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Abstract: We examine forecasts for the German stock market index (DAX), the Dow Jones Industrial Index (DJI) and the Euro Stoxx 50 (SX5E). We revive the thoughts of Ogburn (1934), who claimed that forecasters consistently underestimate the variability of the future, and that their forecasting is characterized by conservatism. We reveal that (a) unusual events are under-represented in the forecasts, (b) the dispersion of the forecasts lags behind that of actual events, (c) the slope of the regression lines in the prediction-realization diagram is < 1, (d) the forecasts are biased to a highly significant degree, and (e) that the quality of the forecasts is not significantly better than that of naïve forecasts.

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1. Introduction

The variability of reality is consistently underestimated. Ogburn (1934) comes to this conclusion during an empirical analysis of the forecasting behavior of experts and lay persons. He traces this back to a tendency which he called the "conservatism of the predictors". In detail, he is referring to:

1. Unusual events are forecasted more seldom than they occur in reality, whereas normal events are over-represented in forecasts.
2. The standard deviation of the forecasts is lower than the standard deviation of the actual events.
3. The extent of the forecasted changes lags behind the scale of the actual changes.

When the variability of reality is systematically underestimated, this can contribute towards very costly errors in the field of stock market forecasts. The reliability of stock market forecasts is seldom examined: there are a large number of studies on pre-tax profit forecasts (cf. Ramnath, Rock & Shane, 2008), but research on forecasts of share prices, stock market indices or stock market returns are still a rarity. This is why we focus on the observation of stock market indices in this study. These are forecasts for the German stock market index (DAX), the Dow Jones Industrial Index (DJI) and the Euro Stoxx 50 (SX5E) which were published in the period 1992–2020 in the German business newspaper *Handelsblatt* (HB) and the quality broadsheet *Frankfurter Allgemeine Zeitung* (FAZ). The forecasts have forecast horizons of six and twelve months and are drawn up regularly by German and international banks.

This study poses the question of whether the actions of the stock market analysts here correspond to the characteristics described by Ogburn (1934) and whether the forecasts can be assessed as fit for purpose or not.

2. Overview of the literature

Until now there have been only a few studies on forecasts of share prices, stock market indices or stock market returns (see the synoptic overview in Table 1). Lakonishok (1980) analyses forecasts for the S&P 425 index in the period from 1947 to 1974. He comes to the conclusion that the reliability of the forecasts does not go recognizably beyond that of naïve forecasts. In addition, the forecasts are biased and systematically underestimate the returns of the S&P 425. Dimson & Marsh (1984) analyze the forecasted returns of 206 selected British shares in the period from 1980 to 1981. The authors come to the conclusion that the forecasts are successful and can lead to systematic excess returns. Fraser & McDonald (1993) examine forecasts for the development of the French CAC 40 index in the period from 1984 to 1987. This reveals that the forecasts are less reliable than naïve forecasts. Furthermore, it is evident that the forecasts tend to be oriented towards the present rather than the future. Spiwoks (2004) and Spiwoks & Hein (2007) consider forecasts for six international share indices (The Dow Jones Industrial Index, the DAX, the FT-SE 100, the CAC 40, MIBtel and the Nikkei 225) issued in the period from 1994 to 2004. The results are very similar. Almost without exception, the forecast time series exhibit greater forecasting errors than the respective naïve forecast. In addition, they exhibit topically-orientated trend adjustment (Andres & Spiwoks, 1999). In other words, they reflect the present situation more than anything else, and hardly provide any insights into future trends. Benke (2006) examines DAX forecasts for the period from 1992 to 2005. He

establishes that the forecasters consistently underestimate the extent of the actual changes. Bacchetta, Mertens & Van Wincoop (2009) analyze forecasts for the Dow Jones Industrial Index and the Nikkei 225 in the period from 1998 to 2005. The authors come to the conclusion that the forecasts are suitable for achieving systematic excess returns. Fujiwara et al. (2013) observe TOPIX forecasts in the years from 1998 to 2010. They come to the conclusion that the forecasters are too strongly orientated towards their previous forecasts and systematically underestimate the actual trends of the TOPIX.

Table 1: Synoptic overview of studies on stock market forecasts

Study	Subject of the forecast	Time scale	Result
Lakonishok (1980)	S&P 425	1947-1974	–
Dimson & Marsh (1984)	Selected British shares	1980-1981	+
Fraser & McDonald (1993)	CAC 40	1984-1987	–
Spiwoks (2004)	Dow Jones Industrial Index, DAX, FT-SE 100, CAC 40, MIBtel and the Nikkei 225	1994-2004	–
Spiwoks & Hein (2007)	Dow Jones Industrial Index, DAX, FT-SE 100, CAC 40, MIBtel and the Nikkei 225	1994-2004	–
Benke (2006)	DAX	1992-2005	–
Bacchetta et al. (2009)	Dow Jones Industrial Index and Nikkei 225	1998-2005	+
Fujiwara et al. (2013)	TOPIX	1998-2010	–

+ = Overall, the forecasts are assessed as good; – = Overall, the forecasts are assessed as being flawed.

As we want to consider the abilities of professional stock market analysts, experimental studies in which the subjects are asked to make stock market forecasts themselves (e.g. De Bondt, 1993; Theissen, 2007; Spiwoks & Bizer, 2018; Spiwoks & Gubaydullina, 2020) are not considered here.

3. Data basis

We evaluate DAX forecasts which were published between 1992 and 2020 in the *Handelsblatt* newspaper (HB). The forecasts have a forecast horizon of one year. In addition, we evaluate forecasts for the DAX and the Euro Stoxx 50 which were published in the period from 2002 to 2020 in the *Frankfurter Allgemeine Zeitung* (FAZ). We also analyze forecasts for the Dow Jones Industrial Index which were published between 2004 and 2020 in the FAZ. These forecasts have forecast horizons of six and twelve months (see Table 2).

The forecasts are from private German banks such as Fürst Fugger Privatbank or Bethmann Bank, from German state banks such as Helaba or Bayerische Landesbank, from major German banks such as Deutsche Bank or Commerzbank, and from international banks like Goldman Sachs, J.P. Morgan or BNP Paribas (see Appendix 1 and Appendix 2).

Table 2: Data basis

Source	Subject of forecast	Forecast horizon	Time scale	Number of forecasts
Handelsblatt	DAX	12 months	1992-2020	964
Frankfurter Allgemeine Zeitung	DAX	6 months	2002-2020	282
		12 months	2002-2020	402
	Dow Jones Industrial Index	6 months	2004-2020	203
		12 months	2004-2020	259
	Euro Stoxx 50	6 months	2002-2020	270
		12 months	2002-2020	381
Σ				2.761

4. Hypotheses and methodology

Fundamentally, we follow Ogburn's assessment of forecasting: Ogburn (1934) assumes that forecasters suffer from conservatism. We orientate ourselves towards Ogburn's methodology, but also include some contemporary additions.

Ogburn (1934) presumes that unusual events are forecasted too seldom, that the standard deviation of the actual events is greater than the standard deviation of the forecasts, and that the forecasted changes lag behind the actual changes. We consider these three aspects in the forecasts as a whole, but also individually for all forecasters who issue forecasts for at least ten years.

Unlike the DAX, the Dow Jones Industrial Index and the Euro Stoxx 50 are price indices. Nevertheless, their long-term development is considered to be non-stationary. Over the long term, a rising trend can be recognized in all three stock indices. To this extent, it is simple to define unusual and normal events. A normal event is an increase of the share price index. An unusual event is a decrease in the share price index.

Hypothesis 1 is: Falls in stock market indices are forecasted more seldom than they occur in reality.

