

Appendix 3.09.6 Accuracy in forecasting

Forecasts play an important role in the investment process. Investment consists of a person committing resources now in the expectation of receiving greater resources in the future. The person who commits the resources (the investor) is implicitly (if not always consciously) making a forecast concerning his expected returns. The role of forecasts in investment can be demonstrated with the following example. A person has £1 million available for investment, and has to choose between two projects. Business A claims that it has developed a revolutionary new product, which will be very profitable and enable it to pay the investor a dividend of £100,000 per year. Business B forecasts that its profitability will be lower and can offer a dividend of only £50,000 per year. On the basis of these forecast, the investor rationally chooses Business A. On the assumption that both forecasts turn out to be correct, the investor will have made the right decision - not only from his personal viewpoint but also from the viewpoint of society as a whole: the decision that leads to the optimal allocation of resources in that it maximizes society's output of goods and services (see pages 2-3 of 'Accounting and distributive justice'). But, if the forecasts turn out to be incorrect, it is possible (but not certain) that the wrong decision will have been made, leading to a misallocation of resources. This would be the case if Business A's new product is rejected by consumers and the business fails. The funds invested in Business A are wasted. The investor loses all his money, whereas, on the assumption that Business B's forecast was correct, he would have been better off investing in that company. But, it is possible for both forecasts to be wrong and yet for the decision that was made on the basis of these forecasts to be correct – for example, even if A's dividend turns out to be lower than expected (£80,000) and B's higher (£60,000), the decision to invest in A was nevertheless correct. But, as a general rule, the more accurate the forecast, the better will be the allocation of resources and the greater will be the output of the economy and the income of society.

This example demonstrates that the functioning of the economy is improved when businesses issue forecasts of their future performance – subject to the condition that the forecasts are accurate. But, by definition, a forecast is a statement relating to a future event or state. Since the event or state lies in the future, the truth of the statement cannot currently be established with 100% certainty. Every forecast is subject to a certain degree of uncertainty. In the case of a forecast issued by a business, it is desirable that the degree of uncertainty should be communicated to those using the forecast. In the above example, the investor would be able to make a more informed decision, if he were to be made aware that the Business A's forecast was subject to a greater degree of uncertainty than that of Business B. Hence, to promote the more efficient functioning of the economy, two aspects of forecasts need to be improved: firstly the communication of the degree of uncertainty attached to the forecast, and secondly the accuracy of the forecast. These two aspects will now be considered.

The communication of uncertainty

A fundamental feature of a forecast is that it is made by a person or s group of persons. Essentially all forecasts are, to a greater or lesser extent, expressions of the subjective opinions of the persons making the forecast. A forecast that does not include an indication of the identity of the person or persons who made the forecast is valueless, in that the receiver of the forecast has no means of

assuring himself of the forecast’s accuracy. The person who made the forecast will generally have a certain degree of confidence that his forecast will turn out to be true. He often expresses this confidence in qualitative terms – for example:

‘It is certain that the sales of the XYZ Company next year will be more than £1 million.

‘Next year’s sales of the XYZ Company are very likely to exceed £1 million’

‘My best estimate of next year’s sales is somewhat in excess of £1 million’.

The inclusion of terms that qualify the forecast (‘certain’, ‘very likely’ and ‘best estimate’) is no doubt an improvement over no qualification at all (‘forecast sales are £1,000,000’), but I feel that these qualitative terms are so vague that they fail to communicate accurately the forecaster’s degree of confidence. For example, does the term ‘very likely’ indicate that the forecaster believes there is only a 1 in a hundred chance of the event not occurring or is the estimated chance one in ten? Communication can be improved by the forecaster adding to the forecast an indication of his subjective probability. Hence, ideally, the above forecasts should be rephrased as follows:

‘I forecast that there is a 99% probability that the sales of the XYZ Company next year will be more than £1 million.’

‘I forecast that there is a 90% probability that next year’s sales of the XYZ Company are will exceed £1 million’

‘I consider that there is a one third chance that next year’s sales will be less than £1 million’

The forecaster’s confidence in his forecast of next year’s sales is best expressed in the form of a probability distribution. The forecaster accepts that there is a some probability attached to every feasible estimate of next year’s sales, with the probabilities of extreme values (such as less than £100,000 and more than £10 million) being very small. He can present his estimate of the probability of the different level of sales in the form of a table, such as;

Forecast sales range	Probability
Less than £900,000	1%
£900,000-£950,000	2%
£950,000-£1,000,000	7%
£1,000,000-£1,050,000	16%
£1,050,000-£1,100,000	24%
£1,100,000-£1,150,000	24%
£1,150,000-£1,200,000	16%
£1,200,000-£1,250,000	7%
£1,250,000-£1,300,000	2%
More than £1,300,000	1%

This table clearly gives more information about the forecaster’s subjective assessment than the brief statement ‘I forecast that there is a 90% probability that next year’s sales of the XYZ Company

are will exceed £1 million’. In addition to the information that the probabilities of sales less than £1,000,000 add to 10%. the table indicates that the forecaster estimates that the most likely level of sales is around £1,100,000 and that there is even a small (1%) chance that they will be over £1,300,000..

