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ASSET PRICE BUBBLES AND CENTRAL BANK POLICIES: THE CRASH OF THE “JACKSON HOLE CONSENSUS”

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Abstract

This paper reexamines the main arguments of whether or not monetary policy should respond to asset bubbles. The question of how the central bank should respond to an asset bubble can be reformulated in two ways. First, how does the central bank respond while an asset bubble is growing, and second, how does it respond after the bubble bursts? There has been strong agreement among economists that a central bank should respond to the bursting of a bubble by aggressively decreasing the Fed funds rate to minimize the adverse impact of financial instability on the real economy. However, there is no clear answer to the question of how the central bank should respond to an asset bubble before it bursts. If there is evidence that the asset price bubble is contributing to inflation, then there is general agreement that the central bank should respond. But what if prices remain stable? These issues are critically reviewed and the conclusion is reached that the high costs associated with the 2007–2009 financial crisis have encouraged the development of a new central bank policy paradigm that encourages “leaning against bubbles” and giving due consideration to alternative tools other than interest rate policy tools.

JEL Classification: E50, E52, E58

Key Words: Asset Bubbles, Financial Crisis, Jackson Hole Consensus, Lean against Bubbles

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Introduction

The global financial crisis that began in mid 2007 progressed to become the most severe economic recession since the Great Depression of the 1930s. In the U.S., the recession officially lasted for about 19 months, from December 2007 to June 2009, with a decline in real GDP by more than 4% and a loss of over 8 million jobs. The unemployment rate doubled from about 5% to 10% during this period. The household sector lost more than \$13 trillion in wealth because of substantial declines in both equities and housing.

Economists, journalists, political panels and commissions, among others, have investigated this global financial crisis in detail and will, in all probability, continue doing so for some time in the future. There is no shortage of likely causes. Candidate causes can be organized in certain groups such as macroeconomic, microeconomic, global, government, institutional, ethical and even psychological. Within each of these groups there is a list of specific factors that may have contributed, propagated, or amplified the crisis. Macroeconomic factors include an overly easy monetary policy from 2002 to 2005 and the development of a real estate bubble. This real estate bubble burst in early 2007, when significant declines in real estate prices that continue to this date took place. This bursting caused macroeconomic financial instability. The microeconomic list is longer and contains subprime lending, opaque derivative securities, underestimation of risk leading to excessive risk taking, failed risk management techniques, insufficiently capitalized banks and shadow banking institutions, too much leverage and the shortage of liquidity. Global considerations cited mention the global savings glut, fixed exchange rates for certain countries with undervalued currencies like China, global imbalances and an unstable global monetary system.

Government policies promoting affordable housing, insufficient regulation of the shadow banking sector, and deficient implementation of existing regulations for financial institutions have also been mentioned. Institutional elements such as the model of originate-to-distribute, the role credit of rating agencies, and suboptimal management compensation incentives that encouraged excessive risk taking, have received attention along with ethical dimensions such as greed and corruption. Finally, psychological factors such as animal spirits, exuberance and panic are introduced to convey the density of the crisis. Kolb (2010, 2011), Paulson (2010), the Financial Crisis Inquiry Report (2011) and Sorkin (2010), among numerous other studies, provide academic, government and journalistic perspectives on the crisis.

With the exception of a handful of analysts, the global financial crisis was not anticipated. The main reason for this failure was the prevailing consensus prior to the crisis that the successful pursuit of price stability over the previous three decades had produced macroeconomic stability, called the Great Moderation, for the U.S. and other industrial economies with steady economic growth, low GDP volatility and low inflation. The Great Moderation paradigm did not focus on financial instability. It was widely accepted that price stability also contributed to financial stability.

In pursuing price stability during the Great Moderation period from the mid-1980s to the onset of the global financial crisis, both the Fed and other central banks around the world were challenged by the emergence of asset bubbles in general and the internet bubble in particular.

Alan Greenspan (1996, p. 6), then Federal Reserve Chairman reminded us

“how do we know when irrational exuberance has unduly escalated asset values, which then become subject to unexpected and prolonged contractions as they have in Japan over the past decade? And how do we factor that assessment into monetary policy? We as central bankers need not be concerned if a collapsing financial asset bubble does not threaten to impair the real economy, its production, jobs, and price stability. Indeed, the sharp stock market break of 1987 had few negative consequences for the economy. But we should not underestimate or become complacent about the complexity of the interactions of asset markets and the economy.”

Because Chairman Greenspan raised this important question in the midst of celebrating the accomplishments of both monetary research and central bank policies that were credited with producing the Great Moderation, a spirited debate erupted on how monetary policy should respond to asset bubbles. It is acknowledged now that the profession’s initial Hamletian

ambivalence towards a central bank “responding to” or “not responding to” an asset bubble was resolved by the formation of a consensus in the U.S. to follow the asymmetric approach to bubbles. This asymmetric approach supported no or little Fed action against an asset bubble, while it was developing, but aggressive cuts in Fed funds when the bubble burst to minimize its potential destabilizing effects on the real economy. This was articulated in Greenspan (2002) during that year’s Jackson Hole Conference and further solidified in subsequent meetings such as in Blinder and Reis (2005).

It is the purpose of this article to re-examine the main arguments of the two methodological lines: monetary policy should respond versus monetary policy should not respond to asset bubbles. The initial question of how the central bank should respond to an asset bubble can be reformulated in two ways. First, how does the central bank respond to an asset bubble while it is growing, and second, how does it respond after the bubble bursts? There has been strong agreement among economists that a central bank should respond to the bursting of a bubble by aggressively decreasing the Fed funds rate to minimize the impact of financial instability on the real economy. Achieving maximum employment is one of the Fed’s mandates. However, there is no clear answer to the question of how should the central bank respond to an asset bubble before it bursts. If there is evidence that the bubble is contributing to inflation, then the Fed will respond; but what if prices remain stable? Some economists argue that the central bank should not respond to the bubble prior to its bursting while others believe that it should try to target it or at least lean against the bubble to avoid future financial instability. Thus, we have two broad responses: the asymmetric approach, mentioned earlier, that advocates no response prior to the bursting and the symmetric approach that argues that the central bank should respond to an asset bubble both before and after it bursts. Within the choice of the symmetric response there are various degrees of intensity: burst the bubble, target the bubble or lean against it. Targeting the bubble during its growth elevates the importance of bubbles to the goal of inflation targeting. Leaning against an asset bubble is a weaker strategy. Kohn (2006, 2008) uses the terminology of “conventional strategy”, focusing on the Fed’s mandate to describe the asymmetric approach, versus “extra action” for the symmetric response when the Fed takes steps against an asset bubble. These questions were debated for several years before the 2002 “Jackson Hole Consensus”, supporting the asymmetric approach to asset bubbles, was reached.

