How to determine fundamental asset prices for the purpose of monetary policy?

Michael Holz

In order to fight asset prices bubbles we have to improve our understanding how to determine “fair” values of stocks and residential real estate (house prices). An empirical approach - based on Tobin’s Q theory - is presented, which identifies long-run stable relationships between asset prices and their underlying fundamentals. House prices have to be in line with rents, construction costs, and (mortgage) interest rates; stock prices should correspond to firms’ earnings, the prices of investment goods, and financing costs. Based on these calculations of fundamental values, robust indicators delivering early warning signals for asset price bubbles are designed. Signals are generated in due time and therefore enable central banks to deliberate appropriate “cures” for the “bubble disease”, long before it turns into an epidemic.

Keywords: asset price bubbles, early warning signals, Tobin’s Q

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1. The current housing and banking crisis and its predecessors

“The global financial system has undergone a period of unprecedented turmoil. Market confidence dwindled and has remained fragile, leading to the collapse or near-collapse of large, and in some cases systemically important, financial institutions, and calling forth public intervention in the financial system on a scale not seen for decades. [...] In response, more comprehensive approaches are now being considered or implemented to bring about a more orderly process of deleveraging and to break the adverse feedback loop between the financial system and the global economy. Such a comprehensive approach - if well coordinated among countries - should be sufficient to restore confidence and the proper functioning of markets and avert a more protracted downturn in the global economy.” (IMF 2008a: 1)

With these drastic words the IMF introduces its October 2008 Global Financial Stability Report. What has begun in summer 2007 as a problem in the US housing market segment for subprime loans, then spilled over to Europe via asset-backed securities, by now seems to have infected the global financial and banking system. Like a “déjà-vu”, the current situation resembles very much the Scandinavian house price bubble and banking crisis in the early 1990s, but unfortunately on a global scale affecting the whole western hemisphere. In terms of cumulative welfare losses (loss in real GDP growth) for the societies of Finland, Sweden, and Norway it matched the Great Depression of the 1930s. The preceding boom was fostered by financial deregulation in all three countries (Jonung 2007; Drees and Pazarbasioglu 1998). By 1993, most big banks in Scandinavia had been nationalized by their respective governments, a process now under way in the United Kingdom, the United States, and many EMU countries. Eventually further countries might follow in assuming full ownership of tumbling banks. Haven’t there been any warning signals or even immense “signs on the wall”, which could have urged policymakers in central banks, finance ministries, and regulatory authorities to deliberate preemptive efforts to stop this propagation process?

Newer theories of the monetary transmission mechanism highlight the role of asset prices as a dominant link between monetary policy and its real economic effects. Recurrent financial crises remind us that the central bank has to take account of financial market developments in designing an efficient monetary policy framework aiming at stable consumer & asset prices, as well as sustainable economic growth. In order to counteract asset prices bubbles we have to improve our understanding how to determine the fundamental value of stocks and residential real estate (house prices). I develop an empirical approach - based on Tobin’s Q theory - which identifies long-run stable relationships between asset prices and their underlying fundamentals. House prices have to be in line with rents, construction costs, and (mortgage) interest rates; stock prices should correspond to firms’ earnings, the prices of investment goods, and financing costs.
Based on these calculations of fundamental values, I construct robust indicators delivering early warning signals for asset price bubbles. These signals are generated in due time and therefore enable central banks to deliberate appropriate “cures” for the “bubble disease”, long before it turns into an epidemic. The effectiveness of my bubble indicators is demonstrated threefold: First, referring to the top of the “New Economy Boom” in 2000, signals turned to red as early as 1997 Q3 for the USA and 1998 Q2 for all EMU countries. This is the evidence for stock prices. Second, regarding house prices (the US subprime mortgage crisis and its spillovers in other countries), “red alert” was triggered 11 quarters before the price top in the USA, and 15 quarters in advance for EMU as a whole; on a national basis even 20 quarters for Spain, and 33 quarters for Ireland. Third, looking back to the Scandinavian banking crisis fostered by a house price boom, the bubble indicator would have worked fine as well.

These results invalidate the critique of orthodox economists claiming that fundamental asset prices are indeterminable, and so monetary policy should abstain from fighting asset price inflation, until ultimately the bubble bursts with the well-known disastrous effects for people’s welfare. The paper is organized as follows: Section 2 gives the idea of an extended version of Tobin’s Q theory in a nutshell. Section 3 explains the construction of our bubble indicators. Section 4 presents empirical results for the three selected crisis episodes. Section 5 concludes with some policy implications.

