBER measure for the United States and the recession indicator from the Economic Cycle Research Institute (ECRI) for other countries. Yield spread data are constructed from ten-year and three-month government bond rates or their closest equivalents. The appendix details the construction of these time series.

[3]For Italy and the Netherlands, the data begin in 1971 and 1972, respectively.

[4]By reliability, we mean that the industrial production series do not get revised as significantly as GDP.

[5]For instance, the correlation between GDP and IP growth in the United States and United Kingdom are 0.76 and 0.72, respectively.

B. Within-Sample Regression

We start with a simple bivariate model:

$$IPGrowth_{t,t+k} = \beta_0 + \beta_1 Spread_t + \varepsilon_{t+k} \tag{2}$$

where $IPGrowth_{t,t+k}$ is the annualized growth rate over the period t through $t+k$, and $Spread_t \equiv i_t^{10\text{year}} - i_t^{3mo}$, the ten-year government bond rate minus the three-month treasury yield (or closest equivalent).

In words, the yield spread at time t predicts the annualized growth rate of industrial production for the k-month period beginning at time t. We examine this model with k equal to 12 and 24 (that is, growth over a one- and two-year time horizon). Since adjacent year-over-year growth figures will be drawing from overlapping data points, the resulting error terms will be serially correlated. To account for this serial correlation, we conduct our statistical inferences using heteroskedasticity- and serial correlation-robust standard errors.[6]

We turn first to the results from the model using the complete data set (1970–2013), displayed in Table 1.[7] The estimated coefficient for the yield spread is positive and significant for all countries, suggesting the yield spread may hold forecasting value. The magnitude of the coefficient is also economically important. Consider the result obtained for France: the estimate of 1.22 implies that for each percentage point increase in the yield spread, French industrial production growth over the next year will increase by 1.22 percentage points. Estimates across countries in our data set vary markedly, ranging from a high of 1.81 in Canada to a low of 0.69 in the United Kingdom.

Despite the existence of statistically significant coefficient estimates for each country, the goodness of fit (according to the R^2 statistic) varies substantially across country models. That being said, the *relative* proportion of variation across countries is of interest. The yield spread in United States, Germany and Canada explains more than 20% of the changes in these countries' annual industrial production growth. In contrast, the yield spread explains less than 10% of the variation in Italy, Japan and Sweden. The Durbin–Watson statistics indicate a high degree of serial correlation. In addition, the White statistics signal heteroskedasticity in most, but not all, instances. The use of Newey–West robust standard errors account for these characteristics of the estimated residuals.[8]

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[6]Unit root tests indicate that the spreads and industrial production changes are stationary.

[7]Appendix Table A1 compares the results from using industrial production to results using GDP. The results are qualitatively similar. Empirically, industrial production has a higher variance, which explains the larger coefficient estimates. The estimates using industrial production are actually more precise than those obtained using GDP.

[8]Each growth observation is calculated using the subsequent 12 months of industrial production data; by construction, consecutive observations share 11 months of industrial production data. Therefore, we choose a lag length of 11 for the Newey–West standard errors.

Table 1: Current Yield Spread as Predictor of Future IP Growth: Full Sample (1970–2013)

	(1) Canada	(2) France	(3) Germany	(4) Italy	(5) Japan	(6) Neth.	(7) Sweden	(8) UK	(9) US
12-month growth									
Spread	1.81	1.22	1.52	0.85	1.23	1.03	0.99	0.69	1.14
	[0.23]***	[0.38]***	[0.30]***	[0.31]***	[0.47]***	[0.27]***	[0.41]**	[0.22]***	[0.22]***
Constant	0.079	−0.022	−0.059	0.84	1.26	0.26	−1.54	0.38	1.71
	[0.65]	[0.72]	[0.71]	[0.80]	[0.95]	[0.58]	[1.02]	[0.49]	[0.61]***
R^2	0.27	0.13	0.23	0.064	0.068	0.11	0.068	0.11	0.20
Observations	501	507	507	495	507	474	495	507	508
Durbin–Watson	0.142	0.245	0.314	0.272	0.133	0.848	0.351	0.286	0.069
White	0.004	0.031	0.001	0.776	0.813	0.050	0.209	0.738	0.002
24-month growth									
Spread	1.22	0.55	1.11	0.056	0.28	0.53	0.74	0.52	0.88
	[0.22]***	[0.24]**	[0.18]***	[0.21]	[0.33]	[0.13]***	[0.36]**	[0.14]***	[0.15]***
Constant	0.71	0.55	0.34	1.13	1.69	0.72	−2.28	0.49	1.85
	[0.58]	[0.55]	[0.48]	[0.58]	[0.74]**	[0.32]**	[1.07]**	[0.39]	[0.50]***
R^2	0.22	0.053	0.27	0.00065	0.0084	0.10	0.046	0.14	0.22
Observations	489	495	495	483	495	462	483	495	496
Durbin–Watson	0.070	0.134	0.202	0.149	0.080	0.743	0.133	0.155	0.048
White	0.001	0.000	0.000	0.323	0.406	0.731	0.002	0.025	0.000

Notes: Data from column are restricted to the country in the column header. Italy and Sweden samples begin in Jan. 1971; Netherlands sample begins in Oct. 1972.
The yield spread is the ten-year government bond yield minus the three-month yield (or closest equivalent).
Durbin–Watson is the d-statistic that tests for first-order serial correlation.
White is the *P*-value from White's test of heteroskedasticity.
HAC standard errors in brackets (**$P < 0.05$, ***$P < 0.01$).

Following Bonser-Neal and Morley (1997), and Kozicki (1997), we examine the corresponding specification for growth over a two-year horizon, displayed in the lower panel of Table 1. While many of the variables are still significant, the explanatory power of the model deteriorates for many countries in the two-year model. Additionally, in every case the magnitude of the yield spread coefficient is smaller in the two-year model relative to the one-year model. The decrease in explanatory power and magnitude of the coefficient estimates for the two-year period suggests that most of the explanatory power is concentrated at the one-year horizon.[9] Only the German, UK and US models exhibit better fit in the two-year model relative to the one-year model.

In order to investigate the time variation in the strength and dynamics of the yield curve/growth relationship, we split the sample after 1997. The choice is primarily pragmatic because it divides the entire sample into two sub-samples, roughly similar in size. At the same time, the choice is somewhat fortuitous, as the latter sub-sample then conforms approximately to the post-EMU period.

Tables 2 and 3, which contain results from the two sub-samples of data, highlight a key finding. The strength of the relationship between term spreads and output growth is driven by the early portion of the sample. Regressions from the first sub-sample (1970–1997) produce precise estimates for the coefficients in eight of the nine countries. In contrast, estimates from more recent data (1998–2013) are less precise but much larger in magnitude, making it difficult to determine whether the relationship between the yield spread and growth has deteriorated or intensified. These findings contrast with those of Dotsey (1998) and Haubrich and Dombrosky (1996), who found declining predictive power of the yield curve.

