

## Economic Brief

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# How Speculation Affects the Market and Outcome-Based Values of Innovation

By *Valentin Haddad*, [Paul Ho](#) and *Erik Loualiche*

Innovation booms often coincide with speculative bubbles. Using data on over 1 million patents, we document two ways in which speculation creates a disconnect between the market valuation of innovation and its actual economic impact. First, an innovation during bubbles raises the stock price of its creator by 40 percent more than is justified by future outcomes. Next, competitors' stock prices move little during bubbles despite their profits suffering. We present a theory of investor disagreement about which firms will succeed that reconciles both facts. Policymakers should account for the disconnect.

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In 1686, William Phips secured funding from England's Second Duke of Albemarle and his syndicate to search for sunken Spanish ships in the Bahamas. His expedition found 34 tons of treasure, yielding large returns to his investors.

Considerable speculation about treasure-hunting technology followed, with 17 patents for ways to recover underwater bounty registered between 1691 and 1693, a large number for the time. In addition, many firms were introduced on equity markets in England and raised large amounts of capital, producing a boom so large that it is sometimes credited for the emergence of the country's developed equity markets. However, the subsequent expeditions were fruitless, finding only a few cannons.

This is a familiar story: Throughout history, there have been countless episodes of similar innovation booms generating many new firms with high valuations in capital markets. And many times, these firms and innovations end up having much lower eventual economic values. How does the speculation during such episodes influence the value of innovation in capital markets and the real economy?

# How Does Speculation Affect Innovation and Its Consequences?

Our paper "[Bubbles and the Value of Innovation](#)" (recently published in the Journal of Financial Economics) analyzes the interaction between innovation and speculation using data on over 1 million patents from 1926 through 2010. We show empirically that speculation on financial markets creates a disconnect between the responses of stock prices and real outcomes to an innovation, as was the case with treasure hunting in the 17th century.

In this article, we focus on two significant findings from our paper:

- The impact of an innovation on the stock price of its creator during a bubble increases by 40 percent relative to the real outcomes it will generate.
- Even though innovation in a firm damages the profits of its competitors, these negative spillovers have no impact on the stock prices of the competing firms during a bubble.

To understand the empirical evidence and its implications, our paper proposes a theory of disagreement among investors about which firms will succeed. For example, investors disagree on whether Twitter or Facebook will be the more successful social network, even though they may agree on the total value of the social network industry. The theory predicts the disconnect between stock prices and real outcomes that we document in the data and allows us to study the implications of such speculative episodes for welfare and government policy.

Our results help better interpret different measures of the value of innovation. This is crucial for numerous questions, such as:

- How much does an innovation boost the profits of a firm?
- What implications are there for the profits and valuations of competing firms?
- How does innovation drive economic growth?
- How should the government tax or subsidize innovation?

Our focus on speculative episodes and the ensuing bubbles echoes José A. Scheinkman's Arrow Lecture "[Speculation, Trading and Bubbles](#)," where he highlights that such bubbles often coincide with technological innovations.

## Measuring the Value of Innovation

One approach to measuring the value of an innovation is to look at the stock market response. In particular, one can compare the market value of a firm before and after a new patent is issued. Economic theory suggests that the change in market value captures how much investors expect the patent to impact the firm's future profits.

An alternative is to look at actual future outcomes. The change in sales, profits and productivity in the years following the patent's issuance (accounting for other factors) can be viewed as a measure of the realized value of the innovation. This measure will tend to be similar to the first measure if investors' forecasts are correct on average, an assumption that is less plausible during speculative episodes.

Economists and policymakers are interested in measuring the value of an innovation for both the innovating firm and its competitors. While an innovation can boost the profits of the innovating firm, it may reduce profits in competing firms that become displaced as a result. For example, the PageRank algorithm led to both the rise of Google and the demise of many other search engines.

## **The Disconnect Between the Market and Outcome-Based Values of Innovation During Bubbles**

We focus on how these valuations behave during speculative episodes, which tend to coincide with innovation booms. For example, the 1920s saw a stock market bubble that coincided with new technologies such as the automobile and aircraft. More recently, the dot-com bubble was connected to the introduction of internet technology.

To that end, we identify bubbles using the definition from the 2019 paper "[Bubbles for Fama](#)" and study the behavior of different measures of the value of innovation in and out of bubbles.

First, we show that the market value of innovation for the innovating firm increases more than usual during bubbles, but real outcomes remain the same on average. Specifically, following the issuance of a patent, the stock price of the innovating firm increases by 40 percent more than it would have in the absence of the bubble. In contrast, the change in firm profits following the patent issuance is identical in and out of a bubble. This disconnect points to relative optimism among investors about the value of a patent during bubbles.

The second empirical fact we document is that the decline in competing firm stock prices after the issuance of a patent is substantially weakened during bubbles even though the eventual decline in firm fundamentals remains unchanged. In other words, while innovation in competing firms continues to reduce profits in their own firms, investors no longer take these spillovers into account during a bubble.

## **Disagreement About Which Firms Will Succeed**

What causes these systematic differences between asset prices and real quantities during bubbles? While there have been numerous theories of bubbles, we argue that these cannot jointly explain our two key empirical facts. Instead, a critical element to understanding the disconnect is that investors disagree about which specific firms will succeed.

Our paper presents such a model and shows that it is consistent with the empirical evidence. In our model, firms can enter a market with blueprints for innovative ideas. Investors each have their own beliefs about which firms or ideas are most likely to be successful and, thus, invest in their own favorite firms.

Similar to what occurred with the treasure hunting industry in the 17th century and internet firms in the 20th century, our model predicts that a large number of firms are initially able to raise capital and have high valuations. However, mirroring those same episodes, many firms eventually fail. The overvaluation by investors mirrors the high market valuation of innovation relative to the real outcomes we find in our first empirical fact.

Since investors have strong opinions about which firms are most likely to succeed, they are less concerned about the presence of competing firms or ideas. As a result, firm valuations in our model decline less (or, in the extreme case, not at all) during bubbles than in the absence of speculation even though the firm competition eventually does matter, consistent with our second empirical fact.

## **Further Implications**

The idea that investors might disagree about specific firms is particularly relevant during an innovation boom. In the presence of new technology, it is difficult to predict the impact of any given patent in the field due to a lack of data or past experience. Investors thus agree to disagree and form their own opinions about individual firms even if they have a common view about the industry as a whole.

This is borne out not only anecdotally but also in the data. First, we document that portfolios are less diverse during bubbles. Typically, investors hold diversified portfolios to spread out their risk. However, when investors have strong views about which specific firms will succeed, they prefer to concentrate their portfolio in a smaller number of firms. In addition, we find that the effect of bubbles on the market value of innovation is smaller for firms that are more diversified. While investors may like a particular idea, they would be less willing to pay a premium if the only way to invest in that idea is to invest in a larger firm with other components that they may be less confident in.

Our theory shows that the disconnect between the measures of the value of innovation during bubbles is not without consequence. In particular, innovation policy during a bubble should not only lean against the overvaluation in the direct value of innovation but should also account for the spillovers across firms even though disagreement prevents these from being reflected in market prices. Economists and policymakers alike should thus be wary when measuring and interpreting the value of innovation in the presence of speculation.

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Valentin Haddad is an associate professor of finance at the UCLA Anderson School of Management, and Erik Loualiche is an assistant professor of finance at the University of Minnesota Carlson School of Management. Paul Ho is an economist in the Research

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**RC Balaban**

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