

Agent-Based Modeling and Strategic Interaction among macro-level actors: A systematic Literature Review

The geo-economic and security context has been changing at an accelerating rate since Russia's invasion of Ukraine. The fading US hegemony and the progressive return to multipolarity have revived interest in the study of strategic interactions.

However, despite the increasing availability of data, quantitative empirical analysis still proves a difficult task as events are rare and data remains of relatively poor quality (Mearsheimer and Walt, 2013; Demarest et al. 2019). Alternative approaches have focused on the use of counterfactuals (Fearon, 1991). However, the analytical utility of counterfactuals as a standalone method is limited in complex strategic environments, where causal relationships are neither stable nor isolable. Robert Jervis (1997) highlights the nonlinear and interactive nature of such systems, while Richard Ned Lebow (2010, 2015) underscores the extent to which causal inferences are context-dependent and epistemologically contingent.

A potential way to address this problem is to incorporate simulations in the empirical analysis. One approach particularly well-suited to capturing adaptive behavior is Agent-Based Modelling. Despite the rapid growth of Agent-Based Modelling applications across disciplines (Achter et al. 2024), to our knowledge no systematic review has examined how this methodology has been deployed to study strategic interactions between states, political groups, or geopolitically significant organizations.

This study conducts a systematic literature review in accordance with the PRISMA methodology. The primary objective is to classify the use cases primarily across domains (e.g. cooperation, deterrence, coercion, collusion ...) and research typology (i.e. descriptive, explorative, explanatory, causal, experimental, applied ...). In doing so, we aim to answer in which research contexts and applications ABM provides a useful methodological complement to model strategic interactions among macro-level actors.

The paper's main contribution is to investigate how ABM can be more rigorously integrated into the study of strategic interactions.

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