2. Tobin’s Q theory and fundamental asset prices

At the centre of Tobin’s theory stands the comparison of two different rates of return: the “supply price of capital” and the “demand price of capital”, or in other words the relation between marginal returns from new physical capital investment and the average return of the capital stock, known as Tobin’s Q. Applied to the stock market, this corresponds to the market valuation of a firm compared with its reproduction costs, i.e. the costs of an identical newly founded firm. In this concept, monetary policy only can influence the market price of the existing capital stock. If monetary policy action leads entrepreneurs to create new capital goods, because now Tobin’s Q is bigger than 1 - i.e. the market value surpasses the reproduction costs - this will cause higher investment at an economy-wide level and a rising GDP (Tobin 1969; Tobin and Brainard 1977). Elsewhere I have presented an elaborated and extended version of Tobin’s Q theory including housing markets and commodity markets (Holz 2007: 334ff.), that further differentiates between stock market investment and investment in new productive capital in the sense of Veblen (Medlen 2003).

Table 1 explains the utilization of Tobin’s concept for identifying stock market and housing market bubbles. To put this theoretical concept into practice, we have to operate
with a reasonable margin of safety. It wouldn’t be appropriate to generate too many early warning signals, urging monetary policy to take counteractions, because the topic of determining fundamental asset prices hasn’t yet come to be resolved. We use conceptualizations of the “supply price” and “demand price” of capital for the stock market and the housing market, conceding that Tobin’s Q mustn’t empirically equal 1.0 all the time. If our calculations lie within a relatively wide corridor from 0.8 to 1.2, we regard this as our “gray area” of indecision. Whether there is predominantly investment in “new” or existing (“old”) capital is a matter of fact, which we interpret as an adjustment path towards (a not exactly identifiable) equilibrium. This is the second row of Table 1. In addition, unproblematic from a monetary policy perspective are the upper left and lower right field titled “normal reactions” according to Post-Keynesian theory.

<table>
<thead>
<tr>
<th>Tobin’s Q &gt; 1.2</th>
<th>predominately investments in “new” capital</th>
<th>no investment activity</th>
<th>predominantly investments in “old” capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“normal reaction”</td>
<td>need for monitoring</td>
<td>speculative bubble</td>
</tr>
<tr>
<td></td>
<td>(according to Post-Keynesian theory)</td>
<td>(market sentiment too pessimistic for new investments?)</td>
<td>abrupt asset price rises (e.g. “New Economy Boom”)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0.8 ≤ Q ≤ 1.2</th>
<th>predominately investments in “old” capital</th>
<th>no investment activity</th>
<th>predominantly investments in “new” capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>economy on adjustment path to equilibrium; only minor new investments</td>
<td>Tobin’s Q ≈ 1.0</td>
<td>economy on adjustment path to equilibrium; only minor asset price changes</td>
</tr>
<tr>
<td></td>
<td>need for monitoring</td>
<td>no change in price or quantity of capital employed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tobin’s Q &lt; 0.8</th>
<th>predominately investments in “new” capital</th>
<th>no investment activity</th>
<th>predominantly investments in “old” capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“overinvestment”</td>
<td>need for monitoring</td>
<td>“normal reaction”</td>
</tr>
<tr>
<td></td>
<td>misallocated resources</td>
<td>(market sentiment too pessimistic for industrial takeovers?)</td>
<td>(according to Post-Keynesian theory)</td>
</tr>
</tbody>
</table>

|                  | (e.g. construction boom in eastern Germany after reunification) |                                      |                                      |

Table 1: Identifying speculative bubbles with the help of Tobin’s Q

Of relevance are the two fields characterizing “abnormal” macroeconomic situations, i.e. reactions in contradiction with theory. The speculative bubble (in the upper right field) is a situation of abruptly rising stock prices or house prices, without triggering considerable new investments in firms’ productive capital or construction of new houses. This is a situation seen e.g. in Spain during the years 2000 to 2007, where massive house price increases were fostered by speculation of private households buying a second (or third) home for speculation. Despite there was considerable construction activity, re-sale transactions of existing homes at a huge profit by far dominated construction. Regarding the stock market, the “New Economy Boom” in the TMT sector (technology, media, and telecommunications) ignited a glut of “stupid money” generated via IPOs of non-sustainable business plans. This money wasn’t predominantly invested in new productive capital, but in intangibles (e.g. UMTS licenses) or burned for marketing expenses,
management bonuses, and investor relation parties. Moreover, a substantial share of corporate investment was financial capital investment instead of productive capital investment, i.e. investment in “old” capital via takeovers of already expensive competitors listed at the stock market.

To supply evidence for my characterization of the “New Economy Boom” let’s have a look at Germany, where the “New Market” segment of the stock exchange was an outstanding example of the hype. Figure 1 presents Tobin’s Q for Germany, together with the investment and stock market financing activity of German firms. Only in the years from 1998 until 2001, stock market IPOs recorded significant levels (of 40 to 60 billion € p.a.). Productive capital investment has always been high in Germany, so the 2000 in-
crease of about 20% was just a single “outlier”. What against this really looks impressive is the massive surge in financial capital investment from 50 billion € in 1997 to 270 billion € in 2000. This surge went hand in hand with the wave of stock market IPOs between 1998 and 2001. Despite a Tobin’s Q of 1.8 in 2000, a considerable part of investment wasn’t in “new” productive capital - as Post-Keynesian theory would suppose -, but in “old” financial capital instead. Therefore, the resulting misallocation of resources had sown the seed for the subsequent stock market crash. Figure 2 presents a longer time horizon (starting in 1980). The boom-bust year 2000 was the only one, where investment in financial capital could catch up with productive capital investment, normally standing for about 80% of overall corporate investment in Germany.

