Corporate earnings and share prices

Over the past two decades, share prices in Germany – against the backdrop of a positive trend – have been subject to considerable fluctuations. The earnings of German public limited companies have followed a similar growth pattern. This supports theoretical reasoning, which sees in (discounted future) corporate earnings an important fundamental determinant of share prices. Looking back, however, the recurrent massive deviations between share price movements and corporate earnings growth is also striking. Particularly remarkable in this respect is the New Economy boom at around the turn of the millennium. Misjudgements with regard to expected earnings due to herd behaviour, information asymmetry or investors' overreactions to changes in earnings expectations forecasts may help explain such share price movements. The following article will examine the relationships between corporate earnings and share prices and look at commonly used indicators for the valuation level on the stock market. Earnings estimates by stock market analysts play an important role in determining these indicators. However, these estimates prove to be relatively slow to adapt and systematically biased, an aspect that has to be borne in mind when interpreting them.

Development of share prices, corporate earnings and dividend payments since 1991

Empirical pattern of share price, ...

As measured by Germany's DAX index, German share prices rose almost 2.5 times between the beginning of 1991 and mid-2009.[1] Yet this was not a continuous development. A steep rise, particularly at the end of the 1990s, driven by the New Economy boom to a high of more than 8,000 index points in March 2000 was followed by a severe slump. By the second quarter of 2003 the DAX had lost more than 70% of its value. With the recovery of global, and subsequently German, economic activity, share prices picked up again to reach a new all-time high in the third quarter of 2007. The financial market crisis emanating from the US real estate market, and attendant fears over the soundness of a number of financial institutions and the volume of required write-downs, resulted in a renewed bout of heavy share price losses. In March 2009, these losses peaked at around 55% of 2007 Q3 levels, after signs became apparent that the financial market crisis would increasingly spill over into the real economy and bring with it a pronounced cooling of global economic activity. Given the recent stabilisation in the financial sector and positive earnings reports by individual financial institutions, prices have since recovered slightly.

... earnings and dividend movements

Apart from a brief phase in the mid-1990s, the corporate earnings of the DAX companies generally followed a similar line of development to share prices, although they did not keep pace with the rise in prices during the

Share prices, actual earnings and current dividend payments

January 1991 = 100,
End-of-month levels, log scale

DAX

Dividend payments

Actual earnings per share[1]

1991　95　00　05　2009
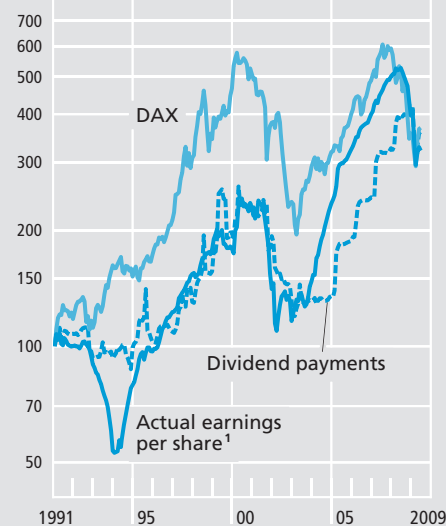
Sources: I/B/E/S and Bundesbank calculations. — **1** In the past 12 months.

Deutsche Bundesbank

New Economy boom.[2] On the whole, they also fluctuated far less markedly. The pattern of dividends, which was also relatively constant, reflects a policy of dividend continuity aimed clearly at avoiding dividend cuts and, thus, at adjusting the payout only to permanent changes in earnings wherever possible.[3] This was visible in the mid-1990s and very recently, when dividends largely remained stable or fell only slightly as earnings declined. In addition, after 2003, payouts did not keep

1 The dividend payments are already included (Performance Index). Based on the pure share price increases, the DAX has risen nearly 130% since 1991.
2 The earnings and dividends used here each refer to the DAX Performance Index.
3 Possible reasons for a policy of smoothing dividends are market frictions (eg asymmetric distribution of information). In a perfect capital market, on the other hand, payout policy proves to be irrelevant. See M H Miller and F Modigliani (1961), Dividend Policy Growth and the Valuation of Shares, in Journal of Business 34, pp 411-433.

Earnings from a macroeconomic perspective

Corporate earnings are a key measure of success in a market economy. Going forward, they have an important signalling and allocative function for production and investment decisions; they are also an important source of equity funding; and they may serve as a buffer allowing enterprises to absorb short-term external price and cost shocks.

One difficulty in determining earnings at the single-entity and macroeconomic level is that they are generally calculated as a residual. Problems of measuring and evaluating revenues and costs, as well as flexibility in (balance sheet) accounting, may result in significant differences in reported earnings. Nevertheless, they represent an important determinant of stock price developments and have a central role to play in assessing stock valuation levels.

This article will therefore focus on the earnings of public limited companies and in particular the earnings of the DAX 30 companies. They reported combined earnings (after taxes) of around €29 billion in 2008.

However, their size, sector composition and international focus mean the DAX companies studied do not fully model the German economy. To obtain a more comprehensive picture of earnings trends for domestic enterprises, it therefore makes sense to use national accounts data.

