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HISTORICAL PERSPECTIVES**

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Centre for Economic Policy Research

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BUBBLES AND CENTRAL BANKS: HISTORICAL PERSPECTIVES[†]

Abstract

This paper reviews some of the most prominent asset price bubbles from the past 400 years and documents how central banks (or other institutions) reacted to those bubbles. The historical evidence suggests that the emergence of bubbles is often preceded or accompanied by an expansionary monetary policy, lending booms, capital inflows, and financial innovation or deregulation. We find that the severity of the economic crisis following the bursting of a bubble is less linked to the type of asset than to the financing of the bubble—crises are most severe when accompanied by a lending boom and high leverage of market players, and when financial institutions themselves are participating in the buying frenzy. Past experience also suggests that a purely passive “cleaning up the mess” stance toward the buildup of bubbles is, in many cases, costly. Monetary policy and macroprudential measures that lean against inflating bubbles can and sometimes have helped deflate bubbles and mitigate the associated economic crises. However, the correct implementation of such proactive policy approaches remains fraught with difficulties.

JEL Classification: E44, E52, F34, G01 and N10

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I. Introduction

There is a long-standing debate regarding the role that monetary policy should play in preventing asset price bubbles. In the years before the recent financial crisis, the Federal Reserve and most other central banks were reluctant to use monetary policy as an instrument for tackling asset price bubbles. However, in light of the huge costs of the crisis, many observers speculate whether these costs could have been avoided or at least reduced if central banks had taken into account the evolution of asset prices in their monetary policy. The debate gathered momentum in the aftermath of the crisis as it was feared that historically low interest rates and nonconventional monetary measures would give rise to new asset price bubbles and thereby plant the seeds for a new crisis.

There exist a number of different views concerning the role of monetary policy with regard to asset price bubbles. Bernanke and Gertler (1999, 2001) argue that asset prices should play a role in monetary policy only insofar as they affect inflation expectations. In this regard, the components of price indices used by policy makers play a decisive role. Typically, asset prices are not explicitly included in these price indices. However, real estate prices are indirectly taken into account through rents. Consequently, Goodhart (2001) argues that the whole debate could be solved if asset prices were given a larger weight in the inflation target. In contrast, others take the view that asset price developments should not be targeted by monetary policy at all. For example, the Fed's declared policy prior to the subprime crisis was to "clean up the mess," i. e., to mitigate the consequences of bursting bubbles rather than try to detect and prevent asset price bubbles (Greenspan, 1999, 2002).

Several arguments have been brought forward to support the belief that monetary policy should not react to asset price bubbles. First, bubbles cannot be identified with confidence.

A deviation from the fundamental value of an asset could be detected only if the asset's fundamental value was known. Second, monetary policy instruments are said to be too blunt to contain a bubble in a specific market. In particular, while hikes of the policy rate—if large enough—may in fact deflate a bubble, this comes at the cost of substantial drops in output and inflation (Assenmacher-Wesche and Gerlach, 2008). These costs may well outweigh the benefits of bursting the bubble. Third, bubbles appear to be a problem especially in combination with unstable financial institutions or markets. Therefore, bubbles should be tackled by financial regulation rather than monetary policy. Overall, these arguments resonate closely with the “divine coincidence” of standard New Keynesian models (Blanchard and Galí, 2007): If inflation is stable, then output will be at its natural level, so there is no need to give any extra attention to asset prices and potential bubbles.

This view has been forcefully opposed by the Bank for International Settlements (BIS). Several prominent BIS economists have argued that monetary policy should “lean against the wind,” i. e., try to prevent the buildup of bubbles by reacting early on to upward-trending asset prices (Cecchetti et al., 2000; Borio and Lowe, 2002; White, 2006). Although they recognize the difficulties associated with the identification of bubbles, proponents of this policy approach argue that a passive role is not optimal. As in other decision problems under uncertainty, policy makers should rely on a probabilistic approach. To underpin these arguments, some point to the fact that many observers detected the recent housing bubble in the United States well before it burst.

Moreover, the expected costs of bursting bubbles are said to outweigh the costs of early intervention. Such costs include, for example, the risk of new bubbles after a cleaning approach has been taken. The reason is that such a policy is asymmetric, which tends to raise the price level and risks creating the next bubble (the famous “Greenspan put”).

Finally, proponents suggest that financial regulation as a means to avoid or counter asset price bubbles may not be fully effective in all circumstances. This regards the timing as well as the scope of interventions. With respect to timing, financial regulation may prove to be procyclical rather than countercyclical. Concerning the scope, regulation may be undermined by regulatory arbitrage. Monetary policy could be a more effective tool since it also reaches the shadow banking system. Indeed, the central bank may not even need to *directly* adjust monetary policy; instead, it could use verbal communication to dampen bubbles—in effect, “talk down” the market.

In the run-up to the recent financial crisis, the Fed and other central banks largely followed the Greenspan view of a monetary policy that did not try to prevent the emergence of bubbles. Instead, they “cleaned up the mess” when the crisis broke, just as they had done after the dot-com bubble burst in 2000. In fact, they had considered the ex-post cleanup operation quite successful. Of course, they ignored the fact that the dot-com bubble had been largely financed by equity and not by debt as the subprime bubble had been. However, the recent crisis has shown quite plainly the huge costs that can arise from bursting asset price bubbles. The theoretical links between (bursting) bubbles, financial crises, and the associated macroeconomic fallout are discussed in detail in Brunnermeier and Oehmke (2013). Overall, the recent crisis experience tilted the view toward more intervention, and the old consensus (Greenspan view) has seemingly shifted to a new consensus closer to the BIS view (see, for example, the speeches by Jeremy Stein, former member of the Board of Governors of the Federal Reserve System, February 7, 2013 and March 21, 2014). The new debate therefore centers more on the question of how to react to asset price bubbles. Most people agree that the newly created macroprudential instruments can serve this purpose.

The question, however, is whether this is sufficient or whether monetary authorities should explicitly consider asset price distortions in their decisions.

This paper attempts to shed new light on this debate by taking a historical perspective. We document the most prominent asset price bubbles from the past 400 years, characterizing the types of assets involved, the holders of assets, policy environments during the emergence of bubbles, the severity of crises, and policy responses. By the very nature of our approach, we cannot present any definitive policy conclusions. Rather, we try to identify typical characteristics of bubbles and illustrate the inescapable trade-offs at the heart of the “leaning versus cleaning” debate. In particular, we link the severity of crises to certain features of bubbles and to the subsequent policy response.

Our overview of bubbles is inevitably selective. We typically learn about bubbles that either were not tackled and burst or that were tackled by mistake, resulting in severe crises. In order to deal with this selection problem, we also searched for bubbles that did not result in severe crises because these are most likely to be instructive regarding effective ex-ante policy measures. Although we cannot hope to remove the selection problem from historical reporting, this may help mitigate it.

The paper will proceed in Section II by describing our selection of crises and by providing an overview of the 23 identified bubble episodes, including the types of assets and economic environments. Section III tries to link the severity of crises to the described characteristics of bubble episodes. Section IV then develops a number of hypotheses regarding the effectiveness of various policy responses. These hypotheses are then discussed informally by providing illustrative supporting or contradicting evidence from individual bubble episodes.

Section V concludes by summarizing our results and deriving some policy implications. The appendix contains a detailed overview of the 23 crises on which our analysis is based.

II. An Overview of Bubble Episodes

II.1 Selection of bubble episodes

Our analysis focuses on 23 famous bubble episodes from economic history. In order to identify these episodes, we started from the full sample of crises in the seminal book by Kindleberger and Aliber (2011), *Panics, Manias, and Crashes: A History of Financial Crises*. We reduced the sample by only considering episodes that were related to an asset price boom. Hence, an overheated economy would not be described as a bubble if no particular bubble asset was involved. For example, the Panic of 1819, which is sometimes called America's first great economic crisis, can be traced to an overheated economy that included overtrading and speculation in nearly all kinds of assets. Other crises, such as the Panic of 1907, evolved mainly because of other factors, such as an unsound banking sector. We also had to keep the size of our sample manageable and therefore excluded episodes that were very similar to included episodes but for which less material was available. In other cases, bubble episodes seemed closely related to previous crises or did not provide additional insights. Moreover, some episodes had to be removed because too little secondary literature could be found on them. We did not drop episodes merely because the crises were not severe enough. Rather, such crises may be the most interesting for us because they could point toward effective policies for dealing with a crisis. Nevertheless, the listing in Kindleberger and Aliber already has a selection bias in the direction of severe crises, which we could not avoid. This limitation should be kept in mind when interpreting our sample of crises. We complemented the sample by adding some important bubble episodes that are

not covered in Kindleberger and Aliber's book: namely, the Chicago real estate boom of 1881-83, the Norwegian crisis of 1899, and the Australian real-estate bubble in the early 2000s.

Table 1: Overview of sample of bubble episodes

	Event	Time	Place
1	Tulipmania	1634-37 (crisis: Feb. 1636)	Netherlands
2	Mississippi bubble	1719-20 (crisis: May 1720)	Paris
3	Crisis of 1763	1763 (crisis: Sept. 1763)	Amsterdam, Hamburg, Berlin
4	Crisis of 1772	1772-73 (crisis: June 1772)	England, Scotland
5	Latin America Mania	1824-25 (crisis: Dec. 1825)	England (mainly London)
6	Railway Mania	1840s (crises: April/Oct.1847)	England
7	Panic of 1857	1856-57 (crisis: Oct.1857)	United States
8	Gründerkrise	1872-73 (crisis: May 1873)	Germany, Austria
9	Chicago real estate boom	1881-83 (no crisis)	Chicago
10	Crisis of 1882	1881-82 (crisis: Jan. 1882)	France
11	Panic of 1893	1890-93 (crisis: Jan. 1893)	Australia
12	Norwegian crisis of 1899	1895-1900 (crisis: July 1899)	Norway
13	U.S. real estate bubble	1920-26 (no crisis)	United States
14	German stock price bubble	1927 (crisis: May 1927)	Germany
15	U.S. stock price bubble	1928-29 (crisis: Oct. 1929)	United States
16	"Lost decade"	1985-2003 (crisis: Jan. 1990)	Japan
17	Scandinavian crisis: Norway	1984-92 (crisis: Oct. 1991)	Norway
18	Scandinavian crisis: Finland	1986-92 (crisis: Sept. 1991)	Finland
19	Asian crisis: Thailand	1995-98 (crisis: July 1997)	Thailand
20	Dot-com bubble	1995-2001 (crisis: April 2000)	United States
21	Real estate bubble in Australia	2002-04 (no crisis)	Australia
22	Subprime housing bubble	2003-10 (crisis: 2007)	United States
23	Spanish housing bubble	1997-? (crisis: 2007)	Spain

Our selection leads to a sample of 23 bubble episodes, listed in Table 1 and spanning almost 400 years. The table in the appendix contains a detailed overview of all bubble episodes considered. The first bubble is the Tulipmania of 1634-37, and the most recent ones are the U. S. subprime housing bubble and the Spanish housing bubble. The table in the appendix starts by giving a brief overview of the respective bubbles and their wider context. Then it lists the major characteristics of these bubbles, such as the type of assets, their holders and their financiers, and the "displacement" that presumably triggered the bubble. The table

then describes the economic environment accompanying the origins of the bubbles. We specifically consider expansive monetary policy, the occurrence of lending booms, foreign capital inflows, and financial deregulation. These four factors are typically said to accelerate the emergence of bubbles. The table also collects indicators regarding the severity of crises, focusing on three aspects: the severity of the recession, the occurrence of a banking crisis, and spillovers to other countries. Most importantly, the table displays various types of policy reactions. The final line of the table lists the sources.

One word of caution about nomenclature is necessary here. We are using the word “bubble” in a rather broad (and somewhat sloppy) sense here. Our data are not sufficiently rich to have any chance of truly identifying deviations of prices from fundamental values. Therefore, the word “bubble” here merely refers to the fact that the asset price movement was considered excessive—rightly or wrongly—by market participants and that the result was often (but not always) a sharp price decrease when the bubble burst.

II.2 Characteristics of bubbles

The list shows that bubbles historically occurred in many different asset classes, ranging from commodities (such as tulips, sugar, or grain) to financial assets (especially stocks and bonds), real estate (land as well as residential and commercial building sites), and infrastructure projects. Bubbles in commodities were present especially in the earlier part of the time span examined in our sample. The 19th century saw many bubbles in the area of infrastructure, such as railroads and canals. In contrast, bubbles in securities and real estate emerged throughout our sample period.

With respect to the holders of bubble assets, we are particularly interested in whether the assets were held by specific groups of society or by large parts of the population. When

assets are held by specific groups, such as specialized traders or wealthy individuals, wealth effects on consumption and investment are likely to be smaller than when assets are held widely and constitute a large share of agents' wealth. We also analyze whether assets were held directly by financial institutions, which could amplify a crisis owing to fire sales or margin calls. Regarding the financing of bubble assets, a crucial aspect is the importance of debt financing because this raises the probability of spillovers to other parts of the economy. Virtually all bubbles in our sample were financed by debt to a large degree. Two noteworthy exceptions are the Chicago flat craze and the dot-com crisis, which were to a large extent financed by equity, as will be discussed in more detail below. In addition, we are interested in whether banks were involved in the financing of the bubble assets because this increases the likelihood of a banking crisis.

