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Bubbles and Central Banks: Historical Perspectives[1]

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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 they are accompanied by a lending boom, 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 towards inflating bubbles in many cases is costly. At the same time, while interest-rate leaning policies and macroprudential tools can and sometimes have helped to deflate bubbles and mitigate the associated economic crises, the correct implementation of such proactive policy approaches remains fraught with difficulties.

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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 System and most other central banks were reluctant to use monetary policy instruments in order to tackle 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 by a central bank taking into account the evolution of asset prices in its monetary policy. The debate gathered momentum in the aftermath of the crisis as it is feared that historically low interest rates and non-conventional monetary measures may give rise to new asset price bubbles and thereby plant the seed 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 trying to detect and prevent asset price bubbles when they emerge (Greenspan 1999, 2002). Several arguments have been brought forward to indicate why 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 only be detected 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 may – if large enough – 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 so-called "divine coincidence" of standard New Keynesian models (Blanchard and Galí, 2005): 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 build-up of bubbles by reacting early on to upward-trending asset prices (Cecchetti et al. 2000, Borio and Lowe 2002, White 2006). Albeit recognizing 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 following a cleaning approach. The reason is that such a policy is asymmetric, which tends to raise the price level and risks creating the next bubble. Finally, proponents bring forward 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 pro- 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 – it could instead use verbal communication to damp bubbles, in fact "talking 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, for example through unconventional monetary policy measures. However, the recent crisis has shown quite plainly the huge costs that may 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 towards more intervention, and the old consensus (Greenspan view) seems to shift to a new consensus closer to the BIS view (see, for example, the speech by Jeremy Stein, 7 February 2013; 21 March 2014).

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, holders of assets, policy environments during their emergence, severity of crises, as well as 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, and that resulted 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 from historical reporting, this may help mitigating 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, regarding 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 tested informally by providing illustrative supporting or contradicting evidence from individual bubbles 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 "Panics, Manias, and Crashes." 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 back to an overheated

economy including overtrading and speculation in nearly all kinds of assets. Other crises, such as the Panic of 1907, evolved mainly due to 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 these episodes. We did not drop episodes merely due to the fact that the crises were not severe enough. Such crises may be the most interesting for us because they may point towards effective policies dealing with the crisis. Nevertheless, the listing in Kindleberger 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's book, namely the Chicago real estate boom 1881-1883, the Norwegian crisis of 1899, and the Australian real-estate bubble in the early 2000s.

Our selection leads to a sample of 23 bubble episodes, spanning almost four hundred years. The Appendix table contains a detailed overview of all bubble episodes considered. The first bubble is the Tulipmania of 1634 till 1637, the most recent ones are the subprime housing bubble in the United States 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 we list the major characteristics of bubbles, such as the type of bubble assets, their holders and their financiers, as well as the "displacement" that presumably triggered the bubble. The table then describes the economic environment accompanying the origins of bubbles. We specifically consider expansive monetary policy, the occurrence of lending booms, foreign capital inflows, as well as financial deregulation. These four factors are typically said to accelerate the

emergence of bubbles. Then, the table 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. Finally, the table lists various types of policy reactions. The final line of the Appendix table lists the employed 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 is 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 by market participants – rightly or wrongly – and that often (but not always) resulted in 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 concerning 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 whether they were widely held 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 due 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 as well as the dotcom crisis, which were to a larger 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 2005, p. 54). Examples are technological innovations (such as railways or the new economy), financial innovations (e. g., futures, acceptance loans, or securitization) or deregulation (opening new business opportunities), as well as political events (like the beginning or end of a war). This displacement frequently concerns 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 is going to 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 1824-1825 when country banks issued large volumes

of small-denomination banknotes (Neal, 1995, 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 borrowed money in the call market. In this market, banks, caisses and individuals lent money to stockbrokers for one day (reports), who used it to finance their stock inventory and expected to roll over the loan each day. 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 1772, the invention of the acceptance loan before the crisis of 1763, or the securitization of mortgages in the run-up to the 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 exaggerations in a particular asset market. Hence, lending booms appear to be an (almost) 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 was also fueled by massive foreign investments in the railway system. Similarly, prior to the Panic of 1857, the United States received capital inflows especially from England, but also from Germany and France. Nearly 50 percent of about $400 million outstanding railroad bonds in the middle of 1850s were financed by foreign investors. According to Riddiough and Thompson (2012, p. 4), following net investment outflows of $3 million in 1849, net inflows amounted to $56 million in 1853, $240 million in 1856 and $250 million in the crisis year 1857, respectively. Foreign capital also played a considerable role during the Panic of 1893 and the German stock price bubble of 1927. Often, the burst of bubbles leads to the redirection of capital flows, spurring new asset price booms in other regions (Kindleberger, 2009). Examples are the Scandinavian and Asian asset price bubbles after the burst of the Japanese bubble, as well as the dotcom bubble and the subprime housing bubble after the Asian crisis. Finally, bubbles often occur in 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. Compared to the beginning of the 1980s, real estate loans in Japan had doubled by 1990.

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 to their economic environments. The role of policy responses is discussed in the next section.

Regarding the types of bubble assets, no clear relationship with the severity of crises exists in our sample. Bubbles involving real estate often lead to a severe recession. However, the same is true for 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 to some extent appears to have happened in the aftermath of the recent crisis – is misplaced. A prominent example where a real estate bubble did not lead into a deep depression is the real estate bubble in the United States 1920-1926 (see Alston et al., 1994, White, 2009). This period saw a boom and bust in housing prices similar to the recent financial crisis. Nevertheless, the immediate effects on both the banking system and the real economy were rather modest. 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 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 as 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 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. Another comparison can be made between the Railway Mania in England in the 1840s and the dotcom 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 dotcom 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 dotcom crisis ended in a rather mild recession and did not involve any major bank failure. Lending booms, especially when accompanied by decreasing lending standards as in Australia 1893 or in Japan in the 1980s, are dangerous especially because they make the occurrence of banking crises more likely. This in turn is a major determinant of the severity of crises. 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 for this phenomenon is the Chicago real estate boom of 1881-1883, 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 bubble because they themselves were holding the assets in question. 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 set the grounds for the following deep crisis.