Let us assume that actual sales turn out to be £949,000. Clearly the forecast was wrong. We can measure the extent of the error from the above table. The probability that actual sales would be less than £950,000 was estimated to be only 3%. The forecaster assigned a tiny probability to the event that actually happened – clearly a very poor forecast. Intuitively the forecaster who stated that ‘I consider that there is a one third chance that next year’s sales will be less than £1 million’ was more accurate or rather less inaccurate. This can be demonstrated by presenting the full table of his forecast:

Forecast sales range	Probability
Less than £800,000	9.6%
£800,000-£850,000	4.2%
£850,000-£900,000	5.3%
£900,000-£950,000	6.5%
£950,000-£1,000,000	7.5%
£1,000,000-£1,050,000	8.2%
£1,050,000-£1,100,000	8.6%
£1,100,000-£1,150,000	8.6%
£1,150,000-£1,200,000	8.2%
£1,200,000-£1,250,000	7.5%
£1,250,000-£1,300,000	6.5%
£1,300,000-£1,350,000	4.2%
Over £1,350,000	9.6%

This forecaster assessed the probability of sales being less than £950,000 to be 25.6%, which is very much higher than the first forecaster’s figure of 4%. I feel that the second forecaster did the better job, in that he communicated successfully the greater degree of uncertainty attached to his forecast. The full table communicates to the receiver of the forecast that there is a significant probability of relatively low values (as well as high values), so he should be prepared for an unpleasant surprise.

The above tables represent an ideal situation. It is unrealistic to expect someone to express their confidence in the occurrence of a future event to one decimal place. The forecaster in the above example who expressed his subjective feelings in term of ‘a one third chance’ was being more realistic than the one who referred to a ‘90% probability’. At best these tables should be interpreted as presenting a rough picture of the forecaster’s opinions.

The figures in the above tables are based on the normal distribution: the first table has a mean of £1,100,000 and a standard deviation of £78,000; the second table has the same mean of £1,100,000 and a standard deviation of £280,000. The forecasters agreed on the most likely value but disagreed on the level of uncertainty. I chose the normal distribution, principally because it is easy to work

with, but I suspect that it represents reasonably well many people's subjective estimates. Thus many people should be able to give an approximate answer to the questions: 'What is your best estimate of next year's sales?' and 'What is the range of sales for which you feel there is a two in three chance of achieving?' The answer to the first question gives a reasonable approximation to the mean and the answer to the second question a rough estimate of the standard deviation of the normal distribution. But there are certainly forecasts for which the normal distribution is inappropriate; for example, when the level of sales depends heavily on the outcome of a future event, such as the award of a government contract, the probability distribution is likely to have two separate peaks: one peak reflecting the award of the contract and a second, lower peak that reflects the failure to get the contract. .

The discussion so far has been highly theoretical. It is certainly not feasible to ask forecasters to provide the amount of detail that is presented in the above tables. But I feel that it is essential that both the maker of the forecast and the user should be made aware of the uncertainty attached to the forecast. This can be achieved by communicating not only the best estimate but also the range of probabilities, such as suggested by the question: 'What is the range of sales for which you feel there is a two in three chance of achieving?'

The message of this section may be summarized as follows: it is essential that the maker of a forecast communicate the degree of confidence that he has in his forecast. For a sophisticated forecaster, this may be achieved by presenting a full probability distribution. The less sophisticated should be encouraged to present their forecasts in the form of a range and not as a single point

The accuracy of forecasts

It is an unavoidable characteristic of a forecast that it reflects, to a greater or lesser extent, the subjective judgement of the forecaster(s). How can this subjective element be lessened and the objective element be increased? The following example, taken from the physical world, offers suggestions on how this may be achieved.

