

Charles Holt

The field of experimental economics became more widely known with the awarding of the Nobel Prize in economics to the groundbreaking experimentalist Vernon Smith in 2002. It has many practitioners today, but one of the most respected — and busiest — is Charles Holt of the University of Virginia.

In addition to racking up an impressive track record of market experiments, Holt has helped bridge the gap between the laboratory and the real world. He designed a new type of auction that was used by the Federal Communications Commission (FCC) this year to lease critical segments of the electromagnetic spectrum. Recently, he has been involved with designing a market for carbon emissions among the northeastern states that would improve on the less-than-successful experience with carbon markets in Europe.

As an early advocate of the experimental approach to economics, Holt was active in the formative years of the Economic Science Association — the professional organization for experimental economists — and counts Vernon Smith as one of his professional influences and close friends. Holt also co-authored the first comprehensive textbook in the experimental economics field.

Stephen Slivinski interviewed Holt at his office on the University of Virginia campus on June 26, 2008.



RF: When did you know you were interested in studying economics?

Holt: The football coach in my high school history class, in Blacksburg where I grew up, made a comment about how he couldn't understand why baseball teams traded one player for another. He wondered: Didn't they know the one player was getting the short end of the stick? I remember thinking: Gee, what if one team has extra first basemen and another has an extra pitcher. They could make a swap and both teams would win more games and be better off. So, I think I was interested in economics early on.

Later, there was a required religion class in my Northern Virginia boarding school, and we were having a discussion on usury. I remember asking why, if there's a shortage of funds, the people who have the money couldn't charge a high interest rate. I remember all these people looking at me like I was saying something very sinful.



Then I went to Washington and Lee. I majored in economics and politics. One year we read the book, *The Calculus of Consent*, which was written by James Buchanan and Gordon Tullock. They were at the University of Virginia and had written the book the year before. So it had come over the mountains and into the classroom one year after it was written and long before it had really gotten widespread attention.

So, I remember being interested in politics and economics and wondering which one I wanted to go to graduate school for. I realized that the things I was learning in economics will still be established principles in 20 years, while the things I was learning in politics seemed more fluid and undeveloped.

RF: Who were your influences in grad school?

Holt: I went to grad school at Carnegie Mellon. It was a tiny program — I took maybe eight classes. Two of them were taught by people who later won Nobel Prizes.

Robert Lucas was one of them. That was a class of six or seven people. When he started class he would say something like: "This is a pattern of employment participation across

different countries, and here's a correlation. I want to try to explain it. So let's do an econometric exercise." In the next class he would say, "I'm going to show you the starting point of a model that doesn't quite explain what I want it to. So I'm going to throw it away and start again." It was like an ongoing insight into his research process. He took his time. But what I liked was that he would focus on what he thought was an important empirical pattern and didn't go off into the theoretical world without thinking about what was really going on.

Ed Prescott, who was one of my thesis advisors, was another one. Ed was the same way. He would always ask about what empirical regularity you were trying to explain. He was focused. He took great joy in doing research.

Carnegie Mellon was largely an engineering school, and the business school had a practical feel to it. The department heads would basically tell the economics faculty that if they wrote a paper with a graduate student, they would just assume the faculty member did all the work so they shouldn't worry about sharing their ideas. They would still be getting full credit for them. As a result, they did a lot of joint work with graduate students, and I was a direct beneficiary of that.

I remember working on a paper with the president of the university, Dick Cyert. He had been a co-author with Herbert Simon and Franco Modigliani, and he was involved in the early days of behavioral economics. Cyert and I were working with Morris DeGroot, the statistician who was my other thesis advisor, and we would meet on Saturday mornings to work on our paper. The great thing I remember about that was these guys had a lot of confidence. We wrote a couple of papers together, and they each got rejected. But it didn't phase them at all. Another thing I remember about that experience was that they spent a lot of time on the process. We read the papers out loud before we sent them to journals. Every sentence had to be perfect.

RF: When did you become interested in economics experiments?

Holt: After grad school, I went to the University of Minnesota and taught there. I became interested in experiments at that time. I had written a thesis on auctions that compared revenues raised in different types of auctions. When journal editors would see the word "auction" in the title of a paper that was submitted, they'd want to get a theorist's point of view. So I was receiving these papers to referee. I got one

from Vernon Smith that I thought was very interesting. I got another from Charlie Plott, and I remember thinking it was very interesting too. What struck me was that you would see patterns in the data that were consistent with what you would see in the theoretical models. Then the Economic Science Association started having meetings in Tucson in the '80s. I went to the very first ones of those, and I kept going. They had a big influence on me.

RF: You designed an auction to help Georgia apportion irrigation rights in 2000. Tell me about that.

Holt: There was a drought that year and Georgia had some money from the national tobacco settlement. The officials there didn't want to hold hearings and decide which land would be taken out of production. So, they decided on a program to pay farmers not to irrigate. It was a voluntary program in which the farmers would bid on how much they would want to receive — a lump-sum payment on a per-acre basis — for not irrigating that season.

