

# Time is limited on the road to asymptopia

## Asking the ergodicity question when validating ABMs

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### Abstract

One challenge in the empirical validation of financial market agent-based models (FABMs) is how to infer reliable insights using numerical simulations calibrated by only a unique single observed time series. Ergodicity (besides stationarity) is a precondition in any estimation-related task, however it has not been systematically explored and is therefore often simply presumed. For non-ergodic observables it remains largely unclear how to deal with the associated uncertainty. Here we show how an understanding of the ergodic properties of moments can help to improve the validation and calibration of ABMs. We take two prototype FABMs and run Monte Carlo experiments to study the convergence behaviour of moments. We find that for most moments the convergence times are infeasibly long, thus leaving us in pre-asymptopia. Choosing an efficient mix of ensemble size and simulated time length can help guiding validation efforts through this jungle of uncertainty.

20 **Keywords** Broken Ergodicity, Simulated Method of Moments, Validation, Calibration, Agent-based Models

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