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Forecasting the Past:

The Case of U.S. Interest Rate Forecasts

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Forecasting the Past: The Case of U.S. Interest Rate Forecasts

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ABSTRACT

This study evaluates the interest rate forecast efforts of U.S. banks, insurance companies, other financial service companies, research- and consulting institutes, associations, and industrial companies. Subjects of analysis are 10-year US-Government bond yield forecasts and 3-month US-Treasury bill rate forecasts for the period between October 1989 and December 2004. In total 134 forecasts time series with more than 14,000 forecast data are scrutinized. This makes it the most extensive analysis of interest rate forecasts so far. Forecast error measures are Theil's U_2, TOTA coefficient, and the forecast quality matrix. All of the 134 forecast time series lag behind reality. Most of them prove to be inferior to the naïve forecast.

KEY WORDS Interest rate forecasts, forecast accuracy, topically orientated trend adjustment behavior, quasi-naïve forecast

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INTRODUCTION

Forecasts of the future interest rate development are of fundamental importance for many business decisions. This especially holds for the banking sector. Commercial banks obtain a substantial profit contribution by maturity transformations. In which design and to which extent these maturity transformations are useful depends on the present and expected future interest rate development. Only if reliable interest rate forecasts can be generated the risks arising from maturity transformations shrink to a manageable residual.

Interest rate forecasts are indispensable requirements for the successful implementation of active portfolio management strategies in the bond market. Both the proprietary trading and the asset management departments of investment banks thus depend on reliable interest rate forecasts. Among others, fundamental stock market- and exchange rate forecasts are usually based on interest rate forecasts. Research departments also work out interest rate forecasts as input for further forecasts of the financial market.

Industrial companies create interest rate forecasts to achieve the best possible timing for their investments. Capital procurement cost in a high interest rate phase can amount to many times over the cost of finance in a low interest rate phase. Also, with regard to the future, medium- and long-term price policies should consider the interest rate as a cost issue.

Against the background of the important role interest rate forecasts play for various financial areas of responsibility within banks and industrial companies it is of special

interest if, and if so, to which extent, U.S. companies succeed in dealing with this task. This study takes up a series of examinations with various results.

Throop (1981) concludes that the reviewed estimations of market professionals lead to better forecast results than an autoregressive forecasting equation based on the past history of the interest rate. Belongia (1987) shows that the reviewed interest rate forecasts by analysts in less than 50% foresee the correct development trend. Additionally, the estimates made by analysts prove to be inferior to the naïve forecast. Dua (1988) comes to mixed conclusions. Depending on examined forecast subject, forecast horizon, and forecasting period the forecasts are partly better and partly worse than the naïve forecast. In a further comparison of interest rate forecasts of different market experts with the naïve forecast Hafer and Hein (1989) establish that, depending on the reviewed period of time and the applied forecast error measure, sometimes the naïve forecast and sometimes the analysts' forecast provide minimally better results. This impression is widely confirmed in the later study of Hafer, Hein, and MacDonald (1992). Domian (1992) argues that money market mutual funds which are able to forecast interest rates should lengthen their maturities before a drop in rates, and shorten their maturities before a rise in rates. An examination of the maturity structures of the reviewed funds shows that the fund managers were not able to predict the future interest rate development. In a similar study Francis (1991) examines commercial bank exposure positions. The intuition is that the management of exposure to interest rate risk reveals the banks' implicit forecast of interest rates. It emerges that changes in the exposure position are unrelated to later changes of the interest rate level. Kolb and Stekler (1996) show that interest rate forecasts by market experts were not significantly better than random walk forecasts.

Table I. Synoptic Overview of Existing Literature on the Success of Interest Rate Forecasts

Study	Evaluated forecast subject	Source of data	Frequency of forecast	Period of time	Remarks
Throop (1981)	3-month US-Treasury bill rate	Goldsmith-Nagan Bond and Money Market Letter	Quarterly	1970 – 1979	
Belongia (1987)	3-month US-Treasury bill rate	Wall Street Journal	Six-monthly	1981 – 1986	Only 9 reviewed market experts
Dua (1988)	3- and 12-month US-Treasury bill rate, federal funds rate, rate on high-grade tax-exempt bonds, and rate on Aaa utility bonds	Goldsmith-Nagan Bond and Money Market Letter / Federal Reserve Bulletin / The Bond Buyer	Quarterly	1972 – 1985	
Hafer / Hein (1989)	3-month US-Treasury bill rate	Bond and Money Market Letter	Quarterly	1969 – 1989	
Hafer / Hein / MacDonald (1992)	3-month US-Treasury bill rate	Bond and Money Market Letter / Wall Street Journal	Quarterly and six-monthly	1977 – 1988	
Kolb / Stekler (1996)	3-month US-Treasury bill rate and 30-year US-Government bond yield	Wall Street Journal	Six-monthly	1982 – 1990	
Gosnell / Kolb (1997)	3-month Euromarket rate for USA, UK, Germany, Japan, Switzerland	Risk	Monthly	1990 – 1992	Only 10 reviewed market experts
Albrecht (2000)	3-month German money market rate 10-year German Government bond yield	Finanzen	Monthly	1991 – 1997	In German; only 12 reviewed market experts
Spiwoks (2003)	10-year German Government bond yield	Consensus Forecasts	Monthly	1989 – 1999	In German
Greer (2003)	30-year US-Government bond yield	Wall Street Journal	Six-monthly	1984 – 1998	

Opposed to this Gosnell and Kolb (1997) find that the reviewed interest rate forecasts by market experts were if only a little, but discernible better than naïve forecasts. Albrecht (2000) and Spiwoks (2003) show that interest rate forecasts by German banks predict future interest rate developments less correctly than corresponding naïve forecasts. Greer (2003) establishes that the reviewed analysts' estimates have a better forecast quality than the random walk forecast.

Further research efforts are necessary for the following reasons: 1. A number of existing studies present significantly differing results. 2. In some studies the data basis is rather small, because either only six-monthly or quarterly data were evaluated, the reviewed period of time is relatively short, or because only few market experts were included in the study. 3. An investigation of ten-year US-Government bond yield forecasts is still outstanding (Table I).

This study therefore focuses on the evaluation of ten-year US-Government bond yield forecasts and three-month US-Treasury bill rate forecasts which were monthly published by 34 banks, insurance companies and other financial services companies, research- and consulting institutes, associations and industrial companies between October 1989 and December 2003 (Chapter "Empirical Results"). The underlying methods are presented in the next Chapter, while the data base is defined in the Chapter after next. A summary of research results as well as the conclusion follows in the last Chapter.

METHODS

Let us assume that a black box generates a quantifyable event in regular time intervals. We can observe the time series of these events, but we have no insight whatsoever into the processes occuring inside the black box, and how the visible results were generated. Let us also assume that despite our complete ignorance we have to make a forecast on the future tendency of the time series. As we have no information on the genesis of events, both the future increasing and decreasing course of the time series are equally probable. Thus it seems sensible to assume an unchanged situation in the future (naïve forecast). This idea goes back to the French mathematician Pierre Simon Laplace (1814), who introduced it into the literature as the "principle of insufficient reason". Since then the naïve forecast has been judged as the rock-bottom of forecast quality. Even if nothing is known about the forecast subject, the forecast quality of a naïve forecast can be achieved without effort. If a market expert at least roughly understands the processes to be forecast, his forecasts should have a significantly better quality than naïve forecasts.