I throw a ball into the air. I can forecast with a very high degree of confidence (99.9999%) that it will return to earth. In 999,999 cases out of 1,000,000 the ball returns to earth. The one in a millionth chance (when a bird swoops down and catches the ball in mid-flight) simply illustrates the truism that one can never forecast a future event with 100% accuracy. But, in appropriate circumstances, one can make much more detailed forecasts, for example predicting exactly where and when the ball will land. To make such forecasts, two conditions must be fulfilled: firstly, that the forecaster has a deep understanding of the principles that govern the behaviour of the object (in the case of the ball, these are Newton's laws of motion); secondly that one has accurate knowledge of past and current events (in the case of the ball, the direction in which it was thrown and its initial speed). One can improve the accuracy of the forecast by gaining more knowledge on both counts: for example by ascertaining the effect of air pressure on the ball's trajectory and measuring the current air pressure. The effect of improvements in both the understanding of general processes and in the measurement of current conditions is well illustrated by the increased accuracy of weather forecasts over the past fifty years. Fifty years ago, weather forecasts were a joke; notorious

for their inaccuracy. But, over the past fifty years, there have enormous improvements in the two areas: in the understanding of the physical processes that create weather, and in the measurement and reporting of current conditions. I would claim that weather forecast today include a far smaller subjective element compared to those of fifty years ago; they are more objective in that they are based to a greater extent on objective measurements. But, there is still the unavoidable subjective element in weather forecasting, which reflects the fact that it is impossible to make a statement about a future event with 100% accuracy. This was vividly demonstrated in October 2105, when the US weather forecasting service predicted that the hurricane 'Patricia' would cause severe damage when it hit the west coast of Mexico. In fact, 'Patricia' caused very little damage. What had been forecast as 'the most severe hurricane in the history of North America' turned out to be little more than a common-or-garden' tropical storm – not even a hurricane.

How can one apply these ideas to the task of forecasting next year's sales? Firstly one needs to gain an understanding of the factors that influence the level of sales. Such an understanding may be gained by examining the behaviour of sales in previous years, for example by establishing how sales fluctuated with respect to such matters as: price (of both the firm's products and competitors' products), product quality, the general state of the economy, the income of customers and so on. Frequently a computer is used to model the behaviour of specific elements of a business. In recent years, there has been a marked increase in the use of computer models to forecast the future. The first models were developed by government agencies to forecast elements of the national economy, such as the level of unemployment and the rate of inflation. But the same technique may be used by business firms. Undoubtedly to base a forecast on the output of a computer model of the firm does increase the forecast's objectivity, but not necessarily its accuracy, for there are a number of reasons why the forecast may be wrong:

1. The computer model implicitly assumes that the same factors that determined behaviour in the past will also operate in an identical way in the future. But the past may be a poor guide to the future.
2. Errors may be made in measuring inputs to the model.
3. A business is a very complex system and inevitably any model represents a simplification. In particular, human beings are important elements in the system and their behaviour is often unpredictable. There is a fundamental difference between the behaviour of an inanimate object, such as the ball that I threw in the air) and that of a human being, who may behave in a thoroughly unpredictable way when he finds himself in an unexpected situation.

Hence I feel that the science of forecasting business behaviour is in a rudimentary state, but with very significant possibilities for progress.

Special considerations relating to forecasts by businesses

It is the general practice that forecasts relating to the future performance of a business are made either by the management or by persons subject to the management's authority. This raises the possibility that the forecast may be biased, for frequently the management has an incentive to

present an unduly optimistic picture of the business's prospects. For example, the management of Business A may be very keen to obtain the finance that is required for the execution of its project and does not want to deter the investor, by presenting a negative view of the future. The management may not have a deliberate intention to mislead. It may simply be the case that persons, who have been closely involved in the development of a project, are not sufficiently detached to make an objective assessment of the project's prospects.

There would seem to be ways with which to tackle this inherent bias in business forecasts: the forecast should be made by an independent body, or, alternatively, the management's forecast should be audited by an independent body.

It would certainly be feasible for an independent body, such as a consultancy firm, to make a forecast of the business's prospects. In fact, it is common for financial analysts to issue forecasts of such matters as the future profits of quoted companies. But a major problem with such forecasts concerns the question of who pays for the work involved in preparing the forecast. If the independent body bears the costs, it is unlikely that it would have the incentive to allocate sufficient resources to the work to ensure an accurate forecast. If the management pays for the preparation of the forecast, there is certainly a doubt that the forecast will be completely objective. Furthermore, it would seem that the persons best able to prepare a business forecast are those with an intimate knowledge of the business's operations – that is the business's own staff. Hence, the preparation of a forecast by an outside body is not without problems.

Thus a second possibility is for the forecast to be prepared by the business's staff and then checked by an outside body, such as the auditor. The auditor should check that the computer model reflects accurately both the business's operations and its environment, and does not include assumptions and elements that are unduly favourable to the business. The auditor should also check that, in preparing the forecast, the model has been operated correctly, with the correct input, and that the published forecast is consistent with the model's output. The successful execution of these tasks requires a significant level of technical knowledge on the part of the auditor – which many auditors are unlikely to possess. But the bigger problem is that the auditor is paid by the management and cannot be regarded as completely independent.

Conclusion

The conclusions to be drawn from the above analysis are rather negative. It is highly desirable that businesses should issue forecasts of their future activities, but, as presently practised, there is no guarantee that such forecast will be accurate. Clearly, in this field, there is a great need for further work and research.