The Journal of Psychology and Financial Markets
2002, Vol. 3, No. 1, 37–43



# Asset Markets

**Gunduz Caginalp, David Porter and Vernon Smith**

**Arnold Wood:** I'm going to bypass the introductions and start with our next speaker.

**Vernon Smith:** I'll be talking about experimental asset markets. This is more on the same topics that Colin [Camerer] was talking about. And I'm just going to introduce the research program that started back in 1983 and kind of set the stage for Gunduz and Dave.

This also is a background to what Colin [Camerer] was talking about. I'm going to talk about an even simpler environment than he had. In a sense, Colin's experiments were concerned with the robustness of our findings with respect to changes in the environment, okay, because we were looking at a very simple finite horizon with respect to the environment.

We bring people into the laboratory. They've already had an experience with double auction trading. They've already been in the ordinary supply and demand experiments, so they know what a bid/ask—electronic bid/ask market looks like. We've been doing this since the first electronic bid/ask program that we started using in the lab. That was in 1976. Then we modified it for asset trading and we started these, I think, about 1983.

So here's the environment. Each person is given an endowment of cash and shares, for example 9.45 in cash and one share. And then the shares earned a dividend at the end of each period through a dividend drawing. For example, from a distribution like this, four-point distribution equal probability of 0, 8, 28 and 60 cents would be drawn and that's multiplied by the number of shares paid into your account in cash at the end of every period.

And I should say that we started out with the idea that we wanted to see if we could create bubbles in the lab. And in order to do that we wanted to first have a baseline that would be so transparent that we wouldn't see any bubbles. And that's what this transparent baseline was, except that it was not a baseline without bubbles.

So here is the dividend distribution and that's common information to the subjects. It has an expected value of 24 cents. We compute that for them, and tell them that this means on average that if you sit there and just hold the shares in the first period the holding value of a share will be $3.60. Why? Because you're holding a claim to 15 draws and 15 times 24 is 360. So the holding value in the first period is $3.60. We figured they would know that the holding value should have something to do with the buying and selling value. And then at the end of the first period we draw a number and it's 0, 8, 28 or 60. That draw is multiplied by the number of shares and paid into each person's individual account. At the end of that period, we also give them a little summary and they see the high price, the low price and the average price. Of course, they saw all of these prices in real time on the screen as they were made.

And then we go into the second period. Before we get into the second period, we point out to them the holding value in the second period is $3.36 which is 3.60 minus 24. Because there are 14 periods left, 14 times 24, is 3.36 and so we just lay a heavy hand on them at the end of each period. Well, they totally ignore that information. And if you think that subjects do what the experimenter expects them to do, this is a powerful counter-example.

So I'm going to give you the details here of one experiment. There's been over a hundred of these done, I would guess.

**David Porter:** Way over a hundred.

**Vernon Smith:** We've done them and Colin [Camerer] has. For a while people thought there was a bubble factory in Arizona. So they tried them at Wharton and they tried them at Cal Tech. They thought they wouldn't get bubbles, but it turns out the bubble factory works at Cal Tech and Wharton.

Here the fundamental value is well defined and during period one it's $3.60. Okay, during the first experiment we did there was a bid and an ask as $1.50, so someone took that trade. I gave this talk back about 1985 when I gave talks about this in economics departments near oceans and large lakes and one of them was at Princeton. And I showed this slide and one of the theorists said, "That's stupid, anyone who would sell at $1.50,"

**Gunduz Caginalp** is a professor in the Mathematics Department at the University of Pittsburgh.

**David Porter** is a professor in the Department of Economics and Law at George Mason University.

**Vernon Smith** is a professor in the College of Arts and Sciences at George Mason University.

Requests for reprints should be sent to: Gunduz Caginalp, Mathematics Department, University of Pittsburgh, Thackeray 506, Pittsburgh, PA 15260. Email: caginalp+@pitt.edu

and I said, "Well, no, maybe not. If he thought it was going to fall, it was not so stupid."