IV. Policy responses

In the existing literature, there is little empirical evidence concerning 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, leaning, macroprudential policies and central bank communication ("talking down the market").

The category "(only) cleaning" contains those bubbles where no significant policy reaction was observed before the bursting of the bubble. A policy reaction is called "leaning" if we observe increases in interest rates in the run-up phase of the bubble. It is difficult to distinguish between deliberate and unintentional leaning, and we do not attempt to do so. For deriving policy implications it is primarily relevant whether these rate increases had an effect or not, regardless of the initial intentions. An extreme form of leaning are policy actions resulting in the bursting of the bubble, 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.

We also searched for policy reactions that do not employ interest rate tools but other types of measures that would nowadays be called "macroprudential" or "quantity instruments." This includes limits on the loan-to-value ratios for banks and explicit credit restrictions. Note that such measures are *not* subsumed under "leaning" in our paper as we are using a narrow definition of leaning here, including only interest rate changes.[2] Macroprudential instruments are considered separately in the analysis.

Finally, we asked whether central banks could "talk down" overvalued assets. Given that private agents have broadly 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 (2013) 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 be suggestive of the underlying trade-offs, rather than yielding definitive policy recommendations for the present.

[2] A similar definition was, for example, used by Jean-Claude Trichet, former president of the European Central Bank, who 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" (Speech, 8 June 2005).

Hypothesis 1: "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 Australian crisis of 1893. There was no policy intervention trying to mitigate the bubbles in mining shares and land or the accompanying lending boom. The consequences of the final collapse of the bubble were severe, leading into a deep depression and the breakdown of a significant part of the financial system. Another example is the crisis of 1763 when no authority felt responsible or was capable of intervening to mitigate the enormous lending boom. Again, the disruptions in both the financial sector and the real economy were severe. 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 against the wind" 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 long-term risks from these developments. Later, the Reserve Bank tightened monetary 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, much 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 policy in principle can be effective and avoid or mitigate crises.

However, some caveats are in order. First and foremost, it is – in the case of the Australian crisis – difficult to cleanly disentangle the effect of the leaning policy from the impact of macroprudential measures, which were introduced at around the same time (as discussed below).Furthermore, we see leaning-type 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 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 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 US subprime bubble. The Fed raised interest rates starting already in 2004. However, the level of interest rates was still low and housing prices continued to rise until 2006. Another example is the Gründerkrise 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 in the 1840s, the Bank of England was criticized for having reacted too late to speculation, and the bursting of the bubble led to a deep recession and one of the worst British banking panics. Another example is the US stock price bubble in the late 1920s

where interest rates were raised when 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, as is discussed next.

Hypothesis 4: Leaning may be harmful if it is too strong.

In both of the just mentioned episodes (United States 1929, Japan 1990), the interest rate response was late but strong, contributing to the bursting of the respective bubbles. White (1990, p. 82) criticizes the Federal Reserve for having pushed the US 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). Of course, the counterfactual is unclear. Maybe a further expansion of the bubble would have led to an even more severe recession.

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 John Law in the Mississippi bubble does not seem to have led to a severe disruption. Similarly, the possibly unintentional pricking of the dotcom bubble by Greenspan led to a sharp decrease in stock prices and huge losses for the holders of dotcom stocks, but the effect on the overall economy was modest and the financial system was hardly affected. Although a policy preventing the emergence of bubbles seems preferable to a late pricking, it is less clear whether “pricking” is worse than letting the bubble collapse without intervening at all before the burst. Overall, this substantial heterogeneity in experiences is an important reason for our wariness of hastily deriving definitive policy recommendations.

An alternative to conventional monetary policy measures are macroprudential instruments. Under this category, we consider all instruments that attempt to reduce lending through other means 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 in the more recent episodes. An early and successful use of macroprudential instruments occurred in the real estate bubble in the United States (1920-1926, see White, 2009). According to the National Banking Act of 1864 banks outside of the central reserve cities were subject to loan-to-value restrictions for real estate loans with a maturity of up to 5 years of 50 percent. Moreover, total real estate lending was limited to 25 percent of a bank's capital. This may 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, this policy seems to have been quite successful in avoiding disruptions.

In other 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 US, central banks also applied macroprudential tools. Reichsbank President Schacht curbed stock market lending by threatening banks to restrict or even deny 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 respective economies. 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 non-existing bubble. Although the following 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 non-existing bubble (through leaning 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 should not exceed the growth rate of their total loans. This measure is said to be one reason why the increase in real estate prices was stopped (Kindleberger and Aliber, 2011, p. 285) although the economy did not recover for a long time. The Finnish authorities tried to limit credit expansion by raising reserve requirements to 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 (Nyborg, 1994, p. 15). In Thailand, the central bank obliged banks and finance companies to hold higher cash reserve requirements 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 in 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 credit was substituted

through other sources and because 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, the timing and dosage 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 a 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 more blunt measures, which capture all parts of the financial system.

Hypothesis 6: Central banks may not be able to 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* actual policy interventions. Without a credible threat or promise of an actual later policy response, it is not clear whether the mere verbal statement would have in fact sufficed to move asset prices in the desired direction.

