WHY AUSTRIANS SHOULD QUIT WORRYING AND LEARN TO LOVE THE LAB

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ABSTRACT

Experimental economics has been treated with skepticism by some Austrian economists. We argue that experimental methods are consistent with strong versions of praxeology, and are therefore not methodologically problematic for Austrians. We further argue that experimental research methods have illustrated many uniquely Austrian themes and provide a fruitful method for future Austrian-inspired research.

1. INTRODUCTION

Both Ludwig Von Mises and Frederick Hayek wrote critical assessments about the use of experimental methods in economic research. Some modern-day Austrian economists remain critical of experimental methods. Yet, Vernon Smith, who won the Nobel prize in 2002 for his work in founding experimental economics, considers much of his research as a demonstration of some key Austrian ideas (Smith, 1999, 2005).

Our purpose in this chapter is twofold. First we argue that experimental economics is perfectly consistent with Austrian methodology. Second, we

What is so Austrian About Austrian Economics?
Advances in Austrian Economics, Volume 14, 145–163

ISSN: 1529-2134/doi:10.1108/S1529-2134(2010)0000014010

argue that experiments can be fruitfully used by Austrians to advance their research. Experimental economics provides a powerful forum for evaluating and critiquing neoclassical ideas. It is also a particularly useful tool for exploring and developing uniquely Austrian alternatives.

Our chapter proceeds by first briefly outlining the method of experimental economics. In Section 3 we consider Austrian objections to experimental methods and explain where experimental methodology fits in the Austrian paradigm. Section 4 surveys experimental studies that draw on and contribute to Austrian insights and suggests future avenues of Austrian experimental research. The final section concludes.

2. THE EXPERIMENTAL METHOD

Experimental economics is the application of laboratory methods to questions regarding economic behavior and the welfare implications of economic institutions. Typically, undergraduate students are recruited for participation and are paid in cash based on the decisions they make in the experiment. Experiments rely on a methodological tool called induced value theory (Smith, 1976). Subjects are given reservation values (or costs) over outcomes of the experiment, and their payments are related monotonically to these payoffs. Experimenters additionally impose rules regarding what sorts of decisions are available to subjects, what information subjects have access to and how subjects' decisions impact one another's payoffs. These rules collectively constitute an experimental design. Most modern experiments are run using networked software that allows experimenters to study extremely complicated environments and interactive institutions.

Typically, experiments begin with hypotheses drawn from neoclassical theory (NCT) and are designed to examine the degree to which these hypotheses describe behavior. In multisubject experiments, these hypotheses are equilibrium predictions. In single subject experiments they are behavioral predictions made based on NCT heuristics (e.g. optimization, Bayesian learning, etc.). Typical experimental designs have subjects repeatedly making similar decisions to focus attention on the evolution of behavior over time. Most experiments therefore produce data on how well subjects come to learn optimal behavior or consistency after processes of mistake making. Thus, even when studying neoclassical models, experiments frequently incorporate Austrian concerns with feedback, learning, and correction.

Experimental designs generally include multiple versions of the sets of rules or the environment. Often these treatments are inspired by the fact that

such changes in treatment variables alter NCT equilibrium predictions. By studying multiple treatments, the experimenter can study not only the precise predictions of the theory but also the degree to which predicted qualitative changes in behavior are borne out in the lab. Experimenters therefore frequently use NCT not merely as a tool for predicting precise outcomes but rather as a tool for predicting qualitative patterns. Experimenters also often design treatments that vary facts about the environment or institution that NCT does not predict should affect equilibrium behavior. These treatments are typically designed either to examine the behavioral effects of distinctions NCT considers irrelevant or to examine factors that NCT tools are incapable of analyzing. Therefore while experimental design interfaces strongly with NCT, it is not necessarily bound by its assumptions. Indeed, in extreme cases, experimenters design experiments over which NCT can make few or no predictions at all.

Typically, economics experiments include multiple replications of each treatment, each with different cohorts of subjects, to look for regularities in behavior across instances. Sometimes this results in the observation of well-defined patterns of predictable behavior that are robust to replication. Other times replication reveals strong heterogeneity across subjects and cohorts, revealing a sort of indeterminacy of outcomes. In either case, the important methodological feature of economic experiments is that the faculties of subjects – for instance their rationality, foresight or learning heuristics – are not imposed (as they are in neoclassical theory) but observed. In many cases the experimental method uses equilibrium constructs as potentialities induced by the environment and institutions rather than inevitabilities. It is therefore essentially a method for relaxing the behavioral determinism required of some neoclassical theorizing while organizing inquiry around well-defined equilibrium states. For this reason non (or out of) equilibrium behavior lies at the center of much of experimental economics.