Henri Theil (1955, 1966, 1971) used this assumption to develop forecast error measures which allow an implicit comparison of a forecast time series with the time series of the respective naïve forecast. Hereby especially Theil's new inequality coefficient (Theil's U_2) has been generally accepted.

$$U_2 = \frac{\sqrt{\frac{1}{T-h}\sum_{t=h+1}^{T}(P_t - A_t)^2}}{\sqrt{\frac{1}{T-h}\sum_{t=h+1}^{T}(A_t)^2}} \qquad (1)$$

$$P_t = \frac{\hat{x}_t - x_{t-h}}{x_{t-h}} \tag{2}$$

$$A_t = \frac{x_t - x_{t-h}}{x_{t-h}} \tag{3}$$

with

t : Continuous time index

T : Total amount of present forecasts or actually occured events

x_t : Occured event at point of time t (t from t = 1 to T)

$\hat{x}_t$: Present forecast at point of time t (t from t = 1 to T)

h : Forecast horizon

x_{t-h} : Occured event at point of time t-h (point of origin of forecast)

Theil's U_2 provides several good characteristics which significantly enable this forecast error measure to assess quantitative forecast time series of the financial market: 1. A mutual cancelling out of over- and underestimates is impossible. 2. The standardization enables the comparison of forecast data of different market phases (i. e. high interest rate phase and low interest rate phase). 3. Strong deviations of a forecast from the actual event are over-proportionally included into the forecast error measure. 4. By the implicit comparison with the respective time series of naïve forecasts each forecast time series can be qualified as suitable or unsuitable without further comparison data. 5. The findings can be interpreted easily and unambiguously.

For a perfect forecast follows $U_2 = 0$. If $U_2 = 1$ the reviewed forecast time series on average is as bad as the time series of naïve forecasts. For $U_2 > 1$ the applied forecasting procedure is even worse than naïve forecasting. According to Theil a forecast time series which is systematically better than the time series of naïve forecasts will result

in $U_2 < 0{,}4$. Although forecast time series with a test result of $1 > U_2 > 0{,}4$ are clearly better than the naïve forecast, still this "success" may simply be based on an accidental oscillation around value 1, which represents the naïve forecast.[1]

When forecasts are shaped mainly by the current development of the variable to be forecast, so that the forecasts to a larger extent correspond with actual events at the time of their respective emergence than with those at their respective point of time of validity, this is labelled as topically orientated trend adjustment behavior of forecasts (TOTA).

Financial market forecasts which are continually adjusted to actual market developments may, in the worst case, completely lose their future-oriented character. Therefore it is of special interest if a forecast is marked by topically orientated trend adjustment behavior. The TOTA coefficient (see Andres and Spiwoks, 1999, pp. 531-534, or Bofinger and Schmidt, 2003, p. 444) can be used to identify this characteristic. To calculate the TOTA coefficient at first the coefficient of determination of the forecast data and the actual events are calculated (R^2_A; Figure 1). Then the coefficient of determination of the forecast data from the time of emergence with the actual events is calculated (R^2_B; Figure 2).

$$\text{TOTA coefficient} = \frac{R^2_A}{R^2_B} = \frac{R^2_{\text{forecasts; actual}}}{R^2_{\text{forecasts; actual - } h}} \tag{4}$$

[1] Following case shall serve as an example: A market expert totally used to rely on the naïve forecast for years; he always forecasts the actual value for the future. Just at one single forecast date he makes a bet and flips a coin. Heads mean he fixes the forecast value minimally below the actual value. Tails mean he fixes the forecast value minimally above the actual varible. Be it tails and the forecasted value incidentally increases in the forecast period of time, U_2 has a value of < 1, although the market expert has had no clear idea of the future development. For a forecast time series to be systematically better than the time series of naïve forecasts, the correlation of forecasts and actually values must be so close that Theil's $U_2 < 0{,}4$. Theil defined this borderline for Theil's old inequality coefficient (U_1). In analogy it can be also used for U_2. See Theil (1961), p. 32.

With h: Forecast horizon

If the value of the TOTA coefficient is < 1, a topically oriented trend adjustment must be assumed. In this case the forecast time series transferred back to its time of emergence shows a higher correspondence with the actual values than the forecast time series at the time of its validity with the actual values. For TOTA coefficient < 1 the forecast time series stronger reflects the presence than the future.

The understanding of the quality of forecast time series can be significantly improved if apart from Theil's U_2 also the TOTA coefficient is considered. TOTA coefficient was developed by Andres and Spiwoks (1999). It has received attention especially since Bofinger, one of the highly ranked economics consultants of the German government, has taken up this analysis tool and applied it in several studies (a. o. see Bofinger and Schmidt, 2003; Bofinger and Schmidt, 2004; Leitner, Schmidt, and Bofinger, 2003).

With the help of Theil's U_2 and the TOTA coefficient now four different forecast qualities can be differentiated in the forecast quality matrix (see Andres and Spiwoks, 1999, pp. 535-536; Spiwoks, 2004, pp. 563-564). On the one hand it is taken into account if the reviewed forecast time series is better or worse than the corresponding time series of naïve forecasts. On the other hand there is the separation into existing and non-existing topically oriented trend adjustments. If these two distinctive features are combined the quality forecast matrix (Figure 13) emerges, with which the following four forecast categories could be set up:

1. The quasi-naïve forecast ($U_2 > 1$; TOTA < 1): This forecast quality is lower than that of the naïve forecast. A further significant characteristic is its topically oriented

trend adjustment. The market expert was not able to make proper assumptions about future events. Instead he was closely oriented at the development of the variable to be forecast at the time of making the forecast. Focused on the current data he was not better able to judge the trend of development (increasing or decreasing) than using the naïve forecast. Such a forecast is definitely not suited as the basis of decision-making.

2. The directional forecast ($U_2 < 1$; TOTA < 1): Although this forecast time series shows a topically oriented trend adjustment, considering the actual value it still meets the development trend better than the respective time series of naïve forecast. For many decisions it is highly significant to estimate the degree of expected change. This forecast type can not deliver the necessary valuable information. Yet, for many issues it can be very helpful to know the correct development trend. Therefore, within limits, the directional forecast suits as a basis of decision-making.

3. The vain forecast ($U_2 > 1$; TOTA > 1): In this case the effort to forecast the future without defining the market development as dominating factor, was not successful. Although this forecast time series shows no topically oriented trend adjustment, the forecast quality is not higher than the time series of naïve forecasts. Therefore this forecast category does not deliver a suitable basis for financial decisions.

4. The future-depicting forecast ($U_2 < 1$; TOTA > 1): This forecast time series presents a significantly higher quality than the time series of naïve forecasts and is not dominated by the phenomenon of topically oriented trend adjustments. The market experts recognized the facts of future development without having been influenced too much by the market developments at the time of making the forecast. This forecast category is undoubtedly the one best suited as the basis for decision-making.

The differentiation between vain forecast and quasi-naïve forecast is especially helpful to assess the market experts, and to demonstrate possibilities of improvement. It is important to know if mainly an inappropriately strong orientation at current market events at the time of making the forecast has to be corrected, or if the model underlying the forecast does not reflect reality. The differentiation between directional forecast and future-depicting forecast is important regarding the usability of the forecast. If the degree of future market developments is important for the decision-making, a directional forecast is not sufficient.

This study uses Theil's U_2 and the TOTA coefficient as criteria. They allow a thorough characterization of the reviewed forecast time series within the forecast quality matrix. As an introduction some forecast time series are graphically analyzed to simplify an intuitive understanding of the character of forecast time series.

DATA

Bates and Granger (1969) were the first to ask if through the combination of forecasts better forecast results could be achieved. This is based on the idea that each of the existing forecasts contains useful information on future events, and that these sets of information could be merged by combining the forecasts. This theory initiated a lively scientific discussion about the possibilities and limits of combined forecasts, which culminated in 1989 with special editions of both the Journal of Forecasting and the International Journal of Forecasting. Before the background of this pointed discussion the Consensus Economics company founded the Consensus Forecasts magazine. It has been published monthly since October 1989. In each reviewed economy local finan-

cial service companies, research institutions, and industrial companies deliver the forecast data for their countries to Consensus Economics. Forecasts are made for important economic values. The consensus forecasts are made by the unbalanced average of the included single forecasts.