This paper concludes that the 2007-09 global financial crisis undermined the Jackson Hole Consensus and the new central bank policy paradigm has shifted towards “leaning against bubbles.” Such an examination necessitates framing the discussion in the broader context of asset bubbles and financial instabilities. Another way to state the intention of this paper is to say that financial instabilities created by the bursting of asset bubbles can be extremely disruptive to the real economy, and that the policy of “leaning against” potential bubbles appears to dominate central bank neutrality.

While our focus is anchored on asset price bubbles and the shifting paradigm of central bank policies, we contribute towards an integrative approach between the real and financial sectors of an economy by presenting first a general overview of asset bubbles that supports their existence. Then, we discuss how the bursting of asset price bubbles may cause financial instability that often impacts the real sector of an economy adversely. This analysis guides us to re-examine how central banks should respond to asset price bubbles. We make a distinction between normative and positive responses of a central bank to asset price bubbles. We also introduce the concept of macroprudential regulation, originally advocated by Borio (2003) and reprinted in this volume, as an approach for leaning against asset bubbles. This leads us to draw three main conclusions at the close of the paper. We also follow a balanced approach in that all the pieces highlighted in this overview are important. This enables us to avoid the methodological selectivity that prevailed during the Jackson Hole Consensus.

Risk Management by Central Banks

Central banks around the world have mandates to promote price stability. In the U.S. the Fed by congressional mandate also seeks to achieve stable economic growth. Clearly, targeting stable asset prices is not an explicitly mandated goal of the Fed. Why then is the Fed concerned with asset price bubbles?

In 1996, Alan Greenspan raised concerns about an asset bubble as quoted earlier. Reviewing a half-century of changes in monetary policy, Taylor (2002) does not mention concerns about asset bubbles. According to Taylor, the big and dramatic changes in monetary policy occurred as a result of five occurrences: the famous Accord reached between the Treasury and the Federal Reserve in 1951, the end of the Bretton Woods fixed exchange rate system, the significant rise in inflation during the 1970s to the early 1980s, the dramatic success of

disinflation in the early 1980s and the Great Moderation. While Taylor celebrates the great successes of monetary policy during the Great Moderation, both in the U.S. and in numerous other countries, Greenspan (2004, p.35) contemplates that

“[p]erhaps the greatest irony of the past decade is that the gradually unfolding success against inflation may well have contributed to the stock price bubble of the latter part of the 1990s. Looking back on those years, it is evident that technology-driven increases in productivity growth imparted significant upward momentum to expectations of earnings growth and, accordingly, to stock prices. At the same time, an environment of increasing macroeconomic stability reduced perceptions of risk. In any event, Fed policymakers were confronted with forces that none of us had previously encountered.”

This quotation from Greenspan clearly answers the question of why monetary policy may be concerned with asset bubbles. To paraphrase Greenspan, during normal times, monetary policy focuses on price stability and maximum employment. However, when irrational exuberance drives asset prices to unsustainable levels and the risk of a bubble bursting increases the likelihood of financial instability, monetary policy is expected to address these issues.

Greenspan (2004, p. 37) has clearly stated that

“the conduct of monetary policy in the United States has come to involve, at its core, crucial elements of risk management. This conceptual framework emphasizes understanding as much as possible the many sources of risk and uncertainty that policymakers face, quantifying those risks when possible, and assessing the costs associated with each of the risks. In essence, the risk management approach to monetary policymaking is an application of Bayesian decisionmaking.”

Greenspan is clearly advocating an activist discretionary central bank policy. Friedman (2006) describes this nonmechanistic flexibility of the Greenspan Fed. Such discretion offers broader latitude to central bankers in considering the risks of an asset bubble bursting and the costs of mopping up afterwards. In contrast a “rules only” driven price stability policy is not distracted by asset bubbles unless asset price increases foster inflationary expectations as consumers choose to spend a portion of their appreciated wealth.

Asset Price Bubbles

The risk management approach to monetary policy may call for a judgment about the existence of an asset bubble, the stage of its development, and the risks associated with its bursting. Asset bubbles are just one among many developments that the risk management approach to monetary

policy considers. The stock market crash of October 19, 1987, the bursting of the internet bubble in March 2000, and the collapse of the real estate market in 2007 are representative asset bubbles. The Fed however, has also addressed, during the last twenty years, many other economic and political developments. For purposes of illustration, a representative sample might include the Asian Financial Crisis of 1997-98, the Russian debt default of August 1998, the collapse of the Long Term Capital Management hedge fund in September 1998, the potential Y2K problem on January 1, 2000, the September 11, 2001 terrorist attacks, and the deflation fears in 2004.

Of course, in addition to these events, the central bank is continuously assessing in its risk management approach, the risks of inflation and the risks of a recession. Thus, asset bubbles are only a subset of the central bank's concerns, yet asset bubbles are very critical in view of the adverse financial consequences of the bursting of a bubble. Furthermore, among various asset bubbles that may develop in an economy, the Fed has identified only stock market bubbles and housing bubbles as financial developments that may cause serious instabilities. Commodity bubbles, like oil and gold, or exchange rate crashes as in the Asian Financial Crisis, have not explicitly been addressed by the Fed.

What is an asset price bubble in general? Do asset bubbles exist in financial markets? We hypothesize that if the price of an asset exceeds its "fundamentals", there is a bubble. The implication is that the asset price exceeds fundamentals by a significant amount and this persists for some time. If the price of an asset exceeds its fundamentals by a very small amount, we can call this amount noise. Also, if the deviation from fundamentals lasts for a very short trading interval, this may be called a temporary mispricing. When, however, the price of an asset exceeds its fundamentals by a large amount, say 30% above its fundamental value, for several months or even years, we can call it a bubble.

Kindleberger (1978) describes a bubble as an upward price movement over an extended range that then implodes. He also says that an asset bubble occurs when the purchase of an asset is not made because of the rate of return on the investment, but in anticipation that the asset can be sold to a "greater fool" at an even higher price. He lists and discusses numerous episodes of financial bubbles. Brunnermeier (2008) adopts Kindleberger's definition and says that a bubble refers to an asset price that exceeds the asset's fundamental value because the trader who buys it high believes he can resell it at an even higher price in the future.

