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Forecasting games: can game theory win?

Paul Goodwin*

School of Management, University of Bath, Claverton Down, Bath BA2 7AY, UK

Abstract

I present evidence to suggest that studying the use of game theory in prediction is a legitimate area of research and suggest ways in which game theory might be used to make or support predictions. Green's study predominately assesses the accuracy of predictions by game theorists (who *may* have made informal use of game theory concepts) rather than predictions obtained from formal game theory models. I argue that the accuracy of predictions derived from such models is likely to be contingent on the characteristics of the conflict and provide a partial taxonomy of these characteristics, together with their hypothesised effects. I also argue that it would be worth investigating the potential use of game theory as an aid to obtaining probabilistic predictions. © 2002 International Institute of Forecasters. Published by Elsevier Science B.V. All rights reserved.

1. Introduction

The paper by Green (2002) deals with a fascinating and important area, namely the prediction of outcomes of conflicts. The paper extends earlier work, reported in Armstrong (2001), which has shown that the use of role playing to predict the outcomes of conflicts leads to forecasts that are significantly more accurate than those obtained through unaided expert judgment. In the current paper, the focus is on the relative accuracy of forecasts obtained through role-playing and game theory. This commentary addresses four questions: (i) Is it legitimate to study the use of game theory for prediction? (ii) Is game theory being assessed in

the study, or game theorists? (iii) To what extent can we draw practical inferences from the results of the study. (iv) Where should future research effort be directed?

2. Game theory and prediction

A key question underlying the paper is: *should game theory be used for prediction* or is it essentially a prescriptive tool designed to aid decision-makers who have to make strategic choices under conditions of conflict? There are close parallels with decision analysis here. Much evidence suggests that *unaided* decision-makers do not make choices consistent with those suggested by decision analysis (Goodwin & Wright, 1998). Allais's paradox (Allais, 1953) where people violate the prescriptions of utility theory, is a famous example of this.

*Tel.: +44-122-532-3594; fax: +44-122-582-6473.

E-mail address: mnspg@management.bath.ac.uk (P. Goodwin).

Factors like habit, the inability of decision makers to process all of the information associated with a decision, and the consequent use of mental heuristics (Goodwin & Wright, 2001; Tversky & Kahneman, 1974), are all likely to lead to discrepancies between what people choose and what normative methods say they should choose. Indeed, the *raison d'être* of a prescriptive technique is that the unaided decision maker would make a different (inferior) decision to that prescribed by the technique.

However, two factors suggest that the use of game theory in forecasting *is* a legitimate area for investigation. First, I selected a convenience sample of six introductory textbooks on game theory and found that two of these suggest that the technique does have value as a forecasting method. For example, Dixit and Skeath (1999), in their book 'Games of Strategy', state:

The second use (of Game Theory) is in prediction. When looking ahead to situations where multiple decision makers will interact strategically, we can use game theory to foresee what actions they will take and what outcomes will result.

Indeed, as Hargreaves, Heap, and Varoufakis (1995) point out, regarding game theory as merely a prescriptive technique would: "greatly undermine [its] attraction since the arresting claim of game theory is that it can be used to explain social interactions". Explanation is, of course, a necessary precursor of insightful prediction.

Second, game theory *is being used* as a predictive technique in practical contexts. For example, Decision Insights Inc. of New York, who claim to work with Fortune 500 companies, government institutions and investment banks, amongst others, state on their website (www.diiusa.com) that they:

... develop practical game theory models

... to [inter alia] forecast the outcome of political events that influence business activity.

3. Game theory or game theorists?

The second main question about the paper is: *is game theory being assessed or game theorists?* To consider this, it may be instructive to consider the possible approaches a game theorist might adopt when faced with the task of prediction. The 'purest' approach would involve the exclusive use of a game theory model to derive the prediction. To achieve this the game theorist would, ideally, need to obtain information on factors such as the number of players, the strategies available to the players, and the players' utilities (which are likely to be multiattributed) for all strategy combinations. In addition to this, information on the type of game would be required. For example, do the players determine their moves sequentially or simultaneously; do all the players have full information or is some information known only to certain players; can the rules of the game be manipulated; are agreements enforceable? While modern game theory is capable of handling a diverse range of game types, much of this information may be difficult to obtain. For example, determining players' multi-attribute utilities will be dependent on having knowledge of their value systems and attitudes to risk. When this knowledge is not available, approximations or assumptions will be required. For example, a multiattribute utility function might be approximated by ranks designed to reflect the relative attractiveness of a game's outcomes to a given player. Sensitivity analysis may be useful in situations like this to determine the robustness of predictions to changing assumptions. Nevertheless, inadequate models may still lead to erroneous predictions. For example, in ex-

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