Examining the R^2 across sub-samples reveals that four of the country models exhibit a better fit when using the later data subset. Japan exhibits the sharpest drop-off in model fit between time periods: the yield spread explains nearly 20% of the variation in industrial production growth in the 1970–1997 sub-sample but almost nothing in the 1998–2008 sub-sample. The later period coincides with the Asian financial crisis and may reflect that Japan's short-term rates hit the zero lower bound. One implication of the Japanese results, relevant to current debate, is that we might anticipate a deteriorated fit for the relationship between the US yield curve and output, given that the federal funds effective rate has essentially hit zero.

We have checked to see if the results are sensitive to the inclusion of time trends. Typically, the improvement in fit is small when the relationship is estimated over the entire sample period; the most notable impact is that the implied growth rate for a given spread is lower when the time trend is included. This suggests that for the regressions involving growth in industrial production, using the latter sub-sample is more appropriate.

[9]For an empirical investigation into this issue, see Kozicki (1997).

Table 2: Current Yield Spread as Predictor of Future IP Growth: Early Sample (1970–1997)

	(1) Canada	(2) France	(3) Germany	(4) Italy	(5) Japan	(6) Neth.	(7) Sweden	(8) UK	(9) US
12-month growth									
Spread	2.00	1.63	1.15	1.28	1.47	0.91	0.55	0.68	1.37
	[0.21]***	[0.42]***	[0.22]***	[0.31]***	[0.47]***	[0.25]***	[0.35]	[0.24]***	[0.27]***
Constant	0.93	1.03	0.37	2.59	2.46	0.43	−1.14	1.12	2.68
	[0.60]	[0.63]	[0.61]	[0.80]***	[0.92]***	[0.58]	[1.00]	[0.58]	[0.61]***
R^2	0.41	0.29	0.25	0.18	0.21	0.12	0.035	0.12	0.34
Observations	336	336	336	324	336	303	324	336	336
Durbin–Watson	0.217	0.400	0.503	0.465	0.147	0.993	0.435	0.344	0.103
White	0.055	0.000	0.032	0.084	0.422	0.534	0.751	0.512	0.007
24-month growth									
Spread	1.29	0.71	0.89	0.26	0.52	0.48	0.41	0.50	0.98
	[0.21]***	[0.26]***	[0.16]***	[0.24]	[0.32]	[0.13]***	[0.38]	[0.13]***	[0.16]***
Constant	1.60	1.42	0.58	2.28	2.60	0.77	−2.30	1.22	2.79
	[0.52]***	[0.49]***	[0.46]	[0.58]***	[0.78]***	[0.35]**	[1.29]	[0.45]***	[0.49]***
R^2	0.33	0.12	0.33	0.021	0.049	0.11	0.019	0.16	0.33
Observations	336	336	336	324	336	303	324	336	336
Durbin–Watson	0.102	0.201	0.327	0.265	0.071	0.785	0.137	0.209	0.076
White	0.024	0.046	0.000	0.127	0.123	0.409	0.006	0.031	0.000

Notes: Data from column are restricted to the country in the column header. Italy and Sweden samples begin in Jan. 1971; Netherlands sample begins in Oct. 1972.
The yield spread is the ten-year government bond yield minus the three-month yield (or closest equivalent).
Durbin–Watson is the d-statistic that tests for first-order serial correlation.
White is the *P*-value from White's test of heteroskedasticity.
HAC standard errors in brackets ($^{**}P < 0.05$, $^{***}P < 0.01$).

Table 3: Current Yield Spread as Predictor of Future IP Growth: Late Sample (1998–2013)

	(1) Canada	(2) France	(3) Germany	(4) Italy	(5) Japan	(6) Neth.	(7) Sweden	(8) UK	(9) US
12-month growth									
Spread	1.60	2.45	5.04	2.57	5.86	1.95	6.04	0.44	1.19
	[0.89]	[1.26]	[1.40]***	[1.49]	[5.92]	[1.19]	[1.67]***	[0.53]	[0.50]**
Constant	−1.75	−4.49	−4.25	−5.01	−6.74	−0.99	−8.51	−0.99	−0.38
	[2.27]	[2.72]	[2.22]	[3.00]	[8.53]	[2.01]	[3.00]***	[0.78]	[1.48]
R^2	0.10	0.21	0.46	0.19	0.035	0.13	0.45	0.041	0.14
Observations	165	171	171	171	171	171	171	171	172
Durbin–Watson	0.082	0.202	0.233	0.142	0.152	0.611	0.386	0.178	0.059
White	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
24-month growth									
Spread	1.54	2.24	3.21	1.77	0.30	0.93	4.59	0.24	1.32
	[0.81]	[0.81]***	[0.72]***	[1.03]	[2.90]	[0.47]	[0.89]***	[0.38]	[0.43]***
Constant	−1.90	−4.04	−2.16	−3.60	−0.40	0.20	−7.16	−0.97	−0.73
	[1.97]	[1.70]**	[1.32]	[2.11]	[4.20]	[0.85]	[1.98]***	[0.55]	[1.14]
R^2	0.18	0.34	0.42	0.19	0.00030	0.11	0.43	0.026	0.34
Observations	153	159	159	159	159	159	159	159	160
Durbin–Watson	0.054	0.166	0.146	0.074	0.117	0.665	0.200	0.104	0.056
White	0.000	0.000	0.007	0.000	0.016	0.037	0.026	0.000	0.000

Notes: Data from column are restricted to the country in the column header. Italy and Sweden samples begin in Jan. 1971; Netherlands sample begins in Oct. 1972.
The yield spread is the ten-year government bond yield minus the three-month yield (or closest equivalent).
Durbin–Watson is the d-statistic that tests for first-order serial correlation.
White is the P-value from White's test of heteroskedasticity.
HAC standard errors in brackets ($^{**}P < 0.05$, $^{***}P < 0.01$).

C. Out-of-Sample Forecasting

A common criticism of using in-sample fit to assess model validity is that it fails to confront the model with the real-world challenge of forecasting with limited data. Specifically, the coefficient estimates in Table 1 were generated using the entire dataset, from 1970 to 2013. Forecasters in 2000 who were trying to predict the next year's industrial production growth would not have been able to use 2000–2013 data to generate their estimates; they would only have had access to data up to 2000. Using the coefficients in Table 1 to forecast could overstate the predictive power of the independent variable.

In this section, we conduct pseudo-out-of-sample forecasts. Instead of using the entire dataset to generate coefficient estimates for forecasting, we run recursive regressions. Hence, each regression contains only information that predates the time period we are forecasting. For example, to forecast industrial production growth from January 1980 through 1981, we regress industrial production on yield spreads using only data that would have been available prior to January 1980 (that is, January 1970 to December 1979). Coefficients from this regression are used to forecast industrial production growth from January 1980 through 1981. Then, to estimate growth from February 1980 to February 1981, we re-run the regressions using data from January 1970 to January 1980, obtain new parameter estimates that we use to forecast and so on.