This way Consensus Economics produces, among others, interest rate development forecasts. Not only the combined forecasts, but also the single forecasts of the involved companies and institutions are published. These data are the basis of this study. Forecasts of the ten-year US-Government bond yield and forecasts of three-month US-Treasury bill rate with forecast horizons of 3 and 12 months are evaluated. Here all companies are examined which delivered their interest rate forecasts for at least 5 years without interruption to Consensus Forecasts.[2] This applied to 34 companies total, among which were banks, insurance companies, and other financial services companies like U. S. Trust, Northern Trust, Merrill Lynch, Credit Suisse First Boston, J. P. Morgan, Chase Manhattan, Smith Barney, Wells Fargo, Chemical Bank, Nations Bank, Continental Bank, Core States Financial Corp., First Union, Fannie Mae, Metropolitan Life, and Prudential Insurance. Also included are research- and consultant institutes as well as associations like Interindustry Forecasting at the University of Maryland (Inforum), Research Seminar in Quantitative Economics at the University of Michigan (RSQE), Oxford Economic Forecasting (OEF), Wharton Econometric Forecasting Associates (WEFA), Conference Board, Standard & Poor's, Regional Financial Association, Consensus Economics, Dun & Bradstreet, Griggs & Santow, National Association of Homebuilders, and National Association of Manufactures. Also

[2] Occasionally some forecast data are missing in the time series, because there was no or no timely delivery of the forecasts to Consensus Economics. The gaps were closed by later research and supplementation of the forecast data after contacting the respective forecasting companies. In some cases this was not possible because the company does not exist any more or was not willing to cooperate. Then the data gaps were closed by linear interpolation.

big industrial companies such as General Motors, Ford Motors, Daimler/Chrysler, Amoco, DuPont, and Eaton Corp. appear as market experts.

The researched period of time is October 1989 to December 2004. The 134 forecast time series contain more than 14,000 data. The shortest examined time series is 60 months, the longest 171 months. On average each of the 134 time series provides 105 monthly data.

EMPIRICAL RESULTS

Initially the ten-year US-Government bond yield forecasts with a forecast horizon of 12 months are analyzed. At first the time series of the combined forecasts of Consensus Economics is examined (Figure 1). It is obvious that the forecast time series reflects the actual interest rate development very insufficiently. Thus the forecast for October 1994 designates a local interest rate low of 5.7%, but actually there is a local interest rate high of 7.9%. In January 1996 a local interest rate high of 7.9% is forecast, while in reality there is a local interest rate low of 5.6%. Again, in January 2000 the interest rate level is significantly underestimated. While the forecast expects a local interest rate low of 5.0%, a local interest rate high of 6.6% appears. May 2003 provides an absolute interest rate low of 3.4% whereas the forecast suggests a local interest rate high of 5.7%.

Yet, it is apparent that the forecast time series corresponds with the actual interest rate development in a certain way. The forecast time series seems to be a delayed image of the factual interest rate development; the forecast lags behind reality. This is especially recognizable when the forecast data are each shifted left for the forecast horizon

(12 months), so that the forecast data are no longer attributed to their respective points of validity but to their respective points of time of emergence (Figure 2). This projection indicates that the market experts were highly influenced by the current market situation. It could be claimed that not the future, but merely the presence is "forecast". There is obviously a topically oriented trend adjustment for this time series. The TOTA coefficient value is 0.387 and thus confirms the topically oriented trend adjustment. A final evaluation of the forecast time series of Consensus Economics also requires the calculation of Theil's $U_2 = 1.184$. A strict orientation at the naïve forecast would have led to better (but still not good!) forecast results. The forecast time series must be categorized within the forecast quality matrix as a quasi-naïve forecast. It is therefore definitely an unsuitable support of finance decisions.

To show that the characteristics of the forecast time series of Consenus Economics is not a special case some further examples are presented as charts. The forecast time series of Core States / First Union (Figures 3 and 4), Standard & Poor's (Figures 5 and 6), as well as Eaton Corp. (Figures 7 and 8) show the same obvious shortcomings. For these and all other examined 10-year US-Government bond yield forecast times series with a forecast horizon of 12 months a TOTA coefficient < 1 is calculated (Table II). Thus all 34 cases reflect a significant topically oriented trend adjustment.

Theil's $U_2 > 1$ is the result to be found for 29 of the 34 forecast time series (Table II). In this cases a consistent orientation at the naïve forecast would thus have led to better (albeit not good!) forecast results.

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Table II. Accuracy of the 10-year US-Government bond yield forecasts with 12 months forecast horizon

Institution	Forecasting period	Months	Theil's U_2	TOTA coeff.
Consensus Forecasts	Oct. 1989 – Dec. 2003	171	1.184	0.387
Ford Motors	Oct. 1989 – Dec. 2003	171	1.215	0.446
Standard & Poor's	July 1990 – Dec. 2003	162	1.270	0.231
Eaton Corp.	Nov. 1991 – Dec. 2003	146	1.167	0.119
DuPont	Oct. 1992 – Dec. 2003	135	1.134	0.118
Wells Fargo	Mar. 1993 – Dec. 2003	130	1.277	0.126
Griggs & Santow	Nov. 1989 – July 2000	129	1.095	0.236
United States Trust	Oct. 1993 – Dec. 2003	123	1.140	0.131
Conference Board	Oct. 1993 – Dec. 2003	123	1.348	0.270
J. P. Morgan	Oct. 1993 – Dec. 2003	123	1.328	0.158
General Motors	Jan. 1994 – Dec. 2003	120	1.249	0.156
Daimler/Chrysler	Apr. 1994 – Dec. 2003	117	1.163	0.323
Nat. Assn. Homebuilders	June 1994 – Dec. 2003	115	1.337	0.052
WEFA Group	July 1991 – June 2000	108	1.107	0.061
Prudential Insurance	Dec. 1993 – Oct. 2002	107	1.309	0.071
Fannie Mae	Feb. 1995 – Dec. 2003	107	1.187	0.127
Core States Fin. Corp.	Oct. 1989 – Apr. 1998	103	1.109	0.160
Northern Trust	Oct. 1989 – Feb. 1998	101	1.070	0.206
Smith Barney	Oct. 1989 – Oct. 1997	97	0.907	0.247
RSQE - Univ. Michigan	Mar. 1996 – Dec. 2003	94	1.302	0.071
Chase Manhattan	Oct. 1989 – Mar. 1997	90	1.054	0.069
Merrill Lynch	Oct. 1989 – Feb. 1997	89	1.161	0.026
Metropolitan Life	Oct. 1989 – Sep. 1996	84	0.927	0.001
Regional Financial Assn.	May 1994 – Jan. 2001	81	1.188	0.010
Amoco Corp.	Oct. 1989 – June 1996	81	0.942	0.051
Chemical Bank	Nov. 1989 – Jan. 1996	75	1.067	0.001
OEF - Oxford Economics	Oct. 1997 – Dec. 2003	75	0.981	0.335
Nat. Assn. Manufacturers	Oct. 1989 – Dec. 1995	75	1.072	0.037
Credit Suisse First Boston	Oct. 1989 – July 1995	70	1.046	0.012
Inforum - Univ. Maryland	Apr. 1998 – Dec. 2003	69	1.170	0.011
First Union	June 1998 – Dec. 2003	67	1.370	0.062
Dun & Bradstreet	Apr. 1991 – July 1996	64	1.104	0.186
Nations Bank	Aug. 1993 – Aug. 1998	61	0.903	0.001
Continental Bank	Oct. 1989 – Sep. 1994	60	1.091	0.067

Table III. Accuracy of the 10-year US-Government bond yield forecasts with 3 months forecast horizon