Bubbles are typically triggered by some type of "displacement," an exogenous shock that significantly changes expectations and fuels a bubble (see Kindleberger and Aliber, 2011). Examples are technological innovations (such as railways or the emergence of the New Economy), financial innovations (e. g., futures, acceptance loans, or securitization) or deregulation (opening new business opportunities), and political events (like the beginning or end of a war). This displacement frequently happens in specific sectors and channels funds into specific uses. It is often accompanied by euphoria and extrapolative expectations, making people believe that the upward movement of prices will continue forever.

II.3 Economic environment

The second section of the appendix table characterizes the economic environment in which the bubbles emerged. The overall picture is familiar and confirms standard results from the literature. We see that most of the identified crises emerged when the stance of monetary

policy was expansive. For earlier periods, when central banks either did not exist or were more similar to private banks, the issuance of bank notes by private banks often had an expansionary effect on money supply in the early phase of a bubble episode. An example is the Latin American Mania in England in 1824-25, when country banks issued large volumes of small-denomination banknotes (Neal, 1998, p. 55). Another example is the Gründerkrise, when some federal states in Germany broadened the rights of money emission for certain banks. In other cases, such as the crisis of 1857 or the panic in Australia in 1893, gold discoveries caused an expansion of the money supply and spurred optimistic expectations. Although we cannot make any causal statements here, our observations are in line with evidence by Bordo and Landon-Lane (2013), who show that “loose” monetary policy has a positive impact on asset prices, especially in periods of asset price booms.

Similarly, the overwhelming share of bubbles was accompanied by a lending boom, which appears to be an almost universal feature of asset price bubbles. This expansion of credit was frequently related to financial innovation. For example, before the crisis of 1882, forward securities trading at the Paris and the Lyon exchanges were financed through a system of “reports”: To purchase a security, the investor could make a down payment and borrow the rest from a stockbroker (“agent de change”). The broker himself borrowed money in the call market from banks, caisses, and individuals for one day and expected to roll over the loan each day, a structure that proved to be vulnerable in a crisis. Other examples of financial innovations entailing the rapid expansion of credit are “swiveling” (the use of fictitious bills of exchange to create credit) before the crisis of 1772, the invention of the acceptance loan before the crisis of 1763, or the securitization of mortgages in the run-up to the U. S. subprime crisis. Reversely, not all lending booms lead to asset price bubbles, as they may also lead to a more general overheating of the economy rather than to

exaggerations in a particular asset market. Hence, lending booms appear to be (almost) a necessary, but not sufficient, condition for the occurrence of asset price bubbles.

In some cases, bubbles seem to have been fueled by capital inflows from abroad. In more than half of the bubble episodes, not only domestic but also foreign investors participated in the buying frenzy. Examples are found throughout the period considered in this study. The Railway Mania in England during the 1840s was fueled by massive foreign investments in the railway system. Similarly, prior to the Panic of 1857, the United States received large capital inflows, mainly from England but also from Germany and France. Nearly half of about \$400 million in outstanding railroad bonds in the mid-1850s was financed by foreign investors; following net investment outflows of \$3 million in 1849, net inflows grew to \$250 million in the crisis year 1857 (Riddiough and Thompson, 2012, p. 4, and sources therein). Foreign capital also played a considerable role during the Panic of 1893 and the German stock price bubble of 1927. Often, the bursting of bubbles leads to a redirection of capital flows, spurring new asset price booms in other regions. Examples are the Scandinavian and Asian asset price bubbles after the bursting of the Japanese bubble, as well as the dot-com bubble and the U. S. subprime housing bubble after the Asian crisis.

Finally, bubbles often occur during phases of financial deregulation. Examples are the Gründerkrise of 1872-73, when the reform of stock corporation law led to a surge in the foundation of joint-stock companies, as well as most of the recent crises in our sample. Differences in the extent and speed of deregulation of financial markets and banks are pointed out as a major cause of the lending boom and the associated difficulties in the Japanese asset price bubble (see, e. g., Hoshi and Kashyap, 2000; Posen, 2003). Finance became less dependent on banks due to the deregulation of bond and stock markets (e. g., the opening of foreign bond markets and less stringent collateral requirements). Remaining

relatively strictly regulated, banks lost their best clients and were not able to enter into new fields of business. Therefore, they responded with a rapid expansion of lending to small firms, to foreign borrowers, and especially to the real estate sector. By 1990, real estate loans in Japan had doubled from the beginning of the 1980s.

III. Severity of Crises

All bubble episodes in our sample are characterized by strong increases in asset prices, but not all of them ended in deep depressions. In this section, we ask how the severity of crises was related to the characteristics of bubbles and their economic environments. The role of policy responses is discussed in the next section.

In our sample, no clear relationship exists between the types of bubble assets and the severity of crises. Bubbles involving real estate often lead to a severe recession. However, the same is true for many bubbles not involving real estate. For example, the bubble in grain and sugar in 1763, the Latin America Mania and the Railway Mania (both involving securities and commodities), and the French crisis of 1882 (involving securities) all had severe real consequences. This is important because it suggests that an overly narrow focus on bubbles in real estate markets—which appears to have happened following the recent crisis due to the prominence of real estate bubbles at that time—is misplaced. A prominent example of a real estate bubble not leading to a deep depression is the real estate bubble in the United States during 1920-26 (see Alston et al., 1994; White, 2009). This period saw a boom and bust in housing prices similar to that during the recent financial crisis. Nevertheless, the immediate effects on both the banking system and the real economy were rather modest.²

² Postel-Vinay (2014) has a less benign view of real estate lending in that period. She argues that it was an important determinant of subsequent bank failures during the Great Depression, but due not to low loan quality but to its effect on banks' liquidity.

An interesting question is whether this can be explained by specific policy responses, as will be discussed below.

Generally, the *financing* of asset bubbles seems to be more relevant than the *type* of bubble asset. Since real estate is typically debt-financed, such bubbles tend to be severe. But the same can be true for other asset bubbles if debt financing is pervasive. In fact, the severity of a crisis is clearly related to the presence of a lending boom. Compare, for example, the two early commodity bubbles in our sample, the Tulipmania and the crisis of 1763. The former was not accompanied by a lending boom given that the purchase of tulips was partly equity-financed and the extension of loans was limited to a rather small share of the population. Moreover, loans were granted directly by the sellers of the bulbs without the involvement of financial intermediaries. When the bubble collapsed, market participants experienced painful losses, but these did not spread to the rest of the economy.

The situation in 1763 was very different. Through chains of bills of exchange, credit expanded greatly, especially among financial institutions. When asset prices collapsed, highly leveraged financial institutions failed, leading to fire sales and a large-scale financial crisis with severe repercussions for the real economy (Schnabel and Shin, 2004). Another comparison can be made between the Railway Mania in England during the 1840s and the dot-com crisis. In both instances, the displacements were technological innovations—railways and the Internet, respectively. Wide parts of the population were captured by the euphoria surrounding the new technologies. But only the former crisis was accompanied by a lending boom, whereas the purchase of stocks in the dot-com crisis was, to a larger extent, financed by equity. Consequently, the Railway Mania was accompanied by a severe banking crisis followed by a serious recession, whereas the dot-com crisis ended in a rather mild recession and did not involve any major bank failure. Lending booms in the banking sector,

especially when accompanied by decreasing lending standards as in Australia in 1893 or in Japan during the 1980s, are dangerous especially because they make the occurrence of banking crises more likely. And banking crises are a major determinant of the severity of a crisis. Indeed, almost all crises in our sample that were accompanied by a banking crisis led to a severe recession. In contrast, none of the crises without a banking crisis ended in a severe recession.

The mildest crises were those where the leverage of market participants was limited. One example of this phenomenon is the Chicago real estate boom of 1881-83, which was characterized by rather low leverage of market participants and did not end in a severe recession.

In several episodes, financial institutions were directly affected by the bursting bubbles because they themselves were participating in the speculation and were therefore holding the assets in question on their balance sheets. Important examples are the crisis of 1763 in Northern Europe and the Panic of 1893 in Australia. In both instances, the banking crisis was accompanied by fire sales, which accelerated the asset price decline even further. In other cases, such as the German stock price bubble of 1927, one can argue that the decline in asset prices (in this case, stocks) weakened banks' balance sheets and laid the groundwork for the ensuing deep crisis.

IV. Policy responses

The existing literature presents little empirical evidence of the role that policy can play in dealing with asset price bubbles. Our 23 bubble episodes offer a broad spectrum of policy responses in different phases of asset price bubble cycles. We broadly distinguish between

four types of policies: cleaning up the mess, leaning interest rate policy, macroprudential measures, and central bank communication (or “talking down the market”).

The category “(only) cleaning” contains those bubbles where no significant policy reaction was observed before the bubble burst. Meanwhile, a policy reaction is called “leaning” if it has the potential to dampen the bubble in the run-up phase. It is difficult to distinguish between deliberate and unintentional leaning, and we do not attempt to do so. For deriving policy implications, it is relevant whether these policy responses had an effect or not, regardless of the initial intentions. Extreme forms of leaning are policy actions resulting in the bursting of bubbles, sometimes called “pricking” in the literature. Pricking can be understood as a leaning policy that comes too late or is too strong, bursting the bubble rather than deflating it slowly.

Leaning can involve interest rate increases (called “leaning interest rate policy” in this paper) or other types of measures that would nowadays be called “macroprudential” or “quantity instruments.” These include limits on the loan-to-value ratios for banks and explicit credit restrictions. Note that “leaning” is sometimes used in a narrower sense, including only interest rate changes.³ In our analysis, macroprudential instruments are also considered leaning instruments.

Finally, central banks could also lean by “talking down” overvalued assets. Given that private agents broadly have access to the same information as central banks, it is not a priori clear whether mere statements—without any implied news about future interest rate movements or macroprudential policy responses—can in fact shift asset prices. Abreu and Brunnermeier

³ Such a definition was, for example, used by Jean-Claude Trichet, former president of the European Central Bank, who in a June 8, 2005 speech described leaning as follows: “The leaning against the wind principle describes a tendency to cautiously raise interest rates even beyond the level necessary to maintain price stability over the short to medium term when a potentially detrimental asset price boom is identified.”

(2003) offer one potential explanation for the suggested link between purely verbal communication and actual asset prices: Rational investors (bubble arbitrageurs) may understand that the bubble market will eventually collapse, but choose not to exit because they cannot synchronize their actions with the other arbitrageurs. A central bank declaration can coordinate the exit behavior and so lead to a quick deflation of the bubble.

Our discussion of policy responses will take place along a number of hypotheses. In all cases, it should be kept in mind that our analysis by design can only suggest the underlying trade-offs, rather than yield definitive policy recommendations for the present.

Hypothesis 1: “Pure cleaning” is costly

A pure cleaning policy implies that interventions occur only when the bubble bursts by itself. This may be particularly costly because of the large adjustment needed at this point in time. One example of a cleaning policy is offered by the crisis of 1763, when no authority felt responsible for or was capable of intervening to mitigate the enormous lending boom, leading to a deep depression and the breakdown of a significant part of the financial system. Another example is the Australian crisis of 1893. Again, there was no policy intervention trying to mitigate the bubbles in mining shares and land or the accompanying lending boom. And again, the disruptions in both the financial sector and the real economy were severe.

Hence, the evidence supports the view that pure cleaning is costly. However, the evidence also shows that pure cleaning strategies are found only in relatively immature financial systems. Most advanced systems show some form of policy responses, many of which can be characterized as leaning. Even the Greenspan policy was not a pure cleaning strategy.

Hypothesis 2: Leaning interest rate policy may mitigate crises

The most well-known example of successful leaning is the Australian real estate bubble in the early 2000s. When the Reserve Bank of Australia became more and more alarmed by rising housing prices and strong credit expansion, it first used communication to emphasize the long-term risks from these developments. Later, the Reserve Bank tightened interest rate policy in several steps beginning in mid-2000. Although these steps were officially motivated by inflationary pressures and not explicitly targeted to asset prices, their effect was a deceleration of housing price rises without any severe disruptions. The success of this leaning policy also appears intimately linked to its timing: The central bank reacted at a relatively early stage, long before the bubble could reach dangerous proportions, and so deflation of the bubble required no *substantial* rate hikes.

In other episodes, such as the Norwegian crisis of 1899, the relatively mild recession may partly be due to an early increase in interest rates mitigating the real estate bubble, although the evidence is less clear than for the Australian case. Overall, these episodes suggest that a leaning interest rate policy can in principle be effective and avoid or mitigate crises.

However, some caveats are in order. First, it is—in the case of the Australian crisis—difficult to cleanly disentangle the effect of the leaning interest rate policy from the impact of macroprudential measures, which were introduced at around the same time (as discussed below). Second, we see leaning interest rate policies in many other episodes in our sample, and most of these episodes nevertheless led to severe recessions. This suggests that the implementation of leaning policies is far from trivial. Leaning interest rate policy may become ineffective if it comes too late or is too weak and it can be harmful if it is too strong, leading to our next two hypotheses.

Hypothesis 3: Leaning interest rate policy may be ineffective if it is too weak or comes too late

In many of our sample episodes, we see interest rate increases prior to the crisis, but these seem to have been too weak to curb the bubble. A telling example is the U. S. subprime bubble. The Fed raised interest rates starting as early as 2004. However, the level of interest rates was still low and housing prices continued to rise until 2006. Another example is the Gründerkrise of 1872-73, when interest rate increases were not sufficient to mitigate the boom in stocks and real estate.

