Error Statistics for the Survey of Professional Forecasters for Moody's Corp Bond Rate (Aaa)

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Source for Historical Realizations: Moody's Corporation

1. OVERVIEW.

This document reports error statistics for median projections from the Survey of Professional Forecasters (SPF), conducted since 1990 by the Federal Reserve Bank of Philadelphia. We provide the results in a series of tables and, in the PDF version of this document, a number of charts. The tables show the survey variable forecast and, importantly, the transformation of the data that we used to generate the statistics. (The transformation is usually a quarter-over-quarter growth rate, expressed in annualized percentage points. However, some variables, such as interest rates, the unemployment rate, and housing starts are untransformed and, thus, expressed in their natural units.)

The paragraphs below explain the format of the tables and charts and the methods used to compute the statistics. These paragraphs are general. The same discussion applies to all variables in the survey.

2. DESCRIPTION OF TABLES.

Tables 1A-1B report error statistics for various forecast horizons, sample periods, and choices of the real-time historical value that we used to assess accuracy. In each quarterly survey, we ask our panelists for their projections for the current quarter and the next four quarters. The current quarter is defined as the quarter in which we conducted the survey. Our tables provide error statistics separately for each quarter of this five-quarter horizon, beginning with the current quarter (denoted H = 1) and ending with the quarter that is four quarters in the future (H = 5). For each horizon, we report the mean forecast error [ME(S)], the mean absolute forecast error [MAE(S)], and the root-mean-square error [RMSE(S)]. All are standard measures of accuracy, though the academic literature generally places the most weight on the latter.

We define a forecast error as the difference between the historical value and the forecast. The mean error for each horizon is simply the average of the forecast errors at that horizon, constructed over the sample periods shown in Table 1A. Other things the same, a forecast with a mean error close to zero is better than one with a mean error far from zero. The mean absolute error is the sample average of the absolute value of the errors. Many analysts prefer this measure to the mean error because it does not allow large positive errors to offset large negative errors. In this sense, the mean absolute error gives a cleaner estimate of the size of the errors. Decision makers, however, may care not only about the average size of the errors but also about their variability, as measured by variance. Our last measure of accuracy is one that reflects the influence of the mean error and the variance of the error. The root-mean-square error for the SPF [RMSE(S)], the measure most often used by analysts and academicians, is the square root of the the average squared error. The lower the root-mean-square error, the more accurate the forecast.

2.1. Benchmark Models.

The forecast error statistics from the SPF are of interest in their own right. However, it is often more interesting to compare such statistics with those of alternative, or benchmark, forecasts. Tables 1A-1B report four such comparisons. They show the ratio of the root-mean-square error of the SPF forecast to that of four benchmark models. The benchmark models are statistical equations that we estimate on the data. We use the equations to generate projections for the same horizons included in the survey. In effect, we imagine standing back in time at each date when a survey was conducted and generating a separate forecast with each benchmark model. We do this in the same way that a survey panelist would have done using his own model.

Table 1A reports the root-mean-square-error ratios using as many observations as possible for each model. The number of observations can differ from model to model. We first compute the RMSE for each model. We then construct the ratio.

Table 1B reports RMSE ratios after we adjust the samples to include only the observations common to both models in the pair. Accordingly, the ratios reported in Table 1B may differ slightly from those of Table 1A, depending on the availability of sufficient real-time observations for estimating the benchmark models or for computing the errors of the SPF or benchmark forecasts. Table 1B also reports three two-sided p-values for each ratio. The p-values, corrected for the presence of heteroskedasticity and serial correlation in the time series of differences in squared forecast errors, are those for the test of equality of mean-square error between the SPF and the benchmark. The p-values are those for:

(1) The Diebold-Mariano statistic (July 1995, Journal of Business and Economic Statistics), using a uniform lag window with the truncation lag set to the forecast horizon minus unity. When the uniform lag window produces a nonpositive standard error, the Bartlett window is used.

(2) The Harvey-Leybourne-Newbold correction (1997, International Journal of Forecasting) to the Diebold-Mariano statistic.

(3) The Diebold-Mariano statistic, using a Bartlett lag window with the truncation lag increased four quarters beyond that of (1) and (2).

A RMSE ratio below unity indicates that the SPF consensus (median) forecast has a root-mean-square error lower than that of the benchmark. This means the SPF is more accurate. We now describe the benchmark models. The first is perhaps the simplest of all possible benchmarks: A no-change model. In this model, the forecast for quarter T, the one-step-ahead or current-quarter forecast, is simply the historical value for the prior quarter (T - 1). There is, in other words, no change in the forecast compared with the historical value. Moreover, the forecast for the remaining quarters of the horizon is the same as the forecast for the current quarter. We denote the relative RMSE ratio for this benchmark as RMSE(S/NC), using NC to indicate no change. The second and third benchmark models generate projections using one or more historical observations of the the variable forecast, weighted by coefficients estimated from the data. Such autoregressive (AR) models can be formulated in two ways. We can estimate one model to generate the forecasts at all horizons, using an iteration method to generate the projections beyond the current quarter (IAR), or we can directly estimate a new model for each forecast horizon (DAR). The latter formulation has been shown to reduce the bias in a forecast when the underlying model is characterized by certain types of misspecification. The root-mean-square error ratios are denoted RMSE(S/IAR) and RMSE(S/DAR), respectively.

The one- through five-step-ahead projections of the benchmark models use information on the quarterly average of the variable forecast. The latest historical observation is for the quarter that is one quarter before the quarter of the first projection in the horizon. In contrast, the panelists generate their projections with the help of additional information. They submit their projections near the middle of each quarter and hence have access to some monthly indicators for the first month of each quarter, when those data are released before the survey deadline. This puts the projections of panelists for some variables at an advantage relative to the corresponding benchmark projections. Moreover, the panelists may also examine the very recent historical values of such monthly indicators in forming their projections for quarterly averages. Such monthly statistical momentum represents an advantage not shared by the benchmark models, which use only quarterly averages. For survey variables whose observations are reported at a monthly frequency, such as interest rates, industrial production, housing starts, and unemployment, we estimate and forecast a fourth benchmark model, the DARM. This model adds recent monthly historical values to the specification of the DAR model. For the projections for unemployment, nonfarm payroll employment, and interest rates, we add the values of monthly observations, beginning with that for the first month of the first quarter of the forecast horizon. These values should be in the information set of the survey panelists at the time they formed their projections. In contrast, for variables such as housing starts and industrial production, we include only lagged values of monthly observations. For such variables, the panelists would not have known the monthly observation for the first month of the first quarter of the forecast horizon. In general, we find that adding monthly observations to the benchmark DAR models improves accuracy. Indeed, for the projections for interest rates and the unemployment rate, the accuracy of the benchmark DARM projections rivals that of the SPF projections.

2.2. Real-Time Data.

All benchmark models are estimated on a rolling, fixed window of 60 real-time quarterly observations. Lag lengths, based on either the Akaike information criterion (AIC) or the Schwarz information criterion (SIC), are re-estimated each period. The tables below indicate whether the lag length was was chosen by the AIC or SIC.

We would like to make the comparison between the SPF forecast and the forecasts of each benchmark as fair as possible. Therefore, we must subject the benchmark models to the same data environment the survey panelists faced when they made their projections. This is important because macroeconomic data are revised often, and we do not want the benchmark models to use a data set that differs from the one our panelists would have used. We estimate and forecast the benchmark models with real-time data from the Philadelphia Fed real-time data set, using the vintage of data that the survey panelists would have had at the time they generated their own projections. (For more information on the Philadelphia Fed real-time data set, go to www.philadelphiafed.org/econ/forecast/real-time-data/.)

An open question in the literature on forecasting is: What version or vintage of the data should we use to compute the errors? A closely related question is: What version of the data are professional forecasters trying to predict? Our computations take no strong position on these questions. In Tables 1A - 1B, we evaluate the projections (SPF and benchmark) with five alternative measures of the historical values, all from the Philadelphia Fed real-time data set. These measures range from the initial-release values to the values as we know them today. All together, we compute the forecast error statistics using the following five alternative measures of historical values:

(1) The initial or first-release value;
(2) The revised value as it appears one quarter after the initial release;
(3) The revised value as it appears five quarters after the initial release;
(4) The revised value as it appears nine quarters after the initial release;
(5) The revised value as it appears today.

