

# Error Statistics for the Survey of Professional Forecasters for 10-Year Tbond Rate [QA,PPs]

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## 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.

Table 1 reports 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 period shown in Table 1. 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. Table 1 reports four such comparisons. It shows 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.

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 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/](http://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. Rather, in Table 1, 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 1 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 Table 1. Any forecast error can be written as the equation given by  $\text{error} = \text{realization} - \text{forecast}$ . 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. These 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 predates by one month the vintage that SPF panelists would have had at their disposal when they formed their projections. The effect is likely small because revisions to the CPI are generally small. 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 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 root-mean-square error. The latter is estimated over the aforementioned sample, using the measure of history listed in the footnote.

Table 1. Forecast Error Statistics for SPF Variable: TBOND (10-Year Tbond Rate [QA,PPs])

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Computed Over Various Sample Periods  
 Various Measures of Realizations  
 Transformation: Level  
 Lag Length for IAR(p), DAR(p), and DARM(p) Models: AIC  
 Last Updated: 09/01/2009 10:22

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H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
History: Initial Release									
1993:01-2007:01									
1	-0.06	0.13	0.16	0.41	0.43	0.43	0.80	57	57
2	-0.17	0.46	0.54	0.87	0.84	0.85	1.01	57	57
3	-0.28	0.64	0.75	0.97	0.89	0.84	0.99	57	57
4	-0.38	0.76	0.91	0.99	0.86	0.83	0.93	57	57
5	-0.47	0.85	0.99	1.02	0.82	0.81	0.86	57	57
1993:01-1996:04									
1	-0.04	0.13	0.16	0.31	0.33	0.33	0.69	16	16
2	-0.08	0.58	0.66	0.80	0.79	0.78	0.93	16	16
3	-0.09	0.85	0.96	0.89	0.82	0.75	0.93	16	16
4	-0.17	1.05	1.16	0.94	0.80	0.76	0.86	16	16
5	-0.31	1.09	1.23	0.97	0.76	0.71	0.77	16	16
1997:01-2007:01									
1	-0.07	0.14	0.16	0.48	0.50	0.50	0.85	41	41
2	-0.21	0.41	0.48	0.94	0.89	0.91	1.09	41	41
3	-0.35	0.55	0.66	1.06	0.95	0.93	1.04	41	41
4	-0.46	0.65	0.79	1.04	0.92	0.91	1.00	41	41
5	-0.53	0.75	0.89	1.06	0.88	0.92	0.96	41	41
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H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
History: One Qtr After Initial Release									
1993:01-2007:01									
1	-0.06	0.13	0.16	0.41	0.43	0.43	0.80	57	57
2	-0.17	0.46	0.54	0.87	0.84	0.85	1.01	57	57
3	-0.28	0.64	0.75	0.97	0.89	0.84	0.99	57	57
4	-0.38	0.76	0.91	0.99	0.86	0.83	0.93	57	57
5	-0.47	0.85	0.99	1.02	0.82	0.81	0.86	57	57
1993:01-1996:04									
1	-0.04	0.13	0.16	0.31	0.33	0.33	0.69	16	16
2	-0.08	0.58	0.66	0.80	0.79	0.78	0.93	16	16
3	-0.09	0.85	0.96	0.89	0.82	0.75	0.93	16	16
4	-0.17	1.05	1.16	0.94	0.80	0.76	0.86	16	16
5	-0.31	1.09	1.23	0.97	0.76	0.71	0.77	16	16
1997:01-2007:01									
1	-0.07	0.14	0.16	0.48	0.50	0.50	0.85	41	41
2	-0.21	0.41	0.48	0.94	0.89	0.91	1.09	41	41
3	-0.35	0.55	0.66	1.06	0.95	0.93	1.04	41	41
4	-0.46	0.65	0.79	1.04	0.92	0.91	1.00	41	41
5	-0.53	0.75	0.89	1.06	0.88	0.92	0.96	41	41

H ME(S) MAE(S) RMSE(S) RMSE(S/NC) RMSE(S/IAR) RMSE(S/DAR) RMSE(S/DARM) Nspf N

History: Five Qtrs After Initial Release

1993:01-2007:01

1	-0.06	0.13	0.16	0.41	0.43	0.43	0.80	57	57
2	-0.17	0.46	0.54	0.87	0.84	0.85	1.01	57	57
3	-0.28	0.64	0.75	0.97	0.89	0.84	0.99	57	57
4	-0.38	0.76	0.91	0.99	0.86	0.83	0.93	57	57
5	-0.47	0.85	0.99	1.02	0.82	0.81	0.86	57	57

