

SPEECH

Asset Bubbles and the Implications for Central Bank Policy

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Thank you for that kind introduction. Today I want to tackle a difficult subject: How should central bankers deal with potential asset price bubbles. As always, my remarks do not necessarily reflect the views of the Federal Open Market Committee or the Federal Reserve System.

As I see it, we need to reexamine how central banks should respond to potential asset bubbles. After all, recent experience has underscored the fact that poorly regulated financial systems are prone to such bubbles and that the costs of waiting to respond to an asset bubble until after it has burst can be very high.

Today, I will try to define some of the important characteristics of asset price bubbles. I will argue that bubbles do exist and that bubbles typically occur after an innovation that has created uncertainty about fundamental valuations. This has two important implications. First, a bubble is difficult to discern and, second, each bubble has unique characteristics. This implies that a rules-based approach to bubbles is likely to be ineffective and that tackling bubbles to diminish their potential to destabilize the financial system requires judgment.

Despite the fact that it is hard to discern bubbles, especially in their early stages, I conclude that uncertainty is not grounds for inaction. Instead, the decision whether to act depends on whether appropriate tools can be deployed to limit the size of a bubble and whether the benefits of acting and deploying such tools are likely to exceed the costs.

That cost-benefit calculus, in turn, depends crucially on the tools we can deploy to limit the growth of bubbles and the consequences when they burst. In this respect, I will argue that, in most cases, use of the bully pulpit and macroprudential tools, such as rules limiting loan-to-value ratios or leverage, are likely to prove superior to monetary policy.

Turning to the first issue of whether there are asset bubbles, I am going to be a bit of a heretic and argue that there is little doubt that asset bubbles exist and that they occur fairly frequently. By an asset bubble, I mean price increases (or declines) that become unmoored from fundamental valuations. I want to be clear that I am distinguishing this from price movements that are tied to changes in fundamentals. I know this runs afoul of the efficient markets hypothesis—which in this context would argue that if a bubble were obvious, then people would take the other side and the bubble would not occur in the first place.

There are several reasons why this argument does not hold in practice. First, it is not always easy to take the other side. There may be constraints on the ability to short the asset in question. Such limits on the ability to short sell can arise for many reasons. For some assets, short selling in size might simply not be possible because the markets are not sufficiently developed. Also, even if there were instruments that can be used to go short, it may not be an easy trade to undertake. For example, if a bubble builds up over many years and market participants' compensation is based on year-to-year performance, there may be disincentives to take the short side. Compensation schemes and other practices that skew incentives may create a bias to simply "trade with the market."

Second, bubbles may simply emerge from the way market participants process information and trade. Experimental work done by behavioral economists has shown that people often trade in ways that generate price bubbles. In many carefully controlled experiments in which the intrinsic value of the asset could be determined with certainty, participants still bid prices up far above fundamental valuations, with the bubbles being followed by sharp declines in prices.

Let me give you an example of one of the seminal studies of this type. In this experiment, all investors start with an identical asset that pays the same dividend generated from a known probability distribution at the end of each trading period.¹ This means that all participants know the expected value of the dividend stream with certainty. The participants are allowed to buy and sell these assets from one another. In this framework, if all participants were fully rational, then trading should occur only at intrinsic values based on the expected dividend stream. But this is not what happens in practice. In 14 of the 22 experimental runs, prices rose significantly above fundamental valuations and these price bubbles were followed by crashes. When traders in these experimental runs were "experienced," meaning that they had participated in the experiment before, the probability of a bubble was reduced, but not eliminated. The authors conclude: "What we learn from the particular experiments ... is that a common dividend and common knowledge thereof is insufficient to induce initial common expectations. ..." The lack of common initial expectations leads to a willingness to trade to try and earn capital gains above fundamental value.² Relaxing the conditions in these types of behavioral studies to admit more uncertainty about fundamental asset valuations works to enhance the propensity for bubbles by

increasing the degree of divergence in participants' initial expectations.