Definitions of bubbles depend on a model of valuating fundamentals. Furthermore such fundamentals usually involve a long stream of future earnings appropriately discounted. Both the expected earning and the discounting factor are uncertain and thus the fundamental value is also uncertain. By definition, efficient markets that continuously reevaluate the arrival of new information contribute to the discovery of the fundamental value of a particular asset. However, for new innovations whose future earnings are very uncertain, the pricing of fundamentals has a very large margin of error. In the past, bubbles have developed and then crashed in stocks of railroad, electricity, aviation, automobiles, radio, pharmaceutical, internet and bio-technology firms when they were new technologies. Do we currently have bubbles in stocks of firms in search-engine and social network technologies?

Asset price bubbles are often accompanied by increases in trading volume and also by high price volatility. As price bubbles develop, they encourage increases in the supply of similar assets. After the crash, the valuation of most firms in the bubble sector decreases. This was experienced during the internet bubble. In contrast to loud bubbles with high price volatility, there are also quiet bubbles with substantial price increases but with low volatility as discussed in Hong and Staer (2011).

In general, the common underlying characteristic of mispricing is the high degree of uncertainty that surrounds the future profitability of the asset. The theory of market efficiency does not recognize the existence of asset bubbles. It accommodates the high degree of uncertainty that may surround new technologies and views the high volatility as evidence of a continuous reassessment of the fundamental value by market participants. It claims that if a price of an asset significantly exceeds its fundamentals value, arbitrage activities will exploit such discrepancies and return the asset price to its fundamental value. However, if arbitrage is limited, behavioral finance believes that bubbles may persist.

There are a large number of theoretical papers that study asset price bubbles. Useful surveys include Bhattacharya and Yu (2008), Brunnermeier (2008), Vogel (2010) and, in this book, Barlevy (2012). Brunnermeier (2008) offers an excellent brief survey by organizing the bubbles literature into four categories. We cite some representative results to illustrate that there is theoretical support for the existence of asset bubbles. The first group of papers assumes that all investors are rational and have identical information. In this case, finite bubbles cannot arise but infinite ones can develop under certain conditions and with a precise rate of growth. The

second group of papers maintains the assumption of rational expectations, but investors now have asymmetric information. In this group, bubbles develop a little easier. The third group of papers allows traders to be either rational or behavioral and bubbles may last for a long period since rational and behavioral investors struggle to influence the evolution of prices. The final group allows traders to have heterogeneous beliefs. Reprinted in this book, Scheinkman and Xiong (2003) combine heterogeneous beliefs with a short sale constraint to show that speculative bubbles can emerge. The mechanism that generates bubbles with high trading volume and price volatility relies on optimistic or overconfident traders willing to buy an asset at a higher price while pessimistic traders are unable to moderate the bubble because of short sale constraints. Barlevy (2012) focuses on the important issue of the welfare implications of central banks choosing to burst a bubble. He argues effectively that the recent crisis has highlighted that most models of asset bubbles do not address the critical question of whether bursting a bubble by the central bank is welfare improving or not.

Beyond the theoretical literature that offers conditions for the existence of asset bubbles, there is extensive evidence in experimental economics about the emergence of bubbles in the laboratory. The classic reference is Smith, Suchanek and Williams (1988), and more recently Hussam, Porter and Smith (2008). Also, behavioral economists such as Shiller (2002) have argued in favor of the existence of bubbles. Shiller argues that the key idea for the formation of bubbles is the feedback mechanism. A price increase for an asset leads to investor enthusiasm, which further causes increased demand and additional price increases. The high demand is supported by the public's memory of high past returns or by optimism that this new asset will generate very high future earnings. Various bubbles have different positive feedback mechanisms, but because non-fundamentally driven price increases cannot be sustained indefinitely, a negative feedback pattern will eventually replace the positive one. Usually, the initial increases are slow, and it takes a long time for the bubble to grow. In contrast, bubble crashes take place during a relatively short period.

Kindleberger (1978) describes the feedback mechanism in detail and gives numerous illustrations of specific bubbles. Keynes (1936), in his famous Chapter 12, clearly states that an investor's

“knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible” (p. 149).

This description leads Keynes to talk about his famous “beauty contest” since there are no readily available concrete valuation benchmarks. He adds that

“[M]ost, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits –of spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities” (p. 161).

Akerlof and Shiller (2009) elaborate in detail on Keynes’ idea of animal spirits and demonstrate its importance in several areas of economics.

The successful speculator Soros (1987, 2010) introduces the idea of “reflexivity” to explain the development of asset bubbles. Soros’s point of departure is philosopher Karl Popper’s claim that empirical truth cannot be known with absolute certainty. If this is correct, Soros argues that financial markets cannot be exactly correct moment by moment in their valuation of all assets. If prices generated by market participants are not exactly correct, they are biased contrary to the claim of market efficiency. The degree of distortion or fallibility usually ranges from the negligible, called a random error, to the significant, called an asset bubble. Next, this principle of fallibility interacts with the principle of reflexivity that says that the prices generated by market forces are a reflection of fundamentals. So if market participants are euphoric about a certain asset and its price increases, this price now has an impact on the assessment of the asset’s fundamentals. As the price increases, the value of the fundamentals increases and various financial decisions that depend on fundamentals such as leverage, both debt and equity, are influenced. Soros then proceeds to develop several steps that an asset bubble goes through from its inception to its collapse.

Gisler and Sornette (2010) generalize the idea of a bubble, from a phenomenon related to asset pricing, to social bubbles that describe reinforcing feedback mechanisms for social projects such as the Apollo Space Project. Malliaris (2005) discusses asset bubbles across countries and globally. Finally, Tuckett and Taffler (2008) and Tuckett (2009) apply psychoanalytic techniques to explain the development of asset bubbles. They argue that financial assets have the power to generate both excitement and anxiety causing risk and reward judgments to become uneven. When the utility of potential gain is detached from the disutility of potential loss, critical reasoning is disturbed, and the emergence of an erroneous consensus may lead to the development of asset bubbles.