Sure enough, the guy that sold here was a bidder. He was this bidder here, but somebody overbid him, but he failed to get back in. He was just doing very myopic trading, okay. Then we have a series of bids and asks leading to this bid/ask spread. Then an ask is taken and so on. We have a series of eight trades, the floating number of shares is 18. There are nine people in this experiment so, on average, they're holding two shares. So the floating stock is 18 eight-unit trades.

These, by the way, are experienced subjects. This is the second time they've already seen an asset trading experiment. This is not the first time for them. I'll show you the first time pretty soon. Then the period ends and we go into the second period of trading. The fundamental value is now dropped to $3.36. Everybody gets reminded of that. Bids and asks, this ask is accepted, bid, okay, and so there goes the market. By the third period the fundamental value falls down to $3.12, but here is the trading up to almost $6 in the third period. The price has gone from a low of about $1.40 up here to a high of around $5.75. And then it peaks out and it starts to fall and there she goes, okay.

Now, that's kind of a fairly typical bubble that we get in one of these experiments where it's a group of subjects that have already done this once with perhaps different dividend pay-out arrangements. And there's a simple way of characterizing the dynamics of this, and it's called eyeball rule. I just looked at this data and look here, there's lots of bids and very few asks, bids, the asks are thickening up and the bids are—all we're doing is counting the bids, the number of orders, each trade here is for a single unit, we're just counting them. The asks are starting to thicken up, the market is getting ready to turn and when it turns, there are a lot of asks but not as many bids. When prices fall until the market stabilizes, there are only two units that trade.

Notice here it's below fundamental value; the number of bids is starting to thicken up. The asks are thinning out, the market is ready to turn and then the last period there's one trade and it's 24 cents—final fundamental value. Okay, that's the typical sort of arrangement. We can think of this as a surrogate measure of excess demand arising from capital gains expectations and those capital gains expectations are just coming out of the woodwork.

In the instructions we tell everything that we possibly can in order to indicate that there is no value coming out of the woodwork, the value is all in those dividends. Okay. So capital gains are zero sum. The intercept here is negative, well, it should be because the value is falling, okay, and in fact this is minus 12—that's not significantly different actually than minus 24—which is a one period dividend value. Also, the multiplicative factor on excess bids is always positive, and significantly positive, and the third factor determining price is just random noise, okay.

**Arnold Wood:** Did you know who was doing the bidding and the asking at any point in time?

**Vernon Smith:** Sure, we've got them all by number and name.

Okay, if you look at mean price deviations from fundamental value, here is what happened. It started out below fundamental value, dropped, stabilized, dropped again, overreacted, went below fundamental value and then recovered and came right into the fundamental value again.

If we look at this same group during the first experiment they did, here are the characteristics of the bubble the first time. We notice the volume is quite high relative to the number of shares, but the volume tends to get smaller if you bring people back. By the third time the volume almost disappears, okay. And I'll give you an example of that. This chart doesn't have the volume on it, but it gives you an idea what happens to the prices. One of the things that I was told right away is what's wrong with these experiments. People can't short sell or buy long or buy on margin, they told us. If they could do that, the few people who could see the deviation from fundamental value would short sell like crazy when it went above fundamental value. And if people could buy on margin, they could see it was undervalued and would buy like crazy when it was low and that would be the end of the undervaluation.

So we introduced short selling and margin buying. Well, the bubbles go through the roof then. So we cut that out. The problem with short selling is your timing has got to be right. Anyone who's ever short sold knows that. And you've got people starting to short sell as soon as it gets above the fundamental value. And it gets up higher and people start to get nervous, see, and what you have is more short selling up here, but at the same time buying to cover for these people who short sell early. So, if anything, the short selling can actually make the bubble worse. It all depends—you see, this has nothing to do with fundamental value; it has to do with your expectations and what the people are going to do given the prices relative to fundamental value. So you bring these people back a second time and you see we're a little bit closer to fundamental value. Bring them back a third time and they're quite close. Sometimes at the end of the experiment there's no trade at all and it just ends with a bid/ask spread, and what we're taking

is the mid-point of that bid/ask spread. So this is kind of the process.

