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Can We Prevent the Next Bubble?

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It's been three years since the collapse of the last economic bubble, so it's probably time to start worrying about the next one. Sure enough, commentators are increasingly concerned about gold bubbles, "tech 2.0″ bubbles and venture capital bubbles. To be clear, I know nothing about any of these bubbles; this post isn't about the virtues of a Groupon IPO or the true value of precious metals. Instead, I'm interested in the persistence of *all* bubbles. Why are they so inevitable? Why don't we ever learn? And can they be prevented?

But first, a little history: One of the first financial bubbles was about flowers. In the late 16th century, tulips were introduced to the Netherlands from the Ottoman empire. The flowers were an instant sensation, and were soon cultivated by connoisseurs all across the country, who bred increasingly ornate color varieties.

The speculation began in the early 1630s, when gardeners started selling the spring flowers — tulips only blossom for a few fleeting weeks in April and May — in the winter months. This led to the creation of a futures markets, as buyers bought and sold the promise of spring buds. By the winter of 1636, prices for the flowers began a steep ascent, so that a single tulip bulb was worth approximately 10 times the salary of a skilled craftsman. Acres of land, gold jewelry and prized oil paintings were traded away on the promise of multicolored petals.

And then, in February 1637, the bubble burst. Tulip prices entered a steep decline, with the value of some rare bulbs declining more than 99 percent. In many instances, the speculators ended up with expensive futures contracts they couldn't resell. All they got was a flower.

While tulipmania might strike modern investors as a ridiculous frenzy, it's hard to argue that our financial bubbles are less absurd. In recent years, we've lived through the aftermath of the dot-com boom, in which startups without business models were suddenly worth billions of dollars, and the real estate bubble, in which Las Vegas tract homes tripled in value before they were even finished. Each bubble has its own macroeconomic explanation – loose money policy,

Fannie/Freddie, shady Wall Street "innovations" — but those stories still beg the question: Why don't we know better? Because here's the paradox of bubbles: In retrospect the speculation always seem foolish. How can a tulip be worth more than a house? Is Cisco really the most valuable company in the world? But in the frenzied moment, the trading proves hard to resist, so that even amateur investors begin betting on bulbs, dabbling in Nasdaq shares and flipping condos.

In recent years, scientists have begun deciphering the irrational underpinnings of bubbles. Consider an economics experiment led by Colin Camerer, a neuroeconomist at Caltech. He set up a stock exchange in his lab, consisting of shares in a single pretend company, and invited Caltech undergrads to participate. (The simulation was inspired by similar research first done by Vernon Smith, the Nobel Prize-winning economist.) At the start of the market, every "investor" was given two shares and a small amount of money to buy more shares. In order to accurately simulate the real stock market, Camerer made the shares pay a small dividend of 24 cents per period, with the market lasting for fifteen periods. If a student owned one share for the entire game, they earned a total of $3.60, or $.24 x 15.

Camerer designed the experiment so that the value of the shares was transparent. For example, one share at the start of the game was worth $3.60, since that's how much a student could expect to earn in dividends. By round two, that same share was only worth $3.36. In the next round, it would be worth $3.12, and so on. If the students were rational traders, the shares would steadily decrease in value, until they ended up being worth only 24 cents in the last round.

But that isn't what happened. As soon as trading began, the students bid the price of each share above $3.60, as they engaged in a typical bout of irrational exuberance. What was strange, however, was the persistence of this speculative bubble. Even when the shares were worth less than $1, students were still bidding more than $2.50. The lesson is that even in a transparent marketplace — the value of the investment was perfectly obvious — bubbles inevitably develop. We can't help but speculate.

Of course, this still begs the question: Why are we so dumb? To better understand the source of our compulsive speculation, Read Montague, a neuroscientist now at Virginia Tech, has begun investigating the formation of bubbles from the perspective of the brain. He argues that the urge to speculate is rooted in our mental software. In particular, bubbles seem to depend on a unique human talent called "fictive learning," which is the ability to learn from hypothetical scenarios and counterfactual questions. In other words, people don't just learn from mistakes they've actually made, they're able to learn from mistakes they might have made, if only they'd done something different.