In other cases, interest rates were raised at a very late stage of the crisis. For example, in the Railway Mania in England during the 1840s, the Bank of England reacted relatively late to speculation, and the bursting of the bubble led to a deep recession and one of Britain's worst banking panics. Another example is the U. S. stock price bubble in the late 1920s, when interest rates were raised after the bubble had already grown to an unsustainable level. Similarly, the increase in interest rates came very late in the Japanese crisis, and the economy entered into a long-lasting depression sometimes called the "lost decade." When interest rates were finally raised, the response was often quite harsh, leading to the bursting of the bubble, discussed next.

Hypothesis 4: Leaning interest rate policy may be harmful if it is too strong

In both of the just mentioned episodes (the United States in 1929 and Japan in 1990), the interest rate response was late but strong, contributing to the bursting of the respective bubbles ("pricking"). White (1990, p. 82) criticizes the Federal Reserve for having pushed the U. S. economy even further into recession. Similarly, the Bank of Japan was criticized for having promoted the recession by pricking the bubble (Patrick, 1998, p. 12). However, the

counterfactual is unclear. It is well conceivable that a further expansion of the bubble would have led to an even more severe recession. Once asset prices have risen to unsustainable levels, all policy options can be costly.

But there are also episodes in our sample where the pricking of a bubble was not followed by a severe recession. For example, the deflation of share prices by Scottish financier John Law in the Mississippi bubble does not seem to have led to a severe disruption. Similarly, the possibly unintentional pricking of the dot-com bubble by Greenspan led to a sharp decrease in stock prices and huge losses for the holders of dot-com stocks, but the effect on the overall economy was modest and the financial system was hardly affected. Hence, it is far from clear whether “pricking” is worse than not intervening at all and letting the bubble collapse.

Overall, this substantial heterogeneity in experiences is an important reason for our wariness to derive definitive policy recommendations. Nevertheless, a policy preventing the emergence of bubbles in the first place seems preferable to a late pricking.

An alternative to interest rate instruments are macroprudential tools. Under this category, we consider all measures that attempt to reduce lending through means other than interest rates. Examples are quantity restrictions for lending or the imposition of loan-to-value ratios. In fact, such instruments were used in a number of bubble episodes, and the evidence yields some interesting insights.

Hypothesis 5: Macroprudential instruments may mitigate crises

In the early crises in our sample, we do not observe the use of macroprudential instruments. However, such instruments seem to have gained importance since the beginning of the 20th

century. An early and successful use of macroprudential instruments occurred in the 1920-26 real estate bubble in the United States (see White, 2009). According to the National Banking Act of 1864, national banks outside of the central reserve cities were subject to loan-to-value restrictions of 50 percent for real estate loans with a maturity of up to five years. Moreover, total real estate lending was limited to 25 percent of a bank's capital. This may help explain why most banks survived the bursting bubble relatively well and why the stability of the entire financial system was not threatened. Another positive example is the Australian real estate bubble in the early 2000s, when the authorities imposed higher capital requirements for certain loans, such as home equity loans. In combination with leaning interest rate policy, this seems to have been quite successful in avoiding disruptions.

But macroprudential policy is subject to the same pitfalls as leaning interest rate policy. In several episodes, macroprudential policy was not able to prevent crises or may even have been counterproductive. In the stock price bubbles of 1927 in Germany and 1929 in the U. S., central banks also applied macroprudential tools. Reichsbank President Schacht curbed stock market lending by threatening banks with restricted or even denial of access to rediscount facilities. Similarly, the Federal Reserve denied access to the discount window for banks granting further loans on securities. In both cases, these policies were very effective in reducing stock lending, but at the same time they induced a severe crash in stock markets, causing disruptions in the economy. Similar to other episodes discussed above, the measures seem to have come too late and were too strong. With respect to the German case, it has been argued that the central bank pricked a nonexistent bubble. Although the ensuing recession was mild, the economy may have evolved much more favorably in the absence of pricking (Voth, 2003). Moreover, the decline in stock prices weakened banks'

balance sheets. The pricking of a nonexistent bubble (through leaning interest rate policy or macroprudential tools) is certainly undesirable.

There are other examples where macroprudential measures that seem reasonable in principle were ineffective in practice. For example, the Japanese central bank introduced quantitative restrictions in 1990 to limit the growth rate of banks' real estate loans, which could not exceed the growth rate of their total loans. This measure is said to be one reason why the increase in real estate prices came to a halt (Kindleberger and Aliber, 2011, p. 285); nevertheless, the economy did not recover for a long time. In Finland, the authorities tried to limit credit expansion by raising reserve requirements by up to 12 percent for banks that did not reduce their lending. It seems, however, that this measure was not strong enough to stop the credit expansion as some banks preferred to continue lending (Nyberg and Vihriälä, 1994, p. 15). In Thailand, the central bank required banks and finance companies to hold higher cash reserves for short-term deposits owned by foreigners. Again, this measure was implemented relatively late and seems to have had a minor effect on foreign borrowing.

Finally, the most well-known example of macroprudential policies is that of the Spanish authorities during the recent housing bubble. In fact, Spain was the first country to introduce countercyclical measures in the form of dynamic provisioning. Interestingly, these measures did little to limit the overall credit expansion in good times because 1) credit was substituted through other sources, and 2) the measures were simply not strong enough. In contrast, they were quite effective in mitigating the credit crunch in bad times (Jiménez et al., 2012).

Overall, the evidence suggests that macroprudential measures *can* be successful in mitigating crises. Their main advantage is that they are much more targeted than monetary policy measures because they can be applied directly to the sectors where bubbles emerge.

However, just as with leaning interest rate policy, the timing and dosage of macroprudential measures are of the essence. When applied too late, they become ineffective. Moreover, a late response may force sharp actions that often have disruptive effects. The Spanish experience points to another potential shortcoming of macroprudential tools, which is just the other side of the coin of being more targeted: They may be circumvented when credit is substituted from other sources not covered by the regulation. This, in turn, is an advantage of the blunt measures, which capture all parts of the financial system.

Hypothesis 6: Central banks cannot simply “talk down” bubbles

During various bubble episodes in our sample, central bank communication appears to have had a clear impact on asset prices. For example, in Germany in the late 1920s, Hjalmar Schacht, then President of the Reichsbank, publically voiced his displeasure with equity price developments and urged banks to curb lending for equity purchases. Similarly, in the Australian crisis of the early 2000s, the central bank very explicitly telegraphed its policy goals. Private-sector expectations duly adjusted, and the bubble slowly deflated. However, the common theme in these and many other verbal interventions was the close link between verbal message and future *threatened* or *clearly signaled* policy interventions. Without a credible threat or promise of a later policy response, it is not clear whether the mere verbal statement would in fact have sufficed to move asset prices in the desired direction. Indeed, recent experience in the U. S. reinforces this skepticism. In the late 1990s, Fed Chairman Greenspan on multiple occasions warned that equity prices were excessive, credit spreads too narrow, or bank lending terms too generous. However, asset prices did not respond markedly in the intermediate run to the Chairman’s comments, suggesting that investors barely update their beliefs about fair valuation after a mere verbal declaration by central bankers (Kohn and Sack, 2003). Overall, then, there is no clear empirical evidence that pure

verbal communication—unaccompanied by any credible outlook for actual future policy adjustments—is in fact capable of substantially moving valuations.

Conclusions

Our paper has given an overview of interesting bubble episodes in the past 400 years. While being highly selective, we hope to provide some interesting lessons for today. By the very nature of our analysis, we cannot hope to derive any definitive policy recommendations and so, in particular, cannot present a simple solution that will work under all circumstances. All of the considered instruments worked well in some instances but failed in others. The particular characteristics of the bubble matter, as does the economic environment. Nevertheless, we can distill the following general lessons.

First, contrary to popular wisdom, the *financing* of bubbles is much more relevant than the *type* of bubble asset. Bubbles in stocks may be just as dangerous as bubbles in real estate if the financing runs through the financial system. The fallout from bursting bubbles appears to be most severe when the bubble is accompanied by a lending boom, high leverage and a liquidity mismatch of market players, and financial institutions participating in the buying frenzy.

Second, a policy of passively “cleaning up the mess” is likely to be expensive. The historical episodes we reviewed suggest that policy measures in many cases can indeed be effective in mitigating crises. This general thrust of the evidence notwithstanding, the complexities of a swift and precise identification of bubbles, coupled with the difficulty of gently deflating them, remain serious impediments to such proactive approaches.

Third, the timing of interventions—should they be desired—is of the essence. Late interventions can be ineffective or even harmful if they enforce sharp measures that would suddenly burst the bubble and cause severe disruptions. This emphasizes the need for a continuous macroprudential analysis that monitors important time series and tries to detect the emergence of bubbles in certain market segments at an early stage, thus allowing for an early and preventive intervention.

Fourth, no particular instrument is found to be dominant in dealing with asset price bubbles. Interest rate tools are blunt and also affect parts of the economy not showing any signs of overheating; however, they have the advantage of being less subject to circumventing behavior. To minimize the adverse effects on the rest of the economy—and, more fundamentally, to ensure that asset prices remain at all sensitive to interest rate fluctuations—early intervention is necessary, underlining yet again the need for constant monitoring. In contrast, macroprudential tools can be targeted at specific market segments or institutions, which can be useful in many circumstances. But they are always subject to regulatory arbitrage. Both instruments can be accompanied by verbal declarations, but such communication may not by itself be sufficient to appreciably change valuations.

Overall, leaning interest rate policies and macroprudential instruments appear to be complementary. Should a central bank indeed decide that an active stance against bubbles is desirable, then a combination of macroprudential tools and active interest rate policy seems preferable in many cases. As long as problems are detected in specific sectors or within particular institutions, targeted macroprudential measures are sufficient. If the bubble is more widely spread or if regulatory arbitrage is a serious threat, then a proactive interest rate policy may well be the best way to go.

So what does our paper imply for the current situation? This situation is different from most episodes in our sample in that rising asset prices coincide with overall weakness, both in the real and the financial sectors, at least in Continental Europe. In a post-bust phase there is a trade-off between preserving financial stability and getting the economy growing again. Essentially, central banks try to induce market participants to invest and take on more risk. This tends to lead to more financial risk-taking and, hence, less financial stability. In such a situation, high asset prices are driven by the central bank's cleaning strategy rather than by euphoria.

When banks are vulnerable and leverage is high in all parts of the economy, leaning interest rate policy seems to be a bad option. The Swedish example is telling in that respect: When the Swedish central bank raised interest rates in 2010 to dampen the boom in real estate prices and the overborrowing of households, inflation fell sharply and even became temporarily negative, raising the burden on debtors and plunging the economy back into recession. This example shows quite plainly that policy options are to be judged differently after a financial crisis than in boom times. If the macroeconomic environment is weak, leverage is high, and the financial system is fragile, leaning interest rate policy can be very costly. Macroprudential tools may be more appropriate in that context. The appearance of bubbles in the immediate aftermath of a financial crisis has no precedent in our sample of bubbles. Further research is desperately needed.

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Event Time	Tulipmania 1634-37 (crisis: Feb. 1636)	Mississippi bubble 1719-20 (crisis: May 1720)	Crisis of 1763 1763 (crisis: Sept. 1763)
Place	Netherlands	Paris	Amsterdam, Hamburg, Berlin
Overview	<p>Tulipmania is one of the first prominent speculative bubbles in history. It refers to the extraordinary rise in prices for tulips in the Netherlands during the 17th century. The mania went along with the introduction of futures markets, where the bulbs, which were considered luxury products, were pre-sold during the year for the season from June to September. Prices rose dramatically, with nonprofessional traders buying bulbs on credit provided by the sellers. While no severe recession followed, economic activity declined after tulip prices fell.</p>	<p>The Mississippi bubble goes back to John Law, a Scottish immigrant, who acquired the Compagnie d'Occident in August 1717 to administer trade with the colony of Louisiana and with Canada. Speculation in Compagnie stocks emerged when the Compagnie expanded its economic activity greatly: Under the new name Compagnie des Indes, it controlled trade outside Europe, acquired the right to mint coins and to collect taxes, and finally purchased most national French debt. Law aimed at reviving the economy after the bankruptcy induced by the wars of Louis XIV and at establishing an economic system where the ample supply of finance fosters economic activity. Thus, he facilitated the supply of credit by introducing paper money and by founding the private Banque Générale in June 1716, which became Banque Royale, a public entity, in 1719. With the Banque Royale increasing issuance to facilitate stock sales of the Compagnie, the amount of banknotes in the market and share prices spiked. Inflation set in and, with the beginning of 1720, market expectations changed: Investors started seeking more solid investment opportunities, and confidence in the paper money eroded. The Banque Royale was taken over by the Compagnie des Indes in February 1720, which stopped backing its own share prices with banknotes. Share prices were pegged to banknotes, and direct conversion became possible. Law started deflating share prices, gradually dismantling the bubble.</p>	<p>The Seven Years' War (1756-63) was accompanied by an economic boom and a rapid growth of credit. Credit expansion was fueled by the financial innovation of the "acceptance loan," a sophisticated form of bills of exchange. Important features were the strict regulation regarding the enforceability of the loan (Wechselstrenge) as well as the joint liability of all signatories for obligations from the bill. At that time, Holland took the role as main creditor, whereas Prussia can be considered an "emerging market" economy and Hamburg was in an intermediary position. The easy availability of credit-fueled commodity speculation, especially regarding sugar and grain, precipitated a sharp increase in asset prices. The bubble burst when commodity prices declined dramatically with the coming of peace and credit conditions tightened. Merchants suffered direct and indirect losses. Eventually, the failure of the De Neufville, a major banking house in Amsterdam, caused a panic, which rapidly spread from Amsterdam and Hamburg to Berlin.</p>
Bubble asset	Tulips	Stocks of John Law's Mississippi Company	Grain, sugar
Type of bubble asset	Commodities	Securities	Commodities
Displacement	Financial innovation (futures)	Fiat money, the "Law system"	Financial innovation (acceptance loans), war
Holder of asset	Small-town dealers, tavern keepers, horticulturalists, wealthy individuals	Wealthy people, the King as a principal shareholder, former stockholders of Banque Générale	Merchant bankers

