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How can you tell if you're in a bubble? You can't until it pops—there will always be reasons why this time is different and what appears to be a bubble, really isn't … until it bursts and reveals that it really was a bubble after all. So how can you tell if a bubble has burst? Well, obviously, prices fall sharply. But any long bull market will be punctuated by occasional corrections that can be quite sharp. Even the term "correction" implies that the sell-off is only a temporary suspension of the ongoing upward trajectory.

Researchers, including Brad Cornell (*The Journal of Portfolio Management*, Spring 2013), have attempted to discover the real-world events that produced the largest market price moves. But they have failed completely to find any smoking guns. As best one can tell, the bursting of a bubble is a lot like the scene in a Road Runner cartoon, when the villain, Wile E. Coyote, chases the Road Runner off a cliff. There is no longer anything holding him up, but it is only when he looks down that he falls.

In two recent articles in *The New York Times* (Sept. 15, 2017 and Oct. 19, 2017), Nobel Laureate Robert Shiller discusses investors' frame of mind before earlier market debacles such as the 2001 collapse of the Internet bubble and the classic crashes of 1987 and 1929. The description sounds not entirely unlike Wile E. Coyote suddenly noticing a distinct lack of support for his current position. Shiller acknowledges the absence of visible economic triggers for market meltdowns and focuses instead on psychological factors, which seem to be of two sorts. One is described as a "narrative" about the market, which spreads by word of mouth from person to person like a rumor and influences how investors think about investments. In 1929, terms like "speculative orgy" and "tulipomania" were widely used, while in 1987 it was concern about portfolio insurance. In his 2000 book of the same name, Shiller himself gained notoriety by attributing Internet stock prices to "irrational exuberance."

Market dynamics are also affected by a second psychological factor related to Keynes's analogy of the market as being like a beauty contest where it doesn't matter what the individual himself believes, only what he thinks other investors believe. By March 2017, in terms of earnings, stocks were already priced higher than at any time in the past other than 1929 and during the Internet bubble, and many commentators had begun predicting the end of the bull market "at some point." Yet even in October 2017, Shiller did not think a crash was imminent. He felt that the conditions for a stampede were not yet present because the narrative that everyone else might be about to bail out had not taken hold, as it had in earlier crashes.

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All of which raises the question for today, Feb. 5, 2018: The Dow has just fallen more than 1,800 points (−7.6%) in the last two trading sessions: Did somebody look down?

While awaiting further information on that disturbing question, we turn to this issue of *The Journal of Derivatives*. Our first article offers something that is a true rarity in investing: a trading strategy that both reduces risk and can also increase expected return. Many portfolio managers try to maintain a target asset allocation among asset classes and individual securities, such as the classic 60/40 stock/bond mix. But as market prices fluctuate, actual weights drift away from the target levels and produce tracking errors relative to the benchmark. To get back to the desired exposures, securities that have gone up faster than expected must be sold, and those that have fallen need to be purchased. Israelov and Tummala note that this is essentially the way a call option behaves: Exposure to the underlying increases when the price rises, and a price drop reduces exposure. They show how to set up an option writing strategy to offset the drift in portfolio weights. Both out-of-the-money calls and puts are written, so excess shares are called away when a stock's price rise increases its portfolio weight above the target level, and a put exercise will automatically increase weights on stocks that have gone down. And to the extent that option prices contain a variance risk premium, reducing risk by writing options also increases expected returns.

Next is another look at the "willow tree" lattice structure for numerical option pricing. In contrast to the binomial tree, each node in a willow tree allows branching to many successor nodes in the next time period. This produces a much more flexible tree that can be easily tailored to specific problems. Wang and Xu show how different single-factor interest rate processes can all be handled efficiently in the willow tree framework, including arbitrage-free models that must embed the current yield curve within the tree.

One of the great appeals of option models in the Black–Scholes framework is that valuation (relative to the underlying) is independent of risk aversion in the market. We are more or less comfortable in modeling the behavior of return processes, but not so much in modeling risk premia. But the risk-neutral probabilities that go into option prices are affected by variation in both. In the third article, Rebonato and Ng modify the standard Heston stochastic volatility model to allow the parameters that are affected by variance risk premia—the long-term variance and the reversion speed—to follow their own mean-reverting stochastic processes. The extended model connects return dynamics under the empirical distribution with the dynamics of the risk-neutralized process, thus bringing the true returns distribution and market risk premia into the same model. An empirical application to exchange rate determination shows that this hybrid model can fit currency markets well.

In the fourth paper, Zimmermann digs into the intellectual history of the key idea that allows a risk-neutral density to be extracted from option prices by taking the second partial derivative of the pricing function with respect to the option strike price. The modern reference for this idea is to a 1978 article by Breeden and Litzenberger, but Zimmermann traces the origins through a little-known note by Fischer Black in 1974 and all the way back to Bachelier's 1900 dissertation. Lastly, Chen, Hsieh, and Huang offer an analysis of the shifted log-normal model as a way to handle short-term interest rates that may be anomalous and can even go negative. Their model performs well for swaps, caps, and swaptions.

Finally, let me throw into the mix of uncertainty two more prognostications of equally high reliability. First, on Groundhog's Day this year, Punxsutawney Phil, the quasi-official U.S. Groundhog, saw his shadow, thus forecasting six more weeks of winter before spring begins. (Videos of the event are readily available on the web.) Then, in one of the best Super Bowls in recent memory, the Philadelphia Eagles of the NFC, edged out the New England Patriots of the AFC, which all football fans know means the stock market is supposed to have a good year. (If so, it's off to a pretty weak start.) It is nice to chuckle over such "fake forecasts," especially since they are generally at least as accurate as those offered in a more serious vein about the market.

Stephen Figlewski
Editor