This process generates a series of predicted industrial production growth rates, with each prediction forecasted from a unique regression. To evaluate the performance of this forecasting model, we compare the root mean square error (RMSE) relative to historical data against a naïve forecast RMSE. Our naïve forecast is a simple AR(1) model of growth. We also calculate the RMSE for a forecast using three other specifications: AR(1) and the yield spread, the yield spread and three-month rate, and the yield spread, three-month rate and AR(1). We conclude that there exists a marginal benefit to estimating a growth model with the yield spread (as opposed to the simple AR(1) model) if the RMSE from the yield spread model specification is significantly less than that of the AR(1) model (according to the Diebold–Mariano statistic). Figures 2 and 3 display results for the euro-area and select countries outside the euro area respectively, using the yield spread as the independent variable, compared to results from the AR(1) model. While extreme fluctuations were not always well predicted by the out-of-sample model, the general shape of the data seems to be captured in many cases, certainly when compared to the AR(1) model. Notably, the yield spread did not predict contractions in the late 2000s but tracked the actual series fairly well in Canada and the United States during the subsequent recovery.

Results relative to the AR(1) model across all countries are mixed. Table 4 displays the results of the RMSE scores for all model specifications. The yield curve model (column 2) exhibits lower RMSE than the AR(1) model (column 1) for all

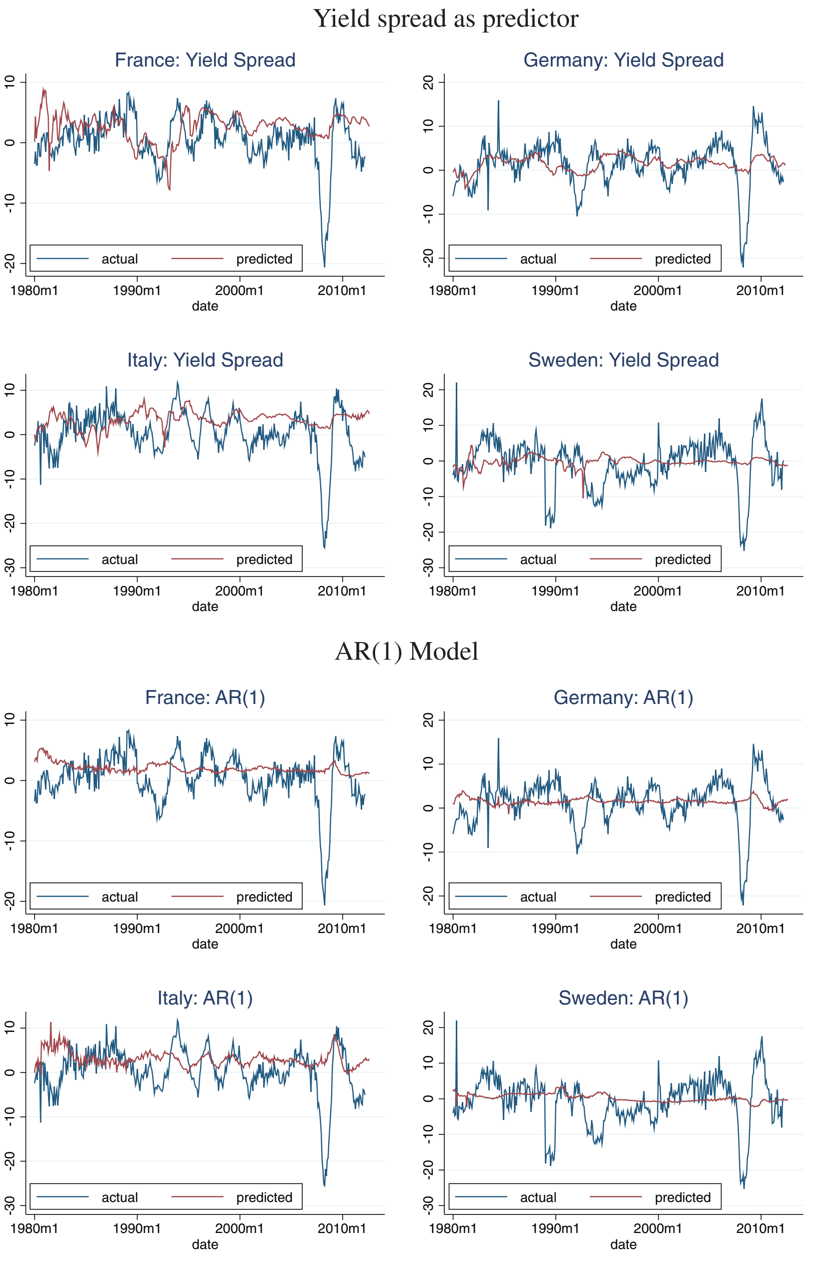

Figure 2: Pseudo out-of-sample forecasts: euro area.
Each panel compares pseudo out-of-sample predictions to actual industrial production growth. The top four panels use the yield spread as a predictor while the bottom four panels use an AR(1) model.