Lastly, over the past few decades, there simply have been too many episodes in which asset prices have dramatically overshot on the upside and then violently corrected to suggest that the behavioral studies conducted in the laboratory do not also have real world counterparts. In the United States, these include the run-up in the value of the dollar in the mid-1980s, the stock market rise and crash in 1987; the compression of spreads due to convergence trades in the run-up to the Long-Term Capital Management debacle in 1998; the technology stock market boom of the late 1990s; and the credit and housing price bubble and crash of recent years. All these episodes were marked by spectacular price booms, followed by subsequent collapses.

An examination of some of these recent bubbles suggests that while asset bubbles are idiosyncratic in terms of their causes, institutional features, duration and severity, they often share several significant features. These shared features are important in assessing how policy might be used to temper incipient bubbles in the future.

In my view, asset bubbles often come about through a particular sequence of events. First, there is typically an innovation that changes the fundamental valuation in a meaningful, but uncertain way.³ Asset valuations associated with the innovation change (as they should), but there is significant uncertainty about how valuable the innovation will turn out to be. This leads to a divergence in expectations concerning how much the fair value of the assets should increase. I believe that this uncertainty about what constitutes fair value is important in fueling the bubble.

For example, the technology stock market boom in the late 1990s coincided with the development of the Internet, which fostered the reorganization of many business processes and generated significant productivity improvements. At the time, it was unclear just how significant the innovation would be or how successful the companies would be that sought to take advantage of it. On the one hand, there were companies such as Cisco, which sold the "shovels"—the routers that enabled the Internet to work—that were very successful. On the other hand, there were companies such as Webvan, which sought to use the new technology to revolutionize the delivery of grocery supplies and services, and that failed miserably.

Similarly, the recent housing boom was driven by two innovations: (1) in housing finance, where subprime lending made mortgage credit available to households that were much less creditworthy, and (2) in structured finance instruments such as collateralized debt obligations (CDOs). The first innovation significantly broadened the availability of mortgage credit to households. The second innovation reduced the cost of this credit. Cash flows from the underlying mortgage assets were apportioned among senior and junior tranches. These tranches, which had been rated by the rating agencies, were then distributed to a wide range of investors. This structured finance innovation, in turn, was supported by innovations in the shadow banking system. Securities lenders, structured investment vehicles and conduits bought the highly rated tranches of the structured financed products and financed these assets in the wholesale short-term funding markets.

The second element common to many asset bubbles is a surge in economic activity in the particular sector associated with the innovation. In the case of the technology stock market boom, there was a surge in business investment in technology goods and services. In the subprime/structured finance boom, there was a surge in demand for housing as credit availability increased sharply. This surge in activity is important because it reinforces the notion that the innovation is indeed significant and that "this time is different."

Third, there is often a positive feedback mechanism that tends to reinforce the belief system that underpins the extreme valuations associated with the boom. Without this, the boom isn't likely to persist for long or push valuations far above what is justified by the fundamentals. As a result, the asset price movements are unlikely to be big or broad enough to threaten financial and macroeconomic stability.

During the technology stock boom there were a number of reinforcing mechanisms. One important reinforcing mechanism was the strong notion that those who got to the market with their new Internet innovations would achieve large first-mover advantages. This perception was due to the fact that successful Internet-based models could expect to achieve strong network effects, which created significant barriers to entry and the prospect of extraordinary profits. Amazon might be a good example of a company that (eventually) succeeded at this.

In this environment, many firms—both well-established companies and start-ups—invested heavily in the new technology. The ensuing sharp rise in investment in technology equipment and software led in turn to rapid earnings growth, which helped (for a time) to sustain stratospheric valuations.

In addition, the sharp rise in stock prices led to a re-assessment of the appropriate equity risk premium. The higher that stock prices rose, the more people thought that equities had little risk. Everyone could become a millionaire with little risk or effort.⁴

Similarly, in the subprime/structured finance boom, there were several important positive feedback mechanisms. In particular, the surge in credit availability drove up the demand for housing and pushed up housing prices. This increase in demand caused the default experience associated with such lending to be very low, reinforcing the notion that subprime lending was not very risky. It also reinforced the demand for the complex CDOs secured by such assets. During the boom, the structured finance models appeared to be sound because losses on the underlying subprime mortgage loans were low and because the correlation rates in

performance across different assets in the pools were low, just as the models had assumed.

