EXPERIMENT IN ECONOMICS

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Abstract

In contrast to sciences such as physics, chemistry and psychology, using experimental methods in economics has encountered significant resistance reaching as far back as Mill. The basic reason for the resistance is the widely accepted view that experiment is not suited to analyzing complex human activity including economic behaviors. However, experimental studies, which started to test economics theories from the 1940s, have now reached an important point. The purpose of this study is to show how economics arrived to this point and outline the effect of experimental studies on the future of economics.

Key Words: Experiment, Laboratory Experiment, Field Experiment
JEL Classification: C9

1. INTRODUCTION

Historically, scientific experiment has been used as a tool reaching for improving knowledge that can be applied universally and reliably. This knowledge is based on the combination of rational thinking and empirical evidence. Therefore, experiment is identified most strongly with the idea of science (Smith, 2002:32).

The debate on the importance of experimental methods was first seen in the 17th and 18th centuries. At this time, experiments first became considered to be a major source of achieving knowledge in the different scientific fields. However, although the experimental method has functioned as an important device for enabling human progress, its use has been uneven across the sciences. It was first used in the natural sciences, particularly for physics, chemistry and biology. Then, in the late 19th century the social sciences adopted the procedures and methods of the natural sciences. The influence on social sciences of the fundamental changes that had taken place in the natural sciences were transferred to the field of psychology, with experiments in the Leipzig laboratory built Wilhem Wuntd in 1897. Despite these developments it was not until the middle of 20th century that this method was first used in economics. In this point, as asked by Starmer (1999),

there is an important question: although experimental method has contributed so much to the development of knowledge in the natural sciences, why has experimental method played a less significant role in economics?

The purposes of this study are to reveal the discussions behind whether or not to use experimental method in economics and second to show the effects of using experiment on economics. In order to achieve these objectives, first, the arguments against the use of experimental method in economics are considered. Second, studies which use the experimental method are discussed at the market and individual level. Finally, the problem of external validity of the economic experiments is assessed.

2. THE ARGUMENTS AGAINST THE USE OF EXPERIMENTS IN ECONOMICS

One of the key quotes justifying the failure to use experiments in economic is by Samuelson and Nordhaus who argue that:

> One possible way of figuring out economics laws…..is by controlled experiments…..Economists (unfortunately)…..cannot perform the controlled experiments of chemists or biologists because they cannot easily control other important factors. Like astronomers or meteorologists, they generally must be content largely to observe (Samuelson & Nordhaus, 1985:8).

Although these authors made this claim in 1985, according to Leonard and Fontaine the idea that the experimental method is not a suitable tool for economists and can be traced back to J. S. Mill (2005:1). In Mill's view (1970), discovering the laws of economics using experiments was problematic because of both the nature of the experimental method and the impossibility of it being applied to complex social issues. *In Essays on Economics and Society Part I,* after explaining concepts such as "crucial experiments", "recorded experiments", "decisive experiment", "extensive experiment" and "actual experiment", Mill concludes that moral sciences (meaning social sciences), in contrast to the natural sciences, cannot use controlled experiments (Mill, 1967).

According to Sagal (1977:154) the strongest statement for non-empiricist methodologies in the English speaking world is attributed to Lionel Robbins. In *An Essay on the Nature and Significance of Economic Science*, which is accepted for its fundamental importance to the methodological debate in economics, Robbins (1984:104) explains his ideas on the nature of economic methodology. He argues that in terms of both method and issues economic science is

considerably different from the natural sciences. According to Robbins (1981:2), while in the natural sciences a quantitative relationship can be easily ascertained, establishing a causal connection is not possible in economics due to the nature of economic behavior.

Thus a number of important economists argue that economics is a science that is based on the study of complex behavior of people setting it aside from the natural sciences. It is for this reason that experimental methods are considered to be unsuitable for economics issues. Although this idea has dominated economic thought for centuries, subsequent editions of Samuelson and Nordhaus' book have excluded the quote above, thus signifying a breaking point with the tradition on non-experimental methodologies. In the next section, it will be shown how this change was achieved by economic studies using the experimental method.

3. THE PERIOD OF THE USE OF EXPERIMENTS IN ECONOMICS

3.1. Experiments at the Market Level

Scholars such as Roth (1995), Butler and Hey (1987), and Sugden (2005) argue that an early experiment in the organization of markets reported by Chamberlin in 1948 exerted a major influence on modern experimentation. Chamberlin's purpose was to test perfect competition in order to prove his theory of monopolistic competition by implying that commercial activity in the real market would not generate perfect competition (Dimand, 2005:6).