For an excellent survey of the field, the reader is referred to Plott and Smith (2008), which provides a fairly comprehensive overview of what we have learned from laboratory research in economics.

3. EXPERIMENTAL ECONOMICS IN AUSTRIAN METHODOLOGY

Austrian reluctance to incorporate experimental methodology stems from their objection to scientism – inappropriate applications of the methods of the physical sciences to the social sciences. In this section we attempt to

show that experimental methods are perfectly consistent with Misesian praxeology, arguably the strictest variety of Austrian methodology. To the extent that we are able to show experimental methods are consistent with Mises' praxeology we believe that it is also compatible with other less restrictive Austrian methodologies.

In the taxonomy suggested by praxeology, economic theory consists only of propositions that are true a priori and not subject to empirical testing. All economic theory is deduced from the action axiom and a few subsidiary assumptions (such as the disutility of labor). Economic theory either applies or does not apply to a given situation in the naturally occurring world depending on whether the subsidiary assumptions used to derive the theory are present. No empirical occurrence in the real world can prove or disprove economic theory, by the definition of economic theory under praxeology. By this definition, economic theory is disproved only by showing a flaw in the chain of logical deductions from the action axiom and the subsidiary assumptions. An important implication of this taxonomy is that the vast majority of conjectures made in neoclassical theory are not theory in the sense of praxeology but are rather empirical conjectures.

For praxeologists there is a sharp distinction then between economic theory and what Mises called "history" or other economists might refer to as applied economics. Mises (1949) wrote,

> There is economics and there is economic history. The two must never be confused. All theorems of economics are necessarily valid in every instance in which all the assumptions presupposed are given. Of course, they have no practical significance in situations where these conditions are not established (p. 66).

Economic history, in this schema, involves establishing whether all the assumptions of a theory are present and then using the theory to describe the particulars of the unique event being investigated. Economic history also involves nonaprioristic interpretation of the relative magnitude and importance of various factors present in any given situation. Applied economic history thus involves a priori theory and non a priori judgments of magnitudes and importance.

When Austrians object to experimental methodology it is on the grounds that they believe experimental economics is being used to "test" a priori theory. Mises raised this objection before experimental economics was even practiced. Mises (1949) wrote,

> History can neither prove nor disprove any general statement in the manner in which the natural sciences accept or reject a hypothesis on the grounds of laboratory experiments. Neither experimental verification nor experimental falsification of a general proposition are possible in this field (p. 31).

The same objection was raised by some Austrians in 2002 after Vernon Smith won the Nobel Prize for his work on the development of experimental economics. Anderson (2002) complained that "As one can imagine, Austrians are not exactly enthralled with 'Experimental Economics,' as they think the whole thing to be rather silly." He then described some of the work Smith has done in illustrating the efficiency of the market but concluded,

> All of this is well and good, of course, but it does not "prove" that free markets are best for society at large. That is not because Smith's work is slipshod or biased, but rather because it violates a central premise of Austrian methodology, that laws of human action cannot be "tested" for falsification.

Shostak (2002) made the same methodological critique,

> Various conclusions that are derived from this knowledge of purposeful action are valid as well, implying that there is no need to subject them to various laboratory tests as is done in the natural sciences. For something that is certain knowledge, there is no requirement for any empirical testing.

going so far as to claim, "While a laboratory is a valid way of doing things in the natural sciences, it is not so in economics. If anything, the introduction of a laboratory in economics only stifles our understanding."

However, an Austrian economist need not interpret any experimental result as "testing" praxeological theory. Experimental economics investigates concrete cases of human action much like economic history does. Austrian economics does not reject historical, ethnographic, or econometric findings per se. It rejects their capacity to test praxeological theory. So should be the case with experimental economics. Even if one holds that propositions in economic theory are beyond testing, experimental results can at least illustrate them.