In the national accounts system, corporate earnings (before taxes) of corporations and quasi-corporations (including mixed income) are calculated in the sense of the operating result from ongoing production activity in a particular period. Enterprises' operating surplus is corrected by adding (or deducting) the property income receivable (payable) in connection with entrepreneurial activities.[1] Overall, it amounted to around €517 billion in 2008; it has therefore more than doubled since the end of 1991 (see adjacent chart). At last count, non-financial corporations contributed around four-fifths to the total.

Trends in corporate earnings reflect the fact that many enterprises concentrated on balance sheet consolidation at the beginning of the decade. The favourable global economic environment (up until 2007) and Germany's economic recovery have – given relatively moderate wage increases – been reflected in a sharp rise in macroeconomic earnings. Moreover, the increased significance of enterprises with the legal form of corporations and quasi-corporations likely contributed to earnings growth.[2] The onset of the financial crisis in mid-2007 as well as the subsequent pronounced macroeconomic contraction worldwide and in Germany subsequently resulted in both a decline in the earnings of financial corporations and in perceptibly slower general earnings growth.

The national accounts sectors "non-financial corporations" and "financial corporations" include not only corporations in the narrower sense of the word, such as public limited companies (*Aktiengesellschaft* or AG) and private limited companies (*Gesellschaft mit beschränkter Haftung* or GmbH), but also quasi-corporations (for instance, general partnerships (*Offene Handelsgesellschaft* or OHG) and limited partnerships (*Kommanditgesellschaft* or KG)). Public limited companies are not listed separately in the national accounts. The corporate balance sheet statistics published by the Deutsche Bundesbank, which are based on the annual accounts of non-financial corporations, provide an indication of the macroeconomic importance of public limited companies' earnings.[3] These data show public limited companies contributing just over 25% to aggregate corporation earnings before taxes.[4]

Corporations' earnings according to the national accounts

End-of-year levels

pace with earnings; companies were obviously at first taking advantage of the rise in earnings above all to raise profit retention and "clean up" their balance sheets (for information on earnings from a macroeconomic perspective, see also the box on page 17).

Despite these differences in the details, actual earnings per share and current dividends grew at rates similar to share prices in the period under review. All in all, the average annual growth rates have ranged between 6% and 7% since 1991. This is consistent with theoretical reasoning on the relationship between the variables mentioned above.

Relationship between earnings and share prices: theoretical reasoning

Share prices not dependent on fundamentals alone

In a perfect market, the price of a rationally valued share should be equivalent to the present value of the expected future dividends, with the discount factor being made up of the risk-free interest rate and a risk premium which investors demand as compensation for uncertainties surrounding the dividend streams. However, experience shows that share prices are sometimes found, at least in retrospect, to be at odds with a rational valuation. Such cases include asset price bubbles, which deviate strongly from a fundamentally justified valuation. Occurrences such as herd behaviour, an asymmetric distribution of information among investors or overreaction to changes in earnings expectations can help asset price bubbles to form. Other psychologically driven patterns of investor behaviour, the effect of which is studied in the field of behavioural finance, can likewise help explain share price movements that are not justified by fundamentals.

When applying the dividend discount model, corporate earnings are of importance in assessing fundamentally justified equity valuation levels. Other simple measures for assessing equity price levels are the price-earnings (P/E) ratio and the dividend yield, which represent the current or expected earnings and the dividend in relation to the share price respectively. A related indicator is the Fed model, which is equivalent to the difference between the inverse P/E ratio – the earnings yield – and a risk-free interest rate, and can be interpreted as a risk premium over a safe investment.

Measures based on earnings and dividends

Whereas problems are seen in comparing such indicators across different market segments or national stock markets due to differences in the risk premiums, accounting and real interest rates, it is common practice to interpret them in comparison with an average that is deemed to be fundamentally justified. On the basis of deviations from this average, conclusions are drawn with regard to the appropriateness of the valuation. If, for example, the current P/E ratio overshoots (undershoots) its long-term average, the shares appear – in terms of the actual or expected earnings – overpriced (underpriced). The advantage of this procedure is that it reduces complexity while also being empirically justifiable (see page 24). One drawback of the commonly used valuation method is that only the earnings or the dividend of one period are used as the basis for valuation and are considered to

be representative of the entire future. When average values are used, the effect the surpluses or distributions in the more immediate future have on the present value is neglected.

Dividend discount models

Dividend discount models avoid these drawbacks in that they involve discounting all future dividends with the expected real stock yield – ie the total of risk-free interest and an equity risk premium – as the discount factor. In the simple version, the future dividend payments are determined by taking the current dividend as the basis and assuming a constant dividend growth rate. With the three-stage dividend discount model, which the Bundesbank also uses, a distinction is made between three phases of dividend growth. Whereas in the first phase a constant dividend growth is assumed, the growth rate in the second phase, in line with the assumption, linearly approaches its long-term equilibrium, which is then reached in the third phase.[4] In practice, the model is often solved for the equity risk premium; comparing it with a long-term average enables an assessment of the valuation level. A high equity risk premium indicates a comparatively strong reluctance to invest and, therefore, a relatively low share price valuation.

With the dividend discount model, changes in dividend growth rates have an especially strong impact on the price level when the assumed long-term dividend growth rate is close to the expected stock yield.[5] It is therefore crucial for the informativeness and the interpretation of the model that the assumed dividend growth rates correctly reflect the actual expectations of the investors and represent accurate estimates of actual dividend growth.

