An Exponential Smoothing Model with a Life Cycle Trend

OPRE-2019-06-267

13 August 2019

This paper introduces a new model for life cycle trends which has some advantages over existing models. In particular, it is an extension of existing exponential smoothing models, it allows for full probabilistic forecasting, and it appears to be relatively accurate compared to the main competitor models.

A few minor comments follow.

1. p3, l13. The M4 competition required participants to make prediction intervals at a single forecast horizon, not rolling quantile forecasts. Also, the data were not all macroeconomic.
2. p4–5 I had to read these pages a couple of times before realising that you were not saying the data follow a tilted-Gompertz distribution, but that the trend had a shape described by the tilted-Gompertz density function. This could be made clearer.
3. p6, eq (1). This model is numerically unstable due to the division by ℓ_{t-1}. See Ch 15 of Hyndman et al. (2008).
4. p7. There doesn't seem much benefit using the notation $1 + \varepsilon_t$ in (2) when you never use the ε_t's directly. Why not replace $(1 + \varepsilon_t)$ with e_t^{ε}? where ε_t is normally distributed.
5. p7. It is perhaps worth pointing out that setting $\tau = 1$ leads to something similar to an ETS(M,Md,M) model — the only difference being the log normal distribution rather than a normal distribution on the errors.
6. Section 2.3. The connection between the forecast function (7) and the tilted-Gompertz diffusion model is worth noting in passing, but it seems to get far more attention than it deserves. It is not clear to me how this connection leads to any insights or results that help in forecasting of life-cycle trends. If space is an issue, this is a section that could be reduced without losing the main value of the paper.
7. p19. It is a little odd to evaluate the median as a point forecast using RMSE or MAPE, neither of which lead to the median as the optimal point forecast. Since you are using pinball loss, why not average the pinball loss over a fine grid of quantiles to get something equivalent to CRPS?
8. p21. Surely the prior distributions for α and β^* are not identical for all 170 series? How do the authors explain this?
9. p23. In the simultation study, did you generate data for the full life-cycle, or a partial life-cycle? Only the latter gives useful results here as there is no need to forecast full life-cycles. Assuming you simulated partial life-cycles, how was the time of the last observation determined?
10. p24. The ETS(A,Md,N) model is numerically unstable and not recommended by Hyndman et al.
11. p38. The details of Holt (1957) are incorrect. The title was 'Forecasting trends and seasonal by exponentially weighted averages'. The 2004 version is correctly listed (with a different title).

References

Hyndman, RJ, AB Koehler, JK Ord & RD Snyder (2008). *Forecasting with exponential smoothing: the state space approach*. Berlin: Springer-Verlag.