Tomorrow is Another Day: Forecasts and their Uses

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The economist John Kenneth Galbraith is reputed to have said, “There are two types of forecaster: those who don’t know ... and those who don’t know they don’t know.” Many people (economists included!) are quick to ridicule economists and their ability to forecast accurately. Comments such as, “Economists have forecast 9 out of the last 5 recessions,” are frequently heard. In a similar manner, questions like, “Why employ economists?” are often answered with retorts such as, “To make weather forecasters look good.” If economists get such typically bad press from forecasting, why do they bother? After all, a forecast is a prediction of the future state of a process which hasn’t happened yet, so how important can it be that the forecast is accurate?

Lets consider who makes forecasts. Without following formal procedures or using sophisticated models, we all forecast many times every day. Why? Because we are faced with many choices about possible courses of action which will have different consequences, and we select a particular action once we have forecast which outcome we think will best achieve our goals. Consider for example a decision I make every morning when I arrive at work: to take the lift or the stairs to my office, on the 5th floor. Your view of my choice may be modified when you learn that I cycle to work every day and keep the bike in my office. The lift may seem a clear winner at this stage. However, I often arrive at work shortly before the first lecture of the day, which unfortunately (for me) is precisely the time when the lifts are full of students (who never seem to use the stairs!) and stop on every floor. In such circumstances it is often quicker for me to carry the bike up the stairs. If time was not crucial I could wait and take the lift, but as being late for lectures is not a good way to start them (especially when you’re giving the lecture!) I often choose to use the stairs, at least during the teaching periods of the year. Of course, I could always get up earlier!

While the above example may seem trivial, it does include features which are also common to all economic forecasting situations. The decision I make concerning the best route to my office depends on my forecast of the likely time and effort it will take me, which in turn depends on both the time of day and of the year. To phrase this in economic forecasting terms, a forecast of the future is a random variable whose probability distribution is conditional on the currently available information set; the outcome of such a forecast determines actions to be taken now. Put more simply, take account of all relevant factors when making a prediction of what will happen, then act accordingly.

To illustrate that the same ideas apply to situations which many people would view as more important than my arrival at work, consider the following questions:
How would a new style of (Nike/Adidas/pick an international sports-shoe manufacturer) basketball boot affect New Zealand sales of other (Nike) basketball boots, of (Nike) shoes in general, and of total New Zealand sports-shoe sales? Would the same conclusions apply worldwide? Should the boot be made available worldwide, or only in certain markets.

Should a new library be built somewhere on the Kapiti Coast? If so, how big should it be, where is the best place to site it, and when should it open?

How will the rate of inflation in New Zealand be affected if the marginal income tax rate is raised by 3%?

Will changing the date at which student loans start to accumulate interest lead to a change in overall student debt? If so, will the debt increase or decrease, and by how much?

The answers to those questions are of course unknown, but would be of great interest, not least to Nike (or your chosen manufacturer), Kapiti Coast District Council, the Reserve Bank of New Zealand, and the New Zealand Minister of Education respectively. Decisions concerning such questions must be made regularly by public and private companies, local authorities, regulatory agencies and governments. There are ‘high stakes’ associated with all decisions of this type, irrespective of whether the ‘pay-offs’ are measured in monetary or social welfare terms. This explains why governments and firms are prepared to pay for forecasts, which they hope will help them to make better decisions concerning their appropriate future course of action.

As a specific example of the value of forecasts, consider the generation of electricity. It is necessary to forecast short-term electricity demand to ensure the efficient operation of electricity plant. If demand is forecast incorrectly there are associated monetary losses. If demand is higher than forecast, high costs are incurred due to the slow response time of idle plant, the considerable start-up costs of such generating equipment, and the loss of goodwill and revenue. It is also costly if demand is lower than forecast, due to the resulting wastage, since there are only limited ways in which excess power may be stored. To avoid these high losses, it is necessary for power companies to generate power at a level which includes some reserve capacity. Commonly the reserve capacity is made proportional to the average size of the forecast errors: that is the size of the difference between the actual and predicted usage. Hence reducing the size of forecast errors can reduce costs significantly, since less reserve capacity is needed.

The sums of money involved in short term electricity demand forecasting are considerable. In 1984 prices, a 1% reduction in average forecast error would have reduced the yearly operating costs of the UK Central Electricity Generating Board by 10 million pounds sterling. (That is NZ$24.32 million at December 1984 rates, or approximately NZ$41 million in 1999, using the New Zealand PPI for the price adjustment). One in a hundred is a small amount by which to improve a mistake, yet it would have given a saving of 41 million dollars per year in present terms. Several papers concerned with electricity demand forecasting are presented in Bunn and Farmer (1985), while a more recent paper on forecasting electricity demand in New Zealand is Bruce, Jurke and Thomson (1994).