Moreover, much confusion stems from the fact that neoclassical economists and praxeologists use the word theory in very different ways. The vast majority of theories economists *do* test in the lab are theories that lie well outside of the scope of praxeology (i.e., are propositions that the Misesian taxonomy would not classify as theory). Most experimental theory tests, for example, concern the predictive power of game theory in strategic settings. The various forms of Nash equilibrium tested for in these experiments would certainly not be held as a prioristically true by most Austrians. Other classes of experiments test behavioral conjectures common in neoclassical economics such as Bayesian learning, altruism and consistency

axioms over preferences and beliefs. Austrians would classify these theories as psychological rather than praxeological. Finally, the study of market experiments often focuses on specific patterns of out-of-equilibrium behavior (e.g., tattonement dynamics or Edgeworth cycles), testing neoclassical conjectures that make far finer (though, a priori, perhaps less reliable) predictions than the core conclusions of praxeological theory.

In each of these cases, covering the vast majority of "theory tests" in experimental economics, the theories being tested would not be classified as theory at all in praxeology. Instead they would be classified as empirical (or historical or psychological) conjectures. The mathematical predictions made in neoclassical economics are, in fact, often regarded with no small amount of skepticism by many Austrians. If these theories have no predictive power, they should certainly lack predictive power in the lab. Thus, experimental economics, as a controlled form of economic history, can help economists weed out the useful extra-praxeological neoclassical conjectures from the unuseful ones. Moreover, Austrians can use experimental methods to challenge neoclassical claims that run counter to praxeological ones. Indeed a number of bad ideas in mainstream economics have been discredited using laboratory tests.

Both Mises and Hayek were skeptical, however, of the value that experimental economics could add. Mises (1949) wrote,

> The experience to which the natural sciences owe all their success is the experience of the experiment in which the individual elements of change can be observed in isolation. ... The experience with which the sciences of human action have to deal is always an experience of complex phenomena. No laboratory experiments can be performed with regard to human action. We are never in a position to observe the change in one element only, all other conditions of the event being equal to a case in which the element concerned did not change. Historical experience as an experience of complex phenomena does not provide us with facts in the sense in which the natural sciences employ this term to signify isolated events tested in experiments (p. 31).

Hayek (1935), also writing before the emergence of experimental economics, was equally skeptical,

> In all sciences except those which deal with social phenomena all that experience shows us is the result of processes which we cannot directly observe and which it is our task to reconstruct. All our conclusions concerning the nature of these processes are of necessity hypothetical, and the only test of validity of these hypotheses is that they prove equally applicable to the explanation of other phenomena. What enables us to arrive by this process of induction at the formulation of general laws or hypothesis regarding the process of causation is the fact that the possibility of experimenting, of observing the repetition of the same phenomena under identical condition, shows the existence of definite regularities in the observed phenomena.

> In the social sciences, however, the situation is the exact reverse. On the one hand, experiment is impossible, and we have therefore no knowledge of definite regularities in the complex phenomena in the same sense as we have in the natural sciences (p. 126)

What Mises and Hayek, writing before the advent of experimental economics, claim is impossible – experimenting on subjects while changing only one element of the environment – is precisely what many experiments do. They keep the same subjects and constraints and vary only one aspect of the environment at a time and observe the change in outcomes. Smith (1999, p. 197) speculates that the reason no one believed that experiments could be used in economics by the time *Human Action* was published was "simply that almost no one tried or cared."

The fact that experiments can be run varying only one (or a few) aspects of the environment at a time need not change the status of praxeological laws. It is perfectly possible to hold certain propositions as a prioristic truths while using laboratory examination to demonstrate the working of these laws. In fact, as Smith concludes in 1999,

> Experimental economics, created in the 50 years since Human Action, is kind to the Austrians in enabling us to *demonstrate* that the spontaneous order, operating through property right institutions, *exhibits* the desirable characteristics that the Austrians claimed for it. *This power of demonstration* is for me far more compelling than the appeal to reason, especially by Mises (emphasis ours: 208).

Although many Austrians, no doubt, will find a priori deduction more convincing than the demonstration of praxeological claims through either traditional applied history or experiment, it is no doubt the case that many people, like Smith, find illustrations of the theory more persuasive.

So far we have argued that (1) Austrians can consistently classify experiments as a part of economic "history," (2) experimental "theory" tests are typically tests of conjectures that would not count as theory to a praxeologist, and (3) contra claims by Mises and Hayek, experiments are possible. We believe work in experimental history also offers Austrians promising avenues of research that traditional empirical (or economic history) methods do not offer.