Event Time	Tulipmania 1634-37 (crisis: Feb. 1636)	Mississippi bubble 1719-20 (crisis: May 1720)	Crisis of 1763 1763 (crisis: Sept. 1763)
Financier of asset	Equity and credit from sellers of the bulbs; no financial intermediaries	Financing through bills of state, Banque Générale/Banque Royale	Bills of exchange (Amsterdam investors)
Economic environment during the emergence of the bubble			
(1) Expansive monetary policy	No	Yes: "(...) the commercial scheme chosen was to print money" (Garber, 2000, p. 98)	No
(2) Lending boom	No	Yes: "Expansion of circulating credit was the driving force for economic expansion" (Garber, 2000, p. 107)	Yes
(3) Foreign capital inflows	No	Yes: Stocks of Compagnie d'Occident and Compagnie des Indes were bought by British and Dutch investors	Yes: Holland as a major creditor, Prussia as a debtor country
(4) General inflation	No	Yes "[...] the average monthly inflation rate from August 1719 through September 1720 was 4 percent, with a peak of 23 percent in January 1720" (Garber, 2000, p. 101)	Yes: "At the same time inflation became a widespread phenomenon in northern Europe, as many German states and other countries like Sweden financed the war by debasing their currencies" (Schnabel and Shin, 2004, p. 13)
Severity of crisis			

Event Time	Tulipmania 1634-37 (crisis: Feb. 1636)	Mississippi bubble 1719-20 (crisis: May 1720)	Crisis of 1763 1763 (crisis: Sept. 1763)
(1) Severe recession	No: Negative impact on household consumption but no serious distress	No: No indication of a severe recession	Yes: Decline in industrial production and stagnation of credit; relatively quick recovery in Amsterdam and Hamburg, long-term recession in Berlin
(2) Banking crisis	No	No: No general banking panic, but run on Banque Royale	Yes: Wave of bank failures, contagion due to Wechselstrenge, fire sales; but rather a liquidity crisis than solvency crisis
(3) Spillover to other countries	No	Yes: Close connection to South Sea Bubble; speculation in the two crises affected Dutch and northern Italian cities as well as Hamburg	Yes: Repercussions on London, Scandinavia
Policy reactions			
(1) Cleaning	No	Yes: Issuance of a decree to liquidate the Compagnie des Indes and the Banque Royale and to readjust public debt on January 26, 1720; exchange of existing bills and stocks against new public obligations (value between 100% and 5% of original obligations, depending on the extent of speculation)	Yes: In Berlin, Friedrich II assisted merchants, easing the pressure on credit markets by recalling old coins and minting new ones in Amsterdam on the basis of credits from the Dutch bankers; no direct public intervention in Amsterdam and Hamburg

Event Time	Tulipmania 1634-37 (crisis: Feb. 1636)	Mississippi bubble 1719-20 (crisis: May 1720)	Crisis of 1763 1763 (crisis: Sept. 1763)
(2) Leaning monetary policy	No	Yes: Law stops supporting the Compagnie des Indes' stock price with banknotes in February 1720; peg of share prices to banknotes at 9000 livres and possibility of conversion of shares into banknotes between March 5 and May 21 (monetization of shares); decree on May 1 to deflate share prices to 5000 livres until December 1	No
(3) Pricking	No	Yes: After the decision of May 1, 1720 to deflate share prices to 5000 livres until December 1, those share prices dropped faster than intended: to 2000 in September and to 1000 in December 1720	No
(4) Macroprudential instruments	No	No	No
Sources	Garber (1989), Garber (2000), Kindleberger and Aliber (2011)	Conant (1915), Garber (2000), Kindleberger and Aliber (2011)	Kindleberger and Aliber (2011), Schnabel and Shin (2004)

Event Time	Crisis of 1772 1772-73 (crisis: June 1772)	Latin America Mania 1824-25 (crisis: Dec. 1825)	Railway Mania 1840s (crises: April/Oct.1847)
Place	England, Scotland	England (mainly London)	England
Overview	<p>The bubble of 1772 was accompanied by the early industrial revolution, thus an increase in manufacturing, mining, and civic improvement. London speculators excessively traded stocks and futures of the East India Company, while shares of turnpikes and canals, as well as enclosures and building construction, surged. Speculation was accompanied by a lending boom. Following the restrictive policy of chartered banks in Scotland, competitors expanded credit. Ayr Bank in Scotland was founded to increase the money supply. When the bank's starting capital was exhausted, it drew a chain of bills on London. The bubble burst, when a main creditor of Ayr, the London banking house Neal, James, Fordyce and Down, closed on June 10, 1772. Ayr Bank had to suspend payments and the panic spread. Having widespread repercussions in England, Scotland, Amsterdam, Stockholm, St. Petersburg, and the colonies, the situation only calmed after the cooperative intervention by several central banks and rich men.</p>	<p>The Latin American Mania, which resulted in a panic in December 1825, refers to a stock market boom, related especially to speculation in securities of real and fictitious South American governments (e.g., Poyais) and mines. Joint stock companies as well as cotton were further objects of speculation. In the peace years after the Napoleonic Wars, expansionary monetary policy fueled a lending boom and banks tended to make riskier loans. Similar developments took place in France, where speculation also extended to buildings. When the bubble burst in London, the panic precipitated a systemic banking crisis and a severe recession. When trade slowed, distress stretched out to banks in France, Leipzig, Vienna, and Italy. Latin America experienced its first sovereign debt crisis.</p>	<p>The Railway Mania refers to the speculative frenzy during the 1830s and 1840s, which was halted by several crises. Speculation in railway stocks and related assets was mainly financed by cheap credit and foreign capital. Large amounts of capital were bound in railway investments. Moreover, imports became necessary due to a bad harvest and famine, forcing the Bank of England to increase interest rates. Both aspects led to a tightening of money markets. The bubble burst in 1845, when tensions about the situation in the railway market and expectations of a bad harvest entailed declining share prices. However, the situation became tenser and escalated into two panics in 1847. While the crisis of April was precipitated by a reversal of monetary policy, distress in October emerged when the Bank of England had difficulties due to a severe internal and external drain of reserves. In both cases, investors were no longer able to meet calls for the subscription of new shares. Britain experienced one of its worst banking panics, and the government decided to suspend the Bank Act (gold backing). When the Bank of England finally intervened, the tightening of monetary policy worsened the crisis.</p>
Bubble asset	East India Company, turnpikes, canals, enclosures, building construction	Securities of South American governments and mines, joint stock companies, cotton	Railway related securities, corn
Type of bubble asset	Securities, real estate	Securities, commodities	Securities, commodities
Displacement	Technological innovation (industrial revolution), financial innovation (swiveling, foundation of the Ayr Bank in 1769)	Independence of former colonies, privatization of mines, lower returns on British government bonds	Technological innovation (railways)
Holder of asset	London speculators, businessmen	Widely held: "All classes of the community in England seem to have partaken" (Conant, 1915, p. 620)	Widely held: "... from the clerk to the capitalist the fever reigned uncontrollable and uncontrolled." (Evans, 1848, p. 2)

Event Time	Crisis of 1772 1772-73 (crisis: June 1772)	Latin America Mania 1824-25 (crisis: Dec. 1825)	Railway Mania 1840s (crises: April/Oct.1847)
Financier of asset	Bank credit (Ayr Bank, country banks), bills of exchange (money brokers), trade credit	Bank credit (country banks, Bank of England)	Bank credit, acceptances, foreign investments, also savings
Economic environment during the crisis			
(1) Expansive monetary policy	Yes: No centralized monetary policy. Expansive policy by the Bank of England after 1763. Chartered banks in Scotland adopted restrictive policy. This encouraged competitors (e.g., British Linen Company, local and private banks) to follow an expansive policy and issue new notes.	Yes: Liberal policy by the Bank of England "to commodate the government's fiscal demands" (Bordo, 1998, p. 79) until 1825; expansion of monetary base enabled an increasing number of country banks to freely replace coinage in the domestic circulation and issue small-denomination banknotes; also open market operations by the Treasury	Yes: "era of cheap money" (Ward-Perkins, 1950, p. 76), e.g., in 1842, rates of interest were reduced to 4%; market discount rates were below 2% and then below 3% in 1844
(2) Lending boom	Yes: "Accompanying the more tangible evidence of wealth creation was a rapid expansion of credit and banking leading to a rash of speculation and dubious financial innovation" (Sheridan, 1960, p. 171)	Yes: "credit was the universal currency" (Evans, 1859, p. 15)	Yes: Cheap credit: "From 1842 discounts had been easy and money plentiful, the funds maintained a high rate; low interest only could be obtained" (Evans, 1848, p. 2)
(3) Foreign capital inflows	No	No: Rather capital exports and outflow of gold; decrease of foreign holdings of British debt	Yes: Substantial amount of foreign railway investment
(4) General inflation	No: "... expanding output of goods kept pace with the increase in the supply of money..." (Hamilton, 1956, p. 411)	Yes: In 1825: "sharp increase in [...] the prices of commodities [...]. The rising prices in the latter half of the year 1825 reduced purchases" (Conant, 1915, p. 621); also compare Silberling (1924)	Yes: Prices increased from 1843 to early 1847
Severity of crisis			

Event Time	Crisis of 1772 1772-73 (crisis: June 1772)	Latin America Mania 1824-25 (crisis: Dec. 1825)	Railway Mania 1840s (crises: April/Oct.1847)
(1) Severe recession	Yes: The Gentleman's Magazine stated that "no event for 50 years past has been remembered to have given so fatal a blow both to trade and public credit" (Sheridan, 1960, p. 172); credit crisis, decrease in trade, unemployment, rising average number of bankruptcies (310 in the eight years preceding the panic, 484 in 1772, and 556 in 1773)	Yes: Serious recession in early 1826, "massive wave of bankruptcies" (Neal, 1998, p. 65), severe unemployment, contraction of loans	Yes: Serious recession similar to 1825, bankruptcies throughout the U.K.
(2) Banking crisis	Yes: Wave of bank failures in London and Edinburgh; Ayr Bank had to suspend payments, later also failures in Amsterdam	Yes: "systemic stoppage of the banking system" (Neal, 1998, p. 53), widespread failures (73 out of 770 banks in England, 3 out of 36 in Scotland)	Yes: One of the worst British banking panics; bank runs, hoarding of money
(3) Spillover to other countries	Yes: Crisis had severe effects in Amsterdam, which also spread to Hamburg, Stockholm, St. Petersburg (but without "serious disaster" in the latter three; see Clapham, 1970, Volume I, p. 248) as well as to colonies in India and America	Yes: As a result of declining continental sales, the crisis spread from England to Europe (especially banks in Paris, Lyon, Leipzig, and Vienna were affected) and Latin America, where it caused a sovereign debt crisis	Yes: Banks and brokers failed in Paris, Frankfurt, Hamburg, and Amsterdam due to declining share prices; also effects were felt in New York; impact on trade between India and Britain
Policy reactions			
(1) Cleaning	Yes: Bank of England discounted heavily (had to hire additional clerks), government bailout of the East India company (loan of £1.4 million and export concessions), the Bank in Stockholm supported sound banks, Empress Catherine assisted British merchants	Yes: First "Policy of contraction during the first days of panic caused absolute paralysis of business" (Conant, 1915, p. 621) then change in policy; critical debate as to who should act as lender of last resort; finally Bank of England granted advances on stocks and exchequer bills, also heavy discounting, aid by the Banque de France to prevent suspension of convertibility	No: Bank of England was criticized for not acting as a lender of last resort; suspension of the Bank Act

Event Time	Crisis of 1772 1772-73 (crisis: June 1772)	Latin America Mania 1824-25 (crisis: Dec. 1825)	Railway Mania 1840s (crises: April/Oct.1847)
(2) Leaning monetary policy	Yes: Early in 1772, Bank of England increased the discount rate and "tried to put a brake on over-trading by a selective limitation of its discounts, a policy which it had often adopted before" (Clapham, 1970, Volume I, p. 245)	Yes: In view of declining reserves and "Alarmed at the speculative spirit abroad, the Bank of England were the first to adopt precautions, by contracting their circulation; and the example was followed by the country banks" (Evans, 1859, p. 15). Contractive policy by the Bank of England, mainly through divesting Exchequer bills to cut circulation beginning in March 1825, again in May and June, and from September	Yes: Rise in interest rates due to drain of bullion, especially after food imports since October 1845, when bubble had already burst; criticism that Bank of England reacted too late to speculation worsened the panic; increase in minimum interest rate (3% in October 1845, 3.5% in November until August 1846, 4% in January, 5% in April 1847)
(3) Pricking	No	Possibly: "unclear what caused the April 1825 collapse, but the Bank of England had in March sold a very large block of Exchequer bills, presumably to 'contract the circulation'" (Bordo, 1998, p. 77)	No
(4) Macroprudential instruments	No	No	No
Sources	Clapham (1970), Hamilton (1956), Hoppit (1986), Kindleberger and Aliber (2011), Sheridan (1960)	Bordo (1998), Conant (1915), Evans (1959), Kindleberger and Aliber (2011), Neal (1998), Silberling (1924)	Clapham (1970), Dornbusch and Frenkel (1984), Evans (1848), IMF (2003), Kindleberger and Aliber (2011), Ward-Perkins (1950),

