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Order effects in judgmental forecasting

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ABSTRACT

In two experiments, forecasters produced a sequence of five forecasts from different types of time series, either from the nearest horizon to the most distant one (1, 2, 3, 4, 5) or in one of two other orders, both of which required the forecast for the most distant horizon to be made first ('end-anchoring'). These latter two orders differed in terms of the direction of the remaining forecasts: either a horizon-increasing order (1, 2, 3, 4) or a horizon-decreasing one (4, 3, 2, 1). End-anchoring improved the forecast accuracy, especially for more distant horizons, and resulted in the trajectory of the forecast sequence being closer to the optimal one. The direction of forecasting after end-anchoring affected the forecast quality only when the optimal trajectory of the forecast sequence displayed a strong nonlinearity. End-anchoring provides a simple means of enhancing judgmental forecasts when predictions for a number of horizons are being produced from each series.

1. Introduction

There is now a large corpus of research on judgmental forecasting (Lawrence, Goodwin, O'Connor, & Önkal, 2006). Although some studies have found judgmental forecasts to be as accurate as statistical ones (e.g., Lawrence, Edmundson, & O'Connor, 1985), others have shown them to be subject to a number of systematic errors or biases (e.g., Carbone & Gorr, 1985; Sanders, 1992). Examples of such errors include those that occur when people damp trends by producing a sequence of forecasts with a trend that is less steep than that in the data series (Eggleton, 1982; Harvey & Reimers, 2013; Lawrence & Makridakis, 1989); when they overestimate the degree of sequential dependence in independent series (Bolger & Harvey, 1993; Eggleton, 1982; Reimers & Harvey, 2011); when they add noise to their sequence of forecasts in proportion to the level of noise in the data series (Harvey, 1995; Harvey, Ewart, & West, 1997); and when they make higher forecasts for desirable outcomes than for undesirable outcomes, possibly because action can be expected to be taken to prevent increases in the latter case (Eggleton, 1982; Harvey & Reimers, 2013; Lawrence & Makridakis, 1989).

Techniques that have been found to improve judgmental forecasts include training with feedback (Goodwin & Fildes, 1999; Goodwin, Önkal-Atay, Thomson, Pollock, & Macaulay, 2004), decomposing the forecasting task by making a separate estimate for each component of the time series and then combining them (Edmundson, 1990; Webby, O'Connor, & Edmundson, 2005), combining predictions from a number of forecasters (Clemen, 1989), and taking advice (Goodwin, Gönül, & Önkal, 2013; Lim & O'Connor, 1995). Unfortunately, most of these sorts of techniques impose heavy additional costs in terms of time, money or effort.

The above findings are based primarily on research into point forecasts for the immediate horizon (i.e., the next data point after the most recently observed one). There have been fewer studies into judgmental forecasts for more distant horizons (i.e., data points beyond the most recently observed one). Here, we have two main aims. First, we shall investigate factors that affect the forecast accuracy differentially for different horizons. Second, we shall use our

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findings to identify a very low cost technique for improving judgmental forecasts, particularly those for more distant horizons.

In the next section, we provide a brief review of the research on the effects of the horizon on judgmental forecasting. Then, we introduce the two factors that we manipulate in our experiments and outline our hypotheses about their effects.

1.1. Effects of forecast horizon

Uncertainty increases as we progress into the future. Hence, except when data series possess unique short-term volatility characteristics (Thomson, Pollock, Henriksen, & Macaulay, 2004), both statistically-based and judgmental forecasts tend to be worse for more distant forecast horizons (Lawrence et al., 1985). The rate of deterioration, measured by the increase in the mean absolute percentage error (MAPE), is broadly similar for the two types of forecast (Lawrence, Edmundson, & O'Connor, 1986), but the reasons for it differ. As we saw above, judgmental forecasts, unlike most statistical forecasts, show trend damping. This causes their directional error to increase over the forecast horizon (Harvey & Reimers, 2013; Lawrence & Makridakis, 1989). What potential explanations are there for this increase in error with the increasing horizon?

