From models to experiments; James Buchanan and Charles Plott

Gil Hersch and Daniel Houser

Biography:

Gil Hersch is a Postdoctoral Fellow at the Virginia Tech Department of Philosophy and the Program in PPE (Philosophy, Politics, and Economics). His focus is on ethical questions at the intersection of economics, policy, and business, primarily with respect to well-being.

Daniel Houser is Professor and Chairman of Economics at George Mason University, where he is also Director of Nobel Laureate Vernon Smith's Interdisciplinary Center for Economic Science (ICES), a research institution focused on advancing the newest frontiers of Experimental and Behavioral Economics. His research has appeared in leading journals in economics, psychology, political science and general science.

Abstract:

Buchanan's work, and in particular *The Calculus of Consent*, which he wrote with Gordon Tullock, has been foundational in the field of public choice. One of his students, Charles Plott, became a pioneer with multiple seminal contributions in the field of experimental public choice. In this chapter we focus on Buchanan's work on decision making under majority rule, and any influence it may have had on Plott. While Buchanan and Tullock address environments with single decisions, they focus much more on decision making under repeated votes, a topic they found of great interest. Plott's seminal 1978 paper with Morris Fiorina, however, focuses on single decisions. It may seem puzzling, then, that Plott has often suggested Buchanan's influence on his work. We offer a resolution to this puzzle.

Keywords:

Buchanan; Plott; Committee decision making; Majority rule; Experimental economics; Vote trading

1. Introduction

James Buchanan's contribution to economics in general, and public choice in particular, cannot be overstated. Many works examine and discussing Buchanan's contributions. Buchanan's most noted contribution—for which he received the Nobel Memorial Prize in Economic Sciences—was "his development of the contractual and constitutional bases for the theory of economic and political decision-making" (https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1986). Buchanan's focus on political players as rational actors, his focus on institutional arrangements, and his distinction between the constitutional level and the postconstitutional level enabled him to provide a novel framework for understanding the political world. The *Calculus of Consent*, which he wrote with Gordon Tullock, is considered one of the most influential works in public choice. Much of the attention the *Calculus of Consent* receives is for the importance it places on rules that determine the process for setting the rules (Romer, 1988). However, one of the most interesting insights in the *Calculus of Consent* has to do with decision making under majority rule, and specifically on the market for votes, or logrolling. Our goal with this paper is to add a specific context through which to view Buchanan's contribution to the field of public choice—focusing on Buchanan's influence on one of his most prominent students and a pioneer in his own right of another field (experimental economics)—Charles Plott.

Charles Plott is the William D. Hacker Professor of Economics and Political Science at Cal Tech. He pioneered the field of experimental public choice, developing and executing a variety of novel experiments and experimental methods in the 1970s. His focus throughout his career has been on finding the principles that govern behavior as guided by institutions in general, either occurring naturally or constructed in laboratory settings (Plott, 2001). His work has been shaped by a belief that both general economic laws of market behavior exist and a belief that such laws govern behavior in social settings that are not traditionally viewed as markets. The main thrust of Plott's work has been to discover whether these laws can be observed in simple economic laboratory experiments. At Caltech, Plott founded the Laboratory for Experimental Economics and Political Science (EEPS), which serves as a model for experimental economics labs around the world. Plott's recent work has focused on designing information aggregation mechanisms, and on experimenting on complex systems that can operate successfully in situations that often result in market failures (http://www.hss.caltech.edu/content/charles-r-plott).

In this paper we discuss Buchanan's contribution in the narrow domain of understanding committee voting under majority rule. We then go on to discuss Plott's seminal experimental work on the topic that sparked a wave of public choice experimental work. However, despite Plott's claims that Buchanan influenced him significantly, it seems puzzling that his work with Fiorina explores a question outside of those which Buchanan and Tullock found interesting. We suggest several ways to resolve this tension. Our chapter concludes by discussing a lacuna in the experimental public choice literature in which Buchanan was particularly interested —logrolling, or vote trading.