Institution	Forecasting period	Months	Theil's U_2	TOTA coeff.
Consensus Forecasts	Oct. 1989 – Dec. 2003	171	1.247	0.820
Ford Motors	Oct. 1989 – Dec. 2003	171	1.422	0.819
Standard & Poor's	July 1990 – Dec. 2003	162	1.316	0.773
Eaton Corp.	Nov. 1991 – Dec. 2003	146	1.275	0.733
DuPont	Oct. 1992 – Dec. 2003	135	1.265	0.714
Wells Fargo	Mar. 1993 – Dec. 2003	130	1.401	0.694
Griggs & Santow	Nov. 1989 – July 2000	129	1.214	0.755
United States Trust	Oct. 1993 – Dec. 2003	123	1.272	0.700
Conference Board	Oct. 1993 – Dec. 2003	123	1.603	0.675
J. P. Morgan	Oct. 1993 – Dec. 2003	123	1.394	0.722
General Motors	Jan. 1994 – Dec. 2003	120	1.415	0.722
Daimler/Chrysler	Apr. 1994 – Dec. 2003	117	1.409	0.760
Nat. Assn. Homebuilders	June 1994 – Dec. 2003	115	1.350	0.718
WEFA Group	July 1991 – June 2000	108	1.443	0.387
Prudential Insurance	Dec. 1993 – Oct. 2002	107	1.671	0.494
Fannie Mae	Feb. 1995 – Dec. 2003	107	1.518	0.651
Core States Fin. Corp.	Oct. 1989 – Apr. 1998	103	1.337	0.696
Northern Trust	Oct. 1989 – Feb. 1998	101	1.263	0.666
Smith Barney	Oct. 1989 – Oct. 1997	97	1.346	0.633
RSQE - Univ. Michigan	Mar. 1996 – Dec. 2003	94	1.348	0.771
Chase Manhattan	Oct. 1989 – Mar. 1997	90	1.183	0.680
Merrill Lynch	Oct. 1989 – Feb. 1997	89	1.312	0.653
Metropolitan Life	Oct. 1989 – Sep. 1996	84	1.181	0.634
Regional Financial Assn.	May 1994 – Jan. 2001	81	1.635	0.474
Amoco Corp.	Oct. 1989 – June 1996	81	1.393	0.552
Chemical Bank	Nov. 1989 – Mar. 1996	77	1.508	0.478
OEF - Oxford Economics	Oct. 1997 – Dec. 2003	75	1.236	0.663
Nat. Assn. Manufacturers	Oct. 1989 – Dec. 1995	75	1.229	0.693
Credit Suisse First Boston	Oct. 1989 – July 1995	70	1.222	0.708
Inforum - Univ. Maryland	Apr. 1998 – Dec. 2003	69	1.335	0.644
First Union	June 1998 – Dec. 2003	67	1.354	0.570
Dun & Bradstreet	Apr. 1991 – July 1996	64	1.241	0.407
Nations Bank	Aug. 1993 – Aug. 1998	61	1.218	0.441
Continental Bank	Oct. 1989 – Sep. 1994	60	1.127	0.744

Table IV: Accuracy of the 3-month US-Treasury bill rate forecasts with 12 months forecast horizon

Institution	Forecasting period	Months	Theil's U_2	TOTA coeff.
Consensus Forecasts	Oct. 1989 – Dec. 2003	171	1.279	0.290
Ford Motors	Oct. 1989 – Dec. 2003	171	1.414	0.311
Standard & Poor's	July 1990 – Dec. 2003	162	1.054	0.281
Eaton Corp.	Nov. 1991 – Dec. 2003	146	1.424	0.296
Griggs & Santow	Nov. 1989 – Sep. 2001	143	0.986	0.115
DuPont	Oct. 1992 – Dec. 2003	135	1.262	0.296
United States Trust	Oct. 1993 – Dec. 2003	123	1.119	0.357
Conference Board	Oct. 1993 – Dec. 2003	123	1.469	0.278
J. P. Morgan	Oct. 1993 – Dec. 2003	123	1.280	0.415
General Motors	Oct. 1993 – Dec. 2003	123	1.676	0.181
Nat. Assn. Homebuilders	Oct. 1993 – Dec. 2003	123	1.466	0.232
Fannie Mae	Oct. 1993 – Dec. 2003	123	1.539	0.208
RSQE - Univ. Michigan	Nov. 1993 – Dec. 2003	122	1.577	0.188
Daimler/Chrysler	Apr. 1994 – Dec. 2003	117	1.663	0.428
WEFA Group	July 1991 – June 2000	108	1.048	0.013
Prudential Insurance	Dec. 1993 – Oct. 2002	107	1.873	0.107
Core States Fin. Corp.	Oct. 1989 – Apr. 1998	103	0.972	0.113
Northern Trust	Oct. 1989 – Feb. 1998	101	0.916	0.233
Smith Barney	Oct. 1989 – Oct. 1997	97	0.913	0.190
Chase Manhattan	Oct. 1989 – Mar. 1997	90	0.974	0.175
Merrill Lynch	Oct. 1989 – Feb. 1997	89	0.963	0.202
Wells Fargo	Jan. 1993 – Jan. 2000	85	1.022	0.005
Amoco Corp.	Oct. 1989 – Oct. 1996	85	0.939	0.139
Metropolitan Life	Oct. 1989 – Sep. 1996	84	0.899	0.121
Regional Financial Assn.	May 1994 – Jan. 2001	81	1.077	0.250
Chemical Bank	Oct. 1989 – Jan. 1996	76	1.074	0.051
OEF - Oxford Economics	Oct. 1997 – Dec. 2003	75	1.363	0.316
Nat. Assn. Manufacturers	Oct. 1989 – Dec. 1995	75	0.948	0.201
Inforum - Univ. Maryland	Apr. 1998 – Dec. 2003	69	1.589	0.369
Dun & Bradstreet	Mar. 1991 – July 1996	65	1.045	0.006
Credit Suisse First Boston	Oct. 1989 – Oct. 1994	61	0.922	0.271
Nations Bank	Aug. 1993 – Aug. 1998	61	0.885	0.157
Continental Bank	Oct. 1989 – Sep. 1994	60	0.944	0.226

Table V: Accuracy of the 3-month US-Treasury bill rate forecasts with 3 months forecast horizon

Institution	Forecasting period	Months	Theil's U_2	TOTA coeff.
Consensus Forecasts	Oct. 1989 – Dec. 2003	171	1.186	0.922
Ford Motors	Oct. 1989 – Dec. 2003	171	1.595	0.915
Standard & Poor's	July 1990 – Dec. 2003	162	1.204	0.916
Eaton Corp.	Nov. 1991 – Dec. 2003	146	1.640	0.880
Griggs & Santow	Nov. 1989 – Sep. 2001	143	1.198	0.868
DuPont	Oct. 1992 – Dec. 2003	135	1.342	0.903
United States Trust	Oct. 1993 – Dec. 2003	123	1.209	0.915
Conference Board	Oct. 1993 – Dec. 2003	123	1.299	0.896
J. P. Morgan	Oct. 1993 – Dec. 2003	123	1.161	0.944
General Motors	Oct. 1993 – Dec. 2003	123	1.499	0.902
Nat. Assn. Homebuilders	Oct. 1993 – Dec. 2003	123	1.307	0.924
Fannie Mae	Oct. 1993 – Dec. 2003	123	1.386	0.906
RSQE - Univ. Michigan	Nov. 1993 – Dec. 2003	122	1.273	0.915
Daimler/Chrysler	Apr. 1994 – Dec. 2003	117	1.277	0.922
WEFA Group	July 1991 – June 2000	108	1.536	0.792
Prudential Insurance	Dec. 1993 – Oct. 2002	107	1.861	0.825
Core States Fin. Corp.	Oct. 1989 – Apr. 1998	103	1.162	0.903
Northern Trust	Oct. 1989 – Feb. 1998	101	1.090	0.935
Smith Barney	Oct. 1989 – Oct. 1997	97	1.012	0.949
Chase Manhattan	Oct. 1989 – Mar. 1997	90	1.018	0.920
Merrill Lynch	Oct. 1989 – Feb. 1997	89	1.130	0.925
Wells Fargo	Jan. 1993 – Jan. 2000	85	1.572	0.816
Amoco Corp.	Oct. 1989 – Oct. 1996	85	1.139	0.890
Metropolitan Life	Oct. 1989 – Sep. 1996	84	1.134	0.893
Regional Financial Assn.	May 1994 – Jan. 2001	81	1.376	0.387
Chemical Bank	Oct. 1989 – Jan. 1996	76	1.260	0.876
OEF - Oxford Economics	Oct. 1997 – Dec. 2003	75	1.263	0.921
Nat. Assn. Manufacturers	Oct. 1989 – Dec. 1995	75	1.239	0.892
Inforum - Univ. Maryland	Apr. 1998 – Dec. 2003	69	1.472	0.918
Dun & Bradstreet	Mar. 1991 – July 1996	65	1.200	0.777
Credit Suisse First Boston	Oct. 1989 – Oct. 1994	61	0.996	0.933
Nations Bank	Aug. 1993 – Aug. 1998	61	1.327	0.848
Continental Bank	Oct. 1989 – Sep. 1994	60	1.141	0.912