One of the things that we added as part of the program was asking them to make forecasts of the mean price next period. So they had to do that one period ahead. We look at the mean prices and the forecasts of average price. It's a consensus forecast, okay.

So they start out, here they are, this is the mean price they gave us. They're trading below equilibrium. Well, when there's a big jump in price, they give us a big jump in the forecast. Okay. Price has gone up, so they forecast a further increase, but it didn't happen, it fell. This is one of the examples where the market falls and then recovers. When that happens on the way up, on a boom, some people start hoping that's going to happen again, okay. So here it goes up and here the market drops some and then it finally turns and this is a late crash.

So they basically can't even forecast their behavior one period ahead. This is not professional forecasters looking at some other process. They're just trying to forecast their own behavior and they can't do it. That's how myopic this whole process is.

**David Porter:** Looks like they did a good job of it up to when it turned. They just can't forecast the crash?

**Vernon Smith:** Yes, they don't do a bad job forecastng which things are just kind of moving nice and easy, but then you get a jump and they miss it, see, and they always miss the turning points and they're just like professional forecasters. You know, if things don't change very much from year to year or they're just growing at a steady rate, forecasts are pretty good, but they're not good at forecasting turning points.

Okay, now we've done many, many variations on this and I'm going to turn it over to Dave and Gunduz here to give you some of the new results. But let me show you one thing we looked at back after the so-called big crash of October 1987. There were all these committees put together and all of them were coming up with saying we ought to have price change limit rules, okay. Circuit breakers.

We thought we'd have a look at that, and so here is. Here's an experiment where the expected dividend is 16 cents per period and we're making the price change limit rule plus or minus 32 cents, just twice the dividend. In other words, if the closing price is P(T) where T is the period, then the ceiling next to period is going to be P(T) plus 32 and the floor is going to be P(T) minus 32. We just take the closing price and everybody knows that. So here's what we get.

With these price ceilings and floors there are a lot more cases where the market starts out clear above fundamental value. Under these conditions it turns just like a typical inexperienced group. It turns and the problem is there are no buyers when the market turns. One of the things that seems to make these bubbles carry even further with these price ceilings and floors is that people feel comfortable that their downside risk has been reduced, it can't fall more than 32 cents, so let it blow.

The problem is when it drops there's no one there to buy but they never thought of that. Well, now they have to learn that. Well, how long does it take them to learn that? Three times. If we look at the second time with that same group back, we find that they are now expecting it to bubble and crash. And, of course, that's what it does. And it crashes earlier, okay, and here it tops out and goes down, look here, it's falling, no trade, no trade, no trade, no trade, zero, zero, zero, finally gets down here and we get five trades right close to fundamental value.

Bring them back a third time, that same group there; they are trading very close to fundamental value and very, very low volume. It started out here with pretty good volume and then it just completely dried up. Well, you know, you need price ceilings and floors for these people to learn to trade at fundamental value the third time back. So, if anything, the lesson here from the circuit breakers is that it makes the bubbles carry longer and further. That's the background for Dave.

**David Porter:** As Vernon mentioned, there have been a lot of experiments done with this particular asset market and most of the experiments were conceived from criticisms. Well, this doesn't have short selling. It doesn't have margin buying. It doesn't have futures markets, etc. We've tried everything to eliminate this bubble, and haven't found too many things that are useful.

And some mathematician in Pittsburgh actually read the darn paper and he said, "Geez, you know, maybe there's a way to describe what's going on as opposed to creating fixes." And Gunduz created this model which has different investor sentiment which we'll talk about in a little bit, but I'm going to talk about a very recent set of experiments we've done. It's got a sexy title that includes Momentum, everybody likes that; Liquidity, you can't argue with that and expectations of traders. Those are the culprits that lead to the bubbles. And let's see, here are some observations from the experiments in the past, okay.