Each measure of the historical value has advantages and disadvantages. The initial-release value is the first measure released by government statistical agencies. A forecaster might be very interested in this measure because it enables him to evaluate his latest forecast soon after he generated it. However, early releases of the data are often subject to large measurement error. Subsequent releases [(2) - (5)] are more accurate, but they are available much later than the initial release. As we go from the first measure to the fifth, we get more reliability, at the cost of higher delays in availability.

The last two columns in Table 1A report the number of observations that we used to compute the error statistics. Some observations are omitted because the data are missing in the real-time data set, such as occurred when federal government statistical agencies closed in late 1995.

2.3. Recent Projections and Realizations.

Tables 2 to 7 provide information on recent projections and realizations. They show how we align the data prior to computing the forecast errors that form the backbone of the computations in Tables 1A - 1B. Any error can be written as the equation given by error = realization - forecast. For our computations, we must be more precise because, for each projection (SPF and benchmarks), we have different periods forecast (T) different forecast horizons (h), and several measures of the realization (m). Thus, we can define the forecast error more precisely as

$$\text{error}(T, h, m) = \text{realization}(T, m) - \text{forecast}(T, h).$$

Tables 2 to 7 are organized along these lines. Table 2 shows recent forecasts from the SPF. Each column gives the projection for a different horizon or forecast step (h), beginning with that for the current quarter, defined as the quarter in which we conducted the survey. The dates (T) given in the rows show the periods forecast. These also correspond to the dates that we conducted the survey. Tables 3 to 6 report the recent projections of the four benchmark models. They are organized in the same way as Table 2. Table 7 reports recent values of the five alternative realizations (m) we use to compute the error statistics.

2.4. Qualifications.

We note two minor qualifications to the methods discussed above. The first concerns the vintage of data that we used to estimate and forecast the benchmark models for CPI inflation. The second concerns the five measures of realizations used for the unemployment rate, nonfarm payroll employment, and CPI inflation. To estimate and forecast the benchmark models for CPI inflation, we use the vintage of data that would have been available in the middle of each quarter. This postdates by one month the vintage that SPF panelists would have had at their disposal when they formed their projections.

To compute the realizations for unemployment, nonfarm payroll employment, and CPI inflation, we use the vintages associated with the middle of each quarter. The measure that we call initial comes from this vintage, even though the initial estimate was available in the vintage dated one month earlier. Thus, for these variables, our initial estimate reflects some revision by government statistical agencies. The effect for unemployment and CPI inflation is likely small. The effect could be somewhat larger for nonfarm payroll employment.

3. DESCRIPTION OF GRAPHS.

3.1. Root-Mean-Square Errors.

For each sample period shown in Table 1, we provide graphs of the root-mean-square error for the SPF forecast. There is one page for each sample period. On each page, we plot (for each forecast horizon) the RMSE on the y-axis. The x-axis shows the measure of the historical value that we used to compute the RMSE. These range from the value on its initial release to the value one quarter later to the value as we know it now (at the time we made the computation).

The graphs provide a tremendous amount of information. If we focus on a particular graph, we can see how a change in the measure of the realization (x-axis) affects the root-mean-square-error measure of accuracy. The effect is pronounced for some variables, such as real GDP and some of its components. For others, there is little or no effect. For example, because the historical data on interest rates are not revised, the estimated RMSE is the same in each case.

If we compare a particular point on one graph with the same point on another, we see how the forecast horizon affects accuracy. In general, the RMSE rises (accuracy falls) as the forecast horizon lengthens. Finally, if we compare a graph on one page with the corresponding graph on another page, we see how our estimates of accuracy in the SPF change with the sample period. Periods characterized by a high degree of economic turbulence will generally produce large RMSEs.

3.2. Fan Charts.

The last chart plots recent historical values and the latest SPF forecast. It also shows confidence intervals for the forecast, based on back-of-the-envelope calculations. The historical values and the SPF forecast are those associated with the latest vintage of data and survey, respectively, available at the time we ran our computer programs. The confidence intervals are constructed under the assumption that the historical forecast errors over the sample (shown in the footnote) follow a normal distribution with a mean of zero and a variance given by the squared root-mean-square error. The latter is estimated over the aforementioned sample, using the measure of history listed in the footnote.

Table 1A.
Forecast Error Summary Statistics for SPF Variable: BOND (Moody's Corp Bond Rate (Aaa))

Computed Over Various Sample Periods
Various Measures of Realizations
Transformation: Level
Lag Length for IAR(p), DAR(p), and DARM(p) Models: AIC

Source for Historical Realizations: Moody's Corporation

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History: Initial Release

H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
1991:04-2018:03									
1	-0.05	0.13	0.16	0.55	0.53	0.53	0.98	108	108
2	-0.17	0.35	0.42	0.94	0.87	0.88	1.01	108	108
3	-0.29	0.50	0.59	1.06	0.95	0.92	1.01	108	108
4	-0.39	0.60	0.72	1.11	0.94	0.91	1.00	108	108
5	-0.50	0.70	0.82	1.17	0.92	0.93	0.98	108	108
1991:04-1996:04									
1	-0.04	0.11	0.13	0.37	0.38	0.38	0.83	21	21
2	-0.13	0.41	0.48	0.79	0.72	0.70	0.94	21	21
3	-0.21	0.63	0.72	0.91	0.78	0.73	0.85	21	21
4	-0.28	0.73	0.85	0.93	0.72	0.67	0.77	21	21
5	-0.41	0.78	0.91	0.95	0.65	0.62	0.67	21	21
1997:01-2018:03									
1	-0.06	0.13	0.16	0.61	0.58	0.58	1.01	87	87
2	-0.18	0.34	0.41	1.01	0.95	0.98	1.03	87	87
3	-0.31	0.47	0.56	1.14	1.06	1.05	1.11	87	87
4	-0.41	0.57	0.68	1.21	1.09	1.11	1.16	87	87
5	-0.52	0.68	0.79	1.27	1.12	1.19	1.22	87	87

History: One Qtr After Initial Release

H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
1991:04-2018:03									
1	-0.05	0.13	0.16	0.55	0.53	0.53	0.98	108	108
2	-0.17	0.35	0.42	0.94	0.87	0.88	1.01	108	108
3	-0.29	0.50	0.59	1.06	0.95	0.92	1.01	108	108
4	-0.39	0.60	0.72	1.11	0.94	0.91	1.00	108	108
5	-0.50	0.70	0.82	1.17	0.92	0.93	0.98	108	108
1991:04-1996:04									
1	-0.04	0.11	0.13	0.37	0.38	0.38	0.83	21	21
2	-0.13	0.41	0.48	0.79	0.72	0.70	0.94	21	21
3	-0.21	0.63	0.72	0.91	0.78	0.73	0.85	21	21
4	-0.28	0.73	0.85	0.93	0.72	0.67	0.77	21	21
5	-0.41	0.78	0.91	0.95	0.65	0.62	0.67	21	21
1997:01-2018:03									
1	-0.06	0.13	0.16	0.61	0.58	0.58	1.01	87	87
2	-0.18	0.34	0.41	1.01	0.95	0.98	1.03	87	87
3	-0.31	0.47	0.56	1.14	1.06	1.05	1.11	87	87
4	-0.41	0.57	0.68	1.21	1.09	1.11	1.16	87	87
5	-0.52	0.68	0.79	1.27	1.12	1.19	1.22	87	87

History: Five Qtrs After Initial Release

H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
1991:04-2018:03									
1	-0.05	0.13	0.16	0.55	0.53	0.53	0.98	108	108
2	-0.17	0.35	0.42	0.94	0.87	0.88	1.01	108	108
3	-0.29	0.50	0.59	1.06	0.95	0.92	1.01	108	108
4	-0.39	0.60	0.72	1.11	0.94	0.91	1.00	108	108
5	-0.50	0.70	0.82	1.17	0.92	0.93	0.98	108	108
1991:04-1996:04									
1	-0.04	0.11	0.13	0.37	0.38	0.38	0.83	21	21
2	-0.13	0.41	0.48	0.79	0.72	0.70	0.94	21	21
3	-0.21	0.63	0.72	0.91	0.78	0.73	0.85	21	21
4	-0.28	0.73	0.85	0.93	0.72	0.67	0.77	21	21
5	-0.41	0.78	0.91	0.95	0.65	0.62	0.67	21	21
1997:01-2018:03									
1	-0.06	0.13	0.16	0.61	0.58	0.58	1.01	87	87
2	-0.18	0.34	0.41	1.01	0.95	0.98	1.03	87	87
3	-0.31	0.47	0.56	1.14	1.06	1.05	1.11	87	87
4	-0.41	0.57	0.68	1.21	1.09	1.11	1.16	87	87
5	-0.52	0.68	0.79	1.27	1.12	1.19	1.22	87	87