First, experiments can illustrate the working of the market process in ways that naturally occurring data cannot. Hayek (1968) famously wrote,

> The reason we use competition is that in those cases in which it might be interesting, the validity of the theory can never be tested empirically. We can test it on conceptual models, and we might conceivably test it in artificially created situations, where the facts which competition is intended to discover are already known to the observer. But in such cases, it is of no practical value, so that to carry out the experiment would hardly be worth the expense.

Unlike Hayek, we believe that these illustrations do create value far over their expense. Austrians can theorize how the market process of competition discovers what is unknown but in using naturally occurring data, the counterfactual, what could have been discovered but was not, is never known and available to illustrate the theory. In constructing laboratory environments, the experimenters are able to know what subjects could discover through competition. The repeated success of subjects in discovering this knowledge provides an illustration of the discovery process succeeding in a way that could not be done in the naturally occurring world since the point of the discovery procedure is precisely to discover what is unknown.

Contra Hayek, the aim of experimental study is not to facilitate discovery but to study it. An experimentalist can examine the degree to which institutional facts (in this case the degree to which competitive forces are allowed) map into possibly unintended achievement of optimal states. To the degree that we want to compare how rules, laws, and institutions impact the discovery process, experiments can be of a great deal of practical value. Koppl, Kurzban, and Kobilinsky (2008, p. 155) summarize the value of experiments in studying the epistemic discovery process of different institutional environments nicely:

> We construct the truth, the preferences, and the institutional environment of choice. We construct ... the world in which we place our subjects. From this godlike perspective we are in a position to compare the epistemic properties of different institutional arrangements. When we return from our constructed world to the real world, we lose our privileged access to the truth and return to the normal uncertainty common to all. But we carry with us a knowledge of which institutional structures promote the discovery and elimination of error and which institutional structures promote error and ignorance. This knowledge can be carried from the constructed world of the laboratory to the natural world of social life because of the common element in both worlds, namely, the human mind. The one vital element of the experimental world that is *not* constructed is the human mind, which makes choices within the institutional context of the laboratory experiment (emphasis original).

This brings us to another important value that experiments add – replicability. As Austrians often stress, each naturally occurring historical event is a unique complex phenomenon. Although praxeological theory is prioristic, it does not tell us empirical magnitudes and is sometimes silent on the role of institutional details (e.g., the relative effectiveness of one set of auction rules versus another). These are empirical facts, left for the applied economist/economic historian to sort out. However, it is hard to make historical generalizations about the magnitude of any theoretical law because of the uniqueness of each individual historical occurrence. Experiments enable us to better control for all of the unique factors and vary the fewer

factors of interest repeatedly so that we can make better generalizations from the work we do in economic history. This replicability gives experimental methods a unique place in the practice of economic history and opens up new avenues for demonstrating and refining various Austrian insights.

A further relevant question is the degree to which the results from experiments can be used to judge and predict naturally occurring circumstances. Sometimes experimental methods are criticized for putting people in "unrealistic" situations. Smith (2005) quotes Hayek from *Law, Legislation and Liberty* saying "fruitful social science must be very largely a study of what is not." He claims that this is exactly what he does in his lab. "Of course it's not realistic, and that is why we do it! Because we want to learn two things: we want to better understand what is; why the rules are what they are!... The second reason why we study what is *not* is that we want to study social change" (emphasis original: 140–141).

It is important to realize that in most cases, experimental work is much more concerned with characteristics of economic processes and behaviors under comparative circumstances than with making precise forecasts. Experimental economics can be understood as an empirical method for developing pattern predictions of the sort suggested by Hayek. Results of experiments often suggest tendencies and distributions of outcomes rather than hard and fast rules. We can, moreover, use experiments to make predictions about outcomes of complex social processes that are difficult to make using a prioristic reasoning alone. Refinements of our understanding of these tendencies can generally be best achieved by further experimentation rather than extrapolation of results into law-like predictions. Indeed there is a relatively strong culture in experimental economics of replication and iteration of designs to challenge past results or discover their robustness to institutional and environmental idiosyncrasies.

To sum up, Austrians need not interpret experiments as tests of praxeological theory. They should instead view them as a new way of doing economic history. However, because of their controlled and replicable nature they open up new avenues for Austrian empirical/historical work that were previously underexploited. We now examine some of these themes in experimental research.