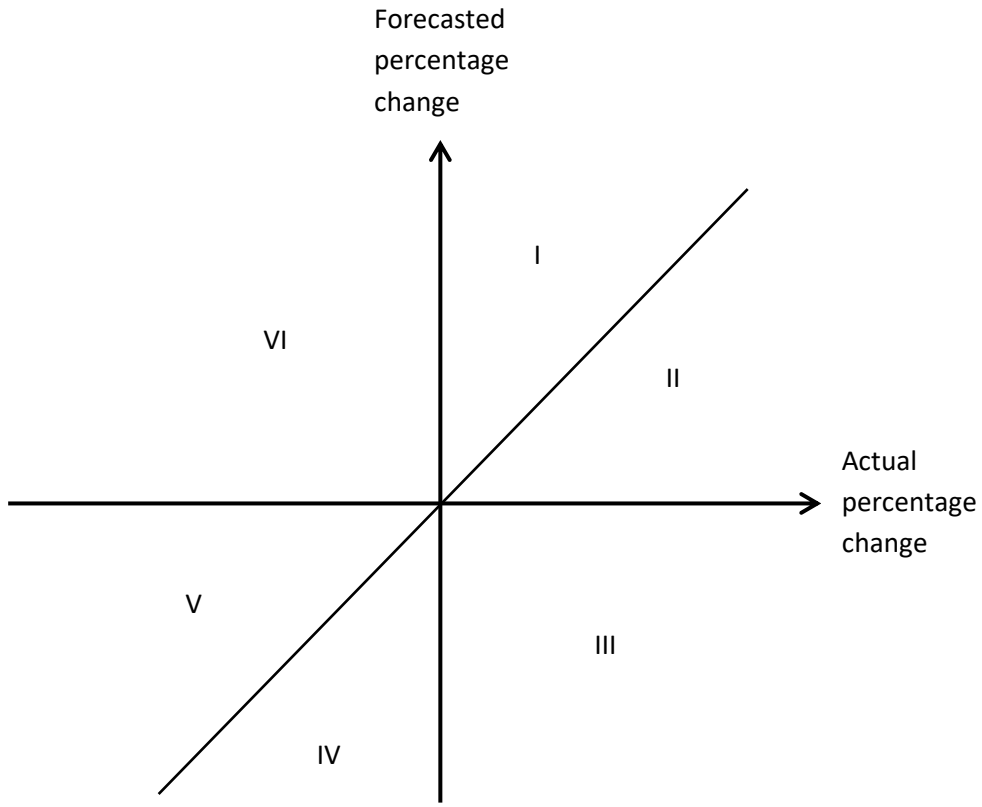
Null hypothesis 1 is therefore: Falls in stock market indices are forecasted no less than they occur in reality.

Hypothesis 2 is: The standard deviation of the forecasted changes of the stock market indices is lower than the standard deviation of the actual changes in the indices.

Null hypothesis 2 is therefore: The standard deviation of the forecasted changes of the stock market indices is no less than the standard deviation of the actual changes in the indices.

When the variability of actual events is systematically underestimated, the slope of the regression lines in the prediction-realization diagram (Theil, 1958), should be lower than one. A flat course of the regression lines (slope < 1) indicates an underestimation of the actual changes.

Figure 1: Prediction-realization diagram following Theil (1958)



I The percentage increase of the stock market index is overestimated.
II The percentage increase of the stock market index is underestimated.
III The stock market index rises although a fall is forecasted.
IV The percentage decrease of the stock market index is overestimated.
V The percentage decrease of the stock market index is underestimated.
VI The stock market index falls although a rise is forecasted.

Hypothesis 3 is: The slope of the regression lines in the prediction-realization diagram is lower than one (slope < 1).

Null hypothesis 3 is therefore: The slope of the regression lines in the prediction-realization diagram is not lower than one (slope ≥ 1).

We initially used the prediction-realization diagram as an illustration. However, the essential element is to observe the slope of the regression lines. In the case of a systematic underestimation of the variability of reality, the slope of the regression line would have to be lower than one. For all forecasters who have been taking part in forecasting surveys for at least ten years, we determine the slope of the regression lines individually. All of the other forecasts are evaluated within the framework of the total number of forecasts analyzed and within the framework of the consensus forecasts.

The continuation of this analysis takes the form of the unbiasedness test. The unbiasedness test using the Mincer-Zarnowitz regression (Mincer & Zarnowitz, 1969) can check whether forecasting errors are systematic. The Mincer-Zarnowitz regression takes the following form:

$$A_t = \alpha + \beta\, P_t + u_t$$

A_t = event which has actually occurred at the moment in time t (dependent variable)

α = constant

β = coefficient of the respective forecast

P_t = forecast of the actual event at the moment in time t

u_t = error term at the moment in time t

Based on this equation, forecasts are considered unbiased if α is not significantly different to 0, and β is not significantly different to 1. In addition, the error term u_t may not be autocorrelated. Forecasts are considered unbiased when, with a low probability of error, the joint hypothesis of α = 0 und β = 1 does not have to be rejected. This is checked by using the Wald test (Wald, 1943). A further condition is the absence of autocorrelation in the values of the error term u_t, which is examined with the Wooldridge test (Wooldridge, 2002). If, according to these criteria, a forecast time series is unbiased, Granger and Newbold (1973) argue that this by no means signifies that the forecasts are perfect. They merely do not exhibit any *systematic* errors.

If the forecasters are guided by the conservatism described by Ogburn (1934), the forecasts have to be biased, particularly because β has a value smaller than one (β < 1).

Hypothesis 4 is: The forecasts prove to be biased.

Null hypothesis 4 is therefore: The forecasts do not prove to be biased.

Finally, we compare the forecasts with the naïve forecast. A forecaster who has obtained a notable insight into the future trend of the subject matter should at least be able to make better forecasts than if one were to always assume that nothing at all will change (naïve forecast).

Simple measurements of forecast quality (such as the mean absolute squared error or the mean squared error) enable us to make a comparison with a naïve forecast. However, these simple approaches do not permit an assessment of statistical significance. This deficit is remedied by using the Diebold-Mariano test (Diebold & Mariano, 1995). To do so, we calculate the mean squared error (MSE) for the time series of the expert prognoses and for the time series of the naïve forecasts. The test statistics of the Diebold-Mariano test are defined as follows:

$$DM = \frac{\frac{1}{T}\sum (V(P_{t1}) - V(P_{t2}))}{\sqrt{\hat{\gamma}\, d/T}}$$

T = number of observations

V = loss function

P_1 = naïve forecast

P_2 = expert forecast

$\sqrt{\hat{y}\, d/T}$ = joint spread of the two loss functions

The null hypothesis tested in this way is that the naïve forecast (P_1) and the expert forecast (P_2) have the same accuracy. Neither one of the two alternatives thus provides clearly better results. The numerator is the mean deviation between the loss function V of the two forecasting approaches to be compared. Normally a squared loss function is assumed. In other words, the squared errors of the two forecast approaches are compared (P_1 and P_2). The denominator is the joint spread of the two loss functions. This is estimated on the basis of the long-term autocovariances of the loss function. In the case of large samples, this test value is asymptotically normally distributed.

In view of the results of previous studies (Lakonishok, 1980; Fraser & McDonald, 1993; Spiwoks, 2004; Spiwoks & Hein, 2007), we expect that the quality of the forecasts will not be significantly better than that of naïve forecasts.

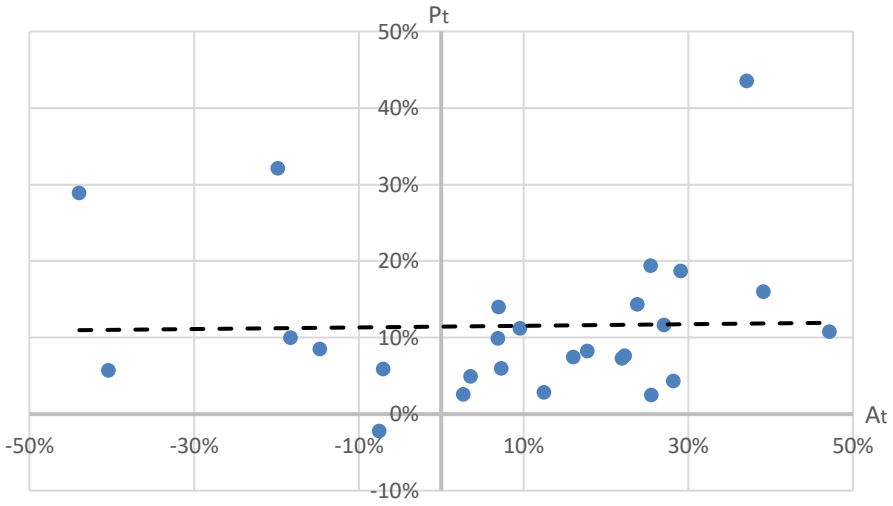
Hypothesis 5 is: The quality of the forecasts is not significantly higher than that of naïve forecasts.