The theoretical literature about bubbles does not address the extensive narratives related to booms and busts, bubbles and crashes, animal spirits and panics, and exuberance and contraction discussed in Kindelberger (1978), Minsky (1986), Soros (1987), Akerlof and Shiller (2009) and others. This is surprising because financial booms and busts and business cycles appeared joined together in various theories even before Keynes. For example, Haberler's (1960) original version on *Prosperity and Depression* was completed in the summer of 1936 and contains several expositions of the role of financial instabilities as a source of recessions. Laidler (2003) gives a detailed account of the inter-war debate on financial and economic stability and shows how the recent bursting of the stock and housing bubbles and their impact on the real economy "do bear more than a passing resemblance to earlier episodes" (p.17). Today's reader will find these descriptive theories perhaps limited in their explanatory scope. Modern mixed capitalist economies with sophisticated financial markets and global financial integration have little in common with pre-WWII economies. Besides, the Keynesian revolution has overshadowed this old literature, primarily by advocating the use of fiscal and monetary policies to combat recessions and financial instabilities.

Thus both the academic and popular literature, recent as well as pre-Keynesian, attest to the existence of asset bubbles as a financial phenomenon in contrast to advocates of market efficiency who reject their presence. Prior to bursting, the existence of an asset bubble is only a probable event and only after it bursts is there certainty that it has occurred. To give some quantitative evidence of past stock market and housing bubbles we reproduce a table from the IMF (2002).

Equity and Housing Price Bear Markets in Industrial Countries

(Median over all episodes)

	Real Equity Prices		Real Housing Prices	
	Contraction ¹ (percent)	Duration ² (quarters)	Contraction ¹ (percent)	Duration ² (quarters)
Bear markets ³	-24.4	5	-5.7	5
Busts ⁴	-45.5	10	-27.3	16
1960s	-40.5	11	-	-
1970s	-49.5	10	-27.3	19
1980s	-47.6	10	-28.5	16
1973 ⁵	-60.1	10	-	-
2000 ⁶	-43.6	10	-	-

Source: IMF staff calculations.

¹Contraction from peak to trough in real equity and housing prices, respectively.

²Time from peak to trough (excluding the peak quarters)

³All bear markets including busts.

⁴All bear markets in the bottom quartile (see text).

⁵Busts beginning during 1972-74.

⁶Busts beginning at the peaks recorded in 2000 and ending in 02:Q3 (end of sample)

This table does not include the recent global financial crisis. It clearly illustrates that stock market and housing bubbles and crashes, or busts and bear markets are not rare financial events. No wonder the Fed was concerned ex ante with the internet bubble. With this discussion as a guide, let us assume that at any given time period there may be one or more asset bubbles in an economy. The central bank need not be concerned with a potential bubble in the price of individual assets, such as Google or Facebook or even a bubble in gold or oil. The central bank however is concerned with the aggregate stock market or the real estate market. Sometimes overvaluations may self-correct or deflate. Other times the bubble in the stock market or the real estate market may continue to grow until some triggering event causes a crash as in Japan in 1989. Crashes usually destabilize financial markets, but in certain cases, as in the October 1987 crash, there is no spillover to the real economy. The bursting of the internet bubble in 2000, despite an almost 80% crash in the NASDAQ, had only a small impact on the real economy with a short and mild recession. Unfortunately, both in Japan and the U.S., the joint crashes of the stock and real estate bubbles had serious real effects: the lost decade in Japan and the financial

crisis of 2007-09 in the U.S. At the present time there are no theoretical models about bubbles that can direct central banks to choose confidently the symmetric or asymmetric approach to bubbles. Thus, we continue the descriptive analysis by asking the critical question: how does the bursting of an asset bubble destabilize the financial system?

Financial Instability

Asset bubbles are an inherent part of the financial system and the financial system is part of the total economy. A theoretical challenge remains to eventually integrate the real and financial sectors with sufficient quantitative details so that answers can be provided to the following questions: under what conditions is the financial sector stable or unstable? What are the causes of financial instability? What role do asset bubbles and crashes play in causing financial instabilities? What are the relationships between asset bubbles and crashes, booms and busts, exuberance and panic, jubilant animal spirits and depressions, manias and financial crises? Under what conditions do financial crises impact the real economy by reducing GDP and employment? And, of course, what can monetary and fiscal policies do, if anything, to stabilize both the financial system and the real economy.

Minsky (1975, 1986) unwearingly opined that financial crises have been coupled with capitalism throughout history. He has also argued that Keynes's principal contribution was his hypothesis that capitalism is inherently unstable. Furthermore, such instability originates in the financial sector that allocates capital to investment decisions driven by animal spirits. Minsky (1986) develops these Keynesian ideas into his famous financial instability hypothesis. He argues that in a modern capitalist economy with expensive capital assets and a complex and sophisticated financial system, actual economic activity is greatly influenced by firms' expectations of future profits and financing decisions by banks and other financial institutions. Minsky proposes a credit cycle model of five stages: displacement, boom, euphoria, profit taking and panic. There is an active interplay between the real economy and the financial sector in this process. Minsky (1968) describes how asset managers become optimistic with a new technology, such as the internet, and are willing to finance it. Gradually, this sector grows and an asset boom develops. As the sector attracts new funding further technologies are developed and the financial and technological euphoria grows. Certain triggering events, such as disappointing

earnings, lead to profit taking. Further deterioration in fundamentals translates into a panic. The bursting of an asset bubble leads to financial instability that causes real sector instability.

In spite of Minsky's concerns about the inherent financial instability of capitalism, the Great Moderation doctrine, supported by empirical evidence, led to the conclusion that "this time is different." Reinhart and Rogoff (2009) document that this assessment is a recurring theme. They offer comprehensive narratives and analysis of the connections between the financial and real sectors of an economy, how financial crises impact both sectors and how financial crises appear idiosyncratic. Details may differ because of the rapidly evolving financial sector, but the essential mechanisms of positive feedback initially, followed by negative feedback later, persist.

The financial sector includes the central bank, commercial and investment banks, non-bank financial institutions such as insurance companies, managed money flowing through financial markets for equity, debt, real estate, commodity, currency and other derivative instruments traded over the counter or on established exchanges. Alternatively, and perhaps an easier definition, is to say that the financial sector is the one that allocates financial resources efficiently in the domestic and global economies. Financial sectors may have their roots in a given country, but nowadays they extend globally. The concept of a financial sector is dynamic, global and evolving. As the recent crisis demonstrated, even the very best financial experts may not have a comprehensive understanding of all its financial and legal intricacies.

In the U.S. and in many advanced economies, the financial sector has a total financial assets equivalent to several times the size of the country's GDP. Adrian and Shin (2008) discuss the current financial system in the U.S. and its stability with emphasis on security brokers and dealers. Kaufman (2004) gives a detailed analysis of macroeconomic stability and links it to bank soundness. The Federal Reserve Flow of Funds accounts describe how the share of assets of commercial banking as a percent of total financial assets in the financial sector has been declining for several decades while the share of assets held by other financial institutions and money managers has been growing.