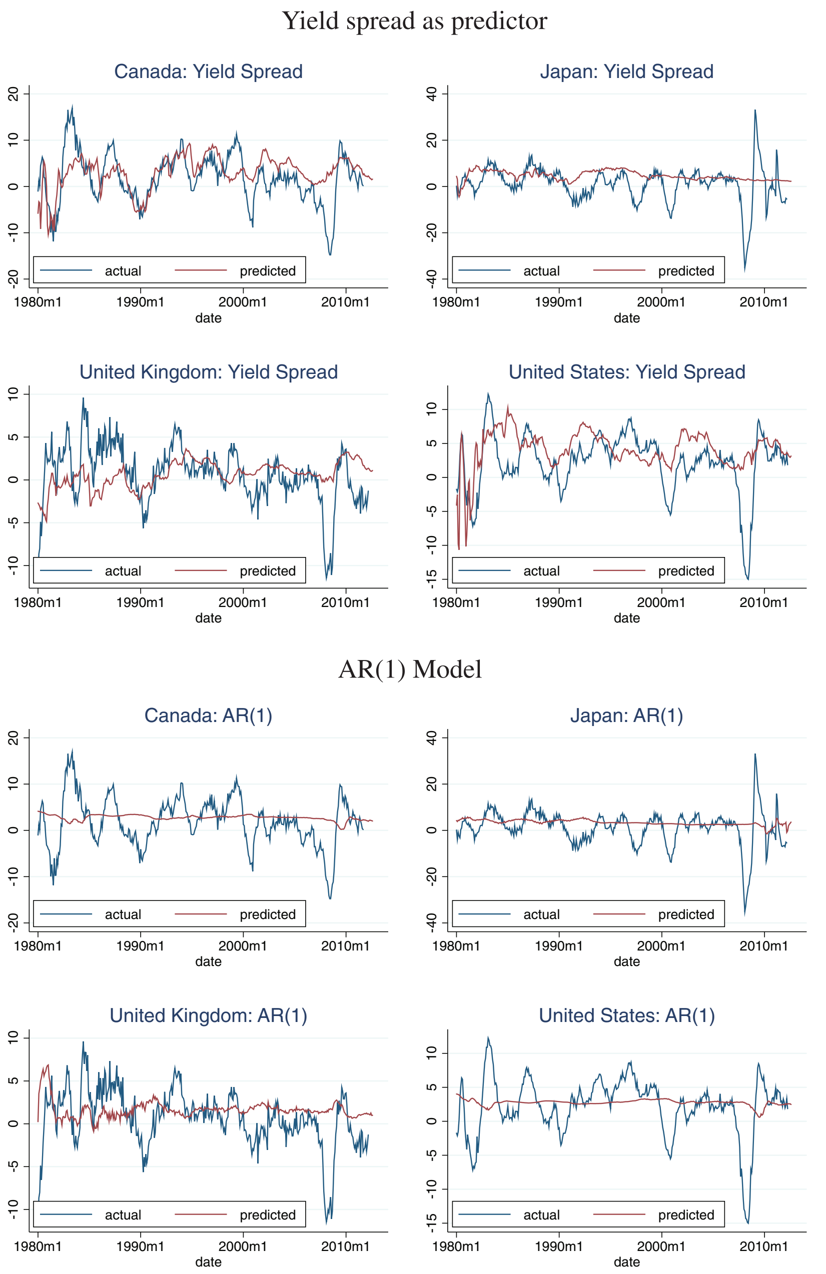

Figure 3: Pseudo out-of-sample forecasts: other countries.
Each panel compares pseudo out-of-sample predictions to actual industrial production growth. The top four panels use the yield spread as a predictor while the bottom four panels use an AR(1) model.

Table 4: Historical Ex Post-Simulation: MSE

	AR1	Spread	Spread and AR1	Spread and 3-Mo	Spread, 3-Mo and AR1
Canada	33.10	25.25	22.83	20.74	20.64
D-M Stat*	.	0.0601	0.0106	0.0189	0.0179
France	20.43	22.33	16.57	16.27	16.30
	.	0.445	0.242	0.213	0.253
Germany	27.37	21.49	19.46	20.22	19.49
	.	0.0404	0.0755	0.0408	0.0656
Italy	37.03	39.54	30.69	30.26	30.22
	.	0.544	0.250	0.259	0.225
Japan	58.85	66.56	52.81	54.20	48.80
	.	0.0260	0.279	0.369	0.323
Netherlands	20.32	20.24	16.86	19.65	16.80
	.	0.974	0.0959	0.789	0.114
Sweden	52.54	50.68	46.94	46.88	46.81
	.	0.558	0.281	0.256	0.263
UK	16.33	13.60	12.21	11.57	11.66
	.	0.413	0.211	0.123	0.134
US	20.76	20.86	15.92	15.81	15.71
	.	0.976	0.0374	0.0607	0.0574

Notes: Each column displays RMSE from a separate forecasting model of IP growth using the column headers as explanatory variables. Diebold–Mariano statistic is the *P*-value for equal forecasting power.

countries except Japan and the United States. However, we only reject the test for equal forecasting power for Germany according to the Diebold–Mariano test. When we include the three-month interest rate (column 4), forecasts for Canada and the United States are significantly better than the AR(1).

The relatively poor out-of-sample results could, in part, be due to fundamental changes in the relationship between the yield curve and economic activity over time. If the structure of the relationship changed in the middle of our sample, coefficient estimates using historical data may not be useful in predicting future out-of-sample growth. A number of events over the past ten years may have affected the predictive power of the yield curve, including the advent of the European monetary union, the 'Great Moderation', the global savings glut and the Japanese experience with a policy rate at the ZLB.

D. Rolling-Window Regressions

To examine changes in the predictive power of the yield curve over time, we use rolling-window regressions. For each country, we restrict data to include only January 1970 through December 1979 and regress growth on the yield spread to obtain a coefficient estimate. Then, we run another regression using data from February 1970 through

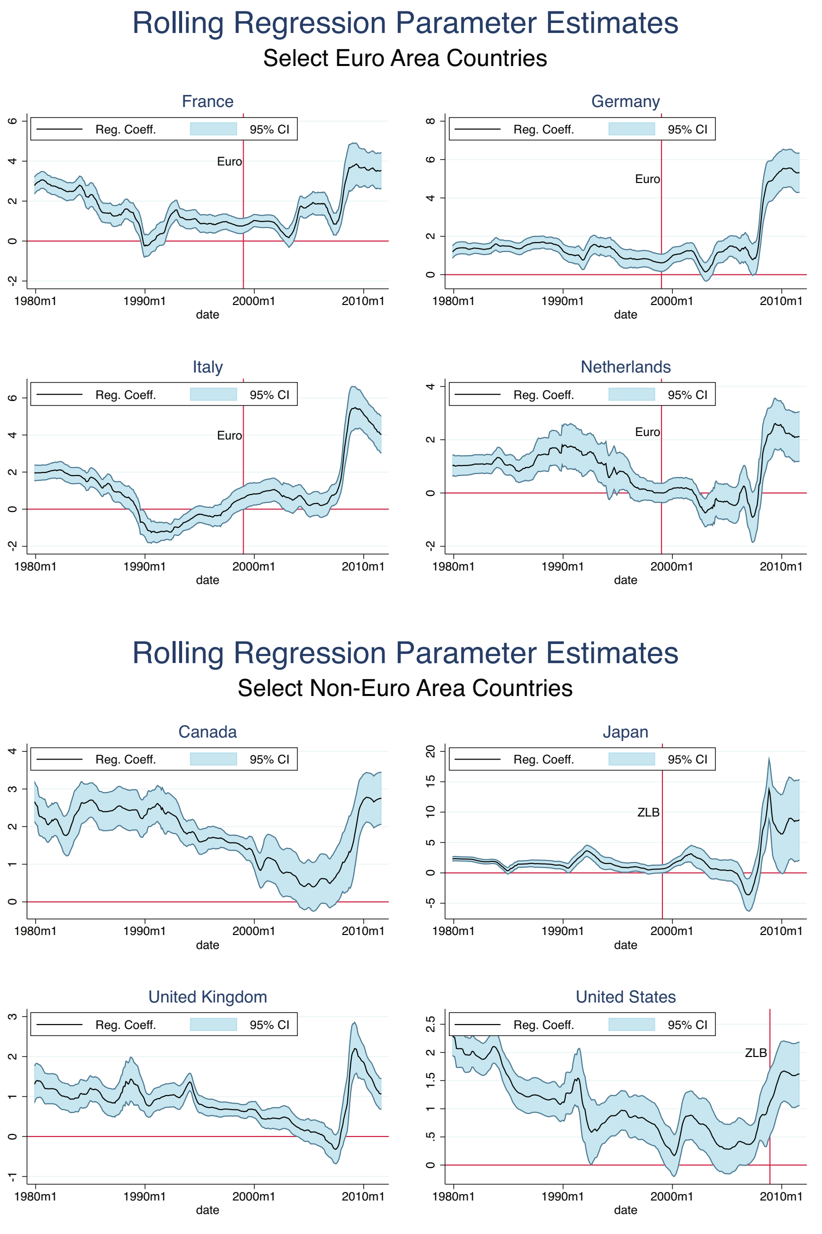

Figure 4: Rolling window regressions.
Coefficient estimates and 95% confidence intervals for the yield curve for each overlapping 10-year time interval beginning with January 1970–December 1979 through January 2013–December 2013.

