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Abstract

While the yield spread has long been recognized as a good predictor of recessions, it seems to have been largely overlooked by professional forecasters. We examine this puzzle, established by Rudebusch and Williams (2009), in a data-rich environment including not just the yield spread but many other predictors as well. We confirm the puzzle in this context by examining the contributions of both the SPF forecasts and the yield spread in predicting recessions, and by examining the information content of SPF forecasts directly. Furthermore, we take the first step towards a possible resolution of this puzzle by recognizing the heterogeneity across professional forecasters.

JEL-Code: C530, E430, E470.

Keywords: probability forecasts, yield spread, real-time data.

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1 Introduction

It is well known since at least the eighties that the yield spread (the difference between long and short term interest rates) is useful in forecasting real GDP growth and recessions (see Estrella, Rodrigues, and Schich (2003)). Despite this well-articulated result, Rudebusch and Williams (2009) (henceforth RW) show that participants in the Survey of Professional Forecasters (SPF) do not seem to use the yield spread when forecasting recessions. They establish this puzzling finding by showing that a simple probit model based on the yield spread outperforms the SPF forecasts at longer horizons.

We re-examine this *yield spread puzzle* through additional exercises and robustness checks. We allow for the possibility that professional forecasters may rely on a wider information set besides the yield spread. We examine the role of the yield spread in a data-rich environment by investigating the contributions of the SPF forecasts, the yield spread, and many other predictors in forecasting recessions and by modeling the information content of the SPF forecasts more directly. We are able to confirm the puzzle in several related but distinct ways, and we take the first step towards a possible resolution of this puzzle by focusing on the heterogeneity in forecast efficiency among the SPF respondents.

2 The yield spread puzzle revisited

2.1 The puzzle of the enduring power of the yield spread

Following RW, we illustrate the puzzle by comparing the SPF recession forecasts and those made using the yield spread. Specifically, we construct out-of-sample forecasts of recession using probit models estimated recursively with expanding samples with only the yield spread. We also follow RW in defining the binary recession indicator, taking the value 1 for quarters with negative "first final" (the release at the end of the third month

after a quarter) real GDP growth.[1] Besides the usual Brier's quadratic probability score (QPS), we report the Kuiper score and the odds ratio, whcih can be more informative in evaluating forecasts of uncommon binary events. To keep the results comparable across all our exercises, we use a sample from 1982Q1 to 2011Q3.

The results, in Table 1, show that the SPF current quarter ($h = 0$) and one-quarter-ahead ($h = 1$) forecasts have strong predictive power, although it diminishes rather quickly as the forecast horizon increases beyond 2. In fact, as suggested by the odds ratio and the Kuiper score, the SPF four-quarter ahead forecasts have almost no predictive power. Compared to the yield spread forecasts, at shorter horizons (0 and 1), the SPF forecasts are clearly superior, while at longer horizons (3 and 4), they are inferior.[2]

Our evidence supports RW's finding about the comparative performance of the SPF and the yield spread forecasts. However, as the professional forecasters may use information from many predictors besides the yield spread, the puzzle needs to be re-examined in such a context.

2.2 Predictive performance revisited using many predictors

To reassess the puzzle in the context of a rich information set with many predictors, we proceed in a fashion similar to Lahiri and Monokroussos (forthcoming) and use the framework of Giannone, Reichlin, and Small (2008). We estimate with Kalman filtering techniques dynamic factor models using their data set with nearly 200 variables beginning in 1982Q1 but updated to 2011Q3. Our specification is as follows:

$$y_t = \alpha + \beta' F_t + \gamma' Z_t + v_t \tag{1}$$

and $F_t = AF_{t-1} + Bu_t$, $x_t = \mu + \Lambda F_t + \xi_t$, where the dynamic factors, F, extracted from x, summarize the information in the data set; Z is a vector of additional predictors; v,

[1] We conducted all our exercises in this paper using all definitions of recession (R1, R2, NBER) and data vintages (advance, first final, latest) used by RW. Our results are robust to these alternative definitions and to the use of the post 1987 subsample.

[2] These results are confirmed by various statistical tests, cf. Lahiri and Wang (forthcoming). The Diebold-Mariano tests of the QPS suggest that the SPF forecasts are significantly better at 10% than the yield spread forecasts at horizon 0, whereas they are worse at horizons 3 and 4.

u and ξ are error terms.[3]

The performance of the SPF and the yield spread forecasts can be evaluated by embedding the above in a standard probit model for the binary recession indicator. Z here includes the SPF forecasts and the yield spread.

Table 2 reports the results from estimating this model with all the predictors. The SPF forecasts are significant in explaining recessions from horizons 0 to 3. In contrast, the yield spread is significant for horizons 2 to 4. Thus, the SPF forecasts beyond horizon 1 do not seem to use the yield spread sufficiently. Meanwhile, the dynamic factors are only significant for the current-quarter forecasts and are insignificant from horizon 1 onwards in the presence of the SPF forecasts and the yield spread. Therefore, we are able to confirm the RW puzzle in the context of a much larger information set.