Analysts' estimates as indicators of expected corporate earnings

Data sources

Analysts' estimates are one commonly used measure of expected corporate earnings. The source of data most often referred to in connection with studies on analysts' forecasts is the I/B/E/S (Institutional Brokers Estimate System) database.[6] This database contains estimates of the balance sheet profit over different time horizons ranging from twelve months to five years. Most market participants focus on the next 12 months, for which reason the majority of forecasts refer to the current and the next business year. Since 1991, an average of almost 30 forecasts per company have been available for the 12-month outlook for the DAX companies. This relatively high forecast density shows that

Expected earnings on the basis of analysts' estimates

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4 For details, see Deutsche Bundesbank, Monthly Report, March 2003, p 35.
5 In the three-stage dividend discount model, which is an extension of the simple Gordon growth model, the price level P_t is approximated as:

$$P_t = \frac{D_t\left[(1+g)+(A+\frac{B}{2})(g_t^*-g)\right]}{(ERP_t+r_t)-g},$$

where D_t represents the expected dividend at time t, g_t^* the real dividend growth rate based on analysts' estimates, and A and B the duration of, respectively, the first and second dividend growth phase in years. The assumed long-term dividend growth rate g has a strong influence on the present value. The closer g is to the expected stock yield (equity risk premium ERP_t plus real interest rate r_t) and the lower the denominator of the fraction therefore is, the greater the influence on the price level of changes in the variables used. The model is unsolvable if g is equal to or greater than the expected stock yield.
6 These are forecasts by sell-side analysts, whose reports are not aimed primarily at the analysts' own employer but at external target groups. By contrast, buy-side analysts usually work for institutional investors. Their job is to provide their own managers with sound input for decisions on purchasing securities. This information is not published, however. The two groups are often covered separately in the literature because of this difference in orientation, which also implies different target functions.

analysts concentrate their activities primarily on large firms.[7] For the observed firms, greater analyst coverage means an improved information environment that ultimately ought to lead to a more reliable consensus forecast.[8]

The analysts' average firm-level forecast is weighted according to the market capitalisation of the respective company. These figures are then added together to form an aggregate figure for the index. However, analysts do not as a rule update their forecasts at monthly intervals. For the DAX companies, it may be seen that since 1991 only roughly every fourth estimate was revised monthly.[9] Although this ratio has risen since 2000 to just under one-third (32%), this still means that the majority of the forecasts included in the overall index are the same as for the previous month. As is explained in more detail below, the result of this is, among other things, that the (average) earnings forecasts are slow to adjust to sudden change.

Analysing earnings developments

Since 1991, earnings growth expected for the most part

Since 1991, with very few exceptions, analysts have consistently expected (positive) growth in German corporate earnings. The 12-month-ahead earnings forecast has almost always been higher than the actual earnings in the previous 12 months (see chart on page 21). Although earnings expectations have plummeted in the current financial market crisis, analysts are again expecting earnings to rise in the next 12 months (+15%).

With regard to earnings developments, there are visible differences between the stock mar-

ket boom at the end of the 1990s and the current financial market crisis. For example, while the hi-tech bubble was forming, the prices of the 30 top German shares rose markedly more strongly than expected earnings, and the subsequent slump in share prices was likewise considerably more pronounced than the revision of expected earnings. On the other hand, both the subsequent rise in share prices until 2007 and the share price crash that followed were largely in line with earnings expectations. These differences in development are borne out by a more thorough examination of analysts' revisions of earnings expectations. During the boom at around the turn of the millennium, the number of earnings estimates that were revised downwards had already exceeded the number of upward revisions by the beginning of 1999. Thus, at this comparatively early point in time, the majority of analysts surveyed with regard to the DAX companies were already sceptical as to whether the earnings expected up to that point would actually be realised. Consequently, the share price increase which continued into the year 2000 resulted in prices becoming increasingly decoupled form expected earnings. In the upswing which preceded the current crisis, and which had a substantially broader sectoral base than the New Economy boom, the number of earnings estimates that were revised

New Economy bubble versus financial market crisis

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7 By comparison, since the broad based Dow Jones Euro-Stoxx was launched in 1999, only just under 18 analyst forecasts on average have been issued per company and month. Sources: I/B/E/S, Bundesbank calculations.
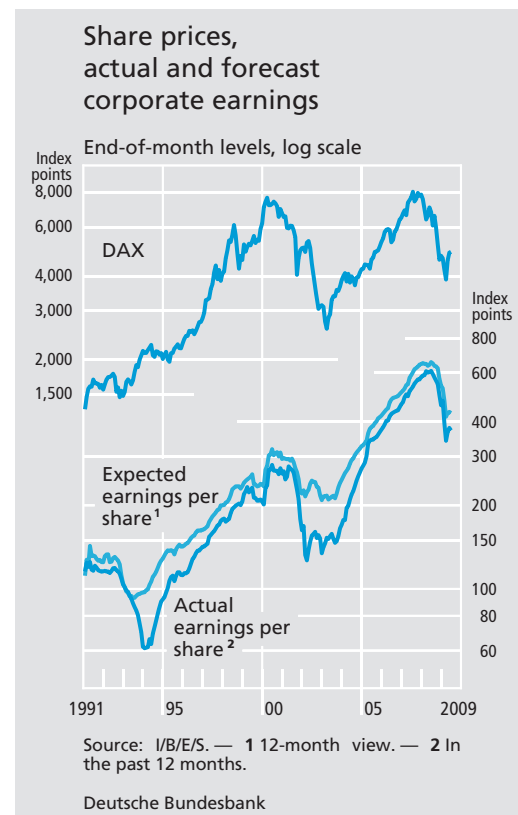**8** See, for example, R Frankel, S P Kothari and J Weber (2006), Determinants of the Informativeness of Analyst Research, Journal of Accounting and Economics 41, pp 29-54.
9 Where estimates are unchanged, no information is available on the extent to which they were updated.