2. Buchanan's contribution to collective decision-making

Buchanan and Tullock's main thrust in the *Calculus of Consent*, as their subtitle makes clear, is developing logical foundations for constitutional democracy. In developing their conceptual framework, Buchanan and Tullock make clear their application of methodological individualism in the realm of politics, and the value of framing the political sphere as a type of market that consists of political decision makers motivated by their own private interests (Haight, Gramajo, & Wenzel, 2011). Using this foundation, Buchanan and Tullock analyze collective decision-making.

In collective-decision arrangements, unanimity insures the least imposition of society on individuals but comes at great decision-making costs. The other extreme of dictatorship comes at little decision-making costs but allows society to impose large costs on individuals. No rule is optimal for all situations. Nevertheless, only unanimity can achieve Pareto-optimality. This leads Buchanan and Tullock to propose unanimity as necessary at the constitutional level, since it provides legitimacy to the rules. The high decision-making costs of unanimity is thus only required at the constitutional level, allowing for less costly decision-making to be used thereafter. While the book is replete with novel and interesting ideas, we focus here on what Buchanan and Tullock say regarding decision making under simple majority rule. The reason we do so (as will be made clearer in §2) is to explore the influence Buchanan (and Tullock) had on Plott's subsequent experimental research.

For the purpose of discussing decision making under simple majority rule, Buchanan and Tullock assume the existence of a constitution that provides background for group decision making. Further, they assume the individual to be motivated by his own interests and to maximize his own expected utility. Buchanan and Tullock begin by focusing only on cases in

which an individual chooses directly among alternatives of collective action. They view such a model, however, as having highly limited applicability to natural environments, suggesting that it might be relevant only to cases such as New England town meetings.

Buchanan and Tullock discuss decision making under simple majority rule as a single shot game only as a prelude to an issue about which Buchanan and Tullock have greater interest — collective decision making over time. This interest is due to the importance they attach to the interactions among voters in a repeated game setting. In particular, they find it more insightful to analyze decision-making rules in terms of the results they produce over an extended period of time rather than within a single shot game. Viewing the collective decision-making process as extending over time gives rise to an analysis that one-shot models cannot recognize—the potential for "gains from trade."

Recognizing that individual votes are scarce resources highlights their economic value. Viewing this value in the context of time opens the door for an analysis of vote trading, or 'logrolling' as distinct from 'immoral' or 'corrupt' behavior. Since each individual vote has economic value, a market will emerge unless a strong prohibition, either legal or moral, against such trade exists. Ultimately, Buchanan and Tullock are primarily interested in analyzing voting rules when vote trading, or 'logrolling,' can occur. This, they believe, will offer a much more realistic and useful analysis of the collective decision-making process.

To demonstrate the limits of a one-shot voting game, Buchanan and Tullock suppose that a group is required to make only a single decision—how to divide manna from heaven. The group consists of five members and a constitution dictates that collective decisions be made by simple majority rule. In this case Buchanan and Tullock argue that whatever group of three individuals forms a coalition first will be the *de facto* decision makers. Using this example

Buchanan and Tullock show that voting rules can be viewed as a means of rationing, one which might distribute the goods in a way that is unrelated to individual evaluations and consequently will not maximize overall social utility.

In fact, Buchanan and Tullock believe that concentrating on single issues, taken one at a time and separately, for example the way (Downs, 1957) and (Black, 1958) have done, may not be particularly helpful when trying to analyze the choice of voting rules themselves:

> These contributions [by Downs and Black] have been important ones, but the political process has been drastically simplified by concentration on single issues, taken one at a time and separately. Such an approach appears to have only a limited value for our purpose, which is that of analyzing the operation of voting rules as one stage in the individual's constitutional-choice problem, that of choosing the voting rules themselves. (Buchanan & Tullock, 1999, p. 132)

3. Plott's early experimental work on majority rule decision making

Charles Plott was one of James Buchanan's most prominent graduate students at the University of Virginia. His first appointment was at Purdue University, and he is currently the Edward S. Harkness Professor of Economics and Political Science at Caltech. He was a central figure in what was at the time the fledgling field of experimental economics. A key focus of Plott's research has been on finding the principles that govern behavior as guided by institutions in general, either occurring naturally or constructed in laboratory settings (Plott, 2001). His work has been shaped by a belief that both general economic laws of market behavior exist and a belief that such laws govern behavior in social settings that are not traditionally viewed as markets. The main thrust of Plott's work has been to discover whether these laws can be observed in simple economic laboratory experiments.