INSERT HERE Figure 13

Even worse are the results of the 10-year Government bond yield forecasts with a forecast horizon of three months (see Figures 9-10 and Table III). In all cases the TOTA coefficient is < 1, and Theil's U_2 is > 1. So without exception these are quasi-naïve forecasts. The 3-month Treasury bill rate forecasts are hardly more successful (see Figures 11-12 and Tables IV and V).

As a summary it can be established that all 134 reviewed forecast time series have a TOTA coefficient < 1. Also the exemplary graphic analysis shows that the analysts are strongly oriented at the current, or past, market situation when they generate their forecasts. Of the 134 reviewed forecast time series 117 show a $U_2 > 1$. Had the bet always been on the naïve forcast these forecast results had been better. Neither are the other 17 forecast time series more convincing. Their U_2-values lie between 0.885 and 0.986 and can therefore be accounted to the random oscillation around value 1.

117 of the134 reviewed forecast time series must be assigned to the category of quasi-naïve forecasts. They are definitely not suited as the basis of investment decisions. Given that the other 17 forecast time series only marginally fall below the U_2–threshold value of 1 they provide no reliable basis for decision-making, either.

The question arises how it can be possible that, while the most market experts, when doing their forecasts, are strongly oriented at the actual market situation, not more of them managed to achieve an U_2-value of just below 1 – even if this was merely accidental. A look at the graphic presentation of the data clarifies this (Figures 2, 4, 6, 8, 10, 12).

The bad results can probably be put down to the fact that all relevant market developments are mirrored in the forecasts with a delay of one to three months. To put it more pointedly: The examined institutions did not forecast the future. They have not even

been able to “forecast” the presence, which would have led to U_2–values of around 1. In fact they merely re-established in their forecasts the interest rate development of the prior one to three months – they “forecast” the past.

This time lag of course stronger affects short forecast horizons than longer ones, and it explains why the forecast success of forecast time series with a 3-month forecast horizon is significantly inferior to that of forecast time series with a 12-month forecast horizon.

The on average a little better U_2–results of the 3-months US-Treasury bill rate forecasts can probably be ascribed to the long lateral movement of the Treasury bill rate between the end of 1994 and mid of 1999. Lateral movements support the topically oriented trend adjustment behavior of financial analysts.

The graphic analysis shows the exaggerated cautiousness of the bond market analysts. While they speedily reflect interest rate increases in their forecasts, they wait for some time when interest rates decrease to find out if this trend is lasting. As the interest rate level during the research period on balance decreased, this asymmetrical behavior of the analysts might be the reason for the inferior success of the most forecast time series as opposed to the time series of naïve forecasts ($U_2 > 1$).

EXAMINATION RESULTS AND CONCLUSION

It must be concluded that the evaluation of 134 interest rate forecast time series (with a duration of 60 to 171 months between October 1989 and December 2004) does not indicate that the reviewed market experts were able to generate reliable interest rate forecasts. 117 of the analyzed forecast time series fall into the category of quasi-naïve

forecasts and are therefore not suited as bases for decision-making. The other 17 forecast time series show U_2–values which are only marginally below the threshold value 1. So these forecast time series, too, are no secure basis for decision-making. The TOTA coefficient results and especially the graphic display of the forecast time series at their respective points of time of validity (Figures 1, 3, 5, 7, 9, 11) and their respective dates of generation (Figures 2, 4, 6, 8, 10, 12) reveal: the bond analysts do not forecast the future. Rather, their "forecasts" merely reflect the present, and often only the past.

This examination results are especially serious for two reasons:

1. Sources for the review were banks, insurance companies, other financial services companies, research- and consulting institutes, associations, and industrial companies: a cross-section through the U.S. forecast landscape. The fact that not a single one of the reviewed institutions could achieve satisfying forecast results nourishes the suspicion that the presented outcome is characteristic for the whole guild of interest rate forecasters.
2. The examined forecast data on average cover a period of nine years, some even more than fourteen years. Therefore it can be excluded that the bad forecast results might be the consequence of an "adverse" period of time.

The practical consequences arising from the unsatisfying quality of the interest rate forecasts are extensive:

In the face of the weaknesses regarding the forecast of the market-determining 10-year US-Government bond yields and the 3-month US-Treasury bill rates a reliable forecast of the future interest rate development seems, on the whole, not to be guaranteed. Therefore, it is not possible to master the risk of changing interest rates when dealing

with maturity transformation solely with the help of interest rate forecasts. A critical inspection into the maturity transformation volume as well as a consistent use of the known procedures of risk evaluation and –limitation appears to be urgently recommended before the background of this study results.

Without the necessary reliability of interest rate forecasts, active investment strategies in the bond market can not lead to the desired success, namely the achievement of systematic surplus yields. As active investment strategies are also relatively expensive, a stringent orientation to passive investment strategies should be pursued.

Before the background of the low reliability of interest rate forecasts established here also other financial market forecasts should be critically examined on their accuracy, because fundamental stock market- and exchange rate forecasts normally rely on assumptions on the future interest rate development. All research results should be subject to a thorough, systematical controlling to avoid false assumptions regarding one's own forecast competence.

Finally, industrial companies should not depend their timing of real investments on expected changes of the cost of finance.

The findings of the present study may lead to further interesting areas of research: What is the reason of the timid behavior of financial analysts? Why do they so strongly align their forecasts to present interest rate levels, although for years this has only led to drastic failure? Do anchoring-heuristics or possible rational herd behavior of financial analysts play a role here?

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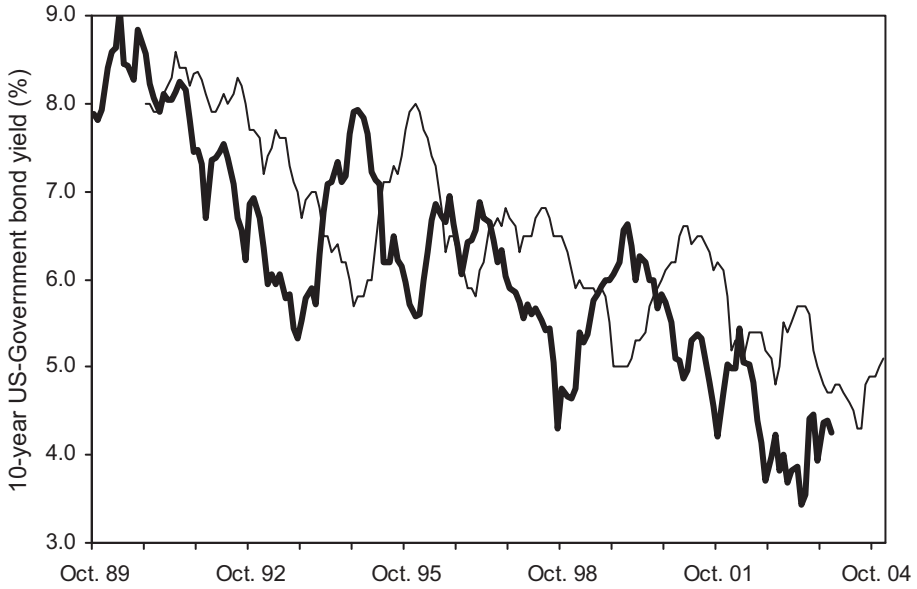