downwards did not exceed the number of upward revisions until October 2007 – which is to say after the stock market had peaked. Clearly, the crisis took stock market analysts by surprise, all the more as the real economic forecasts at that time had shown no indication of an abrupt economic slump.

Granger causality of share prices and expected earnings

The feedback effect, observed in 2007, of share prices on earnings estimates can generally be proven. Analysts include past price movements of the share of the company under review in their estimate. Using a Granger causality test, the hypothesis that past share prices have no influence on earnings expectations can be rejected at the 1% level in the 1991 to 2009 period.[10] This empirical finding suggests a cautious use of present value models, as they assume that earnings forecasts are estimated independently of past price developments. To back up this interpretation, however, analysts' individual estimates and their adjustment over time need to be examined more closely, as so far account has not been taken of when the individual estimates included in the consensus forecast were made (see box on pages 22-23). As a second result, the Granger causality test based on a monthly frequency does not reveal any market-relevant influence of earnings estimates on future share prices. Yet this does not necessarily contradict the dividend discount model, as one would expect share prices to react much earlier to changes in earnings expectations in information-efficient markets. The impulse response functions generated by the VAR model confirm a corresponding direct reaction by stock yields to changes in earnings expectations.

Share prices, actual and forecast corporate earnings

End-of-month levels, log scale

Source: I/B/E/S. — **1** 12-month view. — **2** In the past 12 months.

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Indicators based on analysts' estimates

Assessing the valuation level

The relationship between share prices and earnings expectations is also the basis for other commonly used stock market valuation measures.[11] In practice, analysts' estimates often form the basis for determining P/E ratios, dividend yields or equity risk premiums from dividend discount models. As explained above, to assess the fundamentally justified

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10 There is no evidence of any economic equilibrium relationship (cointegration) between the two time series. For the econometric analysis, the two variables are therefore examined in their first (logarithmic) differences using a vector autoregressive (VAR) model with which conclusions may be drawn regarding the dynamic relationship between the modelled endogenous variables. This is the objective of, above all, the Granger causality concept, which tests for a possible influence of the lagged values of one variable on the current value of the other variable. **11** See J Y Campbell and R J Shiller (2001), Valuation Ratios and the Long-run Stock Market Outlook: An Update, NBER Working Paper 8221.

What factors determine the quality of securities analysts' earnings estimates?

Securities analysts act, to a degree, as a link between the companies they cover and potential investors or market observers. They can therefore be regarded as information intermediaries. Their task is to collect and evaluate a wide range of information of varying quality and – in the case of an earnings estimate – condense it into a single figure. The result of their analysis is generally published prominently, but not any information on the preceding decision-making process. However, the quality and rationality of the forecasts can be properly assessed only if the factors influencing the decision are known. In the following, we will analyse various determinants that could have an impact on securities analysts' decision-making process and the quality of their forecasts. We will study, first, what influence the individual environment has on forecast quality and, second, to what extent publicly available information is reflected in forecasts.[1]

Irrespectively of the determinants to be examined, any empirical study on forecast quality must control for the forecast horizon, which is defined as the period (generally measured in months) between the time the forecast is produced and the end of the business year for which the forecast is made. As expected, there is a negative correlation: forecast accuracy diminishes as the forecast horizon grows longer. The business year in question can also exert a specific influence, which has to be taken into account in any analysis.

Analyst-specific and broker-specific factors

Differences in individual analysts' forecast quality can, in part, be explained by the individual environment or specific analyst characteristics.[2] For instance, various studies show that long professional experience has a significant positive impact on forecast quality. One explanation is the "learning by doing" effect: the longer someone works as an analyst, the greater his experience in the field, which in turn leads to better forecast results. In addition, Hong and Kubik (2003) state that, for analysts

working in the United States, continued employment in the industry is closely linked to forecast accuracy.[3] In other words, analysts with comparatively many years of experience have undergone a selection process in which they were able to prevail over their rivals. However, the positive correlation between professional experience and forecast accuracy proved weak or even inexistent especially for European analysts, which is explained, *inter alia*, by differences in the incentive structure.[4] The literature therefore makes a further distinction between general and company-specific professional experience. The latter relates exclusively to the period over which an individual analyst has covered a specific company. The positive correlation generally proves robust in empirical analysis; one possible reason is that communications between the analyst and the management of the covered company improve with years on the job.