1993:01-1996:04

1	-0.04	0.13	0.16	0.31	0.33	0.33	0.69	16	16
2	-0.08	0.58	0.66	0.80	0.79	0.78	0.93	16	16
3	-0.09	0.85	0.96	0.89	0.82	0.75	0.93	16	16
4	-0.17	1.05	1.16	0.94	0.80	0.76	0.86	16	16
5	-0.31	1.09	1.23	0.97	0.76	0.71	0.77	16	16

1997:01-2007:01

1	-0.07	0.14	0.16	0.48	0.50	0.50	0.85	41	41
2	-0.21	0.41	0.48	0.94	0.89	0.91	1.09	41	41
3	-0.35	0.55	0.66	1.06	0.95	0.93	1.04	41	41
4	-0.46	0.65	0.79	1.04	0.92	0.91	1.00	41	41
5	-0.53	0.75	0.89	1.06	0.88	0.92	0.96	41	41

H ME(S) MAE(S) RMSE(S) RMSE(S/NC) RMSE(S/IAR) RMSE(S/DAR) RMSE(S/DARM) Nspf N

History: Nine Qtrs After Initial Release

1993:01-2007:01

1	-0.06	0.13	0.16	0.41	0.43	0.43	0.80	57	57
2	-0.17	0.46	0.54	0.87	0.84	0.85	1.01	57	57
3	-0.28	0.64	0.75	0.97	0.89	0.84	0.99	57	57
4	-0.38	0.76	0.91	0.99	0.86	0.83	0.93	57	57
5	-0.47	0.85	0.99	1.02	0.82	0.81	0.86	57	57

1993:01-1996:04

1	-0.04	0.13	0.16	0.31	0.33	0.33	0.69	16	16
2	-0.08	0.58	0.66	0.80	0.79	0.78	0.93	16	16
3	-0.09	0.85	0.96	0.89	0.82	0.75	0.93	16	16
4	-0.17	1.05	1.16	0.94	0.80	0.76	0.86	16	16
5	-0.31	1.09	1.23	0.97	0.76	0.71	0.77	16	16

1997:01-2007:01

1	-0.07	0.14	0.16	0.48	0.50	0.50	0.85	41	41
2	-0.21	0.41	0.48	0.94	0.89	0.91	1.09	41	41
3	-0.35	0.55	0.66	1.06	0.95	0.93	1.04	41	41
4	-0.46	0.65	0.79	1.04	0.92	0.91	1.00	41	41
5	-0.53	0.75	0.89	1.06	0.88	0.92	0.96	41	41

H	ME(S)	MAE(S)	RMSE(S)	RMSE(S/NC)	RMSE(S/IAR)	RMSE(S/DAR)	RMSE(S/DARM)	Nspf	N
History: Latest Vintage									
1993:01-2007:01									
1	-0.06	0.13	0.16	0.41	0.43	0.43	0.80	57	57
2	-0.17	0.46	0.54	0.87	0.84	0.85	1.01	57	57
3	-0.28	0.64	0.75	0.97	0.89	0.84	0.99	57	57
4	-0.38	0.76	0.91	0.99	0.86	0.83	0.93	57	57
5	-0.47	0.85	0.99	1.02	0.82	0.81	0.86	57	57
1993:01-1996:04									
1	-0.04	0.13	0.16	0.31	0.33	0.33	0.69	16	16
2	-0.08	0.58	0.66	0.80	0.79	0.78	0.93	16	16
3	-0.09	0.85	0.96	0.89	0.82	0.75	0.93	16	16
4	-0.17	1.05	1.16	0.94	0.80	0.76	0.86	16	16
5	-0.31	1.09	1.23	0.97	0.76	0.71	0.77	16	16
1997:01-2007:01									
1	-0.07	0.14	0.16	0.48	0.50	0.50	0.85	41	41
2	-0.21	0.41	0.48	0.94	0.89	0.91	1.09	41	41
3	-0.35	0.55	0.66	1.06	0.95	0.93	1.04	41	41
4	-0.46	0.65	0.79	1.04	0.92	0.91	1.00	41	41
5	-0.53	0.75	0.89	1.06	0.88	0.92	0.96	41	41

Table 1 notes.