Fourth, the proportion of market participants who believe that a particular episode of asset price increases are justified by the innovation tends to rise as the boom persists. Those that had doubts about the importance of the innovation or the persistence of the gain in asset prices lose confidence in their opinions as they underperform and lose business and market share. Those who believed that the large gains in asset prices were justified by the innovation and who benefited from those beliefs become more dominant. Casual investors see the large rise in prices and jump in. This shift is important because, in markets, prices are driven by the marginal investor. As new and often less well-informed investors plunge in to participate in the boom, they can overwhelm the so-called “smart money” that gets frustrated after having lost repeatedly trying to take the other side.

In this respect, a bias toward optimism may also play an important role. Studies have found that most people believe that they are above average in terms of their acumen, be it as investors, car drivers or in other activities.⁵ This overconfidence may cause some people to keep investing in the asset, even when they are skeptical about its valuation because they are overly confident that they will anticipate the end of the bubble and be able to get out in time.

Fifth, asset bubbles occur more easily when it is difficult to short the assets. For example, the technology stocks associated with initial public offerings were very difficult to short because the available supply or “float” was small—a high proportion of the shares in the companies were held by the original venture capital investors and subject to lock-up periods before the shares could be lent out to short sellers or sold. Similarly, housing is notoriously difficult to short. The option of selling one’s home in order to rent is expensive not only in terms of time and effort, but also in terms of transaction costs. And, shorting complex structured finance products was difficult because there were no standardized instruments; the securities rarely traded and were very difficult to value. It was not until the development of the ABX indexes—which allowed investors to buy and sell credit default swaps on pools of structured finance obligations—that investors had a vehicle that allowed them to short subprime mortgage-backed securities more easily.⁶

Asset bubbles often come to an end when the basic belief system is contradicted by events. This can happen very naturally as a matter of course because economic fundamentals deteriorate, or because there is a change in rules or regulations that disrupts the balance between supply and demand. In the technology boom, this might occur because each company cannot get to the market first. So even if there is a first-mover advantage, not everyone will be able to take advantage of it. Over time, the failure to achieve first-mover status becomes evident and valuations adjust to reflect this, or lock-up provisions on Internet stocks expire, leading to a large increase in supply that leads to a sharp fall in prices.⁷

In the housing boom, the end came about for several reasons. One limiting factor was that the rise in home prices outstripped income growth. Thus, for the boom to persist, underwriting standards had to be continually relaxed; only in this way could a new cohort of first-time buyers qualify for big enough mortgages to be able to “afford” to buy their homes. The difficulty in replenishing the pool of new home buyers limited how fast demand could keep rising. In addition, the rise in home prices led to an explosion of supply especially in areas like Arizona, Florida, Nevada and inland California, where buildable land was plentiful.

As supply caught up to demand, this led to a downturn in prices. Once this occurred, the poor underwriting standards associated with subprime mortgage lending became apparent. Subprime borrowers could no longer easily refinance or sell the house at a higher price and repay the original mortgage. As Warren Buffett reportedly once quipped: “Only when the tide goes out do you discover who has been swimming naked.”

So what does this analysis imply for a central bank that might want to limit the development of such bubbles? The first conclusion is that assessing whether there is a bubble or not or the size of the prospective bubble is going to be very challenging. Because there is an innovation, asset values should rise, but by how much? It is difficult to assess what is the new, appropriate valuation after an important innovation. For example, consider some questions that might have arisen relative to the technology bubble: What does the Internet mean for technology investment? How many of the new business startups will survive and prosper? Is an Amazon rare? How fast will the volume of Internet traffic grow and for how long?