The second rarer case is characterized as “overinvestment” (in the lower left field). An outstanding example for overinvestment in real estate/housing is the period after German reunification. Because of over-optimism and misguided tax incentives, a construction boom took place in eastern Germany. Some years later house prices collapsed, which was the starting point for the German house price deflation until today, which stands in astonishingly contrast to the 2000 - 2007 experience in most other EMU countries. Additionally, “overinvestment” may arise because of “hog-cycle” phenomena in construction. It may follow a housing bubble at times when a recession is just under way. Despite falling prices and vacancies of existing houses or offices, there is still investment in new projects (if credit is still available), which were planned and already started before the downturn became evident. This effect exacerbates the bust, so that real estate downturns may last longer than economic downturns.

3. The construction of indicators for asset price bubbles
3.1 A stock price bubble index

The index is a composite of three individual valuation components for stocks. Each component is given the same weight:

\[
\text{Bubble index (stocks)} = \frac{1}{3} \cdot Q \text{ (stocks)} + \frac{1}{3} \cdot \text{earnings (stocks)} + \frac{1}{3} \cdot \text{valuation (stocks/bonds)}
\]

All components have a “normal” value of 1.0, which means that stock prices are in line with prices (PPI) of investment goods (excluding construction), firms’ earnings (as a long-term trend), and the valuation of a risk-free alternative investment (10-year government bonds) as measured by the price/earnings ratios (P/E) of stocks vs. bonds.

The first component is based on traditional Tobin’s Q theory. We use long time series of stock prices and producer costs of new investment goods, starting in 1970. Both series are indexed to a common base date (e.g. 1995 Q1 = 100), where for each individual
country we identify a fundamentally “fair” valuation of stock prices regarding the PPI of investment goods. This is defined as an episode, where Tobin’s Q should be about 1.0, so the stock market valuation resembles reproduction costs of firms’ assets.

The second component compares the evolution of selected countries’ stock market indices with the aggregated earnings of all the companies comprised in an index. At each point in time, this allows to calculate the P/E ratio of the index, e.g. the DAX 30 for Germany, and to compare it with its long-term average valuation. In addition, over long horizons there should be a statistical cointegration relationship of stock prices and earnings (calculations not shown here), pushing stock prices back to fundamentals or justifying rising stock prices via rising earnings, which means that stock prices have a tendency to correct bubbles sooner or later. Earnings therefore play the role of an attractor for share prices. To make this point explicit: If stocks have been valued fairly in 1970 and in 1995, then the stock index as well as the index of earnings should have expanded at the same rate (e.g. an accumulated 250 % over this 25 years period).

The third component is based on the famous “Fed model” for identifying a relative misvaluation of assets (see e.g. Board of Governors 2003: 23). The relative valuation of stocks versus bonds assumes that rising bond prices should go hand in hand with rising stock prices. If interest rates are low, this means that bonds have a high P/E ratio. A coupon of 4 % p.a. corresponds with a bond P/E of 25. If the P/E of stocks is substantially lower, e.g. only 15, then there is a relative undervaluation of stocks versus bonds. Of course, this is only true in times of well-functioning capital markets, when macroeconomic and financial risks are low and adequately reflected in asset prices. Nevertheless, here again a long-run statistical cointegration relationship can be identified at least for the period before the “New Economy Boom” (calculations again not shown here). In Germany the mean (median) P/E ratio for stocks / bonds was 13.81 / 13.61 (13.35 / 13.42) for the years 1975 - 1996, with a maximum / minimum of 24.0 / 8.8 for stocks and 17.1 / 9.4 for bonds.

Because P/E ratios are the reciprocal values of yields, this third component regards annual returns of bonds versus stocks (which are complementary assets in private portfolios in the sense of Tobin), whereas the first two components concentrate on the level of stock prices and the level fundamental values. The “normal” value of the overall bubble index is 1.0, i.e. a stock market valuation in line with fundamentals. The threshold value for generating early warning signals is 1.2, which points towards an overvaluation of 20 %. On the other hand, an index value below 0.8 hints towards a considerable undervaluation.
3.2 A house price bubble index

For identifying a significant house price overvaluation, the procedure resembles the one for stock prices. Again, the overall index comprises three components, which are equally weighted.

\[ \text{Bubble index (housing)} = \frac{1}{3} \cdot Q(\text{housing}) + \frac{1}{3} \cdot \text{rents} + \frac{1}{3} \cdot \text{valuation (houses/bonds)} \]