Event	Panic of 1857	Gründerkrise	Chicago real estate boom
Time	1856-57 (crisis: Oct. 1857)	1872-73 (crisis: May 1873)	1881-83 (no crisis)
Place	United States	Germany, Austria	Chicago
Overview	<p>The crisis of 1857 is considered the first worldwide crisis. Having its origins in the United States, it quickly spread to Britain, continental Europe, and the colonies. The speculative bubble preceding the turmoil emerged against the backdrop of gold discoveries, railway extension, and a global boom. Foreign investors additionally contributed to rising values of railroad securities and land in the U.S. However, increasing uncertainty about the future status of slavery (Dred Scott decision) reduced the territories' attractiveness. While conditions in the money market had already tightened several years before the crisis, interest rates in New York rose sharply from June to August of 1857. The situation escalated in September after the failure of the Ohio Life and Trust Company, which had been involved in fraudulent practices. Depositors hoarded their money, and deposit withdrawals peaked with a bank run in New York. Distressed sales aggravated the situation among banks and farmers. The federal government was unable to intervene effectively. A severe recession, including numerous failures and price declines, was the result. Only the joint efforts of banks finally calmed the situation.</p>	<p>Excessive speculative activities in stocks and real estate were one of the main underlying causes of the severe crisis at the end of the 19th century in continental Europe. Over-expansion during the so-called Gründerjahre in Germany and Austria was facilitated by an expansion of bank credit—for example, through new types of banks (e.g., Maklerbanken and Baubanken). In addition, French war reparations were used to expand the money supply. Optimistic expectations and euphoria in the context of the World Exhibition as well as reform of the stock corporation law further fueled speculation. Whereas signs of trouble had been evident before, the bubble burst in May, when the World Exhibition in Vienna opened with disappointing sales. The sharp drop in stock prices and the closure of the Vienna stock exchange (“Black Friday”) were followed by a banking crisis. Despite bailouts and other emergency measures, the crisis could not be contained and it developed into a ruinous depression.</p>	<p>The Chicago real estate boom at the beginning of the 1880s was rooted in the recovery from the serious depression of 1877. Against the backdrop of improving economic conditions, Chicago, considered an important economic center, benefited from increasing wages and profits. Thus, nearly every class of society accumulated large wealth, and real estate was considered the most attractive investment. In combination with increasing immigration, this led to soaring rents, demand for housing, and growing apartment construction. In reference to the latter, this period is also known as "the flat craze." However, with the beginning of the recession of 1883, the bubble burst, albeit without severe consequences.</p>
Bubble asset	Railroad stocks and bonds, land	Stocks, railroads, houses, land	New buildings, houses from foreclosure proceedings, land
Type of bubble asset	Securities, real estate	Securities, real estate	Real estate
Displacement	Gold discoveries, railway extension	End of war, World Exhibition, liberalization (banks, stock corporation law)	Innovation (apartments, skyscrapers), railroad construction, immigration
Holder of asset	Widely held	Widely held, also by banks (cf. Wirth, 1890, pp. 474 ff.)	Widely held: capitalists, businessmen, mechanics, laborers, railroad and manufacturing companies

Event Time	Panic of 1857 1856-57 (crisis: Oct. 1857)	Gründerkrise 1872-73 (crisis: May 1873)	Chicago real estate boom 1881-83 (no crisis)
Financier of asset	Bank credit (domestic and foreign banks), promissory notes (sellers), debt-for-equity swaps (railroad companies), foreign investments, private capitalists	Bank credit	To a large extent equity-financed
Economic environment during the event			
(1) Expansive monetary policy	Yes: Note issuance not centralized; New York banks could expand loans due to increase in specie	Yes: War reparations were used to strike new gold coins, and some federal states increased money emission rights for some banks or founded new central banks	Yes: Mortgage interest rates were at extremely low levels in 1877; rate of growth of U.S. money stock was extraordinarily high from 1879 to 1881: over 19 % p.a. (Friedman and Schwartz, 1963, p. 91)
(2) Lending boom	Yes: Despite a rapid increase in the number of banks, they were not able to meet the demand for loans	Yes: "credit at banks was stretched to the limit" (Kindleberger and Aliber, 2011, p. 52)	No: Rather equity-financed; large wealth had been accumulated by 1879 among all ranks of society and was made available for investment
(3) Foreign capital inflows	Yes: Foreign capital from England, also Germany and France	Yes: French war reparations	No
(4) General inflation	No: "Prices did not advance in proportion to the increase in the volume of metallic money [...] because a large part of the new money was absorbed by the lateral expansion of commerce in quantity" (Conant, 1915, p. 637)	Yes: "All of this had the combined effect of raising the prices of everything, especially rents, wages and the products of industry" (McCartney, 1935, p. 79); peak in 1873 with an index of 114.3 based on prices in 1860	Yes: "Rising prices and profits margins speeded up production, increased employment, and furnished the funds for a brief era of speculation that culminated in 1883" (Hoyt, 1933, p. 128)
Severity of crisis			

Event Time	Panic of 1857 1856-57 (crisis: Oct. 1857)	Gründerkrise 1872-73 (crisis: May 1873)	Chicago real estate boom 1881-83 (no crisis)
(1) Severe recession	Yes: 8.6% GDP contraction in the U.S. (Bordo, 2003, p. 65), wave of company failures, decreasing prices	Yes: Manufacturers suffered since purchasing power was greatly reduced; "ruin of German industry seemed to be at hand" (McCartney, 1935, p. 78); numerous insolvencies in Austria	No
(2) Banking crisis	Yes: Wave of bank failures, hoarding of money, and deposit withdrawals, bank run in New York on October 13; suspension of convertibility throughout the country	Yes: Sharp decrease in profitability and credit volume; increase in insolvencies, also fire sales	No
(3) Spillover to other countries	Yes: First worldwide crisis; spread to continental Europe and Britain, had effects in South America, South Africa, and Far East	Yes: Immediate effects on Italy, Switzerland, Holland, and Belgium; in September panic reached the United States; spillover to Great Britain, France, Russia	No
Policy reactions			
(1) Cleaning	No: "An analysis of the crisis of 1857 suggested that the Federal government was incapable of intervening effectively and that the public, including the banks, was left without guidance to stem the crisis" (Kindleberger and Aliber, 2011, p. 219)	Yes: In Austria, bailout of the Bodencredit-Anstalt by the central bank and a bank consortium; suspension of the Bank Act of 1862 to allow for central bank assistance in case of a liquidity crunch; syndicate of bankers was established to make advances on sound securities; the Treasury granted loans	No

Event Time	Panic of 1857 1856-57 (crisis: Oct. 1857)	Gründerkrise 1872-73 (crisis: May 1873)	Chicago real estate boom 1881-83 (no crisis)
(2) Leaning monetary policy	No	Yes: But probably too late and too little to prevent the crisis; National Bank of Austria-Hungary raised interest rates in July 1869, in 1872, and in March 1873 up to 5% for exchange and 6% for Lombard loans	No
(3) Pricking	No	No	No
(4) Macroprudential instruments	No	No	No
Sources	Conant (1915), Calomiris and Schweikart (1991), Evans (1859), Kindleberger and Aliber (2011), Gibbons (1858), Riddiough (2012), Riddiough and Thompson (2012)	Burhop (2009), Conant (1915), McCartney (1935), Schwartz (1987), Wirth (1890)	Hoyt (1933)

Event Time	Crisis of 1882 1881-82 (crisis: Jan.1882)	Panic of 1893 1890-93 (crisis: Jan. 1893)	Norwegian crisis 1895-1900 (crisis: July 1899)
Place	France	Australia	Norway
Overview	<p>The French stock market bubble emerged during a boom period and mainly involved the Bourses in Paris and Lyon. Due to the success of national securities, investors believed in the safety of all kinds of securities. Masses of the French population fell into euphoria. A main trigger was the financial innovation of negotiable securities and forward contracts, implying that purchasers made a down payment and borrowed the rest from an agent de change who himself borrowed in the call-money (reports) market. Besides the system of reportage, capital inflows contributed to the boom. Confronted with falling reserves, the Banque de France was forced to contract monetary policy in autumn 1881, even though it intended to avoid a sharp increase of the discount rate. Consequently, interest rates for reports increased. When the Austrian government refused to grant a concession to the Banque de Lyon, share prices fell. In January, Union Générale, which played a crucial role during the boom, failed and panic broke out. The values of all classes of securities plummeted. Investors in the forward market experienced huge losses, and the Bourse de Lyon had to close. Despite efforts by a consortium of banks, as well as the Banque de France, to fight the financial crisis, their interventions could not avert a deep recession.</p>	<p>After the gold rushes, Australia experienced a long boom period during the 1880s, which went along with a speculative boom in real estate values and mining shares. The Australian financial system was relatively immature: No central bank existed, while little legal regulation restricted banks. Stock exchanges were only established to create a market for mining stocks, and speculation in the latter was more important than transactions in industrial shares. The speculative bubble was supported by a lending boom, while the banks themselves were heavily engaged in these markets and accumulated more and more risks. Distress manifested when British capital was withdrawn after the Baring failure. In addition, more and more depositors withdrew their money, since they expected banks would be unable to roll over debt. Eventually, panic broke out in January, when the relatively newly established Bank of Melbourne collapsed. The consequence was severe financial distress. By May, 14 commercial banks had failed, while only 12 weathered the crisis. Besides severe real effects on the Australia economy, the crisis also had an international dimension. It spread to the United States, and repercussions were felt also in Berlin, Vienna, and Italy.</p>	<p>Increasing exports and economic activity in 1894 and 1895 propelled a bubble in the Norwegian real estate market. At the same time, banks could take advantage of the booming stock market to get cheap capital. While interest rates declined, reaching a low in 1895, bank lending growth accelerated. However, the gold standard put limits on the scope of Norges Bank. The Bank was forced to raise interest rates throughout 1898 as a result of declining exports. Prior to the crisis, the Bank had low reserves as a result of large credit growth. Consequently, as the Bank became prone to gold drains, uncertainty spread and liquidity conditions tightened. The crisis broke in the summer of 1899 and was triggered by the failure of Chr. Christophersen, a highly leveraged nonfinancial firm. While financial distress mainly concerned banks in Oslo, several Norwegian cities were affected by a real estate crash. Due to stable international growth as well as support from the central bank, the crisis in 1899 and 1900 was moderate. Norges Bank also played a central role in restructuring and liquidating insolvent banks. Hence, the crisis of 1899, considered the first major banking crisis in Norway, was less severe than later crises. Nonetheless, the net wealth of households and firms declined due to a fall in asset prices, and credit conditions throughout the country worsened.</p>
Bubble asset	Securities in general, stocks of new banks	Mining shares, land	Land, new homes, real estate shares
Type of bubble asset	Securities	Securities, real estate	Real estate
Displacement	Financial innovation (negotiable securities), payment of war reparations after the Franco-Prussian war	Gold discoveries, population growth, financial deregulation (e.g., land accepted as collateral, no limit on note issuance)	Export boom, 1894 Parliament decision to expand railways
Holder of asset	Widely held: "masses of the French people" (Conant, 1915, p. 659)	Banks, foreign investors, households	Construction sector, manufacturers, brokers, stock market investors

Event Time	Crisis of 1882 1881-82 (crisis: Jan.1882)	Panic of 1893 1890-93 (crisis: Jan. 1893)	Norwegian crisis 1895-1900 (crisis: July 1899)
Financier of asset	Bank credit (banks, caisses de reports), also equity-financed (French people)	Credit by nonbanks (pastoral companies, building societies, land mortgage companies) and banks (trading banks)	Bank credit (especially commercial banks)
Economic environment during the crisis			
(1) Expansive monetary policy	Yes: Mean discount rate of the Banque de France in 1875 was 4% compared to 2.5% in 1880; mean circulation increased between 1875 and 1880	Yes: No central bank, but trading banks were note-issuing banks and expanded the monetary base	Yes: The monetary base increased in the 1890s due to specie inflows from exports; Norges Bank did not sterilize the inflow; discount rate began decreasing in January 1892, reaching its low in 1895
(2) Lending boom	Yes: Expansion of credit through a system of delayed payments (reportage), existence of "many different institutional avenues for the expansion of credit" (Kindleberger and Aliber, 2011, p. 63), rapid increase in the number of trust companies, investment societies, and syndicates	Yes: "...nearly every little community supported branches of all the leading banks, and obtained excessive loans on property which could not be converted into quick assets" (Conant, 1915, p. 695)	Yes: Acceleration of bank lending growth since the mid-1890s; "the share of overall credit outstanding granted by banks rose markedly" (Gerdrup, 2003, p. 9)
(3) Foreign capital inflows	No	Yes: British public, investment and financial companies that invested heavily in Australian mines and speculated in Australian real estate	No: Inflows of foreign exchange due to the repatriation of incomes from shipping services and exports, net foreign claims of private banks in 1899
(4) General inflation	No (Maddison, 1991)	No: Prices relatively stable between 1870 and 1890	No: Price level fell in the first half of the 1890s, but a sharp increase occurred in 1898
Severity of crisis			