History: Nine Qtrs After Initial Release

H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
1991:04-2018:03									
1	-0.05	0.13	0.16	0.55	0.53	0.53	0.98	108	108
2	-0.17	0.35	0.42	0.94	0.87	0.88	1.01	108	108
3	-0.29	0.50	0.59	1.06	0.95	0.92	1.01	108	108
4	-0.39	0.60	0.72	1.11	0.94	0.91	1.00	108	108
5	-0.50	0.70	0.82	1.17	0.92	0.93	0.98	108	108
1991:04-1996:04									
1	-0.04	0.11	0.13	0.37	0.38	0.38	0.83	21	21
2	-0.13	0.41	0.48	0.79	0.72	0.70	0.94	21	21
3	-0.21	0.63	0.72	0.91	0.78	0.73	0.85	21	21
4	-0.28	0.73	0.85	0.93	0.72	0.67	0.77	21	21
5	-0.41	0.78	0.91	0.95	0.65	0.62	0.67	21	21
1997:01-2018:03									
1	-0.06	0.13	0.16	0.61	0.58	0.58	1.01	87	87
2	-0.18	0.34	0.41	1.01	0.95	0.98	1.03	87	87
3	-0.31	0.47	0.56	1.14	1.06	1.05	1.11	87	87
4	-0.41	0.57	0.68	1.21	1.09	1.11	1.16	87	87
5	-0.52	0.68	0.79	1.27	1.12	1.19	1.22	87	87

History: Latest Vintage

H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
1991:04-2018:03									
1	-0.05	0.13	0.16	0.55	0.53	0.53	0.98	108	108
2	-0.17	0.35	0.42	0.94	0.87	0.88	1.01	108	108
3	-0.29	0.50	0.59	1.06	0.95	0.92	1.01	108	108
4	-0.39	0.60	0.72	1.11	0.94	0.91	1.00	108	108
5	-0.50	0.70	0.82	1.17	0.92	0.93	0.98	108	108
1991:04-1996:04									
1	-0.04	0.11	0.13	0.37	0.38	0.38	0.83	21	21
2	-0.13	0.41	0.48	0.79	0.72	0.70	0.94	21	21
3	-0.21	0.63	0.72	0.91	0.78	0.73	0.85	21	21
4	-0.28	0.73	0.85	0.93	0.72	0.67	0.77	21	21
5	-0.41	0.78	0.91	0.95	0.65	0.62	0.67	21	21
1997:01-2018:03									
1	-0.06	0.13	0.16	0.61	0.58	0.58	1.01	87	87
2	-0.18	0.34	0.41	1.01	0.95	0.98	1.03	87	87
3	-0.31	0.47	0.56	1.14	1.06	1.05	1.11	87	87
4	-0.41	0.57	0.68	1.21	1.09	1.11	1.16	87	87
5	-0.52	0.68	0.79	1.27	1.12	1.19	1.22	87	87

Notes for Table 1A.

(1) The forecast horizon is given by H, where H = 1 is the SPF forecast for the current quarter.
(2) The headers ME(S), MAE(S), and RMSE(S) are mean error, mean absolute error, and root-mean-square error for the SPF.
(3) The header RMSE(S/NC) is the ratio of the SPF RMSE to that of the no-change (NC) model.
(4) The headers RMSE(S/IAR), RMSE(S/DAR) and RMSE(S/DARM) are the ratios of the SPF RMSE to the RMSE of the iterated and direct autoregressive models and the direct autoregressive model augmented with monthly observations, respectively. All models are estimated on a rolling window of 60 observations from the Philadelphia Fed real-time data set.
(5) The headers Nspf and N are the number of observations analyzed for the SPF and benchmark models.
(6) When the variable forecast is a growth rate or an interest rate, it is expressed in annualized percentage points. When the variable forecast is the unemployment rate, it is expressed in percentage points.
(7) Sample periods refer to the dates forecast, not the dates when the forecasts were made.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 1B.
Ratios of Root-Mean-Square Errors for SPF Variable: BOND (Moody's Corp Bond Rate (Aaa))
Alternative P-Values in Parentheses

Computed Over Various Sample Periods
Various Measures of Realizations
Transformation: Level
Lag Length for IAR(p), DAR(p), and DARM(p) Models: AIC

Source for Historical Realizations: Moody's Corporation

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History: Initial Release
1991:04-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.549	0.531	0.531	0.976	108	108	108	108
	(0.000)	(0.000)	(0.000)	(0.779)				
	(0.000)	(0.000)	(0.000)	(0.781)				
	(0.000)	(0.000)	(0.000)	(0.801)				
2	0.940	0.873	0.877	1.006	108	108	108	108
	(0.239)	(0.014)	(0.037)	(0.917)				
	(0.248)	(0.017)	(0.042)	(0.918)				
	(0.258)	(0.028)	(0.051)	(0.912)				
3	1.061	0.949	0.920	1.011	108	108	108	108
	(0.226)	(0.474)	(0.338)	(0.882)				
	(0.240)	(0.486)	(0.351)	(0.885)				
	(0.261)	(0.476)	(0.313)	(0.867)				
4	1.109	0.936	0.914	1.000	108	108	108	108
	(0.082)	(0.492)	(0.418)	(0.999)				
	(0.095)	(0.508)	(0.435)	(0.999)				
	(0.081)	(0.475)	(0.394)	(0.999)				
5	1.168	0.923	0.930	0.975	108	108	108	108
	(0.049)	(0.507)	(0.577)	(0.821)				
	(0.062)	(0.526)	(0.594)	(0.829)				
	(0.037)	(0.491)	(0.567)	(0.817)				

History: Initial Release
1991:04-1996:04

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.371	0.379	0.379	0.835	21	21	21	21
	(0.000)	(0.000)	(0.000)	(0.214)				
	(0.002)	(0.000)	(0.000)	(0.239)				
	(0.000)	(0.000)	(0.000)	(0.157)				
2	0.793	0.724	0.701	0.942	21	21	21	21
	(0.017)	(0.001)	(0.001)	(0.497)				
	(0.039)	(0.007)	(0.007)	(0.535)				
	(0.001)	(0.000)	(0.000)	(0.452)				
3	0.912	0.777	0.728	0.846	21	21	21	21
	(0.155)	(0.028)	(0.021)	(0.163)				
	(NA)	(0.067)	(0.056)	(0.234)				
	(0.053)	(0.006)	(0.000)	(0.013)				
4	0.933	0.716	0.669	0.771	21	21	21	21
	(0.102)	(0.009)	(0.002)	(0.038)				
	(NA)	(0.041)	(0.018)	(0.099)				
	(0.048)	(0.001)	(0.000)	(0.000)				
5	0.954	0.652	0.623	0.669	21	21	21	21
	(0.138)	(0.001)	(0.000)	(0.001)				
	(0.257)	(0.016)	(0.000)	(NA)				
	(0.231)	(0.001)	(0.000)	(0.000)				

History: Initial Release
1997:01-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.613	0.580	0.580	1.007	87	87	87	87
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.947)				
2	1.012	0.949	0.978	1.031	87	87	87	87
	(0.816)	(0.304)	(0.668)	(0.661)				
	(0.820)	(0.316)	(0.674)	(0.668)				
	(0.821)	(0.359)	(0.687)	(0.641)				
3	1.144	1.058	1.055	1.109	87	87	87	87
	(0.045)	(0.402)	(0.442)	(0.155)				
	(0.054)	(0.417)	(0.457)	(0.171)				
	(0.033)	(0.390)	(0.430)	(0.129)				
4	1.205	1.090	1.110	1.158	87	87	87	87
	(0.018)	(0.291)	(0.200)	(0.059)				
	(0.026)	(0.314)	(0.222)	(0.074)				
	(0.014)	(0.259)	(0.186)	(0.041)				
5	1.274	1.121	1.194	1.219	87	87	87	87
	(0.019)	(0.236)	(0.050)	(0.021)				
	(0.029)	(0.264)	(0.067)	(0.032)				
	(0.012)	(0.176)	(0.036)	(0.012)				

