

CAPABILITIES OF EXPERIMENTAL BUSINESS GAMING

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ABSTRACT

Throughout the history of the field, business games have been used for basic research, but business games offer a greater potential for research than has been realized. Comparisons between the fields empirical industrial organization, experimental economics and business gaming show capabilities for research with business games. This paper helps to develop opportunities for using business games as experiments.

INTRODUCTION

The use of business games for experiments has a long history (Faria, 2001; Shubik, 2001). Keys and Wolfe (1990) summarized their review on gaming with the forecast that perhaps the most important use of the games will be as research laboratories. Dickinson, Gentry and Burns (2004) stated that business research mostly is either oriented to the design of simulation games or to the use of games in education and training. Their seminal review showed that the potential for using business games for basic research has not fully been realized. This paper helps to develop opportunities for research with business games.

While the main purpose of business games is to teach the participants about markets and behavior of firms (Washbush and Gosen, 2001), there are a number of fields that study the functioning of markets and the decision making of firms; for example marketing, strategic management, management science and industrial organization. Specifically, industrial organization studies the structure of firms and markets and of their interactions (Carlton and Perloff, 1994). Industrial organization has two approaches: one theoretical, where relations between variables are described with theories, one empirical with data from real markets, where theories are tested and relations between variables are studied. Theories in industrial organization are also tested with experiments (Holt, 1995). The advantage with experiments over the empirical approach with data from real markets is that the models of the markets and the data can be controlled in the experiments.

Experiments are common in psychology and in experimental economics. Experiments in these fields are conducted and reported in standardized ways. Experimental economics mainly tests economic theory with comparisons to solution concepts, but it is also used to establish empirical regularities of behavior as a basis for new theory (Tirole, 1988; Smith, 1994). Business games on the other hand

capture the essence of how reality is related to the purpose of playing them (Feinstein and Cannon, 2002 and 2003). That is, a model in experimental economics represents a theory while a business game represents a real market. This paper shows how basic research with business games as experiments, here called experimental business gaming (Shubik, 2001), can take a similar approach as experimental economics.

The paper has the disposition as follows. The fields empirical industrial organization, experimental economics and business gaming are briefly described. The capability for research with business games is shown with comparisons between the fields. Opportunities for experimental business gaming are described. Some challenges and solutions are presented, and finally the capabilities are discussed.

EMPIRICAL INDUSTRIAL ORGANIZATION

Empirical data from real markets have been used for research for a long time (Bresnahan, 1989; Scherer and Ross, 1990; Schmalensee, 1989). The field is here called empirical industrial organization, and it is defined with the paradigm known as the "structure-conduct-performance" paradigm. To simplify, structure refers to how many firms compete in the market, conduct refers to the decisions the firms make, and performance refers to the profits the firms make.

The main theory in the paradigm is that the number of competitors and profits are negatively related, that is, profits decrease when the number of competitors increases. This relationship is tested with econometric models. Some support has been found for this relationship, but the results have also been criticized. Many problems interfere with the reliability estimation of the econometric models. Among them are definitions of industries, firms and products, and measurement problems of profits, prices and costs. The complexity of real markets, with a number of variables and also the dynamics in the market, make analysis and relationships complex as well. However, a number of empirical regularities have been found and presented as stylized facts and a large number of articles are published in the field, testing theories or generating hypotheses from observed behavior in the market.

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EXPERIMENTAL ECONOMICS

Experimental economics has a number of handbooks (Smith, 1991; Hey 1991; Davis and Holt, 1994; Friedman and Sunder, 1994; Kagel and Roth 1995), and the results of the experiments are published in a number of economic journals. The articles describe the economic models and instructions in full detail, so that when the experiments are repeated, the same results are expected from one time to another. Experimental economics in this section and business gaming in the next section are briefly described with the use of the standard for reporting experiment in the American Psychological Association Publication Manual (2001). The order of subsections in the method section is participants, apparatus (here called model or business game), and procedures. Then in the result section, decisions and actions of the participants as well as the outcomes are analyzed.

Participants. The participants are usually students. They are recruited on voluntary basis. The purpose of their participation is research and they are not expected to learn from the experiment.

Models. The models are described in full detail and optimal solutions are determined. Most experiments consist of one decision variable. The models are static, but since the decision making could be made repeatedly, the decision making can be perceived as dynamic.

Procedure. Experimental laboratories are used so the participants can be controlled, and participants interact only when the experiment requires interaction. The instructions are precise and are read to the participants. The information the participants can use is controlled. The outcomes of the decisions are converted to monetary rewards, and the participants act to earn as much money in the experiments as possible. They receive proportional monetary rewards to the profits they earn.

Results. Decisions and outcomes are compared to solution concepts, and comparisons are also made between treatments in the experiments. The main question is if theories of competition give a good description of the decisions made in the experiments. Regularities in decisions, stylized facts, are studied as basis for new theory.

BUSINESS GAMING

A large number of business games exist and they are extensively used in academia and in business (Faria, 1987 and 1998; Faria and Wellington, 2004). Business gaming is briefly described in comparison to experimental economics (e.g., Elgood, 1988).