Event Time	Crisis of 1882 1881-82 (crisis: Jan.1882)	Panic of 1893 1890-93 (crisis: Jan. 1893)	Norwegian crisis 1895-1900 (crisis: July 1899)
(1) Severe recession	Yes: "The spectacular crash of the French stock market in 1882 inaugurated a deep recession that lasted until the end of the decade" (White, 2007, p. 115)	Yes: "The eventual downturn in the property market led to a severe financial crisis and a depression unequalled in Australia's experience" (Bloxham et al., 2010, p. 12); 10% real output decline in 1892 (1893: -7%), large investment activity dampened for almost 20 years, deflation	No: Impact on credit conditions and confidence, but only moderate effects during 1899 and 1900; more broad-based recession and deflation from 1901 to 1905 due to international recession
(2) Banking crisis	Yes: After bankruptcies among many brokers and clients, banks and their caisses collapsed, runs and subsequent failures of the Banque de Lyon and Union Générale	Yes: Small number of banks failed in 1892, 13 of 22 note-issuing banks failed in 1893, "collapse of a significant proportion of the Australian financial system" (Kent, 2011, p.126), especially nonbank financial institutions	Yes: But concerned mainly banks in Oslo; moderate bank runs
(3) Spillover to other countries	No	Yes: Shock spilled over to the United States and also affected stock markets in Berlin, Vienna, Austria-Hungary, and Italy	No
Policy reactions			
(1) Cleaning	Yes: Assistance to Union Générale as well as to brokers by a consortium of Paris banks headed by the Banque de Paris et des Pays-Bas (Parisbas) and another group headed by the Rothschild house to win some time until the end of January settlement and to work out arrangements; later Lyon brokers received 100 million francs from the Banque de France upon securities that would not ordinarily have been accepted; the Paris agents of exchange received 80 million francs upon the guarantee of a syndicate of bankers; Banque de France itself received aid from the Bank of England.	Yes: Crisis was solved without intervention by the colonial governments; Queensland government rescued National Bank; government intended to prevent liquidity crisis by passing temporary legislation making privately issued bank notes legal tender; Victoria government urged banks to give financial assistance to one another, proclaimed bank holiday; in the end restructuring of the Commercial Bank as well as other banks, which ended the crisis	Yes: Norges Bank provided liquidity support and was involved in the orderly restructuring process and liquidation of insolvent banks, private liquidation of smaller commercial banks; government support to <i>Industribanken</i> ; Norges Bank experienced losses in the aftermath of the crisis

Event Time	Crisis of 1882 1881-82 (crisis: Jan.1882)	Panic of 1893 1890-93 (crisis: Jan. 1893)	Norwegian crisis 1895-1900 (crisis: July 1899)
(2) Leaning monetary policy	Yes: The Banque de France was confronted with declining reserves due to bad crops and increasing gold flows to the U.S.; Banque de France tried to avoid a sharp increase in the discount rate and therefore paid light coin and charged a premium for bullion, but had to raise interest rates by 1 percentage point on October 20, 1881	No	Yes: Restrictions due to gold standard; increase of the discount rate from 4% to 5.5% through 1898 due to drop in exports, then a rise from 5% to 6% in February and March one year later
(3) Pricking	No	No	No
(4) Macroprudential instruments	No	No	No
Sources	Conant (1915), Kindleberger and Aliber (2011), Maddison (1991), White (2007)	Bloxham et al. (2010), Conant (1915), Kent (2011), Lauck (1907), McKenzie (2013), Merrett (1997)	Gerdrup (2003)

Event Time	Real estate bubble in the U.S. 1920-26 (no crisis)	German stock price bubble 1927 (crisis: May 1927)	U.S. stock price bubble 1928-29 (crisis: Oct. 1929)
Place	United States	Germany	United States
Overview	<p>The U.S. housing bubble of the 1920s can partly be attributed to postwar recovery and coincides with an agricultural boom. Loose monetary policy ignited a lending boom and contributed to increasing values of residential real estate. In addition, securitized mortgages played a central role. However, mortgages were rather short-term and financial regulation prescribed a low loan-to-value ratio. Banks remained prudent lenders and were relatively well capitalized. When the bubble burst and real estate values declined, the number of foreclosures increased; however, further, if any, distress was contained regionally. Since the riskiest securitized assets were primarily in the hands of investors but not held by financial institutions, the latter were less affected and no systemic banking crisis emerged. Losses for banks were modest.</p>	<p>The stock market crash of 1927 is sometimes referred to as the onset of Germany's Great Depression. Following the recovery of the severe post-World War I hyperinflation, the German economy experienced a boom with rising employment and exports and stable inflation. At the same time, stock prices rose, and speculative purchases financed by bank credit as well as foreign capital inflows increased. Investment was largely financed by short-term money market credit instead of capital market lending. To counter both, Reichsbank president Schacht successfully urged banks to reduce lending for speculative use in May 1927. As a consequence, the stock market fell by 11% in one day ("Black Friday 1927"). The crash reduced margin lending and thereby investment. Confidence eroded, stock market liquidity declined, and firm balance sheets weakened, further curtailing investment. When Germany slid into recession, the economy was in a weak position due to already deteriorated balance sheets.</p>	<p>The late-1920s U.S. stock price bubble culminated in one of the most shattering stock market crashes in U.S. history, the "Black Tuesday" of October 1929. Owing to the prosperity and increasing profits of the Roaring Twenties, speculation blossomed in the United States. More and more Americans invested heavily in stocks. Restrictive policy by the Federal Reserve to contain the credit boom and curb speculation was ineffective. While broker loans by banks declined, other financiers substituted for it. However, in view of an oncoming recession, expectations began to change in the summer of 1929 . When the Federal Reserve Bank of New York raised interest rates in August, it pricked the bubble and precipitated the crisis. While the direct effects of the crash were first confined to the stock market due to prompt actions by the New York Fed, increasing interest rates, distressed sales, and falling industrial production soon aggravated the situation. The crash thus marked the beginning of the Great Depression, affecting all industrialized economies.</p>
Bubble asset	Residential housing, also securitized mortgages	Stocks	Stocks (companies, utilities)
Type of bubble asset	Real estate	Securities	Securities
Displacement	Low interest rates, postwar recovery, deregulation (legalization of private mortgage insurance)	End of hyperinflation and economic recovery	Innovation (development of an industrial securities market, productivity improvements)
Holder of asset	Banks, private individuals (domestic)	Wealthy individuals, institutional investors, banks	Widely held; also commercial banks (and their securities affiliates)

Event Time	Real estate bubble in the U.S. 1920-26 (no crisis)	German stock price bubble 1927 (crisis: May 1927)	U.S. stock price bubble 1928-29 (crisis: Oct. 1929)
Financier of asset	Bank credit (savings and loans, mutual savings banks, commercial banks, insurance banks), informal lending (family, friends, etc.)	Stock market lending (banks, foreign investors)	Stock market credit (domestic banks, later private investors, corporations, and banks in Europe/Japan)
Economic environment during the event			
(1) Expansive monetary policy	Yes: Interest rate was lowered in 1925, remained at low levels in 1926	Yes: Discount rate was reduced in several steps (10% on average in 1924, 9% in February 1925, and a reduction in four steps to 6% in June 1926), but Reichsbank lost power over money supply due to gold standard (free capital flows); discount rate was higher than the money market rate	Yes: New York Fed had already decreased discount rate from 4.5% in April to 3% in August 1924; discount rates of all Fed banks decreased from 4% to 3.5% from July to September 1927; also open market purchases
(2) Lending boom	Yes: Especially rapid expansion of mortgage credit	No: Sharp increase in stock market lending during 1926 and 1927, but level was still below prewar volume	Yes: "This eagerness to buy stocks was then fueled by an expansion of credit in the form of brokers' loans that encouraged investors to become dangerously leveraged" (White, 1990, p. 68), but credit conditions in general were tight
(3) Foreign capital inflows	No: USA as a major net lender	Yes: Inflow of long- and short-term foreign funds during 1926, but sharp decline after Reichsbank intervention at the end of the year	Yes: Loans from foreign banks in Europe and Japan substituted for bank loans after the intervention by the Fed
(4) General inflation	No: "Great moderation of inflation after World War I" (White, 2009, p. 11)	No: After hyperinflation, low and stable inflation in 1925 and 1926	No: In 1928 and 1929, the consumer price index declined; no significant increase in the monetary base
Severity of crisis			

Event Time	Real estate bubble in the U.S. 1920-26 (no crisis)	German stock price bubble 1927 (crisis: May 1927)	U.S. stock price bubble 1928-29 (crisis: Oct. 1929)
(1) Severe recession	No	No: Mild recession (investment fell, no effect on consumer spending), which later turned into the Great Depression	Yes: Only moderate direct effects on wealth, but confidence and households' balance sheets were weakened; later came Great Depression with 29.7% contraction in GDP (Bordo, 2003)
(2) Banking crisis	No: Decline in housing prices and increase in foreclosure rates, but only modest losses for banks; 80% of failures were in rural areas and mainly related to expectations in agriculture; runs and failures of certain bank chains, but no general banking crisis: "failures did not imperil the whole of the banking system" (White, 2009, p. 46)	No: But bursting bubble weakened banks' balance sheets, which may have contributed to the banking crisis of 1931	No: Later; at first a banking panic was prevented, owing to interventions by the New York Fed, and the direct financial effects of the crash were limited to the stock market (also included distressed sales and margin calls)
(3) Spillover to other countries	No	No	Yes: No direct effects of the crash, but reduction in U.S. lending had impact on Germany, Latin America, and Australia. Later, the Great Depression affected countries worldwide.
Policy reactions			
(1) Cleaning	No	No	No: Restrictive policy by the Fed, a result of fears about excessive speculation, worsened the recession; however, actions by the New York Fed (despite resistance from the Board) shortly after the crash made sure that money market rates remained stable and member banks were not threatened by defaulting loans on securities

Event Time	Real estate bubble in the U.S. 1920-26 (no crisis)	German stock price bubble 1927 (crisis: May 1927)	U.S. stock price bubble 1928-29 (crisis: Oct. 1929)
(2) Leaning monetary policy	No: No change in interest rates; rather, use of macroprudential instruments	No: Only a few months before the crisis, beginning in October 1926; discount rate was reduced from 6% to 5% toward the end of 1926	Yes: A few months before the crash, beginning in early 1929; the New York Fed argued against selective credit control and voted in favor of interest tools, but was frequently turned down by the Board; eventually the Fed was permitted to increase the discount rate from 5% to 6% in August 1929
(3) Pricking	No	Yes: Reichsbank intervention pricked the bubble, "...crash induced by the curtailment of margin lending..." (Voth, 2003, p. 87)	Yes: Restrictive policy possibly contributed to the bursting of the bubble and worsened the recession; "Instead of allowing the stock market bubble to expand and burst of its own accord, the Federal Reserve's policies helped to push the economy further into a recession" (White, 1990, p. 82)
(4) Macroprudential instruments	Yes: Long-standing quantitative regulations; National Banking Act of 1864: For national banks outside the central reserve cities (New York, Chicago, St. Louis) the loan-to-value ratio for real estate loans with maturity up to 5 years had to be less than 50%; total real estate loans were limited to 25% of bank's capital; somewhat weaker state regulation; also increase in real estate taxes	Yes: Reichsbank President Schacht addressed stock market lending by threatening to decrease or even deny bank access to rediscount facilities	Yes: Board applied "direct pressure"; no access to the discount window for banks granting loans on securities; also decision by Massachusetts regulators to deny a request for splitting stocks to counter speculation
Sources	Alston et al. (1994), White (2009)	Balderston (1993), Voth (2003)	Friedman and Schwartz (1963), Kindleberger and Aliber (2011), White (1990)