Indeed, recent experience in the US reinforces this skeptical conclusion. In the late 1990s, Chairman Greenspan on multiple occasions warned that equity prices were excessive, credit spreads too narrow or bank lending terms too generous (Kohn and Sack, 2003). 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 of central bankers. Overall, then, there is no clear empirical evidence whether 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 four hundred years. While not being exhaustive and 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 distillate 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 fall-out from bursting bubbles appears to be most severe when the bubble was accompanied by a lending boom, high leverage and 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 *can* in many cases indeed be effective in mitigating crises. This general thrust of the evidence notwithstanding, the complexities of swift and precise identification of bubbles, coupled with the difficulty of gently deflating these bubbles, 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 implying the sudden bursting of the bubble and causing severe disruptions. This emphasizes the need for a continuous macroprudential analysis monitoring important time series and trying to detect the emergence of bubbles in certain market segments at an early stage.

Fourth, we do not find the dominance of a particular instrument in dealing with asset price bubbles. On the one hand, interest rate tools are blunt and also affect parts of the economy that are 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. On the other hand, 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; such communication, however, may not in itself be sufficient to appreciably change valuations.

Overall, policy rate leaning 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 would seem preferable. As long as problems are detected in specific sectors or within particular institutions, targeted macroprudential measures are sufficient. If the bubble is not concentrated, if it is identified reasonably early, or if regulatory arbitrage is a serious threat, then a proactive interest rate policy may well be the best way to go.

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Event	Tulipmania	Mississippi bubble	Crisis of 1763	Crisis of 1772
Time	**1634-1637 (crisis: Feb. 1636)**	**1719-1720 (crisis: May 1720)**	**1763 (crisis: Sept. 1763)**	**1772-1773 (crisis: June 1772)**
Place	Netherlands	Paris	Amsterdam, Hamburg, Berlin	England, Scotland
Overview	The Tulipmania is one of the first prominent speculative bubbles in history. It refers to the extraordinary rise in prices for tulips in the Netherlands in the 17th century. The mania went along with the introduction of futures markets where the bulbs, which were considered as luxury products, were pre-sold during the year for the season from June to September. Prices rose dramatically, with non-professional traders buying bulbs on credit provided by the sellers. While no severe recession followed, economic activity declined after tulip prices fell.	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 Louisiana and with Canada. Speculation in Compagnie stocks, financed to 75 percent by bills of state, 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 as well as 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.	The Seven Years' War (1756-1763) 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.	The bubble of 1772 is 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.
Bubble asset	Tulips	Stocks of John Law's Mississippi Company	Grain, sugar	East India Company, turnpikes, canals, enclosures, building construction
Type of bubble asset	Commodities	Securities	Commodities	Securities, real estate
Displacement	Financial innovation (futures)	Fiat money, the "Law system"	Financial innovation (acceptance loans), war	Technological innovation (industrial revolution), financial innovation (swiveling, foundation of the Ayr Bank in 1769)
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	London speculators, business men
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)	Bank credit (Ayr Bank, country banks), bills of exchange (money brokers), trade credit

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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**	**Yes:** No centralized monetary policy. Expansive policy by the Bank of England after 1763. Chartered banks in Scotland adopted restrictive policy. This enouraged competitors (e.g. British Linen Company, local and private banks) to follow an expansive policy and issue new notes.
(2) Lending boom	**No**	**Yes:** "Expansion of circulating credit was the driving force for economic expansion" (Garber, 2000, p. 107)	**Yes**	**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)
(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	**No**
(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)	**No:** "… expanding output of goods kept pace with the increase in the supply of money..." (Hamilton, 1956, p.411)

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Severity of crisis				
(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	**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)
(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 liquidity than solvency crisis	**Yes:** Wave of bank failures in London and Edinburgh, Ayr Bank had to suspend payments. Later also failures in Amsterdam.
(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	**Yes**: Crisis had severe effects in Amsterdam, 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
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 five per cent of original obligations, depending on the extent of speculation)	**Yes:** In Berlin Friedrich II assisted merchants, he eased 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	**Yes:** Bank of England discounted heavily (had to hire additional clerks), government bail-out 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
(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 5th and May 21st (monetization of shares), decree on May 1st to deflate share prices to 5000 livres until December 1st	**No**	**Yes:** Early in 1772, Bank of England increased 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)

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(3) Pricking	**No**	**Yes:** After the decision of May 1st 1720 to deflate share prices to 5000 livres until December 1st, those share prices dropped faster than intended: to 2000 in September, 1000 in December 1720	**No**	**No**
(4) Macroprudential instruments	**No**	**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)	Clapham (1970), Hamilton (1956), Hoppit (1986), Kindleberger and Aliber (2011), Sheridan (1960)

Event	Latin America Mania	Railway Mania	Panic of 1857	Gründerkrise
Time	**1824-1825 (crisis: Dec. 1825)**	**1840s (crises: April/Oct.1847)**	**1856-1857 (crisis: Oct.1857)**	**1872-1873 (crisis: May 1873)**
Place	England (mainly London)	England	United States	Germany, Austria
Overview	The Latin American Mania, which resulted in a panic in December 1825, refers to a stock market boom, especially related to speculation with securities of real and fictitious South American governments (e.g. Poyais) and mines. Joint stock companies as well as cotton were further speculative objects. 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 concerned buildings. When the bubble burst in London, the panic precipitated a systemic banking crisis and severe recession. When trade slowed down, distress stretched out to banks in France, Leipzig, Vienna and Italy. Latin America experienced its first sovereign debt crisis.	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 bad harvest and a famine, forcing the Bank of England to increase interest rates. Both aspects led to a tightening of money markets. The bubble already burst in 1845 when tensions about the situation in the railway market and the expectation of bad harvest entailed declining share prices. However, the situation became tenser and escalated in 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.	The crisis of 1857 is considered the first worldwide crisis. Having its origins in the United States, it quickly stretched to Britain, continental Europe and the colonies. The speculative bubble preceding the turmoil emerged against the background of gold discoveries, railway extension and a global boom. Foreign investors additionally contributed to rising values of railroad securities and land in the US. However, increasing uncertainty about their future status regarding 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 sharply rose 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.	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 money supply. Optimistic expectations and euphoria in the context of the World Exhibition as well as the 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 bail-outs and other emergency measures, the crisis could not be contained and developed into a ruinous depression.
Bubble asset	South American governments and mines, joint stock companies, cotton	Railway related securities, corn	Railroad stocks and bonds, land	Stocks, railroads, houses, land
Type of bubble asset	Securities, commodities	Securities, commodities	Securities, real estate	Securities, real estate
Displacement	Independence of former colonies, privatization of mines, lower returns on British government bonds	Technological innovation (railways)	Gold discoveries, railway extension	End of war, World Exhibition, liberalization (banks, stock corporation law)
Holder of asset	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 feiver reigned uncontrollable and uncontrolled." (Evans, 1848, p.2)	Widely held	Widely held, also by banks (cf. Wirth, 1890, pp. 474 ff.)
Financier of asset	Bank credit (country banks, Bank of England)	Bank credit, acceptances, foreign investments, also savings	Bank credit (domestic and foreign banks), promissory notes (sellers), debt-for-equity swaps (railroad companies), foreign investments, private capitalists	Bank credit