Participants. The participants consist of both students and professionals. Compared to experimental economics playing of the business games is usually part of a course or for training where participation is mandatory. The emphasis is to learn about features in real markets. Groups of participants are usually the decision makers.

Business games. Compared to models in experimental economics, business games usually have more than one decision variable and they also have dynamic properties (Gold and Pray, 2001; Thavikulwat, 2004). Context and realism of the games are important and they are often discussed at debriefings.

Procedure. Business games can be played for a few hours or up to a semester. The rules can be extensive. When the games are played in between classes, the information the participants use is not controlled. The reward for students playing can be part of a grade, and for professionals, the honor of winning.

Results. Both decisions and outcomes are discussed at debriefings, but due to the complexity of the games, focus is usually on outcomes. Comparisons of outcomes are often limited to the firms in the same game session. Theories of behavior are discussed.

COMPARISONS BETWEEN FIELDS

The purpose of Table 1 is to show generalizations of empirical industrial organization, experimental economics and business gaming. It should be pointed out that there are exceptions to the table.

Table 1 shows that most aspects of empirical industrial organization and of experimental economics differ. The models of markets tested in experimental economics are too simple compared to the reality they represent and they do not reflect the complexity studied in empirical industrial organization. If the fields produce different results, there are a number of sources that could account for the differences. Thus, there is a gap between these two fields.

Many aspects are similar in empirical industrial organization and in business gaming: the decision makers could be the same, real markets and models in business games have a number of decision variables and are dynamic, the time for decision making could be longer than a few hours, additional sources of information could be used for decision making, and there could be multiple objectives.

The similarities between experimental economics and business gaming are that both use models to control the market and the results could be compared to theory. The number of decision variables and the dynamic properties in models can be defined as complexity of the models. The main difference between the two fields is the higher complexity in business gaming compared to experimental economics. Since complexity is an important aspect of real markets (Heiner, 1983), there is a need for conducting experiments with more complex and realistic models. Figure 1 shows how experimental business gaming can fill the gap between empirical industrial organization and experimental economics. That is, the aspects of business gaming, with relatively complex game models, make it a useful complement to both empirical industrial organization and experimental economics.

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Table 1: Comparison between empirical industrial organization, experimental economics and business gaming.

	Empirical industrial organization	Experimental economics	Business gaming
Participants	professionals	students	students, professionals
Decision maker	individual/groups	individual	groups
Purpose	profit in real market	research	learning, assessment
Models	dynamic	static	dynamic
Decision variable	≥ 1	1	≥ 1
Solution concept	not available	analytical	numerical
Context	business	sparse	story
Procedure	open	controlled	open
Duration of play/time	hours – years	< 2 hours	≥ 2 hours – 1 semester
Readings	reports, literature	sparse	literature
Objective	multiple objectives	profit	multiple objectives
Rewards	salary, bonus	monetary	grades, assessment
Participation	mandatory	voluntary	mandatory
After playing	analysis	payment	debriefing
Results			
Analysis	econometric	econometric	comparisons
Research interest	decisions and profits market structure	decisions and profits	assessment of learning design of games

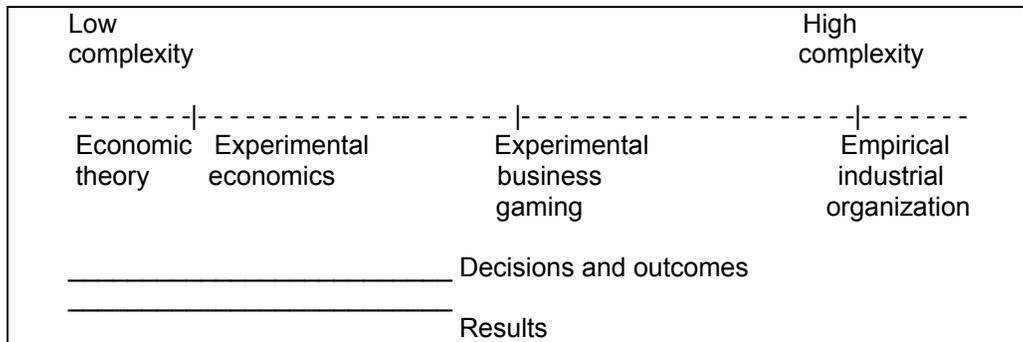


Figure 1: Complexity in economic theory, experimental economics, experimental business gaming and empirical industrial organization.

The results, i.e., decisions and outcomes, in experimental business gaming can be compared to results in empirical industrial organization and in experimental economics, and also to economic theory. Basic research with business games as experiments has the capability to provide important insights to:

- (1) Test an economic theory, where experimental economics may be the first step and experimental business gaming the second step, before searching empirical evidence in real markets
- (2) Explore empirical regularities observed in real markets, where experimental business gaming may be the first step and experimental economics the second step before formulating economic theory
- (3) Generate hypotheses of behavior that can be compared to real markets, experimental economics and to economic theory

The following exemplifies the capability.