Null hypothesis 5 is therefore: The quality of the forecasts is significantly higher than that of naïve forecasts.

5. Results

The graphic representation in a prediction-realization diagram of the DAX forecasts of Berenberg, a German private bank, already suggests that conservative forecasting is at work here (Figure 2).

Figure 2: DAX forecasts by the German private bank Berenberg in a prediction-realization diagram



P_t = Forecasted change in %; A_t = Actual change in %.

Berenberg issued a total of 27 DAX forecasts in the observation period (1992-2020). It is recognizable straight away that only one fall in the DAX is forecasted, but that the DAX actually does fall in seven out of the 27 years. This means that unusual events (falls in the DAX) are under-represented in the forecasts.

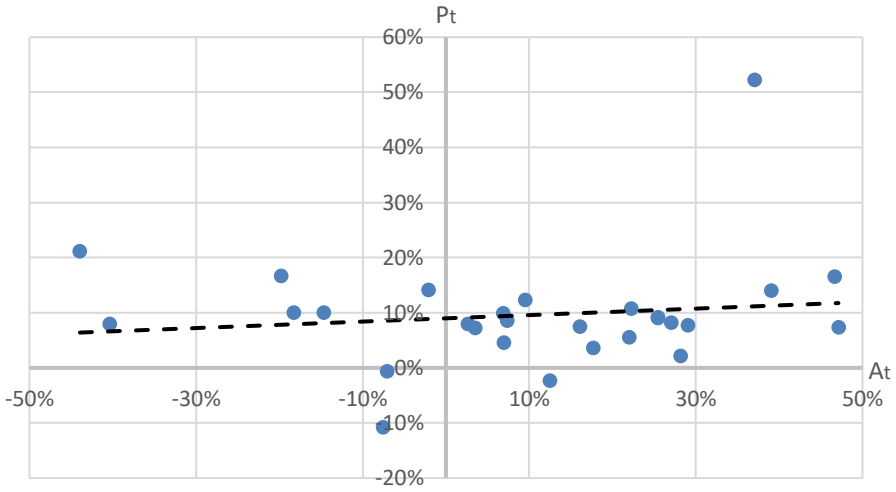
In addition, it can be seen that the dispersion of the actual events (scattering along the A_t axis) is greater than the dispersion of the forecasts (scattering along the P_t axis). The standard deviation of the actual events is 22.76%. The standard deviation of the forecasts, however, is only 9.98% (Table A3-2 in Appendix 3).

The slope in the regression line in the prediction-realization diagram of 0.011 is thus nowhere near the threshold value 1 (Table A3-2 in Appendix 3). The variability of the actual events is dramatically underestimated.

As another example, we consider the prediction-realization diagram of DAX forecasts made by the Franco-German private bank Oddo BHF (Figure 3).

This reveals a picture which is very similar to that of the prediction-realization diagram for Berenberg. In the period 1992–2020, at the end of each year Oddo BHF forecasts the DAX for the coming year. This occur a total of 28 times. A fall in the DAX is forecasted on three occasions. In reality, however, the DAX falls in eight of the 28 years. This means that unusual events (falls in the DAX) are under-represented in the forecasts.

Figure 3: DAX forecasts by the private bank Oddo BHF in a prediction-realization diagram



P_t = Forecasted change in %; A_t = Actual change in %.

In addition, it can be seen that the dispersion of the actual events (scattering along the A_t axis) is greater than the dispersion of the forecasts (scattering along the P_t axis). The standard deviation of the actual events is 23.39%. The standard deviation of the forecasts, however, is only 10.41% (Table A3-2 in Appendix 3).

The slope of 0.059 in the regression line in the prediction-realization diagram is thus nowhere near the threshold value 1 (Table A3-2 in Appendix 3). The variability of the actual events is dramatically underestimated.

Table 3 depicts the main results of the DAX forecasts from the *Handelsblatt* newspaper. All of the forecasters who have taken part in the forecasting surveys of the *Handelsblatt* for at least ten years are analyzed individually. All of the forecasters who issue less than 10 forecasts in the period from 1992 to 2020 are not analyzed individually, but are taken into account as part of the overall analysis of all forecasts and within the framework of the of the consensus forecasts (see Table 3, final lines).

The third column of Table 3 indicates whether fewer falls in the DAX are forecasted than actually occur. As the DAX is a performance index and exhibits a rising trend over the long term, all falls in the index are interpreted as 'unusual events'. According to Ogburn (1934), conservative forecasting leads to 'normal events' (here: an increase of the DAX) being over-represented in the forecasts, while 'unusual events' (here: a decrease in the DAX) are under-represented in the forecasts. This is the case in 33 of the 38 forecasters who are analyzed individually here: a proportion of 86.8%. Unusual events are also under-represented in the consensus forecasts and when the total number of the forecasts is considered as a whole. The detailed data is given in Appendix 3, where one can see how often a falling DAX was forecast, and how often the DAX really falls. One can also note how often an upward trend was forecast for the DAX, and how often the DAX really rises (Table A3-1)

The picture is clearer in the case of the standard deviations. According to Ogburn (1934), conservative forecasting leads to standard deviations of the forecasts which are lower than the standard deviations of the actual events. The fourth column of Table 3 considers whether this applies to the DAX forecasts, and reveals that this is the case in all 38 of the 38 forecasters analyzed. Also with regard to the consensus forecasts and when all 964 forecasts are considered, the standard deviation of the forecasts lags behind the standard deviation of the actual events. The standard deviations are listed in detail in Appendix 3 (Table A3-2).

Ogburn (1934) states that conservative forecasting leads to an underestimation of the variability of reality. In the prediction-realization diagram, this should lead to a slope in the regression lines which is lower than one. The fifth column of Table 3 illustrates this aspect. It can be seen that in 38 cases out of 38, the slope in the regression lines is lower than one. The fact that the slopes are usually clearly below the threshold value of one is revealed in Appendix 3, where the intercepts and the slopes in the regression lines are shown (Table A3-2).

The German quality newspaper the *Frankfurter Allgemeine Zeitung* (FAZ) only started a regular survey of forecasts in 2002. As a result, the share price falls in the years 2000 and 2001 no longer have an effect. It is interesting to see whether this leads to significantly different results in the forecasts. In addition, the *Frankfurter Allgemeine Zeitung* not only surveys annual forecasts, but also six-month forecasts. It is quite possible that the characteristics of the forecasts with differing forecast horizons vary. Let us first consider the main results for the DAX forecasts. Once again, all of the forecasters who have taken part in the forecasting surveys of the FAZ at least ten times are analyzed individually (Table 4).