Event Time	"Lost decade" 1985-2003 (crisis: Jan. 1990)	Scandinavian crisis: Norway 1984-92 (crisis: Oct. 1991)	Scandinavian crisis: Finland 1986-92 (crisis: Sept. 1991)
Place	Japan	Norway	Finland
Overview	<p>During the 1980s, Japan's economy was spurred by euphoria and an economic boom, liberalization, and financial innovation. When deregulation of financial markets deprived Japanese banks of large customers and increased the competitive pressure, they rapidly expanded lending, seeking new customers. These factors in combination with low interest rates led to the emergence of a massive asset price bubble in stock and property markets. Especially financial institutions, but also households, were engaged in these investments. Realizing the unsustainability of these developments, the Bank of Japan decided to increase interest rates at the end of 1989. Even when equity prices had already declined, the Bank further raised the policy rate in the summer of 1990 and held it stable for about one year. However, the sharp reversal in monetary policy pricked the bubble and precipitated a stock market crash. The persistent decline in asset prices resulted in a large proportion of nonperforming loans, causing serious difficulties for financial institutions. The bursting of the asset price bubble is therefore associated with what is referred to as Japan's "lost decade," a protracted period of economic stagnation.</p>	<p>Beginning in 1983, Norway experienced a period of accelerating growth. Widespread financial deregulation accompanied by foreign capital inflows contributed to a lending boom. In this environment, a bubble emerged in the market for real estate. Increasing competitive pressure on banks led to declining lending standards and augmented risk taking. At that time, Norges Bank pursued monetary policy to meet the government's main objective of a low, stable interest rate. Real interest rates were close to zero or even negative. However, beginning in 1986, declining oil prices, high wages, and speculative currency attacks challenged the economy. Fiscal policy was tightened and, for Norges Bank, the defense of the fixed exchange rate regime became the priority. Consumption and investment started to decline in 1987 and the bubble deflated. The crisis began with the failure of several smaller banks in autumn of 1988. Others followed and a systemic banking crisis evolved, reaching its peak in 1991. Norges Bank delivered liquidity support on several occasions and reduced interest rates considerably. Moreover, the Norwegian government provided capital injections and banks were nationalized through the Government Bank Insurance Funds. Norway experienced a severe recession and had to de-peg its currency in 1992.</p>	<p>A large economic boom at the end of the 1980s provided the backdrop for a real estate and stock market bubble in Finland. Overheating was also facilitated by a lending boom (especially in foreign currency) and generous tax schemes. At the same time, banks and financial markets were widely deregulated without intensifying banking supervision. The Bank of Finland recognized the adverse developments, especially the excessive expansion of credit, and decided to tighten monetary policy slightly in early 1989. In 1991, declining exports to the Soviet Union, associated with decreasing output and devaluation of the markka, and slowing domestic consumption dampened the economy. Market interest rates were rising and reduced the ability of debt servicing. Eventually, the serious difficulties of Skopbank, a commercial bank acting as central bank for savings banks, triggered a systemic banking crisis. The government and the Bank of Finland had to step in to provide guarantees, take over banks, and provide monetary assistance. Yet, financial distress spilled over to the real economy. Several hundreds of firms failed and output dropped rapidly. Due to intense speculative pressure, the markka was left to float in September 1992.</p>
Bubble asset	Stocks, convertible bonds, real estate	Commercial real estate, residential housing	Land, residential housing, stocks
Type of bubble asset	Securities, real estate	Real estate	Real estate, securities
Displacement	Lending boom due to financial deregulation and innovation, euphoria about the "new economy"	Broad-based financial deregulation	Broad-based financial deregulation
Holder of asset	Widely held (especially corporations, also banks)	Firms, households	Firms, households

Event Time	"Lost decade" 1985-2003 (crisis: Jan. 1990)	Scandinavian crisis: Norway 1984-92 (crisis: Oct. 1991)	Scandinavian crisis: Finland 1986-92 (crisis: Sept. 1991)
Financier of asset	Bank and mortgage loans (banks, finance companies, government financial institutions)	Credit (domestic and foreign banks)	Credit (domestic and foreign banks, finance companies)
Economic environment during the crisis			
(1) Expansive monetary policy	Yes: Interest rates were reduced from 5.5% in 1982 to 5% in 1983, to 3.5% at the beginning of 1986, and to 2.5% one year later	Yes: Until the end of the 1980s, Norges Bank followed the government's goal of a low interest rate. Norges Bank had to sell foreign exchange to counter several speculative attacks on the krone, but sterilized the policy by increasing its [OK?] loans to banks	Yes: Constrained monetary policy due to the fixed exchange rate regime, accelerating growth of the money supply (13.5% in 1987, 23.6% one year later) as a result of increasing demand
(2) Lending boom	Yes: Deregulation of financial markets, but not banks, and financial innovations increased competitive pressure on banks and fueled an expansion of loans, also accompanied by declining lending standards ("... there is a consensus view among economists on how partial financial deregulation in Japan in the 1980s led to a lending boom", Posen, 2003, p. 214)	Yes: Increasing demand for credit; "real lending growth at both commercial and savings banks increased rapidly after 1982" (Gerdrup, 2003, p. 22)	Yes: "Households as well as businesses started to borrow as never before" (Nyberg and Vihriälä, 1994, p. 13); in 1988, bank lending growth peaked at 30%
(3) Foreign capital inflows	No: Japan as a major creditor	Yes: Capital inflows after relaxation of fixed exchange rate in 1984; "...this time an inflow of foreign capital supported and reinforced their high lending growth"(Gerdrup, 2003, p. 22)	Yes: "Particularly foreign borrowing was widely used, starting in the mid-1980s, although more than half of this financing was intermediated by the banks" (Nyberg and Vihriälä, 1994, p. 7)
(4) General inflation	No: Inflation remained low	Yes: Increasing rates of inflation: 1985: 5.7%, 1986: 7.2%, 1987: 8.7%, and 1988: 6.7% (Moe et al., 2004, p. 32)	No: Inflation was declining since 1984 (8.9%, 1985: 5.1%, 1986: 4.6%), but increase since 1987 (5.3%, 1988: 6.9%)
Severity of crisis			

Event Time	"Lost decade" 1985-2003 (crisis: Jan. 1990)	Scandinavian crisis: Norway 1984-92 (crisis: Oct. 1991)	Scandinavian crisis: Finland 1986-92 (crisis: Sept. 1991)
(1) Severe recession	Yes: Very protracted, credit crunch	Yes: Worst recession since interwar period	Yes: "The rapid decline in output that had begun during 1989 continued all through 1991 and 1992" (Nyberg and Vihriälä, 1994, p. 22); decline of total demand by 6.5% and unemployment rate of 11% in 1991; real GDP dropped by 3.5% in 1992; 800 business failures in October 1992 alone
(2) Banking crisis	Yes: High volume of nonperforming loans and failures of three large banks, but no runs or losses to depositors; "many financial institutions were de-capitalized and remained in business only because of the implicit support of the government" (Kindleberger and Aliber, 2011, p. 115)	Yes: Systemic banking crisis, large losses for banks across all asset classes	Yes: Rapid increase in nonperforming assets; bank losses soared (reaching a peak of FIM 22 billion in 1992); numerous banks came close to failure and required assistance; considerable bank losses until 1995
(3) Spillover to other countries	Yes: Impact on Hawaii, Taiwan, and South Korea (close economic relations)	Yes: But strictly limited to Scandinavian countries	Yes: But strictly limited to Scandinavian countries
Policy reactions			
(1) Cleaning	Yes: Reduction of the discount rate to 4% until spring 1992 and further, but still above 3% at the end of that year and later reduced to almost zero; loan purchasing program by the government in 1993, capital injections, nationalizations, fiscal stimulus package	Yes: Considerable interest rate reductions in 1993; Norges Bank provided liquidity support; loans below market rates, capital injections by the government, and nationalizations through Government Bank Insurance Funds	Yes: Government declared it would secure financial stability by all means; Bank of Finland provided liquidity support; Government Guarantee Fund, creation of bad banks, reorganization of supervision

Event Time	"Lost decade" 1985-2003 (crisis: Jan. 1990)	Scandinavian crisis: Norway 1984-92 (crisis: Oct. 1991)	Scandinavian crisis: Finland 1986-92 (crisis: Sept. 1991)
(2) Leaning monetary policy	Yes: Very late; after being held at 2.5% until May 1989, the discount rate was increased to 4% late that year; despite equity price declines, it was increased further to 6% in 1990, remaining at that level until mid-1991	Yes: In order to defend the currency peg, the central bank was forced to raise the discount rate despite decelerating economic growth due to rising interest rates in Germany	Yes: The defense of the exchange rate peg was the main target; however, restrictive interest rate policy in late 1988 and early 1989 due to excessive credit growth and increasing inflationary pressures
(3) Pricking	Yes: Leaning was probably too strong; "the Bank of Japan finally began to raise interest rates sharply in a series of steps, puncturing the bubbles, and leading to eventual economic growth slowdown, and then stagnation" (Patrick, 1998, p. 12); "the decision [...] to restrict the rate of growth of bank loans for real estate pricked the asset-price bubble" (Kindleberger and Aliber, 2011, p. 285)	No	No
(4) Macroprudential instruments	Yes: Quantitative restrictions in 1990; central bank regulation instructing banks to restrict the growth rate of their real estate loans (must not exceed the growth rate of their total loans); increase in taxes on capital gains from investments in land	No	Yes: At the beginning only strong statements; later in February 1988, increase of special reserve requirement in accordance with the banks (cash reserve requirement could be increased up to 12% [from 8%] in case lending was not reduced), but "some banks in the savings bank sector chose to pay the new penal rates rather than curtail their rapid credit expansion. Furthermore, as markets were now free, borrowing in foreign currencies continued to increase" (Nyberg and Vihriälä, 1994, p.15)
Sources	Hoshi and Kashyap (2000, 2004), Okina and Shiratsuka (2003), Kindleberger and Aliber (2011), Patrick (1998), Posen (2003)	Gerdrup (2003), Moe et al. (2004), Vale (2004)	Bordes et al. (1993), Nyberg and Vihriälä (1994), Vihriälä (1997)

Event Time	Asian crisis: Thailand 1995-98 (crisis: July 1997)	Dot-com bubble 1995-2001 (crisis: April 2000)	Real estate bubble in Australia 2002-04 (no crisis)
Place	Thailand	United States	Australia
Overview	<p>The crisis had its origins in high growth and a credit boom, spurring bubbles in the real estate sector and in the stock market. Current-account liberalization entailing capital inflows from abroad after the bursting of the bubble in Japan, as well as financial deregulation and strong tax incentives for foreign borrowing, contributed to the lending boom. While regulatory and corrective measures generally lagged behind the rapid growth of banks, some Thai banks also circumvented regulations by funding nonbank financial intermediaries. The scope of monetary policy in Thailand was limited due to the pegged exchange rate. It remained relatively loose at the beginning of the 1990s. In winter of 1996, the unregulated finance company sector suffered the first losses, causing mistrust among foreign investors. When the Thai economy was confronted with increasing oil prices, declining exports, and a sudden reversal of capital inflows, confidence in the regional banking system collapsed. Massive speculative attacks on the Thai baht forced the government to de-peg the currency in the summer of 1997. The crisis spread to most of Southeast Asia. Thailand suffered from a credit crunch and a deep but short recession. Troubled financial institutions received official backing by the central bank. The IMF stepped in and initiated stabilization programs.</p>	<p>The dot-com bubble refers to the speculative stock market boom in the United States and other industrialized countries at the end of the 1990s related to the founding of new Internet companies, called “dot-coms.” The period is associated with a considerable economic boom in the United States. After the Long Term Capital Management crisis in 1998, the Fed eased monetary policy and also provided additional liquidity toward the end of 1999. Venture capital for new firms was widely available, while American households invested heavily in new technology shares, also encouraged by the massive media response to the boom. Asset prices surged. In his famous speech in December 1996, former Fed Chairman Alan Greenspan warned that “irrational exuberance” might have contributed to overvalued asset prices. During the course of 1999, the Fed modestly tightened monetary policy to sterilize former operations, but also because of increasing concerns about a general bubble and inflationary pressures. The bubble collapsed during 1999 and 2001. The Nasdaq dropped 20% in April and May of 2000 and 42% from September to January. Nevertheless, real consequences were modest, while financial markets continued to function smoothly.</p>	<p>The Australian bubble at the beginning of the millennium is commonly known because of the interventions of the Reserve Bank of Australia. Thereafter, housing prices declined smoothly without severe consequences. Previously, financial market deregulation, increasing competitive pressures on banks, financial innovation in securitization, and a more favorable tax treatment for housing investors had spurred a massive increase in housing values. Banks heavily expanded credit and shifted toward household lending, but focused on high credit quality and low loan-to-value ratios. The Reserve Bank of Australia became more and more attentive to potential problems arising from these developments and first tried to openly communicate potential long-term risks. Later, it tightened monetary policy in several steps beginning in mid-2000. However, the steps were officially motivated by inflationary pressures and not explicitly targeted to asset prices. In addition, regulators and other official bodies participated in the discussion and also took some actions. Having modest adverse effects on consumption, the deceleration of housing prices proceeded without severe disruptions.</p>
Bubble asset	Stocks, commercial and residential real estate	New technology company stocks	Residential housing
Type of bubble asset	Real estate, securities	Securities	Real estate
Displacement	Liberalization, capital inflows after implosion of the bubble in Japan, export boom	Technological innovation (Internet, information technologies), capital inflows after burst of Asian bubble	Financial innovation (securitization), financial deregulation
Holder of asset	Professional housing developers and individuals (Renaud et al., 2001)	Households, retail investors	Households