Common expectations, meaning if you bring them back the third time and they've all experienced it, they've seen all the information about the excess bids going on, then they tend to converge to fundamental value. Vernon mentioned there's an excess bids model, which is a good fore-

cast for the next period change. So if you could see the market forming in terms of the bids and asks ahead of time, maybe that could give you a read on what's going to happen with prices. And then, of course, we have a momentum model that Gunduz developed.

Here's what it predicts. When prices are below fundamental value, the fundamental value guys, the value traders come in and start buying. So prices get pushed up. Then the momentum guys come in, they start pushing the price up and they get a good surge. They, of course, overwhelm the fundamental guys, but they're spending money to buy the shares and all of a sudden their funds dry up and then the sentiment is reversed. There's nobody there to buy anymore. So selling starts letting in, the prices go down, the Momentum guys can't get out fast enough and then you've got the bubble and crash.

Gunduz made sure his model had everything in it in terms of the shares, the amounts of turnover and the amount of the cash that's involved. So he has a model that actually has predictions based upon the amount of cash that's in the system, values on the shares and so forth. So what I'm going to talk about is a slight variation in the mechanism by which shares were traded in the experiments we did.

Vernon talked about the double auction. Just to see if everybody is awake, I'm going to switch to mechanism. Mind you, it's a call action. Every period all the buyers sent in their bids, so you get the demand for shares and it's sealed so nobody sees this as that period is called. So in period one, when the shares are worth $3.60, we ask everybody to send in their bids to buy. On the other hand, if you wanted to sell, if you had shares, you would send in your ask to sell. The bids and asks are sealed, nobody sees them until after the market is formed. You cross the market and, of course, when you cross the market you get the number of shares that trade and a price. What you see is an equilibrium price and the number of shares traded.

All of these guys who sent in these orders trade and all of these who send in those orders trade, and so then you get a sealed bid offer or the SBO, as we call it. So we use this particular mechanism to determine the price because we didn't want to use averages or anything. It's a single price, one uniform price. We don't have to worry about closing prices, averages and all that sort of stuff. However, the excess bid information is always after the fact. You only get to see how the market formed after the call is done. So in some case you may have this big overhang of excess bids, but you only see that after the markets done. If you could have seen this information maybe as the market was forming, you may have been able to place more orders by utilizing that knowledge. For example, if you have an overhang of asks, so people are willing to sell and these people didn't get to see this overhang while it was going on, maybe it would have induced some buyers to come in.

So we created an open book treatment. We allowed the participants to see the orders as they were placed. So as orders came in, you would see those curves forming. You could see what the current cross is and given that information, you see the specialist's book basically. And you can see how the market is forming and maybe they'd have some potential to get people to have their expectations become more jaded, in the sense that they can see there's a lot of bids coming in. Perhaps they would think, "Maybe I ought to switch to the other side of the market. I'm bidding now, but if I were to switch to the sell side, maybe I should get in."

**Voice:** Does that mean you allow people to cancel?

**David Porter:** Yes, in this particular case, yes. There are a lot of different versions of it. You can design it so that when you're in the cross, you can't withdraw it. If you're on the other side of the cross, in other words you're not in the market, you can always withdraw. That's called another side rule.

In this particular one, we made it wide open so you could cancel if you were in the cross or out of the cross. It turns out it's very much like Colin's [Camerer] result that those things get ignored. People know when some guy is going to pull his bid out. You see it sometimes at the beginning. It doesn't even affect the price at all. You see very little of it because people line up at that margin so if one guy drops out, it doesn't change the price at all.

Liquidity is something we were interested in, and, of course, this is a really great quote because it's really true, liquidity, like pornography is easily recognized, but not so easily defined, and that's true. The story I got was liquidity, that is the way you measure it, is you don't want to be left holding the bag. You can always get your order out there and not move the price. Well, I don't even know what that means, but Gunduz's model actually has a way to do this. So the more cash that's in the market relative to the fundamental value, the more it places upward pressure on the trading price. So in other words, if you give people more money, they will raise the price. Vernon and I saw this in some of the experiments we did where we allowed margin buying. Margin buying in those experients was like throwing gas on a fire. If you put some money in their pocket, they're going to invest.