When is a financial sector stable? Defining financial stability or instability is challenging. Financial stability can broadly be distinguished between 'micro-stability', which involves conditions of individual financial institutions, and 'macro-stability', which focuses on the efficient functioning of the financial system as a whole. In a more intuitive sense, financial stability means the avoidance of financial shocks that are large enough to cause economic loss to

the real economy. Here we view macroeconomic financial stability as influenced not only by banks and other financial institutions, but also by the volatility of asset prices. Spotton (1996) identifies financial instability with dramatic swings in the price of financial assets. Schinasi (2004) discusses the concept of financial stability in detail and proposes the following definition:

“A financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial imbalances that arise endogenously or as a result of significant and unanticipated events” (p.8).

Mishkin (2007) describes a financial system as stable if it performs the function of efficiently channelling funds to optimal investment opportunities. Friedman and Laibson (1989) focus on the role of stock markets with their extreme movements as part of the financial system allocating scarce capital resources. Malliaris and Yan (2010) describe that even in stable markets capital allocation may be slow and give a behavioural explanation. Bernanke (2011a) addresses domestic financial stability as it relates to global imbalances in capital flows, currency devaluations or even country defaults.

Suppose that financial stability means that the financial system allocates capital efficiently. Then, if the system becomes unstable, there are dramatic swings in asset prices, and as a result the financial system does not allocate capital efficiently. When the system is unstable, two types of interrelated risks emerge. First, the system experiences valuation risk because the financial instability has increased uncertainty and traders have difficulty correctly measuring fundamental values of assets. Second, there is macroeconomic risk. This means that traders also need to assess the likelihood of a recession as a result of financial disruptions in investment and consumer spending. Thus, financial instability creates uncertainty, asset price volatility and misallocation of capital, all of which negatively impact the real economy. It is logical to ask, “what economic policies may contribute to financial stability?”

One important expectation of monetary policy during the ‘70s and ‘80s was that price stability would also bring financial stability. When inflation was high during the 1970s, asset prices were distorted. It was debated whether the stock market was a hedge against inflation. Housing prices increased in response to inflation in the late 1970s. The financial sector during this period of high inflation performed poorly. A monetary policy targeting inflation was believed to lead to financial stability. Taylor (2002) documents the long journey of monetary policy from inflation and financial instability to price stability and the Great Moderation. He

discusses how low and stable inflation rates reduce uncertainty and promote sound economic decisions. Price stability removes market distortions in price signals and, by anchoring inflation expectations, risk premia in interest rates are reduced, along with the likelihood of misperceptions about future asset returns.

In a seminal paper, Bernanke and Gertler (1999), also reprinted in this book, develop a macroeconomic model and obtain the result that price stability and financial stability are complementary and mutually consistent objectives. Kuttner (2012), in this book, discusses price and financial stability and several other results of the Bernanke and Gertler (1999) paper in detail. Ferguson (2002), Papademos (2006) and Plosser (2008) examine the interplay between price stability and financial stability. Often, an economy simultaneously experiences price and financial stabilities, as during most of the 1990s. However, there have been periods of price inflation and financial stability, as during the 1970s. Between 2000 and 2004 there was price stability with financial instability. Currently we have price stability but markets remain financially unstable. Borio and White (2003) tell us that episodes of financial instabilities with serious macroeconomic costs have taken place with greater frequency the last thirty years than earlier in the midst of price stability, both in developed and emerging markets.

In other words, in the presence of price stability, financial markets have become more volatile recently than in the past. Once inflation was conquered, the challenge of financial instability arose again. Greenspan (2004, 2005) reflects on this issue of price stability producing a decrease in real volatility but paradoxically an increase in financial volatility. Rajan (2005) articulates in detail how the financial system has increased risk. Most of the times, central banks pursue their mandated price stability goal; however during periods of financial crises, central banks give priority to stabilizing the financial sector in order to contain losses to the real sector. Thus, price stability is neither necessary nor sufficient for financial stability.

Borio and White explore this paradox and argue that, in order to resolve it, one needs to examine carefully the procyclicality of the financial sector. In an economic environment of economic growth, with a credible monetary policy that is achieving its primary objective of price stability, the financial sector may expand rapidly and asset prices may increase. Confidence based on sound economic performance tends to drive up both the amount of credit and asset prices. If monetary policy continues to only pursue price stability, the eventual decline in asset prices may destabilize the financial system and the economy.

Issing (2002) argues that, as market-based financing has expanded during the last decade, asset prices have gradually gained in importance and monetary policy transmission mechanisms have become more diversified and complex. As a result, a change in asset prices might have a huge impact on financial system stability and economic activity in general and hinder the effectiveness of monetary policy.

If a successful monetary policy, as the one during the Great Moderation, cannot produce longterm financial stability, can financial instability impact monetary policy? Yes. Papademos (2006) argues that a reduction of interest rates, for example, may have weaker effects than under normal conditions if the financial system is unstable, because increasing risk premia may prevent most lending rates from falling, or because of credit rationing arising from a general unwillingness on the part of banks from lending. A striking example of this sort has been the asset price bubble in Japan in the late '80s. Plummeting asset prices and rising non-performing loans have undermined the solvency position of banks, making them unwilling to lend, or perhaps incapable of lending. The extremely accommodating policy stance, with interest rates close to zero percent, did not reopen the bank lending channel. Currently, the U.S. has used an essentially zero Fed funds rate to address the serious unemployment problem that resulted from the financial crisis. The very slow improvement in the job market is evidence that financial instability constrains the effectiveness of monetary policy.

Domestic financial stability is also closely interrelated to the global monetary system. Mishkin (1999, p. 6) carefully develops a conceptual framework for global monetary instability and concludes by proposing the following definition: Financial instability occurs when shocks to the financial system interfere with information flows so that the system can no longer do its job of channeling funds to those countries with productive investment opportunities.

Beyond the definitions of stability given above, Brock and Malliaris (1989) present a comprehensive exposition of the technical concept of stability and its applications to economics. They define stability as a special property of an economic system that allows it to return quickly to its original state after an exogenous or endogenous shock. These authors view an economic system as a group of relationships between endogenous variables represented as a vector X , exogenous variables as I and random shocks as U . Furthermore, one can decompose the vector X into real variables R and financial variables F , so that $X = R + F$. Suppose that GDP is one key real endogenous variable that is used to monitor the stability of the system. Disturbances in such

a system may occur because of shocks to X , real or financial, or I or U . One may wish to characterize the source(s) of instability arising endogenously (drop in productivity, technology) or exogenously (decline in foreign trade or foreign currencies) or from random shocks (terrorist attacks, wars, natural disasters). What we are interested in is disturbances in the financial sector F or in any other variable that immediately involves F .