January 1980 and so on. Figure 4 plots the estimated coefficients from these regressions and the 95% confidence intervals for each overlapping ten-year interval beginning with January 1970 to December 1979 and ending with January 2013 to December 2013.

Generally declining coefficient estimates and widening confidence bands confirm our suspicion that the relationship between the yield curve and economic growth has deteriorated over the last 10–15 years. However, many models exhibit a significant strengthening during the Great Recession.

The euro-area countries appear similar to one another in some respects: the coefficient estimates tend to decline into 1990, when they generally become insignificant. This is consistent with the fact that many macroeconomic variables (including both industrial production and the yield spread) became significantly less volatile, decreasing the detectability of any relationship. The recent uptick in the coefficient estimates is consistent with recent macroeconomic volatility.

Canada, the United Kingdom and the United States all exhibit deterioration post-1998; the significance band widens in the United States and Canada while the coefficient estimate draws closer to zero in the United Kingdom. Some have speculated that the global savings glut may have affected not only the United States but also other countries with strong legal regimes and liquid financial markets.[10] If Canada and the United Kingdom were affected by the global savings glut in the same way as the United States, this is the parallel deterioration one might expect. Certainly, there exist other potential confounding factors, yet it remains an interesting coincidence.

IV. The Yield Curve and Recessions

We now move to a nonlinear version of the same question we asked earlier, given that recessions are a specific characterization of (negative) output growth. Following Moneta (2003) and Wright (2006), we test if the yield spread can predict recessions, considered as a binary dependent variable.

There is little agreement on this question in the literature, especially in a cross-country context. While Moneta (2003) finds the yield curve alone is a useful predictor of recessions when using aggregate euro-area data, Wright (2006) argues there is no reason to believe that an increase in the short-term interest rate should have the same consequence as a decrease in the long-term rate, so he augments the conventional recession/yield curve specification with the US federal funds rate to isolate the effect of changes in the short-term rate. Indeed, Wright's model with the federal funds rate performed better when using US data.

Following the literature, the models we use are as follows:

$$\Pr(R_{t+1,t+k} = 1) = \phi(\beta_0 + \beta_1 Spread_t) \tag{3}$$

$$\Pr(R_{t+1,t+k} = 1) = \phi(\beta_0 + \beta_1 Spread_t + \beta_2 3mo_t) \tag{4}$$

[10]See, for example, the 2009 Economic Report of the President, Chapter 2 (Council of Economic Advisors 2009).

where t is the current time period, k is the forecast period and $\phi(\ldots)$ denotes the standard normal cumulative distribution function. We use the three-month interest rate to isolate the effect of movements in short-term interest rates. The recession indicator variable equals one if there is a recession in any month between $t+1$ and $t+k$, inclusive. We estimate both models using k equal to 6 and again with k equal to 12 (that is, a six-month and one-year forecast).

Tables 5 and 6 display the results from the probit model estimates for each country over the full sample. The top block of each table reports results from the six-month forecasting horizon, while the lower block displays the 12-month forecasting results. For the United States, our results differ somewhat from the results obtained by Wright (2006); the yield spread parameter is significant over both the six-month and 12-month forecasting periods, even when the short-term rate is included in the regression. However, the three-month interest rate parameter is statistically insignificant over both horizons.

Results from the models for Germany and Canada are similar to the United States model: the yield spread is significant even with the addition of the short-term interest rate and the short-term interest rate parameter is not statistically significant at either forecast horizon. Interestingly, results for the some of the remaining countries are starkly different. Across many other non-US countries, adding the short-term rate to the model reduces both the magnitude and significance of the yield spread. In Sweden, the short-term rate is significant while the yield spread coefficient actually becomes statistically insignificant. For Japan, adding the short-term yield makes the coefficient on the yield spread significant. In all countries excluding Japan, the coefficient for the short-term interest rate is positive, suggesting that high relative short-term interest rates precede periods of slower growth.

We display in Figure 5 the estimated probabilities of recession in the subsequent 12 months using only the yield spread as an explanatory variable. Generally speaking, recessions were well predicted by the yield curve across countries in the 1970s and 1980s. When we look at recessions in the 1990s and 2000s, however, the results are less consistent. United States and German recession probabilities peaked near 100% prior to the recessions in the 1970s and 1980s, as anticipated. Additionally, the estimated probability exceeded 80% preceding the 1990 recession. While the probability peaked at lower levels before the 2000 and 2007 recessions, in both cases the model ascribed a probability well in excess of 50%. The results for the UK, Sweden, France and Canada paint a different picture. Probabilities generated by the model fit the recession data reasonably well through 1990; however, the models were not predictive in the months leading up to the 2007 recession. These findings suggest that the recessions of the 2000s may have been structurally different from their predecessors. The results for Japan and Italy are generally quite poor. When using only the yield spread as an independent variable, the coefficient is not statistically significant and the model explains almost nothing.

Table 5: Current Yield Spread as Predictor of Future Recession: Full Sample (1970–2013)

	(1) Canada	(2) France	(3) Germany	(4) Italy	(5) Japan	(6) Sweden	(7) UK	(8) US
Next 6 months								
Spread	−0.39	−0.37	−0.68	−0.094	−0.059	−0.29	−0.067	−0.46
	[0.11]***	[0.091]***	[0.17]***	[0.093]	[0.095]	[0.12]**	[0.10]	[0.085]***
Constant	−0.73	−0.43	0.11	−0.51	−0.42	−0.21	−0.68	−0.64
	[0.23]***	[0.19]**	[0.23]	[0.19]***	[0.18]**	[0.19]	[0.19]***	[0.19]***
R^2	0.18	0.12	0.34	0.016	0.0045	0.10	0.0094	0.27
Observations	519	519	509	505	519	519	519	519
Next 12 months								
Spread	−0.49	−0.44	−0.63	−0.053	−0.020	−0.29	−0.11	−0.69
	[0.12]***	[0.10]***	[0.15]***	[0.089]	[0.099]	[0.13]**	[0.099]	[0.12]***
Constant	−0.50	−0.14	0.31	−0.36	−0.23	−0.047	−0.51	−0.29
	[0.22]**	[0.20]	[0.24]	[0.19]	[0.18]	[0.19]	[0.19]***	[0.20]
R^2	0.24	0.15	0.29	0.0050	0.00051	0.11	0.025	0.38
Observations	519	519	509	505	519	519	519	519

Notes: Data from column are restricted to the country in the column header. Italy and Sweden samples begin in Jan. 1971, Netherlands sample begins in Oct. 1972.
The yield spread is the ten-year government bond yield minus the three-month treasury yield (or closest equivalent).
HAC standard errors in brackets ($^{**}P < 0.05$, $^{***}P < 0.01$). Reported R^2 is pseudo R^2.