So this is it, if you put more cash, there's pressure to invest. It takes the prices higher before the

dry-up and the moment sentiment switches. So the differential equation model predicted that if you take this particular amount of cash relative to the fundamental value and change it, you're going to exacerbate the bubble and the length of the bubble.

So the question was, is this true? So we'll go find out. So what we did is we designed several treatments. We looked at liquidity. This was the initial cash, all the cash in the system. So it's the money supply in this particular economy, divided by the fundamental value times the number of shares that are outstanding. So this number gives us a liquidity value that is measured in dollars per share. We used values of $1.8 (low liquidity), then doubled it to $3.6 (neutral liquidity), or same amount of cash as value of shares and then doubled it to $7.2 (high liquidity). So this is just adding more cash relative to fundamental value. Okay.

We used the SBO and we either had it open or closed book. So here's the treatment, a little 2 by 2 matrix. So the first result is that for each dollar increase in liquidity, we get another period duration in the bubble, we get another $1.22 in the amplitude. By amplitude we mean the difference between fundamental value and the price. The highest difference is there.

So if you look at a bubble, there are three dimensions. Vernon and I have looked at amplitude, as we just defined, as a measure of the size of the bubble. Another is the duration, how many periods it's still growing. And the last part is stock turnover, or the amount of churn. In other words, of the shares outstanding, how many times are those shares outstanding turned over? And you get an increase in about 27 percent of the stock turning over for every dollar. It's really amazing.

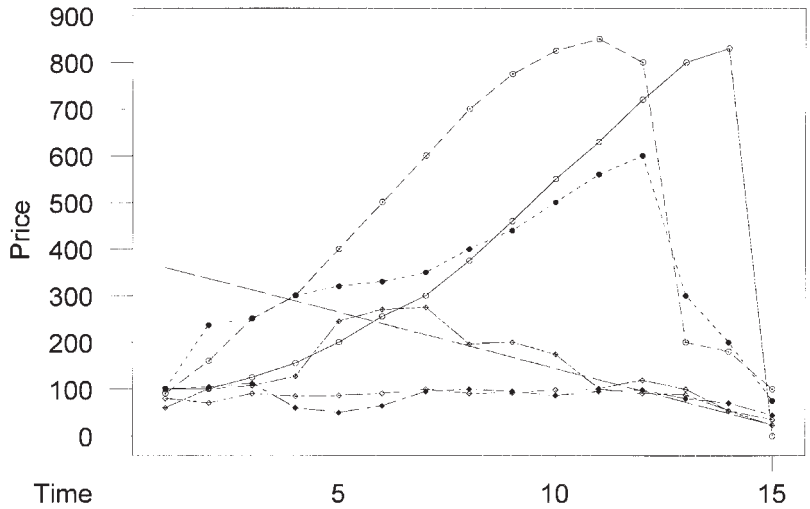
Here are the results [Figure 1]. At the highest level of liquidity, it's like putting gasoline on the fire as all these are up there with seven, eight, ratio of the price to fundamental value. So you see that when you have this high level of liquidity, you get a bigger rise and a big old fall. With the intermediate one, you get a little bit of rise. The duration is a little longer and it goes down. And the lowest levels of liquidity yield the smallest bubble. So, basically liquidity has a very strong effect on that bubble.

**David Dreman:** I was going to say that's very similar to the chart I showed yesterday that displayed the market in late 1998 when the Fed pumped a lot of money in to offset the long-term capital debacle and the Russian default, and then again at the end of 1999 where we had worries over the Y2K problem. The NASDAQ went straight up.

**David Porter:** That's kind of interesting because for the experiment we have a clear measurement for what we mean by liquidity, because we have a closed system. We haven't really come up with something that's equivalent for, you know, the field markets.