Figure 1. Ten-year US-Government bond yield (bold line) and respective forecasts of Consensus Economics with 12 months forecast horizon (thin line)

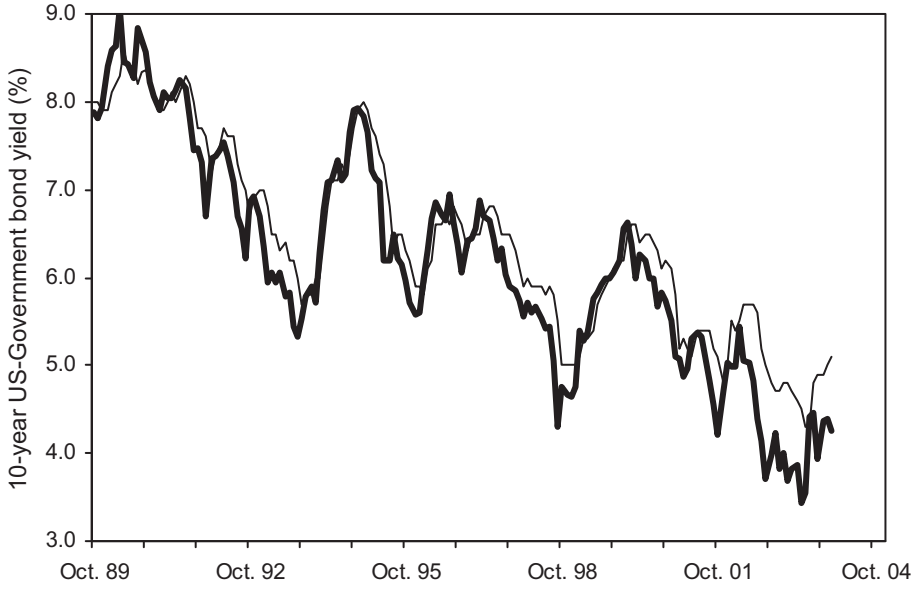

Figure 2. Ten-year US-Government bond yield (bold line) and forecasts shifted to the left by 12 months from Consensus Economics (thin line)

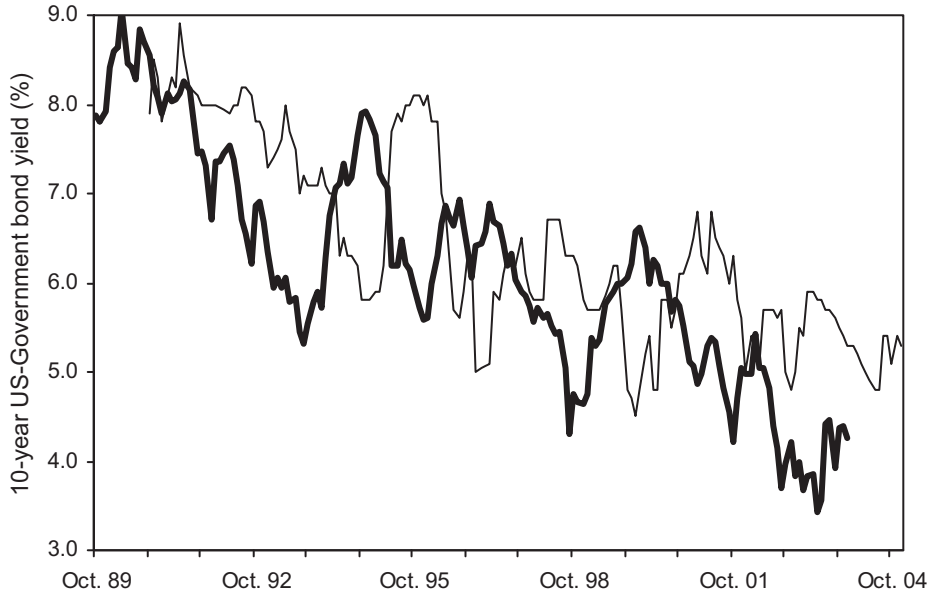

Figure 3. Ten-year US-Government bond yield (bold line) and respective forecasts of Core States / First Union with 12 months forecast horizon (thin line)

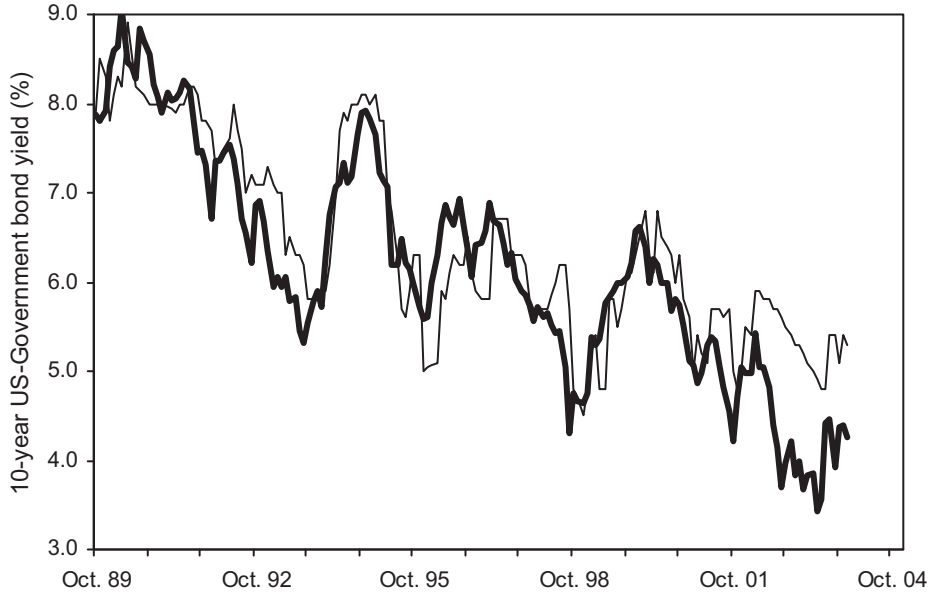

Figure 4. Ten-year US-Government bond yield (bold line) and forecasts shifted to the left by 12 months from Core States / First Union (thin line)

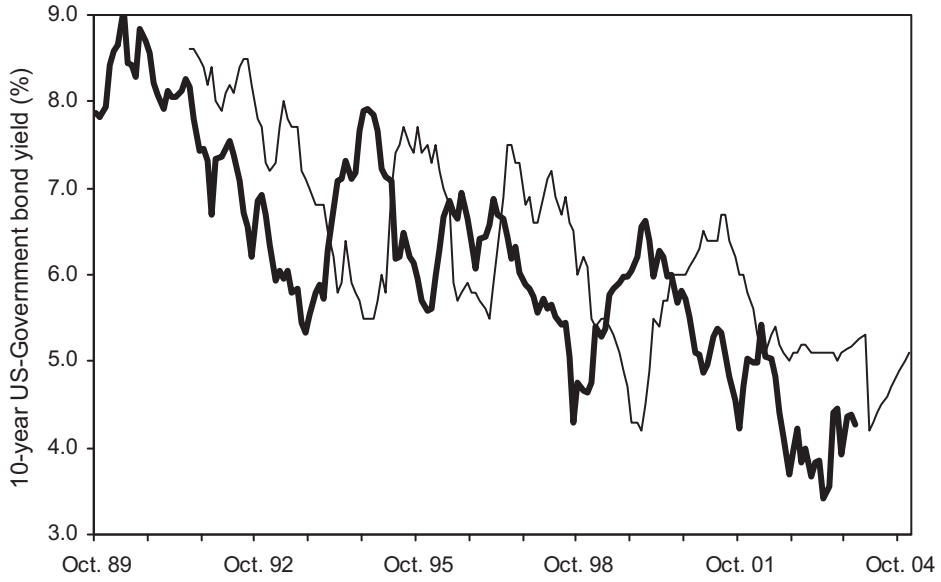

Figure 5. Ten-year US-Government bond yield (bold line) and respective forecasts of Standard & Poor's with 12 months forecast horizon (thin line)