A further analyst-specific determinant whose potential impact is investigated in empirical studies is the number of forecasts that an analyst makes for a firm in a business year. If a large number of revisions are necessary, this points to difficulties in establishing an adequate assessment, which results in a negative correlation between this variable and forecast accuracy, particularly at the beginning of the business year. Conversely, at the end of the business year, the number of revisions should have ensured that the necessary adjustments have been made, which would mean a statistically significant difference can no longer be found.

Broker-specific factors include the size of the portfolio an individual analyst covers. Here, a negative correlation is assumed in theory: the more enterprises or sectors an analyst covers, the less time he has to analyse a specific company, which is reflected in a significantly greater forecast error.

Various studies also show that the size of an analyst's employer is statistically significant. US studies in particular

1 For an up-to-date overview of literature on analyst estimates, see S Ramnath, S Rock and P Shane (2008), The Financial Analyst Forecasting Literature: A Taxonomy with Suggestions for Future Research, International Journal of Forecasting 24, pp 34-75. — **2** See, for example, M B Clement (1999), Analyst Forecast Accuracy: Do Ability, Resources, and Portfolio Complexity Matter?, Journal of Accounting and Economics 27, pp 285-303. — **3** H Hong and J D Kubik (2003),

Analyzing the Analysts: Career Concerns and Biased Forecasts, Journal of Finance 58, pp 313-351. — **4** See G Bolliger (2004), The Characteristics of Individual Analysts' Forecasts in Europe, Journal of Banking and Finance 28, pp 2283-2309. According to Bolliger, the assessment of individual analysts' performance is not as closely linked to individual forecast errors in Europe as in the United States. — **5** Bolliger (2004), loc cit. — **6** L D Brown (2001), How Important is Past Analyst

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demonstrate that analysts employed by larger brokerage houses make better forecasts than their peers at smaller houses. One possible explanation is that analysts with important brokerage houses have better access to companies' management. Similarly, they could have better resources at their disposal. Larger brokerage houses are regarded as the more attractive employers, partly for the reasons outlined above, potentially leading to them employing the better analysts. However, this argument does not necessarily apply to the European market, as brokerage houses do not hire staff based as exclusively on past forecast accuracy as in the United States.[5]

Although the above-mentioned variables are used to try to explain, as much as possible, the differences in forecast quality based on analyst-specific and broker-specific behaviour, a large part remains unexplained. As a result, prior analyst-specific forecast quality generally proves highly significant in addition to the above-mentioned determinants. For instance, Brown (2001) shows that a simple model containing only analysts' individual prior forecast quality as an explanatory variable performs just as well as a model that contains the analyst characteristics described above.[6]

Processing publicly available information

As mentioned above, a financial analyst's real achievement is to collect, weight and compress existing information. An important source of information is doubtless the current consensus forecast among other analysts, which is the subject of intense debate in the literature. The individual analyst starts out in the same situation as other uninvolved market players. While he is familiar with the result of the consensus estimate, he does not know what factors may have played a role in his peers' decision-making process. Unlike other market players, however, the analyst's own forecast gives him an idea of how the consensus estimate could change.

According to Banerjee's definition (1992), individual analysts' behaviour is classified as non-rational herd behaviour if they base their forecast exclusively on other analysts' consensus estimate and neglect their own information.[7] Such behaviour is, however, difficult to prove empirically. As different analysts usually respond to similar information signals, they will likely arrive at similar recommendations. In this case, it is therefore not clear whether synchronised analysts' earnings revisions are due to herd behaviour or merely to the fact that they base their decisions on the same information. Clement, Hales and Xue (2007) demonstrate for the United States that the consensus forecast is used in a rational manner. They find that analysts are more likely to incorporate information from the consensus forecast into their own forecast the greater the number of analysts involved in the consensus forecast.[8] In this case – if analysts use the consensus forecast as one of several sources of information – their own forecast accuracy may improve.[9] It would therefore be premature to describe proof that the consensus forecast has an influence on analyst decisions as irrational behaviour. For Germany, Naujoks et al (2009) even show that analysts systematically go against the consensus forecast in order to raise their profile (anti-herding).[10]

Past stock market performance is similar to the consensus forecast. Even though this is publicly known and available information, taking share prices into account may well help improve the quality of earnings forecasts.[11]

Another source of information for which one would expect similar analyst behaviour is the macroeconomic outlook. Unexpected changes in and increased uncertainty about future macroeconomic developments are both likely to impact analyst-specific earnings forecasts.

Forecast Accuracy?, Financial Analysts Journal 57, pp 44-49. — **7** A V Banerjee (1992), A Simple Model of Herd Behavior, Quarterly Journal of Economics 57, pp 797-817. — **8** M B Clement, J Hales and Y Xue (2007), When Do Financial Analysts Look to Others for Answers?, Working Paper. — **9** D Bernhardt, M Campello and E Kutsoati (2006), Who herds?, Journal of Financial Economics 80, pp 657-675, demonstrate that changes to the consensus forecast may well contain relevant and valuable information which individual analysts must not ignore. — **10** See M Naujoks, K Aretz, A Kerl and A Walter (2009), Do German Security Analysts Herd?, Financial Markets and Portfolio Management 23, pp 3-29. — **11** See T Lys and S Sohn (1990), The Association Between Revisions of Financial Analysts' Earnings Forecasts and Security-Price Changes, Journal of Accounting and Economics 13, pp 341-363.