First, an additional Tobin’s Q is calculated for the housing market (Holz 2007: 334ff.). In accordance with the traditional stock market Q, we calculate the housing Q as the ratio of prices for existing houses and construction costs for new ones. If house prices are rising substantially and construction costs remain subdued, then future home owners are supposed to build a new house (investment in “new” capital), because this is cheaper than buying an existing house. Of course, there are other relevant aspects to this decision on an individual basis, e.g. if someone wants a home today or one year later, or if property for construction is available. But at the national level and over an extended time period, there should be building contractors and real estate investors expanding the supply of new houses, if prices of already existing houses continue to go up. Here again, we employ long-term time series of house prices and construction costs for each country. For most countries, prices and costs seem to have been in line before the start of the latest house price boom, which has come to an end in summer 2007. Therefore we index time series to 2000 Q1 = 100 for our Tobin’s Q calculations.

Second, house prices should not only be in harmony with construction costs, but with rents paid for housing services too (from the point of view of a real estate investor in countries with a high share of tenants), or alternatively with the fictitious user-costs of housing (from the point of view of owner-occupiers). A house could be said to have a fair price, if this is a reasonable multiple of the annual rent. For this second component, we concentrate on the evolution of price levels and rent levels, supposing that both should move nearly synchronous, or at least act as attractors for each other in the long run.

Third, there is a component watching yields instead of price, rent, and cost levels. We compare annual returns of the two complementary asset categories housing/real estate versus bonds. Both are said to be relatively low-risk investments during normal times, i.e. without bubbles or market turbulence. Regarding e.g. EMU countries in the last 20 years, rental yields followed a slow-moving downward trend, resembling the downward trend of government bond yields that accelerated just before the introduction of the Euro in 1999. Bond yields are more volatile, but they oscillate around rental yields. Therefore, if rental yields are substantially lower than bond yields, and yields aren’t driven by a re-
duction in the rent level, but by fast rising house prices instead, then this index component signals a house price overvaluation, which has to be cross-checked with the results of the first two components, for the overall indicator to generate an early warning signal.

As for the stock market, the “normal” value of the overall housing bubble index is 1.0, i.e. house prices in line with fundamentals. The threshold value for generating early warning signals is again 1.2, which points towards an overvaluation of 20 %. On the other hand, an index value below 0.8 hints towards a considerable undervaluation, which now is the case in Germany.

4. Empirical results

4.1 Stock prices: Warning signals of the “New Economy Boom”

We apply our indicator for identifying stock market bubbles to the period from 1995 until 2000, known as the “New Economy Boom”. Following our classification in Table 1 (on p. 4), according to Post-Keynesian theory this was the prototype of a speculative bubble. In order to keep presentation short and simple, we concentrate on the overall EMU stock market (EuroStoxx 50 index) and Germany as the most important EMU submarket (the DAX 30). Nevertheless, because this boom nearly moved synchronously in all industrialized countries’ stock markets, we can cut out indices for e.g. the USA or the UK.

Figure 3: Tobin’s stock market Q for Germany and EMU (1990-2007)

Figure 3 presents Tobin’s Q (our first indicator component) for the EMU and German stock market. While during the early 1990s Tobin’s Q remained at relatively low levels, in 1996 it started rising and surpassed the level of 1.0 in 1998, in the course of which firms’ overall investment activity rose substantially, not so much the share of investment in “new” productive assets, but predominantly the share of investment in existing finan-
cial assets (cf. Figure 2 on p. 5). A top was reached in 2000, when $Q$ was 1.8 for Germany and 1.9 for EMU, which coincided with stock market all-time highs (in Germany reached once more in summer 2007). In fall 2000 stock prices started to collapse, together with Tobin’s $Q$ which fell below its “neutral” level of 1.0 in 2003.

The two variables defining Tobin’s $Q$, stock prices and producer costs of new capital goods (excluding construction), are shown in Figure 4. The up and down of stock markets from 1996 until 2003 took place despite the PPI developed slowly and continuously, without any abrupt price changes. Stock prices had lost touch with fundamentals, so sooner or later this undesirable development called for drastic correction. This conclusion is backed by the second component of the bubble index presented in Figure 5.
Stock prices rose much faster than firms’ profits from 1997 until 2000. Until 1996 they have been in close touch. Even in 2006/07 there were no signs of an overvaluation of stocks relative to profits. The last index component for our bubble indicator can be seen in Figure 6. Comparing the price/earnings (P/E) ratios of stocks and bonds, stocks were relatively expensive in 2000, in the aftermath of the bust central banks lowered interest rates and investors decided to buy government bonds as “safe havens”, rendering stocks relatively cheap in comparison with bonds.