Event	Latin America Mania	Railway Mania	Panic of 1857	Gründerkrise
Time	1824-1825 (crisis: Dec. 1825)	1840s (crises: April/Oct.1847)	1856-1857 (crisis: Oct.1857)	1872-1873 (crisis: May 1873)
Economic environment during th				
(1) Expansive monetary policy	**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%, below 3% in 1844	**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
(2) Lending boom	**Yes:** "credit was the universal currency" (Mc Evan, 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)	**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 & Aliber, 2011, p. 52)
(3) Foreign capital inflows	**No:** Rather capital exports and outflow of gold, decrease of foreign holdings of British debt	**Yes:** Substantial amount of foreign railway investment	**Yes:** Foreign capital from England, also Germany and France	**Yes:** French war reparations
(4) General inflation	**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	**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 latteral 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" (Mc Cartney, 1935, p.79), peak in 1873 with an index of 114,3 based on prices in 1860

Event Time Severity of crisis	Latin America Mania 1824-1825 (crisis: Dec. 1825)	Railway Mania 1840s (crises: April/Oct.1847)	Panic of 1857 1856-1857 (crisis: Oct.1857)	Gründerkrise 1872-1873 (crisis: May 1873)
(1) Severe recession	**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 UK	**Yes**: 8.6% GDP contraction in the US (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
(2) Banking crisis	**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	**Yes:** Wave of bank failures, hoarding of money and deposit withdrawals, bank run in New York on October, 13, suspension of vonvertibility throughout the country	**Yes:** Sharp decrease in profitability and credit volume, increase in insolvencies, also fire sales
(3) Spillover to other countries	**Yes**: As a result of a declining continental sales, the crisis spread from England to Europe (especially banks in Paris, Lyons, Leipzig and Vienna were affected) and Latin America where it caused a sovereign debt crisis	**Yes:**Banks and brokers failed in Paris, Frankfurt, Hamburg, Amsterdam due to declining share prices, also effects in New York, impact on trade between India and Britain	**Yes**: First worldwide crisis, spread to continental Europe and Britain, had effects in South America, South Africa, Far East	**Yes:** Immediate effects on Italy, Switzerland, Holland, Belgium. In September panic in the United States, spillover to Great Britain, France, Russia
Policy reactions				
(1) Cleaning	**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 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 Bank of France to prevent suspension of convertibility	**No:** Bank of England was critizised for not acting as a lender of last resort, suspension of the Bank Act	**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 & Aliber, 2011, p.219)	**Yes:** In Austria, bail-out 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
(2) Leaning monetary policy	**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, June and from September	**Yes:** Raise 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, also 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)	**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

Event	**Latin America Mania**	**Railway Mania**	**Panic of 1857**	**Gründerkrise**
Time	**1824-1825 (crisis: Dec. 1825)**	**1840s (crises: April/Oct.1847)**	**1856-1857 (crisis: Oct.1857)**	**1872-1873 (crisis: May 1873)**
(3) Pricking	**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**	**No**	**No**
(4) Macroprudential instruments	**No**	**No**	**No**	**No**
Sources	Bordo (1998), Conant (1915), Evans (1959), Kindleberger and Aliber (2011), Neal (1998), Silberling (1924)	Clapham (1970), Dornbusch and Frenkel (1984), Evans (1849), IMF (2003), Kindleberger & Aliber (2011), Ward-Perkins (1950),	Conant (1915), Calomiris and Schweikhart (1991), Evans (1859), Kindleberger & Aliber (2011), Gibbons (1858), Riddiough (2012), Riddiough and Thompson (2012)	Burhop (2009), Conant (1915), McCartney (1935), Schwartz (1987), Wirth (1890)

Event	Chicago real estate boom	Crisis of 1882	Panic of 1893	Norwegian crisis
Time	1881-1883 (no crisis)	1881-1882 (crisis: Jan.1882)	1890-1893 (crisis: Jan. 1893)	1895-1900 (crisis: July 1899)
Place	Chicago	France	Australia	Norway
Overview	The Chicago real estate boom at the beginnings of the 1880s rooted in the recovery from the serious depression of 1877. Against the background of improving economic conditions, Chicago, considered as an important economic center, benefitted 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. Referring to the latter, this period is also known as "the flat craze". However, with the beginning recession of 1883, the bubble burst, albeit without severe consequences.	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 French 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 Bank of 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. 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 of a consortium of banks, as well as the Bank of France, to fight the financial crisis, their interventions could not avert a deep recession.	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 found 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 to not be able to roll over debt. Eventually, panic broke out in January, when the relatively new 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, while repercussions were also felt in Berlin, Vienna and Italy.	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 to the scope of the 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 summer 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 compared to later crises. Nonetheless, net wealth of households and firms declined due to a fall in asset prices and credit conditions throughout the country worsened.
Bubble asset	New buildings, houses from foreclosure proceedings, land	Securities in general, stocks of new banks	Mining shares, land	Land, new homes, real estate shares
Type of bubble asset	Real estate	Securities	Securities, real estate	Real estate
Displacement	Innovation (apartments, skyscrapers); railroad construction, immigration	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: Capitalists, business men, mechanics, laborers, railroad and manufacturing companies	Widely held: "masses of the French pepople" (Conant, 1915, p. 659)	Banks, foreign investors, households	Construction sector, manufacturers, brokers, stock market investors
Financier of asset	To a large extend equity financed	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)