Valuation indicators for the DAX

End-of-month levels

Sources: I/B/E/S and Bundesbank cacula-
tions. — **1** Measure for the risk premium
demanded by investors. Calculated using a
three-stage dividend discount model; see
Deutsche Bundesbank, Monthly Report,
March 2003, p 37.

Deutsche Bundesbank

valuation level, these are compared with their long-term average. This is based on the assumption that the earnings estimates are representative of the future development of earnings and dividends, and that the historical average of the figures is similar to an equilibrium value from which the current values deviate only temporarily – eg when price developments are temporarily dominated by non-fundamentals – but to which they return, however, in the long run (mean reversion). This would appear plausible in the case of the P/E ratio, and can be empirically confirmed by the appropriate econometric tests (unit root tests).

However, the average P/E ratio, calculated ex post, over the entire period under review can differ significantly from averages calculated at earlier points in time, thus subjecting the "equilibrium value" to uncertainty. Moreover, the time intervals between two points at which the P/E ratio intersects its average vary greatly in length, ranging from one month (in 2001) to almost seven years.

P/E ratio, dividend yield and equity risk premium

The development of the P/E ratio, dividend yield and equity risk premium emphasises the differences mentioned between the New Economy bubble and the financial market crisis. Around the turn of the millennium, the P/E ratio reached its all-time high of 30 in the period under review. At the same time, the dividend yield and equity risk premium (at 1.6% each) were at their lowest level since 1991. This reflects investors' particularly pronounced willingness at that time to invest in shares, despite expectations of relatively low earnings and dividends, and thus indicates a decoupling of the stock market from the fundamentals. By contrast, the respective figures were closer to their long-term averages when the financial market crisis broke out in mid-2007. After the P/E ratio, following severe stock market losses, bottomed out (and the dividend yield and equity risk premium peaked) at the turn of the year 2008-09, all these indicators appear to have returned to some semblance of normality in recent months on the back of rising prices and downward revisions of earnings estimates. Nevertheless, they are still significantly removed from their long-term averages.

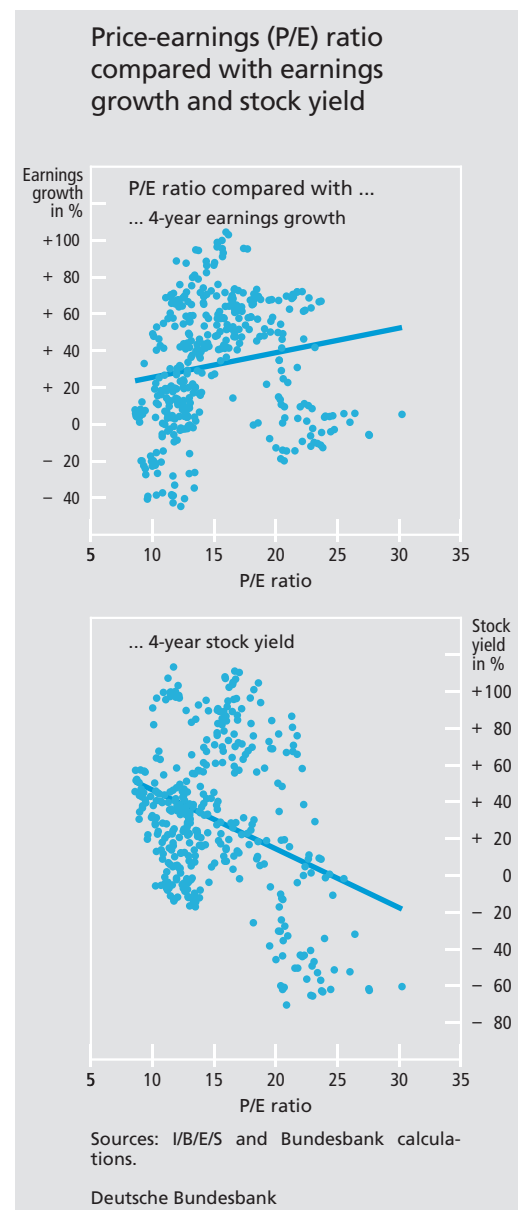*Determinants of the adjustment of the P/E ratio*

For the P/E ratio, the tendency to return to an equilibrium value means that there is at least one driving factor which causes the ratio to return to its long-term average. Generally

speaking, this adjustment can be driven by share prices (the numerator), earnings (the denominator) or both. This means, for example, that a higher-than-average P/E ratio should result in either an increase in earnings, falling share prices or both.[12] In economic terms, one explanation for these adjustments may be that a relatively high P/E ratio is likely to make investors shy away from a stock market investment, as – given the assumed earnings expectations – they cannot expect to receive the usual return. Another is that investors' earnings expectations might also be more optimistic than analysts' expectations because, for example, they possess more accurate or more recent information. In this case, the observed rise in share prices anticipates the analysts' earnings revisions. This could also explain the empirical finding that past price movements have their own informative value in respect of analysts' earnings estimates. The adjacent chart supports both hypotheses.[13] The linear trend lines show that over a prolonged period (four years), both the share prices and the expected earnings play a part in the return of the P/E ratio to the long-term average.

