

■ Financial bubbles and monetary policy

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We look here at a number of periods in which asset prices have displayed bubble behaviour, that is, an apparently over-optimistic rise followed by a crash. We consider some major issues such as how a bubble can arise and how bubbles can be identified. Our main concern, however, is a central bank's approach to such price developments: should it try to identify and counter the bubble at an early stage or wait until the bubble has burst before taking measures to limit its harmful effects? We consider that a largely preventive strategy is ruled out by the lack of knowledge about how a price bubble can be countered with measures of monetary policy. Still, there are grounds for continuing to analyse financial asset markets and identifying different types of imbalances, thereby possibly helping to discourage price bubbles and their deleterious consequences.

Bubbles in financial prices have attracted the attention of many academics and policy-makers in recent years, not least in the analysis of monetary policy. A contributory cause is the troublesome situation in the Japanese economy, which is considered to stem to a high degree from the asset bubble that burst in the early 1990s. But while there is relatively widespread agreement on price bubbles as a very serious threat to a national economy, there is no consensus on whether or how such bubbles can be prevented with measures of monetary policy. Moreover, identifying price bubbles can be difficult. This article therefore aims to map the state of knowledge about how monetary policy should relate to financial bubbles. Measures in a situation where a burst price bubble threatens financial stability are considered only in passing.¹

First we look at the relevance of financial bubbles for the monetary policy analysis and present a general account of the concept of a price

Price bubbles can be a serious threat to the national economy.

¹ Steeply falling asset prices, indicating that a bubble has burst, call for an assessment of the potential threat to financial stability. In addition to measures of interest rate policy, a part can be played by controls of various kinds; see Collins & Senhadji (2002) and the G10 report "Turbulence in Asset Markets: The Role of Micro Policy", Contact Group of Asset Prices, September 2002.

bubble. This is followed by a review of the literature on why financial price bubbles can arise. The most familiar presumed financial price bubbles are then described with reference to such issues as how and why they developed and the part that monetary policy played. Finally we present published views on how financial asset prices and, in particular, bubbles can be taken into account in the formation of monetary policy.

Financial price bubbles – an introductory survey

WHY SHOULD FINANCIAL BUBBLES INTEREST A CENTRAL BANK?

Several reasons why asset bubbles are relevant for a central bank have been put forward.

In general terms, a bubble in financial prices implies a period during which asset prices rise rapidly to unreasonably high levels that are not sustainable and then, when the bubble bursts, fall steeply.² At least three reasons have been put forward for asset bubbles being relevant for a central bank.

(i) Bubbles can threaten financial stability. Historically, periods with rapidly rising asset prices have often been associated with credit growth. The root of the problem is an excessively optimistic appraisal of investment opportunities, often reflected in an asset price bubble. When investments fail to meet expectations, loan losses are liable to occur. Moreover, the sharp price fall that occurs when a bubble bursts reduces the value of the assets with which loans have been secured and this can add to the loan losses of the credit institution. In extreme cases a bank may then fail, possibly leading to the collapse of the financial system as a whole. The Japanese experience clearly illustrates the huge costs this may entail. For a central bank, an important task is to try to counter such a development, for instance by providing liquidity and emergency credit.³

(ii) Bubbles can lead to undesirable real economic fluctuations. Even if a bank crisis as per *(i)* can be avoided, a bubble that bursts may have undesirable real economic consequences. Before the bubble bursts there is a risk of high asset prices leading to over-investment, while a burst bubble may pose the opposite problem. Here, too, the costs are evident from the Japanese experience. In addition, the abrupt shifts in asset prices entail arbitrary redistributions of wealth and impair savers' possibilities of arranging a reliable reallocation of resources over time.

² What constitutes levels that are unreasonable and unsustainable is considered on pp. 121 f.

³ See Daltung (2001).

(iii) *Bubbles can lead to poorer price stability.* A relatively new argument, put forward for example by Kent & Lowe (1997), is that, besides allowing for the role of asset prices in the prospects for inflation, in the formation of monetary policy even a central bank which focuses solely on price stabilisation can have cause to consider bubbles for preventive purposes. The crucial assumption behind this conclusion is that a burst bubble results in a very troublesome situation where the effectiveness of the financial markets and thereby of monetary policy is greatly reduced, making price stability difficult to achieve. Once again, Japan provides an example of a collapse in asset prices leading to a deflationary trend whereby real interest rates have become unduly high even though the central bank has lowered the nominal interest rate virtually to zero. In order to avoid such a situation, the best option may be to tighten monetary policy with a view to preventing a bubble even though a traditional, forecast-based assessment favours a more expansionary policy.

It should be borne in mind that the potential economic hazard from an asset-price bubble depends on the environment in which the bubble develops. Considerable financial instability will be less likely in the absence of a concurrent unbalanced development of credit. The historical record suggests that periods characterised by price stability have had smaller elements of asset bubbles and a greater degree of financial stability.⁴ But there have been notable exceptions and, as we discuss later, the relationship between price stability and financial stability is not entirely straightforward.

PRICE BUBBLES AND FUNDAMENTAL VALUATIONS

In order to make any progress in an analysis of price bubbles it is necessary to define what a price bubble is. That is not a simple matter. At times, moreover, it is pertinent to distinguish between a bubble in a *wide* sense and a bubble in a *narrow* sense (or a *genuine* bubble). In general, a broad definition of a bubble in financial prices is the *difference between the current market price and a fundamental price*. Defined in such general terms, a price bubble can mirror a wide range of phenomena, for example financial noise, an over-reaction to new information or a mistaken assessment of fundamentals, and it can be either positive or negative.