- (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 Phila 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 2. Recent SPF Forecasts - Dated at the Quarter Forecast

Variable: TBOND (10-Year Tbond Rate [QA,PPs])  
 By Forecast Step (1 to 5)  
 Transformation: Level  
 Last Updated: 09/01/2009 10:22

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2002:04	3.985	4.600	5.475	5.265	5.000
2003:01	4.005	4.090	4.900	5.600	5.400
2003:02	3.960	4.200	4.225	5.180	5.635
2003:03	4.200	4.160	4.400	4.460	5.300
2003:04	4.400	4.300	4.295	4.630	4.665
2004:01	4.200	4.500	4.400	4.470	4.875
2004:02	4.550	4.415	4.620	4.500	4.600
2004:03	4.600	4.800	4.650	4.800	4.750
2004:04	4.290	4.810	5.000	4.845	4.930
2005:01	4.250	4.500	5.145	5.200	5.005
2005:02	4.400	4.490	4.710	5.350	5.335
2005:03	4.354	4.620	4.700	4.975	5.466
2005:04	4.600	4.600	4.850	4.910	5.130
2006:01	4.600	4.900	4.800	5.050	5.100
2006:02	5.100	4.800	5.150	4.950	5.200
2006:03	5.109	5.230	4.850	5.200	5.040
2006:04	4.780	5.240	5.250	4.900	5.200
2007:01	4.787	4.810	5.200	5.250	5.000
2007:02	4.700	4.830	4.900	5.210	5.200
2007:03	4.870	4.767	4.870	4.950	5.225
2007:04	4.453	4.975	4.800	4.980	5.000
2008:01	3.674	4.500	5.015	4.900	4.995
2008:02	3.750	3.675	4.570	5.100	4.900
2008:03	4.000	3.800	3.817	4.675	5.125
2008:04	3.786	4.093	3.930	4.000	4.767
2009:01	2.711	3.800	4.220	4.100	4.168
2009:02	3.000	2.900	3.870	4.311	4.200
2009:03	3.630	3.060	3.050	3.950	4.500
2009:04	NA	3.775	3.200	3.175	4.000
2010:01	NA	NA	3.900	3.318	3.500
2010:02	NA	NA	NA	3.950	3.500
2010:03	NA	NA	NA	NA	4.075

Table 2 notes.

- (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: TBOND (10-Year Tbond Rate [QA,PPs])  
 By Forecast Step (1 to 5)  
 Transformation: Level  
 Lag Length for IAR(p): AIC  
 Last Updated: 09/01/2009 10:22

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2002:04	4.092	5.221	5.280	5.062	5.423
2003:01	4.074	4.120	5.205	5.225	5.065
2003:02	3.809	4.023	4.113	5.209	5.197
2003:03	3.725	3.919	4.068	4.247	5.226
2003:04	4.588	3.933	3.995	4.221	4.314
2004:01	4.143	4.560	3.946	3.986	4.238
2004:02	4.123	4.291	4.660	3.969	3.993
2004:03	4.638	4.002	4.138	4.513	3.949
2004:04	4.012	4.443	3.882	4.011	4.302
2005:01	4.401	4.200	4.590	3.990	4.083
2005:02	4.076	4.210	4.032	4.482	3.998
2005:03	4.227	4.111	4.200	4.003	4.368
2005:04	4.357	4.372	4.253	4.324	4.176
2006:01	4.498	4.340	4.349	4.211	4.236
2006:02	4.635	4.543	4.403	4.413	4.290
2006:03	5.258	4.697	4.611	4.457	4.459
2006:04	4.707	5.152	4.625	4.530	4.423
2007:01	4.662	4.773	5.177	4.594	4.520
2007:02	4.501	4.474	4.591	5.034	4.601
2007:03	4.920	4.492	4.464	4.593	4.893
2007:04	4.808	5.049	4.657	4.628	4.734
2008:01	4.171	4.858	5.092	4.666	4.640
2008:02	3.486	4.159	4.785	5.038	4.740
2008:03	4.082	3.539	4.175	4.829	5.017
2008:04	3.908	4.211	3.710	4.380	4.833
2009:01	3.386	4.257	4.506	3.990	4.498
2009:02	2.594	3.490	4.255	4.540	4.148
2009:03	3.501	2.524	3.339	4.196	4.451
2009:04	NA	3.493	2.636	3.570	4.236
2010:01	NA	NA	3.799	2.842	3.653
2010:02	NA	NA	NA	3.769	2.901
2010:03	NA	NA	NA	NA	3.631

Table 3 notes.