An aggregation of all three components results in our stock price bubble index presented in Figure 7. A “fair” stock market valuation (in terms of prices of new capital goods, firms’ earnings, and the valuation of alternative investments) would exist around an indicator level of 1.0. We choose a comfortable confidence interval of ± 0.2, so bubble signals are only generated, if the indicator surpasses the threshold of 1.2 (signals of a negative bubble or “overshooting” in the crash result below levels of 0.8, as seen in 2003). Since the start of the globalization era in 1990, only one signal was generated, warning of the high-tech bubble. For the EuroStoxx and the DAX, this signal came in 1998 Q2, eight quarters before the bubble burst. Of course, during the LTCM and Russian debt crisis the bubble indicator dipped below its threshold, but quickly regained momentum. Because of the traditionally higher volatility of stock markets (as compared with bond or housing markets) there is no all-clear signal generated, just because indicator values drop for a quarter or two. In this case, a return to carelessness would be exactly the wrong conclusion. If responsible central bankers and national policymakers had observed stock markets with scrutiny, there would have been time for counteraction, preventing the final “irrational exuberance” of 1999/2000 and thereby reducing the enormous potential for correction in the aftermath.
Figure 7: Stock market bubble signals for Germany and EMU (1990-2007)

![Graph showing stock market bubble signals for Germany and EMU (1990-2007).]

Table 2: Stock prices during the „New Economy Boom” (1995 - 2000)

<table>
<thead>
<tr>
<th>Index</th>
<th>Top of the stock price cycle</th>
<th>Signal generated</th>
<th>Advance warning time (quarters)</th>
<th>Maximum price rise (since 1995)</th>
<th>Maximum degree of overvaluation ♣</th>
<th>Max. loss from the top</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td>2000 Q2</td>
<td>1997 Q3</td>
<td>11</td>
<td>225%</td>
<td>59%</td>
<td>-42%</td>
</tr>
<tr>
<td>EuroStoxx</td>
<td>2000 Q2</td>
<td>1998 Q2</td>
<td>8</td>
<td>305%</td>
<td>70%</td>
<td>-58%</td>
</tr>
<tr>
<td>DAX</td>
<td>2000 Q2</td>
<td>1998 Q2</td>
<td>8</td>
<td>266%</td>
<td>76%</td>
<td>-64%</td>
</tr>
<tr>
<td>CAC 40</td>
<td>2000 Q3</td>
<td>1998 Q2</td>
<td>9</td>
<td>248%</td>
<td>73%</td>
<td>-57%</td>
</tr>
<tr>
<td>MIB (Italy)</td>
<td>2000 Q3</td>
<td>1997 Q4</td>
<td>11</td>
<td>236%</td>
<td>74%</td>
<td>-51%</td>
</tr>
<tr>
<td>IBEX (Spain)</td>
<td>2000 Q2</td>
<td>1997 Q3</td>
<td>11</td>
<td>293%</td>
<td>75%</td>
<td>-46%</td>
</tr>
<tr>
<td>DJ Ireland</td>
<td>2001 Q3</td>
<td>1997 Q3</td>
<td>16</td>
<td>230%</td>
<td>42%</td>
<td>-37%</td>
</tr>
<tr>
<td>FTSE</td>
<td>2000 Q1</td>
<td>1998 Q2</td>
<td>7</td>
<td>115%</td>
<td>56%</td>
<td>-42%</td>
</tr>
</tbody>
</table>

♣ The threshold value for generating early warning signals is an overvaluation of 20 %.

Table 2 demonstrates, that for the United States an early warning signal was generated in 1997 Q3, placing policymakers in an even more comfortable position to undertake preventive efforts. In contrast to housing markets (to which we turn next), national stock markets moved much more in common. Signals for the USA, the UK, EMU as a whole, and the biggest EMU countries (Germany, France, Italy, Spain), as well as Ireland were all generated between 1997 Q3 and 1998 Q2, showing a wave of over-optimism of stock market investors in all big markets. The maximum stock market performance ranged between 225 % and 305 %, with the exception of the UK (115 %). This coincided with a maximum degree of overvaluation (derived from our bubble indicator) reaching about 70 %. The subsequent crash wiped out between 37 % and 64 % of total stock market capitalization in the countries affected.
4.2 House prices: Warning signals of the recent housing boom until 2007

For house prices, which now stand in the focus of attention for nearly 1½ years, the picture is less clear cut, because national house price cycles aren’t as synchronous as stock market cycles. Nevertheless, the good news is that our bubble indicator generated signals well in advance. Compared with a warning time of at least eight quarters before the 2000 stock market crash, a considerable overvaluation of house prices was identified at least 11 quarters before the cycle reached its top. Despite we weren’t able to foresee the horrible scenario of October 2008, with house prices and stock prices collapsing as a consequence of the subprime mortgage crisis and bank failures in the USA, the UK, and EMU countries, the underlying main trigger of overvalued house prices stood out quite clear for a long time. Therefore, the prognosis of falling house prices in e.g. the USA or Ireland was well founded. It was exacerbated because of securitization of subprime mortgages and greed on the side of bankers and investors. This amplifier was only recognized, when correction was already under way.