Unfortunately, fictive learning can also lead us astray, which is what happens during financial bubbles. Investors, after all, are constantly engaging in fictive learning, as they compare their

actual returns against the returns that might have been, if only they'd sold their shares before the crash or bought Google stock when the company first went public. And so, in 2007, Montague began simulating stock bubbles in a brain scanner, as he attempted to decipher the neuroscience of irrational speculation. His experiment went like this: Each subject was given $100 and some basic information about the "current" state of the stock market. After choosing how much money to invest, the players watched nervously as their investments either rose or fell in value. The game continued for 20 rounds, and the subjects got to keep their earnings. One interesting twist was that instead of using random simulations of the stock market, Montague relied on distillations of data from famous historical markets. Montague had people "play" the Dow of 1929, the Nasdaq of 1998 and the S&P 500 of 1987, so the neural responses of investors reflected real-life bubbles and crashes.

Montague, et. al. immediately discovered a strong neural signal that drove many of the investment decisions. The signal was fictive learning. Take, for example, this situation. A player has decided to wager 10 percent of her total portfolio in the market, which is a rather small bet. Then, she watches as the market rises dramatically in value. At this point, the investor experiences a surge of regret, which is a side-effect of fictive learning. (We are thinking about how much richer we would be if only we'd invested more in the market.) This negative feeling is preceded by a swell of activity in the ventral caudate, a small area in the center of the cortex. Instead of enjoying our earnings, we are fixated on the profits we missed, which leads us to do something different the next time around. As a result investors in the experiment naturally adapted their investments to the ebb and flow of the market. When markets were booming, as in the Nasdaq bubble of the late 1990s, people perpetually increased their investments. In fact, many of Montague's subjects eventually put all of their money into the rising market. They had become convinced that the bubble wasn't a bubble. This boom would be different.

And then, just like that, the bubble burst. The Dow sinks, the Nasdaq collapses, the Nikkei implodes. At this point investors race to dump any assets that are declining in value, as their brain realizes that it made some very expensive mistakes. Our investing decisions are still being driven by regret, but now that feeling is telling us to sell. That's when we get a financial panic. In the last year, Montague has expanded on these provocative results. He's shown, for instance, thatheavy smokers are less vulnerable to fictive learning. This is probably because they've learned, over time, to ignore those regretful thoughts telling them to quit smoking. (Although they lament their nicotine addiction — they know it's killing them — they keep on lighting up.) The upshot is that their ability to not learn from fictional scenarios might also make them more resistant to the allure of bubbles. The lesson, I guess, is that it might be good to have a stock broker with a debilitating addiction.

Montague has also begun exploring the power of social comparison, or what he calls the "country club effect," on the formation of financial bubbles. "This is what happens when you're sitting around with your friends at the country club, and they're all talking about how much money they're making in the market," Montague told me. "That casual conversation is going to change the way you think about investing." In a series of ongoing experiments, Montague has studied what happens when people compete against each other in an investment game. While the subjects are making decisions about the stock market, Montague monitors their brain activity in two different fMRI machines. The first thing Montague discovered is that making more money than someone else is extremely pleasurable. When subjects "win" the investment game, Montague observes a large increase in activity in the striatum, a brain area typically associated with the processing of pleasurable rewards. (Montague refers to this as "cocaine brain," as the striatum is also associated with the euphoric high of illicit drugs.) Unfortunately, this same urge to outperform others can also lead people to take reckless risks.

More recently, a team of Italian neuroscientists led by Nicola Canessa and Matteo Motterlini have shown that regret is also contagious, so that "observing the regretful outcomes of another's choices reactivates the regret network." (In other words, we internalize the errors of others. Or, as Motterlini wrote in an e-mail, "We simply live their emotions like these were our own.") Furthermore, this empathy impacts our own decisions: The "risk-aptitude" of investors is significantly shaped by how well the risky decisions of a stranger turned out. If you bet the farm on some tech IPO and did well, then I might, too.

There are two important takeaways to this research. The first is that neuroscience might soon be able to help make macroeconomic diagnoses, allowing us to better distinguish between booms and bubbles. For instance, one could have subjects "play" the current gold market in a scanner, if only to see how their brain activity compares to that of people playing previous market bubbles.

The second is that speculative bubbles are rooted in a very adaptive learning mechanism, which is probably why they're so hard to prevent. The only way to keep us from bidding up LinkedIn stock and tulips is to keep us from learning through counterfactuals. Of course, that means we'd be cut off from a crucial means of self-improvement, a way of benefiting from mistakes we didn't actually make. In other words, the reason we sometimes make such stupid investment decisions is because we're so damn smart.