4. EXPERIMENTAL ILLUSTRATIONS OF AUSTRIAN ECONOMICS

Austrian economists have long emphasized the vital role of property rights, the informational role of prices, and the market's competitive discovery

process. These topics have been of direct interest to experimental economists since the field was founded. The earliest two-sided market experiments were multilateral bargaining markets conducted by Edward Chamberlain in the 1940s and 1950s. A subset of agents were given values over fictitious units and thereby provided incentives to buy units. A second subset was given costs for producing and had incentives to sell units. These values and costs were heterogeneous across units, so that in aggregate they formed supply and demand curves and a corresponding equilibrium price and quantity. Two features of mainstream competitive equilibrium theory were violated in setting up this experiment. First, there were relatively few buyers or sellers instead of the unboundedly large market imagined by Marshall. Second, subjects were given no information about the supply and demand environment other than their own private value or cost. Subjects were then allowed to walk around the room and negotiate sales and purchases. Chamberlain found a marked failure of competitive equilibrium theory to predict prices and, as a result, observed deadweight loss in these markets.

Vernon Smith conjectured that the results of such an experiment would be highly sensitive to the institutions governing trade. Smith conducted a similar experiment using the double-auction, an institution frequently used in asset trading exchanges (Smith 1962). In the double auction, buyers and sellers submit public bids and asks for units, and are allowed to increment offers until a price is agreed upon. What Smith found in these initial experiments was a reversal of Chamberlain's results. Prices quickly converge to competitive equilibrium levels and markets attain striking efficiency – deadweight losses often disappear altogether. This experiment has been replicated thousands of times, with many different supply/demand environments, cohort sizes, and demographics. The results are strikingly robust: The double auction institution leads to nearly perfectly efficient equilibrium outcomes in virtually all cases. This discovery marked the birth of modern experimental economics.

These results have obvious relevance to Austrian market process theory and reflect many conjectures made in that literature. Subjects in these experiments know only their own particular circumstances and through a process of learning and adjustment quite literally discover adaptively what the experimenter would recognize as the equilibrium price. The market price and the corresponding efficiency of markets in this case is a spontaneous order, generated unintentionally by agents making use of market-grown information. Experimentalists call the idea that markets can economize on scarce information in this way the "Hayek hypothesis" and have found a great deal of evidence in support of this hypothesis in the past 40 years.

Although the literature on experimental markets is vast, we would like to focus on only two further applications. First, the double auction experiment has been extended to general equilibrium settings in which many interlinked markets exist simultaneously. In these incredibly complex multimarket settings, experimentalists frequently observe price discovery converging on the competitive equilibrium. This occurs via dynamics similar to those in single market experiments; subjects adjust and learn from prices simultaneously, eventually unintentionally arriving at highly efficient outcomes (Williams, Smith, Ledyard, & Gjerstad, 2000).

Second, a great deal of experimental work has focused on financial markets. In these experiments, subjects hold assets with an unknown value. Typically, subjects are given probabilistic (risk) information about the potential value of the asset. A number of information aggregation experiments have been conducted in which individual subjects are given private information about the value of a good and then are allowed to trade assets in a double auction. The efficient market hypothesis and the idea of rational expectations equilibrium imply that prices should converge to a level that acts as a sufficient statistic for underlying information. That is, as Hayek conjectures, prices should summarize information held by individual participants. Convergence in these markets depend on agents taking account of information gathered in the price as they trade, continuously learning and updating their beliefs over time. Multiple studies have demonstrated a great deal of information aggregation in prices in these markets and have studied factors contributing to or detracting from these aggregative properties (Plott & Sunder, 1988).

Another important strand of literature on financial markets examines the formation of expectations driven bubbles in asset markets (Smith, Suchanek, & Williams, 1988). In these studies, subjects are given identical information and are allowed to trade an asset that returns dividends in each of (typically) 15 periods. At the end of the final period, assets lose their value altogether. Intuitively, the asset's value decreases over time, becoming worthless by the end. Agents trading based on fundamentals should therefore trade the asset (if at all) at the expected value in each period. However, the price agents are willing to trade at, in fact, depends on endogenously formed expectations about the future price other agents will be willing to purchase at. Because experiments do not restrict such expectations, experimentalists can actually observe the subjective evaluations of agents in financial markets proxied through the market price. In many (though not all) of these markets, agents form expectations that other agents will buy at higher prices, and bubbles form, with prices rising above

expected value, sustained by a complex set of self-reinforcing expectations. Eventually these expectations collapse, causing crashes in the price. One interesting finding from extensions of this research is that traders eventually learn through experience to avoid bubbles and can in fact arbitrage away bubbles formed by less experienced traders.