Event	Chicago real estate boom	Crisis of 1882	Panic of 1893	Norwegian crisis
Time	1881-1883 (no crisis)	1881-1882 (crisis: Jan.1882)	1890-1893 (crisis: Jan. 1893)	1895-1900 (crisis: July 1899)
Economic environment during th				
(1) Expansive monetary policy	**Yes:** Mortgages interest rates were at extremely low levels in 1877; rate of growth of US money stock was extraordinarily high from 1879 to 1881: over 19 % p.a. (Friedman and Schwartz, 1963, p. 91)	**Yes:** Mean discount rate of the Bank of 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 1890s due to specie inflows from exports. NB did not sterilize the inflow. Decreasing discount rate in January 1892, reaching its low in 1895.
(2) Lending boom	**No:** Rather equity financed, large wealth had been accumulated by 1879 among all ranks of society and was made available for investment	**Yes:** Expansion of credit through a system of delayed payments (reportage), existence of "many different institutional avenues for the expansion of credit" (Kindleberger & 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**	**No**	**Yes:** British public, investment and financial companies heavily invested in Australian mines and speculated in Australian real estates	**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	**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)	**No** (Maddison, 1991)	**No:** Prices relatively stable between 1870 and 1890	**No:** Price level fell in first half of the 1890s, but: sharp increase in 1898

Event	Chicago real estate boom	Crisis of 1882	Panic of 1893	Norwegian crisis
Time	**1881-1883 (no crisis)**	**1881-1882 (crisis: Jan.1882)**	**1890-1893 (crisis: Jan. 1893)**	**1895-1900 (crisis: July 1899)**
Severity of crisis				
(1) Severe recession	**No**	**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 moderate during 1899 and 1900, more broad-based recession and deflation from 1901 to 1905 due to international recession
(2) Banking crisis	**No**	**Yes:** After bankruptcies among many brokers and clients, banks and their caisses collapsed, run and subsequent failure of the bank of Lyons 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, weak bank runs
(3) Spillover to other countries	**No**	**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	**No**	**Yes:** Assistance to the 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 Lyons brokers received 100 million francs from the Bank of France upon securities which would not ordinarily have been accepted, the Paris agents of exchange received 80 million francs upon the guarantee of a syndicate of bankers, Bank of France itself received aid by 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 suggestion of "reconstructuring" the Commercial bank by their directors ended crisis when other banks followed	**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 *Industribanken,* NB experienced losses in the aftermath of the crisis
(2) Leaning monetary policy	**No**	**Yes:** The Bank of France was confronted with declining reserves due to bad crops and increasing gold flows to the US, Bank of France tried to avoid a sharp increase in the discount rate, therefore paid light coin and charged a premium for bullion, but had to raise interest rates by one percentage point on October 20th, 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, rise from 5% to 6% in February and March one year later

Event	**Chicago real estate boom**	**Crisis of 1882**	**Panic of 1893**	**Norwegian crisis**
Time	**1881-1883 (no crisis)**	**1881-1882 (crisis: Jan.1882)**	**1890-1893 (crisis: Jan. 1893)**	**1895-1900 (crisis: July 1899)**
(3) Pricking	**No**	**No**	**No**	**No**
(4) Macroprudential instruments	**No**	**No**	**No**	**No**
Sources	Hoyt (1933)	Conant (1915), Kindleberger & Aliber (2011), Maddison (1991), White (2007)	Bloxham et al. (2010), Conant (1915), Kent (2011), Lauck (1907), McKenzie (2013), Merrett (1997)	Gerdrup (2003)

Event	Real estate bubble in the US	German stock price bubble	US stock price bubble	Lost decade
Time	1920-1926 (no crisis)	1927 (crisis: May 1927)	1928-1929 (crisis: Oct. 1929)	1985-2003 (crisis: Jan. 1990)
Place	United States	Germany	United States	Japan
Overview	The US 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. Further distress however, if any, was contained regionally. Since the most risky 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.	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 market 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 percent on 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.	The late 1920s US stock price bubble culminated in one of the most shattering stock market crashes in US 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 summer 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 of 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.	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 from large customers and increased 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 household 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 already declined, the Bank further raised the policy rate in summer 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 burst of the asset price bubble is therefore associated with what is referred to Japan’s “Lost decade”, a protracted period of economic stagnation.
Bubble asset	Residential housing, also securitized mortgages	Stocks	Stocks (companies, utilities)	Stocks, convertible bonds, real estate
Type of bubble asset	Real estate	Securities	Securities	Securities, real estate
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)	Lending boom due to financial deregulation and innovation, euphoria about the "new economy"
Holder of asset	Banks, private individuals (domestic)	Wealthy individuals, institutional investors, banks	Widely held, also commercial banks (and their securities affiliates)	Widely held (especially corporations, also banks)
Financier of asset	Bank credit (savings & 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)	Bank and mortgage loans (banks, finance companies, government financial institutions)