Similar questions arose with respect to the recent housing bubble: How much will subprime lending increase the demand for housing? How will this increase in demand translate into prices? What will the default rate be once demand growth slows? What is the appropriate correlation rate in terms of the loss experience across the different subprime and Alt-A mortgage pools that should be used in assessing the value of collateralized debt obligations? How are such correlations likely to differ in the boom versus in the bust?

This uncertainty means that policymakers can never be sure about the existence, size or persistence of an incipient asset bubble. As a result, this task of dealing proactively with bubbles will be very difficult!

So what should the policymaker do? I think the first step is for the policymaker to work hard to investigate what is generating the sharp rise in prices for the asset in question. Sustained price increases are a symptom of changes in demand and supply. The policymaker needs to develop a perspective about whether these demand and supply changes are realistically sustainable to the extent implied by market prices. In particular, carefully analyzing the assumptions that underpin sustained increases in asset prices—which might be symptoms of a bubble—and considering the risk that these assumptions might be wrong is important.

Also, looking carefully at the dynamics of the system on which the beliefs are based may be useful. In particular, are the dynamics of the system reinforcing or dampening? If the dynamics are reinforcing, then there is greater likelihood of an asset bubble.

The next step is for the policymaker to evaluate what tools might be available to curb the imbalances that have been identified. The idiosyncratic nature of the innovations and belief systems associated with particular bubbles implies that the tools used to respond to each bubble will likely have to be different and tailored to the features of the particular bubble in question.

Finally, the policymaker needs to conduct a careful cost-benefit analysis, weighing how successful a particular policy might be in restraining the rise in asset prices versus how costly it would be to remain passive, letting the bubble grow and then potentially burst disruptively. Many factors will affect the outcome of this analysis including the magnitude of the potential asset bubble and whether the potential asset bubble is occurring in the equity or debt markets.

In this analysis, the policymaker is likely to find that compared with equity market bubbles, credit market bubbles are more prone to generate higher costs when they burst. Thus, the benefits of preventing credit bubbles from forming and collapsing are likely to be higher.

Credit bubbles that burst threaten the stability of the financial system much more directly than equity bubbles.⁸ That is because much of the debt is held by banks and securities dealers that are highly leveraged. As a result, when the bubble deflates, it can take the financial system with it. In contrast, because most equities are held on an unleveraged basis by investors, such as pension and mutual funds, a sharp decline in equity prices will not typically threaten the entire financial system. A comparison of the consequences of the technology stock market crash in equities versus the mortgage debt market crash strongly supports this thesis. Although the wealth loss was roughly comparable, the bursting of the housing bubble had a much greater negative effect on the financial system and the macroeconomy.

In this cost-benefit analysis, the central bank must understand that it will make mistakes. On one hand, it may fail to temper bubbles that turn out to be disruptive when they collapse. Or, on the other hand, it may try to temper price movement that it thinks are bubbles but are not bubbles at all. The costs of these types of errors must be weighed against the potential benefits of tempering an asset bubble and limiting the damage from its subsequent collapse.⁹

So what are the tools with which the policymaker should respond? As I see it, there are three broad sets of tools available: 1) The bully pulpit; 2) macroprudential tools; and 3) monetary policy. Let me now discuss each of these in turn.

The first tool available is to simply lean against the wind of conventional wisdom by speaking out about the dangers associated with the incipient bubble. The policymaker could point out the assumptions embedded in the rapid rise in asset prices and question the accuracy of the assumptions. Obviously, the policymaker might be ridiculed by true believers about the lack of understanding about the important nature of the innovation. But I suspect that over time, a proactive central bank that laid out the risks clearly would gradually gain credibility with market participants. Use of the bully pulpit would allow the central bank to signal its concern. This might shift the risk/reward trade-off by raising the risks that the talk might foreshadow more forceful action. That, by itself, could temper behavior. Announcement effects can be very powerful, especially when they can be followed by changes in policy.