Determining the extent to which an asset is wrongly valued accordingly involves forming an opinion about its fundamental value. A fundamental value of the Swedish stock market, for instance, mainly rests on the long-term future earnings of the listed companies and the market's

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⁴ See Bordo & Wheelock (1998).

required return but in principle it should also include cyclical and monetary policy factors.⁵ There are two reasons for including a cyclical component. One is that it results in a more precise expression of the fundamental value, which may be important when it comes to estimating the degree of any evaluation error. The other is the need to assess the extent to which monetary policy may affect equity prices and thereby possibly counter the development of a bubble. Monetary policy's effect on stock markets has been analysed to just a limited extent and the work that has been done suggests that on average the influence of monetary policy on equity prices is not particularly great (for a review of the literature, see Sellin (2001)).

A CLOSER LOOK AT BUBBLES

The serious pricing errors are those we call a bubble in the narrow sense, where the price is largely disconnected from the fundamental valuation.

For many purposes the discussion above of bubbles in the sense of deviations from fundamental values is too general. As a rule, pricing errors may not be a major cause for concern, at least from the viewpoint of monetary policy, if they represent a relatively brief and – in their context – minor deviation from the fundamental level. The serious pricing errors are those we call a bubble in the narrow sense (a genuine bubble), where the price is largely disconnected from any sort of fundamental valuation and is subject instead to the mechanisms of pyramid games (investors are prepared to buy an asset for a higher and higher price in the hope that the price will go on rising in the period during which they intend to hold the asset).⁶ A closer look reveals that a genuine bubble has the following characteristics:

⁵ In general terms, the price of an asset is given by the expected discounted value of future income. A common simplified assumption in the case of stock markets is that the required return on equity (R) and the growth of dividends (g) are constant, which gives Gordon's valuation: $F(t) = d_t \frac{1+g}{R-g}$, where $F(t)$ is the fundamental value and d_t is the dividend in period t . A more precise expression of the fundamental price is obtained by taking into account that both the required return (which is closely connected with the interest rate) and future dividends are dependent on the business cycle. By specifying monetary policy's impact on interest rates and economic activity (measured as the output gap, for example), it is possible in principle to derive a monetary policy component for the expression for the fundamental value. In practice, however, price valuation models that include a monetary policy component are scarce, though an example is to be found in Boyle & Peterson (1995).

⁶ A price bubble can be defined more formally: suppose that in period t the expected return on equity, R_t , is given by the expected dividend in the next period (d_{t+1}) and the expected capital gain in accordance with $R_t = (d_{t+1}^e + P_{t+1}^e - P_t) / P_t$, where P_t is the stock market price in period t and the superscript e denotes the expected value. Assume for simplicity that the required return is constant ($R_t = R$) and solve for the price: $P_t = (d_{t+1}^e + P_{t+1}^e) / (1+R)$ (i). Substituting the corresponding expressions for future prices k times in (i) gives $P_t = F(t,k) + B(t,k)$ (ii), where the price equals the sum of the expected discounted dividends in the following $k+1$ periods, $F(t,k) = \sum_{n=0}^{k+1} d_{t+n}^e / (1+R)^n$, plus the expected discounted price in period $t+k+1$, $B(t,k) = E_t \left[P_{t+k+1} \right] / (1+R)^{k+1}$. Introducing the condition that the "bubble term" $B(t,k)$ approaches zero as k approaches infinity gives the fundamental solution as the discounted sum of all expected future dividends. Non-fundamental solutions accordingly correspond to solutions where the "bubble" $B(t,k)$ does not approach zero as k approaches infinity.

For as long as a bubble continues without bursting, via a rapid increase in value it provides a return that exceeds the return on a fundamentally valued asset. This implies that after a time the bubble will be the dominant component of the price.

Intuitively it can be said that, notwithstanding the risk of it bursting, a bubble is sustained because it provides an excess return for as long as it does not burst. The above characteristics also imply that for certain types of asset, bubbles are unlikely to form. In general, the following principle holds:

Bubbles do not occur for assets that have a natural upper price limit and/or a limited duration.

The reason why assets with a limited duration ought to be immune to bubbles is that, according to the above characteristics, a bubble would give the asset a value that exceeds the final amount due to the holder, which is not possible. Bonds are an important class of assets for which bubbles, according to this principle, do not occur. It also seems reasonable that bubbles occur most readily when a fundamental valuation is complex, as is the case, for example, with equity, in that future earnings and dividends are difficult to predict. On the other hand, there have been instances of price bubbles for residential property even though a fundamental valuation here is not as difficult.

It seems reasonable that bubbles occur most readily when a fundamental valuation is complex, as is the case, for example, with equity.

Why do bubbles occur?

RATIONAL BUBBLES

The mechanisms behind the formation of a price bubble need to be understood in order to arrive at a better picture of the part that monetary policy may play in this process. This is not a simple matter but we can start by noting that for the individual, it may not be irrational to invest in an asset with a price bubble. In the so-called rational bubble constructed by Blanchard & Watson (1982), people are prepared to invest even though they correctly perceive a risk of the bubble bursting, the reason being that the return is sufficiently large as long as the bubble does not burst.⁷ Neither does a rational bubble necessarily indicate a complete disconnection from fundamental factors; it can occur because the price overreacts to

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⁷ Blanchard & Watson assume that the price bubble, B_t , develops in accordance with

$$B_{t+1} = \left\{ \begin{array}{ll} \frac{(1+R)}{q} B_t + e_{t+1} & \text{with probability } q \\ e_{t+1} & \text{with probability } 1-q \end{array} \right\}$$

It is readily seen that the expected return is R if the random term e has a zero mean. Given that the bubble does not burst, the return, $(1+R)/q$, exceeds R by just enough to compensate for the risk of the bubble bursting.

fundamental factors.⁸ The observation that for the individual it can often be rational to invest in price bubbles implies that the self-regulating market forces which should normally prevent bubbles from occurring are largely absent.