History: One Qtr After Initial Release
1991:04-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.549	0.531	0.531	0.976	108	108	108	108
	(0.000)	(0.000)	(0.000)	(0.779)				
	(0.000)	(0.000)	(0.000)	(0.781)				
	(0.000)	(0.000)	(0.000)	(0.801)				
2	0.940	0.873	0.877	1.006	108	108	108	108
	(0.239)	(0.014)	(0.037)	(0.917)				
	(0.248)	(0.017)	(0.042)	(0.918)				
	(0.258)	(0.028)	(0.051)	(0.912)				
3	1.061	0.949	0.920	1.011	108	108	108	108
	(0.226)	(0.474)	(0.338)	(0.882)				
	(0.240)	(0.486)	(0.351)	(0.885)				
	(0.261)	(0.476)	(0.313)	(0.867)				
4	1.109	0.936	0.914	1.000	108	108	108	108
	(0.082)	(0.492)	(0.418)	(0.999)				
	(0.095)	(0.508)	(0.435)	(0.999)				
	(0.081)	(0.475)	(0.394)	(0.999)				
5	1.168	0.923	0.930	0.975	108	108	108	108
	(0.049)	(0.507)	(0.577)	(0.821)				
	(0.062)	(0.526)	(0.594)	(0.829)				
	(0.037)	(0.491)	(0.567)	(0.817)				

History: One Qtr After Initial Release
1991:04-1996:04

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.371	0.379	0.379	0.835	21	21	21	21
	(0.000)	(0.000)	(0.000)	(0.214)				
	(0.002)	(0.000)	(0.000)	(0.239)				
	(0.000)	(0.000)	(0.000)	(0.157)				
2	0.793	0.724	0.701	0.942	21	21	21	21
	(0.017)	(0.001)	(0.001)	(0.497)				
	(0.039)	(0.007)	(0.007)	(0.535)				
	(0.001)	(0.000)	(0.000)	(0.452)				
3	0.912	0.777	0.728	0.846	21	21	21	21
	(0.155)	(0.028)	(0.021)	(0.163)				
	(NA)	(0.067)	(0.056)	(0.234)				
	(0.053)	(0.006)	(0.000)	(0.013)				
4	0.933	0.716	0.669	0.771	21	21	21	21
	(0.102)	(0.009)	(0.002)	(0.038)				
	(NA)	(0.041)	(0.018)	(0.099)				
	(0.048)	(0.001)	(0.000)	(0.000)				
5	0.954	0.652	0.623	0.669	21	21	21	21
	(0.138)	(0.001)	(0.000)	(0.001)				
	(0.257)	(0.016)	(0.000)	(NA)				
	(0.231)	(0.001)	(0.000)	(0.000)				

History: One Qtr After Initial Release
1997:01-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.613	0.580	0.580	1.007	87	87	87	87
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.947)				
2	1.012	0.949	0.978	1.031	87	87	87	87
	(0.816)	(0.304)	(0.668)	(0.661)				
	(0.820)	(0.316)	(0.674)	(0.668)				
	(0.821)	(0.359)	(0.687)	(0.641)				
3	1.144	1.058	1.055	1.109	87	87	87	87
	(0.045)	(0.402)	(0.442)	(0.155)				
	(0.054)	(0.417)	(0.457)	(0.171)				
	(0.033)	(0.390)	(0.430)	(0.129)				
4	1.205	1.090	1.110	1.158	87	87	87	87
	(0.018)	(0.291)	(0.200)	(0.059)				
	(0.026)	(0.314)	(0.222)	(0.074)				
	(0.014)	(0.259)	(0.186)	(0.041)				
5	1.274	1.121	1.194	1.219	87	87	87	87
	(0.019)	(0.236)	(0.050)	(0.021)				
	(0.029)	(0.264)	(0.067)	(0.032)				
	(0.012)	(0.176)	(0.036)	(0.012)				

History: Five Qtrs After Initial Release
1991:04-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.549	0.531	0.531	0.976	108	108	108	108
	(0.000)	(0.000)	(0.000)	(0.779)				
	(0.000)	(0.000)	(0.000)	(0.781)				
	(0.000)	(0.000)	(0.000)	(0.801)				
2	0.940	0.873	0.877	1.006	108	108	108	108
	(0.239)	(0.014)	(0.037)	(0.917)				
	(0.248)	(0.017)	(0.042)	(0.918)				
	(0.258)	(0.028)	(0.051)	(0.912)				
3	1.061	0.949	0.920	1.011	108	108	108	108
	(0.226)	(0.474)	(0.338)	(0.882)				
	(0.240)	(0.486)	(0.351)	(0.885)				
	(0.261)	(0.476)	(0.313)	(0.867)				
4	1.109	0.936	0.914	1.000	108	108	108	108
	(0.082)	(0.492)	(0.418)	(0.999)				
	(0.095)	(0.508)	(0.435)	(0.999)				
	(0.081)	(0.475)	(0.394)	(0.999)				
5	1.168	0.923	0.930	0.975	108	108	108	108
	(0.049)	(0.507)	(0.577)	(0.821)				
	(0.062)	(0.526)	(0.594)	(0.829)				
	(0.037)	(0.491)	(0.567)	(0.817)				

History: Five Qtrs After Initial Release
1991:04-1996:04

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.371	0.379	0.379	0.835	21	21	21	21
	(0.000)	(0.000)	(0.000)	(0.214)				
	(0.002)	(0.000)	(0.000)	(0.239)				
	(0.000)	(0.000)	(0.000)	(0.157)				
2	0.793	0.724	0.701	0.942	21	21	21	21
	(0.017)	(0.001)	(0.001)	(0.497)				
	(0.039)	(0.007)	(0.007)	(0.535)				
	(0.001)	(0.000)	(0.000)	(0.452)				
3	0.912	0.777	0.728	0.846	21	21	21	21
	(0.155)	(0.028)	(0.021)	(0.163)				
	(NA)	(0.067)	(0.056)	(0.234)				
	(0.053)	(0.006)	(0.000)	(0.013)				
4	0.933	0.716	0.669	0.771	21	21	21	21
	(0.102)	(0.009)	(0.002)	(0.038)				
	(NA)	(0.041)	(0.018)	(0.099)				
	(0.048)	(0.001)	(0.000)	(0.000)				
5	0.954	0.652	0.623	0.669	21	21	21	21
	(0.138)	(0.001)	(0.000)	(0.001)				
	(0.257)	(0.016)	(0.000)	(NA)				
	(0.231)	(0.001)	(0.000)	(0.000)				

History: Five Qtrs After Initial Release
1997:01-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.613	0.580	0.580	1.007	87	87	87	87
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.947)				
2	1.012	0.949	0.978	1.031	87	87	87	87
	(0.816)	(0.304)	(0.668)	(0.661)				
	(0.820)	(0.316)	(0.674)	(0.668)				
	(0.821)	(0.359)	(0.687)	(0.641)				
3	1.144	1.058	1.055	1.109	87	87	87	87
	(0.045)	(0.402)	(0.442)	(0.155)				
	(0.054)	(0.417)	(0.457)	(0.171)				
	(0.033)	(0.390)	(0.430)	(0.129)				
4	1.205	1.090	1.110	1.158	87	87	87	87
	(0.018)	(0.291)	(0.200)	(0.059)				
	(0.026)	(0.314)	(0.222)	(0.074)				
	(0.014)	(0.259)	(0.186)	(0.041)				
5	1.274	1.121	1.194	1.219	87	87	87	87
	(0.019)	(0.236)	(0.050)	(0.021)				
	(0.029)	(0.264)	(0.067)	(0.032)				
	(0.012)	(0.176)	(0.036)	(0.012)				

History: Nine Qtrs After Initial Release
1991:04-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.549	0.531	0.531	0.976	108	108	108	108
	(0.000)	(0.000)	(0.000)	(0.779)				
	(0.000)	(0.000)	(0.000)	(0.781)				
	(0.000)	(0.000)	(0.000)	(0.801)				
2	0.940	0.873	0.877	1.006	108	108	108	108
	(0.239)	(0.014)	(0.037)	(0.917)				
	(0.248)	(0.017)	(0.042)	(0.918)				
	(0.258)	(0.028)	(0.051)	(0.912)				
3	1.061	0.949	0.920	1.011	108	108	108	108
	(0.226)	(0.474)	(0.338)	(0.882)				
	(0.240)	(0.486)	(0.351)	(0.885)				
	(0.261)	(0.476)	(0.313)	(0.867)				
4	1.109	0.936	0.914	1.000	108	108	108	108
	(0.082)	(0.492)	(0.418)	(0.999)				
	(0.095)	(0.508)	(0.435)	(0.999)				
	(0.081)	(0.475)	(0.394)	(0.999)				
5	1.168	0.923	0.930	0.975	108	108	108	108
	(0.049)	(0.507)	(0.577)	(0.821)				
	(0.062)	(0.526)	(0.594)	(0.829)				
	(0.037)	(0.491)	(0.567)	(0.817)				