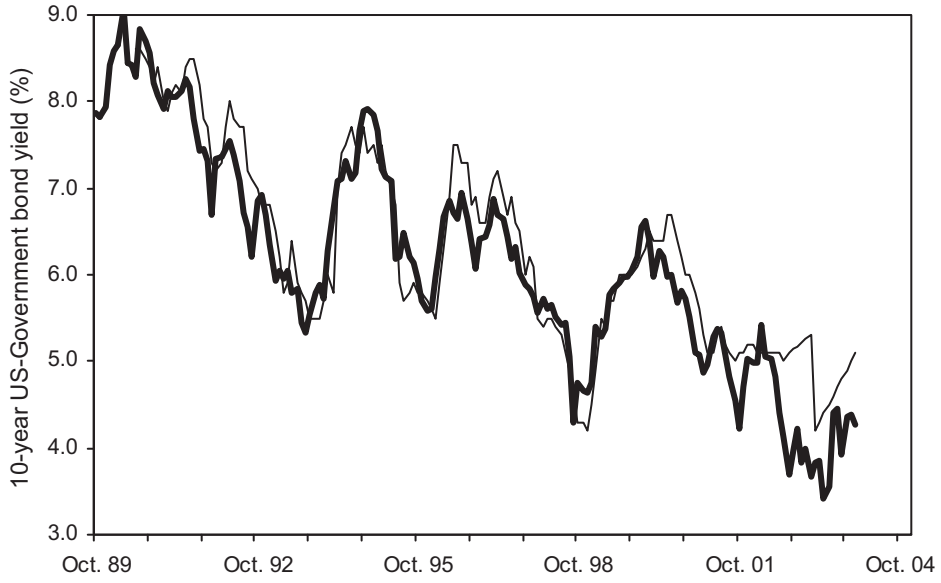

Figure 6. Ten-year US-Government bond yield (bold line) and forecasts shifted to the left by 12 months from Standard & Poor's (thin line)

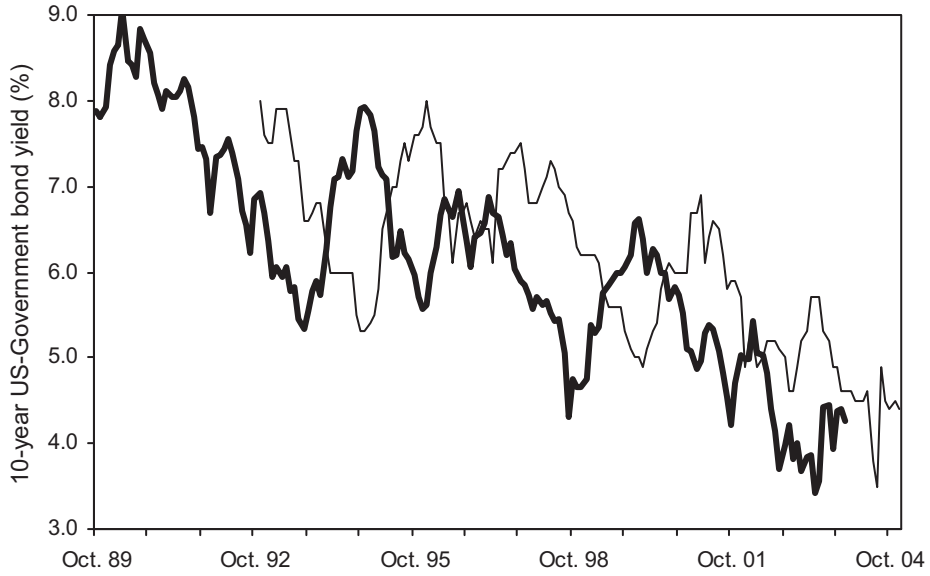

Figure 7. Ten-year US-Government bond yield (bold line) and respective forecasts of Eaton Corp. with 12 months forecast horizon (thin line)

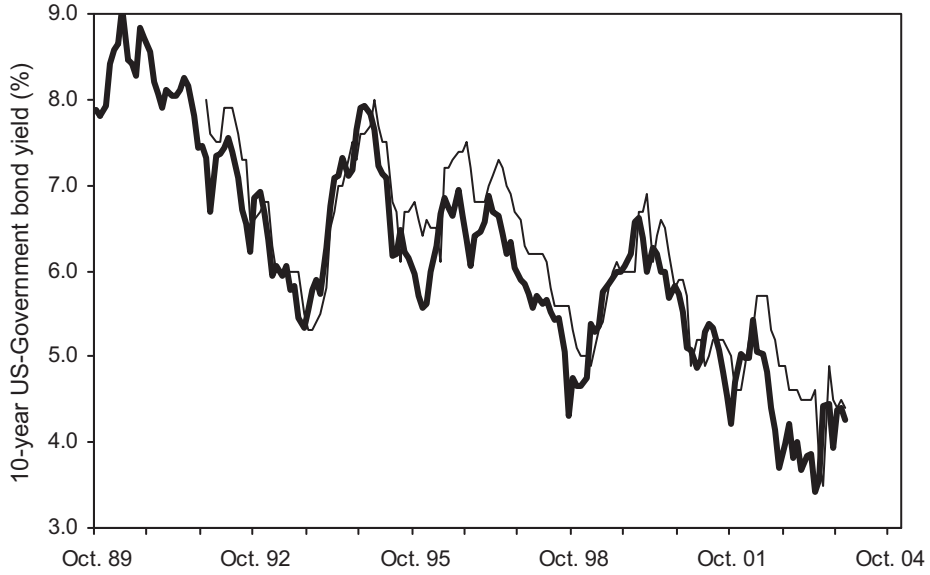

Figure 8. Ten-year US-Government bond yield (bold line) and forecasts shifted to the left by 12 months from Eaton Corp. (thin line)

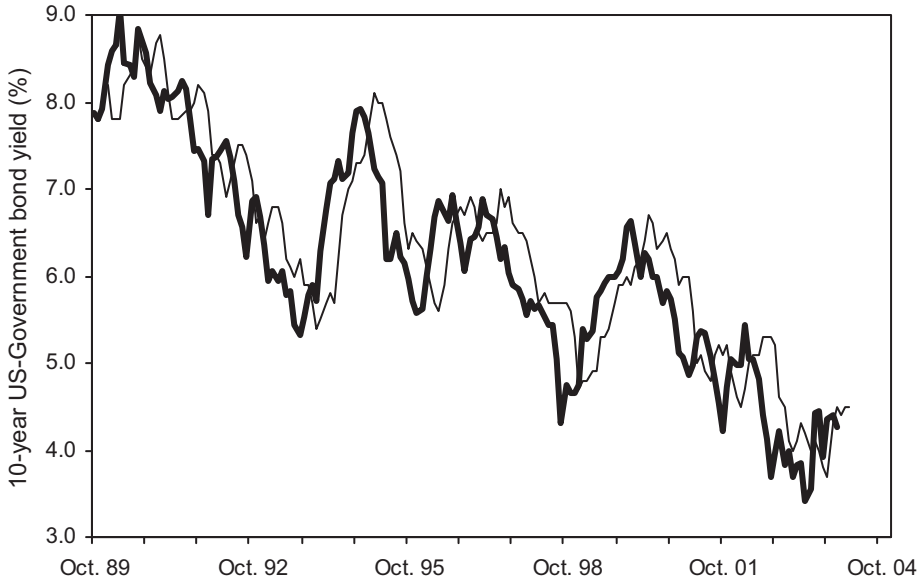

Figure 9. Ten-year US-Government bond yield (bold line) and respective forecasts of Consensus Economics with 3 months forecast horizon (thin line)