MARKET IMPERFECTIONS AND PSYCHOLOGICAL FACTORS

A question that presents itself is whether price bubbles are a consequence of shortcomings in the functioning of financial markets.

While it may be rational for an individual player to invest in an existing bubble, there is still the problem of how a bubble begins (see e.g. Diba & Grossman (1988)). A question that presents itself is whether price bubbles are a consequence of shortcomings in the functioning of financial markets. Allen & Gale (2000) have shown, for instance, that loan-financed (rational) investors willingly invest in assets for which prices are higher than they would be if everyone only invested their own capital. In this way and provided the creditors are ignorant of how the borrowed funds are being invested, rational investors can push the price up. As the loan-financed investors carry just a minor share of any loss, while their return may be very high if the investment does well, their situation can be said to resemble the purchase of a call option. Drawing on option theory, this also means that the more uncertain the return, the more they will be prepared to pay for an asset.⁹

There seems to be a herd mentality among investors that can contribute to asset price deviations from fundamental values.

The analysis in Allen & Gale (2000) demonstrates a market imperfection of principle importance. Asset market players make investment decisions on the understanding that the costs of a poor decision will be shared with others. A portfolio manager may be inclined to invest in potential bubble assets on account of the bonuses that may accrue if the investment does well (the bubble continues), while the costs of a poor outcome (the bubble bursts) will be carried to a large extent by others. Psychological factors probably reinforce this mechanism. Discontent over a bad portfolio choice when the asset bubble bursts is mitigated by many others being in the same position. A manager who bases the portfolio on a more fundamental valuation of asset prices will perform less well than the majority of colleagues as long as the bubble continues and the impression of a lone loser may be difficult to bear even if the strategy does generate a better return in the longer run. There seems to be a herd mentality among

⁸ See Froot & Obstfeld (1991), who introduce what they call an "intrinsic bubble" (because it is determined as a (non-linear) function of fundamental determinants of the asset price, whereas an ordinary bubble is given exogenously). In this case the deviations from the fundamental value can be related to fundamentals but the relationship between the price and fundamental factors leads to an unduly rapid increase in value.

⁹ Negative bubbles are also conceivable according to Allen & Gale (2000). A steep fall in asset prices (e.g. because a positive bubble bursts) may force banks to realise assets and thereby trigger a further price fall; such a situation with insufficiently liquid markets can give rise to a negative price bubble.

investors that can contribute to asset price deviations from fundamental values.¹⁰ The new line of economic research — Behavioural Finance — that has been developed in recent years, for example with the aid of experimental psychology, aims to understand the mechanisms described here and why financial price formation sometimes deviates from fundamental values.¹¹

EMPIRICAL ANALYSIS OF BUBBLES AND MACROECONOMIC IMBALANCES¹²

Another approach to asset bubbles involves extending the analysis to include other macroeconomic imbalances. This also makes it easier to assess whether a future correction of asset prices may give rise to other problems, such as a threat to financial stability. A possible bubble that develops in the absence of other imbalances implies not only that the costs of it bursting will be more limited but also that it is actually not a bubble. In an analysis based on indicators,¹³ Borio & Lowe (2002) demonstrate that financial crises are frequently preceded by a combination of price bubbles and indications of other imbalances (in credit and investment). The historical survey that follows shows that bubbles tend to arise in connection with an undue expansion of credit that then accentuates the threat to financial stability. According to Bordo & Wheelock (1998), a lack of price stability has often contributed to an exaggerated development of asset prices and ultimately to a financial crisis. In the historical analysis in the next section, however, there are instances of price bubbles and financial instability occurring notwithstanding price stability; this has fuelled some criticism of an unduly restricted implementation of price stability policy. Thus, for example, Cecchetti, Genberg, Lipsky & Wadhvani (2000) point out that a comparatively tight monetary policy to counter a nascent price bubble can sometimes be justified even though it is not indi-

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¹⁰ For an instructive survey of how herd behaviour affects price formation in financial markets, see Ericsson (1995); see also Chapter 10 in Shiller (2001).

¹¹ For an introduction to behavioural finance, see Fromlet (2001). See also Barberis & Thaler (2002).

¹² For reasons of space we refrain from a closer discussion of how the occurrence of price bubbles can be tested and identified with statistical methods but can mention some contributions to this field. For direct tests of specific bubble models, see Flood & Garber (1980), Flood, Garber & Scott (1984) and Nydahl & Sellin (1999). West (1987) proposed the use of an indirect specification test for determining the occurrence of bubbles. An alternative approach (initiated by Hamilton & Whiteman (1985) and Diba & Grossman (1988)) involves testing whether prices and fundamental variables (primarily dividends) show a similar trend, which should be the case in the absence of price bubbles. Evans (1991) showed that the most common types of statistical test could not detect periodically collapsing bubbles; the trend test has recently been developed so as to be capable of detecting this type of price bubble (see e.g. Hall, Psaradakis & Sola (1999) and Psaradakis, Sola & Spagnolo (2001)).

¹³ The analysis, developed from a method presented by Kaminsky & Reinhart (1999), shows that when indicators of macroeconomic imbalances exceed certain thresholds, this often predicts future financial crises.

cated by inflation prospects. In any event, the interaction between different types of macroeconomic imbalances in the light of the rapid development of financial markets is an important field for future research.

Historical experience

THE 1929 STOCK MARKET CRASH – A BURST BUBBLE OR MISTAKEN MONETARY POLICY?