A system $f(X, I, U)$ is stable if such shocks to any of the variables R, F, I or U do not translate to deviations from trend GDP. If such shocks cause deviations from trend GDP (say a recession) then we say the system is unstable. In particular the system is financially unstable if a shock in some financial variable F causes a recession and prevents the economy's GDP from recovering quickly. It remains a formidable analytical challenge to develop a sufficiently complete macroeconomic model that is capable of addressing factors contributing to macroeconomic instability. Such a model needs to distinguish between endogenously caused instability due to real or financial factors and exogenously due to random shocks. Asset price bubbles straddle between the real and financial sectors with their fundamentals driven by the real sector and the bubble component by the financial sector. If the fundamentals disappoint, the bubbles burst. When the bubble bursts, the financial sector, because of excessive credit and leverage, becomes unstable and transmits this instability to the real sector. How can a theorist decompose these interrelated feedback mechanisms?

This brief bibliographical discussion leads to the observation that, when asset price bubbles burst, they often cause financial instability. This instability in turn diminishes the effectiveness of the financial sector to allocate capital efficiently and it may also reduce the effectiveness of monetary policy. Furthermore, it is not known how long such instability could last or to put it differently, it is not known how quickly both the financial and real sectors can recover. The lost decade in Japan and the loss of the last 4 years in the U.S. demonstrate the great risks associated with asset bubbles bursting. This leads us to the next question. How should monetary policy respond to asset price bubbles?

Asset Prices and Monetary Policy

When Greenspan (1996) reported that the stock market appeared to be driven by irrational exuberance and wondered how this should factor into the conduct of monetary policy, a lively debate erupted. Bordo and Wheelock (2004, 2007) studied stock market booms and monetary

policy both in the U.S. and in nine other industrialized countries. They identified several episodes of sustained price increases in stock prices in the 19th and 20th centuries and then examine the growth of real output, productivity, the price level, and credit during each episode. They concluded that most asset price bubbles occurred during periods of relatively rapid real economic growth with increases in productivity and credit. Also most asset bubbles during the 20th century developed during periods of price stability, but there were bubbles during the 19th century that developed during periods of inflation or deflation. Booms often ended within a few months of an increase in inflation and consequent monetary policy tightening.

Cogley (1999), Bullard and Schaling (2002) and Goodfriend (2002) study how monetary policy should respond to asset prices. They conclude that using monetary policy to attempt to burst asset price bubbles is likely to result in greater economic instability than waiting for bubbles to burst on their own. In particular Bullard and Schaling (2002) study the macroeconomic consequences of a Taylor-type monetary policy rule that targets the level of equity prices in addition to inflation and output growth. They find, in extreme cases, that a policy that explicitly targets equity prices can lead to an indeterminate rational expectations equilibrium.

Rigobon and Sack (2003) acknowledge that it is difficult to estimate the response of asset prices to changes in monetary policy because both stock prices and interest rates react to numerous other variables. They develop a new estimator and conclude that an increase in short-term interest rates results in a decline in stock prices. Bernanke and Kuttner (2005) also analyze the impact of changes in monetary policy on equity prices. They find that, on average, a hypothetical unanticipated 100-basis point increase in the Fed funds rate is associated with about a 5% decline in broad stock indexes. Their results imply that a series of modest Fed funds increases may not moderate asset bubbles effectively. Kuttner (2012) in this book reconfirms the empirical evidence that marginal interest rates adjustments cannot effectively dampen asset price bubbles.

Filardo (2000, 2001) explores the role of monetary policy in an economy with asset bubbles by developing a small-scale macroeconomic model and running various simulations. He finds that if there is no uncertainty about the role of asset prices in determining output and inflation then monetary policy should respond to asset prices. In a later paper, Filardo (2004)

suggests that, in dealing with asset price bubbles, the use of both fiscal policy and financial regulation policies should be considered along with monetary policy.

Blanchard (2000) and Bordo and Jeanne (2002) use a dynamic New Keynesian framework in which asset price bubbles lead to excessive capital or debt accumulation which result in a prolonged slump when the asset price bubble bursts. Bordo and Jeanne argue that more restrictive monetary policy will dampen an asset price bubble at a cost of lower output during the bubble. The benefit of such a monetary policy is higher output than otherwise would have been the case when the bubble bursts. However, Bordo and Jeanne are skeptical about whether, in the real world, central bankers can actually identify bubbles accurately and assess the inter-temporal trade-offs involved in attempting to dampen an asset price bubble.

In an influential cited earlier and reprinted in this book, Bernanke and Gertler (1999) apply the Bernanke, Gertler and Gilchrist (1999) financial accelerator model by incorporating exogenous bubbles in asset prices. The asset bubble affects real activity via the wealth effect on consumption and firms' financial decisions via appreciations of their assets in the balance sheet. Stochastic simulations lead Bernanke and Gertler to conclude that central banks should view price stability and financial stability as highly complementary and central bank policies should not respond to changes in asset prices, except insofar as they signal changes in expected inflation. Bernanke and Gertler (2001) use the same model to perform stochastic simulations to evaluate the expected performance of alternative policy rules. Their findings are complementary to their earlier study. An aggressive inflation targeting rule stabilizes output and inflation when asset prices are volatile and there is no significant additional benefit to responding to asset prices. Bean (2003, 2004) is supportive of the Bernanke and Gertler results. He reasons that flexible inflation targeting essentially considers the entire future path of expected inflation and growth and, thus, there is no further reason to consider asset prices. Kuttner (2012) offers a detailed assessment of the Bernanke and Gertler results in view of the financial crisis.

Cecchetti, Genburg, Lipshy and Wadhvani (2000), and Cecchetti, Genberg and Wadhvani (2002) critique the Bernanke and Gertler results, and argue for a central bank that pursues both inflation targeting at a given time horizon and achieves a smooth path for inflation, these policies will most likely achieve better results by considering asset prices along with inflation forecasts and output gaps. Their logic is based on the fact that reacting to asset prices

during normal times will reduce the probability of asset bubbles forming and growing to the point that their bursting may destabilize the economy.