Table 3: The main results of the DAX forecasts from 1992 to 2020 from the *Handelsblatt* newspaper

Institution	Number of forecasts	'Normal' events over-represented in the forecasts	SD of the forecasts < SD of the actual events	Slope of the regression lines < 1
Bank Julius Bär	23	Yes	Yes	Yes
Bank of America	11	Yes	Yes	Yes
Bankhaus Lampe	25	Yes	Yes	Yes
Bayerische Landesbank	26	Yes	Yes	Yes
Berenberg	27	Yes	Yes	Yes
Bethmann Bank	12	Yes	Yes	Yes
BNP Paribas	18	Yes	Yes	Yes
Commerzbank	28	Yes	Yes	Yes
Credit Suisse	13	Yes	Yes	Yes
Dekabank	19	Yes	Yes	Yes
Deutsche Bank	25	Yes	Yes	Yes
Dresdner Bank	15	Yes	Yes	Yes
DZ Bank	29	Yes	Yes	Yes
Haspa	13	Yes	Yes	Yes
Hauck & Aufhäuser	26	Yes	Yes	Yes
Helaba	28	No	Yes	Yes
HSBC Trinkaus	22	Yes	Yes	Yes
J.P. Morgan	22	Yes	Yes	Yes
LBB Landesbank Berlin	18	Yes	Yes	Yes
LBBW	21	Yes	Yes	Yes
Lehman Brothers	12	No	Yes	Yes
M.M. Warburg & Co.	29	Yes	Yes	Yes
Morgan Stanley	14	No	Yes	Yes
National-Bank	15	No	Yes	Yes
NATIXIS	17	Yes	Yes	Yes
NordLB	12	No	Yes	Yes
Oddo BHF	28	Yes	Yes	Yes
Pictet & Cie.	13	Yes	Yes	Yes
Postbank	11	Yes	Yes	Yes
Sal. Oppenheim	21	Yes	Yes	Yes
Santander	24	Yes	Yes	Yes
Société Générale	20	Yes	Yes	Yes
SYZ & Co.	10	Yes	Yes	Yes
UBS	14	Yes	Yes	Yes
Unicredit HypoVereinsbank	28	Yes	Yes	Yes
VP Bank	11	Yes	Yes	Yes
WestLB	21	Yes	Yes	Yes
WGZ Bank	16	Yes	Yes	Yes
Consensus	29	Yes	Yes	Yes
All forecasts	964	Yes	Yes	Yes

DAX = German stock market index; SD = Standard deviation. See the detailed results in Appendix 3.

Table 4: The main results of the DAX forecasts from 2002 to 2020 from the FAZ

Institution	Number of forecasts	'Normal' events over-represented in the forecasts	SD of the forecasts < SD of the actual events	Slope of the regression lines < 1
Forecast horizon 6 months				
Bayern LB	10	No	Yes	Yes
Deka Bank	16	Yes	Yes	Yes
DZ Bank	16	No	Yes	Yes
Helaba	14	No	Yes	Yes
HSH Nordbank	10	No	Yes	Yes
HVB-Unicredit Bank	16	Yes	Yes	Yes
LBBW	17	Yes	Yes	Yes
M.M. Warburg	17	Yes	No	Yes
Oddo BHF	10	Yes	Yes	Yes
Postbank	13	No	Yes	Yes
Santander Asset Managem.	13	Yes	Yes	Yes
Société Générale	10	No	No	Yes
Consensus	17	Yes	Yes	Yes
All forecasts	282	Yes	Yes	Yes
Forecast horizon 12 months				
Allianz SE	11	Yes	Yes	Yes
Bayern LB	11	Yes	Yes	Yes
BNP Paribas	12	Yes	Yes	Yes
Commerzbank	18	Yes	Yes	Yes
Deka Bank	18	Yes	Yes	Yes
Deutsche Bank	10	Yes	Yes	Yes
DWS	13	Yes	Yes	Yes
DZ Bank	18	Yes	Yes	Yes
Helaba	15	No	Yes	Yes
HSBC Trinkaus & Burkhardt	13	Yes	Yes	Yes
HSH Nordbank	11	Yes	Yes	Yes
HVB-Unicredit Bank	18	Yes	Yes	Yes
J.P. Morgan	12	Yes	Yes	Yes
LBBW	19	Yes	Yes	Yes
M.M. Warburg	19	Yes	Yes	Yes
Oddo BHF	17	Yes	Yes	Yes
Postbank	14	Yes	Yes	Yes
Santander Asset Managem.	16	Yes	Yes	Yes
Société Générale	11	No	Yes	Yes
UBS	10	No	Yes	Yes
WestLB	11	Yes	Yes	Yes
Consensus	19	Yes	Yes	Yes
All forecasts	402	Yes	Yes	Yes

DAX = German stock market index; FAZ = Frankfurter Allgemeine Zeitung; SD = Standard deviation. See the detailed results in Appendix 4.

The results are in fact somewhat less clear than those for the DAX forecasts from the *Handelsblatt*. In 24 out of 33 cases (72.7%), normal events (increase of the DAX) are over-represented in the forecasts (Table 4, column 3 and Table A4-1 in Appendix 4). Unusual events are also under-represented in the

consensus forecasts and when all 282 six-month and all 402 twelve-month forecasts are considered as a whole.

The result of the standard deviations is quite clear: In 31 out of 33 cases (93.9%), the forecasts lag behind the actual events (Table 4, column 4 and Table A4-2 in Appendix 4). This finding also applies to the consensus forecasts as well as when all 282 six-month and all 402 twelve-month forecasts are considered as a whole.

The fact that the forecasters persistently underestimate the variability of reality is revealed most clearly in the slope of the regression lines in the prediction-realization diagram (Table 4, column 5 and Table A4-2 in Appendix 4). In 33 out of 33 cases, the slope is below one. This result also applies to the consensus forecasts as well as when all 282 six-month and all 402 twelve-month forecasts are considered as a whole.

Table 5: Main results of the forecasts of the Dow Jones Industrial Index from 2004 to 2020 from the *Frankfurter Allgemeine Zeitung*

Institution	Number of forecasts	'Normal' events over-represented in the forecasts	SD of the forecasts < SD of the actual events	Slope of the regression lines < 1
Forecast horizon 6 months				
Deka Bank	15	Yes	No	Yes
Helaba	14	No	No	Yes
LBBW	16	Yes	Yes	Yes
M.M. Warburg	15	Yes	Yes	Yes
Postbank	12	No	Yes	Yes
Santander Asset Managem.	13	Yes	Yes	Yes
Consensus	16	Yes	Yes	Yes
All forecasts	203	Yes	Yes	Yes
Forecast horizon 12 months				
BNP Paribas	10	Yes	Yes	Yes
Commerzbank	10	Yes	Yes	Yes
Deka Bank	16	No	Yes	Yes
Helaba	15	No	Yes	Yes
HSH Nordbank	11	No	Yes	Yes
LBBW	17	No	Yes	Yes
M.M. Warburg	17	Yes	Yes	Yes
Oddo BHF	15	Yes	Yes	Yes
Postbank	13	Yes	Yes	Yes
Santander Asset Managem.	16	Yes	Yes	Yes
Consensus	17	Yes	Yes	Yes
All forecasts	259	Yes	Yes	Yes

SD = Standard deviation. See the detailed results in Appendix 5.

The forecasts of the Dow Jones Industrial Index yield only slightly different results. Once again, all of the forecasters who have taken part in the forecasting survey at least ten times are analyzed individually (Table 5).

The Dow Jones Industrial Index is a price index, but it exhibits a long-term rising trend nevertheless. To this extent, one can also presume here that a rise in the index can be considered a normal event, and that a fall in the index represents an unusual event. In ten out of 16 cases (62.5%), normal events (increase of the Dow Jones Industrial Index) are over-represented in the forecasts (Table 5, column 3 and Table A5-1 in Appendix 5). Unusual events are also under-represented in the consensus forecasts and when all 203 six-month and all 259 twelve-month forecasts are considered as a whole.

The result for the standard deviations is more marked. In 14 out of 16 cases (87.5%), the fluctuations in the forecasts lag behind those of the actual events (Table 5, column 4 and Table A5-2 in Appendix 5). This finding also applies to the consensus forecasts as well as when all 203 six-month and all 259 twelve-month forecasts are considered as a whole.

The fact that the forecasters persistently underestimate the variability of reality is revealed most clearly in the slope of the regression lines in the prediction-realization diagram (Table 5, column 5 and Table A5-2 in Appendix 5). In 16 out of 16 cases, the slope is below one. This is also the same for the consensus forecasts as well as when all 203 six-month and all 259 twelve-month forecasts are viewed as a whole.

The picture drawn by the forecasts of the Euro Stoxx 50 is even more distinct (Table 6). Here again, all of the forecasters who have taken part in the forecasting survey at least ten times are analyzed individually. All of the other forecasts form part of the consensus forecasts and are also evaluated as part of the total number of forecasts.