Chamberlin, by using PhD students in his class, created an artificial market based on many traders and imperfect information. The outcome was that the actual volume of sales differed substantially from the equilibrium volume. Based on this outcome Chamberlin states a "proposition which must be of substantial importance in applying theory to the real economic world, since all actual markets, whether purely or monopolistically competitive, are more or less imperfect" (1948:97). Friedman and Cassar (2004:84) argue the importance of Chamberlin's experiments was that it opened the door to the importance of induced values and market institutions in experimental economics.

In the wake of Chamberlin's research other researchers conducted experiments by establishing simulated markets in the class to establish if people behave according to theory. In 1960 a joint experiment between the psychologist Siegel and the economist Fouraker looked at bargaining between two competitors under conditions of incomplete information in which both buyers and sellers know only their own payoff in a bilateral monopoly context. They reported that negotiated prices, unlike negotiated quantities, are influenced not only by economic

considerations but also by psychological, historical, and cultural forces. In fact, Siegel and Fouraker (1960: v) argue one of the most important features of this study is that it benefits from an interdisciplinary study.

In 1962 Smith, who became a key pioneer of experimental economics, carried out his first experiment in the auction market, which he published as "An Experimental Study of Competitive Market Behavior" in the *Journal of Political Economy*. In this study Smith performed an experiment based on Chamberlin's study with a number of changes in order to test assumptions underpinning neoclassical competitive market theory. Smith considered the design of Chamberlin's experiment to be faulty and that by altering the design a different conclusion in favor of the competitive equilibrium would be obtained. Therefore, he designed an experiment that included a learning mechanism in which participants could receive knowledge of the movements of bids and offers within the market. Smith's results were very different from Chamberlin's. In the ten experiments, Smith (1962:134) reported that competitive equilibrium mechanism works under assumptions of the absence of a secret agreement in the market and of complete opening regarding the movement of market activities.

Smith continued his research into the different types of auctions. He used an experiment style in which both buyers may make bids and sellers react by evaluating buyers' price offers. Such a market institution later became standard and known as the Oral Double Auction (ODA) (Friedman & Cassar, 2005:84). In a study which had six experimental sessions and 162 subjects consisting of students in the undergraduate courses in economics, Smith (1965) concluded that the auction-market mechanism had strong competitive equilibrating tendencies.

Smith's studies also conducted experimental studies in other different areas including: reflecting the auction mechanism in public goods (Smith, 1980); demonstrating the effects of price controls in the posted offer market (Coursey & Smith, 983); showing the empirical characteristics of market bubbles (Smith, 1988); examining the effects of non-binding price controls on the dynamics of competitive markets (Smith, 1991); and comparing the outcomes under double oral auctions with such alternative institutions as posted prices and sealed-bid auctions. As a result of his contributions, Smith was awarded the Nobel Prize in Economics in 2002.

3.2. Experiments at the Individual Level

Thurstone is generally accepted as the person who conducted early experiments on individual decision-making (Roth, 1995; Starmer, 1999). In his paper "The

Indifference Curves" published in the *Journal of Social Psychology*, Thurstone (1931) attempted an experiment to show the individual indifference and satisfaction curves using a psychological base. Psychologist Thurstone's experimental design was in two stages. In the first stage he created mathematical equations for both the satisfaction and difference curve. The second stage investigated their verification using experiments. In the experiment the subjects was asked to explain their preference for two products (hat and shoes) with the same value. An important assumption was that the subjects decided in accordance with their perception about each product's price and quality. In this experiment Thurstone showed that the preference of individual choice could be determined by this type of method is based on experimental data.

Although Thurstone's method was criticized by a number of economists in the 1940s and 1950s, scholars in mathematics and especially in psychology published further important studies on individual decision-making. One of the most important works in the 1940s was *The Theory of Games and Economic Behavior* by mathematician von Neumann and economist Morgenstern. Although expected utility theory by von Neumann and Morgenstern (1944) is accepted as a normative theory of behavior, it does not study the real behavior of people but rather how people can maximize their utility using a rational decision-making process (Plous, 1993:81) However, it led to new experimental studies involving individual decision-making to test the validity of the expected utility theory (Roth, 1995:7).