Chairman Greenspan (2002) participated in this debate and articulated the asymmetric approach to asset bubbles. He claimed that

“[t]he notion that a well-timed incremental tightening could have been calibrated to prevent the late 1990s bubble is almost surely an illusion. Instead, we ... need to focus on policies to mitigate the fallout when it occurs and, ease the transition to the next expansion” (p.5).

Blinder and Reis (2005) strongly support the asymmetric approach. They state

“[r]egarding the Greenspan’s legacy, then, we pose a simple rhetorical question. If the mopping-up strategy worked this well after the mega-bubble burst in 2000, shouldn’t we assume that it will also work well after other, presumably smaller, bubbles burst in the future? Our suggested answer is apparent.” (p. 68).

This position was also articulated by Kohn (2006, 2008), Mishkin (2008), Evans (2009) and others. Issing (2009) was the first to call this position the “Jackson Hole Consensus”. As already discussed earlier, this consensus proposes that central banks should ignore an asset bubble while it is growing and follow a “mop-up” strategy after a bubble bursts. This involves supplying sufficient liquidity to the financial system following the bursting of the bubble to avoid a macroeconomic collapse. Issing (2009, 2011) carefully articulates that the European Central Bank did not adopt the Jackson Hole Consensus and instead followed a strategy of leaning against bubbles. Thus, the initial considerations of central banks targeting asset price bubbles or trying to puncture bubbles were quickly dismissed as viable strategies both in the U.S. and in Europe.

Instead of asking the normative question about how monetary policy should respond to asset bubbles, Hayford and Malliaris (2001, 2004, and 2005) take a positive approach. They use a forward-looking Taylor rule model to examine if monetary policy since 1987 has been influenced by the valuation of the stock market. They search for empirical evidence that the Fed is stock market neutral while the bubble is emerging as suggested by the Jackson Hole Consensus. They develop several models and use different inputs and find empirical evidence that during the 1994-1999 period, the Fed not only avoided neutralizing the asset bubble, as expected, but also, perhaps, unintentionally may have contributed to the bubble’s growth.

Roubini (2006) argues that central banks can deflate asset price booms without an adverse impact on economic activity. To support his argument he cites the cases of the real estate markets of the United Kingdom during 2003-2004, Australia during 2003-2005 and New Zealand during 2004-2005 as empirical evidence that

“...prove[s] that monetary policy can if used wisely and moderately, be very effective in pricking asset and housing bubbles without leading to significant economic or financial damage.” (p.99)

In the case of the UK and Australia the central banks increased short-term interest rates by relatively modest amounts starting from low initial levels. For example for the UK, rates went up by 125 basis points starting from 3.50%, an increase that arguably was from slightly below, up to a neutral short-term interest rate. The Reserve Bank of New Zealand increased the official cash rate, their primary instrument of monetary policy from about 5.0% in January 2004 to 6.75% in summer 2005. According to Roubini this was done both to cool inflationary pressures and to deflate the housing bubble. As a result of this tightening, economic growth decreased from 4.8% to 2.3% which Roubini states “...is hardly an economic or financial meltdown.” In all three of these cases economic growth slowed in response to the tightening of monetary policy.

Taylor (2007) acknowledges that the Fed had

“...good reasons stated at the time for the prolonged period of low interest rates, most importantly the risk of deflation following the experience of Japan in the mid-1990s.” (p.471)

However Taylor (2007) argues that the Fed could have prevented the housing bubble that ended up bursting in 2007 if the Fed had stuck to the Taylor rule and increased the Federal funds rate at the beginning of 2002. Taylor’s argument seems to depend entirely on whether or not the risk from causing a housing boom and bust was greater than the risk of deflation. When the Fed did start to increase the Federal funds rate in 2004, long term interest rates, such as the 30 year fixed mortgage rate, did not increase.

The cause of this “bond market conundrum”, that is, the lack of response of long term interest rates to monetary tightening has not been resolved. At least two explanations have been proposed: Ben Bernanke (2005) has suggested the cause was a global saving glut while Smith and Taylor (2007) argue it was due to U.S. monetary policy deviating from the Taylor rule by not increasing the Federal funds rate sooner. However the fact that inflation did not accelerate as a consequence of the Fed deviating from the Taylor rule from 2002-2004 provides partial

evidence that the risk of deflation was real and was dealt with. If the Fed had increased the Federal funds rate as in Taylor's counterfactual, deflation may have occurred along with a stop to the boom in housing starts. This episode points out the difficulty central bankers face in balancing multiple risks to the economy while having only one monetary policy instrument. One way to deal with the risk of deflation and the housing boom would have been to use monetary policy as was done, but also to additionally regulate real estate lending more closely. Since the Fed followed an easy monetary policy during 2002-2004, Taylor's argument that the Fed contributed to the housing bubble appears to have some validity. Bernanke (2010) reviews Taylor's evidence on the link between monetary policy during 2002-06 and the rapid increases in housing prices during this period and concludes that the direct links are weak.

Jalilvand and Malliaris (2010) ponder if there is a link between the internet bubble crashing and the housing bubble. They reason that the asymmetric approach to bubbles may have contributed to the internet bubble. When the bubble burst in 2000, the easy monetary policy that followed due to the recession and also to prevent deflationary worries may have fueled the housing bubble. This link between the internet and housing bubbles can be called a sequence of bubbles. One may further argue that the remarkably easy monetary policy during the 2008-2011 years, also motivated by the Jackson Hole Consensus, may currently be contributing to the emergence of new bubbles in the sequence.

Yellen (2009) gives an overview of the lessons she learned from the current financial crisis about financial bubbles and monetary policy. She acknowledges that there are several difficult issues for monetary policy makers that prevent them from taking action. Among these issues are the following: (1) Do we know that a bubble exists? (2) What is the optimal timing to lean against the bubble? (3) How can we assess the risk and reward characteristics of the bubble? (4) How much risk is too much? (5) How can we estimate or evaluate the consequences of the bursting of the bubble? (6) What tools do we have to manage or target the bubble? She concludes that the current crisis challenges economists to provide answers to such questions instead of advocating the asymmetric approach. She answers the question we have been discussing

“[s]hould central banks attempt to deflate asset price bubbles before they get big enough to cause big problems? Until recently, most central bankers would have said no. They would have argued that policy should focus solely on inflation, employment, and output goals—even in the midst of an apparent asset-price bubble. That was the view that prevailed during the tech stock bubble and I myself have supported this approach in the past. However, now that we face the

tangible and tragic consequences of the bursting of the house price bubble, I think it is time to take another look.” Yellen (2009, p.8).