Ron Cummings, Susan Laury — both from Georgia State University — and I started running experiments with students as soon as the law passed. We came up with some designs that the Georgia Environmental Protection Division (EPD) steered us away from for political reasons, and that was perfectly sensible. We ended up with a multi-round auction where the provisional winners — those who were asking for the least amount of money not to farm — were announced after each round of bidding.

In the experiments to test the auction design, we used students but we let them talk to each other and collude. It was a very uncontrolled situation for a normal laboratory experiment. That's because we knew the farmers who were going to be involved in the auction had cell phones and probably knew each other. So we wanted to create that kind of environment.

The EPD officials from Atlanta would come to some of the experiments and just sit down to watch the process. I think it gave them a good idea of how a multi-round auction would play out. We also did a field test in southern Georgia where we set up bid stations in different towns about 50 miles apart. Everything was run through the Web to a site in Atlanta where the EPD officials could watch the bids coming in.

Then they asked us to run the actual auction for them. We set up bid sites in seven or eight different locations around the Flint River

Charles Holt

► Present Position

A. Willis Robertson Professor of Political Economy, University of Virginia

► Previous Faculty Appointment

University of Minnesota (1977-1983)

► Education

B.A., Washington and Lee University (1970); M.A. and Ph.D., Carnegie Mellon University (1977)

► Selected Publications

Author or co-author of papers in such journals as the *American Economic Review*, *Games and Economic Behavior*, *American Political Science Review*, and *Southern Economic Journal*. Co-author (with Douglas Davis) of the textbook, *Experimental Economics* (1993)

► Awards and Offices

Past president of the Southern Economic Association and the Economic Science Association; Honorary Professor, University of Amsterdam

Valley in southern Georgia, and the EPD officials would watch the bids from Atlanta and decide if they wanted to go to another round of bidding. Because the bidders never knew if the first round would be the last round, they knew they had to be serious about their bids.

The farmers would fill out their bids by hand on paper — they were basically contracts — we would review them, and then enter them into the computer. My bid site was a grade school dining hall that had those little, low seats. And these farmers were big guys so it was amusing to watch.

The people who were more willing to not irrigate during that growing season posted the lowest bids, and they would be included in the next round of the auction. You, of course, want the most valuable land and crops to be irrigated, so the farmers of those crops — like peach trees, for instance — would either bid high or not participate in the auction at all.

The auction took place one Saturday morning. It was over and done about three weeks before the deadline for planting. That's the great thing about auctions: They're fast and they're fair.

RF: What sort of auction did you design recently for the FCC and what was unique about it?

Holt: My co-author Jacob Goeree [of Caltech] and I contacted Martha Stancill at the FCC. We sent her an idea on how to set up a simple combinatorial auction that doesn't have a zillion possible combinations of licenses and so it would be easy for bidders to understand how pricing works.

This type of auction is one in which you can bid on a collection of licenses. Say you have one national license and multiple regions across the country. The goal is to let the bidding determine if the license gets awarded as a single national one or a bunch of regional ones. In general, in a combinatorial auction the number of possible combinations gets large very quickly — it's an exponential function. That complexity deterred officials from using them for a decade. The procedure we suggested was simple enough that you could do it with a paper and pencil if you needed to. That simplicity also gave the officials confidence that they could answer questions about it in a press conference if they had to.

For a company like Verizon, it might be more valuable to have a collection of licenses in a region. So, if in a particular round of bidding, the highest regional bids add up to more than the national bid, you would provisionally declare the regional bidders the winners. But you would reveal those regional bids so the national bidder would know how high they have to go to knock out the regional bidders.

Conversely, if the highest bid is a national bid, as it was sometime during the actual FCC auction, then the differ-

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ence between the national bid and the sum of the regional bids is how much higher the regional bidders have to go to knock out the national bidder. In a case like that, our procedure would take the difference between the bids and allocate it to the regional level. So, each region had a price which

was their current high bid, plus a share of the increase needed to beat the national bid. These prices provided information to the bidders during the auction about how high they needed to go to get into the action.

One idea behind that procedure is that it helps the bidders on the regional level solve a coordination problem. Each person would prefer someone else to raise their bid to knock off the national bidder. What this does is push everybody up together. The FCC gave this procedure a name (Hierarchical Package Bidding), an acronym (HPB), and decided to use it for a large band (the C block) of the 700 MHz spectrum auction held this past spring.

There was no set number of rounds either. The FCC procedure has always been to let the auction keep going until there are no more bids coming in. So the process lasted a couple of months, from January to March, and consisted of over 100 rounds. This auction raised about \$19 billion.

RF: You've been involved with helping to design a regional greenhouse gas emission auction among the northeastern states recently. How has that differed from the European experiment with carbon permit trading?