The second set of tools includes those that are macroprudential in nature. I would define macroprudential tools as regulatory and supervisory actions that are not applied on a firm-specific basis. These include tools designed to temper demand or increase supply in the asset subject to the bubble or to increase the ability of skeptics to take the other side of the market in which the bubble may be occurring. For example, to counteract a housing bubble, tools available might include limiting loan-to-value ratios, limiting debt service-to-income ratios or increasing the taxes on housing transactions. Several Asian and some European countries have used such tools to limit speculative real estate activity, apparently with some success, although the counterfactual cannot be known by definition.¹⁰ To limit a subprime lending boom, the authorities might wish to enforce strict underwriting practices, including verifying purchasers' incomes and enforcing rigorous appraisal valuations. Increasing the ability of investors to short the assets in question might also be helpful.

In terms of macroprudential tools, I'd also include tools that influence how the financial system operates and functions. Such tools might include supervisory measures that set liquidity and capital requirements for financial institutions and other intermediaries. They might also include tools that try to limit the overall buildup of leverage in the financial system. For the equity market, macroprudential tools might include margin rules for cash, options, futures and equity over-the-counter derivatives. For the fixed income market, such tools might include raising the haircuts charged to securities dealers on their repo financing; raising the haircuts that the securities dealers assess against the collateralized borrowings of their customers as part of their prime brokerage business, or raising initial margin requirements on OTC derivatives transactions.

Macroprudential tools are undoubtedly difficult to use effectively in practice. For example, it is difficult to judge their impact. If, for example, loan-to-value ratios for single-family mortgages are lowered by 5 percentage points, how big an impact will this have on housing demand? There also is a risk that the rules or regulations will simply be circumvented. For example, investors might move to instruments or to off-shore regimes with less stringent margin and leverage restrictions. Thus, it is important that the authorities have the ability to apply the macroprudential tools broadly throughout the financial sector.¹¹

None of this is going to be easy. A lot more work will be required to develop a portfolio of tools that could be used, that would be effective and would not be subject to significant evasion or unintended consequences.

In terms of the use of macroprudential tools, let me briefly take note of another issue that requires significant consideration—the issue of governance. Who controls all these tools? Who decides when the tools will be deployed and how extensively or intensively? Having a sufficient toolkit seems like a good idea. But lodging all this authority within a single entity or institution might not be practical or desirable.

The final tool available to the central bank is monetary policy. This tool is not likely to work as well as macroprudential tools because it is too broad. Typically, monetary policy will not address specifically the sources of the changes in supply and demand that are driving the bubble and, obviously, monetary policy will have big effects elsewhere.

Some argue that monetary policy should “lean against” incipient asset bubbles. The notion is that by pursuing a slightly tighter monetary policy, the central bank would take out insurance against the risk that the rise in asset prices is a bubble and that its busting would be disruptive. Although this sounds attractive, it critically depends on how expensive the insurance is relative to the losses that the insurance protects against. It is not clear to me that a modest tightening in monetary policy beyond that needed to achieve full employment and price stability in the absence of a bubble would represent a favorable cost-benefit trade-off. The costs of the deviation from the optimal monetary policy in terms of lost output and employment might be high relative to the benefits of a somewhat smaller bubble. This seems likely to be the case in most instances. Historical experience does not suggest that bubbles are very sensitive to the level of short-term interest rates.

That said, there is some evidence that a tighter monetary policy will reduce desired leverage in the financial system by flattening the yield curve and reducing the profitability of maturity transformation activities.¹² To the extent this is true, that may imply a somewhat more favorable trade-off in “leaning against” a bubble. More research is needed on this subject. For now at least, monetary policy appears to be inferior to macroprudential tools that seek either to limit the size of prospective bubbles or to strengthen the financial system so that it is more resilient when asset prices fall sharply.

In conclusion, let me underscore the challenge that central bankers face in combating asset price bubbles. Doing so effectively requires us to be successful in both identifying the incipient bubble and in developing and implementing a response that will limit bubble growth and avert a destructive asset price crash. This is not easy because asset bubbles are hard to recognize in real time and each asset bubble is different. However, these challenges cannot be an excuse for inaction. Recent experience strongly suggests that asset bubbles exist and that their collapse can be very damaging to the financial system and the macroeconomy.