Event	Real estate bubble in the US	German stock price bubble	US stock price bubble	Lost decade
Time	1920-1926 (no crisis)	1927 (crisis: May 1927)	1928-1929 (crisis: Oct. 1929)	1985-2003 (crisis: Jan. 1990)
Economic environment during th				
(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, from 9% in February 1925 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:** NY Fed already decreased discount rate from 4.5% in April to 3% in August 1924. Decrease of the discount rate of all Fed banks from 4 to 3,5% from July to September 1927, also open market purchases	**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
(2) Lending boom	**Yes**: Especially rapid expansion of mortgage credit	**No:** Sharp increase in stock market lending during 1926 and 1927, but level 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 general were tight	**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))
(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	**No**: Japan as a major creditor
(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	**No:** Inflation remained low

Event Time Severity of crisis	Real estate bubble in the US 1920-1926 (no crisis)	German stock price bubble 1927 (crisis: May 1927)	US stock price bubble 1928-1929 (crisis: Oct. 1929)	Lost decade 1985-2003 (crisis: Jan. 1990)
(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 weakened confidence and households' balance sheets, later Great Depression with 29.7% GDP contraction (Bordo, 2003)	**Yes:** Very protracted, credit crunch
(2) Banking crisis	**No:** Decline in housing prices and increase in foreclosure rates, but only modest losses for banks, 80% of failures in rural areas and mainly related to expectations in agriculture, run and failure of certain bank chains, but no general banking crisis: "failures did not imperil the whole of the banking system" (White, 2009, p. 46)	**No:** Later, bursting bubble was one contributing factor due to the weakening of banks' balance sheets	**No:** Later, first a banking panic was prevented, owing to interventions by the NY Fed, and the direct financial effects of the crash were limited to the stock market (also including distressed sales and margin calls)	**Yes:** High volume of non-performing loans, failure of 3 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 & Aliber, 2011, p.115)
(3) Spillover to other countries	**No**	**No**	**Yes:** No direct effects of the crash, but reduction in US lending had impact on Germany, Latin America, Australia. Later, the Great Depression affected countries worldwide.	**Yes:** Impact on Hawaii, Taiwan and South Korea (close economic relations)
Policy reactions				
(1) Cleaning	**No**	**No**	**No:** Restrictive policy of the Fed resulting from fears about excessive speculation worsened the recession, however: actions by the NY 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	**Yes:** Reduction of the discount rate to 4% until spring 1992 and further, but still above 3% at the end of that year, later reduction to almost zero; loan purchasing program by the government in 1993, capital injections, nationalizations, fiscal stimulus package
(2) Leaning monetary policy	**No:** no change in interest rates, rather use of macroprudential instruments	**No:** Few months before the crisis, beginning in October 1926; reduction of discount rate from 6 to 5% towards the end of 1926	**Yes:** Few months before the crash, beginning in early 1929; NY Fed argued against selective credit control and voted in favour of interest tools, but was frequently turned down by the Board, eventually was permitted to increase discount rate from 5 to 6% in August, 1929	**Yes:** Very late; after being held at 2.5% until May 1989, the discount rate was raised up to 4% late that year. Despite equity price declines, it was increased further to 6% in 1990. It remained at that level until mid 1991.

Event Time	Real estate bubble in the US 1920-1926 (no crisis)	German stock price bubble 1927 (crisis: May 1927)	US stock price bubble 1928-1929 (crisis: Oct. 1929)	Lost decade 1985-2003 (crisis: Jan. 1990)
(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 burst 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)	**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 & Aliber, 2011, p.285)
(4) Macroprudential instruments	**Yes:** Long-standing quantitative regulations; National Banking Act of 1864: For 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 adressed stock market lending by threatening banks to decrease or even deny 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 of splitting stocks to counter speculation	**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
Sources	Alston et. al. (1994), White (2009)	Balderston (1993), Voth (2003)	Friedman & Schwartz (1963), Kindleberger & Aliber (2011), White (1990)	Hoshi & Kashyap (2000), Hoshi & Kashyap (2004), Okina & Shiratsuka (2003), Kindleberger & Aliber (2011), Patrick (1998), Posen (2003)

Event	Scandinavian crisis: Norway	Scandinavian crisis: Finland	Asian crisis: Thailand	Dotcom bubble
Time	**1984-1992 (crisis: Oct. 1991)**	**1986-1992 (crisis: Sept. 1991)**	**1995-1998 (crisis: July 1997)**	**1995-2001 (crisis: April 2000)**
Place	Norway	Finland	Thailand	USA
Overview	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 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.	A large economic boom at the end of the 1980s provided the background for the 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, 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.	The crisis had its origins in high growth and a credit boom, spurring bubbles in the real estate sector and on the stock market. Current account liberalization entailing capital inflows from abroad after the burst 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 beginnings of the 1990s. In winter 1996, the unregulated finance company sector suffered 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 summer 1997. The crisis spread to most of Southeast Asia. Thailand suffered from a credit crunch and deep but short recession. Troubled financial institutions received official backing by the central bank. The IMF stepped in and initiated stabilization programs.	The Dotcom 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 foundation of new internet companies, named "dotcoms". The period is associated with a considerable economic boom in the United States. After the LTCM crisis in 1998, the Fed eased monetary policy and also provided additional liquidity towards the end of 1999. Venture capital for new firms was widely available, while American households heavily invested 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 President Alan Greenspan warned that "irrational exuberance" might have contributed to overvalued asset prices. In the course of 1999, the Fed modestly tightened monetary policy to sterilize former operations, but also due to increasing concerns about a general bubble and inflationary pressures. The bubble collapsed during 1999 and 2001. The Nasdaq dropped by 20 percent in April and May 2000 and by 42 percent from September to January. Nevertheless, real consequences were modest, while financial markets continued to function smoothly.
Bubble asset	Commercial real estate, residential housing	Land, residential housing, stocks	Stocks, commercial and residential real estate	New technology company stocks
Type of bubble asset	Real estate	Real estate, securities	Real estate, securities	Securities
Displacement	Broad-based financial deregulation	Broad-based financial deregulation	Liberalization, capital inflows after implosion of the bubble in Japan, export boom	Technological innovation (internet, information technologies), capital inflows after burst of Asian bubble
Holder of asset	Firms, households	Firms, households	Professional housing developers and individuals (Renaud et al., 2001)	Households, retail investors
Financier of asset	Credit (domestic and foreign banks)	Credit (domestic and foreign banks, finance companies)	Credit (finance and securities companies, banks)	To a large extent equity-financed