Holt: Carbon trading was tried in Europe, but there were problems with how things were implemented. They took the current emissions levels and then divided them by a certain number of allowances — each allowance was good for one ton of carbon dioxide. From the current level, the officials would then scale down the total level of emissions to a specific target and release that number of allowances into the market. Since the electric power companies were one of the groups who needed many of these allowances, they argued to their governments that, if they had to pay for their allowances, they would simply raise the price of electricity. That's never a popular thing to do, so they were given the allowances for free, and approximately proportional to their past emissions.

Some of the companies that had extra allowances in the Eastern European countries would turn around and sell them and suddenly the prices were very high for a while. Those companies got windfall profits from that. And the price of electricity rose anyway — if you cut back on output, price, of course, will tend to rise. This created a backlash against the entire cap-and-trade process.

Here in the United States, a number of northeastern states, led by New York, set up an arrangement where they would cooperate to regulate carbon dioxide emissions in that region. They wanted to focus on the electric power generators.

Early on, a decision was made — and I think this was a very important decision — to require at least 25 percent of the allowances to be allocated by auction instead of simply giving them away. Then New York announced early that they would allocate 100 percent of their allowances by auction, and everyone is anticipating that most, if not all, of the allowances the other states issue will be allocated by auction too. This is the opposite of the European approach where about only 5 percent of the allowances were auctioned. Now the Europeans are interested in what the Regional Greenhouse Gas Initiative in the northeast states — or RGGI, pronounced “Reggie” — is doing. They send representatives to the RGGI meetings, and I think they will go to 100 percent auctions fairly soon.

The states in RGGI are doing this with the understanding that the proceeds of the auctions could be spent on a variety of things, such as strategic energy initiatives or conservation programs. Or, if the price of electricity rises, the proceeds could provide relief for low-income consumers.

RF: How will the RGGI system work and what were your contributions to its development?

Holt: The RGGI administrators will set the cap on emissions, and electricity providers will bid on the number of allowances, each of which equals a set number of tons of carbon. The goal of the administrators initially is to set a fairly loose initial cap so there are no surprises in the auctions — no bottlenecks or dramatic run-ups in price. Then, over time, they would gradually tighten the emissions cap for the next 15 years so the firms can scale their emissions down in a planned, coordinated way. This also gives conservation programs time to come into effect.

The Georgia and FCC auctions were meant to be held only once. The RGGI auctions will be held quarterly in an ongoing fashion, beginning this September. That actually takes a little bit of pressure off the auction design process — if one design doesn’t work so well, you can try another one later. But I think it’s important, for the success of the program, for the first several auctions to go well.

The RGGI auction design team included environmental economists Karen Palmer and Dallas Burtraw from Resources for the Future in D.C., Jacob Goeree from Caltech, and Bill Shobe from the University of Virginia, who had run an innovative clock auction for nitrous oxide emissions allowances for the state of Virginia several years before. My role was to set up the laboratory experiments. There was a concern in the RGGI meetings about possible collusion in the auction process. So, in many of our experiments, we focused on the possibility of firms to either collude tacitly or even explicitly — we would let

subjects talk to each other in a chat room to see what effect that had.

For instance, one of the possible auction types we tested was a clock auction. That’s when you announce a price — in this case, you start low — so demand is much higher than supply. Then the auctioneer notches the price up in increments, and each time you do that demand falls a little bit. You stop when demand equals supply.

In the experiments with opportunities for open discussion, you could look at the chat room transcripts and see what the participants were thinking. You would see them say things like, “Well, in the last auction we all started off demanding a lot. And when the price rose, we all cut back our demand. In the end, we had to accept the result. So, with the next round, why don’t we just start with what we got in the end of the last round? Instead of letting the price go up, let’s agree to stop the auction right at the beginning.” So, many of the clock auction experiments stopped right away because of that collusion. Also, the discussion focused on only one dimension — the quantity dimension — and not on the price dimension because that was determined by the clock.

For the September auction, the RGGI administrators have opted for a sealed-bid uniform-price auction. In that one, the bids are submitted secretly to the auctioneer, they are ranked from high to low, and the price at which supply equals demand is where the price of the allowance is set. When we tested it, we discovered that this design was somewhat more resilient to collusion than the clock auction, both when chatting was permitted and when it was not.

It’s important to realize what you can take away from these experiments. In the real world, collusion is illegal. There will also be lots of bidders. Brokers can buy allowances in our scenario and then sell them to different companies. That’s going to make collusion a lot harder too.

RF: How can experiments be used to teach economics?

Holt: Economic research can be fun and exciting if you follow your interests. For me, experiments provide a hands-on connection between the beauty of economic theory and actual human behavior. The auctions and games I use in research are great for adding excitement to economics classes, which otherwise can be dauntingly theoretical. Teams of students in my classes design their own experiments and use the lab software to run them on the other students, followed by a presentation of the results in the next class. Those who have been in the auction or market have seen the economic process from the inside, learned lessons the hard way, and class discussions are often lively and focused as a result. There’s no better way to teach notions like opportunity cost or sunk cost when some of the students have earned 40 percent less than some of their classmates who priced correctly. In case you’re wondering, I pick one person at random afterward and pay them some small fraction of their earnings. **RF**