In my view, a proactive approach is appropriate when three conditions are satisfied: First, circumstances should suggest that there is a meaningful risk of a future asset price crash that could threaten financial stability. Second, we have identified tools that might have a reasonable chance of success in averting such an outcome. Third, we are reasonably confident that the costs of using the tools are likely to be outweighed by the benefits from averting the prospective crash. When these three conditions are satisfied, we should be willing to act.

Thank you for your kind attention.

¹See Vernon L. Smith, Gerry L. Suchanek, and Arlington W. Williams. 1988. “Bubbles, Crashes, and Endogeneous Expectations in Experimental Spot Asset Markets.” *Econometrica* 56, no. 5 (September): 1119-51.

²In a more restrictive experiment in which speculation is not possible, bubbles and crashes still occur. See Vivian Lei, Charles N. Noussair, and Charles R. Plott. 2001. “Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality.” *Econometrica* 69, no. 4 (July): 831-59.

³One might argue that an innovation is not a necessary condition for an asset bubble. For example, the run-up of the dollar in the mid-1980s was not associated with any particular innovation. Instead, a sharp shift in fiscal policy led to high real interest rates that stimulated a strong demand for the dollar, which caused the dollar to appreciate sharply. This eventually unwound as the dollar's rise undercut U.S. trade competitiveness. This caused the U.S. economy to slow, interest rates to decline and the dollar to fall. The lack of experience with a floating exchange rate regime undoubtedly played a role here. The world moved to a floating exchange rate system in the early 1970s. There was not much experience with how an expansive fiscal policy would affect exchange rates. This undoubtedly increased uncertainty about the sustainability of the dollar's appreciation.

⁴In fact, one book, *Dow 36,000*, which was published in 1999 shortly before the stock market peaked, argued that “fair value” for the Dow Jones Industrial Average should be 36,000 because the appropriate risk premium for the equity market versus Treasury bonds should be zero.

⁵Overconfidence actually applies to a broad range of activities, not just investing. For a more general treatment of this issue of overconfidence and other ways in which economic agents depart from complete rationality, see Richard Thaler. “From Homo Economicus to Homo Sapiens.” 2000.

⁶This is not to argue that short positions could not be established at all. Monoline guarantors, AIG Financial Products and some securities dealers were willing to sell protection in the form of credit default swaps on some of these assets. Michael Lewis examines how some investors managed to take positions that benefitted from a collapse of the housing bubble in *The Big Short: Inside the Doomsday Machine*.

⁷See Eli Ofek and Matthew Richards. 2003. "Dotcom Mania: The Rise and Fall of Internet Stock Prices." *Journal of Finance* LVIII, no. 3 (June): 1113-37.

⁸This argument has been made by many others. See, for example, Frederic Mishkin. [How Should We Respond to Asset Bubbles?](#) [OFFSITE](#) May 15, 2008.

⁹An example of a sustained rise in asset prices that was not a bubble is the bull market in U.S. equities that began in the 1950s. At the start of the sustained rise in equity prices, stock dividend yields exceeded the yields on Treasury bonds and this was perceived as normal, partly reflecting the searing experience of the Great Depression. Instead, corporate earnings rose relatively steadily, supporting dividend growth. This observation led investors to bid up stock prices and push down dividend yields and this proved—more or less—sustainable. Even today, the yield on the S&P 500 index is below the 10-year Treasury note yield.

¹⁰However, in the recent crisis, the different outcomes in the United States and Canada might be instructive. Canada had a tougher regime in terms of mortgage underwriting standards. Also, Canada had imposed an overall leverage limit on its banks, which helped to limit the amount of gearing in the financial system. Both of these differences may help to explain why the Canadian financial system and macroeconomy were less affected by the global financial crisis than the United States.

¹¹Imposition of tighter rules and regulations may also be politically unpopular.

¹²Adrian, Tobias, Arturo Estrella, and Hyun Song Shin. 2010. [Monetary Cycles, Financial Cycles, and the Business Cycle](#). Federal Reserve Bank of New York *Staff Reports* 421.

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