History: Nine Qtrs After Initial Release
1991:04-1996:04

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.371	0.379	0.379	0.835	21	21	21	21
	(0.000)	(0.000)	(0.000)	(0.214)				
	(0.002)	(0.000)	(0.000)	(0.239)				
	(0.000)	(0.000)	(0.000)	(0.157)				
2	0.793	0.724	0.701	0.942	21	21	21	21
	(0.017)	(0.001)	(0.001)	(0.497)				
	(0.039)	(0.007)	(0.007)	(0.535)				
	(0.001)	(0.000)	(0.000)	(0.452)				
3	0.912	0.777	0.728	0.846	21	21	21	21
	(0.155)	(0.028)	(0.021)	(0.163)				
	(NA)	(0.067)	(0.056)	(0.234)				
	(0.053)	(0.006)	(0.000)	(0.013)				
4	0.933	0.716	0.669	0.771	21	21	21	21
	(0.102)	(0.009)	(0.002)	(0.038)				
	(NA)	(0.041)	(0.018)	(0.099)				
	(0.048)	(0.001)	(0.000)	(0.000)				
5	0.954	0.652	0.623	0.669	21	21	21	21
	(0.138)	(0.001)	(0.000)	(0.001)				
	(0.257)	(0.016)	(0.000)	(NA)				
	(0.231)	(0.001)	(0.000)	(0.000)				

History: Nine Qtrs After Initial Release
1997:01-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.613	0.580	0.580	1.007	87	87	87	87
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.947)				
2	1.012	0.949	0.978	1.031	87	87	87	87
	(0.816)	(0.304)	(0.668)	(0.661)				
	(0.820)	(0.316)	(0.674)	(0.668)				
	(0.821)	(0.359)	(0.687)	(0.641)				
3	1.144	1.058	1.055	1.109	87	87	87	87
	(0.045)	(0.402)	(0.442)	(0.155)				
	(0.054)	(0.417)	(0.457)	(0.171)				
	(0.033)	(0.390)	(0.430)	(0.129)				
4	1.205	1.090	1.110	1.158	87	87	87	87
	(0.018)	(0.291)	(0.200)	(0.059)				
	(0.026)	(0.314)	(0.222)	(0.074)				
	(0.014)	(0.259)	(0.186)	(0.041)				
5	1.274	1.121	1.194	1.219	87	87	87	87
	(0.019)	(0.236)	(0.050)	(0.021)				
	(0.029)	(0.264)	(0.067)	(0.032)				
	(0.012)	(0.176)	(0.036)	(0.012)				

History: Latest Vintage
1991:04-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.549	0.531	0.531	0.976	108	108	108	108
	(0.000)	(0.000)	(0.000)	(0.779)				
	(0.000)	(0.000)	(0.000)	(0.781)				
	(0.000)	(0.000)	(0.000)	(0.801)				
2	0.940	0.873	0.877	1.006	108	108	108	108
	(0.239)	(0.014)	(0.037)	(0.917)				
	(0.248)	(0.017)	(0.042)	(0.918)				
	(0.258)	(0.028)	(0.051)	(0.912)				
3	1.061	0.949	0.920	1.011	108	108	108	108
	(0.226)	(0.474)	(0.338)	(0.882)				
	(0.240)	(0.486)	(0.351)	(0.885)				
	(0.261)	(0.476)	(0.313)	(0.867)				
4	1.109	0.936	0.914	1.000	108	108	108	108
	(0.082)	(0.492)	(0.418)	(0.999)				
	(0.095)	(0.508)	(0.435)	(0.999)				
	(0.081)	(0.475)	(0.394)	(0.999)				
5	1.168	0.923	0.930	0.975	108	108	108	108
	(0.049)	(0.507)	(0.577)	(0.821)				
	(0.062)	(0.526)	(0.594)	(0.829)				
	(0.037)	(0.491)	(0.567)	(0.817)				

History: Latest Vintage
1991:04-1996:04

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.371	0.379	0.379	0.835	21	21	21	21
	(0.000)	(0.000)	(0.000)	(0.214)				
	(0.002)	(0.000)	(0.000)	(0.239)				
	(0.000)	(0.000)	(0.000)	(0.157)				
2	0.793	0.724	0.701	0.942	21	21	21	21
	(0.017)	(0.001)	(0.001)	(0.497)				
	(0.039)	(0.007)	(0.007)	(0.535)				
	(0.001)	(0.000)	(0.000)	(0.452)				
3	0.912	0.777	0.728	0.846	21	21	21	21
	(0.155)	(0.028)	(0.021)	(0.163)				
	(NA)	(0.067)	(0.056)	(0.234)				
	(0.053)	(0.006)	(0.000)	(0.013)				
4	0.933	0.716	0.669	0.771	21	21	21	21
	(0.102)	(0.009)	(0.002)	(0.038)				
	(NA)	(0.041)	(0.018)	(0.099)				
	(0.048)	(0.001)	(0.000)	(0.000)				
5	0.954	0.652	0.623	0.669	21	21	21	21
	(0.138)	(0.001)	(0.000)	(0.001)				
	(0.257)	(0.016)	(0.000)	(NA)				
	(0.231)	(0.001)	(0.000)	(0.000)				

History: Latest Vintage
1997:01-2018:03

H	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	N1	N2	N3	N4
1	0.613	0.580	0.580	1.007	87	87	87	87
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.941)				
	(0.000)	(0.000)	(0.000)	(0.947)				
2	1.012	0.949	0.978	1.031	87	87	87	87
	(0.816)	(0.304)	(0.668)	(0.661)				
	(0.820)	(0.316)	(0.674)	(0.668)				
	(0.821)	(0.359)	(0.687)	(0.641)				
3	1.144	1.058	1.055	1.109	87	87	87	87
	(0.045)	(0.402)	(0.442)	(0.155)				
	(0.054)	(0.417)	(0.457)	(0.171)				
	(0.033)	(0.390)	(0.430)	(0.129)				
4	1.205	1.090	1.110	1.158	87	87	87	87
	(0.018)	(0.291)	(0.200)	(0.059)				
	(0.026)	(0.314)	(0.222)	(0.074)				
	(0.014)	(0.259)	(0.186)	(0.041)				
5	1.274	1.121	1.194	1.219	87	87	87	87
	(0.019)	(0.236)	(0.050)	(0.021)				
	(0.029)	(0.264)	(0.067)	(0.032)				
	(0.012)	(0.176)	(0.036)	(0.012)				

Notes for Table 1B.

(1) The forecast horizon is given by H, where H = 1 is the SPF forecast for the current quarter.
(2) The headers RMSE(S/NC), RMSE(S/IAR), RMSE(S/DAR), and RMSE(S/DARM) are the ratios of the SPF root-mean-square error to that of the benchmark models: No-change (NC), indirect autoregression (IAR), direct autoregession (DAR), and direct autoregression augmented with monthly information (DARM). These statistics may differ slightly from those reported in Table 1A because they incorporate only those observations common to both the SPF and the benchmark model. The previous statistics make use of all available observations for each model.
(3) All models are estimated on a rolling window of 60 observations from the Philadelphia Fed real-time data set.
(4) A set of three two-sided p-values (in parentheses) accompanies each statistic. These are the p-values for the test of the equality of mean-square-error. The first is for the Diebold-Mariano (1995, JBES) statistic, using a uniform lag window with the trunction lag set to the forecast horizon minus one. (The tables report the p-values using a Bartlett window when the uniform window produces a negative standard error.) The second is for the Harvey-Leybourne-Newbold (1997, IJF) correction to the Diebold-Mariano statistic. The third is for the Diebold-Mariano statistic, using a Bartlett lag window with the truncation lag increased four quarters.
(5) The headers N1, N2, N3, and N4 show the number of observations used in constructing each ratio of root-mean-square errors.
(6) Sample periods refer to the dates forecast, not the dates when the forecasts were made.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 2. Recent SPF Forecasts
(Dated at the Quarter Forecast)

Variable: BOND (Moody's Corp Bond Rate (Aaa))
By Forecast Step (1 to 5)
Transformation: Level