Regression analysis

A regression analysis confirms the, at first, only visual impression (see table on page 26). The P/E ratio proves statistically significant with regard both to the future four-year stock yield and to the change in four-year-ahead earnings expectations. However, for each of these cases its explanatory power is relatively limited. 9% of the variation of future stock returns and 11% of the change in expected earnings can be explained via the current P/E ratio. Evidently, a number of other factors

Price-earnings (P/E) ratio compared with earnings growth and stock yield

Sources: I/B/E/S and Bundesbank calculations.

Deutsche Bundesbank

also influence the stock yield and corporate earnings, triggering primarily short-term adjustments, as it is noticeable that the explanatory power of the estimates decreases signifi-

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12 See also the line of argument presented by Campbell and Shiller (2001), loc cit, who conduct a similar study for the USA.
13 Share prices and earnings expectations are not price-adjusted, as it is assumed that both variables are subject to the same general price index.

Regression of stock yield and of expected earnings growth on the price-earnings ratio °

Logarithmic values

Dependent variable	Forecast horizon in months (N)					
	1	3	12	24	36	48
Stock yield over N months						
P/E ratio (N)	– 0.01	– 0.03	– 0.18 *	– 0.27 *	– 0.37 *	– 0.46 **
$R^2(N)$	0.00	0.01	0.04	0.05	0.07	0.09
Expected earnings growth over N months						
P/E ratio (N)	0.03 ***	0.09 ***	0.15 **	0.24 **	0.32 ***	0.35 ***
$R^2(N)$	0.03	0.06	0.05	0.07	0.10	0.11

o ***/**/* indicate significance at the 1%, 5% and 10% levels respectively; the error terms are Newey-West standard errors which are robust to both heteroscedasticity and serial correlation.

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cantly as the forecast time horizon shortens. [14]

Forecast accuracy of earnings expectations

Consensus forecast error

Deviations of the P/E ratio from its long-term average can be consistent with a fundamentally justified share price level if – as mentioned above – investors do not consider analysts' short-term earnings expectations to be representative of the future. For use of analyst estimates to be meaningful, therefore, it is essential that they correlate closely with actual earnings. Forecast error is considered a decisive criterion in assessing the quality of analyst estimates. Because the deviation of each individual analyst's forecast from the actual value is measured, it is not the quality of

the forecast models used or of the information entered into them that is assessed, but solely – and, naturally, ex post – the accuracy of the result. [15]

The aggregate forecast error is calculated by comparing the actual earnings of the last 12 months with the 12-month-ahead earn-
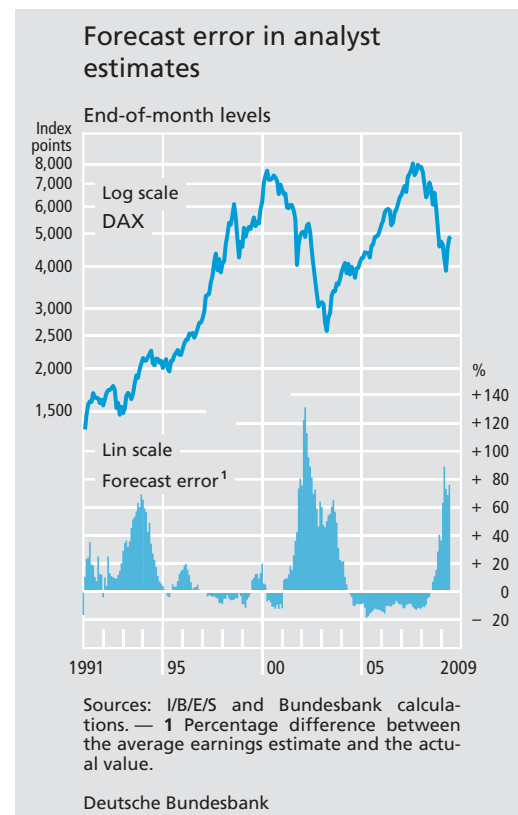
14 For the stock yield, the P/E ratio only proves statistically significant with regard to the future twelve-month or longer stock yield. For expected earnings, by contrast, the one-month forecast using the P/E ratio is already statistically significant even if, given an adjusted R^2 of 3%, it displays less explanatory power than with the longer horizons. See also J Y Campbell, A W Lo and A C MacKinlay (1997), The Econometrics of Financial Markets, Princeton University Press, p 267 ff, in which the authors study the explanatory power of the dividend yield for the US market. They, too, find that, the longer the forecast horizon, the greater the coefficient of determination.
15 For details on the determinants that affect the quality of the individual analyst's earnings estimates, see the box on pp 22-23.

ings expected 12 months ago (see adjacent chart).[16] As an average for the almost 20 years under review, analysts expected annual earnings growth of 21%. In fact, however, the average increase was only 11%.[17] Thus, the forecast error is significantly biased upwards, which indicates over-optimism on the analysts' part. Furthermore, in the period under review it is striking that, in phases of plummeting share prices, the average earnings expectation systematically deviates more strongly from the actual values than in comparable upward stock market trends. During the three post-1990 economic downturns[18] and the attendant severe declines in share prices, the cumulative forecast error in analyst estimates surpassed 50%. By contrast, in phases of sharply rising share prices the forecast error was markedly lower and often even negative.