In several papers in which Plott reflects on his own past influences, he discusses Buchanan in detail. In all of these he is clear that Buchanan was a significant influence both on

him and on experimental public choice more generally. In (Plott, 2012), Plott discusses the *Calculus of Consent* and how Buchanan and Tullock were open to institutions being constructed in any form (not only those that maximize the social good). This openness allowed Buchanan and Tullock to consider the performance of different decision procedures. In (Plott, 2014) Plott states:

> "The importance of the ''rules of the process'' had an enormous influence on the development of laboratory experimental methods. As someone who was deeply associated with the transition from the very first, I appreciate the opportunity to report on the subtle ways in which public choice theory contributed to the basic science and my participation along the way." (Plott, 2014, p. 332)

While much attention was paid to procedures and methods in developing experimental work, "an equally large part was focused on institutions, which clearly reflected the influence of Buchanan and what would be latter be called the constitutional political economy strand of Public Choice research" (Plott, 2014, p. 341).

Plott adds that "[t]he development of experiments in the early 1970s was driven by curiosity about the power of institutions to shape collective choice, much of which was stimulated by the work of James Buchanan and Gordon Tullock together with the broad issues of public choice and political science" (Plott, 2014, p. 351). According to Plott, his experiment with Levine (Levine & Plott, 1977), demonstrated the critical role institutions and procedures, such as agendas and agenda formation, play in determining the final outcome. These kinds of experiments provide evidence that theoretical models that emphasize, in this case the centrality of agenda setting, are useful models (Plott, 2012, p. 297). Nevertheless, Plott admits that he does not know whether "Buchanan and Tullock share that view, but in classes and in discussions with graduate students, neither hesitated to allow the conversation to wander off into the hypothetical and imaginary. Indeed, the *Calculus of Consent* is built on that methodology." (Plott, 2012, p. 298).

One of Plott's most influential papers, an experimental work on majority rule decision making, was conducted early in his career. In their seminal paper "Committee Decision under Majority Rule: An Experimental Study" (a description used by (McKelvey & Ordeshook, 1990)) Fiorina and Plott examine in a laboratory setting the decisions a committee makes under majority rule (Fiorina & Plott, 1978). Interestingly, however, this work does not investigate what Buchanan considered to be of particular value—how vote trading, or logrolling, works.

In their experiment, Fiorina and Plott create the following simplifying conditions:

a. There is no uncertainty about the consequences of any decision;
b. There is no indifference or lack of personal interest on the part of committee members;
c. The committee uses majority rule but little or no additional formal procedure such as an agenda; and
d. There are no caucuses or extra-committee meetings among members of the committee.

What they actually did was create five-person committees, induce preferences for outcomes among the committee members, and give them a decision rule—majority rule (578). They then ask whether there is a model which will predict the decision of a group under these conditions (590). What they find is that if an equilibrium exists and preferences are strongly held, the committee's choice is predicted by the model's equilibrium.

But when Fiorina and Plott set out to conduct their experiment, they were not expecting such a result:

> In all candor, we suspected that formal models of committee processes had little to recommend them other than logical rigor. This negative presumption went by the board rather quickly-after a few pilot experiments. Some of the models actually appeared to work. Thus, our task changed from the easy one of generating negative results to a more difficult and painstaking one of determining why some models work, and when. (Fiorina & Plott, 1978, p. 590)

Fiorina and Plott do clearly recognize that their one-shot game might miss out on important aspects of bargaining in committees:

> [I]f the committee decision is regarded by the members as only one stage in a sequence of games, might behavior in the committee reflect strategic considerations from the larger game? If so, a model which explains the behavior in the larger game might produce implications for the committee stage which differ substantially from those implied by models successful in explaining the processes of isolated committees. (593)

This is one of the limitations of the experiment. Fiorina and Plott agree that:

> One can gradually (and carefully) complicate a research design to make it more analogous to real-world political processes. By doing so, we can determine whether the complications destroy the applicability of models which work in simpler contexts.