- (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: TBOND (10-Year Tbond Rate [QA,PPs])  
 By Forecast Step (1 to 5)  
 Transformation: Level  
 Last Updated: 09/01/2009 10:22

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2002:04	4.260	5.100	5.077	4.770	4.980
2003:01	4.007	4.260	5.100	5.077	4.770
2003:02	3.920	4.007	4.260	5.100	5.077
2003:03	3.620	3.920	4.007	4.260	5.100
2003:04	4.233	3.620	3.920	4.007	4.260
2004:01	4.287	4.233	3.620	3.920	4.007
2004:02	4.020	4.287	4.233	3.620	3.920
2004:03	4.600	4.020	4.287	4.233	3.620
2004:04	4.303	4.600	4.020	4.287	4.233
2005:01	4.173	4.303	4.600	4.020	4.287
2005:02	4.297	4.173	4.303	4.600	4.020
2005:03	4.160	4.297	4.173	4.303	4.600
2005:04	4.213	4.160	4.297	4.173	4.303
2006:01	4.490	4.213	4.160	4.297	4.173
2006:02	4.570	4.490	4.213	4.160	4.297
2006:03	5.070	4.570	4.490	4.213	4.160
2006:04	4.897	5.070	4.570	4.490	4.213
2007:01	4.630	4.897	5.070	4.570	4.490
2007:02	4.680	4.630	4.897	5.070	4.570
2007:03	4.847	4.680	4.630	4.897	5.070
2007:04	4.730	4.847	4.680	4.630	4.897
2008:01	4.260	4.730	4.847	4.680	4.630
2008:02	3.663	4.260	4.730	4.847	4.680
2008:03	3.887	3.663	4.260	4.730	4.847
2008:04	3.863	3.887	3.663	4.260	4.730
2009:01	3.253	3.863	3.887	3.663	4.260
2009:02	2.737	3.253	3.863	3.887	3.663
2009:03	3.313	2.737	3.253	3.863	3.887
2009:04	NA	3.313	2.737	3.253	3.863
2010:01	NA	NA	3.313	2.737	3.253
2010:02	NA	NA	NA	3.313	2.737
2010:03	NA	NA	NA	NA	3.313

Table 4 notes.

- (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: TBOND (10-Year Tbond Rate [QA,PPs])  
 By Forecast Step (1 to 5)  
 Transformation: Level  
 Lag Length for DAR(p): AIC  
 Last Updated: 09/01/2009 10:22

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2002:04	4.092	5.236	5.315	5.219	5.658
2003:01	4.074	4.175	5.035	5.127	5.393
2003:02	3.809	3.954	4.226	5.162	5.136
2003:03	3.725	3.971	4.042	4.267	5.144
2003:04	4.588	3.876	4.018	4.197	4.306
2004:01	4.143	4.544	3.795	4.159	4.194
2004:02	4.123	4.293	4.550	3.976	4.473
2004:03	4.638	4.041	4.088	4.304	4.012
2004:04	4.012	4.319	3.740	3.890	3.992
2005:01	4.401	4.156	4.371	3.858	3.874
2005:02	4.076	4.243	4.010	4.151	3.683
2005:03	4.227	4.057	4.192	3.858	4.319
2005:04	4.357	4.364	4.087	4.272	4.267
2006:01	4.498	4.342	4.306	3.923	3.903
2006:02	4.635	4.514	4.364	4.304	4.106
2006:03	5.258	4.688	4.549	4.365	4.318
2006:04	4.707	5.107	4.592	4.396	4.239
2007:01	4.662	4.722	5.045	4.499	4.358
2007:02	4.501	4.484	4.516	4.832	4.432
2007:03	4.920	4.412	4.313	4.371	4.586
2007:04	4.808	5.038	4.541	4.549	4.555
2008:01	4.171	4.892	5.090	4.555	4.544
2008:02	3.486	4.173	4.822	5.019	4.725
2008:03	4.082	3.885	4.179	4.841	4.979
2008:04	3.908	4.040	3.771	4.350	4.797
2009:01	3.386	4.018	4.298	4.042	4.497
2009:02	2.594	3.448	4.330	4.591	4.488
2009:03	3.501	2.906	3.452	4.428	4.615
2009:04	NA	3.408	3.075	3.746	4.480
2010:01	NA	NA	3.497	2.928	3.767
2010:02	NA	NA	NA	3.790	3.180
2010:03	NA	NA	NA	NA	3.851

Table 5 notes.