Event	Scandinavian crisis: Norway	Scandinavian crisis: Finland	Asian crisis: Thailand	Dotcom bubble
Time	1984-1992 (crisis: Oct. 1991)	1986-1992 (crisis: Sept. 1991)	1995-1998 (crisis: July 1997)	1995-2001 (crisis: April 2000)
Economic environment during th				
(1) Expansive monetary policy	**Yes:** Until the end of the 1980s, NB followed the government's goal of a low interest rate. NB had to sell foreign exchange to counter several speculative attacks on the krone, but sterilized the policy by increasing ist 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	**Yes:** Relatively loose monetary policy (reduced from 12% at the beginnings 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 in the context of the transition to the next millenium
(2) Lending boom	**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, 1994, p. 13), in 1988, bank lending growth peaked with 30%	**Yes:** Bank lendig growth accelerated and peaked with 30,26% 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)
(3) Foreign capital inflows	**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, 1994, p. 7)	**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 & 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
(4) General inflation	**Yes:** Increasing rate of inflation: 1985: 5.7%, 1986: 7.2% 1987: 8.7%, 1888: 6,7% (Moe et al., 2004, p. 32)	**No:** Inflation was declining since 1984 (8.9%1985: 5.1% 1986: 4.6%), but reversal tendency since 1987 (5.3% 1988: 6.9%)	**No:** Moderate and stable inflation (1991: 5.70% 1992: 4.07% 1993: 3.36%1994: 5.19% 1995: 5.69% 1996: 5.85% 1997: 5.61% ;Corsetti et al., 1999, p. 323)	**No:** "The US 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 & Aliber, 2011, p. 181)

Event Time Severity of crisis	Scandinavian crisis: Norway 1984-1992 (crisis: Oct. 1991)	Scandinavian crisis: Finland 1986-1992 (crisis: Sept. 1991)	Asian crisis: Thailand 1995-1998 (crisis: July 1997)	Dotcom bubble 1995-2001 (crisis: April 2000)
(1) Severe recession	**Yes:** Worst recession since interwar period	**Yes:** "The rapid decline in output that had begun during 1989 continued all through 1991 and 1992" (Nyberg, 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 only in October 1992	**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 & Aliber, 2011, p. 85), especially the new technology firms were hit hard
(2) Banking crisis	**Yes:** Systemic banking crisis, large losses for banks across all asset classes	**Yes:** rapid increase in non-performing 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	**Yes:** "The results were widespread corporate bankruptcies, collapse in the confidence of the regional banking system, and further declines of asset prices" (Collyns &Senhadji, 2002, p. 12), "losses were particularly heavy in the largely unregulated finance company sector" (ibid., p. 12), 56 finance companies failed	**No**
(3) Spillover to other countries	**Yes:** But strictly limited to Scandinavian countries	**Yes:** But strictly limited to Scandinavian 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
Policy reactions				
(1) Cleaning	**Yes:** Considerable interest rate reductions in 1993, Norges Bank provided liquidity support, loans below market rates, capital injections by the government and nationalisations 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	**Yes:** Bailouts and official backing for troubled financial institutions, e.g. central bank's Financial Institutions Development Fund (FIDF), IMF support	**No**
(2) Leaning monetary policy	**Yes:** In order to defend the currency peg; **central bank** was forced to raise the discount rate despite decelerating economic growth due to rising interest rates in Germany	**Yes:** Although the defense of the exchange rate peg was the main target; restrictive interest rate policy in late 1988 and early 1989 due to excessive credit growth and increasing inflationary pressures.	**Yes:** More restrictive monetary policy since 1994, due to currency depreciation induced by lose monetary policy; more restrictive (increase by 0,5 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; dotcom bubble itself was not a concern, officially Greenspan (2002) emphasizes 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 due to concern about general bubble in equity markets and inflationary pressures

Event **Time**	**Scandinavian crisis: Norway** **1984-1992 (crisis: Oct. 1991)**	**Scandinavian crisis: Finland** **1986-1992 (crisis: Sept. 1991)**	**Asian crisis: Thailand** **1995-1998 (crisis: July 1997)**	**Dotcom bubble** **1995-2001 (crisis: April 2000)**
(3) Pricking	**No**	**No**	**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 & Aliber, 2011, p. 102)
(4) Macroprudential instruments	**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, 1994, p.15)	**Yes:** In mid-1996, the central bank obliged banks and finance companies to hold higher cash reserve requirements for short-term deposits owned by foreigner	**No**
Sources	Gerdrup (2003), Moe et al. (2004), Vale (2004)	Bordes et al. (1993), Nyberg (1994), Vihriälä (1997)	Bank of Thailand, Collyns & Senhadji (2002), Corsetti et al. (1999), Lauridsen (1998), Renaud et al. (2001)	BIS Annual Report (2000), BIS Annual Report (2001), Greenspan (2002), Cochrane (2003), Kindleberger & Aliber (2011), Ofek & Richardson (2008)