Figures 8 to 11 display house prices and their two main economic fundamentals (leaving out interest rates discussed later) for EMU as a whole (excluding Germany, which is special concerning house price trends in recent years), Spain, Ireland, and finally Germany for comparison. The long-term chart for EMU in Figure 8 is instructive. Since 1970 house prices had moved in parallel with rents and construction costs. This came to an abrupt end in 2000, when house prices started their remarkable rally until 2007. The potential for a massive correction was obvious, leaving open if this had to come via a house price crash, or a mild house price correction together with rising rents and construction costs. The latter should have been the case, if investors had acted pursuant to Tobin’s Q theory, implying a construction boom driving costs upwards. Figure 9 for Spain looks exactly like the overall EMU picture, but whereas EMU house prices rose by 90 % between 2000 and 2007, Spanish house prices went up 140 %.

Figure 8: House prices and fundamentals in EMU (1970-2007)
Another case is Ireland in Figure 10. The top was reached one year earlier than in the rest of EMU, so the correction was already under way in 2007, and part of the adjustment took place via a massively rising rent level. Remember that the ratio of house prices to rents is the second component of our housing bubble indicator (not shown separately here). On the other end of the spectrum stands Germany. Figure 11 demon-
strates that house prices and construction costs nearly moved in common, even in the 1990 reunification boom, whereas rents for a long time lagged behind prices and costs. From 1995 onwards, there was a mild house price deflation, whereas rents and especially construction costs picked up lately. Here we have the clear signal for an undervaluation of German residential real estate.

Following the procedure applied in Section 4.1 for stock prices, we have to calculate Tobin’s Q from our house price and construction cost data. The overall bubble indicator again consists of three components, but in many EMU countries it is dominated by Q. Figure 12 shows the house price signal generated for EMU (excluding Germany) together with the Tobin’s Q component. Both variables show a similar trend, but there are two main exceptions relevant for monetary policy purposes, because we have to correct for the influence of interest rates on (potential) home owners’ decision-making. Taking account of high interest rates in 1989-92, house prices were too high in some southern EMU countries. In the 2000-07 boom, house prices would have been overvalued even more (according to Tobin’s Q), if the introduction of the Euro hadn’t lowered interest rates significantly in exactly those countries (Spain, Italy) that already went through a minor house price bubble in 1990.

This is backed by Figure 13, presenting the third component of our bubble indicator. Because comparable data on mortgage interest rates for each EMU country are only available for recent years, we use government bond yields instead, which have shown substantial divergences between hard and soft currency countries before 1998. Our approach therefore is comparable to the “Fed model” for the stock market (see p. 7). If investments in residential real estate and bonds are complements in private investors’ portfolios, then there should be a stable long-run relationship between their annual yields: interest rates and rental rates. Since 1986 both yields followed a gradual downward trend, with bonds being relatively more attractive than housing from 1988 to 1995,
and rents taking lead from 1996 onwards. Because of the very low level of (bond and mortgage) interest rates since 1999, it turned out to be an attractive investment opportunity to buy a second or third house (to let or even not inhabited) for mere speculation on further rising prices.

Figure 13: Comparison of investment yields for bonds and real estate in EMU (1986-2007)

Figure 14 presents the overall house price bubble indices for individual EMU countries. The bubble grew biggest in Ireland, but the crash set in earlier, followed by Spain, where in 2007 overvaluation reached significant levels too. Even in France there was a clear divergence between house prices and fundamentals. Italy is a case of minor worry, whereas in Germany house price deflation resulted in an undervaluation of about 30%. In contrast to stock markets, where only a single bubble was identified since 1990, our indicator hints to another bubble in Spain and Italy in the early 1990s. But the economic effects were relatively small, because nominal prices fell only slightly in the years thereafter, while a high inflation rate wiped out real profits. In those times, real estate was preferred over bonds in southern Europe in order to preserve households' purchasing power in an inflationary environment.

Figure 14: Housing bubble signals in selected EMU countries (1986-2007)
Figure 15 displays the housing bubble index for EMU (ex Germany) together with the corresponding indices for the USA and the UK. Once again, it is remarkable that signals show a more or less common trend of house price cycles for these three currency areas. For the first time, our bubble indicator reached the signal level of 1.2 for the USA and the UK in 1988, as well as for EMU in 1990 (mainly driven by Spain and Italy). The subsequent correction to lower indicator levels was faster in the Anglo-Saxon countries. After 2000, the UK was the first country showing house price overvaluation, the USA and EMU followed five quarters later. All three indicators reached a top that hints to a massive overvaluation of about 60%, before correction set in. More results and facts are presented in Table 3. The maximum house price appreciation between 2000 and 2007 was 139% in Spain and 111% in the USA, corresponding with overvaluations of 80% and 62%. Overvaluation in Ireland even reached 131%, because of extremely low rental yields, falling to 2%.