The issue of whether the US stock market crash in 1929 was the result of a speculative bubble is still being debated

An issue that is still being debated is whether the US stock market crash in 1929 was the result of a speculative bubble that the Federal Reserve deliberately burst rather than being due to an unnecessarily restrictive monetary policy that countered a sound development of equity prices motivated by fundamentals. According to Galbraith (1954), it was a bubble that burst. Shiller (2001) is more tentative but considers that over-reactions to fundamentals led to an over-valued stock market. Fisher (1930), on the other hand, claims that the stock market was presumably undervalued even before the crash in autumn 1929! In a recent analysis, McGrattan & Prescott (2001) concluded that Fisher was right. While it is difficult to tell which assessment is correct, the 1929 crash and the subsequent depression do prompt three interesting observations on the role of monetary policy:

(i) Monetary policy was crucial for the stock market's development

There is a relatively broad consensus that US monetary policy was crucial for the stock market crash of 1929, though opinions differ as to whether this was appropriate. The 1929 crash is therefore an important illustration of an appreciable stock market effect from monetary policy. It is also clear that the Federal Reserve explicitly intended to counter a speculative bubble.

(ii) It is hard for a central bank to avoid criticism even when it acts correctly

The debate about how the Federal Reserve acted in connection with the 1929 crash shows that criticism is hard to avoid for a central bank that actively tries to counter a bubble because there is always a wide range of conceivable interpretations. The equity price fall that a successful intervention entails is perceived by many shareholders as an appreciable and unnecessary cost, while the gain inherent in preventing a considerably

more dramatic fall is less tangible. It may also be the case that the earlier and more effectively a central bank acts, the harder it will be to demonstrate that a serious bubble was forming.

(iii) Shortcomings in monetary policy after the crash

The Federal Reserve's initial reaction to the 1929 crash was to lower the interest rate and maintain the money supply. But this line was abandoned relatively soon and policy was tightened to meet the requirements of the gold standard. This is considered to have contributed to problems in the bank sector in particular, thereby exacerbating the depression in the 1930s.¹⁴

THE 1987 STOCK MARKET CRASH

Although the equity price fall on 19 October 1987 was the largest to date for a single trading day, the aftermath was just a brief parenthesis: the US stock market had fully recovered two years later. Still, some observations can be made:

(i) Computerised trading may have contributed

There is no generally accepted explanation for why the stock market fell so dramatically in October 1987. The speedy recovery and the favourable trend that followed make it less likely that the fall represented a correction to more fundamentally motivated levels. It has been suggested instead that computerised trading triggered numerous signals to sell and thereby greatly accentuated what had initially been a relatively limited downward tendency. Although this theory has not been confirmed, the events of 1987 did elicit restrictions on computerised trading.

(ii) Vigorous reaction by the Fed

The resolute action by the US Federal Reserve, with interest rate cuts and commitments to provide liquidity, is considered by many to have been the main reason why the harmful effects of the 1987 crash could be limited. The Fed had learned from the 1930s' depression and there was a greater awareness of the financial system's vulnerability when asset prices fall dra-

¹⁴ See e.g. Feldstein (1991).

matically. It is even conceivable that the Fed was too successful in the sense that the stock market's prompt recovery may have encouraged undue optimism about the excellence of equity investment in general and its capacity to recover in particular. The speedy recovery may also have benefited from a favourable macroeconomic situation with strong export demand.

THE ASIA CRISIS

The Asia crisis seems to confirm that an exaggerated price trend is liable to follow a period of strong economic development and credit growth.

The financial collapse that hit the so-called Asian tiger economies in 1997 led to a serious setback in economic growth. While over-valued asset prices as a result of a credit boom clearly contributed here, other factors were also important.¹⁵ The combination of fixed exchange rates, relatively low interest rates elsewhere and implicit government guarantees had generated a massive inflow of foreign capital that turned into a large outflow when the crisis occurred. Radelet & Sachs (1998) characterise this as financial panic on the part of investors and, later, governments rather than the result of a burst price bubble. Corsetti, Pesenti & Roubini (1998) point instead to the relationship between the poor macroeconomic situation and the extent to which the crisis hit different countries. The part that a conceivable asset price bubble may have played during the crisis is difficult to identify but even the Asia crisis seems to confirm that an exaggerated price trend is liable to follow a period of strong economic development and credit growth. An unusual feature of the Asia crisis is the direct stock market interventions in Hong Kong. When capital outflows threatened to lower the Hong Kong exchange, the Hong Kong Monetary Authority supported the market by purchasing equity. In the period 14–28 August 1998 the Authority's purchases totalled HK\$ 118 billion (one fifth of Exchange Funds' total assets) and succeeded in stabilising the market.

THE JAPANESE BUBBLE

A favourable economic trend led to excessive optimism whereby demand for assets was over-stimulated and their prices rose sharply.

The strong upward trend in Japanese asset prices in the second half of the 1980s and the subsequent fall in the early 1990s is perhaps the clearest and most important example of an asset bubble. A variety of circumstances appear to have contributed to the formation of the bubble. For one thing, fundamental factors in the early 1980s pointed to a rising stock market. In the decade 1984–94, which included a burst bubble, the

¹⁵ An extensive bibliography on the Asia crisis will be found at Nouriel Roubini's website (www.pages.stern.nyu.edu/globalmacro).

Nikkei index did in fact double its level.¹⁶ The strength of the Japanese economy was then confirmed by its performance in the 1980s, which justified a good deal of the initial equity price rise. Okina, Shirakawa & Shiratsuka (2001) consider that this performance led in time to excessive optimism and that this, together with an over-stimulation of asset demand, meant that asset prices rose sharply.