Last Updated: 02/23/2021 14:23

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2014:02	4.350	4.700	4.750	4.508	4.210
2014:03	4.280	4.460	4.799	4.850	4.600
2014:04	4.099	4.460	4.574	4.893	4.900
2015:01	3.650	4.200	4.515	4.673	4.974
2015:02	3.700	3.800	4.350	4.750	4.821
2015:03	4.120	3.894	4.000	4.450	5.000
2015:04	4.100	4.190	4.000	4.133	4.600
2016:01	4.050	4.250	4.400	4.130	4.300
2016:02	3.750	4.155	4.367	4.574	4.275
2016:03	3.450	3.900	4.249	4.450	4.670
2016:04	3.500	3.600	4.100	4.305	4.567
2017:01	4.000	3.700	3.800	4.190	4.500
2017:02	3.970	4.100	3.790	4.000	4.300
2017:03	3.800	4.140	4.182	3.825	4.170
2017:04	3.750	4.010	4.300	4.400	4.000
2018:01	3.890	4.000	4.105	4.400	4.550
2018:02	4.029	4.041	4.150	4.250	4.500
2018:03	4.061	4.192	4.200	4.300	4.375
2018:04	4.200	4.188	4.300	4.300	4.340
2019:01	3.900	4.389	4.338	4.450	4.450
2019:02	3.750	4.015	4.500	4.491	4.556
2019:03	3.270	3.800	4.125	4.600	4.636
2019:04	3.000	3.350	3.855	4.198	4.750
2020:01	2.965	3.100	3.425	3.950	4.303
2020:02	2.479	3.054	3.202	3.535	4.071
2020:03	2.255	2.571	3.097	3.236	3.560
2020:04	2.320	2.420	2.715	3.125	3.253
2021:01	2.500	2.358	2.500	2.705	3.188
2021:02	NA	2.575	2.400	2.520	2.813
2021:03	NA	NA	2.595	2.500	2.600
2021:04	NA	NA	NA	2.732	2.540
2022:01	NA	NA	NA	NA	2.766

Notes for Table 2.

(1) Each column gives the sequence of SPF projections for a given forecast step. The forecast steps range from one (the forecast for the quarter in which the survey was conducted) to four quarters in the future (step 5).
(2) The dates listed in the rows are the dates forecast, not the dates when the forecasts were made, with the exception of the forecast at step one, for which the two dates coincide.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 3. Recent Benchmark Model 1 IAR Forecasts
(Dated at the Quarter Forecast)

Variable: BOND (Moody's Corp Bond Rate (Aaa))
By Forecast Step (1 to 5)
Transformation: Level
Lag Length for IAR(p): AIC

Source for Historical Realizations: Moody's Corporation

Last Updated: 02/23/2021 14:23

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2014:02	4.442	4.600	4.514	3.908	3.778
2014:03	4.216	4.444	4.603	4.517	3.895
2014:04	4.121	4.216	4.446	4.606	4.519
2015:01	3.886	4.125	4.215	4.447	4.609
2015:02	3.589	3.895	4.129	4.215	4.449
2015:03	3.926	3.607	3.904	4.132	4.214
2015:04	4.113	3.954	3.624	3.912	4.136
2016:01	4.022	4.138	3.980	3.640	3.920
2016:02	3.951	4.049	4.161	4.004	3.656
2016:03	3.629	3.974	4.073	4.182	4.027
2016:04	3.377	3.666	3.996	4.097	4.202
2017:01	3.844	3.415	3.701	4.016	4.118
2017:02	3.988	3.879	3.451	3.733	4.035
2017:03	3.839	4.015	3.912	3.484	3.763
2017:04	3.689	3.876	4.039	3.942	3.516
2018:01	3.597	3.722	3.909	4.061	3.969
2018:02	3.776	3.632	3.753	3.940	4.082
2018:03	3.954	3.803	3.664	3.782	3.968
2018:04	3.925	3.970	3.828	3.695	3.809
2019:01	4.135	3.940	3.986	3.852	3.723
2019:02	3.848	4.143	3.953	4.000	3.874
2019:03	3.617	3.864	4.151	3.966	4.015
2019:04	3.118	3.639	3.880	4.158	3.978
2020:01	3.039	3.136	3.660	3.895	4.164
2020:02	2.918	3.052	3.153	3.680	3.909
2020:03	2.418	2.923	3.063	3.169	3.699
2020:04	2.182	2.391	2.928	3.075	3.185
2021:01	2.277	2.135	2.363	2.932	3.086
2021:02	NA	2.247	2.087	2.335	2.937
2021:03	NA	NA	2.218	2.039	2.308
2021:04	NA	NA	NA	2.189	1.991
2022:01	NA	NA	NA	NA	2.160

Notes for Table 3.

(1) Each column gives the sequence of benchmark IAR projections for a given forecast step. The forecast steps range from one to five. The first step corresponds to the forecast that SPF panelists make for the quarter in which the survey is conducted.
(2) The dates listed in the rows are the dates forecast, not the dates when the forecasts were made, with the exception of the forecast at step one, for which the two dates coincide.
(3) The IAR benchmark model is estimated on a fixed 60-quarter rolling window. Its forecasts are computed with the indirect method. Estimation uses data from the Philadelphia Fed real-time data set.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 4. Recent Benchmark Model 2 No-Change Forecasts
(Dated at the Quarter Forecast)

Variable: BOND (Moody's Corp Bond Rate (Aaa))
By Forecast Step (1 to 5)
Transformation: Level

Source for Historical Realizations: Moody's Corporation

Last Updated: 02/23/2021 14:23

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2014:02	4.440	4.593	4.507	3.963	3.877
2014:03	4.217	4.440	4.593	4.507	3.963
2014:04	4.117	4.217	4.440	4.593	4.507
2015:01	3.877	4.117	4.217	4.440	4.593
2015:02	3.570	3.877	4.117	4.217	4.440
2015:03	3.897	3.570	3.877	4.117	4.217
2015:04	4.087	3.897	3.570	3.877	4.117
2016:01	3.993	4.087	3.897	3.570	3.877
2016:02	3.927	3.993	4.087	3.897	3.570
2016:03	3.590	3.927	3.993	4.087	3.897
2016:04	3.337	3.590	3.927	3.993	4.087
2017:01	3.807	3.337	3.590	3.927	3.993
2017:02	3.960	3.807	3.337	3.590	3.927
2017:03	3.800	3.960	3.807	3.337	3.590
2017:04	3.653	3.800	3.960	3.807	3.337
2018:01	3.560	3.653	3.800	3.960	3.807
2018:02	3.747	3.560	3.653	3.800	3.960
2018:03	3.937	3.747	3.560	3.653	3.800
2018:04	3.910	3.937	3.747	3.560	3.653
2019:01	4.127	3.910	3.937	3.747	3.560
2019:02	3.830	4.127	3.910	3.937	3.747
2019:03	3.593	3.830	4.127	3.910	3.937
2019:04	3.100	3.593	3.830	4.127	3.910
2020:01	3.027	3.100	3.593	3.830	4.127
2020:02	2.913	3.027	3.100	3.593	3.830
2020:03	2.447	2.913	3.027	3.100	3.593
2020:04	2.230	2.447	2.913	3.027	3.100
2021:01	2.307	2.230	2.447	2.913	3.027
2021:02	NA	2.307	2.230	2.447	2.913
2021:03	NA	NA	2.307	2.230	2.447
2021:04	NA	NA	NA	2.307	2.230
2022:01	NA	NA	NA	NA	2.307

Notes for Table 4.

(1) Each column gives the sequence of benchmark no-change projections for a given forecast step. The forecast steps range from one to five. The first step corresponds to the forecast that SPF panelists make for the quarter in which the survey is conducted.
(2) The dates listed in the rows are the dates forecast, not the dates when the forecasts were made, with the exception of the forecast at step one, for which the two dates coincide.
(3) The projections use data from the Philadelphia Fed real-time data set.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 5. Recent Benchmark Model 3 DAR Forecasts
(Dated at the Quarter Forecast)

Variable: BOND (Moody's Corp Bond Rate (Aaa))
By Forecast Step (1 to 5)
Transformation: Level
Lag Length for DAR(p): AIC