### Table 3: House prices since the end of the „New Economy Boom“ (2000 - 2007)

<table>
<thead>
<tr>
<th>Country</th>
<th>Top of the housing cycle</th>
<th>Signal generated</th>
<th>Advance warning time (quarters)</th>
<th>Maximum price rise (since 2000)</th>
<th>Maximum degree of overvaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>2006 Q2</td>
<td>2003 Q3</td>
<td>11</td>
<td>111%</td>
<td>62%</td>
</tr>
<tr>
<td>EMU (ex Germany)</td>
<td>2007 Q2</td>
<td>2003 Q3</td>
<td>15</td>
<td>93%</td>
<td>53%</td>
</tr>
<tr>
<td>Germany</td>
<td>Falling house prices &amp; signal of considerable undervaluation (about 30%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>2007 Q2</td>
<td>2004 Q3</td>
<td>11</td>
<td>105%</td>
<td>49%</td>
</tr>
<tr>
<td>Italy</td>
<td>2007 Q2</td>
<td>Late weak signal (2006 Q2); no bubble, only slight overvaluation</td>
<td>70%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>2007 Q2</td>
<td>2002 Q2</td>
<td>20</td>
<td>139%</td>
<td>80%</td>
</tr>
<tr>
<td>Ireland</td>
<td>2006 Q3</td>
<td>1998 Q2</td>
<td>33</td>
<td>108%</td>
<td>131%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2007 Q2</td>
<td>2002 Q2</td>
<td>20</td>
<td>100%</td>
<td>59%</td>
</tr>
</tbody>
</table>

*The threshold value for generating early warning signals is an overvaluation of 20%.*
The important aspect to conclude with is that bubble signals were generated with a comfortable advance warning time. In 2003 Q3, indicators for EMU and the USA surpassed their threshold levels and were further rising in all subsequent quarters. This was 11 quarters before the cyclical top in the USA and 15 quarters before EMU’s top. For the UK, a bubble signal was sent in 2002 Q2, 20 quarters before house prices peaked. These results invalidate orthodox neo-classical critique claiming that asset price bubbles cannot be identified in due time, but only when they burst. Therefore it is a challenge for Post-Keynesian economists to deliver the appropriate technical devices (e.g. these indicators) and a sound theoretical foundation for a proactive monetary and regulatory policy fighting the build-up of further stock market or house price bubbles.

4.3 House prices: Warning signals of the Scandinavian banking crisis

As a robustness check, we have experimented with our bubble indicator using data from the Scandinavian banking crisis between 1988 and 1993, which went hand in hand with a housing boom too. This Nordic experience might deliver some policy recommendations for the solution of the current systemic financial crisis in the USA and Europe, as well as further implications for rendering the international financial system more resilient, once banks and asset markets have regained confidence again.

Table 4: House prices during the Scandinavian banking crisis (1988 - 1993)

<table>
<thead>
<tr>
<th>Country</th>
<th>Top of the stock price cycle</th>
<th>Signal generated</th>
<th>Advance warning time (quarters)</th>
<th>Maximum price rise (since 1980)</th>
<th>Maximum degree of overvaluation</th>
<th>Max. loss from the top</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>1989 Q2</td>
<td>1987 Q3</td>
<td>7</td>
<td>289%</td>
<td>71%</td>
<td>-40%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1991 Q1</td>
<td>1988 Q2</td>
<td>11</td>
<td>118%</td>
<td>44%</td>
<td>-21%</td>
</tr>
<tr>
<td>Denmark</td>
<td>1986 Q2</td>
<td>1984 Q1</td>
<td>9</td>
<td>70%</td>
<td>32%</td>
<td>-16%</td>
</tr>
<tr>
<td>Norway</td>
<td>1988 Q1</td>
<td>1984 Q4</td>
<td>13</td>
<td>172%</td>
<td>63%</td>
<td>-26%</td>
</tr>
</tbody>
</table>

♣ The threshold value for generating early warning signals is an overvaluation of 20%.

Table 4 summarizes the main results from this crisis episode. From 1980 until the peak in 1989 Q2 house prices in Finland had risen by 289%. In Norway and Sweden the appreciation between 1980 and their respective tops was 172% and 118%. Denmark stands apart, with house prices rising “only” 70%, of course slightly overvalued by about 30%, but not as drastic as in the other three Scandinavian countries. When the crash set in, house prices fell 21% in Sweden and 26% in Norway, just about the magnitude seen in the USA until today. The reaction in Finland was more drastic, with losses of 40%. According to our bubble indicator, the maximum degree of overvaluation reached 71% in Finland (compared with e.g. 80% in Spain 2007), and 63% in Norway (compared with e.g. 62% in the United States 2006). Our housing bubble indicator has generated early signals of considerable house price overvaluation in the Scandinavian
countries with an advance warning time of seven quarters for Finland, 11 quarters for Sweden, and 13 quarters for Norway (compared with 11 quarters for the USA and 15 quarters for EMU in the current 2007/08 crisis).