Event Time	Asian crisis: Thailand 1995-98 (crisis: July 1997)	Dot-com bubble 1995-2001 (crisis: April 2000)	Real estate bubble in Australia 2002-04 (no crisis)
Financier of asset	Credit (finance and securities companies, banks)	To a large extent equity-financed	Credit (banks, mortgage originators)
Economic environment during the event			
(1) Expansive monetary policy	Yes: Relatively loose monetary policy (reduced from 12% at the beginning of the 1990s to 9% in 1993, held until mid-1994), but no independent monetary policy due to pegged exchange rate	Yes: Reversal of tightening policy of 1994, further easing in 1998 due to concerns about fragile monetary arrangements after the LTCM crisis; toward the end of 1999, abundant liquidity was provided to prevent problems related to the transition to the next millenium	Yes: Reduction in several steps from 6.25% in 2000 to 4.25% in 2001
(2) Lending boom	Yes: Bank lending growth accelerated and peaked at 30.3% in 1994; lending boom in Thailand was the largest among the Asian countries	No: Proceeds from securities sales were used to buy more securities; "margin lending for the purchase of equities rose sharply, albeit to still low levels..." (BIS, 2000, p. 5)	Yes: Rapid credit growth and shift toward household lending
(3) Foreign capital inflows	Yes: "Thus the expansion of the asset price bubbles in the Asian capitals followed from the implosion of the asset price bubble in Tokyo and the surge in the flow of money from Japan [...]. The flow of money from Tokyo to Thailand and Indonesia... " (Kindleberger and Aliber, 2011, p. 178), intermediated by local banks	Yes: Capital inflows due to a change in the trade balance with Mexico in 1995 and 1996; also inflows after the collapse of the bubbles in Southeast Asia, when these countries repaid their debt	No
(4) General inflation	No: Moderate and stable inflation (1991: 5.70%, 1992: 4.07%, 1993: 3.36%, 1994: 5.19%, 1995: 5.69%, 1996: 5.85%, and 1997: 5.61%; Corsetti et al., 1999, p. 323)	No: "The U.S. economy boomed in the 1990s. The inflation rate declined from above 6% at the beginning of the 1990s to less than 2% at the end of the 1990s [...]" (Kindleberger and Aliber, 2011, p. 181)	No: "...low and stable inflation environment through the early 1990s" (Bloxham et al., 2010, p. 15); 1991-2000: 2.2%, 2001: 4.4%, 2002: 3.0%, and 2003: 2.8% (BIS, 2004)
Severity of crisis			

Event Time	Asian crisis: Thailand 1995-98 (crisis: July 1997)	Dot-com bubble 1995-2001 (crisis: April 2000)	Real estate bubble in Australia 2002-04 (no crisis)
(1) Severe recession	Yes: Sharp recession and credit crunch, but relatively quick recovery in 1999	No: "The recession that began in the United States in 2001 was relatively mild and brief" (Kindleberger and Aliber, 2011, p. 85); especially the new technology firms were hit hard	No: In 2003 "Australia continued to expand briskly" (BIS, 2004, p. 13); consumption decelerated in 2004 and 2005 but was weaker than expected; "the welcome deceleration in house prices seen so far has had benign effects relative to more disruptive potential scenarios" (BIS, 2005, p. 66)
(2) Banking crisis	Yes: "The results were widespread corporate bankruptcies, collapse in the confidence of the regional banking system, and further declines of asset prices" (Collins and Senhadji, 2002, p. 12); "losses were particularly heavy in the largely unregulated finance company sector" (ibid., p. 12); 56 finance companies failed	No	No
(3) Spillover to other countries	Yes: Regional turmoil in Southeast Asia had global spillovers; economic growth worldwide slowed	Yes: Nasdaq as the main anchor, thus worldwide decline of technology indexes	No
Policy reactions			
(1) Cleaning	Yes: Bailouts and official backing for troubled financial institutions, e.g., central bank's Financial Institutions Development Fund (FIDF), IMF support	Yes: Sharp decrease in the federal funds rate, starting in early 2001	No

Event Time	Asian crisis: Thailand 1995-98 (crisis: July 1997)	Dot-com bubble 1995-2001 (crisis: April 2000)	Real estate bubble in Australia 2002-04 (no crisis)
(2) Leaning monetary policy	Yes: More restrictive monetary policy since 1994, due to currency depreciation induced by loose monetary policy; more restrictive (0.5 increase to 9.5% in September 1994 and 10.5% in March 1995), but ineffective due to capital inflows	Yes: But relatively late and with another focus; the dot-com bubble itself was not a concern; officially Greenspan (2002) emphasized the intention to "focus on policies to mitigate the fallout when it occurs and, hopefully, ease the transition to the next expansion"; modest increase in interest rates from mid-1999 to May 2000, by 150 basis points, in order to reverse previous rate cuts and owing to concern about general bubble in equity markets and inflationary pressures	Yes: Timely; motivated by inflationary pressures, but also by rises in house prices and household borrowing; increase in interest rates in 2002 by 0.5 basis point, in 2003: no cut rates through the year (in contrast to all other developed countries); increase of the cash rate by 0.25 in November and December to 5.25%, "close to levels seen as consistent with long-run non-inflationary sustainable growth" (BIS, 2005, p. 65) but also justified by the desire to contain the developments in the housing sector (ibid., p. 66)
(3) Pricking	No	Yes: "The late 1990s bubble in U.S. stock prices was pricked by the Federal Reserve in 2000 when it sought to withdraw some of the liquidity that it had provided in anticipation of the Y2K problem" (Kindleberger and Aliber, 2011, p. 102)	No
(4) Macroprudential instruments	Yes: In mid-1996, the central bank obliged banks and finance companies to hold higher cash reserve requirements for short-term deposits owned by foreigners	No	Yes: "Open mouth policy" (Bloxham et al., 2010) to raise public awareness: clear communication, central bank was "telegraphing their intention," clarification of policy goals resulted in "verbal tightening" (forward-looking behavior of private sector due to change in expectations) (BIS, 2004, p. 75); higher capital requirements for nonstandard loans (e.g., home equity loans) and lenders' mortgage insurers after stress test; securities and competition regulators (ASIC and ACCC) reinforced investigation of illegal activities by property marketers
Sources	Bank of Thailand, Collyns and Senhadji (2002), Corsetti et al. (1999), Lauridsen (1998), Renaud et al. (2001)	BIS Annual Report (2000, 2001), Greenspan (2002), Cochrane (2003), Kindleberger and Aliber (2011), Ofek and Richardson (2008)	BIS Annual Report (2003, 2004, 2005, 2006), Bloxham et al. (2010), RBA Annual Report (2003)

Event Time	Subprime housing bubble 2003-10 (crisis: 2007)	Spanish housing bubble 1997-? (crisis: 2007)
Place	United States	Spain
Overview	<p>The recent U.S. housing bubble is associated with the most severe financial crisis since the Great Depression. What began as distress in the U.S. subprime sector developed into a global financial crisis. In the early 2000s, financial deregulation and innovation including securitization and new financial instruments, accompanied by the rapid growth of the shadow banking sector, contributed to a credit boom in the housing sector. Soaring housing values and optimistic expectations spurred the real estate bubble. However, with the decelerating economy and rising interest rates, price increases slowed in 2005 and reversed in mid-2006. Delinquency rates increased and the values of mortgage-backed securities and other structured products dropped. While uncertainty spread, severe distress for financial institutions in and beyond the shadow banking sector emerged. The crisis entered a new phase when the U.S. government let the investment bank Lehman Brothers fail in September 2008. Concerns about the soundness of the financial system became paramount, severely reducing lending to the real economy and in the interbank market. The crisis spread to different markets and around the globe.</p>	<p>The Spanish economy relied heavily on domestic demand and the real estate sector since the mid-1990s. Low interest rates in the eurozone, increasing competition among banks, population growth, foreign house purchases, and a booming construction sector further fueled the housing bubble. It burst when the U.S. subprime crisis spread to Europe. Spanish banks were hit very hard by the spillovers as they were strongly engaged in financing construction and property development activities. While the direct exposure to subprime losses was limited, changing expectations regarding the development of housing prices, as well as the credit crunch in the interbank market and the wholesale market for mortgage-financing products (on which Spanish institutions relied heavily), had a great impact. The crisis had dramatic effects on the real economy, leading the government to reorganize the banking sector in 2010 and to strengthen prudential regulation. Bank bailouts, decreasing tax revenues from the construction sector, the severity of the recession, and failing confidence in the eurozone caused the fiscal situation to deteriorate markedly. As a consequence, sovereign bond spreads rose and a sovereign debt crisis evolved. Spain applied for EU rescue financing under the European Financial Stability Facility (EFSF) on June 25, 2012 and left the European Stability Mechanism (ESM, the EFSF's successor institution) program after 18 months in January 2014.</p>
Bubble asset	Subprime mortgages, securitized assets	Residential housing
Type of bubble asset	Real estate	Real estate
Displacement	Financial innovation (securitization), financial deregulation, savings glut	Spillover from the U.S.
Holder of asset	Widely held	Widely held

Event Time	Subprime housing bubble 2003-10 (crisis: 2007)	Spanish housing bubble 1997-? (crisis: 2007)
Financier of asset	Credit (banks, shadow banks), international investors (especially banks)	Credit (banks, especially cajas)
Economic environment during the event		
(1) Expansive monetary policy	Yes: Lax policy by the Fed; 1 % key rate from mid-2003 to mid-2004, when house prices increased significantly	Yes: The ECB's interest rate was too low for the Spanish situation (Garcia-Herrero and de Lis, 2008); reference rate for housing loans decreased from 9.6% in 1997 to 3.3% in 2007
(2) Lending boom	Yes: "This combination of cheap credit and low lending standards resulted in the housing frenzy that laid the foundations for the crisis" (Brunnermeier, 2009, p. 82)	Yes: Credit expansion; "the housing boom was reflected in a credit boom, with rates of growth that peaked above 25% in 2006" (Garcia-Herrero and de Lis, 2008, p. 3); loans to the construction and housing sector amounted to approximately 45% of GDP in 2007
(3) Foreign capital inflows	Yes: "U.S. economy was experiencing a low interest rate environment, both because of large capital inflows from abroad, especially from Asian countries, and because the Federal Reserve had adopted a lax interest rate policy" (Brunnermeier, 2009, p. 77)	Yes: "...the purchase of secondary homes by other EU countries' citizens, especially in the Mediterranean coast (net foreign investment in housing ranged between 0.5% and 1% of Spanish GDP for each year between 1999 and 2007)"(Garcia-Herrero and de Lis, 2008, p. 3)
(4) General inflation	No: "...quiescence of underlying inflation..." (BIS, 2006, p. 60); 1991-2003: 2.7%, 2004: 2.7%, 2005: 3.4%, and 2006: 3.2% (BIS, 2006, p. 11)	Yes: Higher inflation in Spain compared to eurozone: 1993-2003: 3.3%, 2004: 3.1%, 2005: 3.4%, and 2006: 3.6% (eurozone: 1991-2003: 2.4%, 2004: 2.1%, 2005: 2.2%, and 2006: 2.1%) (ECB)
Severity of crisis		

Event Time	Subprime housing bubble 2003-10 (crisis: 2007)	Spanish housing bubble 1997-? (crisis: 2007)
(1) Severe recession	Yes: Worst recession since Great Depression	Yes: Sharp recession; GDP fell 6.3% in the first quarter of 2009; a short period of positive growth came in 2011; negative rates since then, as well as severe unemployment (rose from 8.3% in 2007 to 20.1% in 2010); credit crunch
(2) Banking crisis	Yes: Runs, liquidity hoarding, and massive failures; also fire sales and margin calls	Yes: Banks in highly precarious position: high risk concentration, refinancing problems, asset value losses amounted to 9% of GDP, failures and rescues
(3) Spillover to other countries	Yes: Global financial crisis	Yes: After the bubble burst, the economy went into recession; tax revenues collapsed and deficits soared; Spain entered this recession at rather low levels of government debt, but domestic banks relied heavily on finance from abroad; in what followed, Spain became a major source of spillovers to other European countries' government bond markets (cf. Claeys and Vašíček, 2012)
Policy reactions		
(1) Cleaning	Yes: Bailouts, liquidity facilities, reduction of interest rates to almost zero, recapitalization, TARP, unconventional monetary policy (e.g., quantitative easing, extension of collateral eligibility), Economic Stimulus Act	Yes: Bailouts and nationalization, fiscal consolidation, and reorganization of the banking sector: Fund for Orderly Bank Restructuring (FROB), measures to restore confidence (stress tests, transparency etc.), equity, etc.

Event Time	Subprime housing bubble 2003-10 (crisis: 2007)	Spanish housing bubble 1997-? (crisis: 2007)
(2) Leaning monetary policy	Yes: But not intentional; according to Fed Chairman Bernanke, regulatory policy and not central bank should deal with bubble; however, the Fed raised the interest rate from 1% in June 2004 in 17 steps up to 5.25% in June 2006	Yes: Leaning timely enough, but a loosening of provision requirements occurred in Q1:2005: "a net modest loosening in provisioning requirements for most banks (i.e., a tightening of the provision requirements offset by a lowering of the ceiling of the dynamic provision fund)" (Jiménez et al., 2012, p. 4); magnitude of shock further curtailed effectiveness
(3) Pricking	No: After the Fed had raised interest rates, mortgage rates continued to decline one more year; however, increasing mortgage rates later induced refinancing problems for homeowners, and delinquencies increased	No
(4) Macroprudential instruments	No: But some efforts were made to address poor underwriting standards by developing guidance for nontraditional mortgage products in cooperation with other regulators	Yes: Tightening of prudential regulation (regulatory capital and loan loss provisioning requirements for real estate exposures); dynamic provisioning introduced in third quarter of 2000, modification at the beginning of 2005; sudden lowering of the floor of the dynamic provision funds in late 2008 from 33% to 10%; countercyclical capital buffers with positive real effects
Sources	Brunnermeier (2009), FCIC (2011), Gorton and Metrick (2012), Reinhart and Rogoff (2009), Shiller (2008)	Carballo-Cruz (2011), Claeys and Vašíček (2012), Garcia-Herrero and de Lis (2008), Jiménez et al. (2012), Müller (2011)