- (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: TBOND (10-Year Tbond Rate [QA,PPs])  
 By Forecast Step (1 to 5)  
 Transformation: Level  
 Lag Length for DARM(p): AIC  
 Last Updated: 09/01/2009 10:22

Qtr Forecast	Step 1	Step 2	Step 3	Step 4	Step 5
2002:04	4.095	4.726	5.329	5.359	5.425
2003:01	4.005	4.230	4.683	5.110	5.234
2003:02	4.119	3.963	4.091	4.739	5.040
2003:03	4.298	4.204	4.040	4.217	4.755
2003:04	4.228	4.670	4.248	4.237	4.294
2004:01	4.133	4.372	4.532	4.251	4.383
2004:02	4.559	4.284	4.618	4.537	4.521
2004:03	4.388	4.476	4.106	4.265	4.184
2004:04	4.110	3.968	4.205	3.948	3.952
2005:01	4.188	4.269	4.191	4.489	3.955
2005:02	4.186	3.992	4.099	4.019	4.334
2005:03	4.271	4.073	3.749	3.930	4.079
2005:04	4.521	4.384	4.010	4.000	4.186
2006:01	4.344	4.508	4.302	3.632	3.729
2006:02	5.068	4.374	4.533	4.256	3.919
2006:03	5.082	5.150	4.506	4.591	4.264
2006:04	4.681	4.858	5.016	4.295	4.430
2007:01	4.755	4.698	4.770	4.970	4.335
2007:02	4.633	4.522	4.507	4.594	4.806
2007:03	4.972	4.529	4.295	4.355	4.424
2007:04	4.522	5.075	4.670	4.536	4.599
2008:01	3.611	4.483	5.012	4.702	4.525
2008:02	3.761	3.482	4.421	4.843	4.930
2008:03	3.992	3.993	3.425	4.414	4.761
2008:04	3.863	4.110	4.070	3.474	4.406
2009:01	2.518	4.221	4.133	4.354	3.745
2009:02	3.063	2.670	4.362	4.425	4.684
2009:03	3.489	3.364	3.193	4.426	4.469
2009:04	NA	3.457	3.579	3.577	4.430
2010:01	NA	NA	3.749	3.484	3.475
2010:02	NA	NA	NA	3.342	4.046
2010:03	NA	NA	NA	NA	3.721

Table 6 notes.

- (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.

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 Table 7. Recent Realizations (Various Measures)  
 Source: Philadelphia Fed Real-Time Data Set  
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Variable: TBOND (10-Year Tbond Rate [QA,PPs])  
 Transformation: Level  
 Last Updated: 09/01/2009 10:22

- 1- Initial Release  
 2- One Qtr After Initial Release  
 3- Five Qtrs After Initial Release  
 4- Nine Qtrs After Initial Release  
 5- Latest Vintage  
 -----

Obs. Date	(1)	(2)	(3)	(4)	(5)
2002:04	4.007	4.007	4.007	4.007	4.007
2003:01	3.920	3.920	3.920	3.920	3.920
2003:02	3.620	3.620	3.620	3.620	3.620
2003:03	4.233	4.233	4.233	4.233	4.233
2003:04	4.287	4.287	4.287	4.287	4.287
2004:01	4.020	4.020	4.020	4.020	4.020
2004:02	4.600	4.600	4.600	4.600	4.600
2004:03	4.303	4.303	4.303	4.303	4.303
2004:04	4.173	4.173	4.173	4.173	4.173
2005:01	4.297	4.297	4.297	4.297	4.297
2005:02	4.160	4.160	4.160	4.160	4.160
2005:03	4.213	4.213	4.213	4.213	4.213
2005:04	4.490	4.490	4.490	4.490	4.490
2006:01	4.570	4.570	4.570	4.570	4.570
2006:02	5.070	5.070	5.070	5.070	5.070
2006:03	4.897	4.897	4.897	4.897	4.897
2006:04	4.630	4.630	4.630	4.630	4.630
2007:01	4.680	4.680	4.680	4.680	4.680
2007:02	4.847	4.847	4.847	NA	4.847
2007:03	4.730	4.730	4.730	NA	4.730
2007:04	4.260	4.260	4.260	NA	4.260
2008:01	3.663	3.663	3.663	NA	3.663
2008:02	3.887	3.887	NA	NA	3.887
2008:03	3.863	3.863	NA	NA	3.863
2008:04	3.253	3.253	NA	NA	3.253
2009:01	2.737	2.737	NA	NA	2.737
2009:02	3.313	NA	NA	NA	3.313
2009:03	NA	NA	NA	NA	NA
2009:04	NA	NA	NA	NA	NA
2010:01	NA	NA	NA	NA	NA
2010:02	NA	NA	NA	NA	NA
2010:03	NA	NA	NA	NA	NA