2.3 Information content of SPF probability forecasts

Given the above results, it would be interesting to study, in a more direct way, the extend to which the professional forecasters use the rich information set, including the yield spread. For this purpose, we use again the Giannone, Reichlin, and Small (2008) framework, with y in equation (1) now being the SPF probability forecasts. Z here includes the yield spread and its lagged values. The results from this exercise are presented in the top half of Table 3 (model with factors and yield spread), where the SPF forecasts being explained are the consensus, i.e., averages of all individual forecasts. We also report the results from the yield-spread-only models. The results show that the two dynamic factors are significant in explaining the SPF consensus forecasts for horizons 0 to 3. For the same horizons, the yield spread and its four lags are jointly significant. However, neither the factors, nor the yield spread and its lagged values are significant in explaining the four-quarter ahead forecasts, indicating that none of them is used in forecasting recessions one year ahead. It is not surprising that at this horizon, when no information is used, the SPF forecasts perform poorly. Note that, compared to yield

[3]Following the literature we use two factors, estimated without the yield spread. Since the data is monthly, we use the Mariano-Murasawa filter to convert it to quarterly figures. See Giannone, Reichlin, and Small (2008) for relevant details of the model and the data set.

spread only, the two factors explain a much larger part of the SPF forecasts, particularly at horizons current to the second quarter.

It is well known that the SPF forecasts contain a significant amount of cross-sectional heterogeneity. Therefore, we examine if the superior forecasters absorb information (including the yield spread) more efficiently. We identify the top 10 forecasters quarter-by-quarter using their squared forecast errors and explore the information content of their average forecasts. The results, shown in the lower half of Table 3, are strikingly different from those of the consensus forecasts. The top 10 forecasters use a substantial amount of information contained in the yield spread as well as in the factors for all five horizons – both the factors and the yield spread are significant, and the R^2s are notably higher than before. Even for the three-quarter and four-quarter ahead forecasts, around 40% of the variation is explained. Here again, the two factors together are substantially more important than the yield spread. The adjusted R^2s for the former varies from 64% to 38% for horizons 0 to 4; those of the yield-spread-only model varies from 18% to 10% respectively. We have also conducted this exercise using the mean forecasts from the bottom 10 forecasters. The results show that less accurate forecasters use information from the factors and the yield spread less efficiently, particularly at the longer horizons.

3 Conclusions

In this paper, we reaffirm the puzzle about the power of the yield spread in forecasting recessions as compared to that of the SPF forecasts in the context of a large data set with many predictors. Additionally, we take the first step towards resolving this puzzle by exploring the information content of the SPF forecasts.

We examine the predictive performance of the SPF forecasts, the yield spread forecasts, and the dynamic factors summarizing a large amount of information. We find that the SPF forecasts are superior to the yield spread forecasts for the current quarter and the next quarter while the yield spread forecasts are better at longer horizons, especially four quarters ahead.

Our study of the information content of the SPF consensus forecasts shows clearly that professional forecasters do not rely much on the yield spread in forecasting recessions beyond two or three quarters. But this pattern of usage varies greatly across forecasters. In fact, the best forecasters do seem to use a rich information set including the yield spread even in making four-quarter-ahead forecasts.

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Table 1. Evaluating SPF forecasts and yield spread forecasts

Variable	Horizon	Odds Ratio	Kuiper Score	Brier's QPS
SPF Forecasts	0	14.13	0.54	0.04
	1	6.07	0.37	0.05
	2	2.62	0.17	0.07
	3	1.31	0.04	0.08
	4	0.95	-0.01	0.09
Yield Spread Forecasts	0	1.60	0.05	0.08
	1	2.28	0.10	0.08
	2	2.27	0.11	0.07
	3	2.78	0.14	0.07
	4	2.16	0.11	0.07

Expanding sample from 1955Q1 to 2011Q3.

Table 2. Probit model for recession using SPF probability forecasts, yield spread, and dynamic factors

Horizon	SPF Forecasts		Yield Spread		Dynamic Factor 1		Dynamic Factor 2	
	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value
0	0.044	**0.055**	0.751	0.266	0.242	**0.078**	-0.338	0.130
1	0.106	**0.024**	-0.089	0.815	0.009	0.882	-0.239	0.106
2	0.256	**0.009**	-1.141	**0.068**	-0.071	0.352	0.042	0.785
3	0.085	**0.055**	-0.608	**0.052**	0.056	0.176	-0.010	0.910
4	0.015	0.795	-0.765	**0.016**	0.050	0.307	-0.033	0.713

* Bold numbers are p-values $\leq$ 10%. (Same for Table 3.)

Table 3. Information content of SPF consensus forecasts

SPF Forecasts	Horizon	Model with Factors and Yield Spread							Yield Spread Only Model		
		Factor 1		Factor 2		Lags of Yield Spread		Adj. R^2	Lags of Yield Spread		Adj. R^2
		Coeff.	p-Value	Coeff.	p-Value	Sum of Coeff.'s	Joint Sign.		Sum of Coeff.'s	Joint Sign.	
Consensus	0	2.38	**0.00**	0.63	**0.01**	-1.21	**0.00**	0.71	-7.50	**0.00**	0.23
	1	1.34	**0.00**	1.18	**0.00**	-0.09	**0.00**	0.62	-5.66	**0.00**	0.25
	2	0.53	**0.00**	0.76	**0.00**	-1.09	**0.06**	0.43	-3.36	**0.00**	0.20
	3	0.05	0.60	0.21	**0.08**	-0.36	**0.07**	0.11	-0.84	**0.01**	0.10
	4	-0.06	0.54	-0.22	0.10	0.44	0.27	0.02	0.96	0.27	0.01
Top 10	0	2.74	**0.00**	0.38	0.22	-1.52	**0.03**	0.64	-8.00	**0.00**	0.18
	1	2.12	**0.00**	1.00	**0.00**	-1.57	**0.07**	0.59	-9.30	**0.00**	0.19
	2	1.37	**0.00**	0.77	**0.00**	-1.58	0.45	0.47	-5.26	**0.00**	0.16
	3	0.85	**0.00**	0.35	**0.02**	-1.01	0.74	0.41	-2.65	**0.00**	0.14
	4	0.78	**0.00**	0.12	0.40	0.59	0.59	0.38	-1.76	**0.01**	0.10