Okina et al. also consider that the strong asset price rise was fuelled by an unduly expansionary monetary policy in the second half of the 1980s. In their opinion, this policy was due to a variety of circumstances. From autumn 1985 monetary policy had been characterised by a lowering of the instrumental rate that brought this down to 2.5 per cent in February 1987 in accordance with guidelines adopted at a number of meetings on international policy coordination.¹⁷ The aim was to stimulate domestic demand as a way of boosting import demand and thereby creating more balanced foreign trade. One purpose of the policy coordination was to stabilise exchange rate fluctuations between the leading currencies.

In the spring and summer of 1987 the Bank of Japan (BOJ) began to express concern about the expansionary monetary conditions; market expectations derived from the yield curve started to count on interest rate hikes. The tighter tendency was international, with interest rate increases in the USA and Germany. The stock market crash on 19 October 1987 then put an end to the planned realignment and BOJ again chose to participate in a coordination of policy and its line remained expansionary. It should be noted that the fall in the Japanese stock market in autumn 1987 was modest as well as brief and it was accompanied by an acceleration of economic growth. It is therefore conceivable that, via its effects on Japanese monetary policy, the 1987 stock market crash did tend to fuel the Japanese asset bubble. It was not until mid 1989, when a new central bank governor had been appointed, that a tightening of Japanese monetary policy was initiated but by that time the asset bubble was approaching its maximum. It is not clear to what extent this late tightening contributed to the bursting of the bubble at the beginning of the 1990s but the fact that asset prices also fell in this period in other parts of the world (including Sweden) suggests that international factors were involved as well.

The strong asset price rise was fuelled by an unduly expansionary monetary policy in the second half of the 1980s.

It is conceivable that, via its effects on Japanese monetary policy, the 1987 stock market crash did tend to fuel the Japanese asset bubble.

¹⁶ The Nikkei index was around 10,000 in 1984 and then climbed to a high of almost 40,000 around the turn of 1989. The bubble burst soon after that and in the following years the index dropped to about 20,000; there has been a further decline since then.

¹⁷ Mainly the Plaza Agreement in September 1985 and the Louvre Accord in February 1997.

A marked tightening of monetary policy at the beginning of 1988 might have prevented or at least subdued the Japanese asset bubble.

As to whether a more restrictive monetary policy could have prevented the Japanese asset bubble, Okina et al. consider that this would have been difficult *in practice* given the problem of determining fundamental asset values, plus the fact that inflation was low while the bubble was developing. In a simulation, however, Bernanke & Gertler (1999) show that a normal pattern of monetary policy reactions¹⁸ would have given a marked tightening at the beginning of 1988 that might have prevented or at least subdued the Japanese asset bubble. It has also been suggested that a more explicitly directed Japanese policy for price stabilisation – for example inflation targeting, possibly preceded by a temporary fixed exchange rate regime (at a weak yen rate) – could have helped to counter the deflationary tendency that has characterised the Japanese economy in recent years.¹⁹

A point to note is that the burst bubble proved very costly in terms of an extensive bank crisis and a weak real economy.

Finally it can be noted that the burst bubble proved very costly in terms of an extensive bank crisis and a weak real economy. Chirinko & Schaller (2001) find that the high asset prices led to considerable over-investment, which entailed large costs in the form of unutilised or under-utilised capital stocks. Moreover, falling consumer prices make it difficult to obtain the low (presumably negative) real interest rates that are needed to stimulate the Japanese economy. Okina et al. conclude that monetary policy should adopt a more preventive approach to the risk of bubbles.

THE IT BUBBLE

The notion of a new economy that was put forward to explain the rising stock market in the latter 1990s is a traditional phenomenon.

In the past century there have been numerous sharp ups and downs on stock markets in the United States as well as elsewhere.²⁰ Shiller (2001) notes that episodes with rapidly rising stock markets in the United States have been characterised by talk of a “new era”: strong equity price increases are motivated by some new and favourable development in the economy. Thus, the notion of a new economy that was put forward to explain the rising stock market in the latter 1990s is a traditional phenomenon.

It is mainly in the latter 1990s that there are indications of a possible IT bubble.

Equity prices rose very markedly in the United States during the last two decades of the twentieth century but it is mainly in the latter 1990s that there are indications of a possible IT bubble. From January 1998 to February 2000 the increase in the broad Standard & Poor 500 index

¹⁸ A normal pattern refers to the interest rate rule that Bernanke & Gertler (1999) estimated for BOJ.

¹⁹ See e.g. Svensson (2001).

²⁰ For a survey of dramatic ups and downs on stock markets outside the United States, see Chapter 6 in Shiller (2001).

amounted to 50 per cent as against as much as 206 per cent for the technology dominated Nasdaq index, while a more specifically internet index (see Ofek & Richardson (2001)) shot up almost 1,000 per cent.

Hobijn & Jovanovic (2000) argue that the notion of a bubble is not needed to account for the stock market trend. They present a model that explains the development of equity prices in connection with the introduction of a new, revolutionary technology. According to this model, in the 1970s the value of listed equity was depressed by expectations of large costs for investment in new IT technology. The rising stock market in the 1980s and 1990s mainly stems, entirely in accordance with the model, from newly listed companies that had developed and/or benefited from the new technology.

The dramatic increase in equity prices was followed by an even more dramatic fall, which runs counter to the analysis by Hobijn & Jovanovic. The value of the internet index was halved during March 2000 and was then halved again in the following twelve months. In this period (March 2000 – March 2001) the Nasdaq index fell 59 per cent and the S&P 500 index by a more modest 18 per cent.

The dramatic increase in equity prices was followed by an even more dramatic fall.

A number of studies since 2000 have assumed that what needs to be accounted for is a price bubble. The resultant explanation focuses on the limited possibility of selling short²¹ the equity in new IT companies (Ofek & Richardson (2000, 2001), Lamont & Thaler (2001), Duffie, Gârleanu & Pedersen (2002) and Cochrane (2002)).