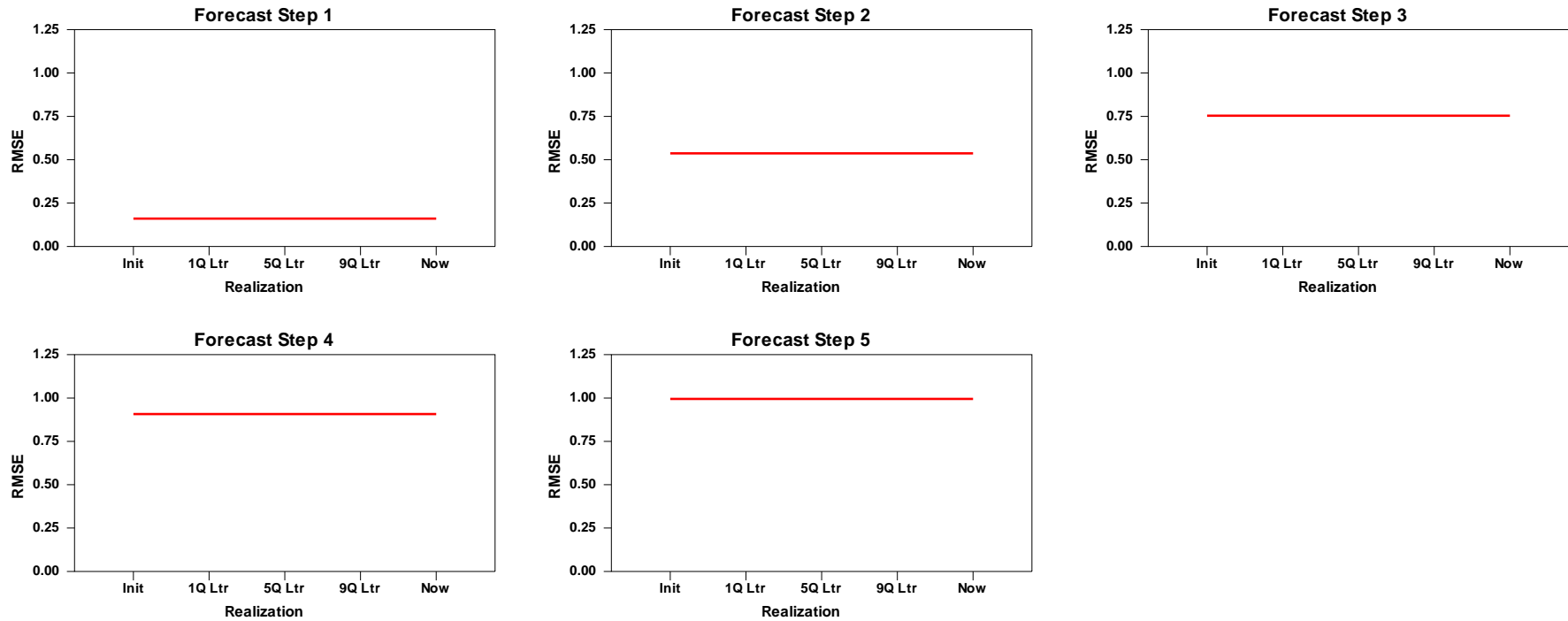
Table 7 notes.

- (1) Each column reports a sequence of realizations from the Philadelphia Fed real-time data set.  
 (2) The date listed in each row is the observation date.  
 (3) Moving across a particular row shows how the observation is revised in subsequent releases.

Source: Tom Stark, Research Department, FRB Philadelphia.