Conservatism among forecasters can lead to them forecasting unusual events too rarely. The Euro Stoxx 50 is a price index, but in spite of this it exhibits a long-term upward trend. To this extent, one can also presume here that a rise in the index can be considered a normal event, and that a fall in the index represents an unusual event. In the predictions of 24 of the 26 forecasters analyzed individually (92.3%), unusual events are under-represented (Table 6, column 3 and Table A6-1 in Appendix 6). The consensus forecasts and the overall total of all 270 six-month forecasts and all 381 twelve-month forecasts also show that unusual events are forecast more seldom than they occur in reality.

The standard deviations provide a very clear picture. The standard deviations of the forecasts lag behind the standard deviations of the actual results in 26 out of 26 cases (Table 6, column 4 and Table A6-2 in Appendix 6). This also applies to the consensus forecasts and the overall total of 270 forecasts with a forecast horizon of six months and all 381 forecasts with a forecast horizon of twelve months.

Finally, it can be seen that the slope in the regression lines in the prediction-realization diagrams is significantly below one in 26 out of 26 cases. The forecasters are thus obviously underestimating the variability of reality (Table 6, column 5 and Table A6-2 in Appendix 6). These findings are also confirmed when the consensus forecasts and the overall total number of forecasts are considered.

Table 6: The main results for the Euro Stoxx 50 forecasts from 2002 to 2020 from the FAZ

Institution	Number of forecasts	'Normal' events over-represented in the forecasts	SD of the forecasts < SD of the actual events	Slope of the regression lines < 1
Forecast horizon 6 months				
Bayern LB	10	Yes	Yes	Yes
Deka Bank	16	Yes	Yes	Yes
DZ Bank	16	Yes	Yes	Yes
Helaba	14	Yes	Yes	Yes
HSH Nordbank	10	No	Yes	Yes
HVB-Unicredit Bank	16	Yes	Yes	Yes
LBBW	17	Yes	Yes	Yes
M.M. Warburg	16	Yes	Yes	Yes
Oddo BHF	10	Yes	Yes	Yes
Postbank	13	Yes	Yes	Yes
Santander Asset Managem.	13	Yes	Yes	Yes
Consensus	17	Yes	Yes	Yes
All forecasts	270	Yes	Yes	Yes
Forecast horizon 12 months				
Allianz SE	11	Yes	Yes	Yes
Bayern LB	11	Yes	Yes	Yes
BNP Paribas	11	Yes	Yes	Yes
Commerzbank	18	Yes	Yes	Yes
Deka Bank	18	Yes	Yes	Yes
DWS	12	Yes	Yes	Yes
DZ Bank	18	Yes	Yes	Yes
Helaba	15	No	Yes	Yes
HSBC Trinkaus & Burkhardt	14	Yes	Yes	Yes
HSH Nordbank	11	Yes	Yes	Yes
HVB-Unicredit Bank	18	Yes	Yes	Yes
LBBW	19	Yes	Yes	Yes
M.M. Warburg	19	Yes	Yes	Yes
Oddo BHF	17	Yes	Yes	Yes
Postbank	14	Yes	Yes	Yes
Santander Asset Managem.	16	Yes	Yes	Yes
WestLB	11	Yes	Yes	Yes
Consensus	19	Yes	Yes	Yes
All forecasts	381	Yes	Yes	Yes

FAZ = Frankfurter Allgemeine Zeitung; SD = Standard deviation. See the detailed results in Appendix 6.

Without exception, it can be observed that the forecasters underestimate the variability of reality. This can be seen in the fact that the slope in the regression lines in the prediction-realization diagram always remains below the threshold value of one. This leads us to the assessment that this aspect in particular deserves special attention. The unbiasedness test takes the slope of the regression line in the prediction-realization diagram into account as an essential element. Forecasts are viewed as unbiased when the slope in the regression line does not diverge significantly from one, the intercept of the regression line does not deviate significantly from zero, and the residuals are randomly

distributed. The decisive advantage of this approach lies in the opportunity to go beyond purely descriptive statistics and to examine the statistical significance of the results.

Table 7: Unbiasedness test

Stock market index	Source	Forecast horizon	Number of observations	Slope	Intercept	F test p-value	Wooldridge test p-value
DAX	HB	12 M	964	0.034	0.084	0.000***	0.000***
DAX	FAZ	6 M	282	-0.075	0.024	0.000***	0.000***
DAX	FAZ	12 M	402	0.054	0.085	0.000***	0.006***
DJI	FAZ	6 M	203	0.040	0.014	0.010***	0.098*
DJI	FAZ	12 M	259	0.029	0.057	0.000***	0.623
SX5E	FAZ	6 M	270	-0.007	0.023	0.000***	0.091*
SX5E	FAZ	12 M	381	0.017	0.080	0.000***	0.042**

*** = significant with an error probability of 1%, ** = significant with an error probability of 5%,
* = significant with an error probability of 10%; DAX = German stock market index; DJI = Dow Jones Industrial Index; SX5E = Euro Stoxx 50; HB = Handelsblatt; FAZ = Frankfurter Allgemeine Zeitung; 12 M = 12 months; 6 M = 6 months.

In all seven cases, it can be seen that given an error probability of ≤ 1% either the slope of the regression line in the prediction-realization diagram is ≠ 1 and/or the intercept is ≠ 0. In addition, the residuals are obviously not randomly distributed in six of the seven cases. The forecasts are clearly not unbiased (Table 7).

Finally, with the aid of the Diebold-Mariano test we examine whether the quality of the forecasts is significantly superior – from a statistical perspective – to that of naïve forecasts (Table 8). The result is that the forecasts of the Euro Stoxx 50 are significantly poorer than the corresponding naïve forecasts, and the quality of the forecasts for the DAX and the Dow Jones Industrial Index does not go significantly beyond that of naïve forecasts.

Table 8: Comparison of the forecasts with the naïve forecast

Stock market index	Source	Forecast horizon	Diebold-Mariano test Result	p-value
DAX	HB	12M	o	0.8143
DAX	FAZ	6M	o	0.1221
DAX	FAZ	12M	o	0.7429
DJI	FAZ	6M	o	0.7053
DJI	FAZ	12M	o	0.3491
SX5E	FAZ	6M	-	0.0000
SX5E	FAZ	12M	-	0.0540

o = no significant result, - = significantly poorer than the naïve forecasts, + = significantly better than the naive forecast, DAX = German stock market index; DJI = Dow Jones Industrial Index; SX5E = Euro Stoxx 50; HB = Handelsblatt; FAZ = Frankfurter Allgemeine Zeitung; 12 M = 12 months; 6 M = 6 months.

In Table 9 the results of the hypothesis testing are summarized. In hypotheses 1–3 the result which was determined for "all forecasts" in a forecasting area is used. In the case of the DAX forecasts from the *Handelsblatt* survey, for example, that is the 964 forecasts which are noted in the final line of Table 3. For hypothesis 4, the results of the unbiasedness test (Table 7) are taken into account, and for hypothesis 5 the results of the Diebold-Mariano test (Table 8).

Table 9: The results of hypothesis testing

Stock market index	Source	Forecast horizon	Hypothesis 1	Hypothesis 2	Hypothesis 3	Hypothesis 4	Hypothesis 5
DAX	HB	12 M	+	+	+	+	+
DAX	FAZ	6 M	+	+	+	+	+
DAX	FAZ	12 M	+	+	+	+	+
DJI	FAZ	6 M	+	+	+	+	+
DJI	FAZ	12 M	+	+	+	+	+
SX5E	FAZ	6 M	+	+	+	+	+
SX5E	FAZ	12 M	+	+	+	+	+

+ = null hypothesis has to be rejected; - = null hypothesis cannot be rejected; DAX = German stock market index; DJI = Dow Jones Industrial Index; SX5E = Euro Stoxx 50; HB = Handelsblatt; FAZ = Frankfurter Allgemeine Zeitung; 12 M = 12 months; 6 M = 6 months.