Source for Historical Realizations: Moody's Corporation

Last Updated: 02/23/2021 14:23

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2014:02	4.442	4.605	4.475	3.843	3.752
2014:03	4.216	4.459	4.590	4.437	3.834
2014:04	4.121	4.234	4.471	4.576	4.378
2015:01	3.886	4.128	4.258	4.467	4.531
2015:02	3.589	3.902	4.149	4.284	4.449
2015:03	3.926	3.613	3.914	4.183	4.276
2015:04	4.113	3.929	3.633	3.950	4.201
2016:01	4.022	4.130	3.930	3.659	3.980
2016:02	3.951	4.053	4.117	3.940	3.690
2016:03	3.629	3.982	4.064	4.113	3.940
2016:04	3.377	3.674	4.004	4.056	4.103
2017:01	3.844	3.435	3.711	4.019	4.042
2017:02	3.988	3.858	3.477	3.748	4.001
2017:03	3.839	4.016	3.870	3.524	3.758
2017:04	3.689	3.881	4.008	3.829	3.547
2018:01	3.597	3.742	3.901	4.012	3.891
2018:02	3.776	3.644	3.770	3.901	4.004
2018:03	3.954	3.805	3.678	3.795	3.891
2018:04	3.925	3.972	3.816	3.706	3.777
2019:01	4.135	3.951	3.969	3.837	3.708
2019:02	3.848	4.144	3.954	3.965	3.832
2019:03	3.617	3.879	4.147	3.947	3.957
2019:04	3.118	3.659	3.892	4.138	3.928
2020:01	3.039	3.195	3.685	3.897	4.112
2020:02	2.918	3.086	3.242	3.690	3.879
2020:03	2.418	2.960	3.143	3.259	3.687
2020:04	2.182	2.466	2.991	3.161	3.260
2021:01	2.277	2.189	2.501	3.023	3.162
2021:02	NA	2.260	2.214	2.521	3.023
2021:03	NA	NA	2.239	2.225	2.640
2021:04	NA	NA	NA	2.236	2.235
2022:01	NA	NA	NA	NA	2.234

Notes for Table 5.

(1) Each column gives the sequence of benchmark DAR projections for a given forecast step. The forecast steps range from one to five. The first step corresponds to the forecast that SPF panelists make for the quarter in which the survey is conducted.
(2) The dates listed in the rows are the dates forecast, not the dates when the forecasts were made, with the exception of the forecast at step one, for which the two dates coincide.
(3) The DAR benchmark model is estimated on a fixed 60-quarter rolling window. Its forecasts are computed with the direct method. Estimation uses data from the Philadelphia Fed real-time data set.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 6. Recent Benchmark Model 4 DARM Forecasts
(Dated at the Quarter Forecast)

Variable: BOND (Moody's Corp Bond Rate (Aaa))
By Forecast Step (1 to 5)
Transformation: Level
Lag Length for DARM(p): AIC

Source for Historical Realizations: Moody's Corporation

Last Updated: 02/23/2021 14:23

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2014:02	4.247	4.538	4.517	4.118	3.637
2014:03	4.159	4.308	4.552	4.486	4.072
2014:04	3.911	4.189	4.324	4.516	4.425
2015:01	3.496	3.980	4.219	4.334	4.528
2015:02	3.619	3.594	4.002	4.232	4.340
2015:03	4.248	3.549	3.581	4.014	4.222
2015:04	3.884	4.044	3.565	3.587	4.058
2016:01	4.118	4.048	4.009	3.599	3.715
2016:02	3.679	4.095	4.053	4.011	3.661
2016:03	3.427	3.822	4.086	4.031	4.081
2016:04	3.625	3.504	3.840	4.071	4.009
2017:01	3.932	3.567	3.541	3.857	4.067
2017:02	3.883	3.906	3.595	3.564	3.876
2017:03	3.832	3.964	3.906	3.648	3.632
2017:04	3.676	3.884	3.974	3.835	3.644
2018:01	3.649	3.754	3.887	3.947	3.787
2018:02	3.946	3.704	3.779	3.919	3.934
2018:03	3.917	3.887	3.728	3.817	3.931
2018:04	4.170	3.949	3.880	3.785	3.812
2019:01	3.976	4.152	3.943	3.848	3.781
2019:02	3.743	4.067	4.134	3.915	3.833
2019:03	3.407	3.809	4.077	4.135	3.903
2019:04	3.031	3.514	3.854	4.052	4.079
2020:01	3.023	3.136	3.566	3.902	4.038
2020:02	2.472	3.076	3.331	3.591	3.897
2020:03	2.311	2.636	3.111	3.347	3.621
2020:04	2.446	2.335	2.753	3.124	3.382
2021:01	2.494	2.390	2.360	2.778	3.150
2021:02	NA	2.468	2.336	2.384	2.871
2021:03	NA	NA	2.448	2.305	2.543
2021:04	NA	NA	NA	2.311	2.323
2022:01	NA	NA	NA	NA	2.327

Notes for Table 6.

(1) Each column gives the sequence of benchmark DARM projections for a given forecast step. The forecast steps range from one to five. The first step corresponds to the forecast that SPF panelists make for the quarter in which the survey is conducted.
(2) The dates listed in the rows are the dates forecast, not the dates when the forecasts were made, with the exception of the forecast at step one, for which the two dates coincide.
(3) The DARM benchmark model is estimated on a fixed 60-quarter rolling window. Its forecasts are computed with the direct method and incorporate recent monthly values of the dependent variable. Estimation uses data from the Philadelphia Fed real-time data set.

Source: Tom Stark, Research Department, FRB Philadelphia.

Table 7. Recent Realizations (Various Measures)
Philadelphia Fed Real-Time Data Set

Variable: BOND (Moody's Corp Bond Rate (Aaa))
Transformation: Level

Source for Historical Realizations: Moody's Corporation

Last Updated: 02/23/2021 14:23

Column (1): Initial Release
Column (2): One Qtr After Initial Release
Column (3): Five Qtrs After Initial Release
Column (4): Nine Qtrs After Initial Release
Column (5): Latest Vintage

Obs. Date	(1)	(2)	(3)	(4)	(5)
2014:02					
2014:03					
2014:04					
2015:01					
2015:02					
2015:03					
2015:04					
2016:01					
2016:02					
2016:03					
2016:04					
2017:01					
2017:02					
2017:03					
2017:04					
2018:01					
2018:02					
2018:03					
2018:04					
2019:01					
2019:02					
2019:03					
2019:04					
2020:01					
2020:02					
2020:03					
2020:04					
2021:01					
2021:02					
2021:03					
2021:04					
2022:01					

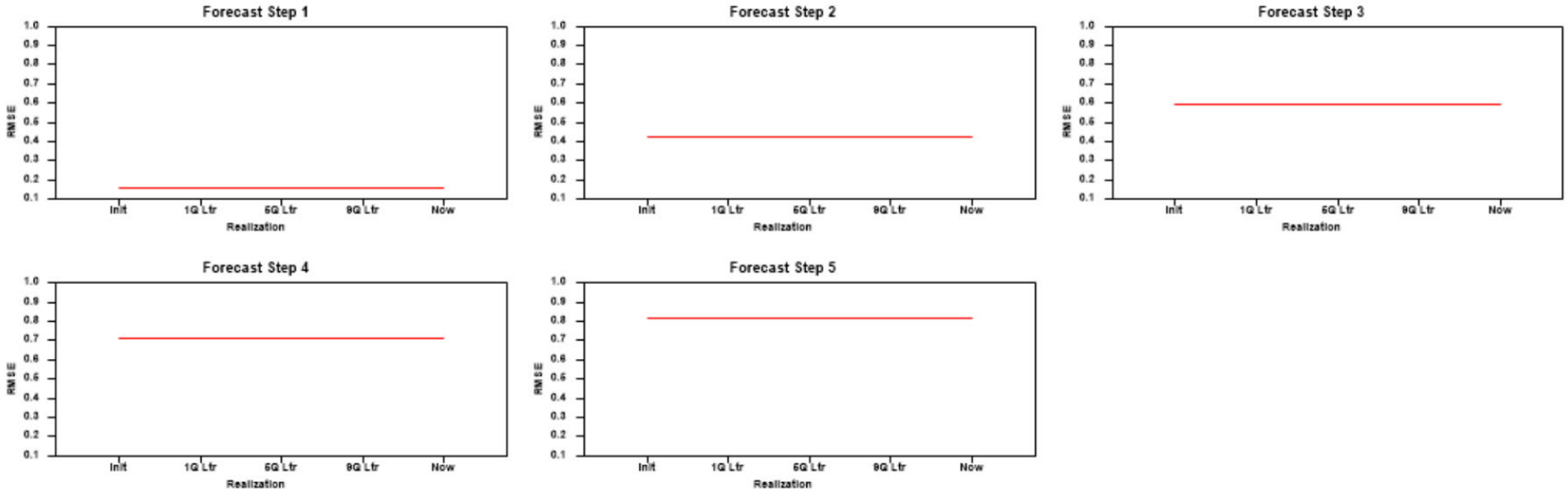
Notes for Table 7.