In the early 1950s Princeton mathematicians such as Tucker, Nash, Milnor, Shubik, and Shapley started to use games in their studies. Tucker devised the Prisoner's Dilemma based on a 2-person non-zero-sum and non-cooperative game (Cunningham, 1967). In *The Bargaining Problem,* Nash (1950), who was awarded a Nobel Prize in Economics in 1994, attempted to solve the bargaining problem in economic issues. Shubik (1964) brought a different aspect to game theory by applying class games of social (or economic) survival based on individuals' decisions that concerned both potential gain and survival.

The studies into expected utility highlighted a number of paradoxes that queried the validity of the theory. The most widely known is the Allais paradox. Allais showed how small changes in problems affect the choices of the decision-maker in contrast to the expected utility theory which states that subjects' preferences will not be affected even if the presentation style of the problems was changed (Tversky, 1975:168).

The Allais Paradox resulted in the development of alternatives to expected utility theory. The most widely accepted of these is prospect theory, which was

developed by Kahneman and Tversky (Sugden, 2005). Kahneman and Tversky (1979) showed that risky choices have several significant effects that are inconsistent with the fundamental principle of expected utility theory. Kahneman and Tversky demonstrated that people's preferences systematically violate the principles of expected utility theory. Indeed prospect theory is a more accurate description of how people actually make choices. The importance of this research was recognized in the awarding of the 2002 Nobel Prize in Economics to Kahneman (Amos Tversky, his long time collaborator, had unfortunately died in 1996).

4. THE PROBLEM OF EXTERNAL VALIDITY OF ECONOMIC EXPERIMENTS

According to Gualla (1998) experimental methods always face the problem of whether or not the conclusions from the laboratory reflect the real world: this is termed the problem of external validity of the experiments (Gualla, 1998). In many experiments the participants are university students who are typically young and less experienced than an average member of the population. Thus, the use of students in experiments has been the most important critique as to the generalizability of the results of the experiments.

Hence, many researchers have used the experimental conclusions found in the laboratory to test people in the real world (in the field). A number of studies have found no difference between the laboratory conclusions and the field research. For instance, Lichtenstein and Slovic (1971) found the preference reversals in a laboratory experiment. Lichtenstein and Slovic (1973) also replicated their experiment in a casino in Las Vegas and reported that preference reversals are not limited to the laboratory. Gigerenzer (1984) investigated the external validity of the conclusions of the experiments in the laboratory as part of the frequency-validity relationship on the basic of mean validity judgments of repeated and non-repeated assertions by subjects. He compared his conclusion obtained from subjects in real world with conclusion found in Hasher et al's (1977) study that used college students in a university laboratory. Gigerenzer reported that the laboratory findings had a high degree of external validity.

On the other hand other studies conclude the results obtained from using people in the real world differ from those gained from experiments using students. For example, Burks et al (2009) investigate the behavioral differences between students in the laboratory and bicycle messengers from Switzerland and the US in relation to a sequential prisoner's dilemma which recognizes the cooperativeness of the participants. They conclude that the experimental students are less

cooperative than the real world bicycle messengers. Furthermore, List (2006) studied if subjects' social preferences differ between the laboratory and the field. He reported that agents behave differently in tightly controlled laboratory experiments than in their naturally occurring environment.

In these debates, researchers such as Levitt and List (2009) argue that laboratory experiments are useful because they can be replicated and controlled in future studies. Reiley and List (2007) argue that compared with laboratory experiments the underlying idea behind the majority of field experiments is to use randomization in an environment that captures important characteristics of the real world. Perhaps, as argued by Harrison and List (2005:21), the basic methodological lesson in these debates is that researchers should be careful to generalize from the evidence given by student subjects that have no experience at all with the field context. Since economists have always been rather skeptical of laboratory results, in order to generalize a laboratory result, the researcher has to show that the system constructed in the laboratory replicates the one at work in the real world; thus, experiments act as "mediators" (Gualla 1998). In this regard, field experiments represent a useful bridge between data gathered in the laboratory and uncontrolled field data (List, 2009).

5. CONCLUSION

The view that the experimental method is inappropriate for economics has been generally accepted since Mill's time. However, this negative attitude started to change with experimental studies devoted to market construction in the 1940s. This process gained speed with experimental studies on individual decision-making under uncertain conditions in the 1960s and 1970s. As a result of these developments, the question to what extent are economic theories valid in the real world can be answered. Although experimental studies in economics raise questions about their externality validity because of the use of students in the research the most important effect has been to contribute to end the identity of economics as "a strict normative science" and to develop interdisciplinary studies with another sciences such as mathematics and especially psychology.

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