# Root-Mean-Square Errors: 1993:01-2007:01

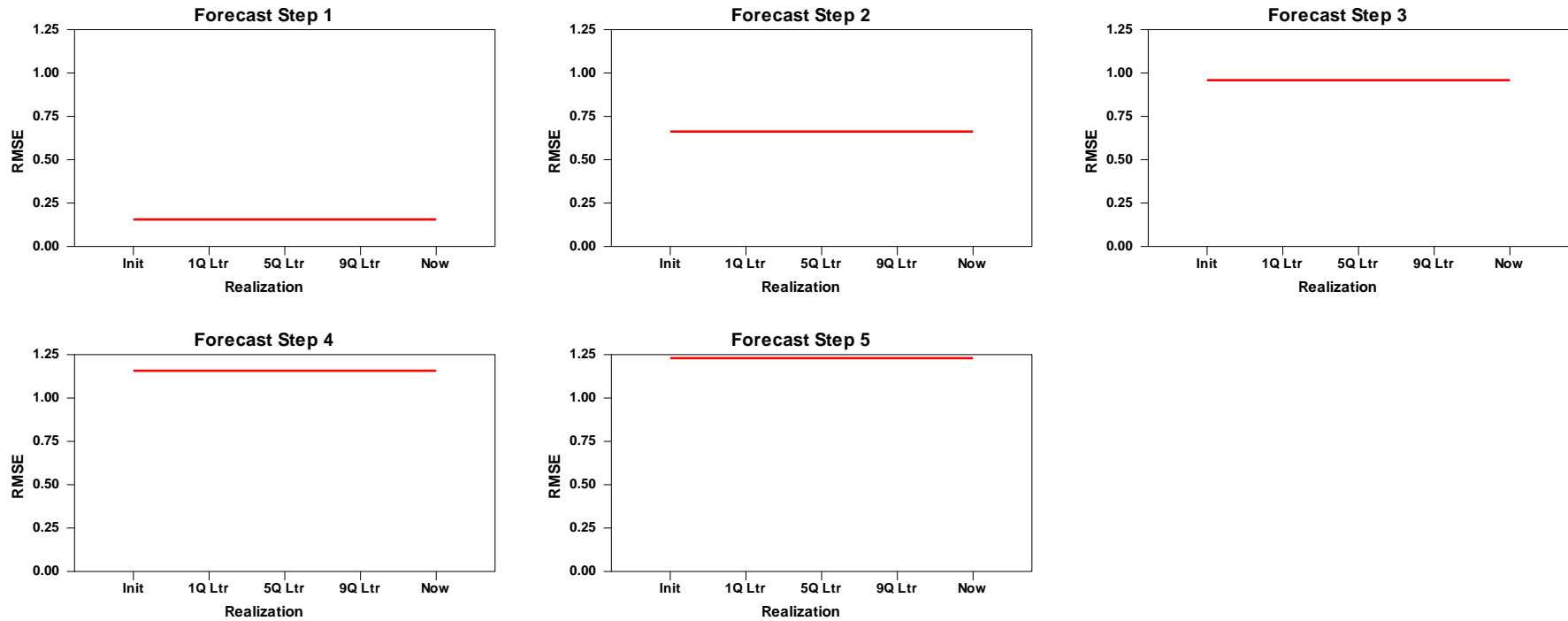
*SPF Projections for 10-Year Tbond Rate [QA,PPs], Transformation: Level*



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: 1993:01-1996:04

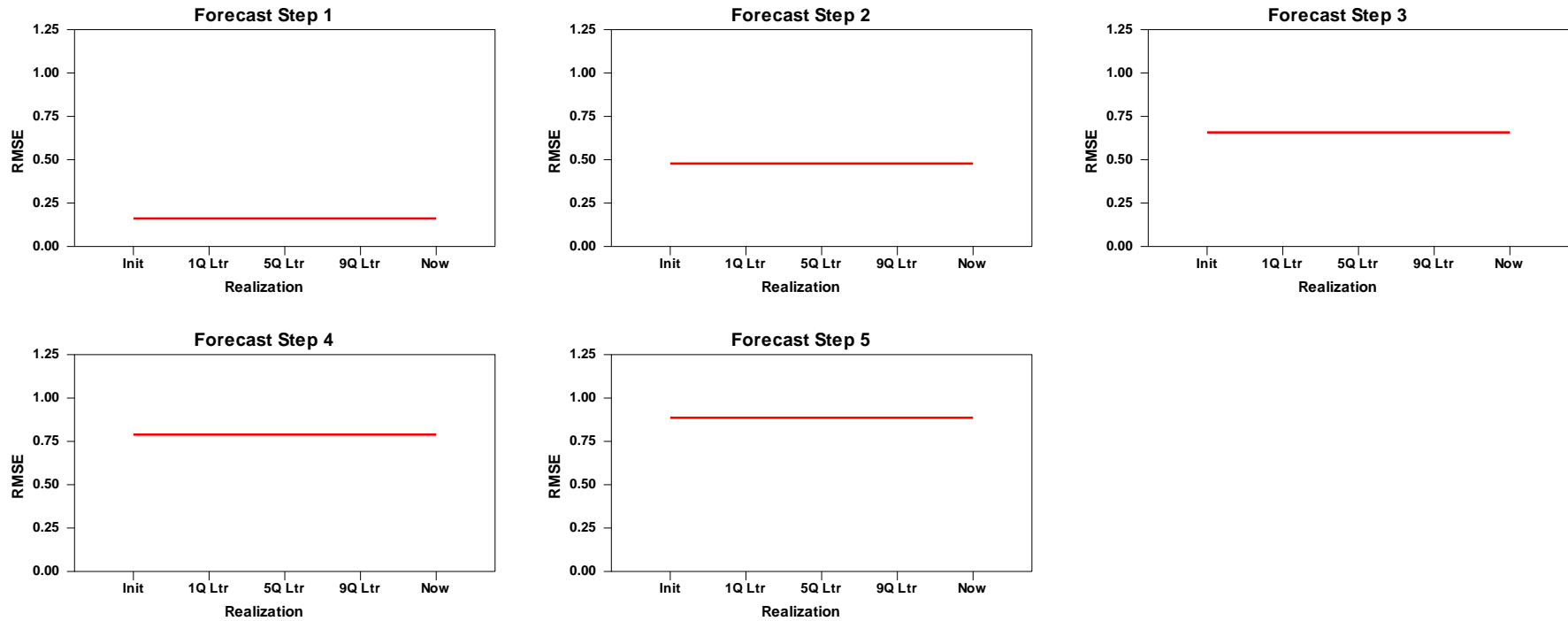
*SPF Projections for 10-Year Tbond Rate [QA,PPs], Transformation: Level*