In the case of hypothesis 1 there is a uniform pattern for all areas of forecasting and all forecast horizons. Normal events (index rises) are over-represented in the forecasts. Unusual events (index falls) are under-represented in the forecasts. Null hypothesis 1 has to be rejected in all seven cases.

In the case of hypothesis 2 there are no differences between the subjects of the forecasts and the forecast horizons. In all seven cases, null hypothesis 2 has to be rejected. The dispersion of the forecasts (measured against the standard deviation) thus lags behind the dispersion of the actual events.

A uniform picture is also shown with regard to hypothesis 3. In all seven forecasting areas the slope of the regression line in the prediction-realization diagrams is clearly below one. Null hypothesis 3 has to be rejected in all seven cases. This means that the rates of change of the stock-market indices are significantly underestimated.

In the case of hypothesis 4 there are also no relevant differences regarding the subjects of the forecasts or the forecast horizons. In all seven areas, the forecasts prove to be biased. These results are highly significant. In all seven cases, null hypothesis 4 has to be rejected.

In hypothesis 5 there is also a concurring result for all seven forecast groups. Null hypothesis 5 has to be discarded. The precision of the forecasts does not go significantly beyond that of naïve forecasts.

The findings of Ogburn (1934) are thus fully confirmed in the stock market forecasts which we analyzed. It can certainly be stated that these stock-market analysts systematically underestimate

the variability of reality and that the success rate of their forecasts does not extend beyond that of naïve forecasts.

The path which has to be followed to obtain better stock market forecasts thus becomes clear: analysts have to be more courageous. They need to react to new trends with more flexibility. They have to leave their comfort zone more frequently and stand by assessments which are not necessarily approved of by the majority of their peers. That alone will presumably not suffice to generate reliable stock market forecasts: they will also need to work hard on the quality of their approaches to forecasting. But if they want to significantly improve the reliability of their forecasts, there is no alternative for analysts to changing their overly cautious, very conservative and thus inflexible attitudes.

6. Summary

We examine forecasts for the German stock market index (DAX), the Dow Jones Industrial Index (DJI) and the Euro Stoxx 50 (SX5E) which were published in the period 1992–2020 in the German business newspaper *Handelsblatt* (HB) and the quality broadsheet the *Frankfurter Allgemeine Zeitung* (FAZ). These forecasts have a horizon of six and twelve months. The forecasts are from German and international banks such as Deutsche Bank, Goldman Sachs, J.P. Morgan or BNP Paribas.

We take up the thoughts of Ogburn (1934), who, on the basis of a small empirical survey, became convinced that forecasters consistently underestimate the variability of the future, and that their forecasting is of a conservative nature.

Conservative forecasting behavior leads to unusual events being under-represented in forecasts, to the dispersion of the forecasts (as measured by their standard deviation) lagging behind the dispersion of the actual events, and to the extent of the forecasted changes being smaller than the actual changes. The latter aspect is reflected in a flat course of the regression line in the prediction-realization diagram (slope < 1) and thus also leads to failure in the unbiasedness test.

We analyze a total of 2,761 forecasts which are divided up into seven groups according to the subject of the forecast (DAX, DJI, SX5E), the forecast horizon (6 and 12 months) and the source (FAZ, HB). The findings are that in all seven groups (a) unusual events are under-represented in the forecasts, (b) the dispersion of the forecasts lags behind that of actual events, (c) the slope in the regression lines in the prediction-realization diagram is < 1, (d) the forecasts are biased to a highly significant degree, and (e) that the quality of the forecasts is not significantly better than that of naïve forecasts.

It is more than surprising how closely these stock market forecasts for the years 1992–2020 correspond to the characteristics which Ogburn described back in the 1930s. The stock market analysts prove to be too conservative, inflexible and cautious.

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Appendix 1: Forecasters in the *Handelsblatt* newspaper

1. ABN Amro
2. Adca-Bank
3. B. Metzler Seel. Sohn & Co.
4. Baader Bank
5. Baden-Württembergische Bank
6. Bank in Liechtenstein
7. Bank Julius Bär
8. Bank of America
9. Bank Sarasin
10. Bankhaus Ellwanger & Geiger
11. Bankhaus Lampe
12. Bankhaus Metzler
13. Banque Nationale de Paris
14. Barclays
15. Bayerische Landesbank
16. Bayerische Vereinsbank
17. Berenberg
18. Bethmann Bank
19. BNP Paribas
20. Cheuvreux
21. Citi
22. Commerzbank
23. Crédit Lyonnais
24. Credit Suisse
25. Daiwa Europe (Deutschland)
26. Dekabank
27. Deutsche Bank
28. Donner & Reuschel
29. Dresdner Bank
30. DZ Bank
31. Fürst Fugger Privatbank
32. Fürstl. Castell'sche Bank
33. Goldman Sachs
34. Gontard & Metallbank
35. GZ-Bank
36. Haspa
37. Hauck & Aufhäuser
38. Helaba
39. HSBC Trinkaus
40. HSH Nordbank
41. IKB
42. IMI Bank
43. J. Safra Sarasin
44. J.P. Morgan
45. Kepler Equities
46. Kleinwort Benson Research
47. LB Rheinland-Pfalz
48. LBB Landesbank Berlin
49. LBBW
50. Lehman Brothers
51. LGT Bank in Liechtenstein
52. M.M. Warburg & Co.
53. Macquarie
54. Merck Finck & Co.
55. Merrill Lynch
56. Morgan Stanley
57. National-Bank
58. NATIXIS
59. NIBC
60. Nomura
61. NordLB
62. Oddo BHF
63. Pictet & Cie.
64. Postbank
65. Royal Bank of Scotland
66. S.G. Warburg
67. Sal. Oppenheim
68. Santander
69. Saxo Bank
70. SBC Warburg
71. Schröder Bank
72. Schröder Münchmeyer Hengst
73. Schroder Salomon Smith Barney
74. Schweizerischer Bankverein
75. SGZ-Bank
76. Société Générale
77. SYZ & Co.
78. Targobank
79. UBS
80. Unicredit HypoVereinsbank
81. Union Bancaire Priveé
82. Union Bank of Switzerland
83. Vereins- und Westbank
84. Vontobel
85. VP Bank
86. Weberbank
87. WestLB
88. WGZ Bank

Appendix 2: Forecasters in the *Frankfurter Allgemeine Zeitung*

1. Adig
2. Allianz SE
3. Bankgesellschaft Berlin
4. Bankhaus Lampe
5. Barclays Capital
6. Bayern LB
7. Berenberg
8. BNP Paribas
9. Citigroup
10. Commerzbank
11. CSFB
12. Deka Bank
13. Deutsche Bank
14. Deutsche Bank/Postbank
15. DIT
16. Dresdner Bank
17. DWS
18. DZ Bank
19. Erste Group
20. Goldman Sachs
21. Helaba
22. HSBC Trinkaus & Burkhardt
23. HSH Nordbank
24. HVB-Unicredit Bank
25. IKB
26. ING Deutschland
27. J.P. Morgan
28. Julius Bär
29. Landesbank Berlin
30. Landesbank Rheinland-Pfalz
31. LBBW
32. M.M. Warburg
33. Macquarie
34. Merck Finck Invest
35. Merrill Lynch
36. Morgan Stanley
37. Nomura
38. Nord LB
39. Oddo BHF
40. Postbank
41. Raiffeisen Bank International
42. Sal. Oppenheim
43. Santander Asset Management
44. Société Générale
45. UBS
46. Union Bancaire Privée
47. Union Investment
48. Vereins- und Westbank
49. Weberbank
50. WestLB
51. WGZ Bank

Appendix 3: The results in detail of the DAX forecasts of 1992–2020 from the *Handelsblatt*

Tabelle A3-1: Number of DAX forecasts (Handelsblatt) and the actual events divided up into "unusual events" (falling DAX) and "normal events" (rising DAX)