According to Ofek & Richardson (2000, 2001), investors were certainly active in the market and sold internet equity short to a greater extent than other equity; but because the possibility of selling short was limited, the IT bubble was still able to survive for longer. The introduction of a company is followed by a period (usually six months) during which the original shareholders may not dispose of their holdings. Many new internet companies were introduced in 1998–99 and Ofek & Richardson present data which show that a large proportion of this equity capital was released for sale around the turn of 1999. This may have made an important contribution to the IT bubble's collapse early in 2000. Cochrane (2002) takes the analysis a step further with the argument that IT equity attracted a liquidity premium similar to what a holder of money has in relation to short treasury paper. When liquidity rose dramatically at the beginning of 2000, the liquidity premium and equity prices fell.

²¹ Selling short involves borrowing equity and selling it; when the time comes to return the borrowed equity, it has to be bought back, hopefully for less than it was sold for.

It seems clear that the Federal Reserve was highly aware of the risk of an asset price bubble.

It is still too early to draw monetary policy conclusions from the IT bubble; perhaps tentative conclusions will be possible in a couple of years' time, when the repercussions of the burst bubble have subsided. But it does seem clear that the Federal Reserve was highly aware of the risk of an asset price bubble. It is not evident, however, that this had any notable influence on monetary policy before the bubble burst. Still, monetary policy was given a more expansionary direction during 2001 and this was partly motivated by the intention of countering problems with financial stability.²²

The developments in the United States have highlighted a problem that price stability sometimes entails. Borio & Lowe (2002) point out that high productivity growth, which tends to dampen inflation, can simultaneously fuel an exaggerated optimism and rapidly rising asset prices.²³ They also note that a credible price stability policy which promotes a balanced development of wages and prices may mean that a general increase in demand shows up first in profits and asset prices, with the risk of this developing into a hotbed for price bubbles and financial imbalances.

REAL ESTATE PRICES IN SWEDEN IN THE LATE 1980s

Price bubbles can arise, however, even for non-equity assets.

The survey above refers mainly to stock market bubbles but price bubbles can also arise for other kinds of asset. The development of real estate prices in Sweden in the late 1980s is sometimes cited as an example of a bubble and one, moreover, that may have accentuated the bank crisis in the early 1990s. But was this a bubble? Lind (1998) considers that a bubble developed in the real estate market; Björklund & Söderberg (1999) argue that property prices were partly driven by a speculative bubble. Englund (1998) judges that the fluctuations in house prices can be attributed mainly to fundamental factors, an assessment for which there is support in Hort (1997).²⁴ The strong house price trend in the 1980s was supported by the combination of high inflation, tax relief, a favourable development of income and, to some extent, the credit market's deregulation. When a tax reform in the early 1990s then coincided with a down-

²² This is evident in the first place from the motivations that accompanied the Federal Reserve's interest rate cuts shortly after the terrorist attacks on 11 September 2001; see Monetary policy report submitted to the Congress on February 27, 2002, on <http://www.federalreserve.gov/boarddocs/hh/2002/February/ReportSection1.htm>.

²³ It seems to be taken for granted that higher potential growth is associated with higher asset prices, particularly for equity, via higher future dividends. This is not self-evident in theory because higher growth also tends to raise the general level of interest rates and that dampens asset prices.

²⁴ Note that Lind (1998) appears to use a broad definition of a price bubble that includes every form of deviation from fundamental values.

ward shift in inflation, property prices also fell markedly. But there were elements of non-fundamental price formation and Englund (1998) considers that a price bubble probably developed for commercial properties. Although the extent to which the property price fall can be attributed to a collapsing price bubble is not clear, the price fall did exacerbate the Swedish bank crisis in the early 1990s. Other factors were probably more important, for example the rapid growth of credit after the deregulation in 1985 and the expansionary economic policy.²⁵

WHAT DOES THE HISTORICAL SURVEY SAY ABOUT WHY PRICE BUBBLES OCCUR?

Neither is it all that easy to draw any general conclusions from the above survey, though certain observations can be made. (i) Bubbles tend to form if asset prices are unusually strong for some time. (ii) Much of the strong trend often stems from fundamental factors and even after a price correction, the level of asset prices may be considerably higher than before their prices took off. The problem seems to be that the favourable economic trend is over-interpreted and this establishes an exaggerated notion of “a new era”. (iii) The excessive increase in asset prices often appears to be promoted by credit growth and/or an expansionary economic policy. Voth (2000) argues that an unduly expansionary monetary policy fanned a price bubble both in the United States in the 1920s and in Japan and Sweden in the late 1980s. (iv) Although the historical record suggests that price stability reduces the risk of asset bubbles and financial instability, this does not guarantee an absence of financial market imbalances. Developments in the US economy in the latter 1990s are conceivably an example of this. But it should also be noted that asset bubbles have occurred mainly in regimes with no explicit objective for price stability. (v) Monetary policy's role when price bubbles have burst is not clear. It seems reasonable to suppose that monetary policy tightening contributed to the bursting of the Japanese asset price bubble and the Swedish price bubble for commercial property in the early 1990s. On the other hand, the bursting of the IT bubble appears to have been mainly due to the IT companies' inability to match the expected earnings that lay behind the high equity prices.

Monetary policy's role when price bubbles have burst is not clear.

²⁵ For an account of the causes of the Swedish bank crisis, see Englund (1999).

Monetary policy and bubbles

The issue of monetary policy's approach to asset bubbles has generated two points of view: the reactive strategy and the preventive strategy.