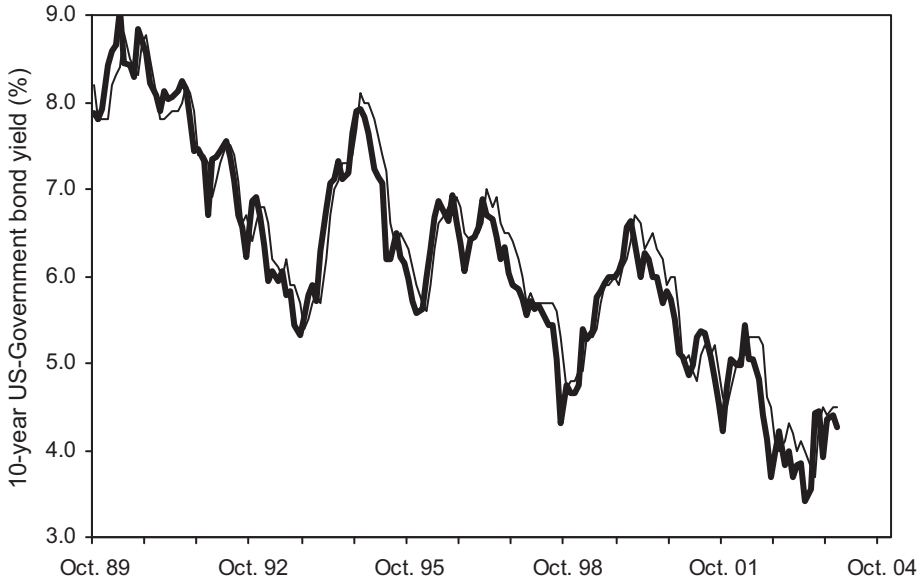

Figure 10. Ten-year US-Government bond yield (bold line) and forecasts shifted to the left by 3 months from Consensus Economics (thin line)

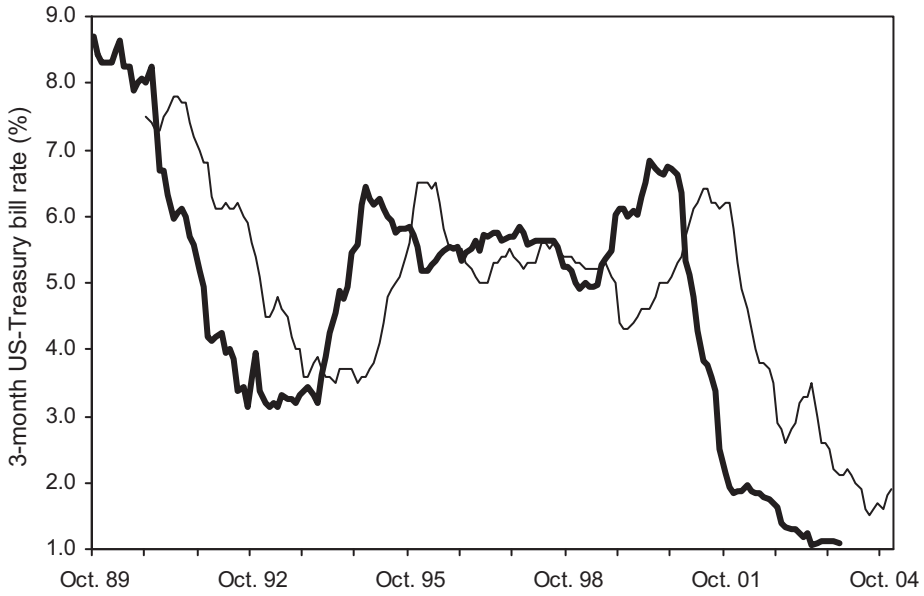

Figure 11. Three-month US-Treasury bill rate (bold line) and respective forecasts of Consensus Economics with 12 months forecast horizon (thin line)

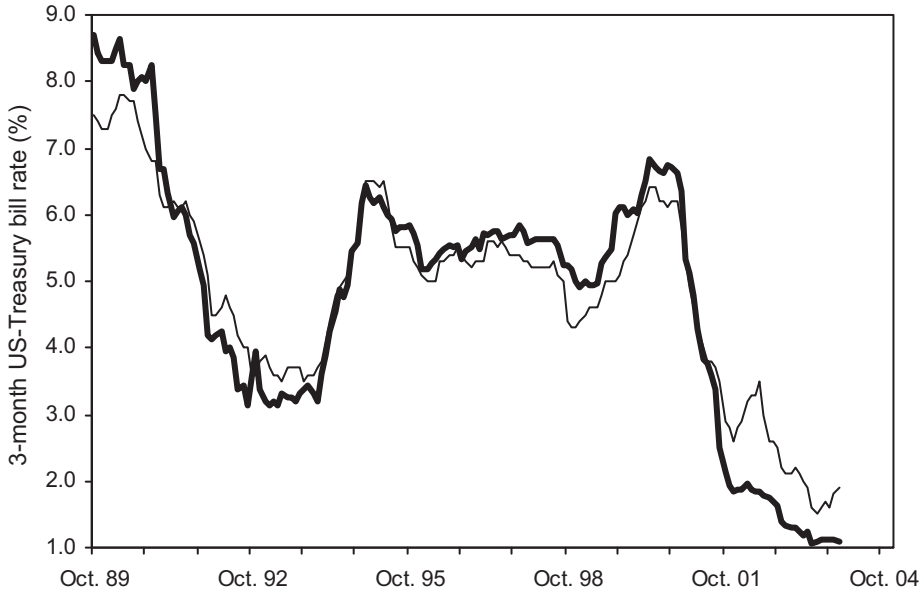

Figure 12. Three-month US-Treasury bill rate (bold line) and forecasts shifted to the left by 12 months from Consensus Economics (thin line)

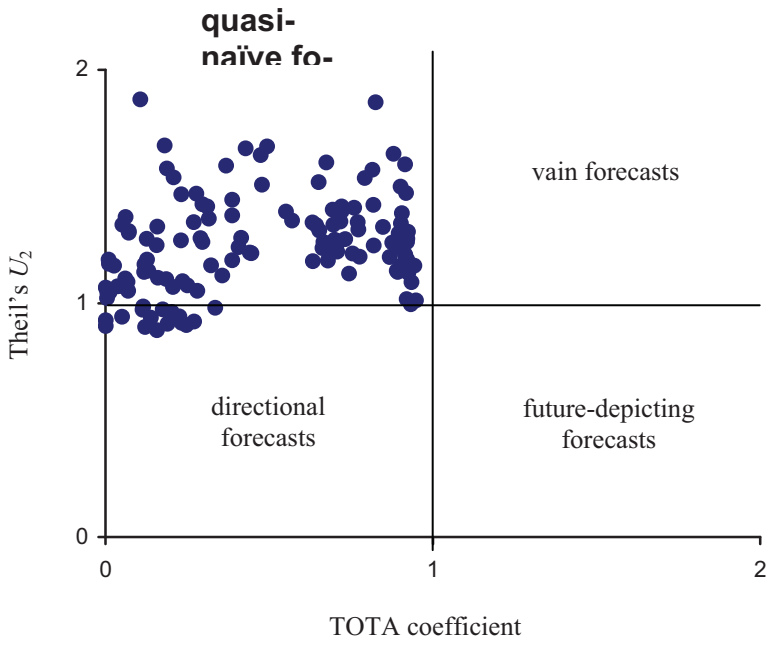

Figure 13. Classification of the forecast time series into the forecast quality matrix