Institution	Forecasts issued	Forecasts		Actual events	
		DAX falls	DAX rises	DAX falls	DAX rises
Bank Julius Bär	23	2	21	8	15
Bank of America	11	0	11	2	9
Bankhaus Lampe	25	1	24	6	19
Bayerische Landesbank	26	1	25	6	20
Berenberg	27	1	26	7	20
Bethmann Bank	12	2	10	5	7
BNP Paribas	18	3	15	4	14
Commerzbank	28	2	26	7	21
Credit Suisse	13	2	11	5	8
Dekabank	19	1	18	4	15
Deutsche Bank	25	2	23	7	18
Dresdner Bank	15	0	15	5	10
DZ Bank	29	7	22	8	21
Haspa	13	0	13	3	10
Hauck & Aufhäuser	26	5	21	6	20
Helaba	28	8	20	7	21
HSBC Trinkaus	22	3	19	7	15
J.P. Morgan	22	4	18	6	16
LBB Landesbank Berlin	18	3	15	6	12
LBBW	21	1	20	6	15
Lehman Brothers	12	5	7	4	8
M.M. Warburg & Co.	29	3	26	8	21
Morgan Stanley	14	6	8	4	10
National-Bank	15	3	12	3	12
NATIXIS	17	1	16	3	14
NordLB	12	2	10	2	10
Oddo BHF	28	3	25	8	20
Pictet & Cie.	13	3	10	5	8
Postbank	11	0	11	3	8
Sal. Oppenheim	21	2	19	5	16
Santander	24	1	23	7	17
Société Générale	20	4	16	5	15
SYZ & Co.	10	0	10	2	8
UBS	14	3	11	4	10
Unicredit HypoVereinsbank	28	3	25	8	20
VP Bank	11	1	10	2	9
WestLB	21	3	18	7	14
WGZ Bank	16	1	15	5	11
Consensus	29	1	28	8	21
All forecasts	964	117	847	264	700

Table A3-2: Standard deviation of the DAX forecasts (Handelsblatt) and the actual events as well as the intercepts and slopes of the regression lines in the prediction-realization diagram (in decimal figures)

	Standard deviation		Regression line	
Institution	Forecast	Actual	Intercept	Slope
Bank Julius Bär	0.062	0.248	0.088	-0.023
Bank of America	0.066	0.207	0.117	-0.001
Bankhaus Lampe	0.081	0.234	0.089	0.097
Bayerische Landesbank	0.067	0.230	0.080	-0.006
Berenberg	0.100	0.228	0.114	0.011
Bethmann Bank	0.095	0.284	0.101	-0.109
BNP Paribas	0.061	0.223	0.056	0.140
Commerzbank	0.089	0.234	0.120	-0.064
Credit Suisse	0.072	0.290	0.106	0.059
Dekabank	0.101	0.227	0.090	0.154
Deutsche Bank	0.070	0.237	0.091	-0.043
Dresdner Bank	0.084	0.276	0.080	0.099
DZ Bank	0.107	0.231	0.073	0.088
Haspa	0.047	0.202	0.080	0.045
Hauck & Aufhäuser	0.101	0.235	0.072	-0.040
Helaba	0.108	0.234	0.053	0.092
HSBC Trinkaus	0.085	0.256	0.080	-0.022
J.P. Morgan	0.100	0.244	0.084	0.038
LBB Landesbank Berlin	0.140	0.233	0.088	0.027
LBBW	0.107	0.226	0.090	0.093
Lehman Brothers	0.098	0.259	0.040	0.062
M.M. Warburg & Co.	0.091	0.231	0.076	-0.016
Morgan Stanley	0.123	0.285	0.030	0.136
National-Bank	0.086	0.202	0.082	0.028
NATIXIS	0.065	0.231	0.077	0.057
NordLB	0.038	0.153	0.041	-0.089
Oddo BHF	0.104	0.234	0.090	0.059
Pictet & Cie.	0.114	0.279	0.092	-0.074
Postbank	0.069	0.225	0.098	0.087
Sal. Oppenheim	0.093	0.248	0.067	0.111
Santander	0.093	0.239	0.116	0.101
Société Générale	0.096	0.228	0.065	0.043
SYZ & Co.	0.058	0.235	0.144	-0.042
UBS	0.120	0.242	0.112	0.007
Unicredit HypoVereinsbank	0.079	0.233	0.083	0.043
VP Bank	0.042	0.155	0.084	0.034
WestLB	0.106	0.260	0.081	0.124
WGZ Bank	0.172	0.211	0.110	0.301
Consensus	0.065	0.231	0.085	0.037
All forecasts	0.091	0.230	0.084	0.034

Appendix 4: The results in detail of the DAX forecasts of 2002–2020 from the FAZ

Table A4-1: Number of DAX forecasts (FAZ) and the actual events divided up into "unusual events" (falling DAX) and "normal events" (rising DAX)

Institution	Forecasts issued	Forecasts		Actual events	
		DAX falls	DAX rises	DAX falls	DAX rises
Forecast horizon 6 months					
Bayern LB	10	5	5	3	7
Deka Bank	16	3	13	5	11
DZ Bank	16	6	10	5	11
Helaba	14	6	8	5	9
HSH Nordbank	10	7	3	4	6
HVB-Unicredit Bank	16	4	12	6	10
LBBW	17	3	14	6	11
M.M. Warburg	17	3	14	6	11
Oddo BHF	10	1	9	4	6
Postbank	13	6	7	4	9
Santander Asset Managem.	13	1	12	3	10
Société Générale	10	6	4	3	7
Consensus	17	2	15	6	11
All forecasts	282	83	199	103	179
Forecast horizon 12 months					
Allianz SE	11	0	11	2	9
Bayern LB	11	0	11	2	9
BNP Paribas	12	1	11	3	9
Commerzbank	18	0	18	4	14
Deka Bank	18	1	17	3	15
Deutsche Bank	10	0	10	2	8
DWS	13	0	13	3	10
DZ Bank	18	2	16	4	14
Helaba	15	6	9	3	12
HSBC Trinkaus & Burkhardt	13	2	11	3	10
HSH Nordbank	11	2	9	3	8
HVB-Unicredit Bank	18	1	17	4	14
J.P. Morgan	12	1	11	3	9
LBBW	19	0	19	4	15
M.M. Warburg	19	1	18	4	15
Oddo BHF	17	1	16	4	13
Postbank	14	0	14	3	11
Santander Asset Managem.	16	0	16	3	13
Société Générale	11	4	7	2	9
UBS	10	1	9	1	9
WestLB	11	2	9	3	8
Consensus	19	0	19	4	15
All forecasts	402	31	371	88	314

Table A4-2: Standard deviation of the DAX forecasts (FAZ) and the actual events as well as the intercepts and slopes of the regression lines in the prediction-realization diagram (in decimal figures)

	Standard deviation		Regression line	
Institution	Forecast	Actual	Intercept	Slope
Forecast horizon 6 months				
Bayern LB	0.047	0.094	0.028	-0.286
Deka Bank	0.061	0.096	0.040	-0.002
DZ Bank	0.065	0.096	0.009	0.032
Helaba	0.075	0.102	0.025	-0.375
HSH Nordbank	0.095	0.098	-0.030	-0.039
HVB-Unicredit Bank	0.063	0.104	0.035	-0.035
LBBW	0.048	0.102	0.019	0.090
M.M. Warburg	0.122	0.102	0.030	-0.039
Oddo BHF	0.041	0.121	0.049	-0.058
Postbank	0.071	0.104	0.008	-0.087
Santander Asset Managem.	0.029	0.099	0.033	0.073
Société Générale	0.087	0.072	-0.023	-0.431
Consensus	0.028	0.102	0.024	-0.077
All forecasts	0.072	0.095	0.024	-0.076
Forecast horizon 12 months				
Allianz SE	0.044	0.155	0.072	0.018
Bayern LB	0.036	0.159	0.069	0.011
BNP Paribas	0.055	0.210	0.066	0.110
Commerzbank	0.081	0.233	0.119	0.032
Deka Bank	0.104	0.195	0.082	0.200
Deutsche Bank	0.047	0.212	0.104	-0.017
DWS	0.027	0.202	0.076	0.038
DZ Bank	0.066	0.222	0.072	0.063
Helaba	0.121	0.196	0.025	0.249
HSBC Trinkaus & Burkhardt	0.066	0.262	0.065	-0.102
HSH Nordbank	0.080	0.213	0.055	0.192
HVB-Unicredit Bank	0.078	0.228	0.077	0.077
J.P. Morgan	0.064	0.233	0.095	0.140
LBBW	0.097	0.227	0.091	0.093
M.M. Warburg	0.097	0.227	0.078	-0.018
Oddo BHF	0.045	0.225	0.093	-0.092
Postbank	0.070	0.208	0.096	0.048
Santander Asset Managem.	0.052	0.195	0.107	0.048
Société Générale	0.088	0.155	0.067	-0.347
UBS	0.118	0.151	0.136	0.027
WestLB	0.128	0.282	0.075	0.204
Consensus	0.061	0.227	0.087	0.064
All forecasts	0.083	0.215	0.085	0.054