**Vernon Smith:** It's a simple closed system. We're doing it now with two assets. In the current case, it's one asset plus money. You can only do two things with your money. You can sit there and do

**FIGURE 1**
**Price Evolution Under Conditions Maximizing and Minimizing Bubbles**




*Note:* The price evolution is shown for six experiments, along with the straight line representing the fundamental value (which declines from $3.60 to $0.24. In the three experiments, marked by circles, in which prices soar far above the fundamental value, there is an excess of cash, the dividends are distributed at the end of each period (adding more cash) and there is a closed book so that traders do not know the entire bid–ask book. In the experiments marked by diamonds, the opposite conditions prevail, and prices remain low and there is no bubble.

nothing with it or you can use it to buy shares. And we know how much money is devoted to the stock market because we control it.

**Gunduz Caginalp:** Even though it is more difficult to show the effect of liquidity (or excess cash) inthe field, the point that David [Dreman] made is very important. As the Fed lowers interest rates, particularly in the absence of sluggish economic conditions, it actually frees up much more money to go into the stock market, thereby boosting prices.

**David Porter:** What that does is to lower the opportunity cost of where you can send your money, by lowering the appeal of the bond market. It's earning less in the bond market, so now it's burning a hole in your pocket, and you've got to put it somewhere, so you put it in stocks.

**Gunduz Caginalp:** At the same time Greenspan was talking about this stock market being too high and "irrational exuberance," he was actually fueling this bubble.

**Voice:** Could you comment on what happens in the high liquidity situation in terms of terminal price?

**David Porter:** It usually closes a little below fundamental value. Sometimes they don't crash down to fundamental value.

**Gunduz Caginalp:** Basically, in real terms they're going from about $8 to 48 cents. It's a pretty big crash, but they don't go from $8 to 24 cents or 12 cents.

**David Porter:** That's a good point because the scale I am using is not the deviation from fundamental value, it's the percentage. So this one, even though it's at 2, it's close to 48 cents instead of 24 cents.

**Voice:** That's just sort of a nice psychophysics issue in terms of proportionality. You know, 4 cents is almost nothing relative to the $8 peak.

**Gunduz Caginalp:** Yes, you lost most of your money.

**Voice:** An interesting aspect of this is that there seems to be a natural process of starting low and moving up; a little bit kick-starts this.

**David Porter:** Well, you know, this is idea is based not on these pictures, but the idea was based on momentum models from Gunduz. And the first thing we examined was to see if it's true that a low initial price leads to a bigger bubble. So we created a case where we had callers only in the first period. And the lower you make it, the bigger is the boom. So the lower they start, the higher they bubble. So anyway, moving on, here are results of open versus closed book.

**Voice:** Before you moved on, it's tempting to say that Greenspan under the influence of the Y2K hoax filled the market with money, pushed the bubble beyond belief, and then when he sucked the money back out right after the New Year, that was the end of the bubble.

**Gunduz Caginalp:** When it's going down, momentum actually drives it down faster. So the liquidity plus the momentum kicking is pretty much the answer.

**David Porter:** So here are the results of the open versus closed book. The presence of an open book doesn't change bubble duration at all. They still bubble. It actually reduces the amplitude by 67 cents. That happens to be actually significant and it reduces stock turnover, but that is not significant. So liquidity is what's causing these results anyway and there are the results with the open book. For level of liquidity, $1.8 (low liquidity) it reduces the amplitude, but the rest of it is nothing to write home about. You notice these all—this one hangs up here and it's an open book, I don't know why. And here is one with a higher level of liquidity. Here you don't even see the effect of the open book, since the liquidity swamps it so much. That's it. What I'm going to do now is to hand it over to Gunduz.

**Gunduz Caginalp:** Just to show you another perspective, here are the actual prices in Figure 1 without subtracting out the fundamental value. The fundamental value goes from $3.60 down to zero. If we compare the prices in experiments with conditions that are most favorable to bubbles to those that are least favorable, there is a dramatic difference. One other factor that I should mention is that we examined the effect of deferring dividends. That wasn't a large factor in the high liquidity cases, but was significant when the liquidity was lower. In particular, instead of giving the 24 cents each period, which adds more cash, we said let's suppose we hold off on that. We credit them, but we paid them at the end of the experiment, so that doesn't count as cash that can fuel the liquidity or bubble. And so there are, in fact, three factors we found to be significant. And if we compare the price evolution and the maximizing conditions and minimizing conditions, it's very conspicuous.