A related electricity demand example concerns the longer-term forecasts needed to schedule the building of electricity generating equipment. As argued by Court (1979), official forecasts of New Zealand
electricity demand in the mid 1970s were unrealistically high and lead to premature investment in electricity generating capacity. Court estimated the deadweight loss to the country was at least NZ$50 million (in 1978 prices, or approximately NZ$181 million in 1999, again using the New Zealand PPI to adjust prices). That loss was calculated as foregone interest, and Court claimed that the associated erosion of amenity and environmental values was considerable.

As the last two examples illustrate, there are large incentives to improve forecast performance. However this raises two further issues: what constitutes a good forecast, and how should forecasters be assessed in a fair way? The world is an uncertain place, and no real process is entirely pre-determined; hence all forecasts are likely to be in error to some degree. The difference between a good and bad forecast should be measured by the size of the forecast error, compared to some reasonable benchmark. It is common to look at the average ‘size’ of the errors (in fact squared errors are usually considered). However, there are times when other types of penalty are more appropriate. As a related example (which concerns measurement error), consider the petrol gauge on a car. Ideally all gauges would be accurate, but if you had to pick the least costly direction of measurement error, you would probably go for a gauge which said you had run out when you hadn’t, rather than one which said you’d got quarter of a tank left when it was empty! Thus in certain situations, the direction of an error can be just as important as its size.

When evaluating forecasts, one forecast is often compared against others. Such comparisons can be misleading though. Imagine I ask 10 different forecasters to forecast five separate processes over a period of time. If I look at the average (squared) error over the five processes for each of the 10 forecasters, I will find the best (or equal best) forecaster. However, it is quite likely that for each of those five processes I can find a time in the period when one of the other nine forecasters did better than my ‘best’ choice. Although such comparisons are not fair, they are frequently made. Performance should be evaluated over a period of time or a range of processes, since a single forecast can be either very good or very bad but that may not accurately reflect the long-run ability of the forecaster or the method used.

If people think of forecasts, they usually expect single numbers – for example, what will New Zealand’s GDP be in 2000? Those people are then critical if the actual figure differs from the forecast. What is both more realistic and more helpful is to give a range of numbers within which the forecaster predicts the actual value to lie. If the true value is not in the forecast range, it is then fair to criticise the forecast. However, since the world is full of unexpected events, realistic forecast intervals are often quite wide, and people unfairly dismiss such intervals as reluctance to give a definite answer on the part of forecasters. Irrespective of the method used to produce a forecast, if a process has a history of large, unpredictable movements, any realistic forecast interval will have to reflect the large range of uncertainty associated with the process.

The crisis in certain Asian economies in the latter half of 1997 is a good recent example of an unforeseen series of events that had dramatic effects on several of the world’s economies. In New Zealand the economic effects of the “Asian crisis” were magnified by two subsequent years of drier than average weather conditions, which detrimentally affected agricultural output. More recent forecasts of domestic interest rates, exchange rates and growth rates have been quite different from those made in 1997, before the Asian difficulties and the
New Zealand “drought” were apparent. A forecast of the future can only reflect what is known at the time the forecast is made; that is, it reflects the available information set.

Since forecasts affect decisions, it is important the decision maker and the forecaster understand each other and work closely together as a team. It is common in business and other economic situations for these two roles to be distinct, though this is clearly not essential. Therefore it is very important that decision makers realise any forecast will be in error, but that good forecasts are very useful when planning future strategy. Having a good idea of the range of likely outcomes for a process obviously helps to plan ahead.

If there are high costs associated with an ‘incorrect’ decision, the decision maker is likely to be prepared to pay a higher price (ceteris paribus) for an accurate forecast. Such a situation is clearly open to abuse by the forecaster, but in fact has an important consequence: there are many ways to forecast the same process, and different approaches cost differing amounts of both time and money (which amount to the same thing if someone else is paying the bill!). One of the skills required to produce ‘good’ forecasts is to find the best pairing for a client of relative forecast accuracy and affordability of the forecasting procedure. In some cases, the decision maker will want to understand why a forecast takes its particular value, while in other situations they may simply wish to know what will happen, so they can act accordingly. That is a bit like not needing to know how to build an engine in order to drive a car.

This short article has concentrated on the practical side of forecasting. We highlighted how even small improvements in forecast quality can lead to huge savings in certain areas. It was also suggested that forecasts are often assessed in an unrealistic way, since errors are to be expected, even with very good forecasts. What is important is that sensible use is made by planners of the accurate reflection of the uncertainty present in the real world. However, forecasting is also a vibrant field of academic research, where many important theoretical and practical innovations are made every year. Such innovations often become standard practice for practical forecasters, a few years after they were first proposed. For those curious to know more, a good introduction to the wide range of approaches to business and economic forecasting can be found in textbooks such as Granger (1989), Makridakis, Wheelwright and Hyndman (1998), and Newbold and Bos (1994). Most universities also offer courses at various levels, either exclusively on forecasting or with a sizeable forecasting content.

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**ENDNOTE**

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