Appendix 5: Results in detail of the forecasts of the Dow Jones Industrial Index from 2004 to 2020 from the *Frankfurter Allgemeine Zeitung*

Table A5-1: Number of DJI forecasts (FAZ) and the actual events divided into "unusual events" (falling DJI) and "normal events" (rising DJI)

Institution	Forecasts issued	Forecasts		Actual events	
		DJI falls	DJI rises	DJI falls	DJI rises
Forecast horizon 6 months					
Deka Bank	15	5	10	8	7
Helaba	14	6	8	6	8
LBBW	16	7	9	8	8
M.M. Warburg	15	3	12	7	8
Postbank	12	6	6	5	7
Santander Asset Managem.	13	1	12	6	7
Consensus	16	4	12	8	8
All forecasts	203	67	136	106	97
Forecast horizon 12 months					
BNP Paribas	10	0	10	3	7
Commerzbank	10	0	10	3	7
Deka Bank	16	6	10	4	12
Helaba	15	7	8	3	12
HSH Nordbank	11	5	6	3	8
LBBW	17	4	13	4	13
M.M. Warburg	17	1	16	4	13
Oddo BHF	15	0	15	3	12
Postbank	13	0	13	3	10
Santander Asset Managem.	16	0	16	4	12
Consensus	17	0	17	4	13
All forecasts	259	33	226	65	194

Table A5-2: Standard deviation of the DJI forecasts (FAZ) and the actual events as well as the intercepts and slopes of the regression lines in the prediction-realization diagram (in decimal figures)

	Standard deviation		Regression line	
Institution	Forecast	Actual	Intercept	Slope
Forecast horizon 6 months				
Deka Bank	0.070	0.066	0.018	0.171
Helaba	0.081	0.077	0.019	-0.406
LBBW	0.052	0.073	0.010	0.116
M.M. Warburg	0.061	0.075	0.034	0.233
Postbank	0.053	0.079	0.003	0.035
Santander Asset Managem.	0.019	0.081	0.026	-0.095
Consensus	0.019	0.073	0.014	0.036
All forecasts	0.061	0.070	0.014	0.040
Forecast horizon 12 months				
BNP Paribas	0.040	0.183	0.072	-0.059
Commerzbank	0.052	0.169	0.081	0.120
Deka Bank	0.099	0.137	0.051	0.002
Helaba	0.107	0.149	0.008	0.193
HSH Nordbank	0.067	0.163	0.022	-0.032
LBBW	0.058	0.142	0.053	-0.042
M.M. Warburg	0.071	0.142	0.063	-0.107
Oddo BHF	0.022	0.147	0.058	0.054
Postbank	0.063	0.160	0.084	0.012
Santander Asset Managem.	0.051	0.146	0.070	0.093
Consensus	0.033	0.142	0.055	0.006
All forecasts	0.066	0.140	0.057	0.029

Appendix 6: The results in detail of the Euro Stoxx 50 forecasts from 2002 to 2020 from the FAZ

Table A6-1: Number of Euro Stoxx 50 forecasts (FAZ) and the actual events divided into "unusual events" (falling Euro Stoxx 50) and "normal events" (rising Euro Stoxx 50)

Institution	Forecasts issued	Forecasts		Actual events	
		SX5E falls	SX5E rises	SX5E falls	SX5E rises
Forecast horizon 6 months					
Bayern LB	10	4	6	5	5
Deka Bank	16	3	13	8	8
DZ Bank	16	3	13	8	8
Helaba	14	6	8	8	6
HSH Nordbank	10	6	4	6	4
HVB-Unicredit Bank	16	3	13	8	8
LBBW	17	6	11	9	8
M.M. Warburg	16	2	14	8	8
Oddo BHF	10	2	8	5	5
Postbank	13	6	7	7	6
Santander Asset Managem.	13	2	11	6	7
Consensus	17	5	12	9	8
All forecasts	270	82	188	144	126
Forecast horizon 12 months					
Allianz SE	11	0	11	4	7
Bayern LB	11	0	11	3	8
BNP Paribas	11	1	10	3	8
Commerzbank	18	1	17	5	13
Deka Bank	18	1	17	5	13
DWS	12	0	12	5	7
DZ Bank	18	1	17	6	12
Helaba	15	5	10	5	10
HSBC Trinkaus & Burkhardt	14	3	11	4	10
HSH Nordbank	11	1	10	4	7
HVB-Unicredit Bank	18	0	18	6	12
LBBW	19	1	18	6	13
M.M. Warburg	19	1	18	6	13
Oddo BHF	17	1	16	6	11
Postbank	14	0	14	4	10
Santander Asset Managem.	16	0	16	5	11
WestLB	11	1	10	4	7
Consensus	19	0	19	6	13
All forecasts	381	29	352	123	258

Table A6-2: Standard deviation of the Euro Stoxx 50 forecasts (FAZ) and the actual events as well as the intercepts and slopes of the regression lines in the prediction-realization diagram (in decimal figures)

	Standard deviation		Regression line	
Institution	Forecast	Actual	Intercept	Slope
Forecast horizon 6 months				
Bayern LB	0.043	0.078	0.011	-0.244
Deka Bank	0.063	0.093	0.049	0.022
DZ Bank	0.064	0.093	0.030	0.186
Helaba	0.079	0.095	0.019	-0.406
HSH Nordbank	0.085	0.099	-0.030	-0.214
HVB-Unicredit Bank	0.070	0.101	0.023	-0.085
LBBW	0.053	0.098	0.028	0.088
M.M. Warburg	0.073	0.101	0.055	-0.014
Oddo BHF	0.042	0.116	0.033	-0.009
Postbank	0.060	0.097	0.004	-0.100
Santander Asset Managem.	0.033	0.099	0.030	0.110
Consensus	0.030	0.098	0.023	-0.018
All forecasts	0.073	0.094	0.023	-0.007
Forecast horizon 12 months				
Allianz SE	0.042	0.130	0.071	-0.035
Bayern LB	0.039	0.127	0.058	-0.044
BNP Paribas	0.044	0.194	0.076	-0.069
Commerzbank	0.064	0.195	0.080	0.017
Deka Bank	0.093	0.170	0.094	0.107
DWS	0.043	0.175	0.078	-0.019
DZ Bank	0.075	0.193	0.090	0.096
Helaba	0.117	0.177	0.048	0.292
HSBC Trinkaus & Burkhardt	0.082	0.209	0.065	-0.141
HSH Nordbank	0.071	0.195	0.076	0.119
HVB-Unicredit Bank	0.064	0.193	0.070	0.050
LBBW	0.078	0.190	0.088	0.003
M.M. Warburg	0.083	0.190	0.074	-0.073
Oddo BHF	0.047	0.192	0.072	-0.074
Postbank	0.054	0.190	0.086	0.032
Santander Asset Managem.	0.053	0.178	0.095	0.078
WestLB	0.088	0.231	0.073	0.127
Consensus	0.044	0.190	0.083	0.020
All forecasts	0.073	0.179	0.080	0.017