Other experimental research has relevance for Austrian studies of entrepreneurship. Individual decision experiments have studied ambiguity (often called Knightian uncertainty). Under ambiguity, agents know what outcomes are possible but do not have any good reason to place probabilities over particular outcomes. A component of neoclassical theory known as subjective expected utility theory argues that agents place subjective probability judgments on these possibilities and then treat their decision as if it were a response to any other risky proposition. Careful experiments show that a large proportion of (though not all) agents make decisions that are inconsistent with SEU theory and in fact show a positive aversion to ambiguity (e.g. a preference for risk over Knightian uncertainty). Most agents will avoid ambiguity even at relatively great expense to themselves. This finding, and the fact that it is only descriptive of a portion of the population, might be a clue to the entrepreneurial function and therefore may be an important piece of market process theory. Perhaps entrepreneurs are not only agents who are particularly alert, as Kirzner argues, but also particularly tolerant of ambiguity.

In the past 20 years, neoclassical economists have been particularly interested in economic problems in which agents' actions strongly influence one another's welfare. Game theory provides a method for classifying sets of mutually consistent strategies (or in Austrian terms, mutually consistent plans) in these types of settings. Experimental economists have conducted hundreds of experiments studying how real human subjects make inconsistent plans and learn how to reconcile these plans in equilibria (Camerer, 2003). This area, often called behavioral game theory, attempts to use experiments to create psychologically rich models of decision making and expectations in strategic settings. One often-used model, the Quantal Response Equilibrium (McKelvey & Palfrey, 1995), is based on the idea that agents make mistakes more frequently when the mistakes are relatively less costly. That is, the discovery of a best strategy is more likely when the relative returns from such a discovery are higher. The idea that both agents react this way simultaneously generates predictions about the pattern of coordination that will be observed across pairs of agents. The QRE model, as it turns out, does a good job of rationalizing behavior in a wide variety of games.[1] In fact, beyond the QRE, the correspondence between the size of

payoffs and the reliability of rational action is a robust finding in experimental economics. We see in this a family resemblance to the conjecture, often made in market process theories, that entrepreneurial alertness may be stimulated by profit motives (Kirzner, 1973).

In both game-theoretic and market settings, experimentalists are frequently interested in the convergence of behavior over time. Out-of-equilibrium behavior and learning are the major focus of a great deal of work in this literature. Neoclassical equilibrium constructs take on a new life in the laboratory, where they are understood as descriptive benchmarks for convergence rather than expressions of individual rationality. Neoclassical theories of equilibrium become taxonomies of states of rest. In the lab, the focus returns to the processes of mistake-making, learning, and mutual understanding that lead toward or away from equilibrium and the institutional details that shape these processes. Laboratory experiments have in turn stimulated a great deal of interesting neoclassical theoretical work striving for deeper characterizations of out-of-equilibrium behavior. The parallels between this approach and traditional Austrian critiques of the place of equilibrium in neoclassical theory should be obvious. Experimental economics naturally incorporates these critiques and in the process serves as a method for learning about the character of disequilibrium processes and the realism (or in some cases unrealism) of neoclassical notions of equilibrium.

We have tried to make the case that insights and evidence relevant to market process theory and consistent with praxeology can be found throughout the experimental literature. Although we are convinced that Austrian economics can profit from consumption of experimental research, we suspect Austrian economics may gain more by becoming producers of experimental research.

Experimental economics provides a forum for Austrian economists to evaluate and critique neoclassical theory. The lab allows for a unique intersection between NCT notions of equilibrium rationality and Austrian notions of subjective human action. Using it, NCT predictions can be, and frequently are, meaningfully reinterpreted as potential eventual achievements of agents learning through time. NCT models, in this light, become useful tools for identifying plan consistencies, with experimental work filling in the institutional and behavior factors governing the market process in relation to equilibrium.