When making forecasts for the first horizon, people appear to use the last data point as a mental anchor and then make some adjustment away from that point in order to take the pattern of the series into account. Typically, these adjustments are insufficient.[1] As a result, trend damping is observed with trended series, while the forecasts from non-trended series appear to exaggerate the sequential dependence in the data. Furthermore, people add random noise to the result of the anchoring and adjustment process when producing their forecasts (Harvey, 1995; Harvey et al., 1997). One possible explanation for this phenomenon is that forecasters add noise, either intuitively or deliberately, in order to make their sequence of forecasts appear more representative of the data series presented (Harvey, 1995).

Bolger and Harvey's (1993) analysis of their experiments showed that the forecasts for longer horizons are made in a similar way, except that the previous forecast is used as a mental anchor rather than the last data point. If their account is correct, then the random noise added to previous forecasts would accumulate as people make forecasts for increasingly distant horizons. If this accumulation of random noise could be eliminated, the forecasts for these more distant horizons would improve in accuracy, and the variability across forecasters in the trajectory of the forecast sequence would be reduced.

1.2. End-anchoring

The theoretical analysis presented in the previous section suggests that the forecasting performance could be improved by preventing forecasts for horizons beyond the first one from being made in sequence, and therefore accumulating the random errors associated with each one. One obvious way of doing this is to ask forecasters to forecast the most distant horizon first. We might assume that forecasters will do this using the anchoring and adjustment heuristic that is normally used for making initial forecasts. For example, for trended series, instead of making a forecast for the first horizon by anchoring on the last data point and adjusting away from that value by a proportion (P) of the difference between the last two data points (Bolger & Harvey, 1993), they could make a forecast for, say, the fifth horizon by anchoring on the last data point and adjusting away from that value by $5P$ (i.e., five times the size of the adjustment used when forecasting for the first horizon rather than the fifth).

Forecasters may find making an initial forecast for the most distant horizon more difficult than for the first horizon, and it may take them a little longer. However, once that forecast has been made, their task is transformed from one of extrapolation to one of interpolation.

We would expect the greatest improvement from this manipulation to occur for the forecast of the most distant horizon, as this is the horizon that would be affected most by the accumulation of the noise components in the previous forecasts. However, because interpolation is a more constrained task than extrapolation, the end-anchoring achieved by making an initial forecast for the most distant horizon may also improve the forecasts for less distant horizons. To produce the intervening forecasts, people may simply use linear interpolation between the last data point and their forecast for the most distant horizon. We would still expect them to add a noise component to each forecast in this interpolation (Harvey, 1995), but this would not determine the trajectory of the forecast sequence.

Based on the above rationale, we will test the following hypotheses.

H_1: Requiring forecasters' initial forecast to be for the most distant horizon will produce more accurate forecasts for that horizon than when they forecast it last.

H_2: Requiring forecasters to make their forecast for the most distant horizon first rather than last will also increase the accuracy of the forecasts for less distant horizons.

1.3. Reversing the direction of the forecasting

Once forecasters have made their initial forecast for the most distant horizon, they could proceed in one of two ways. First, they could forecast from the last data point towards their existing forecast for the most distant horizon, and thus, the forecasts for five horizons would be made in the order: 5, 1, 2, 3, 4, where lower numbers represent shorter horizons. This will be referred to as *horizon-increasing forecasting*. Alternatively, they could make forecasts in the reverse direction, working from their initial forecast for the most distant horizon back towards the last data point. Thus, if forecasts for five horizons were required, they would make them in the order: 5, 4, 3, 2, 1, where lower numbers again represent shorter horizons. We shall refer to this as *horizon-decreasing*

[1] When trends are very shallow, the opposite of trend damping ('anti-damping') is observed (Harvey & Reimers, 2013).