The relationship between monetary policy and price bubbles should be considered as an integral part of monetary policy's general approach to asset prices.²⁶ In the first place there are reasons of principle for including asset prices in the price index the central bank adopts as its target variable (see e.g. Alchian & Klein (1973) and Bryan, Cecchetti & O'Sullivan (2002)); however, such an arrangement is seldom advocated in practice because asset prices are more volatile and thereby harder to control than other prices.²⁷ Then there is the fact that asset prices can be important indicators of market expectations of future inflation and monetary policy, besides playing a notable role in the transmission mechanism. So there are a number of reasons for a central bank to monitor and analyse asset market developments. As to the more specific issue of monetary policy's approach to asset bubbles, it can be said with some simplification that there are two main points of view: (a) the *reactive* strategy and (b) the *preventive* strategy.

THE REACTIVE STRATEGY

A reactive strategy means that monetary policy does not attempt to counter the occurrence of a bubble but reacts when the bubble has burst.

Simplifying somewhat, the reactive strategy can be summarised in the principle that in the normal case asset prices shall influence monetary policy only in so far as they affect the outlook for inflation. It is only when a bubble has burst that an additional reaction from interest rate policy may be motivated by concern for financial stability. A reactive strategy means that monetary policy does not attempt to counter the occurrence of a bubble but reacts when the bubble has burst. This has been the dominant view to date in the central bank world. In work from the Riksbank we find that Ekdahl, Eriksson & Marlor (1998) conclude that a central bank shall not use monetary policy measures to burst a bubble preventively. However, in certain cases Heikensten (2001) can — in principle — consider using monetary policy preventively even though the inflation target is not threatened. It should be stressed that even a reactive monetary policy is naturally influenced by the occurrence of a price bubble. The risk of a sizeable asset price correction has often featured prominently in the Inflation Report in the risk assessment that, together with the inflation forecast, guides monetary policy. The usual arguments for a reactive monetary policy are:

²⁶ For a general discussion of the economic role of asset prices, see e.g. Berg & Galvenius (1994).

²⁷ The pros and cons of including asset prices when measuring inflation are analysed in Goodhart (2001).

(i) A central bank is not better than the market at determining the stock market's fundamental value, so there is no basis for a monetary policy reaction that aims to correct the market.

(ii) A central bank with price stability as its overriding objective (except in situations where financial stability is clearly threatened) will have difficulty in motivating a departure from a monetary policy traditionally based on forecasting inflation.

(iii) There is considerable uncertainty about the monetary policy reaction that would be needed to prevent a bubble from occurring.

A reactive monetary policy is also advocated by some prominent scholars. On the basis of simulations, Bernanke & Gertler (2001) argue for a relatively strict inflation-targeting policy with no explicit allowance for the size of an exogenous bubble.²⁸ Using much the same model, Cecchetti, Genberg, Lipsky & Wadhvani (2000) come to a somewhat different conclusion that explicitly allows for the bubble's size. An important reason behind this difference of opinion is that whereas Cecchetti et al. assume a fixed path for the bubble, Bernanke & Gertler let it develop stochastically, which seems more realistic. The fact that in the simulations presented by Cecchetti et al. the central bank knows when the bubble will burst enhances the effectiveness of a preventive monetary policy.

A PREVENTIVE STRATEGY

A preventive strategy means that, in addition to their influence on inflation prospects, asset prices (and price bubbles in particular) are explicitly taken into account with a view to preventing or countering the development of a price bubble. The leading advocates of such a strategy in recent years are Cecchetti, Genberg, Lipsky & Wadhvani (2000), who respond as follows to arguments (i)–(iii) above:²⁹

(i) *Fundamental stock market valuations are feasible.* Such a valuation is certainly difficult but not necessarily harder than the assessment of other central variables such as potential output. Moreover, a rough guide to the fundamental value can be obtained with established models (e.g. Gordon's model, see footnote 5 on p. 122).

A preventive strategy means that, in addition to their influence on inflation prospects, asset prices are explicitly taken into account with a view to preventing a price bubble from occurring.

²⁸ The bubble is allowed for implicitly in so far as it affects the inflation forecast.

²⁹ A similar argument for a preventive monetary policy strategy is put forward in Borio & Lowe (2001).

(ii) A central bank that focuses entirely on price stability should try to prevent a price bubble from arising even at the expense of poorer goal fulfilment in the short run. The basic notion here is that if a bubble becomes so large that the financial system collapses when the bubble bursts, the functioning of the financial markets changes so much that it may become hard for the central bank to control inflation.³⁰ It has proved difficult, for example, to counter the Japanese economy's deflationary tendencies in recent years with monetary stimuli. To prevent such a situation from arising there may be a case for tightening monetary policy even though that would result in forecast inflation being below the target for the normal horizon.

(iii) Allowing explicitly for asset prices makes a bubble less probable. The point here is that a tight monetary policy which works against excessive market optimism could counter the development of a price bubble.³¹ This seems to be the most critical argument put forward by Cecchetti et al. and they do not really either prove or support it. It is worth noting that the simulations they use in the analysis are based on a path for the bubble that is given exogenously, which means that it cannot be influenced by monetary policy. This may be correct but research does not have much to say about that at present.

Dupor (2002) likewise argues for an explicit allowance for asset prices in the formation of monetary policy. In a micro-based model that includes investment, Dupor shows that welfare gains are to be had by stabilising asset prices in addition to inflation and output. Note, however, that in this model, deviations from fundamental asset values stem from temporary shocks in investment behaviour; this is not what is normally meant by a price bubble, which often builds up over a number of years.

It should be underscored that in practice a preventive monetary policy will not necessarily differ from a reactive strategy because they both react to asset price movements. What distinguishes them is the preventive strategy's stronger reaction to asset prices in order to stop a bubble from occurring. Good policy communication by the central bank is probably important. An interest-hiking policy that is not motivated by referring to a disturbing development of asset prices might be perceived as confirmation of the economy's capacity to generate profits and thereby be counterproductive. Another strategy could be for the central bank to adhere to a reactive policy while raising its profile in the analysis of asset prices. In

In practice a preventive monetary policy will not necessarily differ from a reactive strategy because they both react to asset price movements.