Their takeaway from this is, however, not that their work is irrelevant to the real-world context, merely that it might be only a first step, and additional experimental work is needed.

Despite Plott having been a student of Buchanan's, despite his claims to be significantly influenced by Buchanan, despite his working on decisions under majority rule early in his career, and despite his recognition that treating committee decisions as part of a multi-shot game might be a better model of the real-world, there is reason to be skeptical regarding whether Buchanan and Tullock's *Calculus of Consent* influenced Plott's experimental work. In particular, because Buchanan and Tullock skip quickly past one-shot collective decision games, it seems that Fiorina and Plott's paper sheds very little light on Buchanan and Tullock's main area of interest. Where then, is evidence for the influence of Buchanan on Plott? In the next section we discuss the move from theoretical models to laboratory experiments and discusses several possible explanations for this apparent puzzle.

4. From models to experiments

Plott considers laboratory experimental methodology as inherently relevant to developing the theoretical principles in public choice, since it allows one to test whether these principles work in a simple and controlled setting:

> While laboratory success by no means implies field study success for a model, laboratory failure raises grave doubts about a model's applicability in field studies. Thus, while we reject the suggestion that the laboratory can replace creative field researchers, we do maintain that it can help them decide which ideas deserve further consideration. (576)

This was not, at the time, nearly as obvious to many in the economics community as it might seem today. Chris Stramer made this abundantly clear through some quotes he collected from prominent economists (Starmer, 1999):

> [U]nfortunately, we can seldom test particular predictions in the social sciences by experiments explicitly designed to eliminate what are judged to be the most important disturbing influences. (Friedman, 1953: 10)

> It is rarely, if ever, possible to conduct controlled experiments with the economy. Thus economics must be a non-laboratory science. (Lipsey, 1979: 39)

> Economists . . . 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)

> One of the weaknesses in the claim that the social sciences are sciences at all is their inability to conduct controlled experiments. Physicists can create vacuums, chemists can establish sterile environments, even doctors can conduct blind trials. But economists, sociologists, political scientists and those who study management find their subject matter will never stand still. (Kay, 1997)

Plott takes laboratory experiments as primarily aimed at refuting hypotheses made by different public choice theories. In (Plott, 1979) he discusses what he calls the “fundamental equation”:

> Preferences ○ institutions ○ physical possibilities = outcomes

The problem Plott raises is that obtaining information about the different elements of the fundamental equation outside of the laboratory setting is “very difficult, expensive, and

sometimes impossible to uncover the historical situations against which the relative accuracy of competing models can be gauged (139).” Instead, one can turn to laboratory experimental methods, which can help overcome some of these challenges. To do so requires relying on two axioms that are inherited from economics:

1. The behavior of various modes of organization is independent of the *sources* of preferences as long as the preferences themselves remain unchanged.
2. The relationship between outcomes, preferences, and institutions is (supposed to be) independent of the nature of the social alternatives.

When these two axioms are combined with the theory of induced preferences (Smith, 1976), it follows that the fundamental equation can be studied in the laboratory.

Understanding the move Plott made from models to experiment is clarified by recalling discussion in the philosophy of economics literature regarding the relationship between models and theories. Mäki argues that economic models (depending on the literature, ‘theories’ might also be an adequate term to use) play a similar role in the process of economic science, for all intents and purposes (Mäki, 2005). The central difference between experiments and models is that experiments rely on material manipulations to achieve the requisite isolation for maintaining control whereas models do this through a reliance on an explicit a set of assumptions.

Morgan, by contrast, argues that the ontological difference between models—which are artificial worlds meant to represent a phenomenon in the real world—and experiments—which are capture a version of the real world within an artificial laboratory environment—leads to an epistemic advantage for experiments in our ability to draw inferences from them to the real world (Morgan, 2005). Guala adopts a similar position to Morgan’s, emphasizing that both theoretical models and laboratory experiments in nonlaboratory sciences (such as economics)

““stand for” the target systems of interest,” and both require an external validity hypothesis regarding their relationship to the target system (Guala, 2005).