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: 1997:01-2007:01

*SPF Projections for 10-Year Tbond Rate [QA,PPs], Transformation: Level*



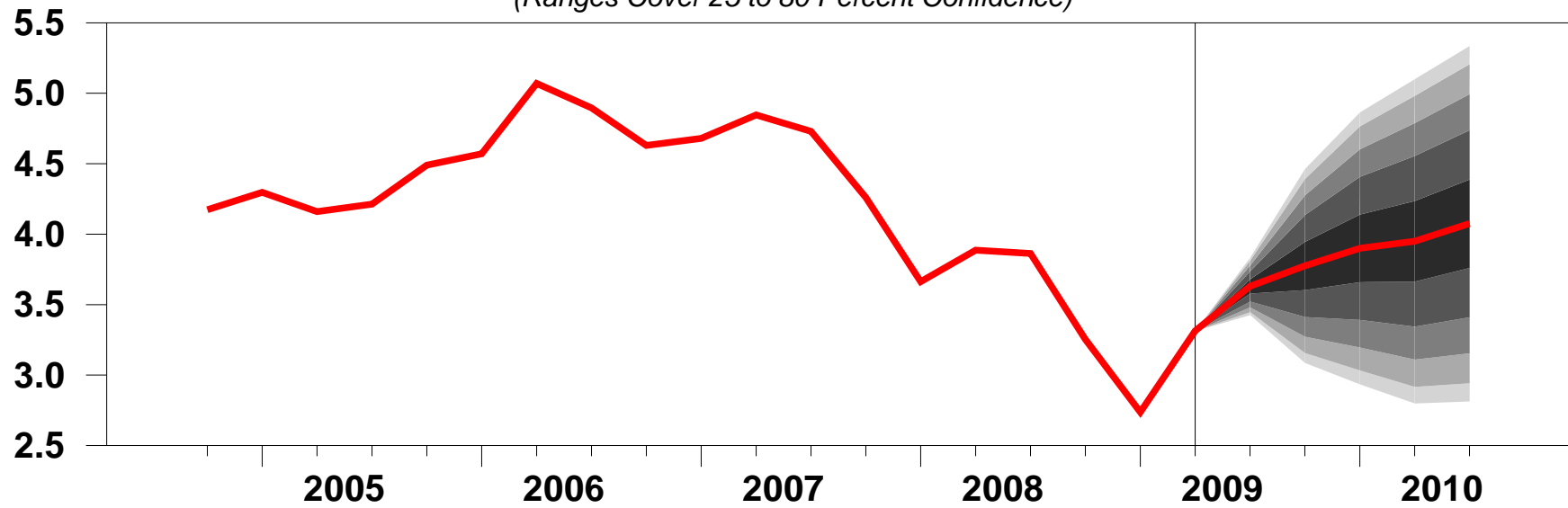
The RMSE is plotted against the realization used to compute it, from the value on initial release to the value as we now know it. Source: Tom Stark, FRB Philadelphia.

# 10-Year Tbond Rate [QA,PPs]

*History, Forecasts, and Ranges for the SPF of 2009:03*

## Level

*(Ranges Cover 25 to 80 Percent Confidence)*



Ranges at each horizon use the  $N(0, \text{MSE})$  density. The MSEs are based on the sample 93:01-08:01 and use the realization: Five Qtrs After Initial Release. Source: T.Stark, FRB Phila.