So I want to just mention a couple of theoretical ideas and then speculate a bit in terms of the markets. As David [Porter] said, we tried to address the question of how much does each dollar in excess cash per share result in higher prices per share, and he has presented the results. In terms of these regular units without subtracting but the fundamental value, the conclusion is that a dollar extra in extra cash per share gives you a dollar extra trading price per share at maximum level. But one interesting aspect that arises from theoretical studies, this just comes out of the mathematics naturally, is that we have two ways of thinking of price per share. There is the price per share that someone pays, i.e., the trading price. There is the very important price that David Dreman has told us for

decades, the fundamental value, which is the price per share that I should pay for this company or for this asset. And beyond that there's this other price per share, which seems to be important. That is the total cash in the closed system divided by the total number of shares. We believe that this last factor is how one can attain a price of $7.20 per share when the fundamental value declines from $3.60 to $0.24. So in other words, when we look at one of these things, a price of $7 or $8 cannot be justified. However, if we look at the graphs of experiments, a lot of them seem to attain the liquidity price, the number of dollars per share, which is $7.20 in some cases. There seems to be something substantial in terms of this new price per share.

We've already discussed this idea of the Fed injecting liquidity and so on, but there's one other important issue that can be understood from this set of ideas and this perspective. As we discussed earlier today, the underwriters are trying to raise money for new IPO's. So let's assume we have a hot IPO and we believe that the total amount of cash out there for this new IPO, say, XYZ Technology, is a hundred million dollars. And let's also assume that the investors have no concept of value.

How much should I pay per share? If the number of shares sold to the public is 10 million, by our type of analysis we say a hundred million dollars divided by 10 million shares would give me a liquidity value of $10 per share. And that's apparently how a lot of these prices evolve when the underwriters believe there is a hundred million dollars of public appetite. They want to sell 10 million shares and that gives you a share at $10.

As was noted this morning, often they would raise the offering price while the number of shares sold is fixed. They don't typically alter those. However, if they find that there's $200 million available, well, that gravitates the price up to $20 a share (in terms of liquidity price per share) and then on the first day of trading they find it's even more, maybe even 400 million and the price goes up to the natural value of $40 per share.

Now, the only problem with all this is really evident when you read the prospectus. At the outset, there's something that's very striking. Namely, the value that we the investors pool is a hundred million dollars of money, okay. However, we only own 5 percent of the shares. The remaining 95 percent is owned by these geniuses that underwrote the company and had these great ideas. The shareholders, putting up almost all the money, only own 5 percent of the company. The fact that the investors who have put up the money only own 5% of the stock means that there is a dilution by a factor of 20. Simple arithmetic tell us the $10 shares are really worth 50 cents per share because we've given away 95 percent of the company to these geniuses. They write this in the prospectus, that there's this dilution. They don't usually quantify it this way but they do allude to this as one of the risks. They have a huge number of risks, one of which is that they don't have any product or they don't have any earnings or so on.

The fundamental value is at 50 cents, but shareholders paid a hundred million dollars for 5 percent of the company. And so if you would multiply by the full number of shares, which would be 20 times that, there's a $2 billion market cap. And this is the simple explanation of why we had market caps of $2 billion for companies that had very little in terms of any value or products or anything else because we're multiplying by this.

Now, of course, this 95 percent that the insiders hold is locked up for six months. And so once the lock-up period ends, there's this avalanche of selling ready to come to the market and there's a huge number of sellers compared to buyers. At that point the liquidity value does go to 50 cents. Very simply, what we defined as liquidity value was $10 originally, but once the "lock-up" selling begins, the liquidity value is 50 cents a share because we are now dividing the same amount of dollars by more shares (a factor of 20 times more). This is roughly how a lot of these things ended up, assuming no deterioration in the business.

I think that's pretty much all that I had to say. Thank you for your interest.