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The admissible parameter space for exponential smoothing models

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Abstract We discuss the admissible parameter space for some state space models, including the models that underly exponential smoothing methods. We find that the usual parameter restrictions (requiring all smoothing parameters to lie between 0 and 1) do not always lead to stable models. We also find that all seasonal exponential smoothing methods are unstable as the underlying state space models are neither reachable nor observable. This instability does not affect the forecasts, but does corrupt the state estimates. The problem can be overcome with a simple normalizing procedure. Finally we show that the admissible parameter space of a seasonal exponential smoothing model is much larger than that for a basic structural model, leading to better forecasts from the exponential smoothing model when there is a rapidly changing seasonal pattern.

Keywords Exponential smoothing · Invertibility · Observability · Parameter space · Reachability · Stability · State space models · Structural models