Figure 16: Housing bubble signals in Scandinavian countries (1983-1993)

Figure 16 completes this short flashback with a graphical illustration of the bubble indicator values. In contrast to the current boom-bust-period, the Scandinavian crisis wasn’t as synchronous as today. Denmark and Norway took lead, followed by Finland and Sweden about three years later. Despite Denmark’s housing market had shown less stress symptoms than the three others, in 1993 house prices had fallen significantly and were undervalued by more than 20%. This seems to be due to spillover effects in Scandinavia. The drawback at this time was that these countries were intertwined in the highest degree, but each had its own currency and therefore national policymakers in Finland or Sweden might have thought they could ignore the evident “signs on the wall”, because their country was supposed to be different.

5. Policy implications

The necessity for policy intervention in the current financial crisis is now widely accepted, even by liberal economists and otherwise market-radical politicians. There is urgent need to stabilize the banking system und restore trust and confidence on the side of private households, firms, and between banks. Though it rests an enigma, how expensive crisis resolution will be - i.e. how high will be the costs of direct capital injections and guarantees for the banking sector, and the indirect losses in terms of GDP growth foregone -, there are some hints. If governments take over preferred stock in tumbling banks or even nationalize banks, the long-run costs should be relatively small in an optimistic scenario of re-privatizations after a couple of years. This is a lesson from the Scandinavian crisis, where resolution costs for Sweden were estimated at 4%.
of GDP in 1992, reduced to 2% in 1997, and lately turned out to have resulted in a small profit (Lundgren 2008).

The costs of GDP growth forgone hinge on the depth and length of the recession that lies ahead. Here, perspectives aren’t that advantageous. Newer studies carried out at the IMF (IMF 2008b: 139) and the BIS present results, that recessions associated with credit crunches and house price busts are deeper and longer than normal recessions. According to this past evidence by Claessens et al. (2008: Table 10.A), at least for those countries hit by such a double crisis, the following recession may last between four and five quarters and the cumulative loss may add up to 5% or 6% of GDP.

Nevertheless, a typical house price bust still goes on after the recession has faded out, and may last 18 quarters. The potential exception might be Germany, which hasn’t seen a house price boom before, nevertheless struggles with bank losses too. But as pointed out in the BIS study, the current monetary policy response is more aggressive relative to earlier periods and fiscal policy acts more expansionary, so crisis resolution hopefully will be successful. In addition, on the positive side the balance sheets of non-financial corporations seem to be relatively healthy today (Claessens et al. 2008: 32).

Ben Bernanke was among the first economists to recognize these “nonmonetary effects” of financial crisis leading into recession. 25 years ago, he studied the reasons for the Great Depression. His insights sound like a description of the situation he is confronted with today as Federal Reserve chairman: “The financial crisis of 1930-33 affected the macroeconomy by reducing the quality of certain financial services, primarily credit intermediation.” (Bernanke 1983: 263) Maybe in October 2008 we are at the same decisive moment of the current crisis, that Bernanke described as follows:

“After struggling through 1931 and 1932, the financial system hit its low point in March 1933, when the newly elected President Roosevelt’s ‘bank holiday’ closed down most financial intermediaries and markets. March 1933 was a watershed month in several ways: It marked not only the beginning of economic and financial recovery but also the introduction of truly extensive government involvement in all aspects of the financial system. It might be argued that the federally directed rehabilitation - which took strong measures against the problems of both creditors and debtors - was the only major New Deal program that successfully promoted economic recovery. In any case, the large government intervention is prima facie evidence that by this time the public had lost confidence in the self-correcting powers of the financial structure.” (Bernanke 1983: 272)

In addition, there are some lessons from the Scandinavian banking crisis worth recalling in the form of bullet points (Jonung 2007: 16ff.):

- **Beware of** the dangers of financial ignorance,
- the dangers of backward-looking policy behavior,
• the dangers of procyclical monetary and fiscal policy,
• the dangers of abrupt financial liberalization instead of sequencing financial reforms,
• the dangers of inadequate micro-prudential financial supervision, and
• most importantly take care for the existence of adequate resolution policies.

What has to be learned from the current deep crisis is the “Medusa’s head” character of financial systems. They can work as shock absorbers or as shock amplifiers. If financial markets were complete and efficient in the sense of neo-classical theory, there wouldn’t be much to care about; but if today’s financial markets and institutions are incomplete and inefficient, they are prone to recurrent crises. Large shocks then may lead to excessive asset price volatility, financial fragility, contagion, and bubbles (Allen and Carletti 2008).

Beyond restoring trust and confidence in the financial and political system, it is the duty of central bankers, financial regulators, economists, and competent politicians in charge of human welfare to obtain a better understanding of the macroeconomic order of events preceding a crisis. Early warning signals, as generated e.g. by our asset bubble indicators, may be “just another brick in the wall” of future crisis prevention, hopefully rendering such “resolution policies of last resort” from now on unnecessary.
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