(1) As of mid-October, 2016, the source agency considers these historical data proprietary. The Philadelphia Fed cannot release the values to the public.

Source: Tom Stark, Research Department, FRB Philadelphia.

Root-Mean-Square Errors: 1991:04-2018:03

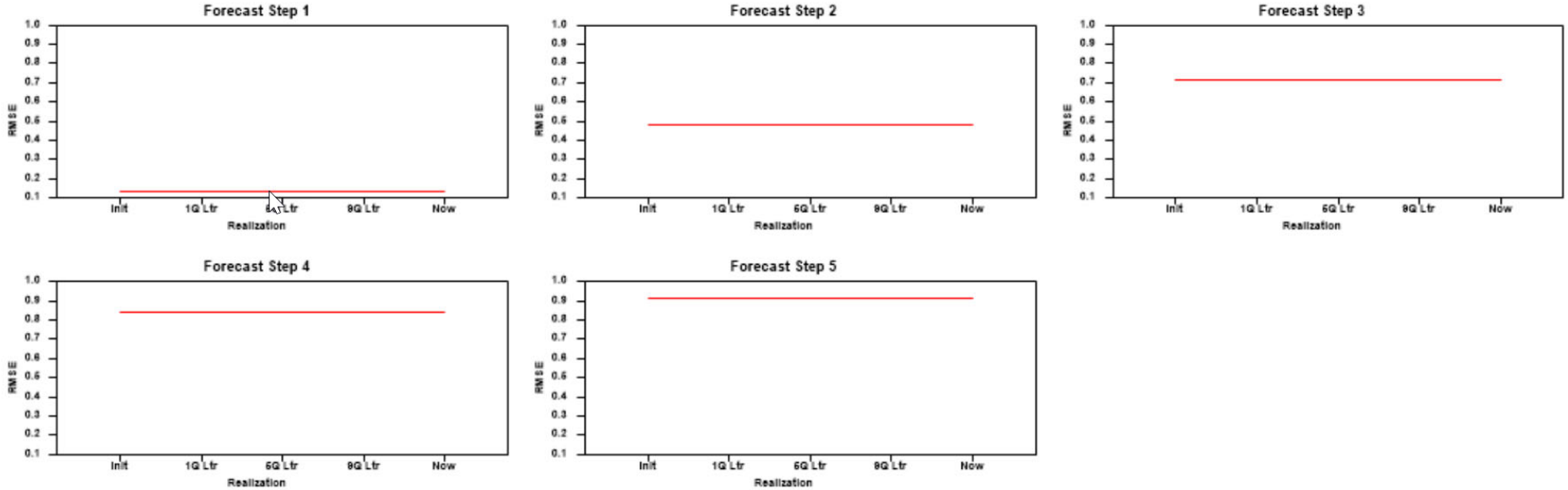
SPF Projections for Moody's Corp Bond Rate (Aaa), Transformation: Level



The RMSE is plotted against the realization used to compute it, from the value on initial release to the value as we now know it. Source: Tom Stark, FRB Philadelphia.

Root-Mean-Square Errors: 1991:04-1996:04

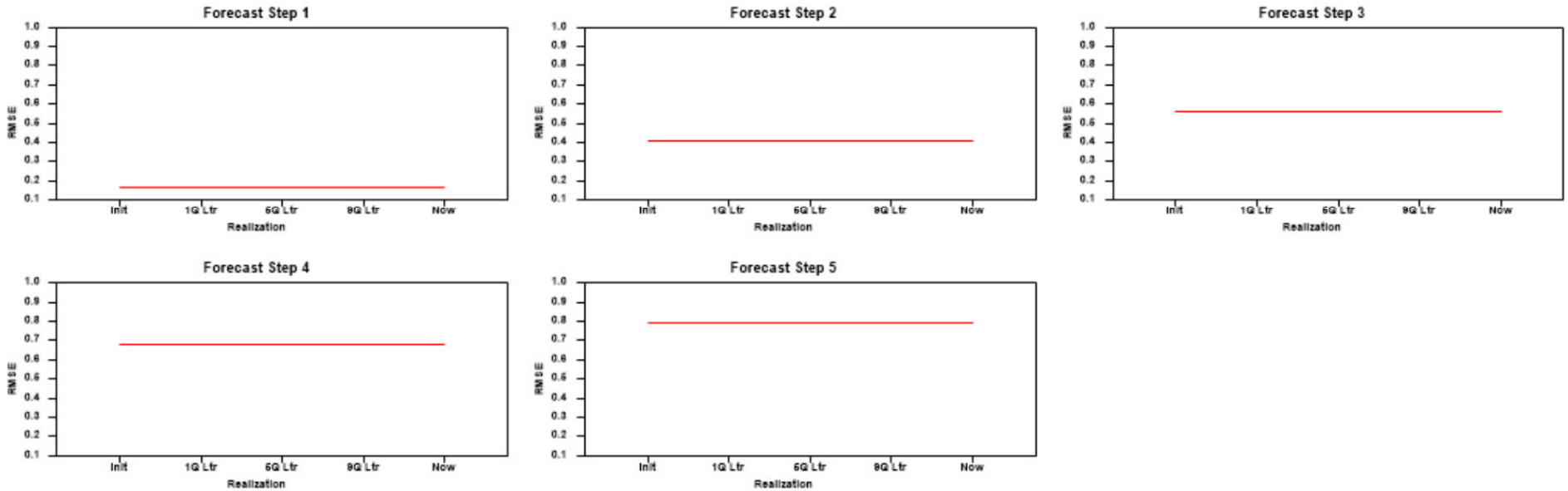
SPF Projections for Moody's Corp Bond Rate (Aaa), Transformation: Level



The RMSE is plotted against the realization used to compute it, from the value on initial release to the value as we now know it. Source: Tom Stark, FRB Philadelphia.

Root-Mean-Square Errors: 1997:01-2018:03

SPF Projections for Moody's Corp Bond Rate (Aaa), Transformation: Level



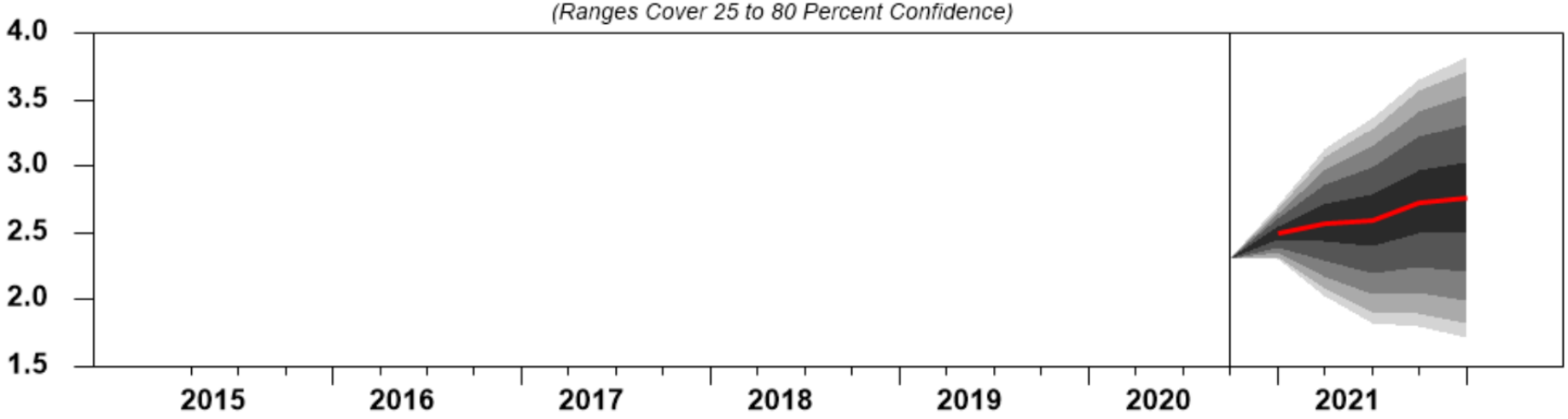
The RMSE is plotted against the realization used to compute it, from the value on initial release to the value as we now know it. Source: Tom Stark, FRB Philadelphia.

Moody's Corp Bond Rate (Aaa)

History, Forecasts, and Ranges for the SPF of 2021:01

Level

(Ranges Cover 25 to 80 Percent Confidence)



Ranges at each horizon use the N(0,MSE) density. The MSEs are based on the sample 91:04-19:03 and use the realization: Five Qtrs After Initial Release. Proprietary history is not shown. Source: T.Stark, FRB Phila.