In circumstances where tractability concerns motivate NCT to impose too-stringent restrictions on the problems being modeled, Austrian practitioners can adjust experimental designs to reflect their critiques. Smith's original double auction experiment is an ideal example. Although competitive theory

demands that agents have perfect knowledge of the economic environment, Smith implemented a competitive market in which this perfect knowledge assumption was done away with. His finding was that competitive equilibria were robust to the tractability assumptions placed on the neoclassical model. An ideal method for critiquing unrealistic features in the modeling of problems is to simply implement experiments in which these features are relaxed. As historic critics of NCT's theoretical assumptions, Austrian economists might have a comparative advantage formulating and experimentally illustrating hypotheses about the importance of these assumptions.

To close our review of experimental literature, we want to mention a few recent pieces of experimental research that have been conducted by self-identified Austrian economists or that have focused explicitly on entrepreneurial discovery.

Two recent experiments have focused on entrepreneurial discovery. First, Demmert and Klein (2003) conducted an interesting, though imperfectly executed, experiment explicitly studying whether profits caused subjects to discover a counterintuitive method for accomplishing a task (involving moving water from one point to another in a field). The study aimed to examine whether profit motivation causes agents, as Kirzner conjectures, to unintentionally (i.e. nondeliberately) discover a superior method for accomplishing their task. The study concluded (based on questionnaires) that agents who discovered the counterintuitive method for solving the task were in fact engaging in deliberate search and that, as a result, the study failed to illustrate Kirznerian discovery.

A second, and more successful, attempt to examine entrepreneurial discovery was made by Crockett, Smith, and Wilson (2009). Subjects interacted in a "virtual village" consisting of plots of land and houses. Each subject was given a plot of land where goods were produced and houses where goods were consumed. Subjects were able to choose to allocate their resources to produce two goods. After producing goods, subjects were allowed to drag goods from their land to their house and thereby consume the good. Subjects were given nonseparable preferences over consumption – that is they needed to "consume" both goods to make money. In addition to producing, subjects were allowed to communicate with one another via a chat room.

Subjects were not told that the computer program assigned them different abilities to produce different goods and that there were therefore gains from specialization. Subjects were also unaware that, instead of dragging goods to their houses, they could drag their goods to the houses of other players. Therefore subjects could not discover how to specialize without discovering that they could trade. The institution of exchange itself had to be discovered

and only by being discovered could subjects learn how to trade. In contrast to Demmert and Klein (2003), subjects had no reason to treat the experiment as a search task because the experimenters never implied the possibility that there was something to be discovered other than the best way to allocate productive energies. Crockett et al. (2009) found that agents frequently discovered exchange and in many cases learned to fully specialize. These discoveries often (though not always) were contagious, leading to exchange and specialization elsewhere in the virtual village. The authors subsequently engaged in research trying to understand factors that lead to the discovery of more complicated exchange institutions with the hope of eventually observing the endogenous development of complex markets.

We discussed using experiments to learn about the process of discovery and the price system as suggested by Hayek earlier. Koppl et al. (2008) investigate the epistemic properties of forensic science discovery procedures. When courts rely on the opinion of a single expert (or lab) that may have their own bias, the court will be prone to making the wrong decisions by either under- or over-valuing the expert's opinion. Koppl et al. create an experiment where there are senders of information, like forensic experts, and receivers who are like the courts. Receivers earn money by coming to the correct conclusion of the truth (in this case, one of three shapes). Senders earn money by either the receiver choosing the truth or by the receiver choosing the object that the sender has an induced bias toward. The experiment varies the returns to truth and bias for senders and also varies the number of senders for any one receiver. Koppl et al. unsurprisingly find that when the returns to bias are higher, more false information is sent and more incorrect verdicts are made by receivers. Interestingly, they find that by adding more senders it can result in senders sometimes sending even more false information, however, because of the greater information received by receivers they more often choose the truth. In studying the epistemic features of these various institutional arrangements Koppl et al. find that although their laboratory study does not inform us of which particular expert judgments are correct and incorrect it can "tell us that the monopoly structure of forensics today produces a needlessly high error rate" (p. 155). This experiment illustrates how studying the discovery procedure in the laboratory can lead directly to recommendations for improving institutional arrangements in the real world to better facilitate discovery.