She concludes that “monetary policy that leans against bubble expansion may also enhance financial stability by slowing credit booms and lowering overall leverage” (p. 10).

Dudley (2010) also argues that the financial crisis of 2007-09 necessitates the need for central banks to reexamine the asymmetric approach to bubbles because it has been demonstrated very clearly that the cost of waiting to respond to an asset bubble until after it has burst can be very high. He argues in favor of a policy that leans against the bubble. Such a policy may use three broad sets of tools: first, the bully pulpit where the policymakers speak out about the dangers associated with an incipient bubble; second, the use of macroprudential tools and third, a tighter monetary policy that may reduce desired leverage in the financial system by flattening the yield curve.

In a noteworthy paper Christiano, Ilut, Motto and Rostagno (2010) use historical data and model simulations containing 18 booms in the U.S. to show that, if inflation is low during stock market bubbles, an interest rate rule that narrowly targets inflation actually destabilizes asset markets and the whole economy. The authors remark that economic historians like Bordo and Wheelock (2004, 2007), mentioned earlier, and White (2009) have documented, that in every stock market bubble in the last 200 years excluding the Civil War and WWI and II, asset price bubbles occurred during years of low inflation. A logical consequence of this empirical fact is that by setting interest rates to target low inflation, the central bank is induced to set real rates below the natural rate, thus fueling a bubble. This is consistent with Hayford and Malliaris (2001, 2004, 2005). Thus one can make the argument that a central bank that follows an asymmetric response to asset bubbles actually encourages a bubble in its growing phase. This challenges the conventional wisdom of the Jackson Hole Consensus. To correct this problem, Christiano, Ilut, Motto and Rostagno (2010) propose targeting credit growth as a good proxy for the natural rate.

Also, it is important to recognize several contributions of Geanakoplos on leverage and asset bubbles and how central banks should respond. They are briefly discussed in Geanakoplos (2011) in this book. The author argues that leverage causes asset price bubbles and such leverage cannot be stopped by increasing interest rates nor can it be boosted by lowering interest rates. Leverage must be managed directly. Geanakoplos suggests that central banks manage both

interest rates and the leverage cycle. Acharya and Naqvi (2012), in this book, argue that asset bubbles are formed only when bank liquidity is high enough because such high liquidity leads bank managers to underprice risk. Therefore the authors suggest that leaning against a bubble by a central bank takes the specific form of leaning against liquidity.

Lastly, Bernanke (2011b) without directly discussing the bursting of the housing bubble and the seriousness of the recent financial crisis, outlines what are the important sources of systemic risks for both national and global financial and real stability. He advocates the macroprudential approach that supplements the traditional supervision and regulation of individual banks with an explicit deliberation of risks undermining the stability of the entire financial system.

Conclusions

There are three conclusions that follow from our detailed exposition. The first and most important is that the Jackson Hole Consensus, favoring the asymmetric approach to responding to asset price bubbles, has lost its commanding power among central bankers. The Jackson Hole Consensus proposed that asset bubbles take a long time to develop, often with numerous corrections and reassessments along the slow climb to the top, only to crash very quickly and dramatically in a fraction of the time it took to reach the peak. Central bankers cannot agonize for several years about what to do with asset bubbles while they are growing. Increasing Fed funds rates gradually and continuously if the bubble persists over an extended period of time entails very high risks of the central bank itself causing a recession, without sufficient evidence of the effectiveness of such marginal Fed funds increases. It is less risky to ignore the bubble and decrease interest rates rapidly after its bursting. Thus, the asymmetry of asset bubbles translates into an asymmetry of central bank policy. While the bursting of the internet bubble should have challenged this consensus, it actually solidified the consensus. Had the consensus been weakened by the internet bubble bursting, the housing bubble may have been avoided all together. It took the great recession of 2007-09 to educate central bankers that the consensus had crashed and needed to be replaced by leaning against asset bubbles. However, leaning against an asset bubble while it is developing, often over several years, is currently only a guiding principle and much remains to be articulated before central banks can implement it.

The second conclusion is that the pursuit of price stability does not always deliver financial stability. The triumph of price stability as a strategy that produced the Great Moderation is now being reconsidered as new research documents that a central bank pursuing inflation targeting during low inflation environments may drive the real interest rate below its natural rate and thus fuel asset bubbles. Could it be that, instead of central bankers asking how to respond to asset price bubbles, they should be asking “How may central banks be causing asset bubbles?” Alternatively, with each bursting of an asset bubble, as with the internet bubble in 2000 and the housing bubble in 2007-09, the fear of deflation causes the Fed to ease aggressively in order to avoid an experience similar to the lost decade of Japan. How does the Fed know whether or not the degree of stimulative excess may be planting the seeds of the next bubble? How does the Fed avoid moral hazard that leads to financial instability? How does the Fed conduct monetary policy in the presence of several financial institutions that are too big to fail? The Dodd-Frank Wall Street Reform and Consumer Act created a new Financial Stability Oversight Council to address these issues, among numerous other threats to the stability of the financial system of the U.S. Will it work where others have failed? Will financial stability remain the responsibility of the Fed or will it be transferred to the Financial Stability oversight Council? Will the Council recommend appropriate monetary policies to promote financial stability or will the Council use macroprudential policies?

The third conclusion is that the asset bubble literature has made great progress in determining what drives the feedback mechanisms but much more is needed. When it comes to macro bubbles such as the entire stock market or housing, we need to know more about the conditions that give rise to such bubbles as well as the mechanisms that propel them to grow and then crash. The research of economic historians has been very useful in identifying the emergence of bubbles with the development of new technologies, solid economic growth with high productivity, and stable monetary conditions as characterized by low inflation and low interest rates. Naturally there is a paradox. All these conditions are those for which central banks typically strive. How can central banks avoid this Promethean penalty? The Dodd-Frank Act has established, within the Treasury Department, the Office of Financial Research that may choose to collect data to evaluate conditions conducive to the emergence and development of asset bubbles, their growth and eventual crash. The approach is similar to the way national income accounting data has contributed to identifying business cycles. Such new data on asset booms

and busts may help in the formulation and testing of new hypotheses about bubbles and the appropriate policies to moderate them. Moving forward, economists have an opportunity to respond to the challenge of developing theoretical models of asset price bubbles, and assessing the risks and benefits in terms of the welfare of both the symmetric and asymmetric approaches. Central banks need to respond to an asset bubble ex ante rather than fighting a new bubble using the lessons learned from the bursting of the last bubble.

Notes:

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