- (1) In economic theory, the level of competition is related to the number of firms competing in the same market (Tirole, 1988). Support has been found for this theory in experimental economics for three and more firms (Dufwenberg and Gneezy, 2000; Huck, Normann, Oeschssler, 2004). Experimental business gaming can study if this relationship exists with higher complexity, whereas empirical evidence for the relationship from real markets has not been conclusive (Schmalensee, 1989).
- (2) Price rigidity has been found in real markets (Carlton, 1986; Blinder, Cancetti, Lebow and Rudd, 1998) and in experimental business gaming (Edman, 2004), whereas price rigidity has rarely been reported in experimental economics.

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- (3) Edman (2004) observed in a business game that decisions were dispersed in prices and even more in advertising, while Baye and Morgan (2004) observed price dispersion in real markets and in experimental economics, and provided theoretical result for price dispersion.

EXPERIMENTAL BUSINESS GAMING

Next, research opportunities for experimental business gaming is presented. The experiments can, as a starting point, be conducted with the original procedures of business gaming presented in Table 1. Thus, the insights are limited to experiments with these procedures.

Participants. The fact that both students and professionals regularly play the business games gives the opportunity to analyze if results between them differ; for example, some regularities in decisions may be observed in the behavior of professionals but not in the behavior of students, or vice versa. Also, since business games are played in groups, there is an opportunity to follow discussions when decisions are made, and opinions of individuals can be captured. When a business game is played with similar participants and the same procedure in different locations or at different times, the game is replicated. Since business games are played regularly in many locations, results from the playing of the games can be obtained. For consistency, same or similar results are expected from one time to another. Differences in results provide a research opportunity, where causes for the different results can be studied.

Business games. For business games, the results of altering the number of firms competing in the same market and parameters, for example parameters for the dynamic properties in the game, need to be studied. Also, the effect of different levels of complexity and context in business games provides research opportunities (Shubik, 2001). Furthermore, if optimal solutions can be determined, comparisons can be made to results in the games (Edman, 2005).

Procedures. The information about feedback from results can be altered to find out what information the participants respond to and what information has only marginal effect or no effect (Edman, 2004). If the participants in the firms are required to write strategies, the strategic decision making process could be studied (Segev, 1987; Dutton and Stumpf, 1991). Furthermore, the objectives for playing the games can be altered so targets need to be met to obtain bonuses. Also, the original procedures for playing the games can be altered towards the procedures in experimental economics, without reducing learning and the gaming experience for the participants.

Results. The results consist of a number of decision and outcome variables for a number of firms over a number of periods. With sufficient repetitions of the playing of a business game, statistical tests can be used. Earlier research in empirical industrial organization and experimental

economics provides a good start for analyzing the results of business games. Still, there is an opportunity to improve the methodology when studying complexity, where business games have the advantages over real markets since the models and data are controlled. Both Simon (1991) and Smith (1994) emphasized the value of experimentation without an independent variable, that is, behavior in different experimental situations is of interest to study. Analysis of the results will increase the general knowledge of how participants play business games. Comparisons can be made to results in empirical industrial organization and experimental economics. Regularities in decisions (Shubik, 2002), stylized facts, provide insights into how firms compete in markets as well as into deficiencies and flaws in decision-making (March, 1994; Plous, 1993); for example, rigidity in decisions, sunk cost and overly competitive behavior. Furthermore, the use of decision rules in decision making can be explored in a complex environment (Rassenti, Reynolds, Smith and Szidarovszky, 2000). Moreover, one treatment variable could be altered at the time in experiments, and the results before and after the alterations could be compared.

CHALLENGES

Experimental business gaming has some challenges to face. First, in order to provide insights into the field industrial organization, business games used for research need to be related to findings in empirical industrial organization or to economic theory (Bresnahan, 1989; Gold and Pray, 2001; Thavikulwat, 2004; Tirole, 1988). Second, results from the playing of the games need to be recorded and stored. Information is needed about the participants, the design of the games, the procedures and the results (Friedman and Sunder, 1994). Third, published research needs to have information included about game design and the results of playing the game. It is not completely understood what effect access to such information has on decisions when playing a game. There are several solutions to this challenge. The name of the game could be kept secret or the game can be played with different sets of parameters. It should, however, be pointed out that professionals in real markets are likely to have some prior information and even some research about the market where they make decisions. Additionally, there is a research opportunity to study the effect of prior knowledge about a game when playing it.

DISCUSSION

Regularities in behavior when business games are played are studied in experimental business gaming. An important gap between empirical industrial organization and experimental economics can be filled, as experiments with business games provide significant insights into decision making in complex but controlled situations. A number of opportunities are open for basic research with business

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games. The field of business gaming has potential to develop and to grow if these opportunities are taken.

The insights into how participants play games also increase the general knowledge about simulation and gaming (Wolfe and Crookall, 1998). This is useful when selecting a game for educational purpose and when designing new business games. Since decisions made in when playing a business game reflect knowledge and learning, analyses of decisions can be used when assessing learning, identifying and addressing learning needs, and to improve debriefings (Lederman Costigan, 1992; Peters and Vissers, 2004). Finally, comparisons between behavior in business games, in empirical industrial organization and in experimental economics and to economic theory add to the listing of what business game can teach (Washbush and Gosen, 2001).

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