Rothbard (1970) is one of the earliest examples of Austrian economists interested in the study of anarchism. Since his pioneering work, many other Austrians have taken up this research program studying both theoretic

mechanisms for coordination without a state and historical work to document the voluntary institutions anarchic societies have used.[2] Buchanan (1975) is critical of anarchy and assumes that in an institutionless state of nature there would be a Hobbesian war of all against all where life would be "nasty, brutish, and short." However, humans have always had institutions for coordination even in anarchic situations. So there is no naturally occurring data to evaluate Buchanan's predictions against. Powell and Wilson (2008) use the laboratory to create a real time Hobbesian jungle to measure the deadweight cost of predation and evaluate Buchanan's claims. In their laboratory societies, each of the six individuals can choose how much, if any, of their productive endowment to invest in offense and/or defense. The subjects are not compartmentalized, exogenously or endogenously, as either pure producers or pure plunderers; they can choose the degree to which they wish to allocate productive units to offense and defense and can change these allocations throughout the experiment. Moreover, the experiment is conducted in continuous time (i.e., defensive decisions do not necessarily precede offensive ones, and offensive choices do not necessarily follow defensive decisions). There are no rounds in which subjects repeatedly face the same decisions. Actions can occur at any time. Each subject also has just one shot with their "life." Since productive assets earn subjects money whereas offensive and defensive units do not, Powell and Wilson are able to examine the inefficiency of a Hobbesian jungle without external enforcement. Their laboratory jungles were neither utopian nor particularly brutish, and were 42.9 percent efficient on average. Powell and Wilson's experiment illustrates how "history" can be done in the lab to critique assumptions made by neoclassical theorists when there are no naturally occurring data to evaluate their claims against.

5. CONCLUSION

There is no inherent methodological divide between experimental and Austrian economics and there are many potential gains from exchange. Experimental work is nothing else but controlled empirical analysis and for a praxeologist can easily take a place beside traditional empirics as a part of economic history. Even if one holds that certain conjectures about economic behavior lie beyond empirical verification, experimental work can provide powerful, complementary empirical demonstrations of these conjectures. Moreover laboratory experiments can serve as an arena to study magnitudes, strategic problems and specific patterns of learning under

various institutions, allowing Austrians and other economists to ask questions about economic life that lie outside of the scope of a prioristic theory.

Experiments differ from traditional history work in at least three important ways. The first and most obvious is that the institutional setting is not naturally occurring but is designed by the investigator. For experiments to have relevance for the naturally occurring world experimental institutional environments cannot abstract from factors that are important for subjects in the naturally occurring world. Second, investigators have more control and knowledge of important parameters and counterfactuals to evaluate experimental results against so they can better understand how economic behavior and discovery processes work. Finally, because of the prior two features, experiments are replicable, unlike historic moments in the naturally occurring world. This allows experimentalists to more directly investigate the robustness of their findings.

Although we believe experimental economics falls in the realm of what praxeologists call history, we do not believe that it is simply "a history of lab results." We believe that in many cases these lab results have direct relevance for our understanding of the naturally occurring world. The strong and rapid tendency toward a known equilibrium in experimental settings should strengthen confidence in the market's ability to discover the unknown efficiently and give us a more subtle understanding of the countervailing forces that impede such discovery. The same is true for other experimental results. In short, we learn from experimental history in the same manner as we learn from naturally occurring history. Which form of history is most appropriate to use will depend on the topic being investigated but Austrians should not be biased against experimental methods.

Our aim in this chapter is not to convince Austrians to abandon their interest in a prioristic theory, but rather to convince them that experimental economics is a useful branch of empirics. Experimental economics is a tool by which praxeologists can ask detailed questions about the nature of market processes that are inaccessible to deductive reasoning alone. As such we believe that experimental economics has a place for Austrians alongside the traditional practice of economic history.

NOTES

1. As a reviewer noted, QRE models provide an interesting and consistent ex post explanation for deviations from Nash play but do not, in and of themselves, offer proof of the source of deviations from Nash equilibrium.

2. See Powell and Stringham (2009) for a survey of the vast economics literature on anarchism. Although they focus on how anarchism fits into the public choice research program, the survey summarizes much work done by Austrian economists.

ACKNOWLEDGMENT

We thank Jonathan Haughton, an anonymous referee and the participants at the Wirth Institute conference on "What is so Austrian about Austrian Economics" in Toronto for helpful comments on an earlier version of this chapter.

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