Event	**Real estate bubble in Australia**	**Subprime housing bubble**	**Spanish housing bubble**
Time	**2002-2004 (no crisis)**	**2003-2010 (crisis: 2007)**	**1997-? (crisis: 2007)**
Place	Australia	USA	Spain
Overview	The Australian bubble at the beginning of the millennium is commonly known because of the interventions of the Reserve Bank of Australia after which housing prices declined smoothly without severe consequences. Previously, financial market deregulation, increasing competitive pressures on banks, financial innovation in securitization as well as a more favorable tax treatment for housing investors had spurred a massive increase in housing values. Banks heavily expanded credit and shifted towards 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. Besides, regulators and other official bodies participated in the discussion and also took some actions. Having modest adverse effects on consumption, the following deceleration of housing prices proceeded without severe disruptions.	The recent US housing bubble is associated with the most severe financial crisis since the Great Depression, developing from distress in the US subprime sector to a global financial crisis. In the early 2000s, financial deregulation and financial 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 slowing of the economy and rising interest rates, price increases slowed in 2005 and reversed in mid-2006. Deliquency 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 US 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.	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 US subprime crisis spread to Europe. Spanish banks were hit very hard by the spill-overs 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, the credit crunch in the interbank market and the wholesale market for mortgage-financing products, on which Spanish institutions relied heavily, took great effect. The crisis had dramatic effects for the real economy, urging 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 prompted 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's (ESM; the EFSF's successor institution) program after 18 months in January 2014.
Bubble asset	Residential housing	Subprime mortgages, securitized assets	Residential housing
Type of bubble asset	Real estate	Real estate	Real estate
Displacement	Financial innovation (securitization), financial deregulation	Financial innovation (securitization), financial deregulation, savings glut	Spillover from the US
Holder of asset	Households	Widely held	Widely held
Financier of asset	Credit (banks, mortgage originators)	Credit (banks, shadow banks), international investors (especially banks)	Credit (banks, especially cajas)

Event **Time** **Economic environment during th**	**Real estate bubble in Australia** **2002-2004 (no crisis)**	**Subprime housing bubble** **2003-2010 (crisis: 2007)**	**Spanish housing bubble** **1997-? (crisis: 2007)**
(1) Expansive monetary policy	**Yes:** Reduction in several steps from 6,25% in 2000 to 4,25% in 2001	**Yes:** Lax policy by the Fed, 1 % key rate from mid-2003 to mid-2004, when house prices increased significantly	**Yes:** ECB's interest rate too low for Spanish situation (Garcia-Herrero & de Lis, 2008), reference rate for housing loans decreased from 9.6% in 1997 to 3.3% in 2007
(2) Lending boom	**Yes:** Rapid credit growth and shift towards household lending	**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 & de Lis, 2008, p. 3), loans to the construction and housing sector amounted to approx. 45% of GDP in 2007
(3) Foreign capital inflows	**No**	**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 & de Lis, 2008, p. 3)
(4) General inflation	**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%, 2003: 2.8% (BIS, 2004)	**No:** "...quiescence of underlying inflation…" (BIS, 2006, p. 60); 1991-2003: 2.7% 2004: 2.7% 2005: 3.4% 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% 2006: 3,6% (eurozone: 1991-2003: 2.4% 2004: 2.1% 2005: 2.2% 2006: 2.1%) (ECB)

Event Time Severity of crisis	Real estate bubble in Australia 2002-2004 (no crisis)	Subprime housing bubble 2003-2010 (crisis: 2007)	Spanish housing bubble 1997-? (crisis: 2007)
(1) Severe recession	**No:** In 2003 "Australia continued to expand briskly"(BIS, 2004, p. 13), consumption decelerated in 2004 and 2005 but 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)	**Yes:** Worst recession since Great Depression	**Yes:** Sharp recession, GDP fell by 6.3 % in the first quarter of 2009, short period of postivie growth in 2011, negative rates since then, severe unemployment (rose from 8.3 % in 2007 to 20.1 % in 2010), credit crunch
(2) Banking crisis	**No**	**Yes:** Runs, liquidity hording 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	**No**	**Yes**: Global financial crisis	**Yes:** After the 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 heavily relied on finance from abroad. In what followed, Spain became a major source of spillovers to other European contries' government bond markets (cf. Claeys & Vašíček, 2012)
Policy reactions			
(1) Cleaning	**No**	**Yes:** Bail-outs, 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, reorganization of the banking sector: Fund for Orderly Bank Restructuring (FROB), measures to restore confidence (stress tests, transparency etc.), equity, etc.
(2) Leaning monetary policy	**Yes:** Timely, motivated by inflationary pressures, but also rise in house prices and household borrowing. Effect not obvious immediately and increasing concerns about risks when growth expectations deteriorated, but discussion continued. Increase in interest rates in 2002 by 0,5 basis points, 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)	**Yes**: But not intentional; according to Fed President Bernanke regulatory policy and not central bank should deal with bubble. But Fed raised interest rate from 1% in June 2004 in 17 steps up to 5.25% in June 2006	**Yes:** Leaning timely enough, but loosening of provision requirements 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

Event Time	Real estate bubble in Australia 2002-2004 (no crisis)	Subprime housing bubble 2003-2010 (crisis: 2007)	Spanish housing bubble 1997-? (crisis: 2007)
(3) Pricking	**No**	**No:** After the Fed had raised interest rates, mortgage rates continued to decline one more year. However, later increasing mortgages rates induced refinancing problems for homeowners and deliquencies increased	**No**
(4) Macroprudential instruments	**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 expectation) (BIS, 2004, p. 75), higher capital requirements for non-standard loans (e.g. home equity loans) and lender's mortgage insurers after stress test, securities and competition regulators (ASIC and ACCC) reinforced investigation of illegal activities by property marketers	**No**: But: some efforts 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	BIS Annual Report (2003), BIS Annual Report (2004) BIS Annual Report (2005), BIS Annual Report (2006), Bloxham et al. (2010), RBA Annual Report (2003)	Brunnermeier (2009), FCIC (2011), Gorton and Metrick (2012), Reinhart & Rogoff (2009), Shiller (2008)	Carballo-Cruz (2011), Claeys & Vašíček (2012), Garcia-Herrero & Fernández de Lis (2008), Jiménez et al. (2012), Müller (2011)