Possible reasons for asymmetric forecast errors

One reason for the deviations might be found in a certain inertia of the estimates. Since analysts do not issue a new earnings forecast every month for the companies they observe, many of the individual values included in the consensus estimate date back to earlier points in time. This only explains earnings expectations lagging prices to some extent, but not asymmetry. Research literature cites a possible conflict of interests as an explanation for the considerably greater deviations in downturn periods, arguing that some analysts consciously sought to avoid issuing negative earnings forecasts in order not to jeopardise good business relations with companies.[19]

Forecast error in analyst estimates

Sources: I/B/E/S and Bundesbank calculations. — **1** Percentage difference between the average earnings estimate and the actual value.

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Coefficient of variation

It should be noted when interpreting the forecast error that it is the sum of positive and negative deviations from the actual value. To assess forecast quality more precisely, therefore, it is necessary to analyse add-
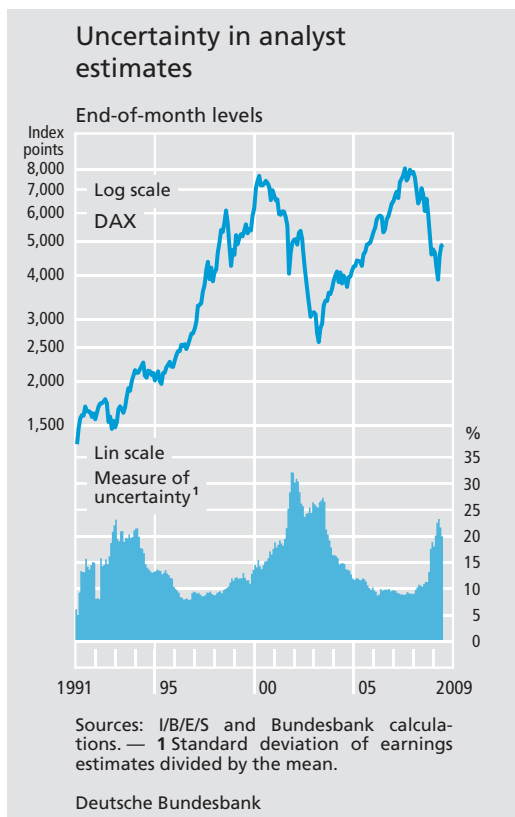
16 The forecast error is stated as a percentage deviation of the actual from the expected earnings: $FE_t = \frac{E^*_{t,t-1}-E_t}{E_t}$, where FE_t represents the forecast error in t, $E^*_{t,t-1}$ the earnings expected for t in $t-1$, and the actual earnings in t.
17 See W F M DeBondt and R H Thaler (1990), Do Security Analysts Overreact?, in American Economic Review 80, pp 52-57. The study, one of the first to provide evidence of a positive bias of analyst estimates for the US market, thus triggered a flurry of additional research.
18 These are the recession in the first half of the 1990s after the German reunification boom, the downturn triggered by the bursting of the New Economy bubble around the turn of the millennium and the current financial market crisis.
19 See, for example, L K C Chan, J Karceski and J Lakonishok (2003), Analysts' Conflict of Interest and Biases in Earnings Forecasts, NBER Working Paper 9544, and A R Jackson (2005), Trade Generation, Reputation, and Sell-Side Analysts, Journal of Finance 60 (2), pp 673-717.

Uncertainty in analyst estimates

End-of-month levels

Sources: I/B/E/S and Bundesbank calcula-
tions. — **1** Standard deviation of earnings
estimates divided by the mean.

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itional indicators which take the dispersion of
the estimates into consideration. One such in-
dicator is the coefficient of variation, which
models the standard deviation of the analyst
forecasts in relation to the expected earnings.
In the period under review, the dispersion of
analysts estimates increases – as does the
forecast error – particularly in phases of fall-
ing stock market prices (see above chart).
A greater dispersion of analyst estimates is
associated with a greater absolute forecast
error. Hence, the correlation between both
measures is more than 0.8. This would sug-

gest interpreting the estimates with greater
prudence as dispersion of the forecasts in-
creases.

Conclusion

In looking at the DAX companies, it can be
empirically proven for Germany that the
long-run relationship between corporate
earnings and share prices that one would ex-
pect in theory does exist. The P/E ratio is
shown to display mean-reverting behaviour –
in other words, it always returns to its "equi-
librium value" over a sufficiently long-run
period. Using the P/E ratio as an indicator for
assessing an "appropriate" valuation level on
the stock market, however, requires reliable
earnings forecasts. As a rule, these are based
on analyst forecasts that are prone to a cer-
tain degree of forecast error. For the 30 DAX
companies, it has been shown that, even if all
analyst estimates are averaged, these esti-
mates deviate systematically from the actual
value. In downturn phases in particular, esti-
mates have an upward bias. This must be
borne in mind when interpreting relevant in-
dicators. Especially in downturn periods, it is
therefore advisable not to rely solely on the
aggregate earnings estimate but also, for ex-
ample, to include the ratio of upward and
downward revisions and the dispersion of the
analyst estimates in the analysis.