Table 6: Current Yield Spread as Predictor of Future Recession: Full Sample (1970-2013)

	(1) Canada	(2) France	(3) Germany	(4) Italy	(5) Japan	(6) Sweden	(7) UK	(8) US
Next 6 months								
Spread	−0.33	−0.22	−0.51	−0.025	−0.74	−0.11	−0.036	−0.46
	[0.15]**	[0.13]	[0.21]**	[0.12]	[0.16]***	[0.14]	[0.095]	[0.12]***
Three-month	0.031	0.096	0.12	0.036	−0.37	0.14	0.029	−0.0036
	[0.090]	[0.066]	[0.098]	[0.044]	[0.072]***	[0.057]**	[0.063]	[0.083]
Constant	−1.00	−1.26	−0.68	−0.88	1.25	−1.42	−0.93	−0.62
	[0.85]	[0.62]**	[0.70]	[0.49]	[0.35]***	[0.52]***	[0.60]	[0.66]
R^2	0.18	0.16	0.35	0.028	0.26	0.19	0.015	0.27
Observations	519	519	509	505	519	519	519	519
Next 12 months								
Spread	−0.44	−0.28	−0.44	0.0044	−0.70	−0.12	−0.070	−0.68
	[0.16]***	[0.14]**	[0.18]**	[0.12]	[0.15]***	[0.14]	[0.094]	[0.13]***
Three-month	0.022	0.100	0.15	0.030	−0.37	0.13	0.041	0.00082
	[0.086]	[0.059]	[0.088]	[0.043]	[0.073]***	[0.057]**	[0.062]	[0.079]
Constant	−0.69	−1.00	−0.66	−0.67	1.53	−1.18	−0.86	−0.29
	[0.80]	[0.58]	[0.61]	[0.48]	[0.38]***	[0.50]**	[0.60]	[0.65]
R^2	0.24	0.19	0.32	0.013	0.27	0.18	0.036	0.38
Observations	519	519	509	505	519	519	519	519

Notes: Data from column are restricted to the country in the column header. Italy and Sweden samples begin in Jan. 1971, Netherlands sample begins in Oct. 1972. The yield spread is the ten-year government bond yield minus the three-month treasury yield (or closest equivalent). HAC standard errors in brackets (**$P < 0.05$, ***$P < 0.01$). Reported R^2 is pseudo R^2.

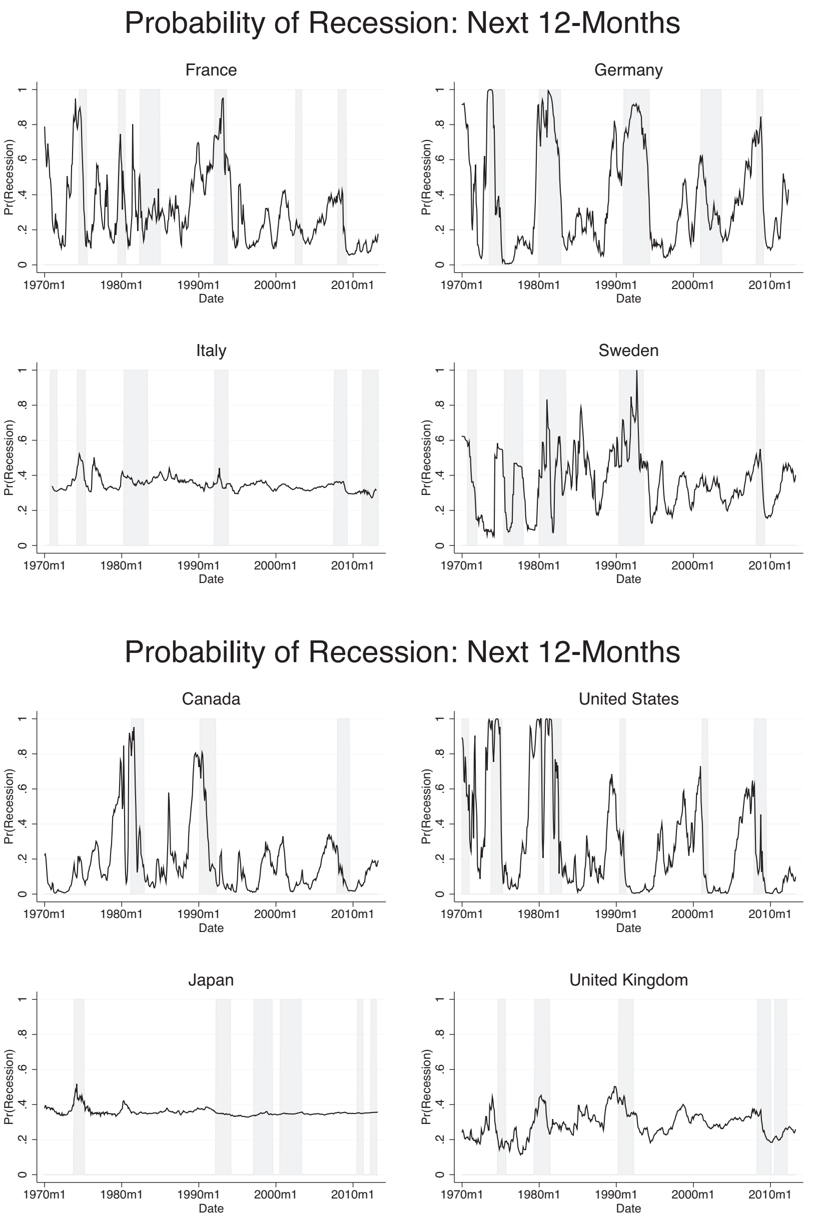

Figure 5: Predicting recessions.
Predicted probability of recessions are the coefficient estimates on the yield curve from a probit regression of the yield spread on a recession indicator that equals one if a recession appears in the next 12-months and zero otherwise.

V. Real-Time Data

In the previous exercises, we used historical data as they are currently reported. However, industrial production data, like most measures of economic activity, is subject to revision. For instance, United States industrial production for December 2008 was originally reported as 106.1, but by April 2009, the December data had been revised down to 104.8. From a forecasting perspective, using data as it appears most recently (the current vintage) is not the same as using data as it looked prior to the estimation period. If, today, we want to evaluate how the model would have performed in December 2008, using data as it appeared in December 2008 more closely simulates estimating the model in 2008.