The extent to which models and experiments are similar and different has direct implications for what is required when moving from theoretical models of the kind Buchanan and Tullock develop, to the type of laboratory experiments that Fiorina and Plott design and implement. One way to understand this move is as an expansion of the potential for independent action by the players. In a theoretical model the actions a player chooses is deductively given by the assumptions of the model. The move to an experimental setting expands the freedom the players (now real humans) have in choosing their actions, or their “agency”. In a laboratory experiment players are not constrained to those actions normally understood as rational, self-interested and utility maximizing. However, this expanded freedom comes at the expense of experimenter control. In particular, it becomes less clear in relation to formal models whether players understand and are motivated by the rules of the game (see (Santos, 2009).

Interestingly, Plott clearly states that Buchanan and Tullock were influential on the development of experimental methodology, not only in experimental public choice, but in general:

> The new approach to laboratory experimental methods was constructed on public goods so the generalization to experiments with externalities existed at the very base… Much of modern experimental methods in economics and political science was influenced by the *Calculus of Consent*. (Plott, 2012, p. 297)

This only emphasizes our puzzle. Considering the purported influence Buchanan had on experimental public choice in general and on Plott in particular, why would Plott conduct experimental work focused on a question that Buchanan thought had not much value, rather than conducting experiments on issues in which Buchanan had interest?

A first possible explanation is that single-shot games offered Fiorina and Plott low hanging experimental fruit. While a repeated game might be a more realistic representation of the way in which committees make decisions under majority rule, it is clearly easier to design an experiment in which there is only a single instance of interaction rather than a repeated one. Since prior to Fiorina and Plott's experiment there were no laboratory experiments testing committee behavior under the conditions Fiorina and Plott examined, a single-shot game experiment was sufficiently novel to not only produce a publishable paper, but to produce a highly influential one. In view of this, it is sensible that Fiorina and Plott would first grab the low hanging fruit. What this explanation fails to address is why, since they recognize the potential importance of examining more complex scenarios (593), would Fiorina and Plott not then go on to pick the slightly higher hanging fruit. Of course, there might be a whole host of reasons for this, be it insufficiently novel in their eyes, institutional obligations, or other more interesting research each had in mind.

This leads us to a second possible explanation—it might simply be that Plott was developing his own independent experimental research agenda. This explanation is plausible given that one of Fiorina and Plott's chosen models is that of Voting Equilibrium, which was introduced by Black (Black, 1958; Black & Newing, 1951) and formally developed by Plott in an early theoretical paper (Plott, 1967). While Plott thanks Buchanan in (Plott, 1967), he does devote an entire paper to develop formally a model that Buchanan did not view as having much value. Evidently, Buchanan and Plott disagreed regarding the relative importance of Black's work. Of course, since Buchanan was thanked by Plott in that paper, it is reasonable to assume that Buchanan's comments, regardless of his view of the relative importance of the research project, were valued by Plott as he developed his own ideas leading to that paper.

Further, one might offer as an explanation the claim that a technological barrier prevented Fiorina and Plott from working on vote trading—the main topic of interest in majority decision making for Buchanan. Such a barrier might exist due to the fact that experimental economics was still in its infancy in the 70's, and experimental methods to test some economic models were neither well understood nor well designed.

Plott views one of the uses of laboratory experiments as primarily aimed at refuting hypotheses made by different public choice theories. Viewed in this light it is clear that in their specific paper Fiorina and Plott turn to laboratory experiments in order to resolve the competition "between closely related but competing general principles" (Plott, 1979: 141) regarding the best model of committee decision making under majority rule in a single-shot game. But at the time there were also competing theories regarding vote trading. In his 1981 published working paper "Sour note on the theory of vote trading," Ferejohn reviews the then current state of theoretical literature on vote trading (Ferejohn, 1981). Ferejohn laments the current status of theoretical work on vote trading, arguing that "[t]he recent literature has been quite long on intuitive argument and carefully constructed examples, and short on general theorems" (1).
Among other, Ferejohn discusses work by (Bernholz, 1973; Coleman, 1966; Wilson, 1969). This entails that a similar move Fiorina and Plott made to resolve experimentally competition between competing theories in the case of committee decision making could have been useful in the context of vote trading.