³⁰ A formal presentation of this argument is given in Kent & Lowe (1997).

³¹ Cecchetti et al. clearly state that they do *not* propose that the central bank should either try to burst an existing bubble or aim for a particular level of asset prices.

itself, such an analysis could be a suitable counterweight to excessive optimism about future asset prices and thereby deter the occurrence of price bubbles.

To sum up, in our opinion it is not the difficulties in identifying a bubble that make it less advisable to implement a monetary policy which aims to counter the occurrence of an asset bubble. A number of useful models and indicators are available to elucidate whether a serious bubble is building up. For a central bank with price stability as monetary policy's overriding objective there are good reasons for preventing a price bubble if it can. The problems connected with sharply falling asset prices probably create difficulties for price stability policy in the longer run. The main argument against a monetary policy that to a high degree aims to counter the formation of bubbles is our present inadequate knowledge of the relationship between monetary policy actions and price bubbles.

The main argument against a monetary policy that aims to counter the formation of bubbles is the present inadequate state of the art.

Summary conclusions

There may be a number of reasons for taking asset bubbles into account in the formation of monetary policy. A burst bubble can lead to a situation where financial stability is threatened at the same time as price stability is hard to maintain. Moreover, marked fluctuations in asset prices can lead to undesirable shifts in real economic activity and, not least, to suboptimal investment decisions. In that asset bubbles impair the workings of both the real and the financial economy, there are reasons for trying to prevent them from arising.

In that asset bubbles impair the workings of both the real and the financial economy, there are reasons for trying to prevent them from arising.

In practice it appears to be hard, though not necessarily impossible, for monetary policy to prevent a bubble from occurring. One problem is the difficulty in telling whether a bubble is actually on the way. During its initial phase, however, a bubble needs to generate a substantial excess return if it is to have a chance of surviving; this observation can be used to decide whether it actually is a bubble. Moreover, there are a number of valuation models that can be used to judge the extent to which an asset's current value deviates from the fundamental level and various methods have been developed for identifying bubbles. These methods tend not to tell us much about the economic factors that may underlie a bubble. An assessment of whether a bubble is forming and the consequences this would have should be integrated in a broader analytic frame that also includes other types of macroeconomic imbalances, for example excessive credit growth.

In practice it appears to be hard, though not necessarily impossible, for monetary policy to prevent a bubble from occurring.

A bigger problem is understanding why bubbles arise and whether monetary policy can influence their development.

Understanding why bubbles arise and whether monetary policy can influence their development is presumably more of a problem. The literature to do with so-called rational bubbles shows that for the individual it is often rational to invest in bubble assets even when it is not entirely clear why the bubble arose in the first place. An important factor here is probably certain market imperfections whereby the investor can avoid carrying the entire cost if the bubble bursts. There may be a herd mentality in the market that strengthens the tendency for a bubble to form. There is therefore every reason to draw on the insights which are being generated in the line of research known as *Behavioural Finance*. It is a problem, however, that monetary policy's ability to influence a price bubble still seems to be a rather unexplored field.

In practice the risk of bubbles seems to be greatest when the value of assets has risen unusually strongly for some time.

In practice the risk of bubbles seems to be greatest when the value of assets has risen unusually strongly for some time because this paves the way for an optimistic belief that the historical trend will continue even though fundamentals indicate otherwise. It is not unusual for a part of the favourable increase in value to mirror fundamental factors, such as a strong potential growth rate initially and an expansionary economic policy. An example of this is the development of asset prices in Japan in the 1980s. The Japanese experience illustrates the risks of an unduly expansionary monetary policy and it seems reasonable to conclude, at least with hindsight, that this policy ought to have focused more than it did on countering the development of asset bubbles. On the other hand, experience from the 1929 stock market crash shows that a policy focused on bursting a bubble may be hazardous. A debate is still in progress on whether there really was a stock market bubble in 1929 and whether US monetary policy led unnecessarily to an asset price fall that contributed in turn to the 1930s' depression. But there does seem to be some consensus about US monetary policy being too tight for a time after the 1929 crash. The resolute action of the Federal Reserve after the stock market crash in 1987 is usually cited as an example of what ought to be done. The Federal Reserve also acted resolutely after the so-called IT bubble burst but it is still too early to draw any far-reaching conclusions about this.

It is conceivable that pointing to asset market imbalances and the associated dangers would diminish the risk of a price bubble actually forming.

The diversity of experiences of monetary policy action in connection with stock market crashes is also mirrored in the current debate. There are two main points of view on monetary policy's approach to asset bubbles: (a) the *reactive* strategy, which means that monetary policy is normally to be guided by inflation prospects without taking the possibility of a bubble explicitly into account – a departure from this principle is warranted only when a bubble bursts and financial stability is threatened; and (b) the *preventive* strategy, which means that in addition to their impact on inflation prospects, asset prices are considered explicitly with a view to preventing

or countering the development of a price bubble. Our tentative conclusion is that the present lack of knowledge about how monetary policy could actually counter a price bubble argues against a monetary policy strategy that is markedly preventive. It is also the case that the Swedish stock market often follows an international trend that Swedish monetary policy is hardly in a position to influence. From this perspective it seems at least as important to follow the Swedish real estate market, which is probably more closely related to Swedish economic policy. Finally, however, it may still be prudent to follow and analyse the development of asset prices more closely and thereby raise the Riksbank's profile in this respect. It is conceivable that pointing to asset market imbalances (including tendencies to bubbles) and the associated dangers would diminish the risk of a price bubble actually forming.

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