Koenig et al. (2003) point out that the relationship between early estimates of economic output and early estimates of explanatory variables is the relationship of interest to forecasters. To capture the relationship between early estimates of output and explanatory variables, they suggest creating a 'real-time vintage' by compiling a single time series for each variable that include only the first estimate. Furthermore, they argue that revisions to data are unpredictable (essentially extraneous noise) at the time of issuance so using a real-time vintage on the left-hand side of an equation eliminates the noise and in fact provides more accurate forecasts.

In this section, we use real-time vintage data created from the OECD Main Economic Indicators real-time data and revisions database.[11] Due to data availability, we use real GDP as a measure of economic output and restrict our sample of countries to Canada, Germany, Japan, the United Kingdom and the United States. Since the interest rates used to construct the yield spread are not typically revised, using the current vintage for the yield spread sufficiently represents a real-time vintage. The dataset contains GDP vintages from 1987Q3 to 2013Q2. To construct this dataset, we have a series of real-GDP vintages for Canada, Germany, Japan, the United Kingdom and the United States. For each vintage, we calculate four-quarter GDP growth. We collapse the set of GDP vintages down to one series for each country that contains only the final observation from each vintage (the initial data release). Current-vintage yield spread data are used to predict four-quarter GDP growth rates in the constructed 'real-time vintage'.

Table 7 displays the results of the real-time data analysis. Significant parameter estimates across all countries (for the United States only at the 90% confidence level), except Japan, suggest the yield curve does tend to provide significant information regarding first estimate economic growth over the next four quarters. Table 8 shows a comparable set of regressions in which the current vintage of GDP is

[11]Vintages prior to 2004 were graciously provided by Lucio Sarno, as used in Sarno and Valente (2009).

Table 7: Current Yield Spread as Predictor of Future GDP Growth: Real-Time Data

	(1) Canada	(2) Germany	(3) Japan	(4) UK	(5) US
Yield Spread	0.75	0.72	−0.63	0.47	0.35
	(0.23)***	(0.34)**	(0.37)	(0.22)**	(0.19)
Constant	1.04	0.82	1.98	1.43	1.87
	(0.54)	(0.66)	(0.63)***	(0.36)***	(0.49)***
Observations	104	104	104	104	104
R^2	0.257	0.134	0.040	0.141	0.074

Each column is a separate regression of the yield spread on GDP growth over the next four quarters. HAC standard errors ($^{**}P < 0.05$, $^{***}P < 0.01$). Data range from 1987Q3 to 2013Q2 for all countries.

Table 8: Current Yield Spread as Predictor of Future GDP Growth: Current Vintage

	(1) Canada	(2) Germany	(3) Japan	(4) UK	(5) US
Yield Spread	0.69	0.66	−0.69	0.36	0.32
	(0.17)***	(0.32)**	(0.47)	(0.23)	(0.20)
Constant	1.53	0.61	2.15	2.38	2.23
	(0.46)***	(0.60)	(0.85)**	(0.46)***	(0.55)***
Observations	104	86	104	104	104
R^2	0.231	0.143	0.036	0.066	0.052

Each column is a separate regression of the yield spread on GDP growth over the next four quarters. HAC standard errors ($^{**}P < 0.05$, $^{***}P < 0.01$). Data range from 1987Q3 to 2013Q2 for all countries.

used to calculate growth rates. Results using current-vintage data are very similar to the real-time data results. Industrial production data tend to be revised to a lesser extent than GDP; therefore, finding similar results across current-vintage and real-time datasets suggests that one can be more confident that the findings in the previous sections using only current-vintage data are not driven by the current-vintage structure.

VI. Conclusion

This article has explored the importance of the yield spread in forecasting future growth and recession. Generally speaking, when using the entire data series, from 1970 to 2013, in-sample results suggest the yield spread is indeed important and has significant predictive power over a one-year time horizon. The results deteriorate when forecasting growth two years ahead. Moreover, it appears that the forecasting power is weaker during the 'Great Moderation', up until the financial crisis of 2008. However, each of the six European country models exhibited relatively high R^2 statistics (above 0.1) when using data from 1998 to 2013. While the explanatory power is somewhat less for certain models estimated over the early sub-sample, the data still suggest the yield curve possesses some forecasting power for European countries.

The results we obtained in the out-of-sample forecasting exercises were somewhat less definitive. Of the European countries examined, only for Germany did the yield curve possess significantly greater predictive power than a simple AR(1). Certainly the relationship between the yield spread and growth has declined in recent years; however, it appears that the relationship has held up best in some European countries and may have strengthened with the increasing volatility of macroeconomic data over the past few years.

The contrast across countries was marked when predicting recessions. The short-term rate was significant in several instances; however, its inclusion often resulted in a decrease in the economic and statistical significance of the yield spread. The model predicted recessions relatively well for the United States, Germany and Canada over the entire data set, while the remaining models largely failed to anticipate the recessions of the 2000s. The Japan and Italy models did not predict recessions well.

In summary, we do not obtain a simple story for the yield curve's predictive power. The yield curve clearly possesses some forecasting power. However, there is also some evidence the United States is something of an outlier, in terms of its usefulness for this purpose. And overall, the predictive power of the yield curve seems to have rebounded in the lead up to the Great Recession, reversing a longer term trend of declining predictive power.

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References

Ang, A., M. Piazzesi and M. Wei (2006), 'What Does the Yield Curve Tell Us About GDP Growth?', *Journal of Econometrics*, 131, 359–403.

Bonser-Neal, C., and T. R. Morley (1997), 'Does the Yield Spread Predict Real Economic Activity? A Multi-Country Analysis', *Federal Reserve Bank of Kansas City Economic Review*, 82(3), 37–53.

Chauvet, M., and S. Potter (2002), 'Predicting a Recession: Evidence from the Yield Curve in the Presence of Structural Breaks', *Economics Letters*, 77, 245–53.

Chauvet, M., and S. Potter (2005), 'Forecasting Recessions Using the Yield Curve', *Journal of Forecasting*, 24, 77–103.

Chen, N.-F. (1991), 'Financial Investment Opportunities and the Macroeconomy', *Journal of Finance*, 46(2), 529–54.

Council of Economic Advisors (2009), *The Economic Report of the President*. Washington, DC: Government Printing Office.

Davis, E. P., and G. Fagan (1997), 'Are Financial Spreads Useful Indicators of Future Inflation and Output Growth in EU Countries?', *Journal of Applied Econometrics*, 12, 701–14.

Davis, E. P., and S. G. B. Henry (1994), 'The Use of Financial Spreads as Indicator Variables: Evidence for the United Kingdom and Germany', *IMF Staff Papers*, 41, 517–25.