More importantly, Mckelvey and Ordeshook published their experimental results on vote trading (Mckelvey & Ordeshook, 1980) merely two years after Fiorina and Plott's (1978) paper. This suggests that it was not a technological barrier that prevented Fiorina and Plott from working on vote trading. Mckelvey and Ordeshook were testing an apparent paradox, raised by

Riker and Brams, that while logrolling is individually advantageous for the traders, the sum of trades is disadvantageous for everybody (Riker & Brams, 1973). Mckelvey and Ordeshook do not find support for Riker and Brams's claims. Bearing in mind the dangers if committing a false dichotomy, one could view Mckelvey and Ordeshook findings as giving a little support (however miniscule) to Buchanan and Tullock's claims regarding the efficiency enhancing nature of logrolling.

Finally, and perhaps most compellingly, we might simply trust Plott's words, as noted above:

> In all candor, we suspected that formal models of committee processes had little to recommend them other than logical rigor. This negative presumption went by the board rather quickly-after a few pilot experiments. Some of the models actually appeared to work. Thus, our task changed from the easy one of generating negative results to a more difficult and painstaking one of determining why some models work, and when. (Fiorina & Plott, 1978, p. 590)

This type of statement is somewhat unusual within the context of a scientific contribution. Perhaps they included this because Plott had been substantially influenced by Buchanan, so much that he (and Fiorina) felt that a quick easy paper was available by running experiments that would cast doubt on one-shot models of collective-decision making, thus offering a clear path to future research in more sophisticated environments. If that was the intent, then perhaps the above statement can be understood as something of an apology to Buchanan. An explanation that Plott undertook this in an effort to show Buchanan correct, and was surprised to find otherwise.

5. Experimental work on vote trading

In view of the above, it is interesting to enquire regarding how scholars should evaluate the usefulness of a single-shot game model of majority rule. Are Buchanan and Tullock right that

such a model is of little use, or are Fiorina and Plott, following Black and many others, correct in seeing the utility of these models? In fact, the vast experimental work on elections and committee decisions under majority rule games makes clear that this is an area Buchanan and Tullock seemed too quick to dismiss (McKelvey & Ordeshook, 1990; Ordeshook, 1997; Palfrey, 2009). But the sparsity of experimental work on vote trading offers a puzzle. Vote trading, as Buchanan and Tullock and other conceive of it, clearly offers a worthwhile topic of analysis, yet very few (predominately Mckelvey and Ordeshook, and later Casella with coauthors), have devoted attention to it.

Vote buying in its various forms has received much attention in experimental work, but the concept of vote trading as logrolling has not. There is some experimental work on the topic of vote buying/selling (e.g. (Dekel, Jackson, & Wolinsky, 2008, 2009), though this work does not address trading among the voters themselves. There is also work on vote buying and selling for money (Casella, Palfrey, & Turban, 2014), though again different from a focus on logrolling, which entails trading votes in one election for votes in another. Two other experimental papers on vote trading as logrolling are (Mckelvey & Ordeshook, 1980) from almost four decades ago, and (Casella & Palfrey, 2016), a working paper. This paucity of work is in itself surprising, as the concept of logrolling is obviously of great interest.

One possible reason for this lacuna in the literature was raised by (Casella, Llorente-Saguer, & Palfrey, 2012). Casella et. al. argue that a market for votes differs from classic markets since votes are indivisible, they have no intrinsic value, votes held by one voter can affect the payoffs to other voters, and payoffs are discontinuous at the point at which majority changes. Since there has been so little theoretical work on vote trading since the early 1970's there is no reason to expect experimental work to develop as well. As Ferejohn puts it: "The

recent literature on logrolling or vote trading has been quite long on intuitive argument and carefully constructed examples, and short on general theorems" (Ferejohn, 1981, p. 1). This points to the lack of sufficiently developed theoretical models of vote trading. Buchanan and Tullock's model is insufficiently developed to provide clear guidance on how one might develop such experiments. Ferejohn discusses this lacuna in the 1980's, yet the lacuna remains.

This, then, is a puzzle, this time with respect to Buchanan and Tullock's influence on experimental public choice—why has the topic of logrolling, which they find as interesting and important as they do, not sparked relatively little theoretical or experimental activity? We are certain and Buchanan and Tullock would agree that there remains much space for more work to be done in this area.

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