Dotsey, M (1998), 'The Predictive Content of the Interest Rate Term Spread for Future Economic Growth', *Federal Reserve Bank Richmond Economic Quarterly*, 84(3), 31–51.

Estrella, A., and G. Hardouvelis (1991), 'The Term Structure as a Predictor of Real Economic Activity', *Journal of Finance*, 46(2), 555–76.

Estrella, A., and F. S. Mishkin (1997), 'The Predictive Power of the Term Structure of Interest Rates in Europe and the United States: Implications for the European Central Bank', *European Economic Review*, 41, 1375–401.

Estrella, A., A. P. Rodrigues and S. Schich (2003), 'How Stable is the Predictive Power of the Yield Curve? Evidence from Germany and the United States', *Review of Economics and Statistics*, 85(3), 629–44.

Harvey, C. R. (1988), 'The Real Term Structure and Consumption Growth', *Journal of Financial Economics*, 22(2), 305–33.

Harvey, C. R. (1989), 'Forecasts of Economic Growth from the Bond and Stock Markets', *Financial Analysts Journal*, 45(5), 38–45.

Harvey, C. R. (1991), 'The term structure and world economic growth', *The Journal of Fixed Income*, 1(1), 7–19.

Haubrich, J. G., and A. M. Dombrosky (1996), 'Predicting Real Growth Using the Yield Curve', *Federal Reserve Bank of Cleveland Economic Review*, 32(1), 26–34.

Koenig, E., S. Dolmas and J. Piger (2003), 'The Use and Abuse of "Real-Time" Data in Economic Forecasting', *Review of Economics and Statistics*, 85(3), 618–28.

Kozicki, S. (1997), 'Predicting Real Growth and Inflation with the Yield Spread', *Federal Reserve Bank Kansas City Economic Review*, 82, 39–57.

Moneta, F. (2003), 'Does the Yield Spread Predict Recessions in the Euro Area?', European Central Bank Working Paper Series No. 294.

Plosser, C. I., and K. G. Rouwenhorst (1994), 'International Term Structures and Real Economic Growth', *Journal of Monetary Economics*, 33, 133–56.

Rudebusch, G., E. T. Swanson and T. Wu (2006), 'The Bond Yield "Conundrum" from a Macro-Finance Perspective', Federal Reserve Bank of San Francisco Working Paper No. 2006-16.

Rudebusch, G., and J. C. Williams (2009), 'Forecasting Recessions: The Puzzle of the Enduring Power of the Yield Curve', *Journal of Business & Economic Statistics*, 4, 492–503.

Sarno, L., and G. Valente (2009), 'Exchange Rates and Fundamentals: Footloose or Evolving Relationship?', *Journal of the European Economic Association*, 7(4), 786–830.

Smets, F., and K. Tsatsaronis (1997), 'Why Does the Yield Curve Predict Economic Activity? Dissecting the Evidence for Germany and the United States', BIS Working Paper No. 49.

Stock, J., and M. Watson (1989), 'New Indexes of Coincident and Leading Economic Indicators', in O. J. Blanchard and S. Fischer (eds), *NBER Macroeconomics Annual*, Volume 4. Cambridge, MA: MIT Press, pp. 351–94.

Warnock, F., and V. C. Warnock (2006), 'International Capital Flows and U.S. Interest Rates', NBER Working Paper No. 12560.

Wright, J. (2006), 'The Yield Curve and Predicting Recessions', Federal Reserve Board Finance and Economic Discussion Series No. 2006-07.

Wu, T. (2008), 'Accounting for the Bond-Yield Conundrum', *Federal Reserve Bank of Dallas Economic Letter*, 3(2).

Appendix

Data for this article came from two sources. All of the recent data came from Haver Analytics. When the series in Haver did not extend back to 1970, the Haver series were spliced with data from the Bonser-Neal and Morely (1997) dataset. These data include the following:

Canada:
Three-month interest rate from 1/1970 to 12/1979 (IFS)
Industrial Production from 1/1970 to 12/1980 (BIS)
France:
Three-month interest rate from 1/1970 to 5/1989 (BIS)
Ten-year interest rate from 1/1970 to 8/81 (BIS)
Germany:
Ten-year interest rate from 1/1970 to 12/1979 (OECD, FRB)
Italy:
Three-month interest rate from 1/1971 to 12/1979 (lFS)
Ten-year interest rate from 1/1970 to 12/1979 (BIS, IFS)
Industrial Production from 1/1960 to 12/1979 (BIS)
Japan:
Three-month interest rate from 1/1970 to 4/1979 (BIS)
Ten-year interest rate from 1/1970 to 8/1987 (BIS)
Netherlands:
Three-month interest rate from 10/1972 to 12/1981 (BIS)
Ten-year interest rate from 1/1970 to 4/1982 (IFS)
Industrial Production from 1/70 to 12/79 (IFS)
Sweden:
Three-month interest rate from1/1970 to 12/1982 (IFS)
Ten-year interest rate from 1/1970 to 12/1986 (IFS)
Industrial Production from 1/1970 to 12/1989 (FRB)
UK:
Three-month interest rate from 1/1970 to 12/1985 (FRB)

Table A1: Current Yield Spread as Predictor of Future Growth: GDP vs IP

	(1) Can	(2) Fra	(3) Ger	(4) Ity	(5) Jap	(6) Ned	(7) Swe	(8) UK
Industrial production								
Spread	1.86	1.25	1.54	0.86	1.25	1.02	0.72	1.17
	(0.26)**	(0.44)**	(0.35)**	(0.41)*	(0.45)**	(0.52)**	(0.22)**	(0.24)**
Constant	0.024	−0.048	−0.083	0.83	1.25	−1.58	0.37	1.69
	(0.72)	(0.78)	(0.65)	(0.88)	(0.90)	(1.12)	(0.60)	(0.67)*
Rsq	0.28	0.14	0.26	0.069	0.073	0.075	0.13	0.21
Obs	167	169	169	165	169	165	169	170

	(1) Can	(2) Fra	(3) Ger	(4) Ity	(5) Jap	(6) Ned	(7) Swe	(8) UK
GDP								
Spread	0.83	0.34	0.57	0.15	−0.16	0.63	0.37	0.52
	(0.16)**	(0.16)*	(0.17)**	(0.22)	(0.20)	(0.19)**	(0.16)*	(0.13)**
Constant	1.87	1.91	1.42	1.75	2.74	1.33	2.16	2.54
	(0.36)**	(0.31)**	(0.42)**	(0.43)**	(0.50)**	(0.42)**	(0.45)**	(0.35)**
Rsq	0.32	0.071	0.15	0.012	0.0071	0.19	0.098	0.17
Obs	170	170	170	166	170	170	170	170

HAC standard errors ($^{*}P < 0.05$, $^{**}P < 0.01$). Yield spread is ten-year sovereign debt yield minus three-month, or closest eq.
IP and GDP are measured as year over year using quarterly frequency.